ECONOMIC AND ENVIRONMENTAL

PRINCIPLES AND GUIDELINES

FOR WATER AND RELATED LAND RESOURCES

IMPLEMENTATION STUDIES

March 10, 1983

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Foreword

These Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies have been developed to guide the formulation and evaluation studies of the major Federal water resources development agencies. This document is the product of extensive work by experts from a variety of professions and was developed with the help of hundreds of comments from the public. It contains the best currently available methods for calculating the benefits and costs of water resources development alternatives accurately and consistently, and is intended to ensure proper and consistent planning by the covered Federal agencies. I am confident that these Principles and Guidelines will enhance our ability to identify and recommend to the Congress economically and environmentally sound water project alternatives.

In accordance with section 103 of the Water Resources Planning Act, as amended (42 U.S.C. 1962a-2), the Water Resources Council voted on September 9, 1982, to repeal the existing Principles, Standards and Procedures(18 CFR, Parts711, 713, 714, and 716) and to establish these Principles and Guidelines. The President approved the Principles on February 3, 1983. In accordance with Executive Order 11747 (38 FR 30993, November 7, 1973), I hereby approve the new Standards (Chapter I) and Procedures (Chapters II and III).

<Signature of James G. Watt>

James G. Watt
Chairman
U.S. Water Resources Council

Economic and Environmental Principles for Water and Related Land Resources Implementation Studies

These Principles are established pursuant to the Water Resources Planning Act of 1965 (Pub. L. 89-80), as amended (42 U.S.C. 1962a-2 and d-1). These Principles supersede the Principles established in connection with promulgation of principles, standards and procedures at 18 CFR, Parts 711, 713, 714 and 716.

1. Purpose and Scope

These principles are intended to ensure proper and consistent planning by Federal agencies in the formulation and evaluation of water and related land resources implementation studies.

Implementation studies of the following agency activities are covered by these principles:

(a) Corps of Engineers (Civil Works) water resources project plans;

(b) Bureau of Reclamation water resources project plans;

(c) Tennessee Valley Authority water resources project plans;

(d) Soil Conservation Service water resources project plans.

Implementation studies are pre- or post authorization project formulation or evaluation studies undertaken by Federal agencies.

2. Federal Objective

The Federal objective of water and related land resources project planning is to contribute to national economic development consistent with protecting the Nation's environment**,** pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements.

(a) Water and related land resources project plans shall be formulated to alleviate problems and take advantage of opportunities in ways that contribute to this objective.

(b) Contributions to national economic development (NED) are increases in the net value of the national output of goods and services, expressed in monetary units. Contributions to NED are the direct net benefits that accrue in the planning area and the rest of the Nation. Contributions to NED include increases in the net value of those goods and services that are marketed, and also of those that may not be marketed.

3. State and Local Concerns

Federal water resources planning is to be responsive to State and local concerns. Accordingly, State and local participation is to be encouraged in all aspects of water resources planning. Federal agencies are to contact Governors or designated State agencies for each affected State before initiating studies, and to provide appropriate opportunities for State participation. It is recognized, however, that water projects which are local, regional, statewide, or even interstate in scope do not necessarily require a major role for the Federal Government; non-Federal, voluntary arrangements between affected jurisdictions may often be adequate. States and localities are free to initiate planning and implementation of water projects.

4. International Concerns

Federal water resources planning is to take into account international implications, including treaty obligations. Timely consultations with the relevant foreign government should be undertaken when a Federal water project is likely to have a significant impact on any land or water resources within its territorial boundaries.

5. Alternative Plans

Various alternative plans are to be formulated in a systematic manner to ensure that all reasonable alternatives are evaluated.

(a) A plan that reasonably maximizes net national economic development benefits, consistent with the Federal objective, is to be formulated. This plan is to be identified as the NED plan.

(b) Other plans which reduce net NED benefits in order to further address other Federal, State, local, and international concerns not fully addressed by the NED plan should also be formulated.

(c) Plans may be formulated which require changes in existing statutes, administrative regulations, and established common law; such required changes are to be identified.

(d) Each alternative plan is to be formulated in consideration of four criteria: completeness, effectiveness, efficiency, and acceptability. Appropriate mitigation of adverse effects is to be an integral part of each alternative plan.

(e) Existing water and related land resources plans, such as State water resources plans, are to be considered as alternative plans if within the scope of the planning effort.

6. Plan Selection

A plan recommending Federal action is to be the alternative plan with the greatest net economic benefit consistent with protecting the Nation's environment (the NED plan), unless the Secretary of a department or head of an independent agency grants an exception to this rule. Exceptions may be made when there are overriding reasons for recommending another plan, based on other Federal, State, local and international concerns.

7. Accounts

Four accounts are established to facilitate evaluation and display of effects of alternative plans. The national economic development account is required. Other information that is required by law or that will have a material bearing on the decision making process should be included in the other accounts, or in some other appropriate format used to organize information on effects.

(a) The national economic development (NED) account displays changes in the economic value of the national output of goods and services.

(b) The environmental quality (EQ) account displays non monetary effects on significant natural and cultural resources.

(c) The regional economic development (RED) account registers changes in the distribution of regional economic activity that result from each alternative plan. Evaluations of regional effects are to be carried out using nationally consistent projections of income, employment, output, and population.

(d) The other social effects (OSE) account registers plan effects from perspectives that are relevant to the planning process, but are not reflected in the other three accounts.

8. Discount Rate

Discounting is to be used to convert future monetary values to present values.

9. Period of Analysis

The period of analysis to be the same for each alternative plan.

10. Risk and Uncertainty

Planners shall identify areas of risk and uncertainty in their analysis and describe them clearly, so that decisions can be made with knowledge of the degree of reliability of the estimated benefits and costs and of the effectiveness of alternative plans.

11. Cost Allocation

For allocating total project financial costs among the purposes served by a plan, separable costs will be assigned to their respective purposes, and all joint costs will be allocated to purposes for which the plan was formulated. (Cost sharing policies for water projects will be addressed separately.)

12. Planning Guidelines

In order to ensure consistency of Federal agency planning necessary for purposes of budget and policy decisions and to aid States and the public in evaluation of project alternatives, the Water Resources Council (WRC), in cooperation with the Cabinet Council on Natural Resources and Environment, shall issue standards and procedures, in the form of guidelines, implementing these Principles. The head of each Federal agency subject to this order will be responsible for consistent application of the guidelines. An agency may propose agency guidelines which differ from the guidelines issued by WRC. Such agency guidelines and suggestions for improvements in the WRC guidelines are to be submitted to WRC for review and approval. The WRC will forward all agency proposed guidelines which represent changes in established policy to the Cabinet Council on Natural Resources and Environment for its consideration.

13. Effective Date

These Principles shall apply to implementation studies completed more than 120 days after issuance of the standards and procedures referenced in Section 12, and concomitant repeal of 18 CFR, Parts 711, 713, 714, and 716.

These economic and environmental Principles are hereby approved.

<Signature of the President of the United States,
Ronald Reagan>

February 3, 1983

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CHAPTER I — STANDARDS

Section I — Introduction

1.1.1 Purpose and Scope.

(a) These Guidelines establish standards and procedures for use by Federal agencies in formulating and evaluating alternative plans for water and related land resources implementation studies. These Guidelines implement the Principles for Water and Related Land Resources Implementation Studies.

(b) These Guidelines are for Federal administrative purposes and shall not create any substantive or procedural rights in private parties.

(c) Departures in an individual study from these Guidelines are to be documented and justified in the study report.

(d) Implementation studies are pre- or postauthorization project formulation or evaluation studies undertaken by a Federal agency. Studies for the following agency activities are covered:

(1) Corps of Engineers (Civil Works) water resources project plans.

(2) Bureau of Reclamation water resources project plans.

(3) Tennessee Valley Authority water resources project *plans*.

(4) Soil Conservation Service water resources project plans.

(e) These Guidelines establish the basic process for Federal agencies in carrying out implementation studies. Activities conducted pursuant to the requirements of the National Environmental Policy Act of 1969 (NEPA) (42 U.S.C. 4321, *et. seq*.) are to be fully integrated with this process.

(f) The accounts described in these Guidelines encompass and are consistent with the concept of human environment as used in NEPA and the appropriate portions of the NEPA regulations established by the Council on Environmental Quality (CEQ) in 40 CFR Parts 1500-1508.

1.1.2 Authority.

These Guidelines are established pursuant to Section 103 of the Water Resources Planning Act (Pub. L. 89-80) and Executive Order 11747.

1.1.3 Applicability.

(a) These Guidelines apply to implementation studies completed more than 120 days after issuance of the Guidelines. Studies completed within 120 days should be concluded in accordance with the guidance applicable to them prior to issuance of these Guidelines.

(b) Preauthorization or postauthorization studies are considered completed when the appropriate planning documents have been approved by the responsible agency's field office.

(c) In the case of reevaluation studies in which there is no reformulation of the plan, the portions of this chapter dealing with plan formulation do not apply.

(d) The administrator of each Federal or Federally assisted program covered is responsible for applying these Guidelines.

Section II —The Federal Objective.

(a) The Federal objective of water and related land resources planning is to contribute to national economic development consistent with protecting the Nation's environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements.

(b) Contributions to national economic development (NED) are increases in the net value of the national output of goods and services, expressed in monetary units. Contributions to NED are the direct net benefits that accrue in the planning area and the rest of the nation. Contributions to NED include increases in the net value of those goods and services that are marketed, and also of those that may not be marketed.

(c)The Federal objective for the relevant planning setting should be stated in terms of an expressed desire to alleviate problems and realize opportunities related to the output of goods and services or to increased economic efficiency.

(d) Each statement of a problem or opportunity should be expressed in terms of a desired output. Example statements are—

(1) Reduce flood losses in the Red River floodplain to increase agriculture production;

(2) Reduce the cost of agricultural production in the irrigated sector of Tolland County; and

(3) Increase the value of the recreational experience at Lake Zoar.

Section III — Summary of the Planning Process

1.3.1 Introduction.

The planning process consists of a series of steps that identifies or responds to problems and opportunities associated with the Federal objective and specific State and local concerns, and culminates in the selection of a recommended plan. The process involves an orderly and systematic approach to making determinations and decisions at each step so that the interested public and decisionmakers in the planning organization can be fully aware of: the basic assumptions employed; the data and information analyzed; the areas of risk and uncertainty; the reasons and rationales used; and the significant implications of each alternative plan.

1.3.2 Major Steps.

(a) The planning process consists of the following major steps:

(1) Specification of the water and related land resources problems and opportunities (relevant to the planning setting) associated with the Federal objective and specific State and local concerns.

(2) Inventory, forecast, and analysis of water and related land resource conditions within the planning area relevant to the identified problems and opportunities.

(3) Formulation of alternative plans.

(4) Evaluation of the effects of the alternative plans.

(5) Comparison of alternative plans.

(6) Selection of a recommended plan based upon the comparison of alternative plans.

(b) Plan formulation is a dynamic process with various steps that should be iterated one or more times. This iteration process, which may occur at any step, may sharpen the planning focus or change its emphasis as new data are obtained or as the specification of problems or opportunities changes or becomes more clearly defined.

1.3.3 Specification of the Problems and Opportunities Associated With the Federal Objective and Specific State and Local Concerns.

(a) The desire to alleviate problems and realize opportunities should be specified for the planning area in terms of the Federal objective and specific State and local concerns. The problems and opportunities should be defined so that their definition does not dictate a narrow range of alternatives.

(b) The problems and opportunities should be defined in such a way that meaningful levels of achievement can be identified. This will facilitate the formulation of alternative plans in cases in which there may be financial, environmental, technical, legislative, or administrative constraints on the total alleviation of a problem or realization of an opportunity.

(c) The problems and opportunities should be stated for both current and future conditions. Desired conditions for the future should be explicitly stated.

(d) The problems and opportunities should reflect the specific effects that are desired by groups and individuals as well as the problems and opportunities declared to be in the national interest by the Congress or the Executive Branch. This identification and detailing of problems and opportunities is the process of making explicit the range of preferences and desires of those affected by resource development. It should be understood that the initial expressions of problems and opportunities may be modified during the planning process.

1.3.4 Inventory and Forecast of Water and Related Land Resource Conditions.

The potential for alleviating problems and realizing opportunities is determined during inventorying and forecasting. The inventory and forecast of resource conditions should be related to the problems and opportunities previously identified.

1.3.5 Formulation of Alternative Plans.

Alternative plans are to be formulated in a systematic manner to insure that all reasonable alternatives are evaluated. Usually, a number of alternative plans are identified early in the planning process and become more refined through additional development and through subsequent iterations. Additional alternative plans may be introduced at any time.

1.3.6 Evaluation of Effects.

(a) General. The evaluation of the effects of each alternative plan consists of assessment and appraisal.

(b) *Assessment.* Assessment is the process of measuring or estimating the effects of an alternative plan. Assessment determines the difference between without-plan and with-plan conditions for each of the categories of effects.

(c) *Appraisal.*

(1) Appraisal is the process of assigning social values to the technical information gathered as part of the assessment process.

(2) Since technical data concerning benefits and costs in the NED account are expressed in monetary units, the NED account already contains a weighting of effects; therefore, appraisal is applicable only to the EQ, RED, and OSE evaluations.

(d) *Displays*. The results of the evaluation should be displayed according to the directions provided in Section Vlll—Displays.

1.3.7 Comparison of Alternative Plans.

(a) The comparison of plans focuses on the differences among the alternative plans as determined in the evaluation phase.

(b) The differences should be organized on the basis of the effects in the four accounts or on a combination of the NED account and another appropriate format for other significant effects.

1.3.8 Plan Selection.

After consideration of the various alternative plans, their effects, and public comments, a plan is selected following the general guidance in Section X—Plan Selection.

Section IV—General Planning Considerations

1.4.1 Federal-State Relationship in Planning.

(a) The responsible Federal planning agency is to contact the Governor or designated agency for each affected State before initiating a study and enter into such agreements as are appropriate to carry out a coordinated planning effort.

(b) The State agency or agencies responsible for or concerned with water planning are to be provided with appropriate opportunities to participate in defining the problems and opportunities, in scoping the study, and in review and consultation.

1.4.2 International Consultations.

When a Federal water project is likely to have a significant impact on any land or resources situated in a foreign country or to affect treaty obligations, the responsible Federal planning agency, through the Department of State, should enter into consultations with the government of the affected country, with a view to determining the international implications of the project under consideration.

1.4.3 General Public Participation.

(a) Interested and affected agencies, groups, and individuals should be provided opportunities to participate throughout the planning process. The responsible Federal planning agency should contact and solicit participation of: other Federal agencies; appropriate regional, State, and local agencies; national, regional and local groups; other appropriate groups such as affected Indian tribes; and individuals. A coordinated public participation program should be established with willing agencies and groups.

(b) Efforts to secure public participation should be pursued through appropriate means such as public hearings, public meetings, workshops, information programs, and citizen committees.

1.4.4 Review and Consultation.

Review and consultation with interested and affected agencies, groups, and individuals are needed in the planning process. Reviews are to be consistent with the requirements of applicable Federal statutes and the CEQ NEPA regulations (40 CFR Parts 1500-1508). The planning process described in these Guidelines and the CEQ and NEPA regulations are complementary.

1.4.5 Interdisciplinary Planning.

An interdisciplinary approach should be used in planning to ensure the integrated use of the natural and social sciences and the environmental design arts. The disciplines of the planners should be appropriate to the issues identified in the scoping process. The planning agency should supplement its available expertise, as necessary, with knowledgeable experts from cooperating agencies, universities, consultants, etc.

1.4.6 Agency Decisionmaking.

Decisionmaking is a dynamic process that leads to selection of a recommended plan. Decision making begins at the field level and occurs at differentlevels through subsequent reviews and approvals as required by the agency until it reaches the level having authority to approve the project (final level). The individual in the responsible planning agency making the decisions at each level is referred to as the "agency decisionmaker." The identity of the agency decisionmaker depends upon the level of project development and review. For projects requiring congressional authorization, the final agency decisionmaker is the Secretary of the Department or head of the independent agency. For projects that do not require congressional approval, the final decisionmaker is the Secretary of the Department, head of the agency, or such other official as appropriately delegated.

1.4.7 Planning Area.

The planning area is a geographic space with an identified boundary that includes:

(a) The area identified in the study's authorizing document;

(b) The locations of alternative plans, often called "project areas"; and

(c) The locations of resources that would be directly, indirectly, or cumulatively affected by alternative plans, often called the "affected area."

1.4.8 Scoping.

(a) Planning should include an early and open process termed "scoping" to identify both the likely significant issues to be addressed and the range of those issues. This process is complementary with the scoping process described in the CEQ NEPA regulations (40 CFR Parts 1500-1508). The agency should begin scoping as soon as practicable after a decision to begin planning. The scoping process should include affected Federal, State, and local agencies and other interested groups or persons. Scoping should be used as appropriate throughout planning to ensure that all significant - decisionmaking factors are addressed and that unneeded and extraneous studies are not undertaken.

(b) As part of the scoping process, the agency should:

(1) Determine the extent to which the likely significant issues will be analyzed.

(2) Define the planning area based on the problems and opportunities and the geographic areas likely to be affected by alternative plans.

(3) Identify and eliminate from detailed study any issues that are not significant or that have been adequately covered by prior study. However, important issues, even though covered by other studies, should still be considered in the analysis.

(4) Identify any current or future planning that is related to but not part of the study under consideration.

(5) Identify review and consultation requirements so that cooperating agencies (as defined in 40 CFR 1508.5) may prepare required analyses and studies concurrently with the study under consideration.

(6) Indicate the tentative planning and decisionmaking schedule.

(7) The scoping process should be integrated with other early planning activities.

(c) Scoping may be used to combine or narrow the number of problems and opportunities, measures, plans, effects, etc., under consideration so that meaningful and efficient analysis and choice among alternative plans can occur.

(d) Scoping should include consideration of ground water problems and opportunities, including conjunctive use of ground and surface water, and in stream flow problems. Appropriate consideration should be given to existing water rights in scoping the planning effort.

1.4.9 Forecasting.

(a) Formulation and evaluation of alternative plans should be based on the most likely conditions expected to exist in the future with and without the plan. The without-plan condition is the condition expected to prevail if no action is taken. The with-plan condition is the condition expected to prevail with the particular plan under consideration.

(b) The forecasts of with- and without-plan conditions should use the inventory of existing conditions as the baseline, and should be based on consideration of the following (including direct, indirect, and cumulative effects)—

(1) National regional projections of income, employment, output, and population prepared and published by the Department of Commerce.

(2) Other aggregate projections such as exports, land use trends, and amounts of goods and services likely to be demanded;

(3) Expected environmental conditions; and

(4) Specific, authoritative projections for small areas.

Appropriate national and regional projections should be used as an underlying forecasting framework, and inconsistencies therewith, while permissible, should be documented and justified.

(c) National projections used in planning are to be based on a full employment economy. In this context, assumption of a full employment economy establishes a rationale for general use of market prices in estimating economic benefits and costs, but does not preclude consideration of special analyses of regions with high rates of unemployment and underemployment in calculating benefits from using unemployed and underemployed labor resources.

(d) National and State environmental and health standards and regulations should be recognized and appropriately considered in scoping the planning effort. Standards and regulations concerning water quality, air quality, public health, wetlands protection, and floodplain management should be given specific consideration in forecasting the with- and without-plan condition.

(e) Other plans that have been adopted for the planning area and other current planning efforts should be considered.

(f) Forecasts should be made for selected years over the period of analysis to indicate how changes in economic and other conditions are likely to have an impact on problems and opportunities.

1.4.10 Prices.

(a) The prices of goods and services used for evaluation should reflect the real exchange values expected to prevail over the period of analysis. For this purpose, relative price relationships of outputs and inputs prevailing during, or immediately preceding, the period of planning generally represent the real price relationships expected over the life of the plan, unless specific considerations indicate real exchange values are expected to change.

(b) The general level of prices for outputs and inputs prevailing during or immediately preceding the period of planning is to be used for the entire period of analysis. In the case of agricultural planning, normalized prices prepared by the Department of Agriculture should be used.

1.4.11 Discount Rate.

Discounting is to be used to convert future monetary values to present values. Calculate present values using the discount rate established annually for the formulation and economic evaluation of plans for water and related land resources plans.

1.4.12 Period of Analysis.

(a) The period of analysis is to be the same for each alternative plan. The period of analysis is to be the time required for implementation plus the lesser of—

(1) The period of time over which any alternative plan would have significant beneficial or adverse effects; or

(2) A period not to exceed 100 years.

(b) Appropriate consideration should be given to environmental factors that may extend beyond the period of analysis.

1.4.13 Risk and Uncertainty—Sensitivity Analysis.

(a) Plans and their effects should be examined to determine the uncertainty inherent in the data or various assumptions of future economic, demographic, social, attitudinal, environmental, and technological trends. A limited number of reasonable alternative forecasts that would, if realized, appreciably affect plan design should be considered.

(b) The planner's primary role in dealing with risk and uncertainty is to identify the areas of sensitivity and describe them clearly so that decisions can be made with knowledge of the degree of reliability of available information.

(c) Situations of risk are detained as those in which the potential outcomes can be described in reasonably well-known probability distributions such as the probability of particular flood events. Situations of uncertainty are defined as those in which potential outcomes cannot be described in objectively known probability distributions.

(d) Risk and uncertainty arise from measurement errors and from the underlying variability of complex natural, social. and economic situations. Methods of dealing with risk and uncertainty include:

(1) Collecting more detailed data to reduce measurement error.

(2) Using more refined analytic techniques.

(3) Increasing safety factors in design.

(4) Selecting measures with better known performance characteristics.

(5) Reducing the irreversible or irretrievable commitments of resources.

(6) Performing a sensitivity analysis of the estimated benefits and costs of alternative plans.

(e) Reducing risk and uncertainty may involve increased costs or loss of benefits. The advantages and costs of reducing risk and uncertainty should be considered in the planning process. Additional information on risk and uncertainty can be found in Supplement I to this chapter.

1.4.14 Documentation.

Planning studies are to be documented in a clear, concise manner that explains the basic assumptions and decisions that were made and the reasons for them. The documentation should be prepared in a manner to expedite review and - decisionmaking.

Section V — Inventory and Forecast of Conditions Without a Plan

1.5.1 Resource Conditions.

(a) An inventory should be made to determine the quantity and quality of water and related land resources of the planning area and to identify opportunities for protection and enhancement of those resources. The inventory should include data appropriate to the identified problems and opportunities, as determined by scoping, and the potential for formulating and evaluating alternative plans. The inventory does not necessarily include an exhaustive listing of resources of the area. This inventory should describe the existing conditions and should be the baseline for forecasting with- and without-plan conditions.

(b) The most likely future condition without a plan should be used for evaluating the effects of alternative plans.

1.5.2 Problems and Opportunities.

(a) Inventory and forecasting should include an analysis of the identified problems and Opportunities and their implications for the planning setting. Resource inventories should be limited to resources affecting the problems and opportunities or likely to be affected by the alternative plans. As alternative plans are developed or refined, the adequacy of these resource inventories should be reassessed. This analysis should be used to redefine the specific problems and opportunities associated with the Federal objective and other State and local concerns.

(b)Based on this analysis, an appraisal should be made of the potential for alleviating the problems and realizing the opportunities. The appraisal provides guidance on the possible scope and magnitude of actions needed to address each problem or opportunity. This appraisal should identify possibilities for management, development, preservation, and other opportunities for action. Resource inventories and forecasts may suggest additional problems or opportunities. These possibilities will indicate the resource capabilities relative to specific commodities, services, or environmental amenities desired by the public. By proper selection of these development or management possibilities, alternatives may be formulated for each problem or opportunity.

Section Vl — Alternative Plans

1.6.1 General.

(a) An alternative plan consists of a system of structural and/or nonstructural measures, strategies, or programs formulated to alleviate specific problems or take advantage of specific opportunities associated with water and related land resources in the planning area.

(b) Alternative plans should be significantly differentiated from each other.

(c) Alternative plans should not be limited to those the Federal planning agency could implement directly under current authorities. Plans that could be implemented under the authorities of other Federal agencies, State and local entities, and nongo-vernment interests should also be considered.

(d) Alternative plans may either—

(1) Be in compliance with existing statutes, administrative regulations, and established common law; or

(2) Propose necessary changes in such statutes, regulations, or common law.

(e) A range of measures that can, over time, balance water demand for various purposes with water availability should be considered, including measures that will—

(1) Reduce the demand for water;

(2) Improve efficiency in use and reduce losses and waste;

(3) Improve land management practices to con serve water; and/or

(4) Increase the available supply of water.

(f) Nonstructural measures should be considered as means for addressing problems and opportunities.

(1) Nonstructural measures are complete or partial alternatives to traditional structural measures. Nonstructural measures include modifications in public policy, management practice, regulatory policy, and pricing policy.

(2) A nonstructural measure or measures may in some cases offer a complete alternative to a traditional structural measure or measures. In other cases, nonstructural measures may be combined with fewer or smaller traditional structural measures to produce a complete alternative plan.

(g) Protection of the Nation's environment is to be provided by mitigation (as defined in 40 CFR 1508.20) of the adverse effects (as defined in 40 CFR 1508.8) of each alternative plan. Accordingly, each alternative plan should include mitigation determined to be appropriate by the agency decision- maker.

(1) Appropiate mitigation to address effects on fish and wildlife and their habitat should be determined in consultation with Federal and State fish and wildlife agencies in accordance with the Fish and Wildlife Coordination Act of 1958 (16 U.S.C. 661-666(c)), or other appropiate authority.

(2) Appropiate mitigation to address other adverse effects should be determined in accordance with applicable laws, regulations, and Executive Orders.

(3) Mitigation measures determined to be appropriate should be planned for concurrent implementation with other major project features, where practical.

(h) Other existing water and related land resource plans, such as State water resource plans, should be considered as alternative plans if within the scope of the planning effort.

(I) Various schedules, including staged construction, for implementing alternative plans should be considered.

1.6.2 Formulation

(a) Alternative plans which contribute to the Federal objective should be systematically formulated, in addition to a plan which reasonably maximizes contributions to NED, other plans may be formulated which reduce net NED benefits in order to further address other Federal, State, local, and international concerns not fully addressed by the NED plan. These additional plans should be formulated in order to allow the decisionmaker the opportunity to judge whether these beneficial effects outweigh the corresponding NED losses.

(b) In general, in the formulation of alternative plans, an effort is made to include only increments that provide net NED benefits after accounting for appropiate mitigation costs. Include appropiate mitigation of adverse environmental effects, as required by law, in all alternative plans. Increments that do not provide net NED benefits may be included, except in the NED plan if they are cost-effective measures for addressing specific concerns.

(c) Alternative plans, including the NED plan, should be formulated in consideration of four criteria: Completeness; effectiveness; efficiency; and acceptability.

(1) Completeness is the extent to which a given alternative plan provides and accounts for all necessary investments or other actions to ensure the realization of the planned effects. This may require relating the plan to other types of public or private plans if the other plans are crucial to realization of the contributions to the objective.

(2) Effectiveness is the extent to which an alternative plan alleviates the specified problems and achieves the specified opportunities.

(3) Efficiency is the extent to which an alternative plan is the most cost effective means of alleviating the specified problems and realizing the specified opportunities, consistent with protecting the Nation's environment.

(4) Acceptability is the workability and viability of the alternative plan with respect to acceptance by State and local entities and the public and compatibility with existing laws, regulations, and public policies.

1.6.3 The NED Plan

A plan that reasonably maximizes net national economic development benefits, consistent with the Federal objective, is to be formulated. This plan is to be identified as the national economic development plan.

1.6.4 Other Alternative Plans

(a) Other alternative plans should be formulated to adequately explore opportunities to address other Federal, State, local, and international concerns not fully addressed by the NED plan.

(b) The number and variety of alternative plans should be governed by—

(1) The problems and opportunities associated with the water and related land resources in the study area;

(2) The overall resource capabilities of the study area;

(3) The available alternative measures; and

(4) Preferences of and conflicts among State and local entities and different segments of the public.

(c) When institutional barriers would prevent implementation of an economically attractive plan, alternative plans which include removal of those barriers should be presented where such plans are implement able.

Section Vll — Accounts

1.7.1 General.

(a) Four accounts are established to facilitate evaluation and display of the effects of alternative plans. These accounts are: national economic development (NED), environmental quality (EQ), regional economic development (RED), and other social effects (OSE). These four accounts encompass all significant effects of a plan on the human environment as required by the National Environmental Policy Act of 1969 (NEPA) (42 U.S.C. 4321 *et seq.*). They also encompass social well-being as required by Section 122 of the Flood Control Act of 1970 (Pub. L. 91-611, 84 Stat. 1823). The EQ account shows effects on ecological, cultural, and aesthetic attributes of significant natural and cultural resources that cannot be measured in monetary terms. The OSE account shows urban and community impacts and effects on life, health and safety. The NED account shows effects on the national economy. The RED account shows the regional incidence of NED effects, income transfers, and employment effects.

(b) The NED account is the only required account. Other information that is required by law or that will have a material bearing on the decisionmaking process should be included in the other accounts (EQ, RED, and OSE) or in some other appropriate format used to organize information on effects.

(c) The same effect may be shown only once within a given account except that the OSE account may show the incidence of an effect from more than one point of view. Beyond this exception, claiming the same benefit, cost, change in a resource attribute, or effect more than once in a given account would constitute double counting.

(d) Relationships between short-term use of the human environment and the maintenance and enhancement of long-term productivity should be displayed. Any irreversible or irretrievable commitments of resources should be displayed.

(e) Effects on the values and attributes of ground water and instream flow should be displayed.

(f) Effects of an alternative plan in the displays are the differences between the forecasted conditions with the plan and forecasted conditions without the plan.

(g) Effects in the NED account are to be expressed in monetary units. EQ effects are to be expressed in appropriate numeric units or non-numeric terms. RED and OSE effects are to be expressed in monetary units, other numeric units, or non-numeric terms.

(h) Monetary values are to be expressed in average annual equivalents by appropriate discounting and annualizing techniques using the applicable discount rate.

1.7.2 National Economic Development Account.

(a) *General.*

(1) The NED account describes that part of the NEPA human environment, as defined in 40 CFR 1508.14, that identifies beneficial and adverse effects on the economy.

(2) Beneficial effects in the NED account are increases in the economic value of the national output of goods and services from a plan; the value of output resulting from external economies caused by a plan; and the value associated with the use of otherwise unemployed or under-employed labor resources.

(3) Adverse effects in the NED account are the opportunity costs of resources used in implementing a plan. These adverse effects include: Implementation outlays, associated costs, and other direct costs.

(4) Procedures which should be used for evaluating NED effects are in Chapter ll of these Guidelines.

(i) When an alternative procedure provides a more accurate estimate of a benefit, the alternative estimate may also be shown if the procedure is documented.

(ii) Steps in a procedure may be abbreviated by reducing the extent of the analysis and amount of data collected where greater accuracy or detail is clearly not justified by the cost of the plan components being analyzed. The steps abbreviated and the reason for abbreviation should be documented.

(iii) Proposals for additions to or changes in the procedures in Chapter ll may be made when an agency head determines that the new technique will improve plan formulation and evaluation. These proposals are to be submitted to the Water Resources Council for review and approval for inclusion in Chapter ll. Procedures which represent changes in established policy are to be referred to the Cabinet Council on Natural Resources and Environment for its consideration.

(b) *Goods and services*: General measurement standard. The general measurement standard of the value of goods and services is defined as the willingness of users to pay for each increment of output from a plan. Such a value would be obtained if the "seller" of the output were able to apply a variable unit price and charge each user an individual price to capture the full value of the output to the user. Since it is not possible in most instances for the planner to measure the actual demand situation, four alternative techniques can be used to obtain an estimate of the total value of the output of a plan: Willingness to pay based on actual or simulated market price; change in net income; cost of the most likely alternative; and administratively established values.

(1) *Actual or simulated market price*. If the additional output from a plan is too small to have a significant effect on price, actual or simulated market price will closely approximate the total value of the output and may be used to estimate willingness to pay. If the additional output is expected to have a significant effect on market price and if the price cannot be estimated for each increment of the change in output, a price midway between the price expected with and without the plan may be used to estimate the total value.

(2) *Change in net income*. The value of the change in output of intermediate goods and services from a plan is measured by their total value as inputs to producers. The total value of intermediate goods or services to producers is properly measured as the net income received by producers with a plan compared to net income received without a plan. Net income is defined as the market value of producers' outputs less the market value of producers' inputs exclusive of the cost of the intermediate goods or services from a plan. Increased net income from reduced cost of maintaining a given level of output is considered a benefit since released resources will be available for production of other goods and services.

(3) *Cost of the most likely alternative*. The cost of the most likely alternative may be used to estimate NED benefits for a particular output if non-Federal entities are likely to provide a similar output in the absence of any of the alternative plans under consideration and if NED benefits cannot be estimated from market price or change in net income. This assumes, of course, that society would in fact undertake the alternative means. Estimates of benefit should be based on the cost of the most likely alternative only if there is evidence that the alternative would be implemented. In determining the most likely alternative, the planner should give adequate consideration to nonstructural and demand management measures as well as structural measures.

(4) *Administratively established values*. Administratively established values are proxy values for specific goods and services cooperatively established by the water resources agencies. An example of administratively established values is the range of unit-day values for recreation.

(c) *Goods and services: Categories*. The NED account includes goods and services in the following categories:

(1) Municipal and industrial (M&I) water supply

(2) Agricultural floodwater, erosion and sedimentation reduction

(3) Agricultural drainage

(4) Agricultural irrigation

(5) Urban flood damage reduction

(6) Power (hydropower)

(7) Transportation (inland navigation)

(8) Transportation (deep draft navigation)

(9) Recreation

(10) Commercial fishing

(11) Other categories of benefits for which procedures are documented in the planning report and which are in accordance with the general measurement standards in paragraph (b) of this section.

(d) *Other direct benefits*. The other direct benefits in the NED benefit evaluation are the incidental direct effects of a project that increase economic efficiency and are not otherwise accounted for in the evaluation of the plan or project. They are incidental to the purposes for which the water resources plan is being formulated. They include incidental increases in output of goods and services and incidental reductions in production costs. For example, a project planned only for flood damage reduction and hydropower purposes might reduce downstream water treatment costs; this reduction in costs would be shown as another direct benefit in the NED account.

(e) *Use of otherwise unemployed or underemployed labor resources.*

(1) The opportunity cost of employing otherwise unemployed and underemployed workers is equal to their earnings under the without plan conditions

(2) Conceptually, the effects of the use of unemployed or underemployed labor resources should be treated as an adjustment to the adverse effects of a plan on national economic development. Since this approach leads to difficulties in cost allocation and cost sharing calculations, the effects from the use of such labor resources are to be treated as an addition to the benefits resulting from a plan.

(3) Beneficial effects from the use of unemployed or underemployed labor resources are limited to labor employed on site in the construction or installation of a plan. This limitation reflects identification and measurement problems and the requirement that national projections are to be based on a full employment economy.

(4) If the planning region has substantial and persistent unemployment and these labor resources will be employed or more effectively employed in installation of the plan, the net additional payments to the unemployed and underemployed labor resources are defined as a benefit.

(f) *Adverse NED effects: Measurement standards.*

(1) In evaluating NED costs, resource use is broadly defined to include all aspects of the economic value of the resource. This broad definition requires consideration of the direct private and public uses that producers and consumers are currently making of available resources or are expected to make of them in the future.

(2) If market prices reflect the full economic value of a resource to society, they are to be used to determine NED costs. If market prices do not reflect these values, then an estimate of the other direct costs should be included in the NED costs.

(3) NED costs may reflect allowance for the salvage value of land, equipment, and facilities that would have value at the end of the period of analysis.

(g) *NED cost categories*. For convenience of measurement and analysis, NED costs should be classified as implementation outlays, associated costs and other direct costs.

(1) *Implementation outlays*. These are the financial outlays (including operation, maintenance and replacement costs) incurred by the responsible Federal entity and by other Federal or non-Federal entities for implementation of the plan in accordance with sound management principles. These costs do not include transfer payments such as replacement housing assistance payments as specified in 42 U.S.C. 4623 and 4624.

(2) *Associated costs*. These are the costs in addition to implementation outlays for measures needed to achieve the benefits claimed during the period of analysis. For example, associated costs would include the cost of irrigation water supply laterals if they are not accounted for in the benefit estimate.

(3) *Other direct costs*. These are the costs of resources directly required for a project or plan, but for which no implementation outlays are made. These costs are uncompensated, unmitigated NED losses caused by the installation, operation, maintenance, or replacement of project or plan measures. Examples of other direct costs include increased downstream flood damages caused by channel modifications, dikes, or the drainage of wetlands, increased water supply treatment costs caused by irrigation return flows, and displaced public recreation.

1.7.3 Environmental Quality Account.

(a) *General*

(1) The EQ account is a means of displaying and integrating into water resources planning that information on the effects of alternative plans on significant EQ resources and attributes of the NEPA human environment, as defined in 40 CFR 1507.14, that is essential to a reasoned choice among alternative plans. Significant means likely to have a material bearing on the decisionmaking process.

(2) Beneficial effects in the EQ account are favorable changes in the ecological, aesthetic, and cultural attributes of natural and cultural resources.

(3) Adverse effects in the EQ account are unfavorable changes in the ecological, aesthetic, and cultural attributes of natural and cultural resources.

(4) A suggested procedure which may be used for evaluating effects included in the EQ account appears in Chapter lll of these Guidelines.

(b) *Significant EQ resources and attributes*.

(1) An EQ resource is a natural or cultural form, process, system, or other phenomenon that—

(i) Is related to land, water, atmosphere, plants, animals, or historic or cultural objects.

(ii) Has one or more EQ attributes (ecological, cultural, aesthetic).

(2) EQ attributes are the ecological, cultural, and aesthetic properties of natural and cultural resources that sustain and enrich human life.

(i) Ecological attributes are components of the environment and the interactions among all its living (including people) and nonliving components that directly or indirectly sustain dynamic, diverse, viable ecosystems. In this category are functional and structural aspects that require special consideration because of their unusual characteristics.

(ii) Cultural attributes are evidence of past and present habitation that can be used to reconstruct or preserve human lifeways. Included in this category are structures, sites, artifacts, environments, and other relevant information, and the physical contexts in which these occur.

(iii) Aesthetic attributes are perceptual stimuli that provide diverse and pleasant surroundings for human enjoyment and appreciation. Included in this category are sights, sounds, scents, tastes, and tactile impressions and the interactions of these sensations, of natural and cultural resources.

(3) Significant EQ resources and attributes should be identified based on institutional, public, and technical recognition.

(c) *Significant effects.*

(1) An effect on an EQ resource occurs whenever estimates of future with- and without-plan conditions of the resource are different.

(2) An effect may be described in terms of duration, frequency, location, magnitude, and other characteristics, such as reversibility, retrievability. and the relationships to long-term productivity, where their description is relevant and useful to decisionmaking.

(3) The significance of an effect may be established based on institutional, public, and technical recognition.

(d) *Summary.* There should be an overall summary of significant beneficial and adverse effects on EQ resources.

1.7.4 Regional Economic Development Account.

(a) *General*

(1) The RED account registers changes in the distribution of regional economic activity that result from each alternative plan. Two measures of the effects of the plan on regional economies are used in the account: Regional income and regional employment

(2) The regions used for RED analysis are those regions with in which the plan will have particularly significant income and employment effects. Effects of a plan not occurring in the significantly affected regions are to be placed in a ”rest of nation" category.

(3) Effects that cannot be satisfactorily quantified or described with available methods, data, and information or that will not have a material bearing on the decisionmaking process may be excluded from the RED account.

(b) *Positive effects on regional economic development.*

(i) *Regional income.* The positive effects of a plan on a region's income are equal to the sum of the NED benefits that accrue to that region, plus transfers of income to the region from outside the region.

(ii) Regional incidence of NED benefits. Because of the definition of region used for the RED account, all or almost all of the NED benefits for the plan will accrue to that region, plus transfers of income to the region from outside the region.

(ii) Transfers. Income transfers to a region as a result of a plan include income from: Implementation outlays, transfers of basic economic activity, indirect effects, and induced effects. In each case income transfers refer to increases in net income within the region rather than to increases in total expenditure.

(A) Income from implementation outlays is that portion of project outlays that becomes net income in the regional economy, exclusive of NED benefits from use of otherwise unemployed or underemployed labor resources.

(B) Income from transfers of basic economic activity is net income from economic activity that locates in the region as a direct result of differences between the with- and without-plan conditions.

(C) Income from indirect effects is regional net income resulting from expansion in the production of inputs to industries supplying increased final products and regional exports.

(D) Income from induced effects is regional net income resulting from changes in consumption expenditures generated by increases in personal income.

(2) *Regional employment.*

(i) The positive effects of a plan on regional employment are directly parallel to the positive effects on regional income, so that analysis of regional employment effects should be organized in the same categories using the same conceptual bases as the analysis of positive regional income effects. Regional employment associated with each of the regional income categories should be calculated and listed accordingly.

(ii) To the extent practical, planning reports should provide reasonable estimates of the composition of increased employment according to relevant service, trade, and industrial sectors,

including a separate estimate for agriculture. The nature of the employment increase to each sector should be classified as to the level of skill required—unskilled, semiskilled, and highly skilled.

(c) *Negative effects on regional economic development.*

(1) Regional income. The negative effects of a plan on a region's net income are equal to the sum of the NED costs of the plan that are borne by the region, plus transfers of income from the region to the rest of the Nation.

(i) Regional incidence of NED costs. The NED costs of a plan that are borne by a region should be organized in the same categories used in the cost section of the NED account. Information from the cost allocation and cost sharing analysis undertaken as a part of the planning process will be needed to estimate these direct expenditures.

(ii) Transfers. Income transfers from the region include net income losses from plan-induced shifts of economic activity from the region to the rest of the Nation and losses in existing transfer payments, plus any impacts that may affect the region as a result of NED costs or transfers from the region.

(2) Regional employment.

(i) The negative effects of a plan on regional employment should be organized and analyzed using the same categories and conceptual bases used for negative regional income effects (paragraph (c)(1) of this section).

(ii) The incidence of negative regional employment effects should be shown in a manner similar to that required for the positive regional employment effects.

(d) *Relationship between RED and NED effects*. Income information in the RED account should be organized in the same categories as the NED effects. The relationship between the affected regional economies and the national economy should be recognized. Since the NED account registers all effects on the national economy**,** any differences between the regional and national economic effects of a plan take the form of transfers from the rest of Nation. The effects of these transfers should be listed in a "rest of Nation" category. The effects in the rest of Nation category are equal to the difference between the RED effects and NED effects of a plan. This rest of nation category should be displayed in the RED account together with the RED and NED effects.

1.7.5 Other Social Effects Account.

(a) *General.*

(1) The OSE account is a means of displaying and integrating into water resource planning information on alternative plan effects from perspectives that are not reflected in the other three accounts. The categories of effects in the OSE account include the following: Urban and community impacts; life, health, and safety factors; displacement; long-term productivity; and energy requirements and energy conservation.

(2) Effects may be evaluated in terms of their impacts on the separate regions and communities affected.

(3) Effects on income, employment, and population distribution, fiscal condition, energy requirements, and energy conservation may be reported on a positive or negative basis. Effects on life, health, and safety may be reported as either beneficial or adverse. Other effects may be reported on either a positive negative basis or a beneficial adverse basis.

(4) Effects that cannot be satisfactorily quantified or described with available methods, data, and information or that will not have a material bearing on the decisionmaking process may be excluded from the OSE account.

(b) *Urban and community impacts.*

(1) A formal treatment of urban related impacts is not required for implementation studies. However, types and locations of significant impacts, broken down by salient population groups and geographic areas, may be reported in the OSE account.

(2) The principal types of urban and community impacts are—

(i) Income distribution;

(ii) Employment distribution, especially the share to minorities;

(iii) Population distribution and composition;

(iv) The fiscal condition of the State and local governments; and

(v) The quality of community life.

(c) *Life, health, and safety*. Effects in this category include such items as risk of flood, drought, or other disaster affecting the security of life, health, and safety; potential loss of life, property, and essential public services due to structural failure; and other environmental effects such as changes in air or water quality not reported in the NED and EQ accounts.

(d) *Displacement.* Effects in this category include the displacement of people, businesses, and farms.

(e) *Long-term productivity*. Effects in this category include maintenance and enhancement of the

productivity of resources, such as agricultural land, for use by future generations.

Section VIII—Displays

1.8.1 General.

(a) Displays are graphs, tables, drawings, photographs, summary statements, and other graphics in a format that facilitates the analysis and comparison of alternative plans. Concise, understandable displays are helpful during the planning process and provide documentation in compliance with NEPA.

(b) Displays should facilitate the evaluation and comparison of alternative plans necessary to make the following determination:

(1) The effectiveness of given plans in solving the problems and taking advantage of the opportunities identified in the planning process.

(2) What must be given up in monetary and non monetary terms to enjoy the benefits of the various alternative plans.

(3) The differences among alternative plans.

1.8.2 Content and Format.

The content and format of the displays should be determined by the planning agency according to the following guidance:

(a) Existing and forecasted resource conditions without any of the alternative plans and the problems and opportunities related to the planning setting should be reported.

Table 1.8.2.—Effects of the Recommended Plan on Natural and Cultural Resources

Types of resources	Authorities	Measurement of effects[1]
Air Quality.....	Clean Air Act, as amended (42 U.S.C. 1857h-7 *et seq.*).	Enter area in square miles where State air quality classifications would change for each affected classification.
Areas of particular concern within the costal zone.	Costal Zone Management Act of 1972, as amended (16 U.S.C. 1451 *et seq.*)	Enter gains and losses in appropriate units.

.Table 1.8.2.—Effects of the Recommended Plan on Natural and Cultural Resources

Types of Resources	Authorities	Measurement of effects[1]
Endangered and threatened species	Endangered Species Act of 1973, as amended (16 U.S.C. 1531 *et seq.*).	(Enter list of species affected and area of each critical habitat type gained and lost in acres.)
Fish and Wildlife habitat	Fish and Wildlife Coordination Act (16 U.S.C. 661 *et seq.*)	(Enter area of each habitat type gained and lost, in acres.)
Floodplains.....	Executive Order 11988, Floodplain Management.	(Enter area gained and lost, in acres.)
Historic and Cultural properties	National Historic Preservation Act of 1966, as amended (16 U.S.C. 470 et seq.).	(Enter number and type of National Register [listed or eligible] properties affected.)
Prime and Unique farmland	CEQ Memorandum of August 1, 1980: Analysis of Impacts on Prime or Unique Agricultural lands in implementing the National Environmental Policy Act.	(Enter area of each farmland type gained and lost, in acres.)
Water quality.....	Clean Water Act of 1977, as amended (42 U.S.C. 1857h-7 *et seq.*).	(Enter length in miles of water course, and area in acres for water bodies, where state water quality classifications would change for each classification.)
Wetlands.....	Executive Order 11990, Protection of Wetlands: Clean Water Act of 1977, as amended (42 U.S.C. 1857h-7 *et seq.*).	Enter area of each wetland type gained and lost, in acres.)
Wild and Scenic Rivers	Wild and Scenic Rivers Act, as amended (16 U.S.C. 1271 *et seq.*).	(Enter length of each river type gained and lost, in miles.)

[1] If a type of resource is not present in the planning area, enter "Not present in planning area." If a type of resource is not affected, enter "No effect."

(b) Displays regarding reasonable alternatives, including those required by NEPA, should include the following items:

(1) Measures in each plan.

(2) Effects in the NED account.

(3) Other effects, when shown in either the EQ, RED, and OSE accounts, or in some other appropriate format.

(c) For the recommended plan, an aggregate display of effects on natural and cultural resources, in the format of Table 1.8.2, should be included.

(d) A matrix should be included which shows existing or planned Federal and non-Federal projects or facilities having significant economic, environmental, or physical interactions with the recommended plan together with a brief narrative description of these interactions.

(e) Alternative actions that were considered but were not developed into plans should be described briefly. The descriptions should include the measures and effects and the reasons for not proceeding further.

Section IX — Cost Allocation

1.9.1 General.

(a) The need for cost allocation stems from pricing and cost-sharing policies that vary among purposes. Cost allocation is the process of apportioning total project financial costs among purposes served by a plan.

(b) Financial costs are implementation outlays, transfer payments such as replacement housing assistance payments as specified in 42 U.S.C. 4623 and 4624, and the market value of contributions in kind, e.g., lands.

(c) Financial costs are to be allocated to those purposes for which the plan is formulated. These purposes do not include other direct benefits (see Section 1.7.2(d)) and use of otherwise unemployed or underemployed labor resources. All purposes are to be treated comparably

1.9.2 Definitions.

(a) Separable cost for each purpose in a plan is the reduction in financial cost that would result if that purpose were excluded from the plan. This reduction in cost includes—

(1) The financial cost of measures serving only the excluded purpose; and

(2) Reductions in the financial cost of measures serving multiple purposes. In some cases removal of a purpose would result in selection of different measures to address the remaining purposes.

(b) Joint cost is the total financial cost for a plan minus the sum of separable financial costs for all purposes.

(c) Alternative cost for each purpose is the financial cost of achieving the same or equivalent benefits with a single-purpose plan.

(d) Remaining benefit for each purpose is the amount, if any, by which the NED benefit or, when appropriate, the alternative financial cost exceeds the separable financial cost for that purpose. The use of alternative cost is appropriate when alternative financial cost for the purpose is less than the NED benefit, or when there are project purposes that do not address the NED objective.

1.9.3 Cost Allocation Standard.

Costs allocated to each purpose are the sum of the separable cost for the purpose and a share of joint cost as specified below:

(a) Joint cost may be allocated among purposes in proportion to remaining benefits.

(b) Joint cost may be allocated in proportion to the use of facilities, provided that the sum of allocated joint cost and separable cost for any purpose does not exceed the lesser of the benefit or the alternative cost for that purpose.

1.9.4 Allocation of Constituent Cost.

Cost-sharing policies for some purposes pertain to cost constituents such as construction costs, and operation and maintenance costs. Costs for each cost constituent specified in the relevant cost sharing policy should be allocated among purposes.

Section X — Plan Selection

1.10.1 General.

The planning process leads to the identification of alternative plans that could be recommended or selected. The culmination of the planning process is the selection of the recommended plan or the decision to take no action. The selection should be based on a comparison of the effects of alternative plans. (See Section 1.6.2—Alternative Plans, Formulation.)

1.10.2 Selection.

(a) The alternative plan with the greatest net economic benefit consistent with protecting the Nation's environment (the NED plan) is to be selected unless the Secretary of a department or head of an independent agency grants an exception when there is some overriding reason for selecting another plan, based upon other Federal, State, local, and international concerns.

(b) The alternative of taking no action, i.e., selecting none of the alternative plans, should be fully considered.

(c) Plan selection is made by the agency - decisionmaker for Federal and Federally-assisted plans. Agency officials and State and local sponsors may recommend selection of a plan other than the NED plan. The agency decisionmaker (the Secretary of a department or the head of an independent agency) will determine whether the reasons for selecting a plan other than the NED plan merit the granting of an exception.

(d) The basis for selection of the recommended plan should be fully reported, including considerations used in the selection process.

(e) Plans should not be recommended for Federal development if they would physically or economically preclude non-Federal plans that would likely be undertaken in the absence of the Federal plan and that would more effectively contribute to the Federal objective when comparably evaluated.

Supplement I

Risk and uncertainty—Sensitivity analysis

Uncertainty and variability are inherent in water resources planning. For example, there is uncertainty in projecting such factors as stream flows, population growth, and the demand for water. Therefore, the consideration of risk and uncertainty is important in water resources planning.

This supplement provides guidance for the evaluation of risk and uncertainty in the formulation of water resources management and development plans.

S1 Concepts.

(a) *Risk.* Situations of risk are conventionally defined as those in which the potential outcomes can be described in reasonably well known probability distributions. For example, if it is known that a river will flood to a specific level on the average of once in 20 years, a situation of risk, rather than uncertainty, exists.

(b) *Uncertainty*. In situations of uncertainty, potential outcomes cannot be described in objectively known probability distributions. Uncertainty is characteristic of many aspects of water resources planning. Because there are no known probability distributions to describe uncertain outcomes, uncertainty is substantially more difficult to analyze than risk.

(c) *Sources of risk and uncertainty*. (1) Risk and uncertainty arise from measurement errors and from the underlying variability of complex natural, social, and economic situations. If the analyst is uncertain because the data are imperfect or the analytical tools crude, the plan is subject to measurement errors. Improved data and refined analytic techniques will obviously help minimize measurement errors.

(2) Some future demographic, economic, hydrologic, and meteorological events are essentially unpredictable because they are subject to random influences. The question for the analyst is whether the randomness can be described by some probability distribution. If there is an historical data base that is applicable to the future, distributions can be described or approximated by objective techniques.

(3) If there is no such historical data base, the probability distribution of random future events can be described subjectively, based upon the best available insight and judgment.

(d) *Degrees of risk and uncertainty*. The degree of risk and uncertainty generally differs among various aspects of a project. It also differs over time, because benefits from a particular purpose or costs in a particular category may be relatively certain during one time period and uncertain during another. Finally, the degree of uncertainty differs at different stages of the analysis—for example, between rough screening and final detailed design, when more precise analytic methods can be applied.

(e) *Attitudes*. The attitudes of decisionmakers toward risk and uncertainty will govern the final selection of projects and of adjustments in design to accommodate risk and uncertainty. In principle, the government can be neutral toward risk and uncertainty, but the private sector may not be. These differences in attitudes should be taken into account in estimating the potential success of projects.

S2 Application.

(a) *The role of the planner*. (1) The planner's primary role in dealing with risk and uncertainty is to characterize to the extent possible the different degrees of risk and uncertainty and to describe them clearly so that decisions can be based on the best

available information. The planner should also suggest adjustments in design to reflect various attitudes of decisionmakers toward risk and uncertainty. If the planner can identify in qualitative terms the uncertainty inherent in important design, economic, and environmental variables, these judgments can be transformed into or assigned subjective probability distributions. A formal model characterizing the relationship of these and other relevant variables may be used to transform such distributions to exhibit the uncertainty in the final outcome, which again is represented by a probability distribution.

(2) At all stages of the planning process, the planning can incorporate any changes in project features that, as a result of information gained at that stage, could lead to a reduction in risk and uncertainty at a cost consistent with improvement in project performance.

(b) Some risk and uncertainty are assumed in nearly every aspect of a water resources project. Some types of risk and uncertainty are dealt with in terms of national planning parameters—for example, ranges of population projections and other principal economic and demographic variables. Other types of risk and uncertainty are dealt with in terms of project or regional estimates and forecasts. When projects are related to other projects and programs in their risk and uncertainty aspects (e.g., interrelated hydrologic systems), reasonable attempts should be made to see that the same analyses and presumed probability distributions are used for all of them.

(c) The risk and uncertainty aspects of projects are likely to be seen and analyzed differently as planning proceeds from rough screening to detailed project proposals. An effort should be made, therefore, to relate the techniques used in characterizing and dealing with risk and uncertainty to the stage of the planning process.

(d) The resources available for analyzing aspects of risk and uncertainty should be allocated to those assessments that appear to be the most important in their effects on project and program design. Rather than assuming in advance that one or another variable is a more important source of risk and uncertainty, the planner should make a thorough effort to determine which variables will be most useful in dealing with measurement errors and natural sources of risk and uncertainty.

(e) The aspects of project evaluation that can be characterized by a probability distribution based on reasonably firm data, such as hydrologic risk, can be treated by standard methods of risk evaluation developed by Federal agencies and others.

(f) Most risk and uncertainty aspects of projects cannot be characterized by probability distributions based on well established empirical data. A first step in dealing with this problem is to describe why the project or specific aspects of it are uncertain, as well as the time periods in which different degrees of uncertainty are likely. A range of reasonably likely outcomes can then be described by using sensitivity analysis—the technique of varying assumptions as to alternative economic, demographic, environmental, and other factors, and examining the effects of these varying assumptions on outcomes of benefits and costs. In some cases and in some stages of planning, this approach, when accompanied by a careful description of the dimensions of uncertainty, will be sufficient. It can be accompanied by descriptions of design adjustments representing various attitudes toward uncertainty.

(g) It may be appropriate in some cases to characterize the range of outcomes with a set of subjective probability estimates, but the project report should make clear that the numerical estimates are subjective. Moreover, subjective probability distributions should be chosen and justified case by case, and some description of the impact on design of other subjective distributions should be given. Design alternatives reflecting various attitudes toward uncertainty may be suggested.

(h) Utility functions may be used in conjunction with assessments of uncertainty to explore design adaptations reflecting specific preferences. Public preferences, if well known, may be used to illustrate to decisionmakers what the best design would be, given the uncertainties and preferences in a particular case. If public preferences are not well known, justification could be given for the selection of various utility functions, which can be used only to illustrate the effects on design of various preferences.

(i) At each level of analysis, the planner should take into account the differences in risk and uncertainty among project purposes and costs, among various time periods, and among different stages of planning.

(j) Adjustments to risk and uncertainty in project evaluation can be characterized as general or specific. General adjustments include the addition of a premium rate to the interest, overestimation of costs, underestimation of benefits, and limitations on the period of analysis. Such general adjustments are usually inappropriate for public investment decisions because they tend to obscure the different degrees of uncertainty in different aspects of projects and programs. Specific adjustments—including explicit assessments of different degrees of risk and uncertainty in specific aspects of a project or program and specific adjustments to them—are preferable. Additional information on methods of dealing with risk and uncertainty can be found in Section 1.4.13(d) of Chapter 1.

(k) One guide to the use of the techniques discussed here is displayed in Table S-2. In general, more complex techniques are appropriate as planning proceeds from the initial development and the screening of alternatives to the analysis and presentation of the final set of alternative plans. For example, sensitivity analysis—testing the sensitivity of the outcome of project evaluation to variation in the magnitude of key parameters—may be most useful and applicable in the early stages of planning, when the concern is to understand single factors or relatively general multiple-factor relationships. Multiple-factor sensitivity analysis, in which the joint effects or correlations among underlying parameters are studied in greater depth, may be more appropriate in the detailed analytic stage than in the screening stage.

(l) Similarly, analysis of risk and uncertainty based on objective or subjective probability distributions would be more appropriate in the detailed analytic stage than in the early screening stage. Although hydrologic and economic probabilities may be used in the screening stage, the full use of independent and joint probability distributions, possibly developed from computer simulation methods, to describe expected values and variances, is more appropriately reserved for the detailed stage.

Table S-2 — Planning Task and Approaches to Risk and Uncertainty

	Planning Tasks		
	Screening alternatives	Detailed analysis of projects	Final presentation of alternatives
Sensitivity analysis.....	X	X	X
Use of objective and subjective probability distributions.....		X	X
Illustrative application of public preferences and decision-makers' attitudes.....		X	X

(m) Although decisionmakers' attitudes and decision rules can be used to give perspective on alternative designs throughout the planning process, they are more appropriate at the stage of displaying alternative designs.

(n) The differences among the underlying degrees of risk and uncertainty, the design adaptations to them, and the preferences of decisionmakers should be kept clear throughout the analysis. The first two depend primarily on technical expertise; the last is the set of preferences based on various attitudes toward risk and uncertainty.

S3 Report and display.

The assessment of risk and uncertainty in project evaluation should be reported and displayed in a manner that makes clear to the decisionmaker the types and degrees of risk and uncertainty believed to characterize the benefits and costs of the alternative plans considered.

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Chapter II—National Economic Development (NED) Procedures

Section I—General

2.1.1 Purpose.

(a) The NED procedures in this chapter are for Federal administrative purposes and do not create any substantive or procedural rights in private parties.

(b) This chapter provides procedures for evaluating NED effects of alternative plans.

(1) When an alternative procedure provides a more accurate estimate of a benefit, the alternative estimate may also be shown if the procedure is documented.

(2) Steps in a procedure may be abbreviated by reducing the extent of the analysis and amount of data collected where greater accuracy or detail is clearly not justified by the cost of the plan components being analyzed. The steps abbreviated and the reason for abbreviation should be documented.

(3) Proposals for additions to or changes in the procedures in Chapter ll may be made when an agency head determines that the new technique will improve plan formulation and evaluation. These proposals are to be submitted to the Water Resources Council for review and approval for inclusion in Chapter ll. Procedures that represent changes in established policy are to be referred to the Cabinet Council on Natural Resources and Environment for its consideration.

2.1.2 Conceptual basis.

Compare project NED benefits and costs at a common point in time. Present the following information:

(a) *Installation period*--the number of years required for installation of the plan. If staged installation is proposed over an extended period of time, the installation period is the time needed to install the first phase.

(b) *Installation expenditures*--the dollar expenses expected to be incurred during each year of the Installation period.

(c) *Period of analysis*--the time horizon for project benefits, deferred installation costs, and operation, maintenance, and replacement (OM&R) costs. Use the same period of analysis for all alternative plans. The period of analysis is the time required for implementation plus the lesser of (1) the period of time over which any alternative plan would have significant beneficial or adverse effects; or (2) a period not to exceed 100 years. Appropriate consideration should be given to environmental factors that may extend beyond the period of analysis.

(d) *Benefit stream*--the pattern of expected benefits over the period of analysis.

(e) *OM&R costs*--the expected costs over the period of analysis for operation, maintenance, and replacement necessary to maintain the benefit stream and agreed-upon levels of mitigation of losses to fish and wildlife habitats.

(f) *Discount rate*--the rate established annually for use in evaluating Federal water projects.

2.1.3 Calculating net NED benefits in average annual equivalent terms.

Net NED benefits of the plan are calculated in average annual equivalent terms. To perform this calculation, discount the benefit stream, deferred installation costs, and OM&R costs to the beginning of the period of analysis using the applicable project discount rate. Installation expenditures are brought forward to the end of the period of installation by charging compound interest at the project discount rate from the date the costs are incurred. Use the project discount rate to convert the present worth values to average annual equivalent terms.

2.1.4 Definitions.

Terms used in these guidelines are defined as follows:

Agricultural drainage. (1) The rehabilitation and improvement of existing drainage systems or the construction of new drainage systems to improve the efficiency of cropland, woodland, and grassland by lowering the water level in areas in which agricultural production has been limited by naturally high water tables, normal precipitation or normal tide action, seepage, or excess irrigation water.

(2) Drainage projects include measures for surface drainage, the removal of excess water above the surface of the ground; and subsurface drainage, the removal of excess water below the surface of the ground. Drainage projects involve watershed or sub watershed areas composed in whole or in part of lands drained or proposed to be drained. The boundaries of the water problem area may consist of artificial barriers that prevent the inflow of water originating outside of the area.

Agricultural flood damage reduction. The adjustment in land use and the structural and nonstructural measures designed to reduce hazard from floodwater, erosion, and/or sediment. Reduction of sediment on agricultural land will normally serve the single purpose of flood damage reduction. Reduction of sediment in channels or reservoirs may serve other purposes as well (i.e., navigation, water supply, power) and should be identified accordingly. To differentiate flood damage reduction from agricultural and rural drainage of flatlands, flood damage reduction is defined as any measure undertaken to reduce or prevent damages from surface water caused by abnormally high direct precipitation, stream overflow. or floods caused or aggravated by wind or tidal effects.

Flood. A general and temporary condition of partial or complete inundation of normally dry land from the overflow of inland or tidal waters, or the unusual and rapid accumulation or runoff of surface waters from any source.

Nonstructural measure. A modification in public policy, an alteration in management practice, a regulatory change, or a modification in pricing policy that provides a complete or partial alternative for addressing water resources problems and opportunities.

Separable feature. A project element that can be implemented or constructed independently of other features and that does not depend on other features for its structural (or other) viability.

Urban drainage. (1) The adjustment in land use and storm sewer systems designed to collect runoff from rainfall or snow melt in an urban area and convey it to natural water courses or to previously modified natural waterways. Storm sewer systems include storm drains, inlets, manholes, pipes, culverts, conduits, sewers, and sewer appurtenances, onsite storage and detention basins, curbs and gutters, and other small drainageways that remove or help to manage runoff in urban areas.

(2) Storm sewer systems are designed to solve urban storm drainage problems. which are typified by excessive accumulations of runoff in depressions, overland sheet flow resulting from rapid snowmelt or rainfall, and excessive accumulation of water in one or more components of a storm sewer system.

Urban flood damage reduction. The adjustment in land use and the structural and nonstructural measures designed to reduce flood damages in urban areas from overflow or backwater due to major storms and snowmelt. The measures include structural and other engineering modifications to natural streams or to previously modified natural waterways. Urban flood damage reduction is accomplished by modifying temporary conditions of inundation of normally dry land from the overflow of rivers and streams or from abnormally high coastal waters due to severe storms.

Water supply. The water that becomes available for consumptive and nonconsumptive uses either through increases in quantity or improvements in quality of existing supplies.

Section II—NED Benefit Evaluation Procedures—Municipal and Industrial (M&I) Water Supply

2.2.1 Introduction.

This section provides procedures for the evaluation of NED benefits of municipal and industrial (M&I) water supply features of water resource plans. The procedures presented apply to both structural and nonstructural elements of such plans.

2.2.2 Conceptual basis.

(a) The conceptual basis for evaluating the benefits from municipal and industrial water supply is society's willingness to pay for the increase in the value of goods and services attributable to the water supply. Where the price of water reflects its marginal cost, use that price to calculate willingness to pay for additional water supply. In the absence of such direct measures of marginal willingness to pay, the benefits from a water supply plan are measured instead by the resource cost of the alternative most likely to be implemented in the absence of that plan.

(b) The benefits from nonstructural measures are also computed by using the cost of the most likely alternative. However, the net benefits of certain nonstructural measures that alter water use cannot be measured effectively by the alternative cost procedure for the following reasons: (1) Structural measures and many nonstructural measures (except those that alter use) result in similar plan outputs, whereas use-altering measures (e.g., revised rate structures) may change levels of output; and (2) use-altering measures may have fewer direct resource costs than measures based on higher levels of output. Because of this lack of comparability, the benefit from such use-altering nonstructural measures should not be based on the cost of the most likely alternative. Attempts to measure the benefits of use-altering nonstructural measures on the basis of

willingness to pay are encouraged, although the display of such benefits is not required.

2.2.3 Planning setting.

(a) *Without-project condition.* The without-project condition is the most likely condition expected to exist in the future in the absence of the proposed water supply plan, including any known changes in law or public policy. Several specific elements are included in the without-project condition:

(1) *Existing water supplies*. Existing water supplies are included in the without-project condition. Make adjustments to account for anticipated changes in water supply availability because of the age of facilities or changed environmental requirements.

(2) *Institutional arrangements*. Existing and expected future water systems and water monument contracts and operating criteria are considered part of the without-project condition unless revision of these systems, contracts, or criteria is one of the alternative plans being studied.

(3) *Additional water supplies*. The without-project condition includes water supplies that are under construction or authorized and likely to be constructed during the forecast period.

(4) *Probability of water supply*. Include calculation and specification of the probability of delivery for each source of water supply in the analysis.

(5) *Water quality*. Water use is based on both the quantity and the quality of water supply. Different uses may require different qualities as well as quantities of water. Supplies also vary according to quality and quantity. Because water quality is a critical factor in water supply, it should be specified in any consideration or presentation related to water quantity. The degree of detail used to describe water quality should be suitable to permit differentiation among water sectors or available water supply sources.

(6) *Nonstructural measures and conservation*. The without-project condition includes the effects of implementing all reasonably expected nonstructural and conservation measures. These measures include:

(1) Reducing the level and/or altering the time pattern of demand by metering, leak detection and repair, rate structure changes, regulations on use (e.g., plumbing codes), education programs, drought contingency planning;

(2) Modifying management of existing water development and supplies by recycling, reuse, and pressure reduction; and

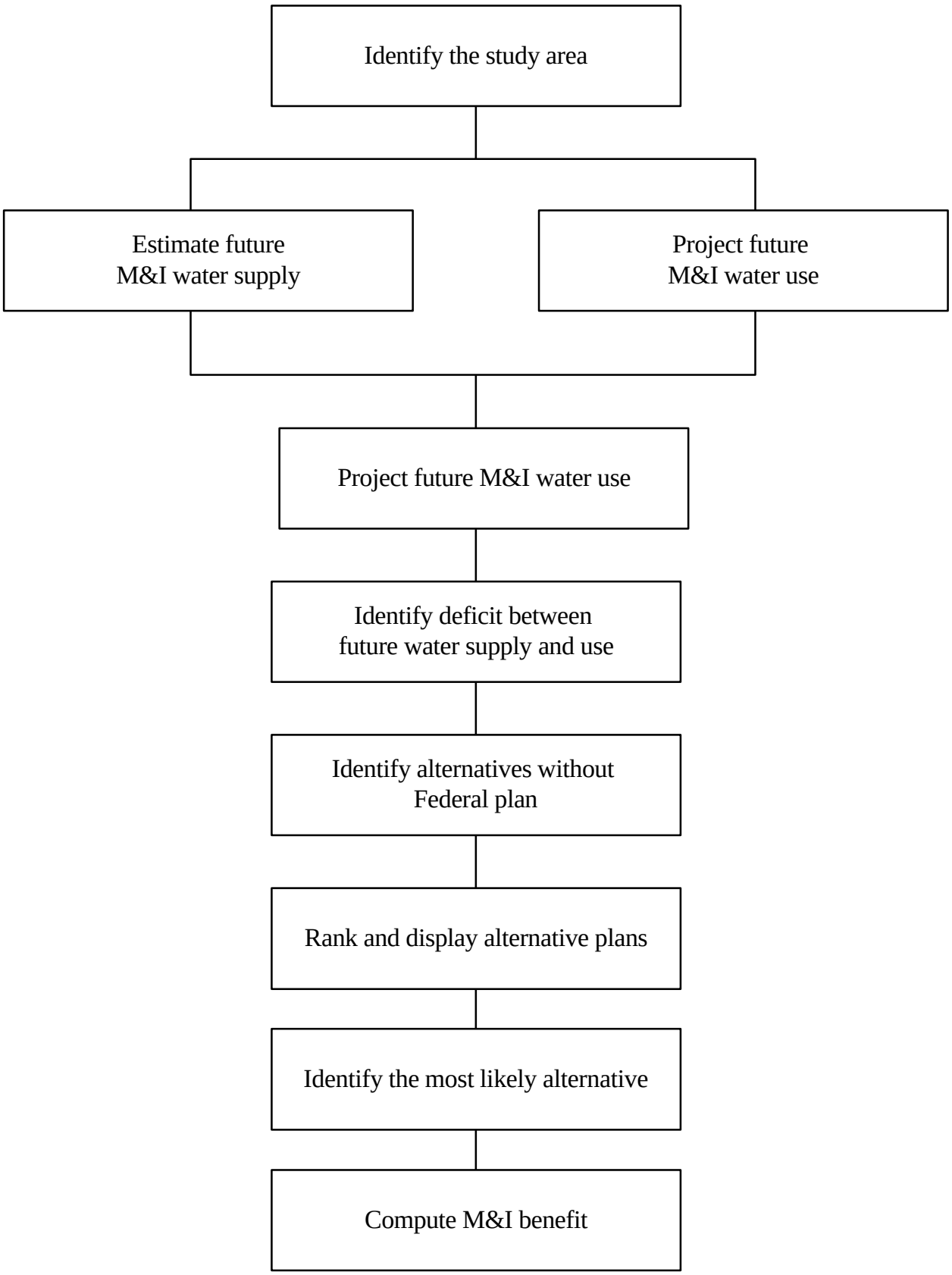
(3) Increasing upstream watershed management and conjunctive use of ground and surface waters.

(b) *With-project condition*. The with-project condition is the most likely condition expected to exist in the future with the Federal water supply plan under consideration. The six elements and assumptions addressed in the without-project condition should also be addressed in the with-project condition. Nonstructural water supply measures may be used alone or in Combination with structural measures. If the proposed measures are already in the process of implementation, they are part of the without-project condition.

2.2.4 Evaluation procedure: General.

Follow the steps described in 2.2.5 through 2.2.13 to estimate NED benefits that would accrue to one or more alternative plans for providing an M&I water supply (see Figure 2.2.4). The level of effort expended on each step depends on the nature of the proposed development, the state of the art for accurately refining the estimate, and the sensitivity of project formulation and justification to the estimate.

Figure 2.2.4 -- Flowchart of M&I Benefit Evaluation Procedures



2.2.5 Evaluation procedure: Identify study area.

The study area is the area within which significant project impacts will accrue from the use of M&I water supplies, including areas that will receive direct benefits and/or incur costs from the provision of M&I water supply.

2.2.6 Evaluation procedure: Estimate future M&I water supplies.

Prepare an analysis of all sources of supply expected to be available to the M&I water user. Data may be obtained from various sources, including water utilities, State and local planning agencies, and State water resources agencies. This analysis should be by time period and include existing water supplies. institutional arrangements, additional water supplies, probability of water supply, and water quality.

2.2.7 Evaluation procedure: Project future M&I water use.

Project future water use by sector in consideration of seasonal variation. Base projections on an analysis of those factors that may determine variables in levels of water use.

(a) *Sector analysis*. Project future water use for the same time periods as for the supply projections for each of the following sectors: Residential (include indoor use and outdoor uses such as lawn irrigation and car washing); commercial (include water use for retail and wholesale trade, offices, hospitals, schools, medical laboratories. restaurants, service industries, etc.); industrial (include all water used by manufacturing industries as an input in the production process); and additional uses (include public service use--for example, fire protection--and unaccounted-for losses).

(b) *Analysis by time of use*. Identify seasonal variations in use for each of the above sectors and maximum day use for the system for each season.

(c) *Related factors analysis*. (1) Identify the determinants of demand for each sector. Use such determinants as price of water and sewer service; income; number and type of housing units and population per unit; industrial mix; and level of economic activity. Explain the variable projection of these factors as well as the extent to which they influence projection of water use in various sectors.

(2) Determine the relationship expected to exist between future levels of water use and the relevant determinants of water demand. Develop and use a forecast or forecasts of future levels of the determinants to project alternative future water use by sector and explain the choice of the particular forecast used.

(d) *Aggregation of projections*. Aggregate separate projections for each sector to a single projection by time period. (This should not, however, be viewed as a deterrent to meeting the needs of each sector by separate alternatives.)

2.2.8 Evaluation procedure: Identify the deficit between future water supplies and use.

Compare projected water use with future water supplies to determine whether any deficits exist in the study area. Make an analysis of the intensity, frequency, and duration of the expected deficits. Address deficits in three basic options: (a) reduce protected water use by implementation of nonstructural or conservation measures that are not part of the without-project condition; (b) increase and/or more efficiently use water supplies through structural measures; and (c) accept and plan to manage water supply shortages. Plans generally are formulated to include some or all of these options.

2.2.9 Evaluation procedure: Identify alternative without Federal plan.

Identify alternative plans that are likely to be implemented by communities and/or industries in the absence of any Federal alternative. Test various alternatives to the Federal plans for acceptability, effectiveness, efficiency, and completeness as defined in Chapter I, section 6.2(c). These plans should be identified through analysis of the total water resources of the region, allowing for present and expected competing uses.

(a) Consideration of alternative plans is not limited to those that would completely eliminate the projected gap between supply and demand. Plans that do not completely satisfy water supply objectives should also be considered. Include in such plans measures to minimize and allocate shortages when they occur (drought management measures). Balance the increased risk of occasional shortages against the savings from lesser investments that would increase the probability of occasional shortages. The costs of shortages include the costs of implementing drought management measures and the costs of related public health and safety measures.

(b) Alternative plans need not be based on the development of a single source of supply at one time. They may consist of the development of a single source or the conjunctive development of several sources with increments phased to match anticipated growth in water use.

(c) If institutional obstacles to implementation are noted, the plan should still be considered if the barriers are substantially within the power of the affected water users to correct. Inched a detailed description of the institutional obstacles. with a discussion of the basis for any conclusion that the obstacles cannot be overcome.

2.2.10 Evaluation procedure: Rank and display the alternative plans based on least cost analysis.

(a) Rank all of the alternatives in order from the highest cost alternative to the lowest. Calculate the annualized costs of the alternatives on the basis of the service (depreciable) life of the facility or the paroled of analysis. whichever is less.

(b) Calculate costs of the alternatives on the following basis: (1) Annualize all costs charged to the alternative on the basis of the Federal discount rate; (2) no costs for taxes or insurance should be charged to the alternative; and (3) all other assumptions and procedures used in calculating the costs of the alternatives, including external diseconomies, should be parallel to those employed in calculating the costs for the proposed Federal project.

2.2.11 Evaluation procedure: Identify the most likely alternative

Begin identification of the most likely alternative with the least costly. If an alternative with a lesser cost is passed over for a more expansive one, present the justification for not selecting the lower cost plan.

2.2.12 Evaluation procedure: Compute M&I water supply annualized benefits

(a) Annualized benefits of the Federal water supply plan are equal to the annualized cost of the most likely alternative. When applicable, the evaluation should reflect differences in treatment, distribution, and other costs compared to the most likely alternative.

(b) The alternative cost of providing a water supply for smaller communities (population of 10,000 or less) may be extremely expensive on a per capita basis because these communities lack the efficiencies of large-scale development. If such communities are not able to afford an alternative water supply comparable to the Federal water supply plan as identified in the procedure described above. that alternative should not be used as the basis for evaluating the benefits of the Federal water supply plan. In this case, the benefit may be considered equal to the cost of the separable M&I facilities plus an appropriate share of the remaining joint cost of the project. Provide documentation of the without-project condition.

2.2.13 Evaluation procedure: Problems in the application.

(a) Two major problems exist in the application of this procedure. The first is identification of the value of conservation and other nonstructural measures. Examples of evaluation of conservation strategies. pricing methods, and drought management measures are available in technical publications.

(b) A second major problem will arise over the desegregation of water use by sectors. Some communities do not collect water use data by sectors. Where the system is fully metered, such data can be obtained by coding customer accounts and accumulating data on use for at least one year. Water use by unmetered customers may be estimated by extrapolating experience with similar metered systems, recognizing that unmetered customers face a price of zero. Verify that data and/or forecasts obtained from all sources are reliable and reasonable.

2.2.14 Report and display procedures.

Tables 2.2.14-1, 2, and 3 are suggested presentations for reports that include municipal and industrial water supplies. Tables 1 and 2 summarize by time period (and season, if applicable) the projected use by sector. projected supply by source, and the difference between the two for average day and maximum day, respectively. Table 3 shows the costs of alternative plans and the quantity supplied under each alternative by time period (and season, if applicable).

Table 2.2.14-1—M&I Water Supplies—Without Project Condition—Average Day Use and Capacity

Projected average day water use [1]	Time period [2]			
	P_1	P_2	P_3	P_N
Residential (mgd)	.....	.....	.....	.....
Commercial (mgd).....	.....	.....	.....	.....
Industrial (mgd)	.....	.....	.....	.....
Additional (includes public services and unaccounted for losses) (mgd).....	.....	.....	.....	.....
Total	.....	.....	.....	.....
Average day water supply capacity without a plan:	.....	.....	.....	.....
Source 1 (mgd)	.....	.....	.....	.....
Source 2 (mgd)	.....	.....	.....	.....

Table 2.2.14-1. M&I Water Supplies -Without Project Condition-Average Day Use and Capacity (continued)

Projected average day water use [1]	Time period [2] P_1	P_2	P_3	P_N
Source 3 (mgd)	.....	.....	.....	.....
Source X (mgd).....	.....	.....	.....	.....
Total	.....	.....	.....	.....
Difference between projected average day water use and supply without a plan (mgd)	.....	.....	.....	.....

[1] Include effects of nonstructural and conservative measures.
[2] Show by time period and season where there are seasonal variations, e.g.

P_1

W S S F

Table 2.2.14-2. M&I Water Supplies -Without Project Condition- Maximum Day Use and Capacity

Projected average day water use [1]	Time period [2] P_1	P_2	P_3	P_N
Residential (mgd)	.....	.....	.....	.....
Commercial (mgd).....	.....	.....	.....	.....
Industrial (mgd)	.....	.....	.....	.....
Additional (includes public services and unaccounted for losses) (mgd).....	.....	.....	.....	.....
Total	.....	.....	.....	.....
Average day water supply capacity without a plan:				
Source 1 (mgd)	.....	.....	.....	.....
Source 2 (mgd)	.....	.....	.....	.....
Source 3 (mgd)	.....	.....	.....	.....
Source X (mgd)	.....	.....	.....	.....
Total				
Difference between projected average day water use and supply without a plan (mgd)	.....	.....	.....	.....

[1] Include effects of nonstructural and conservative measures.
[2] Show by time period and season where there are seasonal variations, e.g.

P_1

W S S F

Table 2.2.14-3—M&I Water Supply Alternatives
[Period of analysis, price level, discount rate]

Alternatives	Annualized cost (in thousands of dollars)	Quantity supplied (mgd) time period[1] P_1	P_2	P_3	P_N
Most likely alternative	.....	.....	.....	.....	.....
Recommended plan	.....	.....	.....	.....	.....
Other plans	.....	.....	.....	.....	.....

[1] Show by time period and season where there are seasonal variations

Section III—NED Benefit Evaluation Procedures: Agriculture

2.3.1 Introduction.

This section provides procedures for the evaluation of agricultural benefits from water resources plans. The benefits attributable to flood damage reduction, drainage, irrigation, erosion control and sediment reduction should be evaluated separately to the extent practical.

2.3.2 Conceptual basis.

(a)*NED Benefits*. The NED benefits are the value of increases in the agricultural output of the Nation and the cost savings in maintaining a given level of output. The benefits include reductions in production costs and in associated costs; reduction in damage costs from floods, erosion, sedimentation, inadequate drainage, or inadequate water supply; the value of increased production of crops; and the economic efficiency of increasing the production of crops in the project area.

(b) *Basic and Other Crops*. (1) Basic crops (rice, cotton, corn, soybeans, wheat, milo, barley, oats, hay, and pasture) are crops that are grown throughout the United States in quantities such that no water resources project would affect the price and thus cause transfers of crop production from one area to another. The production of basic crops is limited primarily by the availability of suitable land.

(2) On a national basis, production of crops other than basic crops is seldom limited by the availability of suitable land. Rather, production is generally limited by market demand, risk aversion, and supply factors other than suitable land. Thus, production from increased acreage of crops other than basic crops in the project area would be offset by a decrease in production elsewhere. In some parts of the Nation analysis of local conditions may indicate that the production of other crops is limited by the availability of suitable land. (Suitable land is land on which crops can be grown profitably under prevailing

market conditions.) In this case, crops other than basic crops listed above may also be treated as basic crops when measuring intensification benefits by farm budget analysis. (See Section 2.3.5(d) to determine when other crops may be treated as basic crops.)

(c) *Benefit categories*. Agricultural benefits are divided into two mutually exclusive categories, depending on whether there is a change in cropping pattern:

(1) damage reduction benefits, that is, benefits that accrue on lands where there is no change in cropping pattern between the with- and without-project conditions; and

(2) intensification benefits, that is, benefits that accrue on lands where there is a change in cropping pattern. There is also a subcategory of intensification benefits called efficiency benefits, which accrue from reduced costs of production.

(d) *Measurement of NED benefits*. (1) Damage reduction benefits. Damage reduction benefits are the increases in net income due to the plan, as measured by farm budget analysis. These income increases may result from increased crop yields and decreased production costs.

(2) Intensification benefits. Intensification benefits are measured either by farm budget analysis or by land value analysis. Intensification benefits from increased acreage of basic crops and other crops that are constrained by the availability of suitable land in the WRC assessment subarea (ASA) are measured as the net value of the increased production. Intensification benefits from increased acreage of other crops (except for acreage of crops to be treated as basic crops because they are land constrained) result when there are production cost savings. These production cost savings are called efficiency benefits and are measured as the difference between production costs in the project area and production costs on land elsewhere in the ASA.

(i) Farm budget analysis. On land where the intensification benefit is solely from increased acreage of basic crops (and crops to be treated as basic crops), benefits are measured as the change in net income (see Section 2.3.5(d) through (g)). On land where the intensification benefit is from increased acreage of other crops, use the efficiency procedure found in section 2.3.5(h).

(ii) Land value analysis. Intensification benefits alternatively may be measured as the difference in the value of benefiting lands with and without the plan. The market value of a parcel of land reflects the capitalized value of the expected net income that can be derived from the land. Therefore, the difference in market value of two parcels of land that are identical except for the provision of improved water conditions reflects the present value of the additional net income (i.e., the intensification benefit) that can be attributed to improved water management or supply. (See Section 2.3.5(i).)

2.3.3 Evaluation Components.

Evaluation of the impact of water management practices or control measures should consider the following components:

(a) *Cropping patterns*. Project the most probable cropping patterns expected to exist with and without the project. If project measures are designed to reduce damage or associated cost problems without changing cropping patterns, project the current cropping pattern into the future for both with- and without-project conditions.

(b) *Prices*. Use normalized crop prices issued by the Department of Agriculture to evaluate NED agricultural benefits; adjustments may be made to reflect quality changes caused by floods or drought. For crops not covered above, statewide average prices over the three previous years may be used.

(c) *Production costs*. (i) Analyze production costs that can be expected to vary between the with- and without-project conditions. These may include the costs of equipment ownership and operation; production materials; labor and management; system operation, maintenance, and replacement (OM&R); and interest payments. If costs associated with project measures (e.g., on-farm drainage or water distribution costs) are included in the project cost analysis, exclude them from production costs.

(ii) Value purchased inputs at current market prices. Compute interest at the project discount rate. Value all labor, whether operator, family, or hired, at prevailing farm labor rates. Estimate management cost on the basis of the type of farming operation. The estimate normally is expected to be at least six percent of the variable production cost (the cost of equipment ownership and operation, production materials and labor, but excluding the cost of land and added capital improvements).

(d) *Crop yields*. Project current yields with average management in the project area to selected time periods. Adjust future yields to reflect relevant physical changes (e.g., erosion, drainage, water supply, and floodwater runoff) in soil and water management conditions. Increases In yields due to future improvements in technology may be included in the evaluation when realization of these benefits is dependent upon installation of the project. The costs associated with these improvements in technology should be accounted for in the analysis. Changes in yields, both with and without the project, should be

projected consistently with the water management and production practices accounted for in the production cost analysis.

(e) *Livestock production*. In geographically isolated areas increased livestock production may depend on installation of the water resources project. Where this can be demonstrated, net income from additional livestock production may be included as a benefit. The test for dependency is whether the livestock feeds can economically be transported into or out of the area. Benefits cannot exceed the delivered cost of the livestock feed if it were purchased for use in the project area. Such purchase prices would automatically include the costs of transporting the feeds into the area.

(f) *Comparable lands*. Comparable lands are lands that have climate, aspect, slope, soil properties and water conditions similar to those of a given category of lands benefiting from a plan.

(g) *Land values*. The market value of lands method for estimating the economic benefits of alternative plans requires the involvement of qualified land appraisers with local experience. Use of this procedure is appropriate when:

(1) lands to be affected by the proposed alternative plan are comparable to lands elsewhere which can be appraised;

(2) water resources conditions on comparable lands are similar to those to be provided on lands affected by an alternative plan, and they can be identified and evaluated;

(3) current market data are used to determine the value of capital improvements and other factors when making adjustments for these factors on comparable lands; and

(4) the estimated value of lands to be affected by the plan is not changed by speculation that Federal action is anticipated.

2.3.4 Planning setting.

(a) The without-project condition, including conservation measures, is the condition expected to exist in the absence of an alternative plan.

(b) The with-project condition is the condition expected to exist with each alternative plan under consideration.

(c) Agricultural income and production costs should be determined for various conditions or levels of land and water quantity and/or quality use. (Include other resources associated with changes in land and water quantity and/or quality.) The level of use to be evaluated initially is the without-plan condition. Other levels of use to be evaluated will depend on the number of alternative plans selected for analysis.

2.3.5 Evaluation procedure: Crops

This procedure is for the evaluation of benefits to crop production that would accrue from an alternative plan. Steps in this procedure are summarized in Figure 2.3.5.

(a) *Step 1. Identify land use and cropping patterns with and without a plan*. This information is generally developed for segments of the plan area with significantly different characteristics. Collect appropriate data about the current and historic cropping patterns and yields in the project area. When appropriate, collect similar data on other areas with comparable soils to determine conditions expected with alternative plans. Analyze trends and expected changes for without-project conditions. Project future cropping patterns and yields under without-plan conditions. Include the effects of conservation and structural and nonstructural measures expected under existing programs. Project future cropping patterns and yields for each alternative plan. For analytical purposes, separate land in the project area into two categories: lands on which the cropping pattern is the same with and without the plan; and lands on which there would be a change in cropping pattern with the plan. To estimate crop production benefits on lands where there would be a change in cropping pattern, go to Step 3. To estimate crop production benefits on lands where there would not be a change in cropping pattern, proceed with Step 2.

(b) *Step 2. Determine damage reduction benefit.* For land on which the cropping pattern would not change, determine the change in net income with and without a plan. This is the damage reduction benefit. Income increases may result from increased crop yields and decreased production costs. They are measured as reduced damage to crops from excessive soil moisture, water inundation, drought and erosion, and reduced costs associated with using water and land resources for the production of crops.

(i) Estimate reduced damage to crops from excessive soil moisture on the basis of the change in frequency and duration of excessive soil moisture. Estimate reduced damage to crops from water inundation on the basis of the change in frequency, depth, and duration of inundation. Estimate reduced damage from drought on the basis of the change in frequency and duration of inadequate soil moisture during the growing season. Estimate reduced damage from erosion on the basis of the change in land voiding from gully and stream bank erosion and on the basis of the change in productivity losses from floodplain scour, sheet erosion, over bank deposition, and swamping.

(ii) Estimate reduced costs associated with using water and land resources for the production of crops on the basis of the changes in the costs of equipment ownership and operation; production materials; labor and management; and system operation, maintenance, and replacement.

(iii) Use farm budget analysis to measure changes in net income from reduced damage to crops and reduced costs of production.

(c) *Step 3. Select evaluation method for estimating intensification benefits*. For land on which the cropping pattern would change, select either farm budget analysis or land value analysis as the method for measuring intensification benefits. If land value analysis is selected, go to Step 9. If farm budget analysis is selected, proceed with Step 4.

(d) *Step 4. Determine whether other crops are to be treated as basic crops*. If the change in cropping pattern increases the acreage in production of other crops and if it is believed that the production of other crops is constrained by the availability of suitable land, the following test may be applied to determine whether these crops should be treated as basic crops in the benefit analysis. If the test is not applied, go to Step 8.

(1) Select a representative sample of farm operations on lands comparable to lands benefiting from the project under with-project conditions.

(i) For each farm operation determine the respective acreage of basic and other crops.

(ii) Use these data to compute the proportion of other crop acreage to total crop acreage for each farm.

(iii) Use farm budget analysis to identify the top 25 percent of farms in the representative sample in terms of expected net income per acre.

(iv) The average of the proportions of other crop acreage to total crop acreage for the top 25 percent of farm operations is defined as the 'optimal proportion.' The optimal proportion for these farm operations will reflect risk and uncertainty, returns to management, and prevailing market conditions.

(2) If it can be demonstrated through standard statistical tests that the optimal proportion is not statistically different from the proportion computed as the average of individual farm operation proportions for the complete sample, then the production of other crops can be considered to be constrained by the availability of suitable land in the ASA and, therefore, treated as basic crops. Otherwise it can be inferred that production of other crops is not land constrained in the ASA. When the crops are not land constrained, go to Step 8; otherwise, proceed with Step 5.

(e) *Step 5. Determine limit on acreage of other crops that may be treated as basic crop acreage.* If the production of the other crops is found to be constrained by availability of suitable land in the ASA, then multiply the acreage of comparable land in the project area by the optimal proportion found in Step 4(1). This is the maximum acreage of other crops that may be analyzed using the steps that apply to basic crops (Steps 6 and 7). To analyze benefits for any acreage of other crops in excess of this maximum acreage, go to Step 8.

(f) *Step 6. Project net value of agricultural production with and without the plan*. Use information from farm budget analysis to estimate the net value of agricultural production under without-plan conditions. Estimate the net value of agricultural production associated with each of the alternative plans. Account for variable costs related to production. Include non-project OM&R costs and associated costs for each alternative plan.

(g) *Step 7. Compute intensification benefits for acreage of basic crops and other crops to be treated as basic crops*. Compute intensification benefits as the change in net income between the without-project condition and conditions with an alternative plan. Express these intensification benefits in average annual equivalent terms. This completes the analysis of benefits for lands with increased acreage of basic crops and other crops that are to be treated as basic crops.

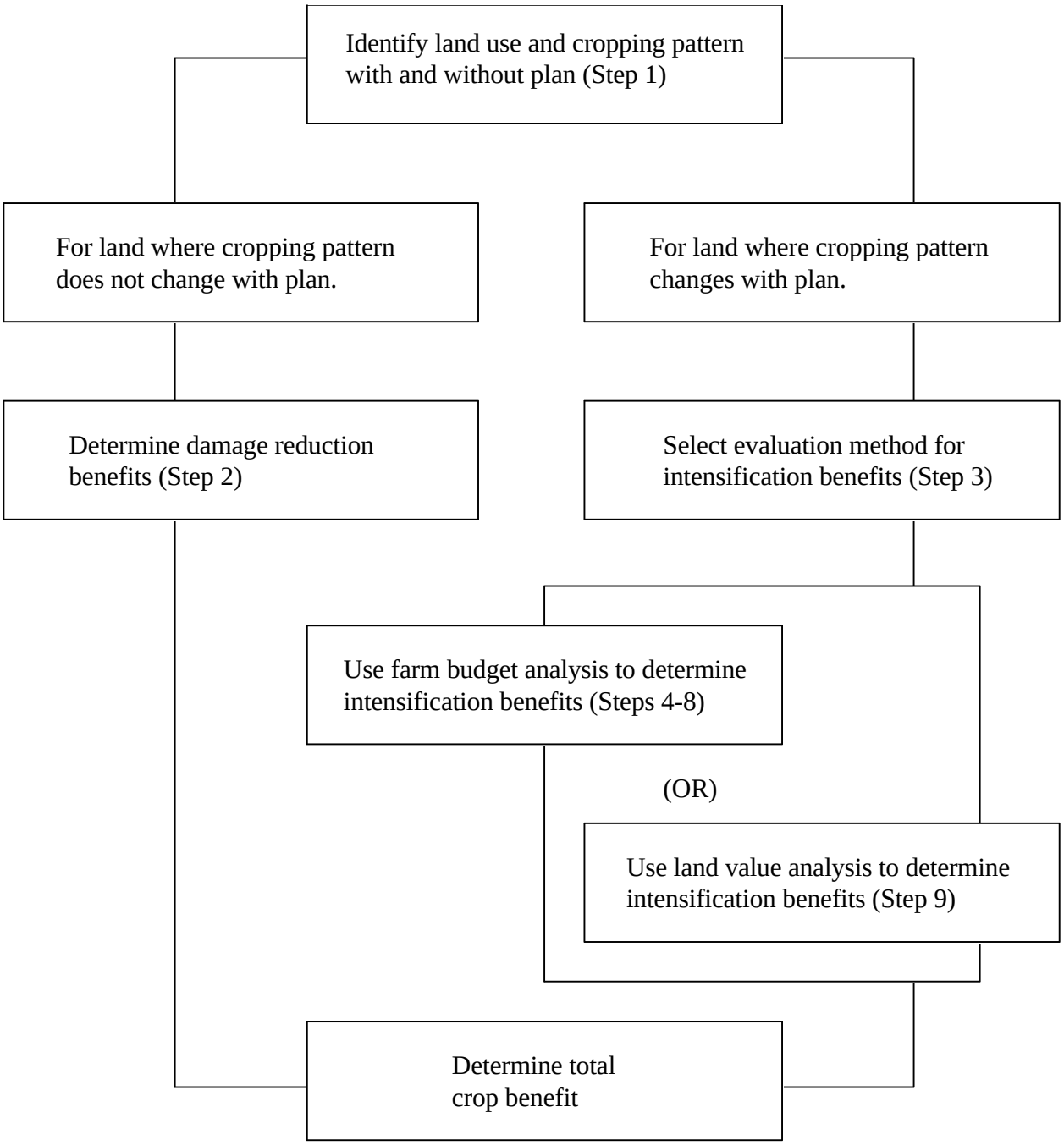
(h) *Step 8. Determine efficiency benefits*. Compute efficiency benefits for acreage producing other crops not treated as basic crops as the sum of:

(1) the difference between the cost of producing the crops in the project area and the cost of producing them on other lands in the ASA; and

(2) the net income that would accrue from production of an appropriate mix of basic crops on those other lands. Express this efficiency benefit in average annual equivalent terms.

(i) *Step 9. Land value analysis*. When estimating intensification benefits on the basis of land value analysis, base appraisals on market values, not on capitalized income values.

Figure 2.3.5 -- Flowchart of Agricultural Benefit Evaluation Procedure: Crops



(1) Obtain appraisals of the current market value of lands that would benefit from the plan. These lands should be divided into various categories where values differ significantly.

(2) Obtain and appropriately adjust appraisals of non-project lands in the ASA that are comparable to lands in each category of project lands and that have water conditions comparable to those that would result from each alternative plan.

(i) Adjust the value of these comparable lands for facilities and other capital improvements that are not present on project lands. For example, subtract the current market value of improvements such as investments in orchards.

(ii) In the case of irrigation projects, add to the appraised value of comparable lands the present value of water costs incurred by the operator. These water costs include both payments to outside suppliers and the cost of self-supplied water Use the project discount rate to calculate the present value of these costs.

(iii) control for other factors that may affect the value of land, such as kinds of crops grown, distance-to urban areas, availability of transportation facilities, presence of utilities, zoning regulations, and special property tax rates. This control may be achieved by using totally comparable parcels of lands; by collecting a sample large enough so that differences will be averaged out; or by a statistical means such as regression analysis.

(3) Subtract the value in (1) from the adjusted value in (2). This is the intensification benefit.

(4) Annualize the intensification benefit found in (3) at the project discount rate.

2.3.6 Evaluation procedure: Damage reduction for other agricultural properties and associated agricultural enterprises.

(a) *Determine damage reduction for other agricultural properties*. The term 'other agricultural properties' includes physical improvements associated with various farm enterprises and the agricultural community. Measure benefits to such properties as reduction in damages in the future with the project compared to without the project. The following discussion identifies key analytical steps in the evaluation. Benefits accrue through alterations in water conditions or in altering the susceptibility of the property to damage (e.g., flood-proofing).

(i) Inventory damageable improvements. Identify the location, type, number, and value of other agricultural properties within the area that are subject to damage. This information is most easily obtained through interviews of farmers and field reconnaissance.

(ii) Determine damage to improvements. Gather historical data on damages to other agricultural properties, such as equipment, improvements, and agricultural enterprises.

(iii) Determine average annual equivalent damage to improvements. Use appropriate data to determine average annual equivalent damage to improvements. For example, use depth-damage relationships for each reach, integrated with hydrologic data, to develop average annual flood damages with and without the plan. Include consideration of the frequency and duration of the damage.

(b) *Determine damage reduction benefits for associated agricultural enterprises*. Associated agricultural enterprises are economic activities that may be affected by changed water supply or water management conditions. Evaluate damages of this type as reduced net income under without-project and with-project conditions. An example of this type of damage is delay in spring planting on flood free lands because of flooding of access roads.

(c) *Calculate average annual equivalent benefits*. The damage reduction benefit is the difference between average annual equivalent damages with and without the plan.

2.3.7 Evaluation procedure: Off-site sediment reduction.

Determine average annual equivalent sediment damages by adding the costs in constant dollars of removing sediment from roads, culverts, channels, etc., over a representative period of time and dividing by the years of record. The difference in damages with and without the project is the benefit. Extending the useful life of an existing reservoir is another type of sediment reduction benefit. Discount the net value of the extension to present values, and amortize it over the project life. The increased cost of providing goods and services (e.g., additional treatment costs for removing sediment from municipal water) can also be used to evaluate damages. Reductions in the costs of sediment removal or water treatment provide the basis for assessing benefits with the plan.

2.3.8 Evaluation procedures: Problems in application.

(a) *Damage reduction benefits*. Damage reduction benefits are measured by farm budget analysis. Proper measurement of such benefits requires accurate estimates of with- and without-plan soil,. water, and land use conditions. Changes in physical conditions take place at different rates and over different time periods. Analysis can be improved by projecting changes in

physical conditions to selected time periods, analyzing net income for the time periods, and converting net income for the time periods to an average annual equivalent value. In farm budget analysis, double counting can be avoided by taking a holistic approach (including all soil, water and land use conditions in a single farm budget analysis).

(b) *Determination of land constraint*. Intensification benefits for other crops are measured either as a change in net income or as an efficiency gain depending on whether there is an adequate supply of suitable land in the region for growing crops other than basic crops (that is, whether production is land constrained). This determination requires a regional (ASA) analysis of comparable lands. In order to make this determination properly, care must be exercised to ensure that lands being evaluated are fully comparable. Care must also be exercised in order to obtain the proper determination of aggregate acreages of basic and other crops for the top 25 percent of the farms. (See Section 2.3.5(d) (1).)

(c) *Benefit attribution*. In flatland watersheds, drainage and flood damage reduction benefits cannot be separated analytically. Therefore, they are arbitrarily allocated on a 50/50 basis. The value of benefits in other categories is determined on the basis of changes in physical conditions with and without the plan. The benefits are assigned according to the following: the proportion of the change in net income attributed to changes in soil moisture, water inundation, drought and erosion; the proportion of land use changes attributed to each of the above; and changes in production costs attributed to each of the above. Except for the problem with drainage and flood damage reduction in flatland watersheds, benefits can be measured independently if proper assumptions are made to avoid double counting. Double counting can be avoided by making sure that total benefits measured independently do not exceed total benefits from a holistic farm budget analysis.

(d) *Residual damages*. In evaluating with-plan conditions, care must be taken to consider residual damages, that is, damages that would still occur with implementation of the plan.

(e) *Land value analysis*. Because proper land value analysis is dependent on accurate appraisals, the appraisals on which this analysis is based Should be performed by qualified land appraisers. Adjustment of appraised values of lands comparable to project lands to account for capital improvements, costs of water supply, and other factors affecting the values requires detailed knowledge of local physical and financial conditions.

2.3.9 Evaluation procedure: Data sources.

(a) *Interviews*. Interviews with farmers and other area residents are important for most of the categories of benefits to be evaluated. Interviews should not be confined to farmers in the project area. Data collected outside the project area serves as a comparative basis for estimating damages and yields in the project area. Use only interview forms approved by the Office of Management and Budget. In the project report, the questionnaire and a summary of responses should be compiled and displayed in such a way as to prevent the disclosure of individual sources.

(b) *Physical specialists*. Agronomists and soil scientists can provide data to establish yield estimates by soil type and the effects on production of soil depletion or sediment deposition.

(c) *Universities and Federal agencies*. Many universities and the Department of Agriculture have developed typical enterprise budgets that can be modified to reflect conditions in the area being studied.

(d) *Land appraisers*. Market values of project lands and comparable lands should be provided by qualified land appraisers.

2.3.10 Report and display procedures.

A clear presentation of the study results will facilitate review. Tables 2.3.10-1 and 2 are suggested presentations.

Table 2.3.10-1 Summary of Crop Benefits
(Farm Budget Analysis Method)

Item	Current Year	Base Year	Year$_a$	Year$_a$	Year$_a$	Year$_a$	Year$_a$	Annualized Value$_b$
Without Plan.....	.....	.....	.....	.....	.....	.....	.....	.....
Acres:.....	.....	.....	.....	.....	.....	.....	.....	.....
basic crops.....	.....	.....	.....	.....	.....	.....	.....	.....
other crops.....	.....	.....	.....	.....	.....	.....	.....	.....
Value of agriculture production....	.....	.....	.....	.....	.....	.....	.....	.....

Table 2.3.10-1 Summary of Crop Benefits - Continued

(Farm Budget Analysis Method)

Item	Current Year	Base Year	Year[a]	Year[a]	Year[a]	Year[a]	Year[a]	Annualized Value[b]
Agricultural production costs.....	.....	.....	.....	.....	.....	.....	.....	.....
With Plan								
Acres:								
basic crops	.....	.....	.....	.....	.....	.....	.....	.....
other crops	.....	.....	.....	.....	.....	.....	.....	.....
Value of agricultural production	.....	.....	.....	.....	.....	.....	.....	.....
Agricultural production costs	.....	.....	.....	.....	.....	.....	.....	.....
NED BENEFITS	.....	.....	.....	.....	.....	.....	.....	.....

[a] Annual value at the given year
[b] Annualized at - - percent discount rate

Table 2.3.10-2 Intensification Benefits

(Land Value Analysis Method)

Item	Current Year	Annualized[a]
With Plan		
Value of agricultural land	.....	.....
With plan		
Value of agricultural land	.....	.....
INTENSIFICATION BENEFIT	.....	.....

[a] Annualized at -- percent discount rate.

Section IV—NED Benefit Evaluation Procedures: Urban Flood Damage

2.4.1 Introduction.

This chapter presents the procedure for measuring the beneficial contributions to national economic development (NED) associated with the urban flood hazard reduction features of water resource plans and projects.

2.4.2 Conceptual basis.

(a) *General*. Benefits from plans for reducing flood hazards accrue primarily through the reduction in actual or potential damages associated with land use.

(b) *Benefit categories*. While there is only one benefit standard, there are three benefit categories, reflecting three different responses to a flood hazard reduction plan.

(1) *Inundation reduction benefit*. If floodplain use is the same with and without the plan, the benefit is the increased net income generated by that use. If an activity is removed from the floodplain, this benefit is realized only to the extent that removal of the activity increases the net income of other activities in the economy.

(2) *Intensification benefit.* If the type of floodplain use is unchanged but the method of operation is modified because of the plan, the benefit is the increased net income generated by the floodplain activity.

(3) *Location benefit*. If an activity is added to the floodplain because of a plan, the benefit is the difference between aggregate net incomes (including economic rent) in the economically affected area with and without the plan.

(c) *Types of flood damage.* Flood damages are classified as physical damages or losses, income losses, and emergency costs. Each activity affected by a flood experiences losses in one or more of these classes.

(1) *Physical damages*. Physical damages include damages to or total loss of buildings or parts of buildings; loss of contents, including furnishings, equipment, decorations, raw materials, materials in process, and completed products; loss of roads, sewers, bridges, power lines, etc.

(2) *Income loss*. Loss of wages or net profits to business over and above physical flood damages usually results from a disruption of normal activities. Estimates of this loss must be derived from specific independent economic data for the interests and properties affected. Prevention of income loss results in a contribution to national economic development only to the extent that such loss cannot be compensated for by postponement of an activity or transfer of the activity to other establishments.

(3) *Emergency costs*. Emergency costs include those expenses resulting from a flood that would not otherwise be incurred, such as the costs of evacuation and reoccupation, flood fighting, and

disaster relief; increased costs of normal operations during the flood; and increased costs of police, fire, or military patrol. Emergency costs should be determined by specific survey or research and should not be estimated by applying arbitrary percentages to the physical damage estimates.

2.4.3 Planning setting.

(a) *General.* The benefit of flood hazard reduction plans is determined by comparison of the with- and without-project conditions.

(b) *Without-project condition*. The without-project condition is the land use and related conditions likely to occur under existing improvements, laws, and policies. There are three significant assumptions inherent in this definition:

(1) *Existing and authorized plans*. Existing flood hazard reduction plans are considered to be in place, with careful consideration given to the actual remaining economic life of existing structures. Flood hazard plans authorized for implementation but not yet constructed are evaluated according to the relative likelihood of actual construction. If there is a high likelihood of construction, the authorized plan is considered to be in place.

(2) *Flood Disaster Protection Act*. The adoption and enforcement of land use regulations pursuant to the Flood Disaster Protection Act of 1973 (Pub. L. 93-234) is assumed.

(i) *Regulation certified or near certification*. If the local land use regulation has been or will be certified, partially waived, or adjusted by the Flood Insurance Administration (FIA) as adequate under 24 CFR 1910.3 (c) and/or (d) and 24 CFR 1910.5, that regulation defines the without-project condition.

(ii) *Regulation not yet certified.* It is assumed that the local jurisdiction will adopt in the near future land use regulations certifiable to FIA under the without-project condition as a datum and under the with-project condition if a residual hazard will remain. This applies to floodplains regulated under 24 CFR 1910.3 (a) and (b); to floodplains regulated by local ordinances independent of FIA; and to floodplains with no flood regulation in effect. For revenue situations, the following two crucial features are included: no future confinement or obstruction of the regulatory floodway; and no future occupancy of the flood fringe unless residences are elevated to or above the 100-year flood level and nonresidences are floodproofed to that level.

(iii) *Application*. It is assumed that floodproofing costs will be incurred if an activity decides to locate in the floodplain.

(3) *Executive Orders*. Compliance with E.O. 11988, *Floodplain Management* and E.O. 11990, *Protection of Wetlands*, is assumed.

(4) *Individual actions*. In addition to the three assumptions stated in paragraphs (b) (1), (2), and (3) of this section, the analyst shall consider the likelihood that individuals will undertake certain flood hazard reduction measures, such as flood proofing, when the cost of such measures is reasonable compared to the costs of potential flood damages.

(c) *With-project condition*. The with-project condition is the most likely condition expected to exist in the future if a specific project is undertaken. There are as many with-project conditions as there are alternative projects.

(1) In projecting a with-project condition, the analyst must be sensitive to the relationship between land use and the characteristics of the flood hazard for the alternative project being analyzed.

(2) The same assumptions underlie the with-project and without-project conditions.

(3) Consideration should be given to both structural and nonstructural alternatives and to alternatives incorporating a mix of structural and nonstructural measures. Nonstructural measures include:

(i) Reducing susceptibility to flood damage by land use regulations, redevelopment and relocation policies, disaster preparedness, flood proofing, flood forecasting and warning systems, floodplain information, floodplain acquisition and easements; and

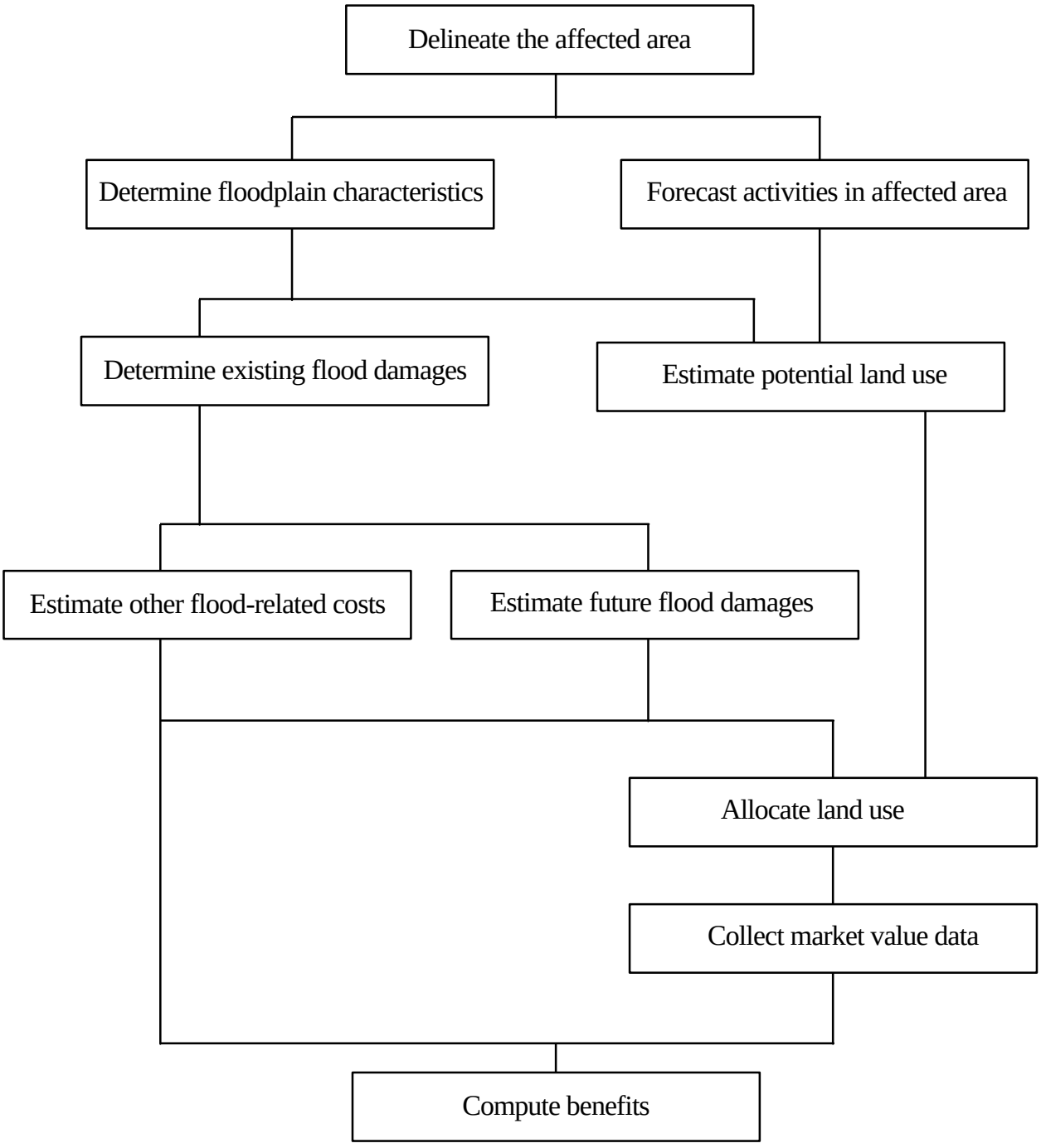
(ii) On-site detention of flood waters by protection of natural storage areas such as wetlands or in manmade areas such as building roofs and parking lots.

(4) Since project alternatives can differ in their timing as well as in their physical characteristics, the optimal timing of projects and of individual project features should be considered in project formulation.

2.4.4 Evaluation procedure: General.

Ten steps are involved in computing benefits (see Figure 2.4.4). The steps are designed primarily to determine land use and to relate use to the flood hazard from a NED perspective. The level of effort expended on each step depends on the nature of the proposed improvement and on the sensitivity of project formulation and justification to further refinement. The first five steps result in a determination of future land use; emphasis is on evaluating the overall reasonableness of local land use plans with respect to (a) OBERS and other larger area data, and (b) recognition of the flood hazard.

Figure 2.4.4—Flowchart of Urban Flood Damage Benefit Evaluation Procedures



2.4.5 Evaluation procedure: Step 1—Delineate affected area.

The area affected by a proposed plan consists of the floodplain plus all other nearby areas likely to serve as alternative sites for any major type of activity that might use the floodplain if it were protected; one example of a major activity-type is commercial. If the potential use of the floodplain includes industrial use within a standard metropolitan statistical area (SMSA), the entire SMSA is the affected area; for residential use, even within an SMSA, a much smaller area may be designated the affected area.

2.4.6 Evaluation procedure: Step 2—Determine floodplain characteristics.

The existing characteristics of the floodplain must be determined before its actual use can be estimated; therefore, undertake an inventory of the floodplain to determine those characteristics that make it attractive or unattractive for the land use demands established in steps 3 and 4, with emphasis on those characteristics that distinguish the floodplain from other portions of the affected area. Use the following categorizations as a guide:

(a) *Inherent characteristics of a floodplain*. Floodplain characteristics may include:

(1) *Flooding*. Describe the flood situation, including a designation of high hazard areas. The description should include characteristics of the flooding, such as depths, velocity, duration, and debris content; area flooded by floods of selected frequencies, including 100-year frequency; historical floods, and, where applicable, larger floods.

(2) *Floodway, natural storage*. Describe and delineate those areas which, if urbanized or structurally protected, would affect natural storage, velocity, or stage, or would affect flood flows elsewhere.

(3) *Natural and beneficial values, including open space, recreation, wildlife, and wetlands*. Many floodplains, particularly those near urban areas, are potential recreation, open space, wetland, or wildlife preserves. The potential of the floodplain for these purposes should be recognized and present

(4) *Transportation*. Floodplains near navigable streams have inherent attractiveness for industries that demand water-oriented transportation. Floodplains also serve as sites for railroads, highways, pipelines, and related facilities that are not susceptible to serious flood damage but have a tendency to attract Industry to the area.

(5) *Other attributes*. Other Inherent attributes of floodplains may include soil fertility, reliability of water supply, waste disposal, and sand, mineral, and gravel deposits.

(b) *Physical characteristics*. Describe pertinent physical characteristics, including slope, soil types, and water table.

(c) *Available services*. Most activities require some or all of the following services: transportation (highway and rail), power, sewerage, water, labor, and access to markets. Indicate the availability of such services in or near the floodplain, including comparisons with similar services available in other portions of the affected area.

(d) *Existing activities*. Include in the inventory of the floodplain a list of existing activity types, the number of acres, and the density, age, and value of structure for each activity-type by flood hazard zone.

2.4.7 Evaluation procedure: Step 3—Project activities in affected area.

Base economic and demographic projections on the most recent available studies and include the following: population, personal income, recreation demand, and manufacturing, employment, and output. Additional projections may be necessary for any given area, depending on the potential uses of the floodplain and the sensitivity of the plan to these projections. Base projections on assessment of trends in larger areas and appropriate data (e.g., OBERS); the relationship of historical data for the affected area to trends projected for larger areas; and consultation with knowledgeable local officials, planners, and others. The basis for the projections should be clearly specified in the report.

2.4.8 Evaluation procedure: Step 4—Estimate potential land use.

Estimate potential land use within the affected area by converting demographic projections to acres. The conversion factors can normally be derived from published secondary sources, from agency studies of similar areas, or from empirical and secondary data available in the affected area. The categories of potential land use need be only as detailed as necessary to reflect the incidence of the flood hazard and to establish the benefits derived from a plan.

2.4.9 Evaluation procedure: Step 5—Project land use.

Allocate land use demand to floodplain and non-floodplain lands for the without-project condition and for each alternative floodplain management plan.

(a) *Basic factors*. Base the allocation on a comparison of the floodplain characteristics, the characteristics sought by potential occupants, and the availability of sought-after characteristics in the non-floodplain portions of the affected area.

(b) *Criteria*. The floodplain should not be used unless it has characteristics that give it a significant economic advantage to the potential user over all other available sites within the affected area. If such advantages exist, determine whether they overcome potential flood losses, potential flood proofing costs, and the costs of other related hazards. Flood losses and costs should be specific to the zone of the floodplain being considered.

2.4.10 Evaluation procedure: Step 6—Determine existing flood damages.

Existing flood damages are the potential average annual dollar damages to activities affected by flooding at the time of the study. Existing damages are those expressed for a given magnitude of flooding or computed in the damage frequency process. No projection is involved. The basis for the determination of existing damages is losses actually sustained in historical floods; therefore, specify the year and month of all significant recorded discharges above zero point of damage and indicate the damages actually sustained by reach or zone and type of property and activity. Historical data are often incomplete; urbanization and other changes will have occurred over the years. Many streams and reaches do not have gaging stations. Therefore, data on historical flood losses should be carefully scrutinized and supplemented by appraisals, use of area depth-damage curves, and an inventory of capital investment within the floodplain. Further, estimates of damages under existing conditions should be computed for floods of magnitude that have not historically occurred. Estimate average annual losses by using standard damage-frequency integration techniques and computer programs that relate hydrologic flood variables such as discharge and stage to damages and to the probability of occurrence of such variables. Annual hydrologic data are normally sufficient for urban drainage estimates. Access flood damages by activity-type and by whether they are borne by the owner or by the public at large.

2.4.11 Evaluation procedure: Step 7—Project future flood damages.

Future flood damages are the dollar damages to economic activities identified in step 3 that might use the floodplain in the future in the absence of a plan. Use this step in combination with step 5 (land use) to determine land use and associated damages for each future with-project and without-project condition. “Future” is any time period after the year in which the study is completed; in order to relate costs ultimately to benefits, however, future damages must be discounted to the base year. Determine future flood damages on the basis of losses sustained both by the floodplain occupant and by others through insurance subsidies, tax deductions for casualty losses, disaster relief, etc.

(a) *Hydrologic changes*. Changes in basin land use may result in major alteration of drainage characteristics, particularly surface runoff; project such hydrologic changes for the planning period. Average future hydrologic conditions should not be used, since they obscure situations in which the level of protection afforded by a project may be significantly different from average conditions by the end of the planning period.

(b) *Economic changes*. Economic changes can be expected to result in a change in the level of future flood losses. A benefit-cost ratio for the existing condition should always be shown. If the ratio is greater than 1:1, the projection of future benefits may be accomplished in abbreviated form unless it would distort the comparison of alternative projects or the cost allocation and cost sharing in multiple purpose projects. In the latter situation, the detail and accuracy of the estimates of flood control benefits should be comparable to the estimates of benefits for other water resources purposes.

(c) *Projection of physical damages*. Base measurement and projection of flood damages on the establishment of actual, observed relationships between damages, flood characteristics, and those indicators used for measurement and projection. These relationships should be modified as appropriate by consideration of constraints that change the historically derived relationship between flood damages and a given indicator. The relationships should be made explicit in the report and their accuracy and representativeness supported, to the extent possible, by empirical evidence. Use three steps in measuring flood damages for a future year: estimate the number and size of physical units; estimate the future value of units; and determine the damage susceptibility of units.

(1) *Physical units*. The first step in measuring flood damages for a future year is to determine from step 2 (2.4.6) the number and size of physical units with potential to use the floodplain by hazard zones for each activity type. Care must be taken to determine whether existing structures will continue to occupy the floodplain over the period of analysis and, if not, the future land use and damage potential of new structures.

(2) *Value per physical unit*. This step involves estimating future unit value. Increases in the value of property in the floodplain may result from the expansion of existing facilities or the construction of new units. The following guidance applying to content value is derived from an empirical study of flood-prone property:

(i) *Existing development*. Use the OBERS regional growth rate for per capita income as the basis for increasing the real value of residential contents in the future.

(ii) *Future development*. Project the value of contents within new residential structures from the year each unit is added.

(iii) *Translation to future flood damages*. Use the projected rate of increase in the value of flood-susceptible household contents as the basis for increasing the future unit flood damage to household contents.

(iv) *Limit*. The value of contents should not exceed 75 percent of the structural value of the residence unless an empirical study proves that a special case exists (e.g., trailer parks), nor should the increase in value of household contents be projected beyond project year 50.

(v) *Commercial and industrial property*. The procedure described for residential contents does not apply to commercial and industrial categories.

(3) *Damage susceptibility*. The third step in measuring future flood damages is to determine the damage susceptibility of units. Once the number of physical units and the value associated with each unit are known, examine possible future changes, if any, in damage susceptibility relationships as a function of the total value of each physical unit and the stream's flood characteristics. such as velocity, depth, duration, volume, debris load, and salinity. Some of the determinants of damage susceptibility are type of activity, vertical development, location within the floodplain, nature of flood proofing, construction material used, and individual response.

(d) *Projection of income losses*. Income losses may be projected to increase on the basis of projected land use. Increases in physical losses should not be used to project income losses.

(e) *Projection of emergency costs*. Emergency costs encompass a wide variety of programs. Some, such as emergency shelter and food, are primarily a function of occupancy of the floodplain but not of the value of development in the floodplain. Emergency costs should not be projected to increase as a direct function of physical losses.

2.4.12 Evaluation procedure: Step 8—Determine other costs of using the floodplain.

The impact of flooding on existing and potential future occupants is not limited to flood losses. Some of the impacts are intangible but others can be translated into NED losses. These latter include the following:

(a) *Flood proofing costs*. High flood hazards lead to high flood costs. Therefore, compute the flood proofing costs of different activity-types and different flood hazard zones.

(b) *National flood insurance costs*. A national cost of the flood insurance program is its administration. The cost of servicing flood insurance policies in effect at the time of the study is the average cost per policy, including agent commission, and the costs of servicing and claims adjusting. FIA should be contacted to obtain these costs.

(c) *Modified use*. In some cases, the flood hazard has caused structures to be used less efficiently than they would be with a project. For example, the first floor of garden apartments may not be rented because of a flood hazard, or property may be configured in a different way with the plan compared to without a plan.

2.4.13 Evaluation procedure: Step 9—Collect land market value and related data.

If land use is different with and without the project, compute the difference in income for the land. This is generally accomplished by using land market value data. Provide supporting data in the situations described in paragraphs (a) through (d) of this section.

(a) *Land use is different with project*. If land use is different with compared to without the project, collect the following data as appropriate to complete step 10.

(1) *Comparable value*. If the plan does not result in a major addition to the supply of land in the area, the value with protection is the market value of comparable flood-free land. If the plan results in a major addition to the supply of land, the effect on the price of land should be taken into account in estimating the value of floodplain lands with protection. The flood-free land should be comparable in terms of physical and infrastructural characteristics.

(2) *Existing value*. Use the value of nearby floodplain sites or, as appropriate, the current value of the floodplain. In either case, report the current and, if available, past market values of the floodplain. Use actual market values, not capitalized income values. Therefore, it should not be assumed that the value of land being used for agriculture in an urban or urbanizing situation is the capitalized value of agricultural returns or that any value higher than that is due to speculation that a Federal program will be constructed or lack of knowledge. On the contrary, without-project land values in excess of agricultural land values should be expected, reflecting the probability of future use as well as existing and anticipated infrastructural investments.

(3) *Net income data*. The net income (earned) with a project may be estimated directly based on an analysis of a specific land use with the project. This approach would be used, for example, for lands to be developed for recreation; the projected recreation benefits would constitute the gross income earned on the floodplain and would be shown as a project benefit.

(4) *Encumbered title market value*. Estimate the market value of land with an encumbered title for inclusion as a benefit in step 10 in situations in which the floodplain is to be evacuated, no specific public use is planned, and the land could be resold with an encumbered title (which would ensure that future uses would be consistent with Executive Order 11988— *Floodplain Management*, May 24, 1977).

(b) *Land use is same but more intense with project*. If land use is the same but more intense, as when an activity's use of the floodplain is modified as a result of the project, base determination of the increase in income on increased land values or direct computation of costs and revenues.

(c) *Evacuation plan*. In the case of an evacuation plan, changes in market value of properties adjacent to a restored floodplain may reflect recreation or open-space benefits to occupants of those properties. Document such an NED benefit by empirical evidence. Care must be taken to avoid double counting of benefits.

(d) *Market value is lowered by flood hazard*. If the market value of existing structures and land is lower because of the flood hazard, restoration of the market value represents a quantification of otherwise intangible benefits. In such cases, the benefit is the difference between increased market value and that portion of increased market value attributable to reductions in flood damages. Careful attention should be given to ensuring that factors not related to the flood hazard are not included as project benefits.

(e) *No projected increase in market value*. Projected increase in the market value of land over the project life with and without a plan should not be used to measure flood hazard reduction benefits because the current market value of land theoretically captures the expected stream of income over time.

2.4.14 Evaluation procedure: Step 10—Compute NED benefits.

At this point in the analysis, enough information is available to compute NED benefits for structural and nonstructural measures. Table 2.4.14 displays the types of benefits claimable for three of the major flood hazard reduction measures and the steps in this procedure that provide the necessary data. The table applies generally; specific cases may vary. Discount and annualize all benefits at the appropriate discount rate to the beginning of the period of analysis. Benefits are categorized in the following way:

Table 2.4.14— Guide to Types of Benefits

Type of benefit (And step)	Structural	Flood-proofing	Evacuation
Inundation			
Incidental flood damages (step 6)	Claimable	Claimable	Claimable
Primary flood damages (step 6)	Claimable	Claimable	Not claimable
Floodproofing costs reduced (step 7)	Claimable	Not claimable	Not claimable
Reduction in insurance overhead (step 7)	Claimable	Claimable	Claimable
Restoration of land value (step 9)	Claimable	Claimable	Not claimable
Intensification (steps 7 and 9)	Claimable	Claimable	Not claimable
Location			
Difference in use (step 9)	Claimable	Claimable	Not claimable
New use (step 9)	Not claimable	Not claimable	Claimable
Encumbered title (step 9)	Not claimable	Not claimable	Claimable
Open space (step 9)	Not claimable	Not claimable	Claimable

(a) *Inundation reduction benefits*. To the extent that step 5 indicates that land use is the same with and without the project, the benefit is the difference in flood damages with and without the project (step 7), plus the reduction in flood proofing costs (step 8), plus the reduction in insurance overhead (step 8), plus the restoration of land values in certain circumstances (step 9). To the extent that step 5 indicates a difference in land use for an evacuation plan the benefit is the reduction in externalized

costs of floodplain occupancy that are typically borne by taxpayers or firms providing services to floodplain activities. Examples of such costs are subsidized flood insurance; casualty income tax deductions; flood emergency costs; and flood damages to utility, transportation, and communication systems. Reduction of costs not borne by the floodplain activities may be a major benefit of projects to evacuate or relocate floodplain activities. Reduction of flood damages borne by floodplain activities should not be claimed as a benefit of evacuation or relocation because they are already accounted for in the fair market value of floodplain properties.

(1) *Benefit from saving insurance costs*. One category of costs that can be avoided by a removal plan is public compensation for private flood damages through the subsidized Federal Flood Insurance Program. Expressing savings in these externalized costs as project benefits is appropriate for properties in communities that participate in the Federal Flood Insurance Program or are expected to participate under the without-project condition. This benefit is the reduction of insurable flood damages projected over the life of the project with careful attention to the projected without-project condition.

(2) *Insurable flood damages*. Base the projection of insurable flood damages on traditional depth damage-frequency relationships used in projecting total flood damages. Then reduce projected total damages by subtracting: losses that are non insurable either because they are in non insurance loss categories or because they exceed the coverage limits of the subsidized program; the deductible portion of each expected flood damage event; and the annual cost of the insurance premium paid by the policyholders. For this benefit calculation, assume that all eligible parties purchase subsidized insurance. This assumption is appropriate because the market value of properties, which determines project costs. reflects the availability of the program, not the extent of its utilization by current floodplain occupants.

(b) *Intensification benefits*. If step 5 indicates that land uses are the same with and without the project but activity is more intense with the Project, measure the benefit as the increase in market value of land from step 9 or changes in direct income from step 6. Care must be taken to avoid double counting.

(c) *Location benefits*. If step 5 indicates that land use is different with and without the project, measure the benefit by the change in the net income or market value of the floodplain land and certain adjacent land where. for example, the plan creates open space (step 9).

2.4.15 Evaluation procedure: Problems in application.

There are four major problem areas in computing flood hazard reduction benefits:

(a) *Income losses*. The loss of income by commercial, industrial, and other business firms is difficult to measure because of the complexity involved in determining whether the loss is recovered by the firm at another location or at a later time. Direct interview and empirical post-flood studies are the most appropriate data sources for analyzing whether a real resource loss, such as idle capital or decaying inventories. is involved. The loss of income because of idle labor may be measured from the point of view of the firm or the household, but care must be taken to avoid double-counting. Loss of income because of idle labor must be net of income to labor employed in cleanup and repair of damages; unemployment compensation and other transfer payments to idle labor are not income from an NED perspective.

(b) *Intensification benefits*. This category of benefits is theoretically applicable to urban situations, but there are to date few documented case studies. This benefit cannot exceed the increased flood damage potential when the existing activity is compared to the intensified activity (without the proposed plan).

(c) *Risk*. The analysis of response to a flood hazard is based on a probability weighting of floods of various magnitude. This implies that floodplain occupants are risk-neutral, but many occupants, individually or as a group, either avert or accept risk. Therefore, responses to actual and potential flood damages should be viewed broadly in determining land use, mode of conducting business, and even benefits. Explain any significant deviations from expected behavior based on actual or potential flood damages computed on a risk-neutral basis.

(d) *Sensitivity analyses*. The report should contain sensitivity analyses that present a range of benefit levels representing data and assumptions about which reasonable persons might differ. Report the benefit level that is most probable; present other levels for public information. If increases in damages are based on increases in value, conduct a sensitivity analysis of value per structure under the alternate assumption that there is no increase in the average value of structure or contents and that increases in damages are due solely to increases in the number of structures and/or shifts from one type of structure to another.

2.4.16 Evaluation procedure: Data sources.

The following summarizes problems associated with two key data sources:

(a) *Interviews*. The primary use of personal interviews is to collect flood damage data, but interviews may also be used to collect other necessary data not available from secondary sources. Use only interview forms approved by the Office of Management and Budget. Use statistically sound techniques for selecting the interview sample and for devising the questions. The questionnaire and a summary of responses should be compiled and displayed in the final report in a way that protects the source of individual disclosures. Describe the errors and uncertainty inherent in the sampling methods and responses.

(b) *Local land use plans*. Local land use plans and zoning ordinances are valuable guides to future land use in the floodplains but caution must be exercised in the use of such plans and ordinances. First, the demographic implications of local plans and ordinances must be consistent with, or convincingly distinguished from, trends in a larger area, e.g., OBERS. Second, a local plan is not an acceptable projection for the without-project condition if it ignores the flood hazard. Third, the status, date, and likelihood of change of local plans vary. Finally, local plans may not contain sufficiently detailed information to be of direct use in benefit analysis.

2.4.17 Report and display procedures.

Include in the report enough data to enable the reviewer to follow the key steps above and, more important, the underlying rationale for the project.

(a) *Report procedures for risk and uncertainty*. To assist reviewers in assessing response to risk, summarize the following separately and display the information in tabular form:

(1) *Remaining flood damage situations*: Categorizations. The remaining damages are those expected to occur even with a floodplain management plan in operation. Remaining damages include:

(i) Damages to activities that would occupy the floodplain with as well as without the plan;

(ii) Damages to activities that would occupy the floodplain only with the plan; and

(iii) Increased damages to activities outside the protected area with and without the plan. This includes downstream flooding, if any, caused by the plan or project.

(2) *Flood with two-tenths of 1 percent of occurrence*. Fully describe the flood with two-tenths of 1 percent chance of occurrence (500-year frequency) with and without the plan. The report should contain, for example, two-tenths of 1 percent flood damages; the number of people and towns affected; the number of structures and acres by land-use type; disruption of essential services (e.g., water, power, fire protection, and sanitary services) and distance to unaffected essential services; anticipated warning time; flood depths, velocity, duration, debris content, etc.; and other indicators pertinent to catastrophic flooding.

(b) *Summary tables*. Summary tables 2.4.17-1 through 4 are suggested presentations for all reports that include flood hazard reduction as a purpose. Other summary tables. such as the displays presented in 2.4.5 through 2.4.15, may be necessary and pertinent. The summary tables should include pertinent land use data for computing not only NED benefits, but also environmental, social, and regional impacts. Also present other floodplain data pertinent to the evaluation on one or more maps: Flood limits and depths with and without the project; current and future land use; and 100-year and other flood limits and depths.

Table 2.4.17—1 Summary of Annualized NED Benefits and Costs for Alternative Projects
[Applicable discount rate: ——]

Project benefits and costs	Alternatives			
	1	2	3	X
Flood hazard reduction benefits:				
Inundation:				
Physical	.....	.....	.....	.....
Income	.....	.....	.....	.....
Emergency	.....	.....	.....	.....
Total	.....	.....	.....	.....
Intensification	.....	.....	.....	.....
Location:				
Floodplain	.....	.....	.....	.....
Off floodplain	.....	.....	.....	.....
Total	.....	.....	.....	.....
Total Flood Benefits	.....	.....	.....	.....
Benefits from other purposes	.....	.....	.....	.....
Total project benefits	.....	.....	.....	.....
Project costs	.....	.....	.....	.....
Net benefits	.....	.....	.....	.....

Table 2.4.17—2 Flood Damages by Decade, Alternative Projects

[Applicable discount rate: — —]

Project	Time Period[1]			
	P0	P10	P20, etc.	AAE[2]
No. 1				
No. 2				
No. 3				

[1] The designation P10 and P20 identify the 10th and 20th years, respectively, of project life.
[2] Average annual equivalent

Table 2.4.17—3 Flood Damages by Decade Without Project

[Applicable discount rate: — —]

Property type	Time Period[1]						
	P-50	P-40, etc.	Existing	P0	P10	PN	AAE[2]
Residential:							
a (Subclassification of residential)							
b							
c							
Commercial							
Industrial							
Other							
Total							

[1] The designation P10 and P20 identify the tenth and twentieth years, respectively, of project life. P-50 is 1932, P-40 is 1942, etc.
[2] Average annual equivalent

Table 2.4.17-4 Number of, Floodplain Without Project[1]

Property type	Acres							
	Existing	Time Period[2]						
		P0	P10	P20	P30	P40	P50	P100
Residential:								
a (Subclassification of rate residential units)								
b								
c								
Commercial								
Industrial								
Semipublic								
Transportation								

[1] Comparable tables may be made for all alternatives, if pertinent.
[2] The designations P10 and P20 identify the 10th and 20th years, respectively, of project life.

Section V—NED Benefit Evaluation Procedures: Power (Hydropower)

2.5.1 Introduction.

This section describes procedures for the evaluation of national economic development (NED) benefits of hydropower features of water resources projects and plans. These features include single--purpose hydropower, the inclusion of hydropower as a function in new multipurpose projects, addition of power-generating facilities to existing water resource projects, and expansion of existing hydropower plants.

2.5.2 Conceptual basis.

(a) The conceptual basis for evaluating the benefits from energy produced by hydroelectric power plants is society's willingness to pay for these outputs. If this is not possible or cost effective, benefit information may sometimes be obtained through examination of market prices. Although utility pricing of electricity is complex and usually based on average cost rather than marginal cost, in cases where it can be determined that market price to the final consumer is based on marginal production costs, this may be used as a measure of benefits. When using market price as a measure of benefits the increment in supply should ordinarily be relatively small compared to the total (i.e., little change would be expected in market price due to the incremental supply). Continued movement of retail electricity pricing towards marginal cost approximations (e.g., seasonal rates. time of day rates. etc.) may make market Prices more relevant for benefit evaluation in the future. In the absence of such direct measures of marginal willingness to pay, the benefit from energy produced by hydroelectric power plants is measured by the resource cost of the most likely alternative to be implemented in the absence of the alternatives under consideration. Non-federal investment analysis generally does not provide an adequate basis for evaluation of potential investments of Federal resources in hydroelectric power. This is because non-federal investments reflect financial conditions, insurance, and tax incentives that differ from those applying to Federal investments. The procedure that follows allows the planner to construct an NED benefit estimate based on real resource cost of the most likely non-federal alternative. Simplifications are encouraged for small scale hydropower projects. An alternative hydropower benefit evaluation procedure is provided for single-purpose projects that are to be 100 percent non federally financed, provided that there are no significant incidental costs.

(b) The real resource cost of the most likely alternative can also be used to compute benefits from nonstructural measures. However, the net benefits of certain nonstructural measures that alter the electric power load cannot be measured effectively by the alternative cost procedures for the following reasons: (1) structural measures and many nonstructural measures (except those that alter the load) result in similar plan outputs, whereas load-altering measures (e.g., revised rate structures) may change levels of output; and (2) load-altering measures may have fewer direct resource costs than measures based on higher levels of output. Because of this lack of comparability. the benefits from such load-altering nonstructural measures should not be based on the cost of the most likely alternative. Attempts to measure the Benefits of load-altering nonstructural measures on the basis of direct willingness to pay are encouraged.

2.5.3 Planning setting.

(a) *Without-project condition*. The without-project condition is the most likely condition expected to exist in the future in the absence of a project, including any known changes in law or public policy. The without-project condition includes the following specific assumptions:

(1) *Existing resources*. Existing generating resources are part of the without-project condition. Make adjustments to account for anticipated plant retirements and changes in plant output due to age or environmental restrictions associated with existing policy and regulations.

(2) *Existing Institutional arrangements*. Existing and reasonably expected future power system and water management contracts, treaties, and non power river operating criteria are part of the without-project condition. If revision of these arrangements is part of an alternative plan, the new arrangement (revised contract, criteria, etc.) would be considered in the with-project condition.

(3) *Alternative actions anticipated or under way*. The without-project condition includes those generating resources that can reasonably be expected to be available in the forecast period.

(4) *Nonstructural measures and conservation*. The without-project condition includes the effects of implementing all reasonably expected nonstructural and conservation measures.

(*b) With-project condition*. (1) The with-project condition is the most likely condition expected to exist in the future with the plan under consideration. Examples of alternative plans include: alternative combinations of projects in a basin study; alternative sites in a reach study; alternative plant sizes at a specific site; alternative reservoir sizes at a reservoir site; use of reregulation and/or pump back to increase firm capacity; and reallocation of storage to increase firm energy output.

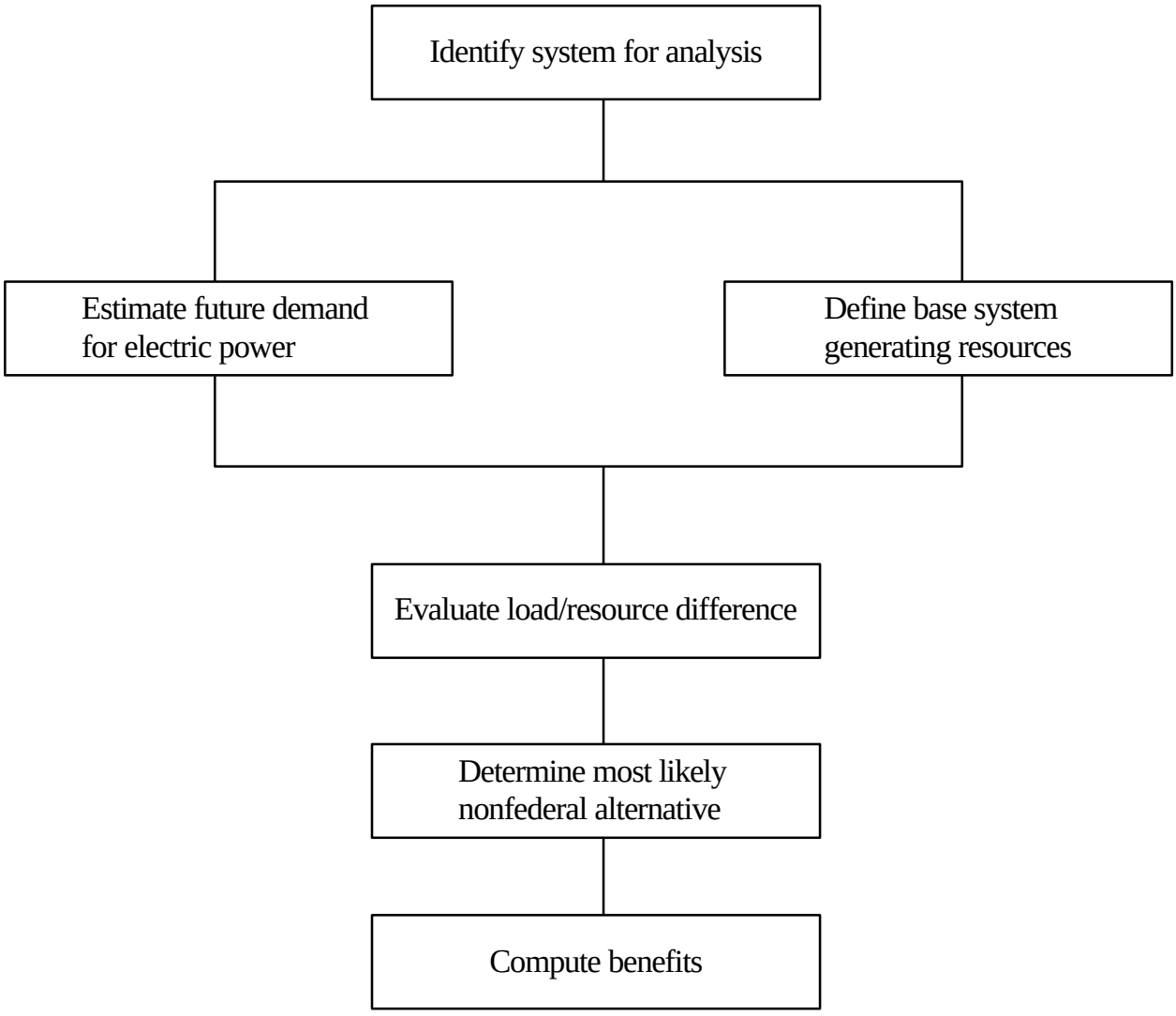
(2) Nonstructural alternatives to hydropower may be used alone or in combination with structural measures. Nonstructural measures include but are not limited to reducing the level and/or time pattern of demand by time-of-day pricing; utility-sponsored loans for insulation; appliance efficiency standards; education programs: inter-regional power transfers; and increased transmission efficiency.

2.5.4 Evaluation procedure: General.

(a) Follow these steps to estimate NED benefits that would accrue whenever the plan would not be 100 percent nonfederally financed. When single purpose hydropower alternatives being studied would be 100 percent nonfederally financed, the market-based procedure specified in Section 2.5.10 may be used. Nonfederally financed means that all construction and operation costs would be financed entirely from sources other than federally appropriated funds. The level of effort expended on each step depends upon the nature of the proposed development, the state of the art for accurately refining the estimate, and the likely effect of further refinement on project formulation and justification.

(b) For the purpose of ensuring efficiency in the use of planning resources, simplifications of the procedures set forth in this section are encouraged in the case of single-purpose, small scale hydropower projects (25 MW or less), if these simplifications lead to reasonable approximations of NED benefits and costs. In addition, an analysis of marketability may be substituted for determination of need for future generation for hydropower projects up to 80 MW at existing Federal facilities.

Figure 2.5.4 -- Flowchart of Hydropower Benefit Evaluation Procedures



2.5.5 Evaluation procedure: Identify system for analysis.

Because of the trend toward interconnection and coordination among utilities and power systems, it is most appropriate to evaluate NED benefits for hydropower on a system basis, rather than on the needs of an individual utility or local area. The size of the system would depend on the situation but could consist of a power pool, a National Electric Reliability Council (NERC) regional area, the marketing area of a Federal power marketing administration, or other geographic region.

In some cases, physical or institutional constraints may limit the analysis to a smaller area, but care must be taken to ensure that benefits are not misstated by such analysis.

2.5.6 Evaluation procedure: Determine need for future generation.

(a) *Estimate future demand for electric power*. Forecast electric power loads in terms of the annual peak demand period. When a high proportion of the generation is from hydropower, a forecast of annual energy demand should be made. Also forecast weekly load shapes to represent a minimum of three periods in the year (e.g., typical summer, winter, and spring/fall days) to assist in determining the type of load that a hydropower project could carry. Load forecasts should reflect the effects of all load management and conservation measures that, on the basis of present and future public and private programs, can reasonably be expected to be implemented during the forecast period. Load forecasts should be made and analyzed by sectoral use (e.g. residential, commercial, industrial). Estimate loads at increments of no more than 10 years from the present to a time when the proposed plant will be operating in a state representative of the majority of its project life. In the case of staged hydropower development or where generation system resource mixes may change markedly, load forecasts may be appropriate for 20 years or more beyond the initial operation date. Account for system exports and reserve requirements.

(b) *Define base system generating resources.* Project future generating resources and imports at various points in time without the proposed plan or any alternative plan. Estimate resources for the time periods stated in 2.5.6(a). Provide information on peak capacity and on average annual energy production where a high proportion of the systems generation is hydropower. Data are readily available on projected system resources for about 10 years. Base projected resource additions beyond that time on system studies. Account for retirement of older plants as well as the reduction of output of some plants due to age or environmental constraints.

(c) *Evaluate load/resource difference*. Compare the loads identified under 2.5.6(a) with the resources identified under 2.5.6(b) to determine: (1) when generating resource deficits will occur, (2) the magnitude of these deficits, and (3) what portion of these deficits could be met by the hydropower project. If nonstructural measures are components of an alternative plan and these measures reduce system loads, the amount of such reduction lessens system deficits. Hydropower sites can be developed to provide either a base load, mid-range, or peaking service. Evaluate the system demand for each class of hydropower generation. Simple tabulation of annual peak and energy loads and resources is generally adequate for preliminary studies. Use system load-resource models that account for load characteristics and generating plant operating capabilities, if available, to evaluate accurately the usability of specific projects.

2.5.7 Evaluation procedure: Determine the most likely non-federal alternative.

(a) *General.* Select the one alternative most likely to be implemented in the absence of the proposed Federal project. Begin identification of the most likely alternative to the plan being considered with the least costly alternative. If an alternative with a lesser cost is passed over for a more expensive one, justify not selecting the lower cost plan.

(b) *Screen alternatives*. The alternatives to a specific hydropower project must be viable in terms of engineering, environmental quality, and other national policy considerations. Engineering viability limits thermal alternatives to commercially available electric power plants. Environmental viability implies that plant costs include all equipment required to meet environmental quality criteria. National policy considerations include factors such as legal limitations on the use of oil, natural gas, and other 'scarce' fuels for electric power generation. Each alternative need not in itself deliver service similar in kind to the hydropower project, but the total power system with the alternative must deliver service similar in kind to the system with the hydropower project. If nonstructural measures or conservation are components of an alternative plan and these measures reduce the need for additional capacity or for additional power, the amount of such reduction constitutes provision of service similar in kind; this ensures that evaluation procedures will not be biased against the selection of an alternative that utilizes nonstructural measures.

(c) *Identify the most likely alternative*. (1) Compare the system with the hydropower project under

consideration to alternatives capable of meeting system loads within established criteria of system reliability. Base the comparison on the basis of cost and other factors to determine the most likely alternative, i.e., the structural and/or nonstructural measures that will be implemented if the project under consideration is not implemented.

(2) If institutional obstacles to implementation are noted, an alternative plan should still be considered the most likely if the barriers are substantially within the power of the affected users to correct. A detailed description of the institutional obstacles should be included, with a discussion of the basis for the conclusion that the obstacles cannot be overcome.

(3) If the most likely alternative includes new thermal plants, use those plants' capacity costs (including amortized investment costs, transmission costs, and fixed operating and maintenance (O&M) costs) as the measure of the value of the hydropower project's generating capacity, and use the thermal plants' energy costs (primarily variable O&M costs and fuel costs) as the measure of the value of the hydropower project's energy production.

2.5.8 Evaluation procedure: Compute benefits.

(a) *Compute hydropower plant annual benefits*. Compute annualized benefits based on the costs of the most likely alternative for each hydropower development and installation component.

(1) *Alternative costs*. (i) Base the calculation of alternative costs to be used as a measure of NED benefits on the following: (A) calculate all interest and amortization costs charged to the alternative on the basis of the Federal discount rate; (B) charge no costs for taxes or insurance to the alternative; and (C) in calculating costs of the most likely alternative, use assumptions and procedures that parallel those used to calculate the costs of the plan being evaluated.

(ii) In many cases, benefits may vary over the life of a project. This may be due to such factors as staged development of the hydropower project, changes in operation of the hydropower project resulting from changes in the resource mix in the total generating system, and real escalation in fuel costs (if the most likely alternative system includes a thermal plant). Compute project benefits by time intervals and discount these values to derive annualized power benefits.

(iii) When applicable, the evaluation shall reflect differences in the cost of transmission, distribution, and other facilities compared to the most likely alternative.

(iv) Occasionally, the initial output of a hydropower project is large compared to annual growth in system load; two or more years may be recolored to fully absorb its output into the load. In these cases adjust the credit (benefit) to reflect the generating capacity and energy actually used in the load in the early years of project life.

(2) *Energy value adjustment.* Account for the effect on system production expenses when computing the value of hydroelectric power. Adding structural or nonstructural measures of a plan to a system instead of adding an alternative power source may result in greater or lesser system production expenses than if a particular thermal capacity were added; the effect on production expenses can be determined by performing a system analysis. If there is a difference in system production expenses, adjust the energy value in the economic analysis of the plan. If the alternative plan would lower system production costs, the adjustment would be negative. If the alternative plan would increase system production expenses, the adjustment would be positive. Consider system production expenses in determining the most likely alternative.

(3) *Capacity value adjustment.* The physical operating characteristics of hydropower projects differ significantly from alternative thermal plants. Appropriate credit may be given to hydropower projects to reflect their greater reliability and operating flexibility. When the value of these characteristics cannot otherwise be quantified, an adjustment can be made to the alternative plant capacity costs. Typically, the adjustment per kilowatt of capacity ranges from 5 to 10 percent of the cost per kilowatt of thermal capacity, depending on the operating characteristics of the hydropower project and alternatives that include thermal capacity. The adjustment may be applied by increasing the capacity cost of the most likely alternative by the appropriate percentage determined by the Federal Energy Regulatory Commission (FERC).

(4) *Intermittent capacity adjustment.* The dependable capacity of a hydropower project is based on the load-carrying capability of the project under the most adverse combination of system loads, hydrologic conditions, and plant capabilities. This value, conservative approach is unrelated to the dependable capacity of a hydropower project's alternative if thermal capacity is included and given no credit for the value of capacity that is available a substantial amount of the time. When power system operation studies show that there is an intermittent capacity value to the system, a capacity adjustment should be made.

(5) *Price relationships.* Assume relative price relationships and the general level of prices prevailing

during the planning study to hold generally for the future, unless specified studies and considerations indicate otherwise. Examples of the latter include escalation of relative fuel cost (e.g., due to increasing scarcity) or increased capital costs expected to result from changed environmental or safety criteria. Fuel costs used in the analysis should reflect economic prices (market clearing) rather than regulated prices.

(b) *Compute benefits of nonstructural measures.* Compute the average annual benefits of nonstructural measures, based on the cost of the most likely alternative identified above, except as specified in 2.5.2(b).

2.5.9 Evaluation procedure: Data sources.

Data on existing and planned resources, loads, marketability criteria; and alternative costs are available from various agencies and groups, including the Department of Energy, NERC regional councils, FERC regional offices, Federal power marketing administrations, State energy agencies, utility companies, and regional planning groups. If specific operating characteristics of individual plants are not available, generalized data can be obtained from other sources, including the Electric Power Research Institute. Load-resources models based on simulated system operation may be used if available. Some of these models are available from various sources, including FERC, Federal power marketing administrations, and a number of consulting services.

2.5.10 Alternative Procedure: Financial Evaluation.

(a) *General.* This section provides an alternative hydropower benefit evaluation procedure that may be used for evaluating single-purpose projects that are to be 100 percent nonfederally financed, provided that there are no significant incidental costs. This approach employs market data based on long run (10 or more years) utility wholesale prices as an estimate of the cost of producing equivalent power from the most likely alternative. These prices may be used to evaluate and compare the financial feasibility of alternative plans, provided that they are consistently applied to all of the alternatives. The formulation of alternative plans under this procedure is subject to the provisions of chapter 1, including evaluation of incidental benefits and costs, compliance with environmental laws, and inclusion of appropriate mitigation. Through this process, the most financially attractive alternative is identified. Because the benefits and costs of all alternative plans are evaluated in a consistent way, the most financially attractive plan can be identified as the NED plan.

(b) *Industry long-run wholesale prices*. The market approach must be carefully applied to ensure that the long-term (10 or more years) contract prices reflect the energy and capacity characteristics of the proposed hydropower project. In screening contracts for applicability, a number of factors should be examined, including: term of contract, power and energy availability (daily, weekly, seasonally), geographic relationship, delivery voltage, power factor, point(s) of delivery (busbar, high voltage grid, load center), interconnecting facilities, reliability standards and emergency backup. Information on long-term wholesale power contracts may be obtained from the Federal Energy Regulatory Commission, State public service commissions, the Federal power marketing administrations, and electric generating and distribution utilities.

2.5.11 Report and display procedures.

(a) Tables 2.5.11-1 through 2.5.11-3 are suggested for presentation for reports that include federally financed hydropower measures. Table 2.5.11-1 summarizes the output of all plans by peaking capacity and system load factor, and presents the costs of each alternative plan. Tables 2.5.11-2 and 3 summarize the output of the structural component of each alternative, the benefits of the structural components, and the resource costs of all structural and nonstructural components of each alternative plan. The number of benefit categories included will vary from project to project. Not all projects will have intermittent capacity, for example, and in some cases it will be appropriate to account separately for firm and secondary energy. System energy costs are sometimes included in the unit energy values; in those cases such costs would not have to be accounted for separately.

(b) Table 2.5.11-3 is suggested if the nature or magnitude of hydropower benefits changes substantially over time. Examples are: staged construction of the hydropower project; change in the role of hydropower in the system over time; and situations in which several years are required to absorb a large project into the system.

(c) When the alternative financial evaluation procedure is used to evaluate financial feasibility of plans that are to be 100 percent nonfederally financed (see Section 2.5.10), physical data similar to that found in tables 2.5.11-1 through 3 should be displayed. Capacity and energy values, as developed through the financial analysis, should also be displayed in a manner facilitating comparison

among alternatives. These displays are in lieu of the standard presentation of hydropower benefits and project costs in the NED account. Also display any incidental benefits and costs of the alternatives. However, no benefit-cost ratio can be presented, because the analysis of the hydropower project's financial feasibility is not comparable to economic analysis.

Table 2.5.11-1—Electric Power Supply Alternatives

[Period of analysis, price level, discount rate]

Alternatives	Annualized cost[1] ($1,000)	Peak power supplied, conserved, and system load factor (MW)[2] by time period[3]			
		P_1	P_2	P_3	P_N
Most likely alternative					
Recommended plan					
Other plans analyzed					

[1] Annual equivalent cost includes system adjustment costs.

[2] For example, for the summer season, an entry "90 10 6" would represent meeting the 100 MW deficit in the summer peak use identified in the without-project condition by supplying 90 MW and reducing the quantity used by 10 MW, the system load factor for the entire system for the summer would be .6.

[3] Show by time period and season where there are seasonal variations.

Table 2.5.11-2 Summary of Annualized NED Benefits for Structural Measures and NED Costs for Structural and Nonstructural Measures[1]

[(Thousands of month, year dollars) Applicable discount rate:— —]

	Alternative			
	1	2	3	X
Plant data:				
Installed capacity, MW	----------	----------	----------	----------
Dependable capacity, MW	----------	----------	----------	----------
Intermittent capacity, MW	----------	----------	----------	----------
Average annual energy, gWh	----------	----------	----------	----------
Average annual capacity factor (percent)	----------	----------	----------	----------
Benefits:				
Unit capacity and value ($/kW-yr)	(---------)	(---------)	(---------)	(---------)
Dependable capacity benefits	----------	----------	----------	----------
Intermittent capacity benefits	----------	----------	----------	----------
Unit energy value (mills/kWh)	(---------)	(---------)	(---------)	
Energy benefits	----------	----------	----------	----------
Unit system energy adjustment (mills/kWh)	(---------)	(---------)	(---------)	(---------)
System energy cost adjustment	----------	----------	----------	----------
Real fuel cost escalation rate (percent)	(---------)	(---------)	(---------)	(---------)
Period of real fuel cost adjustment (years)	(---------)	(---------)	(---------)	(---------)
Real fuel cost adjustment	----------	----------	----------	----------
Total hydro benefits	----------	----------	----------	----------
Other purpose benefits (list)	----------	----------	----------	----------
Annualized cost	----------	----------	----------	----------
Structural measures	----------	----------	----------	----------
Nonstructural measures	----------	----------	----------	----------
Net annualized benefits	----------	----------	----------	----------

[1] Note that benefits from load-altering nonstructural measures are excluded. This table may be used for displaying the benefits of nonstructural measures that do not alter the load (see 2.5.2 (b)).

Table 2.5.11—3 Time Distribution of NED Electric Power Benefits for structural Measures of Alternative —[1]

[Applicable discount rate:——]

	Time period [2]				
	P_1	P_1	P_1	P_1	AAE[3]
Plant data:					
Installed capacity, MW	----------	----------	----------	----------	----------
Dependable capacity, MW	----------	----------	----------	----------	----------
Intermittent capacity, MW	----------	----------	----------	----------	----------
Average annual energy, gWh	----------	----------	----------	----------	----------
Average annual capacity factor (percent)	----------	----------	----------	----------	----------
Benefits:					
Unit capacity and value ($/kW-yr)	(---------)	(---------)	(---------)	(---------)	(---------)
Dependable capacity benefits	----------	----------	----------	----------	----------
Intermittent capacity benefits	----------	----------	----------	----------	----------
Unit energy value (mills/kWh)	(---------)	(---------)	(---------)	(---------)	
Energy benefits	----------	----------	----------	----------	----------
Unit system energy adjustment (mills/kWh)	(---------)	(---------)	(---------)	(---------)	(---------)
System energy cost adjustment	----------	----------	----------	----------	----------
Real fuel cost escalation rate (percent)	(---------)	(---------)	(---------)	(---------)	(---------)
Period of real fuel cost adjustment (years)	(---------)	(---------)	(---------)	(---------)	(---------)
Real fuel cost adjustment	----------	----------	----------	----------	----------
Annualized benefits	_____	_____	_____	_____	_____

[1] Note that benefits from load-altering nonstructural measures are excluded. This table may be used for displaying the benefits of nonstructural measures that do not alter the load (see 2.5.2 (b)).
[2] Time periods selected depend on the nature of project and power system.
[3] Average annual equivalent.

Section VI—NED Benefit Evaluation Procedures: Transportation (Inland Navigation)

2.6.1 Introduction.

This chapter presents the procedure for measuring the beneficial contributions to national economic development (NED) escalated with the inland navigation features of water resource protects and plans.

2.6.2 Conceptual basis.

The basic economic benefit of a navigation project is the reduction in the value of resources required to transport commodities. Navigation benefits can be categorized as follows:

(a) *Cost reduction benefit (same origin-destination; same mode)*. For traffic that uses a waterway both With and without a project, the benefit is the reduction in the economic cost of using the waterway. This reduction represents an economic efficiency or NED gain because resources will be released for productive use elsewhere in the economy; for example:

(1) Reductions in costs incurred from trip delays (e.g., reduced congestion by expanding lock sizes at congested facilities or by imposition of congestion fees).

(2) Reduction in costs because larger or longer tows can use the waterway (e.g., by channel straightening or widening).

(3) Reduction in costs by permitting barges to be more fully loaded (e.g., by channel deepening).

(b) *Shift of mode benefit (same origin-destination; different mode)*. For traffic that would use a waterway with the project but uses a different mode, including a different waterway, without the project, the benefit is the difference between the costs of using the alternative mode without the project and the costs of using the waterway with the alternatives under consideration. The economic benefit of the waterway to the national economy is the savings in resources from not having to use a more costly mode.

(c) *Shift of origin-destination benefit.* If a project would result in a shift in the origin of a commodity, the benefit is the difference in total costs of getting the commodity to its place of use with and without the project. If a project would result in a shift in the destination of a commodity, the benefit is the difference in net revenue to the producer with and without the Project. The shift of origin-destination

benefit cannot exceed the reduction in transportation charges achieved by the project.

(d) *New movement benefit*. This benefit applies if a commodity or additional quantities of a commodity would be transported only because of lowered transportation charge with the Project. The quantities are limited to increases in production and consumption resulting from lower transportation costs. An increase in waterway shipments resulting from a shift in origin or destination is not included. The new movement benefit is defined as the increase in producer and consumer surplus; practically, it can be measured as the delivered price of the commodity less all associated economic costs, including all of the costs of barge transportation other than those of the navigation project. This benefit, like the preceding one, cannot exceed the reduction in transportation costs achieved by the project.

(e) *Use of rates for benefit measurement*. It is currently more difficult to accurately compute the long-run marginal costs of particular rail movements on the basis of cost estimation studies than to determine the rates at which railroad traffic actually moves. In competitive markets, rates (prices) correspond to marginal cost, and, given market stability, prices will settle at long-run marginal costs. Moreover, the rates actually charged determine the distribution of traffic among modes. For these reasons, rates will be used to measure shift of mode benefits. Section 7a of the Department of Transportation (DOT) Act of 1966 (Pub. L. 89-670) requires the use of prevailing rates, as described in 2.6.9(b). In the case of new waterways, this rate may or may not represent the best estimate of long-run marginal costs. In the case of existing waterways, prevailing competitive similar rates are the best available approximation of long-run Marginal costs.

2.6.3 Planning setting.

(a) *Without-project condition*. The without-project condition is the most likely condition expected to exist in the future in the absence of the navigation project or any change in law or public policy. The without-project condition includes any practice likely to be adopted in the private sector under existing law and policy, as well as actions that are part of broader private and public planning to alleviate transportation problems. The following specific assumptions are part of the projected without-project condition:

(1) Assume that all reasonably expected nonstructural practices within the discretion of the operating agency, including helper boats and lock operating policies, are implemented at the appropriate time. Substantial analysis is required to determine the best combination of nonstructural measures to ensure the most effective use of an existing waterway system over time. This analysis should be documented in project reports to assure the reviewer that the best use of existing facilities will be made in the without-project condition and that the benefits of alternative with-project conditions are correctly stated. The criteria for the best utilization of the system are overall public interest concerns, including economic efficiency, safety and environmental impact.

(2) User charges and/or taxes required by law are part of the without-project condition. Proposed or possible fees, charges, or taxes are not part of the without-project condition but should be considered as part of any nonstructural alternatives in the with-project condition.

(3) The without-project condition assumes that normal operation and maintenance will be performed on the waterway system over the period of analysis.

(4) In projecting traffic movements on other modes (railroad, highway, pipeline, or other), the without-project condition normally assumes that the alternative modes have sufficient capacity to move traffic at current rates unless there is specific evidence to the contrary.

(5) Alternative modes should be analyzed as a basis for identifying the most likely route by which commodities will be transported in the future in the absence of waterway improvement.

(6) The without-project condition normally assumes that only waterway investments currently in place or under construction are in place over the period of analysis.

(b) *With-project condition*. The with-project condition is the most likely condition expected to exist in the future if a project is undertaken. The same assumptions as for without-project condition underlie the with-project condition. The following discussion relates to the alternatives considered under the with-project condition.

(1) Management of demand by the use of congestion or lockage fees is a nonstructural alternative, which alone or in combination with structural devices may produce an economic optimum in a congested waterway. Influencing marginal waterway users through a congestion fee can increase the net benefits of a waterway. Evaluate alternatives that influence demand on the same basis as supply-increasing (structural) alternatives.

(2) Additional nonstructural measures not within the current purview of the operating agency may be considered ‘supply management’ measures. One example is traffic management. These supply-increasing (nonstructural) measures can be

used alone or in combination with other structural or nonstructural measures.

(3) Project alternatives can differ in their timing as well as in their physical characteristics. Consider the optimal timing of projects and of individual project features in project formulation, so as to maximize net benefits over time.

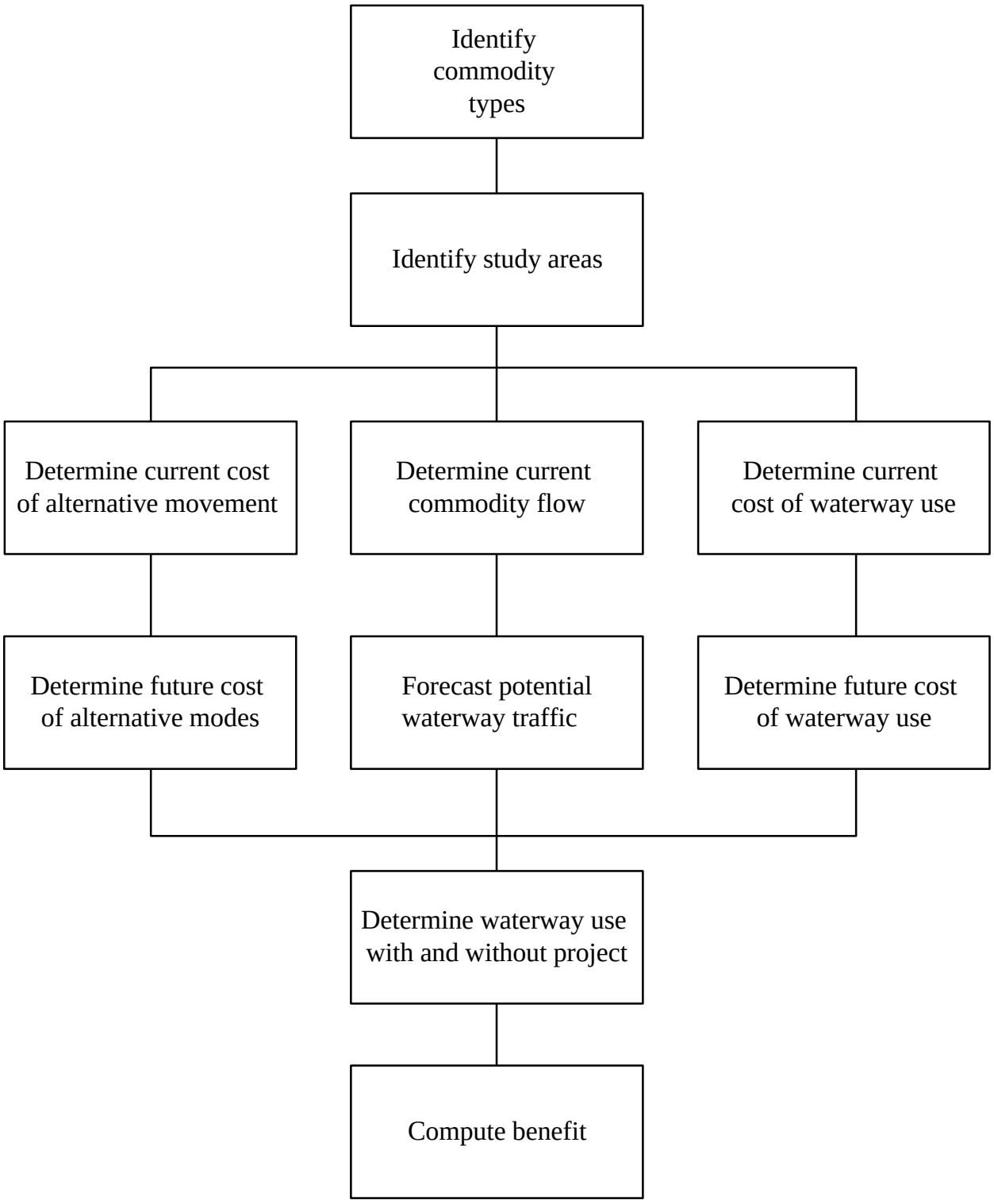
(4) Consider improvements in alternative transportation modes as part of the without-project condition only, as specified in 2.6.3(a)(5).

(5) A change in the waterway system that is currently authorized but not yet under construction may be included if an appropriate share of its associated costs is included in the costs of the alternative under study and its incremental contribution to benefits is explicitly identified.

2.6.4 Evaluation procedure: General.

Use the following 10 steps to estimate navigation benefits. (See Figure 2.6.4.) The level of-effort expended on each step depends upon the nature of the proposed improvement, the state of the art for accurately refining the estimate, and the sensitivity of project formulation and justification to further refinement, especially as applied to steps 6, 7. and 8.

Figure 2.6.4——Flowchart of Inland Navigation Benefit Evaluation Procedure



2.6.5 Evaluation procedure: Step 1—Identify the commodity types.

Identify the types of commodities susceptible to movement on the waterway segment under consideration. The level of detail for each commodity is not prespecified; for example, in some cases "grains" is detailed enough, while in others "corn," "wheat" or "soybeans" is needed.

(a) *New waterways*. Identify commodity types primarily by antennas of shippers and by resource studies. Interviews will identify primarily the benefit potentials of a shift of mode; resource studies will identify primarily the benefit potentials of shifts in origin-destination and in new movements.

(b) *Existing waterways*. Identify commodity types primarily by analysis of data on existing use of the waterway segment under study; e.g., data from the Performance Monitoring System (PMS) and the Water borne Commerce Statistical Center (WCSC).

2.6.6 Evaluation procedure: Step 2—Identify the study area.

The study area is the area within which significant project impacts are incurred. The origins and destinations of products likely to use the waterway are normally included in the study area, broken out by river segments.

(a) *New waterways*. Determine the origins and destinations primarily by interviews of shippers and by resource studies.

(b) *Existing waterways*. Determine origins and destinations by analysis of data on existing use of the waterway segment under study; e.g., PMS and WCSC traffic traced to its ultimate origin and destination.

2.6.7 Evaluation procedure: Step 3—Determine current commodity flow.

Gather current data for commodity movements between origin-destination pairs susceptible to waterway movement as well as for commodities currently transported by waterway.

(a) *New waterways*. This step seeks to identify the total tonnage that could benefit from using the waterway. Obtain this information primarily by interviews of shippers. For benefits from shifts in origin and destination and from new movements, care must be taken to identify whether such movement would be likely to occur if waterway transportation were available; base this information primarily on interviews. Give particular attention to delivered price from substitute sources in the case of benefits from shifts in origin and destination, and to resource and market analysis in the case of benefits from new movements. Assess current transportation costs in the area.

(b) *Existing waterways*. This step seeks to identify uses beyond the existing use of the waterway; it seeks to identify potential commodities that might use the waterway in response to a reduced transportation charge.

2.6.8 Evaluation procedure: Step 4—Determine current costs of waterway use.

Determine current costs of waterway use for all the tonnage identified in step 3. Include in the waterway transportation cost the full origin-to-destination costs, including handling, transfer, demurrage, and prior and subsequent hauls for the tonnages identified in step 3. Consider the effect of seasonality on costs. In calculating the cost of prior and subsequent hauls, care must be taken to avoid inappropriate aggregations and averaging of the costs of movements in situations in which there is a wide geographic dispersion in ultimate origins and or destinations, as in the case of grain traffic.

(a) *New waterways*. The current cost of the proposed waterway use represents the with-project condition; there are no without-project costs for waterway transportation.

(b) *Existing waterways*. Construct two arrays, one representing the without-project and one the with project condition. The difference between the two arrays reflects the reduction in current delays and any gains in efficiencies resulting from the alternative under consideration.

2.6.9 Evaluation procedure: Step 5—Determine current cost of alternative movement.

Determine the current cost of alternative movement for all the tonnages identified in step 3. The cost includes the full origin-to-destination costs, including costs of handling, transfer, demurrage, and prior and subsequent hauls. Consider the effect of seasonality on costs. In calculating the costs of gathering or distribution prior or subsequent to the primary line haul, care must be taken to avoid inappropriate aggregations and averaging of the costs of movements in situations in which the ultimate origins and/or destinations are widely dispersed, as the case of grain traffic. This procedure uses price data when available as a proxy for the long-run costs of movement by other modes. This step, combined with steps 3 and 4, generates a first approximation of a demand schedule for waterway transportation given (1) the costs of transportation by alternative modes,

(2) current levels of production, and (3) the distribution of economic activity.

(a) *New waterways*. In the case of rail movements, use the prevailing rate actually charged for moving the traffic to be diverted to waterways. For traffic induced by the waterway construct the rail rate as in step 5b.

(b) *Existing waterways.* Use rate and other price data when available to estimate the cost of movement by alternative modes. In the case of rail movements, if the rate for that movement is not now used, use prevailing rates that are (1) competitive, and (2) for movements similar to the individual move that would occur without the project. Avoid the use of paper rates, i.e., rates at which no significant amount of traffic is actually moved. A rate is "competitive" to the extent that it is for traffic for which there is intramodal or intermodal competition within the relevant markets. In identifying a 'similar' movement, the factors considered may include geographic location, degree of use, characteristics of terrain, back haul, contract division, seasonality, ownership of rolling stock, and physical rail connection to the shipper. It is the responsibility of the analyst to select rates that, in his or her view, best represent the long-run marginal costs of the movement. Cost estimates for particular movements may be useful in selecting the rate or rates that best meet the criteria of competitiveness and similarity. If more than one competitive and similar rate is identified, an average may be used. Assume that all water-compelled or water-competitive rates are competitive and similar.

2.6.10 Evaluation procedure: Step forecast potential waterway traffic by commodity.

Develop projections of the potential use of the waterway under study for selected years from the time of the study until the end of the project life, over time intervals not to exceed 10 years. Document commodity projections for the commodity groups identified in step 3.

(a) The usual procedure for constructing commodity projections is to relate the traffic base to some type of index over time. Indices can be constructed by many different methods, depending on the scope and complexity of the issue under consideration and the availability of data and previous studies.

(b) Generally, OBERS projections are the demographic framework within which commodity projections are made. There are many instances, however, in which a direct application of OBERS-derived indices is clearly inappropriate. Frequently, there are circumstances that distort the relationship between waterway flows and the economy described by OBERS. Even when total commodity flows can be adequately described through the use of indices derived from OBERS projections, factors such as increasing environmental concerns, changes in international relations and trade, resource depletion, and other factors, may seriously alter the relationship between waterway commodity flows and the economy described by OBERS.

(c) If problems of the type described in paragraph (b) of this section are identified, undertake independent studies to ascertain the most appropriate method of projecting commodity flows. The assessment of available secondary data forms the basis of these independent studies. These data will assist in delineating the bounds on the rate of increase for waterway traffic, as well as facilitate a better understanding of the problem. Supplement these data With (1) interviews of relevant shippers, carriers, and port officials; (2) opinions of commodity consultants and experts: and (3) historical flow patterns. Commodity projections can then be constructed on the basis of the results of the independent studies.

(d) Generally, specific commodity studies are of limited value for projections beyond approximately 20 years. Given this limitation, it is preferable to extend the traffic projections to the end of project life through the use of general indices on a regional and industry basis. Such indices can be constructed from the OBERS projections or other generally accepted multi-industry and regional models.

2.6.11 Evaluation procedure: Step 7—Determine future cost of alternative modes.

(a) Future cost per unit of each commodity will normally be the same as current cost. As stated in 2.6.3(a)(5), the without-project condition normally assumes that the alternative modes have sufficient capacity to move traffic at current rates unless there is specific evidence to the contrary. This step combined with step 6 provides a time series of demand schedules specific to a particular commodity origin-destination pattern. Address the projection of any change in future prices as indicated below.

(b) A future rate is a prevailing rate as defined in step 5. It reflects exclusively a shift in rates because of projected changes in the volume of shipments on a given mode or a shift from one mode to another (e.g., from rail to pipeline). To support such a shift, show that the increase in volume is likely to lead to a change in rate; do not assume, for example, that an increase in volume of traffic of a commodity from one area to another will automatically ensure a more favorable high-volume rate.

2.6.12 Evaluation procedure: Step 8 — Determine future cost of waterway use.

Two separate analyses make up this step. First, analyze the possibility of changes in the costs of the waterway mode for future years for individual origin-destination commodity combinations. Second, analyze the relationship between waterway traffic volume and system delay. Do this second analysis in the context of the total volume of traffic on the waterway segments being studied for with- and without-project conditions. This analysis will generate data on the relationship between total traffic volume and delay patterns as functions of the mix of traffic on the waterway; it may be undertaken iteratively with step 9 to produce a "best estimate."

2.6.13 Evaluation procedure: Step 9— Determine waterway use, with and without project.

At this point the analyst will have a list of commodities that potentially might use the waterway segment under study, the tonnages associated with each commodity, and the costs of using alternate modes and the waterway, including system delay functions with and without the project over time. Use this information to determine waterway use over time with and without the project based upon:

(a) A comparison of costs for movements by the waterway and by the alternative mode, as modified by paragraph (b) of this section.

(b) Any changes in the cost functions and demand schedules comparing (1) the current and future without-project conditions and (2) the current and future with-project condition. Conceptually, this step should include all factors that might influence a demand schedule; e.g., impact of uncertainty in the use of the waterway; ownership of barges and special equipment; level of service; inventory and production processes; and the like. As a practical matter, the actual use of a waterway without a cost savings or nonuse of a waterway with a cost savings depends on the knowledgeable judgment of navigation economists and industry experts.

(c) Account for the 'phasing in' or 'phasing out' of shifts from one mode to another in the analysis. Base diversion of traffic from other modes to the waterway, and from the waterway to other modes as the waterway becomes congested, on expected rate savings as adjusted by any other factors affecting the willingness of users to pay or the speed of the response mechanism to changes in the relative attractiveness of alternative modes. Specifically, determine diversions from congested waterways in the order of the willingness of users to pay for waterway transportation. Divert users with the lowest willingness to pay first.

2.6.14 Evaluation procedure: Step 10 — Compute NED benefits.

Once the tonnage moving with and without a plan is known and the alternative costs and waterway costs are known, total NED navigation benefits can be computed at the applicable discount rate:

(a) For cost reduction benefits, the benefit is the reduction in cost of using or operating the waterway; the cost of the alternative mode is a factor in determining whether the tonnage would move both with and without the project but is not a factor in computing benefits. Cost reduction benefits are generally limited to evaluation of existing waterways. The benefits for current and future cost reductions are reflected by the difference in waterway costs (steps 4 and 8) with and without the project. Compare waterway cost data (steps 4 and 8) with the alternative mode costs (steps 5 and 7) in order to determine the traffic flow by mode over time (steps 3 and 6).

(b) For shift of mode benefits, the benefit is the reduction in costs when the alternative movement is compared with the waterway. These benefits apply to new or existing waterways. Cost differences between the alternative mode and the waterway mode (step 5—step 4 x step 3 and step 7—step 8 x step 6) will identify the shift of mode benefits over time.

(c) For shift of origin-destination benefits and new movement benefits, the benefit is the value of the delivered product less the transportation and production costs with the project. The transportation cost without the project (assuming the with-project movement would have occurred) is a factor in categorizing these benefits but is not a factor in computing them. The upper limit of these benefits can normally be determined by computing reduction in transportation charges achieved by the project. These can be a reduction in waterway costs (steps 4 and 8) with and without the project or changes in mode (step 5—step 4 and step 7—step 8).

2.6.15 Evaluation procedure: Problems in application.

(a) *Changes in system delays*. Differences in system delays resulting from project alternatives are difficult to compute. An assessment of system delays within the state of the analytic art is necessary for a comprehensive benefit analysis. Delays at all points in the system should be analyzed only to the extent that project formulation and evaluation are sensitive to such refinements, and to the extent that the state of the art permits accurate refinement of the estimate. Appropriate

proxy measures may be used in lieu of individual assessments at each element in the system when evaluating system delays.

(b) *Interaction of supply and demand schedules.* The entire evaluation procedure (2.6.4 through 2.6.15) is based on an assumption that the supply and demand schedules are independent; but in fact, they are not. This problem is most acute when considering the variance in delays at high levels of lock utilization. Essentially, shippers will face not an expected delay value but rather a highly uncertain delay value. Shippers' response to uncertainty (as reflected in the demand schedule) may be quite different from their response to an expected shipping cost (as reflected by the intersect of the supply and demand schedules).

(c) *User fee collection.* The incremental collection of user charges, fees, or taxes is not a NED benefit. It is a transfer of resources between the private and public sectors of the economy, manifesting itself as resources committed to the proposed navigation system. The increased collection of these charges, fees, or taxes is therefore considered a decrease in the public sector's contribution to the proposed system.

(d) *Sensitivity analysis*. Project benefits are calculated on the basis of 'the most probable' with-project and without-project conditions. However, risk and uncertainty should be addressed in the analysis of NED benefits and costs. In particular, major uncertainty exists in the proper measure of savings to shippers, namely the difference in long-run marginal costs. To the extent that rates or other prices vary from long-run marginal costs, savings to shippers will contain a component of transfers varying from real resource savings. This element of uncertainty should always be identified or acknowledged in estimates of benefits. In dealing with uncertainty, three techniques may be used: establishing consistent sources of data, expanding the data-gathering, and estimating the range of benefits. Use the following two specific approaches to implement the third technique, and display the results in terms of their effects on project benefits in tabular form in the project report.

(1) *Prespecified sensitivity analysis*. Compute the following and include in the report:

(i) *Current tonnage, new waterway*. For new waterways, compute benefits for the recommended alternative on the basis of current phased-in tonnage (steps 3 and 9c), current rates, and current fleet characteristics.

(ii) *Current rates, fleet.* For both new and existing waterways, compute benefits for the recommended alternative on the basis of tonnage over time, current rates (step 3), and current fleet characteristics.

(iii) *Growth beyond 20-year period*. Compute the benefits for alternatives carried forward for final display assuming no growth in tonnage or changes in fleet characteristics or costs beyond 20 years in the future.

(iv) *Interest rate.* For projects whose authorized discount rate is different from the current discount rate, compute annualized benefits using the current rate.

(v) *User charges.* Estimate the effect on benefits of full cost recovery through user charges.

(2) *Other*. In addition, the report should contain such other sensitivity analyses as are necessary to meet the objective of a clear, concise report presenting a range of benefit levels that represent data and assumptions about which reasonable persons might differ.

(e) *Data sources*. The following discussion summarizes key data sources, including problems in their use.

(1) *Interviews*. Interview data may be used in steps 1 through 9. (Use only forms approved by the Office of Management and Budget.) Collect data not available from secondary sources by personal intervals. Use statistically sound techniques for selecting the interview sample and for devising the questions. The questionnaire and a summary of responses should be compiled and displayed in the final report in such a way as to prevent the disclosure of individual sources. Describe the errors and uncertainty inherent in the sampling methods and responses.

(2) *Other*. The basic organizational source for systematically collected waterway data is the Office of the Chief of Engineers.

2.6.16 Report and display procedures.

Clear presentation of study results, as well as documentation of key input data assumptions and steps in the analysis, will facilitate review of the report. Tables 2.6.16-1 through 4 are suggested presentations for all reports that include navigational objectives. In addition to detailed data on the NED benefits of a project, summary tables may present useful information on other aspects of the project such as its impact on commodity flows on other modes of transportation, and on the location of economic activity. See the following sample tables.

Table 2.6.16—1 Summary of Annualized NED Benefits and Costs for Alternative Projects

[Applicable discount rate: ——]

	Alternatives			
	1	2	3	X
Navigation benefits				
Cost reduction benefits				
Shift of mode benefits				
Shift in origin-destination benefits				
New movement benefits				
Total navigation benefits				
Other purpose benefits (list)				
Total project benefits				
Project costs				
Net benefits				

Table 2.6.16—2 Time Phasing of NED Benefits for Recommended Project[1]

[Applicable discount rate: ——]

	Time period						
	Base Years	Decade[2]					
	(specify)	1	2	3	4	5	AAE[3]
Navigation benefits:							
Cost reduction benefit:							
Traffic volume (10^3 tons/year)							
Benefits							
Shift of mode benefit:							
Traffic volume (10^3 tons/year)							
Benefits							
Shift in origin-destination benefit:							
Traffic volume (10^3 tons/year)							
Benefits							
New movement benefit:							
Traffic volume (10^3 tons/year)							
Benefits							
Total navigation benefits							
Other purpose benefits							
Total project benefits							

[1] Comparable tables may be made for all detailed alternatives.
[2] Value for last year of decade.
[3] Average annual equivalent.

Table 2.6.16—3 Waterway Traffic and Delays, Without Project Condition

[Applicable discount rate: ——]

	Time period							
	Current year	Base Years (specify)	Decade[1]					
			1	2	3	4	5	AAE[2]
Waterway traffic (10^3 tons/year)								
(By major commodity group)								
Delays (minutes/tow)								
Study site								
Critical constraints								
Total system								

Table 2.6.16—3 Waterway Traffic and Delays, Without Project Condition - Continued

	Time period							
	Current year	Base Years (specify)	Decade[1]					
			1	2	3	4	5	AAE[2]
Delays (dollars/ton):								
Study site								
Critical constraints								
Total system								

[1] Value for last year of decade.
[2] Average annual equivalent.

Table 2.6.16—4 Waterway Traffic and Delays, With Recommended Project [1]

	Time period						
	Base Year	Decade[2]					
		1	2	3	4	5	AAE[3]
Waterway traffic (10^3 tons/year)							
(By major commodity group)							
Delays (minutes/tow)							
Study site							
Critical constraints							
Total system							
Delays (dollars/ton):							
Study site							
Critical constraints							
Total system							

[1] Comparable tables may be made for all detailed alternatives.
[2] A value for last year of decade.
[3] Average annual equivalent.

Section VII—NED Benefit Evaluation Procedures: Transportation (Deep-Draft Navigation)

2.7.1 Introduction.

This subpart presents the procedure for measuring the beneficial contributions to national economic development (NED) associated with the deep draft navigation features of water resources plans and projects. Deep-draft navigation features include construction of new harbors and channels and improvements to existing or natural harbors on the sea coasts to meet the requirements of ocean-going and Great Lakes shipping. Harbor improvements include such structural projects as the construction of breakwaters and jetties to protect exposed harbors and the provision of entrance channels, interior channels, turning basins, and anchorage areas. Non-structural deep-draft measures include improved traffic management and pilotage regulations.

2.7.2 Conceptual basis.

The basic economic benefits from navigation management and development plans are the reduction in the value of resources required to transport commodities and the increase in the value of output for goods and services. Specific transportation savings may result from the use of larger vessels, more efficient use of large vessels, more efficient use of existing vessels, reductions in transit time, lower cargo handling and tug assistance costs, reduced interest and storage costs such as from an extended navigation season, and the use of water transportation rather than an alternative land mode. Principal direct benefits are categorized as follows:

(a) *Cost reduction benefits*. If there is no change in either the origin or destination of a commodity, the benefit is the reduction in transportation costs of quantities of the commonalty that would move with and without the plan resulting from the proposed improvement.

Cost reduction benefits apply in the following situations:

(1) *Same commodity, origin-destination, and harbor.* This situation occurs where commodities now move or are expected to move via a given harbor with or without the proposed improvement.

(2) *Same commodity and origin-destination, different harbor*. This situation occurs where commodities that are now moving or are expected to move via alternative harbors without the proposed improvement would, with the proposed plan, be diverted through the subject harbor. Cost reduction benefits from a proposed plan apply to both new and existing harbors and channels.

(3) *Same commodity and origin-destination, different mode*. This situation occurs where commodities that are now moving or are expected to move via alternative land modes without the proposed improvement would, with the proposed plan, be diverted through the subject harbor or channel. Cost reduction benefits from a proposed plan apply to both new and existing harbors and channels. Compute cost reduction benefits for alternate modes in accordance with Section VI (See 2.6.2(e)).

(b) *Shift of origin benefits*. If there is a change in the origin of a commodity as a result of a proposed plan but no change in destination, the benefit is the reduction in the total cost of producing and transporting quantities of the commodity that would move with and without the plan.

(c) *Shift of destination benefits*. If there is a change in destination of a commodity as a result of a proposed plan but no change in origin, the benefit is the change in net revenue to the producer for quantities that would move with and without the plan.

(d) *Induced movement benefits*. If a commodity or additional quantities of a commodity are produced and consumed as the result of lowered transportation costs, the benefit is the value of the delivered commodity less production and transportation costs. More precisely, the benefit of each increment of induced production and consumption is the difference between the cost of transportation via the proposed improvement and the maximum cost the shipper would be willing to pay. Where data are available, estimate benefits for various increments of induced movement. In the absence of such data, the expected average transportation costs that could be borne by the induced traffic may be assumed to be half way between the highest and lowest costs at which any part of the induced traffic would move.

2.7.3 Planning setting.

The planning setting consists of the physical, economic, and policy conditions that influence and are influenced by a proposed plan or project over the planning period. The planning setting is defined in terms of a without-project condition and with-project condition.

(a) *Without-project condition*. The without-project condition is the most likely condition expected to exist over the planning period in the absence of a plan, including any known change in law or public policy. It provides the basis for estimating benefits for alternative with-project conditions. Assumptions specific to the study should be stated and supported. The basic assumptions for all studies are:

(1) Nonstructural measures within the authority and ability of port agencies, other public agencies, and the transportation industry determine changes that are likely to occur. These measures consist of reasonably expected changes in management and use of existing vessels and facilities on land and water. Examples are lightering, tug assistance, use of favorable tides, split deliveries, topping-off, alternative modes and ports, and transshipment facilities.

(2) Alternative harbor and channel improvements available to the transportation industry over the planning period include those in place and under construction at the time of the study and those authorized projects that can reasonably be expected to be in place over the planning period.

(3) Authorized operation and maintenance is assumed to be performed in the harbors and channels over the period of analysis unless clear evidence is available that maintenance of the project is unjustified.

(4) In projecting commodity movements involving intermodal movements, sufficient capacity of the hinterland transportation and related facilities, including port facilities, is assumed unless there are substantive data to the contrary.

(5) A reasonable attempt should be made to reflect advancing technology affecting the transportation industry over the period of analysis. However, the benefits from improved technology should not be credited to the navigation improvement if the technological change would occur both with and without the plan.

(b) *With-project condition*. (1) The with-project condition is the one expected to exist over the period of analyses if a project is undertaken. Describe the with-project condition for each

alternative plan. Since benefits attributable to each alternative will generally be equal to the difference in the total transportation costs with and without the project, the assumptions stated for the without-project condition are used to establish the with-project condition for each alternative.

(2) Management practices that are sometimes within the discretion of a public entity and are therefore subject to change in the with condition include traffic management, pilotage regulations, addition of berths, and additions or modifications to terminal facilities.

(c) *Display*. In the planning report, present the derivation and selection of with- and without-project conditions in accordance with the following guidelines:

(1) State the assumptions specific to the study.

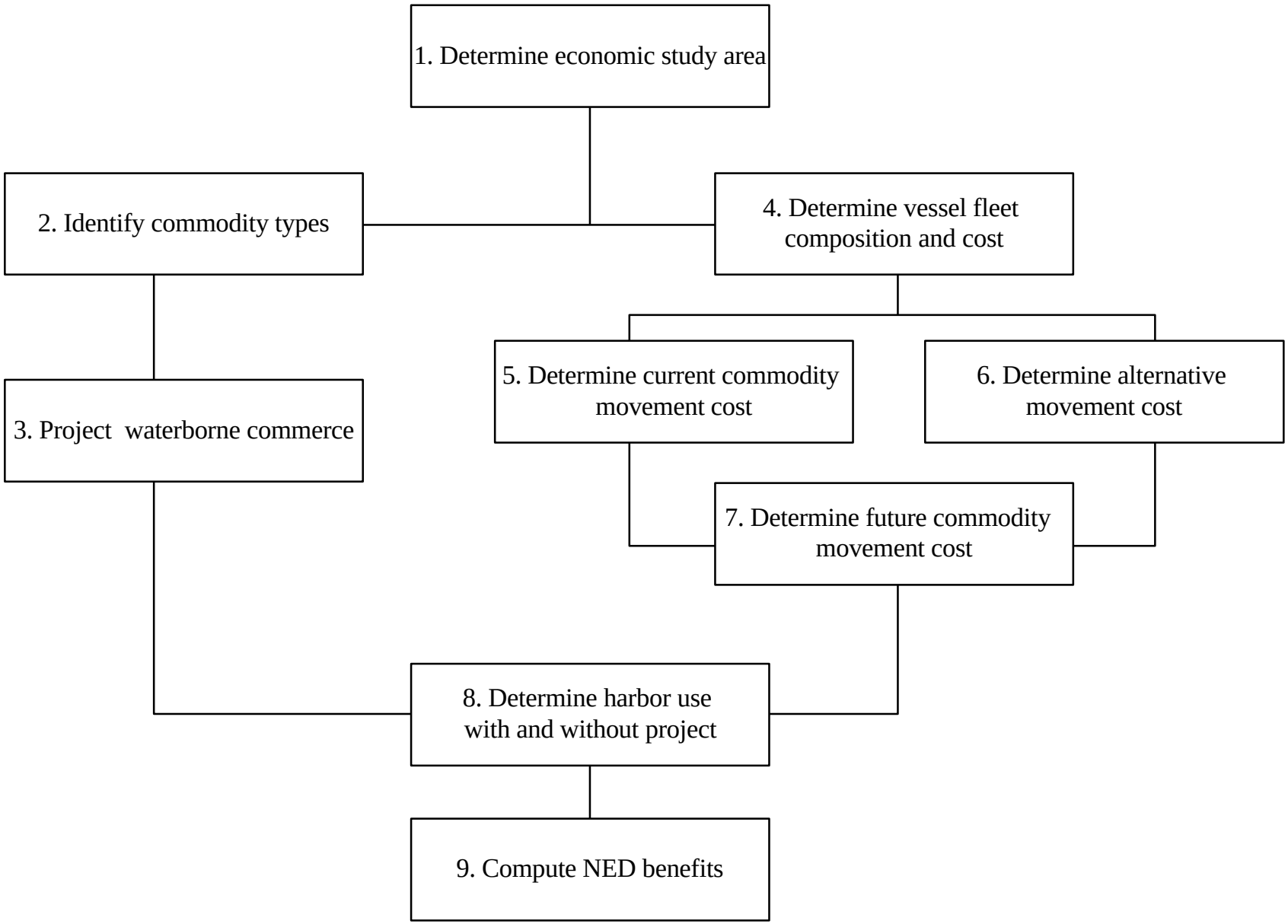
(2) Specify the significant technical, economic, environmental, social, and other elements of the planning setting to be projected over the period of analysis. Discuss the rationale for selecting these elements.

(3) Present the with and without project conditions in appropriate tabular and graphic displays with respect to the elements selected as in paragraph (c)(2) of this section and as exemplified by Tables 2.7.6-1, -4, and -5.

2.7.4 Evaluation procedures.

Use the following steps to estimate navigation benefits. The level of effort expended on each step depends upon the nature of the proposed improvement, the state-of-the-art for accurately refining the estimate, and the sensitivity of project formulation and evaluation to further refinement. A flowchart of navigation evaluation procedures is shown in Figure 2.7.4.

Figure 2.7.4
Flow Chart of Deep Draft
Navigation Benefit Evaluation Procedures



(a) *Step 1—Determine the economic study area*. Delineate the economic study area that is tributary to the proposed harbor and channel improvement. Assess the transportation network functionally related to the studied improvement, including the types and volumes of commodities being shipped, in order to determine the area that can be served more economically by the improvement. Include foreign origins and destinations in this assessment. Consider diversion from or to adjacent competitive harbors as well as distribution via competing modes of transport. It should be recognized that the lines of demarcation for the economic study area are not fixed and that the area may expand or contract as a result of innovations or technological advances in transportation and/or production or utilization of a particular commodity. The economic study area is likely to vary for different commodities. Combinations of economic areas will result in a trade area delineated specifically for the improvement under study. However, in many cases, due to the close proximity of adjacent harbors to the proposed improvement, the economic study area may be the same as, or overlap with, such adjacent harbors. Therefore, in the final delineation of the economic study area for a given improvement, there should be adequate discussion of the trade area relative to adjacent ports and any commonality that might exist.

(b) *Step 2 - Identify types and volumes of commodity flow.* To estimate the types and volumes of commodities that now move on the existing project or that may be attracted to the proposed improvement, analyze commerce that flows into and out of the economic study area. This analysis provides an estimate of gross potential cargo tonnage; the estimate is refined to give an estimate of prospective commerce that may reasonably be expected to use the harbor during the period of analysis in light of existing and prospective conditions. If benefits from economics of ship size are related to proposed deepening of the harbor, the analysis should concentrate on the specific commodities or types of shipments that will be affected. Thus, an historical summary of types and trends of commodity tonnage should be displayed. The considerations generally involved in estimating current volumes of prospective commerce are:

(1) If the plan consists of further improvements to an existing project, statistics on current waterborne commerce will provide the basis for evaluation. For new harbors with no existing traffic, or for existing commodity movements that may be susceptible to diversion from adjacent harbors, basic information is collected by means of personal interviews or questionnaires sent to shippers and receivers throughout the economic study area. Secondary commercial data are usually available through State and local public agencies, port records, and transportation carriers. In the case of new movements, give attention to resource and market analyses.

(2) After determining the types and volumes of commodities currently moving or expected to move in the economic study area, it is necessary to obtain origins, destinations, and vessel itineraries in order to analyze the commodity types and volumes that are expected to benefit from the proposed improvement. Commodities that are now moving without the project but that would shift origins or destinations with the project, as well as induced movements, should be segregated for additional analysis (see steps 5 and 6). A study should be made of various alternatives for the existing traffic and of new traffic susceptible to diversion from alternative harbors or other modes of transportation. The objective of such a study is to determine the type and volume of those commodities for which savings could be affected by movement via a proposed navigation improvement and the likelihood that such movements would occur. Cost reduction benefits sufficient to divert traffic from established distribution patterns and trade routes are navigation project benefits. In determining the likelihood of prospective commerce, particular attention should be given to alternative competitive harbors in the case of new movements and to hinterland traffic. Elements of analysis of current tonnage include: size and type of vessel, annual volume of movements, frequency of movements, volume of individual shipments, adequacy of existing harbor and transportation facilities, rail and truck connections, and service considerations. Generally this prospective traffic is the aggregate of a large number of movements (origin-destination pairs) of many commodities; the benefit from the navigation project is the savings on the aggregate of these prospective movements.

(c) *Step 3 - Project waterborne commerce.* Develop projections of the potential use of the waterway under study for selected years from the time of the study until the end of the project life, over time intervals not to exceed 10 years. Document commodity projections for the commodity groups identified in step 2.

(a) The usual procedure for constructing commodity projections is to relate the traffic base to some type of index over time. Indices can be constructed by many different methods, depending on the scope and complexity of the issue under consideration and the availability of data and previous studies.

(b) Generally, OBERS Projections are the demographic framework within which commodity projections are made. There are many instances, however, in which a direct application of OBERS-derived

indices is clearly inappropriate. Frequently, there are circumstances that distort the relationship between waterway flows and the economy described by OBERS. Even when total commodity flows can be adequately described through the use of indices derived from OBERS projections, factors such as increasing environmental concerns, changes in international relations and trade, resource depletion, and other factors, may seriously alter the relationship between waterway commodity flows and the economy described by OBERS.

(c) If problems of the type described in paragraph (b) of this section are identified, undertake independent studies to ascertain the most appropriate method of projecting commodity flows. The assessment of available secondary data forms the basis of these independent studies. These data will assist in delineating the bounds on the rate of increase for waterway traffic, as well as facilitate a better understanding of the problem. Supplement these data with (1) interviews of relevant shippers, carriers, and port officials; (2) opinions of commodity consultants and experts; and (3) historical flow patterns. Commodity projections can then be constructed on the basis of the results of the independent studies.

(d) Generally, specific commodity studies are of limited value for projections beyond approximately 20 years. Given this limitation, it is preferable to extend the traffic projections to the end of project life through the use of general indices on a regional and industry basis. Such indices can be constructed from the OBERS projections or other generally accepted multi-industry and regional models. Describe projection methods selected in sufficient detail to permit a review of their technical adequacy.

(2) Sensitivity analysis of several levels of projections is used for the economic analysis. There may be a high level projection embodying optimistic assumptions and a low level projection based on assumptions of reduced expectations. The high and low projections should bracket the most foreseeable conditions. The third and fourth levels of projections can reflect the with- and without-project conditions based on the most likely estimates of the future. If a proposed plan would not induce commodity growth, one level of projection may be shown for both the with- and without-project conditions. (See Chapter I, Supplement I).

(3) The commodities included in the projections should be identified, if possible, according to the following waterborne modes: containerized, liquid bulk, dry bulk, break-bulk, etc. Projection-related variables include estimated value, density, and perishability. The commodities should also be categorized by imports, exports, domestic shipments, domestic receipts, and internal trade. Projected tonnages by trade areas both with and without the project should be displayed at least for the study year, the base year, fifth year, tenth year, and then by decades over the period of the analysis.

(4) Most projections of waterborne commerce are static estimates of dynamic events; therefore, the projections should be sufficiently current to support the report conclusions.

(d) *Step 4 - Determine vessel fleet composition and cost — (1) Vessel fleet composition*. Key components in the study of deep-draft harbor improvements are the size and characteristics of the vessels expected to use the project. Present data on past trends in vessel size and fleet composition, and on anticipated changes in fleet composition over the project life. Use estimates of future fleet consistent with domestic and world fleet trends. Undertake studies to the extent necessary to determine the appropriate vessel fleet. The assessment of available secondary data forms the basis of the independent studies. Data may be obtained from various sources including the U.S. Department of Transportation (Maritime Administration), trade journals, trade associations, shipbuilding companies, and vessel operating companies. Determine the composition of the current and future fleet that would utilize the subject harbor both with and without the proposed improvement. Provide adequate lead time for anticipated changes in fleet composition for vessels that are currently a small part of the world fleet. Size selection may vary according to trade route, type of commodity, volume of traffic, canal restrictions, foreign port depths, and lengths of haul. It may not be realistic to assume that the optimum size vessel is always available for charter; the preferred approach is a fleet concept that includes a range of vessels expected to call with and without the project. It is suggested that tabulations in the report show composition of vessel fleets by deadweight tonnage for each type of vessel beginning with the current fleet and by decades through the period of analysis. Historical records of trips and drafts of vessels calling at the existing project should also be displayed.

(2) *Vessel operating costs*. To estimate transportation costs, obtain deep-draft vessel operating costs for various types and classes of foreign and United States flag vessels expected to benefit from using the proposed improvement. Since vessel operating costs are not readily available from ocean carriers or from any central source, the Corps of Engineers, Water Resources Support Center, will develop and provide such costs on an annual basis for use in plan evaluation. Planners should determine to what extent these estimates of vessel costs must be modified to meet the needs of local conditions. Document and display selected vessel operating costs in the report.

(e) *Step 5 - Determine current cost of commodity movements*. Determine transportation costs prevailing at the time of the study for all tonnage identified in Step 2. Transportation costs include the full origin-to-destination cost, including necessary handling, transfer, storage, and other accessory charges. Construct costs for the with- and without project condition. The without-project condition is based on costs and conditions prevailing at the time of the study. Transportation costs with a plan reflect any efficiencies that can be reasonably expected, such as use of larger vessels, increased loads, reduction in transit time and delays (tides), etc. Use competitive rates, rather than costs, for competitive movements by land (See 2.7.2(a)(3), 2.6.2(e), and 2.6.9(b)). This concept also applies to Steps 6, 7, and 9 and elsewhere where a Competitive movement by land is an alternative.

(f) *Step 6 - Determine current cost of alternative movement.* Determine transportation costs prevailing at the time of the study for all tonnage identified in Step 2 for alternative movements. The cost includes the full origin-to-destination cost. Such alternatives include competitive harbors, lightering, lightening and topping-off operations, off-shore port facilities, transshipment terminals, pipelines, traffic management, pilot age regulations, and other modes of transportation. Consider competitive harbors with existing terminal facilities and sufficient capacities as possible alternatives for traffic originating in or destined to the hinterland beyond the confines of the harbor and for all other new commerce as well as all diverted traffic. Commerce with final origins and destinations within the confines of the study harbor is normally noncompetitive with other harbors and need not be considered for diversion unless unusual circumstances exist. Diversion of established commerce now moving through the existing harbor to or from the hinterland is dependent on many different cost and service factors; therefore, to ensure that all of these factors are included in the analysis, interviews, and consultations with shippers and receivers should be conducted prior to any determination concerning diversion of traffic. Factors to be considered in the analysis include transportation costs for both inland and ocean movement, handling and transfer charges, available service and schedules, carrier connections, institutional arrangements, and other related factors. In addition, for commodities with shifts in origins and destinations, as well as for new movements, collect data on the value of the delivered product as well as production and transportation costs for shipments with the project. The specific data and method of collection will vary with the specific situation and the nature of the benefit.

(g) *Step 7 - Determine future cost of commodity movements*. Estimate relevant shipping costs during the period of analysis and future changes in the fleet composition, port delays, and port capacity under the with- and without-project conditions for each alternative improvement under study. Base future transportation costs on the vessel operating cost prevailing at the time of the study. Additional data may be needed to analyze the relationship between total volume and delay patterns and the port capacity for the with- and without-project conditions for each alternative. Changes in costs due to the project should be identified and separated from changes due to other factors.

(h) *Step 8 - Determine use of harbor and channel with and without project.* At this point, the analyst will have a list of commodities that potentially might use the proposed improvement; potential tonnages of each commodity or commodity group; transportation costs for alternatives and for the proposed improvement; and present and future fleet composition with and without the proposed plan. To estimate the proposed harbor use over time, both with and without the project, compare costs, other than project costs, for movements via the proposed plan and via each alternative. Analyze any changes in the cost functions and demand schedules in the current and future without condition and the current and future with condition. Conceptually, this step includes all factors that might influence a demand schedule. Determine the impact of uncertainty in the use of the harbor, the level of service provided, and existing and future inventories of vessels. Provide adequate lead time for adoption for vessels that are currently a small percentage of the world fleet.

(i) *Step 9 - Compute NED benefits.* Once the tonnage moving with and without a plan is known and the cost via the proposed harbor and via each alternative are known, compute total NED navigation benefits will be computed using the applicable discount rate.

(1) *Cost reduction benefits*. (i) Traffic with same commodity, origin-destination, and harbor. For traffic now using the harbor or expected to use it, both with and without the proposed project, the transportation benefit is the difference between current and future transportation cost for the movement by the existing project (without-project condition) and the cost with the proposed improvement (with-project condition) .

(ii) Traffic with same origin-destination; different harbor. For commerce shifted to the proposed improvement from other harbors or alternatives, including future growth, the benefit is any reduction in current and future costs when movement via the

proposed improvement is compared with each alternative.

(iii) Traffic with same commodity and origin-destination, different mode. For commerce shifted to the proposed improvement from other modes, the benefit is any reduction in current and future costs to the producer or shipper. (See 2.7.2(a)(3)) when movement via the proposed improvement is compared with each alternative.)

(2) *Shift of origin benefits*. For commerce that originates at a new point because of the proposed improvement, the benefit is the difference between the total cost of producing and transporting the commodity to its destination with and without the plan.

(3) *Shift of destination benefits*. For commerce that is destined to a new point because of the proposed improvement, the benefit is the difference in net revenues to producers with and without the plan.

(4) *Induced movement benefits*. If a commodity or additional quantities of commodity are produced and consumed as a result of a plan, the benefit for each increment of induced production and consumption is the difference between the cost of transportation via the proposed improvement and the maximum cost the shipper would be willing to pay. To determine the maximum cost the shipper would be willing to pay, estimate how much of a price increase it would take to induce the producer to increase its output by each increment or how much of price decrease it would take to induce consumers to increase their consumption by each increment. In the absence of data suitable for incremental analysis, the expected average transportation costs that could be borne by the induced traffic may be assumed to be half way between the highest and lowest costs at which any part of the induced traffic would move.

2.7.5 Problems in application.

(a) *Multiport analysis*. This procedure calls for a systematic determination of alternative routing possibilities, regional port analyses, and intermodal networks that may require the use of computer modeling techniques. The data needed for such a determination are often difficult to obtain; therefore, interviews with knowledgeable experts will often have to be relied upon.

(b) *Ultimate origins and destinations*. The procedure calls for an analysis of full origin-destination costs to determine routings as well as to measure benefits in some instances. Problems will arise in determining the ultimate origins and destinations of commodities and in determining costs. Therefore, the analyst should attempt to shorten the analysis to the most relevant cost items.

(c) *Sensitivity analysis*. Guidance for addressing risk and uncertainty in the analysis is found in Supplement I to Chapter I. The uncertainty in the estimates of critical variables should be dealt with. These variables specifically related to deep-draft navigation may be traffic projections, especially foreign shipments, fleet composition, and cost of commodity movements.

(d) *Data sources*. The following discussion summarizes key data sources including problems in their use:

(1) *Interviews*. Collect data not available from secondary sources by personal interviews. (Use only interview forms approved by the Office of Management and Budget.) Display the questionnaire used and a summary of responses in the project report in such a way that individual sources are not disclosed.

(2) *Publications*. Data concerning commerce in foreign trade, United States coastal shipping, and activities of U.S. flag vessels in foreign trade, together with limited data concerning the world fleet, are readily available from a number of Federal agencies, trade journals, and port publications. However, data concerning the foreign-flag fleet are often not regularly available in up-to-date form from sources in the United States. Principal governmental sources are the Corps of Engineers, the Maritime Administration and the Bureau of the Census. For more detailed background on world fleet trends, shipping outlooks, and vessel characteristics, available foreign literature must be carefully analyzed. A few of the available foreign ship registers and literature are listed below to illustrate the type of data available from foreign sources.

Lloyd's Register of Shipping, London (Annual).

The Tanker Register, H. B. Clarkson (Annual).

The Bulk Carrier Register, H. B. Clarkson (Annual).

Shipping Statistics and Economics (and special reports), H. P. Drewry, Ltd., London (Weekly).

Fairplay International Shipping Journal (and special reports), London (Weekly).

2.7.6 Report and display procedures.

Clear presentation of study results, as well as documentation of assumptions and steps in the analysis, will facilitate review of the report. The accompanying tables are suggested. The number of displays will depend on the complexity of the study.

Table 2.7.6—1 Projected Vessel Fleet Size Distribution,[a] -- Ft. Channel Plan

[By percentage]

Vessel size (D.W.T.)	Current[b]	Percentage of tonnage					
		Base Year[c]	Year 5	Year 10	Year 20	Year —	Year end
		With project					
Total							
		Without project					
Total							

[a] Size distribution should be made separately, as follows: 1. For foreign and US flag fleets. 2. For vessel types. 3.For trade routes (where distances, constrictions or other circumstances indicated varying sized vessel fleets). 4. For year project plan.
[b] Study year.
[c] First year of project benefits.

Table 2.7.6—2 Typical Vessel Dimensions of Vessel Fleet by Type and Deadweight Tonnage

Type	Vessel characteristics			
	DWT	Length	Beam	Draft, loaded

Table 2.7.6—3 Computation of Annual Transportation Costs[1] for -------

D.W.T. group	Foot channel				Foot channel				Foot channel			
	Tonnage carried		Unit cost	Total cost	Tonnage carried		Unit cost	Total cost	Tonnage carried		Unit cost	Total cost
	Percent	Volume			Percent	Volume			Percent	Volume		
(000)		(000)				(000)				(000)		
Total												

[1] Similar computations should be included for major commodity movements

Table 2.7.6—4 Projected Commerce for Deep-Draft Traffic

Commodity[1]	Current Year[2]	Base Return Year[3]	Year 5	Year 10	Year 20	Year —	Year —	Year end	Average Annual
With project									
Without project									

[1] Commodities should be categorized by trade area
[2] Study area
[3] First Year of project benefits

Table 2.7.6—5 Projected Vessel Trips for Deep-Draft Traffic

Vessel type [1]	Current Year [2]	Base Return Year [3]	Year 5	Year 10	Year 20	Year—	Year —	Year end	Average Annual
With project									
Without project									

[1] Show projected vessel trips by type of vessel and total for project life.
[2] Study year.
[3] First Year of project benefits.

Section VIII—NED Benefit Evaluation Procedures: Recreation

2.8.1 Introduction.

This section provides the procedures for evaluating the beneficial and adverse effects of water project recreation on national economic development (NED). The Federal Water Project Recreation Act of 1965 (Pub. L. 89-72) requires that full consideration be given to the opportunities that Federal multiple-purpose and other water projects afford for outdoor recreation and associated fish and wildlife enhancement.

2.8.2 Conceptual basis.

(a) *General*. (1) Benefits arising from recreation opportunities created by a project are measured terms of willingness to pay. Benefits for projects (or project features) that increase supply are measured as the willingness to pay for each increment of supply. Benefits for projects (or project features) that alter willingness to pay (e.g., through quality changes) are measured as the difference between the without- and with-project willingness to pay. Willingness to pay includes entry and use fees actually paid for site use plus any unpaid value (surplus) enjoyed by consumers. (Payment for equipment, food, transportation costs, or lodging associated with recreation activity cannot be used as direct estimates of willingness to pay, because these payments are not specifically for site use). The total willingness to pay is represented as the area under the demand curve between the old and new supply. Because most recreation is publicly provided, it is usually not possible to estimate demand directly from observed price-consumption data. This section describes procedures for estimating use and willingness to pay by means of travel behavior, user surveys, and other quantifiable measures.

(2) Many proposed projects subject to NED benefit-cost analysis involve both recreation gains and recreation losses. For example, stream and land-based recreation may be lost because of the project, or recreation may be transferred to the proposed site from a more distant site. Net recreation benefits are the value of the gains minus the value of the losses; benefits may be positive or negative. Since reliable empirical methods for estimating willingness to accept compensation for losses have not been developed, measures of willingness to pay are used to value both gains and losses. Evaluation procedures should be based on sound economic rationale and have an empirical basis that permits an objective and reproducible analysis of benefits and costs.

(b) *Criteria for an acceptable evaluation procedure*. An acceptable evaluation procedure has the following characteristics:

(1) Evaluation is based on an empirical estimate of demand applied to the particular project.

(2) Estimates of demand reflect the socioeconomic characteristics of market area populations, qualitative characteristics of the recreation resources under study, and characteristics of alternative existing recreation opportunities.

(3) Evaluation accounts for the value of losses or gains to existing sites in the study area affected by the project (without-project condition).

(4) Willingness to pay projections over time are based on Protected changes in underlying determinants of demand.

(c) *Description of evaluation methods*. The procedures described in this section and its appendices incorporate three evaluation methods. They are the travel cost method (TCM), contingent valuation method (CVM), and unit day value (UDV) method.

The use of any other method should be justified as Conforming to the Characteristics listed in 2.8.2(b) and the selection process described in 2.8.2(d).

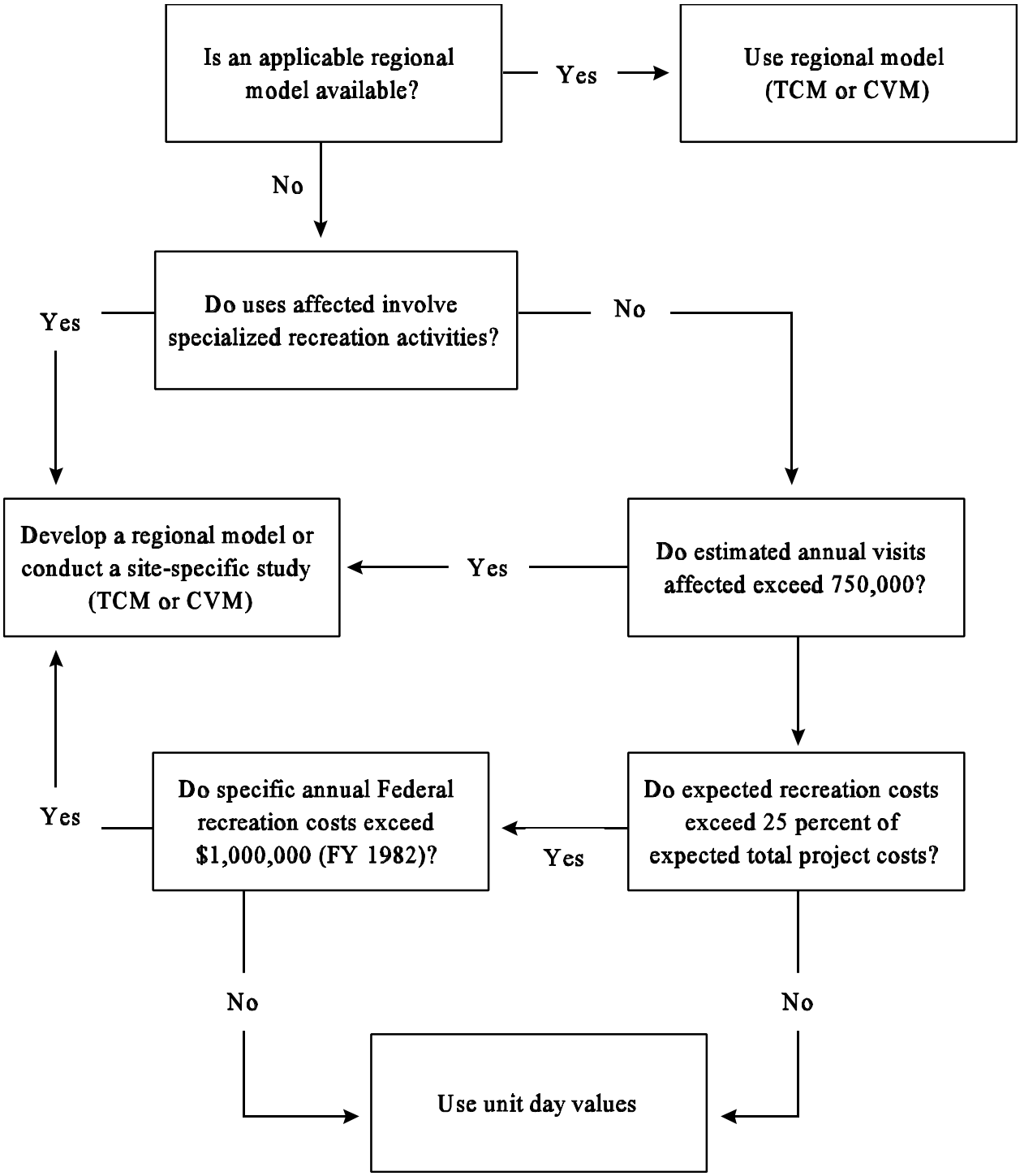
(1) *Travel cost method*. The basic premise of the travel cost method is that per capita use of a recreation site will decrease as out-of-pocket and time costs of traveling to the site increase, other variables being constant. TCM, consists of deriving a demand curve by using the variable costs of travel and the value of time as proxies for price. This method may be applied to a site-specific study or a regional model.

(2) *Contingent valuation method*. The contingent valuation method estimates NED benefits by directly asking individual households their willingness to pay for changes in recreation opportunities at a given site. Individual values may be aggregated by summing willingness to pay for all users in the study area. This method maybe applied to a site-specific study or a regional model.

(3*) Unit day value*. The unit day value method relies on expert or informed opinion and judgment to estimate the average willingness to pay of recreation users**.** By applying a carefully thought-out and adjusted unit day value to estimated use, an approximation is obtained that may be used as an estimate of project recreation benefits.

(d) *Selection of evaluation procedure*. Select a procedure for evaluating each of the following two categories of project-related use: (1) total or gross expected use of project facilities, including transfers of use from other sites: (2) and existing site use displaced or destroyed by project facilities. The criteria for selecting the appropriate procedure for each use category are set out in Figure 2.8.2. Application of the criteria may result in selection of different procedures for the two categories. The criteria given in Figure 2.8.2 consider several dimensions of project evaluation situations: Three measures of the absolute and relative size of the recreation benefit created, displaced, or transferred by the proposed project, and the nature of the recreation activities affected. If either use category specified above involves more than 750,000 annual visits, use either a regional model or site-specific study to evaluate benefits or benefits foregone. If recreation is an important project component relative to other outputs and costs, or if specialized activities (those for which opportunities in general are limited, intensity of use is low, and users skill, knowledge, and appreciation is great) are affected, the criteria also require greater accuracy in benefit estimates. If both specialized activities and general recreation are affected by the project, the choice between a regional model and a more limited site-specific study is at the discretion of the agency, based on consideration of the relative importance of the specialized activity, the advantages of the respective methods, and cost considerations.

Figure 2.8.2——Criteria for Selecting Procedures for Evaluating Recreation Benefits



2.8.3 Planning setting.

(a) *General.* Determine changes in recreation use and value resulting from alternative plans through analysis of without-project and with-project conditions in the study area over the prescribed period of analysis.

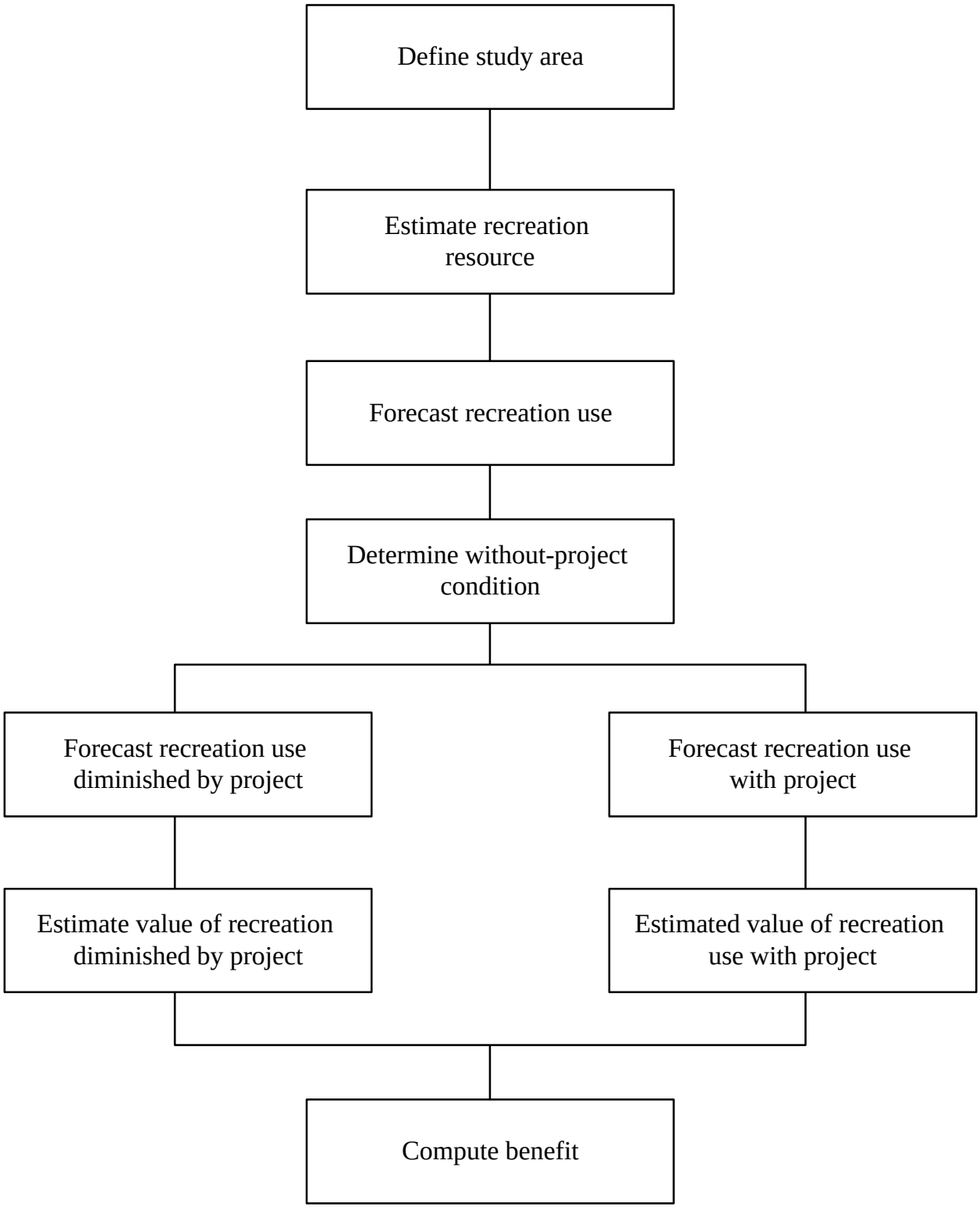
(b) *Without-project condition*. The without-project condition is the pattern of recreation activity expected to prevail over the prescribed period of analysis in the absence of the recreation project or plan. The without-project condition includes existing water and related land recreation resources, and projects and additional recreation resources currently being developed or both authorized and likely to be developed during this period.

(c) *With-project condition*. The with-project condition is the pattern of recreation activity expected to prevail over the prescribed period of analysis with a recreation plan or project. Recreation resources included in the without-project condition provide the basis for the with-project condition. Analysis of the with-project condition considers recreation opportunities that will be diminished in quality or quantity because of project development and operation. This will be accomplished in assessing the use of the proposed recreation development.

2.8.4 Evaluation procedure: General.

Use the following procedure to determine the benefit from recreation resource use with a plan or project. (See Figure 2.8.4.) The benefit is based on the gross value of recreation use of the resource for the with-project condition less the gross loss in recreation use caused by the project or plan. The recreation benefit is measured in nine steps. The level of effort expended on each step depends on the nature of the proposed improvement, the state of the art for accurately refining the estimate. and the sensitivity of project formulation and justification to further refinement.

Figure 2.8.4 Flowchart of Recreation Benefit Evaluation Procedures



2.8.5 Evaluation procedure: Define the study area.

Determine changes in recreation use and value resulting from alternative plans through the analysis of without-project and with-project conditions in the study area over the prescribed period of analysis. The impacts should relate to the geographical recreation "market" defined by the location of actual and potential user populations. Definition of the study area should be justified with respect to the particular characteristics and quality of the site and the availability of similar alternative recreation opportunities. Reference to statistical evidence regarding the spatial distribution of trip generation is encouraged.

2.8.6 Evaluation procedure: Estimate recreation resource.

(a) Include in estimates of the recreation resource capacity for the study area all sites (see 2.8.3(b)) that provide recreation activities similar to those displaced or provided by the project. The recreation resource in the study area is the system of water and related land recreation sites that influence the demand for the proposed project and are influenced in turn by the demand at the existing site.

(b) Include in the inventory of water and related land recreation sites in this study area those Federal. State, county, local, and private sites that are in varying stages of development or that are authorized and likely to be developed in the forecast period.

(c) Identify the ability of recreation alternatives to provide different recreation activities and assess the quality of the alternative recreation experiences.

2.8.7 Evaluation procedure: Forecast potential recreation use in the study area.

Potential use is the expected visitation at prevailing prices unconstrained by supply. Forecast of total recreation use in the study area should be made for each activity currently provided at the project site and for each activity proposed in the plan or project. The potential use for a specified outdoor water and related land recreation activity will depend on the size and characteristics of the study area population and the availability of the specified recreation activity and other types of recreation in the study area.

(a) The recreation use of the site's resources will depend not only on the attributes of the site and its proximity to population centers, but also on its location in relation to the location of other water and related land resources providing similar or complementary types of recreation within the study area.

(b) Forecasting potential future participation in recreation activities for the study area involves four steps: (1) Collect data on explanatory variables that influence the demand for recreation activities; (2) Relate potential use to these variables by means of some use estimating techniques as described in 2.8.9; (3) Forecast values of the explanatory variables over the period of analysis. Justify projections and explain any simplifying assumptions. Reference to statistical evidence on trends is encouraged; (4) Calculate expected use for the study area using the values obtained in Step (3) and the relationships determined in Step (2).

2.8.8 Evaluation procedure: Determine the without-project condition.

Determine the without-project condition for the study area on the basis of a comparison of the available recreation resources as specified in 2.8.6 and the recreation resource use as specified in 2.8.7 for each activity currently provided at the project site and each activity proposed in the plan or project. Compare the capacities of all sites, including the site without the proposed project, to produce recreation activities with the expected demand for each activity.

2.8.9 Evaluation procedure: Forecast recreation use with project.

(a) *General*. Forecast recreation use with the project as a basis for estimating project recreation values. Project use over time by calculating the change in use induced by anticipated changes in the variables that determine use. Explain values employed for projecting future demand and any simplifying assumptions. For the capacity method described in paragraph (b)(4) of this section, use is constant over time as determined by the capacity constraint. Explain use projections and any simplifying assumptions. Reference to statistical projections of recreation participation is encouraged.

(b) *Use estimating techniques*. Use one or more of the following approaches for estimating recreation use for the with-project and/or without-project conditions. The use of any other method should be justified as conforming to the characteristics listed in 2.8.2(b). References to statistical estimates are encouraged.

(1) *Regional use estimating models*. Regional use estimating models are statistical models that relate use to the relevant determinants based on data from existing recreation slates in the study area. The use of regional models can economize

on resources required for site-specific studies. In the absence of a regional model, estimate use by one of the site-specific methods described below. If a use estimating model has already been developed for the region in which a proposed project is to be located, use estimates should be obtained by the following procedure:

(i) Delimit the areas of origin for the proposed project (use of counties or parts of counties as origin areas will facilitate gathering of data in subsequent steps).

(ii) Compute measures of the explanatory variables in the use equation for each origin area and for each year for which an estimate is required.

(iii) Calculate use from each area for each year.

(iv) Aggregate use from each area to get estimated annual use.

(2) *Site-specific use estimating models*. The preferred site-specific method of estimating use is a use estimating model (UEM) that relates use per 1,000 of origin population to distance traveled, socioeconomic factors, and characteristics of the site and alternative recreation opportunities. Use estimating models yield regression coefficients estimated from data gathered at a comparable existing site or cross section of existing sites. The coefficients are used to estimate visitation at a proposed site in the same way as described for regional models. Factors that influence demand for recreation, such as characteristics of user populations and availability of alternative opportunities, are explicitly taken into account by variables in the model. Because of the influence of congestion during heavy use periods, it is desirable to distinguish use during summer weekends and holidays. If data limitations do not permit desegregation, explain treatment of seasonal use variation and any simplifying assumptions.

(3) *Application of information from a similar project.*

(i) If a UEM is not available and cannot be estimated because of data limitations, use may be estimated by the similar project method. This method assumes that recreation demand for a proposed project can be estimated from observations of visitation patterns at one or more existing projects with similar resource, operations, and use characteristics. The alternatives under study are compared with water resource projects and recreation resource areas for which trip generation and other statistics are known. It is Important to obtain as close a match as possible in type, size, and quality of project; market area demographic and socioeconomic characteristics; existence and location of competing recreation opportunities; and other variables that influence demand.

(ii) The most efficient and technically sound similar project procedure is based on per capita use curves (i.e., regression curves relating per capita rate of use to travel distance) from which use estimates are derived. The similar project method involves the following steps:

(A) Evaluate the characteristics of a proposed project or other area under study.

(B) Select a similar project or area by comparing characteristics of the proposed project with available information for existing sites; include evaluation and comparison of the respective recreation market areas.

(C) Adjust the per capita use curve to account for the differences between the similar project and the proposed project.

(D) Determine the county populations within the market area for the years in question, and derive per capita use rates for each county population by measuring road mile distance from the project to the center of the most populated city within the county (proxy for centroid of county population).

(E) multiply each county per capita rate by county population and sum to get total use.

(F) Determine the percentage of total use that the foregoing estimate represents; if 100 percent, use as is; if less, adjust accordingly.

(iii) Justify assumptions used to adjust or modify per capita use curves.

(4) *Capacity method of determining use*. If data on use determining variables are unavailable and are not cost effective to obtain, and if it can be demonstrated that sufficient excess demand exists in the market area to accommodate the additional capacity supplied by a proposed project, use may be assumed to be equal to capacity. Since this method provides no information on trip generation, willingness to pay cannot be evaluated by the travel cost method.

2.8.10 Evaluation procedure: Estimate value of use with the project.

As noted in 2.8.2, three alternative methods can be used to estimate recreation benefits:

(a) *Travel cost estimate of willingness to pay based on use estimating model or per capita use curves*— (1) *Conditions under which TCM may not be used.* (i) Use was not estimated by a technique relating trip-generation to distance to the site;

(ii) There is insufficient variation in travel distances to allow parameter estimation (for example, urban slates); or

(iii) The project site is typically only one of several destinations visited on a single trip.

(2) *Construction of a TCM demand curve*. The area under a demand curve based on travel costs to a site approximates the willingness to pay for access to the recreation opportunities there. This estimate involves the following calculations:

(i) Convert round-trip distance from each origin into monetary values by using the most recent U.S. Department of Transportation average variable costs in cents per mile to operate an automobile, plus the opportunity cost of leisure time spent in travel and on the site. Time costs vary according to the alternative uses of time available to visitors and are correlated with income, age, education, occupation, time of year, and day of week. Explain values assigned to time and any simplifying assumptions.

(ii) Construct a demand curve that relates "prices" to total visits. Given a relationship between travel costs and annual visitation from a use estimating model or a per capita use curve, construct a demand curve by gradually increasing travel cost and calculating the total visitation associated with each increase, until visitation falls to zero for all origins.

(iii) Compute the area under the demand curve plus any user charges or entrance fees. This value measures the annual total willingness to pay for recreation activities available at the site.

(iv) Discussion of travel cost method can be found in Appendix 1 of this section. Appendix 1 is provided for background information. Development and use of techniques more refined than those presented in this Appendix are encouraged.

(b) *Contingent Valuation (survey) estimate of willingness to pay--(1) Use of contingent valuation method for dally or annual values*. CVM may obtain either daily or annual estimates of willingness to pay. Multiply daily estimates by annual use obtained previously. Annual estimates do not require use estimation except to demonstrate the net increase in recreation use in the market area.

(2) *Designing and using simulated markets to identify the value of recreational resources as if actual markets existed*. Five steps are involved:

(i) Establish a market to the respondent.

(ii) Permit the respondent to use the market to make trades and establish prices or values reflecting the respondent's individual evaluation of the recreation opportunities bought or sold.

(iii) Treat the values reported by the respondent of individual values for recreation, contingent upon the existence of the market.

(iv) Given willingness to pay bids from an unbiased sample of users in the market area. the socioeconomic characteristics of respondents, distance to the site, and available alternative recreation opportunities for each origin, obtain multiple regression estimates of average household value for the proposed change in recreation opportunities for households in each group.

(v) Multiply this value by the number of households in the group and sum the group values to estimate the aggregate willingness to pay if- the average values are annual; multiply this value by estimated annual use if average values are daily.

(3) *Obtaining individual bids from personal interviews or mail surveys*. The preferred format is one in which the respondent is required to answer "yes" or "no" to questions if he or she is willing to pay a stated amount of money to obtain a stated increment in annual recreation opportunities. The value is increased gradually until the highest amount that the respondent is willing to pay is identified. Examples of question formats and further discussion of survey techniques can be found in Appendix 2 of this section. Appendix 2 is provided for background information. Development and use of techniques more refined than those presented in this Appendix are encouraged.

(4) *Developing regional contingent valuation models*. Regional models may be developed with CVM as well as use estimating models. All survey forms are subject to the clearance procedures of the Office of Management and Budget.

(c) *Unit day value approximation of willingness to pay--*

(1) *Application of unit day values*. See 2.8.2(c)(3).

(2) *Selection of value*. (i) If the UDV method is used for economic evaluations, select a specific value from the range of values agreed to by Federal water resource agencies. The product of the selected value times the difference in estimated annual use over the project life relative to the without-project condition provides the estimate of recreation benefits.

(A) If evidence indicates that a value outside the agreed-to range is more accurate, a regional model or site-specific study should be conducted. Explain the selection of any particular value within the published range.

(B) To explain the selection of a specific value, a point rating method may be used to reflect quality, relative scarcity, ease of access. and esthetic features. Appropriate use should be made of studies of preferences, user satisfaction. and willingness to pay for different characteristics; particular efforts

should be made to use estimates derived elsewhere from applications of the TCM and CVM techniques.

(ii) Account for site transfers in choosing unit day values. An example of a point rating table that does this and further discussion of unit day value selection can be found in Appendix 3 of this section. Appendix 3 is Provided for background information. Development and use of techniques more refined than those presented in this Appendix are encouraged.

2.8.11 Evaluation procedure: Forecast recreation use diminished with project.

Using the appropriate method described in 2.8.9, forecast the recreation resource uses that would be diminished due to physical displacement expected because of the plan or project.

2.8.12 Evaluation procedure: Estimate value of recreation use diminished with project

Using the appropriate methods described in 2.8.10 and selected by the appropriate criteria described in 2.8.2, estimate the value of the recreation uses that would be diminished by the physical displacement expected to occur as a result of the plan or project. In determining project net benefits, account for changes in recreation use of an existing resource and/or project as a result of transfers to the plan or project under study.

2.8.13 Evaluation procedure: Compute net project benefits.

Compute the project benefit as the difference be-tween the gross value of recreation use as estimated in 2.8.9 and the value of recreation use diminished as estimated in 2.8.12. However, if excess capacity for any activity exists in the study area, benefits are the user cost savings plus the value of any qualitative differences in recreation.

2.8.14 Report and display procedures.

Tables 2.8.14-1 and 2 are suggested presentations for reports that include recreation as a purpose.

Table 2.8.14-1 Recreation Capacity and Use (19--) [1]

	Without project			With project		
	Capacity	Use	Surplus or deficit	Capacity	Gross use	Displaced use
Plan 1						
Plan 2						
Plan 3						
Plan X						

[1] Prepare for representative project years

Table 2.8.14-2 Annualized Recreation Benefits, Recommended Plan

Recreational activity	Value of gross use	Value of displaced use	Net value
Specialized			
General			

Appendix 1 to Section VIII—Travel Cost Method

The basic premise of the travel cost method (TCM) is that per capita use of a recreation site will decrease as the out-of-pocket and time costs of traveling from place of origin to the site increase, other things remaining equal. The method consists of deriving a demand curve for a recreation site by using the variable costs of travel and the value of time as proxies for price. By use of data collected from users of existing sites, the travel cost method permits development of (1) estimated use of the proposed site; (2) a per capita demand function for recreation at the site; and (3) an estimate of the NED recreation benefits of the site. The travel cost procedure consists of two steps: estimating use and deriving a demand curve.

(a) *Estimating use* -- (1) *Use estimating models*. (i) The preferred method for estimating use is a use estimating model (UEM) that relates use at a proposed site to distance traveled, socioeconomic factors, and characteristics of the site and alternative recreation opportunities. Use estimating models are based on data gathered at an existing site or on a cross section of existing sites with the resultant statistical coefficients used to estimate use at a proposed site. Factors that influence demand for recreation, such as characteristics of user populations and availability of alternative opportunities, are explicitly taken into account by variables in the model.

(ii) Application of an existing UEM to a proposed site involves the following steps: (A) Identify the areas of origin for the proposed project (use of counties or parts of counties as origin areas facilitates gathering of data in subsequent steps); (B) compute measures of the explanatory variables in the use equation for each origin area and for each year an estimate is required; (C) calculate use from each area and for each year; and (D) aggregate use from each area to get estimated annual use.

(2) Similar project use estimation. (i) The similar project procedure is based on the concept that recreation demand for a proposed project can be estimated by observing the visitation patterns at one or more existing projects with similar resource, operation, and anticipated recreation-use characteristics. The procedure involves the graphic or statistical matching of the recreation site alternatives under study with existing water resource projects and recreation resource areas for which use statistics and other information are known. The objective of the similar project procedure is to obtain as close a match as possible in type, size, and quality of project; market area demographic and socioeconomic characteristics; the existence and location of competing recreation opportunities; and other demand influencing variables.

(ii) The most efficient and technically sound similar project procedure is based on per capita use curves (i.e., regression curve relating on per capita rate of use to travel distance) from which use estimates are derived. Per capita use curves have been estimated for 52 existing reservoirs.[1] An overview of the methodology adapted from Brown, et al., is provided below.

(iii) Briefly stated, use of the similar project prediction method involves the following steps:

(A) Evaluate the characteristics of a proposed project or area under study.

(B) Select a similar project or area by comparing characteristics of the proposed Project with available information for existing sites; include evaluation and comparison of the respective recreation market areas.

(C) Adjust the per capita use curve to account for the differences between the similar project and the proposed project.

(D) Determine the county populations within the market area for the year in question and derive per capita use rates for each county population by measuring road-mile distance from the project to the center of the most populated city within the county (proxy for centroid of county population).

(E) Multiply the contribution from each county per capita rate by county population, and sum to get total use.

(F) Determine the percentage of total use that the foregoing estimate represents. If 100 percent, use as is; if less, adjust accordingly.

(iv) A critical shortcoming of this similar project method is the subjectivity inherent in the manual adjustment of the per capita use curve required to account for demand factors other than travel distance. The reliability of the method can be enhanced through experience, but it cannot be expected to approach the reliability of the more sophisticated statistical models.

(b) *Deriving demand in the travel cost method*. (1) The travel cost method is based on the correspondence between increasing the distance from areas of origin to the site and increasing the cost or price of recreation at the site. The second step of the procedure consists of calculating total use at different incremental distances (prices); it is based directly on use estimator models or per capita use curves. The result is a demand curve for the site being evaluated that relates "prices" to total visits. Distances are converted to dollar values using per mile conversion factors reflecting both time and out-of-pocket travel costs. The area under the demand curve plus any user charges or entrance fees measure the recreation benefits attributable to the site. The procedure is described in detail below.

(2) The estimate of recreation use for a project derived from application of a per capita use curve or UEM model yields an initial point on a resource's demand curve. This point is the quantity of use that would be demanded at a zero price. For example, assume that the appropriate per capita use rates have been estimated as follows:

Origin	Population	Distance	Visits per capita	Estimated visitation
A	10,000	10	3	30,000
B	1,000	20	2	2,000
C	3,000	30	1	3,000
Total.....	.....	.....	.....	35,000

[1] Brown, R., et al., *Plan Formulation and Evaluation Studies: Recreation*. Vol. II. U.S. Army Engineer Institute for Water Research. 1974

(3) This estimate of 35,000 yields an initial point on the resource's demand curve. To find sufficient points to determine the entire demand curve, it is necessary to make small incremental increases in the price of participation and to measure the quantity of use that would be demanded given these chances. This is equivalent to moving the project farther and farther from the potential users, requiring them to pay more and more in travel costs. As the simulated distance increases, use decreases, and for each increment in distance a new use estimate is computed using either the use estimating model or the per capita use curve. The new use estimates are the various quantities of recreation that would be demanded at increasing prices.

(4) For example, assume that an increment of 10 miles in travel distance is used to simulate an increase in cost for the proposed project described above. The use estimate of use would then be:

Origin	Population	Simulated distance (Actual 10)	Visits per capita	Estimated visitation
A	10,000	20	2	20,000
B	1,000	30	1	1,000
C	3,000	40	0	0
Total	.....	.....	.....	21,000

(5) This would be a second point on the resource's demand curve; the quantity demanded (21,000 visits) at a price equivalent to the travel cost associated with an increment in distance of 10 miles. (A discussion of the proxy for price used to assign a dollar value to this increment is in paragraph (6)(i) of this appendix.)

(6) Remaining points on the resource demand curve are then estimated by making continued increments in the price (simulated increases in distance) until the anticipated visitation from all areas of origin is zero. In the example above using 10 - mile increments, the visitation expected with simulated increases in distance would be:

Estimated Visitation

Origin	[Simulated increase in mileage] 0	10 miles	20 miles	30 miles
A	30,000	20,000	10,000	0
B	2,000	1,000	0	0
C	3,000	0	0	0
Total	35,000	21,000	10,000	0

(i) *Proxy for price*. (A) To determine the price at which the various quantities of use are demanded, the incremental increases in distance are simply converted into the costs that would be incurred by the recreation users if they were required to travel the additional mileage. The variable or out-of--pocket travel costs are used as the proxy for price, since these are the costs that potential users would be most aware of when making a decision about whether to visit a particular resource area.

(B) The conversion of mileage to price should use the most current published results of studies conducted periodically by the U.S Department of Transportation concerning the average cost of operating an automobile. As an example, average variable cost estimates for 1976 are summarized below (U.S. Department of Transportation, 1977).

Average Variable Costs, in cents per mile, to Operate an Automobile

Variable cost category	Automobile type Stand-ard	Com-pact	Subcom-pact	Average
Maintenance, accessories, parts, and tires....	4.2	3.4	3.1	3.6
Gasoline and oil....	3.3	2.5	1.8	2.5
Taxes on gasoline, oil, and tires	0.9	0.6	0.5	0.7
Total	8.4	6.5	5.4	6.8

(C) The variable cost reflects the average out-of-pocket cost per mile to operate various types of automobiles. It does not include such fixed costs as depreciation, insurance, and registration, since those costs would generally not affect the potential user's decision to travel the additional mileage for recreation purposes.

(D) Two adjustments are required, however. before this cost can be used as the proxy for price. The first is an adjustment to round-trip mileage. The distance measure used in the per capita use curve or regional estimator is one-way mileage, while the recreation user must incur the variable costs while traveling to and from the project, so the cost per mile is doubled. Since more than one

user may arrive in each vehicle a second adjustment must be made to distribute the travel costs of the trip between the number of users traveling in each vehicle. This is readily accomplished by using the average number of users per vehicle determined from the survey of the existing sites used to develop the per capita use curve or regional estimator.

(E) The variable travel costs are the proxy for price associated with the simulated increase in distance used to derive the resource demand curve. Using the average variable cost for all three types of automobiles (6.8 cents per mile and using a hypothetical average of 2.7 persons per vehicle, the proxy for price for a simulated increase in distance of 10 mites in the above example would be equal to 80.50 (6.8 cents per mile times 2 for round-trip mileage, divided by 2.7 persons per vehicle, times 10 mile increment).

(ii) *An adjustment for the opportunity cost of time*. (A) The use of variable travel costs alone In the development of the demand schedules ignores the effects of time on recreation decisions. If time is ignored, the demand schedules are constructed under the hypothesis that increasing distance decreases use only because of higher money cost. However, the additional time required to travel the increased distance would seem to be a deterrent equal to or greater than the out-of-pocket money costs. The exclusion of the time factor introduces a bias into the derived demand schedule, shifting it to the left of the true demand schedule and resulting in an underestimation of the recreation benefits.

B) The opportunity cost of time is the value of work or leisure activities foregone to travel to and recreate at the site. The opportunity cost for a person whose work time is variable is measured as income foregone during the recreation visit and associated travel. Most people, however, are constrained by a fixed work week and receive payload vacation days. Recreation occurring during periods where no working time is lost incurs only leisure time costs. This value may range between 0 (if the recreationist would not have engaged in any other leisure activity in the absence of the observed recreation) and the wage rate (if the alternative leisure activity was valuable enough to forego earnings, given that opportunity).

(C) Where direct survey data on time costs are not available, published statistics or studies of work-leisure choices and wage rates may be used to justify particular assumed values. One procedure that may be used to accommodate the disutility of time is to assume a known trade off between time and money; however, but no universally accepted formulation of this tradeoff has been established and empirically tested. In one proposed formulation, time is valued as one-third the average wage rate in the county of origin for adults and one-fourth of the adult value (one-twelfth of the wage rate) for children. Any method used to value time should be supported by documenting evidence. Both travel and onsite time costs should be included in the derivation of total willingness to pay for access to the site.

(iii) *Benefit computation*. (A) The final computational step in the travel cost approach is to measure the area under the demand curve. This area is equal to the amount users would be willing to pay but do not have to pay for the opportunity to participate in recreation at the resource being evaluated. Any user charges or entrance fees should be added to this value to determine the gross value of the resource escalated with the specified management option.

(B) The travel cost approach can be used for evaluating either the with-project or without-project conditions as long as a use estimating model or a per capita use curve is available for estimating use under the specified condition. To evaluate the without-project condition, estimate the value of the recreation that would be lost at a site if a water resource development project were developed. To evaluate a with-project alternative, estimate the value of the new recreation opportunities that would be created. If a use estimator is not available for evaluating either the without-project conditions or one of the with-project conditions, the techniques described in other portions of this manual should be used.

(C) The procedure described above is applicable to any type of activity or groups of activities for which use can be described by a use estimating equation or per capita use curve. The separation of any use from overnight use or sightseeing from other day use activities, for example, is dependent upon the specificity of the survey data and the model formulation.

(c) *Data requirements*. (1) The development of use estimator models as described above requires that data from existing areas be systematically collected. The major requirement is that the data on use and users of a range of facility types and locations span the proposed types and locations for which estimates are to be made. A series of surveys at existing sites can provide such basic data, which would normally include total use, timing and patterns of use, characteristics or users, and users areas of origin.

(2) Methods of data collection that have proved fairly satisfactory involve a short handout questionnaire or interviews of a small sample of randomly selected users of the different recreation areas. It is important that reliable total visit statistics be obtained for each existing area being investigated. This can usually be done satisfactorily with judicious use of traffic counters at most water-based recreation areas. If totals are collected throughout the season, samples for questionnaires or interviews need be drawn only on a few days - on both weekends and weekdays, as patterns are likely to vary greatly between them.

(3) The number of questions asked may also be limited. The major concerns are the origin and purpose of the trip and limited information about the users. A representative range of areas. facilities. and locational proximities should be covered in such surveys. Fully adequate methods that are relatively inexpensive, entail a minimum of difficulty at the site and to the user, and yield meaningful results are available.

Appendix 2 to Section VIII Contingent Valuation (Survey) Methods

(a) *Overview*. (1) Contingent valuation methods (CVMs) obtain estimates of changes in NED benefits by directly asking individuals about their willingness to pay (WTP) for changes in quantity of recreation at a particular site. Individual values may be aggregated by summing the WTPs for all users in the area.

(2) Contingent valuation methods consist of designing and using simulated markets to identify the value of recreation just as actual markets would, if they existed. Three basic steps are involved: (i)The analyst establishes a market to the respondent; (ii) he permits the respondent to "use" the market to make "trades" and to establish prices or values that reflect the respondent's individual valuation of the recreation opportunities "bought" or "sold"; and (iii) the analyst treats the values reported by the respondent as individual values for the recreation, contingent upon the existence of the described market. The respondent's bids are used with the data contained in the market description (step i) to estimate the aggregate value of the recreation being studied.

(3) Contingent valuation methods are particularly appropriate for evaluating projects likely to be one of several destinations on a single trip and projects that will result in a relatively small change in the quality of recreation at a site. Contingent value results may be adversely affected unless questions are carefully designed and pretested to avoid several possible kinds of response bias. Several techniques are available for obtaining the individual bids, which are the basic data for CVM.

(b) *Iterative bidding formats*. (1) Iterative bidding surveys ask the respondent to react to a series of values posed by the enumerator. Following establishment of the market and a complete description of the recreational good, service, or amenity to be valued, the respondent is asked to answer "yes" or "no" to whether he is willing to pay the stated amount of money to obtain the stated increment in recreation. The enumerator iteratively varies the value posed until he identifies the highest amount the respondent is willing to pay. This amount is the respondent's "bid" for the specified increment in recreation.

(2) Iterative bidding techniques are most effective in personal interviews. Mail survey formats have also been used in research studies. These typically ask the respondent to answer "yes" or "no" to a small number of specified values in iterative questions and, finally, ask an open-ended question: "Now, write down the maximum amount you will be willing to pay, $ _____ ." At present, mall survey applications of the iterative bidding technique have not been adequately tested and cannot be recommended.

(3) The recreation facilities to be evaluated will be described in quantity, quality, time, and location dimensions. These descriptions should be hypothetical in the sense that they do not precisely describe features of actual sites or proposed projects, but they should be precise enough to give the respondent adequate information on which to base a valuation. To permit estimation of regional models, quantity, quality, and location dimensions should be varied and the iterative bidding exercise repeated. Verbal descriptions should be precise, and, when practicable, pertinent aspects of the facilities should be displayed or depicted nonverbally (e.g., with photographs, drawings, motion pictures, scale models).

(4) In most cases, the good to be valued is "the right to use (the recreation facility) for one year." The responses obtained are thus *annual* measures of the individual's willingness to pay for a given increment or decrement in recreation opportunities. Bidding formats that define the good in some other terms (e.g., day of use, trip) can also be used in some applications as long as appropriate estimates of numbers of days of use and trips are available to permit calculation of annual values.

(5) The institutional rules pertaining to the hypothetical market will be described in sufficient detail so that the respondent knows his rights and the rights of all others in the market. These rules should be realistic and credible, they should place

the respondent in a role and encourage market behavior with which he is familiar, and they should be of a kind generally viewed as just, fair, and ethically sound. They should be nonthreatening. Formats that threaten the respondent with a welfare shock that he may view as unfair should be avoided.

(6) The method of payment (called payment vehicles) should be carefully pretested. At the pretest stage, always include a neutral vehicle, e.g., "The money collected will be placed in a trust fund and devoted entirely to providing (the good)."

(7) The respondent should be given price or value information and asked, "Would you buy?" With the clear understanding that "if no, you would go without." The wording "Would you be willing to pay · · · ?" should be avoided because some respondents may interpret it as an appeal for voluntary contributions. The question must be worded to suggest the pragmatic "take it, or leave it" atmosphere of the marketplace.

(8) Depending on the "yes" or "no" answer, the price or value is varied iteratively and the question repeated until the respondent's point of indifference between the money and the good is identified. Early iterations may change the price widely until the enumerator senses that he is approaching the respondent's indifference point; then iterative price variations will become finer.

(9) The starting price quote (called "starting point") will vary across respondents. The particular starting point assigned to a given respondent will be chosen randomly.

(10) The payment vehicle should be specified. Payment vehicles that may generate an emotional reaction should be avoided because they might introduce a confusing element into the bid data. Vehicles based on increments in taxes, utility bills, and hunting or fishing license fees may generate such reactions.

(11) General formats for iterative bidding questions are presented below, followed by specific examples. The questions must be specific to the particular measure of value to be elicited from the respondent. WTP formats should always be used; they may be incremental (willingness to pay for an increment in a desired recreation opportunity) or decremental (willingness to pay to availed a threatened decrement in a desired recreation opportunity). The incremental format has two major advantages: it is the theoretically correct measure and, since it offers the respondent the (hypothetical) chance to pay for a desired good, it is unlikely to provoke an offended reaction. The decremental format, which asks the respondent how much he would pay to avoid a change he does not want, may seem unfair or morally offensive to some, and thus may elicit biased or otherwise unreliable value estimates. The incremental version is preferred wherever it is credible.

(12) The incremental version may not be credible if the real world experience is typically one of the decrements rather than increments. For example, the question "if a new, unspoiled natural recreation environment could be created and the right to use it would cost $———— , would you buy?" may be rejected as fantasy by some respondents in a world in which "unspoiled natural recreation environments" are fast disappearing. In such circumstances, it may be necessary to resort to decremental formats. However, since reasonable doubts can be raised, *a priori*. about the efficiency of WTP decremental formats, the following precautions are essential: The format designed must be the most consistent and plausible and least offensive possible; and at least two different formats must be pretested to permit statistical testing for differences in their performance.

(13) General examples of the WTP formats are:

WTP incremental: "If you had the opportunity to obtain [describe an increment in recreation facilities, hypothetical market rules, and payment vehicle], would you pay [starting price]? Yes (pay) ---- Or would you refuse to pay, and do without (the increment)? No (pay) --" Reiterate with new prices until the highest price eliciting a "yes" response is identified.

WTP decremental (example 1): "[Describe a decrement in recreation facilities] will occur unless [describe market rules and payment vehicle]. Would you pay [starting price] to avoid [the decrement]? Yes (pay) ---- Or would you refuse to pay, and thus permit [the decrement]? No (pay) ---"

WTP decremental (example 2): "[Describe a recreation facility currently available to respondent] is currently available [describe current market rules, existing payment vehicle, and existing price]. Unless [the existing price] is increased [describe a decrement] will occur. Would you pay [starting price, which is some increment over the existing price] in order to prevent [the decrement]? Yes (pay)———— Or would you refuse to pay, and thus permit [the decrement]? No (pay) ———— " Reiterate . . .

(14) Since some respondents may bid only zero amounts to WTP questions, it is important to identify which zero bids represent true zero valuations and which, if any, represent a protest against the market rules or payment vehicles in the bidding format. Check questions should always be used to probe "zero" responses to WTP formats, e.g., "Did you bid zero because (check one):"

a. You believe [the stated increment] would be worth nothing to you?

b. You believe [the payment vehicle) is already too high?

c. You believe [the stated increment] would be of value, but you do not think it is fair to expect (the respondent's class of citizen, e.g., hunting license holders, utility customers) to pay for it?

(15) Answers (b) and (c) above are “protest” responses, addressed not to the value of the good but to some element of the question format. Protest bids should be recorded but eliminated from calculations to estimate values. Formats that elicit more than 15 percent protest responses in pretests should be discarded, since a high incidence of protest bids may indicate that some nonzero bids are also distorted.

(c) *Noniteratlve bidding formats*. (1) Noniterative bidding formats are adaptable to implementation with mail surveys. There are two kinds of noniterative formats: close-ended, which ask respondents to answer "yes" or “no” to a single stated value; and open-ended, which ask the respondent to write down the maximum amount he would be willing to pay. A variant of the open-ended format asks the respondent either to select his maximum WTP from a list of stated discrete values or to write down his maximum WTP. Noniterative bidding formats are unlikely to be as reliable as iterative formats.

(2) Noniteratlve mail survey formats may be used only for analysis of small projects. These formats must, to the extent practicable, have the basic attributes of the personal interview formats described above. Survey instruments should include color photographs and, if appropriate, other nonverbal stimuli.

(3) Open-ended bidding formats should be used With one half of the sample and close-ended formts with the other half. The bids obtained should be analyzed to determine if the format influences the results to a significant degree. Examples of these formats are presented below.

(4) *Open-ended.* "Due to pressures of population growth and economic development, 10 miles of trout stream such as that shown in the accompanying photograph are likely to be converted to other uses (e.g., a reservoir) and thus lost for trout fishing. Assume that the only way to preserve this 10 mile stretch for trout fishing is for trout fishermen to agree to buy an annual pass to fish in that stream segment. The money collected would pay for presentation of the stream section. If the stream segment was __ miles from your home, and you could expect to catch __ trout in a typical day's fishing there, what is the *maximum amount* you would pay for the annual fishing pass? Answer: $__ per year.

(5) *Closed-ended*. The information presented in the open-ended format does not change, but the final question reads: “ * * * and an annual fishing pass costs $__ (assign dollar amounts randomly to respondents), would you buy one? Answer: Yes __ No __.”

(d) *Use estimation with CVMs*. (1) All of the contingent valuation procedures described above generate annual value estimates directly, instead of first generating values per user day and then estimates of expected user days. The “annual value estimation” procedure is superior because it is more reliable, it automatically corrects for the economic influence of existing recreation opportunities, and it is better adapted to estimating activity and existence values where both are important.

(2) Contingent valuation formats can also be designed to estimate values per user day but can have questions worded in terms of a day's activity. In the case of proposed increments, great care must be taken to determine the respondent's valuation of a day at the proposed site, given the continued availability of existing sites. Estimates of use may be made either by collecting such information as part of the survey or by other approved methods.

(3) To collect use information in the survey, proceed as follows:

(i) For decrements in recreation opportunities, ask (A): how many trips the household made (*1*) last year or (*2*) in a typical year, if last year was unusual for any reason; (B) how many days the trip lasted; and (C) how many household members participated in each trip.

(ii) For increments, ask (A): the same information as for decrements, but about existing recreation sites similar to the proposed increment. Then, if the proposed increment (described with verbal and nonverbal stimuli) were available. (B) how many trips, for how long, and with how many family members for the proposed increment; and (C) how many trips, for how long, and with how many family members in total for both the existing and proposed sites.

(e) *Using contingent valuation methods*. Contingent valuation methods can be used to develop value estimator models or to estimate recreation benefits for a specific proposed project. These two uses are discussed below.

(1) *Value estimator models*. (i) Value estimator models (VEMs) are statistical models of the relationships between the bid and selected characteristics of the site(s) and user populations. A typical model has the form:

$$V_{jk} = F(E_k, D_{jk}, C_k, A_k, S_{jk}, Q_j, I_j)$$

Where

V_{jk} is the value to household k of the specified change in recreation opportunity at site j.

E_k is a vector of social and demographic variables pertaining to household k, typically including income, ethnicity, and education.

D_{jk} is the distance from the home of k to site j.

C_k is a measure of the capacity use of the existing stock of recreation facilities similar to those at site j in the market area centered at k’s home.

A_k is distance from the home of k to the nearest existing alternative facility offering recreation opportunities similar to those at site j.

S_{jk} is an index of the availability of substitute recreation facilities (e.g., ocean beach for reservoir beach) in the market area centered at k's home.

Q_j is a vector of variables describing the quality of recreation at site j.

I_j is the increment or decrement in recreation at site j specified in the contingent valuation mechanism.

(ii) This method has several desirable characteristics: (A) The V_{Jk} are current WTP estimates of value for increments and decrements in recreation opportunity; (B) the V_J are annual values of the existence of the recreation facilities at site j, and thus replace user days and unit day values; (C) the V_{Jk} are not arbitrarily set at the same daily value for all users, as are unit day values; (D) the variables in vector Q_j provide a systematic statistical basis for estimating how V_J varies with site quality; (E) the variables $C_{k,}$, $S_{jk,}$ and A_k provide a systematic statistical basis for adjusting V_J to account for competing and substitute facilities.

(iii) Estimating a value estimator model requires the following steps:

(A) The final bids, after any calculations necessary to convert them to annual or daily household values, serve as the observations of the dependent variable.

(B) The observations of demographic variables serve as observations for the first set of independent variables.

(C) Existing recreation resource inventories and planning data provide the basis for specifying the second set of independent variables, i.e., those describing the existing stock of recreation opportunities. The location of each respondent's home is recorded on the completed survey instrument, and, together with the inventory and planning data for existing resources, permits calculation of individual observations of those variables that relate the existing stock of recreation opportunities to the location of the respondent's home. To complete the task of specifying these variables, some indices of the availability and quality of the existing recreation stock must be developed. These include indices of facilities and conveniences, and of site quality, especially esthetic quality.

(D) Site-specific descriptors serve as the third and final set of independent observations. These are the data presented to the respondent and upon which he based each of his bids. The estimated esthetic score of each photograph used in the bidding process serves as one of these site-specific descriptors. Other descriptors are the information presented to the respondent on size, distance, etc.

(E) Using the best available econometric techniques, the equation is then estimated. The dependent variable is expressed in terms of annual value per household eliminating the need for separate estimation of user-days and the mean value of a user-day.

(iv) Using an existing VEM to estimate the recreation benefits of a proposed project involves the following steps:

(A) Determine the market area for the recreation services affected by the project. If the market area is expected to exceed 120 miles, document the reasons.

(B) Determine from census data the demographic characteristics of the market area population.

(C) Divide the market area into groups on the basis of demographic variables and distance from the proposed site. One such group might be "households headed by a male of (ethnic group) with 10 to 12 years of education and household income between $12,001 and $15,000 annually, living 51 to 75 miles away from the site."

(D) Calculate separately for each market subarea the values of the variables describing existing recreation facilities obtained from inventory and planning data.

(E) Obtain from project planning data the values of the variables describing project-specific attributes.

(F) Use the specified data and the fitted model to estimate the household value for the proposed increment or decrement in recreation opportunities for a typical household in each group.

(G) Multiply this value by the number of households in the group, and sum the group values to get the aggregate benefit estimate.

(2) *Applying CVM to a specific proposed project*. In some circumstances, CVMs may be used to estimate the recreation benefits of a specific proposed project. Great care must be taken in the design of the survey instruments and editing of the data, however, because some respondents may try to influence the outcome of the analysis by their bidding responses. The survey design and sampling requirements of such a study are discussed under "Data requirements" below.

(3) *Data requirements* -- (i) *Survey design*. For contingent valuation exercises, the survey instrument must contain two major sections: One for bidding formats and one for collecting appropriate demographic data; a brief final section should elicit

respondent feedback. Since there is no reason to prohibit the use of additional sections, other data useful for recreation planning may be gathered during the interview. Additional sections may include recreation activities, attitudes, recreation preferences, and protected use of proposed new recreation facilities. To minimize inconvenience to respondents and to avoid respondent fatigue and lapses of concentration, the complete interview should typically not require more than 30 minutes.

(ii) *Pretesting*. (A) The basic survey instrument, including bidding formats and questions to collect additional data (e.g., demographic data, respondent's history of use of recreation facilities. etc.), must be pretested by using a sample of at least 30 respondents in order to generate a data set permitting appropriate statistical tests. The pretest sample should not be drawn from the same population as the actual study sample. Sampling procedures for the pretest are not especially crucial, but an attempt should be made to obtain a demographic cross section of users. A variety of bidding formats, hypothetical market designs, and payment vehicles should be pretested.

(B) Nonresponses and protest responses should be tabulated for all bidding formats. Those formats eliciting large proportions (i.e., more than 15 percent) of such responses should be eliminated or redesigned and retested. Statistical tests for information bias, vehicle bias, and starting point bias should be performed, and formats that generate any of these biases should be eliminated, or redesigned and retested.

(iii) *Sampling*. (A) Following pretesting and, if necessary, redesign, a sampling frame for the malign survey should be drawn. The household is the basic sampling inlet. For estimation of activity values, samples may be drawn from reliable list of participants (e.g., fishing license holders), if available. For activity values where no such lists exist, and for existence values, the sample must be drawn from the regional population of households.

(B) Sampling procedures should have the performance characteristics of random sampling. To save travel time in a personal anatomy survey, randomized, cluster sampling is permissible, provided that no cluster is larger than one-thirtieth of the sample size, Sample size should be no fewer than 200 households. The respondent selected to answer on behalf of the household should preferably be the head-of-household or spouse of the head. In the absence of the head and spouse, another adult member of the household may be interviewed, provided he or she has assumed a responsible life-role (e.g., is a parent or is financially self-supporting).

(C) Random sampling methods are also used for mail surveys. At least two followup mailings are necessary to reduce nonresidence. In addition, a random telephone survey of 10 percent of the nonresponses after the second followup mailing is necessary. The results of the telephone survey must be analyzed separately in order to permit testing for non response bias.

(iv) *Specific proposed project requirements*. (A) Procedures for valuing recreation benefits using project-specific iterative bidding formats are similar, in some respects, to the procedures described above. Aspects that are different are highlighted in the following:

(B) The population to be sampled is that of the market area(s) for the various categories of recreation opportunities that would be beneficially or adversely affected. Survey instruments follow the basic format described above, with the major exception that the bidding formats provide site-specific information on the proposed project itself. Photographs and other stimuli should be focused on the without-project condition for adverse effects and on the with-project condition for beneficial effects. In the latter case, it may be necessary to use photographs of a completed similar project.

(C) Individual bid data must be used as observations to test carefully for biases, including vehicle bias, information bias, starting point bias, and strategic bias, using established statistical testing procedures. Evidence of bias should *(1)* lead to elimination of formats producing bias at the pretest stage, and *(2)* lead to reporting of any bias remaining after all instrument redesign possibilities have been exhausted. Final bids are aggregated across the sample and then projected to the market area population. These “population aggregate bids” are then used as estimates of the total value, positive or negative of the effects, beneficial or adverse, of the proposed increments or decrements in recreation opportunities. Net project recreation effects are calculated as in (e)(1) of this appendix.

Appendix 3 to Section Vlll—Unit Day Value Method

The unit day value (UDV) method for estimating recreation benefits relies on expert or informed opinion and judgment to approximate the average willingness to pay of users of Federal or Federally assisted recreation resources. If an agency can demonstrate that more reliable TCM or CVM estimates are either not feasible or not justified for the particular project under study, as discussed under applicability criteria, the UDV method may be used;

by applying a carefully thought-out and adjusted unit day value to estimated use, an approximation is obtained that may be used as an estimate of project recreation benefits.

(A) *Implementation*. (1) When the UDV method is used for economic evaluations, planners will select a specific value from the range of values provided in the most current published schedule. Application of the selected value to estimated annual use over the project life, in the context of the with- and without-project framework of analysis, provides the estimate of recreation benefits.

(2) Two categories of outdoor recreation days, general and specialized, may be differentiated for evaluation purposes. "General" refers to a recreation day involving primarily those activities that are attractive to the majority of outdoor users and that generally require the development and maintenance of convenient access and adequate facilities. "Specialized" refers to a recreation day involving those activities for which opportunities in general are limited, intensity of use is low, and a high degree of skill, knowledge, and appreciation of the activity by the user may often be involved.

(3) Estimates of total recreation days of use for both categories, where applicable, will be developed. The general category comprises the great majority of all recreational activities associated with water projects, including swimming, picnicing, boating and most warm water fishing. Activities less often associated with water projects, such as big game hunting and salmon fishing, are included in the specialized category. A separate range of values is provided in a conversion table (Table VIII-3-1) for each for each category and for fishing and hunting to facilitate adoption of a point system in determining the applicable unit values for each individual project under consideration.

Table VIII-3-1 Conversion of Points to Dollar Values

Activity categories	Point values										
	0	10	20	30	40	50	60	70	80	90	100
General recreation (Points from Table VIII-3-2)	1.60	1.90	2.10	2.40	3.00	3.40	3.70	3.90	4.30	4.60	4.80
General fishing and hunting (Points from Table VIII-3-2)	2.30	2.60	2.80	3.10	3.40	3.70	4.10	4.30	4.60	4.70	4.80
Specialized fishing and hunting Points from Table VIII-3-3)	11.20	11.50	11.70	12.00	12.30	13.50	14.70	15.60	16.80	18.00	19.00
Specialized recreation other than fishing and hunting (Points from Table VIII-3-3)	6.50	6.90	7.40	8.00	8.50	9.60	10.60	12.80	14.90	17.00	19.00

Note.--Adjust dollar value for subsequent years to reflect changes in the Consumer Price Index after July 1, 1982

(4) When employing this method to determine recreation benefits, select appropriate values from the range of values provided. If evidence indicates a value outside the published range, use the TCM or CVM method.

(5) In every case, planners are expected to explain the selection of any particular value. To assist in explaining a specific value, a point rating method may be used. The method illustrated here contains five specific criteria and associated measurement standards designed to reflect quality, relative scarcity, ease of access, and esthetic features. Since the list of criteria and weights assigned may vary with the situation, public involvement should occur in the value determination process. Planners in the various agencies are also expected to make appropriate use of studies of preferences, user satisfaction, and willingness to pay for different characteristics. When these studies are used, particular efforts should be made to use estimates derived elsewhere from applications of the TCM and CVM techniques, to support the value selected.

(I) *General recreation (Table Vlll-3-2)*. Activities in this category are those associated with relatively intensive development of access and facilities as compared to the specialized recreation category. Generally, progressively higher physical standards for each unit of carrying capacity is involved in selecting higher unit values, and these may be accompanied by larger related nonproject costs.

(ii) *Specialized recreation (Table Vlll-3-3)*. (A) This category includes those activities whose values are generally lowered, if not actually excluded, by the type of development that enhances activities in the general recreation category. Thus, extensive or low density use and development constitutes the higher end of this range of values (e.g., big game hunting and wilderness pack trips). Also included in the upper end of the range are relatively unique experiences such as inland and marine fishing for salmon and steelhead, white water boating and canoeing, and long-range boat cruises in areas of outstanding scenic value. Examples of activities to which values at the lower end of the range would be assigned include upland bird hunting and specialized nature photography.

Table VIII-3-2 Guidelines for Assigning Points for General Recreation

Criteria	Judgement factors				
(a) Recreation experience [1]	Two general activities [2]	Several general activities		Several general activities: more than one high quality value activity	Numerous high quality value activities: some general activities [3]
Total points: 30 Point value:	0-4	5-10	11-16	17-23	24-30
(b) Availability of opportunity [4]	Several within 1 hr. travel time: a few within 30 min. travel time	Several within 1 hr. travel time: none within 30 min. travel time	One or two within 1 hr. travel time: none within 45 min. travel time	None within 1 hr. travel time	None within 2 hr. travel time
Total points: 18 Point value:	0-3	4-6	7-10	11-14	15-18
(c) Carrying capacity [5]	Minimum facility development for public health and safety	Basic facilities to conduct activities	Adequate facilities to conduct without deterioration of the resource or activity experience	Optimum facilities to conduct activity at site potential	Ultimate facilities to achieve intent of selected alternative
Total points: 14 Point value:	0-2	3-5	6-8	9-11	12-14
(d) Accessibility	Limited access by any means to site or within site	Fair access, poor quality roads to site: limited access within site	Fair access, fair road to site: fair access, good roads within site	Good access, good roads to site: fair access, good roads within site	Good access, high standard road to site: good access within site
Total points: 18 Point value:	0-3	4-6	7-10	11-14	15-18
(e) Environmental quality	Low esthetic factors [6] exist that significantly lower quality [7]	Average esthetic quality: factors exist that lower quality to minor degree	Above average esthetic quality: any limiting factors can be reasonably rectified	High esthetic quality: no factors exist that lower quality	Outstanding esthetic quality: no factors exist that lower quality
Total points: 20 Point value H	0-2	3-6	7-10	11-15	16-20

[1] Value for water-oriented should be adjusted if significant seasonal water level changes occur

[2] General activities include those that are common to the region and that are usually of normal quality. This includes picnicking, camping, hiking, riding, cycling, and fishing and hunting of normal quality.

[3] High quality value activities include those that are not common to the region and/or Nation and that are usually of high quality.

[4] Likelihood of success at fishing and hunting.

[5] Value should be adjusted for overuse.

[6] Major esthetic qualities to be considered include geology and topography, water, and vegetation

[7] Factors to be considered to lowering quality include air and water pollution, pests, poor climate, and unsightly adjacent areas.

Table VIII-3-3 Guidelines for Assigning Points for Special Recreation

Criteria	Judgement factors				
(a) Recreation experience [1]	Heavy use or frequent crowding or other interfernce with use	Moderate use, other users evident and likely to interfere with use	Moderate use, some evidence of other users and occasional interference with use due to crowding	Usually little evidence of other users, rarely if ever crowded	Very low evidence of other users, never crowded
Total points: 30 Point value:	0-4	5-10	11-16	17-23	24-30
(b) Availability of opportunity [2]	Several within 1 hr. travel time: a few within 30 min. travel time	Several within 1 hr. travel time: none within 30 min. travel time	One or two within 1 hr. travel time: none within 45 min. travel time	None within 1 hr. travel time	None within 2 hr. travel time
Total points: 18					

Table VIII-3-3 Guidelines for Assigning Points for Special Recreation -- Continued

Criteria	Judgement factors				
Point value:	0-3	4-6	7-10	11-14	15-18
(c) Carrying capacity [3]	Minimum facility development for public health and safety	Basic facilities to conduct activities	Adequate facilities to conduct without deterioration of the resource or activity experience	Optimum facilities to conduct activity at site potential	Ultimate facilities to achieve intent of selected alternative
Total points: 14					
Point value:	0-2	3-5	6-8	9-11	12-14
(d) Accessibility	Limited access by any means to site or within site	Fair access, poor quality roads to site: limited access within site	Fair access, fair road to site: fair access, good roads within site	Good access, good roads to site: fair access, good roads within site	Good access, high standard road to site: good access within site
Total points: 18					
Point value:	0-3	4-6	7-10	11-14	15-18
(e) Environmental quality	Low esthetic factors [4] exist that significantly lower quality [5]	Average esthetic quality: factors exist that lower quality to minor degree	Above average esthetic quality: any limiting factors can be reasonably rectified	High esthetic quality: no factors exist that lower quality	Outstanding esthetic quality: no factors exist that lower quality
Total points: 20					
Point value H	0-2	3-6	7-10	11-15	15-20

[1] Value for water-oriented should be adjusted if significant seasonal water level changes occur
[2] Likelihood of success at fishing and hunting.
[3] Value should be adjusted for overuse.
[4] Major esthetic qualities to be considered include geology and topography, water, and vegetation
[5] Factors to be considered to lowering quality include air and water pollution, pests, poor climate, and unsightly adjacent areas.

(B) The unit day values to be used for both the general and specialized recreation categories should be further adjusted to reflect additional quality considerations expected to prevail at various project sites at various regions of the Nation, and weighted to their importance to users. For example, a reservoir that is expected to carry a relatively heavy load of suspended silt or is expected to be used beyond optimum capacity would be less desirable, and therefore of lower unit value, than one that will have clear water and be less crowded.

(C) Hunting and fishing may be treated either as general recreation (Table V111-3-2) or specialized recreation (Table V111-3-3) depending upon whether it is associated with developed areas or back country areas, respectively. In either case, the recreation experience (criterion “a” in the tables) will be given points according to the additional consideration of the chances of success: the midpoint of the value range is associated with the regions average catch or bag. Other criteria may be modified if appropriately based on available evidence about the preferences and willingness to pay of hunters and fishermen for different recreation quality factors.

(D) The degree to which alternative nonproject opportunities are available to users is also considered in the assignment of values. Higher values should be assigned if the population to be served does not have existing water-oriented recreation opportunities. If water-oriented recreation opportunities are relatively abundant, as compared to other outdoor recreation opportunities, lower unit values should be assigned, even if a large number of visitations are expected at the proposed development.

(E) The choice of a unit day value must account for transfers to availed double counting of benefits. The net value of a transfer of use from one site to another is the difference in unit day values for recreation at the two sites. If recreation activities at the two sites are comparable, travel cost savings are the only NED benefits associated with the transfer. Use at the site must therefore be disaggregated according to the proportion of total estimated use that would not have occurred without the project and the proportion of total use that represents transfers from existing sites. The respective types of uses must then be assigned different daily values as indicated.

(iii) *Establishing specific values within each range*. Unit values selected are to be considered net of all

associated costs of both the users and others in using or providing these resources and related services. Agencies will be encouraged, through review procedures, demonstration projects, and educational workshops, to adopt the TCM and CVM techniques for project evaluations that would otherwise have used UDVs. As agencies gradually adopt CVM and TCM and develop a more comprehensive set of regional models, reliance on the UDV can be expected to diminish.

(b) *Estimating use in the UDV method*. (1) Using the ranges of values requires the study of estimates of annual use foregone and expected at recreation sites. Use can be estimated by a use estimating equation or per capita use curve as discussed above, but when these means are available, the second step of the travel cost method should generally be used instead of UDVs to derive the benefit.

(2) The capacity method is an alternative method of estimating use, but it has severe limitations. The capacity procedure involves the estimation of annual recreation use under without-project and with-project conditions through the determination of resource or facility capacities (taking into consideration instantaneous rates of use, turnover rates, and weekly and seasonal patterns of use). Seasonal use patterns are dependent on climate and culture and probably account for the greatest variation in use estimates derived through this method. In general, annual use of outdoor recreation areas, particularly in rural locations and in areas with pronounced seasonal variation, is usually about 50 times the design load, which is the number of visitors to a recreation area or site on an average summer Sunday. In very inaccessible areas and in those known for more restricted seasonal use, the multiplier would be less; in urban settings or in areas with less pronounced seasonal use patterns, the multiplier would be greater. In any case, the actual estimation of use involves an analytical procedure using instantaneous capacities, daily turnover rates, and weekly and seasonal use patterns as specific data inputs.

(3) Because the capacity method does not involve the estimation of site-specific demand, its use is valid only when it has been otherwise determined that sufficient demand exists in the market area of project alternatives to accommodate the calculated capacity. Its greatest potential is therefore in urban settlings where sufficient demand obviously exists. Additionally, its use should be limited to small protects with (i) a facility orientation (as opposed to a resource attraction), and (ii) restricted market areas that would tend to make the use of alternative use estimating procedures less useful or efficient.

(c) *Calculating values*. The estimates of annual use are combined with the selected unit day values to get an estimate of annual recreation benefits. The value assigned to each activity or category of activities is multiplied by the number of recreation days estimated for that activity. The products are then summed to obtain the estimate of the total value of an alternative. Recreation days to be gained and lost or foregone as a result of a particular alternative are listed and valuated separately, not merely shown as net recreation days. Transfers of recreational users to or from existing sites in the region must be calculated, and the net regional gain or loss used in the final benefit estimated. Adequate information must appear in the discussion of the use estimation and valuation procedure or elsewhere in the report concerning the alternative being considered, so that the reader can derive a similar value for each activity.

Section IX— NED Benefit Evaluation Procedure: Commercial Fishing

2.9.1 Introduction.

This section provides procedural guidance for the evaluation of the national economic development (NED) benefits of water and related land resources plans to commercial fishing. These procedures apply to marine, estuarine, and fresh water commercial fisheries for both fish and shellfish.

2.9.2 Conceptual basis.

(a) The NED benefits are conceptually measured as the change in consumers' and producers' surplus as a result of a plan. However, since proper measurement of these quantities ordinarily requires estimates of supply and demand elasticities, reasonable approximations may be obtained by the following methods:

(1) When no change in aggregate fish catch is expected as a result of a plan (Perhaps because of an effective quota system), NED benefits may be measured as cost savings to existing fish harvests.

(2) When the fish catch is projected to change as a result of a plan, but the change is too small to affect market prices, a seasonally-weighted average of recent prices may be used to value the without- and with-plan harvests. In this case, it may be convenient for computational purposes to break the total change in income into two parts: (i) the cost savings for the existing (without-plan) catch; and (ii) the change in net income associated with the incremental catch. This latter part may be

measured as the change in total revenue due to the increased catch minus the change in total cost due to harvesting time increased catch.

(3) When the additional fish catch is expected to affect market prices, the change in net income may be estimated in two parts: (i) the cost savings for the existing, or without-plan, catch; and (ii) the change in net income associated with the incremental catch. The incremental gross revenue may be estimated by multiplying the change in catch by a price midway between expected without and with-plan prices. The incremental cost of the harvest is then subtracted from the estimated incremental gross revenue.

(b) Harvest costs expected to vary between the with- and without-plan conditions should be analyzed.

(1) These include the cost of development ownership and operation; harvesting materials; labor and management: maintenance operation, and replacement. Examples of changed costs include reduced travel time, reduced travel time to safe moorage in storm conditions, reduced costs associated with more efficient or larger boats, reduced time awaiting favorable tides, damage reduction to vessels or facilities, reduced fish spoilage, and reduced maintenance expenditures. If costs associated with plan measures (e.g., dock costs, harbor facilities, etc.) are included in the plan cost analysis, exclude them from harvest costs.

(2) Value purchased a input at current market prices. Value all labor, whether operator, hired or family at prevailing labor rates. Value management at 10 percent of variable harvest costs and interest at plan discount rates.

(3) Project current production costs to the selected time periods; any changes should reflect only changes in catch or physical conditions.

2.9.3 Planning setting.

(a) *Without-plan condition*. The without-plan condition is the most likely condition expected to exist in the future in the absence of any of the alternative plans being considered. Several specific elements are included in the without-plan condition:

(1) *Habitat condition*. The biological resources consist of stocks of living resources subject to commercial fishing, any living resources ecologically related to the stocks, the migration pattern and reproduction rate of the stocks and any physical characteristic of the environment essential to these living resources.

(2) *The institutional setting*. Existing and expected local, State, regional, national, and international policies and regulations governing the harvest and sale of the affected species, including the level of access to the fishery are included in the without-plan condition. Other revisions of such policies and rules of the alternative plans being studied.

(3) *Nonstructural measures.* The effects of implementing reasonably expected nonstructural measures. Nonstructural measures include prevention of pollution to the marine environment or relocation of shore facilities.

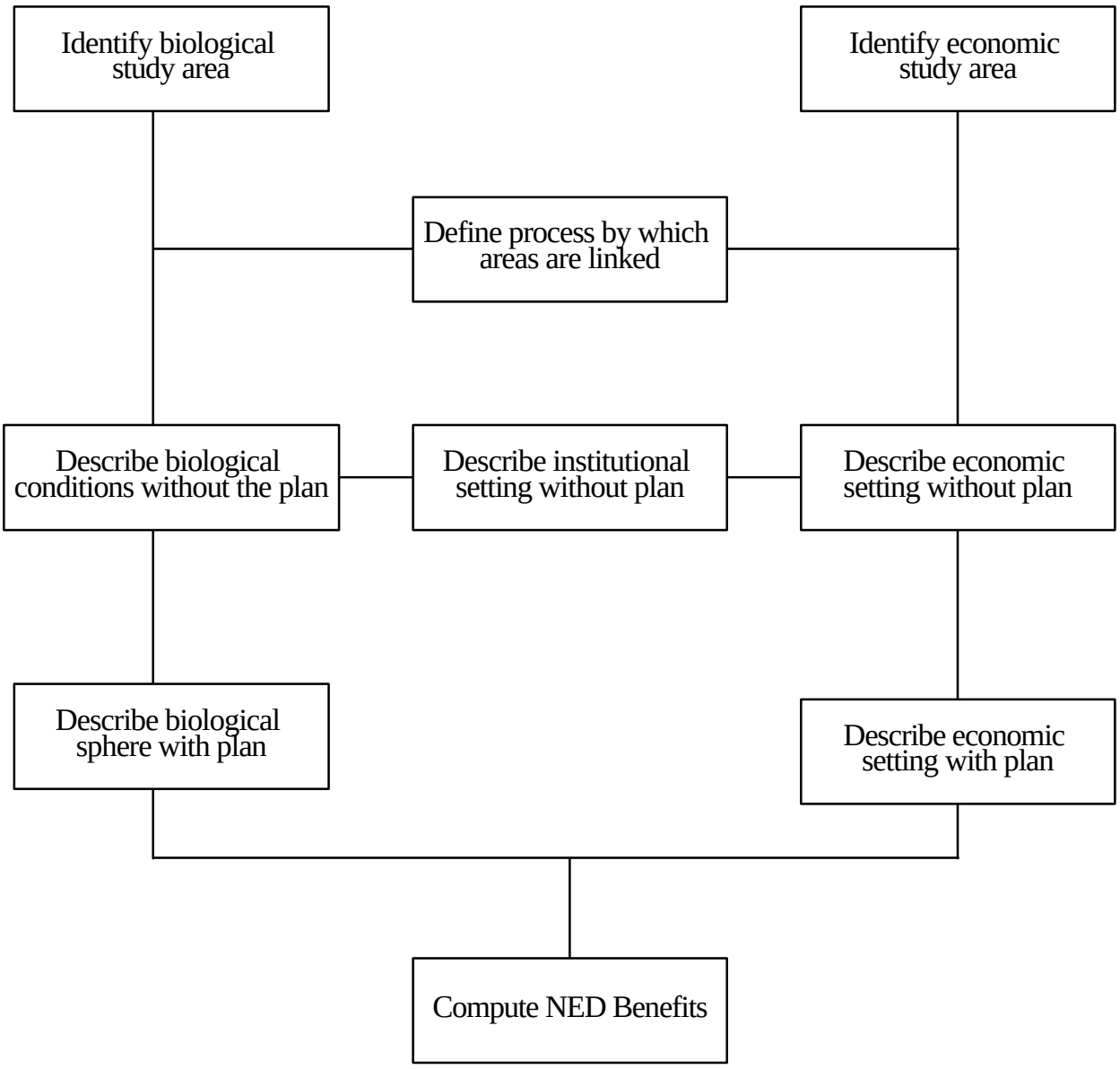
(4) *Market conditions*. Information on the without plan situation includes the projected number of harvesters, the percentage of their time and capacity utilized, harvest technology, the markets in which they buy inputs, fishing efforts, probable harvests, harbors and channels utilized, ex-vessel price of harvests, and probable processing and distribution facilities. See 2.9.2. Project market conditions that are consistent with the projected biological and institutional conditions.

(b) *With-plan condition*. The with-plan condition is the most likely condition expected to exist in the future with a given alternative. The elements and assumptions included in the without-plan condition are also included in the with-plan condition. Special attention should be given to tracing economic conditions related to positive or negative biological impacts of the propose plan.

2.9.4 Evaluation procedure: General.

Follow the steps in 2.9.5 - 2.9.8 to estimate NED benefits to commercial fishing from water or related land resources plans. The level of effort expended on each step depends on the nature of the proposed project, the reliability of data, and the degree of refinement needed for plan formulation and evaluation. (See Figure 2.9.4.)

Figure 2.9.4 -- Commercial Fishing Benefit Evaluation Procedure



2.9.5 Evaluation procedure: Identify the affected areas.

(a) Identify the areas which the proposed alternative plans will have biological impacts.

(b) Identify the areas in which the proposed alternative plans will have economic impacts.

(c) Describe the process by which the biological and economic study areas are linked.

2.9.6 Evaluation procedure: Determine the without-project condition.

(a) Estimate the harvest of the relevant species in physical terms if a plan is not undertaken. Include a detailed description of the stock, including catch per unit of effort and whether the estimated harvest is at, or near. the range of absolute decreasing returns. (See 2.9.3(a)(1) and 2.9.9(a).)

(b) Describe the most likely set of institutional conditions that would exist without a project. (See 2.9.3(a)(2).)

(c) Estimate the total cost of harvesting the relevant species in each of the relevant years if a plan is not undertaken. For each relevant species, determine the current weighted ex-vessel price corrected for seasonal fluctuations. (See 2.9.3(a)(4).)

2.9.7 Evaluation procedure: Determine conditions that would exist with an alternative plan.

(a) Estimate the harvest of the exploited stocks in each of the relevant years if an alternative plan is undertaken.

(b) Estimate the seasonally corrected current price of the harvested species and the total cost of harvesting in each of the relevant years if a plan is undertaken. This will require an understanding of the economics of entry and exit for the fish harvesting industry, as well as the effects of a change in harvest rates on the catch per unit of effort.

2.9.8 Evaluation procedure: Estimate NED benefits.

(a) Calculate the ex-vessel value of the harvest (output) for each alternative plan and for the without-plan condition.

b) Determine the harvesting costs, including nonproject operation, maintenance, and replacement, for the level of catch (output) identified by each alternative plan and the without-plan.

(c) Compute the NED benefit from an alternative plan as the value of the change in harvest less the change in harvesting cost from the without-plan condition to the with-plan condition.

2.9.9 Problems in application.

(a) As the harvest rate of living stocks goes up, it is possible to reach a range in which the increases in annual harvesting efforts will actually produce a long-run decrease in the quantities harvested. In the absence of effective limits on harvesting, it is possible that commercial fishing will operate in this range of absolute decreasing returns. This is possible because individual operators will compare only their revenues and costs; they will not be concerned with the absolute productivity of the stock. This can be very important in determining NED unfits because what may appear to be a positive effect (something that encourages an increase in harvesting effort) may ultimately result in negative benefits (decreased total harvest and increased total cost per unit of harvest).

(b) The fact that fish are common, as opposed to private, property creates special problems in measuring NED benefits. Unless entry is restricted, excessive quantities of capital and labor may enter a fishery; that is, entry may continue until the "economic rent" from the living stock is dissipated. This excess entry will result in economic inefficiency in the utilization of fishery resources because the value of the resulting extra output will be less than the social opportunity cost of the entry. Some economic benefits may be realized but the total benefits will not be as large as they might be if entry were restricted. Although evaluation of this potential has been limited by the specification of the with- and without-plan condition in 2.9.3, three specific points are worthy of separate mention.

(1) *Transitory benefits*. Because the benefits from harvesting open-access fisheries tend to be dissipated through entry of excess capital and labor, some NED benefits from commercial fishing can be transitory. It will therefore be necessary to determine how many years these benefits will last and in what amounts for each year.

(2) *Industry capacity*. The excess capacity that will normally exist will make it difficult to obtain a proper estimate of changes in cost associated with changes in harvests. In some instances, idle boats will be available and the only additional costs will be operating costs, in other instances, vessels that are already operating will be able to harvest the

extra catch without significant change in variable costs.

(3) *Regulation.* Because of the tendency of open access fisheries to attract excess capital and labor which can deplete the stocks, most commercial fishing operations are currently subject to government regulations which stipulate the manner, time, place, etc., in which harvesting may take place. These stipulations usually result in harvesting activity that is not as economically efficient as it might be. These stipulations will therefore affect the size of NED benefits.

2.9.10 Data sources.

(a) Data for annual harvests, demand, harvesting and processing costs, ex-vessel and other prices, physical production, biological modeling, models or information about management policies and regulations, and survey results are available from several Federal, State, and local government agencies, universities (especially those with sea grant programs), private organizations (such as industry groups, fishermen unions, or cooperatives), regional fisheries management councils, and international commissions or organizations.

(b) Initial contacts should be made with the National Marine Fisheries Service Regional Office, United States Coast Guard, State resource agencies having management or other responsibility for the fishery or resource in question, and all local or regional fishery councils, commissions, or institutes that have responsibility or jurisdiction or that are functioning within the area affected by the project. Fisheries dynamics biologists at universities or at National Marine Fisheries Service regional laboratories will be the best source of information on biological effects and their repercussion in the market.

2.9.11 Report and display procedures.

(a) Clear presentation of study results, as well as documentation of key input data assumptions and steps in the analysis, will facilitate review of the report. Table 2.9.11 is a suggested method of data presentation. Its use will provide the reader with information on physical changes in output as well as value.

(b) Because the benefits are broken down into annual flows, it will be possible to determine if and when the open access nature of commercial fishing will lead to a dissipation of any NED benefits provided by the project.

Table 2.9.11

Benefit	Years		
	1	2	n
(1) Change in output.....	.....	.....	.....
(2) Value of change in output (line1 times expected price).....	.....	.....	.....
(3) Change in costs	.....	.....	.....
(4) NED benefit (line 2 minus line 3)	.....	.....	.....

Section X—NED Benefit Evaluation Procedures: Other Direct Benefits

2.10.1 Introduction.

This section provides a definition of other direct benefits and procedural guidelines for the evaluation of other direct benefits attributable to water resources plans and projects. Other direct benefits are the incidental direct benefits of a project. The other direct benefits to be included in the NED benefit evaluation are the incidental effects of a project that increase economic efficiency by increasing the output of intermediate final consumer goods over and above the direct outputs for which the plan is being formulated.

2.10.2 Conceptual basis.

Other direct benefits are incidental to the primary purposes of water resource projects. Primary purposes of projects are those purposes for which the alternative plans are formulated. Other direct benefits derive from incidental increases in outputs of goods and services or incidental reductions in production costs.

2.10.3 Planning setting.

Standard planning procedures involve comparison of the with-project condition to the without-project condition. In considering other direct benefits, define the boundary of direct influence of the plan. Economic efficiency gains to firms in production and satisfaction gains to consumers other than those identified as the direct beneficiaries of primary project purposes should be valued and measured as other direct benefits.

(a) *Without-project condition*. Forecast future conditions expected to exist without implementation of the plan. The without-project condition is the projection of output and production levels and costs of production likely to be achieved in the absence of a plan.

(b) *With-project condition*. Future conditions expected to exist when the plan is fully implemented. The with-project condition is the projection of output and production levels and the costs of production likely to be achieved with the plan.

2.10.4 Evaluation procedure: General.

(a) When applicable, compute other direct benefits according to the procedures for measuring benefits in this chapter. Some benefits, such as reduced water supply treatment costs, can be computed on the basis of reduced costs to consumers.

(b) Improvement in production possibilities of the private market sector as well as the nonmarket sector recreation are other direct benefits. The following are examples: a large water storage project is to be located upstream on a main tributary of a river system that enters the ocean by a delta through an estuary. The direct output of the project is flood control for communities residing on floodplains along upper valleys of the tributary. One effect of regulating flow— reducing winter high and summer low flows—is to increase the recreational potential of land and water in the lower reaches of the river system. A cooling of water temperatures and increased flow during summer increases fish and wildlife productivity; riparian habitats along lower water courses expand and increase in density; salt water marshland receives less saline water in summer. As a result, there is an increase in dove and pheasant hunting as these wildlife populations increase. Opportunities for sport-angling also increase as game fish productivity rises. Shrimp production benefits from the change to less saline water in the marshland,. and commercial shrimp harvest increases, resulting in greater output at lower unit total cost to shrimp fishermen. An incidental effect is the improvement in water quality to downstream users; turbidity is reduced in winter and water hardness is reduced in summer. Treatment costs are lower for firms and households. If the impoundment causes the recharge of groundwater basins in the vicinity of the dam site or along the stream course, these incidental effects are other direct benefits. Pumping costs could be reduced.

2.10.5 Evaluation procedure: Problems in application.

The major problems encountered in the estimation of other direct NED benefits are the identification of the firms, industries, and consumers who will be subject to these incidental effects caused by projects and plans. It must be emphasized that it is not practical or economic to trace out all direct effects.

(a) Determining the “context" or system within which the major incidental impacts might be experienced is a useful first step in identifying likely direct benefits worth measuring. The immediate watershed or the subsystem of a river system would constitute a relevant context. The delineation of geographical and economic market regularities in which impacts are likely to be felt cannot usually encompass the whole regional economy in a highly industrialized area. Nevertheless, it is important to avoid delineating too small an area in which to search for possible effects.

(b) Another procedure for identifying likely impacts is tracing the hydrologic changes that will occur as a result of the project. For example, flows downstream and in other parts of a river system can be changed in quantities and qualities; the water’s chemical and physical characteristics—oxygenation, turbidity, temperature, etc.—can undergo change that may impact on fish and wildlife resources and on the production functions of firms and the satisfaction of consumers.

2.10.6 Evaluation procedure: Data sources.

An assessment of the current situation and the economic efficiency of potentially affected firms and individuals usually entails the collection from primary sources of data on cost, production function, and firm capacity. Studies of industrial structure and the interdependence of firms In the supply of various inputs and the use of outputs can provide valuable supplemental information.

2.10.7 Evaluation procedure: Risk and uncertainty.

Other direct benefits are unique to each project design and its location, so the historical record of data is of limited usefulness. The risk and uncertainty attached to the hypothesized outcomes can be reduced by clearly revealing areas of uncertainty. A physical description of other direct benefits, together with assessment of their relative (major or minor) significance, is an integral part of such a procedure. Nevertheless, these estimates may involve high degrees of risk and relative uncertainty, based as they are on the total mix of project outputs and the effect these mixes would have on stimulating increased productivity.

2.10.8 Report and display procedures.

Other direct benefits should be identified by component and added onto the benefits of the benefit cost analysis. The method used to value the benefits should be presented in the report. Provide a tabular breakdown of all other direct benefits claimed for the project.

Section XI—NED Benefit Evaluation Procedures: Unemployed or Underemployed Labor Resources

2.11.1 Introduction.

The economic effects of the direct use of otherwise unemployed or underemployed labor resources during project construction or installation may, under certain conditions, be included as a national economic development (NED) benefit. Because of the dynamic nature of unemployment situations, the appropriateness of these benefits will be determined in consideration of economic conditions existing at the time the project is submitted for authorization and for appropriations to begin construction. This section provides procedural guidance in the evaluation of NED benefits resulting from increased employment of these labor resources. Use the procedures described in 2. 11.4 to calculate these benefits for all structural and nonstructural alternatives considered during the planning process.

2.11.2 Conceptual basis.

(a) The social cost of a project is less than the market contract cost in situations in which otherwise unemployed or underemployed labor resources are used in project construction. The opportunity cost of employing otherwise unemployed workers in project construction or installation is equal to the value of leisure time foregone by such workers. Because society does not give up any alternative production of goods and services and because it would be difficult to measure the value of leisure time foregone, a zero opportunity cost is used in these procedures. The opportunity cost of employing otherwise underemployed workers equals their without-project earnings, which, by virtue of their underemployment, are less than their market cost. The most straightforward way to reflect the effects of employing unemployed or underemployed labor resources would be to reduce by the appropriate amount the project construction costs in the NED account, but this method would cause accounting difficulties in appropriations, cost allocation, and cost sharing. Therefore, these effects are treated as a project benefit in the NED account.

(b) Conceptually, any employment, anywhere in the Nation, of otherwise unemployed or underemployed resources that results from a project represents a valid NED benefit. However, primarily because of identification and measurement problems and because unemployment is regarded as a temporary phenomenon, only those labor resources employed onsite in the construction or installation of a project or a nonstructural measure should be counted. Benefits from use of otherwise unemployed or underemployed labor resources may be recognized as a project benefit if the area has substantial and persistent unemployment at the time the plan is submitted for authorization and for appropriations to begin construction. Substantial and persistent unemployment exists in an area when:

(1) the current rate of unemployment, as determined by appropriate annual statistics for the most recent 12 consecutive months, is 6 percent or more and has averaged at least 6 percent for the qualifying time periods specified in paragraph (2) and

(2) the annual average rate of unemployment has been at least: (i) 50 percent above the national average for three of the preceding four calendar years, or (ii) 75 percent above the national average for two of the preceding three calendar years, or (iii) 100 percent above the national average for one of the preceding two calendar years.

(c) Only the portion of project construction activity located in such an area is eligible for employment benefits as calculated in accord with the procedures specified below. Any benefit claimed should be clearly justifiable both in terms of availability of amounts of unemployed and/or underemployed labor and their skills and occupations.

2.11.3 Planning setting.

(a) *Without-project condition*. The without-project condition is the most likely condition expected to exist in the future in the absence of a project, including known changes in law or public policy. The evaluation of NED benefits associated with the use of otherwise unemployed and underemployed labor resources is linked to the number by which these resources would be reduced over time without a project.

(b) *With-project condition*. The with-project condition is the most likely condition expected to exist in the future with a given project alternative. There is a different with-project condition and thus a different employment benefit for each alternative plan. Currently, the employment benefit cannot be estimated directly on the basis of a comparison of the size of the pools of unemployed and underemployed labor with and without a project. Instead, the benefit procedure implicitly projects

the percentage of project labor hires estimated to come from the unemployed labor pool.

2.11.4 Evaluation procedure.

(a) *Step 1.* Calculation of employment benefits is limited to onsite project construction or installation activity in eligible regions as defined in 2.11.2(b). The first step therefore is to determine whether a project is wholly or partially located in an eligible area.

(b) *Step 2.* Estimate the number of skilled and unskilled unemployed construction workers in the labor area. Construction labor pool data are usually available from local offices of State employment security agencies.

(c) *Step 3.* Determine the labor requirements for plan implementation as follows:

(1) *Labor cost*. The manpower requirements of water resource projects differ widely. Construction cost estimate data will provide the percentage of labor cost to total construction contract cost.

(2) *Manpower requirements*. Analyze the plan's construction work force and schedule to determine manpower requirements over the construction period for skilled and unskilled categories of workers. Convert these data to total construction wages in skilled and unskilled categories by year of construction. In addition, estimate the yearly wage bill of other workers needed on the project. Use the occupational tables in Appendix 1 of this section to categorize different types of workers.

(d) *Step 4.* Compare the annual manpower requirements of the project to the size of the unemployed labor pool in eligible regions. If labor availability is significantly larger than labor requirements, proceed to the next step. If not, reduce the percentages in the next step based on one or both of the following: expert interviews; or a careful match up of requirements and availability for specific types of jobs (e.g., carpenters).

(e) *Step 5. Calculate NED employment benefits*— (1) *Standard method*. The following percentages are derived from *An Evaluation of the Public Works Impact Program* (PWIP). [2] Although the projects studied in the PWIP report are not fully comparable to many typical water projects, the report does provide an empirical basis for relating public works expenditures to employment of unemployed workers. Case 1, below, covers situations in which there is no “local hire” rule; it is taken directly from the PWIP report, as PWIP has no local hire rule. Case 2 covers situations in which there is a local hire rule; the reference data are modified to account for an 80-percent local hire by scaling up the local hires (for skilled and unskilled workers) to 80 percent, but retaining the distribution of local hires previously employed to local hires previously unemployed.

(i) *Case 1, NED benefits. no local hire rule*. Multiply the total wages determined by categories of workers (skilled, unskilled, and other) by the following percentages to obtain NED benefits by year of construction:

Skilled — 30

Unskilled — 47

Other — 35

(ii) *Case 2. NED benefits, local hire rule*. Apply the following percentages in case 2 situations:

Skilled — 43

Unskilled — 58

Other — 35

Because the 80-percent local hire rule is a goal, nota requirement, support these percentages by data that indicate the local hire goal is likely to be met. If this is unlikely, reduce Case 2 percentages to numbers between the standard Case 1 and Case 2 percentages.

(iii) *Annual NED benefits*. Convert the NED benefits by year of construction to an annual equivalent basis using the current discount rate.

(2) *Alternative methods*. The percentages of unemployment hires may be changed from those used in the standard method if the change can be supported by an empirical study that shows different percentages of unemployed and underemployed workers on a similar project, or on a segment of the same project, for labor market conditions similar to those of the proposed project. In using this method, it may be necessary to vary the categorization of construction workers used in the standard method. The opinions of experts such as local State employment security agencies, local construction firms, associations of contractors, and labor unions may not be substituted for empirical data. Studies used to document alternative percentages for specific types or locations of projects should be cited if not included in the project report.

(3) The percentages are used in the standard method to measure wages paid directly to previously unemployed workers. Previously employed workers may vacate jobs that then become available to unemployed workers, but there are no empirical data to support a quantification of such indirect effects and no

[2] Economic Development Administration, U.S. Department of Commerce. An evaluation of the Public Works Impact Program (PWIP). Springfield, VA, National Technical Information Service (PB-263 089), January 1975.

estimates of these effects should be included in the NED account.

2.11.5 Report and display procedures.

Include the employment benefits of each alternative plan as a line item in the display of NED benefits in the system of accounts for any project or portion of a project located in an area that contains unemployed or underemployed resources, as defined in 2.11.2(b).

Appendix 1 to Section XI—Occupational Tables

Blue Collar Unskilled Occupations
Bricklayer Apprentice
Carpenter Apprentice
  Apprentice Carpenter
  Carpenter Helper
Chainman
Deck Hand
Electrical Apprentice
  Apprentice Electrician
  Apprentice Wireman
  Electrician Trainer
Iron Worker Apprentice
Laborer
  Asphalt Distributor
  Assistant Carpenter
Bottom Laborer
  Brick Tender
  Carpenter Aid
  Carpenter Helper
  Chainsawman
  Common Laborer
  Concrete Braker
  Concrete Laborer
  Concrete Saw
  Construction Laborer
  Ditch Laborer
  Drill Helper
  Flag Person
  Hod Carrier
  Kettleman
  Laborer
  Laborer Apprentice 3rd
  Laborer Group I
  Laborer Group V
  Labor Shop Man
  Laborer Topman
  Laborer Utilityman
  Landscape Laborer
  Mason Helper
  Mason Laborer
  Mason Tender
  Mortarman
  Mortarmler
  Pipe Layer
  Pipe Helper
  Pipe Fitter
  Plasterer Tender
  Powderman
  Pusher
  Rakeman
  Reboundman
  Road Laborer
  Roof Helper
  Sand Blaster
  Set-up-man
  Sprinkler Apprentice
  Stake Setter
  Tender
  Termite Operator
  Tile Setter Operator
  Vibrator Operator
  Water Truckman
Lumberman and Nurseryman
  Tree Thinner
  Treeman
  Treeplanter
Operating Engineer Apprentice
  B. M. Apprentice
  EO Group III
  EO Group 222
Plumber Apprentice
  Plumber Apprentice
  Plumber Helper
Painter's Helper
Sheet Metal Apprentice
Vibrator Operator
Watchman
Night Watchman

Blue Collar Skilled Occupations
Blaster
Boilermaker
Boilermaker Foreman
Bricklayer
  Block Layer
  Truckpointer
  Brick mechanic
Bricklayer Foreman
Carpenter
  Form Setter
  Journeyman Carpenter
  Soft Floor Layer
Carpenter Foreman
Carpenter Superintendent
Cement Mason
  Finisher
  Journeyman Finisher
Cement Mason Foreman
Diver
Driller
  Drill Rig Operator
Electrician
  Journeyman Electrician
  Mechanical Electrician
  Wireman
  Journeyman Wireman
Electrical Foreman
General Foreman
  General Labor Foreman
  Project Foreman
Glazier
Iron Worker
  Reinforcing Ironworker
  Structural Ironworker
  Steel Worker
  Steel Erector
  Steel Setter

Reinforcing Steel Worker
Iron Worker Foreman
Labor Foreman
Construction Foreman
Foreman
Job Foreman
Lead Foreman
Lather
Lather Foreman
Master Mechanic
Mechanic Welder
Repairman
Repairman Leadman
Oiler
Oiler Equipment Operator
Oiler Operator Group II
Oiler Track Type
Operating Engineer
Asphalt Distributor Operator
Asphalt Heaterman
Backhoe Operator
Blade Operator
Bobcat Operator
Bulldozer Operator
Case Operator
Class A Operator
Class C Operator
Crane Operator
Digger Operator
Distributing Operator
Dragline Operator
Equipment Operator
Equipment Operator Group III
Front End Lift Fork Operator
Heavy Equipment Operator
Hi-Lift Operator
Lift Fork Operator
Light Equipment Operator
Loader Operator
Maintenance Loadman
Motor Grader Operator
Operator Group III
Pan Operator
Park Equipment Operator
Power Drive Moister Operator
Power Equipment Operator
Pneumatic Tire Roller Operator
Pneumatic Tractor Operator
Roller Operator
Scraper Operator
Shovel Operator
Tractor Operator
Traxeavator Operator
Trenching Machine Operator
Truck Loader Operator
Operating Engineer Foreman
Leader Operator
Painter
Brush Painter
Roller Painter
Spray Painter
Painter Foreman
Pile Drive
Pipe Fitter
Sp. Box Man
Pipe Fitter Foreman
Sprinkler Foreman
Plasterer
Plasterer foreman
Plumber
Pipe Layer
Plumber Foreman
Plumber General Foreman
Plumber Superintendent
Rigger Foreman
Roofer
Sheet Metal Worker
Journeyman Sheet Metal
Sheet Metal Mechanic
Sheet Metal Operator
Sheet Metal Foreman
Steam Fitter
Tile Setter
Truck Driver
Worker
Axle Truck Driver
4 Axle Truck Driver
Dump Truck Driver
Road Truck Driver
Tandem Truck Driver
Truck Driver II
Truck Driver Highway
Waterproof Foreman

Section XII—NED Cost Evaluation Procedures

2.12.1 Introduction.

This section provides procedures for the evaluation of NED costs of structural and nonstructural elements of water resource plans and projects.

2.12.2 Conceptual basis.

(a) Project measures, whether structural or nonstructural, require the use of various resources. NED costs are the opportunity costs of resource use in evaluating NED costs, resource use must be broadly defined so as to fully recognize scarcity as a component of value. This requires consideration of the private and public uses that producers and consumers are currently making of available resources or are expected to make of them in the future.

(b) The opportunity costs of resource use are usually reflected in the marketplace. When market prices adequately reflect total resource values, they are used to determine NED costs. When market prices do not reflect total resource values, surrogate values are used appropriately to adjust or replace market prices.

(c) Total NED cost is the market value of a resource plus other values not reflected in the market price of the resource; it therefore accounts for all private sector and public sector uses. Market price is used to reflect the public sector use of resources

required for or displaced by a project, and surrogate value is used to reflect the public sector use.

(1) The market price approach relies on the interaction of supply and demand. Price is determined through transactions on the margin between knowledgeable and willing buyers and sellers, neither of whom are able to influence price by their individual decisions. Distortions in market price occur if one or more of the conditions of perfect competition is violated.

(2) The surrogate value approach involves the approximation of opportunity costs based on an equivalent use or condition. Surrogate values are frequently used in restricted markets and in nonmarket situations.

(d) Proper NED analysis requires that project NED costs and benefits be compared at a common point in time. Costs are calculated in annualized terms (see 2.1.3).

2.12.3 Planning setting.

The basis for the evaluation rests in a thorough analysis of expected conditions in the future with a project and without a project. This requires identification of those resources that will be affected by a project; the current value of such uses is measured as the economic worth to the Nation of the services associated with those uses.

2.12.4 Evaluation procedure: General

(a) Resources required or displaced to achieve project purposes by project installation and/or operation, maintenance, and replacement activities represent a NED cost and should be evaluated as such. Resources required or displaced to minimize adverse impacts and/or mitigate fish and wildlife habitat losses are also NED costs. Costs for features not required for project purposes, avoiding adverse effects, and/or mitigating fish and wildlife habitat losses are not project-related NED costs and should not be evaluated.

(b) Base all NED costs on current costs adjusted by the project discount rate to the beginning of the period of analysis as defined in Section 1, 2.1.2(c). Compute all costs at a constant price level and at the same price level as used for the computation of benefits. Base current costs on the price level at the time of the analysis. These costs will be updated in the year(s) the project is submitted for authorization and/or appropriations. Discount deferred costs to the end of the installation period, using the applicable project discount rate. Increase costs incurred before the beginning of the period of analysis by adding compound interest at the applicable project discount rate from the date the costs are incurred to the beginning of the period of analysis. Convert all NED costs to an annual equivalent value over the period of analysis.

(c) Project NED costs may be adjusted by an allowance for the salvage value of land, equipment, and facilities that would have value for nonproject uses at the end of the period of analysis. Significant salvage values of replaceable items (e.g., generators) will normally become adjustments to allowances for replacement costs.

2.12.5 Evaluation procedure: Implementation outlays.

The NED costs of implementation outlays include the costs incurred by the responsible Federal entity and, where appropriate, contributed by other Federal or non-Federal entities to construct, operate, and maintain a project in accordance with sound engineering and environmental principles and place it in operation. These costs are the remaining postauthorization planning and design costs; construction costs; construction contingency costs; administrative services costs; fish and wildlife habitat mitigation costs; relocation costs; historical and archaeological salvage costs: land, water, and mineral rights costs; and operation, maintenance, and replacement costs.

(a) *Postauthorization planning and design costs*. The costs are the direct cost for investigations, field surveys, planning, design, and preparation of specifications and construction drawings for structural and nonstructural project measures. In the evaluation procedure, base these costs on the actual current costs incurred by the responsible Federal entity for carrying out these activities for similar projects and project measures. They may be computed as a percentage of construction costs when there is a documented basis for the rate used. Make adjustments when appropriate to reflect circumstances special to the project under consideration.

(b) *Construction costs*. These costs are the direct cost of installing project measures. They should be based on the market value of goods and services required to install project measures, including those measures required for avoiding adverse environmental effects and public health and safety risks. They include the cost of purchased materials (including associated transportation costs); equipment rental or purchase; construction wages or salaries (including social security and fringe benefit costs); and contractors' management, supervision, overhead, and profit. Base such costs on current contract bid items in the project area or on the current

market value of purchased materials and services, etc.

(c) *Construction contingency costs*. These are project costs normally added to reflect the effects of unforeseen conditions on estimates of construction costs. They are not an allowance for inflation or for omissions of work items that are known to be required. They are included to cover unforeseen construction problems. These costs will vary with the intensity of the surveys and investigations performed. The variability of size conditions, and the type of project measures being installed. They may be computed as an appropriate percentage of estimated construction costs.

(d) *Administrative services costs*. These are the costs associated with the installation of project measures, including the cost of contract administration; permits needed to install the project measures; relocation assistance advisory services; administrative functions connected with relocation payments; review of engineering plans prepared by others; government representatives; and necessary inspection service during construction to ensure that project measures are installed in accordance with the plans and specifications. Base these costs on the actual current costs incurred by the responsible Federal entity for carrying out these activities for similar projects and project measures. These costs may be computed as a percentage of construction costs if there is a documented basis for the rate used. Make adjustments when appropriate to reflect unusual circumstances special to the project under consideration.

(e) *Fish and wildlife habitat mitigation costs*. These are the costs of mitigating losses of fish and wildlife habitat caused by project construction, operation, maintenance, and replacement. The mitigation measures to be included in the project will be determined by the responsible Federal entity in coordination with Federal and State Fish and Wildlife Agencies as required by the fish and Wildlife Coordination Act (Pub. L. 85-625). Installation of these mitigation measures should be concurrent with the installation of other project measures, where practical. These costs include all project outlays associated with the installation of mitigation measures. Including postauthorization planning and design costs; construction costs; construction contingency costs; administrative services costs; relocation costs; land, water, and mineral rights costs; and operation, maintenance, and replacement costs. Base the costs on current market values and the actual current costs incurred by the Federal entity for carrying out these activities for similar mitigation measures.

(f) *Relocation costs*. (l) These are project costs associated with—

(i) the requirements of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Pub. L. 91-646); and

(ii) the relocation of highways, railroads, and utility lines.

(2) Real property acquisition relocation payments are applicable to a displaced person, business, or farm operation. The costs include moving and related expenses for a displaced person, business, or farm operation; financial assistance for replacement housing for a displaced person who qualifies and whose dwelling is acquired because of the project; and termination payments for dislocated businesses whose owners choose to close out. Base the NED cost of replacement housing on replacement in kind. (Costs over and above replacement in kind are treated as financial costs for nonproject purposes.) Base these costs on current market values.

(3) Base the relocation cost of railroads and utility lines on the costs of replacement in kind. In the case of highways, base the relocation cost on replacement that reflects the current traffic count and current standards of the owner, which may result in a justified improvement over the configuration of the existing roadway. The additional relocation cost of highways that are upgraded to increase their carrying capacity for project purposes such as recreation is also a project cost. The relocation cost of highways, railroads, and utility lines shall include all project outlays associated with their relocation, including planning and design costs; construction costs; construction contingency costs; administrative services costs; fish and wildlife habitat mitigation costs; land, water, and mineral rights costs; and historical and archaeological salvage costs. Base these costs on current market values and the actual current costs incurred by the Federal entity for carrying out similar relocations.

(g) *Historical and archaeological salvager operation costs*. These are project costs associated with salvaging artifacts that have historical or archaeological values as prescribed by the Preservation of Historic and Archaeological Data Act (Pub. L. 93-291). Base these costs on the current market price of salvage operations carried on during construction.

(h) *Land, water, and mineral rights costs*. (1) These costs include all costs of acquiring the land, water, and mineral rights required for installing, operating, maintaining, and replacing project measures. They include all expenditures incurred in acquiring land, water, and mineral rights, easements, leases, and rights-of-way. Such costs include the cost of the land, water, and mineral rights minus salvage value; the cost of surveys incident to a sale; legal fees and transfer costs; foregone real estate taxes: and severance payments. Base these costs on current market values and the actual current costs incurred by the Federal entity for carrying out similar land, water, and mineral rights acquisitions. Base the market value of easements on the difference in market value of land without the easement and with the easement.

(2) Some land, water, and mineral rights are owned by Federal, State, and local governments and have been committed to specific uses. Base the NED cost of using such resources for project purposes consistent with their committed uses on the surrogate value of the public services provided by the resources. For example, if State-owned land committed to recreation use is to be used for project recreation development, its NED cost is not the market value of the land, but the value of the recreation services that would be provided by the land without the project. Public domain lands not committed to specific uses should be valued at the market value of comparable private land or a surrogate use value, or a combination if there are complementary uses.

(i) *Operation, maintenance, and replacement costs*. These costs represent the current value of materials, equipment, services, and facilities needed to operate the project and make repairs and replacements necessary to maintain project measures in sound operating condition during the period of analysis. They include salaries of operating personnel; the cost of repairs, replacements, or additions; and an appropriate charge for inspection, engineering, supervision, custodial services, and general overhead. When operation, maintenance, or replacement will be performed by contract, the cost should include an allowance for contingencies and the costs of survey, planning design, and administrative services. Base these costs on actual current costs incurred for carrying out these activities for similar projects and project measures. When the project is an addition to or extension of an existing project for which the costs and benefits are not included or otherwise involved in the project analysis, include only the additional cost of operation, maintenance, or replacement necessitated by the addition or extension to the existing project. Adjustments can be made when appropriate to reflect circumstances special to the project under consideration.

2.12.6 Evaluation procedure: Associated costs.

Associated costs are the costs of measures needed over and above project measures to achieve the benefits claimed during the period of analysis. For example, associated costs include the cost of irrigation water supply laterals, if they are not accounted for in the benefit estimate. Base - associated costs on the current market prices of goods and services required for the installation of measures needed over and above project measures.

2.12.7 Evaluation procedure: Other direct costs.

(a) These are the costs of resources directly required for a project or plan, but for which no implementation outlays are made. Consequently, they are included in the economic costs of a plan but not in the financial costs. These costs may be important for both structural and nonstructural plans. For example, a zoning plan to preserve floodplain values by restricting development would have as a cost the value of with-project development opportunities foregone. A plan that responds to demand growth by reallocating existing outputs from low value uses to high value uses through pricing mechanisms (i.e., raising the price of existing outputs) would have as its main cost the value of the outputs to the users who forego its use as a result of its higher price. On the other hand, a structural project may displace recreation use at the project site. Whenever possible, compute these costs using the procedure set forth in this manual for computing benefits. If these costs are not quantified, they should be otherwise identified.

(b) Other direct costs also include uncompensated NED losses caused by the installation, operation, maintenance, or replacement of project or plan measures. All uncompensated net losses in economic outputs (not transfers) that can be quantified shall be considered project NED costs. The evaluation of such costs requires an analysis of project effects both within and outside the project area.

(c) Examples of other direct costs include increased downstream flood damages caused by channel modifications, dikes, or the drainage of wetlands; increased water supply treatment costs caused by irrigation return flows; erosion of land along stream banks caused by dams that prevent the replenishment of bed load material; loss of land and water recreation values through channel modifications, reduced instream flow due to consumptive use of water by irrigated agriculture, or inundation by reservoirs; increased transportation costs caused by rerouting traffic around a reservoir; new or increased vector control costs caused by the creation of wetlands; and decreased output or increased cost payoff unit of output of private firms caused by project-induced decreases in raw materials. When applicable, compute such costs using the procedures for computing benefits contained in this chapter. Some costs, such as increased water

supply treatment costs, may be computed on the basis of increased costs to resource users.

2.12.8 Evaluation procedure: Problems in application.

(a) Application of the procedures in this section requires care to ensure that all costs are included. The identification and determination of all associated costs and external diseconomies require full perception of the measures required to achieve the benefits being claimed and the impacts produced by the actions taken. It must be emphasized that it is not practical or economic to trace out all other direct effects.

(b) Application of the procedures in this section requires care to avoid double counting. A full understanding of the values reflected by market and surrogate values is necessary to prevent double counting. For example, the market value of land that includes a private recreation development reflects the recreation value. In this case, double counting would result if a surrogate recreation value (loss) were added as a cost. On the other hand, the market value of land that provides free public recreation does not reflect the recreation value, so the surrogate recreation value (loss) must be added as a cost.

(c) Market prices are relatively easy to obtain. However, some prices are subject to large fluctuations in short periods of time, so care must be taken to determine reasonable current costs of such items for project evaluation purposes.

2.12.9 Evaluation procedure: Data sources.

Market price information is available from data on comparable sales, Government publications (e.g., bulletins of the U.S. Departments of Commerce, Agriculture, and Labor), and business reports. Data sources for those NED benefit evaluation procedures having application to cost analysis are covered in their respective sections of this chapter.

2.12.10 Report and display procedures.

Display NED costs identified through the procedures described above as line item entries in the adverse effects section of the NED account. The following display tables are suggested:

Table 2.12.9-1—Project Investment

	Alternative—1			Alternative—2			Alternative—X		
	Unit		Amount	Unit		Amount	Unit		Amount
	Quantity	Price		Quantity	Price		Quantity	Price	
1. Construction cost.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2. Construction contingency costs.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
3. Postauthorization planning and design costs.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
4. Administrative services costs.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
5. Fish and wildlife habitat mitigation costs.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
6 Historical and archeological salvage operation costs									
7. Land, water, and mineral rights costs.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
8. Relocation costs.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
9. Interest during installation period at rate of ---%...	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total investment....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Price level: —									
Installation period: —									
Period of analysis: —									

Table 2.12.9—2 Annualized Adverse Effects

[Price level: period of analysis; discount rate]

	Alternatives		
	1	2	X
Interest on investment			
Amortization of investment			
Average operation and maintenance			
Major replacement			
Associated costs [a]			
Other direct costs [a]			
Total annualized costs			
Other adverse effects not evaluated in monetary terms [a]			

[a] Identified by type

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Chapter III—Environmental Quality (EQ) Procedures

Section I—Introduction

3.1.1 Purpose.

This chapter provides an alternative set of procedures that may be used for evaluating the effects of alternative water resources plans on environmental quality (EQ). The EQ procedures in this chapter are for Federal administrative purposes and do not create any substantive or procedural rights in private parties. The purpose of these procedures is to:

(a) Establish a process for identification and description of beneficial and adverse effects of alternative plans on significant natural resources and historic and cultural properties (referred to hereinafter as natural and cultural resources).

(b) Assist agencies in meeting the requirements of the National Environmental Policy Act of 1969, as amended (NEPA; Pub. L. 91-190; 42 U.S.C. 4321, *et. seq*.), as specified in the CEQ NEPA regulations (40 CFR Parts 1500-1508). Relationships between the CEQ NEPA regulations and these procedures are noted in the text. Appendix B lists relationships that may aid in the preparation of an environmental impact statement (EIS).

(c) Provide a basic analytical framework for focusing the concurrent integration of other related review, coordination, and consultation requirements into the planning process. These other related requirements include those mandated by the Fish and Wildlife Coordination Act of 1958, as amended (Pub. L. 85-624; 16 U.S.C. 661, *et seq.*); the National Historic Preservation Act of 1966, as amended (Pub. L. 89-655, 16 U.S.C. 470, *et seq.*); the Endangered Species Act of 1973, as amended (Pub. L. 93-205; 16 U.S.C. 1531, *et seq.*); and the Coastal Zone Management Act of 1972, as amended (Pub. L. 92-583, 16 U.S.C. 1451, *et seq.*). These procedures for EQ evaluation are intended to rely on and make use of, rather than duplicate, analyses and documentation already used by agencies for compliance with such requirements.

3.1.2 Limitations.

(a) These procedures are limited to evaluation of effects on the ecological, cultural, and aesthetic attributes of Significant natural and cultural resources.

(b) During the course of the EQ evaluation, the planner should be aware that contributions or effects that can be measured in monetary terms are to be monetized and included in the NED account.

Section II—Definitions.

3.2.1 Definitions.

EQ account

The EQ account may be used to describe that part of the NEPA human environment that identifies beneficial and adverse effects on significant EQ resources and attributes.

EQ attributes

EQ attributes are the ecological, cultural, and aesthetic properties of natural and cultural resources that sustain and enrich human life.

(1)*Ecological attributes* are components of the environment and the interactions among all its living (including people) and nonliving components that directly or indirectly sustain dynamic, diverse, viable ecosystems. In this category are functional and structural aspects of the environment, including aspects that require special consideration because of their unusual characteristics.

(i) Functional aspects of the environment include production, nutrient cycling, succession, assimilative capacity, erosion, and other dynamic, interactive processes and systems. Examples are the role of wetlands as a potential sink for nutrients and pollutants; the high productivity of marshes that is often exported to other systems; and prime and unique farmlands.

(ii) Structural aspects of the environment include plant and animal species, populations and communities; habitats; and the chemical and physical properties of air, water (surface and ground), and soil and other geophysical resources. Examples are water quality factors that support or are indicative of trout fisheries; the substrate characteristics and the aggregations of plants and animals that support a rookery; the pH of the rainfall; pristine wilderness areas; endangered, threatened, and other unique or scarce plant and animal species; and rock strata with scientific or educational uses.

(2) *Cultural attributes* are evidence of past and present habitation that can be used to reconstruct or preserve human lifeways. Included in this category are structures, sites, artifacts, environments, and other relevant information, and the contexts in which these occur. Cultural attributes are found in archaeological remains of prehistoric and historic aboriginal occupations; historic European and American areas of occupation and activities; and objects and places related to the beliefs, practices, and products of existing folk or traditional communities and native American groups. Examples

are campsites of prehistoric mammoth hunters, a 19th century farm stead, and a stream crossing in longstanding use by an Appalachian community for baptizing church members.

(3) *Aesthetic attributes* are perceptual stimuli that provide diverse and pleasant surroundings for human annulment and appreciation. Included in this category are sights, sounds, scents, tastes, and tactile impressions, and the interactions of these sensations, of natural and cultural resources. Examples are the sight of a pristine landscape, the view of a historic fortress, the sound of a waterfall or brook, the scent of a hedgerow of honeysuckle or a pine forest, and the taste of mineral water.

EQ resource

An EQ resource is a natural or cultural form, process, system, or other phenomenon that—

(1) Is related to land, water, atmosphere, plants, animals, or historic or cultural objects, sites, buildings, structures, or districts; and

(2) Has one or more EQ attributes (ecological, cultural, aesthetic).

Guidelines

A guideline is a standard, criterion, threshold, optimum, or other desirable level for an indicator that provides a basis for judging whether an effect is beneficial or adverse. Guidelines are to be based on institutional, public, or technical recognition.

Indicator

An indicator is a characteristic of a EQ resource that serves as a direct or indirect means of measuring or otherwise describing changes in the quantity and/or quality of an EQ attribute.

(1) Quantity indicators describe how much of a resource attribute is present in terms of physical size, magnitude, or dimension. They are usually measurable in numeric units (example: The indicator "depth" is measurable in meters, feet, etc.); but they may be described in non-numeric terms (example: The indicator "amount" could be described on a scale of "abundant/adequate/scarce/ unique"). The diversity or stability of an ecosystem or natural community may be a numeric or non-numeric indicator.

(2) Quality indicators are characteristics that describe the degree or grade of an attribute's desirability (how good or how bad). Some quality indicators are measurable in numeric units (example: The indicator “landscape beauty" measured by an ordinal ranking of landscapes); some represent composites of numeric measurements (example: The indicator “class 'A' water quality" is a composite of measurements of concentrations of dissolved oxygen, suspended solids, etc.); some are described in non-numeric units (example: The indicator "desirability of scent" described on a scale of "offensive/neutral/pleasant").

Significant

Significant means likely to have a material bearing on the decisionmaking process. In EQ evaluation, significant EQ resources and attributes (see 3.4.3) and significant effects (see 3.4.12) are identified based on institutional, public, and technical recognition.

Technique

A technique is a systematic procedure for measuring or otherwise describing current and future conditions of a specified indicator in terms of the indicator's specified unit.

Unit

A unit is a numeric or non-numeric term in which change in an indicator is measured or otherwise described.

With-plan condition

The with-plan condition is an estimation of the most probable future condition expected to occur as a result of implementation of a specific alternative plan formulated during a study. The with-plan condition includes changes likely to directly, indirectly, or cumulatively result both from the alternative plan and from all reasonably foreseeable actions that are not part of the plan.

Without-plans condition

The without-plans condition is an estimation of the most probable future condition expected to occur in the absence of any of the study's alternative plans. The without-plans condition includes any changes expected to directly, indirectly, or cumulatively result from all reasonably foreseeable actions without any of the study’s alternative plans. For example, if it is most probable that within the next 20 years 60 percent of a woodland will be cleared for agricultural purposes without any of the plans being considered by the agency, the effects of such clearing would be included in the without-plans conditions. Similarly, if existing legislation, such as the Clean Water Act, is expected to improve water quality in a river, such improvement would be included in the without-plans conditions. The without plans condition is synonymous with "No Action' as used in NEPA and the CEQ NEPA regulations (40 CFR 1502.14(d)).

3.2.2 References for terms.

Table 3.2.2 lists key terms and indicates where their definitions or explanations are located in these procedures or in the CEQ NEPA regulations.

Table 3.2.2—References for Terms

Term	Reference
Activity	3.4.1(b)
Aesthetic attribute	3.2.1—EQ attribute
Affected area	3.2.1—Planning area
Cooperating agency	40 CFR 1501.6
Cultural attribute	3.2.1—EQ attribute
Cumulative effect	40 CFR 1508.7
Direct effect	40 CFR 1508.8(a)
Ecological attribute	3.2.1—EQ attribute
Effect	40 CFR 1508.8 and 714.431(a)
Environmental impact statement	40 CFR 1508.11
EQ account	3.2.1
EQ attribute	3.2.1
Existing condition	3.4.6(a)
Forecast dates	3.4.7(g)
Guideline	3.2.1
Human environment	40 CFR 1508.14
Indicator	3.2.1
Indirect effect	40 CFR 1508.8(b)
Institutional recognition	3.4.3(c)(1) and 3.4.12(b)
Natural and cultural resources	3.1.1(a)
Phase	3.4.1(b)(1)
Planners	3.3.1(c)
Public recognition	3.4.3(c)(2) and 3.4.12(c)
Scoping	40 CFR 1501.7
Significant	3.2.1
Stage	3.4.1(c)(1)
Technical recognition	3.4.3(c)(3) and 3.4.12(d)
Technique	3.2.1
Trend condition	3.4.6(a)
Unit	3.2.1
With-plan condition	3.2.1
Without-plan condition	3.2.1

3.2.3 Abbreviations and acronyms.

Table 3.2.3 lists commonly used abbreviations and acronyms that appear in these procedures.

Table 3.2.3—Abbreviations and Acronyms

Abbreviations and acronyms	Phrase
CEQ	Council on Environmental Quality.
EIS	Environmental impact statement.
EQ	Environmental quality.
et seq	*et sequens* (and the following).
FR	Federal Register.
HEP	Habitat Evaluation Procedures.
NED	National economic development.
NEPA	National Environmental Policy Act.
OSE	Other social effects.
P&G	Principles and Guidelines.
Pub. L	Public law.
RED	Regional economic development.
U.S.C.	United States Code.

Section III—General Evaluation Requirements

3.3.1 Interdisciplinary planning.

(a) An interdisciplinary approach is required by NEPA and the CEQ NEPA regulations (40 CFR 1501.2(a) and 1507.2(a)).

(b) The wide range of resources that should be viewed from the perspective of the EQ evaluation is beyond the scope of any single scientific discipline. Therefore, the use of many scientific disciplines in an ongoing, interactive approach is necessary to deal effectively with the range of EQ resources to be considered in decisionmaking.

(c) The types of generalists and specialists from various disciplines, referred to hereinafter as "planners," needed for an interdisciplinary approach will vary from study to study. An interdisciplinary approach is not limited to the expertise immediately available in the planning agency. As necessary for a particular study, agency expertise may be supplemented by knowledge and skills from cooperating agencies, universities, consultants, and other sources. Regardless of the source of expertise, the types of expertise brought to bear on a given EQ analysis, judgment, or other decision requiring professional judgment should be relevant to the decision.

3.3.2 Public involvement.

(a) Agencies should invite the early and continuing involvement of government entities at the Federal, regional, State, and local levels; national, regional, and local, public and private organizations and groups, including Indian tribes; and individuals. Public involvement is required by the CEQ NEPA regulations (40 CFR 1506.6).

(b) Public involvement in EQ evaluation is appropriate for the following reasons:

(1) First, the public is the basic source, and in many cases the only source, of knowledge and opinions that are needed to make the process work. Such knowledge and opinions are

especially critical in determining public recognition and concerns.

(2) Second, as a reviewer of the results of EQ evaluation, the public will have opportunities to ensure that their views have been properly incorporated; understand the implications of their views on plan formulation; and react to evaluation results in a way that will facilitate modification of alternative plans.

(c) The means to achieve public involvement in EQ evaluation are left to the discretion of agencies. The P&G and the CEQ and NEPA regulations (40 CFR 1506.6) suggest several means of public involvement. In some cases, means of public involvement are specifically established in law and should be relied upon to provide input to EQ evaluation. Examples of specifically established means are:

(1) The NEPA scoping process (see the CEQ NEPA regulations, 40 CFR 1501.7).

(2) The participation of cooperating agencies with jurisdiction by law or special expertise (see the CEQ NEPA regulations, 40 CFR 1501.6, 1501.7, 1508.5, 1508.15, and 1508.26).

(3) Procedures, developed pursuant to Federal laws other than NEPA, that require a specific type of review, coordination, or consultation between planning agencies and agencies with custodial responsibilities for certain EQ-related factors. Such procedures include, but are not limited to, the "Section 7 Consultation Process" pursuant to the Endangered Species Act of 1973, as amended (Pub. L 93-205; 16 U.S.C. 1531, *et seq.*); the "Section 106 Procedure" pursuant to the National Historic Preservation Act of 1966, as amended (Pub. L. 89--655; 16 U.S.C. 470, *et seq.*); the "Coordination Act Report" pursuant to the Fish and Wildlife Coordination Act of 1958, as amended (Pub. L. 85-624 16 U.S.C. 661, *et seq.*); and the "Consistency Determination" pursuant to the Coastal Zone Management Act of 1972, as amended (Pub. L. 92-583; 16 U.S.C. 1451, *et seq.*).

3.3.3 Integration of other review, coordination, and consultation requirements.

(a) To the fullest extent possible, EQ evaluation and its documentation should be conducted and prepared concurrently and integrated with the analyses and documentation required by other review; coordination, and consultation requirements related to EQ evaluation, as required by the CEQ NEPA regulations (40 CFR 1500.2(c), 1501.7(a)(6), 1502.2(d), 1502.25, and 1506.2). Such requirements include, but are not limited so, those related to NEPA; the Endangered Species Act of 1973, as amended (Pub. L 93205; 16 U.S.C. 1531, *et seq.*); the National Historic Preservation Act of 1966, as amended (Pub. L. 89-655; 16 U.S.C. 470, *et seq.*); the Fish and Wildlife Coordination Act of 1958, as amended (Pub. L 85-624; 16 U.S.C. 661, *et seq.*); and the Coastal Zone Management Act of 1972, as amended (Pub. L. 92-583; 16 U.S.C. 1451, *et seq.*).

(b) These procedures for EQ evaluation are not intended to duplicate or in any way modify such other requirements. Rather, the EQ evaluation process described in these procedures may be used as the basic analytical framework for concurrently integrating into water resources planning the information developed in response to other requirements. The relationship between the requirements of NEPA for contents of environmental impact statements and these procedures is given in further detail in Appendix B.

3.3.4 Documentation.

(a) EQ evaluation should be documented in such a way that an independent reviewer can fully and clearly understand the decisions that were made and the reasons for making them. Documentation in water resources project reports, however, should be limited to that required for the agency decision making process. Other documentation should be retained on file and its availability referenced in the project report. Documentation should be clear and concise, as required by the CEQ NEPA regulations (40 CFR 1502.2(a) and (c) and 1502.8).

(b) Information collected by field sampling, laboratory experiments, interviews, literature searches, and other means should be documented to include:

(1) Date and place of information collection;

(2) Name of person(s) who collected the information;

(3) Techniques and methods used; including assumptions and rationale for selecting techniques and methods used;

(4) Known or suspected factors that could affect the accuracy of information collection techniques and methods, including gaps in relevant information and scientific uncertainty;

(5) Information collected; and

(6) Interpretations of the information.

(c) Information collected prior to initiation of an EQ evaluation and referenced or incorporated in the EQ evaluation should be documented as described in paragraph (b) of this section, to the extent practical.

(d) The reasons and bases for actions, decisions, and results required in the EQ evaluation activities should be documented in an appropriate form. Narrative statements, ranging from short notes to extensive descriptions, are appropriate for most documentation needs. Other formats that may be used are: maps, including composites and overlays; graduated scales, including time lines; graphs; lists; tables; scale models; sound recordings; photographs; films; conceptual drawings; and other formats that accurately record information. Appendix A presents examples of documentation formats that may be used.

3.3.5 Performance objectives.

Performance objectives are statements of intent that serve as guides to planners in making decisions on how to carry out and document EQ evaluation. In accordance with the intent of the CEQ NEPA regulations, EQ evaluation and its documentation should be:

(a) Generally understandable to members of the public interested in the evaluation (see 40 CFR 1502.8).

(b) Accessible in a form readily available to members of the public interested in the evaluation (see 40 CFR 1506.6(f)).

(c) Traceable so that members of the public interested in knowing the bases and events that led to decisions can follow these factors through the process (see 40 CFR 1500.2(b), 1502.18, and 1502.24).

(d) Focused on analysis of significant issues (see 40 CFR 1500.1 (b), 1501.7(a) (2) and (3), and 150,2.2(b)).

(e) Analytic rather than encyclopedic, with information that will be useful to making decisions in advancing the planning process (see 40 CFR 1500.1 (b) and (c), 1500.2 (a) and (b), and 1500.4(f)).

(f) At a level of detail comparable to economic and technical analyses (see 40 CFR 1501.2(b)) and necessary for reasonable accuracy of measurements, estimates, and other descriptions needed in understanding and making decisions about alternative plans (see 40 CFR 1502.15).

(g) Based on scientifically valid and, to the extent practical, acceptable precepts (see 40 CFR 1502.24).

(h) The means to identity and describe the effects of alternative plans, rather than to justify decisions already made (see 40 CFR 1502.2(9)).

(i) Complete and timely, so that information about effects that is essential to a reasoned choice among alternative plans is available when needed for decisionmaking, in accordance with 40 CFR 1502.22.

Section IV—EQ Evaluation Process

3.4.1 Orientation.

(a) *EQ evaluation in the planning process.* (1) This section describes the EQ evaluation phases and activities that should be used to identify the significant beneficial and adverse effects of alternative plans on significant EQ resources.

(b) *EQ evaluation phases and activities*. (1) Evaluation in the planning process (Step 4) consists of the assessment and appraisal of effects. As described in these procedures, it also includes the necessary definition and inventorying that are preparatory to assessment and appraisal. These four general actions—define, inventory, assess, appraise—are called phases in these procedures. Each phase is divided into specific actions defined in terms of operational instructions. These specific actions are called *activities* in these procedures. The phases and their activities that make up the EQ evaluation process described in these procedures are graphically illustrated in Figure 3.4.1-1.

Figure 3.4.1-1—EQ Evaluation Process: Phases and Activities

Phases	Activities
Define resources	Identify resources
	Develop evaluation
Inventory resources	Survey existing conditions
	Forecast without-plans condition
	Forecast with-plan condition
Assess effects	Identify effects
	Describe effects
	Determine significant effects
Appraise effects	Appraise significant effects
	Judge net EQ effects

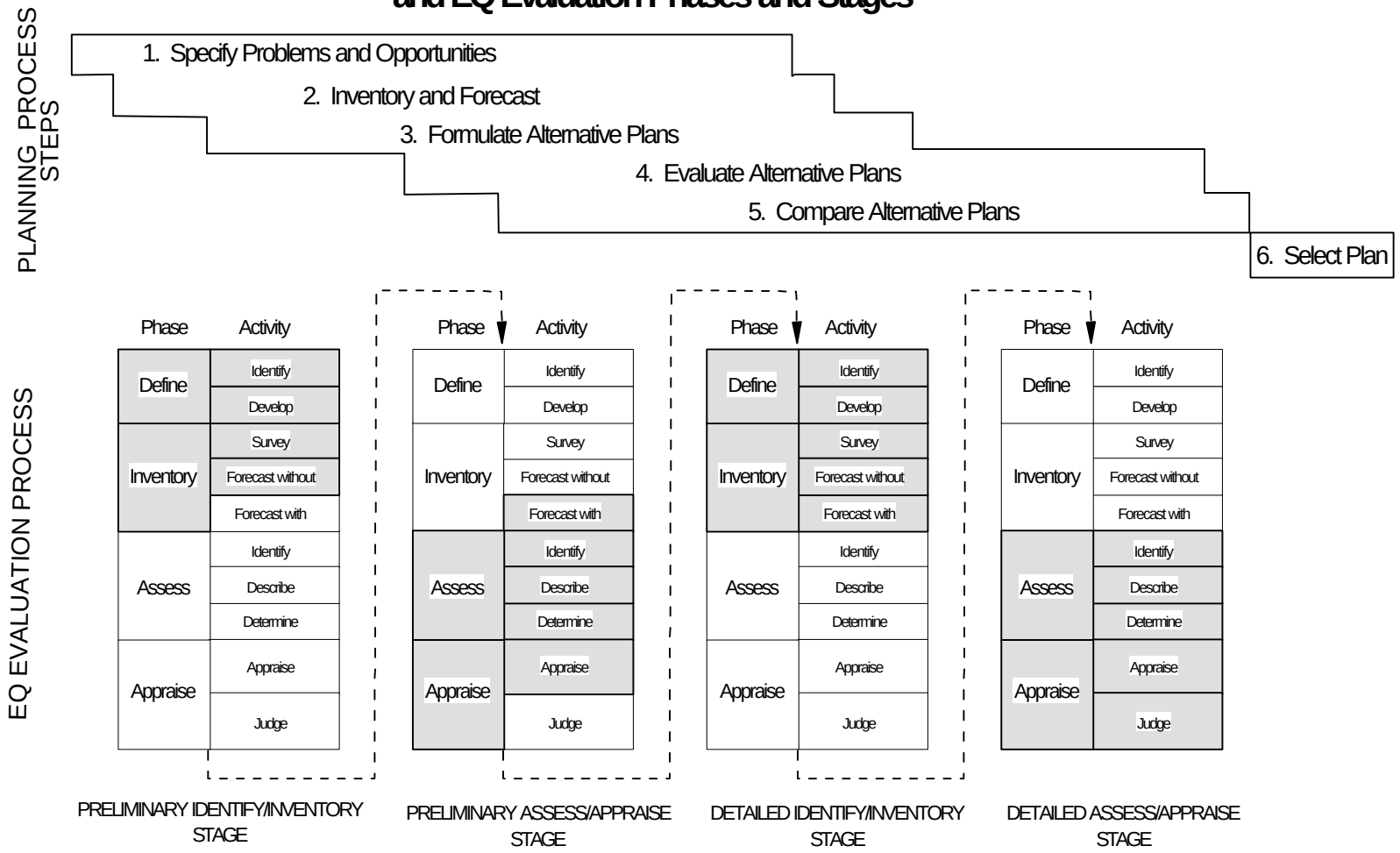
(2) Although these phases are presented in a linear sequence, many interrelationships exist among the phases and their activities. Planners may have to repeat phases and activities in stages to complete a given EQ evaluation.

(c) *EQ evaluation stages.* (1) The interrelationships among EQ evaluation phases and activities, as well as the interrelationships between

EQ evaluation and the planning process, usually necessitate performing and repeating phases and activities in increasing levels of detail, each level commensurate with the evaluation needs of the overall planning effort. Such repetitions are called stages in these procedures. Conducting EQ evaluation in stages of increasing levels of specificity and detail is a study-specific adaptation of the tiering concept described in the CEQ NEPA regulations (40 CFR 1502.20 and 1508.28). The level of detail and number of stages will vary with each planning study, but the following stages, shown graphically in Figure 3.4.1-2, should be considered for every study.

Figure 3.4.1-2

Relationship between Planning Process and EQ Evaluation Phases and Stages



(I) *Preliminary definition-and-inventory stage*. In accordance with the requirements of the CEQ NEPA regulations (40 CFR 1501.2, 1501.7, and 1 507.2(e)), a preliminary definition-and-inventory stage should be undertaken in ~~easy~~ planning. The objective of this stage is to identify EQ resources, develop an evaluation framework, and collect readily available information. This stage emphasizes the activities of the Define Resources Phase to provide an early focus for evaluation and to reveal information needs. Where information gaps are found, allocation and initiation of data collection and forecasting programs should be undertaken in accordance with the CEQ NEPA regulations (40 CFR 1501.6 and 1501.7(a) (4)-(6)).

(ii) *Preliminary assessment-and-appraisal stage*. A preliminary assessment-and-appraisal stage should be undertaken following the preliminary formulation of alternative plans. The objective of this stage is to identify resources likely to be directly, indirectly, or cumulatively affected by one or more plans. This stage emphasizes the activities of the Assess Effects Phase, further focusing information needs on those resources that would be affected by alternative plans. The assessment and appraisal of effects at this stage will help planners understand the enhancement and degradation potentials of alternative plans, thereby providing bases for further reformulations in Steps 3 through 5 of the planning process. Since a substantial amount of time in most planning studies is spent in exploring a wide range of alternative plans, this EQ evaluation stage will probably be repeated several times in a given study. While a complete, detailed inventory is usually not essential at this stage, effects should be identified in adequate detail so they can be compared with economic and technical analyses as required by the CEQ NEPA regulations (40 CFR 1501.2(b)).

(iii) *Detailed definition-and-inventory stage*. In accordance with the requirements of the CEQ NEPA regulations (40 CFR 1502.14(b) and 1507.2(e)), a detailed definition-and-inventory stage should be undertaken during the formulation of specific alternative plans. The objective of this stage is to develop an adequate information base for a detailed assessment and appraisal of effects. This stage emphasizes the activities of the Inventory Resources Phase, including completion of information collection and forecasting programs. This stage may often be conducted concurrently with, or during later repetitions of, the preliminary assessment-and-appraisal stage.

(iv) Detailed assessment-and-appraisal stage. In accordance with the requirements of the CEQ NEPA regulations (40 CFR 1502.14(b)), a detailed assessment-and-appraisal stage should be undertaken following final formulation of specific alternative plans. The objective of this stage is to identify, describe, and appraise individual effects, and appraise the net EQ effect of each alternative plan. This stage emphasizes the activities of the Assess Effects and Appraise Effects Phases to provide the agency decisionmaker with reasonable bases for judging net EQ effects. The results of this appraisal will form the EQ basis for plan selection in planning process Step 6 (selection).

(2) Repeating phases and activities in stages of increasing levels of detail will aid in focusing on resources and effects that will play a role in decisionmaking, rather than on resources unrelated to or not affected by alternative plans.

(d) *Managing evaluation demands*. During the course of EQ evaluation, the number of variables (such as the number of resources, indicators, forecast dates, etc.) identified at a given point in the process will vary. Most activities in these procedures are designed to limit the number of variables being considered. It is important that the number of variables be adequate to fully account for all significant effects. However, increases in the number of variables will increase demands on study time, funds, and expertise. Therefore, a proper balance between adequate analysis and study resources should be achieved.

3.4.2 Define resources phase.

This phase is performed to identify the EQ resources and attributes that will be evaluated, and to specify how they will be measured or otherwise described in EQ evaluation. In the first activity, EQ resources and attributes to be evaluated are identified on the basis of their significance and their likelihood of being affected by an alternative plan. In the second activity, an evaluation framework is developed for measuring or otherwise describing the conditions of identified EQ resources and attributes in terms of indicators, units, guidelines, and techniques.

3.4.3 Identify resources activity.

(a) This activity is performed to identify EQ resources and attributes that will be analyzed in later EQ evaluation activities. This is accomplished by reviewing the planning process Step 2 information base to identify EQ resources and attributes that are—

(1) *Significant*, based on institutional, public, or technical recognition; and

(2) *Likely to be affected* by one or more of the alternative plans.

(b) Many EQ resources will have more than one EQ attribute; these attributes may be interrelated. For example, a wetland may have both ecological and aesthetic attributes, and the ecological attribute may complement the aesthetic attribute. Only when the full range of a given resource's significant attributes is identified and evaluated can the requirements of the NEPA human environment and planning process Step 4 (evaluation) be met.

(c) *Significant* EQ resources and attributes that are institutionally, publicly, or technically recognized as important to people should be taken into account in decisionmaking. Focusing on significant issues is required by the CEQ NEPA regulations (40 CFR 1500.1(b), 1501.7(a) (2) and (3), and 1502.2(b)).

(1) Significance based on *institutional recognition* means that the importance of an EQ resource or attribute is acknowledged in the laws, adopted plans, and other policy statements of public agencies or private groups. Sources of institutional recognition include:

(i) Public laws, executive orders, rules and regulations, treaties, and other policy statements of the Federal government. Table 3.4.3 lists the Federal policies that should be considered in all studies as basis for identifying institutionally recognized resources or attributes. Other Federal policies are to be considered as applicable.

(ii) Plans and constitutions, laws, directives, resolutions, gubernatorial directives, and other policy statements of States with jurisdiction in the planning area. Examples are State water and air quality regulations; State historic preservation plans; State lists of rare, threatened, or endangered species; and State comprehensive fish and wildlife management plans.

(iii) Laws, plans, codes, ordinances, and other policy statements of regional and local public entities with jurisdiction in the planning area. Regional entities include river basin commissions, councils of government, and regional planning boards. Local entities include counties, districts, parishes, cities, towns, and villages. Examples of these entities' sources of institutional recognition are regional open space plans, county lists of historic sites, and town zoning ordinances.

(iv) Charters, bylaws, and formal policy statements of private groups. Examples are the National Audubon Society Blue List of Species, properties of the National Trust for Historic Preservation, and properties of the Nature Conservancy.

Table 3.4.3—Sources of institutional recognition: Federal policies.

(a) *Public laws.*

(1) American Folklife Preservation Act. Pub. L 94-201; 20 U.S.C. 2101, *et seq.*

(2) Anadromous Fish Conservation Act, Pub. L. 89-304; 16 U.S.C. 757, *et seq.*

(3) Antiquities Act of 1906, Pub. L 59-209; 16 U.S.C. 431, *et seq.*

(4) Archeological and Historic Preservation Act, Pub. L. 93-291; 16 U.S.C. 469, *et seq.* (Also known as the Reservoir Salvage Act of 1960, as amended; Public Law 93-291, as amended; the Moss-Bennett Act; and the Preservation of Historic and Archeological Data Act of 1974.)

(5) Bald Eagle Act; 16 U.S.C. 668.

(6) Clean Air Act, as amended, Pub. L. 91-604; 42 U.S.C. 1857h-7, *et seq.*

(7) Clean Water Act, Pub. L. 92-500; 33 U.S.C. 1251, *et seq.* (Also known as the Federal Water Pollution Control Act; and Public Law 92-500, as amended.)

(8) Coastal Zone Management Act of 1972, as amended, Pub. L. 92-583; 16 U.S.C. 1451, *et seq.*

(9) Endangered Species Act of 1973, as amended, Pub. L. 93-205; 16 U.S.C. 1531, *et seq.*

(10) Estuary Protection Act, Pub. L. 90-454; 16 U.S.C. 1221, *et seq.*

(11) Federal Environmental Pesticide Control Act, Pub. L. 92-516; 7 U.S.C. 136.

(12) Federal Water Project Recreation Act, as amended, Pub. L. 89-72; 16 U.S.C. 460-1(12), *et seq.*

(13) Fish and Wildlife Coordination Act of 1958, as amended, Pub. L. 85-624; 16 U.S.C. 661, *et seq.* (Also known as the Coordination Act.)

(14) Historic Sites of 1935, as amended, Pub. L. 74-292; 16 U.S.C. 461, *et seq.*

(15) Land and Water Conservation Fund Act, Pub. L. 88-578; 16 U.S.C. 460/-460/-11, *et seq.*

(16) Marine Mammal Protection Act of 1972, Pub. L. 92-522; 16 U.S.C. 1361, *et seq.*

(17) Marine Protection, Research and Sanctuaries Act of 1972, Pub. L. 92-532; 33 U.S.C. 1401, *et seq.*

(18) Migratory Bird Conservation Act of 1928; 16 U.S.C. 715.

(19) Migratory Bird Treaty Act of 1918; 16 U.S.C. 703, *et seq.*

(20) National Environmental Policy Act of 1969, as amended, Pub. L. 91-190; 42 U.S.C. 4321, *et seq.* (Also known as NEPA; often incorrectly cited as the National Environmental Protection Act.)

(21) National Historic Preservation Act of 1966, as amended, Pub. L. 89-655; 16 U.S.C. 470a, *et seq.*

(22) Native American Religious Freedom Act, Pub. L. 95-341; 42 U.S.C. 1996, *et seq.*

(23) Resource Conservation and Recovery Act of 1976, Pub. L. 94-580; 7 U.S.C. 1010, *et seq.*

(24) River and Harbor Act of 1899, 33 U.S.C. 403, *et seq.* (Also known as the Refuse Act of 1899.)

(25) Submerged Lands Act of 1953, Pub. L. 82-3167; 43 U.S.C. 1301, *et seq.*

(26) Surface Mining Control and Reclamation Act of 1977, Pub. L. 95-89; 30 U.S.C. 1201, *et seq.*

(27) Toxic Substances Control Act, Pub. L. 94-469; 15 U.S.C. 2601, *et seq.*

(28) Watershed Protection and Flood Prevention Act, as amended, Pub. L. 83-566; 16 U.S.C. 1001, *et seq.*

(29) Wild and Scenic Rivers Act, as amended, Pub. L. 90-542; 16 U.S.C. 1271, *et seq.*

(b) *Executive orders*.

(1) Executive Order, 11593, Protection and Enhancement of the Cultural Environment, May 13, 1979 (36 FR 8921; May 15, 1971).

(2) Executive Order, 11988, Floodplain Management. May 24, 1977 (42 FR 26951; May 25, 1977).

(3) Executive Order, 11990, Protection of Wetlands. May 24, 1977 (42 FR 26961; May 25, 1977).

(4) Executive Order, 11514, Protection and Enhancement of Environmental Quality, March 5, 1970, as amended by Executive Order, 11991, May 24, 1977.

(5) Executive Order, 12088, Federal Compliance with Pollution Control Standards, October 13, 1978.

(c) *Other Federal policies*.

(1) Council on Environmental Quality Memorandum of August 1, 1980: Analysis of Impacts on Prime or Unique Agricultural Lands in implementing the National Environmental Policy Act.

(2) Council on Environmental Quality Memorandum of August 10, 1980: Interagency Consultation to Avoid or Mitigate Adverse Effects on Rivers in the Nationwide Inventory.

(3) Migratory Bird Treaties and other international agreements listed in the Endangered Species Act of 1973, as amended, Section 2(a)(4).

(2) Significance based on *public recognition* means that some segment of the general public recognizes the importance of an EQ resource or attribute. Public recognition may take the form of controversy, support, conflict, or opposition and may be expressed formally (as in official letters) or informally. Environmentally related customs and traditions should also be considered. EQ resources or attributes recognized by the public will often change over time as public awareness and perceptions change.

(3) Significance based on *technical recognition* means that the importance of an EQ resource or attribute is based on scientific or technical knowledge or judgment of critical resource characteristics. Examples are a graveyard recognized by an archeologist as being the focal point of a 19th century community; a rock outcropping identified by a landscape architect as being an important scenic element based on aesthetic rating criteria; and a meadow identified by a wildlife biologist as the major breeding ground for a deer herd.

(4) The significance of many EQ resources and attributes may be recognized on more than one basis. For example, a specific bird species may be institutionally recognized (protected by Federal and State law), publicly recognized (of interest to a community), and technically recognized (due to its uniqueness in the environment).

(d) At this early point in the process, a determination of whether or not an EQ resource or attribute would be *likely to be affected* is to be based on some preliminary judgments about causes (in terms of alternative plans) and effects (in terms of EQ resources and attributes). Such preliminary judgments are to be based on the following considerations:

(1) Likely to be affected means that an effect on an EQ resource or attribute is reasonably possible.

(2) The cause of an effect may be one or more alternative plans or individual measures.

(3) The relationship of the cause to the effect may be direct, indirect, or cumulative.

(e) Information included in the planning process Step 2 (inventory and forecast) should be adequate for the purposes of this activity. A fully definitive body of evidence is not required to conclude that an EQ resource or attribute is significant and likely to be affected. For example, it would not be necessary to develop all of the information needed to reach a determination of eligibility for inclusion on the National Register of Historic Places to conclude that a specific archeological site has a cultural attribute.

(f) Future conditions may change the types of EQ resources or attributes or create new ones that may be significant and likely to be affected; these should be considered in this activity. For example, a currently eutrophic lake that is forecast to develop into a wetland ecosystem in the without-plans condition should be considered in this activity. Forecasts developed in later evaluation activities (see 3.4.7 and 3.4.8) will provide the bases for identifying such EQ resources and attributes.

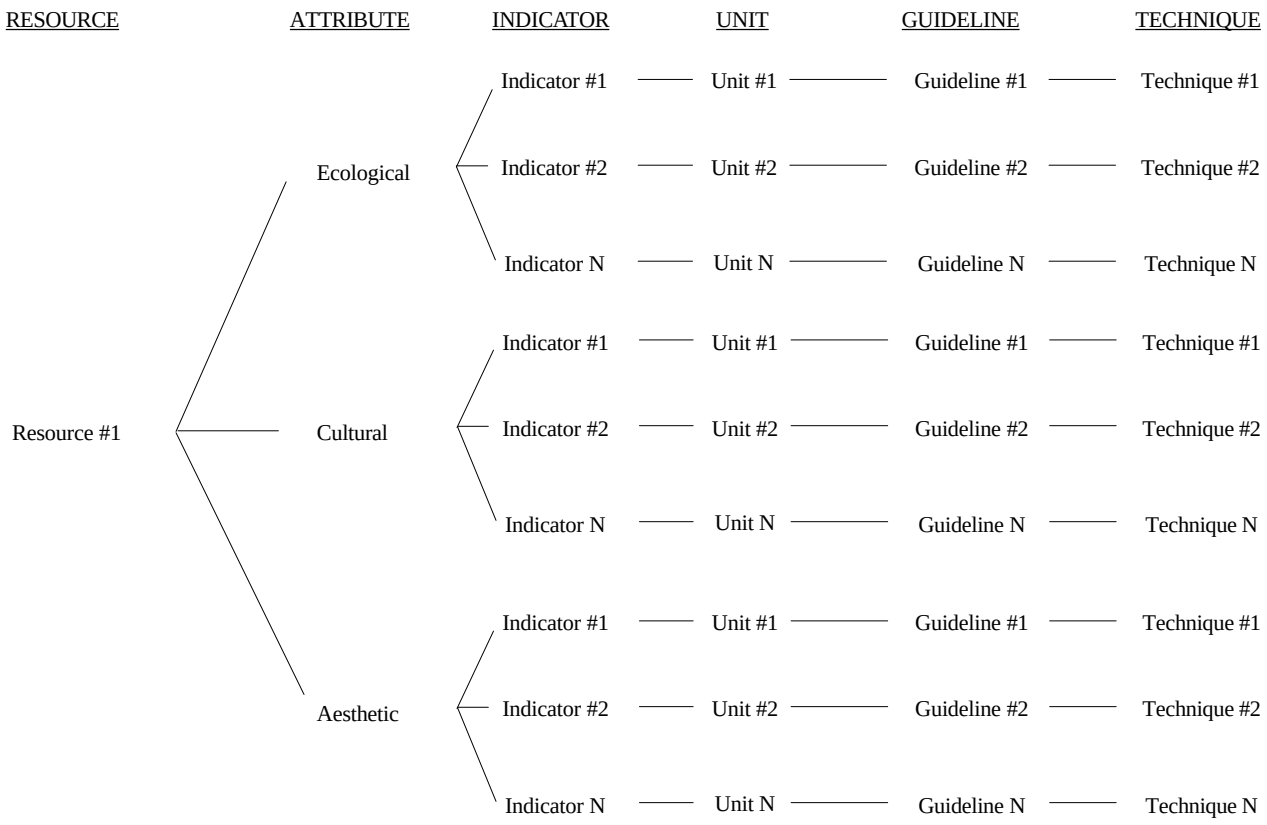
(g) Agencies should invite the public to participate in the identification of EQ resources and attributes that are significant and likely to be affected. Agencies are encouraged to integrate the public's participation in this activity into the means used to meet the scoping requirements of the P&G and the CEQ NEPA regulations (40 CFR 1501.7) to avoid duplication of public involvement efforts.

(h) Appendix A provides an example documentation format for recording the results of this activity.

3.4.4 Develop evaluation framework activity.

(a) This activity is performed to specify the ways in which changes in EQ resources and attributes, as identified in the previous activity, will be measured or otherwise described. For each EQ attribute, planners should specify one or more *indicators* of quantity and/or quality. Indicators are used to measure or otherwise describe existing and future conditions and the effects of alternative plans. For each indicator, planners should specify a *unit* (numeric or non-numeric term in which the indicator is measured or otherwise described); a *guideline* (institutional, public, or technical basis for determining whether an effect on an indicator is beneficial or adverse); and a *technique* (procedure for measuring or otherwise describing the indicator in terms of its unit). Figure 3.4.4 graphically illustrates the evaluation framework.

Figure 3.4.4
Evaluation Framework



See Appendix A, Table 2 for an example

(b) For each EQ resource attribute, planners should specify one or more *indicators*. The number of indicators specified should be sufficient to adequately measure or otherwise describe changes in the quantity or quality of an EQ attribute. Since indicators are the primary factors that will determine the amount and level of detail of information collection, care must be exercised to ensure that the number of indicators is not so large that information requirements are unreasonably demanding. See 3.2.1 for examples of indicators.

(c) For each indicator, planners should specify a unit of measurement or description. Units will usually be readily identifiable from the nature of an indicator. For example, the indicator "area" could be described in terms of the unit "acres" or "square miles." See 3.2.1 for other examples of units.

(d) For each indicator, planners should specify a *guideline*.

(1) Guidelines should be based on institutional, public, or technical recognition. Examples of institutional guidelines are State air and water quality standards and the access criterion for Federally designated wild rivers. Examples of guidelines based on public recognition are preservation of a locally valued natural viewscape and the protection of a regionally popular reach of white water river. Examples of guidelines based on technical recognition are a minimum dissolved oxygen concentration of five parts per million for brown trout and the preservation of an archeological site's association with an important event.

(2) The decision to use a guideline based on technical or public recognition instead of an existing institutional guideline, or to use one institutional guideline instead of another, should be justified. Examples of this situation are the choice of a more restrictive suspended solids standard based on a recent limnological study (technical recognition) over a less restrictive State suspended solids standard (institutional recognition); and the choice of a more restrictive, locally established noise level standard over a State or federally established standard.

(3) Planners should recognize recent and anticipated future changes in guidelines based on changing institutional, public, and technical concerns. The phased implementation of State water quality standards developed pursuant to Pub. L. 92-500 is an example of a change that could be anticipated.

(4) Planners should also recognize that guidelines may differ for a given indicator among localities and regions. For example, air quality standards vary among the States and often vary for areas within a given State.

(5) Guidelines that are stated in a word or phrase may, in some cases, be translated into a number.

(i) For example, the guideline "protection of a popular reach of white water river" could be restated in terms of the physical dimension of the reach, such as "two miles," that provides a specific working definition of "protection".

(ii) Examples of words that may provide a basis for a guideline are enhancement, improvement, preservation, protection, conservation, maintenance, creation, restoration, repair, and rehabilitation.

(6) Guidelines may be expressed as a single level (example: habitat suitability index of 1.0); as a range between two levels (example: pH between 6.5 and 8.0 for fish); or as a threshold level (example: total dissolved solids not greater than 500 parts per million).

(7) In cases where several seemingly conflicting guidelines have been proposed, planners should attempt to specify a single guideline by determining the specific reasons why each proposed guideline is desirable.

(i) For example, the Blue River has an indicator "water flow," which is described in "cubic feet per second (cfs)" units; a local agricultural cooperative that uses the river for irrigation water proposes a guideline of "X cfs;" a homeowners association that enjoys the view of the river proposes a guideline of "Y cfs;" and a fisheries biologist proposes a "Z cfs" based on the needs of the river's anadromous fish populations.

(ii) In this example the "Y cfs" guideline would be appropriate for the rivers visual aesthetic attribute but would not be used for its ecological or cultural attributes. Similarly, the "Z cfs" guideline would be appropriate for the river's fishery ecological attribute. The "X cfs" guideline would not be appropriate for EQ evaluation since it is not related to an EQ attribute.

(e) For each indicator, planners should specify a technique for measuring or otherwise describing current and future conditions of the indicator in terms of the indicator's specified unit. Table 3.4.4 lists examples of techniques currently used in water resources planning. Regardless of the technique used to measure or otherwise describe an indicator agencies should ensure the professional and scientific integrity of techniques and their resultant analyses, as required by the CEQ NEPA regulations (40 CFR 1502.24).

(f) Although the parts of the evaluation framework are presented in a specific order, planners may, after first selecting indicators, select units, guidelines, and techniques in any sequence.

Table 3.4.4—Example Techniques

Technique	Document reference	Availability	Indicator measured	Current uses	Comments
Habitat Evaluation Procedures (HEP).	U.S. Dept. of the Interior, Fish and Wildlife Service. *Habitat Evaluation Procedures.* Washington, DC 20240, March 1980. ESM 102.	Chief, Div. of Ecological Services, Fish and Wildlife Service, U.S. Dept. of the Interior, Washington, DC 20240, (202)343-4764	Habitat quality and quantity.	Nationwide, Major Corps, BR, and SCS water projects.	
		Team Leader, WELUT, Project Impact Evaluation Team, Div. of Ecological Services, Fish and Wildlife Service, U.S. Dept. of the Interior, Creekside One, 2625 Redwing Road, Fort Collins, CO 80526, (303)223-2040		Also applicable to BLM and USFS projects and projects licensed by FERC and NRC.	
Habitat Evaluation System (HES).	U.S. Army Engineer Div., Lower Miss. Valley. *A Tentative Habitat Evaluation System (HES) for Water Resources Planning.* Vicksburg, MS, July 1979.	Chief, Environ. Res. Branch, U.S. Army Engineer Division, Lower Mississippi Valley, P.O. Box 80, Vicksburg, MS 39180, (601)634-5000, ex.5849.	Habitat quality.	Lower Mississippi Valley area.	Information/analysis base fully developed only for the lower Mississippi Valley area.
Instream Flow Incremental Methodology (IFIM).	BoVee, K.D. and T. Cochnaur, 1977. *Development and Evaluation of Weighted Criteria, Probability-of-Use Curves for Instream Flow Assessments: Fisheries.* Instream Flow Information Paper No.3, FWS/OBS-77/63, 38 pages.	Team Leader, WELUT, Instream Flow and Aquatic Systems Group, Div. of Ecological Services, Fish and Wildlife Service, U.S. Dept. of the Interior, Creekside One, 2625 Redwing Road, Fort Collins, CO 80526, (303)223-2040	Minimum, sustained, augmented, and maximum flows.	Nationwide. Major Corps, BR and SCS Projects. Also applicable to BLM and USFS projects and projects licensed by FERC and NRC.	
	BoVee, K.D. and R.T. Milhous, 1978. *Hydraulic Simulation in Instream Flow Studies: Theory and Techniques.* Instream Flow Information Paper No.5, FWS/OBS-78/33, 131 pages.				
	Stainaker, C.D., 1979. *The Use of Habitat Structure Preferenda for Maintenance of Fish Habitat.* The Ecology of Regulated Streams, Edited by J.U. Ward and J.S. Starrford, Plenum Publishing Corp., pp.31-337.				
Visual Resource Contrast Rating.	U.S. Dept. of the Interior, Bureau of Land Management. *BLM Manual Section 8431-Visual Resource Contrast Rating.* Washington, DC. August 1978.	Bureau of Land Management, U.S. Dept. of the Interior, Washington, DC 20240, (202)343-9353	Visual contrast.		
Upland Visual Resource Inventory and Evaluation.	U.S. Dept. of the Interior, Bureau of Land Management. *BLM Manual Section 8411-Upland Visual Resource Inventory and Evaluation.* Washington, DC, August 1978.	Bureau of Land Management, U.S. Dept. of the Interior, Washington, DC 20240, (202)343-9353.	Scenic quality.		

Table 3.4.4—Example Techniques—Continued

Technique	Document reference	Availability	Indicator measured	Current uses	Comments
Procedure To Establish Priorities in Landscape Architecture.	U.S. Dept. of Agriculture, Soil Conservation Service. *Technical Release No. 65, Procedure to Establish Priorities in Landscape Architecture.* Washington, DC, October 1978.	Soil Conservation Service, U.S. Dept. of Agriculture, Washington, DC 20250, (202)447-7443.	Landscape resource quality.	Primarily used for SCS studies.	Developed for nationwide use.
Visual Management System.	U.S. Dept. of Agriculture, Forest Service. *National Forest Landscape Management, Vol.2, Chapter 1,* The *Visual Management System*. Washington, DC, April 1974.	Forest Service, U.S. Dept. of Agriculture, Washington, DC 20250, (202)447-7754.	Scenic variety classes and sensitivity levels.	Primarily used for Forest Service studies.	Developed primarily for the northwestern U.S.; criteria should be adapted for other regions.

(1) Planners should recognize that indicators, units, guidelines, and techniques are highly interdependent and that the specification of one influences the specification of the others. For example, if "dissolved oxygen" and "coliforms" are selected as indicators of the ecological attribute of a river resource and a State's water quality standards for dissolved oxygen and coliforms are selected as guidelines, then the units, such as milligrams per liter (mg/l) for dissolved oxygen and most probable number (MPN) of coliforms, would follow.

(2) If either a unit, a guideline, or a technique cannot be specified for an indicator, then the indicator should not be used.

(g) Appendix A provides an example documentation format for recording the results of this activity.

3.4.5 Inventory resources phase.

This phase is performed to collect and develop information, within the previously defined evaluation framework, for use in assessing the effects of alternative plans. In the first activity, the trend and existing conditions of identified EQ resource attributes are measured or otherwise described. In the second and third activities, future without-plans and with-plan conditions of identified EQ resource attributes are estimated.

3.4.6 Survey existing conditions activity.

(a) This activity is performed to collect information that measures or otherwise describes the trend and existing conditions of the identified EQ resource attributes. The trend condition is the recorded historic measurement or other description of an attribute. The existing condition is the most recent measurement or other description of an attribute as it existed at the latest date of the trend condition. Trend and existing conditions of attributes should be described in terms of the quantity and quality indicators and their related units, as specified in the previous activity.

(b) This EQ evaluation activity is an integral part of the planning process Step 2 (inventory and forecast). It should begin with a review of that information base to determine whether or not information for the identified EQ resource attributes is included. Relevant trend condition information should be collected where it is readily available. If existing condition information for an attribute (in terms of its specified indicators) is not included in Step 2 or, if such information is invalid or out of date, an information collection program should be developed and implemented to provide the necessary information.

(c) Information collection programs should produce information in accordance with the evaluation framework developed in the previous activity, including the use of specified techniques to develop information for each indicator in terms of its specified unit. Information collection programs should use professionals with expertise relevant to each EQ resource attribute for developing and analyzing information, in accordance with the CEQ NEPA regulation requirements related to cooperating agencies (40 CFR 1501.6) and scoping (40 CFR 1 501.7(a)(4) and (6)). Information collection programs should be initiated early enough to ensure that required information is available when needed for EQ evaluation. The EQ information base should be reviewed during each stage of EQ evaluation to progressively focus it at the proper level of detail and completeness necessary for evaluation.

(d) Appendix A provides an example documentation format for recording the results of this activity.

3.4.7 Forecast without-plans conditions activity.

(a) This activity is performed to develop information that measures or otherwise describes the future conditions of EQ resource attributes in the absence of any of the alternative plans under consideration. Without-plans conditions should be estimated in terms of the same quantity and quality indicators used in the previous activity.

(b) This activity is also an integral part of the planning process Step 2 (inventory and forecast), and should begin with a review of that information base to determine whether or not information for the identified EQ resource attributes is included. If without-plans condition information for an EQ resource (in terms of its specified indicators) is not included in Step 2 or, if such information is invalid or out of date, a forecasting program should be developed and implemented to provide necessary information. The subsection on information collection programs (3.4.6(c)) is also applicable to forecasting programs for without-plans conditions.

(c) Without-plans conditions are the most probable conditions based on consideration of the following:

(1) Trend and existing conditions information, as developed in the previous activity;

(2) Other available related forecasts (for example, local land use plans, population projections, plans of commercial and industrial developers);

(3) Established institutional objectives and constraints and customs and traditions related to the resource (for example, State historic presentation plans, management goals for wildlife refuges, zoning ordinances, local agricultural practices);

(4) Direct, indirect, and cumulative effects of all reasonably foreseeable actions of people expected to occur in the absence of any of the study's alternate plans (for example, effects of a habitat management program, a water supply project, or an on farm drainage action);

(5) Direct, indirect, and cumulative effects of natural occurrences, such as natural succession or the passage of time (for example, an existing abandoned farmland might be shown to succeed to a grassland, a shrub land, and finally to a woodland over the period of analysis; a public building may be forecast to be of historic interest in the futures); and

(6) Known effects of comparable past actions on the same or similar resources. (A considerable body of information has been developed on the known effects of existing water resources projects, industrial developments, highways, etc.; many of these include programs to monitor and record ongoing effects).

(d) General forecasting approaches that may be considered are—

(1) Adoption of available forecasts developed by other sources;

(2) Use of scenarios to estimate hypothetical futures and the likely sequences of events that might lead to those futures;

(3) Use of expert group judgment approaches, such as Delphi and nominal group, in which the views of relevant professionals about future conditions are systematically elicited and analyzed; and,

(4) Use of extrapolation approaches, such as trend analysis and simple modeling, which rely on historic trend information to estimate the future.

(5) Use of analogy and comparative analyses, in which the effects of actions similar to those expected in the without-plans condition, on the specified indicators, in similar environmental settings are used to estimate future conditions.

(e) Forecasting approaches should be compatible with the measurement and description techniques specified in the evaluation framework.

(1) For example, if the *Habitat Evaluation Procedure* (HEP; U.S. Fish and Wildlife Service, 1980) is used in the previous activity to describe the existing condition of a particular habitat, the forecasting approach(es) used to estimate the without-plans condition of the habitat must produce information that can be used in the HEP analysis.

(2) In most cases it is not possible to directly forecast change in an indicator. It will usually be necessary to forecast changes in factors that influence the indicator. Influencing factors may include changes in the uses and conditions of related land, water, and air. For example, given the indicator "stream water temperature," it may be necessary to forecast changes in streamside vegetation, upstream water uses, and other influencing factors in order to derive the information needed to apply the technique specified in the evaluation framework for measuring changes in the indicator (stream water temperature).

(f) Forecasts should estimate future conditions over the entire period of analysis; but if this is not realistic or reasonable, planners should develop a forecast of the longest possible duration and give their reasons for not estimating to the end of the period. Conversely, the period of analysis should not constrain longer-term forecasts if they can be

realistically and reasonably made and if they are needed to describe irreversible or irretrievable commitments of resources or the relationship of short term uses of man's environment to long-term productivity, as required by NEPA and the CEQ NEPA regulations (40 CFR 1502.16).

(g) A without-plans condition should be expressed for several specified future dates, hereinafter called forecast dates. A sufficient number of forecast dates should be selected to permit adequate description of future changes in the indicator. However, the number of forecast dates should not be so large that an unreasonable information burden is created. A proper balance between adequate description and information demands should be achieved. Without-plans conditions should not be expressed as an average or median over the period of analysis if such expressions would obscure future changes in an indicator.

(h) A without-plans condition should be the most probable future condition for an indicator.

(i) Appendix A provides an example documentation format for recording the results of this activity.

3.4.8 Forecast with-plan conditions activity.

(a) This activity is performed to develop information that measures or otherwise describes the future conditions of EQ resource attributes under each of the alternative plans being considered. With-plan conditions should be estimated for each alternative plan in terms of the same quantity and quality indicators used in the previous activity.

(b) The bases for estimating with-plan conditions include those used in forecasting without-plans conditions: Trend and existing conditions, related forecasts, institutional objectives and constraints effects of other actions, the effects of natural occurrences, and the known effects of comparable past actions (see 3.4.7(c)).

(c) Approaches that should be considered for forecasting with plan conditions include those used in forecasting without-plans conditions: adoption, scenario writing, expert judgment techniques, extrapolation techniques, and analogy and comparative analyses. (See 3.4.7 (d) and (e)).

(d) The subsection on information collection programs (3.4.6(c)) and forecasting without-plans conditions over the entire period of analysis (3.4.7(f)) are also applicable to with-plan conditions. With plan conditions should be estimated for the same forecast dates used for the without-plan conditions (see 3.4.7(g)).

(e) Appendix A provides an example documentation format for recording the results of this activity.

3.4.9 Assess effects phase.

This phase is performed to identify and describe effects of alternative plans on EQ resource attributes. In the first activity, without-plans conditions and with-plan conditions are compared to identify differences between them. In the second activity identified differences (effects are described in terms of duration, location, and magnitude. In the third activity, the significance of these effects is determined.

3.4.10 Identify effects activity.

(a) This activity is performed to identify differences between the without-plans and with-plan estimates for each indicator. An effect is shown to occur whenever without-plans and with-plan estimates of an indicator are different at one or more of the forecast dates.

(b) If all of the specified indicators for a particular EQ attribute of a resource are shown to be unaffected by each of the alternative plans (that is, each indicator's without-plans and with-plan estimates are the same for all forecast dates), the unaffected attribute should be eliminated from EQ evaluation. The attribute should be reintroduced into EQ evaluation if it is likely to be affected by a new alternative plan.

(c) Appendix A provides an example documentation format for recording the results of this activity.

3.4.11 Describe effects activity.

(a) This activity is performed to describe each effect identified in the previous activity. Effects should be described in terms of their *duration, location*, and *magnitude*.

(b) *Duration* is the time at which, or over which, an effect is expected to occur. It should be described for the forecast dates and may be summarized in terms of a time period beginning at a specific time, such as "20 years beginning in 1990." Duration will usually be continued to a span of time within the period of analysis, but some effects, such as the loss of a distinctive land-form, may exceed the period of analysis (see 3.4.7(f) and 3.4.7(d)).

(c) *Location* is the place at which an effect is expected to occur. It should be described in terms of an identifiable geographic location, such as "between river miles 57 and 63." The location of an effect should be described as specifically as possible without revealing the location of sensitive resources such as archaeological sites and endangered species habitats that could be jeopardized by wide distribution of the information.

(d) *Magnitude* is the size of the difference between an indicator's without-plans and with-plan estimates for a particular forecast date. If an indicator is measured in cardinal units (that is, the units can be added, subtracted, multiplied, and divided), magnitude should be expressed as the numeric difference between the without-plans and with-plan estimates for each forecast date. If an indicator's unit is based on some other type of numeric scale or is descriptive (such as an ordinal scale of "great diversity, moderate diversity, low diversity,") magnitude should be expressed in either a numeric or descriptive form suitable for accurately describing the difference for each forecast date.

(e) Other characteristics of effects may be described if the description is relevant and useful to decisionmaking. Such characteristics could include reversibility, retrievability, and the relationship to long-term productivity.

(f) Appendix A provides an example documentation format for recording the results of this activity.

3.4.12 Determine significant effects activity.

(a) This activity is performed to identify which of the previously described effects are significant; that is, that are *institutionally, publicly*, or *technically* recognized as important to people, and should therefore be taken into account in decisionmaking. Focusing on significant issues is required by the CEQ NEPA regulations (40 CFR 1500.1(b), 1501.7(a)(2) and (3), and 1 502.2(b)).

(b) Significance based on *institutional recognition* means that the importance of the effect is acknowledged in the laws, adopted plans, and other policy statements of public agencies and private groups. See 3.4.3(c)(1) for examples of sources of institutional recognition. Institutional recognition of an effect is often explicit in the form of specific criteria for determining whether an effect is significant. Examples are the criteria in the CEQ NEPA regulation (40 CFR 1508.27), Executive Order 11990 concerning the protection of wetlands, and the regulations of the Advisory Council on Historic Preservation covering the protection of historic and cultural properties (36 CFR Part 800).

(c) Significance based on public recognition means that some segment of the general public recognizes the importance of the effect. Public recognition may take the form of controversy, support, conflict, or opposition; it may be expressed formally (as in official letters) or informally. Environmentally related customs and traditions should also be considered in determining sources of public recognition. An example of public recognition of an effect is local concern over the potential decline of a trout fishery caused by an alternative plan.

(d) Significance based on *technical recognition* means that the importance of an effect is based on technical or scientific criteria related to critical resource characteristics. Examples are maintenance of permanent low flow in a previously intermittent stream that leads to a year-round fishery, and reduction in the number of a certain type of archeological site that contains information related to a particular historic period to the extent that currently numerous sites would become scarce.

(e) If none of the effects on a particular EQ attribute is significant, the attribute should be eliminated from EQ evaluation. The attribute should be reintroduced into EQ evaluation if it is likely to be affected by a new alternative plan.

(f) Appendix A provides an example documentation format for recording the results of this activity. Attributes and resources that are not significantly affected should be documented as required by the CEQ NEPA regulations (40 CFR 1501.7(a)(3)).

3.4.13 Appraise effects phase.

This phase is performed to identify the desirability of significant effects on EQ resources, individually and collectively, for each alternative plan. In thefirst activity, significant effects on indicators and EQ attributes should be appraised as either "beneficial" or "adverse." In the second activity, each alternative plan's overall net effect on EQ should bejudged as "net beneficial," "net adverse," or "no net effect."

3.4.14 Appraise significant effects activity.

(a) This activity is performed to appraise each alternative plan's individual significant effects on each significant EQ resource attribute as either beneficial or adverse. The activity should be performed in two steps. In the first step, the desirability of effects on indicators is appraised according to guidelines. In the second step, the effects on EQ attributes are appraised.

(b) First, the effects on indicators should be appraised as either beneficial or adverse according to the following criteria:

(1) An effect is *beneficial* if, for a given indicator, the with-plan condition more closely approaches or attains the indicator's guideline than its without-plans condition. For example, the Julian City archaeological site has been identified as an EQ resource with an indicator "sense of association with a significant event" for its cultural

attribute. The indicators guideline has been specified as "presentation of the site's sense of association." If, for a given forecast date, the site's without-plans condition shows that the association would be lost as a result of planned residential development, but its with-plan condition for Plan X shows that the association would be preserved as a result of Federal land acquisition included in the plan, the effect of Plan X would be classified as beneficial. See Figure 3.4.14-1 for a graphic illustration of this example.

(2) An effect is *adverse* if, for a given indicator, the without-plans condition more closely approaches or attains the indicator's guideline than its with-plan condition. For example, the Gradey Swamp habitat has been identified as an EQ resource with an indicator "habitat suitability" for its ecological attribute. The indicator's guideline has been specified as "habitat suitability index of 1.0." An adverse effect would occur if, for a given forecast date, the habitat's without-plans condition showed a habitat suitability index of 0.7 and its with-plan condition for Plan Y showed a habitat suitability index of 0.5. See Figure 3.4.14-2 for a graphic illustration of this example.

Figure 3.4.14-1
Example of Beneficial Effect

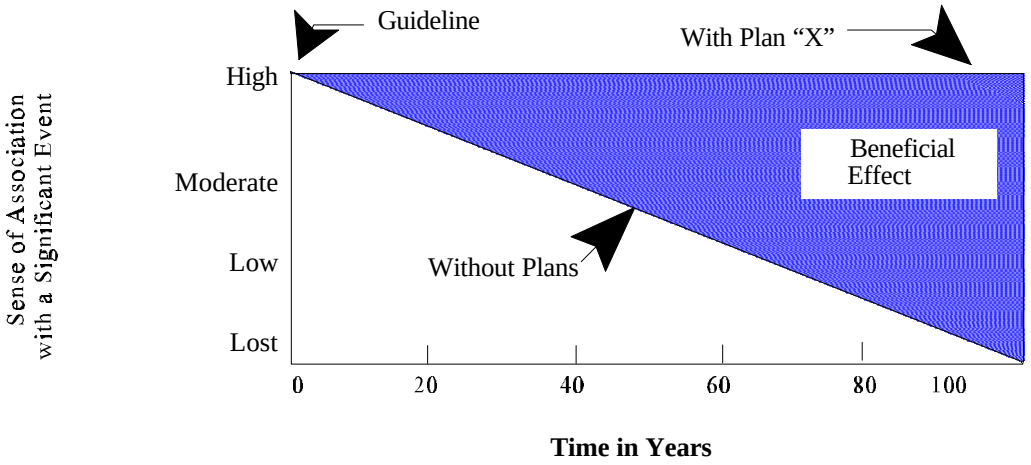


Figure 3.4.14-2
Example of Adverse Effect

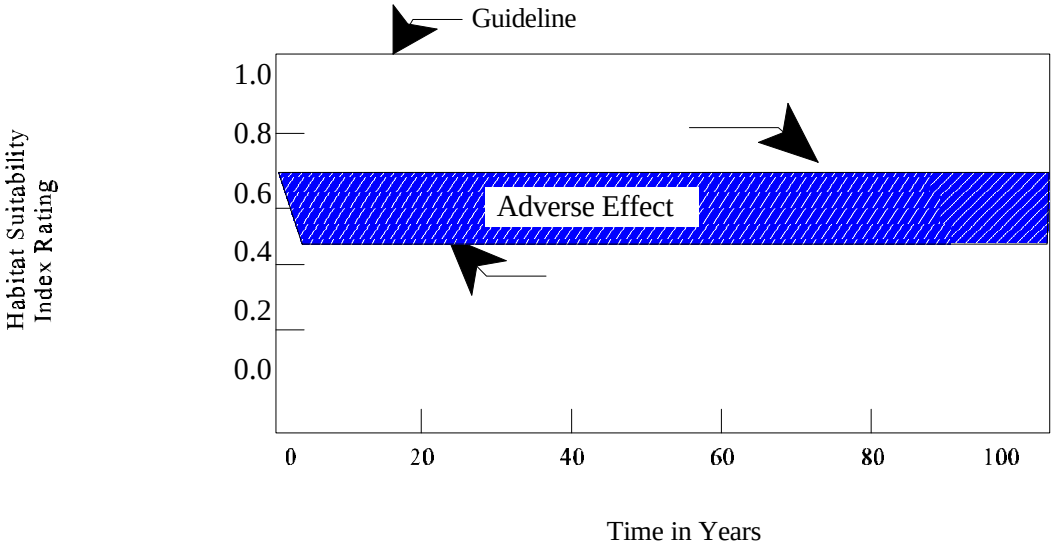
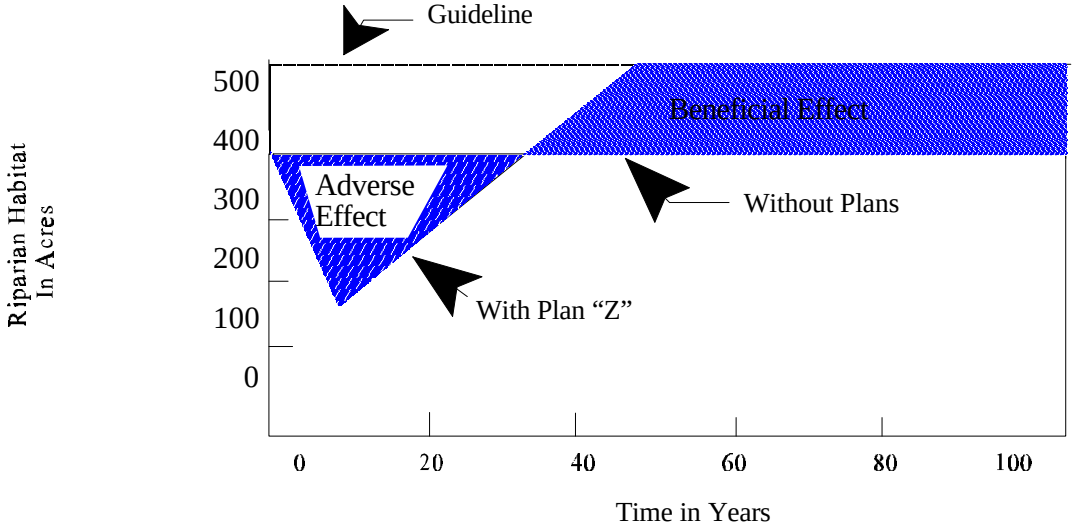


Figure 3.4.14-3
Example of Beneficial & Adverse Effects



(3) If the relationship between an indicator's without-plans and with-plan condition changes over the period of analysis so that an effect would be beneficial part of the time and adverse at other times, the different desirabilities should be shown as identified for each of the forecast dates. For example, a levee to be constructed as a part of Plan Z would initially destroy 200 acres of streamside riparian habitat. However, with the habitat management program included in the plan, the habitat would be restored and an additional 100 acres would be changed to become riparian habitat. See Figure 3.4.14-3 for a graphic illustration of this example.

(c) Second, the effects on each EQ attribute should be appraised as either beneficial or adverse based on the judgment of professionals with expertise relevant to each attribute.

(1) The following should be considered in judging the desirability of an effect on an EQ attribute:

(i) The *duration, location, magnitude*, and other relevant characteristics of effects on the attribute's indicators as previously identified (see 3.4.11).

(ii) The *appraisal of effects* on the attribute's indicators (beneficial or adverse), as identified in the previous step (see paragraph (b) of this section).

(iii) The relationships among the attribute's *quantity and quality* characteristics, as expressed in effects on the attribute's indicators. For example, the acreage (quantity) of a particular habitat may be beneficially increased with an alternative plan, but the habitat's productivity (quality) could be adversely affected by human activities, such as recreation, attracted to the area Conversely, an improvement in the productivity of a habit would not necessarily be beneficial unless an adequate amount of habitat would be available.

(iv) Whether effects on the indicators, the attribute, or the resource would fulfill or violate a public law, executive order, or other source of *institutional recognition*. See 3.4.3(c)(1) for examples of sources of institutional recognition.

(v) Whether effects on the indicators, the attribute, or the resource would be supported or otherwise viewed as beneficial by *the public*, or would be opposed or otherwise viewed as adverse by the public.

(vi) Whether effects on the indicators, the attribute, or the resource would be critical based on *scientific or technical knowledge or judgment.*

(vii) Other considerations that may have a material bearing on decisionmaking. Such other considerations should be clearly described.

(2) Agencies may use various approaches, such as weighting, scaling or ranking, to consider these factors in judging effects on EQ attributes. Approaches used should be documented.

(d) Appendix A provides example documentation formats for recording the results of this activity. A table should be prepared in accordance with the format illustrated in Table 3.4.14 for each candidate plan and provided to the agency decisionmaker for judgment of net EQ effects.

Table 3.4.14—Significant EQ Effects

[Alternative plan “X”]

Significant resources	Effects on EQ attributes: Ecological, Cultural, and Aesthetic	Notes
Resource No. 1. Resource No. 2. Resource No. 3. Resource N.	For each attribute of a resource, enter “beneficial” or “adverse”, and briefly state the rationale for each entry. For example: “Adverse, effect would violate State water quality standards”, and “Beneficial, effect would stabilize ecosystem trophic relationships”.	Briefly enter any other information that may be relevant to the judgment of net EQ effect of the plan, such as notes concerning mitigation, incomplete or unavailable information, etc.

3.4.15 Judge net EQ effects activity.

(a) This activity is performed to describe the net (overall) EQ effect of each alternative plan. Net effect should be described as “net beneficial EQ effect," "net adverse EQ effect," or "no net EQ effect" according to the following criteria:

(1) A *net beneficial EQ effect* occurs when, in the judgment of the agency decisionmaker, an alternative plan's combined beneficial effects on EQ resources outweigh the plan's combined adverse effects on EQ resources.

(2) A *net adverse EQ effect* occurs when, in the judgment of the agency decisionmaker, an alternative plan's combined adverse effects on EQ resources outweigh the plan's combined beneficial effects on EQ resources.

(3) *No net EQ effect* occurs when, in the judgment of the agency decisionmaker, an alternative

plan's combined beneficial effects on EQ resources equal the plans combined adverse effects on EQ resources.

(b) The agency decisionmaker is responsible for judging which of these types of net EQ effects best reflects the desirability of an alternative plan's overall effect on environmental quality. This judgment should be based on a thorough consideration of significant effects on significant EQ resources. In making a judgment of net EQ effect, the agency decisionmaker is acting on behalf of the public and should therefore consider public views related to the judgment. The decisionmaker may change a judgment on the net EQ effect of an alternative plan if the change is a reevaluation of existing information or if relevant new information is brought to his or her attention. Reasons for the change should be properly documented.

(c) Planners should assist agency - decisionmakers by presenting information bearing on the judgment of net EQ effect in a manner that aids the judgment process. As a minimum, the tables used to document the previous activity, as illustrated in Table 3.4.14, should be provided to the decisionmaker prior to his or her judgment of net EQ effect.

(d) The net EQ effect of each alternative plan should be expressed in a clear and complete narrative statement that identifies the type of net EQ effect expected and, as specifically as practical, the reasons that provided the basis for the judgment.

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Appendix A—Example Documentation Formats

Note.—This appendix is provided for background information.

(a) *Introduction.* (1) This appendix provides examples of tables that can be used to record the results of EQ evaluation activities. The tables and the activities are as follows:

(i) Table 1—identify resources activity (3.4.3).
(ii) Table 2—Develop evaluation framework activity (3.4.4).
(iii) Table 3—Survey existing conditions activity (3.4.6).
(iv) Table 4—forecast without-plans conditions activity (3.4.7).
(v) Table 5— forecast with-plan conditions activity (3.4.8).
(vi) Table 6 Identify effects activity (3.4.10).
(vii) Table 7—Describe effects activity (3.4.11).
(viii) Table 8—Determine significant effects activity (3.4.12).
(ix) Table 9—Appraise significant effects activity (3.4.14(b)), appraisal of effects on indicators.
(x) Table 10—Appraise significant effects activity (3.4.14(c)), appraisal of effects on attributes.

(2) The tables are intended for use as working documents; if developed for a given EQ evaluation, they could be included as an appendix to an agency's planning document or EIS (see 40 CFR 1502.10(k) and 1502.18).

(3) See 3.4.9(d) for a discussion of other documentation formats that may be used to record the results of EQ evaluation.

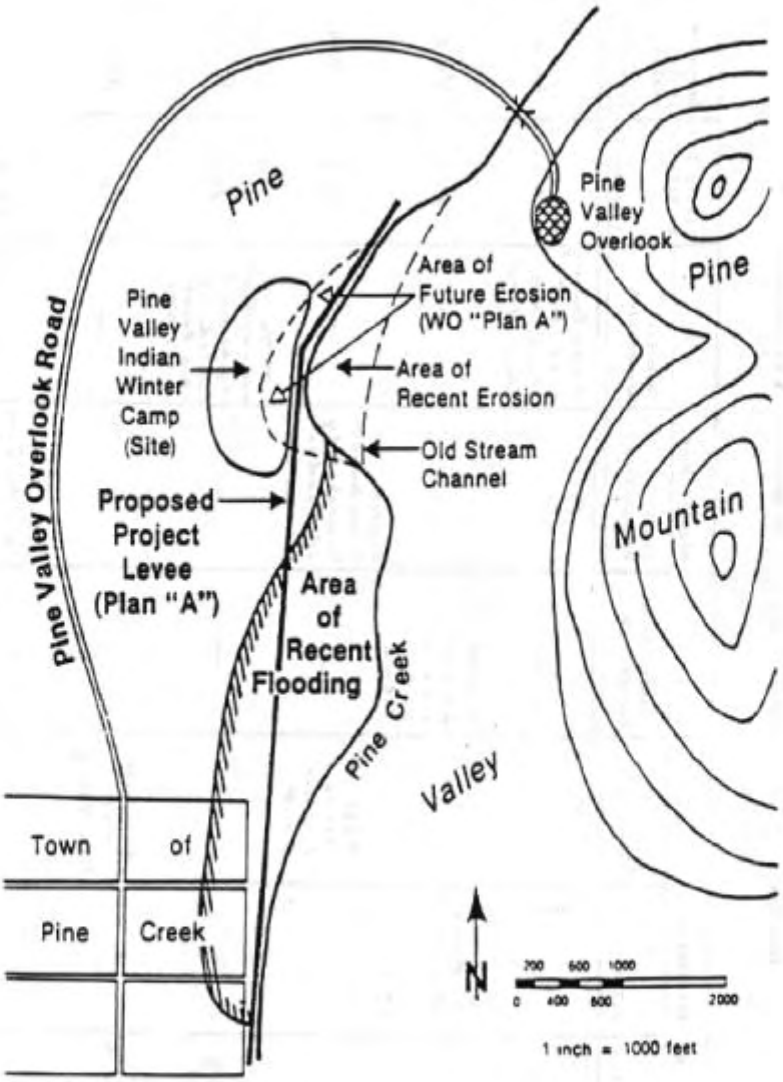
(b) *Table examples*. In addition to format guidance, this appendix presents examples of how the results of EQ evaluation activities could be recorded in the table format. The examples are presented as an aid to follow through the EQ evaluation process. The examples are based on the following hypothetical water resources planning situation:

(1) An alternative plan, designated Plan A, was formulated for the Pine Valley area to address the following problems and opportunities:
(i) Periodic flooding of a portion of the town of Pine Valley due to overtopping of the natural stream banks of Pine Creek.
(ii) The existing stream channel is eroding badly, endangering an Indian winter camp site (Pine Valley Village).
(iii) Pine Valley is noted for its natural beauty, and many people visit the area to view the valley and its surroundings.
(iv) Pine Valley is a major deer fawning area for the Pine Mountain deer herd.

(2) Plan A, which consists of a two-mile long levee, was formulated to protect the town from flooding, and the Indian village site from being destroyed by stream bank erosion. However, construction of the levee would require removal of stream side riparian vegetation along the right bank of Pine Creek. This vegetation comprises most of the fawning area for the Pine Mountain deer herd.

(3) Figure 1 presents a map of this planning setting.

Appendix A — Figure 1



Appendix A—Table 1. Identification of EQ Resources to be Evaluated.

Resources	EQ Attributes			Significance			Likely To Be Affected (yes/no)	Resource To Be Evaluated (yes/no)	Notes
	Ecological	Cultural	Aesthetic	Institutional Recognition	Public Recognition	Technical Recognition			
R_1 *Pine Valley Meadow*	*Deer fawning area*	—	—	—	—	*Major Fawning Area for Pine Mt. Deer Herd*	*yes*	*yes*	
	—	*Indian Winter Camp*	—	*Included in State List of Historic Sites*	—	—	*yes*	*yes*	
	—	—	*View of Meadow & Winter Camp (Site)*	—	*Public Acknowledged Desirability of Meadow & Winter Camp*	—	*yes*	*yes*	
R_2 *Pine Creek (river miles 169-171)*	*Trout Spawning Habitat*	—	—	—	—	*40% of Suitable Spawning Gravels Located in This Reach of Pine Creek*	*yes*	*yes*	
R_3 *Pine Valley Overlook Area*	—	—	*View Site For Pine Valley*	—	—	—	*no*	*no*	
R_4 *Town Of Pine Creek (area of flooding)*	—	—	—	—	*Acknowledged As A Problem That Needs Resolution*	—	*yes*	*no*	*To Be Evaluated in NED*

Appendix A—Table 2. Evaluation Framework.

Resources	EQ Attributes	Indicators	Units	Guidelines	Techniques		Notes
					Names	Documentation References	
R_1 Pine Valley Meadow	*Ecological*	*Terrestrial Habitat (quality & quantity aspects)*	*Habitat Units*	*Not less than 19 Habitat Units*	*HEP*	*Habitat Evaluation Procedures (FWS-E6M 102)*	
		Deer Fawns	*Number of Fawns*	*75 or more Fawns per year*	*State Annual Deer Census (Pine v. Hard)*	*See Bibliography #1*	
	Cultural	*Area of Site*	*Acres*	*Preservation of Entire Site*	*Map Plammeter*	*See Bibliography #2*	
		Representativeness	*Importance Ranking*	*Preservation (High Ranking)*	*Importance Ranking Technique*	*See Bibliography #3*	
		Research Value	*Importance Ranking*	*Preservation (High Ranking)*	*Importance Ranking Technique*	*See Bibliography #4*	
	Aesthetic	*Landscape Priority*	*Landscape Priority Ranking*	*H^9 Ranking*	*PEPLA*	*Procedures to Establish Priorities in Landscape Architecture (SCSTR #CF)*	
R_2 Pine Creek (etc)							

Appendix A—Table 3. Trend and Existing Conditions.

Resources	EQ Attributes	Indicators	Trend Conditions			Existing Condition (Units/Date)	Notes
			Trend (Units/Date)	Trend (Units/Date)	Trend (Units/Date)		
R_1 Pine Valley Meadow	*Ecological*	*Habitat*	*22 (1950)*	*20 (1970)*	*19 (1975)*	*19 (1980)*	*Trend Conditions Estimated From 1950, 1970 & 1978 Surveys (Photos)*
		Fawns	*50 (1950)*	*50 (1970)*	*60 (1975)*	*65 (1980)*	*Information From Annual Census (Pine Mt. Deer Hard)*
	Cultural	*Area of Site*	*6 ac. (1942)*	*6 ac. (1950)*	*6 ac. (1970)*	*6 ac. (1970)*	*Indian Winter Camp Discovered in 1942*
		Represent-ativeness	*unknown*	*unknown*	*unknown*	*High*	
		Research Value	*unknown*	*unknown*	*High*	*High*	
	Aesthetic	*Landscape Priority*	*unknown*	*unknown*	*H^8 Ranking (1978)*	*H^8 Ranking (1980)*	
R_2 Pine Creek							

Appendix A—Table 4. Without-Plans Conditions

Resources	EQ Attributes	Indicators	Without-Plans Conditions						Forecast Techniques		Notes
			Start Implementation Date (1990)	End Implementation Date (1995)	Forecast Date 1 (2005)	Forecast Date 2 (2025)	Forecast Date 3 (2045)	Locational Changes	Names	Documentation References	
R_1 Pine Valley Meadow	*Ecological*	*Habitat* *Fawns*	*22* *68*	*24* *69*	*27* *75*	*29* *78*	*30* *80*	*None* *None*	*Extrapolation* *Extrapolation*	*See Bibliography #5* *See Bibliography #6*	*Local Wildlife group is vaery active in Wildlife Management Program*
	Cultural	*Area of Site* *Represent-ativeness* *Research Value*	*6.9 ac.* *High* *High*	*6.6 ac.* *High* *High*	*5.3 ac.* *High* *Moderate*	*3.0 ac.* *High* *Low*	*2.9 ac.* *High* *Low*	*Less along Eastern Side of Winter Camp due to Erosion Loss of Some Artifacts & Part of Site*	*Extrapolation* *Scenarios* *Extrapolation*	*See Bibliography #7* *See Bibliography #8* *See Bibliography #9*	
	Aesthetic	*Landscape Priority*	*H*[8]	*H*[8]	*H*[7]	*H*[6]	*M*[7]	*None*	*Scenarios*	*Pine County Planning Dept. Report - Future Landscapes for Pine Valley 1978-2028, Vol 2*	
R_2 Pine Creek											

Appendix A—Table 5. With-Plan Conditions for Plan A .

Resources	EQ Attributes	Indicators	With-Plan Conditions						Forecast Techniques		Notes
			Start Implementation Date (1990)	End Implementation Date (1995)	Forecast Date 1 (2005)	Forecast Date 2 (2025)	Forecast Date 3 (2045)	Locational Changes	Names	Documentation References	
R_1 Pine Valley Meadow	*Ecological*	*Habitat* *Deer Fawns*	*19* *65*	*8* *20*	*10* *32*	*14* *47*	*19* *65*	*None* *None*	*Model* *Model*	*See Bibliography #10* *See Bibliography #11*	*Riparian Vegetation Slowly Returned After Construction*
	Cultural	*Area of Site* *Represent-ativeness* *Research Value*	*5.9 ac.* *High* *High*	*5.9 ac.* *High* *High*	*5.9 ac.* *High* *High*	*5.9 ac.* *High* *High*	*5.9 ac.* *High* *High*	*0.1 ac. of Camp Site & Artifacts Lost Due to Erosion* *None* *None*	*Model* *Scenario* *Scenario*	*See Bibliography #12* *See Bibliography #13* *See Bibliography #14*	
	Aesthetic	*Landscape Priority*	*H*[8]	*L*[4]	*L*[4]	*M*[5]	*M*[6]	*None*	*Scenario*	*See Bibliography #15*	
R_2 Pine Creek											

Appendix A—Table 6. Identification of Effects For Plan A .

Resources	E Attributes	Indicators	Difference Between Without-Plans and With-Plan Conditions (yes/no)					Effect (yes/no)	Notes
			Start Implementation Date (1990)	End Implementation Date (1995)	Forecast Date 1 (2005)	Forecast Date 2 (2025)	Forecast Date 3 (2045)		
R_1 Pine Valley Meadow	*Ecological*	*Habitat*	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	
		Deer Fawns	*yes*	*yes*	*yes*	*yes*	*yes*	*yes*	
	Cultural	*Area of Site*	*no*	*yes*	*yes*	*yes*	*yes*	*yes*	
		Representativeness	*no*	*no*	*no*	*no*	*no*	*no*	
		Research Value	*no*	*no*	*no*	*yes*	*yes*	*yes*	
	Aesthetic	*Landscape Priority*	*no*	*yes*	*yes*	*yes*	*yes*	*yes*	
R_2 Pine Creek									

Appendix A—Table 7. Descriptions of Effects For Plan A .

Resources	E Attributes	Indicators	Effect Characteristics								Notes
			Magnitude					Duration	Location	Other Effects Characteristics	
			Start Implementation Date (1990)	End Implementation Date (1995)	Forecast Date 1 (2005)	Forecast Date 2 (2025)	Forecast Date 3 (2045)				
R_1 Pine Valley Meadow	*Ecological*	*Habitat* *Deer Fawns*	*-3* *-3*	*-16* *-49*	*-17* *-43*	*-15* *-31*	*-11* *-15*	*55 years + Long Term (starting 1990)*	—	—	
	Cultural	*Area of Site* *Represent-ativeness* *Research Value*	*0* *No change* *No change*	*+0.3* *No change* *No change*	*+0.6* *No change* *No change*	*+1.4* *No change* *Slight Increase*	*+2.9* *No change* *Great Increase*	— *20 years + Long Term (start 2025)*	—	—	
	Aesthetic	*Landscape Priority*	*No change*	*Great Decrease*	*Moderate Decrease*	*Slight Decrease*	*Slight Decrease*	*45 years + Long Term (starting 1995)*	—	*The levee would detract from the natural look of the meadow even after revegetation*	
R_2 Pine Creek											

Appendix A—Table 8. Determinations of Effects Significance For Plan A .

Resources	E Attributes	Indicators	Significant			Significant Effect (yes/no)	Notes
			Institutional Recognition	Public Recognition	Technical Recognition		
R_1 Pine Valley Meadow	Ecological	Habitat Deer Fawns	40 CFR 1508.27(b) (3) (Ecologically Critical Areas)	Pine Creek Wildlife Club States the Deer Population will Decrease	State & Federal Wildlife Biologists Recognize That the Project Will Decrease Habitat Below Threshold Levels	yes yes	
	Cultural	Area of Site Representative-ness Research Value	40 CFR 1508.27(b) (8) & (10) (Loss of Historic Resource and Loss of Historic Site)	State Historic Preservation Officer Supports Protecting the Site	Site & Associated Characteristics Saved	yes no yes	
	Aesthetic	Landscape Priority	None	Community Groups Support Saving the Area from Erosion, but want Plantings made on the Levee to Compensate For loss of Aesthetic Values	None	yes	
R_2 Pine Creek							

Appendix A—Table 9. Appraisals of Effects (Indicators) For Plan A .

Resources	E Attributes	Indicators	Appraisals (beneficial/adverse)					Notes
			Start Implementation Date (1990)	End Implementation Date (1995)	Forecast Date 1 (2005)	Forecast Date 2 (2025)	Forecast Date 3 (2045)	
R_1 Pine Valley Meadow	Ecological	Habitat	Adverse	Adverse	Adverse	Adverse	Adverse	
		Deer Fawns	Adverse	Adverse	Adverse	Adverse	Adverse	
	Cultural	Area of Site	No change	Beneficial	Beneficial	Beneficial	Beneficial	
		Representativeness	No change	No change	No change	No change	No change	
		Research Value	No change	No change	No change	Beneficial	Beneficial	
	Aesthetic	Landscape Priority	No change	Adverse	Adverse	Adverse	Adverse	
R_2 Pine Creek								

Appendix A—Table 10. Appraisals of Effects (EQ Attributes) for Plan A .

Resources	E Attributes	Appraisal Considerations							Appraisal Judgment (also enter in significant EQ Effects table)	Notes
		Description (magnitude, duration, location; see Table 7)	Appraisal (Beneficial/Adverse; see Table 9)	Quantity/ Quality Factors	Institutional Factors (see Table 8)	Public Factors (see Table 8)	Technical Factors (see Table 8)	Other Factors		
R_1 Pine Valley Meadow	*Ecological*	*Major Loss of Fawning Area*	*Adverse For All Indicators*	*Quantity & Quality of Habitat & Deer Population Decreased*	*Destruction of Critical Ecological Areas*	*Opposed by Pine Creek Wildlife Club*	*Habitat & Population will Drop Below Threshold Levels*	—	*Adverse-Major Loss of Deer Fawning Area*	*Mitigation Recommended*
	Cultural	*Site Saved From Loss Due to Erosion Which Would Have Been Irretrievable*	*Beneficial Because Long Term Losses From Erosion Are Prevented*	*The Quantity of the Site (ac.) is Saved the Quality is Saved*	*State Historic Site Saved*	*State Historic Preservation Officer Supports Plan A*	*Area, Represent-ativeness & Research Value Saved*	—	*Beneficial-Site Saved From Potential Loss Due to Erosion*	
	Aesthetic	*Site Marred By Construction of Levee, but Major Erosion Is Curtailed*	*A Long Term Adverse Effect on Aesthetics Occurs, But Decreases As Vegetation Covers Levee*	*Views Are Degraded*	*None*	*Community Groups Want Restrictions Placed on the Project*	*None*	—	*Adverse-Because View of Meadow As A Whole is Marred*	
R_2 Pine Creek										

Appendix B—Relationships Between NEPA Requirements for EIS Contents and These Procedures

NEPA regulations requirements for EIS contents. (40 CFR 1502.10-1502.18)	Related activities in these procedures.
(a) *Cover sheet*. (40 CFR 1502.10(a) and 1502.11)	None.
(b) *Summary*. (40 CFR 1502.10(b) and 1502.12)	
(1) Major conclusions	Judge net EQ effects activity.
(2) Areas of controversy	Significance of EQ resources and attributes. Determine significant effects activity. Appraisal of effects on EQ attributes.
(3) Issues to be resolved	Significance of EQ resources and attributes. Determine significant effects activity. Appraisal of effects on EQ attributes.
(c) *Table of contents*. (40 CFR 1502.10(c))	None.
(d) *Purpose of and need for action*. (40 CFR 1502.10(d) and 1502.13).	None.
(e) *Alternatives including proposed action.* (40 CFR 1502.10(e) and 1502.14).	
(1) Present effects in comparative form	None.
(2) Explore and evaluate alternatives	Section III, General evaluation requirements. Section IV, EQ evaluation process.
(3) Substantial treatment to each alternative considered in detail	Detailed definition-and-inventory stage. Detailed assessment-and-appraisal stage.
(4) Include alternatives beyond agency jurisdiction	None.
(5) Include no action	Forecast without-plans conditions activity.
(6) Identify preferred alternative(s)	None.
(7) Include mitigation measures	None.
(f) *Affected environment*. (40 CFR 1502.10(f) and 1502.15)	Inventory resources phase.
(g) *Environmental consequences*. (40 CFR 1502.10(g) and1502.16).	
(1) Effects of alternatives	Assess effects phase. Appraise effects phase.
(2) Unavoidable adverse effects	Appraise effects phase.
(3) Relationship between local short-term uses of man's environment and maintenance and enhancement of long-term productivity.	Duration. Location.
(4) Irreversible and irretrievable commitments of resources	Duration.
(5) Direct effects	Forecast without-plans conditions activity. Forecast with-plan conditions activity.
(6) Indirect effects	Forecast without-plans conditions activity. Forecast with-plan conditions activity.
(7) Conflicts between the recommended plan (or candidate plans) and land use objectives.	Institutional recognition.
(8) Energy requirements	None.
(9) Natural or depletable resource requirements	Section IV, EQ evaluation process.
(10) Urban quality, historic and cultural resources	Section IV, EQ evaluation process.
(11) Mitigation means	None.
(h) *List of preparers*. (40 CFR 1502.10(h) and 1502.17)	Interdisciplinary planning.
(i) *List of agencies, organizations, and individuals to whom copies of the statement are sent*. (40 CFR 1502.10(i)).	Public involvement.
(j) *Index*. (40 CFR 1502.10(j))	None.
(k) *Appendices*. (40 CFR 1502.10(k) and 1502.18)	Documentation. Appendix A, Example documentation formats.