

TECHNICAL NOTE

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SOIL CONSERVATION SERVICE  
U.S. DEPARTMENT OF AGRICULTURE

## PROJECT PLANNING FOR WATER QUALITY

### Introduction

The opportunity for the Soil Conservation Service to provide assistance to our nation in the inventory, planning, and application of soil and water conservation practices to improve water quality is not new. SCS has provided assistance to reduce the effects of sediment in water ever since it was established. Awareness of this water quality activity is important because sediment is not only one of the major types of agricultural nonpoint sources, but also the largest pollutant by volume. Sediment is a basic water quality indicator that is used to estimate the loadings of adsorbed, nonsoluble agricultural pollutants. SCS concerns for other agricultural nonpoint source pollutants (pesticides, nutrients, animal wastes, and salinity) are not quite as old, but they are far from new.

Now, there is increased SCS interest in providing assistance to problems of agriculturally affected water quality because of new federal and state legislation. SCS project assistance will not be based on the mere satisfaction of the legal impact of such legislation because these individual problems will be individually satisfied in and of themselves. SCS project assistance will be available to identify and solve water quality problems of a broader public concern. This technical note provides concepts that will aid SCS planners to properly and formally inventory, analyze, plan, assess, and appraise soil and water resources to help state governments meet their water quality goals.

### Formal Planning Guidance for Water Quality

A project planned by SCS to alleviate water quality impairment is considered a Federal water and related land resources project plan. The formal planning steps are required by the Water Resource Planning Act, as amended (42 U.S.C. 196221-2). Compliance with this Act will, therefore, require the use of Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (1983). These Federal guidelines, provided by the Water Resources Council were implemented by Executive Order 11747 in 1983. This familiar guidance, less formally referred to as Principles and Guidelines, in concert with the appropriate manuals and instructions for individual SCS programs are operational directions for water quality project planning. This note may informally reference Principles and Guidelines (P&G) or the appropriate SCS program manual.

### State Role in Management of Water Quality

The management of the surface waters of the United States is generally a function of the state government. Exceptions to state jurisdiction may be associated with Federal, territorial, or Indian tribe control, although they would function in a similar manner to states.

Water management is related to state law through water quality standards. These standards provide criteria for water use designation, goals for water quality, and management information. The state manages its waters through the activities of its state water quality management agency and the quality of these waters are its legal concern. Any modification of water quality

by an SCS activity (or for that matter, any other entity) is subject to state review. Therefore, inclusion of the state water quality management agency in planning activities that affect water quality would be an efficient planning step. SCS planning groups should develop a strong working relationship with this state agency in implementing the water quality planning process.

**Ground-Water Applications**

This note addresses planning for improvement of surface water quality. Its concepts could also be used for ground water problems if the planning program allows such an assistance purpose. Such an application would consist principally of substituting an aquifer for a stream reach in the definition of a resource problem when using this note.

**Contents of the Note**

The basic structure of this note consists of three tables that provide guidance in the water quality planning process. Its application assumes that the planner will follow the six major steps of the planning process (Principles and Guidelines, chapter I, section 1.3.2, page 2). Chapter III of Principles and Guidelines, Environmental Quality (EQ) Procedures, will directly be applied in using this note. Environmental documentation for the project is to be prepared in accordance with CEQ and SCS Regulations (40 CFR 1500-1508 and GM 190-410) and the appropriate SCS planning manual.

Table 1 is a step-by-step description of the Principles and Guidelines planning process as it might be applied to a project that has a water quality problem. The steps in the table follow the Principles and Guidelines planning steps. Flow charts are included (figures 1 through 5) which illustrate the flow of the planning process concentrating on a water quality purpose. Each box on the flow chart is numerically keyed to the step-by-step description in table 1.

Table 2 lists, by planning step, the documentation needed for water quality planning. These documents include reports that are part of the inventory and analysis, contributions to the case file, correspondence with interested agencies and groups, and narratives written specifically for or in support of the formal planning documents (plan, EIS, EA, FONSI, ROD, etc.). The National Watershed Planning Manual was used as a guide in preparing this table, because PL-566 usually requires the most documentation detail for projects of SCS programs. The amount of documentation detail in any plan must respond to the scope and intensity of the project.

Table 3 is a listing of steps in water quality assessment and planning that might be adopted in preparing a plan of work. The format for this table, in the same manner as in the other tables, follows the Principles and Guidelines planning steps. These steps might be modified to describe the project area, the appropriate methodologies and assumptions to be used in planning studies, personnel needs, and direct costs that would be used in a plan of work.

## TABLE 1 - PROJECT PLANNING FOR WATER QUALITY

The following steps may be used in planning for water quality in an SCS project. They match the boxes of the flow charts which are figures 1 through 5 of this technical note.

## STEP 1 - Specify Problems (see figure 1)

1. Determine the classified water uses that have been designated by the state water quality management agency for stream segments which occur in or are affected by the project area. The use classifications are part of the state water quality standards.

2. Determine the water quality of the stream segments through literature, consultation with the state water quality management agency, or measurements. Data sources may include STORET and WATSTORE, state data bases, evaluations by the state water quality management agency, sampling and assessment by SCS or other agencies, forecast of quality based on land features, and various types of measurements and observations.

3. Determine if a problem exists by comparing water quality determined in step 1-2 with the criteria for the water uses defined in step 1-1. If the designated water uses are met, there is NOT a water quality problem. The state water quality management agency should concur with this finding. Special treatment may be required if the future without action forecast, projected during the environmental evaluation, predicts that a water quality problem will occur later in the evaluation period.

4 and 5. If no water quality problem exists, prepare a file document that compares the water quality of stream segments in the project area with their classified uses. This document could be part of a case file that identifies the designated stream uses and contains copies or summaries of diagnostic water quality data. Information in the file would indicate that there are presently no water quality problems because all designated uses are met. The findings would be shared with other planning team members and the state water quality management agency.

6. If a water quality problem exists, prepare a file document which compares the water quality and classified uses designated by state standard for the streams in the project area. This document could be part of a case file that contains a statement of the designated uses and copies or summaries of diagnostic water quality data. A report interprets the findings and indicates which uses are not being met, why they are not being met, where they are not being met, the substance and area of affect that is causing the water quality impairment, and if the substances come from agricultural nonpoint sources. The concurrence of the state water quality management agency should be obtained before completing this step.

7. A list of work items is prepared for the plan of work (POW) to detail the inventories, analyses, forecasts, alternative formulations, and appraisals that are needed to complete all planning steps. The techniques to be used in the inventory and forecast (see Principles and Guidelines, page 104), the time required for completion of the studies and analyses, and who will do the work should be specified.

# PROJECT PLANNING FOR WATER QUALITY

## STEP 1 - SPECIFY PROBLEMS

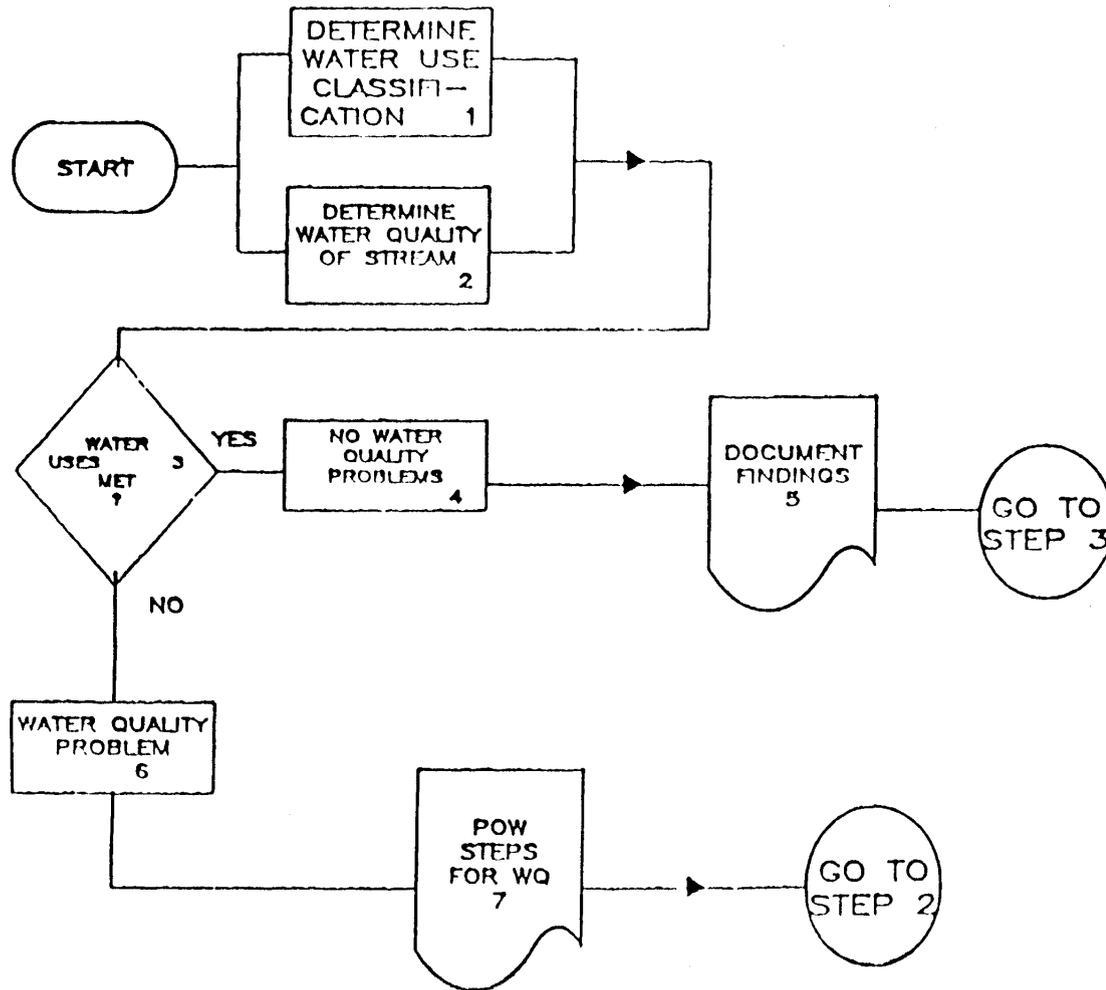


Figure 1--Tasks Used To Determine Water Quality Problems Under Principles and Guidelines

## STEP 2 - Inventory and Forecast (see figure 2)

1. The sources of substances (sediment, animal waste, pesticides, nutrients, or excessive salts) that are causing water use impairment in the project area are inventoried. These substances must come from a source that SCS (or an agency that is cooperating with SCS in project planning) has authorization to treat in order to continue water quality planning as part of the project. The contributing locations of each source should be identified. These substances would generally be an agriculturally derived NPS pollutant to be a target for SCS action.

2. A framework is defined to evaluate the quality of the water resource (see Principles and Guidelines, page 112) characterizing the key polluting substance(s). Parameters used to define the suitability for the classified water use could include trophic state or toxic limit for a chemical. All of the parameters that are used as indicators must have specific units of measure. These units of measure will be used to define water quality during problem definition, inventory and forecast, project formulation, and the balance of the planning steps. Yields (or loadings) of key substances should be estimated by location in the project area. These estimates will quantify the water quality in the classified stream segments. Stream segments where water uses are impaired or where new beneficial water uses might be expected because of the project will become the focal points in planning.

3. Define a budget for key types of pollutant and use the measurement framework to relate substance sources to present land use and management activities. For example, if phosphorus is a key pollutant, a budget is estimated to locate where sources of this nutrient cause water use impairment. The relationships of the key indicator(s) between source and load are determined. A loading or yield level for the key polluting substance(s) should be estimated, in appropriate units of measure, that will provide an objective for formulation of alternative plans for water quality improvement (step 3). The assistance and concurrence of the state water quality management agency should be maintained in completing all of the activities of this planning step.

4. Forecast future water quality conditions without project action by key substance(s) for the evaluation period of the project being planned. These forecasts are frequently based on projections of future land use and management activities that are being made for the project area.

5. Document the measurements, analyses, and forecasts of water quality. This case file may take almost any format and include computer outputs from models, loose-leaf binders, correspondence, trip reports, reports from the state water quality management agency, and fully documented inventory reports. The documentation should be so complete that a scientist or engineer with suitable background will be able to understand the methodologies used in the analyses, findings of the inventory, analyses of sources and pollutant yields, and the bases of the forecasted water quality.

6. Draft narratives should be prepared that will describe the findings, methodology, and analyses used in the inventory and forecast. These narratives could be used in sections of the preauthorization planning report, environmental assessment, investigation and analysis documentation, FONSI and Records of Decision. The narrative may be general for use as a reference in a planning document.

# PROJECT PLANNING FOR WATER QUALITY STEP - 2 INVENTORY AND FORECAST

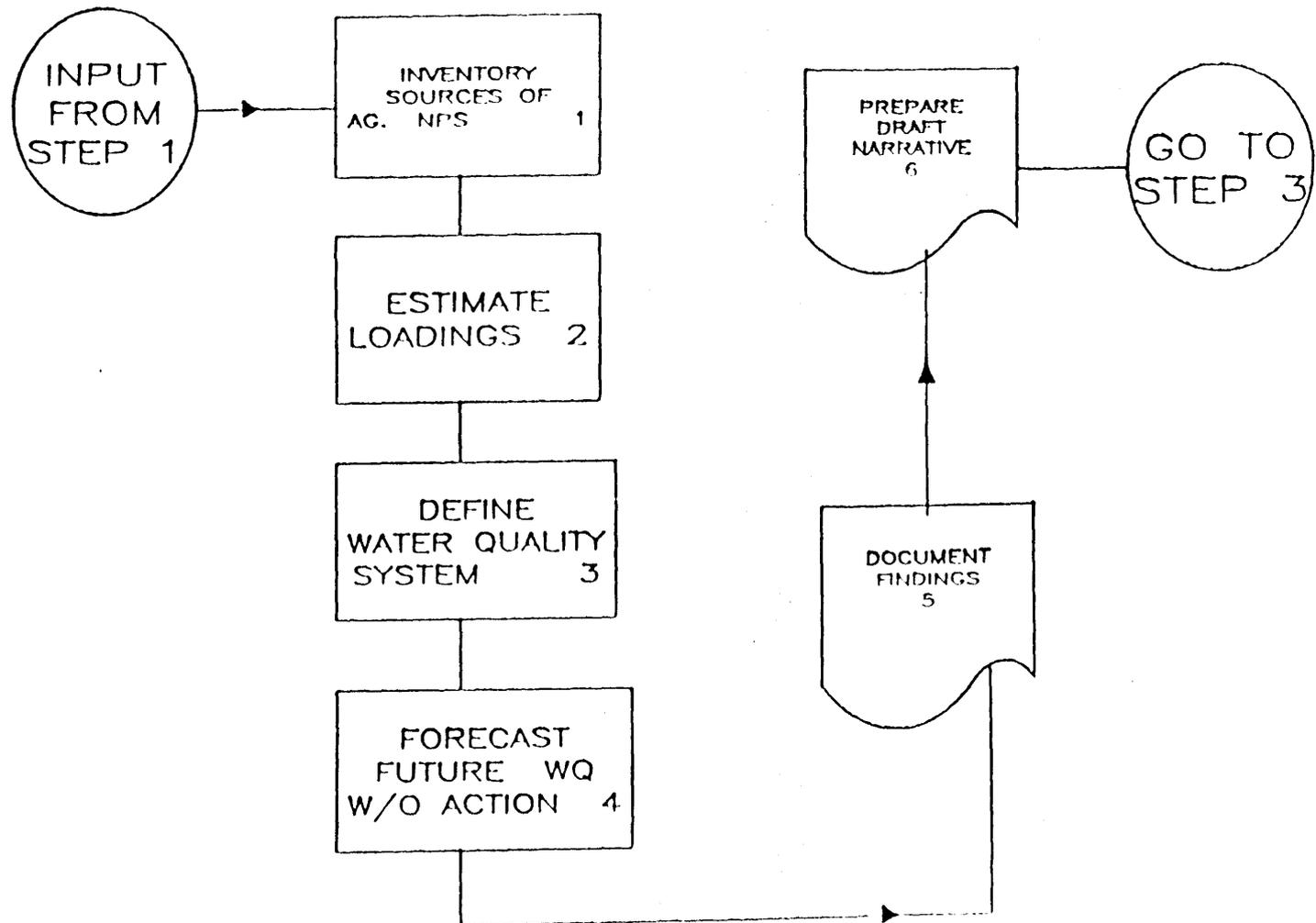


Figure 2--Tasks In The Inventory and Forecast Of The Quality Of The Water Resource

**STEP 3 - Alternative Formulation (see figure 3)**

1. Determine if opportunities exist to support a beneficial water use, not presently designated as one of the classified uses by the state water quality management agency, as a desired purpose for a project action. This determination is frequently conducted as part of step 1. If no additional water uses are desired, continue with step 3-4 described below.

2 and 3. Determine if the present water quality is suitable for a new beneficial use by using methods similar to that described in step 1-2. If present water quality is suitable to support the desired water use and there are no other water quality problems or opportunities that require formulation, authorized actions may be directly formulated to address this new water use in step 3-8. Otherwise, the planner would proceed to step 3-4.

4. Goals that reflect the level of water quality required to meet the desired use or remove the impairment are set in coordination with the state water quality management agency and the water quality management plan of the state. These goals should be set in terms of the water use impairing substance and reflect the measurement framework used in the inventory and analysis.

5. Determine if there are practices or structures that the SCS or agencies cooperating in the action can use as elements to solve the water quality problems. These elements would be vegetal, structural or management practices that may serve as BMP's. If there are no elements that can be used to respond to the water quality problems or opportunities, this planning purpose could be abandoned.

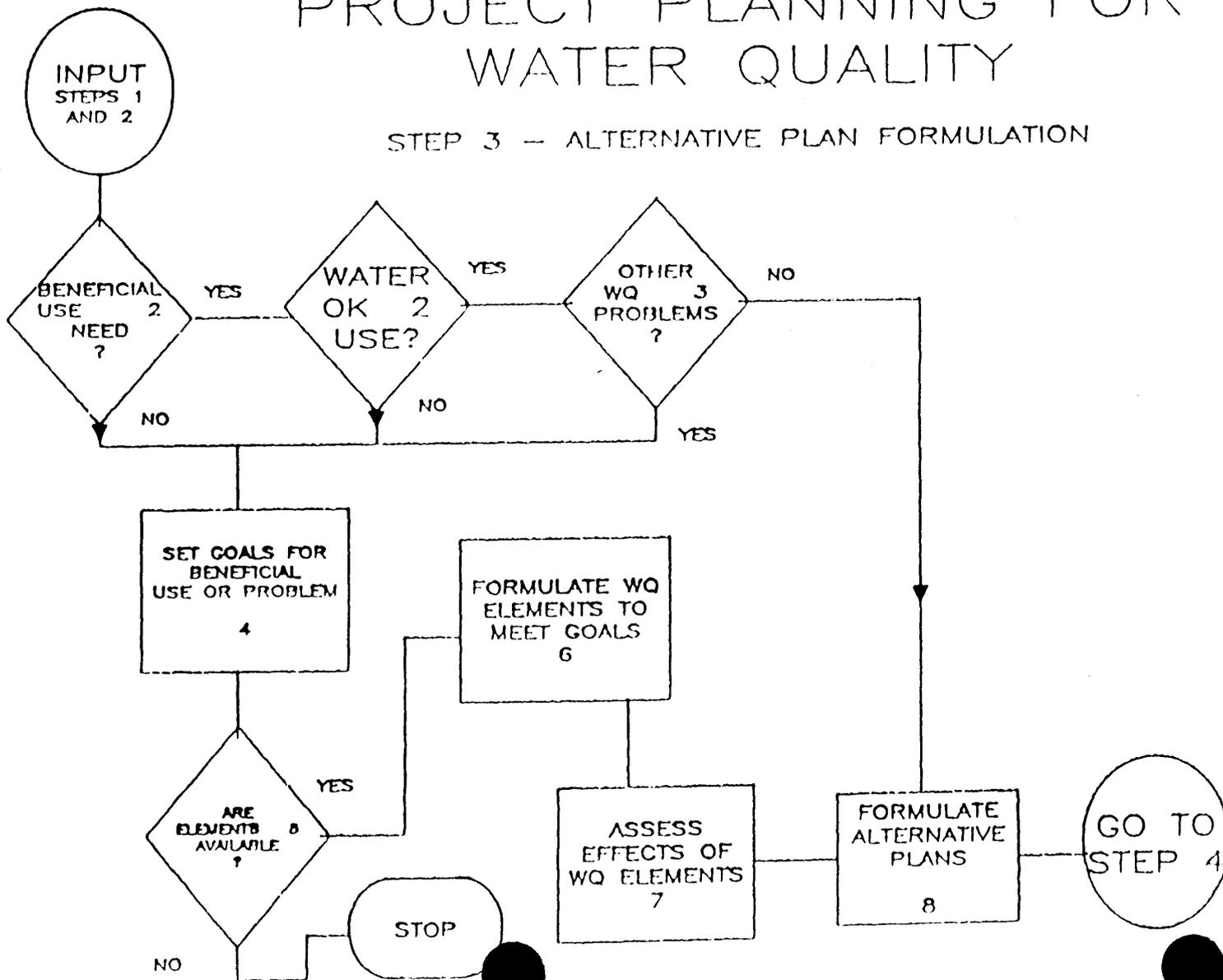
6. Formulate land treatment systems or structures that will address the water quality problems or provide the water use opportunities defined in steps 2-2, 2-3, 2-4, and 3-4. The practices would become elements of alternative plans that will meet the goals for pollution reduction defined in step 3-4.

7. The ability of the individual elements, BMP's, land treatment practices and systems, or structures to solve the water quality problem is assessed.

8. Water quality elements are combined to form alternative strategies (plans) that will meet the water quality goals defined in step 3-4. The effects of these combinations are defined relative to water quality goals. Alternative plans are then formed by linking elements for all project planning purposes. These combinations of water quality elements and elements formulated to solve other resource problems become the alternative plans for the project. Generally there would be at least three alternative plans; no action, the NED plan, and the resource protection plan (RPP) to alleviate the water quality problem.

# PROJECT PLANNING FOR WATER QUALITY

## STEP 3 - ALTERNATIVE PLAN FORMULATION



#### STEP 4 - Evaluate Alternative Plans (see figure 4)

1. A determination is made as to whether a water quality purpose for the plan is still feasible and desirable now that inventory, forecast, and formulation of alternatives have occurred. If the alternative plans are not feasible or adequately responsive to the four Principles and Guidelines criteria (chapter 1, section VI, 1.6.2(c)), the purpose may be dropped and plan elements for water quality deleted. The effects of other elements of alternative plans on water quality must still be evaluated. If the water quality purpose of the project is to be terminated, the planner may proceed to step 4-4.

2. The ability of each alternative plan to meet water quality planning goals is assessed in terms of the reduction in the yield or loading of key substance(s), or beneficial changes in the units of measure of the indicators.

3. The costs and benefits of the water quality elements and of each alternative plan is determined. This data will help test the alternative for economic efficiency and cost effectiveness before reaching step 4-5.

4. When the potential action does not have a water quality problem, each of the alternative plans is evaluated in terms of key substances, water quality parameters, and their units of measure. Commonly, an evaluation in terms of the percentage reduction of sediment and agricultural chemicals is estimated. Costs and benefits of the alternative plans for other purposes (watershed protection, flood prevention, etc.) are also evaluated before proceeding to step 4-5.

5. Each alternative plan, composed of elements that address all planning purposes, is evaluated for its total effects--economic, social, and environmental. The relative ability of alternative plans to respond to all environmental and economic concerns is determined. Evaluation of water quality effects are a part of this determination.

6. Files are documented for all the activities undertaken in planning steps 3 and 4. A brief narrative (file summary) may be prepared that presents the relative ability, benefits, and costs of each alternative plan to respond to water quality concerns even if there is not a water quality purpose. This narrative may be adopted for use in formal planning documents.

#### STEP 5 - Comparing Alternative Plans (see figure 5)

1. A comparison is made of the combined effects of each alternative plan with regard to all purposes and resources. Data developed for this analysis will support the descriptions of alternative plans required in NWSM, section 508.37(c) and (d) and the table "Summary and Comparison of Candidate Plans."

2. The relative ability of the NED and other alternative plans to maintain or improve water quality should be appraised and compared along with the other costs and benefits of each plan. This comparison and appraisal will lead to a recommendation of the best alternative plan to improve water quality.

# PROJECT PLANNING FOR WATER QUALITY

## STEP 4 - EVALUATE ALTERNATIVE PLANS

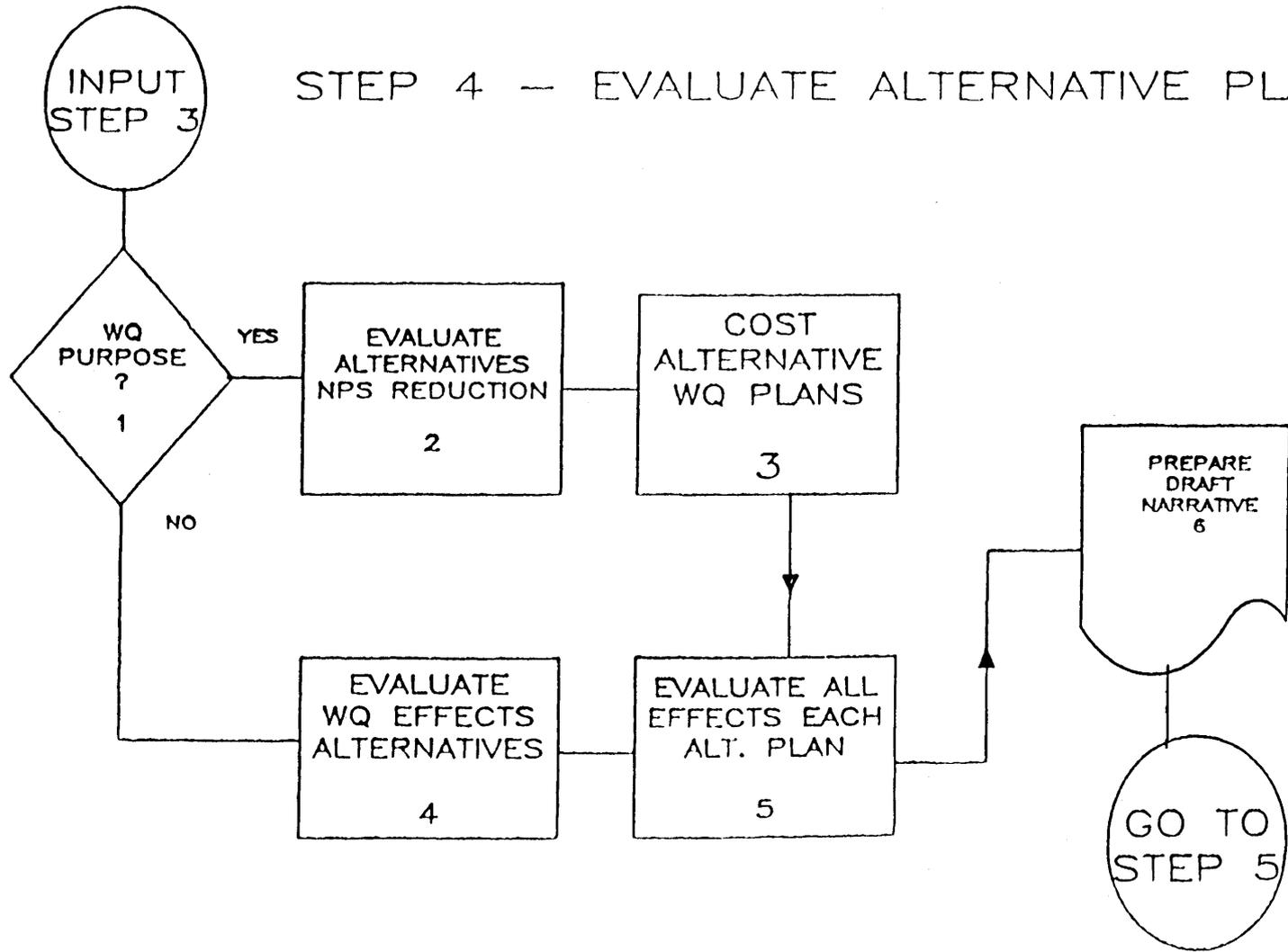


Figure 4--Tasks Used To Evaluate the Effects Of Alternative Plans On Water Quality

3. A narrative is drafted that describes the best alternative plan in terms of the project's water quality goals. The narrative should contain information that may be used to meet the needs of the plan section required by NWSM, section 508.37(g). If the best alternative plan to improve water quality is not the NED plan, data is provided, as required by NWSM, section 504.05(b), describing why another plan (such as the resource protection plan) is superior. This narrative should contain information that might be included in the investigations and analysis section of the documentation, including the tables required by NWSM, section 511.14(b). If there is not a water quality purpose, the narrative should address the effects of alternative plans to protect or improve water quality. The potential to increase the level of classified water uses would be included where appropriate.

STEP 6 - Selecting Recommended Plan (see figure 5)

1. Prepare a narrative to provide data for project plan section required by NWSM, sections 508.38(c), (f), (g), (h), and (i), and 508.39. The narrative describes the impacts of water quality elements of the recommended plan. It also addresses the impacts on water quality of installing plan elements that address other purposes. If structural elements create impoundments, their water quality should be forecasted. It may be appropriate to prepare these narratives as drafts of sections of the project plan/EIS or EA.

2. Draft a formal appraisal of the effects of the selected plan on water quality, following the completion of the plan review process, that will provide data for the preparation of a record of decision (ROD or FONSI).

# PROJECT PLANNING FOR WATER QUALITY STEPS 5 AND 6 – COMPARING ALTERNATIVE PLANS AND SELECTING RECOMMENDED PLANS

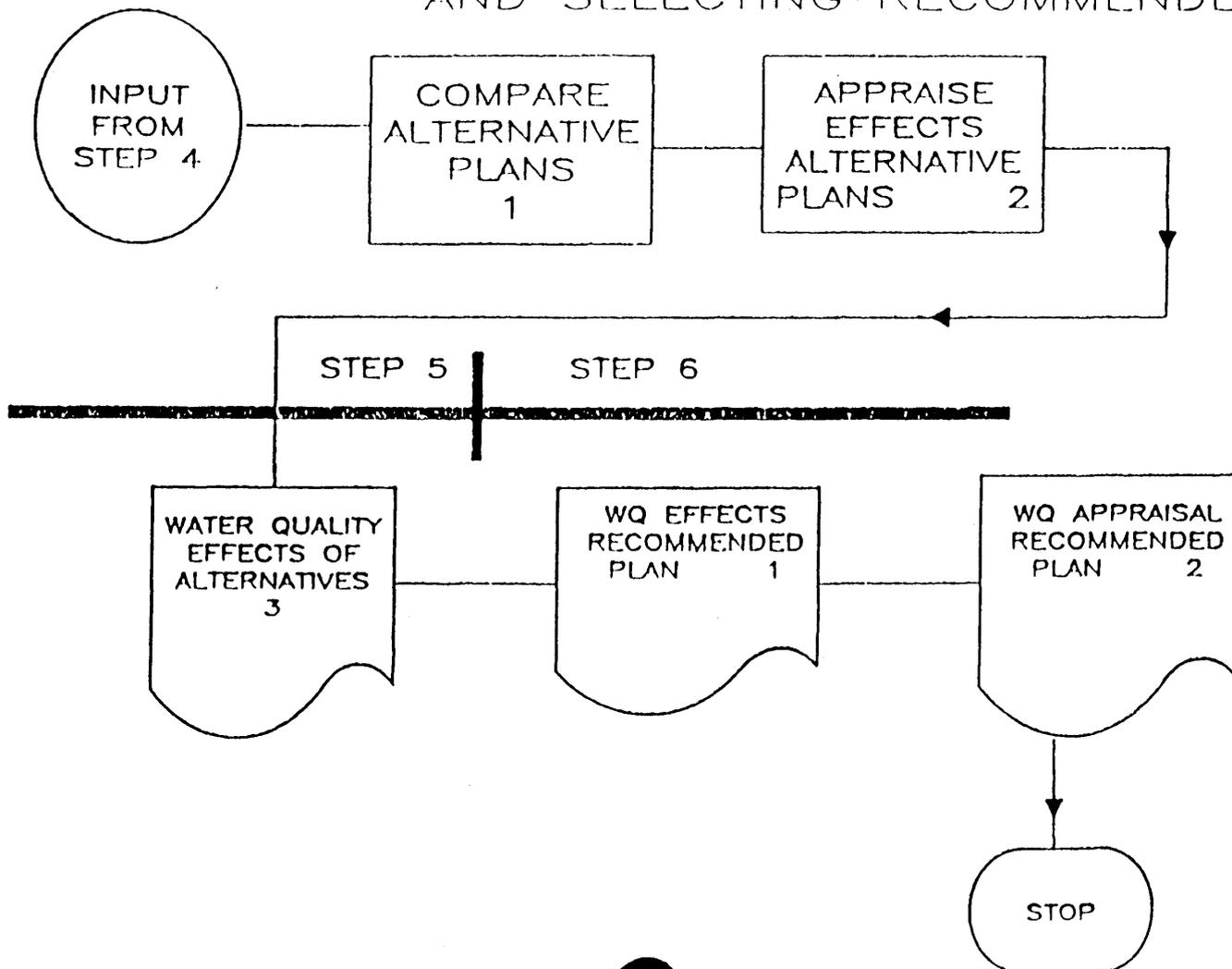


Figure 5--Tasks Related To Water Quality that Are Used To Compare Alternative Plans And Select A Recommended Plan

TABLE 2 - DOCUMENTATION NEEDS IN WATER QUALITY PLANNING

List of documents needed for steps in planning, analysis, evaluation and appraisal of projects with a water quality purpose.

#### STEP 1 - Specify Problem

1. List of classified water uses by stream segment of the study area that have been designated by state statutes (standards).
2. File document identifying present water quality of the streams in the study area. The document might include existing background measurements and observations. Data to be included are interpretations of whether uses are being met, potential for additional beneficial uses, location of water quality problems and sources of agricultural NPS and other pollutants, and letters documenting planning coordination with the state water quality management agency.
3. List of investigations and analyses to assess water quality in the study area that will become steps in the project plan of work.

#### STEP 2 - Inventory and Forecasting.

1. A case file of the analysis of water quality including the identification of polluting substances, key parameters used as indicators and units of measure. Analyses should quantify sources, problem locations, and the relative contribution of various pollutant sources by the key substance(s). The study should use existing information where appropriate and be augmented by measuring and modeling techniques. Loading budgets for each of the key parameters should be developed. Water quality interpretations should be targeted for the project area and other reaches where a water use is impaired or an activity dependent on water quality will occur. Key substance loading or yield estimations should provide a base for the forecast of water quality for the future without action condition.
2. Water quality forecasts for the future without action condition.
3. List of decisions made regarding the methodologies used in the investigations and analyses and how they are to be documented.

#### STEP 3 - Alternative Formulation

1. A set of goals that must be met to meet a water quality purpose or opportunity.
2. A case file in which vegetal, structural, or management practices that will become BMP's are formulated to respond to the water quality goals. Provide a description of the measures to be analyzed that can be used directly or provide support data for the alternative plans narrative of the planning documents. This document is a continuation of the case file that assesses water quality and is noted in above steps 1-2 and 2-1.

#### STEP 4 - Evaluate Alternative Plans

1. A case file in which groups of practices, formulated in step 3 (see figure 3), are combined into alternative plans to address water quality.

These water quality plans are evaluated for cost and effect and combined with alternatives formulated to address other purposes. These alternative plans, for all purposes, are then fully evaluated for all economic, social, and environmental impacts. Description of these plans should be complete enough to be used as a reference for a narrative responding to NWSM, section 508.37(b).

#### STEP 5 - Comparing Alternative Plans

1. A case file document that compares the impacts of all alternative plans with regard to water quality goals. These data should include a description of the elements of each alternative plan when there is a water quality purpose. If there is not a water quality purpose, only the water quality effects of each alternative plan need to be defined. The total social, economic, and environmental effects of each alternative plan is integrated. The beneficial and adverse effects on water quality of each alternative plan are to be appraised as part of this documentation. Recommendations as to which of the alternative plans is best for water quality should be included.

#### STEP 6 - Selecting Recommended Plan

1. Background documentation for the case file should be prepared that fully identify and quantify the impacts of practices used to improve, maintain, protect, or restore water quality of the recommended plan. If there is no water quality purpose in the proposed action, the impact on water quality of the recommended plan for other purposes will be quantified. The documentation would include the results of appraising the effects on water quality of the proposed action as direct aid to the decisionmaker in deciding whether or not to implement the action.

## TABLE 3 - WORK QUALITY ASSESSMENT TASKS FOR THE PLAN OF WORK

## STEP 1 - Specify Problems

1. Determine if there is a resource problem by comparing the quality of waters of the study area with the water uses designated by state standard.
  - a. Determine designated water uses from state standards.
  - b. Evaluate water quality from literature, data bases, field measurements and observations, and consultation with the state water quality management agency.
  - c. Document work.
2. Determine the potential pollutant sources that cause a water resource problem in the study area. If the pollution comes from agricultural non-point sources, determine the key substance(s) causing the water use impairment. If there is not a water quality problem, there may be little additional inventory needed in step 2.
3. Determine the extent of potential water quality effects by interagency scoping. Prepare a plan to assess the water quality background needed for the proposed action. Appropriate methodology and the reasons for its choice should be documented for later inclusion in the Investigations and Analysis Report.
4. Prepare items for a POW and a narrative describing water quality and water use problems for a preauthorization planning report.

## STEP 2 - Inventory and Forecast

1. Determine the key substances, parameters, indicators, and measurement framework for analyses of the water quality problem in coordination with the state water quality management agency.
2. Inventory water quality in the study area and determine a budget for key substances reflecting sources and watershed loadings or yields. The inventory should determine key reaches where action to solve the water quality problem might be focused. The state water quality management agency should be involved with the inventory and concur with its findings.
  - a. Determine the present level(s) of the key substance(s) (goal) that must be reduced to solve a water quality problem.
  - b. Use models to determine relative pollutant sources and the potential to use practices as BMP's to solve water quality problems.
3. Forecast the future levels of water quality based upon the forecasts of factors that cause the use impairment. This forecast will form the future without action condition that is the base for formulation of remedial actions. A forecast of future without action conditions is necessary even if there is not a problem, IF it is found during scoping that actions to solve other resource problems (such as soil erosion) are likely to affect water quality.

4. Document the work. Prepare draft narratives of results of inventory and forecast for planning documents.

#### STEP 3 - Alternative Formulation

1. Formulate goals for agricultural NPS pollutant reduction that will improve or restore impaired water used.

2. Formulate alternative actions to meet specific water quality goals. If there is not a water quality problem, there would probably not be a task during this step. All work should be documented.

#### STEP 4 - Evaluate Alternative Plans

1. The economic and physical efficiency of alternative solutions to the water quality problems is determined. Alternative plans for reduction of agricultural nonpoint sources of pollution should be in accordance with the water quality improvement plans of the state where the project is located.

a. Appropriate models or research results are used to forecast the future effects of alternative actions.

b. The costs and benefits of each each water quality element proposed as an alternative action is determined.

2. Water quality alternatives are combined with alternative solutions to other resource problems to form alternative plans. Costs and effects of alternative plans are forecast.

3. Plan elements that are used to address other resource problems are assessed relative to their water quality effects.

4. Work is documented.

#### STEP 5 - Comparing Alternative Plans

1. The water quality effects of each alternative plan (No action, NED, Resource Protection (RPP), and others as formulated) is described by key substance, parameter, and units of measure. These effects include the cost, water quality effects, and other economic, social, or environmental impacts.

2. The relative effects of alternative plans on water quality are quantitatively compared.

3. Documents are completed, including the tables describing investigations and analyses that deal with impacts of alternatives.

4. If the NED plan is not superior to other alternative plans from the standpoint of solving water quality problems, a rationale to support the recommendation of another alternative plan is drafted.

#### STEP 6 - Selecting Recommended Plan

1. The environmental impacts associated with water quality of the recommended plan are assessed in detail. This includes not only the

quantified ability of the elements of the recommended alternative to solve water quality problems but also the water quality effects of all other project elements. The quality of any impoundments to be created by the action are forecast. These analyses are documented. An appraisal of the beneficial and adverse effects of the recommended plan on water quality is forecast and documented.

2. Narratives are prepared describing the effects on water quality determined in the above step for the planning documents. This would include information that would be parts of the decision documents (ROD or FONSI).