State Water Resources Control Board

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Secretary for Environmental Protection

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March 22, 2001

AB 982 Public Advisory Group (PAG) Members and Alternates:

STATE WATER RESOURCES CONTROL BOARD (SWRCB) MONITORING REPORT

The SWRCB recently released a new report titled "Proposal for a Comprehensive Ambient Surface Water Quality Monitoring Program" (enclosed). This report is required by California Water Code Section 13192 and AB 982 (Ducheny).

If you have any questions regarding the report, please call me at (916) 341-5560. You may also call Gita Kapahi, the staff liaison to the PAG, at (916) 341-5561.

Sincerely,

Craig J. Wilson, Chief
Water Quality Monitoring Unit
Division of Water Quality

Enclosure

cc: Interested Parties

State of California
STATE WATER RESOURCES CONTROL BOARD

PROPOSAL FOR A COMPREHENSIVE AMBIENT SURFACE WATER QUALITY MONITORING PROGRAM

Report to the Legislature

November 30, 2000

PREFACE

This report is a proposal by the State Water Resources Control Board (SWRCB) to create an ambient surface water quality monitoring program that addresses all hydrologic units of the State using consistent and objective monitoring, sampling and analytical methods; consistent data quality assurance protocols; and centralized data management. This report is required by Assembly Bill (AB) 982 (Statutes of 1999). Following are the major elements of AB 982 (Water Code Section 13192) and the SWRCB response:

- **Identification of physical, chemical, biological, and other parameters about which the program shall collect and evaluate data and other information and the reasonable means to ensure that the data are accurate in determining ambient water quality.**

  The proposal calls for the use of biological, chemical, and habitat (including the physical) indicators of water quality.

- **The use of models and other forms of information not directly measuring water quality.**

  The proposal recommends the use of information from geographical information systems, remote sensing, precipitation models, land use practices, and other models.

- **Reasonable quality assurance and quality control protocols sufficient to allow sound management while allowing and encouraging, where appropriate, data collection by entities, including citizens and other stakeholders, such as dischargers.**

  The proposal calls for the development and implementation of a consistent statewide quality assurance project plan and recommends data quality requirements.

- **Steps to develop expeditiously information about waters which the State presently possesses little or no information.**

  For inland waters (watersheds), the program will implement a rotating basin framework where each of the nine Regional Water Quality Control Boards (RWQCBs) will be divided into five areas consisting of one or more hydrologic units. Coastal waters will be monitored using a probabilistic study design.

- **A strategy for assuring that data collected as part of monitoring programs and any quality assurance elements associated with the data collection will be made readily available to the public.**

  All information collected in the program will be available to the public and interested parties on the SWRCB web site.

- **An approach for assessing and characterizing discharges from nonpoint sources of pollution and natural background sources.**

  In watersheds, the program will implement a rotating basin framework to help identify nonpoint sources and natural background sources.

- **A strategy to prioritize and allocate resources in order to effectively meet water quality monitoring goals.**

  The RWQCBs will list regional and site-specific monitoring priorities in their Watershed Management Initiative Chapter. The majority of funding will be used for the rotating basin monitoring scheme.

- **Costs to implement regional and site-specific ambient monitoring.**

  It is estimated that the funding needed to implement fully the proposal ranges from approximately $59 million to $115 million. These cost estimates also include 87 to 132 additional staff. The SWRCB anticipates that approximately 25 percent of this need will be redirected from existing SWRCB and RWQCB monitoring programs as well as from coordination with other monitoring efforts throughout the State. The unmet funding need ranges from approximately $44 million to $87 million.

EXECUTIVE SUMMARY

The Porter-Cologne Water Quality Control Act and the federal Clean Water Act (CWA) direct the water quality programs to implement efforts intended to protect and restore the integrity of waters of the State. California Assembly Bill (AB) 982 (Water Code Section 13192; Statutes of 1999) requires the State Water Resources Control Board (SWRCB) to assess and report on the State monitoring programs and to prepare a proposal for a comprehensive surface water quality monitoring program. Ambient monitoring is independent of the water quality programs and serves as a measure of (1) the overall quality of water resources and (2) the overall effectiveness of Regional Water Quality Control Boards' (RWQCBs') prevention, regulatory, and remedial actions. Current monitoring and assessment capability at the SWRCB is limited and tends to be focused on specific program needs. This has led to a fragmentation of monitoring efforts resulting in gaps in needed information and a lack of integrated analyses.

This report contains a monitoring program proposal, which is designed to address a number of programmatic objectives focused on assessing the quality of the beneficial uses of the State's water resources. Some of these objectives may be satisfied with the information produced by existing monitoring efforts. However, the SWRCB proposes to restructure the existing water quality monitoring programs into a new program, the Surface Water Ambient Monitoring Program (SWAMP).

The major proposed activities of SWAMP are described below.

1. The SWRCB will implement comprehensive environmental monitoring focused on providing the information the SWRCB and RWQCBs need to manage effectively the State's water resources. This will be an umbrella program that monitors and interprets data for each hydrologic unit at least one time every five years. This program shall focus on all waters of the State without bias to known impairment.

2. The program will have consistent monitoring methods with respect to sampling and analysis, data quality objectives, and centralized reporting requirements. Furthermore, the monitoring efforts implemented through SWAMP will be: adaptable to changing circumstances, built on cooperative efforts, established to meet clear monitoring objectives, inclusive of already available information, implemented using scientifically sound monitoring design with meaningful indicators of water quality, comparable methods, regular reporting, and data management.

3. The program will focus on spatial status and temporal trends in water quality statewide. To do this the program will determine the site-specific locations, the areal extent, and temporal trends in a number of measures of the quality of water, sediments, and biota that are widely applicable throughout the State

depending on the type of water body being monitored. In watersheds, the program will implement a rotating basin framework. In coastal waters, a smaller amount of probabilistic monitoring will be completed.

4. The SWRCB will also develop a Water Quality Control Policy, and a means to implement the Policy, to provide listing/delisting criteria, an approach for setting priorities, minimum data needed to list water bodies, categories of acceptable data quality, and other factors that will allow consistent implementation of the CWA Section 303(d) requirements.

Program Goals

SWAMP is proposed as a new comprehensive program which will (1) integrate the existing water quality monitoring of the SWRCB and RWQCBs and (2) coordinate with monitoring programs of other agencies, dischargers, and citizens groups. To ensure that the Program is coordinated and integrated, the monitoring efforts shall be overseen centrally by the SWRCB. The RWQCBs will establish monitoring priorities for the water bodies within their jurisdictions, in coordination with the SWRCB. This monitoring will be done in accordance with protocols and methodologies laid out in the program.

SWAMP is intended to meet four goals as follows:

1. Create an ambient monitoring program that addresses all hydrologic units of the State using consistent and objective monitoring, sampling and analytical methods; consistent data quality assurance protocols; and centralized data management. This will be an umbrella program that monitors and interprets that data for each hydrologic unit at least one time every five years.

2. Document ambient water quality conditions in potentially clean and polluted areas. The scale for these assessments ranges from the site-specific to statewide.

3. Identify specific water quality problems preventing the SWRCB, RWQCBs, and the public from realizing beneficial uses of water in targeted watersheds.

4. Provide the data to evaluate the overall effectiveness of water quality regulatory programs in protecting beneficial uses of waters of the State.

Overview of the Surface Water Ambient Monitoring Program

The proposal calls for a combination of (1) regional monitoring to provide a picture of the status and trends in water quality and (2) site-specific monitoring to better characterize problem and clean locations. This approach balances these two important monitoring needs of the SWRCB and serves as a unifying framework for the monitoring activities being conducted by the SWRCB and RWQCBs. The coordinated SWRCB and RWQCB involvement in study design and sampling is critical to providing a comprehensive, effective monitoring

program that results in identifying degrading and improving conditions in waterways.

The regional component with the rotating basin design and, for some water bodies, the probability-based design described in Section V will allow the SWRCB and RWQCBs to complete comprehensive monitoring required to satisfy CWA Section 305(b) requirements and will contribute to the achievement of the State's various water quality programs. These types of programs allow the State and USEPA to track trends in water quality. This in turn could be used as measures to track the effectiveness of the SWRCB and RWQCB water quality control programs.

The regional monitoring component (Section V) complements the site-specific monitoring effort in two ways. It provides additional data that can be used to put the data from targeted sites into a broader regional context. Equally important, the regional component would serve as a periodic screening mechanism for identifying new problem areas that were not previously known.

The site-specific monitoring (Section VI) provides flexibility for RWQCBs to focus monitoring resources toward specific problems and waters that may be clean. This might involve verifying problems identified in the statewide surveys, other areas suspected of having water quality problems, or locations that represent background or clean conditions. This documentation and verification of a site's water quality status should be a key component of the Section 303(d) listing process.

Regional Monitoring

The overall goal of this activity of SWAMP is to develop a statewide and regionwide picture of the status and trends of the quality of California's surface water resources. It is intended that this portion of SWAMP will be implemented in each hydrologic unit (including coastal waters) of the State at least once every five years. This portion of SWAMP is focused on collecting information on water bodies for which the State presently has little information and to determine the effects of diffuse sources of pollution, and the baseline conditions of potentially clean areas.

For inland waters (watersheds), the program will implement a rotating basin framework where each Region will be divided into five areas consisting of one or more hydrologic units. The major watercourses and tributaries in one of these areas would be monitored for a one-year period at least once every five years. In coastal waters, a smaller amount of probabilistic monitoring will be completed.

Site-Specific Monitoring

The overall goal of this activity of SWAMP is to develop site-specific information on sites that are (1) known or suspected to have water quality problems and (2) known or suspected to be clean. It is intended that this portion of SWAMP

will be targeted at specific locations in each region. The RWQCBs are given significant flexibility to select the specific locations to be monitored. The RWQCBs may, at their discretion, perform monitoring at clean sites to determine baseline conditions (for assessments related to antidegradation requirements) or if this information is needed to place problem sites into perspective with cleaner sites in the Region.

Water Quality Indicators

One of the most important steps in the development of an ambient monitoring program is the selection and use of indicators of water quality. Indicators are the tools used to assess and measure water quality. Section VII of the Report describes the characteristics of indicators, provides supporting rationale for their use, and lists some of the biological, chemical and habitat indicators that will be used in SWAMP.

Quality Assurance

SWAMP will be developed and implemented with the objective of collecting high quality monitoring data that could be of the most use to the SWRCB and RWQCB programs. Section VIII describes the general quality assurance approach, the need for a quality assurance project plan, and describes the periodic scientific review of the monitoring efforts. Quality Assurance (QA) includes activities to ensure that data collected are of adequate quality given the monitoring objectives. QA consists of two separate but interrelated activities – Quality Control and Quality Assessment. Quality Control activities include standardized sampling collection and processing protocols and requirements for technician training.

Data Management, Data Evaluation, and Reporting

Data management, evaluation, and reporting will be high priorities of SWAMP. Too often, limited funds are spent collecting information that ultimately will be of little use due to lack of standardized data management, evaluation, and reporting. SWAMP will include the use of existing data to the extent it can be verified and placed or linked into centralized locations. Any data that are collected as part of the Program will be made available to all stakeholders centrally along with accompanying metadata. Section IX of the Report is focused on the management of information produced by SWAMP and the use of additional information to support the monitoring efforts, a proposal to develop data evaluation tools, and the types of reports that will be produced.

Costs

Water Code Section 13192 also requires the SWRCB to estimate the costs of implementing the proposed comprehensive surface water quality monitoring program. Section X provides an estimate of the needed funding to fully implement SWAMP, including the estimated costs for the various types of monitoring the SWRCB and RWQCBs will perform, the description of the approach used to estimate costs, and the assumptions made. It is estimated that the annual cost to implement fully the proposal ranges from approximately

$59 million to $115 million. These cost estimates also include 87 to 132 additional staff at the SWRCB and RWQCBs. As SWAMP is implemented, the actual costs of the efforts may differ from the estimates presented in this section due to increased costs to perform the monitoring and other factors. The majority of funding will be used for regional monitoring and sufficient funding will be allocated to implement site-specific monitoring as proposed. To ensure that SWAMP is coordinated and integrated, the monitoring efforts shall be overseen centrally by the SWRCB. The RWQCBs shall establish monitoring priorities for the water bodies within their jurisdictions.

The SWRCB anticipates that approximately 25 percent of the needed funding will be redirected from existing SWRCB and RWQCB monitoring programs as well as from coordination with other monitoring efforts throughout the State. The unmet funding need is approximately $44 million to $87 million per year.

In Fiscal Year 2000-01 the Governor's budget included the SWRCB's Water Quality Initiative to support and expand the implementation of ambient monitoring. This initiative is consistent with the approach proposed in this program. As monitoring efforts are further developed and refined through the process outlined in the proposal, additional funding requests may be made. The SWRCB anticipates SWAMP will be phased in over several years.

Strategy to Prioritize and Allocate Resources

As a part of the comprehensive surface water quality monitoring proposal, the SWRCB is required to develop a strategy to set priorities and allocate resources among the SWRCB and the nine RWQCBs to implement effectively the program. This section presents the strategy of allocating resources for the various types of monitoring that the RWQCBs may perform. Section XI provides descriptions of the Watershed Management Initiative (WMI) and the proposed approach to allocate resources and set priorities.

Advisory Group Review

The AB 982 Public Advisory Group (PAG) and AB 982 Scientific Advisory Group have reviewed the draft proposal and provided significant comments. The comments of the AB 982 PAG have been incorporated into this proposal for a comprehensive surface water monitoring program. The PAG report is an appendix to this Report.

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LIST OF ABBREVIATIONS

AB	Assembly Bill
BPTCP	Bay Protection and Toxic Cleanup Program
CALFED	California Federal Bay Delta Program
CAO	Cleanup and abatement order
CERES	California Environmental Resources Evaluation System
CMARP	Comprehensive Monitoring, Assessment and Research Program
CWA	Clean Water Act
DFG	Department of Fish and Game
DHS	Department of Health Services
DPR	Department of Pesticide Regulation
DWR	Department of Water Resources
EMAP	Environmental Monitoring and Assessment Program
FED	Functional Equivalent Document
FY	Fiscal year
GIS	Geographic information system
IEP	Interagency Ecological Program
ITFM	Intergovernmental Task Force on Monitoring
ML	Minimum level
MDL	Method Detection Limit
NA	Not applicable
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRC	National Research Council
OEHHA	Office of Environmental Health Hazard Assessment
PAG	Public Advisory Group
PY	Personnel year
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
RWQCB	Regional Water Quality Control Board
SAG	Scientific Advisory Group
SCCWRP	Southern California Coastal Water Research Project
SD	Standard deviation
SFEI	San Francisco Estuary Institute
SMWP	State Mussel Watch Program
SWAMP	Surface Water Ambient Monitoring Program
SWIM	System for Water Information Management
SWRCB	State Water Resources Control Board
TMDL	Total Maximum Daily Load
TSMP	Toxic Substances Monitoring Program
TTP	Toxicity Testing Program
USEPA	U.S. Environmental Protection Agency
WDR	Waste Discharge Requirements
WMI	Watershed Management Initiative

SECTION I. INTRODUCTION

California Water Code Section 13192 requires the SWRCB to prepare a report to the Legislature on the SWRCB's proposal for a comprehensive surface water quality monitoring program.

This report includes a combination of monitoring objectives, sampling design, indicators, and other factors to implement fully the Surface Water Ambient Monitoring Program (SWAMP), including developmental steps and implementation costs, and a discussion of funding mechanisms. The SWRCB has included general information required to be submitted to the USEPA pursuant to CWA Section 305(b), information required to be submitted under Water Code Section 13181(c)(1), and information required to be submitted to the Legislature by the Supplemental Report of the Budget Act of 1999.

In considering and designing the proposal, the SWRCB has included all of the following as required by Water Code Section 13192:

1. Physical, chemical, biological, and other parameters about which the program shall collect and evaluate data and other information and the reasonable means to ensure that the data are accurate in determining ambient water quality.

2. The use of models and other forms of information not directly measuring water quality.

3. Reasonable quality assurance and quality control protocols sufficient to allow sound management while allowing and encouraging, where appropriate, data collection by entities, including citizens and other stakeholders, such as dischargers.

4. Steps to expeditiously develop information about waters which the State presently possesses little or no information.

5. A strategy for assuring that data collected as part of monitoring programs and any quality assurance elements associated with the data collection will be made readily available to the public.

6. An approach for assessing and characterizing discharges from nonpoint sources of pollution and natural background sources.

7. A strategy to prioritize and allocate resources in order to effectively meet water quality monitoring goals.

SECTION II. BACKGROUND

This section provides a definition of ambient monitoring, presents an overview of the major monitoring efforts in California, and describes the legislation that requires the proposal for a comprehensive surface water quality monitoring program. The Porter-Cologne Water Quality Control Act (Water Code Section 13000, et. seq.) and the federal CWA direct the water quality programs to implement efforts intended to protect and restore the integrity of waters of the State. Ambient monitoring is independent of the water quality programs and serves as a measure of (1) the overall quality of water resources and (2) the overall effectiveness of RWQCBs' prevention, regulatory, and remedial actions.

Ambient Monitoring

Protecting and restoring environmental resources requires an understanding of where we are now and where we want to be in the future. Monitoring is a key component in determining if we are making adequate progress toward our environmental goals. It is impossible to assess directly progress without a tool and critical benchmarks (such as water quality standards) to do so. Monitoring is the tool that helps measure the success of environmental programs and the overall quality of our water resources.

Ambient monitoring refers to any activity in which information about the status of the physical, chemical, and biological characteristics of the environment is collected to answer specific questions about the status and trends in those characteristics. For the purposes of SWAMP, ambient monitoring refers to these activities as they relate to the characteristics of water quality. SWAMP does not include monitoring to identify sources of pollutants or to assess the effectiveness of individual best management practices (BMPs). Both of these activities are essential for the development and implementation of Total Maximum Daily Loads (TMDLs). Monitoring and research for pollutant source identification and BMP effectiveness are funded through the State's TMDL and Nonpoint Source (NPS) programs. Further, SWAMP does not include effluent or discharge monitoring which is covered under National Pollutant Discharge Elimination System (NPDES) permits and Waste Discharge Requirements (WDRs).

Selected Ambient Monitoring Programs and Approaches

A number of ambient water quality monitoring programs are underway that are already collecting information that may influence SWAMP by contributing needed information to the SWRCB and RWQCBs to assess water quality (Table 1). Many of these programs are focused on large scale condition of aquatic life and other beneficial uses (regional monitoring) and many efforts are focused on site-specific conditions. Most of the programs collect data that measure both exposure to pollutants and the effects these pollutants may have on aquatic life.

TABLE 1: SELECTED TYPES OF SURFACE WATER AMBIENT MONITORING PROGRAMS

Program (Agency)	Site-Specific Monitoring	Regional Monitoring	Effects	Exposure	Reference
State Mussel Watch Program (SWRCB)	●			●	1
Toxic Substances Monitoring Program (SWRCB)	●			●	2
Bay Protection and Toxic Cleanup Program (SWRCB)	●	●	●	●	3
Southern California Bight Projects (SCCWRP)		●	●	●	4
San Francisco Regional Monitoring Program (SFEI)		●	●	●	5
Interagency Ecological Program (IEP)	●		●	●	6
USEPA Environmental Monitoring and Assessment Program (EMAP) (USEPA)		●	●	●	7
NOAA Status and Trends Program (NOAA)	●	●	●	●	7
Rapid bioassessments (DFG and RWQCBs)	●		●	●	8
Toxicity studies (SWRCB and others)	●		●		9
Coastal Fish Contamination Program (SWRCB)	●			●	10
Citizen monitoring programs (various groups)	●			●	11
Timber Harvest Plans, Non-Industrial Timber Management Plans	●			●	12
Department of Transportation monitoring	●			●	13
Surveys of swimming area water quality (Counties)	●			●	14

1 e.g., Rasmussen, 1996
2 e.g., Rasmussen, 1997
3 e.g., SWRCB, 1998; SWRCB, 1999a; Hunt et al., 1998a; Hunt et al., 1998b; Anderson et al., 1998; Fairey et al., 1996
4 e.g., SCCWRP, 1998a; SCCWRP, 1998b; Schiff and Gossett, 1998; Bergen et al., 1998; Allen et al., 1998; Bay et al., 1998
5 e.g., San Francisco Estuary Institute (SFEI), 1999
6 e.g., IEP, 1999
7 e.g., Western EMAP study, in progress; Anderson et al., 1997; Ed Long, National Oceanic and Atmospheric Administration (NOAA), personal communication, August 2000.
8 e.g., Davis et al., 1996; Harrington, personal communication, November 1999
9 deVlaming et al., 1999
10 Contract with DFG (9-035-250); contract with OEHHA (9-038-250)
11 http://www.epa.gov/owow/monitor/dir2.html#california
12 Levine, personal communication, June 2000; California Department of Forestry
13 Sheehan, personal communication, September 2000; Department of Transportation
14 Data from Counties provided to SWRCB

Toxic Substances Monitoring Program

The Toxic Substances Monitoring Program (TSMP) was initiated in 1976 by the SWRCB. The TSMP provides a uniform Statewide approach to the detection and evaluation of the occurrence of toxic substances in fish, estuarine, and marine waters of the State through the analysis of fish and other aquatic life. The TSMP primarily targets water bodies with known or suspected impaired water quality and is not intended to give an overall water quality assessment. Sampling stations are selected primarily by the nine RWQCBs. Data are used by the SWRCB, RWQCBs, and other agencies to identify waters impacted by toxic pollutants.

State Mussel Watch

The California State Mussel Watch (SMWP), initiated in 1977 by the SWRCB, provides a uniform Statewide approach to the detection and evaluation of the occurrence of toxic substances in the waters of California's bays, harbors, and estuaries. This is accomplished through the analysis of transplanted and resident mussels and clams. The SMWP primarily targets areas with known or suspected impaired water quality and is not intended to give an overall water quality assessment. Information collected in the SMWP is used by the SWRCB, RWQCBs, and other agencies to identify waters impacted by toxic pollutants.

Toxicity Testing Program

The Toxicity Testing Program (TTP) is intended to assess water quality in surface waters of the State using reliable USEPA standardized toxicity testing procedures, modified USEPA toxicity identification evaluation methods, and supporting chemical analyses.

For the past several years, the TTP has been effective in providing information that can identify waterways where toxicity water quality standards (objectives) are not being met and whether these surface waters can support biological communities in aquatic ecosystems. The intent of the TTP is to identify high risk areas and to identify the spatial and temporal extent of water quality problems, as well as, the geographic and land use/water use sources of the causative chemical(s).

Bay Protection and Toxic Cleanup Program

The Bay Protection and Toxic Cleanup Program (BPTCP) was intended to identify toxic hot spots in the State's enclosed bays, estuaries and coastal waters. The BPTCP used a host of approaches including water and sediment toxicity testing, measurements of chemical concentration in water, sediments, and aquatic life tissues, and assessment of benthic community structure. The monitoring information collected in the BPTCP was used as the basis for the completion of regional cleanup plans. The BPTCP ended in 1999 after completion of the statewide Consolidated Toxic Hot Spots Cleanup Plan.

Other Monitoring Efforts in the State

Many monitoring programs in the State are focused on local monitoring, but some programs are directed towards broader questions related to estimating polluted area in some State waters. All of the programs provide information on the status of water quality including measurements in water, sediments, or biological resources. The contributions of the Southern California Coastal Water Research Project (SCCWRP) and the San Francisco Estuary Institute (SFEI) are particularly notable.

Many of the programs have made significant strides in assessing biological impacts using measures of effects (Table 1). An inventory of enclosed bay, estuary, and coastal monitoring programs was completed in 1998 (http://www.sfei.org/camp). The majority of monitoring programs are designed to assess potential exposure to chemical and bacterial pollutants (e.g., the SMWP and the TSMP). Many assess the impacts of pollutants on biological resources.

Section 115880 of the Health and Safety Code requires the Department of Health Services (DHS), in consultation with local health officers and the public, to adopt regulations that establish minimum standards for the protection of swimming use of public beaches. These regulations require: (1) testing of waters adjacent to all public beaches for total coliform, fecal coliform, and enterococci bacteria; (2) standards to be set for total coliform, fecal coliform, the ratio of total coliform to fecal coliform, and enterococci; (3) establishment of sampling protocols; (4) weekly bacterial testing between April 1 and October 31 for any beach visited annually by more than 50,000 people which also has a storm drain outlet that flows in the summer; (5) posting of beaches whenever that beach fails to meet bacteriological standards; and (6) establishment of a telephone hotline by the health officer to inform the public of all beaches currently closed, posted, or otherwise restricted. These requirements are mandatory only during a fiscal year in which the Legislature has appropriated sufficient funds.

Summary of Selected Monitoring Planning Efforts

Many efforts are underway to plan and encourage ambient water quality monitoring programs. In 1998, the SWRCB and the RWQCBs staff convened a team to evaluate the State's water quality monitoring and assessment approaches, efforts, and needs. These discussions led to the Coastal Monitoring Strategy (California Environmental Protection Agency, 1998) and the FY 2000-01 budget proposal.

In 1997, the SWRCB and RWQCBs began implementation of the Watershed Management Initiative (WMI) (SWRCB and RWQCBs, 1998). The WMI attempts to achieve the water quality goals in all of California's watersheds by supporting the development of local solutions to local problems with the full participation of all affected parties. Some commitments have already been made by RWQCBs to work collaboratively with local stakeholders to meet specific watershed goals.

The WMI is focused on integrating the water quality activities of the SWRCB, RWQCBs, and the USEPA. These include regulatory, monitoring, assessment, planning, standard setting, and nonpoint source activities. The related efforts at other State, local, and federal agencies are also considered and coordinated along with local stakeholders and non-agency initiatives and interests.

Another effort is the California Aquatic Bioassessment Workgroup (CABW) that is focused on coordinating scientific and policy-making efforts toward implementing aquatic bioassessment in California (CABW, 1999).

For the San Francisco Bay and Delta, agencies are developing the Comprehensive Monitoring, Assessment, and Research Program (CMARP) for the San Francisco Bay-Delta system. CMARP is directed at providing new facts and scientific interpretations necessary for CALFED program implementation (CALFED, 1999).

Legislative Report on Ambient Monitoring

In February 2000, the SWRCB submitted a report to the Legislature on a plan for implementing comprehensive ambient water quality monitoring (SWRCB, 2000). This report was required by the 1999 Budget Act. The report provided the starting point for implementing comprehensive surface and groundwater ambient monitoring programs. It presented background information on ambient monitoring and where it fits into the water quality regulatory programs. Also presented were steps for implementing an ambient monitoring program including the starting point for the policy questions that should direct the monitoring programs, approaches available for collecting the needed information, and the concepts of data management, quality assurance, and reporting.

AB 982 (Ducheny)

AB 982 (Chapter 495, Statutes of 1999) also focuses the SWRCB efforts on developing a comprehensive surface water quality monitoring program. It requires the SWRCB, on or before November 30, 2000, to assess and report to the Legislature on the SWRCB's and RWQCBs' current surface water quality monitoring programs for the purpose of designing a proposal for a comprehensive surface water quality monitoring program for the State. The law also requires the SWRCB to convene an advisory group or groups to assist in the evaluation of program structure and effectiveness as it relates to the implementation of the requirements of CWA Section 303(d), applicable federal regulations, and monitoring and assessment programs.

The AB 982 Public Advisory Group (PAG) was established in February 2000. The PAG has met several times to discuss and evaluate the SWRCB's proposals for ambient monitoring. This report incorporates the PAG's recommendations and advice to the SWRCB on the comprehensive surface water ambient

monitoring program proposal. The PAG's recommendations to the SWRCB are included in the Appendix to this Report.

The AB 982 Scientific Advisory Group (SAG) also reviewed the draft proposal, and its comments have been included to the extent possible in preparing this report.

Statutory References for Ambient Monitoring

Even though ambient monitoring is an important tool used to assess the quality of the State's water resources, ambient monitoring is discussed only briefly in the Water Code. For example, Section 13177 discusses the need for the California Mussel Watch Program and expresses the importance of the program in the SWRCB's comprehensive monitoring strategy and how the program should guide the SWRCB and RWQCBs in protecting water quality.

Section 13181 requires the SWRCB to compile a list of monitoring programs and a comprehensive program to monitor the quality of the State's coastal waters, their resources, and various pollutants with a determination of whether standards are being met, methods of improvement, and recommendations. Section 13392.5 requires the RWQCBs to develop an ongoing monitoring and surveillance program to identify toxic hot spots.

The CWA requires the use and collection of ambient water quality information. Section 305(b) of the CWA requires that states and other jurisdictions receiving CWA grant funding submit a water quality report to USEPA every two years. The 305(b) report (SWRCB, 1999b) contains summary information about water quality conditions in rivers, lakes, estuaries, bays, harbors, wetlands, and coastal waters. States must also identify and prepare a list [Section 303(d) list] of waters that do not meet water quality standards after applying existing required controls (e.g., minimum sewage treatment technology). States are required to prioritize waters/watersheds and target high priority waters/watersheds for TMDL development.

SECTION III. PROGRAM GOALS

SWAMP is proposed as a new comprehensive program which will (1) integrate the existing water quality monitoring of the SWRCB and RWQCBs and (2) coordinate with monitoring programs of other agencies, dischargers, and citizens groups. To ensure that the Program is coordinated and integrated, the monitoring efforts will be overseen centrally by the SWRCB. The RWQCBs will establish monitoring priorities for the water bodies within their jurisdictions, in coordination with the SWRCB.

SWAMP is intended to meet four goals as follows:

1. Create an ambient monitoring program that addresses all hydrologic units of the State using consistent and objective monitoring, sampling and analytical methods; consistent data quality assurance protocols; and centralized data management. This will be an umbrella program that monitors and interprets that data for each hydrologic unit at least one time every five years. This program will include all waters of the State without bias to known impairment.

2. Document ambient water quality conditions in potentially clean and polluted areas. The scale for these assessments ranges from the site-specific to statewide.

3. Identify specific water quality problems preventing the SWRCB, RWQCBs, and the public from realizing beneficial uses of water in targeted watersheds.

4. Provide the data to evaluate the overall effectiveness of water quality regulatory programs in protecting beneficial uses of waters of the State.

Section IV provides a brief overview of SWAMP. Section V provides the general monitoring design for meeting Goals 1 and 2. Section VI provides the monitoring design to meet Goals 3. The last goal will be addressed in the development of the CWA Section 303(d) list and the CWA Section 305(b) report as well as in the performance evaluation of the State's water quality programs, including the NPDES, Chapter 15, and Storm Water Programs.

Each of the SWRCB and RWQCBs' existing monitoring programs (e.g., the SMWP, TSMP, TTP, and fish/shellfish contamination studies) shall be incorporated into SWAMP to ensure a coordinated approach without duplication. SWAMP shall also coordinate with other programs implemented in the State to assure that the ambient monitoring efforts are not duplicated.

SECTION IV. OVERVIEW OF THE SURFACE WATER AMBIENT MONITORING PROGRAM

SWAMP will implement a comprehensive environmental monitoring program focused on providing the information needed by the SWRCB and RWQCBs to manage effectively the State's water resources.

The proposal calls for a combination of (1) regional monitoring to provide a picture of the status and trends in water quality and (2) site-specific monitoring to better characterize problem and clean locations. This approach balances these two important monitoring needs of the SWRCB and serves as a unifying framework for the monitoring activities being conducted by the SWRCB and RWQCBs. The coordinated SWRCB and RWQCB involvement in study design and sampling is critical to providing a comprehensive, effective monitoring program that results in identifying degrading and improving conditions in waterways.

The regional component with the rotating basin design and, for some water bodies, the probability-based design described in Section V will allow the SWRCB and RWQCBs to complete comprehensive monitoring required to satisfy CWA Section 305(b) requirements and will contribute to the achievement of the State's various water quality programs. These types of programs allow the State and USEPA to track trends in water quality. This in turn could be used as measures to track the effectiveness of the SWRCB and RWQCB water quality control programs.

The regional monitoring component (Section V) complements the site-specific monitoring effort in two ways. It provides additional data that can be used to put the data from targeted sites into a broader regional context. Equally important, the regional component would serve as a periodic screening mechanism for identifying new problem areas that were not previously known.

The site-specific monitoring (Section VI) provides flexibility for RWQCBs to focus monitoring resources toward specific problems and waters that may be clean. This might involve verifying problems identified in the statewide surveys, other areas suspected of having water quality problems, or locations that represent background or clean conditions. This documentation and verification of a site's water quality status should be a key component of the Section 303(d) listing process.

The monitoring efforts to be implemented by SWAMP are built around the following factors:

Adaptability

California has a huge diversity of natural resources with a variety of surface water resources. The State's water resources include streams, rivers, lakes, estuaries, coastal lagoons, enclosed bays, wetlands, and coastal waters. With the varying scale of dimension and environmental resource value, SWAMP's approach will be easily adaptable to each of these systems.

Cooperative efforts

Monitoring can be expensive due to the scale of the monitoring efforts and the costs of analysis. The most cost-effective efforts are those that bring together all stakeholders to jointly design and implement the ambient monitoring program. The WMI and SWRCB Strategic Plan emphasize full participation of affected parties. This type of cooperative planning initially helps identify redundant efforts and areas in need of monitoring activity and ultimately reduces costs. Cooperative efforts also help the SWRCB and RWQCBs identify existing information to serve monitoring information needs.

Clear Objectives

Because environmental monitoring can be costly, it is important to define clearly the information most useful to resource agencies and stakeholders to protect water quality and safeguard resources. Clear monitoring objectives are essential if the ambient monitoring program is to produce meaningful and useful information.

Use of Available Information

Once monitoring objectives are identified, useful information may already be available. All sources of information should be used if it serves the intended purpose(s) and is of sufficiently high quality. Sources of available information include: compliance monitoring data, regional monitoring efforts already underway, or other monitoring by federal, State, local agencies, volunteer groups, and University efforts. These types of data should be reviewed before any new monitoring is undertaken. If another organization is performing monitoring that serves the purposes of the SWRCB and RWQCBs, then scarce resources can be directed toward other priorities.

Scientifically sound monitoring design

All monitoring programs shall be based on solid, defensible scientific design. Solid scientific information provides a sound basis for changes in water quality programs, policies, and standards set to protect the environment. This will assist in comparing results among programs and regions. To the extent possible, the RWQCBs shall use statewide templates and protocols developed by SWAMP in developing and implementing this program. Using the statewide templates and protocols will allow greater use of other high quality monitoring data collected by citizen monitoring groups, academic institutions, private parties, and government agencies.

Meaningful indicators

SWAMP will use the best available condition and response indicators of water quality. These indicators will be scientifically valid and practical, and they will address the needs of the water quality programs. The selected indicators will provide evidence of the quality of biological resources and human uses.

Comparable methods of sampling and analysis

In order for monitoring information to be comparable among monitoring locations and programs, there must be a measure of consistency in the approaches and analytical methods used, as well as stated minimum detection limits, measurement quality requirements, and other strict quality assurance requirements. The data produced will be of definable or equivalent quality to facilitate both within and between water body comparisons can be made. All methods will be described, validated, performed competently, and to the extent possible, compared to a reference, and performance-based.

Data evaluation

Monitoring data must be evaluated in order to make meaningful assessments of the status of water quality. Such evaluations are integral in evaluating the effectiveness of water quality programs and assessing whether they need modification. Data evaluation is important for the CWA Section 305(b) report, CWA Section 303(d) list of impaired waters, permitting, enforcement, State and local watershed management programs, voluntary pollution prevention and reduction programs, and preservation and restoration programs. Monitoring results will be evaluated using appropriate and meaningful benchmarks.

Data Management

Data management is a high priority for the State's monitoring programs. Too often, limited funds are spent collecting information that ultimately will be of little use due to lack of standardized data management. SWAMP will include the use of existing data to the extent they can be verified and placed or linked into centralized locations. Any data that are collected as part of SWAMP shall be made available to all stakeholders from the centralized location, along with accompanying metadata (i.e., data associated with monitoring data for purposes of description, administration, quality assurance, and usage).

Regular reporting

Although monitoring news may not always be good, assessments of water quality and the changes over time provide needed information for decision makers and the public. Monitoring information is essential in setting priorities. Also, monitoring identifies issues and areas that are not a problem. Such information on clean areas or locations with no impacts is useful for long-term planning, enabling us to evaluate changing conditions and to gauge future stresses on environmental resources.

Monitoring reports provide the feedback to the SWRCB and RWQCBs on the success of regulatory programs and strategies, pollution prevention activities, and cooperative efforts of stakeholders. Additionally, monitoring reports increase public awareness and education on the impacts of the public's activities on the aquatic environment. SWAMP monitoring data and reports will be made available to all interested parties through the SWRCB's web site (http://www.swrcb.ca.gov).

SECTION V. REGIONAL MONITORING

The overall goal of this activity of SWAMP is to develop statewide and regionwide picture of the status and trends of the quality of California's surface water resources. It is intended that this portion of SWAMP will be implemented in each hydrologic unit (including coastal waters) of the State at least one time every five years. This portion of SWAMP is focused on collecting information on water bodies for which the State presently has little information and to determine the effects of diffuse sources of pollution and the baseline conditions of potentially clean areas.

For inland waters (watersheds), the program will implement a rotating basin framework where each Region will be divided into five areas consisting of one or more hydrologic units. The major watercourses and tributaries in one of these areas would be monitored for a one-year period at least once every five years. In coastal waters, a smaller amount of probabilistic monitoring will be completed.

Need for Regional Monitoring

Monitoring is needed that defines the larger scale condition of beneficial uses. This regional monitoring can determine if known local impacts can be observed over large distances and allows the assessment of regionwide or statewide water resource conditions. The result of regional monitoring will help the SWRCB and RWQCBs to determine clearly the effectiveness of the State's water quality control program.

The California Legislature is also very interested in establishing a closer link between budgeted water quality program activities and the impact those activities have on protecting and improving water quality. The Supplemental Report Language to the 1999 Budget Act directed the SWRCB to "… develop performance measures for its core regulatory programs …. that relate directly to water quality outcomes …." While the SWRCB and RWQCBs have established performance measures to manage many activities, the ability to relate directly the performance of their programs to water quality outcomes has been hampered by limited data management capabilities and fragmented and incomplete water quality monitoring data collection, evaluation, and management.

Since 1995, the SWRCB has used several performance objectives and measures for its programs. The measures are generally output related and designed to measure program efficiency and timeliness (such as percent of total inspections completed versus the number of permitted sites, number of Cleanup and Abatement Orders (CAOs); median time required to issue new NPDES permits and WDRs).

Regional monitoring will provide the SWRCB and RWQCBs with a better picture of the water quality outcome of their programs. The information needed to assess

program performance and support CWA Section 305(b) reporting focuses on the area or percentages of the area of the State's surface water that fully or partially support the associated beneficial uses.

Monitoring Objectives

In developing the SWAMP monitoring objectives, the SWRCB used a modified version of the model proposed by Bernstein et al. (1993) for developing clear monitoring objectives. The model makes explicit the assumptions and/or expectations that are often embedded in less detailed statements of objectives such as those presented in the SWRCB Report to the Legislature on comprehensive monitoring submitted in February 2000 (SWRCB, 2000). This section is organized by each major question posed in the January 2000 report.

Is it safe to swim?

Beneficial Use: Water Contact Recreation

1. Throughout water bodies that are used for swimming, estimate the concentration of pathogenic contaminants above and below screening values, health standards, or adopted water quality objectives.

2. Estimate the percent of beach area that poses potential health risks of exposure to pathogens in streams, rivers, lakes, nearshore waters, enclosed bays, and estuaries using several critical threshold values of potential human impact (pathogen indicators).

3. Throughout water bodies that are used for swimming, estimate the concentration of bacterial contaminants from month-to-month above and below screening values, health standards, or adopted water quality objectives.

Is it safe to drink the water?

Beneficial Use: Municipal and Domestic Water Supply

4. Throughout water bodies, estimate the area of lakes, rivers, and streams that are sources of drinking water where the concentration of microbial or chemical contaminants are above and below screening values, drinking water standards, or adopted water quality objectives used to protect drinking water quality.

5. Throughout water bodies that are used as a source of drinking water, estimate the concentration of microbial or chemical contaminants from month-to-month above and below screening values, drinking water standards, or adopted water quality objectives used to protect drinking water quality.

Is it safe to eat fish and other aquatic resources?

Beneficial Uses: Commercial and Sport Fishing, Shellfish Harvesting

6. Estimate the area of streams, rivers, lakes, nearshore waters, enclosed bays, and estuaries where the concentration of chemical contaminants in edible fish or shellfish tissue exceeds several critical threshold values of potential human impact (screening values or action levels).

7. Assess the geographic extent of chemical contaminants in selected size classes of commonly consumed target species that exceed several critical threshold values of potential human impact (screening values or action levels) (Adapted from USEPA, 1995).

8. Throughout water bodies (streams, rivers, lakes, nearshore waters, enclosed bays, and estuaries), estimate the concentration of chemical contaminants in fish and aquatic resources from year to year using several critical threshold values of potential human impact (advisory or action levels).

9. Throughout water bodies that are used for shellfish harvesting, estimate the concentration of bacterial contaminants from month to month above and below health standards or adopted water quality objectives.

10. Throughout water bodies that are used for shellfish harvesting, estimate the concentration of bacterial contaminants above and below health standards or adopted water quality objectives.

Are aquatic populations, communities, and habitats protected?

Beneficial Uses: Cold Freshwater Habitat; Estuarine Habitat; Inland Saline Water Habitats; Marine Habitat; Preservation of Biological Habitats; Rare, Threatened or Endangered Species; Warm Freshwater Habitat; Wildlife Habitat

11. Estimate the percent of degraded water area in lakes, nearshore waters, enclosed bays, and estuaries using several critical threshold values of toxicity, water or benthic community analysis, habitat condition, and chemical concentration.

12. Estimate the percent of degraded sediment area in rivers, lakes, nearshore waters, enclosed bays, and estuaries using several critical threshold values of toxicity, benthic community analysis, habitat condition, and chemical concentration.

13. Identify the areal extent of degraded sediment locations in rivers, lakes, nearshore waters, enclosed bays, and estuaries using several critical threshold values of

toxicity, benthic community analysis, habitat condition, and chemical concentration.

14. Estimate the percent of degraded sediment area from year to year in rivers, lakes, nearshore waters, enclosed bays, and estuaries using several critical threshold values of toxicity, benthic community analysis, habitat condition, and chemical concentration.

15. Estimate the percent of degraded water area from year to year in rivers, lakes, nearshore waters, enclosed bays, and estuaries using several critical threshold values of toxicity, water column or benthic community analysis, habitat condition, and chemical concentration.

Beneficial Use: Spawning, Reproduction and/or Early Development

16. Estimate the area of degraded spawning locations and water or sediment toxicity associated with toxic pollutants in rivers, lakes, nearshore waters, enclosed bays, and estuaries using critical threshold values of early life-stage toxicity, chemical concentration, and physical characteristics

17. Estimate the area degraded spawning locations and water or sediment toxicity associated with toxic pollutants from year to year in rivers, lakes, nearshore waters, enclosed bays, and estuaries using critical threshold values of early life-stage toxicity, chemical concentration, and physical characteristics.

Is water flow sufficient to protect fisheries?

Beneficial Use: Migration of Aquatic Organisms; Rare, Threatened or Endangered Species; Wildlife Habitat

18. Throughout water bodies, estimate the area with the conditions necessary for the migration of aquatic organisms, such as anadromous fish, using measures of habitat condition including water flow, watercourse geomorphology, sedimentation, temperature, and biological communities.

19. Throughout water bodies, estimate the area with the conditions from month to month necessary for the migration of aquatic organisms, such as anadromous fish, using measures of habitat condition including water flow, watercourse geomorphology, sedimentation, temperature, and biological communities.

Is water safe for agricultural use?

Beneficial Use: Agricultural supply

20. Throughout water bodies, estimate the area of lakes, rivers and streams that are used for agricultural purposes where the concentration of chemical pollutants are above or below screening values or adopted water quality objectives used to protect agricultural uses.

21. Throughout waterbodies that are used for agricultural purposes, estimate the concentration of chemical pollutants from year-to-year above or below screening values or adopted water quality objectives used to protect agricultural uses.

Is water safe for industrial use?

Beneficial Use: Industrial Process Supply; Industrial Service Supply

22. Throughout water bodies, estimate the area of coastal waters, enclosed bays, estuaries, lakes, rivers and streams that are used for industrial purposes where the concentration of chemical pollutants are above or below screening values or adopted water quality objectives used to protect industrial uses.

23. Throughout water bodies that are used for industrial purposes, estimate the concentration of chemical pollutants from year to year above or below screening values or adopted water quality objectives used to protect industrial uses.

Are aesthetic conditions of the water protected?

Beneficial Use: Non-Contact Water Recreation

24. Throughout water bodies, estimate the area of coastal waters, enclosed bays, estuaries, lakes, rivers and streams where the aesthetic conditions are above or below screening values or adopted water quality objectives used to protect non-contact water recreation.

25. Throughout water bodies, estimate the aesthetic condition from year-to-year above or below screening values or adopted water quality objectives used to protect non-contact water recreation.

Overall Sampling Design

Each year the SWRCB, in coordination with the RWQCBs, will prepare a detailed workplan that is consistent with the SWAMP goals, objectives, study design, indicators, and quality assurance requirements. The specific study design will be incorporated into contracts or task orders to implement the monitoring program.

While this effort will be coordinated by the SWRCB, the RWQCBs will make any needed region-specific decisions. The steps to establish the specific sampling design are:

1. RWQCBs will divide the Region into five areas consisting of one or more hydrologic units.

2. Identify all major watercourses, tributaries and lakes to sample. Monitoring will be completed in all hydrologic units without bias to known impairments.

3. Select monitoring objectives based on applicable beneficial uses of the water bodies selected. Applicable beneficial uses are uses that are listed in the RWQCB's basin plan, or potential beneficial uses for the water body that are included in the scope of SWAMP.

4. Review available information. The RWQCB will compile all available information including data reports as part of compliance monitoring programs, State monitoring efforts, other agency monitoring, citizen monitoring efforts, or research efforts. Depending on the water body, the RWQCBs and SWRCB will include information produced by the Southern California Bight Projects; the San Francisco Regional Monitoring Program; the USEPA Environmental Monitoring and Assessment Program (EMAP) efforts in the State's enclosed bays, estuaries, coastal streams, and rivers; U.S. Forest Service efforts (Harrington, personal communication, October 2000); NOAA's Status and Trends Program; any information produced as a result of the Unified Federal Policy for a Watershed Approach to Federal Land and Resource Management (U.S. Department of Agriculture et al., 2000); and other federal, State, or local programs that would augment the State's monitoring efforts.

5. Evaluate quality and applicability of available information and then make a determination on the need for new monitoring. Considerations in this evaluation include temporal variability, spatial variability, and critical conditions (such as drought, flood, stream flow, and El Nino).

6. For inland waters (watersheds), the RWQCBs will select long-term, fixed/permanent sites in each perennial lake, major watercourse and tributary. It is assumed that each of these sites will represent upstream water quality conditions or, for lakes, the water body condition. In selecting sites to

monitor, the RWQCBs will consider the existing information or model predictions for the following characteristics:

- Seasonal variation in the water bodies or watersheds including precipitation information;

- Spatial variation in the watershed (the range of physical characteristics in the watersheds) including, but not limited to, land use patterns, topography, and soil characteristics;

- The release of water to support groundwater recharge or surface water diversions;

- Sample representativeness under different flow conditions.

7. For enclosed bays, estuaries, and ocean waters, the SWRCB and RWQCBs, will select sites using probability-based approach. The approach may be either random or stratified random (i.e., strata can correspond to a subpopulation of interest such as land use patterns) with a mechanism for systematically separating samples (Stevens, 1997; SCCWRP, 1998). It is necessary that an adequate number of samples is selected to represent the stratum with adequate precision. Thirty sites should be allocated to each stratum to provide a 90 percent confidence interval of no larger than roughly ±10 percent of the area in the subpopulation (this assumes a binomial probability distribution and p=0.2). Fewer or more sites may be selected if smaller or larger confidence intervals are needed.

8. Select necessary water quality indicators and target species. RWQCBs will select indicators based on the beneficial uses of the water body. For example, if a water body is not a source of drinking water, it is not necessary to implement monitoring focused on drinking water uses. RWQCBs may select alternative indicators if they meet the selection criteria presented in Section VII.

   In all monitoring efforts, the indicators will be selected from the biological response, pollutant, and habitat indicator categories presented in Section VII. Further, indicators representing each category should be collected synoptically. For biological resources, it is important that a triad of measurements (biological, pollutant, and habitat) be collected concurrently. If more than one medium is being monitored, all samples should be synoptically collected, to the extent possible. The most sensitive and waterbody-appropriate indicators should be selected for use.

Program Management

The SWRCB and RWQCB staff will use the following decision matrix to implement this portion of SWAMP.

Task	Responsible Organization		
	SWRCB	RWQCBs	Contractors
Develop contract(s) for monitoring services.	●	●	●
Identify hydrologic units and water bodies to be monitored.	●	●	
Select regional monitoring objectives based on beneficial uses of water body.	●	●	
Make decision on adequacy of available information.		●	●
Prepare specific study design based on monitoring objectives, the assessment of available information, sampling design, and indicators.	●	●	●
Implement study design. (Collect and analyze samples.)			●
Track study progress. Review quality assurance information and make assessments on data quality. Adapt study as needed.	●	●	●

Task	Responsible Organization		
	SWRCB	RWQCBs	Contractors
Report data through SWRCB web site.	●	● (Coordination Role)	●
Prepare written report of data.	●	●	●

SWAMP will be implemented by and supported by a number of State and local agencies. In order for SWAMP to be comprehensive and not to overlap existing efforts it is necessary to involve federal, State, and local agencies in its implementation. SWAMP will be coordinated with the DHS, OEHHA, DWR, DFG, and DPR. The involvement of the SWRCB, RWQCBs, and other agencies in SWAMP will be coordinated through a staff-level task force.

SECTION VI. SITE-SPECIFIC MONITORING

The overall goal of this activity of SWAMP is to develop site-specific information on sites that are (1) known or suspected to have water quality problems and (2) known or suspected to be clean. It is intended that this portion of SWAMP will be targeted at specific locations in each region. This portion of SWAMP is focused on collecting information from sites in water bodies of the State that could be potentially listed or delisted under CWA Section 303(d). The RWQCBs are given significant flexibility to select the specific locations to be monitored. The RWQCBs at their discretion may perform monitoring at clean sites to determine baseline conditions (for assessments related to antidegradation requirements) or if this information is needed to place problem sites into perspective with cleaner sites in the Region.

Monitoring Objectives

In developing the SWAMP monitoring objectives, the SWRCB used a modified version of the model for developing clear monitoring objectives proposed by Bernstein et al. (1993). The model makes explicit the assumptions and/or expectations that are often embedded in less detailed statements of objectives (as presented in SWRCB, 2000). This section is organized by each major question posed in the SWRCB report to the Legislature on comprehensive monitoring (SWRCB, 2000).

Is it safe to swim?

Beneficial Use: Water Contact Recreation

1. At sites influenced by point sources (e.g., storm drains, publicly owned treatment works, etc.) or nonpoint sources of pathogenic contaminants, estimate the concentration of bacteria or pathogens above screening values, health standards, or adopted water quality objectives.

Is it safe to drink the water?

Beneficial Use: Municipal and Domestic Water Supply

2. At specific locations in lakes, rivers and streams that are sources of drinking water and suspected to be contaminated, estimate the concentration of microbial and chemical contaminants above screening values, drinking water standards, or adopted water quality objectives used to protect drinking water quality.

3. At specific locations in lakes, rivers and streams that are sources of drinking water and suspected to be contaminated, verify previous estimates of the concentration of microbial and chemical contaminants above screening values, drinking water standards, or adopted water quality objectives used to protect drinking water quality.

Is it safe to eat fish and other aquatic resources?

Beneficial Uses: Commercial and Sport Fishing, Shellfish Harvesting

4. At specific sites influenced by sources of bacterial contaminants, estimate the concentration of bacterial contaminants above health standards or adopted water quality objectives to protect shellfish harvesting areas.

5. At specific sites influenced by sources of chemical contaminants, estimate the concentration of chemical contaminants in edible aquatic life tissues above advisory levels and critical thresholds of potential human health risk.

6. At frequently fished sites, estimate the concentration of chemical contaminants in commonly consumed fish and shellfish target species above advisory levels and critical thresholds of potential human health risk (Adapted from USEPA, 1995).

7. At frequently fished sites, verify previous estimates of the concentration of chemical contaminants in commonly consumed fish and shellfish target species above advisory levels and critical thresholds of potential human health risk (Adapted from USEPA, 1995).

8. Throughout water bodies (streams, rivers, lakes, nearshore waters, enclosed bays and estuaries), estimate the concentration of chemical contaminants in fish and aquatic resources from year to year using several critical threshold values of potential human impact (advisory or action levels).

Are aquatic populations, communities, and habitats protected?

Beneficial Uses: Cold Freshwater Habitat; Estuarine Habitat; Inland Saline Water Habitats; Marine Habitat; Preservation of Biological Habitats; Rare, Threatened or Endangered Species; Warm Freshwater Habitat; Wildlife Habitat

9. At sites influenced by point sources (e.g., storm drains, publicly owned treatment works, etc.) or nonpoint sources of pollutants, identify specific locations of degraded water or sediments in rivers, lakes, nearshore waters, enclosed bays, or

estuaries using several critical threshold values of toxicity, water column or epibenthic community analysis, habitat condition, and chemical concentration.

10. At sites influenced by point sources (e.g., storm drains, publicly owned treatment works, etc.) or nonpoint sources of pollutants, identify specific locations of degraded sediment in rivers, lakes, nearshore waters, enclosed bays, or estuaries using several critical threshold values of toxicity, benthic community analysis, habitat condition, and chemical concentration.

11. Identify the areal extent of degraded sediment locations in rivers, lakes, nearshore waters, enclosed bays, and estuaries using several critical threshold values of toxicity, benthic community analysis, habitat condition, and chemical concentration.

Beneficial Use: Spawning, Reproduction and/or Early Development

12. At sites influenced by point sources (e.g., storm drains, publicly owned treatment works, etc.) or nonpoint sources of pollutants, identify specific locations of degraded water or sediment in rivers, lakes, nearshore waters, enclosed bays, and estuaries using several critical threshold values of early life-stage toxicity, chemical concentration, and physical characteristics.

13. At sites influenced by point sources (e.g., storm drains, publicly owned treatment works, etc.) or nonpoint sources of pollutants, verify previous measurements identifying specific locations of degraded water or sediment in rivers, lakes, nearshore waters, enclosed bays, and estuaries using several critical threshold values of early life-stage toxicity, chemical concentration, and physical characteristics.

Is water flow sufficient to protect fisheries?

Beneficial Use: Migration of Aquatic Organisms; Rare, Threatened or Endangered Species; Wildlife Habitat

14. At specific sites influenced by pollution, estimate the presence of conditions necessary for the migration and survival of aquatic organisms, such as anadromous fish, using measures of habitat condition including water flow, watercourse geomorphology, sedimentation, temperature, and biological communities.

15. At specific sites influenced by pollution, verify previous estimates of the presence of conditions necessary for the migration and survival of aquatic organisms, such as anadromous fish, using measures of habitat condition including water flow, watercourse geomorphology, sedimentation, temperature, and biological communities.

Is water safe for agricultural use?

Beneficial Use: Agricultural supply

16. At specific locations in lakes, rivers and streams that are used for agricultural purposes, estimate the concentration of chemical pollutants above screening values or adopted water quality objectives used to protect agricultural use.

17. At specific locations in lakes, rivers and streams that are used for agricultural purposes, verify previous estimates of the concentration of chemical pollutants above screening values or adopted water quality objectives used to protect agricultural uses.

Is water safe for industrial use?

Beneficial Use: Industrial Source Supply; Industrial Process Supply

18. At specific locations in coastal waters, enclosed bays, estuaries, lakes, rivers and streams that are used for industrial purposes, estimate the concentration of chemical pollutants above screening values or adopted water quality objectives used to protect industrial use.

19. At specific locations in coastal waters, enclosed bays, estuaries, lakes, rivers and streams that are used for industrial purposes, verify previous estimates of the concentration of chemical pollutants above screening values or adopted water quality objectives used to protect industrial uses.

Are aesthetic conditions of the water protected?

Beneficial Use: Non-Contact Water Recreation

20. At specific locations in coastal waters, enclosed bays, estuaries, lakes, rivers and streams, estimate the aesthetic condition above screening values or adopted water quality objectives used to protect non-contact water recreation.

21. At specific locations in coastal waters, enclosed bays, estuaries, lakes, rivers and streams, verify previous estimates of the aesthetic condition above screening values or adopted water quality objectives used to protect non-contact water recreation.

Overall Sampling Design

Each year the RWQCBs will prepare a detailed workplan for ambient surface water monitoring which is consistent with the SWAMP goals, objectives, overall study design, indicators, and quality assurance requirements. Specific study design will be incorporated into contracts or task orders to implement the monitoring program.

While this effort will be coordinated by SWRCB, the RWQCBs will make the region-specific decisions. The steps to establish the specific sampling design are:

1. Identify site-specific problem(s), potential problem(s), or clean water locations to be monitored.

2. Select monitoring objective(s).

3. Review available information. The RWQCB shall consider all available information including data reported as part of compliance monitoring programs, State monitoring efforts, other agency monitoring, citizen monitoring efforts, and research efforts. To the extent possible, the RWQCBs will solicit new information from interested parties.

4. Evaluate the quality and applicability of available information and then make determination on the need for new monitoring. Considerations in this evaluation include temporal variability, spatial variability, and critical conditions (such as drought, flood, stream flow, and El Nino).

5. Select sites using investigator pre-selection (i.e., point estimates) or a probability-based approach. The approach depends on the RWQCB's needs. If a stratified random sampling approach is used, ensure adequate numbers of samples are selected to represent the stratum with adequate precision (please refer to Section V for the discussion of the number of samples needed).

   The RWQCBs may select monitoring sites in water bodies considered to be clean (unpolluted or unimpacted). These sites may be needed to assess baseline conditions or, if the sites are needed as reference sites, to place other monitoring efforts into perspective, or to make assessments related to antidegradation requirements.

   In developing the design of the site-specific monitoring efforts, the RWQCBs will consider the existing information or model predictions for the following characteristics:

   - Seasonal variation in the water body or watershed including precipitation information;

- Spatial variation in the watershed (the range of physical characteristics in the watershed) including, but not limited to, land use patterns, topography, and soil characteristics;

- The release of water to support groundwater recharge and surface water diversions;

- Sample representativeness under different flow conditions; and

- Variation in the magnitude, duration, and frequency of the suspected water quality problem or unpolluted baseline conditions.

6. Select appropriate water quality indicators and target species, if appropriate. RWQCBs will select indicators based on the potential for impacts on specific beneficial uses of the water body. For example, if a suspected problem is related to potential aquatic life impacts near or at storm drains, the RWQCBs should focus on this specific concern.

   In all monitoring efforts, the indicators will be selected from each of the biological response, pollutant, and habitat indicator categories described in Section VII. RWQCBs may select fewer indicators if the needed monitoring information is available and comparable to the data to be collected.

   Further, indicators representing each category should be synoptically collected. For biological resources, it is important that a triad of measurements (biological, pollutant, and habitat) be collected concurrently. If more than one medium is being monitored, all samples should be synoptically collected, to the extent possible. The most sensitive and water body-appropriate indicators should be selected for use.

Program Management

The SWRCB and RWQCB staff implementing this aspect of SWAMP shall use the following decision matrix.

Task	Responsible Organization		
	SWRCB	RWQCBs	Contractors
Develop contract(s) for monitoring services.	●	●	●
Identify water bodies or sites of concern and clean sites to be monitored.		●	
Identify site-specific locations with potential beneficial use impacts or unimpacted conditions that will be monitored.		●	
Decide if concern is related to objectives focused on location or trends of impacts.		●	
Select monitoring objective(s) based on potential beneficial use impact(s) or need to identify baseline conditions.		●	
Identify already-completed monitoring and research efforts focused on potential problem, monitoring objective, or clean conditions.		●	●

Task	Responsible Organization		
	SWRCB	RWQCBs	Contractors
Make decision on adequacy of available information.		●	●
Prepare site-specific study design based on monitoring objectives, the assessment of available information, sampling design, and indicators.	● (Coordination Role)	●	●
Implement study design. (Collect and analyze samples.)			●
Track study progress. Review quality assurance information and make assessments on data quality. Adapt study as needed.	●	●	●
Report data through SWRCB web site.	●	● (Coordination Role)	●
Prepare written report of data.	●	●	●

SWAMP will be implemented by and supported by a number of State and local agencies. SWAMP will be coordinated with the DHS, the Office of Environmental Health Hazard Assessment (OEHHA), the Department of Water Resources (DWR), the Department of Fish and Game (DFG), and the Department of Pesticide Regulation (DPR). In order for SWAMP to be comprehensive and not to overlap existing efforts it is necessary to involve federal, State and local agencies in the implementation of SWAMP. The SWRCB, RWQCBs, and other agencies involvement in SWAMP will be coordinated through a staff-level task force.

SECTION VII. WATER QUALITY INDICATORS

One of the most important steps in the development of an ambient monitoring program is the selection and use of indicators of water quality. Indicators are the tools used to assess and measure water quality. This section describes the characteristics of indicators, provides supporting rationale for their use, and lists some of the indicators that will be used in SWAMP.

What is an indicator?

An indicator is a "... measurable feature or features that provide managerially and scientifically useful evidence of environmental and ecosystem quality or reliable evidence of trends in quality" (ITFM, 1995). Indicators must be measurable with available technology, scientifically valid for assessing or documenting ecosystem quality, and useful for providing information for management decision making. Environmental indicators include tools for assessment of chemical, physical, and biological conditions and processes.

Selection of Appropriate Indicators

One of the hardest tasks for development of an ambient monitoring program is the selection of meaningful indicators of water quality. General criteria are needed to help shape the monitoring efforts so the results are useful in the decision making process. The use of criteria streamlines the indicator selection process, potentially reduces costs, prevents the use of indicators that will not allow program effectiveness to be assessed, and provides consistency.

Table 2 lists several criteria for selecting environmental indicators based on scientific, practical, and programmatic considerations. Scientific validity is the foundation for determining whether data can be compared with reference conditions or other sites. An indicator must not only be scientifically valid, but its application must be practical (i.e., not too costly or too technically complex) when placed within the constraints of a monitoring program. Of primary importance is that the indicator must be able to address the questions posed by the ambient monitoring program.

Scientific Validity

Measurements of environmental indicators should produce data that allow comparisons on temporal and spatial levels. This is particularly important for comparisons with the reference conditions. Indicators should be sensitive and provide resolution sufficient to detect important environmental change and to indicate the presence of a problem. The indicator methodology should be reproducible and provide the same level of sensitivity regardless of geographic location.

Practical Considerations

The success of a monitoring program is dependent on the ability to collect consistent data. The practical considerations include monitoring costs, availability of experienced personnel, and the practical application of the technology.

A cost-effective procedure should provide a large amount of information in comparison to cost and effort. It is significant to acknowledge that not every quantitative characteristic needs to be measured unless it is required to answer specific questions. Cost effectiveness may be dependent on the availability of experienced personnel and the ability to find or detect the indicating parameters at all locations.

Water Quality Programmatic Considerations

Stated objectives of a monitoring program are an important factor in selecting indicators. Sampling and analysis programs should be structured around questions to be addressed. The term "programmatic considerations" simply means that the program should be evaluated to confirm that the original objectives would be met once the data have come together. If the design and the data being produced by a monitoring program do not meet the original objective(s) within the context of scientific validity and resource availability, then the selected indicators should be reevaluated.

Another important consideration is the ease with which the information obtained can be communicated to the public. Although it is essential to present information for the SWRCB and RWQCBs, scientists, or other specialized audiences, information should also be responsive to public interests and needs.

TABLE 2: ENVIRONMENTAL INDICATOR SELECTION CRITERIA (ITFM, 1995).

Criteria	Definition(s)
	Scientific validity (technical consideration)
Measurable/quantitative	Feature of water quality measurable over time; has defined numerical scale and can be quantified simply.
Sensitivity	Responds to broad range of conditions or perturbations within an appropriate time frame and geographic scale; sensitive to potential impacts being evaluated.
Resolution/discriminatory power	Ability to discriminate meaningful differences in environmental condition with a high degree of resolution.
Integrates effects/exposure	Integrates effects or exposure over time and space.
Validity/accuracy	Parameter is true measure of some environmental conditions within constraints of existing science. Related or linked unambiguously to an endpoint in an assessment process.
Reproducible	Reproducible within defined and acceptable limits for data collection over time and space.
Representative	Changes in parameter/species indicate trends in other parameters they are selected to represent.
Scope/applicability	Responds to changes on a geographic and temporal scale appropriate to the goal or issue.
Reference value	Has reference condition or benchmark against which to measure progress.
Data comparability	Can be compared to existing data sets/past conditions.
Anticipatory	Provides an early warning of changes.
	Practical considerations
Cost/cost effective	Information is available or can be obtained with reasonable cost/effort. High information return per cost.
Level of difficulty	Ability to obtain expertise to monitor. Ability to find, identify, and interpret chemical parameters, biological species, or habitat parameters. Easily detected. Generally accepted method available. Sampling produces minimal environmental impact.
	Water quality programmatic considerations
Relevance	Relevant to desired goal, issue, or SWRCB/RWQCB mission; for example, fish fillets for consumption advisories; species of recreational or commercial value.
Program coverage	Program uses suite of indicators that encompass major components of the ecosystem over the range of environmental conditions that can be expected.
Understandable	Indicator is or can be transformed into a format that target audience can understand; for example, nontechnical interpretation for the public.

List of Indicators

Monitoring programs sponsored by the SWRCB and the RWQCBs have used a variety of environmental indicators. Indicators that have been used in ambient monitoring efforts and meet the requirements of the general criteria are presented in Table 3. These indicators are considered a starting point for the indicators which should be used in the State's ambient monitoring efforts.

TABLE 3: LIST OF INDICATORS FOR SITE-SPECIFIC AND REGIONAL MONITORING

Beneficial Use	Monitoring Objectives[1]		Category	Indicator
	Regional	Site-Specific		
Water Contact	1, 2, and 3	1	Contaminant exposure	Total coliform bacteria Fecal coliform bacteria Enterococcus bacteria Enteric viruses
Drinking Water	4 and 5	2 and 3	Contaminant exposure	Inorganic water chemistry Nutrients Organic water chemistry Total coliform bacteria Cryptosporidum Giardia
Fish and Shellfish Contamin-ation	6, 7, 8, 9 and 10	4, 5, 6, 7, and 8	Contaminant exposure	Fish tissue chemistry Shellfish tissue chemistry Coliform bacteria in shellfish Fecal coliform bacteria in water

[1] The number refers to the monitoring objective discussed previously under regional and site-specific monitoring approaches.

Beneficial Use	Monitoring Objectives[1]		Category	Indicator
	Regional	Site-Specific		
Aquatic Life	11, 12, 13, 14, 15, 16, and 17	9, 10, 11, 12, and 13	Biological response[2]	Phytoplankton Chlorophyll-a Benthic infauna (Animals that live in sediment.) Fish assemblage Fish pathology Recruitment of sensitive life stages Interstitial water toxicity Macroinvertebrate assemblage Periphyton Sediment toxicity Water toxicity
			Pollutant exposure	Acid volatile sulfides/simultaneously extracted metals Debris Interstitial water metal chemistry Reporter Gene System (RGS 450) Organic and inorganic sediment chemistry Total organic carbon Shellfish or fish tissue chemistry Nutrients Turbidity Inorganic and organic water chemistry

[2] While the assessment of invasive species is not a focus of SWAMP, these organisms will very likely be identified when biological community measurements are made.

Beneficial Use	Monitoring Objectives[1]		Category	Indicator
	Regional	Site-Specific		
			Habitat	Dissolved oxygen Sediment grain size and gradations Sediment organic carbon Water flow Water temperature Channel morphology Residual pool volume Instream structure Substrate composition Wetland vegetation Riparian vegetation Electrical conductivity Salinity Hydrogen sulfide Ammonia
Sufficient Flow	18 and 19	14 and 15	Habitat	Water flow Suspended solids Channel morphology Water temperature
			Biological response	Fish assemblage and populations Macroinvertebrate assemblage and populations Periphyton Wetland habitat Riparian habitat
Agricultural Supply	20 and 21	16 and 17	Pollutant Exposure	Organic and inorganic chemistry
Industrial Supply	22 and 23	18 and 19	Pollutant Exposure	Organic and inorganic chemistry Total organic carbon Temperature Electrical conductivity
Aesthetic Condition	24 and 25	20 and 21	Pollutant Exposure	Taste and odor Debris and trash

Adapted from: SWRCB, 1993; SPARC, 1997; SCCWRP, 1998; Stephenson et al., 1994; CalEPA, 1998; CABW, 1998; CDFG, 1998; Noble et al., 1999; AB 982 Scientific Advisory Group, personal communication, August, 2000.

SECTION VIII. QUALITY ASSURANCE

SWAMP will be developed and implemented with the objective of collecting high quality monitoring data that could be of the most use to the SWRCB and RWQCB programs. This section describes the general quality assurance approach, the need for a quality assurance project plan and the periodic scientific review of the monitoring efforts.

Quality Assurance (QA) includes activities to ensure that data collected are of adequate quality given the monitoring objectives. QA consists of two separate but interrelated activities – Quality Control and Quality Assessment. Quality Control (QC) activities include standardized sampling collection and processing protocols and requirements for technician training. Quality assessment activities are usually implemented to quantify the quality control procedures.

Quality Control

QC refers to the technical activities employed to ensure that the data collected are adequate given the monitoring objectives to be tested. The purpose of QC is to control errors that tend to occur in the field, laboratory, or office. This is accomplished by establishing procedures to ensure that sampling, processing, and analytical techniques are applied consistently and correctly. It makes certain that the number of lost, damaged, and uncollected samples is recorded and that the integrity of the data record is maintained and documented from sample collection through data entry. In this way, data collected can be comparable with similar data collected elsewhere; and the study results can be reproduced.

QC activities will include both internal and external checks. Internal checks will be a combination of internal test samples, repeated measurements, and standard reference materials. External checks will include evaluation of reproducibility and comparability of tests using interlaboratory comparisons.

Quality Assessment

Quality assessment activities are implemented to quantify the effectiveness of the quality control procedures. These activities ensure that measurement error is estimated and accounted for and that bias associated with the monitoring program can be identified. Quality assessment consists of both internal and external checks, including repetitive measurements, internal test samples, interchange of technicians and equipment, use of independent methods to verify findings, exchange of samples among laboratories, use of standard reference materials, and audits.

An effective QA system must begin at the onset of the monitoring program planning process and must continue to be an integral component throughout from program implementation and information dissemination. In this way, the level of uncertainty associated with obtaining the required information can be balanced

against the cost of obtaining the data. The QA program should accommodate activities of converting resulting data into useful information and the feedback loops designed to help refine monitoring objectives and approaches.

Quality Assurance Project Plan

A Quality Assurance Project Plan (QAPP) will be developed for SWAMP as a first step in implementing the program. The QAPP will contain descriptions of laboratory and field operations; sampling collection and processing methods; chemical, toxicological, and biological analytical procedures; laboratory data management; measurement quality requirements, including descriptions of representativeness, completeness, comparability, accuracy, and precision; approach for handling data that do not meet the data quality requirements; SWRCB/RWQCB role in quality assurance; and QA reporting requirements.

SWAMP will develop a field manual for standardized fieldwork and sample collection as part of the QAPP. All SWAMP contractors, the RWQCB and SWRCB staff, and citizen monitoring groups (to extent they wish to have their monitoring data used by the RWQCBs) will use this manual.

Representativeness

This data quality attribute addresses two fundamental concerns: (1) all samples taken and analyzed are representative of the water body or site of interest and (2) the data obtained are an accurate reflection of the sample collected and analyzed. The data quality attribute of "representativeness" applies not only to the overall sampling design, but also to individual measurements and samples obtained as part of the SWAMP.

The concern of sample representativeness for biological, chemical, and field methods is extremely complex that involves sampling/reference-site selection, sampling device(s), sampling methods, field subsampling/processing, sample preservation/transport/storage, microbial procedures, chemical analytical methods, method detection limits, toxicological procedures, holding times, biological community sorting/identification, and data entry, management, and analysis. These requirements will be described in the QAPP.

Completeness

Completeness is defined as "a measure of the amount of data collected from a measurement process compared to the amount that was expected to be obtained under the conditions of measurement" (Stanley and Verner, 1985). The completeness goal is 90 percent for the various indicators that will be measured. Failure to achieve this goal usually results from lost or destroyed samples. The QAPP will establish protocols for tracking samples during shipment and laboratory processing to minimize data loss following successful sample collection.

Comparability

Comparability is defined as “the confidence with which one data set can be compared to another” (Stanley and Verner, 1985). Comparability of reporting units and calculations, data base management processes, and interpretation will be stated in the QAPP. Both field and laboratory methods will be described in full detail in field and analytical manuals and made available to the field personnel and analytical laboratories. In addition, the comparability of laboratory measurements will be monitored through interlaboratory comparison exercises. The results of comparability analysis will be reported with other QA metadata. Failure to achieve this comparability goal will result in corrective actions that may include changes in field and laboratory methods or QA requirements.

Accuracy and Precision

Accuracy or certainty is the difference between a measured value and the true or expected value. Measurement accuracy is determined by comparing a sample to a known value for a standard reference material. Some important measures of animal response or impact, such as toxicity tests, may not have true standard references.

To the extent that methods are available, the monitoring will employ quantitative measures that are compared to standard reference materials, reference collections, or other references.

Precision is the degree of agreement among repeated measurements of the same characteristic. To the extent possible, the monitoring efforts shall use high precision, quantitative measurements with written procedures and with quantified measures of precision (replicated measurements within a test, stated measurement quality requirements), professional personnel (or professional oversight), controlled laboratory conditions, and controlled measurements in the field.

Collectively, accuracy and precision can provide an estimate of the total error or uncertainty associated with an individual measured value. Measurement quality requirements for the various indicators are expressed separately as accuracy and precision requirements in Table 4. Accuracy and precision requirements may not be definable for all parameters due to the nature of the measurement type. For example, accuracy measurements are not possible for toxicity testing because "true" or expected values do not exist for these measurement parameters. Various QC samples will be collected and analyzed for most data collection activities to evaluate the measurement quality requirements for accuracy and precision,.

As part of the QAPP, SWAMP shall include minimum levels (MLs) and method detection limits (MDLs) that are sufficient to evaluate the selected monitoring objectives.

TABLE 4: SWAMP MEASUREMENT QUALITY REQUIREMENTS

Indicator	Accuracy Requirement[1]	Precision Requirement[2]	Completeness Goal[3]
Pathogens			
Total Coliform	NA[4]	2 SD[5]	90%
Fecal Coliform	NA	2 SD	90%
Enterococcus	NA	2 SD	90%
Giardia	NA	16%	90%
Cryptosporidium	NA	19%	90%
Enteric viruses	NA	NA	90%
Toxicity			
Water	NA	2 SD[6]	90%
Sediment	NA	2 SD	90%
Interstitial water	NA	2 SD	90%
Benthos			
Sample collection	NA	NA	90%
Sorting	10%	NA	90%
Counting	10%	NA	90%
Identification	10%	NA	90%
Sediment grain size	NA	20%	90%
Total organic carbon	15%	20%	90%
Mineralogy	NA	10%	90%
Fish assemblages			
Sample collection	NA	NA	90%
Counting	10%	NA	90%
Identification	5%	NA	90%
Length (fish)	10%	10%	90%
Biomass	NA	10%	90%
Gross pathology	NA	NA	90%
Tissue chemistry			

[1] Accuracy requirements are expressed as either maximum allowable percent deviation (%) or absolute difference (± value) for the "true" value.
[2] Precision requirements are expressed as maximum allowable relative percent difference or relative percent standard deviation between two or more replicate measurements.
[3] Completeness goals are the percentage of expected results to be obtained successfully.
[4] Not Applicable.
[5] Repeated analysis of bacterial indicators within two standard deviations (SD) of the average value for the laboratory.
[6] For toxicity tests, reference toxicant endpoint is within two standard deviations of the average value for the laboratory.

Indicator	Accuracy Requirement[1]	Precision Requirement[2]	Completeness Goal[3]
Organics	30%	30%	90%
Metals	20%	30%	90%
Sediment chemistry			
Organics	30%	30%	90%
Metals	20%	30%	90%
Water Chemistry			
Organics	30%	30%	90%
Metals	20%	30%	90%
Dissolved oxygen	±0.5 mg/L	10%	90%
Salinity	±1.0 ppt	10%	90%
"pH"	±0.2 units	NA	90%
Temperature	±0.5°C	NA	90%
Nutrients	10%	5%	90%
Total suspended solids	NA	10%	90%

Adapted from Noble et al., 1999; Leecaster, personal communication; SCCWRP, 1999; Stephenson et al., 1994; Valente and Strobel, 1993; Lowe et al., 1999; and USEPA, 1999a.

Scientific Review

Periodically, the SWRCB will convene a panel of scientists to review the study design, progress, and results of the SWAMP. The panel will also review the program's monitoring approach and provide suggestions for monitoring improvements. The panel will be comprised of independent scientific and technical experts including, but not limited to, the fields of toxicology, ecology, bacteriology, organic and inorganic chemistry, experimental design, statistics, bioaccumulation, public health, pesticide management, monitoring program implementation, and QA.

SECTION IX. DATA MANAGEMENT, DATA EVALUATION, AND REPORTING

Data management, evaluation, and reporting will be high priorities of SWAMP. Too often, limited funds are spent collecting information that ultimately will be of little use due to lack of standardized data management, evaluation, and reporting. SWAMP will include the use of existing data to the extent it can be verified and placed or linked into centralized locations. Any data that are collected as part of the Program will be made available to all stakeholders centrally along with accompanying metadata.

This section of the proposal is focused on the management of information produced by SWAMP and the use of additional information to support the monitoring efforts, a proposal to develop data evaluation tools, and the types of reports that will be produced.

Data Management

Background

With the advent of the World Wide Web, it is now possible to share information easily among interested scientists, regulators, dischargers, and the public. It is not necessary to centralize all sources of data; but rather, it is now possible to establish links to databases available on the Internet. For example, the California Resources Agency developed an information system called the California Environmental Resources Evaluation System (CERES) to facilitate access to a variety of electronic data describing California's rich and diverse environments (http://www.ceres.ca.gov).

Another source of information is the Statewide Coastal Monitoring Inventory (http://www.sfei.org/camp). This web site provides information about California's coastal water quality monitoring programs. Information available includes:

- Listings of the major water quality monitoring programs along the California coast and its bays.
- Details about each program including the types of water quality measurements made, frequency of measurement, and QA information.
- Provisions for searches of the inventory for specific information.
- Contact information including links to programs that have web sites and/or actual databases, where available.

The Central Coast RWQCB has established the Central Coast Ambient Monitoring Program (http://www.ccamp.org) to collect, assess, and disseminate scientifically based water quality information for decision makers and the public with the objective of maintaining, restoring, and enhancing water quality and associated beneficial uses. One of the stated objectives is to ensure that data and information is made accessible to users in the most effective way.

Laboratory

Each laboratory involved in SWAMP will coordinate data management so that the Program will consistently:

- Document sampling activities and methods.
- Document sample tracking and shipments.
- Process and organize field, laboratory, and QC data.
- Perform range checks on selected numerical data.
- Facilitate data entry, data dissemination, and archiving of data.

Each of these factors will be presented in the QAPP in order to (1) correct or remove erroneous individual values, and (2) correct or remove inconsistencies that may damage the integrity of the database.

System for Water Information Management

Once all laboratory checks are completed, all information collected by SWAMP will be coordinated with and included in SWRCB's System for Water Information Management (SWIM). The SWRCB and RWQCBs have compelling need to improve our data management capabilities. The SWRCB has submitted for approval a Feasibility Study Report for Phase II of SWIM to enhance its data management system. This new system will have two components: a program information/reporting system and a Geographic Information System (GIS). The program information and reporting component will include data on core regulatory programs, all known potential and actual discharge sites, water quality, ambient monitoring programs, electronic self monitoring reports for enhanced enforcement and compliance, and an interface to water rights data. The GIS component will provide data analysis for the SWRCB's watershed management efforts. Approximately $3.6 million is needed to initiate this task. The total cost for SWIM Phase II is approximately $13.2 million over FYs 2001-02 to 2004-05.

The SWAMP data management activities will provide access to the collected data and related information. The new data generated will be stored in SWIM and available on the SWRCB web site; other information will be accessed through links to other data management systems. GIS data layers will also be made available through the SWRCB web site. Data layers such as watershed boundary

delineations and hydrography will be established as standards and specific protocols for improvement and updates to these data layers will be established in coordination with other agencies. The use of remote sensing (e.g., satellite image analysis and aerial photography) will also be incorporated, to the extent possible.

Data Evaluation

Monitoring data must be evaluated in order to make meaningful assessments of the status of the environment. Such evaluations are integral in evaluating the status of the water quality at the time of the study, as well as in evaluating environmental change over time. Conclusions based on a full analysis of monitoring data enable the RWQCBs and SWRCB to assess the condition of the State's water resources, determine whether the monitoring objectives have been achieved, and ultimately evaluate the success of existing water quality programs and policies.

For the SWAMP monitoring data to meaningfully influence SWRCB and RWQCB decision making, it is necessary that the data collected be evaluated. The evaluation is especially important in determining whether sites or water bodies should be listed on the CWA Section 303(d) list. This section of the proposal presents the SWRCB's approach for developing a consistent set of data evaluation criteria. These criteria shall be focused on primarily listing and delisting sites or water bodies but will be useful for evaluating all the monitoring information collected.

Background

In 1997, an ad hoc workgroup of staff from the RWQCBs, SWRCB, and the USEPA developed informal guidelines that focused on CWA Section 303(d) listing/delisting factors, scheduling and priority setting, public notice procedures, and the Section 303(d) list submittal package. USEPA found that these informal guidelines were consistent with federal law, regulations, and guidance related to CWA Section 303(d).

Based in large part on the informal guidelines, California produced its Section 303(d) list in 1998 which contains 509 water bodies (SWRCB, 1999b).

Comments from a variety of sources have been critical of the guidelines and listing process. There have been suggestions to revise the guidelines substantially. Major revisions that have been suggested include: interpretation of narrative water quality objectives, representativeness of samples of up and down stream conditions, data quality requirements, minimum data needed to support listing decisions, and priority setting.

Approach

To begin to resolve some of these issues, the SWRCB will adopt a Water Quality Control Policy outlining the listing and delisting criteria for establishing the Section 303(d) list, acceptable data quality, the criteria for assigning priority to

Section 303(d)-listed water bodies, public notice procedures, and other pertinent factors. The SWRCB will also evaluate the need for different levels of data quality in decision making.

This Policy will allow for the consistent development of the regional and statewide Section 303(d) lists. It will contain specific listing and delisting criteria, criteria to assist the SWRCB and the RWQCBs in establishing priorities for developing TMDLs, guidelines for acceptability of data, and other measures necessary to facilitate the completion of TMDLs.

Reporting

A variety of reports shall be developed to support SWAMP. To the extent possible, most of the reports shall be made available to the public in paper and electronic form. The types of reports that will be produced include:

1. Periodic management reports. These reports will focus on the status of the implementation of the monitoring efforts including progress on sampling, chemical and biological analysis, and data/interpretative report preparation.

2. Field sampling reports. These reports will document: date and time of sampling, personnel, location of station, station description, type of grab used, field observations, station depth, number of grabs necessary and amount sampled, visual characteristics, water temperature, and other necessary parameters.

3. Data reports. These reports will include all data generated for each task, a written description of any deviations from the stated testing procedures, and a written description detailing QA criteria and the degree to which each is met or compromised. The data reports will be completed in both electronic and paper formats.

4. QA Reports. These reports will summarize the measurement error estimates for the various data types using the QA sample data. The precision, accuracy (as appropriate), completeness, and representativeness of the data will be addressed in this document. QA reports will also accompany each major sampling event and will address QA concerns relevant to data collected during the sampling event.

5. Interpretative Reports. These reports will provide an analysis and interpretation of the data collected. The reports will have written descriptions of the study design, methods used, graphical, statistical, and textual descriptions of the data, and interpretation of the data including comparisons to any evaluation criteria provided by the SWRCB or RWQCBs.

Periodically, the SWRCB and RWQCB will convene a conference or meeting of interested monitoring practitioners and other parties to discuss all the ambient

monitoring efforts. This forum will serve two purposes: (1) to exchange information among SWAMP participants and (2) increase cooperation among universities, other agencies, and interested parties.

SECTION X. COSTS

Water Code Section 13192 requires the SWRCB to estimate the costs of implementing the proposed comprehensive surface water quality monitoring program. This section provides an estimate of the needed funding to fully implement SWAMP, including the estimated costs for the various types of monitoring the SWRCB and RWQCBs will perform, the description of the approach used to estimate costs, and the assumptions made. As SWAMP is implemented, the actual costs of the efforts may differ from the estimates presented in this section due to increased costs to perform the monitoring and other factors.

Approach

Total costs for ambient monitoring depend on a variety of factors including: parameters measured, tests performed, sampling strategy (rotating basin, investigator pre-selection, or probability-based designs), data management, data interpretation, and program management. The cost estimates for SWAMP represent personnel and contract resources needed for each major activity of the proposal (Sections V and VI). The samples costs presented in Table 5 are estimated from previous contracts or informal discussions. These sampling and analytical costs may not represent costs that would be negotiated with potential contractors.

The approach is based on the need for ambient monitoring throughout the State irrespective of the funding currently available. The estimated needs presented in this section make several assumptions of how the funding will be distributed. These projections may change as SWAMP is implemented and specific RWQCB priorities are incorporated.

Overall Assumptions

1. Each RWQCB shall have one or more designated monitoring staff personnel for study design, data evaluation, quality assurance, and contract administration. The estimated cost of a staff person is $100,000 per year (personnel year or PY).

2. Contracts are implemented through a master contract (i.e., a prime contractor/subcontractor arrangement), to the extent possible.

3. One QAPP will be developed to support implementation of all types of monitoring performed as part of SWAMP.

4. The cost estimates are presented for ambient monitoring only; cost estimates for identifying the sources of pollutants or the effectiveness of specific BMPs are not included. These other types of monitoring are funded through other programs or fund sources, such as the TMDL or NPS programs or possibly supplemental environmental project funding.

TABLE 5: ESTIMATED COSTS FOR SAMPLING, ANALYSIS, AND REPORTING AMBIENT MONITORING DATA.

Sample Type	Estimated Costs Per Sample		Water Contact	Drinking Water	Shellfish coliform	Tissue Fish-Shellfish	Freshwater Ambient	Marine Ambient	Flow (Initial)	Flow (2nd yr +)
	Low	High[1]	Per sample	Per sample	Per sample	Per sample	Per sample	Per sample	Per station	Per station
Total/fecal coliform bacteria	$40	$60	$60	$60						
Enterococcus bacteria	$25	$45	$45							
Cryptosporidum Giardia	$300	$450		$450						
Enteric viruses	$425	$600	$600							
Coliform in shellfish	$45	$65			$65					
Water column chemistry[2]	$700	$2,200		$2,200			$2,200			
Tissue chemistry		$2,000				$2,000				
Sediment chemistry		$2,200					$2,200	$2,200		
Freshwater benthos	$900	$1,200					$1,200			
Marine benthos		$1,700						$1,700		
Fish bioassessment		$600								
Freshwater habitat	$600	$2,200					$2,200			
Other habitat		$500						$2,200		
Toxicity tests-freshwater		$300					$300			
Toxicity tests-other water		$450								

Sample Type	Estimated Costs Per Sample		Water Contact	Drinking Water	Shellfish coliform	Tissue Fish-Shellfish	Freshwater Ambient	Marine Ambient	Flow (Initial)	Flow (2nd yr +)
	Low	High[1]	Per sample	Per sample	Per sample	Per sample	Per sample	Per sample	Per station	Per station
Sediment toxicity		$1,000						$1,000		
Pore water toxicity		$560						$560		
Flow gauges installation		$30,000							$30,000	$0
Flow gauges operation		$15,000							$15,000	$15,000
Sampling	$150	$1,500	$150	$1,500	$1,500	$1,500	$1,500	$1,500	$0	$0
Reporting[3]	$15,000	$40,000	$40,000	$40,000	$40,000	$40,000	$40,000	$40,000	$40,000	$40,000

1. Cost estimates in following tables were developed using "high" estimated cost per sample.
2. Costs for water column chemistry are lower for conventional parameters and greater for toxic pollutants.
3. Reporting costs are for individual reports.

Cost estimates are based on: Bay Protection and Toxic Cleanup Program, State Mussel Watch Program, Toxic Substances Monitoring Program, RWQCB staff (September, 2000) and M. Yahya, Orange County Sanitation District, personal communication, May 2000.

5. The costs of laboratory data management and quality assurance are included in the costs for sample collection and sample analysis.

7. The cost of data management at the SWRCB and RWQCBs is presented in Section IX in the subsection titled "System for Water Information Management."

Monitoring Funding Needs

This section is divided into two major components: (1) regional monitoring and (2) site-specific monitoring. For planning purposes, many assumptions are made which either increase or decrease the estimated costs of monitoring.

Regional Monitoring Funding Needs

The regional monitoring component with the rotating basin design and the lesser amount of probability-based monitoring meets the requirement for comprehensive monitoring under CWA Section 305(b). This type of program would allow the State to track trends in the State's water quality. This in turn could be used as a measure to track the effectiveness of the SWRCB and RWQCB programs.

The SWAMP approach will provide the State with a mechanism to assess the overall quality of the State's waters within a five-year timeframe.

Assumptions

1. The SWRCB will systematically monitor all hydrologic units at least once every five years.

2. SWAMP will collaborate with existing programs such as the Southern California Bight Project, San Francisco Regional Monitoring Program, NOAA Status and Trends studies, and USEPA EMAP monitoring efforts in enclosed bays, estuaries, and inland waters. This proposal assumes no new regional monitoring in San Francisco Bay and in marine waters of the Southern California Bight.

3. This component of the monitoring program will answer regionwide and statewide questions as presented in Section V.

4. Costs are separated by types of beneficial uses being monitored, such as water contact, aquatic resource consumption, drinking water, and aquatic life.

5. California has 190 hydrologic units with 655 hydrologic sub-areas and 6271 planning watersheds (Calwater, 1999). Implementation of monitoring objectives in Section V requires at least one sample per hydrologic sub-area or one sample per planning watershed. Not all rivers and streams will have perennial flow.

6. The State has 10,141 lakes. One-half of these lakes are assumed to be sampled in the proposal because some lakes are intermittent, cannot be sampled, or are considered hydrologic sub-areas (as discussed in (5) above).

7. Monitoring will occur in one-fifth of the watersheds of each Region per year.

8. For monitoring in coastal waters (enclosed bays, estuaries, and ocean waters), at least 30 samples per stratum are needed. A stratum could be different land uses in a region or known discharge locations. The coastal monitoring effort will have at least 150 samples per year (~5 strata). Monitoring of coastal waters will occur each year of the five-year monitoring cycle.

9. SWRCB and/or RWQCB staff costs for data evaluation and QA activities is estimated at no more than 10 percent of contract costs.

10. SWRCB and RWQCB staff costs for administration of contracts is estimated at no more than five percent of contract costs.

11. The same QAPP can be used for all sampling and analysis, and it will be updated every year. The proposed cost estimate for revision of the QAPP may be overstated if the plan does not need to be substantially revised. The QAPP is being developed in FY 2000-01 using existing resources.

12. The costs to study the temporal variability of flow characteristics, chemical concentration, and biological communities have not been included in this proposal.

Funding Needs

The funding needed to perform regional monitoring statewide is presented in Tables 6 and 7. The proposal presented in Table 6 represents a low estimate of the needed funding; while Table 7 presents a high estimate of funding needs. New staff resources are proposed because they are needed to administer the contracts to implement the monitoring efforts and to evaluate the monitoring data collected.

Costs are presented as total funding needed, with a breakdown of staff needs and contract needs.

TABLE 6 LOW ESTIMATE OF FUNDING NEEDS FOR REGIONAL MONITORING (FUNDING BY TYPE OF MONITORING, EVALUATION COSTS, AND ADMINISTRATION COSTS).

Tasks	Bioassessment	Water Contact	Drinking water/ Coliform in Shellfish[1]	Fish Tissue	Flow	Evaluation	Administration
Year 1							
Coastal Monitoring	$1,119,000	$330,750	$309,750	$527,500		$228,700	$114,350
Cost for 131 Watersheds	$1,257,600	$288,855	$839,710	$460,683	$2,751,000	$284,685	$142,342
Cost for 1014 Lakes	$9,734,400	$2,235,870	$6,499,740	$3,565,900		$2,203,591	$1,101,796
Costs of Reporting (Nine Regions)	$360,000	$360,000	$360,000	$360,000			
QAPP	$10,000	$10,000	$10,000	$10,000	$10,000		
Total	$12,481,000	$3,225,475	$8,019,220	$4,924,083	$2,761,000	$2,716,976	$1,358,488
Grand Total	$35,486,222						
Year 2							
Coastal Monitoring	$1,119,000	$330,750	$309,750	$527,500		$228,700	$114,350
Cost for 131 Watersheds	$1,257,600	$288,855	$839,710	$460,683	$2,751,000	$284,685	$142,342
Cost for 1014 Lakes	$9,734,400	$2,235,870	$6,499,740	$3,565,900		$2,203,591	$1,101,796
Costs of Reporting (Nine Regions)	$360,000	$360,000	$360,000	$360,000			
QAPP	$10,000	$10,000	$10,000	$10,000	$10,000		
Total	$12,481,000	$3,225,475	$8,019,220	$4,924,083	$2,761,000	$2,716,976	$1,358,488
Grand Total	$35,486,222						
Year 3							
Coastal Monitoring	$1,119,000	$330,750	$309,750	$527,500		$228,700	$114,350
Cost for 131 Watersheds	$1,257,600	$288,855	$839,710	$460,683	$2,751,000	$284,685	$142,342
Cost for 1014 Lakes	$9,734,400	$2,235,870	$6,499,740	$3,565,900		$2,203,591	$1,101,796
Costs of Reporting	$360,000	$360,000	$360,000	$360,000			

[1] For freshwater monitoring, the costs of monitoring drinking water are presented. For marine or bay and estuary monitoring, the costs of monitoring coliform in shellfish tissue are presented.

Tasks	Bioassessment	Water Contact	Drinking water/ Coliform in Shellfish[1]	Fish Tissue	Flow	Evaluation	Administration
(Nine Regions)							
QAPP	$10,000	$10,000	$10,000	$10,000	$10,000		
Total	$12,481,000	$3,225,475	$8,019,220	$4,924,083	$2,761,000	$2,716,976	$1,358,488
Grand Total	$35,486,222						
Year 4							
Coastal Monitoring	$1,119,000	$330,750	$309,750	$527,500		$228,700	$114,350
Cost for 131 Watersheds	$1,257,600	$288,855	$839,710	$460,683	$2,751,000	$284,685	$142,342
Cost for 1014 Lakes	$9,734,400	$2,235,870	$6,499,740	$3,565,900		$2,203,591	$1,101,796
Costs of Reporting (Nine Regions plus one coastal report)	$400,000	$400,000	$400,000	$400,000			
QAPP	$10,000	$10,000	$10,000	$10,000	$10,000		
Total	$12,521,000	$3,265,475	$8,059,200	$4,964,083	$2,761,000	$2,716,976	$1,358,488
Grand Total	$35,646,222						
Year 5							
Coastal Monitoring	$1,119,000	$330,750	$309,750	$527,500		$228,700	$114,350
Cost for 131 Watersheds	$1,257,600	$288,855	$839,710	$460,683	$2,751,000	$284,685	$142,342
Cost for 1014 Lakes	$9,734,400	$2,235,870	$6,499,740	$3,565,900		$2,203,591	$1,101,796
Costs of Reporting (Nine Regions plus one coastal report)	$400,000	$400,000	$400,000	$400,000			
QAPP	$10,000	$10,000	$10,000	$10,000	$10,000		
Total	$12,521,000	$3,265,475	$8,059,200	$4,964,083	$2,761,000	$2,716,976	$1,358,488
Grand Total	$35,646,222						
			PYs	Contracts			
Grand Total per year (Average)		**$35,550,222**	**41**	**$31,474,758**			

TABLE 7: HIGH ESTIMATE OF FUNDING NEEDS FOR REGIONAL MONITORING (FUNDING BY TYPE OF MONITORING, EVALUATION COSTS, AND ADMINISTRATION COSTS).

Tasks	Bioassessment	Water Contact	Drinking water/ Coliform in Shellfish[1]	Fish Tissue	Flow	Evaluation	Administration
Year 1							
Coastal Monitoring	$1,119,000	$330,750	$309,750	$527,500		$228,700	$114,350
Cost for 1254 Watersheds	$12,038,400	$2,765,070	$8,038,140	$4,409,900	$26,334,000	$2,725,151	$1,362,576
Cost for 1014 Lakes	$9,734,400	$2,235,870	$6,499,740	$3,565,900		$2,203,591	$1,101,796
Cost of Reporting (Nine Regions)	$360,000	$360,000	$360,000	$360,000			
QAPP	$10,000	$10,000	$10,000	$10,000	$10,000		
Total	$23,261,800	$5,701,690	$15,217,630	$8,873,300	$26,344,000	$5,157,442	$2,578,721
Grand Total	$87,134,583						
Year 2							
Coastal Monitoring	$1,119,000	$330,750	$309,750	$527,500		$228,700	$114,350
Cost for 1254 Watersheds	$12,038,400	$2,765,070	$8,038,140	$4,409,900	$26,334,000	$2,725,151	$1,362,576
Cost for 1014 Lakes	$9,734,400	$2,235,870	$6,499,740	$3,565,900		$2,203,591	$1,101,796
Cost of Reporting (Nine Regions)	$360,000	$360,000	$360,000	$360,000			
QAPP	$10,000	$10,000	$10,000	$10,000	$10,000		
Total	$23,261,800	$5,701,690	$15,217,630	$8,873,300	$26,344,000	$5,157,442	$2,578,721
Grand Total	$87,134,583						
Year 3							
Coastal Monitoring	$1,119,000	$330,750	$309,750	$527,500		$228,700	$114,350
Cost for 1254 Watersheds	$12,038,400	$2,765,070	$8,038,140	$4,409,900	$26,334,000	$2,725,151	$1,362,576
Cost for 1014 Lakes	$9,734,400	$2,235,870	$6,499,740	$3,565,900		$2,203,591.00	$1,101,796
Cost of Reporting (Nine Regions)	$360,000	$360,000	$360,000	$360,000			

[1] For freshwater monitoring, the costs of monitoring drinking water are presented. For marine or bay and estuary monitoring, the costs of monitoring coliform in shellfish tissue are presented.

Tasks	Bioassessment	Water Contact	Drinking water/ Coliform in Shellfish[1]	Fish Tissue	Flow	Evaluation	Administration
QAPP	$10,000	$10,000	$10,000	$10,000	$10,000		
Total	$23,261,800	$5,701,690	$15,217,630	$8,873,300	$26,344,000	$5,157,442	$2,578,721
Grand Total	$87,134,583						
Year 4							
Coastal Monitoring	$1,119,000	$330,750	$309,750	$527,500		$228,700	$114,350
Cost for 1254 Watersheds	$12,038,400	$2,765,070	$8,038,140	$4,409,900	$26,334,000	$2,725,151	$1,362,576
Cost for 1014 Lakes	$9,734,400	$2,235,870	$6,499,740	$3,565,900		$2,203,591.00	$1,101,796
Cost of Reporting (Nine Regions plus one coastal report)	$400,000	$400,000	$400,000	$400,000			
QAPP	$10,000	$10,000	$10,000	$10,000	$10,000		
Total	$23,301,800	$5,741,690	$15,257,630	$8,913,300	$26,344,000	$5,157,442	$2,578,721
Grand Total	$87,284,583						
Year 5							
Coastal Monitoring	$1,119,000	$330,750	$309,750	$527,500		$228,700	$114,350
Cost for 1255 Watersheds	$12,048,000	$2,767,275	$8,044,550	$4,413,417	$26,355,000	$2,727,324	$1,363,662
Cost for 1014 Lakes	$9,734,400	$2,235,870	$6,499,740	$3,565,900		$2,203,591.00	$1,101,796
Cost of Reporting (Nine Regions plus one coastal report)	$400,000	$400,000	$400,000	$400,000			
QAPP	$10,000	$10,000	$10,000	$10,000	$10,000		
Total	$23,311,800	$5,743,895	$15,264,040	$8,916,817	$26,355,000	$5,159,615	$2,579,808
Grand Total	$87,134,583						
			PYs	Contracts			
Grand Total per year (average)		**$87,203,781**	**77**	**$79,466,966**			

Site-Specific Monitoring Funding Needs

The site-specific monitoring approach allows the RWQCBs significant flexibility in establishing priorities for finding and verifying water quality problems and identifying specific clean sites in waters of the State.

Assumptions

1. All SWRCB and RWQCB monitoring efforts will be implemented and reported in a consistent manner.

2. If problem verification is needed, it will be limited to no more than 25 percent of listed water bodies or sites. Some already-listed sites may need better characterization by the RWQCBs. If verification of water quality problems is not needed this assumption may overestimate the monitoring need.

3. RWQCBs will collaborate with existing programs and will evaluate available existing information on watersheds and water bodies monitored.

4. Programs will address site-specific monitoring objectives. RWQCBs may refine the objectives to be more specific than those presented in Section V.

5. For the purposes of estimating needs, the proposal assumes approximately 13 percent of impacts are assumed to be from pathogens and 87 percent from chemicals on aquatic life, bioaccumulation, and drinking water (SWRCB, 1999b). Agriculture supply, industrial supply, and aesthetic condition monitoring objectives may be covered with chemical measurements and habitat measurements.

6. The cost estimates are based on water body type and estimated areas assessed in the 1998 CWA Section 305(b) report (SWRCB, 1999b).

7. The number of problems that could be identified with this monitoring effort is unknown. For budgeting and planning purposes, the number of problems is assumed to be proportional to area or number of river miles sampled. For example, for streams and rivers, 303 problems were identified on the Section 303(d) list but only seven percent of the total river miles have been assessed. If the total number of problems is proportional to area assessed, then there could be over 4,000 water quality problems to be monitored in targeted watersheds. For this needs assessment, it is assumed that monitoring will occur at least at half of these potentially new problem locations.

8. Monitoring in targeted watersheds will be completed in all Regions each year.

9. SWRCB and/or RWQCB staff cost for data evaluation and QA activities is estimated at no more than 20 percent of contract costs.

10. SWRCB and/or RWQCB staff cost for the administration of contracts is estimated at no more than five percent of contract costs.

11. At least 10 samples are needed to characterize a clean or problem site. This may be an underestimate for water quality problems that are not localized.

12. The targeted watershed monitoring is assumed to be completed over the next 25 years and verification will occur on a five-year cycle.

13. RWQCBs will use multiple indicators (ecological and human health indicators) at sites for identifying new problem or clean sites in water bodies or targeted watersheds. This assumption may overestimate monitoring needs if a RWQCB suspects only one beneficial use is impacted.

Funding Needs

The funding needs to identify site-specific water quality problems or clean sites is presented in Table 8. Provision is made to verify impairments in up to 25 percent of the existing Section 303(d)-listed water bodies and to search for new problem locations. Implicit in the funding needs is that if a RWQCB needs to have site-specific information about clean areas, they have the flexibility to monitor potentially clean locations.

A high and low cost estimate is presented in Table 8. The low estimate assumes that no verification of already-listed sites will occur. The high estimate combines the need for verification and the need for new monitoring.

Costs are presented as total funding needed, including a breakdown of staff needs and contract needs. New staff resources are proposed because they are needed to administer the contracts to implement the monitoring efforts and to evaluate the monitoring data collected.

TABLE 8: FUNDING NEEDS FOR SITE-SPECIFIC MONITORING (FUNDING BY TYPE OF MONITORING, EVALUATION COSTS, AND ADMINISTRATION COSTS).

Task	Bioassessment	Water Contact	Drinking Water or Coliform in Shellfish[1]	Fish Tissue	Evaluation	Administration
1. Verification of 25% of freshwater sites						
19 water quality problems monitored per year	$1,548,837	$53,279	$1,034,171	$567,369	$640,731	$160,183
Reporting cost per year	$40,000	$40,000	$40,000	$40,000		
Total	$1,588,837	$93,279	$1,074,171	$607,369	$640,731	$160,183
Total amount for verification for all types of monitoring	$4,164,570					
2. Confirmation of 25% of marine water, estuary, enclosed bay waterbodies						
7 water quality problems monitored per year	$434,715	$19,244	$18,022	$204,926	$135,381	$33,845
Reporting costs per year	$40,000	$40,000	$40,000	$40,000		
Total	$474,715	$59,244	$58,022	$244,926	$135,381	$33,845
Total amount for verification for all types of monitoring	$1,006,132					
3. Monitoring to identify new freshwater problems						
82 sites monitored per year	$7,893,981	$1,813,149	$5,270,877	$2,891,719	$3,573,945	$893,486
Reporting costs per year	$40,000	$40,000	$40,000	$40,000		
Total	$7,933,981	$1,853,149	$5,310,877	$2,931,719	$3,573,945	$893,486
Total cost for all indicators	$22,509,746					

[1] For freshwater monitoring, the costs of monitoring drinking water are presented. For marine or bay and estuary monitoring, the costs of monitoring coliform in shellfish tissue are presented.

Task	Bioassessment	Water Contact	Drinking Water or Coliform in Shellfish[1]	Fish Tissue	Evaluation	Administration
4. Monitoring to identify new marine water, estuary, and enclosed bay problems						
2 sites monitored per year	$183,886	$54,352	$50,902	$86,685	$75,165	$18,791
Reporting costs per year	$40,000	$40,000	$40,000	$40,000		
Total	$223,886	$94,352	$90,902	$126,685	$75,165	$18,791
Total costs for all indicators	$629,781					

5. Grand Total		Verification (1+2)	New monitoring (3+4)	Total	Contracts
	High Estimate	$5,170,703	$23,126,937	$28,297,640	$22,766,112
	Low Estimate	$0	$23,126,937	$23,126,937	$18,565,550

Baseline Budget

This section is presented so the needs for monitoring presented in the previous sections may be compared to the funding that is currently available.

The baseline FY 1999-00 budget for surface water quality monitoring activities was approximately $2.3 million. These resources are split as follows: 8.9 PYs and $1.4 million in contracts. The FY 2000-01 Budget Act augmented the SWRCB's ambient surface water monitoring budget by 10 PYs and $3.6 million in contracts. The total budget for FY 2000-01 is approximately $5 million in contracts and 19 PYs.

Summary of Total Funding Needs for Ambient Monitoring

Table 9 presents a summary of the range in funding needs for ambient monitoring, based on the various combinations of monitoring types. The low funding estimate is approximately $59 million per year. Under this option, 87 PYs would be needed to implement the overall monitoring effort. This alternative combines the regional monitoring using the rotating basin framework in hydrologic sub-areas plus the site-specific monitoring proposal without any verification of already identified problem or clean areas.

The high funding estimate is approximately $115 million per year. Under this option, 132 PYs would be needed to implement the overall monitoring effort. This alternative combines the regional monitoring using the rotating basin framework in planning watersheds plus the site-specific monitoring proposal including verification of already identified problems or clean areas.

The SWRCB anticipates that approximately 25 percent of the funding need could be met by redirecting the resources from existing SWRCB and RWQCB monitoring programs and through coordination with other monitoring efforts throughout the State. Using such data where appropriate will increase efficiency and save money by substituting planned monitoring by the SWRCB or RWQCBs with quality monitoring data collected by other agencies or citizens.

The SWRCB's current baseline funding for ambient monitoring is nearly 12 percent of the low estimate of funding need and almost 6 percent of the high estimate of funding need. It is plausible to make up an additional 13 to 19 percent of funding need by coordination and cooperation with:

- Other State agencies (e.g., DPR, DHS, DWR, DFG, Department of Food and Agriculture, and Caltrans)
- Local agencies (e.g., NPDES permittees, cities, and counties)
- Federal agencies (e.g., USEPA, NOAA, the U.S. Geological Survey, the U.S. Navy, U.S. Corps of Engineers, and U.S. Department of Agriculture)

Consequently, if 25 percent of the funding need is obtained through redirection of SWRCB/RWQCB monitoring programs and coordination with other monitoring programs, the range of unmet funding need is estimated to be between $44 million and $87 million (Table 9).

There are many uncertainties inherent in these estimates. The funding need will be revised as SWAMP is implemented and SWRCB/RWQCBs evaluate the applicability of others data to the SWAMP process and identify opportunities to coordinate and cooperate with other monitoring programs. The SWRCB believes that this type of more comprehensive discussion is needed in order to provide the Legislature with the information they need in order to fully understand the proposed program, understand how the SWRCB arrived at estimates of funding needs, and understand how the program fits in with other local, state and Federal monitoring efforts.

In Fiscal Year 2000-01 the Governor's budget included the SWRCB's Water Quality Initiative BCP to support and expand the implementation of ambient monitoring. The BCP is consistent with the approach proposed in this program. As monitoring efforts are further developed and refined through the process outlined in the proposal, additional funding requests will be made. The SWRCB anticipates SWAMP will be phased in over several years.

Funding Source(s)

Section 13192 of the California Water Code requires the SWRCB to present funding mechanisms, including any fee structure, for the comprehensive ambient monitoring effort. The SWRCB is developing a separate report to the Legislature that will present its findings on the fee structure that could support this activity as well as other aspects of the Water Quality Program.

TABLE 9: SUMMARY OF MONITORING NEEDS (TOTAL FUNDING, PERSONNEL YEARS, AND CONTRACTS).

Monitoring Focus	Baseline	Estimates of Needed Funding	
Total Funding Need (Contracts and PYs)			
		Low	High
Regional Monitoring (Section V)	0	$35,550,222	$87,203,781
Site-Specific Monitoring (Section VI)	$6,900,000	$23,126,937	$28,297,640
Total	$6,900,000	$58,677,159	$115,501,421
Personnel Years			
		Low	High
Regional Monitoring (Section V)	0	41	77
Site-Specific Monitoring (Section VI)	19	46	55
Total	19	87	132
Contracts			
		Low	High
Regional Monitoring (Section V)	$0	$31,474,758	$79,466,966
Site-Specific Monitoring (Section VI)	$5,000,000	$18,565,550	$22,766,112
Total		$50,040,308	$102,233,078
Unmet Total Funding Need[1] **(Contracts and PYs)**		**Low $44,007,869**	**High $86,626,066**

[1] The SWRCB anticipates that approximately 25 percent of the total funding need will be met by redirecting baseline funding and coordination with other state, Federal, and local monitoring programs.

SECTION XI. STRATEGY TO PRIORITIZE AND ALLOCATE RESOURCES

As a part of the comprehensive surface water quality monitoring proposal, the SWRCB is required to develop a strategy to set priorities and allocate resources among the SWRCB and the nine RWQCBs to effectively implement the program. This section presents the strategy of allocating resources for the various types of monitoring that the RWQCBs may perform. This section provides descriptions of the WMI and the approach to be used to allocate resources and set priorities.

Approach for Allocating Resources for Ambient Monitoring

The RWQCBs shall include monitoring and assessment activities in the both the Watershed Activities and Regionwide Activities Sections of existing WMI Chapters. It is the intent of the SWRCB that the significant majority of the available funding is used for site-specific, ambient monitoring (primarily the rotating basin-type monitoring) needed to achieve the goals of the State's various water quality programs. It is acknowledged that the split between site-specific monitoring and regional monitoring will vary among the RWQCBs.

Watershed Management Initiative

A key component in the 1997 Strategic Plan for the SWRCB and the RWQCBs is a watershed management approach. The WMI is intended to support the goals in the Strategic Plan to:

1. Preserve, enhance and restore water resources while balancing economic and environmental impacts,

2. Promote cooperative relationships and to improve support for the regulated community and the public,

3. Encourage balanced and efficient use of water through water transfers, recycling and conservation,

4. Continuously improve internal efficiency and effectiveness, and

5. Establish a more stable and flexible mix of funding sources.

The WMI seeks to facilitate solutions from all interested parties in a watershed and to coordinate measures to improve watershed health and ultimately the beneficial uses of water. Each RWQCB has identified watersheds in its Region, prioritized water quality issues, and developed its own watershed management strategies, and this information is documented as "chapter" in the Statewide WMI Report. The vision is to incorporate all the strategies with the SWRCB's

coordination role into a single integrated report. The WMI Report is updated yearly to reflect the priorities of the SWRCB and RWQCBs.

Information to be included in WMI Chapter, Regionwide Section

One of the overall goals of SWAMP is to develop a statewide picture of the status and trends of the quality of California's water resources. It is intended that this portion of SWAMP will be implemented in each hydrologic unit of the State at least one time every five years. In this section of the WMI Chapter each RWQCB shall:

1. Highlight existing monitoring efforts by other entities,

2. Describe ongoing RWQCB monitoring efforts, and

3. List priorities for monitoring within the next five years. Monitoring priorities shall be listed for all hydrologic sub-areas in each hydrologic unit without bias to impairment or potential impairment.

Information to be included in WMI Chapter, Watershed Activities Section

The other goal of SWAMP is to develop site-specific information on sites that are known or suspected to have water quality problems and on sites that are clean. It is intended that this portion of SWAMP will be implemented at specific locations in each Region. This portion of SWAMP is focused on collecting information on locations in water bodies the State suspects could be listed or delisted under CWA Section 303(d). In this section of the WMI Chapter each RWQCB shall include:

1. The specific objectives selected.

2. Linkage to regulatory programs (such as Section 303(d) listing, TMDL, and NPS).

3. Highlight of the region-specific strategy for monitoring and assessment, if any.

4. A brief description of the significant ongoing monitoring that is taking place in the Region (such as SMWP, Coastal Fish Monitoring Program, TSMP, TTP, and special studies).

5. A description of any existing or planned links to citizen monitoring efforts, if any.

6. Priority tasks and costs for next two fiscal years.

GLOSSARY

Ambient Monitoring	Any activity in which information about the status of the physical, chemical, and biological characteristics of the environment is collected to answer specific questions about the status and trends in the characteristics.
Beneficial Use	Regulatory definitions of the resources, services, and qualities of specific water bodies that are the ultimate goals of protecting and achieving high water quality. These include, but are not limited to domestic, municipal, agricultural and industrial supply; power generation; recreation; aesthetic enjoyment; navigation; and preservation and enhancement of fish, wildlife, and other aquatic resources or preserves.
Bioassessment	A tool for evaluating the biological integrity of a water body and its watershed, using surveys of the organisms living in the water body.
Chapter 15	The Chapter 15 Program is part of the Core Regulatory Program for waste treatment, storage, or disposal sites. Statute specifically requires the SWRCB to develop regulations to "ensure adequate protection of water quality and statewide uniformity in the siting, operation, and closure of waste discharge sites." These regulations are found in California Code of Regulations [CCR] Title 27 [solid waste, including mining waste] and CCR Title 23, Division 3, Chapter 15 [hazardous waste].
Compliance Monitoring	Monitoring to determine if a specific discharger is meeting the requirements established in WDRs, NPDES permits, or water quality certifications.
Contamination	An impairment of the quality of the waters of the State by waste to a degree that creates a hazard to the public health through poisoning or through the spread of disease. It includes any equivalent effect resulting from the disposal of waste, whether or not waters of the State are affected.
Habitat	The environment occupied by individuals of a particular species, population, or community.
Indicator	A tool used to assess and measure water quality. Indicators must be measurable with available technology,

	scientifically valid, and useful for providing information for management decision making. Environmental indicators include tools for assessment of chemical, physical, and biological conditions and processes.
Site-specific Monitoring	Monitoring that is focused on sites or points known or suspected to be polluted and areas that may serve as sources of pollution. This type of monitoring may also focus on clean or unimpacted sites.
Monitoring	Periodic or continuous collection of environmental information to assess the current status or changes in the environment over time. It can be short or long term in duration and is typically driven by statutory, policy, or other regulatory requirements.
Pollution	An alteration of the quality of the waters of the State by waste to a degree which unreasonably affects either the waters for beneficial uses or the facilities which serve these beneficial uses.
Regional Monitoring	Monitoring that defines the larger scale condition of aquatic life, determines if known local impacts can be observed at large distances, and assesses the natural variability inherent in the environment. Sampling locations are chosen randomly without regard for the presence or absence of known or suspected areas of pollution or other impairments.
Research	Scientific investigation that involves short-term studies focused on cause-and-effect relationships, understanding causative mechanisms, open-ended questions, methods development, and special studies focused on questions generated by monitoring.
Watershed	Lands that drain to a common place. As physical systems, watersheds consist of hillslopes, valleys, and drainage networks.

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APPENDIX

Recommendations on Ambient Monitoring

by the

AB 982 Public Advisory Group

AB 982 Public Advisory Group

Recommendations on Ambient Monitoring
by the AB 982 Public Advisory Group

Report to the
State Water Resources Control Board

October 2000

DRAFT FINAL

Executive Summary

- The PAG does not support the State Board's July 2000 draft Surface Water Ambient Monitoring Program (SWAMP).

- While probabilistic monitoring may be appropriate for larger water bodies such as the ocean and bays, the PAG does not agree with the general application of probabilistic study design in the draft SWAMP and instead requests that the plan be based primarily on a rotating basin methodology as recognized by the U.S. EPA.

- The state should strive to design a comprehensive, statewide ambient monitoring program that provides support for other water quality programs.

- The PAG recommends a rotating basin approach under which each Region would be divided into five areas consisting of one or more hydrologic units. The major watercourses and tributaries in one of these areas for each Region would be monitored for a one-year period at least once every five years. The Regional Boards would, in a coordinated, unbiased effort, strategically select the specific, long-term monitoring sites at major sub-drainage area discharge points (tributaries) of each hydrologic unit, based on regional and state needs. The Regional Boards would also integrate in quality data from other agencies and organizations. The goal is complete spatial and temporal coverage of each Region at least once every five years.

- The PAG would like to emphasize that coordinated Regional Board involvement in study design and sampling is critical to providing a comprehensive, effective monitoring program that results in identifying degrading and improving conditions in waterways.

- The design of the program should not be limited by fiscal constraints or resources. Prioritization of tasks may occur, based on a coordinated framework that emphasizes regional priorities and needs, as is necessary to accommodate final funding availability.

- A Scientific Peer Review Committee should be convened by the State Water Resources Control Board to provide periodic review and evaluation of the State's comprehensive monitoring program.

Table of Contents

I. Introduction

This report presents the AB 982 Public Advisory Group's (PAG's) joint comments and recommendations on the State Water Resources Control Board's effort to develop a Comprehensive Surface Water Quality Ambient Monitoring Program, as outlined in the July 2000 draft report and considering changes shared with several members of the PAG on October 4, 2000.[1] The Public Advisory Group is made up of twelve members of the regulated community and twelve representatives of the environmental community and their alternates.[2]

The draft Surface Water Ambient Monitoring Program (SWAMP) is intended to respond to legislative mandates on the need to establish a comprehensive, statewide ambient monitoring program, a need that came about as a result of the state's poor record on monitoring ambient water quality conditions. For example, the latest 305(b) report states that California monitors only 9% of its rivers and streams. To address this problem, the Legislature required the State Water Resources Control Board (State Board) to develop the following programs (see Attachment 3 for full text of legislative mandates):

- "comprehensive program to monitor the quality of state coastal [waters and watersheds]" (AB 1429);
- "comprehensive surface water quality monitoring program for the state" (AB 982);
- "plan for implementing a comprehensive program for monitoring ambient surface water quality and groundwater quality" (Supplemental Report of 1999 Budget Act).

The members of the PAG recognize and appreciate the Administration's new commitments to water quality monitoring that have taken place during the last year. The commitment of staff positions at Regional Water Quality Control Boards (Regional Boards) and budget changes to support monitoring are important first steps in the process of developing and implementing an effective monitoring program for the state and are a significant improvement over the past.

However, the PAG members have several concerns related to the draft SWAMP proposed for submittal to the California State Legislature. These concerns have been expressed in PAG meetings, as well as in written communications, without significant written response on the part of State Board staff. The PAG, as a whole, felt this separate report was necessary in order to communicate to the State Legislature these concerns.

In particular, the July 2000 draft SWAMP does not adequately address the significant need for truly "ambient" water quality monitoring. Instead, the July 2000

[1] The latest written SWAMP report that the entire PAG has had an opportunity to review is the July 2000 draft. Several changes were made to this draft in October 2000; these changes were shared with (but not given to) three representative members of the PAG Monitoring Subcommittee on October 4th.

[2] See Attachment 1 for list of PAG members.

draft SWAMP proposes a monitoring design that is biased towards problem areas. During the March 23rd PAG meeting, it was unanimously agreed that "the state should create an ambient monitoring program that addresses all surface waters of the state using consistent monitoring, sampling and analysis methods, standardized data quality assurance protocols, and objective, consistent and centralized data management" (emphasis added). Further, the PAG members collectively agreed that "this program should include *both* potentially clean and polluted areas," and that the Regional Boards should "establish monitoring priorities for the water bodies within their jurisdiction." The PAG's concerns regarding the need to include both clean and polluted areas are not sufficiently addressed in either the July draft SWAMP or the October revisions.

Given the monitoring efforts currently underway, including monitoring requirements in NPDES permits, citizen monitoring, collaboration with various academic institutions, and other efforts, this is a significant opportunity for the Regional Boards to coordinate these existing efforts and leverage resources so as to make the statewide monitoring effort more comprehensive. However, the July 2000 draft SWAMP's focus on probabilistic monitoring seeks to impose upon the Regional Boards a more inflexible, "one size fits all" methodology for ambient water quality monitoring that cannot integrate with other monitoring efforts.

A primary responsibility of the PAG monitoring work, as stated in AB 982, is to assist the State Board in the evaluation of its water quality program structure and effectiveness as it relates to the state's monitoring and assessment programs. In order for the State Board to fulfill its own requirements under AB 982 and other legislative mandates, it must prepare a report by November 30, 2000 describing a proposal for a comprehensive surface water quality monitoring program, including associated steps and costs for developing and implementing the program and appropriate funding mechanisms. Since March 2000, PAG members have been meeting routinely to discuss the State Board's water quality program elements, their effectiveness, and necessary changes to ensure the development of a proposal for a truly comprehensive ambient surface water quality monitoring program. During these frequent meetings, the PAG has provided the State Board with constructive input on the framework for a workable comprehensive ambient monitoring program.

To date, there have been some fundamental disagreements between the PAG and State Board staff regarding the framework content of the July 2000 draft SWAMP, as indicated above and described in more detail below. Some of these appear to have been alleviated to some degree in the October 4th amendments shared with the monitoring subcommittee representatives. The PAG believes, however, that additional changes need to be made before the final report is adopted by the State Board.

It is of the utmost importance that ambient conditions in water bodies be accurately characterized so that future trends in water quality conditions can be identified along with identifying specific existing or emerging water quality problems. Furthermore, accurate assessment of water quality is needed to support other water quality program efforts such as 305(b), 303(d), TMDLs, and NPDES permitting

activities. In addition, data collected under a comprehensive monitoring program can be useful in determining the effectiveness of water quality programs. The comments below are aimed at improving the draft SWAMP in order to meet these goals.

II. PAG Consensus Recommendations on General Monitoring Plan Framework

The PAG members found consensus on many areas related to the framework of the state's ambient monitoring program. During PAG meetings, the members developed the following recommendations for the state's ambient monitoring program that were approved by consensus:

- "The State Water Resources Control Board should develop an umbrella program that monitors and interprets that data for each hydrologic unit at least one time every five years. By umbrella program, we mean a minimum baseline monitoring program that focuses on all waters of the State and does not focus on individual problems."

- "The Program will have consistent monitoring methods with respect to sampling and analysis, data quality objectives, and centralized reporting requirements."

- "The Regional Water Quality Control Boards should be able to conduct monitoring for Regional priorities and that monitoring shall be done in accordance with protocols and methodologies laid out in the Program. The Regional Boards shall utilize Statewide templates and protocols in developing their monitoring programs."

- "The Program shall require that to the extent possible, all existing data is verified, useable, and accessible to the public through a centralized location. Future data collected will be recorded along with methods and QA/QC documentation through some State issued template so that it is coordinated."

- "The State Water Resources Control Board should formally adopt a Policy, and a means to implement the Policy, for the Regional Water Quality Control Boards on what constitutes reasonable minimum acceptable credible information. The Policy should also include the methods for determining whether to list or delist water segments on the Section 303(d) list consistent with Federal law."

- "The State Water Resources Control Board should formally adopt a Policy to maximize the Regional Water Quality Control Boards consideration of existing data during the 303(d) process."

- "The SWAMP should be designed based on the need for a comprehensive program instead of funding."

- "The SWAMP should not focus on problem areas but instead should be designed with the goal of accurately characterizing water quality in all watersheds throughout the state. The PAG believes it is equally important that water quality in "non-problem" areas be characterized to establish a baseline for future degradation determinations."

- "Currently, the SWAMP framework does not make any distinction between inland watershed monitoring strategies and ocean monitoring strategies. For instance, different monitoring program design strategies should be used for monitoring open ocean conditions, ocean shoreline conditions, enclosed bays/estuaries, open watersheds, and closed (no-outlet) watersheds. In addition, special monitoring program design considerations should be given when monitoring watersheds in urban areas. In other words, a one size fits all monitoring strategy (e.g., a probabilistic based sampling approach) is inappropriate."

- "The monitoring program should be designed as a component of an adaptive management approach to water quality improvement."

In summary, the PAG members – regulated and environmental community members alike – agreed that the state's monitoring program should (a) address both clean and problem waters, with no bias towards one or the other; (b) be designed based on need, not budget; and (c) address all waters in the state, rather than merely a statistically representative sample.

As currently drafted, however, the SWAMP is slanted towards focusing attention on known problem areas instead of focusing attention on establishing baseline conditions for all water bodies within the state. The SWAMP should have goals and a framework that results in the collection of ambient data that can be used to address basic questions such as:

- What are the ambient conditions of the waters, and have they been characterized accurately?
- Have the temporal and spatial variations in water quality been accurately identified?
- How and why are conditions changing over time?
- Do monitoring efforts support/integrate/complement other existing programs?
- What are the general geographic locations of areas of concern?
- Where are emergent problems (due to both natural conditions and man-made) coming from?

The SWAMP should provide a coherent, comprehensive framework to considers the needs of existing and future programs and provides tools to analyze and understand data and turn it into accessible information. The water quality data produced by a truly comprehensive SWAMP will prove invaluable for making important determinations such as the condition of a water body and the effectiveness of water quality improvement

programs. A systematic method of ambient monitoring of all watersheds ("hydrologic units"), marine waters and nearshore coastal areas in the state should be developed and implemented on a five-year cycle. Specifically, the PAG recommends use of a "rotating basin" approach that enables collection of detailed information within watersheds. This monitoring would be targeted at detecting emerging problems in order to correct them early when they are more tractable and measuring long-term trends on a large spatial scale. Some types of monitoring (such as pathogen indicator monitoring) are already being conducted by other agencies, citizen groups, universities, and others; these types of data should be collected and used on a statewide basis to the extent possible.

III. PAG Concerns Regarding July 2000 Draft SWAMP

The July 2000 draft SWAMP proposes a "two component" monitoring system as depicted in Sections V and VI. The first component, described in Section VI of the draft report, is a "probabilistic monitoring" plan that involves selecting monitoring sites randomly to provide information that should be statistically representative of the overall water quality in the area sampled. The second component, described in Section V, tests sites either picked randomly or strategically by the Regional Boards in order to provide more detailed information on particular problem areas, with a focus on identifying sites for listing or de-listing under CWA Section 303(d).

A. Use of Probabilistic Monitoring

The PAG is concerned about two aspects of the draft in particular. First is the allocation of a set amount of funds to the probabilistic monitoring approach. The PAG members have repeatedly expressed that the implied mandatory use of a probabilistic study design approach is a poor choice because the questions that this sort of design answers have extremely limited use in guiding management actions. The approach produces information at too broad a level of generalization and will not provide the type of data required to support the Legislature's and Cal-EPA's expressed need to provide spatial information suitable for targeting the most effective and cost-effective opportunities for water quality improvement.

U.S. EPA has recognized and accepted at least two general approaches to statewide monitoring throughout the United States:[3]

- the rotating basin approach
- the probabilistic approach

The rotating basin approach uses a site selection process based on the goal of attaining complete spatial coverage of the basin under study and identifying the relative contribution of sub-areas within the basin to the overall water quality of the basin. In California's case, the PAG recommends a rotating basin approach under which each Region would be divided into five areas consisting of one or more hydrologic units. The

[3] Additional information on the rotating basin and probabilistic study design approaches is found in Attachment 2.

major watercourses and tributaries in one of these areas for each Region would be monitored for a one-year period at least once every five years. The Regional Boards would, in a coordinated, unbiased effort, strategically select the specific, long-term monitoring sites at discharge points for the major sub-drainage areas of each hydrologic unit, based on regional and state needs. The Regional Boards would also integrate in quality data from other agencies and organizations. The goal is complete spatial coverage of each region at least once every five years.

The probabilistic approach uses a random or "stratified" random site selection process with the goal of providing information that is statistically representative of the overall water quality in the basin. Unlike the rotating basin approach, this approach provides no information about the relative contributions of areas within the basin. The July 2000 draft SWAMP focuses on the use of probabilistic monitoring to develop generalized conclusions about the overall, statewide quality of California's waters.

The probabilistic study design is most effective for monitoring within water bodies such as large bays, estuaries, nearshore regions, and lakes. In watersheds, a study design based on the form and function of the watershed and the stream and river network (the rotating basin approach) provides more knowledge per unit of effort whether the unit of effort is dollars or staff hours. Even the U.S. EPA has had difficulty with the effectiveness of the probabilistic approach applied at a regional level: "[t]he U.S. Environmental Protection Agency Environmental Monitoring and Assessment Program [a probabilistic approach] attempted to design and implement a national level monitoring program to assess the Nation's environmental resources by building a series of regional monitoring programs throughout the country. This showed promise but proved too costly and succumbed . . . ."[4]

It is the view of the PAG that the probabilistic approach focuses attention on developing abstract percentages of water quality statewide, rather than characterizing ambient water quality for each drainage area in the state. In other words, using this approach may tell us that a certain percentage of a specific type of water body in California is impaired for a particular pollutant, but it will not tell us the quality of any individual waters. Characterizations necessarily should address variations based on time and location of sampling, as well as identify specific sources of pollution, potential pollution and clean water. This is data that probabilistic monitoring, which looks at the state's waters much more broadly, often cannot generate.

While probabilistic monitoring may be of some use for larger waters such as the ocean and bays, useful interpretation of probabilistic monitoring data for inland surface waters will be difficult at best, as it requires staff to make assumptions based on limited data from only a few tested waters. Moreover, the probabilistic monitoring approach can only evaluate the cumulative success of the state's water policies and programs, rather than both cumulative and individual program successes, further limiting its usefulness.

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[4] Hashimoto, J., U.S. EPA, Weisburg, S., SCCWRP, from "Monitoring: Critical Foundations to Protect Our Waters," *Proceedings of the National Water Quality Monitoring Conference* (1998).

The probabilistic monitoring approach is a "one-size-fits-all" strategy that largely ignores the types of watersheds monitored and program needs. For example, the Regional Boards generally would not be able to integrate this program and its results into their WMI chapter activities. The state's ambient monitoring program should allow the Regional Boards sufficient flexibility to develop approaches within the monitoring framework that meet their needs, while coordinating closely with other appropriate entities to maximize use of the aggregate data to develop an accurate picture of water quality statewide.

The probabilistic approach also cannot be readily integrated into most of the other, numerous monitoring activities throughout the state, such as those conducted by other agencies and citizens. The state thus loses the ability to capitalize on these other monitoring programs.

The proposed allocation in the draft SWAMP of a set percentage of funds to probabilistic study design is a de-facto admission of defeat in attaining comprehensive spatial coverage of the waters of California. The state needs to choose a monitoring framework that will meet the needs of existing and foreseeable programs to improve or maintain water quality conditions, and will yield the most useful and meaningful data for the money spent.

The resources that would be ineffectively employed through the use of a probabilistic-based design should be made available to Regional Boards to be incorporated in a coherent, place-based ("rotating basin") approach to monitoring. Probabilistic monitoring should be limited to larger open waters, such as the ocean and large bays and lakes, and inland only where needed to complement and enhance similar, existing U.S. EPA monitoring efforts, such as U.S. EPA's Environmental Monitoring and Assessment Program (EMAP).

Monitoring site selection should be conducted by the Regional Boards along with refined program objectives in the course of their Watershed Management and Basin Planning activities. Some Regional Boards, such as Region 3, have already demonstrated effective approaches to monitoring their watersheds using various designs which are capable of supporting place-based assessment efforts and are transferable to the state-wide level. Examples of disgressionary site selection methods which may be employed include:

- Probabilistic (sites selected based on a random or stratified random approach)
- Stream Network (sites placed at major tributaries and along the main stem)
- Lagrangian (samples taken along the main stem of a river, stream, or drainage channel)
- Paired Watershed (sites placed at the discharge of a control watershed and a study watershed)
- Upstream / Downstream (sites placed upstream and downstream of activity to be measured)

As noted above, the PAG supports a "rotating basin approach," which uses a site selection process based on the goal of attaining complete spatial coverage of the basin under study every five years. Among other things, the advantages of using this rotating basin approach are that it would:

- Ensure the development of a cost-effective framework that truly reflects a comprehensive ambient monitoring program for all water bodies in the state.
- Provide a comprehensive look at all the state's water bodies, rather than just some, primarily by leveraging and reallocating existing resources.
- Allocate monitoring funds towards activities that will maximize the state's ability to assess the success rate of its many water quality programs.
- Be more amendable to integration with other agencies' and organizations' quality monitoring programs than a program focused mainly on probabilistic monitoring. It is both cost-effective and strategic to work with other agencies and groups that have water quality monitoring and improvement responsibilities, as it both increases the amount of data available and creates partnerships that can be used to improve water quality based on the monitoring results.
- Generate meaningful results that could be aggregated upwards to a statewide scale, allowing for <u>both</u> water body-specific and statewide water quality summaries.

Both the rotating basin and probabilistic approaches have merit in certain applications, which are further addressed in Attachment 2. For purposes of developing an ambient monitoring program that serves California's most pressing needs, the PAG strongly recommends a focus on the rotating basin approach, with probabilistic monitoring used only as needed and appropriate.

Arbitrary allocation of resources to probabilistic monitoring, as described in the latest changes to the July 2000 draft SWAMP, using funding percentages for each of the two components cannot be scientifically justified, nor does it recognize and respect the needs of the Regional Boards. Instead, the Regional Boards, based on input from stakeholders where appropriate, should be able to prioritize ambient monitoring efforts within their own regions. While the PAG recognizes and appreciates the changes in the latest draft SWAMP to allocate less funds to probabilistic monitoring and more to specific site monitoring, the PAG is also concerned about allocation of those funds when the actual budget is approved by the Legislature and the Governor. The "Prioritization" section of the report needs to be revised to emphasize the need for site-specific monitoring over the less practically useful results provided by probabilistic monitoring.

B. Monitoring of Both Problem and Clean Waters

The PAG's second major concern with the July draft SWAMP relates to monitoring of both clean and polluted waters. Section V. of the current SWAMP emphasizes use of testing to identify "problem" waters. While it does not prohibit the

Regional Boards from testing clean waters, its emphasis on use of clean waters only as "reference sites" indicates that the State Board views clean sites only as a tangent, rather than a resource to be protected. The directed focus on problems areas alone will not provide information in support of antidegradation goals or allow for the collection of reference site data required to establish background conditions and reasonable specific numeric objectives. This lack of focus on tracking and protecting cleaner waters leaves them vulnerable to degradation. The objective of the SWAMP is to create an ambient monitoring program, not to collect data in problem areas. A true ambient program will include all water bodies, whether or not they are identified as a problem.

This issue is particularly frustrating to the PAG because PAG members have brought up this consensus recommendation repeatedly since March 2000 and still have seen no changes in the draft SWAMP (including the October version) that address this issue. We strongly urge the members of the State Board to consider seriously the recommendations outlined in Section V. of this document with respect to including clean waters as an integral part of the draft SWAMP.

C. Compliance with AB 982 Requirements

The PAG thought that the members of the State Board would find it helpful to have comments tailored towards the specific elements that the SWAMP must include in order to comply with AB 982. These are described below:

AB 982 Requirement 1 - *Physical, chemical, biological, and other parameters about which the program shall collect and evaluate data and other information and the reasonable means to ensure that the data is accurate in determining ambient water quality.*

Comments:

A) The SWAMP should employ a rotating basin site selection approach for watershed monitoring (National Water Quality Monitoring Council, 1998), as opposed to focusing on a statewide probabilistic approach. This will ensure cost effective monitoring which adequately addresses all waters, and which can effectively aid Regions in source identification as mandated by the Strategic Vision of the California Environmental Protection Agency (July, 2000).

B) The SWAMP should make a commitment to the use of response indicators such as bio-criteria as a basis for setting water quality guidelines and determining the condition of the waters of the state. Monitoring data to establish appropriate desired conditions is an essential component in the use of bio-criteria and other biological response indicators. California lags other states in the use of biological endpoints as a basis for decisionmaking. The Clean Water Act mandates assessment of the biological integrity of the nation's waters in addition to the chemical and physical integrity.

AB 982 Requirement 2 - *The use of models and other forms of information not directly measuring water quality.*

Comments:

A) Many types of loading calculations and estimates require modeling because sufficient historical records of contributing factors such as stream/river flow and rainfall do not exist. A centralized repository of model information and data that covers the entire state of California is needed to reduce staff time and duplication of effort at the Regional Board level and provide for statewide consistency. This could be as basic as a State Board website that contains links to Information Services. The SWAMP should identify and commit the resources needed to this task.

B) Geographic Information Systems (GIS) techniques and data play an important role in monitoring and assessment of water quality. Baseline data sets, similar to and compatible with the State Board's existing Geographic Water Body System data set, should be made available by the State Board to the Regional Boards at a central location on the world wide web. Data layers such as watershed boundary delineations and hydrography should be established as standards and specific protocols for improvements and updates to these data layers should be established in the SWAMP.

C) A remote sensing component should be added to the SWAMP that provides for the use of satellite image analysis and aerial photography, which, for example, can track sediment plumes and other pollution visually. This has the potential to be a useful tool for augmenting water quality data to create more comprehensive evaluations.

AB 982 Requirement 3 - *Reasonable quality assurance and quality control protocols sufficient to allow sound management while allowing and encouraging, where appropriate, data collection by entities, including citizens and other stakeholders, such as dischargers.*

Comments:

A) The State should develop an overall Quality Assurance and Control Plan for use by the regions. Quality assurance and quality control protocols should be developed in a manner consistent with the requirements for non-U.S. EPA organizations, as defined in the Code of Federal Regulations. U.S. EPA Quality Staff issues documents that specify how to satisfy these federal regulations. These documents contain policy statements that identify and discuss mandatory elements of EPA's Quality System for organizations receiving financial assistance from EPA. A complete set of guidance documents is available at: www.epa.gov/quality/qa_docs.html.

B) As urged by the SAG, the State Board should appoint a statewide QA/QC officer as well as provide adequate funding for dedicated QA/QC officers at each of the Regional Boards. The statewide QA/QC Plan should be reviewed biennially to ensure appropriate protocols and techniques and to reflect new technologies and findings that may arise in the field of water quality assessment.

C) In order to combine data from various sources, a protocol for establishing defined data quality descriptions and data quality objectives should be established. Requirements for data precision and accuracy vary with the actual use of the data. A variety of definable categories need to be established in order to effectively utilize data from sources outside the SWAMP program.

D) The State Board has added volunteer monitoring coordination staff over the last year. This staff should be engaged in a dialog with staff working on the SWAMP program to fully integrate volunteer/citizen monitoring as a component of SWAMP. Provisions should be made for the various purposes of volunteer monitoring which range from educational purposes to rigorous scientific studies. The need for different levels of quality control and data quality objectives must be recognized.

E) In addition to QA/QC associated with monitoring, the use of data collected by other agencies and organizations requires that the data be stored in a format consistent with data collected by SWAMP. Accordingly, key statewide databases should be converted to the new U.S. EPA STORET at the state level and made available to the regions. Descriptions of the data quality objectives associated with external databases should also be provided. The PAG reiterates that specific databases should be identified for this purpose and that the monitoring plan commit to accomplish these tasks.

AB 982 Requirement 4 - *A strategy to expeditiously develop information about waters which the State presently possesses little or no information.*

Comments:

A) The PAG-recommended rotating basin approach to monitoring site selection will yield data that can be used to make determinations regarding water quality conditions in specific water bodies. By characterizing the discharges of sub-watershed areas, both sources of impairment and ambient water quality can be more readily quantified. The probabilistic approach currently proposed in the draft SWAMP does not address this need.

B) The maintenance of a long term array of monitoring sites to characterize watersheds can serve anti-degradation goals through both trend evaluations and reference condition assessments.

AB 982 Requirement 5 - *A strategy for assuring that data collected as part of monitoring programs and any associated quality assurance elements associated with the data collection will be made readily available to the public.*

Comments:

A) Just as the scientific elements of a monitoring program need detailed design in order to work, the presentation of information and data in the SWAMP require a 'before the fact' design. All too often data is collected and stored and too little thought is put into how to communicate or use the information produced by the data.

B) Information communication methods should be developed concurrent with scientific design. The Web can provide opportunities for effective information dissemination. In addition to providing a convenient method of widely distributing reports, the Web makes it possible to provide access to the underlying data. Access to the data itself can provide stakeholders and interested parties the ability to independently evaluate conclusions and assessments derived from the data.

Requirement 6 - *A strategy for assessing and characterizing discharges from nonpoint sources of pollution and natural background sources.*

Comments:

A) The PAG-recommended rotating basin approach to monitoring site selection can produce data that can be used to make determinations regarding the location and spatial extent of water quality conditions. By characterizing the discharges of sub-watershed areas, both sources of impairment and ambient water quality can be quantified. The probabilistic approach currently proposed in the draft SWAMP does not adequately address this need.

B) In addition, the rotating basin approach can enable broad scale statistical analysis of the performance of management practices in a cost-effective way. Methods developed by the U.S. EPA National Nonpoint Source Monitoring program can be employed to measure the performance of management efforts and program effectiveness over time.

Requirement 7 - *A strategy to prioritize and allocate resources in order to effectively meet water quality monitoring goals.*

Comments:

A) The draft SWAMP does not seem to clearly establish a strategy for allocation of monitoring resources. Currently some Regions benefit from millions of dollars supplied by programs such as the Southern California Water Research Project, the

San Francisco Estuary Institute Regional Monitoring Program, and the Cal-Fed CMARP program. Other Regions which contain some of the state's more pristine waters cannot employ the underlying economic models used to support these types of programs because they lack the high number of permitted dischargers, the population, and/or the highly visible environmental problems. This has the effect of diminishing the protection of some of the state's waters.

B) The monitoring plan needs more detailed treatment of monitoring resource allocations. These allocations should be developed in a dialog that includes both the State Board and the regions.

C) AB 982 requires the State Board to develop a strategy to set priorities and allocate resources in order to effectively meet water quality monitoring goals. In order to maintain the integrity of the Watershed Management Initiative (WMI), the goals of the proposed SWAMP must integrate with the goals developed for the WMI. The focus of the monitoring efforts should be on documenting ambient water conditions of all waters within the State, and not specifically targeting on problem areas.

IV. Scientific Advisory Group Comments

The State Board convened a Scientific Advisory Group to comment on the AB 982 process. State Board staff posed the following question to the panel:

> Are the proposed monitoring approaches sufficient to answer the questions posed (*i.e.*, "Is it safe to swim?"; "Is it safe to drink the water?") and achieve the more specific monitoring objectives?

The scientists could not answer this question in the affirmative based on the monitoring plan framework as written. The fact that this fundamental question could not be answered is a problem. Both the method of determining the questions presented in the draft SWAMP and the methods of addressing the questions warrant additional scientific review.

SAG members commented that certain detailed pieces of information, such as the number of sites to be allocated and the viability of individual indicators, could not be judged for efficacy due to a lack of more detailed specific objectives. SAG members also seemed to be in agreement regarding the need for a formal scientific review process for the entire program and for the establishment of a forum of scientists from various agencies and organizations, including the academic community, to meet regularly to provide coordination of efforts and a channel of communication between monitoring programs and efforts. The SAG also agreed that a QA/QC officer should be housed at the State Board, and that each Region should have at least a half-time QA/QC expert to assess monitoring programs and incoming data.

The PAG has requested the minutes of the Scientific Advisory Group meeting but has not yet received any written material documenting the Scientific Advisory Group comments or recommendations.

The SAG strongly advised that the proposed SWAMP be periodically updated based on feedback from the Regional Boards and reviewed by a Scientific Advisory Committee. Regional Boards and an independent panel of scientists should periodically (at least biennially) review the SWAMP's scientific and programmatic effectiveness. The scientists involved in conducting SWAMP monitoring should be participants in the selection of the Peer Review Committee.

The SAG should also periodically review the QA/QC portion of the SWAMP to ensure that the requirements are kept up-to-date. The State Board should consider hosting periodic meetings with the Regional Boards' dedicated staff members and other interested parties conducting watershed monitoring to review program and QA/QC requirements.

From time to time, it would be extremely beneficial for the State Board to survey the successes of existing monitoring programs being used within and outside the State. For instance, USGS has progressed in their efforts of implementing its National Water Quality Assessment Program (NAWQA) in three watersheds within the State. This program uses a fixed station network approach so that trends in water, sediment and biota can be studied. Learning from the successes of other monitoring programs will help to avoid wasting valuable funding resources.

V. Priority Recommended Changes to Draft SWAMP

As previously mentioned, the PAG members have been able to review only the July 2000 Draft SWAMP. Three members of the Monitoring Subcommittee were shown (but not given) revisions to this document. These comments are based on notes from those revisions, as well as the July 2000 document itself. The PAG may submit additional comments once the next draft or final report is available for review.

The PAG's recommended changes center on the two issues raised above: the over-application of probabilistic monitoring, and a focus on "problem" rather than all waters, including "clean" waters. The PAG appreciates staff's work in the October draft to address the PAG's other priority concern regarding development of a program based on need, not budget. The PAG's comments are divided by chapter below, with additional, more detailed comments in Attachment 4.

A. Draft SWAMP Section III. – "Program Goals"

The goals should be revised to emphasize achieving a truly ambient program; *i.e.*, one that considers all waters, both impaired and clean. The top goal listed focuses on problem waters, which is not an appropriate focus for an ambient monitoring program.

B. Draft SWAMP Section V. – "Study Design: Identifying Specific Problems in Targeted Watersheds"

The very title of this section illustrates the frustration the PAG has had with the responses to PAG comments. While identifying specific problems is important, it is not the sole job of an *ambient* monitoring program, which must address all waters, clean or impaired. "Problems" in the title should be changed to "Conditions," and the language throughout Section V. should be expanded to address clean water specifically, in addition to problem waters.

For example, the new language in Section V. states that the Regional Boards "may" monitor clean sites on a site-specific basis "if needed to compare with problem sites." The PAG has stated repeatedly that this limited focus is insufficient. This language should be changed to state instead that the Regional Boards "*shall* monitor both clean and problem sites as needed to meet program goals, including but not limited to antidegradation mandates and policies." Full consideration of clean sites would of course be addressed in any event through a rotating basin approach, as discussed next.

C. Draft SWAMP Section VI. – "Study Design: Documenting Ambient Water Quality Conditions in Potentially Clean and Polluted Areas"

Section VI. of the draft SWAMP focuses on using the probabilistic approach to meet to collect generalized water quality information, primarily for purposes of meeting Section 305(b) requirements. For the reasons described above, the PAG is concerned about the limitations of this approach.

The PAG instead supports a framework that will be able to address statewide questions while at the same time contribute to regional information needs. The PAG unanimously recommends a "rotating basin" framework, under which each Region would be divided into five areas consisting of one or more hydrologic units. The major watercourses and tributaries in one of these areas for each Region would be monitored for a one-year period at least once every five years. The Regional Boards would, in a coordinated, unbiased effort, strategically select the specific, long-term monitoring sites at major sub-drainage area discharge points for each hydrologic unit, based on regional and state needs. The Regional Boards would also integrate sound water quality data from other agencies and organizations. The goal is complete spatial and temporal coverage of each region at least once every five years.

This process could include a smaller amount of probabilistic (random) monitoring, as needed. Probabilistic monitoring should be limited to larger open waters, such as the ocean and large bays and lakes, and inland only where needed to complement and enhance similar, existing federal monitoring efforts, such as U.S. EPA's Environmental Monitoring and Assessment Program (EMAP).

The process also would include additional, site-specific, "follow-up" monitoring of expanded reaches of selected areas of drainage into either impaired or cleaner waters, as needed to meet refined regional program goals, such as cause-and-effect relationships.

A summary of this approach is as follows:

Statewide - screening, pollution prevention, triage, long-term trends

- Sites primarily selected to monitor the discharge of sub-drainages within hydrologic units
- Sites selected randomly, using probabilistic approach, only where most needed and appropriate (*e.g.*, large bodies of water such as oceans)
- Sites selected without known impairment-based bias
- Sites are fixed/permanent in order to assess long-term trends
- Indicators should be capable of detecting previously unknown problems
- Indicators measured are consistent statewide within each parameter group

Regional - studies of special interest to regions (including impaired and/or clean waters)

- Sites either permanent or temporary
- Sites selected to maximize usefulness of data collected to regions
- Indicators should be capable of measuring the parameters of interest

The recommended "rotating basin" framework described above would address both the overall state information needs under 305(b) that are currently the focus of Section VI. of the draft SWAMP, as well as the site-specific monitoring requirements discussed in Section V. of the SWAMP.

It is our understanding that State Board staff would be interested in using the "rotating basin" approach if assured of its representativeness and practicality. The PAG members submitted materials towards those ends to State Board staff and are collecting additional materials to document the actual, current use of this approach in the state and its applicability in the SWAMP. If the rotating basin approach is adopted, Sections V. and VI. could be collapsed into a single section that outlines the rotating basin framework described above and notes that a smaller amount of additional monies should be set aside for additional, site-specific investigations as the Regional Boards determine is needed, based on the results of their basic ambient monitoring activities.

D. Draft SWAMP Section X. – Funding

As discussed in the Attachment 4 section on funding, the PAG has voiced numerous times its concerns about the problems associated with the State Board's practice of designing a monitoring program based on existing or expected budget, not on need. The PAG thus welcomes and appreciates the significant work by staff to cost out in the latest (October 4th) draft SWAMP (Section X.) a monitoring program that is based on need, rather than on budget. The PAG also appreciates the fact that the majority of the funds in this new Section X. are allocated towards site-specific, rather than generalized

(*i.e.*, probabilistic) monitoring. The PAG recommends that, if the SWAMP is revised to reflect use of the "rotating basin" approach to monitoring described above, these cost estimates be revised accordingly. Such revisions should take into account potential use of existing data collected by other agencies or groups that could be integrated with the rotating basin approach.

E. Draft SWAMP Section XI. – Prioritization

This effort to cost out monitoring in Section X. of the latest draft PAG needs to be coordinated with clear prioritization guidance, in the event the Legislature and Governor do not appropriate all of the funds requested. The PAG is concerned that without this guidance, limited funds may be over-allocated towards probabilistic monitoring at the expense of site-specific needs.

The PAG requests that staff add language to the "Prioritization" section specifying the parameters within which the Regional Boards must work to prioritize the funding they receive from the state. **We ask that this language indicate that the state's main priority is site-specific, ambient monitoring needed to achieve the goals of the state's various water quality programs, and that the section specifically state that the significant majority of appropriated monitoring funds will be used for such activities.** We also ask that this section specifically de-emphasize the use of limited funds for more generalized monitoring, which is primarily useful only for 305(b) reporting purposes, rather than from a program perspective. This language should state that probabilistic monitoring should be limited to areas where is it most beneficial and appropriate, such as for monitoring of large water bodies and for enhancement of inland programs such as EMAP.

Finally, it should also be made clear that, in the fortunate event that the State and Regional Boards receive full funding for monitoring, the allocation percentages provided in Section X. (which range from 70%/30% to 80%/20% Section V./Section VI. monitoring) will not be applied uniformly across regions, but will be only a statewide guideline, dependent on needs developed through coordinated Regional planning. Probabilistic monitoring is essentially of no value in some areas, and so rigid application of these percentages may yield wasteful spending on probabilistic monitoring in some Regions. The PAG recommends keeping 70-80% as a minimum for site-specific monitoring throughout the Regions, with more funding allocated to site-specific monitoring in Regions where probabilistic monitoring is inappropriate. The current draft SWAMP needs to be more clear on how these percentages will be allocated on a regional basis.

VI. Conclusions

The PAG, a public advisory body made up of stakeholders representing both the regulated community and the environmental/citizen group community, agree that the monitoring design proposed in the July 2000 draft SWAMP does not meet the mandates of AB 982, AB 1429, or the Legislature's Supplemental Report of the 1999 Budget Act.

The PAG also agrees that this design does not best meet the pressing needs of the Regions for better monitoring data, and does not provide the public or decisionmakers with the data they most need to determine the condition of the state's waters. The PAG recommends that the State Board adopt the rotating basin monitoring approach, specifically by merging the framework described in Sections V. and VI. into one section entitled "Identifying Ambient Water Quality Conditions," and incorporating the other language changes described in this chapter and Attachment 4. Changing the emphasis in the SWAMP to characterizing ambient water quality throughout the state, rather than focusing on problem areas and a handful of random sites, will help ensure that the intent of AB 982 is carried out effectively.

Attachment 1 - Public Advisory Group Membership

The PAG was established by the SWRCB in February 2000. The PAG is composed of 24 members: 12 members from the regulated community and 12 members from the environmental community. Each member has an alternate. The membership is as follows:

	Member	**Alternate**
Regulated Community (12 members)		
Production Agriculture	Tess Dunham, California Farm Bureau Federation	Brad Luckey, Imperial Irrigation District
Dairies	Paul Martin, Western United Dairymen	David Albers, Milk Producers Council
Rangeland	Bill Thomas, California Cattlemen's Association	Pat Blacklock, California Cattlemen's Association
Forestry	Mark Rentz, California Forestry Association	Mark Pawlicki, Forest Resources Council
Private Construction Stormwater	Cliff Moriyama, California Building Industry Association	Sat Tamaribuchi, The Irvine Company
Municipal Stormwater	Jim Scanlin, Alameda County Stormwater Program**	Armand Ruby, Larry Walker and Associates
Industry	Craig Johns, Kahl/Pownall Advocates*	Dave Arrieta, Western States Petroleum Association
Ports, Waterfront Organizations	Patti Krebs, Industrial Environmental Association	Ellen Johnck, Bay Planning Coalition Randal A. Friedman, U.S. Navy Region Southwest Environmental Department
Municipal Sewage (Publicly Owned Treatment Works)	Roberta Larson, California Association of Sanitation Agencies	Vicki Conway, County Sanitation Districts of Los Angeles County**
Counties	Jim Noyes, Los Angeles County Department of Public Works	Allen Campbell, Humboldt County Public Works
Cities	Dave Kiff, City of Newport Beach	David Tucker, City of San Jose
Water Agency	Peter MacLaggan, California Urban Water Agencies	David Bolland, Association of California Water Agencies**
Environmental		

	Member	**Alternate**
Community (12 members)		
	Linda Sheehan, Center for Marine Conservation**	Cori Fay Traub, Clean Water Action
	Jonathan Kaplan, Waterkeepers Northern California	Bill Jennings, Deltakeeper
	Bob Caustin, Defend the Bay	Bonnie Ahrens, Defend the Bay
	Donna Meyers, Coastal Watershed Council **	Alan Levine, Coast Action Group
	Marco Gonzales, Surfrider Foundation	Emily Roberson, California Native Plant Society
	Leslie Mintz, Heal the Bay	Heather Hoecherl, Heal the Bay
	Bruce Reznik, San Diego Baykeeper	Julie Hamilton, San Diego Baykeeper
	Lynn Barris, Butte Environmental Council	Zeke Grader, Pacific Coast Federation of Fishermen Association
	Barbara Vlamis, Butte Environmental Council	Allen Harthorn, Friends of Butte Creek
	Dave Paradies, Bay Foundation Morro Bay**	John Robinson, Heal the Ocean
	David Beckman, Natural Resources Defense Council*	Steve Fleischli, Santa Monica Baykeeper
	Nicole Capretz, Environmental Health Coalition	Laura Hunter, Environmental Health Coalition

* PAG Co-Chair
**PAG Monitoring Subcommittee

Attachment 2 - Monitoring Design Approaches[5]

Rotating Basin Approach

Strengths:

Organized systematic approach based on accumulating assessment over a fixed period of time.

Coincides with various management programs which are supported by the monitoring and assessment information (i.e. NPDES permit re-issuance, basinwide water quality planning, etc.)

Provides monitoring and assessment information at a local or reach specific scale so that the many issues which occur at this level can be addressed while providing the opportunity to aggregate upwards to a watershed, regional, statewide, or national scale once sufficient data exists.

There is more opportunity to define gradients of specific human disturbances/impacts with assessment information.

Develop and maintain tabs on reference/baseline conditions in a predictable and standardized time frame.

Weaknesses:

Visiting a basin/segment/watershed only once in five years may not be sufficient to satisfy all needs

Probabilistic Design

Strengths:

Statistically robust design when applied to certain types of questions

Transcends state boundary limitations - can facilitate collaborative monitoring between states (if states involved all adopt the same approach)

Weaknesses:

Lacks site specific / issue specific resolution

Logistics are potentially more difficult (i.e. more difficult access to remote monitoring sites and more conflict over access to private land)

Reference condition may be more difficult to define on probability basis alone.

Local scale issues may be overlooked.

Visiting a basin/segment/watershed only once in five years may not be sufficient to satisfy all needs

[5] Adapted from: Yoder, Chris O., 1998, "Important Concepts and Elements of an Adequate State Watershed Monitoring and Assessment Program," in *Proceedings of the National Water Quality Monitoring Council: Monitoring: Critical Foundations to Protect Our Waters.*

<u>Attachment 3</u> – Legislative Monitoring Mandates: AB 982, AB 1429, and the Legislature's Supplemental Report of 1999 Budget Act

Assembly Bill No. 982

Water Code Sec. 13191. (a) The state board shall convene an advisory group or groups to assist in the evaluation of program structure and effectiveness as it relates to the implementation of the requirements of Section 303(d) of the Clean Water Act (33 U.S.C. 1313(d)), and applicable federal regulations and monitoring and assessment programs. The advisory group or groups shall be comprised of persons concerned with the requirements of Section 303(d) of the Clean Water Act. The state board shall provide public notice on its website of any meetings of the advisory group or groups and, upon the request of any party shall mail notice of the time and location of any meeting of the group or groups. The board shall also ensure that the advisory group or groups meet in a manner that facilitates the effective participation of the public and the stakeholder participants.
(b) Notwithstanding Section 7550.5 of the Government Code, on or before November 30, 2000, and annually thereafter until November 30, 2002, the state board shall report to the Legislature on the structure and effectiveness of its water quality program as it relates to Section 303(d) of the Clean Water Act. The report may include the information required to be submitted by the board to the United States Environmental Protection Agency pursuant to Section 305(b) of the Clean Water Act, and any information required to be submitted to the Legislature pursuant to the Supplemental Report of the Budget Act of 1999. In formulating its report, the state board shall consider any recommendations of the advisory group or groups.

13192. (a) Notwithstanding Section 7550.5 of the Government Code, the state board, on or before November 30, 2000, shall assess and report to the Legislature on the State Water Resources Control Board's and regional water control board's current surface water quality monitoring programs for the purpose of designing a proposal for a comprehensive surface water quality monitoring program for the state. The report shall include a proposal for the program, including steps and costs associated with developing the full program, cost of implementation of the program after development, and appropriate funding mechanisms, including any fee structure. The board may include in the report information required to be submitted to the United States Environmental Protection Agency pursuant to Section 305(b) of the Clean Water Act, information required to be submitted pursuant to paragraph (1) of subdivision (c) of Section 13181, and any information required to be submitted to the Legislature pursuant to the Supplemental Report of the Budget Act of 1999.
(b) In considering and designing the proposal, the state board shall address factors that include, but need not be limited to, all of the following:
(1) Physical, chemical, biological, and other parameters about which the program shall collect and evaluate data and other information and the reasonable means to ensure that the data is accurate in determining ambient water quality.
(2) The use of models and other forms of information not directly measuring water quality.
(3) Reasonable quality assurance and quality control protocols sufficient to allow sound management while allowing and Ch. 495 encouraging, where appropriate, data collection by entities including citizens and other stakeholders, such as dischargers.
(4) A strategy to expeditiously develop information about waters concerning which the state presently possesses little or no information.
(5) A strategy for assuring that data collected as part of monitoring programs, and any associated quality assurance elements associated with the data collection, be made readily available to the public.
(6) A strategy for assessing and characterizing discharges from nonpoint sources of pollution and natural background sources.
(7) A strategy to prioritize and allocate resources in order to effectively meet water quality monitoring goals.
(c) Nothing in this section affects the authority of the regional water quality control boards.

Water Code Sec. 13181. (a) For the purposes of this section, the following terms have the following meanings:

(1) "Coastal waters" means waters within the area bounded by the mean high tide line to the three-mile state waters limit, from the Oregon to the Mexican borders.

(2) "Coastal watersheds" means the watersheds of tributary waters that drain to the ocean and significantly influence coastal water quality.

(b) (1) To the extent that funds are available for that purpose, the state board shall prepare and complete on or before January 1, 2000, an inventory of existing water quality monitoring activities within state coastal watersheds, bays, estuaries, and coastal waters. The information generated by preparing the inventory shall be made available as a report, and as an Internet-based index, that is available to the general public. A summary of the results shall be made available to the Legislature. The inventory shall include, but not be limited to, descriptions of all of the following:

(A) The sources of monitoring data, including federal, state, and local governments, the private sector, citizen groups, and nonprofit organizations.

(B) The monitoring methods being used by these sources.

(C) The location of the monitoring sites.

(D) Existing efforts to investigate the discharge of nonvolatile organic pollutants, including trace metals and nontarget organic chemicals, through storm drains into Santa Monica Bay, San Francisco Bay, Humboldt Bay, and San Diego Bay.

(2) Notwithstanding any other provision of law, the state board shall carry out paragraph (1) by contracting with institutions with expertise in coastal water quality monitoring, which may include the Southern California Coastal Water Research Project and the San Francisco Estuary Institute, to undertake the inventory.

(c) (1) To the extent that funds are available for that purpose, the state board, not later than January 1, 2001, shall prepare and submit to the Legislature a report that proposes the implementation of a comprehensive program to monitor the quality of state coastal watersheds, bays, estuaries, and coastal waters and their marine resources for pollutants, including, but not limited to, bacteria and viruses, petroleum hydrocarbons, heavy metals, and pesticides, as defined in Section 12753 of the Food and Agricultural Code. The proposed program shall utilize information available through the sources identified in paragraph (1) of subdivision (b), as appropriate, and shall avoid the duplication of existing and ongoing monitoring efforts to the extent feasible. The proposed program shall include, but not be limited to, all of the following:

(A) To the extent possible, a determination regarding the extent to which existing water quality objectives, sediment quality guidelines, tissue contaminant burden guidelines, and health standards are being met. Where information is not available to make this determination, the report shall identify methods for determining this information.

(B) To the extent possible, a determination regarding the sources of pollution in areas where objectives, standards, and guidelines are not being met. Where information is not available to make this determination, the report shall identify methods for determining this information.

(C) Methods for determining the degree of improvement or degradation in coastal water quality over time with respect to these objectives, guidelines, and standards.

(D) To the extent possible, estimates of the total discharges of pollutants into state coastal watersheds, bays, estuaries, and coastal waters from all sources.

(E) Standard protocols for sampling and data collection methods, to maximize the usefulness of the data resulting from the program.

(F) Recommendations for a standard format for reporting monitoring results to maximize access to and use of the data.

(G) The estimated costs of implementing the program and the proposed schedule of implementation.

(H) A description of the method by which the state board shall provide biennial reporting to the public on water quality within the state's coastal watersheds, bays, estuaries, and coastal waters, and recommended actions that should be undertaken to maintain and improve water quality in those areas.

(I) A description of the method by which the state board shall develop a system for monitoring mass contaminant discharges, including, but not limited to, heavy metals, PCBs, PAHs, and pesticides from storm water at the point of discharge. The system shall provide for the appropriate frequency of monitoring for each specific contaminant. The system shall be designed to identify the relative contribution of contaminants in storm water to the overall anthropogenic discharges into near coastal waters. To the extent possible, the system shall be designed to determine the effectiveness of best management practices in reducing the discharges of contaminants to near coastal waters.

(2) The state board shall consult with the San Francisco Estuary Institute and the Southern California Coastal Water Research Project to prepare the report. Notwithstanding any other provision of law, the state board may carry out paragraph (1) by contracting with institutions with expertise in coastal water quality monitoring, including, but not limited to, the Southern California Coastal Water Research Project and the San Francisco Estuary Institute, to prepare the report. The state board or its contractors shall convene workshops, symposia, and other professional and scientific meetings for the purpose of developing a consensus on the part of regulatory agencies and dischargers with regard to the appropriate methods to be used to monitor water quality on a statewide basis.

(d) The state board shall not use more than 5 percent of the funds allocated to implement subdivisions (b) and (c) for the administrative costs of the contracts permitted under those provisions.

Legislature's Supplemental Report of 1999 Budget Act

The State Water Resources Control Board (SWRCB) is required by the Supplemental Language for the Fiscal Year (FY) 1999-00 Budget to report on the baseline ambient surface water and ground water monitoring programs as follows:

Baseline Ambient Surface and Groundwater Quality Monitoring.

(a) By January 10, 2000, the SWRCB shall report to the Chairs of the Joint Legislative Budget Committee and Senate and Assembly fiscal committees on:

- The specific watersheds and coastal resources where ambient surface water quality monitoring has been conducted or contracted for during the three-year period beginning July 1, 1997. The report shall include the dates the sites were monitored, the type of monitoring, the pollutants monitored for, the results of the monitoring, and expenditures.

- The specific groundwater basins where ambient water quality monitoring has been conducted or contracted for during the three-year period beginning July 1, 1997. The report shall include the dates the sites were monitored, the type of monitoring, the pollutants monitored for, the results of the monitoring, and expenditures.

- A plan for implementing a comprehensive program for monitoring ambient surface water quality and groundwater quality, and how the Governor's 2000-01 budget proposal fits within this plan.

(b) The Legislative Analyst shall review and critique the report required in paragraph (a), and comment on its review at hearings on the 2000-01 budget. The Legislative Analyst's commentary shall include a report on the board's plan for implementing a comprehensive program for monitoring ambient surface water quality and groundwater quality.

ATTACHMENT 4: Additional PAG Comments and Recommendations on Ambient Monitoring

These comments further explain the positions of the PAG outlined in this PAG chapter. They are not intended to be exhaustive, but rather are provided so as to express the general opinion of the PAG.

General Comments

The July 2000 Draft SWAMP includes a framework for conducting ambient water quality monitoring which is based on a probabilistic approach that has frequently been used in designing ocean monitoring programs. This approach has been utilized by U.S. EPA for inland watershed monitoring as part as the EMAP program and has resulted in difficult, at best, data interpretations. A monitoring program based on a rotating basin approach utilizing fixed station networks will yield valuable data that can be easily integrated with existing monitoring activities. This type of monitoring program will also yield data that should be of use in other water quality programs. Adopting a fixed station network approach will also ensure that trends in water quality can be tracked.

In watersheds, the proposed SWAMP should identify what considerations should be given to spatial and temporal variations within the stream/river/lake targeted for monitoring. Also, water quality can be greatly affected by both flood and drought conditions. It is also important that the monitoring program being designed take into consideration the locations of historical sampling sites where background/ambient water quality data were collected to determine original (1975) background/ambient water quality conditions. Integrating historical sampling sites into a modern monitoring program will help to answer antidegradation questions and will avoid misinterpretations of data due to spatial variations within a stream/river reach.

The State Board should emphasize that the Regional Boards use the most appropriate monitoring approach for their specific application. Examples of different types of monitoring approaches and their optimal use would be helpful. For instance, the State Board could provide individual detailed monitoring frameworks for the following applications: ephemeral rivers, perennial rivers, lakes, estuary and ocean monitoring programs. A strong effort should be made to encourage Regional Boards to integrate ambient monitoring plans with current monitoring activities. The recently adopted State Implementation Plan mandates the collection of ambient data. As a result ambient monitoring requirements are being placed into permits and soon there will be a tremendous amount of ambient data generated throughout the State. The Draft SWAMP should require Regional Boards to coordinate ambient monitoring efforts with the NPDES permit monitoring programs in order to maximize the benefit of multiple sampling activities within watersheds.

Physical monitoring concepts should be incorporated into the proposed SWAMP. Identification of gaining reaches (where groundwater discharges to surface water) and losing reaches (where surface water percolates into groundwater) can play an important role when evaluating surface water quality data. For example, if concentrations of a

conservative constituent increase downstream where there is no contribution from tributaries, the concentration increase could be the result of evaporation of surface water or from discharge of a different quality groundwater, both of which can be reflective of natural conditions.

The goals and objectives for the SWAMP should be expanded to include monitoring strategies for identifying watershed characteristics, such as stream morphology, land use, emphemoral or perrenial stream conditions, location of dry reaches, identification of losing and gaining reaches, and identification of point and non-point discharge locations. Using a watershed-based monitoring approach will provide a comprehensive approach to data collection that incorporates water quality as well as watershed characteristics. This approach will ensure that the condition of water resources can be evaluated along with laying a foundation to assist in establishing cause-and-effect relationships.

The SWAMP should produce data that can be used to support other water quality programs that reflect the intent of the Clean Water Act to provide for the "restoration and maintenance of the chemical, physical and biological integrity of the Nation's waters." This can be accomplished by adopting an integrated approach to gather monitoring data from California's surface waters, including macroinvertebrate and/or other biological indicators focusing on multi-metric analysis for both species diversity, EPT taxa, abundance and tolerance values. This is an important component of SWAMP that currently does not exist as a statewide program. Chemical monitoring alone does not provide the necessary comprehensive information to characterize the ecological condition of our waterways. Without biological data, there is no basis for documenting loss or fluctuations in species diversity and abundance. Reference conditions need to be developed along with reference collections for waterways in the state. California lags behind other states in establishing Bio-Criteria as a component of its water quality management strategy. The SWAMP program should make a commitment to providing for the establishment of statewide response indicators such as bio-criteria.

Physical monitoring to assess changes in channel and streambed conditions, stream flow, aggradation and degradation (eroding) conditions, and other relevant physical parameters. Restoration monitoring should also be a component of this. This is especially important for habitat related beneficial uses.

As part of the Regional monitoring program design and development, the State Board should require that the Regional Boards include the following: a written explanation as to why a specific monitoring approach is being employed; how the monitoring program integrates with past and current monitoring efforts; what water quality parameters and indicators will be monitored; how will spatial and temporal variations in water quality be addressed; and identification of the refined monitoring goals for particular watersheds. In addition, each Regional Board should dedicate a single staff person to coordinate and review their monitoring plans to ensure consistency with the proposed SWAMP and subsequent updates to the SWAMP.

Adaptive Management

The monitoring program should be capable of providing information to support appropriate action to solve problems and protect unimpaired waters ("adaptive management"). Without sufficient site-specific monitoring data, adaptive management will remain unattainable.

An effective monitoring program should focus efforts towards assessing water quality and guiding management actions in the most effective and equitable way. For instance, it is less effective to list an entire river and impose control implementation on 2,000 square miles, than to identify subwatersheds that may be the source of 90% of the problem and spend the time and money on focused effort. In watersheds, a fixed monitoring site network which characterizes impacts (both positive and negative) on receiving waters as an aggregation of the individual contributing geographic areas can provide numerous benefits such as:

- Early warning capabilities to support initiation of voluntary, non-regulatory pollution prevention efforts in specific areas. It will probably always be far less expensive to prevent problems or catch them early than to wait until they become severe.
- Cumulative effectiveness and comparison monitoring for sub-watershed areas. For example, rural watersheds where Ranch Plans are being implemented could be compared to similar subwatersheds where they are not being implemented in order to demonstrate effectiveness without intrusive requirements on individual land owners.
- Screening level identification of areas that may need additional site deployments to narrow down the geographic extent of existing or emergent problems.
- A proven, effective, scientific approach to measure watershed scale changes over time.
- Information suitable to support modeling techniques required in many TMDL development situations.

Antidegradation

The draft SWAMP is weak in addressing the need for data for purposes of antidegradation reviews for cleaner waters of the state. The federal antidegradation policy at 40 CFR 131.12 and the State Board policy (Resolution 68-16) require antidegradation reviews whenever water quality may be lowered. These apply to both point and nonpoint pollution. U.S. EPA guidance on the antidegradation policy specifically states that, for those waters that exceed the quality needed to support one or more beneficial uses, an antidegradation analysis must be done that is based on both protection of beneficial uses and on changes in baseline, individual water quality parameters for the waters at issue. "Protection of beneficial uses" alone may not require the type of detailed, parameter-by-parameter monitoring called for in antidegradation reviews of cleaner waters. Thus, the draft SWAMP's limited attention to clean waters needs to be expanded.

State Board legal guidance on this topic adds that this detailed antidegradation analysis must be done not only for waters that have been formally identified as top-quality or ecologically significant, but also for waters that "may" fit this description. To date, resources have been focused largely more on impaired waters, leaving a significant knowledge gap for cleaner waters (*i.e.*, those described by 40 CFR 131.12(a)(2) and (3)). Thus, there is virtually no knowledge base (baseline conditions) to do a proper analysis to see if the quality of these waters will be lowered. This gap needs to be addressed in the monitoring plan. Monitoring for the purpose of supporting antidegradation policies would likely involve all monitoring types (*e.g.* water and sediment chemistry, tissue chemistry, toxicity). The proposed random site selection process will not produce information capable of addressing these issues.

With respect to nonpoint pollution in particular, state and federal antidegradation policies also state that, if water quality will be lowered, "all cost-effective and reasonable" BMPs for nonpoint source control (40 CFR 131.12(a)(2)) must be put into place. Very little monitoring has been performed specifically on nonpoint sources to date. Combined with the lack of monitoring in cleaner waters, there is very little information for the state to use to comply with antidegradation policies that require them to identify which BMP's are needed and are appropriate to offset potential increases in pollution into cleaner waters. The SWAMP should address this nonpoint pollution gap as well.

Beneficial Use Focus

The SWAMP goals indicate that the program is focused on achieving beneficial uses. However, the SWAMP should not be driven only by beneficial uses, but by watershed characterization and assessment needs. In general, the language related to beneficial uses under management objectives is unclear and should be revised. The program must take into account biologic, geomorphologic, and hydrologic conditions. The properly functioning condition of the watersheds requires strategically placed monitoring sites capable of revealing the interactions between various hydrologic subareas.

The Draft SWAMP focused on developing site-specific information on sites that are known or suspected to have water quality problems. The study design should have a science-based foundation and should not be driven or designed based on the need to answer the question of whether or not an individual beneficial use is being achieved. Instead, the focus should be on accurately characterizing ambient water quality conditions for all waters in the State and the uses should be considered when identifying the parameters to be monitored. For example, if a specific water body does not carry drinking water supply or commercial/sport fishing beneficial use designations, the list of chemical constituents to be monitored may be different than those selected for a water body that carries the uses. The list of beneficial uses identified in the draft SWAMP for evaluating specific problems was incomplete. State use designations such as industrial process water and agriculture were omitted.

The answers to whether or not beneficial uses are being protected should not be answered as part of the ambient monitoring program but as part of a separate assessment program. The development of a separate assessment program should include a framework for data interpretation and comparison to water quality objectives. The inclusion of assessment standards within an ambient monitoring program will bias the efforts of the program towards site-specific problem areas. Therefore, it is recommended that no distinction be made in the proposed SWAMP between "problem" and "non-problem" water bodies. Because runoff is the major source of pollution for many California waters, the monitoring program must provide information necessary to quantify the level of pollution and assist in the determination of the effectiveness of BMPs.

TMDL Support

The draft SWAMP fails to specifically address the need to collect ambient monitoring data to support TMDL development. While the level of sampling required to develop rigorous TMDL assessment tools varies and will undoubtably require additional resources, it is possible to tailor an ambient monitoring program to maximize its ability to support initial TMDL development. It is important, however, that this process not slow down the TMDL development. In some cases, the monitoring portion of the AB982 process will be useful in TMDL development as source identification data becomes available. As TMDLs require consideration of both point and nonpoint sources, nonpoint source (including urban runoff) monitoring should be an element of the SWAMP.

Water Quality Indicators

Chemical monitoring of water quality does not always provide a comprehensive view of the ecological condition of the surface water. The use of response indicator data can be extremely valuable, yet are probably the most underutilized in current monitoring programs. The State Board should encourage the Regional Boards to develop monitoring programs that are designed to include response indicator monitoring. Guidance should be included in the proposed SWAMP on how to determine baseline or reference biological conditions of a water body. For instance, it would not be appropriate to perform baseline or reference condition benthic monitoring after a major rain event where the bottom of a stream bed has been subjected to scouring. The design of the monitoring program must attempt to collect response indicator data that can be linked to cause and effect.

Assurance of Comprehensiveness

Important elements of a comprehensive approach include:

- *Establishment of a continuing program for monitoring conventional water quality parameters*. Monitoring of nutrients, dissolved oxygen, turbidity and similar parameters currently has no predictable financial support. Long-term funding should be specifically designated for use by Regional Boards to conduct this type of monitoring.

- *Establishment of a statewide Aquatic bio-assessment Program* with the California Department of Fish and Game Aquatic Bio-assessment Laboratory. Regions should each be allocated a certain number of sites per year just as they currently are with the Mussel Watch and Toxic Substances programs.

- *Establishment of a continuing sediment chemistry monitoring program.* Many substances which impact water quality are most easily detected in sediment. Sampling water itself often provides only a snapshot of a brief period of time. Sediment chemistry can reveal what has taken place at a monitoring site over longer periods of time.

- *Expansion of the State Mussel Watch Program* to provide more sites per year. Bivalves have proven to be a viable indicator of water quality problems, both from the standpoint of identifying bioaccumulative substances and of being representative of one level of the food chain.

- *Expansion of the State Toxic Substances Monitoring Program* to provide more sites per year and more species. Different species bioaccumulate different substances at different rates. A species list which contains information regarding the bioaccumulation rates should become a part of this program's documentation.

- *Expansion of the State Toxicity Testing Program.* Regions should each be allocated a certain number of sites per year just as they currently are with the Mussel Watch and Toxic Substances programs.

- *Establishment of a site and contaminant targeting strategy* based on the Department of Pesticide Regulation Pesticide Use Reporting system and on discharge information provided in NPDES permits, waste discharge requirements, and stormwater runoff programs.

- *Establishment of an integrated site selection system* for each of the programs mentioned above. Sites intended to provide statewide information would be visited every 1 to 5 years. Additional sites would be used for adaptive monitoring to provide Regional Boards with the ability to conduct more focused monitoring in specific areas.

- *Establishment of a statewide data management and analysis system*. Establishment of a user-friendly, multi-agency, GIS-capable internet-accessible database is critical. This database should include all existing and future compliance monitoring data. Compliance monitoring data provide the largest body of fixed station monitoring data in the state. A comprehensive monitoring program should not exclude collection and analysis of this wealth of information. Pooling these data should provide a web of monitoring points covering the state at a far lower cost than actually collecting samples at those locations. Also, the State should provide disclosure when industry collects data, and the database could provide a potential vehicle.

The GEOWBS system should be expanded to include an interface with monitoring data. A statewide electronic storage and access system should be established for all monitoring data, including compliance monitoring. This can be integrated with the State Water Information Management system (SWIM), Geographical Environmental Information Management System (GEIMS), and with the U.S. EPA STORET water quality database. Simple data entry and exploratory data analysis software should be created and distributed for use with the database. This software should be made available to Regional Boards, Cities, Counties, Dischargers, Volunteer Programs, and the public at large.

This database could integrate the programs referenced above and data from numerous other sources, including but not limited to:

- NPDES and WDR monitoring data
- Department of Pesticide Regulation Surface Water Quality database
- Department of Pesticide Regulation Pesticide Use Reporting database
- California Department of Health Services Drinking water sources database
- California Department of Health Services Shellfish database
- California Department of Water Resources database
- Flow and chemical data from USGS and other sources (*see, e.g.*, water.usgs.gov/nawqa/data)
- EPA nutrient database
- Pathogen indicator data from AB 411 and other shoreline monitoring
- Volunteer monitoring program data
- Monitoring data collected as a part of CWA section 205(j), 319(h), 320, Proposition 13, and other programs
- TMDL monitoring data (both source identification and performance evaluation data)
- California Department of Transportation Water Quality Objectives database

The SWAMP identifies data management, data evaluation and reporting as high priorities. Based on the 1998 303(d) listing process it is apparent that in many cases conventional monitoring data, which are routinely reported to the Regional Boards, were not used for assessment purposes because the data themselves were not considered to be readily available (in other words, easily available in a database or spreadsheet format). This situation resulted in incomplete data evaluations and possibly incorrectly identified water bodies. Establishment of a statewide data management system is critical for conducting accurate water quality assessments. It is essential that the State Board have oversight on the data management system and that the system be user-friendly. All data do not necessarily need to be contained in the same database; however, links to all available data should be included at one web site location that is maintained by the State Board. Priority should be given to completing the SWIM system so that compliance data can be easily utilized for assessment purposes. This system has been in the development phase for years and has stalled on numerous occasions due to funding and other priorities. For years, dischargers have been monitoring and reporting valuable data that in most cases have never even been evaluated by Regional Board staff. To maximize the

usefulness of monitoring data, the State Board should develop and support a GIS-based system, similar to what is currently in use on the USGS web site.

The PAG has unanimously agreed that the state should develop more formal guidance for listing and de-listing of waters under section 303(d) of the Clean Water Act. This guidance should provide the basis for final assessments of data collected by SWAMP. The US EPA has also identified the assessment process in California as an area that needs improvement, including additional staff and resources.

Data evaluation activities should be limited to measuring the success or completeness of the monitoring program. The data should be reviewed to see if the monitoring goals have been achieved. For instance, the data should accurately reflect current ambient water quality conditions and locations within the watershed. Data assessments should be made using guidance established in separate programs (*e.g.*, 305(b), 303(d), TMDLs, etc…). This separate guidance should provide flexibility in using and analyzing a broad variety of data, using a hierarchy of approaches based on the type and quality of data available. This approach would be consistent with U.S. EPA's approach to 305(b) water quality assessments as described in U.S. EPA's Guidelines for the Preparation of the Comprehensive State Water Quality Assessments (305(b) Reports) and Electronic Updates (EPA-841-B-97-002A, September 1997).

Data analysis must consider evaluation of source controls, educational programs, BMPs, and other management and planning programs. These data are necessary to determine if source controls are effective. The data therefore needs to be analyzed within a reasonable timeframe and with regards to trends. A strong effort must be made to make information relating to source control assessments (*e.g.*, BMP effectiveness) available to each of the Regional Boards and the public.

Analysis of monitoring data to make listing and delisting decisions requires a significantly more complex analysis than what is needed to determine if ambient monitoring goals are being achieved. Therefore, data assessment techniques and methodologies should be addressed in a separate document.

Quality Assurance/Quality Control

As stated in the draft SWAMP, in order to be of the most use to the State Board and the Regional Board programs, it is essential that data of the highest quality be developed. In order to achieve this goal, the State Board should require that the Regional Board dedicate at least one staff member that will be responsible for administering the monitoring program and QA/QC program requirements. Since this portion of the program is subject to change on a more frequent basis due to the development of new and revised sampling and monitoring techniques, it is imperative that Regional Boards stay apprised of recent developments. Developments in other State Board QA/QC programs should be evaluated and incorporated into the draft SWAMP as necessary. Having a dedicated staff person will also facilitate supporting local volunteer monitoring efforts.

The State Board should publish information documents to disseminate to interested citizen or environmental monitoring groups.

The October draft SWAMP appeared to address some of these comments through the suggested addition of a full-time QA/QC staffer in Sacramento. However, we do not believe it dealt with the recommendation for at least a half-time QA/QC staffer in each Region. The PAG supports addition of these much-needed personnel, who are critical to ensuring that the state collects and uses quality data on a long-term basis.

Stakeholder and Citizen Involvement

The public should be encouraged to play a continuing role in monitoring. Volunteer monitoring data that pass QA/QC thresholds should be incorporated by the Regional Boards as part of SWAMP. Clear quality control information should be available to facilitate volunteer monitoring. The State should consider using schools for certain monitoring activities to cut costs and provide education around water quality issues.

The draft SWAMP is silent on including stakeholders in the process to help identify and select indicators to be monitored. Regional Boards should provide opportunities as appropriate for stakeholders to participate in the selection of indicators that will be used to characterize the level of use attainment and to measure progress. The approach presented in the July 2000 draft SWAMP would hobble the State's watershed management initiative by unilaterally imposing a set of criteria and methodology for interpreting those criteria without concern for localized conditions.

Concerned stakeholders should have the opportunity to be involved as appropriate in the Regional Board's effort to develop monitoring programs. In many cases stakeholders are in possession of valuable information, due to their familiarity with the watershed, that could have a bearing on the design of a monitoring program. Also, many stakeholders, especially dischargers and environmental organizations, have vast experience in implementing and maintaining monitoring programs. Shared experiences and observations on various portions of the watershed may prove to be valuable when designing local comprehensive watershed monitoring programs.

Funding

The approach formerly taken by the State Board in developing a comprehensive surface water monitoring program was to identify the budget available and design a monitoring program accordingly. The design of the SWAMP should be based on meeting the AB 982 objective of developing a comprehensive ambient monitoring program and not be driven by budgetary preconceptions. If funding is used to drive the design of the program, it will compromise the integrity of the monitoring program as a whole and will fall short of achieving the intent of the AB 982 process, as described above. It appears, based on the latest draft SWAMP shared with the PAG Monitoring Subcommittee on October 4th, that this issue has been addressed somewhat through the

design of a program that is more based on need than available funding. It is unclear from that draft, however, whether the regional funding would be tied to fixed percentages of monitoring activities, or whether the funding estimates are reasonably reflective of the projected effort. The PAG recommends that the Regional Boards be allowed to design their own programs, within a coordinated effort with the other Regions and the State Board, rather than be tied to fixed percentages.

Funding will likely drive the implementation of the monitoring program within individual Regions. However, the individual Regional Boards will have the most familiarity with existing local monitoring programs, such as those implemented through the NPDES permitting process or are part of watershed studies and, therefore, should be encouraged to integrate the SWAMP efforts into their existing programs to maximize the effectiveness of monitoring expenditures. Individual Regions should also be directed to reconsider or redesign some of their monitoring strategies for existing monitoring programs and identify existing information gaps. In some cases, the Regional Boards may want to reduce sampling frequency at some receiving water monitoring stations prescribed in NPDES permits monitoring programs and request that the discharger use those same monitoring assets to sample (or increase sampling frequency) at another location in the watershed. The Regional Boards should be able to evaluate their information priorities and design a monitoring program that will meet their needs. Development of a monitoring framework that is based on budget constraints will unnecessarily restrict the Regional Boards' ability to design and implement the comprehensive surface water ambient monitoring program. If and when funding becomes an issue, the Regional Boards should implement the monitoring program in phased approach based on priorities within their Region.

Conclusion

The ultimate goal of the SWAMP is to establish a framework for a monitoring program that will yield useful water quality data that reflects ambient and current conditions of all state surface waters. To this end, the Public Advisory Group process should be used as a tool to help determine the resources that are needed to assess water quality comprehensively in order to achieve and maintain water quality that meets beneficial uses, and is otherwise fully protective of human health and marine ecosystems. This can be accomplished through, among other steps, an aggressive monitoring program, the design of which should not be driven by budget but by need.