Part VIII

Economic Considerations Task Force Report

ECONOMIC CONSIDERATIONS TASK FORCE

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20-Oct-95

ECONOMIC CONSIDERATIONS TASK FORCE
ATTENDANCE ROSTER

Interest Category	Name	M/A	April 19	May 22	June 26	July 24	Aug 28	Sept 25
Facilitator	Douglas R. Kern							
POTW	Sharon Green	M						
POTW	Laura MacEachen	A						
Stormwater	Darrell Eck	M						
Stormwater	Patrick Sweetland	A						
Industry	Scott Folwarkow	M						
Industry	Cliff Moriyama	A						
Agriculture	Robert Robinson	M						
Agriculture	William I. Dubois	A						
Water Supply	Steven Kasower	M						
Water Supply	Wendy Illingworth	A						
Environmental	Mario Menesini	M						
Public Health	Michael L. Kiado	M						
USEPA	Matt Michell	M						
USEPA	Diane Frankel	A						
Fish & Wildlife	Pierre Duvair	M						
RWQCB	Kim Taylor	M						
RWQCB	Mike Carlin	M						
SWRCB	David Kennedy	M						
SWRCB	Wes Ingram	A						
Environmental	W.C. Woodworth							
D.W.R.	Ray Hoagland							
ADE	Jim King							
SWRCB	Kathie Keber							
SWRCB	David Cohen							
SWRCB	Barbara Evoy							
SWRCB	Ling Tseng							
SWRCB	Gerald Bowes							
USEPA	Dan Utech							
	Larry Walker							
	Steve Moss							
	Dhez Woodworth							
	Chris Dumas							
	Kim Dines*							

M = Member ■ = Present
A = Alternate □ = Absent

*Kim Dines substituted for M. Kiado on the Aug. meeting.

Economic Considerations Task Force

(SWRCB - EBE/ISWP Revision Effort)

FINAL REPORT

October 19, 1995

Section 1 - Introduction and Overview

Purpose of the Task Force

The Economic Considerations Task Force met from April 1995 through September 1995, and held a total of 6 meetings. The Task Force was composed of one member and an alternate representing eleven different interest groups (see roster). The task Force agreed at its first meeting that the mission of the Task Force was to "recommend approaches that will allow the State Board to address economic considerations in the adoption of water quality plans."

Overview of the Report

This report summarizes the subjects discussed by the task force, presents conclusions reached, and makes recommendations to the State Water Resources Control Board (SWRCB). Where consensus was not reached, options are offered, and differing viewpoints explained. The Task Force identified members of the SWRCB and SWRCB management as the primary audiences for this report, because they will be responsible for directing the preparation of the economic analysis in decision-making regarding water quality objectives in the Statewide Water Quality Plans.

This report is divided into eleven sections. sections 2 and 3 address overall issues regarding the purpose, scope and framework for conducting economic analysis of water quality objectives. Section 4 describes some tools or techniques available to analyze costs, benefits, and economic impacts. Sections 5 enumerates the steps necessary to determine the initial costs and benefits of a set of proposed water quality objectives. Section 6 discusses some of the major factors to be considered in conducting the economic impact analysis. Section 7 proposes a process recommended by the Task Force for soliciting input from interested parties while the economic analysis is being prepared by SWRCB staff. Section 8 makes recommendations regarding the need for the SWRCB to further develop its institutional capacity to conduct economic analysis. Appendix A provides a brief discussion of economic techniques. Appendix B outlines an approach to the assessment of compliance costs.

The Task Force has done its best in the limited time available to organize the topics discussed in a meaningful way. We note that there were areas that could not be fully developed due to time constraints. The Task Force urges the readers of this report to seek out Task Force members should questions arise about the contents of this report.

Section 2 - Consideration of Economic Analysis by Decision Makers

Purpose of Economic Analyses

The Task Force examined a variety of alternative goals for the economic analysis to be conducted by the SWRCB. After some consideration, the Task Force recommends the following goal for the SWRCB's economic analysis:

> To provide information on the level and distribution of benefits and costs associated with implementation of water quality objectives. This information should enable State Water Resources Control Board members to make more economically efficient and equitable decisions while meeting the requirements of the Porter-Cologne Act.

Options for Scope of the Economic Analysis

Because the issue of resources is closely related to the size of the sample and scope of analysis, the range of sampling options discussed by the Task Force are described below, along with their pros and cons and recommendations.

Option 1: Statistically Valid Sample

Select a sample using a stratified random sampling strategy to represent the water bodies of the State. Criteria which might be used to determine the categories for stratification include water body type (bay, estuary, lake, perennial stream, effluent dependent water body, ephemeral stream, agricultural drain), ecological community type(s) and/or habitat types, salinity, prevalent land uses in the watershed, etc. The primary advantage of this approach is that the SWRCB will be able to extrapolate from the cost and benefit estimates derived from the sample to statewide figures, and would be able to provide a level of confidence in the estimates. The primary disadvantage of this approach is that it may take considerable resources (and time) to conduct a cost and benefit analysis of a sample that is large enough to extrapolate from to develop a valid statewide estimate. Also, because there are likely to be fairly significant data gaps for the sample, the accuracy of the estimates may be insufficient to justify the additional expenditure of time and resources.

Option 2: Sample Based on Data Availability

Select sample of water bodies, based on the availability of ambient water quality data and/or discharge data for those water bodies. The major benefits of this approach are that it would be a more manageable size and that, by definition, data would be available for the entire sample. Examining water bodies with available data is likely to represent the most significant cost and benefit associated with implementation of the Plan. The major disadvantages would be that the

sample might not be representative of the State's water bodies, and the sample might not be large enough to reliably extrapolate from statewide. Therefore, the SWRCB might not be able to develop statewide estimates of the costs and benefits of the Plans, and might only be able to provide examples of the economic impacts of the Plans.

Option 3: Case Study Approach

Select a small number of water bodies (or watersheds) for in-depth analysis of the economic impacts of the Plans. The major advantages of this option are that a fairly detailed analysis could be conducted that would provide policy-makers with a more realistic perspective for how a proposed program may economically impact a community, and that fewer assumptions will have to be made in the analysis because resources can be focused on developing ~~as~~ realistic ~~of~~ scenarios. The primary drawbacks to this approach are that it may not provide a basis for estimating the statewide impacts of the Plans, and it will be impossible to know if the results of any particular case study are relevant in other locations. An additional issue is that, to the extent that case studies focus on watersheds and try to simulate the outcome of a watershed management approach, local stakeholders may be concerned about the implications the case study may have for the watershed and how the results of the case study may be used (i.e. since they presumably would not have been involved in crafting the solutions used in the case study).

- Some members of the Task Force believe that it would be useful for the SWRCB to conduct a study to answer the following questions before a decision is made about the sampling strategy to be used:
  1) How should a sample be stratified to statistically represent the State's water bodies (and, likewise, what methodology should be used to extrapolate from the sample to statewide estimates)?
  2) What sample size would yield a statistically valid sample?
  3) How much would the precision of the estimates increase with the use of a statistically valid sample?
  4) What would be the estimated cost of performing the analysis using a statistically valid sample?

  It may be beneficial for that the SWRCB to utilize assistance from a statistician to develop a sampling strategy for the analysis. (Note: A study on sampling strategies should provide the basis for developing a generic approach to be used by the SWRCB and RWQCBs in the future as they perform economic analysis of proposed water quality objectives.)

- The Task Force believes that whatever sampling strategy the SWRCB decides to pursue should be as representative as possible of the range of water bodies and dischargers in the State. A qualitative discussion of the sampling strategy should be included in the report.

Practical Constraints

The Task Force identified a number of constraints to the preparation of an economic analysis for the revised ISWP/EBEP by the SWRCB. The primary constraints are the lack of comprehensive ambient water quality and pollutant source data, uncertainty in predicting the appropriate pollution control measure, and imprecise methods for relating changes in chemical concentrations in the aquatic environment to changes in the achievement of beneficial uses, the lack of adequate data to analyze certain benefits and costs, and the limited resources allocated by the SWRCB to conduct the analysis. Some of these can be addressed in the short-term by the allocation of greater resources for the economic analysis, while others can only be dealt with over time as the ability to relate water quality changes to costs and benefits improves and a comprehensive monitoring program is implemented to collect and manage necessary data (see section 9 for further discussion).

Selection of Objectives

The Task Force believes that the information provided by the economic analyses may be useful when deciding among alternative water quality objectives. (One task force member commented that the range of alternative water quality objectives will be narrow and that the range is determined by policy decisions and use designations.

The Task Force recognizes that economic analyses cannot fully inform the SWRCB as to impacts associated with its choice to set a specific water quality objective. In some cases, the economic analyses may be hindered by constraints that limit the ability to predict both the change in water quality and the benefits and costs of such a change.

Some members of the Task Force believe it would be prudent for the State Board to consider economic issues, such as cost impacts and water quality benefits, during the implementation of water quality plans. These considerations could inform decision makers on the use of mechanisms such as site-specific objectives or total maximum daily loads, if actions beyond reasonable cost control measures would be required to meet effluent limits based on the objectives in the Plans. This could provide the regulated community with greater assurance that reasonable control measures would be required to comply with the objectives. This type of implementation approach is intended to build upon and should be consistent with the recommendations of other Task Force groups that have addressed implementation of objectives such as the Permitting Task Force, the Site-Specific Objectives Task Force, and the Watershed Task Force.

Some members of the Task Force believe that it is desirable for the SWRCB to establish a clear process and approach to describe how the Board intends to use economic analysis in the adoption and implementation of water quality objectives. Task force members making this suggestion believe it would

be useful to establish a consistent approach for the use of economic analysis by the State and Regional boards. These Task Force members recognized that different criteria may be appropriate for different types of situations, depending on the amount and accuracy of the economic estimates, and the level and distribution of the projected economic impacts.

At its last meeting, the Task Force discussed the possibility of the SWRCB developing specific methods for using the results of economic analyses in decision making. The Task Force did not fully discuss or reach agreement on either specific methods or an approach for decision making. However, the Task Force did agree that the SWRCB should not choose objectives based strictly on a benefit-cost balancing test. The economic analyses would instead provide an accounting and presentation of quantified and qualitative cost and benefit information. The Task Force believes that the State Board should use the economic analyses to consider, to the extent possible, both the differing cost impacts and human health and environmental impacts when choosing among alternative objectives. Some Task Force members also believe that the economic analyses should be used to choose among alternative methods of implementing plans. The task of weighing and comparing the costs and benefits of alternative options in order to choose objectives is a policy judgment to be made by the SWRCB.

Individual members of the Task Force identified some potential criteria that could be used by the SWRCB in the selection of water quality objectives. However, it is important to note that the Task Force did not reach agreement on the appropriateness of all of these particular criteria. Several members of the Task Force believed that, because Task Force members had not had an adequate opportunity to review and discuss the criteria listed below, these criteria should not be included in the report. Other members believed that these criteria should be included as ideas proposed but not endorsed by the Task Force. One member commented that the idea of criteria for decision making is confusing, and that it builds or implies an unnecessary level of complication into a relatively simple judgment, once the facts are in.

The potential selection criteria proposed for SWRCB consideration by individual Task Force members are listed below, and represent the views of some, but not all, members of the Task Force. This is not meant to be an exhaustive list; rather it is intended to indicate options for selection criteria that should be considered. In addition the Task Force members who offered this proposal recognize that no single one of these criteria is likely applicable to all situations.

- The SWRCB could identify alternative objectives for which costs would be substantially reduced for little or no increase in risk to human health and the environment. Similarly, the SWRCB could identify alternative objectives for which human health and the environment would incur significantly lower risks for little or no increase in costs.

- If an alternative objective would yield high costs and low benefits, a less costly alternative - or one with more closely matched costs and benefits - could be selected (if the analysis shows that one exists). For example, in cases where the objective is based on protection of human health and the contaminant is a carcinogen, the SWRCB could apply a less protective risk level in calculating the objective, if the analysis demonstrates that such an alternative would be either less costly or have more closely matched costs and benefits.

- The SWRCB could identify certain types of results, or levels of uncertainty in the analysis, as triggers for further analysis or later action by the SWRCB or RWQCBs. For example, such actions might include the collection of additional data, initiation of use attainability analyses, development of site-specific objectives, or Total Maximum Daily Loads. If the objectives are below detection levels where economic impacts cannot be determined, the SWRCB should consider adopting implementation schedules for the objectives.

- The SWRCB could identify certain changes in the distribution of economic impacts as criteria for selecting from among alternative water quality objectives such as losses of employment (expressed for instance as high unemployment in an industry or region) or tradeoffs between local versus remote benefits.

- The SWRCB could select a criterion such as maximizing net benefits or minimizing net costs as a guide to identifying the most desirable alternative water quality objective. However, as stated elsewhere, The Task Force believes that the SWRCB should avoid a strict benefit-cost balancing test, which may be flawed because of the need to rely on both quantitative and qualitative information in analyzing costs and benefits.

- From among alternative objectives that would obtain equivalent benefits, the SWRCB could select those that would be the least costly to attain. Alternatively, the SWRCB could select objectives that provide the maximum benefits based on a given cost associated with alternative options. Additionally, the Board could direct the RWQCBs to use cost-effectiveness as a criterion in designing the programs of implementation in Basin Plans.

Information to be Presented in the Functional Equivalent Document

The Functional Equivalent Document (FED) should present an analysis of all of the factors, economic and other, to be considered prior to the Board adopting objectives for the set of alternative objectives proposed for each constituent. For the economic analysis, the methodologies and assumptions used should be presented, in addition to the identification of direct costs and benefits and the results of the forecast of economic activity with and without the adoption of the objectives. The FED should also provide an

estimate of the change in environmental quality or the amount of environmentally-damaging activity that will occur, along with a description of the level and timing of expected costs and benefits, and the sources of uncertainty in the estimates. Finally, the FED should identify the reasons for the Board's decision to recommend a particular objective from the set of alternative objectives under consideration.

Section 3 - Framework for Economic Analysis

Geographic Focus

In many of its discussions, the Task Force addressed the issue that for many of the costs and benefits associated with water quality improvements, the appropriate level of analysis of these economic issues is at the regional or local level and not at the state level. While many of the benefits to the environment of improved water quality will be statewide, costs and implementation plans will likely be very different in each location. The scope and importance of the physical, economic and social issues that must be considered will vary from location to location. The pollutant loadings, the benefits to the water quality from reducing those loadings, and the options available to control discharges also vary from location to location. All of these differences led the Task Force to conclude that the economic analysis of water quality objectives and implementation plans would best be undertaken at the regional or local level, most likely by regional boards. It was recognized by members of the Task Force that some benefits of water quality improvements accrue to the public at a statewide level; regional analyses of costs should not restrict this recognition.

A focus on economic impacts at the regional and local level would have several benefits. First, the SWRCB could consider tailoring the objectives and the implementation plans to more closely fit the needs and problems of each locality. In addition, the Task Force believed that this would foster planning for attainment of ambient water quality standards across discharge sources in the region or watershed. The Task Force believed that examining options for control throughout the watershed could increase the cost-effectiveness of implementation plans. Focusing on the watershed rather than on individual dischargers could also lead to changes in implementation plans that would increase the likelihood that water quality objectives could be attained. It would also allow recognition of the interdependence of users of the water body. For example, requiring an upstream discharger to reduce toxic loadings may have downstream benefits that could be overlooked if the analysis focused solely on individual dischargers.

At the same time, the Task Force realized that this regional approach could prove difficult to implement. The SWRCB is required to produce State Water Quality Control Plans. In this cycle of plan development, there is not sufficient time for the Regional Boards or other local groups to develop analyses that could be integrated into a statewide plan by the State Board. In addition, the Regional Boards generally do not have the level of resources or the appropriate mix of staff to undertake these analyses. Because of these problems, it appears likely that the SWRCB will not be able to rely on regional/watershed economic analyses to the extent that the Task Force believes is desirable. However, the Task Force recommends that, to the extent practical, more of the

economic analyses should be conducted at a regional level in future triennial reviews of the water quality plans. One option would be for the State Board provide staff assistance to the Regional Boards to conduct these analyses in a consistent manner. The State Board would also still be required to consider impacts that occur beyond the regional boundaries.

Finally, the Task Force discussed the use of the term "watershed approach". In addition to the use of watershed as a description of a geographic region in which planning is conducted, watershed planning can also be used to identify a comprehensive approach to planning that involves representatives of interested and affected parties within the watershed. The following description of the process was provided by a Task Force member.

Watershed Protection Approach

- Identify the physical borders of the watershed to be protected.
- Establish watershed coordinating committees, consisting of representatives of the environmental, political, economic, and user spheres of interests.
- Conduct an assessment of the current biological, physical, chemical, hydrologic and economic aspects of the watershed.
- Encourage collaboration through stakeholder incentives, including economic, health and welfare benefits, and federal, state and local funding.
- Develop site-specific goals unique to the watershed. The regulations to achieve these goals should be cost-effective and coordinated with federal, state and local regulators.

It was further suggested that the Task Force consider recommending that the SWRCB should encourage development of this watershed protection approach; that the SWRCB should further encourage public information programs that foster voluntary non-point source contaminant reductions; and the SWRCB should consider ways that storm waters could be harnessed to improve watersheds. Because of time constraints, these later suggestions were either not discussed in detail, or not discussed at all by the Task Force. No consensus on these issues could be reported.

Approaches to Economic-Based Decision-Making

The Task Force considered three approaches to economic analysis that can be used in regulatory decision-making: benefit-cost analysis, cost-effectiveness analysis, and affordability analysis. The first two of these analytical approaches are used by the federal government and some state agencies in conducting Regulatory Impact Analyses, while the third is a technique developed by the U.S. Environmental Protection Agency for use in downgrading or de-designating beneficial uses. All three approaches require

the enumeration of costs. However, they differ in the extent to which they consider benefits, and in the criteria used by decision-makers to evaluate the results of each approach. In practice, all of these approaches may be able to play a useful role in water quality decision-making. However, there are barriers to each, such as the amount of information needed about sources of pollutants and the effectiveness of various control measures. Additional information about each approach, and its applicability in the context of the adoption of water quality objectives, is discussed below.

a) Benefit-Cost Analysis

In general, the Task Force recommends that the SWRCB use a benefit-cost framework for consideration of economics in decision making for statewide water quality objectives.

Benefit-cost analysis (BCA) is a technique or tool that can be used to evaluate whether a proposed regulation - in this case a set of water quality objectives - will be expected to generate more benefits relative to costs, or vice-versa. The benefits and costs resulting from alternative regulatory actions can be assessed and comparisons made as to which alternative yields the highest net economic benefits to society.

The benefits and costs that occur in the future are generally discounted, one reason being the value of a dollar today is greater than a dollar in some future period. After accounting for inflation, the benefits and costs that can be quantified are generally presented in terms of "net present values" that result from the implementation of a given regulatory action.

When conducting a BCA for a complex regulatory action, such as promulgating new water quality objectives, it is not always possible to quantify in monetary or any other metric, all of the benefits and costs expected to result from such action. Nonetheless, it is useful to identify every cost and benefit expected to occur, to quantify impacts to the extent possible (with valid and reliable methods), and to express the total dollar value of each type of cost and benefit. Thus, the analyst using the BCA framework should explicitly describe all known or expected impacts, whether or not the impact can be quantified and/or monetized.

The sensitivity of the results to assumptions, such as the discount rate and the appropriate time frame for the analysis, as well as uncertainty associated with quantifying benefits and costs, provides important reasons to avoid reliance on a single benefit- cost ratio. Instead, a clear list of key assumptions, points of uncertainty, and an analysis of the sensitivity of the results to changes in these factors, should be included when reporting analyses of benefits and costs. In addition, a breakdown of results by type of impact and sector could illuminate tradeoffs and transfers between different sectors or industries, different geographic areas, and even different generations.

The Task Force recommends that the SWRCB not calculate benefit-cost ratios, due to the assumptions that must be made in conducting the analyses, the likelihood of data gaps, the levels of uncertainty, and the exclusion of potentially numerous impacts that cannot be quantified. In addition to providing information on quantified benefits and costs, the SWRCB staff should provide qualitative assessments of expected impacts that cannot be quantified.

b) Cost-Effectiveness Analysis

- The Task Force agreed that cost-effectiveness analysis should be used to the extent possible. The Task Force recognizes that there are two constraints to the use of this method. First, there may not be sufficiently detailed information available to adequately evaluate the relative cost-effectiveness. Second, alternatives may not yield sufficiently similar outcomes to allow direct comparisons of costs.

  The U.S. Environmental Protection Agency recommends that cost-effectiveness analysis be used when a law contains a specific regulatory objective, as well as when the benefits of the proposed regulation cannot easily be monetized. Cost-effectiveness analysis can be used to identify the least-cost way of achieving a specified objective, policies that maximize the level of a type of benefit for a given cost, or incremental trade-offs between successively more stringent levels of control when there are no firm benchmarks that must be attained.[1] Cost-effectiveness analysis can also compare control costs for different industries that discharge the same pollutants. Cost-effectiveness could be used as a criterion for allocating load reductions when Total Maximum Daily Loads are established.

  Notwithstanding the current barriers to fully utilizing cost-effectiveness analysis, the Task Force recommends that the SWRCB incorporate to the extent possible cost-effectiveness analysis into its water quality decision making processes.

c) Affordability Analysis

- The Task Force recommends that the SWRCB <u>not</u> use EPA's March 1995 "Interim Final Economic Guidance for Water Quality Standards" regarding affordability analysis as its methodology when the Board conducts economic analyses for the adoption of statewide water quality objectives.

  EPA's economic guidance interprets federal water quality standards regulations. The Guidance discusses EPA's preferred approach to determining when there are economic grounds to find that a beneficial use cannot be attained, that a variance should be granted, or that degradation of high-quality water is warranted. However, the Guidance is not meant for use in setting water quality objectives. The Guidance specifies a process of decision rules to determine when attainment is not affordable.

  The use of EPA's Economic Guidance for downgrades or de-designation of uses or for granting variances was identified as an issue requiring discussion by the Task Force, and substantial concerns were voiced by several Task Force members. However, the Task Force was unable to discuss this topic in the time available.

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[1] U.S. Environmental Protection Agency, <u>Guidelines for Performing Regulatory Impact Analysis</u>, December 1983 (reprinted March 1991), p. M14.

Economic Factors to be Considered

A comprehensive analysis of economic considerations should include an estimate of the total cost of the proposed regulation to society. This total cost is defined as the net value of goods and services that would be lost by society as a result of using resources to comply with and implement the proposed regulation. The Task Force itemized costs and benefits based in part, on the outline presented in the USEPA RIA guidelines. These costs and benefits are presented as follows:

Societal Costs

Primary Cost of Compliance

- Capital costs (including the costs of financing)
- Source control/pollution prevention measures
- Operating and maintenance costs
- Monitoring
- Special studies

Other Societal Costs

- Deadweight welfare losses
- Government regulatory costs
- Adjustment costs
- Adverse effects on product quality, productivity, innovation competitiveness and market structure.

Societal Benefits

- Human health, morbidity and mortality
- Increased yields
- Ecosystems
- Recreation
- Aesthetics
- Reduced treatment costs
- Risk avoidance (for example, reduced impacts from floods)
- Changes to water supply

When assessing the impact of proposed plans on the state and regional economies, in addition to the costs and benefits listed above, the staff should consider the following categories of market impacts:

Primary Market Effects

- Employment
- Changes in level and distribution of income
- Price effects
- Production effects
- Effects on profitability, capital availability and industry growth
- Health

Secondary Market Effects

- Secondary employment effects
- Community effects
- Energy and balance of trade effects

It should be noted that these impacts may be positive or negative. For example, a water quality regulation might result in increased employment in commercial fisheries and in pollution control technologies, while reducing employment in an industry that was required to control its effluent. Whether the net employment effect of the regulation would be positive or negative would depend on the relative size of the changes.

Efficiency and Equity Considerations

The economic considerations reviewed by the Task Force were concentrated on efficiency issues. Efficiency is defined as either obtaining the maximum benefit for a given investment, or minimizing the cost of obtaining a given benefit. Water quality policies developed with these descriptions of efficiency as a basis, are best informed by use of the benefit-cost comparisons and the cost effectiveness approaches that the Task Force has endorsed. We considered various ways in which the Board might employ these techniques to determine the levels of water quality regulation to maximize the benefit to the State of California as a whole.

We recommend that the Board consider regional analysis to determine the incidence and size of localized impacts. We urge the Board to consider not only size of the statewide or region-wide impacts resulting from the implementation of water quality regulations, but also the incidence of costs on various social, commercial, or political subgroups. This assessment of gains and losses across sectors will allow the Board to evaluate the equity of its proposed regulations. Equity can be defined as an investigation of which subgroups will bear the costs or benefits arising from the plans, and the consideration of whether this distribution of costs and benefits is reasonable. In reviewing equity considerations, the Board should also consider the cumulative costs of existing and proposed water pollution controls.

Economics can not provide prescriptive answers to distributional or equity issues. We therefore limit ourselves to recommending that the Board consider the cost and benefit incidence of the objectives and implementation

program proposed by the Board. This consideration can be facilitated by a regional approach to economic analysis that we have recommended elsewhere in this report. Where a particular subgroup of the community would bear a largely disproportionate burden of any costs, the Board should consider whether this burden is justified; if the Board believes that this burden is not justified, it should consider ways of mitigating this burden.

Section 4 - Methodologies for Economic Analysis

A variety of methods are available for compiling data into a decision making approach, estimating the benefits and costs associated with alternative water quality objectives under consideration, and analyzing the associated economic impacts. Although Task Force discussions touched upon many of these approaches, a comprehensive assessment of each of the possible techniques was not made. Instead, various methods are listed below, and described further in Appendix A.

Methods for Estimating Direct Benefits and Costs

- Engineering economics or life-cycle analysis
- Mathematical programming models
- Accounting analysis or case studies
- Hedonic pricing
- Travel cost method
- Contingent valuation method
- Politically revealed preference or control costs method
- Damage functions

Models for Analyzing Market Impacts

- Static simple equilibrium models
- Input-output models
- General equilibrium models

Section 5 - Attainability and Benefit - Cost Approach

To determine the economic impacts of a proposed water quality objective or set of objectives, it is necessary to first determine what the ambient water quality levels of the constituents are in comparison with the proposed objective. Subsequently, compliance costs can be estimated based on the actions that will be necessary to reach the point where the objective is met in the water body. This approach, which has been used in the past by the State and Regional Boards, is often referred to as an attainability analysis. It is important to note that, although the term is sometimes used to mean the ability to comply -- and the cost of compliance -- by regulated dischargers, the Task Force believes that the goal of the SWRCB should be to analyze the cost of attaining a water quality objective in the water body. The determination of water body attainment status and the increment of improvement that is necessary to meet the objectives is also a critical first step in determining the benefits of the proposed objectives.

While relatively simple in concept, carrying out an attainability and benefit-cost analysis is a quite complex task on a statewide basis, and becomes much more complicated when a large number of objectives are proposed. Many assumptions must be used in analyzing water quality objectives being adopted at the state level, since implementation takes place at the regional level following the adoption of the objectives by the SWRCB. This section summarizes the discussions of the Task Force regarding how an attainability and benefit-cost analysis should be structured for the ISWP/EBEP. Note that this section only covers the estimation of direct costs and benefits, and does not include analysis of secondary economic impacts.

Analytical Methodology

The Task Force believes that the steps listed in Table 6-1 provide a useful model for the analysis of attainability, benefits and costs. Issues to be considered in this analysis are discussed below. One Task Force member felt that deleting much of the text would make this section clearer, and this person disagrees with the inclusion of certain portions of the text. The deletions endorsed by this member are indicated in brackets and marked with a * in the margin. Where possible, an explanation of differing views held by Task Force members is included in the text.

Step 1 -- Select a sample of water bodies.

The Task Force was unable to reach consensus on a single uniform approach to the sampling strategy that should be used by the SWRCB, primarily because of differing views about two issues: whether the SWRCB's goal should be to provide statewide estimates of the economic impacts of the Plans, and what role the current level of SWRCB staff resources allocated for conducting economic analysis should play in the recommendations of the Task Force. With respect to the first issue, some members felt that statewide estimates should be developed, with information about regional/local impacts that emerges from the statewide analysis included in the final report. Other members felt that the SWRCB should focus on developing good quality information, and that, at least in the short term, the development of statewide estimates may not be possible due to factors such as inadequate ambient water quality data availability and the difficulty in correlating changes in concentrations of particular pollutants to changes in actual beneficial use attainment. Data availability may be a problem at any level of analysis.

The Task Force was divided on the question of how to factor current SWRCB resource allocations into its deliberations. Some members believe that the Task Force's primary task is to recommend a valid and reliable approach for analyzing economic impacts, whether or not it can be done within current resources, while other members believe that the recommendations should be tailored to the resources available for the analysis. The Task Force was not able to fully resolve the issue of resource constraints, other than to agree that additional resources, above those currently allocated by the SWRCB, will probably be necessary to do a rigorous economic analysis.

Because the issue of resources is closely related to the size of the sample and scope of analysis, the range of sampling options discussed by the Task Force are described below, along with their pros and cons.

Step 2 -- Determine if each of the water bodies exceeds or is likely to exceed the objectives under consideration.

- Identify all waters where ambient water quality monitoring data exist for constituents to be regulated by the Plans.* Ideally, data collected over the last 3-5 years should be utilized. For water bodies where ambient data are unavailable and for effluent dependent water bodies,** collect all readily available priority pollutant concentration data collected over the last 3-5 years , together with available flow data, for direct industrial, POTW, and municipal stormwater discharges.

- Analyze the data statistically, and for each water body or discharge prepare frequency distributions for each pollutant (i.e. plot the percentage of time each discharge achieves a certain concentration of the pollutant).

- Identify alternative sets of possible water quality objectives to be analyzed. (Note: A method for constructing the alternatives based on an analysis of attainability was proposed to the Task Force, and, although the Task Force did not reach consensus about the content of this proposal, it is attached to this Report as Appendix B).

- For each constituent, identify each water body as either impaired, unimpaired, or unknown. If only discharge data are available, compile the data for each priority pollutant, and determine the concentrations that are achievable with existing effluent quality for each type of discharger (i.e. industrial, POTW, stormwater) The categorization of water bodies as impaired or unimpaired should be based on the averaging periods and frequency of exceedance associated with the objectives.

Step 3 -- Identify and characterize significant sources of constituents of concern.

For those water bodies where point source and nonpoint source discharge data is used for the attainability analysis, this step is not necessary for those sources, since the attainability analysis will have established whether or not those sources discharge the constituents of concern, and the concentrations discharged.

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* Information summarizing the availability of ambient water quality monitoring data was provided to the Task Force by SWRCB staff. Based on the description of existing databases, it appears that, for the next several years, the SWRCB will have to piece together data from a variety of sources, including discharge data where ambient water quality data are unavailable, since no single database ~~exists with the type of~~ contains all of the information needed for the attainability analysis.

** Because effluent dependent waters are, by definition, composed of effluent for a majority of their flow, some members of the Task Force believe~~s~~ that discharge data, which is generally more readily available than ambient water quality data, should provide a reasonable surrogate for ambient data.

Where data on discharges is not used for the attainability analysis, existing information from site-specific studies should be used to identify the sources that may contribute to loadings of particular constituents. If no source of data is available and it cannot be collected, some members of the Task Force believe that it may be appropriate for the SWRCB to use supplementary information from the literature, such as the EPA/NOAA document regarding nonpoint source pollution, Guidance Specifying Management Measures for Sources of Nonpoint Pollution In Coastal Waters,**** which provides a quite comprehensive source of information about sources of constituents of concern, as well as about the cost and effectiveness (i.e. removal efficiency) of a wide variety of control measures and practices. However, data from the literature must be applied very carefully because it may not accurately represent the actual circumstances at specific sites. Notwithstanding this caveat, other members of the Task Force do not believe that it is appropriate for the SWRCB to substitute estimates from the literature for actual data when identifying and characterizing significant sources of constituents of concern.

- Determination of the relative contributions of all sources to loadings of specific constituents and calculation of specific load reduction allocations requires that a mass balance, or Total Maximum Daily Load and Wasteload Allocation/Load Allocation, be conducted

Step 4 -- Identify available generic control technologies, including unit cost and effectiveness.

To determine what control measures (or practices) would need to be implemented so that a water body could meet a water quality objective, it is necessary to assess the effectiveness of various available technologies and practices. Options available for estimating the effectiveness include actual measurements, best professional judgment, and estimates from the literature.

Step 5 -- Conduct a cost analysis for point source and nonpoint source dischargers.

For each water body being studied, a determination will have to be made as to what control measures or practices would need to be implemented for the water body to meet the water quality objective. A realistic timetable of expected implementation actions should be developed, consistent with the compliance deadlines in the Plans.

The Task Force identified two options for the methodology for estimating costs for point and nonpoint source dischargers.

Option I:

a. Compile current NPDES/WDR permit data and background information.

**** U.S. Environmental Protection Agency, Guidance Specifying Management Measures for Sources of Nonpoint Pollution In Coastal Waters (840-B-92-002), January 1993.

b. Ensure all effluent limits are consistent with current Plans and policies.

Permits are issued every five years, so current permits may not reflect recent changes in Plans and policies. To develop the baseline, permits will need to be adjusted to reflect these changes.

c. Identify pollutants that have a reasonable potential to exceed the water quality objective.

d. Calculate anticipated permit limits.

The assumptions used in determining permit limits should be consistent with the implementation provisions of the Plans, including, but not limited to, the mixing zone policy and compliance schedule provisions. To the extent the Plans allow the Regional Boards discretion in translating the water quality objectives to permit limits, the cost analysis should contain a range of costs consistent with the range of possible implementation scenarios. The analysis should attempt to identify from this range of costs, the costs based on the most realistic implementation scenario. If the most realistic plan of implementation is projected to fall short of achieving objectives in the ambient water or is projected to result in a site-specific adjustment, this should be noted and analyzed in the benefits and cost section of the report. Some members of the Task Force do not believe that the analysis should rely upon projected site specific adjustments, unless there is certainty that the adjustment will be made.

e. For each water body, determine what control measures or practices (or combination of controls) would need to be implemented for the water body to meet the water quality objective.

Options for control measures and practices include the ability of existing treatment systems to be modified to meet the new limits, opportunities for retrofitting existing treatment systems, opportunities for source reduction and pretreatment, options for new (end-of-pipe) treatment systems, and additional monitoring or other special studies that may be necessary. For nonpoint source dischargers, the Economics Unit of the SWRCB should coordinate closely with the SWRCB Nonpoint Source Management Program. The assumptions regarding implementation for these dischargers should be consistent with the State's Nonpoint Source Management Plan. Although comprehensive data about the nonpoint source management projects that would need to be implemented may not be available, the SWRCB should use actual data to the extent possible. Where data from California-based projects are not available, some members of the Task Force believe that it may be

appropriate for the SWRCB to consider using information from other sources, such as EPA's Guidance Specifying Management Measures for Sources of Nonpoint Pollution In Coastal Waters.[*****] Based on the alternatives developed, the Board should identify the extent to which an objective can be met. This analytical step would primarily be relevant in circumstances in which a water body was not projected to be able to meet an objective because adequate controls could not be identified or potentially available controls could not be foreseeably implemented (for instance, to control abandoned mines, contaminated sediments, or atmospheric deposition).

f. Calculate costs of implementing expected controls.

Option II:

a. Characterize the discharge from each significant source in terms of quantity and quality.

b. For each significant source, identify control technologies, pollution prevention measures, and/or management measures that would result in reduction in the discharge of the constituent of concern.

c. Develop cost and removal effectiveness information for each potential control technology or measure for each significant source.

d. Based on the available technologies and control measures and the sources involved, develop alternatives that would result in achievement of the objective (i.e., result in the required frequency of compliance). The alternatives may include a combination of control technologies and measures for the various sources discharging to the water body. In some cases, it may be appropriate to evaluate alternatives on a watershed basis.

e. Estimate the costs for each alternative, including the initial capital and the ongoing operational and maintenance costs, and determine the total present worth of those costs.

f. Determine the alternative that would result in the most cost-effective means of achieving the proposed objective in the water body. The cost effective alternative for achieving the proposed objective then constitutes the cost of achieving that objective in that water body.

[*****] In addition to the Guidance itself, EPA has also published analyses of the economic impacts of the guidance on specific sectors (e.g. agriculture, forestry), which may contain pertinent information.

Step 6 -- Conduct benefit analysis.

The Task Force identified this as an important component of the analysis, but did not have time to develop an approach.

Step 7 -- Repeat Steps 2 - 5 for alternative water quality objectives.

Step 8 -- Aggregate the range of costs and benefits for alternative water quality objective.

Step 9 -- If conducting a statewide analysis, determine the total statewide range of costs and benefits.

Table 5-1
Attainability and Benefit-Cost Analysis Methodology

1. Select an appropriate sample.
2. Determine if each of the water bodies exceeds or is likely to exceed the objectives under consideration.
3. Identify and characterize significant sources of constituents of concern.
4. Identify available control technologies, including cost and effectiveness.
5. Conduct cost analysis for sample of point and nonpoint source dischargers.
6. Conduct benefit analysis.
7. Repeat Steps 2-5 for alternative water quality objectives.
8. Aggregate the range of costs and benefits for alternative water quality objectives.
9. If conducting a statewide analysis, determine the total statewide range for the costs and benefits.

Section 6 - Economic Impact Analysis/Issues

There are several decisions that must be made before an analysis of the economic impact of regulations can be undertaken. These decisions are crucial to the quality of the analysis, and must be taken with care. The key decisions identified by the Task Force are the following:

- The choice of the baseline analysis to be used;
- The time horizon over which the economic impacts should be analyzed;
- Whether results should be presented as point estimates or ranges;
- Whether the investigation should include sensitivity analyses; and,
- If and how qualitative information should be incorporated into the analysis.

Each of these issues is discussed below, along with a summary of the Task Force recommendations on these issues.

Choice of Baseline

Before the Board staff can determine the economic considerations related to a proposed plan, the staff must estimate the economic activity that would occur in the absence of the proposed plan. This is known as the baseline analysis. Modifications are made to this baseline analysis to reflect the changes that are expected to arise as a result of the proposed plans. Subtracting the estimates of economic measures in the regulation scenario from the estimates in the baseline results in an estimate of the economic impact of the regulations.

By definition, then, the baseline is the situation that would occur without SWRCB action. For the Enclosed Bays and Estuaries and Inland Surface Waters Plans, the baseline could be defined as either:

(i) A no-regulation case, including neither Board nor regulations likely to be promulgated by USEPA; or,

(ii) An USEPA-default regulation case.

The argument for the first proposal is that the Board should consider the changes from currently adopted regulations on the California and local economies. There is no other body that is in a position to conduct such an estimation; the Regulatory Impact Analysis currently being conducted by USEPA is considering only the economic effects of EPA regulations. In its decisionmaking role, the Board should consider the total effect of the proposed changes.

The argument for the second baseline proposal is that if the State Board did not adopt either EBEP or ISWP,

then regulations promulgated by USEPA would come into effect. Absent State Board action, the actual economic situation would reflect adoption of the USEPA regulations. This can only be understood by comparing the economic situation under the State Board's proposed regulations and the situation that would occur with no State Board action; that is, with the default regulations proposed by USEPA.

The Task Force did not reach a consensus on this issue. Part of the group agreed that, in considering the options available to it, the Board should consider both the total costs and benefits that will arise from its decision (the total impact on the community), and any incremental costs and/or benefits that will be gained by promulgating plans that vary from those that are likely to be proposed by USEPA (the costs and benefits of developing state plans as opposed to having USEPA regulations imposed). That group within the Task Force therefore proposed that the Board use two baseline scenarios involving both of the above analyses. All comparisons of alternatives should be reported with reference to <u>both</u> of the base cases. However, there was a strong concern that both baseline scenarios should be reported at all times. POTW interests were concerned that the use of an USEPA-regulation baseline would detract attention from the total costs that would be required of dischargers.

Another segment of the Task Force argued that the USEPA regulation was the only correct baseline, and that the Board should not consider the without-regulation case. There was further concern that the Board staff would not be able to develop a meaningful estimate of the economic impact of USEPA regulations. The final USEPA regulations will not be decided in time for inclusion in the analysis, so that the Board would need to base their study on USEPA's draft regulations. In addition, the USEPA regulations will not include a plan of implementation, so the economic impacts of the proposals could be difficult to determine. Where there were clear ranges of impact uncertainties in the USEPA regulations, the Board staff might need to develop a range of estimated impacts from the USEPA proposals. Some Task Force members felt that there should be two baselines, but that these should reflect the most stringent and least stringent likely outcomes to be expected from the USEPA regulations.

The Time Horizon of the Analyses

The proposed Board regulations do not apply to the current situation alone; in fact, many of the regulations will not be implemented in the near future, and all of them will have effects for some years to come. The Task Force reached a consensus that, to the extent possible, the economic analysis should reflect this through consideration of both short- and long-term effects of the regulation. For water quality analyses, the Task Force determined that short-term impacts should be defined as those incurred in less than ten years from the analysis, and long-term impacts should be those estimated to occur in the period after those ten years.

For example, expected growth in population might make specific plan objectives more difficult to attain and result in higher costs to meet the objective. At the same time, the total benefits to be obtained from reduced health risks or increased environmental or recreational amenities would also grow with the increasing population.

The Task Force also expressed considerable concern over the availability of data for any long-term analysis. Forecasts of population and economic activity can be obtained from state agencies, including the Energy

Commission and the Department of Finance. However, necessary data relating water contamination to changes in population, economic conditions and changed technologies may not be available. This concern is particularly relevant for the studies to be undertaken for the current plans. Concern was also expressed that the best available approximations to the changes in future costs and benefits may not produce useful additional information. For example, Staff may be reduced to making the assumption that a twenty percent increase in population will result in a twenty percent increase in costs and a twenty percent increase in benefits. If existing data do not support greater analytical insights than this, the long-run analysis would be a waste of scarce staff resources.

Use of Ranges to Reflect Uncertainty

In conducting their analysis, the Board's economics staff will need to deal with many uncertainties. In some cases the data necessary for the analysis may be unavailable, or of uncertain quality. In other cases the Board's proposed implementation plans may provide options (e.g., with respect to mixing zones) and costs and benefits should reflect the range of the options considered. The proposed plans may also include new programs or approaches whose success or costs cannot be identified with precision. The Task Force concluded that, in these cases, the Board staff should develop the analyses based on ranges, rather than point estimates. The use of ranges will demonstrate to the Board the level of uncertainty that is inherent in the analyses.

The Task Force further adopted a consensus that where ranges are used they should not be so broad as to encompass every possible outcome. The ranges chosen and presented by the staff should encompass likely outcomes, rather than attempt to include all possible outcomes. When developing these ranges, the staff should bear in mind that, as the upper and lower values assumed become further apart, the value of the analysis is diminished. In addition, ranges have no intrinsic value, and where more precise point estimates can be developed, they are to be preferred.

Sensitivity Analyses

The Task Force reached a consensus to recommend that the Board staff conduct sensitivity analyses where the data or the outcomes are uncertain. This is particularly important where there is a wide range of possible values or outcomes. There are three goals of the sensitivity analyses:

1) To identify where the existing uncertainty is unimportant; that is, that all likely values for the uncertain variable will produce similar results. In these cases, the associated ranges can be dispensed with, and the analysis simplified.

2) To identify where the resolving of the existing uncertainty could make a significant change to outcomes. In these cases it is particularly important that the Board be presented with the range of outcomes that are likely to occur as a result of the proposed regulation.

3) To identify important data that are unavailable. When resolution of existing uncertainty could have a significant effect on policy decisions, these data are important to the policy process. The Board staff should identify these data, and develop plans to improve the collection of these data before the next revision of the ISWP and EBEP.

Use of Qualitative Information

Some data needed for the economic analysis may be unavailable or unquantafiable. Based on current knowledge, any ranges of possible values would be so wide as to be limited in their usefulness. The Task Force agreed that in these cases, the staff should provide a qualitative description of the impact or outcome that is to be expected. These qualitative descriptions are to be included in any summary or overview of the quantitative impacts, to ensure that they are not overlooked.

The Task Force further agreed that the staff should not develop quantification of either costs of benefits where the resulting values are very speculative. In such cases, the quantification may prove misleading, rather than providing useful information for the Board's consideration. A qualitative description of benefits or costs is preferred over numbers with little basis in fact.

Section 7 - Process for Input by Interested Parties

As a part of the economic analysis of the impact of the proposed regulations, the Task Force recommends that the Economics Unit within the SWRCB hold a series of working group meetings. The reasons for this proposal, and a suggested guideline for these meetings are outlined below.

Rationale

The Task Force has two purposes in proposing these working-group meetings. First, the working-group meetings may be used as a mechanism for the SWRCB staff to communicate with stakeholders during the development of economic analyses regarding the specific assumptions and methodologies to be used, with the goals of making the Board analysis as complete and as accurate as possible, and identifying stakeholder concerns. While the staff must retain final responsibility and decisionmaking authority over the analysis, the meetings will allow for identification and discussion of areas of controversy, and will hopefully lead to a broader consensus over the staff approaches at an early stage in the analysis. Second, the working-group meetings would be a means of extending SWRCB resources by soliciting data or analyses relevant to the proposed water quality plans from interested parties. This will provide the staff with access to increased resources and a greater range of expertise than would otherwise be available. The meetings should be held prior to the release for public comment of the proposed statewide water quality plans.

The Task Force recommends that the SWRCB working-group meetings be held with participation by the interested public (widely advertised by SWRCB) at the following stages of the ISWP/EBEP development:

1) Completion of a draft study plan or workplan by the Economics Unit staff, outlining the SWRCB's approach to addressing the economic considerations of the statewide water quality plans. The stakeholders will provide staff with input on the strengths, weaknesses and alternatives to the proposed approach. The staff will provide descriptions of the types of data or analysis they believe they will require. The stakeholders may also offer specific data or analyses for the staff to use in its evaluation.

2) At least one midcourse review of progress on the economic analysis. More than one mid-course meeting may be held at the staff's discretion. The meeting(s) would be scheduled by the Economics Unit staff based on: a) needs of staff for additional input, b) completion of significant portions of the workplan, and c) internal timelines facing staff related to the completion of the work. The meetings should review staff and stakeholder progress to date, and plans for future analysis. The goal of the meeting(s) will be to ensure that the many strands of analysis being conducted by the different groups remain consistent and on-track.

3) A working-group meeting to review draft reporting of the economic considerations related to the water quality plans. The focus of this meeting would be to provide input to improve any areas where the analysis is incomplete, or improve the clarity of presentation or comprehensiveness of discussions.

The Task Force believes the work facing the SWRCB economics staff will be extremely challenging to complete. The resources and expertise of interested stakeholder groups can provide valuable assistance to the staff through continued communications in the form of the working-group meetings. We believe that the information provided in these meetings will serve to enhance the quality of SWRCB analysis and reporting of economic considerations associated with the water quality plans.

We further believe that it is important that these meetings be seen as providing assistance to the Board's staff. We have therefore proposed a set of ground rules that we believe will make the working group meetings most effective and open in the provision of that assistance to the Economics Unit staff.

Guidelines

The Task Force has drawn up the following guidelines for the organization of these working group meetings.

1. The Board staff will need to undertake a proactive stance to ensure a wide range of stakeholders participate in the working group. For example, there appears to have been limited participation in the task forces by environmental groups. Other groups, such as small point and non-point source dischargers, should also be encouraged to participate.
2. The meetings should be conducted as round-table discussions, rather than through formal presentations of completed analysis. The goal of these discussions between staff and stakeholders would be to clearly identify and resolve contentious issues. These discussions will be necessary to ensure that any analysis developed by individual stakeholders will conform to the study guidelines to be used by the staff. The process should not be adversarial; it should <u>not</u> involve sworn testimony and cross-examination. The working-group meetings should be collegial in nature; that is, they should be viewed as an opportunity for outside professionals to cooperate with staff with the view of developing the best analyses possible given the Board's constraints.

3. The working group meetings should begin with presentations from Board staff proposing analytical approaches, assumptions, methods and data to be used. Issues and constraints should also be described.

4. The meeting should then be open to general discussion of the issues raised by the Board staff, and to give stakeholders opportunities to support or voice concerns over the staff proposals, recommend alternatives, and when appropriate, provide data or analyses.

5. A member of the Economics Unit staff should chair the meeting to ensure that the staff objectives are met to the extent possible. It was suggested that other State Board staff possess particular technical knowledge that will be a necessary guide to the process, and that these staff should be involved in the process when needed.

6. Where useful analyses already exist, Board staff should identify the analysis they intend to review, and encourage stakeholders to provide comments on the applicability and validity of these studies and/or analyses.

7. Staff should outline a timetable for provision of comments, data or analysis to allow time for this information to be of assistance in development of the staff analysis.

8. SWRCB staff are expected to critically evaluate all analysis brought to them by other parties. Correctable deficiencies should be brought to the stakeholder's attention as soon as feasible, with the goal of maximizing the acceptability of these studies. Where proffered analyses are rejected or modified

by the staff, staff should provide, on request, a written explanation for these actions To avoid undue pressure on the staff, these written requests for explanation may be considered as public comments and the requests should receive the same form of written response and on the same time-schedule as provided to other public comments.

9. Providers of data do not bind themselves to accept any use that the staff may make of their data. Rather, the providers only undertake that the data and analysis that they will provide will be the best that they can produce given time, data and resource constraints under which they are operating.

10. Any studies made available to staff for their consideration will also be made available to other stakeholders. We suggest that this be done by staff circulation of a list of data/analyses provided, and a contact person and telephone number for each item. We further recommend that a list be maintained of all other studies to be relied on by the staff. Where practical, the stakeholder providing the item will volunteer a contact person to shield Board staff from the time and resource burden of this effort. If this responsibility is too burdensome for the individual stakeholder concerned, Board staff will act as the default contact.

11. Minutes will not be kept of these meetings. Rather, an "action list" will be made of the data/analyses that are volunteered at the meetings. An attendee list will be made at each meeting and distributed to interested parties.

While the Task Force reached consensus on these proposals, three major concerns were raised. The first was that the conduct of these meetings should not become so burdensome as to inhibit the staff's ability to conduct its economic analysis. To ensure that this does not occur, both the scheduling of the meetings and the conduct of the meetings should be within Board staff control. Second, Task Force members wanted to stress that, while they wished to assist the Board staff to the extent possible, the analysis remained the responsibility of the staff, and no control of the analysis should be vested in the working group. Third, members of the Task Force were concerned that participation in the working groups might be limited because of the investment of time that would be necessary. The first guideline outlined above is the Task Force's best effort to address this concern.

Section 8 - Development of Institutional Capacity for Economic Analysis

The Task Force recommends that the SWRCB increase staff ability to perform basic and complex economic analyses related to water quality issues. Economic considerations should be addressed at various points during the process of setting and implementing water quality objectives. Many of the economic analyses are complex and require significant amounts of data or information. The Task Force believes the SWRCB must begin to dedicate resources necessary to develop the institutional capability for conduct of highly reliable and valid economic analyses of water quality issues throughout the State.

Data Collection and Management

The SWRCB needs to provide a means of gathering water quality information and consolidating the data into a useful and easily accessible database(s). The collection and management of this information should be performed in way that allows the SWRCB to address both short-term and long-term questions related to the economic impacts (e.g., benefits, costs) of water quality measures.

Wide Range of Economic Analyses

The SWRCB is called upon to answer a wide range of economic questions, from the compliance costs of a site-specific point source discharger to the benefits of reduced heavy metals in a given water body of the State. Many of the analyses necessary to inform decisions based on economic considerations require expertise in several disciplines.

The Task Force recommends that the SWRCB provide staff with resources necessary to contract experts in fields of study (e.g., environmental economics, finance, sociology) to conduct aspects of complex economic analyses for which in-house staff are not available. The Task Force expects that these types of services will be needed by the SWRCB to examine economic considerations, at a statewide and regional level, associated with the adoption and implementation of water quality objectives. A contingency contract with a firm possessing appropriate fields of expertise could assist the SWRCB in conducting high quality complex analyses.

The Task Force believes it is important for the SWRCB to provide economic analytical services to the regional boards. We suggest that provision of these services from the State Board will promote consistency and cost-efficiency in the treatment of economic considerations at the regional level. Awareness by State Board economics staff of all economic information being generated at the regional level will allow maintenance of a single database and avoidance of unnecessary, duplicative, and costly studies.

Appendix A - Methodologies for Economic Analysis

Appendix A - Methodologies for Economic Analysis

A variety of methods or techniques are available to compile and analyze data or information related to the economic changes or impacts potentially brought about by promulgation of water quality objectives. Due to the limited time available for Tack Force discussions, it was decided that a comprehensive assessment of commonly used economic techniques would not be an efficient use of time. However, some Task Force members felt it was important to provide readers interested in economic methods of analysis or assessment with a brief summary of commonly utilized analytical techniques or methods. Provided below is a summary of such economic methods.

While various types of economic analysis can be performed to measure or assess the magnitude of changes expected to result from a give policy, the appropriate economic measurement techniques(s) or use for a particular impact or change, will depend on the characteristics of the change (e.g., lower health risk, higher treatment costs) and the amount of resources to be dedicated to the analysis.

"Econometric analysis" is the application of various types of statistical procedures or methods to a set of economic data or information. Many of the economic techniques or methods described below utilize some form of econometric analysis to examine the data that has been collected.

It is important to note that all of the methods described below have strengths and weaknesses, and must be appropriately applied to be useful for policymaking. Likewise, analytic findings derived from these techniques are usually based on a number of assumptions, which may be subject to debate. Readers are encouraged to examine other documents which provide in-depth descriptions of these methods, such as those published by state and federal environmental agencies.

A) Engineering Economics or Life-cycle Cost Analysis

These methods provide an accounting for the variable and fixed costs associated with constructing and operating a technology, facility or program. The costs can be described in terms of per unit or output, on an annual basis, or over the entire life-cycle of a technology or a project. The results of engineering economic analyses are often used as inputs for subsequent analyses, from financial evaluation to regional impact models. By using a common set of assumptions, the costs of various technologies can be ranked on the basis of economic efficiency. At the core of an engineering economic analysis is the method used to compare costs among project alternatives.

Life-cycle analysis involves first calculating the present discounted value of all costs necessary to operate the project over its lifetime. For example, these costs can include energy, labor, and material purchases, as

well as other factors. The total investment costs for constructing the project are added to variable costs to arrive at a total life-cycle cost. Both engineering economics and life-cycle analysis can be used as part of broader decision analytic techniques, including both benefit-cost and cost-effectiveness analysis. In engineering economics, five key pieces of information or assumptions are required: 1) the capital investment or "fixed" costs; 2) the annual expenditures for operation and maintenance; 3) expected lifetime of the appropriate interest rate or discount rate. Life-cycle analysis is distinct among analytic methods in that it attempts to account for all benefits and costs associated with a particular action or policy, both direct and indirect.

B) Mathematical Programming Models

Mathematical models can be programmed to estimate the magnitude of changes in certain factors or variables, based upon knowledge of cost, benefit, production, and/or damage functions. These functions represent technical relationships that are described in mathematical terms which can be linear or non-linear relationships, Mathematical programming models enable analysts to examine possible outcome's bases on profit-maximizing behavior or some other decision rule.

Programming models can be used to simulate a firm's decisions based on prospective cost and production information. However, these models typically ignore other aspects of human behavior, such as risk aversion actions. The model represents a static snapshot in which a firm might move from one technology to another because of changes in an objective function or any of the constraint.

Programming models are built on a number of different key assumptions including: 1) short-run cost minimization equals profit maximization; 2) technology costs are will understood and can be specified with a high degree of certainty; 3) input units are divisible down to a sufficiently small amount.

C) Accounting Analysis or Case Studies

This method of economic analysis focuses on the balance sheet of firms within an industry affected by a policy proposal. The method evaluates the impacts of changing costs on individual firm operations. Accounting analysis relies upon case studies to develop results that might be representative of similar types of firms that will be affected by the policy.

Relatively complete financial information for either a firm or an industry is necessary for accounting analysis. Usually the most difficult information to collect is the revenues for privately-held firms or for individual facilities of publicly-held companies. Surveys and business databases, such as the one compiled by Dun and Bradstreet, are commonly used information sources for this method.

D) Hedonic Pricing Method

This method uses the difference in prices for two similarly marketed goods (e.g., houses) identifies differences in characteristics of the two goods; and finally attributes the variation in market price to the public's value associated with the characteristics of interest. For example, if two identical houses in tow different locations differ only in the degree of visibility allowed by air quality, the value of greater visibility would be reflected in the difference in property values. This difference is the implicit market price for the characteristic.

Most hedonic pricing studies of environmental goods or services rely on differences in property values. Thus, the key piece of data for the analysis is information on sales prices for comparable homes or buildings. Information on other factors which may influence house prices, such as location relative to the workplace, quality of government services, other neighborhood characteristics, as well as measures of environmental quality, is also necessary to conduct this type of analysis.

Hedonic pricing was first developed to determine consumer willingness to pay for options on automobiles, such as an automatic transmission. Economists have since used it to value differences in government services such as education and public safety. Hedonic pricing has been used to value changes in air quality in Southern California and water quality in the San Francisco Bay.

E) The Travel Cost Method

The Travel Cost Method (TCM) is bases on the concept that recreators incur travel costs to reach a site, and that these costs can serve as a proxy for the market value of the site. Site use would be expected to decline as distance and travel costs rise. Be observing people's recreation choices (i.e., number and location of site visits) the TCM traces out the prices paid be recreators in terms of travel costs to reach their chosen leisure spot. As recreators travel to a selected location from diverse origins, their different travel costs trace out the price/quantity relationship known as the demand curve for the recreational site. Through application of this technique, certain "use" values for a particular resource (e.g., reservoir) can be measured.

Travel costs are based on both direct out-of-pocket costs such as fuel, hotels, entrance fees, and the opportunity cost associated with time spent traveling to the site. This latter component of time is generally the larger of the two, but also is the most difficult to accurately measure,. For simplified applications of TCM, the analyst often will assume that the opportunity cost of travel time equals some portion of the average hourly wage of individuals in the sample. The travel cost demand function can be statistically extrapolated to the target population to derive estimated "user" values.

The shape of the demand curve for any particular resource and the value of any changes to the resource's

recreational or aesthetic quality are sensitive to the presence of substitutes, alternatives and complements. The incremental value for a change in quality will be larger for resources with fewer substitutes or alternatives that are located near other complementary resources (e.g., two neighboring national parks that are closer to large population centers, and serve higher income user groups), all else being equal.

Three types of TCM studies are usually done. The first approach uses surveys of individuals at the recreation sites to determine visitor characteristics, including place of residence. These results are then used to statistically infer demand for a larger population group, including those who have not traveled to the site. This type of TCM study requires in-depth surveys of a large number of recreators and the application of sophisticated statistical techniques.

The second approach uses a "gravity" model, that is, it takes a population with an expressed or known demand for various recreational opportunities and distributes this demand among the various recreational options based on the relative costs and characteristics for the option. Demand can be estimated from a household survey (rather than a site survey). The exact characteristics of those actually visiting the sites need not be known, but the total number of visitors to all sites must be equal to the number of individuals having indicated they visited the sites in the household survey.

A third approach relies on time-series analysis of a particular site. In this case, visits to a site are statistically compared to factors which might affect demand, such as changes in income, out-of-pocket costs per mile, the size of relative population centers, and key characteristics of the site. To be statistically valid, this approach requires that a sufficient number of observations be gathered.

TCM has been sued mostly to estimate the value attached to recreational opportunities, such as fishing or hunting. For example, values attached to salmon fishing in the Pacific Ocean and on the Sacramento River have been assessed in several studies. The travel cost method has also been used extensively be several federal agencies to evaluate the recreational benefits of areas under their management.

F) The Contingent Valuation Method

The Contingent Valuation Method (CVM) is currently the only direct economic method available to assess the public's value for natural resources that are not used or consumed in markets. The CVM uses a survey instrument to create a hypothetical or contingent market for the natural resource and/or resource service in question. The CVM can be used to estimate what is often called "passive use" or "nonuse" values of goods or services, although the method can be used to assess direct use values as well.

The CVM uses a survey or questionnaire format to assess the "willingness to pay" (or "willingness to accept" compensation for a loss) of individuals for an increase in the level of some good or service. The survey generally describes: 1) the good or service to be valued (e.g., environmental quality change); 2)

how the change will occur; and 3) how payment for the improvement would be made by each household. The survey is administered to a representative sample of individuals who would be affected by the policy that leads to the change. The public's stated willingness-to-pay for the changes is assumed to reflect the monetary value of the resource of services in question.

The survey instrument is developed and refined through use of focus groups and pre-tests. The survey can be administered in the form of an in-person interview, a mail survey, a telephone interview, or some combination of the three survey approaches. The CVM analysis requires an extremely sophisticated, well-designed survey instrument so that respondents fully understand the contingent good being valued, how they would receive it and how they would pay for it. As with any type of survey, there exists the potential for different types of biases that could influence responses to questions.

This method has been increasingly adopted by economists and public agencies as a technique for determining the passive or nonuse values associated with environmental goods. The CVM is now applied by several federal agencies, including the U.S. Bureau of Land Management, the U.S. Army Corps of Engineers, the U.S. Forest Service, the U.S. Department of the Interior, and the U.S. Department of Commerce.

G) Politically Revealed Preferences

The Politically Revealed Preferences (PRP) or control costs method uses the assumption that choices made by political decision makers reflects the values of the voting public, and therefore that these values can be determined from the compliance costs associated with the relevant regulations and laws (i.e., political choices). For instance, the benefit of a given amount of water quality might be represented by the amount of bond funding approved by the voters in a general election, based on the increment of water quality improvement that will result from expenditure of the bond funds. More typically, the PRP method relies upon compliance expenditures (as opposed to voter-approved funding) as a reflection of the public's value of goods or services provided by legally required (politically driven) actions that bring about the particular change in question.

H) Damage Functions

The damage function approach can be used to examine how changes in the level or concentration of pollutants can impact physical resources, public health, and the environment. This approach requires knowledge of the physical "dose-response relationships" between the constituent of concern and potential receptors. The types of responses include, for example, health effects (morbidity and morality), ecological damage to vegetation and animals, damages to economic resources such as agriculture, timber or minerals, materials damages to buildings, fixtures or vehicles and aesthetic concerns (visibility or odors).

This approach first estimates the policy induced changes in "dose" of a pollutant and then converts these

changes into expected "responses" that are aggregated across all receptors. Finally, each of the responses is converted into economic values. This final step requires the use of additional economic methods. Damage function values can be derived from measured income losses (e.g., fishery declines due to water quality impairment), or imputed individual valuations (e.g. differences in lakeside house values from variations in water quality).

Models for Analyzing Market Impacts

"Regional Economic Impact Assessments" are perhaps the most widely used form of analysis be environmental policymakers. Regional impact assessments seek to determine region-specific implications of particular environmental policies. The regional models often focus on the distribution of economic impacts across sectors of the economy, the public, or individual firms.

Three basic types of regional impact assessment models are:

- Static Simple Equilibrium Models
- Input-Output Models
- General Equilibrium Models

1) Static Simple Equilibrium Models

These models are more commonly known in the economic literature as partial equilibrium models, and rely upon an assumption that the effects of a change in supply or demand are limited to the impacted economic sector. In other words, the model assumes that the initial changes in supply and demand induced by a policy will dominate the analytic results. The analysis draws on assumptions and empirical data that measure the responsiveness of supply and demand to changes in prices within the given sector. Participants in the various sectors are assumed to make short-term ("static") decisions that are consistent with long-term ("dynamic") conditions.

A second step can be easily incorporated into partial equilibrium analysis to account for indirect economic impacts in related sectors. In this step, economic impact multipliers drawn from larger regional impact analyses are applied to the model.

Simple equilibrium analysis ignores the induced impacts that may occur as a result of a policy due to regional shifts in resource use and income distribution. Where these effects are localized (e.g., in a small farming community), a case study approach is probably more appropriate, since a large regional analysis would not capture small effects. Regionwide induced impacts are better addressed with regional general equilibrium models.

2) Input-Output Models

These models use desegregated data on industrial and commercial economic activity at a specified geographic level to project changes in spending, income and employment in an area's principal business sectors. The relevant data can be related to a system of inter-industry transactions (i.e., input-output accounts), which tract the flow of dollar expenditures from sector to sector as goods are produced and services are provided. Estimates of demand changes, both positive and negative, for sectoral output as a result of the policy changes are developed and applied to the input-output system to produce projections of direct, indirect and induced changes in regional output, employment, income, and production or service value added.

Examples of I/O models include the U.S. Forestry Service's Impact Planning (IMPLAN); the U.S. Department of Commerce's Regional Impact-Output Modeling System (RIMS II); and the California Department of Water Resources' State 512-sector I-O model used to develop forecasts in Bulletin 160. The multipliers from these models often can be used in partial equilibrium studies without having to operate the entire model.

3) General Equilibrium Models

A computable general equilibrium (CGE) model is a mathematical programming description of a "textbook" economy. These models provide a better accounting of input supply constraints and regional transfers. The model traces the impacts of various policy choices as they ripple through a regional economy. The economy in these models is generally represented by the following: utility-maximizing consumers; profit-maximizing producers; and the government.

Appendix B

A PRACTICAL APPROACH FOR ASSESSING COMPLIANCE COSTS IN THE ADOPTION OF WATER QUALITY OBJECTIVES

August 24, 1995
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STATUTORY REQUIREMENTS

The Clean Water Act (CWA) requires States to adopt specific numeric water quality objectives for the EPA priority toxic pollutants whenever the discharge of such pollutants could reasonably be expected to interfere with the designated uses adopted by the State. The CWA requires EPA to publish recommended water quality criteria, but does not mandate that States adopt the EPA-recommended criteria.

EPA regulations state that in adopting numeric water quality objectives, States should establish values based on: (1) EPA-recommended criteria; (2) EPA-recommended criteria modified to reflect site-specific conditions; or (3) **other scientifically defensible methods.**

The State Water Code requires that:

> "...**the waters of the state shall be regulated to attain the highest water quality which is reasonable**, considering all demands being made and to be made on those waters and the total values involved, beneficial and detrimental, **economic and social**, tangible and intangible."

The Water Code also requires that in establishing water quality objectives the factors to be considered shall include, among other factors:

> "(c) **Water quality conditions that could reasonably be achieved** through the coordinated control of all factors which affect water quality in the area.
>
> (d) **Economic considerations**."

GENERAL APPROACH FOR SATISFYING STATUTORY REQUIREMENTS

Federal and State laws, although different, are not incompatible. One approach for developing water quality objectives that satisfy both Federal and State law is to: (1) develop a range of alternative, scientifically defensible objectives for each pollutant; (2) evaluate the range for attainability, economic considerations, and other pertinent factors; and (3) based on the evaluation, select from within the range the most stringent objective which is reasonable. Several different appropriate (i.e., scientifically defensible) methods for developing a range or set of alternative objectives are being evaluated by both the Site-specific and the Effluent Dependent Waters Task Forces.

An ideal approach for assessing attainability and the cost of attaining objectives has been described in a Cost of Compliance Model, dated June 26, 1995. The model involves a sampling of water bodies throughout the State, an assessment of attainability and compliance costs in those water bodies, and then an extrapolation of the costs statewide. At the present time, however, it is impractical to use the ideal model. There is insufficient data on ambient water quality and pollutant sources to employ the model, and it is impractical to develop the needed data within the time frame established for adopting the State Plans.

PRACTICAL APPROACH FOR ASSESSING ATTAINABILITY AND ECONOMICS

Although it is impracticable within the time frame of these plans to utilize an ideal model, it is both possible and necessary to adopt a short-term practical approach to assess attainability and economic impacts based on existing or easily gathered information.

Specifically, it is feasible to assess attainability and economics for several distinct types of water bodies and then, based on the assessment, to develop statewide objectives for each type. It is appropriate to do this for the following three types of water bodies:

Effluent dependent waters (EDWs),

Agricultural waters, and

All other waters.

Effluent dependent and agricultural waters face the greatest challenges in terms of complying with either EPA-recommended water quality objectives or developing acceptable alternative objectives. In other

waters, anthropogenic discharges generally constitute a lower percentage of the total stream flow and, therefore, there is a greater likelihood that the objectives can be achieved without costly capital expenditures. Fortunately, it is an easier task to assess attainability and economics for effluent dependent and agriculture waters than for other waters.

In addition to developing statewide objectives for these three types of water bodies, it will be necessary to include in the plans a process for adjusting the statewide objectives on a site-specific basis. Site-specific modification of statewide objectives should be considered wherever local application of the statewide objectives would be inappropriate or would not be reasonable.[2]

The following sections describe a practical approach for considering attainability and compliance costs in the development of statewide objectives for each of the three types of waters listed above and in the development of site-specific objectives.

Water Quality Objectives for Effluent Dependent Waters.

Effluent dependent waters (EDWs), by definition, are waters whose uses depend on anthropogenic discharges. As a result, many of these waters are lower in quality than other waters. If EPA-recommended water quality criteria were to be applied across-the-board to EDWs, the most cost-effective alternative in many cases would be to relocate the discharges, either to land or other waters (such as the ocean). This would involve considerable cost and would result in a loss of the uses which are discharge-dependent. For this reason, it is desirable for the SWRCB to develop water quality standards that would allow these discharges to continue. It appears to be possible to develop scientifically defensible objectives which would allow most present discharges to EDWs to continue without significant additional capital expense, while providing an appropriate level of environmental protection for these streams.

Since by definition point and nonpoint source discharges to EDWs dominate the dry weather flows in these water bodies, the analysis can focus on the attainability and cost of achieving alternative water quality objectives at the end of the pipe. This analysis requires information on the quantity and quality of various anthropogenic discharges, including direct industrial discharges, POTWs, and municipal storm water

[2] There are other mechanisms for incorporating economic considerations into water quality management decision-making including TMDLs, market-based approaches, etc. These other mechanisms are not addressed in this paper.

discharges. (Agricultural discharges are addressed separately in the next section.) In other words, there is no need for data regarding ambient water quality or the relative contribution of various upstream pollutant sources. The focus can be strictly on what is necessary to bring individual discharges into compliance with objectives prior to discharge.[3]

The recommended procedures for considering attainability and compliance costs for effluent dependent waters are as follows:

1. Collect all readily available priority pollutant concentration data collected over the last three to five years, together with available flow data, on direct industrial, POTW, and municipal storm water discharges to EDWs (considerable data exist in the regional board offices). The discharges with readily available pollutant concentration data will constitute the sample. Alternatively, select a statistically representative sample of discharges in each class.

2. Analyze the data statistically, and for each discharge prepare frequency distributions for each pollutant (i.e., plot the percentage of time each discharge achieves a certain concentration of the pollutant).

3. Compile the data for each priority pollutant, and determine the concentrations that are achievable with existing effluent quality by 90%, 95%, 99% and 100% of each class of discharger (industries, POTWs, and storm water).

4. Based on this analysis, divide the priority pollutants into three categories:

    a. Constituents of concern, i.e., those for which the EPA-recommended water quality criteria are not achieved by 99%-100% of the dischargers. The objectives for these constituents need to be subjected to an economic analysis.

    b. Constituents not of concern, i.e., those for which the EPA-recommended water criteria are met by 99%-100% of the dischargers. In these cases, the EPA-recommended water quality criteria should be adopted without further analysis.

[3] This approach is predicated on the assumption that when an EDW mixes with a downstream water body, there is an allowance for dilution. Otherwise, the objectives in the downstream water will have to be achieved in the EDW. This issue is being addressed as a part of the Mixing Zone Policy being developed by the Permitting Task Force.

c. Constituents for which insufficient data exist, i.e., there is insufficient data to determine attainability due to lack of monitoring data or insufficient analytical detection limits. In these cases, no water quality objective should be adopted at this time. (Under the CWA, objectives are not required if the pollutant cannot reasonably be expected to interfere with the designated uses. If for some reason, EPA determines that objectives must be adopted irrespective of the lack of data, the least stringent objectives that are scientifically defensible should be adopted. As additional data become available or detection levels are reduced, the objectives can be revisited, and, if necessary, changed.)

5. For each constituent of concern, a set of scientifically defensible objectives should be developed. The set will constitute the alternative objectives that may be considered under Federal law. It is this set of alternative objectives which will be subjected to an attainability and compliance cost analysis in order to also satisfy the State Water Code. (An example of a possible range for human health carcinogens is from a 30-day average concentration based on a cancer risk factor of 1 in 10 million to a long-term, multi-year average concentration based on a cancer risk factor of 1 in 10,000. Although more challenging, it is also possible to develop ranges for non-carcinogenic human health criteria and for aquatic life criteria. The Effluent Dependent Waters Task Force has identified ten different methods potentially useable for developing alternative objectives for EDWs.)

6. Perform an attainability and compliance cost analysis of the alternative objectives for the constituents of concern. Based on the need to simplify the analysis, it is proposed that only two sets of objectives be evaluated: (a) the EPA-recommended objectives; and (b) the most stringent objectives within each range that are achievable by 99%-100% of the dischargers. Obviously, the cost to achieve the latter set of objectives will be small, if any. It is anticipated that the latter set of objectives would be adopted, but to justify these objectives it is necessary to evaluate the attainability and costs of attaining the EPA-recommended objectives.

The attainability and compliance cost analysis should be conducted as follows:

a. Attainability and cost of EPA-recommended objectives.

Identify control technologies, management measures, and/or pollution prevention measures for industries, POTWs, and municipal storm water that would result in a reduction in the discharge of the constituents of concern.

Develop cost and effectiveness information for each potential control technology or measure.

For each discharge not achieving the EPA-recommended criteria for the constituents of concern, determine the reductions in constituent concentrations necessary to achieve the EPA-recommended criteria and the most cost-effective combination of control technologies and measures and the associated costs necessary to achieve those reductions.

Based on the estimated costs for the individual dischargers in the sample and, an estimate of the percentage of the regulated community which these dischargers represent, estimate the total, statewide cost of compliance with the EPA-recommended criteria.

b. Most stringent objectives generally attainable.

Compare the statistical analysis of each discharge with the range of objectives under consideration and identify the most stringent objective in each range that is generally achievable, i.e., achievable by 99%-100% of the discharges, with little or no additional controls.

7. Based on the above analysis, the State Board should take the following action with respect to adoption of statewide water quality objectives for EDWs:

a. Adopt the EPA-recommended criteria which are determined to be presently attained by 99%-100% of the dischargers.

b. For other constituents of concern, adopt the most stringent, scientifically defensible objective which is presently attained by 99%-100% of the dischargers.

c. Exempt those specific waters from EDW classification where it is determined that the uses in those waters are not reasonably protected by the statewide EDW objectives. Such waters should be identified as being subject to the general statewide objectives applicable to other waters, or as appropriate for the development of site-specific objectives.

d. Include in the plans a provision whereby a regional board may later determine that statewide objectives for EDWs are insufficient to protect beneficial uses in a specific water body. The regional board would then have the discretion to develop alternative (site-specific) objectives for that water body. Any regional board development of alternative objectives should consider attainability and economics as described in the site-specific objectives section.

Water Quality Objectives for Agricultural Waters.

Agricultural waters are similar in many respects to EDWs. Thus, the approach used to develop objectives for agricultural waters will be the same as that used to develop objectives for EDWs.

The only difference is that it will first be necessary to sample a significant number of agricultural discharges for the priority pollutants. In contrast to industrial, POTWs, and storm water discharges, little or no priority pollutant data exist for agricultural discharges. It should be sufficient to collect samples from a representative sample of agricultural discharges over a year's period. (The sampling of agricultural discharges is an activity that should be initiated as soon as possible.)

There will be a number of waters that are both effluent dependent waters and agricultural waters. In those waters, the least stringent of the statewide EDW and agricultural waters objectives should be applied.

General Water Quality Objectives for All Other Waters.

These waters include the major streams, rivers and estuaries of the State and are widely used for fishing, recreation and water supply. Further, these waters can fully support beneficial uses in the absence of any anthropogenic activities. In fact, anthropogenic discharges to these waters have the potential of interfering with the full achievement of beneficial uses. Therefore, the protection of these waters and their associated uses is a high priority.

The following procedures are recommended for assessing attainability and compliance costs in these high priority waters:

1. Identify all State waters where relatively recent ambient water quality monitoring data exist for constituents to be regulated by the plans.

2. Develop a matrix of monitored water bodies (vertical) and regulated constituents (horizontal). For each constituent, identify each water body as either (a) impaired; (b) unimpaired; or (c) unknown. The categorization of waters as impaired or unimpaired should be based on the EPA-recommended objectives and take into consideration the averaging periods and allowable frequencies of exceedence recommended by EPA. (The development of this matrix should be initiated as soon as possible.) (Effluent dependent and agricultural dominated waters should not be addressed by the matrix.)

3. From the matrix, make a general assessment of what is known and not known about present water quality, i.e., which EPA-recommended objectives appear to be exceeded, which clearly do not, and which cannot be determined due to lack of data. The constituents associated with the EPA-recommended objectives that appear to be exceeded, at least in some waters, constitute the "constituents of concern" and will be the focus of the attainability and economic analysis. (The Chemical Specific Task Force is considering a recommendation on the identification of constituents of concern using ambient data and relative toxicity.)

4. From the matrix select a sample of water body segments with available monitoring data for assessing attainability and economics. The sample should be statistically representative of the State's water bodies. The selection should be based on factors such as flow regime, salinity, stream characteristics, biological community type, predominant land use in the watershed, etc. If there are an insufficient number of water bodies with ambient data, water bodies without data should be included in the sample. Such water bodies could be evaluated for attainability and economics based on bringing dischargers into compliance with discharge limits based on the alternative objectives and economics based on bringing dischargers into compliance.

5. For the selected water bodies, review and compile the ambient water quality and discharge monitoring data for the constituents for which objectives are proposed. The review should include a review of the quality of the data (i.e., QA/QC). All high quality data should be compiled in both time series and frequency distribution form.

6. For each water body, compare the frequency with which the ambient water achieves the discharge (or those water bodies with discharge data only) the numeric objective under consideration with the required frequency of compliance.

7. Based on this comparison, determine which water bodies exceed or, based on statistical analyses, are likely to exceed the objective under consideration.

8. For each water body that exceeds an objective under consideration, identify the known or suspected sources of the constituent of concern. If this information is not available, proceed to Step 10.

9. Where information exists on all significant sources to the water body, proceed as follows:

   a. Characterize the discharge from each significant source in terms of quantity and quality.

   b. For each significant source, identify control technologies, pollution prevention measures, and/or management measures that would result in a reduction in the discharge of the constituent of concern.

   c. Develop cost and removal effectiveness information for each potential control technology or measure for each significant source.

   d. Based on the available technologies and control measures and the sources involved, develop alternatives that would result in achievement of the objective (i.e., result in the required frequency of compliance). The alternatives may include a combination of control technologies and measures for the various sources discharging to the water body. In some cases, it may be appropriate to evaluate alternatives on a watershed basis.

   e. Estimate the costs for each alternative, including the initial capital and the ongoing operational and maintenance costs, and determine the total present worth of those costs.

   f. Determine the alternative that would result in the most cost-effective or least-cost, means of achieving the proposed objective in the water body.

   g. The cost of the most cost-effective means of achieving the proposed objective then constitutes the cost of compliance for that objective in that water body.

10. Where source information is unavailable, estimate the costs of bringing known industrial, POTW, municipal storm water, and agricultural discharges to the water body into compliance with discharge requirements based on the objectives. Where discharges to a sampled water body have not been monitored for the constituents of concern, concentrations typical of such discharges should be used in the analysis. The costs of bringing these discharges into compliance with discharge requirements should then be compared to the improvements in water quality that will result from controlling these discharges.

11. The total, statewide cost of compliance for a proposed objective is determined by summing the compliance costs for all sampled water bodies and then multiplying by a factor which relates the

sampled water bodies to all of the water bodies that would be subject to the proposed objective. To the extent there is insufficient ambient and/or source data to follow the procedures under "9" above, the analysis should be appropriately qualified in the text of the FED.

12. Based on the above analysis, the State Board should take the following action with respect to general statewide water quality objectives for other waters:

    a. Adopt the EPA-recommended criteria which are determined to be presently attained by 99%-100% of the dischargers.

    b. For other constituents of concern, adopt the most stringent, scientifically defensible objectives which are determined to be reasonable. In some cases, though not presently attained, the EPA-recommended criteria may be determined reasonable.

    c. Include in the plans a provision whereby a regional board may later determine that general statewide objectives are insufficient to protect beneficial uses in a specific water body. The regional board would then have the discretion to develop alternative (site-specific) objectives for that water body. Any regional board development of alternative objectives should consider attainability and economics as described in the site-specific objectives section.

Site-Specific Water Quality Objectives

It is improbable that statewide water quality objectives will be appropriate in all water bodies in the State. For that reason, the plans must contain a process for adjustment of the statewide objectives on a site-specific basis. In order to ensure that the State Water Code is satisfied, the plans should require that the site-specific process be initiated wherever it appears that local application of a statewide objective may be unreasonable. The site-specific process should also be initiated when it appears that the statewide objectives may be insufficient to protect beneficial uses in a particular water body.

The plans should define the process for development of site-specific water quality objectives, including the approach to be utilized for considering attainability and economics. In some cases, site-specific objectives may be developed on a watershed basis, in conjunction with the development of a watershed management plan. Since the site-specific process will focus on individual water bodies or watersheds and often involve the development of additional data, the ideal cost of compliance model and a more sophisticated approach for assessing benefits may be utilized. However, because of the considerable expense associated with the

development of site-specific objectives, the process for assessing attainability and economics may still be constrained by practical considerations, including the lack of scientific data relating benefits to water quality levels.

SUMMARY

Water quality objectives must be both scientifically defensible and reasonable. The Water Code indicates that the determination of reasonableness should be based on an assessment of attainability and economics. Use of the ideal model for assessing attainability and economics is impractical within the time frame of these plans. For this reason, a practical, tiered approach is proposed. This approach involves an increasing level of sophistication as one moves from lower to higher priority waters and from statewide to site-specific situations. The recommended approach is summarized below:

Objectives for Effluent Dependent Waters and Agricultural Waters.

Select objectives primarily on the basis of attainability (i.e., select the most stringent objectives that are presently attained). Economics will be considered with respect to: (1) the cost of achieving the EPA-recommended water quality objectives; and (2) the qualitative benefits that accrue primarily as the result of the discharges to such water bodies.

General Objectives for Other Waters.

Select objectives on the basis of attainability and economics (i.e., select the most stringent objectives that are reasonable). The economic analysis will rely on existing data and involve primarily the estimation of compliance costs, the estimation of the associated improvement in water quality concentrations, and qualitative discussions of the associated benefits. In some cases, it may be possible to assign costs to the benefits that will accrue from improved water quality. The analysis will have to be qualified based on the lack of data.

Site-specific Objectives.

A more detailed and realistic process for assessing attainability and economics should be carried out for the site-specific development of water quality objectives. This process does not need to be constrained by existing data and may involve the collection of additional data necessary to use the ideal cost of compliance model and to assess economics. However, even this process may be constrained in the ability to quantify benefits, in that quantifiable scientific data relating benefits to water quality levels is not yet reliable or widely available.