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United States Agency for International Development

GUIDELINES & PROCEDURES
FOR
PLANNING AND ANALYSIS
OF
WATER AND RELATED LAND RESOURCES PROJECTS

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A. INTRODUCTION

AID legislation stipulates that water or related land resource projects must, in their formulation, meet certain requirements regarding economic feasibility. These requirements prove to be so far reaching as to necessitate detailed instructions for the planning and design of such projects complementary to that found in Handbook 3, Part I. These Guidelines constitute such instructions. They are to be used in conjunction with Handbook 3, Part I, with the understanding that those provisions of the Handbook which are not in conflict with the Guidelines or are not obviously superseded by it remain in force.

The Foreign Assistance Act of 1961 states under Section 611(b):

> Plans required under subsection (a) for any water or related land resource construction project or program shall include a computation of benefits and costs made insofar as practicable in accordance with the procedures set forth in the "Principles and Standards for Planning Water and Related Land Resources" dated October 25, 1973.

The reference to subsection (a) restricts the applicability of subsection (b) to grants and agreements in excess of $100,000 which require substantive technical or financial planning. At the same time, Section 501 of the Foreign Assistance Appropriations Act of 1979, as amended in the Continuing Resolution of 1981, requires that:

> None of the funds herein appropriated...shall be used to finance the construction of any new flood control,

reclamation, or other water or related land resource project or program which has not met the standards and criteria used in determining the feasibility of flood control, reclamation, and other water or related land resource programs and projects proposed for construction within the United States of America under the Principles and Standards for Planning Water and Related Land Resources dated October 25, 1973.

The Principles and Standards referred to are those of the Water Resources Council, an independent agency established by Congress in 1965 to ensure uniform coordinated planning for the development of the Nation's water resources. Aside from the inconsistencies between Sections 611(b) and 501, which are clearly not mutually preemptive, and present no obstacle to the joint application of the two sections, serious problems do confront the Agency in attempting to apply the Water Resources Council Principles and Standards in its program. These problems arise from the fact that the Principles and Standards were written for application exclusively to domestic projects, and although in the main they can be of great utility to AID, many of their requirements prove irrelevant, impractical, or even impossible of performance in the AID context.

The Principles and Standards call for, among other things, substantial public involvement in project planning decisions, they specify a United States-related discount rate for computing costs and benefits, and they define methods of evaluation based on projections, provided by the Water Resources Council, of United

States economic activity, gross national product, population, employment and other economic phenomena. They specify United States-derived prices of commodities for use in evaluations, and, intended as they are for use on the typical huge domestic project, they are lengthy and complex. In brief, the Principles and Standards pre-suppose an elevated level of host country economic, political and institutional sophistication which simply does not obtain, and they mandate the use of United States-derived statistical data which are not relevant.

To enable the Agency to remain faithful to the intent of Congress and the objectives of the Principles and Standards, these Guidelines and Procedures have been prepared for use by Agency staff, borrower-grantee personnel, and consultants engaged in AID water resource project planning. They are in essence a partial modification and adaptation of the material found in the current Principles and Standards for Water and Related Land Resource Planning and its accompanying manuals of evaluation procedures, taking into account their specialized domestic nature on the one hand and the realities of AID borrower-grantee countries and institutions on the other.

1. Purpose

These Guidelines provide methods for systematically carrying out the various steps in water resource planning, including the selection and formulation of alternative projects to meet national objectives, the evaluation and measurement of beneficial and adverse effects, the comparison of alternative projects, and the selection of a recommended project. Their

use will provide for uniformity and consistency in comparing, measuring and judging beneficial and adverse effects of alternative projects, will insure compatibility with recognized environmental management policies and standards, and will insure compliance with applicable AID legislation pertaining to water resource development.

2. Authority

These Guidelines are established under authority of the Foreign Assistance Act of 1961 as amended and the Foreign Assistance Appropriations Act of 1979 as amended, pertinent sections of which are reproduced in the Introduction above. This legislation makes binding upon AID the standards and criteria for determining feasibility of water resource projects set forth under the Water Resources Council Principles and Standards dated October 25, 1973.

In anticipation of the difficulties inherent in attempting to apply a single set of rules across a wide range of projects among a number of diverse Federal Agencies (but hardly foreseeing exportation of such rules) the drafters of the Principles and Standards wisely inserted the following passage in the text:

> "Adjustments required for special situations where the application of these standards is not practical may be made and will be developed by the concerned agency or entity in consultation with the Water Resources Council."

Accordingly, the preparation of these Guidelines has been closely coordinated with the Water Resources Council, and the comments of the Council's Director have been taken into consideration.

3. Scope

These Guidelines cover preliminary planning at the Project Identification Document (PID) stage, and planning and analysis at the feasibility study or Project Paper stage for water and related land resources projects financed by AID. They establish the basic process to be followed in planning for the best use of Host Country national resources to meet national objectives, and specify how each phase of the process is to be performed.

The national objectives and accounts defined by these Guidelines incorporate and are consistent with the need for protection and enhancement of the human environment as expressed in AID Regulation 16, Environmental Procedures.

A list of specific classes of projects covered follows:

- Irrigation and agricultural water supply and drainage
- Municipal and industrial water supply, wastewater and water quality management
- Flood control
- Hydropower
- River basin development and management, including small comprehensive basin management
- Soil and water conservation

4. Applicability

These Guidelines apply to all AID-financed construction projects for developing water or related land resources whose cost exceeds $100,000. A water or related land resource project can be recognized by its primary focus, namely that of improving, developing or exploiting water resources for economic, social, or environmental gain, or similarly, land resources whose development is integrally related to water use. The major forms of development for such water and related land resources are listed in A.3. above. The $100,000 threshold pertains to the value of construction related to the development of water or related land resources, construction being the element critical to this criterion. These Guidelines do not apply to projects which have no construction element, but contain only other types of assistance, for example training or research. A sub-project in an area-wide or in a sector-type project, e.g., an irrigation project within an agricultural project, falls within the purview of these Guidelines, as does an aggregate of small discrete water-related projects contained in a large generalized project, e.g., a number of water wells in an area development project; provided, however, that the estimated cost of the sub-project or the aggregate of small projects exceeds $100,000.

AID frequently participates in financing development with other international agencies and sometimes other governments in so-called multi-donor projects. These Guidelines do not apply to such projects unless AID is the majority

financier. Where AID does not enjoy the latter position, the responsible Agency officials should satisfy themselves that the project has been subjected to a comparative analysis of benefits and costs by another donor and that such analysis is a reasonable substitute for that required by these Guidelines. In the absence of such an analysis, AID will apply the provisions of these Guidelines to the extent practicable, keeping in mind the degree of Agency financial participation, the importance of the project in the host-country context, availability of time and personnel, and the presumably compelling nature of the reasons underlying the Agency's intent to participate.

Planning and analysis effort and, collaterally, the extent of the application of these Guidelines should be held commensurate with the scope and significance of the project under consideration. For small projects, therefore, these Guidelines need not be rigorously applied in their entirety, but may be abbreviated and adapted, insofar as is reasonable and practicable, to the individual case at hand.

Where an abbreviated form of the Guidelines has been used, a brief discussion of the approach used and its justification should be included in the Project Paper.

5. Method of Application

These Guidelines are intended for use by AID in lieu of and to the exclusion of the Principles and Standards.

Projects planned, analyzed, and designed to the satisfaction of the Guidelines will be deemed to have satisfied those provisions of the Principles and Standards invoked by FAA Section 611(b) and FAA Section 501 as amended, insofar as they can be reasonably and practicably applied within the AID program.

Although the Guidelines can, in the main, be regarded as a supplement to Handbook 3, Part I, they do not fit neatly into the Agency's standard project process at any specific point, but rather, they mesh with it in varying degrees of affinity over a wide range from project conception through drafting of the Project Paper. Like Handbook 3, they are a mixture of generalized policy and detailed step by step procedural instruction. They are neither short nor uncomplex, but once understood, they will be perceived as a useful tool for the professional employed in the intricate, intellectually demanding process of project planning and design.

a. Guidelines as Supplement to Handbook 3

A water resource project is conceived as a choice among several alternative solutions (the others will be non-water resource projects, or even non-projects) to a problem identified in the DAP or equivalent country assistance document. At the moment this choice is made, these Guidelines come into play, guiding the planner in formulating, evaluating and comparing, in their rudimentary form, the various feasible alternative water resource plans, which, through the iterative process, ultimately will yield the recommended plan. Much information will be unavailable at this early stage, and only approximate figures and analyses need be used.

The breadth of coverage and the level of precision need be consistent with that of the other elements in the Project Identification Document, no more. As the project evolves, the application of the Guidelines continues closely through the Project Paper stage.

Chapter 4 of Handbook 3 provides detailed guidance for drafting the PID. Generally, for small water resource projects, which is to say the average AID project, no deviation from Handbook 3 guidance is necessary. For larger projects, the PID should include a brief discussion of potential alternative plans conforming to the definitions set forth in section C.2 of these Guidelines. In all cases the PID should describe the expected range and intensity of application of these Guidelines in later stages of project formulation, and consequently the projected level of effort in data collection and analysis. These are defined as a direct function of the size and importance of the project.

These Guidelines enter most pervasively into the AID project process at the Project Paper stage, or more accurately, during the project-specific analyses leading to the Project Paper. They replace in its entirety the economic feasibility analysis, and are collateral to and draw upon the social soundness analysis, the technical feasibility analysis, and the environmental analysis. Expository treatment in the body of the

Project Paper of the planning and evaluation process specified by these Guidelines will be no different from other project-specific analyses. The usual discussion of the methodology and the major findings is basically required, and the balance should be supplied in an appendix or in referenced back-up documents available to those who are interested.

It must be emphasized that the employment of these Guidelines in the project planning process does not lead automatically to the identification of a best or favored project. The Project Paper must, therefore, contain a detailed, logically convincing and well documented argument supporting the selection of the recommended project. Guidance and criteria for this selection are provided in later sections.

b. Effect of Size and Importance of Project

The Principles and Standards are intended to provide uniform and consistent standards for national water resource planning by the major United States agencies active in this field. Almost by definition then they are intended for large projects (especially so by current AID standards) and are necessarily wide-ranging, detailed and complex. In adapting the Principles and Standards to the AID program by means of these Guidelines, there has been no choice but to parallel the Principles and Standards to the degree necessary to maintain full

applicability of the Guidelines to projects on the largest scale despite the scarcity of such projects in the AID program. However, the Guidelines will rarely be applied in their full range, but will be abridged in their application as the user sees fit in consequence of the size and importance of the project. In some instances also, the intensity of application of certain aspects of the Guidelines may be reduced due to the presence of such factors as the scarcity of benefits to be gained, the absence of realistic alternative solutions, and the unique social and environmental characteristics of the planning area. Such limited or abbreviated application will depend for its success upon the skill and knowledge of the project designer, and no specific instructions or universal scale of relevance can be set down for it. Most AID water projects will be small. Correspondingly, the planning and analysis effort should be brief and succinct; no worthwhile end would be served by doing otherwise. For the abbreviated application of these Guidelines to small projects, which is to say most AID projects, the analyst should be guided by three considerations, --the need to limit the cost of the analysis to that commensurate with the project size, the need to respect Congressional intent to avoid prejudiced or arbitrary standards, and the need to maintain the integrity of the vital provisions of the Guidelines. The Agency

professional, experienced in project design and analysis, will quickly discover that for the project of average size the use of these Guidelines will not differ substantially from the Agency's methods employed in the development of other types of construction projects. Indeed, the difference lies chiefly in the form of presentation.

Some specific subject areas where abbreviated application of the Guidelines may be sought profitably without injury to their basic philosophy are public participation, planning area, forecasting, risk and sensitivity, resource conditions, alternative plans, accounts, and cost allocation. Among these, very serious attention may well be paid to alternative plans. In the small project, alternative plans, if any, may be limited principally to sizing and costing of the single most feasible alternative solution. Major emphasis, in these cases, should relate to those parts of the Guidelines that develop beneficial and adverse effects pertinent to the social and cultural account and the environmental account.

B. GENERAL PLANNING CONSIDERATIONS

These Guidelines bear on the Agency project process from the earliest conceptual stage. The Principles and Standards upon which they are based are, in fact, a detailed, specific instruction for project planning devoted to and permeated by the methodology of comparing monetary and non-monetary costs

and benefits of alternative plans. Consequently, it is not possible to adapt the Principles and Standards by means of these Guidelines without overlapping and/or replacing parts of the existing AID planning system.

The Agency deposes that when a project is proposed there is an implicit assumption that it represents the best alternative to the solution of a problem as compared to non-project solutions. At this stage, if it is a water resource project that has been proposed, the first preliminary formulation and examination of alternative projects in conformance with these Guidelines should occur. Alternative projects need not be completely defined, nor need the recommended project even be identified at this stage. These matters will usually depend upon the size and significance of the problem being attacked. However, the first steps will have been taken in the dynamic, iterative planning process that will carry through the PID and Project Paper phases, culminating in the analytically tested, coordinated, and finally recommended project. Throughout this process the measure of project merit will be relative benefits and costs, perhaps better expressed as relative gains and losses defined in terms of the four national accounts.

1. Host Country National Objectives

National goals , as defined in the country DAP or equivalent document, vary among AID recipient countries, but in any country-specific list the following are certain to figure prominently: achieve food self-sufficiency,

reduce unemployment and under-employment, improve conditions of health and education among the poor, and achieve more equitable distribution of income. Management and enhancement of the environment may be implicitly accepted as underlying all of these goals. In a general sense there is no conflict between these goals and the objectives of the Principles and Standards. They may be succinctly defined for universal application as follows:

- National economic development
- Management and enhancement of the environment

To facilitate the embodiment of these objectives in the planning process as an integral part of the methodology of comparing alternatives, the effects of each alternative method should be displayed in four accounts as follows:

- National economic development (NED)
- Environmental quality (EQ)
- Regional economic development (RED)
- Other social effects (OSE)

Contributions to national economic development increase the national output of goods and services. Environmental quality contributions are protection of and improvements in the quality and quantity of natural and cultural resources. Regional economic benefits register improvements in the regional distribution of economic activity. Other social effects are improvements in health, education, nutrition, and the quality of life.

2. Project Origins and Scoping

Scoping commences when a problem or opportunity has been identified in the DAP or a sector analysis and it has been determined that a project (really a range of projects) will be studied as a feasible solution to the problem. In a broad sense scoping can be considered as defining the scope of work. It seeks to identify the substance and range of significant project-related issues and problems, and possible solutions. The scoping process should include contact with all official central and local government agencies, as well as interested, formally-established private groups. This process is similar to the procedures of AID Regulation 16, and duplication should be avoided. Started at the very beginnings of the project, scoping should continue throughout the project development process to insure that all decision-making factors are addressed. As part of the scoping process the project designer should:

a. Determine the extent to which the probably significant issues should be analyzed

b. Eliminate from detailed study any issues that are not significant or have been adequately covered by a prior study

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

d. Identify other review, consultation and study requirements for performance by cooperating agencies

e. Fix a tentative planning and decision-making schedule

f. Repeat the above steps if a change in the planning emphasis or the discovery of new information makes it necessary

Scoping will combine or narrow the range of problems, opportunities, measures, plans, or effects so that meaningful and efficient analysis and choice among alternative plans can occur.

3. Inventory

An inventory should be made of the project area to determine the quantity and characteristics of water and related land resources and to identify opportunities for further use or management of those resources. The inventory should include data pertinent to the identified problems and opportunities and the potential for formulating and evaluating alternative plans. It, however, need not necessarily include an exhaustive listing of resources of the area. Examples of the types of information included in the inventory are:

- Hydrology, geology and topography of the project area
- Current and committed water and land use
- Biological resources and ecological systems
- Geological and archeological resources
- Quality of land and water, including soils data, sources of water pollution, including salinity intrusion
- Land capability and use classifications
- Transportation, communication and other infrastructure for beneficial development of water and related land use

The inventory should identify both present and projected resource conditions without any of the alternatives plans. This without-plan condition serves as the base for evaluating the effects of each alternative plan.

An analysis of the identified problems and opportunities and their implications in the planning setting should be included in the inventory phase. Based on this analysis the capability of the resources to support further use in meeting national objectives should be appraised. This will govern the scope and magnitude of alternative plans to be considered. The appraisal should include identification of possibilities for management, development, restoration or of other opportunities for action such as:

- Reservoir sites
- Flood control embankments
- Channel improvements
- Irrigation facilities
- Drainage facilities
- Wells and other water supply facilities
- Cultural or archeological features susceptible of preservation or enhancement.

At this stage constraints to the attainment of the desired levels of national objectives for the planning period should be identified. They may include resource limitations, competitive use of the resources, legislation, land tenure and management, disincentives to increased production, cultural inhibitions, or other unique limitations.

4. Period of Analysis

The period of analysis will be the same for all effects being evaluated (all plans). It will commence upon completion of construction, and will extend for a period equal to the lesser of:

- The period of time over which any alternative plan would serve a useful purpose considering probable technological trends affecting various alternatives

- The period of time beyond which further discounting of beneficial and adverse effects will have no appreciable impact on the analysis

- A period of 50 years

Where pertinent, consideration should be given to environmental factors which may extend beyond periods significant for analysis of effects for non-environmental accounts. Although, aside from such exceptional long-term environmental factors, the maximum period of analysis will be 50 years. In most cases it will be found practicable to use substantially shorter periods, inasmuch as discount rates currently in use for project evaluation sharply reduce the import of costs and benefits beyond the 40 to 50 year range.

5. Discount Rate

The interest rates used by AID in plan formulation and evaluation for discounting future benefits and costs or otherwise converting benefits and costs to a common time base and their method of derivation vary from time to time,

but are set as a matter of Agency-wide policy. Occasionally the rate is controlled or at least limited by legislation. In the absence of an established Agency-wide rate, the rate used shall be equal to the marginal opportunity cost of capital in the Host Country.

6. Prices and Price Relationships

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 and the general level of prices for outputs (items produced by the project) and inputs (resources consumed by the project) prevailing during or immediately preceding the period of planning will be used as representing the price relationships expected over the life of the project, unless specific considerations indicate real exchange values are expected to change. This general level of prices prevailing during or immediately preceding the period of analysis is to be used for the entire period of analysis. Deviation is permitted only to the extent that specific price changes occur which represent changes in real values that do not require offsetting adjustments of other prices.

In many developing countries, market prices for a great number of goods and services are frequently found to be distorted by non-market influences to a degree rendering them unsuitable, in some cases useless, for calculating real values of costs and benefits. Among the more common and important influences are government action, unemployment or under-employment, a

small number of buyers and sellers, and compartmentalization of markets because of poor communications. Market prices most often found unsuitable for economic evaluations are interest rates, wage rates for unskilled labor, official rates of foreign exchange, and domestic prices of agricultural products.

In such situations, market prices should be adjusted to real economic prices, commonly known as accounting or shadow prices, for evaluation of benefits and costs. The current AID policy and methodology applicable to the derivation and use of shadow prices will govern.

Shadow prices, if employed, will be restricted to economic evaluations and comparisons. For financial analyses, raw market prices should be used, where necessary "normalized" or adjusted to eliminate distortions by short-term swings.

7. Forecasting of Future Conditions

Formulation and evaluation of alternative plans are to 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.

Starting with conditions that exist at present in the planning area, projections of the future without and with project conditions should be made to evaluate beneficial and deleterious effects that may accrue to the project. A

simple before and after comparison is not valid. Changes can occur without the plan in a variety of ways, since social, economic, and environmental conditions are dynamic. Using the inventory of existing conditions as a baseline, forecasts should be made of income, employment, population, land use trends, production, imports, exports, the amounts of goods and services likely to be demanded, and the expected social and environmental conditions, considering all direct, indirect and cumulative effects. In many host countries such projections on both a national and a regional basis are prepared and maintained current by the government; also, in some cases, projections of all or some pertinent factors may have been prepared by an official planning agency. Where they exist such projections should be used.

Caution is to be exercised in forecasting future outputs for the without-plan condition. Many forecasting techniques assume implicitly that factors influencing historical trends will continue into the future, an assumption certain ultimately to be false. Thus, to extrapolate past trend lines may overstate the projected outputs for the without situation. Therefore, only improvements resulting from technology and changes in land and water use that can reasonably be expected to occur should be considered.

Forecasts should be made for selected years over the period of the analysis to indicate how changes in economic, social and environmental conditions are likely to have an impact on problems and opportunities. The

effects of projects already approved or under construction must be included. Environmental projections should be described in terms of indicators of the quality and quantity of natural and cultural resources.

8. Public Participation

It is unlikely that public participation on the scale that it is so widely practiced and accepted in the United States will soon be practicable in the developing countries. Long established and powerful political, administrative, social and cultural rules, attitudes, and habits militate against it, many of them as deeply rooted in their respective societies as the concept of openly arrived at consensus is in ours. Nevertheless, public participation in a significant sense is a feasible and worthwhile goal in project planning. Obviously the effort spent on public participation should be commensurate with the size of the project and a realistic understanding of the degree of success attainable. In this respect, it may be noted that a large project, in which public participation is imperative, will automatically attract public attention. Capitalizing on this phenomenon is a convenient means of leading into fulfillment of public participation requirements. Small projects, on the other hand, offer such opportunities at the local level in the inevitable exchanges between project planners and participants in the project and beneficiaries of it, throughout the planning stage.

Directly related to public participation is the first of the three principal aspects of the Agency's standard project social soundness analysis, namely, "--the compatibility of the project with the sociocultural environment into which it is to be introduced---." For the typical AID project, the research involved in the social soundness analysis, especially if some forethought is given to the subject in planning the analysis, should go far toward fulfilling requirements for public participation.

Clearly, the burden of planning and executing public participation schemes falls squarely on the Host Country officials sponsoring the project. AID's role should be limited to pointing out the need for such participation and supplying experienced advice and guidance. For large projects public participation would ideally be accomplished as described in the following paragraphs.

Interested and affected agencies, groups and individuals should be provided opportunities to participate throughout the planning process. The responsible planning agency should contact other involved central and local government agencies, interested private groups or associations, as well as interested individuals to solicit their views and participation. To the extent possible, a joint public participation program should be established with willing agencies and groups. Public participation may appropriately be accomplished by:

- Soliciting public opinion early in the planning process
- Encouraging periodic expression of views, and recording and considering them
- Advising the public through meetings early in the planning process of the nature and scope of the project
- Holding additional public meetings during the planning period to advise on progress and how views expressed at previous meetings have been dealt with
- Making pertinent plans, reports data analyses and interpretations available for public inspection

9. Interdisciplinary Planning

In all Agency projects an interdisciplinary approach is to be used in planning to ensure the integrated use of the natural, social, and environmental sciences. The disciplines of the planners are to be appropriate to the scope and issues identified in the scoping process. As is found necessary, the Agency will supplement its in-house expertise with technical experts from the Host Country, cooperating agencies, universities and consultants.

10. Sensitivity Analysis

Calculated values of certain NED benefits may vary significantly with small changes in certain inputs. Such relationships may be important if the sensitivity is acute or if the values of the inputs are inaccurately known. Hence, in comparing alternative plans, their sensitivity to key items of available data for which a range of

assumptions or estimates might be appropriate should be computed and considered in reaching a choice. Such key items might include prices, discount rates, yields, population, water flows, or other economic, demographic and technological factors.

11. Risk and Uncertainty

In addition to the sensitivity analysis mentioned in 10. above, plans and their effects are to be examined to determine the risk and 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. The essence of 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 the information base.

It is important to distinguish between risk and uncertainty. Situations of <u>risk</u> are defined 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 <u>uncertainty</u> are defined as those in which potential outcomes cannot be described in objectively known probability distributions. Risk may be characterized as being reasonably predictable. Uncertainty is characterized by the absence of any basis

for predicting the probability of occurrences. Both arise from measurement errors and from the inherent variability of complex, natural, social and economic phenomena.

Some methods of dealing with risk and uncertainty are:

- Collection of more detailed data
- Use of more refined analytical techniques
- Increasing safety factors in design
- Selection of measures with better known performance characteristics
- Reducing the irreversible or irretrievable commitment of resources
- Reinforcing the likelihood of adequate project financing, timely procurement of construction materials, and competent project management

Reducing risk and uncertainty may increase costs or reduce benefits. The advantages and costs of so doing should be fully considered in the planning process.

12. Net Benefits Rule

The recommended plan (project), when considered on the basis of the with-plan versus the without-plan comparison, must have combined NED and EQ benefits that outweigh combined NED and EQ costs (adverse effects). This means that a plan lacking net NED benefits may be recommended if net EQ benefits are sufficiently large, even though EQ benefits are not expressed in monetary terms.

C. PLANNING PROCESS

1. Definition

The planning process consists of consideration of alternative plans by a series of steps that identify or respond to problems and opportunities and culminate in the selection of a recommended plan or project. In these procedures, the terms plan and project are used interchangeably, with the understanding that they apply specifically to AID water resources projects as described previously under A-3 and A-4. The process involves an orderly and systematic approach to make determinations and decisions at each step so that the decision-makers can be aware of: the basic assumptions used, the reliability of data and information available and analyzed, the reasons and rationales used, and the range of implications of alternative projects.

2. Alternative Plans

An alternative plan or project consists of a system of structural and/or non-structural measures formulated to alleviate specific problems or take advantage of specific opportunities associated with water and related land resources in the planning area.

a. Application to the Planning Process

Possible alternative plans are systematically formulated in terms of the contribution that each plan makes to the established objectives. Water conservation should be fully integrated into plan formulation including actions that:

- Reduce the demand for water
- Improve the efficiency in use and reduce losses and waste
- Improve land management practices to conserve water

A clear contrast is drawn between the above conservation elements and storage facilities. Alternative plans should aim toward a range of measures that, over time, will balance the water demanded for various purposes with the water available.

The measures included in alternative plans should be consistent with existing statutes and regulations. However, an alternative that considers the effect of a change in statutes or regulations may be desirable, provided that the identity and rationale for the change is clearly stated.

When a number of alternative solutions are apparent, a preliminary analysis of each plan is made in order to establish its feasibility. After this initial screening, a preliminary evaluation of the benefits and adverse effects is made of the most feasible plans. Those plans that show favorable economic feasibility at this point are then considered further in light of:

- <u>Completeness</u>. Defined as the extent to which the plan provides and accounts for all necessary investments and other actions to ensure the realization of its effects

- Effectiveness. Defined as the extent to which the plan alleviates the specific problems and achieves the specified opportunities

- Efficiency. Defined as the extent to which the plan is the least costly means of responding to the specified problem and opportunities

- Acceptability. Defined as the workability and viability of the plan with respect to acceptance by the public and compatibility with existing regulations and public policies.

b. Type and Number of Alternative Plans

In order to explore adequately the range of alternative solutions, a sufficient number of plans that provide varied contributions to the established objectives should be formulated. A precise number of such plans cannot be specified, but will be governed by the relevancy of the objectives and resource capabilities of the planning setting. To the extent applicable and practical, consideration should be given to plans that:

- Reasonably maximize the national economic development
- Provide a primarily non-structural solution
- Display the effect of no action

As applicable, alternative plans should also consider:

- Measures that require low capital investment and an intensive use of labor

- The feasibility of staging a project, including an economic and financial analysis for each stage

- Full operation of existing water supply facilities with optimum use of non-water measures (fertilizer, high yield seed, pesticides, etc.) to increase agriculture production

3. Plan Formulation

The following items in sequence constitute the steps in formulation of an alternative plan, but these may be adjusted to accommodate a specific planning setting:

a. Place in order those problems and opportunities that are essentially complementary, that is, the satisfaction of one of the problems or opportunities does not preclude satisfaction of other problems or opportunities.

b. Identify relevant alternative measures for alleviating problems or realizing opportunities to meet established goals and objectives. Compiling information in regard to the beneficial and adverse effects of alternative measures will provide the basis for selecting the most effective measure for satisfying problems and opportunities and for identifying those items that are not satisfied or are not relevant to the established objectives.

c. Group the measures that are essentially in harmony in satisfying problems and opportunities. Each group represents a nucleus for an alternative plan.

4. Major Steps

The major steps in the planning process can be summarized as follows:

a. Specify the water and related land resources problems and opportunities relevant to the planning setting and associated with NED and EQ objectives.

b. Inventory, forecast, and analyze the water and related land resource conditions within the planning area relevant to the identified problems and opportunities.

c. Formulate alternative plans (See C.3.).

d. Evaluate the effects of alternative plans.

e. Compare alternative plans and select a recommended plan that is consistent, to the extent possible, with the net beneficial effects rule (See B-12.)

5. Iteration

Plan formulation is a dynamic process, with various steps that might be repeated one or more times. This iteration may occur after completion of the comparison of plans.

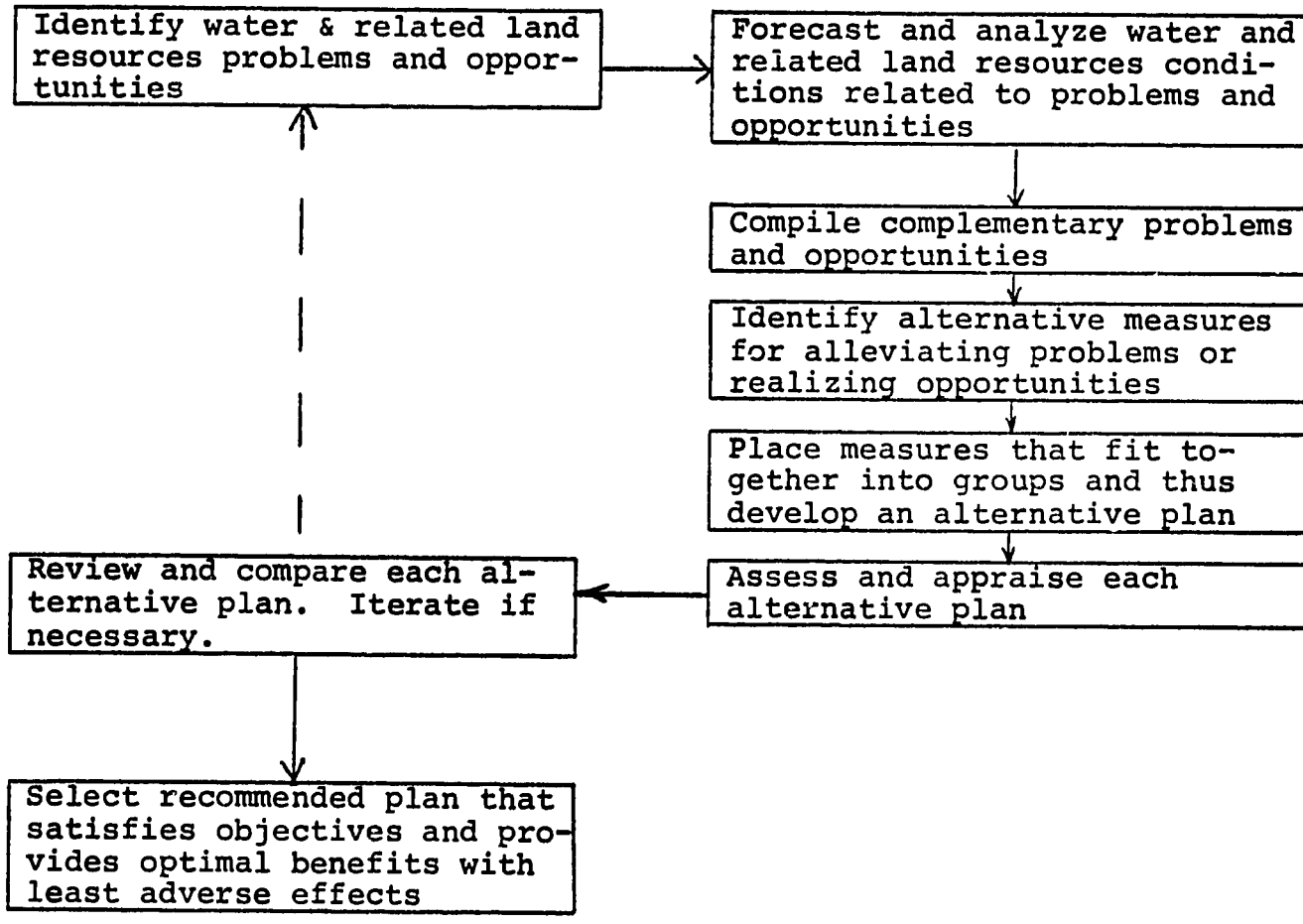
Among the reasons for iteration or returning to an earlier step are the following:

- More detail is needed as a basis for selecting a recommended plan
- The consideration of alternative plans reveals significant shortfalls in alleviating problems or in meeting objectives
- Information obtained on resource capability suggests that the initial specification of problems or opportunities was in error and requires modification.
- Public policy changes occuring during the planning study suggest the need for a change in emphasis as related to the objectives.
- Consideration of alternative plans reveals significant adverse effects.

As a general guide, the number of iterations will be based on a judgment of whether or not new information, further detail, or other changes are likely to result in significant modifications in the identified problems or in the plans under consideration.

The planning process for a specific planning setting or project, including the foregoing steps, is illustrated in Figure I:

FIGURE I - PLANNING STEPS



The likely schedule of implementation of projects is also a consideration in the planning process. A desirable schedule is one that includes a mix of projects that can be completed rapidly and that provide a substantial contribution to established objectives.

D. ACCOUNTS

1. General

In order to display the beneficial and adverse effects of each alternative plan, the use of a system of accounts is suggested. This system enables the different levels of achievement for each plan to be readily compared, and possible trade-offs between plans to be noted. Figure II illustrates this display.

Four accounts are used in this system, including 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. A definition of the accounts and units used in evaluation follows:

- NED. Describes the effects on the national economy; evaluated in monetary units

- EQ. Describes the effects on natural and cultural resources; evaluated in quantitative units and/or qualitative terms

- RED. Describes the regional incidence of NED effects, income transfers, and employment effects; evaluated in a combination of monetary and other quantitative units

- OSE. Describes the urban and community impacts and effects on life, health, and safety; evaluated in monetary and other quantitative units or in qualitative terms

In order for the net beneficial effects rule (see B.12.) to be applied, the effects in the NED and EQ accounts should be mutually exclusive.

To avoid double counting, the same effect should be shown only once within a given account. However, in the OSE account it may be advisable to show the incidence of an effect from more than one point of view.

In each account the evaluation of the effects of a plan is made by considering the differences between the projected conditions with and without the plan. This evaluation will not necessarily be in monetary terms. However, when monetary values are used, they should be annual sums, and converted to the average annual equivalent by appropriate discounting techniques.

Relationships between the short term use of the human environment and the maintenance and enhancement of long term productivity, as well as any irreversible or irretrievable commitments of resources, are to be identified in the EQ account.

2. National Economic Development (NED)

The NED account shows the estimated net effects of a plan on the productive output of a country. This account provides a basis for establishing a benefit/cost relationship. In general, the beneficial effects in this account are the increases the project provides in the value of goods and

services; in the value of indirect benefits or external economics; and in the value associated with unemployed or underemployed labor.

a. Goods and Services

Evaluation of NED beneficial effects is generally based on willingness to pay for additional goods and services provided by the project. Evaluation procedures for specific types of project or measures within multiple purpose projects are described in Section F. If the project is small and its output has no significant effect on the price, the actual or simulated market price will approximate the total value of the output and can be used to estimate the willingness to pay. If the additional output is expected to have a significant effect on the market price, a median between the price with and without the project is used to estimate the total value.

If NED benefits cannot be estimated from the market price, the cost of the most likely alternative can be used. This assumes that a most likely alternative would be implemented in absence of the project under consideration. Non-structural measures should be a consideration in determining this alternative. Municipal water supplies or hydropower development are the types of projects where this method would be most applicable.

Administratively established values is another technique for benefit evaluation. In this instance the value of specific goods and services is set by the national government of the involved country. The value of the additional output from the project would be based on these set prices.

b. Indirect Beneficial Effects or External Economics

These are effects that occur to individuals, groups, and industries which may or may not benefit from the direct output of the project. They are the uncompensated, incidental, unintended effects of a project that increase economic efficiency, and to that extent they are external to the project. Pertinent external economics involve a technical or physical relationship. As an example, a project planned only for flood control and hydropower might reduce downstream water treatment costs.

c. Use of Otherwise Unemployed or Underemployed Labor

Where a planning area has unemployed or underemployed labor and it can be shown that these resources will be employed or more efficiently employed as a result of the project, the net additional payments to the unemployed or underemployed workers will be measured as a benefit. The opportunity cost of employing otherwise unemployed workers is conceptually equal to the value

of non-working time foregone by such workers. Since there is no generally accepted method for measuring the value of non-working time, a shadow wage rate of zero is assigned. The shadow wage rate may be modified by such factors as seasonal fluctuations in demand for labor, different employment conditions in later stages of project life, and varying degrees of labor mobility. Shadow wage rates will be established in accordance with AID policy.

d. Adverse effects

These are the opportunity costs of resources used in implementing the project. They include project outlays, associated costs, and indirect costs or external diseconomies. In each category, market prices will be used as applicable and as modified to reflect pertinent shadow prices. No adjustment will be made to reflect inflation.

Project outlays are those costs incurred to construct the project in accordance with sound engineering and environmental principles, and to place it in operation so as to provide the estimated beneficial effects. These costs include investigations, surveys, planning, design, construction, contingencies, administrative services, mitigations, salvage of historical and archaeological items, water and mineral rights, operation, and maintenance. Associated costs are the cost of those

measures needed over and above the project items to achieve the benefits claimed during the period of analysis. Examples of associated costs are farm access roads, and on-farm irrigation systems.

Indirect costs or external diseconomies are the costs of those uncompensated off-site losses caused by installation, operation or maintenance of the project. An example is the increased need for water supply treatment caused by irrigation return flows.

NED benefits and costs must be compared at a common point in time. To accomplish this the following information is needed:

- Construction period. The number of years required for construction of the project. If staged implementation is proposed over an extended period of time, the construction period will be the time required to install the first phase

- Construction expenditures. The costs expected to be incurred during each year of the construction period

- Period of analysis. The time period for project benefits, deferred installation costs, and operation, maintenance and replacement (OM&R), beginning when the installation is completed, and extending through the useful life of the project

- Benefit stream. The pattern of expected benefits over the period of analysis

- OM&R costs. The expected costs over the period of analysis for operation, maintenance, and replacement necessary to maintain the benefit stream

- Discount rate. The rate used in converting the costs and benefits to the beginning of the period of analysis.

The net NED benefits are calculated in present value terms. To perform this calculation, the benefit stream, deferred construction costs, and OM&R costs, shall be discounted to the beginning of the period of analysis. Construction expenditures shall be brought forward to the beginning of the period of analysis by charging compound interest at the project discount rate from the date the costs are incurred.

3. Environmental Quality (EQ)

Appendix 4B of Handbook 3 describes in detail how and when an environmental analysis is made for each project. Duplication of this effort is not necessary. However, in order to compare all of the effects and trade-offs afforded by each alternative, the beneficial and adverse effects developed in the environmental analysis should be entered into the EQ account.

4. Regional Economic Development (RED)

The RED account registers changes in the distribution of regional economic activity that result from alternative projects. Two measures of the effects of the plan on regional economies are income and employment.

a. 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 the outside. Income transfers into the region include income from:

- Implementation outlays or that portion of a project outlay that becomes net income in the regional economy, exclusive of benefits from use of unemployed or underemployed labor resources

- Transfers of basic economic activity or net income therefrom that locates in the region as a direct result of differences between the with and without project conditions

- Indirect effects or regional net income resulting from expansion in the production of inputs to industries supplying increased final products and regional exports

- Induced effects or regional net income resulting from changes in consumption expenditures generated by increases in personal income

b. Employment

The regional employment positive effects are directly parallel to the positive effects on regional income. Thus, the analysis of employment will be organized in the same categories using the same conceptual bases as regional income. To the extent possible, the nature of employment increase will be classified as to the level of skill required--unskilled, semi-skilled, and highly skilled.

c. Adverse Effects on Income

The adverse effects on the region's 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 country. Income transfers include losses from plan-induced shifts of economic activity from the region and any impacts that may affect the region as a result of NED costs or transfers from the region.

d. Adverse Effects on Labor

Negative effects on regional employment are any decreases in numbers and types of jobs resulting from the project. They will be categorized and accounted for in the same manner as the positive effects on employment.

Since the NED account registers all effects on the national economy, any differences between the national and regional economic effects will take the form of transfers from or to the rest of the country. The effects of these transfers, which are equal to the difference between the RED and NED effects, are shown in the RED account as a "rest of the country" category together with the RED and NED effects.

5. Other Social Effects (OSE)

The project effects in this account are those not reflected in the other three accounts. These effects are to be evaluated in quantitative or qualitative positive or negative terms as to their impacts on the separate regions and communities affected. Appendix 4A of Handbook 3 describes the social soundness analysis that must be made for each project. In order to compare all of the effects and trade-offs afforded by each alternative, the beneficial and adverse effects developed in this analysis should be entered into the OSE account.

E. PRESENTATION

1. General

The presentation of the material and information generated by the planning process that leads to the selection of the recommended plan must be concise, complete and understandable. Graphs, tables, drawings, and summary

statements should be used as necessary in order to provide a clear picture of the alternative plans that have been considered in relation to:

- Their effectiveness in solving the problems and taking advantage of the opportunities identified in the planning process
- What "must" be given up in monetary and non-monetary terms to enjoy their respective benefits
- Their differences in terms of effects as shown in the four accounts

2. Content and Format

The presentation should include the following items, as pertinent:

- Existing and forecasted resource conditions without any of the alternative plans
- Opportunities and problems related to the planning setting
- With reference to the most significant alternative plans and the recommended plan:
  - measures in each plan
  - effects shown in the four accounts
  - a display of differences between the effects of the recommended plan and each of the other significant plans

Figure II illustrates a format for the display

FIGURE II FORMAT FOR DISPLAY OF ACCOUNTS

Plan	Description	Effects							
		NED		EQ		RED		OSE	
		Beneficial	Adverse	Beneficial	Adverse	Beneficial	Adverse	Beneficial	Adverse
A (Recommended Plan)									
B									
Diff A-B									
C									
Diff A-C									
D									
Diff A-D									

F. INFORMATION AND EVALUATIONS RELATED TO THE FOUR ACCOUNTS

As indicated in Section D, the evaluation of project effects for the EQ and OSE accounts will follow procedures provided in Handbook 3, Appendices 4A and 4B, respectively. The effects included in the RED account are derived largely from the NED evaluations and the EQ and OSE factors pertinent to a region. Derivation of adverse effects, which is primarily the cost of a project, and indirect benefits and costs have been described generally in Section D and will not be detailed further in this section.

Thus, this Section will focus on information and evaluation procedures for the NED account as related to:

- Irrigation and agricultural water supply and drainage
- Municipal and industrial water supply, wastewater and water quality management
- Flood control
- Hydropower
- River Basin development and management, including small comprehensive basins
- Soil and water conservation.

1. Irrigation and Agricultural Water Supply and Drainage

a. Benefits

The NED benefits from irrigation elements of water resources projects are computed as the increased net returns that would result from reduced production cost, from more intense cropping because of assured water supply, or from increased acreages placed under irrigation. These benefits are computed as the difference

in net income with and without the project. In the rehabilitation of existing irrigation systems, additional beneficial effects may occur as a reduced cost in the operation, maintenance, and replacement of the existing irrigation facilities. Existing irrigation facilities and acreages, including projects under construction will be considered as part of the without-project condition. The level of detail required for each evaluation will depend on the economic significance of the problems, the availability and reliability of data, and the degree of refinement needed for project formulation.

b. Evaluation Procedure

Identify the land use, cropping patterns and crop yields that could be expected with various water supply levels. Project the cropping patterns to selected time periods to reflect changes in physical conditions and the application of all water conservation measures that could reasonably be applied without the project. Determine the current crop acreages and/or increased irrigated acreage adjusted to reflect the application of reasonable water conservation measures. Data on cropping patterns and yields will be collected from areas with soil and water supplies similar to the various supply levels being projected.

Determine costs of crop production, system OM&R, and associated drainage for each alternative water supply level.

Compute the benefit as the change in net value from the without-project water supply level to the project supply level for current crop acreages and/or increased acreages. Since it would rarely be feasible to provide a full season water supply for all acreages, the benefit analysis will be adjusted to account for the effect of short supply years and, to the extent practical, the value of excess water in wet years. This can be done by including the value of greater or lesser supply according to their probability as evaluated above. Figure III summarizes this benefit calculation. As indicated previously the benefit stream shall be discounted to the beginning of the period of analysis to obtain the present value.

Drainage problems on flatland areas are generally interrelated with inundation damages. Benefits in these cases are evaluated jointly and assigned to specific project purposes after the evaluation is completed. If flood damages are related to the frequency and stage of discharges, flood prevention and drainage benefits are evaluated by different methods and are separable. If flood damages are caused by direct precipitation and beneficial effects result from removing a volume of water in a given time period, drainage and flood prevention benefits

Figure III - BENEFITS FROM IRRIGATION

Item	Current or Base Year	1990			2000			2010		
		Full Irrigation	20% Deficiency	40% Deficiency	Full Irrigation	20% Deficiency	40% Deficiency	Full Irrigation	20% Deficiency	40% Deficiency
Without Project										
Acres: Irrigated										
Maize										
Wheat										
etc.										
Yield: Irrigated										
Maize										
Wheat										
etc.										
Gross crop value										
Crop Prod. cost										
OM&R cost										
Net Value										
With Project										
Acres: Irrigated										
Maize										
Wheat										
etc.										
Yield: Irrigated										
Maize										
Wheat										
etc.										
Gross crop value										
Crop prod. cost										
OM&R cost										
Net value										
Benefit										

are evaluated jointly and then allocated 50 percent to drainage and 50% to flood prevention. Deviation from this arbitrary allocation may be used if physical data support a more accurate division. Computation of the NED benefits from the drainage elements of water projects follow the same procedure as described above for irrigation and agricultural water supply.

2. Municipal and Industrial Water Supply, Wastewater and Water Quality Management

(1) Benefits M&I Water Supply

The conceptual basis for evaluating the benefits from municipal and industrial water supply is the willingness to pay for the additional water provided by the project. Where water is priced at its marginal cost, that price shall be used to calculate the willingness to pay. In the absence of such a direct measure of the benefits, the resource cost of the alternative most likely to be implemented in lieu of the proposed project or items such as time savings for reduced travel, convenience and health aspects should be used as a measure of benefits.

(2) Planning Setting

Consideration shall be given to without and with-project conditions. Elements included in the without conditions are existing water supplies; water management contracts and operating criteria; additional water supplies under construction, including time of delivery; water quality; and effects of implementing all reasonably expected non-structural and conservation measures.

The with-project condition will indicate the additional water supplied by the project and will also address, as applicable, the same elements as those without the project. Non-structural measures to be considered include, but are not limited to:

- Reducing the level and/or altering the time pattern of demand by regulations on use, and by education programs

- Modifying management of existing water development and supplies by recycling and reuse

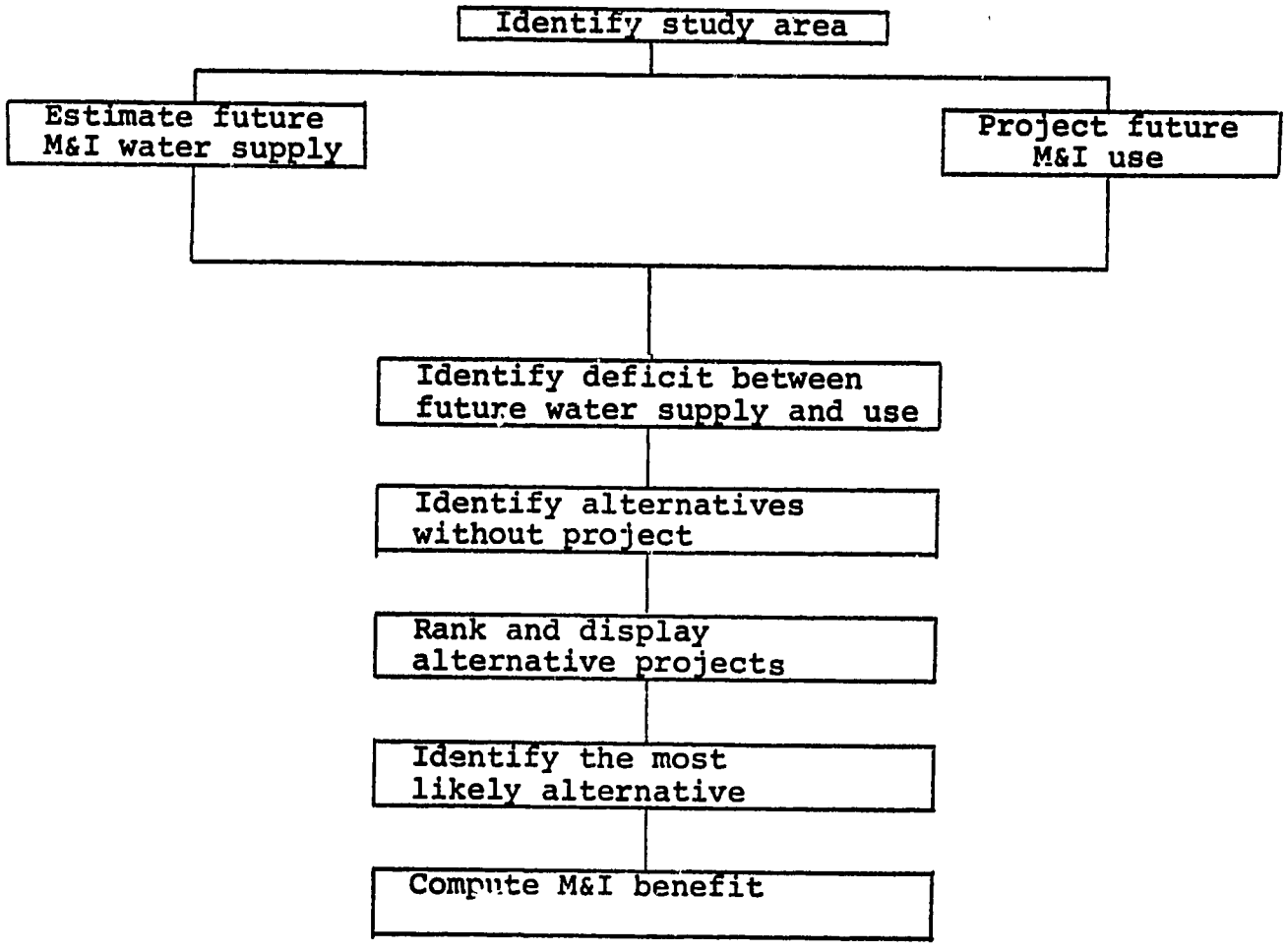
- Increasing upstream watershed management, and conjunctive use of ground and surface waters

- Leakage control, repair and cleaning of pipelines, and training of maintenance personnel.

c. Evaluation Procedures

Figure IV is a flow chart of the procedure for calculating municipal and industrial water supply benefits. The level of effort expended on each step depends on the nature of the proposed development, basic information available for analysis, and the economic status of the beneficiaries of the project.

Figure IV MUNICIPAL AND INDUSTRIAL (M&I) WATER SUPPLY



A brief elaboration on the steps in Figure IV follows:

(a) Identify study area

Include areas that will receive direct benefits and/or incur costs.

(b) Estimate future M&I water supply

Analyze all sources of existing and expected available supply. Obtain data from national and local agencies, and existing water suppliers. The analysis should be by time periods and include water quality

(c) Project future M&I use

Project future water use for the same time periods as the supply projections for residential, industrial, and other uses (public services, losses, etc.). Identify seasonal variations in use and maximum day use for each season.

(d) Identify deficit between future water supply and use.

Analyze the intensity, frequency and duration of the expected deficits.

(e) Identify alternatives without project

Alternatives should be tested for acceptability, effectiveness, efficiency, and completeness. Plans that do not completely satisfy water supply objectives, such as those that minimize and allocate shortages when they occur (drought management measures) shall be considered. The cost of shortages shall include the cost of implementing drought management measures, and losses in development of resources resulting from inadequate water supply. Alternative projects need not be based on the development of a single source of supply at one time, but may consist of conjunctive development of several sources in increments phased to match the water demand.

(f) Rank and display alternative projects

Rank these projects in order from the highest cost to the lowest. The annualized costs shall be calculated on the basis of the service life of the facility or the period of analysis, which

ever is less. The annualized cost of treatment facilities and operation to meet established water quality standards should be included. Taxes and insurance are not included in the cost. Assumptions and procedures used in deriving costs of alternatives shall parallel those used in calculating the cost of the proposed project.

(g) Identify the most likely alternative

Consideration shall be given to the least costly alternative. If this is passed over for a more expensive one, justification shall be provided for this action.

(h) Compute M&I benefits

Annualized benefits of the proposed project are equal to the cost of the most likely alternative. The evaluation shall reflect differences in water quality management, distribution and other costs compared to the most likely alternative. In the absence of a most likely alternative project, determine benefits from reduced travel time to collect water, other conveniences, and enhancement of health derived from the project.

b. Wastewater management

(1) Benefits

Water supply and wastewater management projects should be planned together when possible. The crucial health objectives of water supply

projects normally cannot be achieved unless wastewater management received comparable consideration. Without adequate sewage disposal there is a continuing risk that water supply systems will become contaminated. Like projects for municipal and industrial water supply, the concept of willingness to pay for wastewater control and use is the basis for evaluation of benefits. The technical proficiency of wastewater disposal ranges from sewage collection systems and attendant treatment plants or lagoons to septic tanks and tile fields, or, at the bottom of the scale, open channels emptying into natural waterways. With this wide range of possibilities, the evaluation of many of the benefits on a monetary basis is often impractical. Such benefits as those relating to the health and well being of the beneficiary, the community as a whole, and the prevention of pollution of potable water sources by wastewater can best be expressed in qualitative terms.

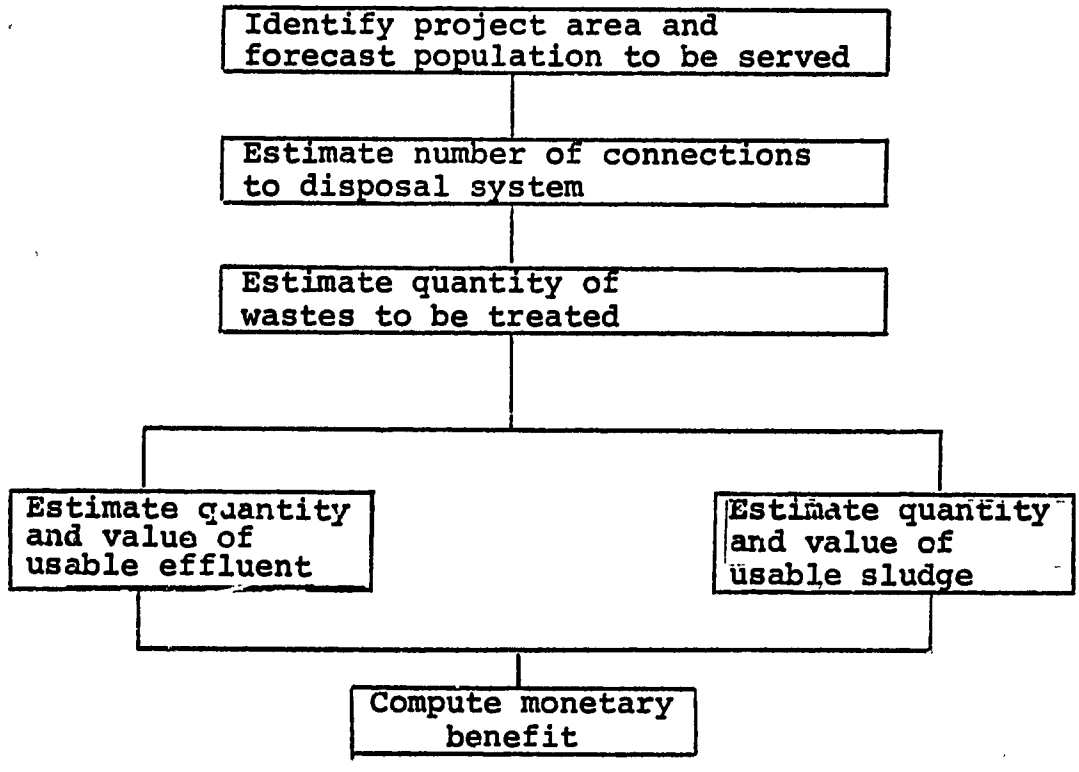
(2) Planning setting

Consideration will be given to the with and without project conditions. Elements in the without condition will include existing facilities; amount and quality of existing wastewater; and current health status of population in the project area, including morbidity and mortality statistics attributed to water related infections and diseases. The with-project condition should include extent and capability of proposed waste disposal facilities, quality and possible use of effluent and sludge, and probable improvement in health aspects and reduction in morbidity and mortality.

(3) Evaluation Procedures

Steps for evaluating monetary benefits are shown on Figure V for a system where sewage is collected and treated:

Figure V - WASTEWATER MANAGEMENT EVALUATION PROCEDURES



A brief elaboration of the steps in Figure V follows:

(a) Identify project area

Include areas that will receive direct benefits and/or incur costs. Project future population by time increments.

(b) Estimate number of connections

Include type of connection (domestic, industrial, etc.), and time increment in which connection is made.

(c) Estimate quantity of wastewater to be treated
Include type of waste (domestic, industrial) and pertinent time increment.

(d) Estimate quantity and value of usable effluent
Indicate where effluent will be used and its quality.

(e) Estimate quantity and value of usable sludge
Indicate where and how it will be used.

(f) Compute monetary benefit
Based on annualizing present worth of value of effluent and sludge.

Since a substantial part of the benefits may be the favorable qualitative effects on health, reduction in morbidity and mortality, and enhancement in individual and community life, a favorable monetary benefit/cost ratio is unlikely. As a result, the potential for proceeding with the project will not always rest exclusively on the willingness of the beneficiaries to pay, but also upon qualitative benefits. Because of scarcity of funds in the low income, developing countries, it is imperative that facilities for waste disposal be of least cost to accomplish the objective.

3. Flood Control - Urban

a. Benefits

Benefits from projects for reducing flood hazards accrue primarily through the reduction in actual or potential damages associated with land use. Benefits are considered in two categories as follows:

- Inundation reduction benefits, which are measured by the increased income from flood plain use because of the project, based on the premise that this use is the same with or without the project.
- Location benefits, which occur when an activity is added to the flood plain because of the project. The benefit is the difference between aggregate net incomes in the affected area with and without the project.

The types of flood damage include:

- Physical damage such as damage to or total loss of buildings and contents; loss of roads, sewers, bridges, power lines, etc.
- Income loss, which includes loss of wages or net profits to business over and above physical flood damages, caused by disruption of normal activities
- Emergency costs, which are expenses resulting from evacuation, reoccupation, flood fighting and disaster relief; and increased costs of police, fire prevention, and military patrol activity.

b. Planning Setting

The benefits from a flood control project shall be based on an analysis of the without and with conditions. The without condition is the land use likely

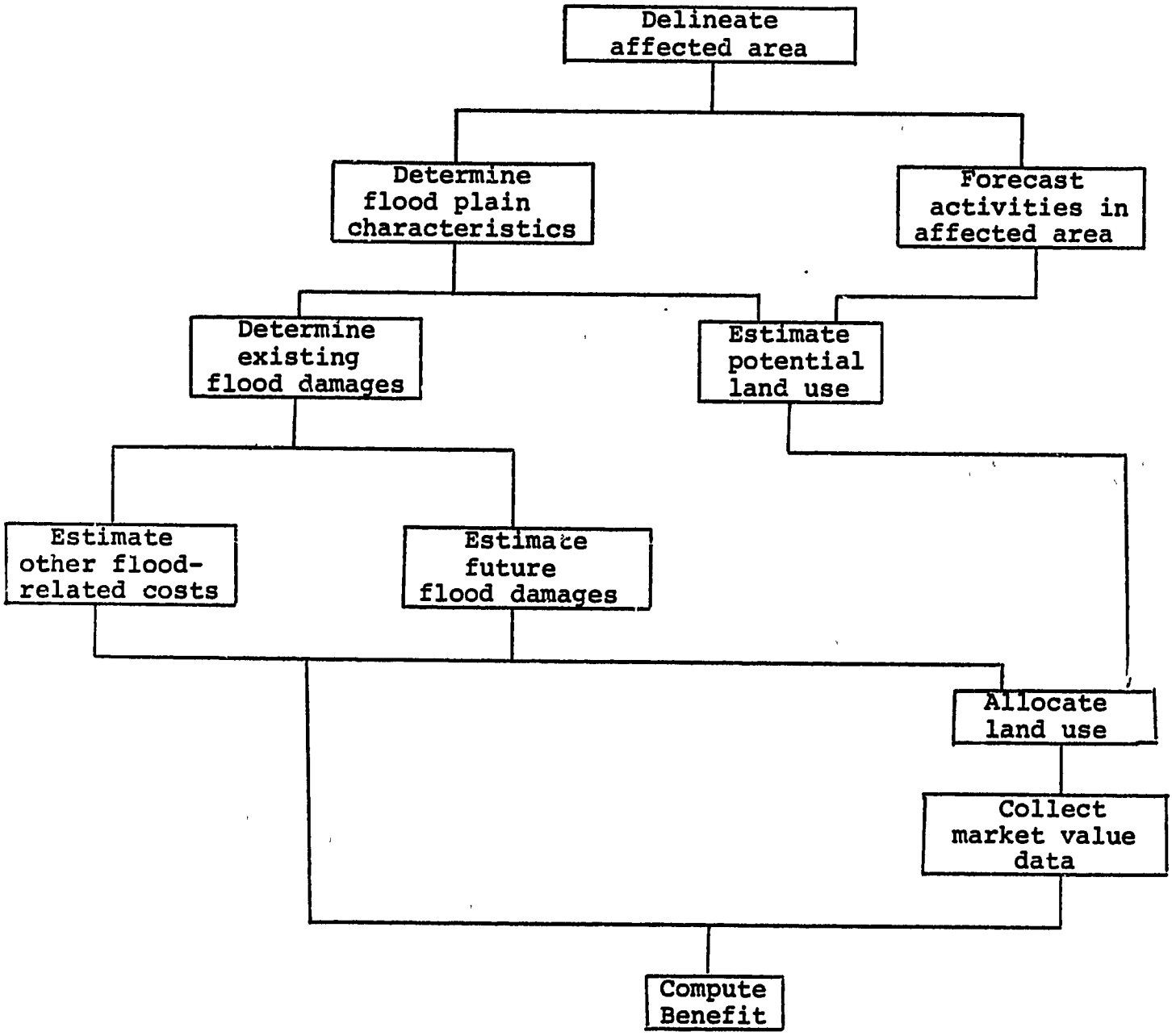
to occur under existing improvements, laws, and policies. The with-project condition is the most likely condition expected to exist in the future if a project is implemented. Consideration should be given to both structural and non-structural measures. Non-structural measures include:

- Reducing flood damage by land use regulation including redevelopment, relocation and acquisition policies, disaster preparedness, floodproofing, and flood forecasting and warning systems
- Reducing the adverse effects of flooding through flood emergency relief programs
- On-site detention of flood waters by protection of natural storage areas such as wet lands.

c. Evaluation Procedures

Figure VI shows the steps to be followed in computing flood control benefits. The level of effort expended on each step depends on the nature and circumstances related to the proposed improvement, and also on the sensitivity of project formulation and justification to further refinement.

Figure VI - URBAN FLOOD DAMAGE EVALUATION PROCEDURES



A brief elaboration of steps in Figure VI follows:

(1) Delineate affected area

This includes not only the flood plain but all areas affected by the proposed project.

(2) Determine flood plain characteristics

Describe characteristics that make the flood plain attractive or unattractive for land use demands; the characteristics of flooding such as depths, velocity, duration, debris content, frequency, and historical floods; natural storage features; existing water oriented transportation; physical characteristics such as slope, soil types and water table; and available services such as highways, railroads, power lines, water and sewerage facilities, and labor situation.

(3) Forecast activities in affected area

These include population, personal income, manufacturing, employment, and output. Indicate the basis for the projections.

(4) Estimate potential land use

This will be obtained by converting demographic projections to acres. The categories of potential land use need only be as detailed as necessary to establish benefits to be derived from the plan, based on the incidence of flood hazard.

(5) Allocate land use

The flood plain should not be used unless it has characteristics that give it significant economic advantage to the potential user over all other sites within the affected area. If such advantages exist, the planner shall determine whether they overcome potential flood losses, and costs of

flood proofing and related hazards.

(6) Determine existing flood damages

The basis for this determination shall be losses sustained in historical floods. Since these data are often incomplete they shall be supplemented by appraisals, use of area depth-damage curves, and an inventory of capital investment within the flood plain. Also, estimates of damages under existing conditions shall be computed for floods of magnitudes that have not historically occurred. Average annual losses shall be estimated by using standard damage-frequency integration techniques that relate hydrologic variables, i.e. discharge and stage, to damages and to the probability of occurrence of such variables.

(7) Estimate future flood damages

Future flood damages are the monetary damages to economic activities identified in Step 3 that might use the flood plain in the future in the absence of a project. This step shall be used iteratively with Step 5 to determine land use and associated damages for each future with and without project condition. A benefit-cost ratio for the project under existing conditions will be shown. If the ratio is greater than 1:1, the projection of future benefits may be derived in an abbreviated form unless it would distort the comparison of alternative projects. The

measurement of flood damages for future years will involve an estimate of the number and size of physical units that may be damaged, an estimate of the future value of these units, and the damage susceptibility of the units. Income losses may be projected to increase on the basis of the projected land use. Emergency costs shall not be projected to increase as a direct function of physical losses.

(8) Estimate other flood related costs

These other items include flood proofing costs of different activity-types and different flood hazard zones; and the cost of structures not used to full capability because of flooding, e.g., the first floor of a garden apartment may not be rented because of a flood hazard.

(9) Collect market value data

If land use in the flood plain is different with and without the project and the project results in raising the value to that of comparable flood free land, the benefit is the amount of this increase in value. If land use is the same with and without the project but more intense with the project, the determination of the increase in in income shall be based on the increased land values.

(10) Compute 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 reduction in flood proofing costs (Step 8), plus the restoration of land values (Step 9). If Step 5 indicates that land use is different with and without the project, the benefit is measured by the change in net income or market value of the flood plain land.

(11) Problems in application

The loss of income because of idle labor may be measured from the point of view of a firm or 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 clean-up and repair of damages.

4. Hydropower

a. Benefits

Benefit evaluations herein described include single purpose hydropower projects, the inclusion of hydropower in multipurpose projects, and expansion of existing hydropower plants. Simplifications of these procedures are permitted in cases of single purpose small scale hydropower projects (25 MW or less) proposed at existing dams and other facilities, or at undeveloped sites if no significant adverse environmental effects are encountered, and if

simplifications lead to adequate approximations of benefits and costs. The basis for evaluating hydropower benefits is the willingness to pay for the outputs of the project. Where energy from electric power plants is priced at its marginal cost, this price shall be used to calculate the willingness to pay. In the absence of such a direct measure of benefits, the resource cost of the most likely alternative will be used.

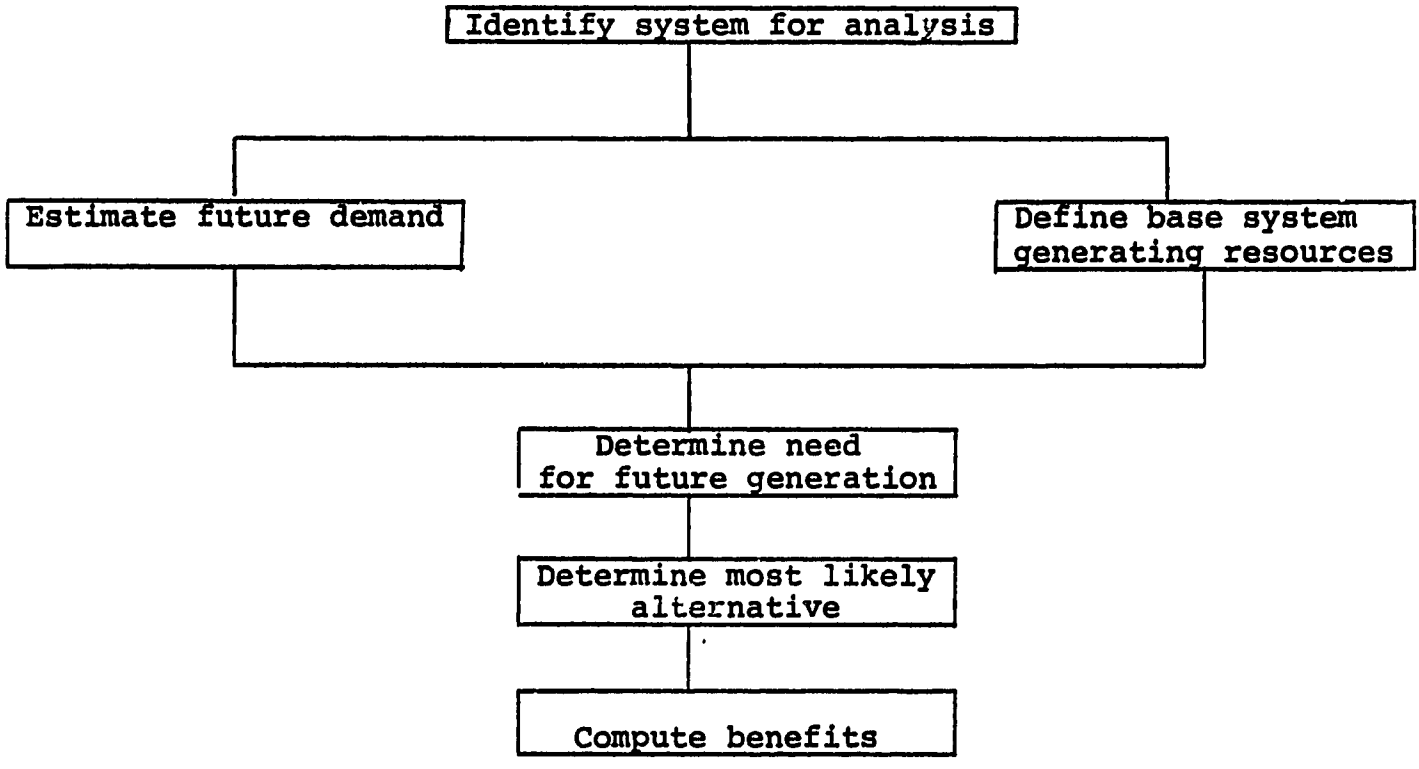
b. Planning Setting

Consideration shall be given to without and with project conditions. The without condition includes existing generating resources, and existing and reasonably expected future power system and water management contracts, treaties, and non-power river operating criteria. The with-project condition is the most likely future condition with the project installed and in operation. Alternative projects may include alternative combinations, sites, plant sizes, reservoir sizes; regulation and/or pumped storage; and reallocation of storage to increase firm energy output. Non-structural alternatives include reducing the level and/or time pattern of demand by time-of-day pricing, education programs, interregional power transfers, and increased transmission efficiency.

c. Evaluation Procedures

Figure VII shows the steps to be followed in computing hydropower benefits. The level of effort expended on each step depends on the nature and size of the proposed project and the likely effect of further refinement on project formulation and justification.

Figure VII HYDROPOWER EVALUATION PROCEDURES



A brief elaboration of the Steps in Fig. VII follows:

(1) Identify system for analysis

This is the area served by the power marketing agency to be supplied by the project.

(2) Determine need for future generation

Forecasts shall be made in terms of annual and monthly energy (including peak) demands. Load

forecasts should be made and analyzed by sectoral use (residential, industrial, agriculture). Load estimates should be made in increments of 10 years and shall account for system exports and reserve requirements.

(3) Define base system generating resources
Project future generating resources for the 10-year increments in Step 2 without the proposed plan or alternative plan. Retirement of older plants and reduction of output of plants due to age or environmental constraints shall be accounted for.

(4) Determine the most likely alternative
The alternative most likely to be implemented in the absence of the proposed project shall be selected. Consideration shall begin with the least costly alternative and justification must be provided if this one is passed over for a more expensive one. The alternatives 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 means that plant costs include equipment required to meet environmental quality criteria. National policy considerations include factors such as limitations on the use of oil, natural gas, and other fuels. If the most likely alternative is a thermal plant, the plant capacity costs such as amortized investment,

transmission, replacement, and fixed operating and maintenance, shall be used as a measure of the value of the hydropower project's generating capacity; and the thermal plant's energy costs, primarily variable O&M and fuel costs, shall be the measure of the hydro plant energy production.

(5) Compute Benefits

The NED benefits will be the costs of the most likely alternative measured on the following basis:

- All interest and amortization costs charged to the alternative shall be calculated using locally accepted interest rates

- Other assumptions and procedures used in calculating costs of the alternative shall parallel those used in calculating the costs of the proposed project

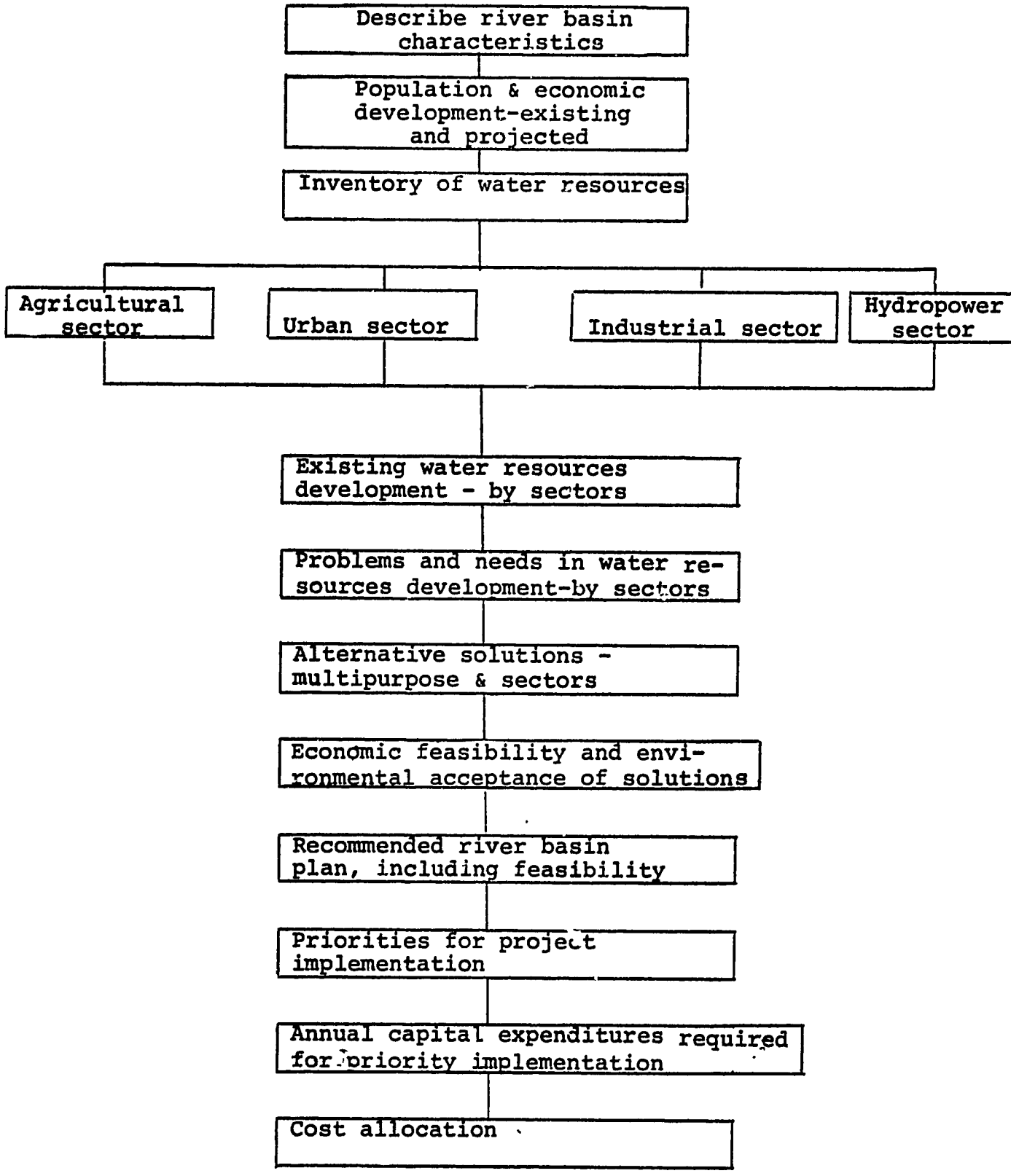
In cases where benefits will vary over the life of a project, such as in staged development, they shall be computed by appropriate time intervals and discounted to derive the annualized benefits. The evaluation shall reflect differences in the cost of transmission, distribution and other facilities compared to the mostlikely alternative. Appropriate credit may be given to hydropower projects to reflect their greater reliability and operating flexibility. Typically, the adjustment per kilowatt of capacity ranges

from 5 to 10 percent of the cost per kilowatt of thermal capacity. The dependable capacity of a hydropower project is based on the load carrying capability of the project under the most adverse hydrologic conditions and plant capabilities.

5. River Basin Development and Management, Including Small Comprehensive Basins

River basin development considers the existing, near future and long range aspects of water and related land resource utilization as related to the various economic sectors. It results in an integrated series of economically feasible and environmentally acceptable projects that are required to meet the short and long range needs of the basin. The evaluation of benefits and economic feasibility described in other sections of these procedures will be used in the analysis of water resources improvements for the agricultural, urban, industrial and hydropower sectors. A program showing priorities for implementing these projects is established including the annual capital expenditures required. Cost allocation to the various functions of a multipurpose project is in many cases an important consideration. Figure IX shows the various steps involved in this planning procedure.

Figure IX PROCEDURES IN RIVER BASIN DEVELOPMENT



A brief elaboration of the steps in Figure IX follows:

(1) Describe river basin characteristics

This will include boundaries, area, physiography and topography

(2) Population characteristics and economic development--existing and projected

This will include density of population, per capita income, employment status, and location or urban and agricultural areas in relation to water resources

(3) Inventory of water resources

Describe the climate, seasonal precipitation, run off characteristics, frequency of floods and droughts, groundwater potential, and stream flow average and extremes at critical locations.

(4) Existing water resources development by sectors

This will include projects under construction, seasonal use and deficiencies.

(5) Problems and needs in water resources development by sectors

This will include potential development needed to meet projected population and economic increase and its effect on the economy, environment, health and culture.

(6) Alternative solutions - multipurpose and by sectors

This will include non-structural as well and structural solutions.

(7) Economic feasibility and environmental acceptance of alternative solutions

Methods for the evaluation of benefits and economic feasibility for proposed projects in river basin developments involving water resources improvements to agriculture, soil conservation, municipalities, industry, and hydropower, and to the control of flood waters are described in other sections of these procedures. Methods of evaluation of environmental, and health and cultural effects are described in Appendices 4B and 4A of Handbook 3.

(8) Recommended river basin plan, including feasibility

This may include fulfillment of all desired objectives or a partial solution. Generally, the preferred solution is one that has the least cost and provides the most favorable effects to the economy, environment, and well being of the beneficiaries.

(9) Priorities for project implementation

These will be determined by the amount of capital that is available from both local and outside sources, and the critical nature of the needed improvement as viewed by the occupants in the river basin.

(10) Annual capital expenditures required for priority implementation

This will show the annual expenditure for capital improvements over the period of project implementation. For a complete picture of required funds

annually, the estimated operation maintenance and replacement expenditures also will be shown.

(11) Cost allocation

Allocation of cost to each sector improvement should be made using procedures described under section G. - Cost Allocation.

6. Soil and Water Conservation

a. Benefits

Benefits from soil and water conservation projects are measured as the increased value of agricultural output or the reduced cost of maintaining a given level of output. The benefits include reductions in production costs, in associated costs, in damage costs from floods, erosion, and sedimentation; and in the value of the increase in crop production.

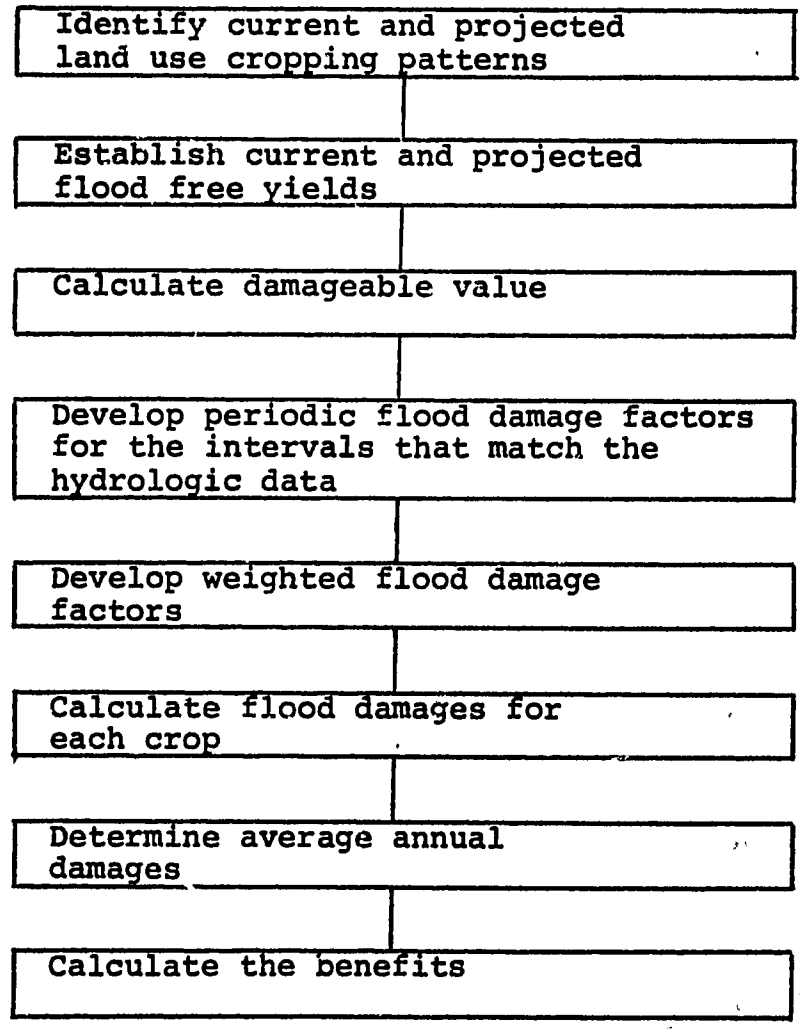
b. Planning Setting

The net return based on fixed factors of production shall be determined for various conditions or levels of land use. The level of use to be evaluated initially is the without project condition. Other levels of land use will depend on the number of alternative projects selected for analysis. The difference in net income between each of the alternative projects and the without-project condition is the benefit.

c. Evaluation Procedures - Benefits from Flood Prevention to Crops

Figure VII is a flow chart of these procedures:

Figure VII - EVALUATION OF FLOOD CONTROL BENEFITS TO PRODUCTION



A brief elaboration of the foregoing steps follows:

(1) Identify current and projected land use cropping patterns

This is generally developed for flood plain reaches that represent segments of the flood plain with significantly different cropping patterns and/or hydraulic characteristics.

(2) Establish current and projected flood-free yields

These are yields in the flood plain during years that no flood occurs based on information generally from flood plain farmers.

(3) Calculate damageable value

Determine the gross value of the flood-free yield for each crop. This will be the value to which flood damage factors are applied.

(4) Develop periodic flood damage factors for the intervals that match the hydrologic data

Gather historical flood damage information from flood plain farmers, including areas flooded, flood depth and/or duration, yield reduction, added expense due to the flood, production costs saved on the flooded crop, and substitute crops and their yields. Crop damage shall then be computed for a given flood depth and/or duration; including such items as value of yield reduction and quality

reduction of flooded crop, added expenses on the flooded crop, production costs saved, and net return from a substitute crop. A damage factor value for a given depth or duration shall be computed by dividing the crop damage for each interval, and for each depth and or duration, by the damageable value for that crop. If insufficient data are available in a given project area to develop damage factors for all intervals, crops, depths or durations, data from other floodplains in the region or proxy values generated by using crop budgeting techniques may be used.

(5) Develop weighted flood damage factors

Each flood damage factor for a given crop and a given flood depth or duration shall be applied to the historical probability of floods occurring during the particular interval. This probability is usually calculated from stream gauge analysis. The sum of products from these calculations represents a weighted flood damage factor.

(6) Calculate flood damages for each crop

Flood damages shall be computed for a given flood depth or duration for each crop by multiplying the yield, price and damage factor percentage. A composite acre consisting of a mix of various crops within a flood plain reach expressed in percentages may be used.

(7) Determine average annual damages

Damage factors can now be integrated with hydrologic data, i.e., flood frequency, acres flooded, flood depth or duration, to determine average annual damages.

(8) Calculate benefits

In the case of a structural improvement, the reduction of damage is the benefit. For a non-structural plan that removes a given land use from the flood plain, the benefit is the cost saving to other economic sectors plus the net returns to the new use of the land.

d. Evaluation Procedures - Benefits from Erosion Prevention

Erosion is generally classified as gully, streambank, flood plain scour and sheet erosion. Factors pertinent to the evaluation procedure include type of problem, extent of area, projected rate of change of affected area, present and future impacts on soil productivity, and potential for and projected rate of recovery. This information shall be developed for relevant time periods as required to reflect the dynamic nature of the problems.

(1) Benefits from reduced gully and streambank erosion

These benefits accrue from a reduction in the destruction of land, reduced production losses

on adjacent areas, and efficiency gains on interdependent areas. Production losses on adjacent areas may be caused by a lowering of water tables, increased cost of production due to irregular field patterns, etc. Efficiency gains result from providing a stable outlet for land treatment measures upstream, thereby permitting more intensive farming operations. Benefits are determined by annualizing projected net income flows over the evaluation period with and without the project.

(2) Benefits from reduced flood plain scour and sheet erosion

Scour and sheet erosion are related to the depth and velocity of the flood water and the resistence of soil to erosion. Determination of benefits follows the same procedure as for gully and streambank erosion with the exception that net income flow will allow for recovery of productivity. Adjustments of inundation damages to crops may be necessary if flood plain scour and sheet erosion damages have been evaluated for the same area.

e. Evaluation Procedure - Benefits from Sediment Reduction

Sediment damages occur from overbank deposition of infertile soils, impairment of drainage systems, and channel filling. Benefits shall be computed as the difference in net income with the project that would

prevent sedimentation compared to without the project.

f. Evaluation Procedure - Flood Control Benefits from Other Agricultural Properties

The evaluation of benefits from the prevention of flood damage to improvements in the flood plain such as buildings, equipment, and irrigation structures generally will follow the procedures described for evaluation of flood control benefits - urban. Damage resulting from interruption of irrigation deliveries should be included in this item.

g. Evaluation Procedure - Benefits from Protecting Other Affected Properties from Erosion and/or Sedimentation

Benefits from protecting roads, bridges, fences, buildings, etc. against erosion shall be based on a depreciated current replacement cost discounted to present worth. Benefits shall be determined as the difference between with-project conditions and without-project conditions. Average annual sediment damages shall be determined by adding the costs of removal of 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 a reservoir is another type of sediment-reduction benefit. The extension shall be discounted to current values and amortized over the project life.

G. COST ALLOCATION

1. General

Cost allocation is the process of apportioning financial costs among purposes served by the recommended project. Purposes include benefit categories other than external economies and use of otherwise unemployed or under-employed labor resources. All purposes are to be treated comparably. Financial costs may differ from NED costs since they may include transfer payments that exclude associated costs and external diseconomies (indirect adverse effects).

2. Basic Concepts

The separable cost for each purpose in the project is the reduction in cost that would result if the purpose were excluded from the project. This reduction in cost includes:

- The cost of facilities and activities that serve only the excluded purpose
- Reductions in the cost of facilities and activities serving multiple purposes

The joint cost for a multiple purpose project is the total cost minus the sum of all separable costs. The remaining benefit for each purpose is the amount, if any, by which the NED benefit or, when appropriate, the alternative cost exceeds the separable cost for that purpose. Alternative cost for each purpose is the financial cost of

achieving the same or equivalent benefits with a single purpose project. The use of alternative cost is appropriate when:

- A purpose generates more than incidental or complementary EQ benefits; or
- Alternative cost for the purpose is less than the NED benefit

3. Cost Allocation Procedure

Cost allocation to each purpose is the separable cost for that purpose plus a share of the joint cost determined in one of the following ways:

Joint cost may be allocated among purposes in proportion to the remaining benefits. This so-called "separable costs-remaining benefits" method consists of the following steps:

(a) Estimate the NED benefit for each purpose

(b) Estimate the separable financial cost for each purpose

(c) Determine the remaining benefits for each purpose

(d) Determine the joint cost

(e) Allocate the joint cost among the purposes in proportion to the remaining benefits

(f) Determine the total allocation to each purpose by adding to the separable cost the allocated share of the joint cost

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

If the joint cost is larger than the sum of the remaining benefits, the allocation to each purpose is determined by:

(a) The larger of the separable cost for that purpose or the NED benefit for that purpose; or

(b) An additional share of the cost assigned by the project planner

4. Other Methods

An exception may be made to the use of the above prescribed methods if, in the judgement of the project planner, they yield unreasonable results. Such an exception and the reasons for it, should be documented, and the alternative method together with its advantages over prescribed methods should be described.