California Water Quality Monitoring Council

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Secretary for Environmental Protection

Lester Snow
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Arnold Schwarzenegger
Governor

December 28, 2010

Ms. Linda S. Adams
Secretary for Environmental Protection
California Environmental Protection Agency
1001 I Street, 25th Floor
Sacramento, CA 95814

Mr. Lester Snow
Secretary for Natural Resources
Natural Resources Agency
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Dear Agency Secretaries:

SUBJECT: COMPREHENSIVE MONITORING PROGRAM STRATEGY FOR CALIFORNIA AND 2010 ANNUAL PROGRESS REPORT

On November 26, 2007, the Secretaries of Cal/EPA and Natural Resources signed the Memorandum of Understanding (MOU) establishing the California Water Quality Monitoring Council (Monitoring Council), as required by CA SB 1070 (Kehoe, 2006). Pursuant to the legislation, the Monitoring Council on December 1, 2008 sent to you its initial recommendations for maximizing the efficiency and effectiveness of existing water quality and associated ecosystem data collection and dissemination, and for ensuring that collected data are maintained and available for use by decision makers and the public. This letter summarizes progress in the past calendar year and presents the Monitoring Council's recommended Comprehensive Monitoring Program Strategy that will guide the Monitoring Council's activities into the future.

The Monitoring Council's Philosophy Is Working

The formation of theme-specific workgroups has developed alliances between key agencies and organizations both within and outside state government. Their actions, under the oversight of the Monitoring Council, are resulting in coordinated action and are beginning to have an influence on policy. For two years, the Monitoring Council has worked with limited resources and the cooperation of other agencies and programs to implement its vision, convening a number of theme-specific workgroups and creating the *My Water Quality* website (www.CaWaterQuality.net) and three prototype internet portals of water quality and associated ecosystem information. Earlier this year, we briefed you on this progress and are grateful for your enthusiastic support.

2010 ANNUAL PROGRESS REPORT

During the past year, the Monitoring Council and its theme-specific workgroups have made substantial progress toward our goals. The following is a summary of accomplishments:

Theme-Specific Workgroups and Internet Portals

- The California Wetland Monitoring Workgroup released the California Wetlands Portal, the third *My Water Quality* internet portal.
- The California Wetland Monitoring Workgroup released their Wetland and Riparian Area Monitoring Program (WRAMP) to not only support the State Water Board's development of a Wetland and Riparian Area Protection Policy, but to also provide the degree of standardization necessary for future assessments of the extent and condition of California's wetland resources. In June, the Monitoring Council endorsed WRAMP implementation by all organizations within Cal/EPA and the Natural Resources Agency. Preliminary agreement on WRAMP implementation has been achieved for the riparian mapping effort that will support development of a Central Valley Flood Protection Plan.
- The recently released *State of the State's Wetlands* report acknowledges the inability to fully assess wetlands at the present time and the efforts of the Wetland Workgroup to coordinate wetland mapping and condition assessment under the Monitoring Council's oversight in order to correct this situation.
- Formal guidelines for theme-specific workgroups and internet portals were adopted to provide greater consistency between the *My Water Quality* portals and to aid the workgroups in becoming successful Monitoring Council partners in the effort to accurately portray the best available information on water quality and the health of our aquatic ecosystems.
- The Healthy Streams Partnership was formed as a workgroup to the Monitoring Council dedicated to promote the improvement of water quality in California streams by informing and encouraging changes in perspectives for resource management decisions and actions. The Partnership produced a mockup of their Stream and River Ecosystem Health portal, which was approved by the Monitoring Council for development and public release in 2011.
- The Bioaccumulation Oversight Group completed their assessment of contaminants in sport fish from California lakes and reservoirs with the publication of their second year report and addition of these data to the Safe to Eat Fish and Shellfish portal.
- The Delta Regional Monitoring Program, the Interagency Ecological Program, and the State and Federal Contractors Water Agency have agreed in principle to form a new California Estuary Monitoring Workgroup that will develop a California Estuaries internet portal initially focusing on the health of the San Francisco Bay-Delta estuary.

Interagency Coordination

- The relationship between the Monitoring Council and the Water Boards' Surface Water Ambient Monitoring Program (SWAMP) has been firmly established, with SWAMP providing leadership for two theme-specific workgroups addressing stream and river ecosystem health and the accumulation of pollutants in fish and shellfish that people eat. In addition, SWAMP provides numerous tools that benefit these programs and

other Monitoring Council workgroups, including a rigorous quality assurance/quality control program, the California Environmental Data Exchange Network to share ambient water quality data between Water Board programs with other agencies and organizations, and a system of Regional Data Centers to assist data generators with data comparability and management.

- Greater engagement and improved participation by organizations within the Natural Resources Agency has been achieved as the result of direction provided by Natural Resources Agency Secretary Snow, following a June briefing on the Monitoring Council's strategy. Also in 2010, Secretary Snow appointed Dale Hoffman-Floerke from the Department of Water Resources as the new Monitoring Council Co-Chair representing the Natural Resources Agency. Councilperson Hoffman-Floerke has been instrumental in bringing the wide variety of Natural Resources Agency monitoring programs to the attention of the Monitoring Council.

Data Management

- The California Environmental Data Exchange Network (CEDEN) was publicly launched to provide a mechanism for bringing monitoring data together from a wide variety of sources. While initially focusing on State and Regional Water Board data sources, CEDEN will soon provide access to data from citizen and regional monitoring efforts and the federal Water Quality Exchange (WQX) network and will serve these data to the public through the *My Water Quality* portals.
- A new BeachWatch database is nearing completion that will improve the flow of bacterial and beach closure data from coastal county environmental health departments to the Water Boards, the U.S. Environmental Protection Agency, Heal the Bay, and the Safe to Swim internet portal via CEDEN.

Council Recognition

- Staff to Senator Kehoe, author of CA SB 1070, was briefed on the Monitoring Council's strategy, which was received with enthusiastic support. The Senator's staff is pleased with the progress to implement the legislation, which has been made in such a short amount of time and with limited resources.
- Greater publicity for the Monitoring Council's work and its internet portals was achieved through well received presentations at the 2010 National Water Quality Monitoring Conference in Denver, the California and the World Ocean Conference 2010 in San Francisco, and the 17th Annual California Aquatic Bioassessment Workgroup meeting at UC Davis and through the addition of the *My Water Quality* button to many Cal/EPA, Natural Resources Agency (e.g., Department of Water Resources), and non-governmental organization websites. Senator Kehoe has also added the button to her legislative website.

Council Governance and Relationships

- The Monitoring Council adopted a governance structure that describes the Council's deliberative process, including procedures for identifying and prioritizing issues, assigning tasks and tracking progress, and communication and outreach, as called for in the MOU. In addition, the governance structure describes the Monitoring Council's relationship with the Secretaries of Cal/EPA and Natural Resources, the theme-specific

workgroups, a new Data Management Workgroup, citizen monitoring efforts, and the National Water Quality Monitoring Council.

RECOMMENDED COMPREHENSIVE MONITORING PROGRAM STRATEGY

Building on our 2008 Recommendations report and the initial success of our workgroups and web portals, we are pleased to deliver to you the recommended Comprehensive Monitoring Program Strategy for California called for in CA SB 1070. The enclosed strategy document was developed in coordination with staff of the State Water Resources Control Board, and includes an update of the SWAMP monitoring and assessment strategy, assessment framework and needs assessment, reflecting the benefits of increased coordination and integration of information from other agencies and information sources. Also included is the Monitoring Council's governance document discussed above. We believe that implementation of this recommended strategy by all relevant organizations within Cal/EPA and the Natural Resources Agency will create lasting benefits for the State's water quality and associated ecosystem management programs by improving the availability of data and information needed for sound decision making.

Chapter 4 of the strategy, beginning on page 50, presents the Monitoring Council's requests and recommendations. To effectively implement the goals of CA SB 1070, the Monitoring Council requests that you:

1. Endorse the Monitoring Council's vision of theme-specific workgroups that operate under the Monitoring Council's guidance and make data and assessment results available through a coordinated series of web portals
2. Endorse a central coordinating and facilitating role for the Monitoring Council that will be continued over the long term
3. Continue to support the Monitoring Council's activities and require the boards, departments, offices, and commissions within your agencies to actively participate in relevant workgroups
4. Support the acquisition of long-term funding needed for implementation of the Comprehensive Monitoring Program Strategy

In addition, the Monitoring Council recommends that:

1. The Department of Public Health be invited to sign the existing MOU between Cal/EPA and the Natural Resources Agency
2. The monitoring and assessment efforts of SWAMP be integrated into the Monitoring Council's recommended Comprehensive Monitoring Program Strategy, as presented in the strategy document
3. The monitoring of state- and federally-funded water quality and ecosystem improvement projects be coordinated and enhanced to ensure that the effectiveness of such projects is evaluated and that the generated data are available for use in larger-scale assessments

4. The Monitoring Council continue to coordinate our efforts with those of the National Water Quality Monitoring Council
5. The Monitoring Council work with its member agencies, the Control Agencies, the Governor's Office, and the Legislature to identify ways to address the contracting and implementation constraints summarized in Section 3.3.3 of the strategy.

We look forward to working with you and the organizations within your agencies to continually enhance the monitoring and assessment of California's water resources and aquatic ecosystems and the reporting of this information to decision makers and the public via the internet.

Sincerely,

Jonathan Bishop, Chief Deputy Director
State Water Resources Control Board
Monitoring Council Co-Chair
Representing Cal/EPA

Dale Hoffman-Floerke, Deputy Director
Department of Water Resources
Monitoring Council Co-Chair
Representing the Natural Resources Agency

Enclosure

cc: Members of the California Water Quality Monitoring Council
Senator Christine Kehoe, State Capitol
Senator Elaine Alquist, State Capitol
Organizations within Cal/EPA and the Natural Resources Agency (see attached list)

Organizations copied:

Within the California Natural Resources Agency
Office of the Secretary for Natural Resources
Department of Water Resources
Department of Fish and Game
Department of Parks and Recreation
Department of Boating and Waterways
Department of Forestry and Fire Protection
Department of Conservation
California Coastal Commission
State Lands Commission
Delta Protection Commission
San Francisco Bay Conservation and Development Commission
Parks and Recreation Commission
California Boating and Waterways Commission
California Water Commission
California Energy Commission
Wildlife Conservation Board
Colorado River Board of California
Central Valley Flood Protection Board
Board of Forestry
Fish and Game Commission
California Tahoe Conservancy
Sacramento-San Joaquin Delta Conservancy
San Diego River Conservancy
San Gabriel & Lower Los Angeles Rivers & Mountains Conservancy
San Joaquin River Conservancy
Sierra Nevada Conservancy
State Coastal Conservancy
Delta Stewardship Council
Ocean Protection Council

Within the California Environmental Protection Agency
Office of the Secretary for Environmental Protection
State Water Resources Control Board
All Regional Water Quality Control Boards
Department of Pesticide Regulation
Department of Toxic Substances Control

A Comprehensive Monitoring Program Strategy for California

Recommendations of the

California Water Quality Monitoring Council

submitted to

Linda S. Adams

Secretary for Environmental Protection

and

Lester Snow

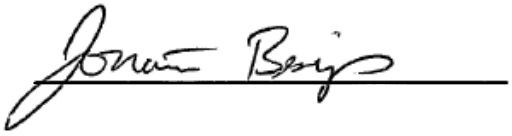
Secretary for Natural Resources

State of California

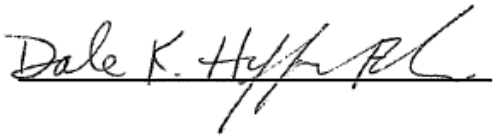
December 23, 2010

Members of the California Water Quality Monitoring Council

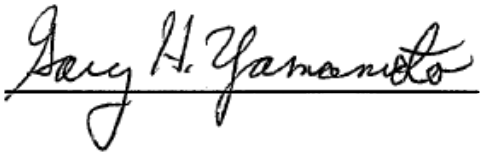
Co-Chair, Representing the
California Environmental Protection Agency
Jonathan Bishop
Chief Deputy Director
State Water Resources Control Board



Co-Chair Representing the
California Natural Resources Agency
Dale Hoffman-Floerke
Deputy Director for Integrated Water Management
Department of Water Resources

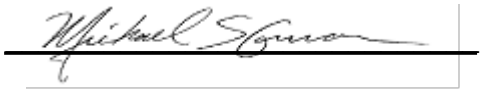


Representing the
California Department of Public Health
Gary Yamamoto
Chief
Division Drinking Water and Environmental Management



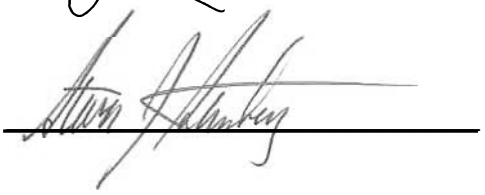
Representing the Regulated Community –
Stormwater
Armand Ruby
California Stormwater Quality Association
Armand Ruby Consulting

Representing the Regulated Community –
Publicly Owned Treatment Works
Mike Connor
General Manager
East Bay Dischargers Authority



Representing Agriculture
Parry Klassen
Executive Director and Board Chairman
East San Joaquin Water Quality Coalition

Representing Citizen Monitoring Groups
Steven Steinberg
Director, Klamath Watershed Institute
Humboldt State University



Representing the Public
Linda Sheehan
Executive Director
California Coastkeeper Alliance

Representing the Scientific Community
Stephen Weisberg
Executive Director
Southern California Coastal Water Research Project

Representing Water Supply
Sarge Green
California Water Institute
Association of California Water Agencies

A Comprehensive Monitoring Program Strategy for California

Recommendations of the

California Water Quality Monitoring Council

submitted to

Linda S. Adams

Secretary for Environmental Protection

Lester Snow

Secretary for Natural Resources

State of California

December 23, 2010

Cover Photo
Ocean Cove, Sonoma County, California
by Jon B. Marshack

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Foreword

The purpose of this report of the California Water Quality Monitoring Council is to lay out a comprehensive monitoring program strategy for California, a ten-year plan to achieve ambitious goals related to the design and implementation of water quality and associated ecosystem monitoring programs, the use of monitoring data in assessments, and the development of tools and supporting infrastructure to enable wide access to data and information products. These are all essential ingredients to effective decision making to protect, restore, and improve water quality and aquatic ecosystems statewide. Since its inception in late 2007, the Monitoring Council has made significant progress toward its goals, working with limited resources and the cooperation of other agencies and programs. The ten-year plan presented here describes the specific actions needed to build on this initial success and create lasting benefits for the State's water quality and associated ecosystem management programs.

The Problem

Many local, state, and federal agencies, regulated dischargers, volunteer monitoring groups, and hundreds of water bond grant recipients spend millions of dollars each year collecting water quality and associated ecosystem data in California. These data must be turned into useable information to help decision makers and stakeholders understand the status of our waters and aquatic ecosystems, public health and welfare issues related to water quality, and the effectiveness of agency programs to manage our water resources.

But California's water quality information system is defective. Because current monitoring programs were developed at different times, to address a variety of site-specific issues, or to fulfill different statutory or regulatory compliance mandates, there are inconsistent monitoring objectives and methods to collect and assess the data, making it impossible to integrate data from different studies to develop valid information for decision making. And there is no single user-friendly place to access the data, which means that the feedback necessary to improve the effectiveness of monitoring programs is often lacking. There is a tremendous opportunity for improvement.

In response, CA State Senate Bill 1070 (Kehoe) was signed into law in 2006, requiring the California Environmental Protection Agency (Cal/EPA) and the California Natural Resources Agency to establish, through a Memorandum of Understanding (MOU), the California Water Quality Monitoring Council. As approved by the two Agency Secretaries, members of the Monitoring Council (see inside front cover) represent state regulatory and resource management agencies, the regulated community, water supply interests, citizen monitoring groups, the scientific community, and the public. The breadth of representation on this council is unique.

CA SB 1070 required that by December 1, 2008 the Monitoring Council report its recommendations for maximizing the efficiency and effectiveness of existing water quality data collection and dissemination, and for ensuring that collected data are available for use by decision makers and the public. Those initial recommendations were submitted to the Agency Secretaries for Environmental Protection and Natural Resources.

The Monitoring Council's Vision

Rather than focusing first or only on technical details, such as methods consistency and standard data formats, the December 2008 recommendations presented a new solution. The Monitoring Council believes that the best way to coordinate and enhance California's monitoring, assessment and reporting efforts is first to provide a platform for intuitive, streamlined access to water quality information that directly addresses users' questions and decision-making needs. Theme-specific workgroups, under the overarching guidance of the Monitoring Council, evaluate existing monitoring, assessment and reporting efforts. They work to enhance those efforts so as to improve the delivery of water quality information to the user, in the form of theme-based internet portals.

Each portal is developed and maintained by a theme-specific workgroup, staffed by issue experts representing key stakeholders for their specific theme. Each workgroup coordinates existing monitoring programs within their theme, developing monitoring and assessment methods and data management procedures according to monitoring program performance measures defined by the Monitoring Council. The goal is to achieve only the degree of standardization necessary to meet users' needs (i.e., coordination). The Monitoring Council establishes common policies and guidelines for the workgroups and the monitoring programs they represent; and acts as a clearinghouse for standards, guidelines, and collaboration.

"My Water Quality" Internet Portals

To implement its vision, the Monitoring Council and its workgroups are developing the *My Water Quality* website (www.CaWaterQuality.net) to provide a single, global access point to a set of theme-based internet portals for water quality monitoring data and assessment information. The website is designed around clear intuitive questions that are readily understood by decision makers, agency managers, legislators, scientists, and the public:

- Is our water safe to drink?
- Is it safe to swim in our waters?
- Is it safe to eat fish and shellfish from our waters?
- Are our aquatic ecosystems healthy?
- What stressors and processes affect our water quality?

Each question leads to a series of web pages that provide map-based access to summary assessment products and detailed monitoring data that address more specific questions. A key function of the workgroups is to evaluate monitoring and assessment programs to improve inputs to the internet portals. Links along the left-hand side of each page enable users to access technical information specific to each theme.

- The Safe to Swim portal initially focuses on Coastal Beaches, Bays & Estuaries. The Beach Water Quality Workgroup and the Central/Northern California Ocean and Bay Water Quality Monitoring Group coordinate the monitoring efforts of state and local agencies and coastal dischargers, and the assessment efforts of regional environmental interests. These data and a variety of assessment tools are included in this web portal, released to the public in July 2009. In the future, this portal will be expanded to also display freshwater swimming safety information.
- The Safe to Eat Fish and Shellfish portal initially focuses on sport fish. The Bioaccumulation Oversight Group is a collaborative effort of a number of state agencies and others to assess the accumulation of pollutants, such as mercury and legacy

pesticides, in fish that people eat. A portal based on their work was released in December 2009. This portal will be updated with additional contaminant data on sport fish from coastal waters, rivers and streams as these data are generated.

- Aquatic ecosystem health information is presented in separate portals for each water body type. The first Aquatic Ecosystem Health portal focuses on Wetlands. The California Wetland Monitoring Workgroup coordinates the efforts of twenty-three state, federal, and local organizations to assess the extent and health of California's wetlands. Their California Wetlands portal was released in March of this year. Due to increased coordination of wetland mapping and assessment methods developed by the Wetland Monitoring Workgroup and endorsed by the Monitoring Council, this portal will eventually allow better regional and statewide assessment of wetland extent and condition.

Other workgroups are organizing to develop additional portals. The Water Board's Groundwater Ambient Monitoring and Assessment (GAMA) program is working with a variety of state and federal agencies to develop a Safe to Drink portal, initially focusing on groundwater. The Healthy Streams Partnership is developing a Stream and River Ecosystem Health portal. The Multi-Agency Rocky Intertidal Network is developing a Tide Pool Ecosystem section of a future Ocean Health Portal. The Interagency Ecological Program, in cooperation with the San Francisco Bay Regional Monitoring Program (RMP), the Delta RMP, and the Delta Protection Commission, will soon begin work on an Estuary Health Portal, initially focusing on the San Francisco Bay-Delta estuary. And the Monitoring Council hopes to convince the Ocean Protection Council to shepherd the development of an Ocean Health portal.

The *My Water Quality* portals provide tremendous opportunities and benefits. The three initial portals represent a tremendous accomplishment, developed with scant resources and largely volunteer efforts. They:

- Deliver answers to the public about our water quality and aquatic ecosystems in a manner easy to understand
- Highlight and help to prioritize efforts to improve monitoring and assessment programs by revealing where data gaps, ineffective monitoring designs, lack of assessment tools, poor data integration, and other problems hamper statewide assessment and effective decision making
- Provide the opportunity to highlight the important work of the agencies and organizations involved
- Permit broader-based assessments than were previously possible
- Automate the annual reporting efforts of governmental organizations by focusing on meaningful environmental outcomes
- Lower costs from improved coordination of monitoring and assessment, reduced duplication of efforts, and easier access to data and products

The Monitoring Council's vision and initial portals have been presented in briefings to Secretary for Environmental Protection Linda Adams, Secretary for Natural Resources Lester Snow, and key legislative staff. All have been highly supportive and encouraged the Monitoring Council to proceed with implementation.

The efforts of theme-specific workgroups to develop three prototype web portals during 2009 and 2010 demonstrate that the Monitoring Council's approach furnishes both the structure and

the motivation for more efficiently addressing technical issues such as monitoring program design, data formats and methods coordination. It has fostered the organization of several theme-specific collaborative workgroups based on partnership among multiple entities with a common interest in a particular water quality or ecosystem health theme. Using this experience as proof of concept, the Monitoring Council recommends the comprehensive water quality monitoring program strategy for California that is presented below.

Legislative Mandates and Agency Agreements

SB 1070 and the November 26, 2007 MOU between the Secretaries for Environmental Protection and Natural Resources task the Water Board, in coordination with the Monitoring Council, with developing a statewide comprehensive monitoring program strategy. Specifically, California Water Code Section 13181(a) states, in part:

> (4) The monitoring council shall review existing water quality monitoring, assessment, and reporting efforts, and shall recommend specific actions and funding needs necessary to coordinate and enhance those efforts.
>
> (5) (A) The recommendations shall be prepared for the ultimate development of a cost-effective, coordinated, integrated, and comprehensive statewide network for collecting and disseminating water quality information and ongoing assessments of the health of the state's waters and the effectiveness of programs to protect and improve the quality of those waters.
>
> (B) For purposes of developing recommendations pursuant to this section, the monitoring council shall initially focus on the water quality monitoring efforts of state agencies, including, but not limited to, the state board, the regional boards, the department, the Department of Fish and Game, the California Coastal Commission, the State Lands Commission, the Department of Parks and Recreation, the Department of Forestry and Fire Protection, the Department of Pesticide Regulation, and the State Department of Health Services.
>
> (C) In developing the recommendations, the monitoring council shall seek to build upon existing programs rather than create new programs.
>
> (6) Among other things, the memorandum of understanding shall describe the means by which the monitoring council shall formulate recommendations to accomplish both of the following:
>
> (A) Reduce redundancies, inefficiencies, and inadequacies in existing water quality monitoring and data management programs in order to improve the effective delivery of sound, comprehensive water quality information to the public and decisionmakers.
>
> (B) Ensure that water quality improvement projects financed by the state provide specific information necessary to track project effectiveness with regard to achieving clean water and healthy ecosystems.

California Water Code Section 13181(e) states, in part

> In accordance with the requirements of the Clean Water Act (33 U.S.C. Sec. 1251 et seq.) and implementing guidance, the state board shall develop, in coordination with the monitoring council, all of the following:
>
> (1) A comprehensive monitoring program strategy that utilizes and expands upon the state's existing statewide, regional, and other monitoring capabilities and describes how the state will develop an integrated monitoring program that will serve all of the state's water quality monitoring needs and address all of the state's waters over time. The strategy shall include a timeline not to exceed 10 years to complete implementation. The strategy shall be comprehensive in scope and identify specific technical, integration, and

> resource needs, and shall recommend solutions for those needs so that the strategy may be implemented within the 10-year timeframe.
> . . .
> (4) Methodology for compiling, analyzing, and integrating readily available information, to the maximum extent feasible, including, but not limited to, data acquired from discharge reports, volunteer monitoring groups, local, state, and federal agencies, and recipients of state-funded or federally funded water quality improvement or restoration projects.
>
> (5) An accessible and user-friendly electronic data system with timely data entry and ready public access via the Internet. To the maximum extent possible, the geographic location of the areas monitored shall be included in the data system.
>
> (6) Production of timely and complete water quality reports and lists that are required under Sections 303(d), 305(b), 314, and 319 of the Clean Water Act and Section 406 of the Beaches Environmental Assessment and Coastal Health Act of 2000, that include all available information from discharge reports, volunteer monitoring groups, and local, state, and federal agencies.
>
> (7) An update of the state board's surface water ambient monitoring program needs assessment in light of the benefits of increased coordination and integration of information from other agencies and information sources. This update shall include identification of current and future resource needs required to fully implement the coordinated, comprehensive monitoring network, including, but not limited to, funding, staff, training, laboratory and other resources, and projected improvements in the network.

The MOU established the following Monitoring Council responsibilities for carrying out the mandates of SB 1070:

> In an effort to: 1) reduce redundancies, inefficiencies, and inadequacies in existing water quality monitoring and data management programs in order to improve the effective delivery of sound, comprehensive water quality information to the public and decisionmakers; and 2) ensure that water quality improvement projects financed by the state provide specific information necessary to track project effectiveness with regard to achieving clean water and healthy ecosystems, the Monitoring Council responsibilities under this MOU include, but are not limited to, the following:
> . . .
> 3. Review existing water quality monitoring, assessment, and reporting efforts and recommend specific actions and funding and staffing levels necessary to coordinate and expand those efforts, as needed, to create an ongoing assessment of the health of the state's waters and the effectiveness of programs to protect and improve the quality of those waters. The Monitoring Council shall initially focus on the efforts of state agencies. The Monitoring Council should build on existing efforts that have successfully achieved key objectives of SB 1070 on statewide or regional scales, promote new information management technologies that could facilitate data integration and sharing, and identify key circumstances where a convergence of interests among agencies provides an opportunity for leverage that could accelerate progress toward the SB 1070's objectives.

Pursuant to these mandates and responsibilities, the Monitoring Council—including its agency representatives from Cal/EPA and Natural Resources—developed the recommended comprehensive monitoring program strategy in coordination with the Surface Water Ambient Monitoring Program (SWAMP) and other Water Board staff. This document is the culmination of that effort.

The Role of SWAMP

SWAMP has played a key role in developing the Monitoring Council's vision and is poised to be a significant player in the issue-specific workgroup and portal development structure. As quoted above, California Water Code Section 13181(e)(7) requires an update of the SWAMP needs assessment, in light of the coordination provided by the recommended comprehensive monitoring program strategy. To address this mandate, SWAMP has revised its *Monitoring and Assessment Strategy, Assessment Framework, and Needs Assessment* (see Appendix 5), adjusting the program's focus to monitoring and assessment of water body types and beneficial uses that have been the forte of SWAMP activities to date. In addition, SWAMP has developed numerous tools and assistance mechanisms that will aid workgroups that address the water body types and beneficial uses not covered by SWAMP.

Strategy Implementation

The MOU also established responsibilities for the two Agencies:

> This MOU cannot be successfully implemented without the cooperation and involvement of numerous state agencies, boards, commissions, conservancies, and departments. The Secretaries for Cal/EPA and Resources will oversee the implementation efforts of this MOU. This MOU focuses on agency programs within Cal/EPA and Resources. Key programs located within the Department of Public Health should be included with the agreement of the Executive Director of the Department of Public Health. Once the basic infrastructure for implementing the MOU has been established, additional monitoring and assessment programs may be considered.
>
> Under this MOU, the responsibilities of the Secretaries of Cal/EPA and Resources (collectively "the Secretaries") include, but are not limited to, the following:
>
> 1. The Secretaries will direct their boards, departments, and offices to establish and cooperatively participate in the Monitoring Council for improving integration and coordination of water quality and related ecosystem monitoring, assessment, and reporting.
> 2. The Secretaries will establish policies and procedures to ensure that water quality improvement projects, including bond-funded grant projects financed by the state, include the ability to track project effectiveness with respect to specific water quality and ecosystem health.

The Monitoring Council is poised to help guide implementation wherever possible, but lacks direct authority to implement the comprehensive monitoring program strategy. Clearly, the responsibility for implementing the strategy falls to the California Environmental Protection Agency and the California Natural Resources Agency, including the allocation of necessary resources. Agency action is vital to the success of this strategy. High-level management support will be needed, including broad-based organizational involvement and conflict resolution. In terms of funding, it is apparent that seed money is needed to prompt coordination (i.e., workgroup formation) and to fund initial portal development and the underlying data management infrastructure. To date, such funding has largely been provided by SWAMP and the U.S. Environmental Protection Agency (USEPA). A broader funding base is needed to sustain this effort.

Chapter 1: Introduction

The Monitoring Council has spent the period since the release of its December 2008 recommendations (CWQMC 2008) implementing the first steps called for in that report, empirically testing the assumptions underlying those recommendations, and preparing the technical and institutional infrastructure needed for their full implementation (see Appendix 2 of the Monitoring Council's first Annual Progress Report (CWQMC 2009). A number of theme-specific workgroups have been formed to address monitoring, assessment and reporting issues specific to their particular theme. Through the efforts of these workgroups, three prototype internet portals have been developed and been made available for public access on the Monitoring Council's portal website (www.CaWaterQuality.net), focusing in order on:

- Swimming safety at beaches (Safe to Swim)
- Human health risk associated with sport fish consumption (Safe to Eat Fish and Shellfish)
- Aquatic ecosystem health, with a focus on wetlands status (Wetlands)

The Monitoring Council found a generally high level of enthusiasm for the web portal concept among parties both inside and outside state agencies and had little difficulty establishing productive partnerships with data sources, users of assessment products, and scientists directly involved in the analysis and interpretation of monitoring data.

The process of developing these web portals showed that the Legislature was correct in its assessment of the status of water quality and associated ecosystem monitoring programs and data. There is a clear need for a body such as the Monitoring Council to fulfill a coordinating role and to ensure access to coordinated data and statewide assessment products. This necessarily involves more than the assembly of data and connections between databases, although this is essential; it also requires developing assessment questions, monitoring designs, methods, and products at the statewide level that respond to a variety of users' questions and perspectives. The process of developing these proof-of-concept web portals has also validated key assumptions underlying the Monitoring Council's core philosophy and confirmed the gains in efficiency of data gathering, analysis, performance assessment, and reporting possible from the portal approach.

Developing the prototype portals also enabled the Monitoring Council to establish a functioning workgroup structure and define the core elements of the infrastructure (both institutional and technical) needed to support complete implementation of the December 2008 recommendations (CWQMC 2008) over the longer term. These accomplishments provide the empirical basis for the Monitoring Council's recommendations, presented in the following chapters, for moving forward with the ten-year Comprehensive Monitoring Program Strategy called for in the statute.

1.1 The Monitoring Council's approach clarifies the problem

SB 1070 (Kehoe, 2006) described a number of problems that hamper the ability of managers, scientists, and the public to find, access, and use water quality and related ecosystem monitoring data and results. While these problems are widely acknowledged, attempts to solve them have had only limited success because of the diversity of monitoring programs and organizations conducting monitoring, the sheer volume and variety of data they produce, and the number of databases and data systems in which data are stored. In particular, the absence of clear user-driven questions has made it more difficult to develop a useful analysis of data integration and access problems.

In contrast, the web portal that addresses the core question: Is it safe to swim in our waters? (and secondary questions such as: How clean was my beach, lake, or stream during the past month?) provides the context needed to effectively evaluate and then resolve monitoring design, coordination, and access problems. The construction of the web portal motivated the Monitoring Council and its "Safe to Swim" workgroup to expand and then organize their knowledge about monitoring programs that focus on this question. As a result, the workgroup has a much clearer picture (Figure 1) of (1) the major sources of data available to answer this question statewide, (2) which data are currently not in databases that can readily be accessed by the web portal, and (3) which assessments are not produced in a timely enough manner to be useful to portal users. Similarly, attempting to apply assessment methods statewide compelled both the Wetlands and Safe to Swim workgroups to explicitly confront inconsistencies in monitoring

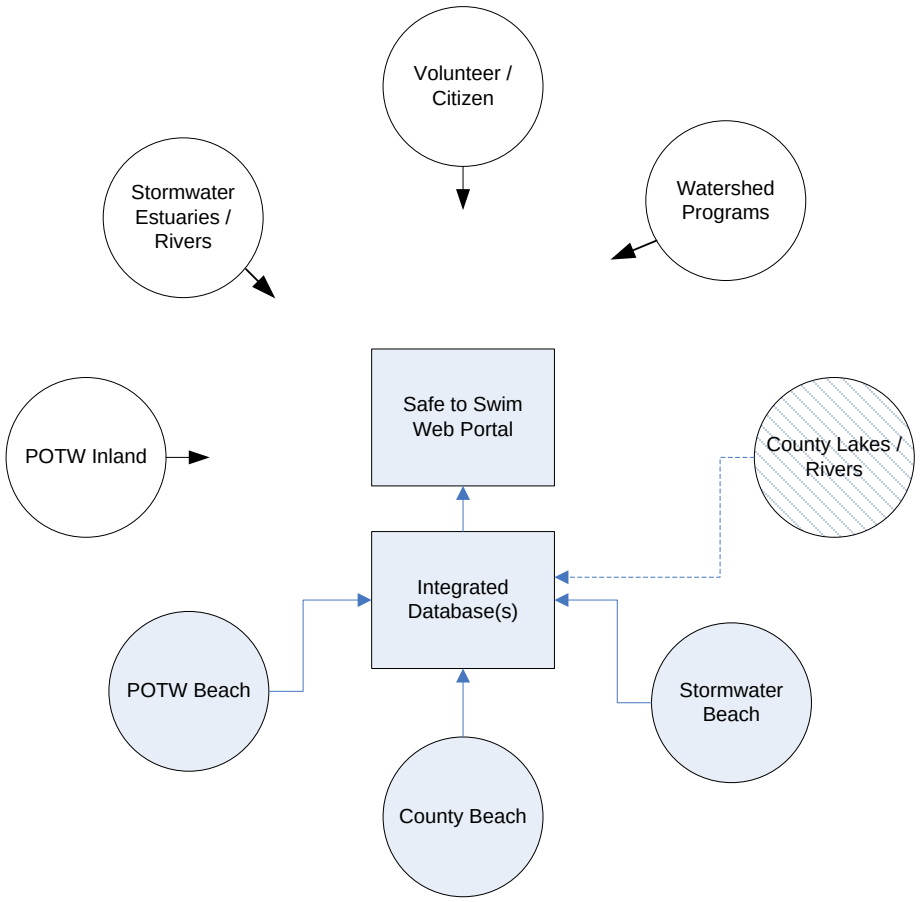

Figure 1. *Schematic of the categories of monitoring programs that produce data relevant to the Safe to Swim web portal. Past efforts at bringing monitoring data together in an integrated statewide database have focused on ocean beaches, and a few county-level monitoring programs at lakes and rivers. Data from other significant inland freshwater monitoring efforts have yet to be addressed. The workplan for this theme therefore includes efforts to incorporate data flows from these remaining program types into the web portal. "POTW" refers to publicly owned treatment works, also known as municipal wastewater treatment plants or water reclamation plants.*

designs and data aggregation methods that diminished the statewide applicability of assessment results.

Scientists and managers involved with these monitoring programs had long been aware of these data gaps and inconsistencies and, to be fair, these issues have not prevented individual programs from meeting their objectives. However, without the goal of producing statewide assessments and a mechanism for integrating and displaying information at this scale, there was little motivation (or need) to improve data access or coordination.

1.2 Web portals foster solutions and improve efficiency

The process of constructing the web portals requires scientists and managers to collaborate on articulating meaningful assessment questions that are both useful to managers and the public and guide the development of effective monitoring programs based on credible science. This collaboration, combined with the Monitoring Council's design principles for the web portals, fosters creative problem solving that makes use of a wider range of insights, tools, and resources than are available strictly within individual state agencies. For example, the Safe to Swim workgroup has proposed a streamlined and accelerated data management and reporting pathway that makes greater use of technical resources at one of the regional data centers, while both the Wetlands and Safe to Eat Fish and Shellfish web portals incorporate mapping features developed by outside partners.

As the web portals continue to develop, they will enable state agencies to dramatically improve the accuracy and efficiency of many of their routine and ad hoc reporting functions. Quicker access to data and assessment products, combined with query and reporting tools built into the web portals, will make it much easier to respond to questions from the Legislature, agency managers, and the public. Such gains in efficiency have been identified in the Statewide Data Strategy Report, released in July 2009 by the Office of the Chief Information Officer, as one of the major benefits of improved data integration. Even the prototype web portals developed by the Monitoring Council have already begun to demonstrate how such dividends can be achieved. For example, the State Water Resources Control Board is planning to use automated outputs from the web portals in annual performance reporting requested by its Office of Research Planning and Performance. And the Safe to Eat Fish and Shellfish web portal makes it possible to quickly create customized assessment products, at scales from individual lakes to the entire state, using monitoring and assessment results that were previously available only from separate databases, agency reports, and agency websites, and only as static products. The web portals provide the more powerful ability for users to choose among, or define, multiple perspectives that suit their particular information needs.

1.3 Implementing the Monitoring Council's Recommended Comprehensive Monitoring Program Strategy

In its first two years of effort, the Monitoring Council has accomplished its primary purpose – to provide the empirical basis for developing clear recommendations for the Comprehensive Monitoring Program Strategy called for in the Statute. The following sections of this report describe the Monitoring Council's core philosophy and approach (Chapter 2), which is fundamental to the success of the ten-year implementation plan (Chapter 3). Implementation will require:

- Further developing the three initial prototype workgroups and internet portals
- Initiating three additional ecosystem health-related workgroups and web portals already identified

- Revising related monitoring and assessment programs using insights gained from the portal development process
- Expanding outreach to new partners, both within state agencies and outside of state government, and their inclusion in both existing and new theme-specific workgroups
- Identifying the next set of priorities for portal development
- Adapting lessons learned from recent efforts to the Monitoring Council's developing plans and procedures
- Designing and implementing the more permanent technical and institutional infrastructure needed to support this expanded and ongoing effort

Chapter 2: Philosophy and Approach

The Monitoring Council's primary vision is that the creation of broader and more streamlined access to monitoring data and statewide assessment products through the efforts of theme-specific workgroups to develop a set of internet portals provides the catalyst to improve the efficiency and effectiveness of California's water quality and associated ecosystem monitoring and assessment programs. A fundamental element of this vision is the philosophy that the theme-based web portals themselves are central to the success of efforts to improve access and create statewide assessment frameworks. As validated by the prototypes developed during 2009 and 2010, creation of the web portals promotes and organizes critical improvements in monitoring, assessment, and reporting that are impossible to achieve in a strictly bottom-up effort focused only on technical design and coordination. This philosophy provides an essential foundation for each element in the Monitoring Council's five-part approach to achieving the goals set by the Statute.

2.1 A philosophy of transparent, continual improvement

The Monitoring Council has established an operating philosophy that defines the complementary roles of the Monitoring Council and the theme-specific workgroups, working within an overall context of transparent and continual improvement. As described more fully in Section 2.2.1 (A Flexible Organizational Structure), the Monitoring Council plays a role made up equally of leadership, coordination, and support, while the theme-specific workgroups are responsible for the majority of the technical work involved in coordinating monitoring, developing assessment methods, and developing the portals themselves.

For the web portals to work as intended, they must meet all six monitoring program performance measures described below in Section 2.2.2 (Performance Measures). In order to meet the performance measures, the Monitoring Council has identified the following principles as key elements of its operating philosophy:

- Constantly evolving data, technology, and management information requirements mean that the web portals, and the monitoring and assessment programs on which they are based, will never be completely "finished" or "perfect"
- The best way to ensure web portals are as responsive as possible to current requirements and constraints is to be as open as possible about the strengths and shortcomings of the web portals and the monitoring programs and assessment methods on which they are based (see Sections 1.1 and 1.2 above)
- The Monitoring Council itself should play a central role in critiquing the web portals, overseeing workgroups' periodic evaluations of their underlying monitoring and assessment programs, and in facilitating plans for their continual improvement
- Such transparency builds credibility and encourages the involvement of the partners needed to continue developing and improving the web portals and their underlying monitoring and assessment programs
- The web portals should provide the framework to both motivate and guide the effort needed to correct shortcomings of monitoring and assessment programs and develop enhanced capabilities for data access and presentation

Organizations whose success is critically dependent on innovation, high quality, and/or high reliability explicitly cultivate just such a culture of open and transparent self-criticism and

continual improvement of core activities and products. The Monitoring Council's central role in this process is illustrated in Figure 2, with the workgroups' role in conducting periodic evaluations of monitoring and assessment programs highlighted.

2.2 A five-part approach to monitoring, assessment, and data integration

The Monitoring Council (CWQMC 2008) described a five-part solution essential to achieving its vision of broader data access through theme-based web portals. While these five elements remain central to the Monitoring Council's approach, the practical experience gained since then (CWQMC 2009, see Appendix 2) has added detail and texture to the original concept of how these elements would function together. The five elements are listed here, followed by more detailed descriptions of how the Monitoring Council conceives them to operate after 2 years of experience:

- An organizational structure built on decentralized, issue-specific workgroups that operate within common policies and guidelines defined by the Monitoring Council
- A set of monitoring program performance measures which each theme-specific workgroup will use to design, evaluate, coordinate, and enhance monitoring, assessment, and reporting efforts. These performance measures are adapted from USEPA's 2003 report *Elements of a State Water Monitoring and Assessment Program* (USEPA 2003) and map directly onto the ten EPA elements as described in CWQMC 2008
- A single, global point of entry to water quality data, and a design template for the complete set of theme-based web portals

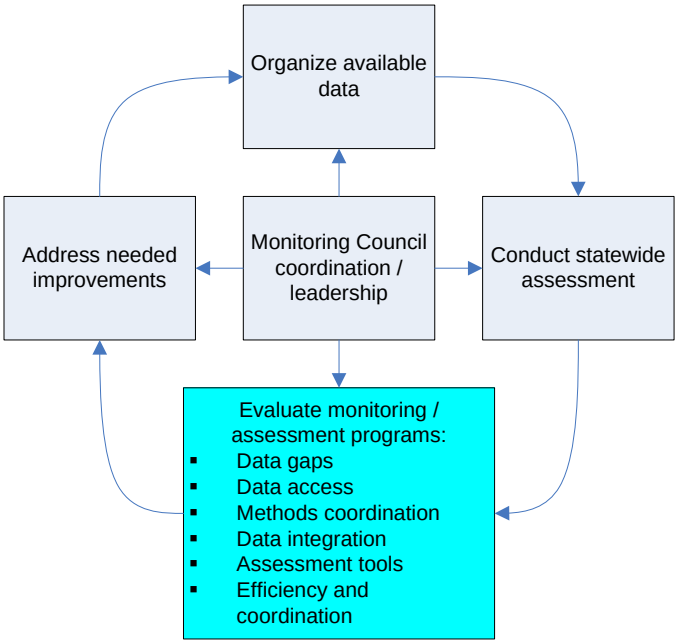

Figure 2. *The Monitoring Council's central role in promoting and organizing a process of continuous improvement in statewide assessments. Theme-specific workgroups have the primary responsibility for addressing functions in the four boxes around the periphery of the figure, with the key evaluation function highlighted.*

- Coordination[1] of monitoring and assessment methods that achieves an appropriate balance between statewide consistency and regional flexibility
- Database and data management practices necessary for more efficient data access and integration

There is a crucial difference between the Monitoring Council's approach and past efforts to provide improved data access and coordination. The Monitoring Council will not simply link to monitoring databases and encourage the more widespread use of standards. Rather, the Monitoring Council will use improved data access and coordination as the basis for conducting higher-level syntheses and assessments at the statewide level. The ready availability of statewide data will enable the Monitoring Council to task its workgroups with developing and applying statewide performance assessments, based on coordinated monitoring programs, that in the past could not be conducted because of problems like those illustrated in Figure 1.

2.2.1 A flexible organizational structure

The Monitoring Council has established an organizational structure based on theme-specific workgroups operating within common policies and guidelines established by the Monitoring Council. The Monitoring Council will either pose the core assessment questions itself or review and sign off on questions developed by the workgroup. This is a critical initial step because the assessment questions structure the remaining features of the web portal, such as maps, assessment products, and links to other web-based resources. The assessment questions also structure the monitoring designs, methods coordination, and data management procedures that produce the raw material for the assessment products. The Monitoring Council has established a basic template for the core assessment questions, modeled after those in the three prototype portals, that focuses on map-based depiction of status and trends at a range of spatial scales, and on the success of efforts to correct or improve problems (Appendix 4, *Guidelines for Workgroups and the Development of My Water Quality Theme-Based Internet Portals*).

Once established, workgroups are responsible for developing the web portal, creating appropriate guidelines for monitoring and assessment methods and data management procedures, and disseminating these guidelines to local and regional monitoring programs that generate raw data. The Monitoring Council will encourage and/or assist with outreach to additional potential partners and review and comment on draft assessment products and web portal prototypes. The Monitoring Council will also ensure that data management and integration procedures are coordinated as needed across themes, comply with developing State policies, and are compatible with the California Environmental Data Exchange Network (CEDEN) system and its network of regional data centers. Finally, the Monitoring Council will provide technical support as needed. The respective roles of the Monitoring Council and the workgroups are summarized in Table 1.

Within this general framework, the past two years' efforts have highlighted the need for flexibility in both working relationships and technical approaches, given the different points from which

[1] The CWQMC uses the term "standardization" to refer to the use of identical methods. In contrast, "coordination" refers to the use of methods that, while technically different, produce comparable results that provide the basis for data integration, comparisons across programs, and larger-scale and more complex assessments. Given the effort required to develop, promulgate, and maintain standardization, and the large number of partners involved in the web portals, the Monitoring Council has opted for coordination. Standardization will be used as a final resort where coordination cannot produce the needed degree of comparability.

Table 1. *Respective roles of the Monitoring Council and the theme-specific workgroups (or other partners) on the six main monitoring program elements defined for the Monitoring Council's efforts in CWQMC 2008 and adapted from USEPA's 2003 report Elements of a State Water Monitoring and Assessment Program (USEPA 2003).*

Monitoring program element	Monitoring Council role	Workgroup / partner role
1. Strategy, objectives, design	Collaborate w/workgroup on assessment strategy Ensure compatibility with related themes Comment and review	Define core management questions Develop assessment strategy, detailed monitoring objectives, and monitoring design(s)
2. Indicators and methods	Set goals for statewide coordination Comment and review	Develop, improve, coordinate indicators and measurement methods Improve monitoring coordination statewide
3. Data management	Set basic guidelines, design principles Ensure coordination across themes as needed Provide technical support	Implement data management procedures, user interfaces, applications
4. Consistency of assessment endpoints	Ensure assessment targets questions at statewide scale Set goals for statewide coordination Comment and review	Develop new or apply existing assessment methods Improve coordination statewide, while providing access to a variety of data perspectives
5. Reporting	Define reporting guidelines for both formal and ad hoc requirements Set goals for improved efficiency of existing reporting functions Comment and review	Design and produce assessment products Develop reporting functions to support agency reporting requirements
6. Program sustainability	Oversee periodic program evaluations Report evaluation results to Agency Secretaries Create and update program plans Obtain needed resources	Conduct periodic evaluations of monitoring and assessment programs and report to Council Implement responses to program evaluations Provide needed input to program planning Predict and highlight resource needs

each effort started, the level of existing coordination, and the specific technical challenges posed by each theme. For example, the Wetlands workgroup included a comprehensive range of stakeholders from its inception, while the Safe to Swim workgroup's membership initially focused only on ocean beaches and the need to satisfy mandates of the federal Beach Act (Beaches Environmental Assessment and Coastal Health Act of 2000, amendments to the Federal Water Pollution Control Act). Similarly, the Safe to Swim web portal was designed and implemented by State Water Board staff, while the California Wetlands portal was developed by

external partners, and the Safe to Eat Fish and Shellfish web portal was a collaborative effort between State Water Board staff and external partners. The Safe to Drink web portal, currently under construction, is initially being structured around the State Water Board's GeoTracker GAMA information system, which was developed independently to address a separate piece of state legislation (Groundwater Quality Monitoring Act of 2001 (AB 599, Liu)). This portal will eventually include data from the Department of Toxic Substances Control's (DTSC) EnviroStor system, which is being expanded to include additional sources of groundwater monitoring data.

While the Monitoring Council's workgroups are organized around a single theme and have a statewide focus, there are monitoring and assessment programs that operate at the smaller watershed or regional scale, but that nevertheless are potentially useful partners for the Monitoring Council's efforts. These regional scale programs have a wide range of missions and sponsors, ranging from volunteer water quality monitoring to collaborative watershed assessments and large-scale ecosystem monitoring and restoration programs. The Monitoring Council's organizational structure provides three ways to collaborate with programs focused on the regional scale:

- Supporting coordination of monitoring and data management methods, and disseminating these to regional scale programs, to ensure that key data types are available to and usable by the Monitoring Council's theme-based web portals
- Incorporating specific elements of regional programs into workgroup efforts to develop statewide assessments (e.g., stream bioassessment monitoring, which could be input to the statewide healthy streams subtheme)
- Creating new subthemes to represent integrated assessments of aquatic ecosystem health at the regional scale, especially those with statewide impact (e.g., integrated assessments of the San Francisco Bay-Delta Estuary)

The Monitoring Council is willing to support a range of such relationships, as long as they are compatible with the Monitoring Council's philosophy. Key to any development path, however, is the maintenance of strong relationships with the entities with primary responsibility for conducting statewide assessments for each theme. The Monitoring Council's approach depends on their involvement to assure the accuracy and relevance of all aspects of each web portal and to ensure adequate access to needed data and expertise.

Table 1 and the workgroup and portal development guidelines (Appendix 4) define core roles and responsibilities for the Monitoring Council, the workgroups, and other partners. However, the past two years of experience with the three prototype portals, and preliminary discussions with other theme-based monitoring and assessment efforts, have highlighted the importance of flexibility and adaptability in the early stages of workgroup development and relationship building. As these relationships mature and workgroups gain experience, the Monitoring Council expects that roles and responsibilities will become more formalized over time.

2.2.2 Monitoring program performance measures

The Monitoring Council adopted a set of monitoring program performance measures and benchmarks (Table 2) based on USEPA's 2003 report *Elements of a State Water Monitoring and Assessment Program* (USEPA 2003), but condensed USEPA's list of ten elements to six. A description of these six performance measures can be found in CWQMC 2008. Each workgroup will use these measures to evaluate existing water quality monitoring, assessment, and reporting efforts in order to develop specific actions and estimate funding needs necessary to coordinate and enhance those efforts. Appendix 6, *Tenets of a State Wetland and Riparian*

Table 2. *Benchmarks associated with each of the six monitoring program performance measures used by the Monitoring Council and the theme-specific workgroups to evaluate existing web-portals and their underlying monitoring and assessment programs. Periodic evaluations conducted by each theme-specific workgroup will provide data needed to track the Monitoring Council's progress toward meeting the goals of each theme's web portal development and monitoring coordination efforts.*

Evaluation criteria	Rating benchmarks / performance measures
1. Strategy, objectives, design	Low: No core questions; no, or many undifferentiated, target audiences; poorly articulated or conflicting objectives; uncoordinated monitoring efforts not focused on questions or objectives Medium: Core questions and target audiences implicit in program design; objectives implicit but only partly coordinated and not directly used to structure design effort High: Core questions coordinated, clearly stated, and focused on specific audience(s); clearly stated and common objectives address coordinated core questions and inform all aspects of design
2. Indicators and methods	Low: Indicators and methods uncoordinated, not validated; no QA procedures or plan Medium: Indicators and methods validated but not coordinated statewide; QA procedures exist but are poorly matched to objectives and not coordinated statewide High: Coordinated, scientifically validated, and clearly documented indicators, methods, and QA procedures that match monitoring objectives
3. Data management	Low: No data management procedures or documentation Medium: Data management procedures exist but are not coordinated statewide and only poorly support access to data High: Coordinated and clearly documented data management procedures are coordinated statewide and fully support access to data at multiple levels
4. Consistency of assessment endpoints	Low: No data analysis or assessment procedures used or documented Medium: Data analyzed but methods not coordinated; assessment tools exist but not fully validated or coordinated High: Data analysis methods and assessment tools fully validated, clearly documented, and coordinated statewide, while providing a variety of valid perspectives on the data
5. Reporting	Low: No reporting process or products Medium: Intermittent static reports, available with some effort High: Readily available regular static and dynamic reports focused on core questions and objectives; ability to create user-defined reports at multiple scales and from multiple perspectives
6. Program sustainability	Low: No systematic program evaluation, planning, or long-term funding devoted to infrastructure needs related to coordination and data integration Medium: Intermittent internal program review and planning that may or may not include infrastructure needs; limited funding for infrastructure High: Regular external program evaluations and planning for all program needs and for statewide integration

Monitoring Program (WRAMP), produced by the California Wetlands Monitoring Workgroup, illustrates the type of detailed evaluation the Monitoring Council envisions each workgroup will periodically produce. As a key part of such evaluations, workgroups must ensure that monitoring designs and assessment approaches target core management questions. The performance measures provided the structure for a preliminary evaluation of a wide range of monitoring and assessment efforts described in Appendix 3 of CWQMC 2008 and summarized in Table A3.2. of that Appendix.

2.2.3 A single, global point of entry

A central design feature of the Monitoring Council's approach is that all theme-based web portals, and the water quality data and assessment products they provide, will be accessible through a single, global point of entry. This point of entry has been established at www.CaWaterQuality.net (Figure 3). The Safe to Swim link provides access to a map-based

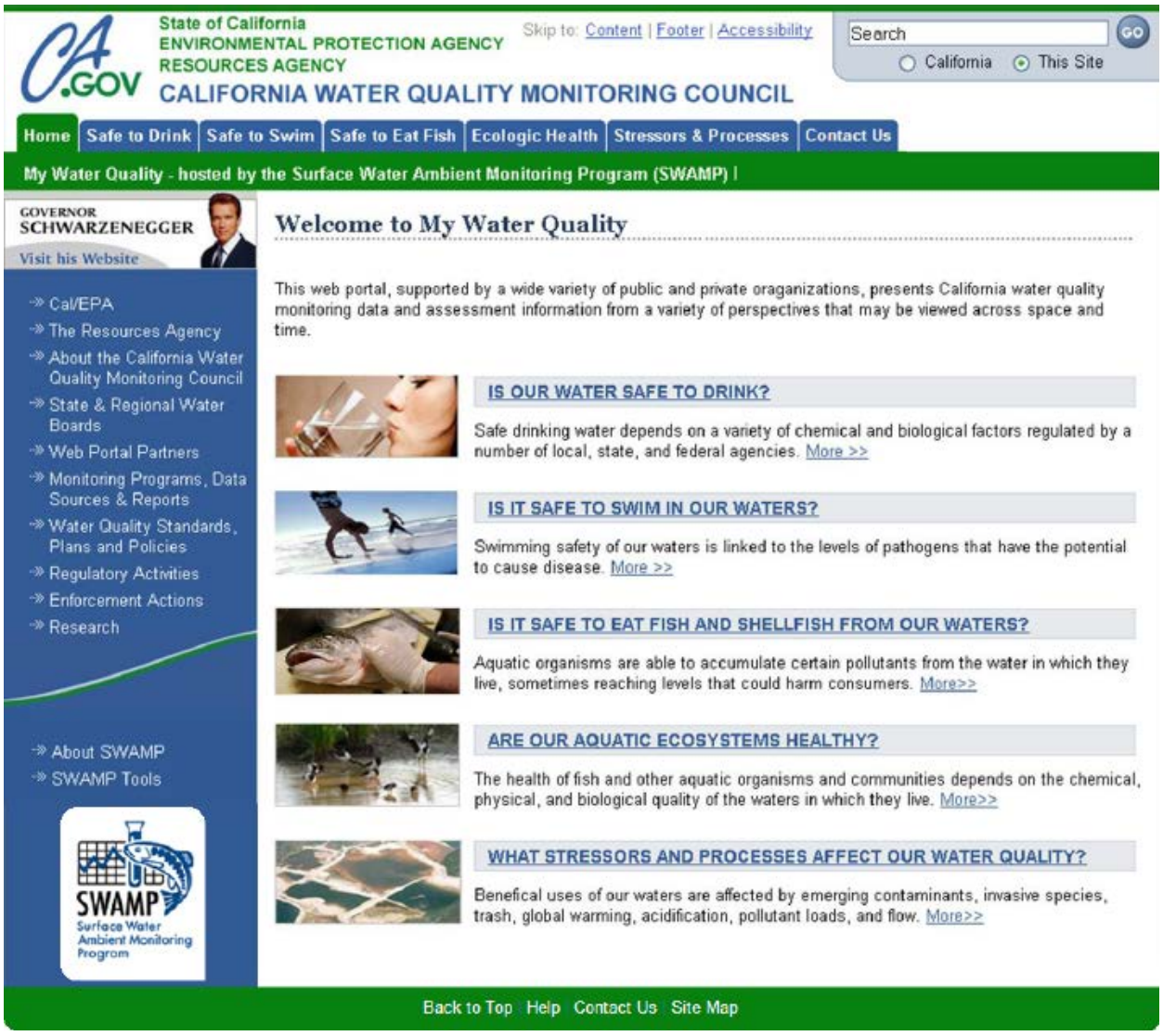

Figure 3. *The Monitoring Council's global point of entry to monitoring and assessment information for all theme-based web portals (www.CaWaterQuality.net)*

interface and a set of secondary questions (Figure 4). The Aquatic Ecosystem Health theme provides access to a series of subthemes that address a variety of aquatic ecosystem types (Figure 5). Figures 3, 4, and 5 also illustrate the page design the Monitoring Council has established for these higher-level entry points, and with which the theme-specific workgroups must comply (Appendix 4).

The main function of this global point of entry is to solve the long-standing, fundamental data access problem, namely, that it can be confusing and time consuming to find data, assessment products, and background information relevant to a particular question or issue. By providing a direct connection to the individual theme-based web portals, this global entry point will also provide organized access to a broad range of relevant databases and websites maintained by other entities. For example, the Safe to Drink web portal (currently under construction) will provide a link to the GeoTracker GAMA website (and soon will also include DTSC's EnviroStor system), the Safe to Swim web portal to Heal the Bay's Beach Report Card website, and the Safe to Eat Fish and Shellfish web portal to the fish consumption advisory website of the Office of Environmental Health Hazard Assessment (OEHHA), in addition to a large number of additional state, federal, and non-governmental organization (NGO) websites and databases.

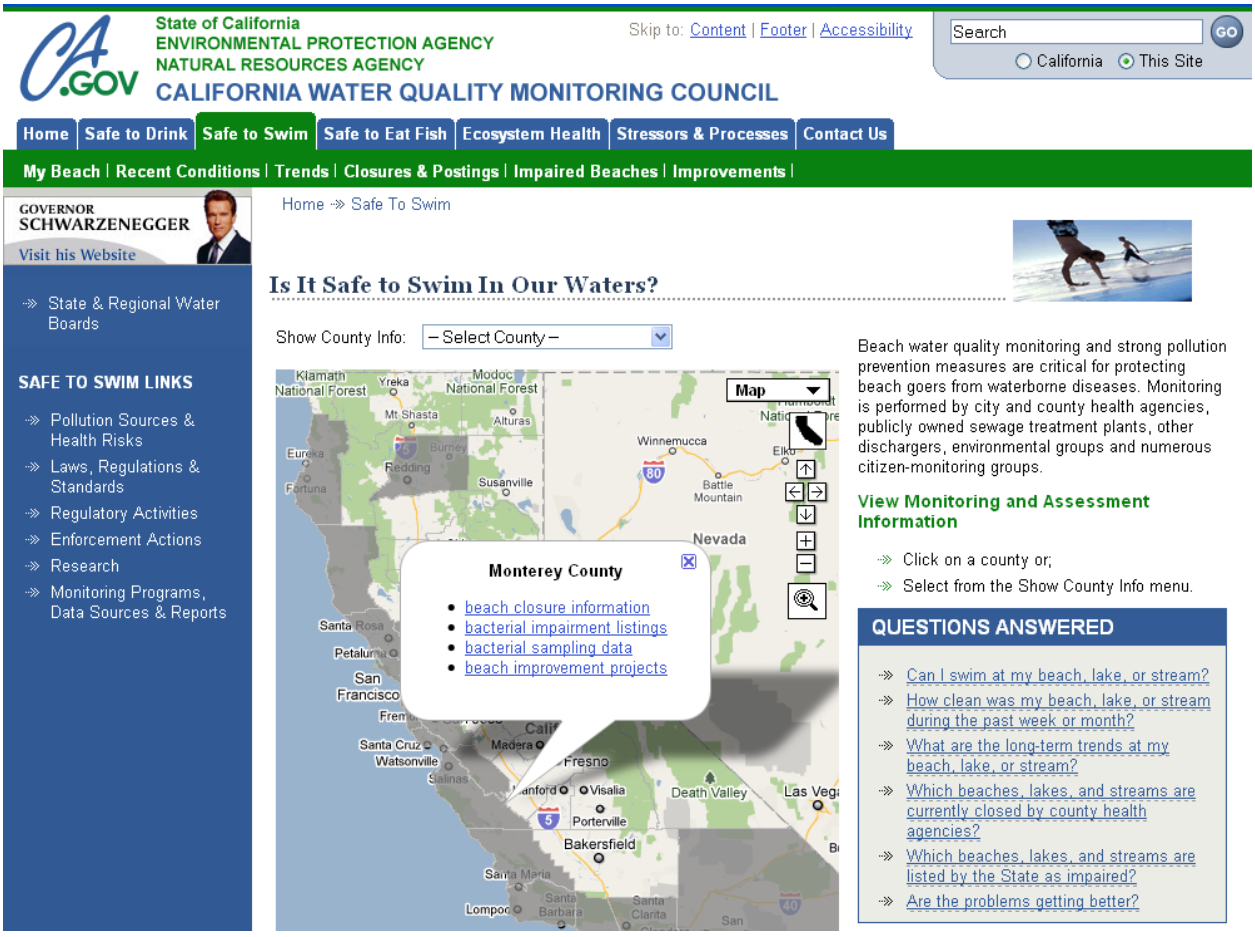

Figure 4. *The main Safe to Swim portal page provides a template for the home pages of individual theme or sub-them portals.*

2.2.4 Coordination of core monitoring program elements

Improving the comparability of monitoring program elements is crucial to the successful functioning of the theme-based web portals (see Table 1, especially criteria 1 – 4). Inconsistent monitoring designs and/or methods, indicators, or assessment approaches make it impossible to present credible and reliable assessments at the statewide scale. Thus, making consistent progress toward improved statewide coordination is an important part of the Monitoring Council's workplan (see Chapter 3).

Experience to date with the three prototype portals, as well as experience from past attempts at improving coordination, suggests that the Monitoring Council will encounter a range of situations regarding monitoring designs, indicators, measurement methods, and assessment approaches. As a result, coordination will not follow the same pathway or present the same challenges for each theme, and different sets of guidelines will be applicable for different themes. For example, beach water quality monitoring programs apply the same assessment thresholds, based on AB 411 (Wayne, 1997), but have different monitoring design philosophies, with the result that measures of the frequency and magnitude of beach closures have different meanings for different programs. As another example, the wetlands theme faces a situation in which common monitoring methods have been agreed on, but there is as yet no agreed-on framework for interpreting monitoring results and arriving at consistent conclusions about wetland status.

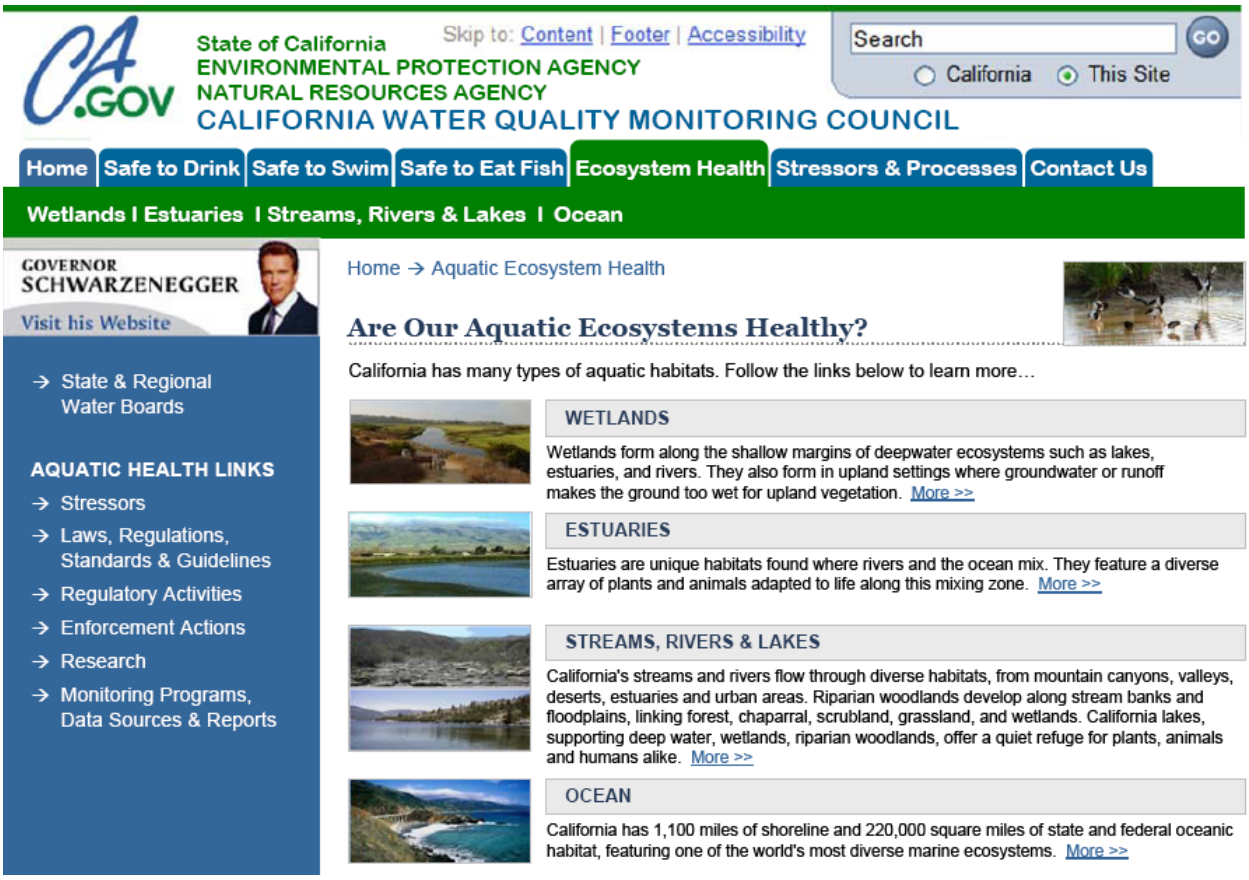

Figure 5. *The Aquatic Ecosystem Health web page provides access to a number of separate subtheme portals focused on different categories of aquatic ecosystems.*

As explained in CWQMC 2008, not all aspects of all monitoring programs require statewide coordination. The Monitoring Council will therefore work with each workgroup to identify program elements that require larger-scale statewide coordination to support comprehensive assessments and those that can vary regionally to support local needs. Where national or state guidelines already exist, the Monitoring Council will encourage adoption of the highest-level guidelines available. In all cases, however, the Monitoring Council's philosophy (see Sections 1.1 and 2.1) is to present available information in a web portal as soon as some useful statewide information is available, even if it contains data gaps and/or inconsistencies. As explained above, this approach creates the structure and motivation for a transparent process of continual improvement of monitoring data, methods, and assessment products (see Figure 2).

2.2.5 Improved data management

The Monitoring Council's approach to improving data access is premised on providing a global point of access to a series of theme-based web portals. These in turn enable access to a wide range of other data sources as needed to fulfill the web portals' analysis, assessment, and reporting functions. This will require comparable monitoring data statewide, technical support for infrastructure and tool development, and the ability for users to query and download a variety of data and assessment products.

Work on the prototype web portals to date has demonstrated both the potential for and the challenges of this goal. Fully implementing the set of web portals envisioned will require finding, accessing, and integrating many different data types from a large number of sources, and providing monitoring data and products to users with valid, often wide, differences in needs and perspectives. These challenges are not limited to the Monitoring Council's efforts, and are in fact an important issue for the State as a whole. The Office of the Chief Information Officer recently released its *Statewide Data Strategy Report* (OCIO 2009), which describes the State's approach to overcoming widespread problems related to data access and integration. While it lays out basic principles for the design, functioning, and integration of the State's data management systems, it also allows for needed flexibility as each agency develops its own solutions and strategies. The Monitoring Council's approach is compatible with the State's strategy and is based on two key elements.

The first element involves implementing a distributed data management strategy by establishing locally centralized access and data input points at regional data centers, which are then linked with an exchange network to bring data together as needed. The State Water Board's Surface Water Ambient Monitoring Program has implemented the distributed CEDEN network (Figure 6) which may evolve into the primary source of data to the Monitoring Council's web portals. CEDEN relies on the California Environmental Resources Evaluation System (CERES) metadata catalog and is a distributed enterprise system intended to be flexible enough to accommodate multiple requirements. The CEDEN regional data center nodes fulfill the role of intermediary between larger state systems and small to medium data providers. CEDEN's architecture has been designed to create a long-term solution for delivering complex, scalable, user-friendly applications and information to a wide variety of users.

CEDEN is committed to participating in the USEPA's National Environmental Information Exchange Network (NEIEN) and in implementing their standards for service oriented architecture (SOA) and web services. These frameworks structured the initial design and implementation of CEDEN, which became operational in 2010. However, the system still requires a substantial amount of development, both of its basic infrastructure and of applications

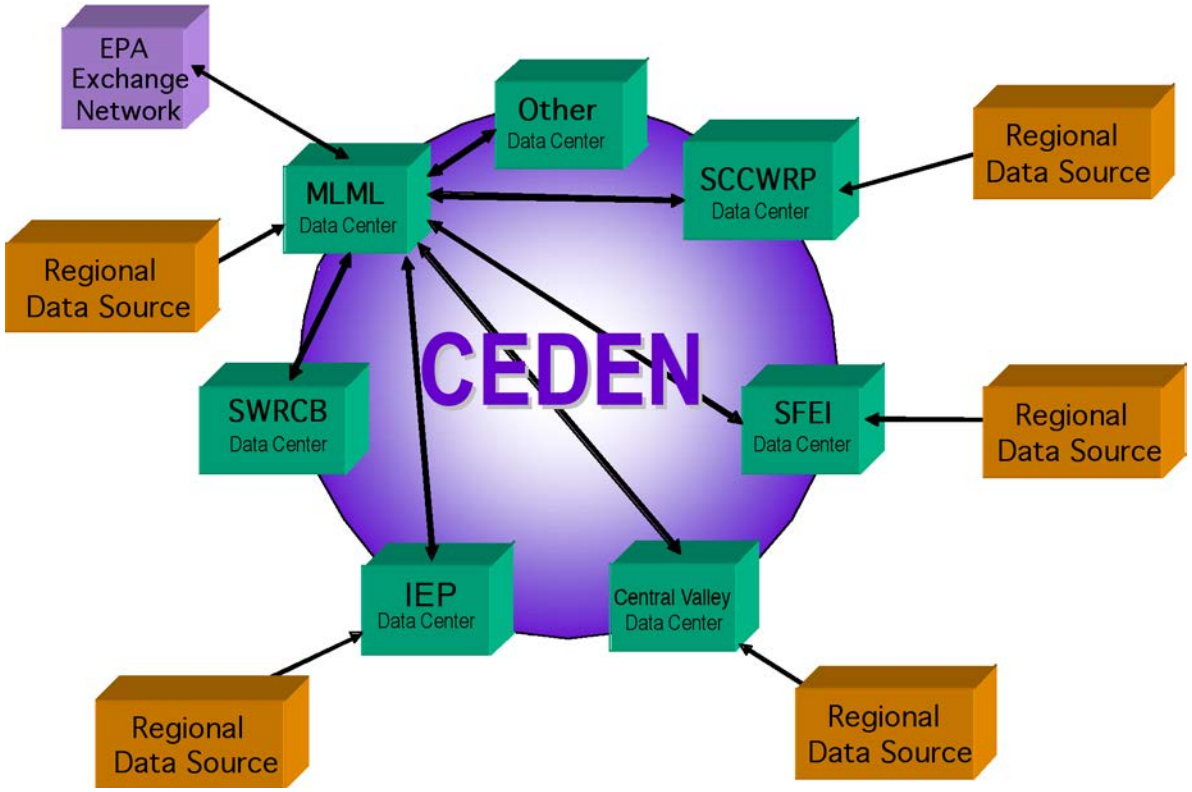

Figure 6. *Schematic depiction of the CEDEN network, illustrating the relationships of the regional data centers to each other, to regional data sources, and to the external EPA Exchange Network.*

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needed to support the theme-based web portals, and this effort is outlined in the workplan in Chapter 3.

The second element of the Monitoring Council's data management approach is a data management workgroup that will play a critical coordinating role to ensure that the theme-specific workgroups:

- Meticulously define their data requirements
- Identify data requirements that cut across multiple themes and that therefore should be coordinated
- Employ data management strategies that comply with appropriate national and state guidelines
- Have a well-established mechanism for communicating data management issues to a body with overall responsibility for oversight and support of individual themes' data management efforts

These functions are illustrated in Figure 7, which shows the Monitoring Council's data management workgroup interacting with the theme-specific workgroups at critical points and supporting needed coordination across workgroups.

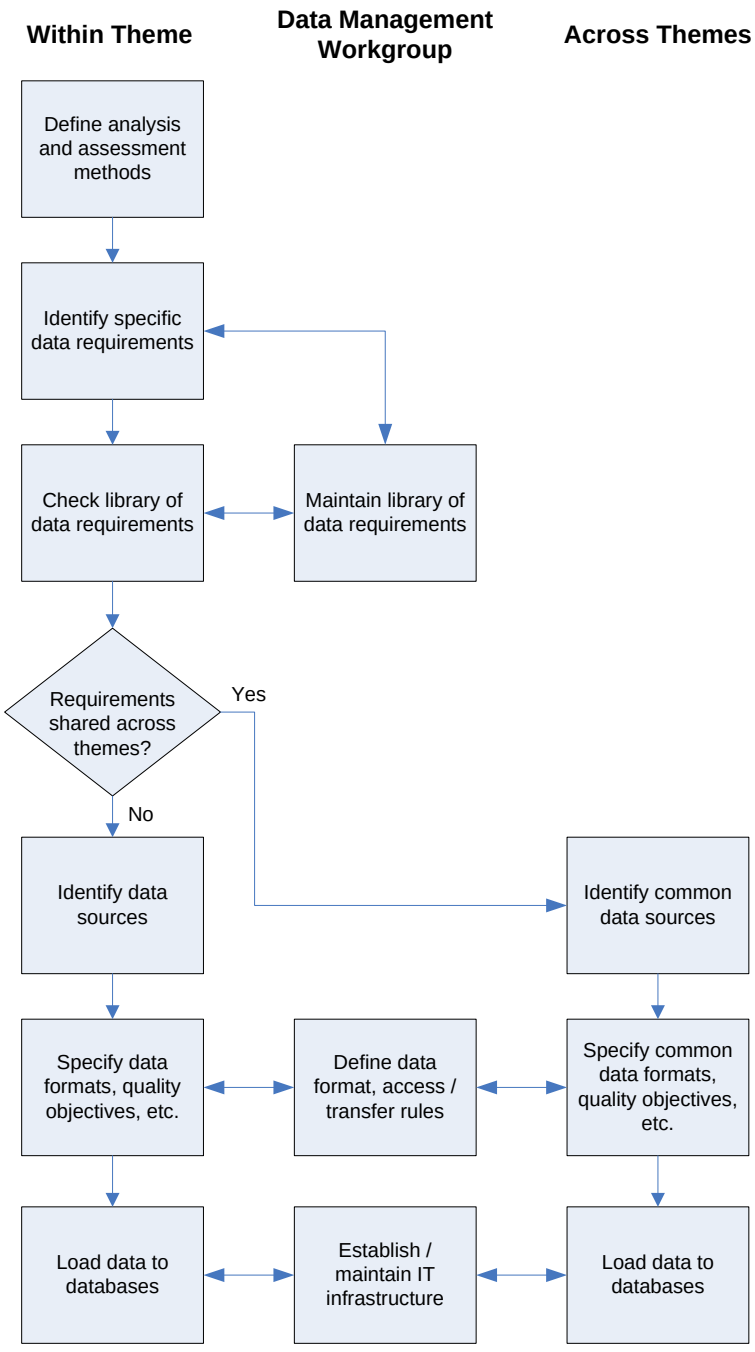

Figure 7. *The Monitoring Council's data management workgroup will support data management efforts of each theme-specific workgroup, as well as playing a coordinating role where data requirements cut across multiple themes.*

In addition to looking inward toward the theme-specific workgroups, the Monitoring Council's data management workgroup will look outward to other partners within and outside of state government to ensure that the Monitoring Council's data management strategy remains aligned

with State and federal initiatives and takes advantage of opportunities to utilize useful tools and approaches developed elsewhere.

2.2.6 Monitoring of state financed water quality improvement projects

The State of California provides millions of dollars of funding for water quality and associated ecosystem improvement projects. For a number of reasons, most of these projects do not generate monitoring data sufficient to document the success or failure of these projects. In response, SB 1070 required that the MOU between Cal/EPA and the Natural Resources Agency "shall describe the means by which the monitoring council shall formulate recommendations to … [e]nsure that water quality improvement projects financed by the state provide specific information necessary to track project effectiveness with regard to achieving clean water and healthy ecosystems." The MOU reiterates this mandate in describing the Monitoring Council's responsibilities.

Others have made recommendations to improve monitoring of state financed water quality improvement projects. The Natural Water Quality Committee (NWQC) was formed at the direction of the State Water Resources Control Board to define natural water quality based on a review of monitoring data in Areas of Special Biological Significance (ASBS). Some of their recommendations focused on monitoring of water quality improvement projects funded by Proposition 84 grants. The following is excerpted from the NWQC's *Initial Recommendations for Monitoring ASBS Implementation Projects* from *Summation of Findings, 2006-2009*.

> After discussions with [State and Regional Water Board] staff, task force members from other grant programs…, and the grantees themselves, the NWQC came to three conclusions regarding the successes and failures of previous grant programs. Frequently in the past, grant programs were incapable of assessing the success/failure of their program for either removal of pollutants or improvements to receiving waters. Inadequate guidance was provided to the grantees on the specific goals of the monitoring programs employed, especially to those grantees that lacked capabilities and experience with monitoring. Specifically, grantees rarely had a vision of the State's monitoring objectives such as cumulative pollutant removal. Even for those grantees with experience and capability, the timeline of the grant programs (typically two to three years) were inconsistent with adequately quantifying the goal of measuring pollutant reductions.
>
> The NWQC discussed several important elements to enhance the Proposition 84 grant program monitoring components. These elements included: 1) a cohesive, question-driven monitoring program; 2) a unified monitoring design that ensures comparability in sampling, data analysis, and information management; and 3) a person or group responsible for coordinating, collating, assessing and reporting on the Proposition 84 monitoring effort. A clear statement of objectives needs to be composed so as to provide a vision for the Proposition 84 monitoring program. Monitoring experts universally agree that this is best achieved through the use of a well-formed and unambiguous monitoring question, much akin to a hypothesis for testing. This question should be crafted with care and agreed to by the Proposition 84 Task Force or other governing body.
>
> A centralized monitoring design should be created with sufficient scientific rigor that the monitoring question can be answered with a specified level of confidence. It is impossible to describe what this design may look like until the monitoring question is created, but there are certain elements that must be included. The first element should be some level of standardized sampling. Standardized sampling approaches ensure representativeness and reduce bias in data collection. For example, flow weighted composite sampling during wet weather runoff can produce very different results than grab sampling, even during the same storm event at the same site. Comparing data from different sampling approaches is inappropriate and could lead to faulty conclusions. Similarly, standardized quality assurance should be achieved through the laboratory analysis portion of a large-

> scale monitoring program. Comparability is paramount and several large-scale monitoring programs use performance-based quality assurance guidelines to ensure comparability for laboratory analysis. Finally, a centralized data management system is necessary for collating the reams of information generated by multiple monitoring programs. Grantees will focus on the monitoring data associated with the management actions specific to their project and these individual data sets will be, for the most part, relatively small and easy to manage. Combining data sets from numerous individual grant projects post hoc, however, would be daunting to impossible and could cost hundreds of thousands of dollars unless a well-conceived information management system is implemented before data collection. Thankfully, several systems exist within the state that could be used as a vehicle for data management.
>
> Finally, a person or group must be tasked from the beginning with the responsibility for coordinating the Proposition 84 ASBS monitoring program. Deriving monitoring questions, ensuring comparability, and quality assurance/training cannot be done as a sideline to one's daily activities. It is a full-time job. The larger the program, the more likely it will require additional personnel to accomplish all of the integration necessary to address the monitoring question. It will be this entity that shall be responsible for communicating with grantees on monitoring and eventually for writing a summary report of the program's success at reducing pollutant loads and/or concentrations.
>
> The NWQC had four recommendations to the ASBS Task Force on a structure for the statewide grant monitoring program to achieve the three goals of monitoring question(s), comparability, and organization. The first recommendation stated the singular monitoring question of utmost importance, "How much pollutant (i.e., in kg) was removed as a result of the grant-funded BMP?" Several additional questions are feasible and perhaps warranted, but this single question must be answered. The second recommendation addressed who should coordinate the Proposition 84 monitoring. The NWQC felt that the [State Water Board] should coordinate this monitoring, perhaps through one of their statewide programs such as the Surface Water Ambient Monitoring Program (SWAMP). Third, the NWQC felt that at least 10% of each grant should be allocated to monitoring activities. Each grantee can conduct this coordinated monitoring themselves or, if they prefer, return 10% of the grant back to the [State Water Board] to arrange for the coordinator to conduct this monitoring. Regardless of who implements the monitoring, the [State Water Board] must use the $1 million set aside from Proposition 84 to conduct the coordination, quality assurance, and data management to ensure comparability. Finally, the NWQC recommended that grantees be allowed a 1-year, no-cost extension to conduct post-construction monitoring. The extra time will provide invaluable monitoring information, particularly in the drier parts of the state where rainfall is limited to a short window of time during the year.

The Monitoring Council believes that these recommendations for monitoring Proposition 84 grant projects provide a sound basis to improve the effectiveness of most monitoring for other state funded water quality and ecosystem improvement projects. The ability of the state to verify the success of these projects and the ability to utilize grant project monitoring results in larger scale assessments depends on reforms such as those outlined above. However, due to contracting problems that currently limit SWAMP and other state agencies (see Section 3.3.3. *Contracting and implementation constraints*, below), it may be better for an existing or new joint powers authority or university to provide monitoring coordination.

There are categories of state funded water quality and ecosystem improvement projects that fall within the purview of existing and future Monitoring Council workgroups. For example, the Clean Beaches Initiative (CBI) grant projects funded by the Water Boards are included in the Safe to Swim portal and the coordination efforts of the Beach Water Quality Workgroups. In such cases,

the theme-specific workgroups would also be appropriate bodies to provide direction and coordination on effectiveness monitoring.

A plan for improvements to monitoring associated with state funded improvement projects will require an estimate of the amount of grant dollars spent on monitoring.

Chapter 3: The Monitoring Council's Ten-Year Workplan

The Monitoring Council has developed a ten-year workplan (Workplan) to implement the approach described in Chapter 2. The Workplan is divided into three phases, with different technical and management challenges and levels of effort allocated to each:

- Start-up: Years 1 – 2
- Development: Years 2 – 8 (overlapping with Start-up)
- Long-term maintenance: Years 9 – 10 (and beyond)

The Workplan includes two complementary and parallel types of effort (Figure 8) essential to accomplishing the five-part solution described in Section 2.2. The left-hand side of Figure 8 represents effort carried out at the level of the individual theme-specific workgroups. This effort would in general follow the approach developed to date for the three prototype themes, applying lessons learned during those initial efforts. The right-hand side of Figure 8 represents tasks that are the direct responsibility of the Monitoring Council because they relate to establishing and maintaining the program's technical, management, and financial infrastructure.

3.1 Theme-by-theme tasks

Specific tasks required to prioritize themes for action, establish workgroups, and develop a series of individual web portals are shown on the left-hand side of Figure 8. The following discussion follows the figure from top to bottom.

3.1.1 Prioritize targets for development

The list of potential themes (see Table 3) will be periodically revisited to determine if adjustments are required. For example, the Monitoring Council recently reorganized the Aquatic Ecosystem Health theme (Figure 5) to streamline the development of web portals for the associated subthemes. The Monitoring Council will assess the readiness of each theme by evaluating its performance on each of the six monitoring program performance measures (see Section 2.2.2 above, and Appendix 3 of CWQMC 2008).

The Monitoring Council will then prioritize themes for development, using a prioritization scheme based on the following three criteria:

- Level of concern to the public and managers
- Level of effort involved (based on each theme's score on the six monitoring program performance measures, as illustrated in detail in Appendix 3 of CWQMC 2008)
- Near-term opportunities (i.e., low-hanging fruit) involving interested monitoring / assessment programs, immediate sources of funding, or situations that demonstrate technical methods or institutional arrangements that further the goals of the Statute

This recent prioritization indicates that groundwater, rivers and wadeable streams, rocky intertidal, kelp beds, and estuaries are the immediate highest priorities for the next set of web portals or portal sections. Each of these is currently being addressed by monitoring programs that provide ready opportunities for productive partnerships with the Monitoring Council. The Groundwater Ambient Monitoring and Assessment (GAMA) program of the State Water Board currently coordinates groundwater monitoring data management between a number of state and federal agencies. The Healthy Streams Partnership being developed by the State Water Board's

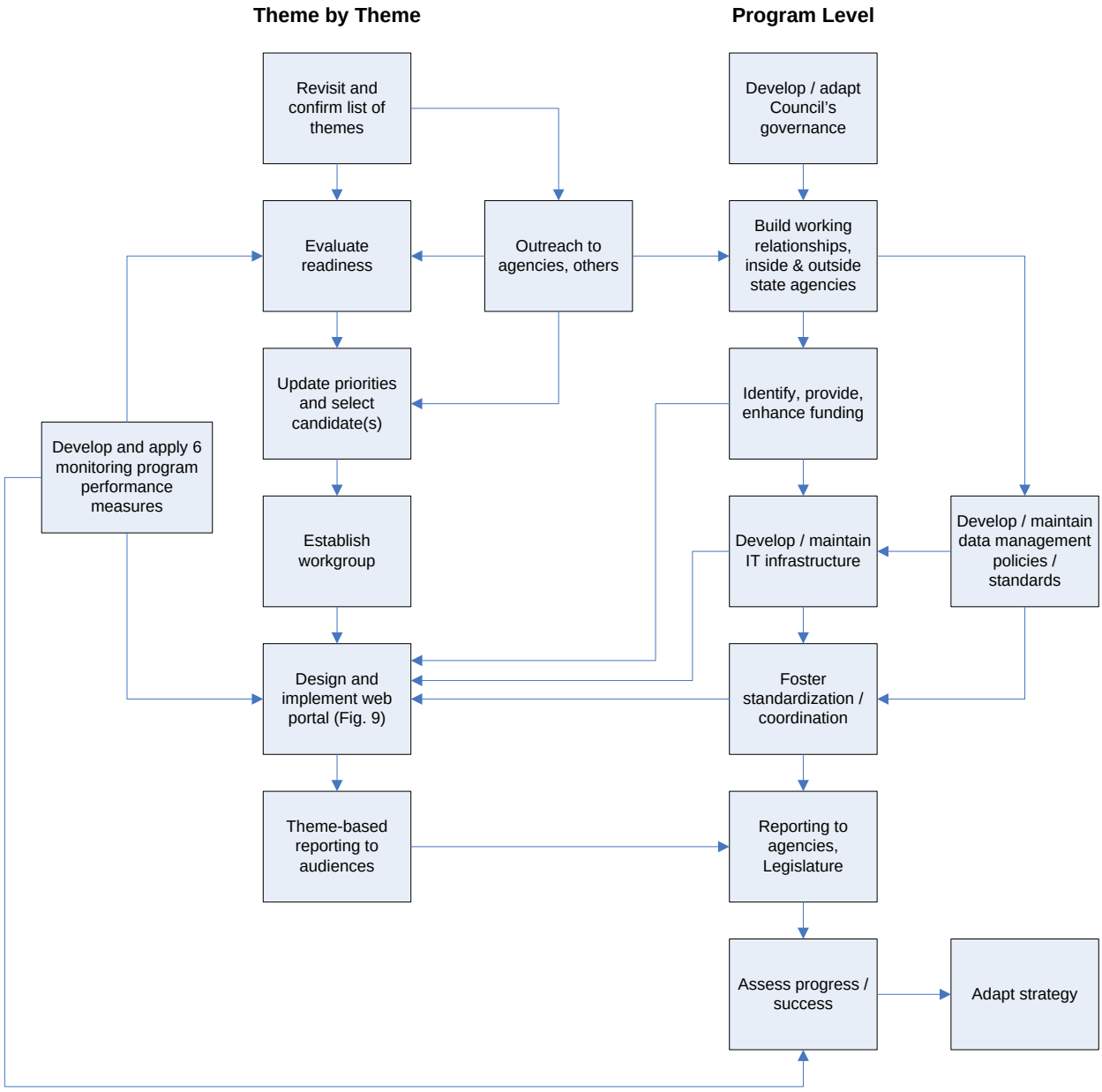

Figure 8. *Parallel tracks needed to implement theme-based monitoring and assessment within the context of web portals. The Comprehensive Monitoring Program Strategy focuses primarily on the right-hand side of the figure.*

Surface Water Ambient Monitoring Program (SWAMP) encompasses the former Perennial Streams Assessment (PSA) which focuses on bioassessment and physical habitat primarily in perennial wadeable streams, Stream Pollution Trends (SPoT) which monitors at the bottom of watersheds including rivers, and efforts to develop biological objectives for these habitats.

The California Ocean Protection Council (OPC) provides coordination and guidance on ocean ecosystem monitoring, assessment, and protection efforts throughout California. At the

September 2010 OPC meeting, Monitoring Council Member Linda Sheehan recommended that the OPC take on the responsibility of developing a California ocean health workgroup and Internet portal, and this was further discussed at the Monitoring Council's October meeting. Within the ocean health theme, the Multi-Agency Rocky Intertidal Network (MARINe) is a statewide intertidal monitoring program sponsored by a consortium of federal, state, and nonprofit partners. Regional surveys of kelp bed extent in the Southern California Bight are sponsored by a group of local permittees and Regional Water Boards with the goal of tracking and explaining patterns and trends in kelp bed extent.

The Interagency Ecological Program, the San Francisco Bay Regional Monitoring Program, and the developing Delta Regional Monitoring Program are currently coordinating various monitoring efforts within the San Francisco Bay-Delta Estuary. Bringing together these three efforts could form the nucleus of a California Estuary Monitoring Workgroup and Internet portal, initially focusing on the largest and most important of California's estuaries. Considering that the Delta is the source of water supply for much of California, the declining status of the Bay-Delta ecosystem has risen to the level of statewide importance.

The Monitoring Council's emphasis on periodic prioritization recognizes the fact that all themes and subthemes cannot be addressed immediately. Implementation must therefore optimize the effectiveness of available resources, address first those issues of most concern to managers and the public, take advantage of existing infrastructure, and build momentum and support for the overall concept of expanding the use of theme-based web portals. Table 3 illustrates how the Monitoring Council has applied the three prioritization criteria. The safety of drinking water received the highest level of concern, with fish and shellfish consumption safety and swimming safety the next priority. In general, the status of aquatic life is a lower priority, with exceptions at certain times and places for some audiences, for example the decline of the San Francisco Bay-Delta estuary ecosystem and the role of water diversions, pollution, and invasive species in that decline. The level of effort needed to meet the goals of the Statute for each portal is rated on four-point scale, based on each theme's scores on the performance measures. High scores correlate with a higher level of effort required. Themes that have expressed an interest in participating in the Monitoring Council's activities, have access to independent sources of funding, and/or have an institutional infrastructure to promote coordination and access are rated as the best opportunities (i.e., lower scores).

Table 3. *Summary results of the prioritization exercise. For each criterion, lower numbers represent a higher priority. The overall priority is the simple average of the individual ratings on three separate criteria. Web portals have been developed for themes and subthemes shown in* ***bold****. Themes shown in highlighted type represent the next set targeted for portal development.*

	Prioritization Criteria			
Theme-based portals *(in italics)* and sub-themes	Level of concern	Level of effort	Opportunity	Overall priority
Is our water safe to drink?				
Surface water	1	1	3	1.7
Groundwater	1	2	1	1.3
Water at the tap	1	3	2	2.0
Is it safe to eat fish and shellfish from				

Theme-based portals *(in italics)* and sub-themes	Prioritization Criteria			
	Level of concern	Level of effort	Opportunity	Overall priority
our waters?				
Sport fish	2	2	1	1.7
Shellfish	2	1	2	1.7
Is it safe to swim in our waters?				
Freshwater	2	4	3	3.0
Beaches, bays, and estuaries	2	1	1	1.3
Are our aquatic ecosystems healthy?				
Estuaries	3	2	2	2.3
Wetlands	2	2	1	1.7
Streams, Rivers, and Lakes				
Wadeable streams	2	1	1	1.3
Rivers	3	3	3	3.0
Lakes	3	4	3	3.3
Freshwater fish	3	4	3	3.3
Anadromous fish	2	2	2	2.0
Ocean				
Shallow marine reefs	3	1	2	2.0
Rocky intertidal	3	1	1	1.7
Kelp beds	1	1	1	1.0
Subtidal benthos	3	1	2	2.0
Sandy beaches				
Marine fish	3	3	3	3.0
What stressors and processes affect our water quality?				
Loadings (include trash/ocean debris)	3	4	4	3.7
Flows	3	1	4	2.7
Levels of contamination				
Water				
Freshwater	3	4	4	3.7
Marine	3	2	4	3.0
Sediment				
Freshwater	3	4	4	3.7
Marine	3	2	3	2.7
Aquatic life				
Freshwater	3	4	4	3.7
Marine	3	3	2	2.7
Invasive species	3	2	3	2.7
Endangered species	1	3	2	2.0
Harmful algal blooms	3	1	1	1.7
Landscape maps	3	3	2	2.7
Measures of climate change	2	1	3	2.0
Ocean acidification	2	4	3	3.0

3.1.2 Establish and task workgroups

The Monitoring Council will then establish workgroups for each of the high priority themes and subthemes. While there is a division of responsibility between the Monitoring Council and the workgroup (Table 1), there is no set formula for how workgroups are established and their members selected. In general, the Monitoring Council anticipates the circumstances shown in Table 4, illustrated with the three prototype web portals addressed in 2009 and the themes identified for 2010.

Table 4. *Possible circumstances the Monitoring Council will face in establishing workgroups to address web portal development for each theme and subtheme. Prototype themes addressed during 2009 and 2010 and additional themes scheduled for the near future (highlighted) are placed in the framework as illustrations.*

	Lead responsibility clear	Responsibility split
Workgroup exists and complete	Rivers and Wadeable Streams Kelp Beds	Wetlands Rocky Intertidal
Workgroup exists but incomplete	Safe to Eat Fish and Shellfish Safe to Swim Safe to Drink-groundwater focus	
No workgroup		Estuaries

Depending on the circumstance, the Monitoring Council could simply adopt an existing workgroup, as it did with the Wetlands and Safe to Eat Fish and Shellfish workgroups, or adopt an existing workgroup and, as work proceeds, reorganize and/or expand the workgroup to include the needed range of expertise and perspectives. For example, the Monitoring Council has recommended reorganizing the Safe to Swim workgroup to foster a statewide perspective and will encourage expansion of both the Safe to Swim and Safe to Drink workgroups to capture, respectively, the perspectives of inland monitoring programs and users of the information provided by the web portal. Where no workgroup currently exists, the Monitoring Council will establish one based on discussions with stakeholders both within and outside of State agencies.

The Monitoring Council will meet with representatives of each workgroup to develop a written charge or workplan for the workgroup (see Appendix 4). Existing web portals will provide examples of the structure, functionality, and look and feel required, and the Monitoring Council at this stage will also clarify data management and data integration guidelines. The Wetland Monitoring Workgroup's evaluation of current monitoring (Appendix 6) illustrates the type of initial examination each workgroup should conduct. Most importantly, the Monitoring Council will either define the core management questions around which the web portal and monitoring programs will be constructed, or review and approve questions developed by the workgroups. (The SWAMP Assessment Framework (Appendix 5) includes detailed discussion of an approach for developing useful management questions.) At the moment, the Monitoring Council and its workgroups are operating on the basis of "handshake" agreements. While these have

sufficed for the three prototypes, a more formal relationship will be needed as the number and variety of workgroups increases (see Section 3.3.1).

3.1.3 Design and implement web portal

Working from its charge, the workgroup will design and implement the theme-based web portal. The process (Figure 9) will follow that used to date to develop the three prototypes, with the addition of more formal procedures for identifying data gaps, applying State and Monitoring Council guidelines, and feeding adjustments back to monitoring programs to improve their coordination and their ability to support statewide assessments. This process locates detailed design responsibility at the workgroup level, while providing for input and review by the Monitoring Council at appropriate points in the process (see also Table 1). Implementing this process will require additional staff support for the Monitoring Council.

The process illustrated in Figure 9 places the definition of core management questions and assessment products at the front end of the web portal design process. This reflects the Monitoring Council's fundamental philosophy that the web portals will be effective only to the extent that they are question driven and that statewide assessments are targeted directly at answering users' questions.

3.1.4 Improve monitoring programs

Starting with the core management questions, the workgroup will use the monitoring program performance measures to evaluate the degree to which existing monitoring and assessment programs are adequate to support the portal functions, with an emphasis on coordinated, statewide assessment. This corresponds to the elements on the right-hand side of Figure 9. Specific actions will depend on the nature of the management questions and the degree of development / coordination of existing monitoring programs. There are multiple useful examples around the state, mostly at local and regional scales, that illustrate how study designs, indicator selection, and the other elements of an effective monitoring program can improved.

3.2 Program-level workplan schedule

Tasks required to develop and implement the Monitoring Council's programmatic infrastructure are shown on the right-hand side of Figure 8 and are the core responsibilities of the Monitoring Council itself. The effort involved in carrying out these tasks, and supporting the theme-by-theme tasks shown on the left-hand side of Figure 8, can be split into three developmental phases:

- Start-up: Years 1 – 2
- Development: Years 2 – 8 (overlapping with Start-up)
- Long-term maintenance: Years 9 – 10 (and beyond)

All tasks shown in Figures 8 and 9, and discussed in Section 3.1, are relevant to each developmental phase. However, the specific technical and management challenges will differ from phase to phase, as will the staffing, cost structure, and level of effort needed to accomplish each task. The following sections briefly describe the tasks specific to each phase of the Workplan. Tasks are discussed in terms of the five-part solution described above (Section 2.2):

- Organizational structure with common policies and guidelines
- Monitoring program performance measures applicable to all themes and web portals

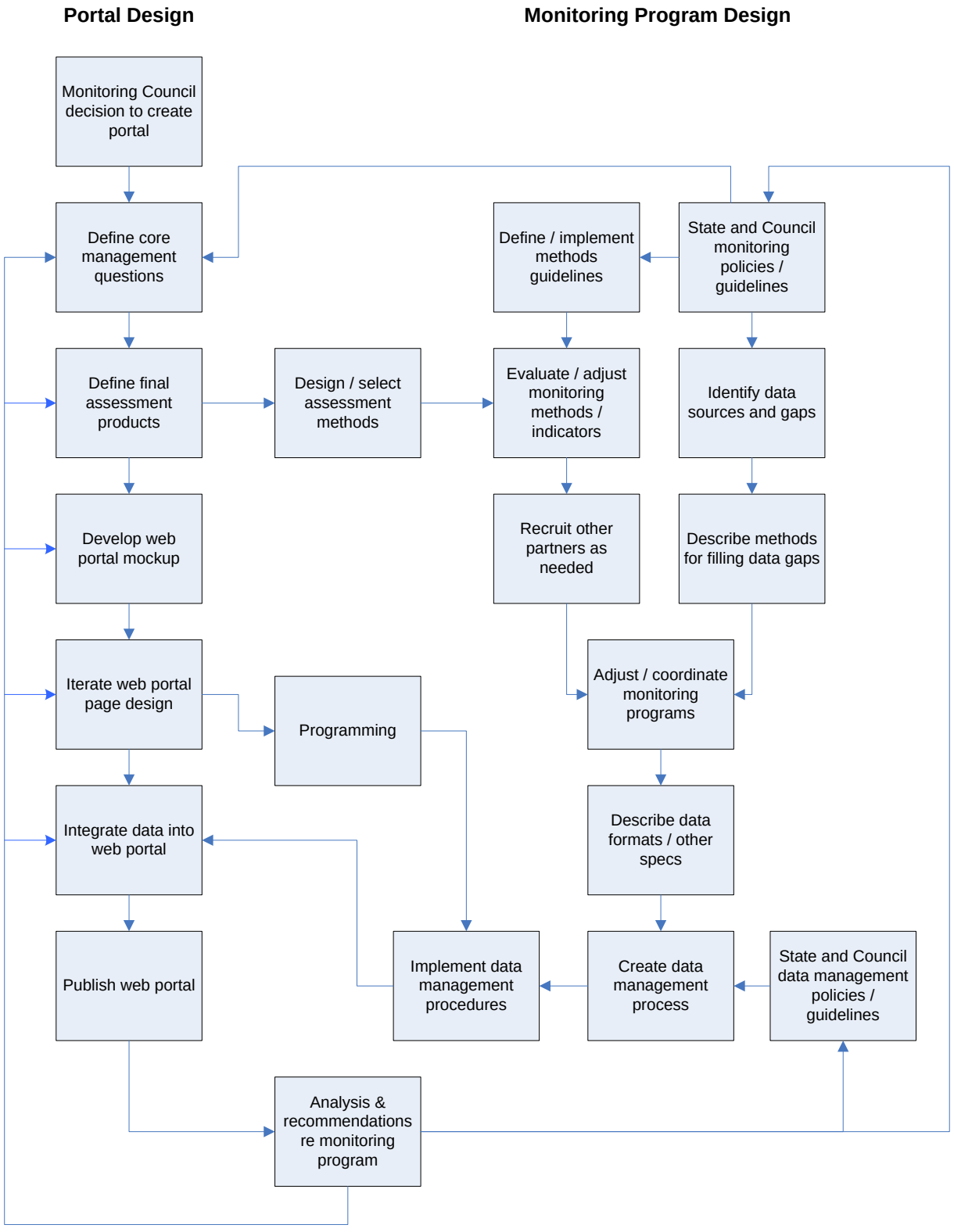

Figure 9. *The process for integrating the design and implementation of individual theme-based web portals with their related monitoring and assessment programs.*

- A single, global point of entry
- Coordination of monitoring and assessment methods that achieves an appropriate balance between statewide consistency and regional flexibility
- Database and data management guidelines necessary for more efficient data access and integration

3.2.1 Start-up: Years 1 – 2

The start-up phase encompasses 2009 and 2010 and continues and expands the foundation building efforts begun in 2009, targeting a series of specific milestones. Work during this phase focuses primarily on completing the development of policies and procedures, solidifying relationships with key partners, and expanding initial web-portal development efforts.

Organizational structure: The Monitoring Council will continue to develop its governance structure and formalize it as needed. Written procedures will be established for recruiting replacement members and for deciding whether and how the Monitoring Council's size and makeup could be adjusted. The respective roles of the Monitoring Council and its workgroups will be described in more detail and a format for a written agreement developed. The Monitoring Council will also further examine the three types of authority described in CWQMC 2008 for ensuring recommendations, especially regarding coordination, are implemented, i.e., voluntary adoption, permit/grant/contract requirements, and legislation. In addition, the Monitoring Council may enter into a variety of cooperative agreements with agencies and other sponsors of monitoring programs. These mechanisms will be described more completely and procedures investigated for implementing them in different situations.

The Monitoring Council will continue its structured outreach to potential partners in State and federal government, local and regional agencies, and non-governmental and volunteer entities. Outreach will be targeted primarily at entities directly involved in monitoring and assessment related to the highest priority themes and subthemes. However, the Monitoring Council will also respond to spontaneous overtures from other potential partners to investigate whether these may provide unexpected opportunities to achieve progress toward the Monitoring Council's objectives. Further developing relationships with upper-level management in key partner agencies and departments will be a high priority, as will developing a closer working relationship with managers involved in developing the State's data management policies.

The Monitoring Council will assess the workload associated with the developing program described here and determine the staffing requirements needed to support this effort. This will contribute to budget change proposals for staff and contract resources.

Monitoring program performance measures: The Monitoring Council will develop more detailed descriptions of the six monitoring program performance measures (Table 2) and a systematic method for applying them to a wide range of web portals and the monitoring and assessment programs on which they are based. It will be important to improve the consistency of the performance measures and to determine whether the existing qualitative scoring system is adequate. The Monitoring Council will develop a plan for applying the performance measures to its web portals and their related monitoring and assessment programs on a regular schedule in order to assess progress and highlight specific areas for improvement. The plan will include a means of reporting results to the program's staff, partners, and audiences.

Single, global point of entry: The Monitoring Council will maintain its main *My Water Quality* web site, complete the initial phase of development for the first three prototype portals, identify and begin needed enhancements to the prototype portals, and begin development of the next set of web portals. This will involve establishing and tasking workgroups, developing core management questions, and embarking on the other tasks described in Section 3.1 and Figure 9.

Coordination: Based on its experience with the three prototype portals, the Monitoring Council will develop a more detailed approach to coordination of those aspects of monitoring programs needed to support statewide assessments of the core management questions for each web portal. This will involve developing procedures to assist workgroups in using the monitoring program performance measures to identify data gaps and methods inconsistencies that undermine the breadth and comparability of monitoring data and assessment results. It will also require the Monitoring Council to develop procedures for resolving these issues and tracking workgroups' progress toward such resolution. At another level, the Monitoring Council will identify other sources of inconsistency that cut across individual web portals and that will require more direct involvement by the Monitoring Council to address.

Data management: The Monitoring Council will stay abreast of the State's developing data management policies and ensure adequate channels of communication are in place. The Monitoring Council will also use development of the prototype web portals to identify data management issues that must be resolved at a higher level, implement the initial phase of CEDEN, and identify policies and procedures needed to ensure that data management methods and the reporting web portals are both compatible with CEDEN and make effective use of its capabilities. In particular, the Monitoring Council will establish a data management workgroup with appropriate representation to achieve the goals outlined in Section 2.2.5. As with the theme-specific workgroups, the data management workgroup will operate under a charge established by the Monitoring Council.

3.2.2 Development: Years 2 – 8

The development phase will encompass 2010 to 2016 and will focus on fully implementing the policies and procedures defined in the Start-up phase, revising them as experience dictates, and moving into the routine development and publication of the series of theme-based web portals. An important function for the Monitoring Council during this phase will be to identify funding sources and obtain needed funding.

Organizational structure: The Monitoring Council will fully implement all policies and procedures developed during the Start-up phase, including establishing more formal working arrangements with the theme-specific workgroups, conducting routine outreach and relationship building/maintenance with existing and potential partners, and formalizing mechanisms for ensuring that coordination policies are fully implemented and complied with.

Monitoring program performance measures: The Monitoring Council will implement regular assessments of its web portals and their related monitoring and assessment programs and report the results to program staff, partners, and audiences. In addition, the Monitoring Council will routinely apply the performance measures to high priority themes and subthemes as they are being considered for development, in order to produce more detailed and accurate estimates of effort required for web portal development.

Single, global point of entry: The Monitoring Council will stabilize the design of its *My Water Quality* main portal entry website and complete the full implementation of all features intended to support data access, analysis, visualization, downloading, and other assessment applications. The second set of web portals will be completed and a series of workgroups established to continue the regular production, maintenance, and enhancement of additional web portals.

Coordination: The Monitoring Council will make the use of the performance measures to identify inconsistencies at the level of individual themes and web portals a standard workgroup practice, and will support, encourage, and require workgroups to resolve inconsistencies and will track each workgroup's progress toward needed coordination. The Monitoring Council will also work with its partners to develop more global monitoring guidelines that cut across multiple themes and will publish these standards to all workgroups and incorporate them into the performance measures.

Data management: In coordination with the Monitoring Council, SWAMP will complete the implementation of CEDEN, including the regional data centers and will publish documentation, policies, and procedures necessary for maintaining the system. The Monitoring Council will also ensure that the data management workgroup stays abreast of new directions in the State's data management policies, as well as of evolving monitoring requirements and users' needs that call for new system capabilities.

3.2.3 Long-term maintenance: Years 9 – 10 (and beyond)

The long-term maintenance phase will extend from 2017 forward and will focus on maintaining and adapting the policies, procedures, funding, and the technical infrastructure needed to ensure the web portals and theme-specific workgroups remain both operational and relevant. This will involve periodically reevaluating all aspects of the Monitoring Council's five-part solution to assess their continued relevance and performance.

3.3 Budget

Accomplishing the goals and activities outlined in Sections 3.1 and 3.2 will require funding at both the Monitoring Council and the theme-specific workgroup levels, that is, for both the left- and right-hand sides of Figure 8. The Monitoring Council's funding strategy is based on its experience with the three prototype portals as well as experience gained by other monitoring and assessment programs that have promoted coordination at regional and statewide scales.

3.3.1. Funding strategy

The Monitoring Council assumes that the bulk of funding for work on individual themes and subthemes (the left-hand side of Figure 8) will come from the participating entities. This bottom-up support will involve varying combinations of ongoing monitoring efforts, in-kind support, outside grants, offsets to existing monitoring requirements, and savings over time from improved coordination and efficiency. Funding for Monitoring Council activities represented on the right-hand side of Figure 8, namely coordinating across themes, developing and maintaining infrastructure, and catalyzing start-up efforts, could come from the budgets of Cal/EPA and the Natural Resources Agency, contributions or grants from other agencies, a portion of monitoring funds allocated to meet grant or regulatory requirements, and/or new fee structures intended to directly support the Council's activities. An important aspect of the Monitoring Council's role will be to ensure that theme-specific workgroups identify and achieve the cost savings possible through increased coordination, efficiency, and access to data.

Elements of this funding strategy have been successfully implemented in many instances throughout the state. At the watershed scale, regional monitoring and assessment programs in the San Gabriel River and Los Angeles River watersheds have been funded by in-kind staff support and by resources made available through achieving efficiencies in existing compliance monitoring programs. At a larger scale, the Southern California Bight Program funds its periodic (once every four years), large-scale monitoring through a combination of compliance monitoring offsets, direct funding by participants, in-kind staff support, and core funding to the Southern California Coastal Water Research Project (SCCWRP). In northern California, the Regional Monitoring Program (RMP) in San Francisco Bay is funded by direct contributions from a wide range of participants. In all four of these examples, regulatory compliance monitoring was reduced and the resources redirected to strengthen regional monitoring efforts. At the statewide level, the three prototype portals illustrate the feasibility of this strategy by combining program-specific funding from a variety of sources with the State Water Board's direct support of the Monitoring Council's activities.

The Monitoring Council believes that several important factors will motivate participation in and support for the theme-specific workgroups and portal design efforts. First, there is visible and growing interest at the highest levels of state and federal agencies in expanded regional and statewide monitoring and assessment. This will provide a rationale and direction for coordinating efforts across programs and agencies. As just one example, the U.S. Fish and Wildlife Service recently initiated a Landscape Conservation Cooperative (LLC) for California that encompasses much of the state with the goal of identifying, mapping, assessing, and conserving a number of key habitat types.

Second, many of the core questions that structure the portals respond directly to regulatory and resource management drivers. Data and assessments that are better coordinated and of higher quality, and that are produced more efficiently, will therefore be valuable to local permittees, management agencies, and public interest groups. For example, the Monitoring Council's Safe to Swim portal was quickly adopted by the Beach Water Quality Workgroups in southern California and the Central/Northern California Ocean and Bay Water Quality Monitoring Group, made up of local health departments, permittees and management agencies. Once the portal's initial design was completed, Heal the Bay, a public interest group, quickly agreed to make its beach report card website accessible through the Monitoring Council's portal. Because they will provide ready access to data and assessments that are coordinated at larger scales, the web portals will also prove useful to planning efforts such as those required for updating municipalities' general plans, thereby expanding the audience for monitoring results. The portals, and the integrated data and assessment tools they are intended to provide, will also dramatically improve the accuracy and efficiency of the State's integrated Clean Water Act (303d/305b) reporting process.

Third, the Monitoring Council's approach to portal development provides an opportunity for monitoring programs to increase their efficiency, broaden the accessibility and utility of their data, and contribute to broader and more complex assessments and synthesis through improved coordination. The Monitoring Council's experience with the three prototype portals and the positive response it received from representatives involved in the next set of themes (i.e., rivers and streams, rocky intertidal, estuaries, ocean waters) validate the strength of this motivation.

3.3.2. Estimated budgets

As previously mentioned, the overall budget needed to accomplish the Monitoring Council's recommended Comprehensive Monitoring Program Strategy will include two main elements: funding for the Monitoring Council's coordinating role and funding for efforts of the individual theme-specific workgroups, with this latter element generated primarily by the entities participating in each theme-specific workgroup.

Based on experience with the three prototype portals and SWAMP's experience developing CEDEN, the Monitoring Council's core coordinating role will require:

- Four fulltime coordinator staff for the first four years of the program, with two devoted to outreach and workgroup coordination and two devoted to directly assisting in developing software for portals and integrating them into an overall data management system; a fifth staff person to be added in Year 5 to assist with workgroup coordination
- $50,000 per year per workgroup for direct support of ongoing workgroup efforts at monitoring coordination, development of improved assessment tools, and implementation of enhanced data management capabilities
- $10 million over ten years for information technology infrastructure

The second main funding element is related to efforts of the theme-specific workgroups. Their number (up to 30, organized into the four main categories shown in Figure 5), diversity, and differing degrees of development make it difficult to accurately estimate the cost for accomplishing the Monitoring Council's strategic goals for each theme and subtheme. However, the Monitoring Council does have recent experience with two examples that bracket the likely range of effort involved in establishing portals and ensuring that monitoring and assessment programs meet the monitoring program performance measures described in Section 2.2.2. Developing the Safe to Swim portal for ocean beaches required a relatively low level of effort by the Monitoring Council that involved building the portal itself, linking to existing datasets and assessment tools, and completing some minor reprogramming of data paths. The cost for this initial effort amounted to approximately $50,000 divided roughly 1/3 and 2/3, respectively, between portal conceptualization and GIS/web development. As explained in Section 1.1 above, the Safe to Swim portal development effort highlighted the need for an improved data management system to allow data to flow more easily among those conducting the monitoring, state and federal regulatory agencies, and the portal. The new system will provide more real-time information access via the portal and is projected to cost an additional $40,000 to develop. While incorporating data from inland swimming sites and improving data management and assessment tools will require additional effort, the $90,000 needed for this initial version of the portal is probably representative of the level of effort needed to create a portal for a theme or subtheme with an existing statewide data management infrastructure and functioning assessment tools.

At the other extreme, the Wetlands workgroup has identified (Appendix 6) a substantial amount of effort needed to implement coordinated monitoring and assessment protocols and to conduct the baseline mapping required for statewide assessment. The workgroup has estimated one-time startup costs related to portal development at $1.2 million (Table 1 of Appendix 6).

The Monitoring Council has generated a rough estimate of overall workgroup costs required to develop the initial versions of working portals based on coordinated monitoring and assessment programs by assuming that 1/3 of portals will involve a level of effort equivalent to the Safe to Swim portal, 1/3 will require effort equal to that estimated by the Wetlands workgroup, and 1/3

Table 5. *Assumptions underlying the budget estimate in Figure 10, below. The number of new portals per year is shown as the number of low, medium, and high cost portals at, respectively, $90,000, $650,000, and $1.2 million per portal.*

	Year									
Costing factor	1	2	3	4	5	6	7	8	9	10
# new portals	2, 2, 0	0, 1, 1	1, 1, 0	2, 1, 1	1, 1, 2	1, 2, 2	2, 1, 2	1, 1, 2	0	0
# workgroups	4	6	8	12	16	21	26	30	30	30
# coordinator staff	4	4	4	4	5	5	5	5	5	5

will fall midway between these two extremes. This is equivalent to 10 portals at $90,000, 10 at roughly $1.2 million, and 10 at approximately $650,000. Basic costing assumptions are shown in Table 5 and estimated annual costs for ten years in Figure 10. Table 5 and Figure 10 show an increasing level of effort, peaking in years 6 and 7 and then declining to a maintenance level.

It is important to reiterate that the budget discussion here addresses only the resources needed to implement the Monitoring Council portion of effort involved in implementing the theme-based web portals. Recommendations regarding the funding and staffing levels needed by the Monitoring Council's partner member agencies to develop and implement the water quality monitoring and assessment programs needed to supply information to these portals have been deferred to future deliberations.

3.3.3. Contracting and implementation constraints

The Monitoring Council's funding strategy and its collaborative, workgroup approach to assessment and portal development depends on the Monitoring Council's ability to allocate

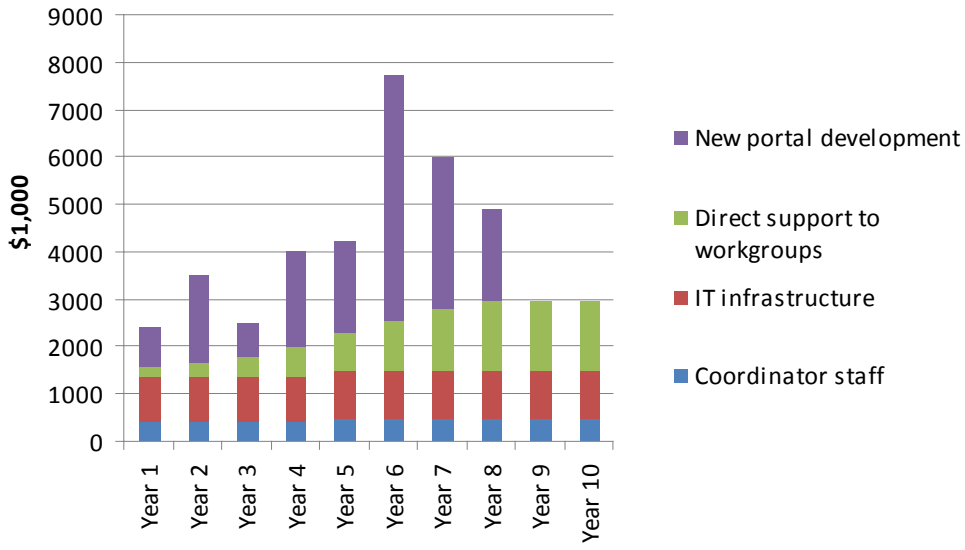

Figure 10. *Summary budget estimate for Monitoring Council activities and portal development over the ten-year period encompassed by the Comprehensive Monitoring Program Strategy.*

funds to a variety of partners, both inside and outside of State agencies, and to build and maintain long-term relationships with these partners. Partners may be other state and federal agencies, academic scientists, universities, non-academic research entities, and private consultants. The past experience of programs within both Cal/EPA and the Natural Resources Agency has demonstrated that policies and procedures put in place by the Control Agencies (Department of Finance, Department of General Services, Department of Personnel Administration, Legislative Analyst's Office) have created contracting and implementation constraints that can severely limit the Monitoring Council's ability to fulfill its objectives.

Such constraints, as documented in the 2006 *Review of California's Surface Water Ambient Monitoring Program (SWAMP)* by the Scientific Planning and Review Committee, (SPARC 2006) include:

- Short limits on contract terms (one year for service contracts, three years for others)
- Long delays in implementing contracts
- A low ($5000) limit on sole-source contracts
- Strict limits on subcontracting
- A preference for low-bid proposals that ignores technical and scientific specialization and quality
- Unpredictable and increasing overhead costs, particularly for contracts managed through the California State University system
- Prohibitions on out-of-state travel that restrict the ability of technical staff to exchange ideas and learn from the experience of practitioners outside of California

The Monitoring Council concurs with the SPARC's findings that contract reform is needed to improve the effectiveness and efficiency of California's water quality monitoring and assessment programs.

Chapter 4: Recommendations

In the past year, the Monitoring Council has begun implementing the recommendations contained in its 2008 report to the Secretaries of Cal/EPA and the California Natural Resources Agency (CWQMC 2008). This effort focused on implementing three prototype theme-based web portals and has validated the efficacy of the Monitoring Council's overall approach to addressing the problems detailed in the legislation (CWQMC 2009, see Appendix 2), as well as the need for an entity such as the Monitoring Council to play a central coordinating role. The past year's experience has therefore provided the basis for the recommended Comprehensive Monitoring Program Strategy described in this document.

In order for the recommended Comprehensive Monitoring Program Strategy to be successfully implemented, the Monitoring Council:

- Requests that the Agency Secretaries endorse the Monitoring Council's vision of theme-specific workgroups that operate under the Monitoring Council's guidance and make data and assessment results available through a coordinated series of web portals
- Requests that the Agency Secretaries endorse a central coordinating and facilitating role for the Monitoring Council that will be continued over the long term
- Requests that the Agency Secretaries continue to support the Monitoring Council's activities and require their boards, departments, offices, and commissions to actively participate in relevant workgroups
- Requests that the Agency Secretaries support the acquisition of long-term funding needed for implementation of the Comprehensive Monitoring Program Strategy
- Recommends that the Department of Public Health be invited to sign the existing MOU between Cal/EPA and the Natural Resources Agency
- Recommends that the monitoring and assessment efforts of SWAMP (sew Appendix 5) be integrated into the Monitoring Council's recommended Comprehensive Monitoring Program Strategy, with SWAMP accepting primary responsibility for:
  - statewide assessment of the health of aquatic ecosystems in streams and rivers, including development of methods for bioassessment and biological objectives
  - statewide assessment of fish tissue contamination in both freshwater and marine habitats and impacts and threats to fishing-related beneficial uses
  - development of appropriate QA/QC protocols and providing assistance to others, including the QA Help Desk
  - continued implementation of the CEDEN network and associated data management functions and providing assistance to others, including the Data Management Help Desk
  - providing assistance to local and regional citizen monitoring efforts through its Clean Water Team and regular informational webinars of the California Water Quality Monitoring Collaboration Network
- Recommends that the monitoring of state- and federally-funded water quality and ecosystem improvement projects be coordinated and enhanced to ensure that the effectiveness of such projects is evaluated and that the generated data are available for use in larger-scale assessments. The Monitoring Council will enlist the support and cooperation of granting agencies to evaluate options and implement the necessary changes.
- Recommends that the Monitoring Council continue to coordinate our efforts with those of the National Water Quality Monitoring Council

- Recommends that the Monitoring Council should work with its member agencies, the Control Agencies, the Governor's Office, and the Legislature to identify ways to address the contracting and implementation constraints summarized in Section 3.3.3 above

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Appendix 1: SB 1070 Requirements Matched to Recommended Comprehensive Monitoring Program Strategy Components

The following table illustrates which aspects of the Monitoring Council's efforts to date address each specific requirement of SB 1070.

SB 1070 requirement	Detail	Status
Public information program on water quality	CWC §13167. … place and maintain on its Internet Web site a public information file on water quality monitoring, assessment, research, standards, regulation, enforcement, and other pertinent matters	Task of the State Water Board; begun with creation of the Monitoring Council's *My Water Quality* website and initial theme-based web portals and the State Water Board's on-line Performance Report
Memorandum of Understanding	CWC §13181(a)(1) … the California Environmental Protection Agency and the [Natural] Resources Agency, on or before December 1, 2007, to enter into a memorandum of understanding for the purposes of establishing the California Water Quality Monitoring Council, which the state board would be required to administer.	MOU signed November 26, 2007 Monitoring Council held first meeting June 23, 2008
Monitoring Inventory	CWC §13181(c) The monitoring council shall undertake and complete, on or before April 1, 2008, a survey of its members to develop an inventory of their existing water quality monitoring and data collection efforts statewide and shall make that information available to the public.	Preliminary inventory completed June 28, 2008; updated as an appendix of the Recommendations Report of December 1, 2008
Recommendations report	CWC §13181(b) The monitoring council shall report, on or before December 1, 2008, to the California Environmental Protection Agency and the [Natural] Resources Agency with regard to its recommendations for maximizing the efficiency and effectiveness of existing water quality data collection and dissemination, and for ensuring that collected data are maintained and available for use by decision makers and the public.	Recommendations report submitted December 1, 2008
Recommend improvements to monitoring	CWC §13181(a)(4) The monitoring council shall review existing water quality monitoring, assessment, and reporting efforts, and shall recommend specific actions and funding needs necessary to coordinate and enhance those efforts.	First set of recommendations presented in December 1, 2008 report; more extensive recommendations are contained in December 2010 Comprehensive Monitoring Program Strategy report (to which this is an appendix)

SB 1070 requirement	Detail	Status
	CWC §13181(a)(5)(A) The recommendations shall be prepared for the ultimate development of a cost-effective, coordinated, integrated, and comprehensive statewide network for collecting and disseminating water quality information and ongoing assessments of the health of the state's waters and the effectiveness of programs to protect and improve the quality of those waters.	See December 2010 Comprehensive Monitoring Program Strategy report (to which this is an appendix)
	CWC §13181(a)(5)(B) For purposes of developing recommendations pursuant to this section, the monitoring council shall initially focus on the water quality monitoring efforts of state agencies, including, but not limited to, the state board, the regional boards, the department, the Department of Fish and Game, the California Coastal Commission, the State Lands Commission, the Department of Parks and Recreation, the Department of Forestry and Fire Protection, the Department of Pesticide Regulation, the State Department of Health Services, and the Department of Toxic Substances Control.	See December 2010 Comprehensive Monitoring Program Strategy report (to which this is an appendix)
	CWC §13181(a)(5)(C) In developing the recommendations, the monitoring council shall seek to build upon existing programs rather than create new programs.	See December 2010 Comprehensive Monitoring Program Strategy report (to which this is an appendix)
	CWC §13181(a)(6) … the monitoring council shall formulate recommendations to accomplish both of the following: (A) Reduce redundancies, inefficiencies, and inadequacies in existing water quality monitoring and data management programs in order to improve the effective delivery of sound, comprehensive water quality information to the public and decision makers.	See December 2010 Comprehensive Monitoring Program Strategy report (to which this is an appendix)
	(B) Ensure that water quality improvement projects financed by the state provide specific information necessary to track project effectiveness with regard to achieving clean water and healthy ecosystems.	See Section 2.2.6 of December 2010 Comprehensive Monitoring Program Strategy report (to which this is an appendix) for initial discussion of this issue
Develop a comprehensive monitoring program strategy	CWC §13181(e) … the state board shall develop, in coordination with the monitoring council, all of the following: (1) A comprehensive monitoring program strategy that utilizes and expands upon the State's existing statewide, regional, and other monitoring capabilities and describe how the State will develop an integrated monitoring program that will serve all of the State's water quality monitoring needs and address all of the State's waters over time.	See December 2010 Comprehensive Monitoring Program Strategy report (to which this is an appendix)

SB 1070 requirement	Detail	Status
	The strategy shall include a timeline not to exceed 10 years to complete implementation.	See Chapter 3 of the December 2010 Comprehensive Monitoring Program Strategy report (to which this is an appendix)
	The strategy shall identify specific technical, integration, and resource needs, and shall recommend solutions for those needs.	See December 2010 Comprehensive Monitoring Program Strategy report (to which this is an appendix); under development through the efforts of individual theme-specific workgroups
	CWC §13181(f) … identify the full costs of implementation of the comprehensive monitoring program strategy developed pursuant to subdivision (e), and shall identify proposed sources of funding for the implementation of the strategy, including federal funds that may be expended for this purpose.	Task of the State Water Board; see Section 3.3 of the December 2010 Comprehensive Monitoring Program Strategy report (to which this is an appendix) for initial coordination cost estimates
Develop an agreement on Indicators	CWC §13181(e)(2) Agreement, including agreement on a schedule, with regard to the comprehensive monitoring of statewide water quality protection indicators that provide a basic minimum understanding of the health of the state's waters. Indicators already developed pursuant to environmental protection indicators for statewide initiatives shall be given high priority as core indicators for purpose of the statewide network.	Under development through the efforts of individual theme-specific workgroups; California Wetland Monitoring Workgroup has developed *Tenets of a Statewide Wetland and Riparian Monitoring Program* (see Appendix 6 of this report)
Develop a Quality Assurance Management Plan	CWC §13181(e)(3) Quality management plans and quality assurance plans that ensure the validity and utility of the data collected.	Under development through the efforts of individual theme-specific workgroups, complemented by the SWAMP and CEDEN quality assurance efforts; see *SWAMP Monitoring and Assessment Strategy* in Appendix 5 of this report
Develop a method for compiling, analyzing, and integrating readily available information	CWC §13181(e)(4) This is to include data from waste discharge reports; volunteer monitoring groups; local, state, and federal agencies; and state and federal grant recipients of water quality improvement projects.	Under development through the efforts of individual theme-specific workgroups; this will be complemented by the efforts of a planned Data Management Workgroup, which will identify data elements that must be more broadly integrated to address larger scale and more complex questions, and the California Environmental Data Exchange Network (CEDEN); see Section 2.2.5 of this report

Develop an accessible and user-friendly electronic Data Management System	CWC §13181(e)(5) To the maximum extent possible, include the geospatial information on the data sites.	Being implemented on the individual theme-based internet portals and through CEDEN
Develop a method for producing timely and complete water quality reports and lists	CWC §13181(e)(6) The reports and lists required are those required under Sections 303(d), 305(b), 314, and 319 of the Clean Water Act, and Section 406 of the BEACH Act.	Under development as part of the reporting features of individual theme-based internet portals; and the State Water Board's California 303(d)/305(b) Integrated Report
Develop an update of the SWAMP needs assessment	CWC §13181(e)(7) The SWAMP program needs will change in light of the benefits of the increased coordination and integration of information from other agencies and information sources.	See the *SWAMP Monitoring and Assessment Strategy, Assessment Framework, and Needs Assessment* in Appendix 5 of this report

Appendix 2: California Water Quality Monitoring Council Annual Progress Report, December 2009

California Water Quality Monitoring Council Annual Progress Report December 2009

Executive Summary

The California Water Quality Monitoring Council has met key benchmarks in the legislation (Senate Bill 1070; Kehoe, 2006) by completing a memorandum of understanding between Cal/EPA and the California Natural Resources Agency in November of 2007 and by submitting a key recommendations report in December of 2008. In early 2010, the Monitoring Council will submit its comprehensive monitoring program strategy for meeting most of the legislation's goals over a ten-year timeframe. Specific accomplishments also include:

- Creating four theme-based workgroups that validated the broad applicability of the collaborative workgroup approach to coordination and web portal development
- Clearly identifying, through the workgroup process, gaps in data acquisition, monitoring coverage, and management responsibility
- Implementing a single point of access, through the Monitoring Council's *My Water Quality* web page, to organized monitoring data, assessment products, and useful background information
- Developing and releasing two theme-based web portals (Safe to Swim and Safe to Eat Fish and Shellfish), with two additional portals scheduled for early 2010, (Wetlands and Safe to Drink Groundwater). These are organized around a small set of core, high-priority questions that provide ready access to monitoring and assessment results
- Developing draft design guidance for future web portals, emphasizing a question-driven structure, map-based assessment products, and direct access to underlying data
- Conducting successful preliminary discussions with several additional monitoring efforts that will provide the focus for the next phase of web portal development
- Achieving tangible improvements in coordination among local, state, federal, and non-governmental agencies
- Making progress on developing and implementing coordinated and/or standardized monitoring designs for beach water quality sampling, seafood tissue contaminant assessment, and wetlands project tracking and overall assessment
- Demonstrating how the web portals, based on improved data acquisition and integration, can increase the efficiency of both routine and ad hoc reporting

The Monitoring Council's next steps include completing the comprehensive monitoring program strategy report; formalizing relationships with the next set of theme-based workgroups; and further developing a statewide data management strategy in cooperation with Cal/EPA, the Natural Resources Agency, and the Office of the Chief Information Officer. In addition, the Monitoring Council will continue to provide logistical and management support to existing workgroups as they address issues identified in 2009. This process will require that the Monitoring Council continue to develop and define its coordinating and advocacy role with respect to other agencies. Finally, the Monitoring Council will use the more detailed comprehensive strategy as a basis for funding requests needed to support the full implementation of the strategy called for in the legislation.

Foreword

This report is the first in a series of annual reports summarizing the California Water Quality Monitoring Council's progress toward implementing the requirements of Senate Bill 1070 (Kehoe, 2006). SB 1070 identified a number of goals and actions intended to improve the efficiency and effectiveness of water quality and associated aquatic ecosystem monitoring, and to provide broader access to monitoring data and assessment results. The legislation required that the California Environmental Protection Agency (Cal/EPA) and the California Natural Resources Agency enter into a Memorandum of Understanding establishing the California Water Quality Monitoring Council (Monitoring Council), to be administered by the State Water Resources Control Board. The MOU was signed November 26, 2007. SB 1070 also requires that "the monitoring council shall review existing water quality monitoring, assessment, and reporting efforts, and shall recommend specific actions and funding needs necessary to coordinate and enhance those efforts." The legislation goes on to say, "[t]he recommendations shall be prepared for the ultimate development of a cost-effective, coordinated, integrated, and comprehensive statewide network for collecting and disseminating water quality information and ongoing assessments of the health of the state's waters and the effectiveness of programs to protect and improve the quality of those waters." These recommendations were presented by the Monitoring Council in its December 1, 2008 to Cal/EPA and the Natural Resources Agency, which included the following commitment:

> On an annual basis, beginning in December 2009, the Monitoring Council will report back to the agency secretaries on progress made in implementing the Council's vision, and in a manner that supports Cal/EPA's conduct of a triennial audit of the effectiveness of the comprehensive monitoring program strategy, as called for in the legislation.

This report provides a summary of progress achieved since December 2008 in implementing the recommendations contained in the December 2008 report; a companion report targeted for March 2010 will present the Monitoring Council's comprehensive monitoring program strategy.

The Monitoring Council's Five-Part Solution

SB 1070 described a set of fundamental issues that have prevented the State from making the most effective and efficient use of the extensive water quality monitoring conducted by permittees; local, state, and federal agencies; and others such as citizen monitoring groups. The Monitoring Council believes that a primary focus on technical tools, though important, would not directly address these issues because it would not be driven by end users' perspectives. The Monitoring Council's solution to the monitoring coordination and data access problems therefore is centered on delivering data to those people who need it in ways that directly address their key questions. The essential components of this concept include a template for web-driven, user-oriented data access portals that are developed and implemented by a series of issue-specific workgroups operating under the Monitoring Council's overall guidance and approval.

This process will promote efficiency by highlighting where (and only where) improved coordination of monitoring methods and data management approaches is necessary for meeting users' needs. Developing these coordinated methods and approaches will be the responsibility of the issue-specific workgroups, working within general guidelines set by the Monitoring Council. The five elements necessary for realizing this vision include:

- An organizational structure built on decentralized, issue-specific workgroups that operate within common policies and guidelines defined by the Monitoring Council
- A set of performance measures which each theme-based workgroup will use to evaluate, coordinate and enhance monitoring, assessment, and reporting efforts

- A single, web-based, global point of entry to water quality data, and a design template for the complete set of theme-based web portals
- Coordination of monitoring and assessment methods that achieves an appropriate balance between statewide consistency and regional flexibility
- Database and data management protocols necessary for more efficient data access and integration

Progress to Date

The following sections describe progress achieved during 2009 for each of the five elements of the Monitoring Council's strategy and demonstrates how these accomplishments provide a proof of concept of the strategy and lay the groundwork for further progress in the future.

Issue-specific workgroups

Collaborative theme-based workgroups are a core piece of the Monitoring Council's strategy and the vehicle through which much of the Monitoring Council's efforts to improve monitoring coordination and access to data will be accomplished. In 2009, the Monitoring Council, building on existing efforts, identified four prototype theme-based workgroups (Safe to Swim, Safe to Eat Fish and Shellfish, Wetlands, Safe to Drink Groundwater) that succeeded in validating the utility and broad applicability of the workgroup approach in a range of technical, regulatory, and institutional settings. This initial set of workgroups leveraged existing efforts at regional and statewide coordination, provided a mechanism for enlisting additional participants, and broadened working relationships among state and federal agencies, permittees, researchers, and others such as NGOs. As described in the following paragraphs, workgroups also identified key gaps in data acquisition, monitoring coverage, and management responsibility that helped to prioritize additional efforts planned for the future. The success of the four prototype workgroups has led to fruitful discussions with groups active in other areas that will shortly lead to the formal establishment of additional workgroups. The following paragraphs illustrate this progress with representative examples.

The Safe to Swim workgroup built on the existing Beach Water Quality Workgroup for southern California and the Central/Northern California Ocean and Bay Water Quality Monitoring Group, integrating them into a more cohesive statewide entity that has formally agreed to manage the continued development and maintenance of the web portal in conjunction with the State Water Board, U.S. EPA, the Southern California Coastal Water Research Project (SCCWRP), and Heal the Bay. The Safe to Swim workgroup accelerated coordination among permittees, county public health agencies, environmental groups, and the State Water Board. However, these efforts, and the data management, assessment, and reporting tools built to support them, have historically focused primarily on ocean beaches. The Monitoring Council's broader emphasis on a statewide perspective resulted in the identification of other monitoring efforts, particularly those focused on inland freshwater swimming locations, that must be included in the web portal in order to present a truly statewide picture of swimming conditions (Figure 1). Future efforts of the Safe to Swim workgroup will focus on filling these gaps in data acquisition and data integration. In addition, portal development caused the workgroup to recognize that the existing beach water quality and closure/posting data management structure was in need of an overhaul. As a result, a new Beach Watch database and data sharing protocols will be developed over the next year at SCCWRP to enhance the flow of data from county health agencies to the State, U.S. EPA, Heal the Bay, and the Safe to Swim portal. By enhancing the ability of data generators to manage their data more easily, the new system is expected to encourage more real-time data availability and streamline reporting efforts.

The Safe to Eat Fish and Shellfish workgroup built on the existing Bioaccumulation Oversight Group (BOG), which has become an integral part of statewide assessments of fish and shellfish tissue contamination, coordinated by the State Water Board's Surface Water Ambient Monitoring Program (SWAMP). These efforts include a 2007 – 2008 survey of 280 lakes and reservoirs, and an upcoming survey of coastal waters being coordinated with the Office of Environmental Health Hazard Assessment (OEHHA), the Department of Fish and Game, the San Francisco Estuary Institute (SFEI), and SCCWRP. SWAMP's success at bringing these parties together led to creation of the BOG, which has formally agreed to manage the continued development and maintenance of the Monitoring Council's Safe to Eat web portal. As an example of this improved coordination, the statewide lakes survey produced data that OEHHA used in 2009 to help update existing fish consumption advisories. The workgroup also acted as a vehicle, with Monitoring Council involvement, for crafting a more comprehensive and integrated set of information products for managers, the public, and other users (see *Combining Multiple Agency Perspectives*, next page).

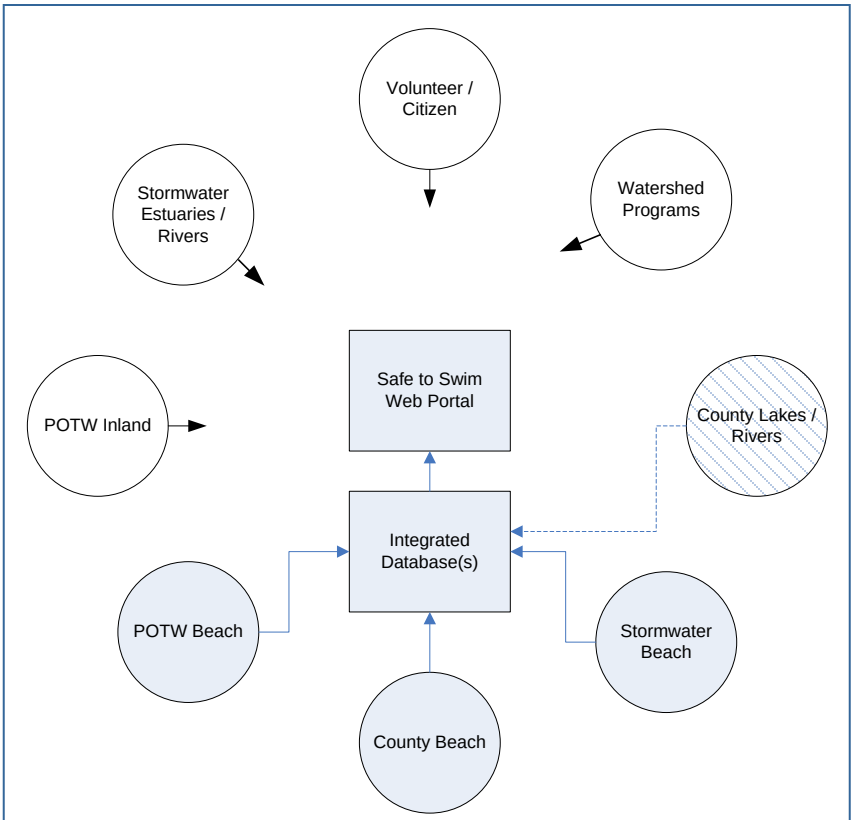

Figure 1. *Schematic illustration of the categories of monitoring programs that produce data relevant to the Safe to Swim web portal. Past efforts at collecting monitoring data in an integrated statewide database have focused on ocean beaches, and some few county-level monitoring programs at lakes and rivers. Data from other significant freshwater monitoring efforts have yet to be addressed. The workplan for this theme therefore includes efforts to incorporate data flows from these remaining program types into the web portal.*

The Wetlands workgroup also built on an existing effort, the California Wetlands Monitoring Workgroup (CWMW) that includes over 20 state, federal, and local entities, both public and private. This workgroup has made substantial progress toward including the large number of agencies involved in wetland monitoring, restoration, and management and is the only venue where these entities come together to collaborate on such issues. The workgroup has achieved important agreements on defining standardized wetland definitions, monitoring approaches, and assessment and reporting methods (see Coordination and Standardization, below) that could provide the basis for a statewide wetlands assessment program. However, in defining these approaches, and in preparing a comprehensive report on the State of the State's Wetlands, the workgroup highlighted the lack of a coordinated statewide policy for monitoring and assessing the extent and condition of California's wetlands. Currently, responsibility for various functions is divided among a number of state, federal, and local agencies, with no overarching assessment and reporting framework. In response, the CWMW has assisted in proposing a coordinated management structure that allocates complementary monitoring and assessment functions to the State Water Board,

Department of Fish and Game, Regional Water Boards, and other agencies, including individual wetland project managers.

Creation of the Safe to Drink web portal has focused initially on groundwater, an area where the State Water Board, the Department of Public Health (DPH), the Department of Pesticide Regulation, the Department of Water Resources, the U.S. Geological Survey, and the Lawrence Livermore National Labs have long worked together. However, developing the web portal led them to begin thinking about common ways of accessing and presenting monitoring information, which required creation of an expanded collaborative relationship among the State Water Board's Office of Information Management and Analysis, its Ground Water Quality Branch, and its outside partners. The initial focus of this effort has been to adapt the existing GeoTracker GAMA website toward the Monitoring Council's question-driven user interface and to begin discussions about how to better assess connections between groundwater and drinking water quality. In addition, security concerns prevent displaying the precise location of public drinking water supply wells on the web portal maps. The agencies involved have worked to investigate ways of meeting these security concerns without obscuring other information on the maps and while still providing users with useful information. With this core set of relationships established, the workgroup may expand its membership to include other entities contributing monitoring data, such as the Department of Toxic Substances Control, as well as other users of the system.

Combining Multiple Agency Perspectives

Development of the Safe to Eat Fish and Shellfish web portal, with its goal of providing a single point of access to data and information, highlighted different assessment and data presentation approaches used by the State Water Board and OEHHA. In the past, these differences were reflected in each agency's separate documents and information products, with little or no synthesis or explanation of how the agencies' different perspectives were related.

As the Safe to Eat Fish and Shellfish web portal was being developed, OEHHA staff expressed several significant concerns, especially about the way data and assessment results were portrayed and about the potential for confusion due to the inclusion of multiple perspectives in a single location. Subsequent discussions among the Monitoring Council, OEHHA, the State Water Board, and the BOG helped the Monitoring Council clarify its approach to presenting assessment findings. This resulted in a web portal that displays alternative views of the monitoring data and explains the different but complementary assessment approaches on which they are based.

As a result, managers, the public, and other interested parties can now find, for the first time and in one place, a consolidated set of data, assessment products, and background information related to fish and shellfish consumption. For example, local health agencies and non-governmental agencies now have more streamlined access to information useful in protecting the most vulnerable populations who often include local fish and shellfish in their diet.

However, these discussions about the web portal also highlighted the fact that SWAMP's statewide monitoring surveys, conducted to assess water quality (i.e., patterns of contamination), do not produce the more comprehensive and detailed data OEHHA needs for developing consumption advisories. From OEHHA's perspective, SWAMP's surveys are useful screening tools, but the absence of a mechanism for regularly acquiring this more detailed information is a data gap that limits agencies' ability to fully answer the web portal's core questions.

The initial four workgroups, intended as a proof of concept, have worked as planned to coordinate and expand existing efforts, recruit new participants, highlight data and management gaps, and catalyze solutions to a range of problems. They have also provided the Monitoring Council with opportunities to better define its role in facilitating problem-solving efforts, bringing higher-level management attention to bear where needed, creating policies and procedures to guide workgroup efforts, and engaging the collaboration of non-state entities such as SFEI, SCCWRP, and Heal the Bay. This will be instrumental to future progress as additional themes are targeted for development that do not necessarily have preexisting workgroup structure on which to build. In preparation for the next round of workgroup creation and web

portal development, the Monitoring Council has begun a formal outreach process to other state agencies and departments, and has also held preliminary discussions with a number of existing or nascent regional and statewide monitoring and assessment programs. These include marine rocky subtidal reefs, the Multi-Agency Rocky Intertidal Network (MARINe), harmful algal blooms, kelpbeds, the State Water Board's Sediment Quality Objectives program for enclosed bays and estuaries, SWAMP's Healthy Streams Initiative, and the Interagency Ecological Program (IEP) in the San Francisco Bay / Delta.

Performance measures

The Monitoring Council understands the importance of explicit benchmarks for success, which can be used both to assess the status of themes as they are prioritized for workgroup formation and web portal development and to track progress toward achieving the legislation's goals. In its December 2008 recommendations report, the Monitoring Council identified a set of six performance measures related to:

- Program strategy, objectives, and design
- Indicators, methods, and QA/QC
- Data management
- Consistency of assessment endpoints
- Reporting and access
- Program sustainability

and described specific benchmarks for rating the degree to which each performance measure is being met by individual theme-based monitoring and assessment programs. These performance measures are based on the U.S. EPA's ten design elements for monitoring, assessment, and reporting programs and directly address the legislation's requirements in terms of indicators, quality control, data analysis and integration, data management and access, and reporting. They have provided the conceptual structure for evaluating each workgroup's progress and prioritizing areas where additional development is needed. The Monitoring Council is incorporating the performance measures into its ongoing evaluation of each workgroup's progress and is encouraging workgroups to use them in managing their own individual efforts.

The performance measures provide a standardized framework for evaluating monitoring, assessment, and reporting programs. While such design principles have long been recognized, the Monitoring Council is in a unique position to help ensure they are applied consistently and rigorously across the full range of water quality monitoring and assessment programs statewide.

Single point of entry

A central design feature of the Monitoring Council's approach is that all theme-based web portals, and the water quality data and assessment products they provide, will be accessible through a single, global point of entry. This point of entry has been established as the *My Water Quality* website at http://www.mywaterquality.ca.gov (Figure 2) and two of its web portals have gone "live" and been released to the public: Safe to Swim on July 28 and Safe to Eat Fish and Shellfish on December 8. A Wetlands portal is due to be released in January 2010 and a fourth prototype portal, Safe to Drink Groundwater, is also scheduled to be released in early 2010. The Monitoring Council has been tracking detailed web portal use statistics since August 26. In that period, nearly 2,000 unique visitors created over 16,000 page views primarily on the Safe to Swim web portal, distributed across the separate assessment questions within that theme.

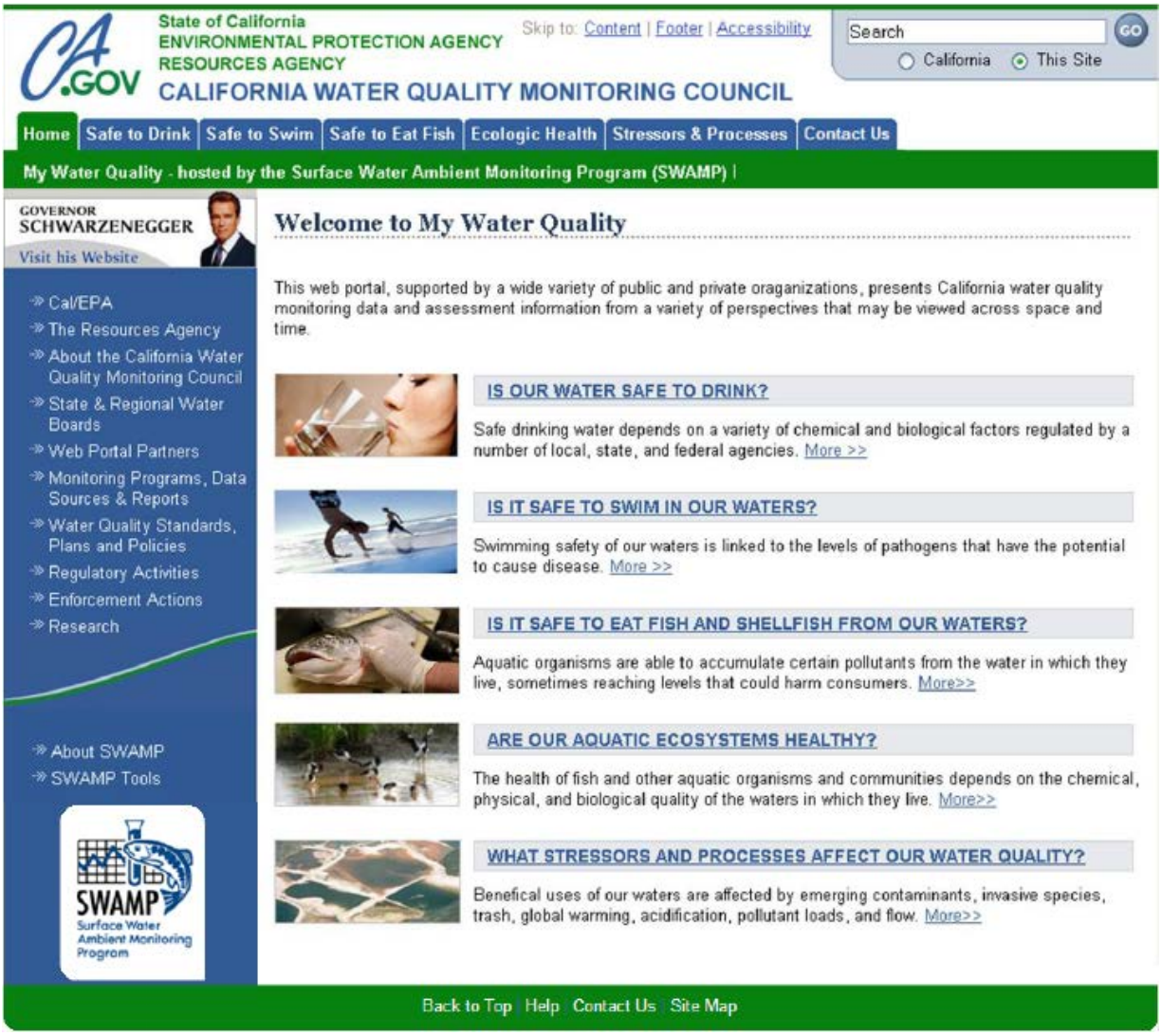

Figure 2. *The Monitoring Council's global point of entry to monitoring and assessment information for all theme-based web portals.*

The Monitoring Council's *My Water Quality* website, and the individual theme-based portals accessible through this global point of entry, are structured around explicit assessment questions that reflect key information needs of managers, scientists, and the public. Where this requires links to databases and websites maintained by other entities, this is accomplished within the question-driven structure of the web portal. This approach enables users to more easily find answers to their concerns and solves the long-standing, fundamental data access problem described in the legislation, namely, that it can be confusing and time consuming to find data, assessment products, and background information relevant to a particular question or issue.

Based on experience with the four prototype web portals, the Monitoring Council is developing guidelines for workgroups to follow as they develop additional web portals and intends to formalize these guidelines early in 2010. The guidelines include structure and content (e.g., question driven, statewide scope, multiple perspectives permitted), format (e.g., map-based interfaces, data download links), and process (e.g., Monitoring Council review and approval). The Monitoring Council intends that these

guidelines promote a consistent look, feel, and functionality across all web portals in order to promote ease of use.

The process of organizing diverse data and information sources into one web portal is helping the Monitoring Council's workgroups to identify opportunities for improved coordination, integration (Figure 1), and streamlining of both monitoring designs and assessment protocols (see *Coordination and Standardization*, below), and to highlight where important data gaps remain. In addition, the availability of the web portals as a single point of entry to data access and reporting tools has begun, as intended, to catalyze improvements to these activities. As discussed under Issue-Specific Workgroups above, for example, the Safe to Swim workgroup, with support from the Monitoring Council, has defined a much more efficient data submission, data management, and reporting procedure. When implemented, this will dramatically improve the efficiency of day-to-day data transfer and integration functions as well as of the State's reporting to U.S. EPA and others on beach water quality. Similarly, full implementation of the Wetlands web portal, with its Wetland Tracker features, will substantially improve agencies' and project managers' ability to quickly summarize information on wetland extent and condition.

Coordination and standardization

One of SB 1070's key goals is to improve the overall effectiveness of water quality and aquatic ecosystem monitoring and assessment by addressing the widespread lack of coordination and standardization across separate programs. Past experience shows that improved coordination can increase the quality of assessments, along with their efficiency and reliability, along the entire data path from sampling through analysis and reporting. The Monitoring Council's theme-based approach, which is centered on workgroups and web portals, has demonstrated the validity of this strategy by identifying specific opportunities for improved coordination and providing a structure for taking advantage of these opportunities.

The Monitoring Council's decision to focus workgroup efforts and web portal development on explicit assessment questions has provided much needed focus to current coordination and standardization efforts at the statewide scale. This decision means that workgroups, Monitoring Council staff, and data managers need no longer struggle to coordinate and/or standardize all monitoring efforts and all monitoring data statewide. Instead, they can concentrate on those monitoring elements and data types that are essential to answering high-priority assessment questions, with a concomitant increase in overall efficiency, as illustrated in the following examples.

At the level of individual themes, the Wetlands workgroup has focused on developing a common assessment approach (California Rapid Assessment Method (CRAM)) to be used for all wetland projects and is working on common monitoring guidelines for use in state and federal management programs. With more than 20 members representing local, regional, state, and federal interests, the workgroup has also provided a vehicle for engaging high-level state and federal managers in key issues such as a definition of wetlands to be used by federal agencies such as the U.S. Army Corps of Engineers and state agencies such as Fish and Game and the State Water Board (see *Theme-Based Workgroups: Forums for Collaboration*, next page). When fully implemented, common wetland definitions, monitoring designs, and assessment approaches will provide important foundational elements for a statewide wetlands management program. The Wetlands workgroup is developing a detailed proposal for such a program, which will be submitted to Cal/EPA and the Natural Resources Agency in early 2010. An important feature of the workgroup process and the web portal's structure is the flexibility to include new wetland environments, such as alpine meadows, as needed. As another example of the benefits of standardization, the Wetland Tracker database, used to collect and organize information on wetland projects, is being slightly modified for use by a regional eelgrass monitoring program being developed for southern California with support from the National Marine Fisheries Service.

Theme-Based Workgroups: Forums for Collaboration

Wetland definitions (what is or is not a wetland) and classifications (descriptions of different wetland types) are highly technical but fundamentally important to agencies' ability to coordinate monitoring and to create integrated maps of wetland extent and assessments of wetland condition. This is because, for example, different definitions or classifications can lead to dissimilar or conflicting boundaries, both for wetlands as a whole and for habitat types within wetlands. This can lead to incompatible results when calculating changes in wetland area or integrating assessments of habitat condition across multiple wetlands or studies.

The CWMW has, therefore, become a key forum in which agencies and other parties collaborate on a common definition and classification system for California. The Interagency Policy Development Team has tasked a Technical Advisory Team (TAT) with recommending a wetland definition that is consistent with that of the Corps of Engineers, but includes modifications to fit circumstances in California. The CWMW has involved senior Corps staff in this effort and CWMW scientists have been directly involved in preparing the draft definition and in obtaining input from other agencies such as U.S. EPA. Development of the associated classification systems is in process and should be completed in 2010.

The CWMW is thus acting as a clearinghouse for an interagency technical review overseen by an Interagency Coordinating Committee. This process is unavoidably complex and time consuming. However, it has achieved agreement by the federal agencies on the Interagency Coordination Committee, particularly the three Corps districts in California and their regional regulatory Branch Chiefs, with the wetland definition recommended to the State Water Board by the TAT.

As another example, the Safe to Swim workgroup is continuing to develop and implement standardized data management and data transfer protocols that will greatly improve the efficiency and reliability of data aggregation at the statewide level. This effort will increase coordination among monitoring programs managed by county public health agencies, permitted dischargers, the State and Regional Water Boards, and environmental groups and has resulted in broad support for a single access point for monitoring data statewide.

Finally, the Safe to Eat Fish and Shellfish workgroup is building on SWAMP's core statewide monitoring and assessment approach, in which probabilistic sampling networks provide a broad overview of status and trends, and help to identify locations where more intensive targeted sampling may be needed to support the development of consumption advisories . The workgroup has enabled a new level of coordination between OEHHA and the State Water Board that resulted in statewide data products such as that illustrated in Figure 3 that could lead to more integrated assessment approaches.

Data management

Data management provides the technical underpinning for all other Monitoring Council and workgroup efforts. Coordination across programs, creation of statewide assessment perspectives, centralized access to data through the web portals, and automated report generation all depend on effective data management systems that collect, store, transfer, integrate, and provide ready access to validated and well documented monitoring data and assessment products. The Monitoring Council's strategy is to build on existing systems and data management capabilities wherever possible, building additional functionality only where needed. This strategy has the following essential elements:

- Identifying data types and data sources essential to answering each theme's core assessment questions
- Defining quality control and data formatting requirements where these do not yet exist
- Creating data integration procedures required for combining multiple data types into coordinated assessments

- Ensuring that all essential data have a home, either in existing data systems or at one or more of the regional data centers planned as pieces of the California Environmental Data Exchange Network (CEDEN)
- Building linkages among data sources to support statewide data integration and assessment
- Building and maintaining working relationships needed to successfully implement the elements of the data management strategy

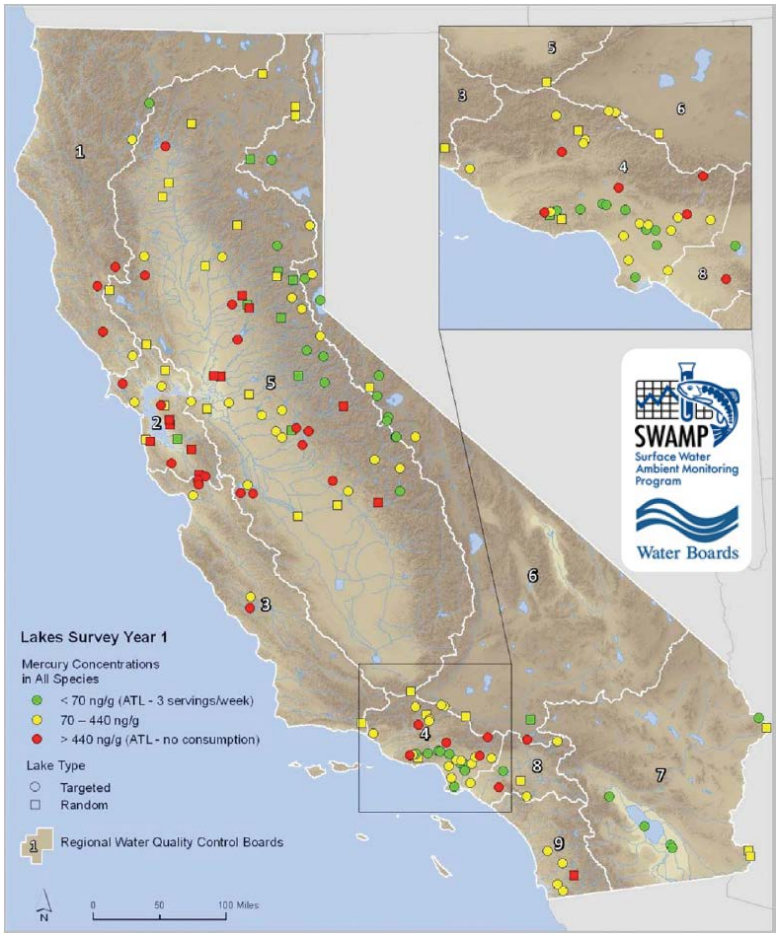

Figure 3. *Highest species average mercury Concentrations, based on data from a statewide screening level survey conducted by the State Water Resources Control Board's Surface Water Ambient Monitoring Program (SWAMP). Fish tissue concentrations were compared with thresholds developed by the Cal/EPA Office of Environmental Health Hazard Assessment (OEHHA).*

The Monitoring Council has used its experience during the past year with the four prototype web portals to define its overall data management strategy, to begin establishing relationships with other data managers both inside and outside of state agencies, and to begin discussions with these managers about the role of a data management workgroup. Because the Monitoring Council believes that its data management strategy should correspond to the types of issues likely to arise during the workgroup and web portal development process, the development of the data management strategy has necessarily lagged to some degree the implementation of the initial four prototype portals. In addition, completion of the CEDEN network and its regional data centers is contingent on funding beyond what is currently available to the Monitoring Council and the State Water Board.

Summary and Next Steps

By establishing four theme-based workgroups and creating prototype web portals for each, the Monitoring Council confirmed the utility of its strategic approach. Each workgroup achieved significant progress toward resolving the set of issues and problems identified in the legislation and meeting its overall goals of improving data access and the coordination of monitoring and assessment programs. This progress includes the creation of new statewide assessments; improved collaboration and coordination among multiple state, federal, and local programs; agreement on standardized monitoring and assessment approaches; increased efficiency of data acquisition and reporting; and simplification of data access through use of the web portals.

These accomplishments were achieved with existing funding and staffing, by building in part on existing efforts and targeting "low hanging fruit" for the initial set of prototypes. Maintaining what has been achieved, completing development of the four prototype web portals, expanding the Monitoring Council's efforts to the full set of themes identified in the December 2008 recommendations, and establishing the programmatic and data management infrastructure needed to support these activities, will require additional effort, funding, and staffing beyond what has been available to date. These requirements are detailed in the Monitoring Council's Comprehensive Monitoring Program Strategy, to be delivered in early 2010. In particular, the Monitoring Council has stressed the importance of outreach, relationship building, and coordination with other state, federal, and local agencies involved in monitoring and assessment. In addition, the Monitoring Council must develop measures to track its own performance against the goals of the legislation and the activities and benchmarks described in its upcoming Comprehensive Strategy.

Appendix 1: SB 1070 requirements

The following table illustrates which aspects of the Monitoring Council's efforts to date address each specific requirement of SB 1070.

SB 1070 requirement	Detail	Status
Public information program on water quality	CWC §13167. … place and maintain on its Internet Web site a public information file on water quality monitoring, assessment, research, standards, regulation, enforcement, and other pertinent matters	Begun with creation of My Water Quality website and initial theme-based web portals; task of the State Water Board
Memorandum of Understanding	CWC §13181(a)(1) … the California Environmental Protection Agency and the Resources Agency, on or before December 1, 2007, to enter into a memorandum of understanding for the purposes of establishing the California Water Quality Monitoring Council, which the state board would be required to administer.	MOU signed November 26, 2007 Monitoring Council held first meeting June 23, 2008
Monitoring Inventory	CWC §13181(c) The monitoring council shall undertake and complete, on or before April 1, 2008, a survey of its members to develop an inventory of their existing water quality monitoring and data collection efforts statewide and shall make that information available to the public.	Preliminary inventory completed June 28, 2008; updated as an appendix of the Recommendations Report of December 1, 2008
Recommendations report	CWC §13181(b) The monitoring council shall report, on or before December 1, 2008, to the California Environmental Protection Agency and the Resources Agency with regard to its recommendations for maximizing the efficiency and effectiveness of existing water quality data collection and dissemination, and for ensuring that collected data are maintained and available for use by decision makers and the public.	Report submitted December 1, 2008
Recommend improvements to monitoring	CWC §13181(a)(4) The monitoring council shall review existing water quality monitoring, assessment, and reporting efforts, and shall recommend specific actions and funding needs necessary to coordinate and enhance those efforts. CWC §13181(a)(5)(A) The recommendations shall be prepared for the ultimate development of a cost-effective, coordinated, integrated, and comprehensive statewide network for collecting and disseminating water quality information and ongoing assessments of the health of the state's waters and the effectiveness of programs to protect and improve the quality of	First set of recommendations presented in December 1, 2008 report; more extensive recommendations to be submitted in Comprehensive Strategy report scheduled for early 2010

	those waters. CWC §13181(a)(5)(B) For purposes of developing recommendations pursuant to this section, the monitoring council shall initially focus on the water quality monitoring efforts of state agencies, including, but not limited to, the state board, the regional boards, the department, the Department of Fish and Game, the California Coastal Commission, the State Lands Commission, the Department of Parks and Recreation, the Department of Forestry and Fire Protection, the Department of Pesticide Regulation, the State Department of Health Services, and the Department of Toxic Substances Control. CWC §13181(a)(5)(C) In developing the recommendations, the monitoring council shall seek to build upon existing programs rather than create new programs. CWC §13181(a)(6) … the monitoring council shall formulate recommendations to accomplish both of the following: (A) Reduce redundancies, inefficiencies, and inadequacies in existing water quality monitoring and data management programs in order to improve the effective delivery of sound, comprehensive water quality information to the public and decision makers. (B) Ensure that water quality improvement projects financed by the state provide specific information necessary to track project effectiveness with regard to achieving clean water and healthy ecosystems.	
Develop a comprehensive monitoring program strategy	CWC §13181(e) … the state board shall develop, in coordination with the monitoring council, all of the following: (1) A comprehensive monitoring program strategy that utilizes and expands upon the State's existing statewide, regional, and other monitoring capabilities and describe how the State will develop an integrated monitoring program that will serve all of the State's water quality monitoring needs and address all of the State's waters over time. The strategy shall include a timeline not to exceed 10 years to complete implementation. The strategy shall identify specific technical, integration, and resource needs, and shall recommend solutions for those needs.	To be presented in the Comprehensive Strategy report scheduled for early 2010
	CWC §13181(f) … identify the full costs of implementation of the	Task of the State Water Board

	comprehensive monitoring program strategy developed pursuant to subdivision (e), and shall identify proposed sources of funding for the implementation of the strategy, including federal funds that may be expended for this purpose.	
Develop an agreement on Indicators	CWC §13181(e)(2) Agreement, including agreement on a schedule, with regard to the comprehensive monitoring of statewide water quality protection indicators that provide a basic minimum understanding of the health of the state's waters. Indicators already developed pursuant to environmental protection indicators for statewide initiatives shall be given high priority as core indicators for purpose of the statewide network.	Under development through the efforts of individual theme-based workgroups
Develop a Quality Assurance Management Plan	CWC §13181(e)(3) Quality management plans and quality assurance plans that ensure the validity and utility of the data collected.	Under development through the efforts of individual theme-based workgroups, complemented by the SWAMP and CEDEN quality assurance efforts
Develop a method for compiling, analyzing, and integrating readily available information	CWC §13181(e)(4) This is to include data from waste discharge reports; volunteer monitoring groups; local, state, and federal agencies; and state and federal grant recipients of water quality improvement projects.	Under development through the efforts of individual theme-based workgroups. This will be complemented by a planned data management and integration workgroup, which will identify data elements that must be more broadly integrated to address larger scale and more complex questions
Develop an accessible and user-friendly electronic Data Management System	CWC §13181(e)(5) To the maximum extent possible, include the geospatial information on the data sites.	Being implemented on the individual theme-based web portals
Develop a method for producing timely and complete water quality reports and lists	CWC §13181(e)(6) The reports and lists required are those required under Sections 303(d), 305(b), 314, and 319 of the Clean Water Act, and Section 406 of the BEACH Act.	Under development as part of the reporting features of individual theme-based web portals
Develop an update of the SWAMP needs assessment	CWC §13181(e)(7) The SWAMP program needs will change in light of the benefits of the increased coordination and integration of information from other agencies and information sources.	To be included as part of the Monitoring Council's Comprehensive Strategy to be delivered in early 2010

Appendix 3: Monitoring Council Governance

California Water Quality Monitoring Council

Governance

This document is intended to record information relevant to the governance of the California Water Quality Monitoring Council. It will be amended and updated by the Monitoring Council as necessary and appropriate, and as additional governance issues arise.

A. Background and Responsibility

California Senate Bill 1070 (Kehoe, 2006) required that the California Environmental Protection Agency (Cal/EPA) and the California Natural Resources Agency enter into a Memorandum of Understanding (MOU) establishing the California Water Quality Monitoring Council. The legislation and MOU task the Monitoring Council with developing recommendations for a comprehensive monitoring program strategy to improve the efficiency and effectiveness of water quality and associated ecosystem monitoring and assessment activities in California through coordination among organizations both inside and outside state government. The legislation and MOU also call for monitoring and assessment information to be made available to decision makers and the public via the Internet.

The scope of monitoring considered by the Monitoring Council is called out in the legislation as water quality and associated ecosystem health. Consequently, the MOU discusses healthy ecosystems, water quality, wildlife populations, and habitat. This led the Monitoring Council to define its scope to include surface waters (**streams, rivers, lakes, wetlands, and the coastal zone**) along with their related ecosystems, wildlife populations and habitats, as well as groundwater.

Actions of the Monitoring Council are advisory to the Secretaries of Cal/EPA and the Natural Resources Agency, who can implement those recommendations through their departments, boards, commissions, and conservancies. The Monitoring Council's authority consists of its ability to set examples, offer persuasive recommendations, and encourage member agencies and organizations to participate. The Monitoring Council does not have authority to set standards.

B. Membership

Members of the Monitoring Council are appointed by the Secretaries of Cal/EPA and the Natural Resources Agency to represent upper-level staff from participating entities with major roles as generators or users of water quality and related ecosystem monitoring data. The Monitoring Council currently consists of ten Members, each representing one of the following entities or interests. Each Monitoring Council Member has specified entities that they respectively represent for the purpose of vetting potential replacement Members, which are shown below each Member category.

a) California Environmental Protection Agency (Co-Chair)
   - State Water Resources Control Board and Regional Water Quality Control Boards

b) California Natural Resources Agency (Co-Chair)
   - California Natural Resources Agency and organizations within that agency

c) California Department of Public Health
   - California Department of Public Health

d) Regulated Community – Stormwater
   - California Stormwater Quality Association

e) Regulated Community - Publicly Owned Treatment Works
   - Tri-TAC; California Association of Sanitation Agencies

f) Agriculture
   - California Farm Water Coalition

g) Citizen Monitoring Groups
   - Klamath Basin Monitoring Program

h) The Public
   - Individual Waterkeepers; Natural Resources Defense Council; Heal the Bay; Southern California Watershed Alliance

i) Scientific Community
   - University of California

j) Water Supply
   - Association of California Water Agencies; State Water Contractors; California Urban Water Agencies; Central Valley Project Water Association

Each Council Member may designate an Alternate to act for the Member when the Member is not able to attend a meeting, or otherwise perform Member duties. The current list of Members and Alternates is displayed on the Monitoring Council's website.

Neither the term of the Monitoring Council nor of its Members is specified in legislation or in the MOU. However, the Monitoring Council has determined that their continued efforts will be needed to ensure consistent, long-term progress in meeting the goals of CA SB 1070. As such, the Monitoring Council will have a long-term role to oversee implementation of its comprehensive strategy.

Upon resignation of an existing Monitoring Council Member, a new Member is selected and approved as follows:

1) Nomination by Water Board staff or Council Member(s) with input from represented entities;
2) Vetting with represented entities by staff and/or outgoing Council Member;
3) Selection of the replacement Member by the Monitoring Council Co-Chairs;
4) Notification of the selection to the Agency Secretaries along with background information; and
5) Confirmation of the new Member's status upon concurrence by or lack of response from the Agency Secretaries within 30 days.

C. Meetings

Meetings of the Monitoring Council are normally held once every other month, alternating between Sacramento and Costa Mesa. Meetings of the Monitoring Council are open to the public and noticed in advance with prepared agendas, as required by the Bagley-Keene Open Meeting Act (Government Code §11120 *et seq*). The Open Meeting Act imposes three main duties on the Monitoring Council:

1) Give adequate notice of meetings to be held;
2) Provide an opportunity for public comment; and
3) Conduct such meetings in open session, except where a closed session is specifically authorized.

A "meeting" includes any congregation of a majority of Monitoring Council Members or Alternates (i.e., a minimum of six) at the same time and place to hear, discuss, or deliberate upon any item that is within the subject matter jurisdiction of the Monitoring Council. As a general rule, all voting on items of business to be transacted will be done at a public meeting. Voting by proxy is not authorized. Items not included on the agenda will not be discussed at the meeting, even if no action is to be taken.

D. Decision Making Process

To date, the Monitoring Council has depended on an informally structured process for setting priorities and making decisions that depends on informal discussion and the emergence of consensus, largely without formal ground rules or decision criteria. Items requiring a vote will be decided by the concurrence of more than 50 percent of voting Members and Alternates present. Decisions are made in public, during formally noticed regular meetings, in order to maintain a transparent process that enables formal input, organizes technical efforts, and publicizes results and recommendations.

E. Strategy Implementation

The Monitoring Council will leverage existing monitoring, assessment and reporting programs to implement its vision through outreach, relationship building, and coordination with other state, federal, and local agencies involved in monitoring and assessment, augmented with contracting or other "for hire" activities as needed and as available resources permit. Equal participation from organizations within both Cal/EPA and the Natural Resources Agency are needed for the strategy to be successful. The Monitoring Council prefers to implement its decisions through collaboration among participating entities, but is willing to pursue more directed action as needed to break through institutional barriers and other constraints. Such directed action includes making recommendations to the Agency Secretaries for action by individual boards, departments, commissions and conservancies and proposing legislative solutions.

The Monitoring Council has agreed that the level of effort to implement its comprehensive monitoring program strategy will depend on available funding. Until additional funding has been identified and secured, the Monitoring Council will maintain its meeting schedule to maintain visibility, ensure ongoing efforts are as successful as possible, and work together to pursue additional funding.

F. Theme-Specific Workgroups

According to the Monitoring Council's strategy, theme-specific workgroups are on the front lines of communication, coordination, and collaboration. Each workgroup is empowered by the Monitoring Council to address a specific theme in water quality or related ecosystem health, approaching problems from the users' perspective to make data comparable and accessible to multiple audiences. A Monitoring Council workgroup is composed of experts representing a variety of agencies and entities, both within and outside state government, who are involved or have expertise in water quality and/or associated ecosystem monitoring and assessment that relates to a specific theme (e.g., the safety of eating fish from our waters).

Under Monitoring Council oversight, the workgroup uses their collective scientific interest and capacity to design, develop and maintain an Internet portal focused on their theme, thereby bringing monitoring and assessment information to the public in an easily understood manner. As a portal is developed, maintained and enhanced, the workgroup strives to concurrently review and enhance the associated monitoring and assessment efforts that underlie the portal, according to performance measures

developed by the Monitoring Council. This may include coordinating monitoring and assessment activities, discovering and breaking down existing barriers to information sharing, and enhancing the efficiency and effectiveness of monitoring, assessment, and reporting for their theme. Each workgroup seeks to achieve the level of standardization necessary to meet the needs of the information users, in a manner that achieves an appropriate balance between statewide consistency and regional flexibility.

Each workgroup periodically reports to the Monitoring Council, raising issues that cannot be internally resolved, that may cross multiple themes, or otherwise require Monitoring Council action. The Monitoring Council establishes common policies and guidelines for the workgroups and the monitoring programs they represent, and acts as a clearinghouse for standards, guidelines, and collaboration.

Disagreements, either within a workgroup or between a workgroup and entities that have been identified as key sources of data or assessment tools, should resolved using the following process, only as far as needed:

a) Workgroup attempts to resolve;

b) Workgroup raises unresolved issues to Monitoring Council;

c) Monitoring Council deliberates and develops a recommendation; and

d) Monitoring Council agency representative(s) brief Agency Secretary(ies) on the issue and its recommended solution(s).

Information on the theme-specific workgroups is available on the Monitoring Council's website. See the Monitoring Council's *Guidelines for Workgroups and the Development of My Water Quality Theme-Based Internet Portals* for additional information on workgroup responsibilities.

G. Data Management Workgroup

The Monitoring Council has determined that a Data Management Workgroup is needed to develop a recommended strategy for water quality and related ecosystem data sharing and integration between state agencies and others. The scope of the strategy should include those information management, Internet, and GIS issues for which standardization is essential to the efficient delivery of information to the user. The Data Management Workgroup should focus on the infrastructure necessary to support the *My Water Quality* internet portals being developed by the theme-specific workgroups, should endeavor not to delay portal development, and should estimate the costs of its recommendations. To the extent practicable, the Data Management Workgroup should refrain from determining portal content. The Data Management Workgroup will be formed and operate in a manner similar to the theme-specific workgroups discussed above and will coordinate with the California Office of the State Chief Information Officer on statewide information technology standards. Due to the wide variety of data types involved, the Monitoring Council believes that the Natural Resources Agency should lead the Data Management Workgroup effort.

H. Staff to the Monitoring Council

CA SB 1070 calls for the Monitoring Council to be administered by the State Water Resources Control Board. The Water Board has assigned a Coordinator from within its Office of Information Management and Analysis to conduct the day-to-day administration of the Monitoring Council. The Coordinator acts to identify and organize issues, elicit and develop points of view and alternative solutions, organize theme-specific workgroups, assign tasks to workgroups and contractors, act as a lightning rod for potential disputes, manage the production of any Council products, and coordinate the development of website(s) and other materials for the Monitoring Council.

To successfully manage administration of the Monitoring Council, coordinate the activities of a wide range of workgroups, and provide outreach and support to prospective participating organizations and

partners, additional coordinators will be needed, including one from within the Natural Resources Agency.

I. Subcommittees of the Monitoring Council

Subcommittees of the Monitoring Council may be formed as needed to address specific issues and to report their findings and recommendations to the Monitoring Council as a whole. A subcommittee of the Monitoring Council would be composed of selected Council Members who have expressed interest in a specific topic. Pursuant to the Open Meeting Act, Monitoring Council Members who are not members of the subcommittee may only attend subcommittee meeting as observers.

To date, the Monitoring Council has not developed formal subcommittees. General interest has been expressed in the future formation of subcommittees to address the following topics:

- Financing/Funding
- Outreach to New Organizations & Working with Existing Work Groups
- Data Management Standardization
- Data Reports

J. Relationship to Agency Secretaries

CA SB 1070 tasks the Monitoring Council with making specific recommendations to the Secretaries of Cal/EPA and the Natural Resources Agency, including recommendations for a comprehensive monitoring program strategy for California. Due to the Monitoring Council's lack of formal authority, responsibility to implement the strategy largely rests with the two Agency Secretaries and the organizations within their two agencies.

In its December 2008 initial recommendations report, the Monitoring Council requested that the Secretaries:

1) Endorse the Monitoring Council's vision and empower the Monitoring Council to guide its development;
2) Direct the boards, conservancies, commissions, departments, and offices within Cal/EPA and the Natural Resources Agency to support and participate in these efforts; and
3) Seek sufficient resources to ensure long-term sustainability.

During implementation of the comprehensive monitoring program strategy, the Monitoring Council will raise critical issues to the Agency Secretaries for resolution, as indicated above.

The legislation tasks the Cal/EPA Secretary, in consultation with the Secretary for Natural Resources, with conducing triennial audits of the effectiveness of the comprehensive monitoring program strategy, including the extent to which the strategy has been implemented, the effectiveness of the monitoring and assessment program and the Monitoring Council with regard to tracking improvements in water quality and evaluating the overall effectiveness of related state agency programs and of state and federally funded water quality improvement projects.

To aid in the development of these audits, the Monitoring Council has committed to provide the Agency Secretaries with annual progress reports. Following submission of these annual reports briefings will be conducted with the Agency Secretaries, patterned after those given by the Monitoring Council Coordinator and selected Monitoring Council Members in 2010.

K. Relationship to Citizen and Regional Monitoring Efforts

The main focus of the Monitoring Council's comprehensive monitoring program strategy is on monitoring, assessment and reporting efforts that have a statewide perspective. However, local and regional monitoring programs and those of citizen monitors play a crucial role. To foster dialogue with and between these programs, The Monitoring Council has partnered with the Water Boards' Surface Water Ambient Monitoring Program, Non-Point Source Program, and the U.S. Environmental Protection Agency to develop a series of voluntary monthly webinars (web-based seminars) to support monitoring community activities. The Water Quality Monitoring Collaboration Network (WQMCN) webinar series allows members of the monitoring community to network and exchange information and ideas on topic of interest. The webinar format, content, and topics of interest vary in response to input from participants. Sessions are planned to share technical and support tools for monitoring, assessment and reporting; to encourage discussion on common concerns like information management and program development; and to provide a forum for networking and collaboration. It is envisioned that the Collaboration Network will help support a state framework to coordinate consistent and scientifically defensible methods and strategies for improving water quality monitoring, assessment, and reporting.

L. Relationship to the National Water Quality Monitoring Council

Members of the California Water Quality Monitoring Council and the Monitoring Council Coordinator will participate, as resources permit, in the efforts of the National Water Quality Monitoring Council, including attending national conferences and participating in the national council's webinar series and workgroups. The goal is to learn from the success of other state and regional monitoring councils and to share lessons learned in California.

Appendix 4: Guidelines for Workgroups and the Development of *My Water Quality* Theme-Based Internet Portals

California Water Quality Monitoring Council

Guidelines for Workgroups and the Development of *My Water Quality* Theme-Based Internet Portals

Background & Purpose

The California Water Quality Monitoring Council is forming workgroups to address California's need for timely and transparent information about water quality and associated ecosystem conditions. These guidelines explain the path to becoming a successful partner in the effort to accurately portray the best available information on water quality and the health of our aquatic ecosystems.

Senate Bill 1070 (Kehoe, 2006) required that the California Environmental Protection Agency (Cal/EPA) and the California Natural Resources Agency enter into a Memorandum of Understanding (MOU) establishing the California Water Quality Monitoring Council. The legislation and MOU mandated coordination of water quality monitoring and assessment activities among organizations both inside and outside state government, and that this information be made available to decision makers and the public via the internet. As stated in its December 2008 recommendations report to the Secretaries of Cal/EPA and the Natural Resources Agency, a key component of the Monitoring Council's vision for enhancing California's system for water quality monitoring, assessment and reporting is the development of a single point of entry to set of internet portals that connect decision makers and the public with water quality and related ecosystem health information. Each portal is developed by an expert stakeholder workgroup and includes interactive maps and monitoring data that focus on a specific water quality or aquatic ecosystem theme. The goal is to present this information in a timely and user-friendly manner that directly addresses users' questions.

A Monitoring Council workgroup is composed of experts representing a variety of agencies and entities, both within and outside state government, who are involved or have expertise in water quality and/or aquatic ecosystem monitoring and assessment that relates to a specific theme (e.g., the safety of eating fish from our waters). Under Monitoring Council oversight, the workgroup uses their collective scientific interest and capacity to design, develop and maintain an internet portal focused on their theme, thereby bringing monitoring and assessment information to the public in an easily understood manner.

The goal of the portal is to convey relevant and timely information about the thematic area, in a variety of spatial and temporal scales, to agency decision makers, legislators, and the public. The portal should directly address users' questions, as well as supply relevant background technical information. As a portal is developed, maintained and enhanced, the workgroup strives to concurrently enhance the associated monitoring and assessment efforts that underlie the portal. This may include coordinating monitoring and assessment activities, discovering and breaking down existing barriers to information sharing, and enhancing the efficiency and effectiveness of monitoring, assessment, and reporting for their theme. The workgroup seeks to achieve the level of standardization necessary to meet the needs of the information users, including the public, legislators, and agency decision makers. The Monitoring Council establishes common performance measures, policies and guidelines for the workgroups and the

monitoring programs they represent, and acts as a clearinghouse for standards, guidelines, and collaboration.

Workgroup Formation & Function

A workgroup may begin as an existing group or organization that seeks Monitoring Council guidance and direction in return for the increased exposure and recognition that result from publication of an internet portal accessed through the *My Water Quality* website (www.CaWaterQuality.net). Alternatively, workgroups may be organized *de novo* by the Monitoring Council to tackle a specific water quality or related ecosystem theme.

Initially, the workgroup asks itself a number of questions, designed to help identify its focus and representation.

1) What is the scope of the assessment that will be presented?
(e.g., streams vs. wadeable streams, beaches vs. ocean beaches)
   a) Short-term focus – What relevant and timely information of sufficient quality is readily available in a form and condition that can be displayed in the initial portal roll-out?
   b) Longer-term focus – What information is needed to more fully and effectively cover the theme?
2) What are the questions that the workgroup is trying to answer about their theme? These should reflect common public questions and key agency management and legislative goals. These questions become the subjects of individual portal pages.
3) Who is the target audience?
Again, this may be subdivided into short- and long-term.
   a) Public
   b) Legislature
   c) Agency decision makers

   } minimum required pursuant to SB 1070

   d) Water quality/watershed management scientists and practitioners
   e) Agency staff performing assessments, evaluating conservation investments, writing permits, developing local land and water use ordinances, taking enforcement, etc.
   f) Non-governmental organizations (e.g., Heal the Bay, Waterkeepers, SCCWRP, SFEI, citizen monitoring groups)
   g) Regulated community
4) Needs Identification
   a) What data sets and assessment tools are needed to effectively respond to the questions being addressed?
   b) Who are the key players, i.e., the sources of relevant data and assessment tools? The answer should inform the workgroup to appropriately expand its membership.
   c) What other workgroups share overlapping subject matter (e.g., related ecosystem health themes)? These workgroups need to establish relationships for cooperation, developing mechanisms for data sharing and dynamic linkages between their portals, and avoiding unnecessary redundancy.

5) Problems Assessment

   a) What are the potential barriers to success?

      (1) Institutional (e.g., data ownership, data access)

      (2) Technical (e.g., data management, web capabilities, GIS and database platform differences)

      (3) Funding / resources

   b) Are there critical players who are unable or unwilling to participate? The Monitoring Council should be able to help to correct these problems by bringing responsible entities to the attention of agency secretaries.

6) Outreach – Sustainability hinges on getting the portals woven into the fabric of each agency's programs. Based on guideline #4 (b) and (c) above, the workgroup needs to market their portal development and coordination efforts to partner agencies, with the goals of improving participation, sharing data, making linkages between agency web sites, and using the portal as part of each agency's program implementation. Stress how each organization benefits from the effort. Fostering these relationships is an important goal of the workgroups.

7) Each workgroup should review existing assessments and their underlying monitoring programs within its thematic area, provide critical review and comment (e.g., biases, data gaps, redundancies, comparability issues) based on the performance measures developed by the Monitoring Council, and encourage improvement over time.

   a) Are existing monitoring and assessment programs able to adequately address key public and resource management questions?

      - What do we do well?
      - What is not being addressed?

   b) What needs to be done to correct the problems or improve performance?

   A detailed critique should be sent to the Monitoring Council with recommendations for agencies/organizations responsible for the assessments. The performance measures provided in the December 2008 Monitoring Council recommendations report (see Section 2.1.2 and Appendix 3) should be used to structure the evaluations.

8) Assessment Threshold Review – A key component of coordination provided by theme-based workgroups involves the thresholds used to assess collected monitoring data and to answer relevant questions on a variety of spatial and temporal scales.

   a) Have commonly accepted metrics and thresholds been developed, if not why, and what can be done to establish them?

   b) What are the pros and cons of existing published thresholds?

   c) What statutory and regulatory requirements must be met in the selection of existing and future thresholds?

   Each workgroup should develop recommendations to the Monitoring Council for making assessment thresholds more uniform across agencies and organizations involved in a particular theme. Recommendations must reflect the requirements of adopted statutory and regulatory mandates and consider regulations under development by potentially

affected agencies. The Monitoring Council will, in turn, make recommendations to the appropriate agencies & organizations.

Portal Focus and Content

9) The central theme of each portal is expressed as a broad question, as presented on the *My Water Quality* home page (www.CaWaterQuality.net), shown in Figure 1 below. Alternatively, a portal may focus on a particular water body type within one of these main questions, e.g., a groundwater focus under the broader question of "Is our water safe to drink?" or a wetlands focus under the broader question of "Are our aquatic ecosystems healthy?"

10) Each portal should inform a wide range of audiences, including the general public, agency decision makers, legislators, and scientists (see guideline #3 above). First present more generalized assessment products that address a broader audience. Allow users to drill

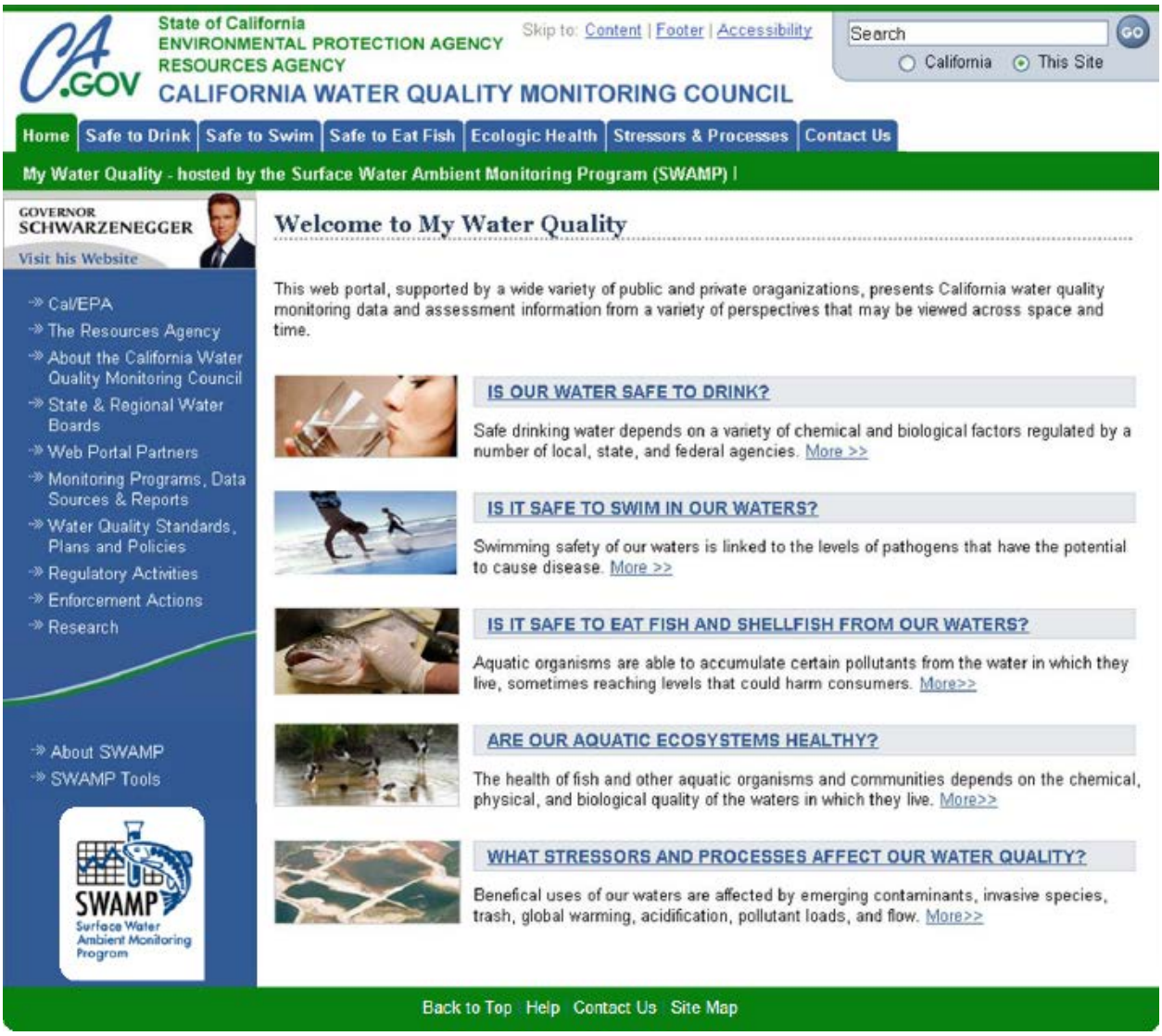

Figure 1. *My Water Quality* home page (www.CaWaterQuality.net)

down to more detailed information that relates to their specific interests.

11) The portal home page should present several more-detailed questions (developed in guideline #2 above). These act as links to additional pages in the portal that present targeted assessments and summaries of monitoring data. See the "Questions Answered" box on the "Is it safe to swim in our waters?" portal home page, shown in Figure 2 below. The California map on the portal home page may also serve to provide place-based links to these more detailed questions. For example, as shown in Figure 2, the map provides links to the same question areas for each county, ecoregion, and/or other state division.

12) Phrase questions in a straightforward manner as the public would likely ask them. Focus questions on topics of interest to agency decision makers, legislators, and the public.

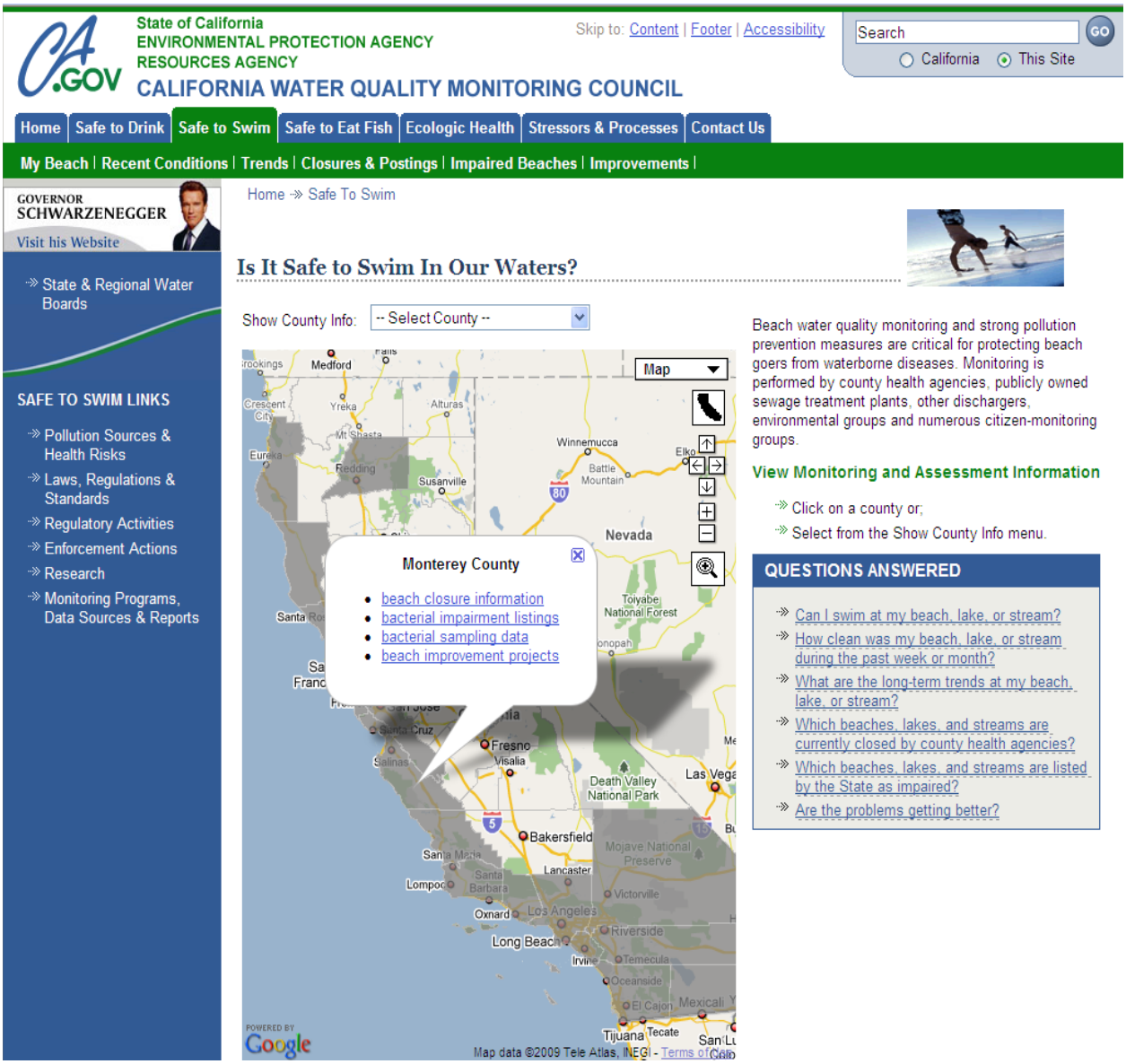

Figure 2. "Is it safe to swim in our waters?" portal home page (http://www.mywaterquality.ca.gov/safe_to_swim/)

13) It is acceptable to ask questions that cannot currently be answered directly. In such cases, either present available monitoring and assessment information that is germane to the question or describe the nature of the data gap and what is being done, or could be done, to fill it. Each portal should clearly identify what is known and not known about the water quality or aquatic ecosystem health theme, with the purpose of identifying, focusing, and motivating efforts to improve monitoring and assessment programs.

14) Present multiple ways to view and interpret monitoring data by including different assessments made by appropriate agencies and organizations (for example, report cards, numbers and trends of exceedances, derived risk measures, indices of habitat or ecosystem health, neutral data summaries). If multiple reputable assessment approaches or thresholds have been published, each should be presented. The portal should explain the difference between the assessment perspectives and their relevance to the portal's questions in terms the public can readily understand.

15) Clearly communicate who is responsible for the monitoring programs and assessments presented in each portal map or data display, why each assessment has been made, its relationship to each question in the portal, and what decisions the assessment supports (see guideline #14, above). Displaying logos of the responsible organizations on the pages where their work resides is encouraged.

16) One or more statewide assessment perspectives should be presented whenever possible. Data gaps and uncertainties should be clearly described (see guideline #13, above).

17) On the home page or in a prominent manner, each portal should communicate that it is a work in process, initially showing what data are readily available, with the goal of adding information as it becomes available.

- Throughout the portal, highlight where data are not being collected or where data are being collected but not currently being compiled.

18) Provide definitions of technical terms in the form of pop-ups or links to pages that present appropriate background information.

19) Include background information on applicable laws, regulations, standards, policies, guidelines, regulatory activities, enforcement activities, and research that are appropriate to the theme of the portal. These are featured as links in the left navigation bar.

20) Include information about the sources of water quality and aquatic ecosystem health problems and their associated risks, threats and impacts on human health, natural resources, and/or ecosystems. These are featured as links in the left navigation bar.

21) Include a mechanism to solicit user input and an invitation to provide comments, e.g., "Did this page answer your question?" See guideline #30(d) below. Capture common comments and responses in the portal.

Portal Layout and Format

22) The following portals should be viewed as templates for other them-based portals:

a) "Is it safe to swim in our waters?" (http://www.mywaterquality.ca.gov/safe_to_swim/)

b) "Is it safe to eat fish and shellfish from our waters? (http://www.mywaterquality.ca.gov/safe_to_eat/)

23) Beginning with the portal main or home page and throughout the portal, emphasize maps and graphic representations of data and assessments in the main page content area.

a) Consistent cartographic design (e.g., colors and symbols) should be used across portals to enhance the clarity of information being presented. For example, red and other warm colors should be used to represent problems, impairments and older information while green and cooler colors should be used to represent better conditions and newer information.

b) Included legends to provide keys to colors and symbols used in maps.

24) Background information is featured as links in the left navigation bar and as hyperlinks within the main page content area.

25) Wherever possible, allow the user to access and download the raw monitoring data on which the assessments are based. For example, the Trends page of the portal "Is it safe to swim in our waters?" (http://www.mywaterquality.ca.gov/safe_to_swim/trends/) and the Data & Trends page of the portal "Is it safe to eat fish and shellfish from our waters?" (http://www.mywaterquality.ca.gov/safe_to_eat/data_and_trends/) provide direct access to bacterial indicator and fish tissue data, respectively. Adding a link to download these data (e.g., as an Excel spreadsheet) for a selected location or area would further improve this feature. Examples of such downloads are on the SWAMP-Moss Landing website at http://swamp.mpsl.mlml.calstate.edu/online-data/year-1-lakes-fish-contaminant-study. Note that the spreadsheets provide filtering tools for each column heading.

26) Use consistent units, scales of measurement, and chemical names throughout the portal. Metric units are expected, unless English units are normally used for the theme.

27) Where possible, use page formats and colors similar to those of existing *My Water Quality* portals to provide a consistent look and feel.

28) Portal content should strive to be accessible to persons with disabilities, so as not to interfere with an individual's ability to obtain and use information quickly and easily. For guidance, see http://www.webtools.ca.gov/Accessibility/.

29) Links to web pages that are outside of the portal should do so by opening a new window.

30) Include the following core page features on all portal pages:

a) A link to return to the main *My Water Quality* home page (www.CaWaterQuality.net), thereby providing access to the other portals. In the portals "Is it safe to swim in our waters?" (http://www.mywaterquality.ca.gov/safe_to_swim/trends/) and t "Is it safe to eat fish and shellfish from our waters?" (http://www.mywaterquality.ca.gov/safe_to_eat/data_and_trends/), this is accomplished via the tabs across the top of the page. Alternatively, one of the My Water Quality buttons may be used for this function.

b) A link to the workgroup information section of the Monitoring Council's page (see http://www.mywaterquality.ca.gov/monitoring_council/#workgroup). In existing portals, this is done via the left navigation link "Monitoring Programs, Data Sources & Reports".

c) A link to the Monitoring Council information page (http://www.mywaterquality.ca.gov/monitoring_council/). In some portals, this is

accomplished via the words "CALIFORNIA WATER QUALITY MONITORING COUNCIL" in the banner at the top of the page.

d) A link to the Contact Us page (http://www.mywaterquality.ca.gov/contact_us/), which provides information on portal roll-out and a place to ask questions and provide comments. In the some portals, this is done via the right tab at the top of the page.

- An example comment link is "Contact the SB 1070 Coordinator with your comments and suggestions." with "SB 1070 Coordinator" linked to mailto:SB1070Coordinator@waterboards.ca.gov.

Portal Development Process

31) The portal is a product of the theme-based workgroup, with conceptual approval by the Monitoring Council.

a) For new portals, the workgroup is responsible for developing a mock-up, and presenting it to the Monitoring Council for approval, prior to portal development.

b) The workgroup is responsible for maintaining the portal with regular updates as new monitoring data and assessment tools becomes available. To keep the portals efficient and timely, updates should be automated to the extent feasible (e.g., drawing information from a regularly updated data management system), with the goal of presenting information in real time.

32) The Monitoring Council will review and approve questions, assessment products, and portal mock-ups prior to portal development. These should be presented to the Monitoring Council as a mock-up of main portal pages.

33) New assessments (ones not formally made by agencies/organizations) presented in a portal are products of the theme-based workgroup. Monitoring Council review and approval of new assessments is required, especially for those expected to be controversial. A test-phase assessment map or data presentation may be included in a portal prior to full workgroup concurrence if it is clearly labeled as such with a mechanism for inviting comments and suggestions from portal users.

34) Technical issues with the performance of maps and other web page displays are to be corrected prior to portal release. Address any GIS and web standards published by participating state agencies and the California Office of the Chief Information Officer.

35) Consider convening one or more focus groups to review and comment on draft versions of the portal before public release. Members of such focus groups should reflect one or more of the target audiences discussed in guideline #3 above.

Data Management

36) The Monitoring Council has endorsed the use of a distributed data management system, such as the California Environmental Data Exchange Network (CEDEN). The creation of new centralized master databases should be avoided, as they are more difficult to develop and maintain.

37) Data from disparate sources should be brought together by establishing linkages and data exchanges. A goal should be automated real-time data exchange and movement of information to the portal.

38) To ensure continued high quality, monitoring data should reside as close to its source as possible, preferably with the organization that generates the data.

39) For monitoring data generators that lack in-house data management systems, their data may be managed through a regional data center, such as those associated with CEDEN. CEDEN regional data centers currently reside at Moss Landing Marine Labs (MLML), the San Francisco Estuary Institute (SFEI), the Southern California Coastal Water Research Project (SCCWRP), and the University of California at Davis (UCD).

Appendix 5: SWAMP Monitoring and Assessment Strategy, Assessment Framework, and Needs Assessment

SWAMP
Surface Water Ambient Monitoring Program

2010 SWAMP Strategy

2010 Update of the Comprehensive Monitoring and Assessment Strategy to Protect and Restore California's Water Quality

Prepared by the Surfaoe Water Ambient Monitoring Program

Deoember 2010

Water Boards

www.waterboards.ca.gov/swamp

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Acknowledgments

Coordination and collaboration promote consistency and minimize duplication of effort. In that spirit, this document borrows liberally from the work of others. Most of the elements of the Surface Water Ambient Monitoring Program (SWAMP) have been patterned after successful efforts that individual regions, other agencies, and other states are implementing. The result is a stronger, more cost effective program in terms of design and implementation. In particular, Terry Fleming at the U.S. Environmental Protection Agency, Region 9, members of the SWAMP Roundtable, the Scientific Planning and Review Committee, the California Water Quality Monitoring Council, and the National Water Quality Monitoring Council have influenced the development of this document.

This SWAMP Strategy is built on the original SWAMP Strategy (2005), the SWAMP Scientific Planning and Review Committee report (SPARC, 2006), and reports from the California Water Quality Monitoring Council (CWQMC, 2008 and 2010).

Executive Summary

This document is an update to the Surface Water Ambient Monitoring Program (SWAMP) *Comprehensive Monitoring and Assessment Strategy to Protect and Restore California's Water Quality* (Strategy) developed in 2005. This 2010 Strategy update reports on the progress SWAMP has made in the first five years of a ten-year effort to develop a coordinated and comprehensive monitoring framework for Water Board programs. It also highlights steps that need to be implemented to complete the framework and integrate it into other Water Board programs and improve coordination among other state agencies, local agencies and districts, and non-governmental organizations that monitor surface water throughout the state. The Strategy is organized into the USEPA's 10-elements of a comprehensive monitoring program. The goals remain the same as in the 2005 Strategy with updated objectives (which are not listed in order of priority).

SWAMP's mission is to provide resource managers, decision makers, and the public with timely information to evaluate the condition of surface waters throughout California. SWAMP accomplishes this through carefully designed, externally reviewed monitoring programs, and by assisting other entities statewide in the generation of comparable data that can be brought together in integrated assessments that provide answers to current management questions. The SWAMP program has established the following guiding principles as the foundation upon which to prioritize its activities:

- SWAMP monitoring evaluates the physical, chemical, and biological integrity of California's waters.
- Monitoring and assessment at both statewide and regional levels is necessary to protect and restore water quality.
- Monitoring of both high quality waters and those known or suspected to be degraded is essential to a robust ambient monitoring program.
- Monitoring is designed to support a network of information users that include state, federal, and local agencies, the regulated community, the interested public, and their elected representatives.
- Monitoring efforts are prioritized, and coordinated to maximize utility and minimize costs.
- SWAMP seeks to make the most efficient use of data collected by all Water Board programs, as well as the large amount of data collected by other agencies and the regulated community.

In 2008, the California Water Quality Monitoring Council (CWQMC) was formed to develop a 10-year comprehensive monitoring program strategy for coordinating the water quality and related ecosystem monitoring, assessment, and reporting activities among the various boards, departments, and offices at the California Environmental Protection Agency (CalEPA), the California Natural Resources Agency, the Department of Public Health, and other governmental and non-governmental organizations that monitor California's waters.

The Secretaries of the CalEPA and the California Natural Resources Agency signed a Memorandum of Understanding (MOU) that requires the boards, departments and offices within the two agencies to integrate and coordinate their water quality and related ecosystem monitoring, assessment, and reporting. The SWAMP Strategy has been updated to include coordination with CWQMC efforts and will be appended to the CWQMC's strategy.

The SWAMP Strategy also incorporates the operating principles, monitoring goals, monitoring objectives and strategies of the State Water Board's Strategic Plan. The SWAMP Strategy is a living document that will be updated every five years. The Strategy will serve as the framework for monitoring priorities at both the State and Regional Water Boards.

The SWAMP was created to fulfill the State Legislature's mandate for a unifying program that would strive to coordinate all water quality monitoring conducted by the State and Regional Boards to assess attainment of all core beneficial uses in all waterbody types. Therefore, continued implementation of the SWAMP monitoring and assessment programs at both the state and regional scales remains a top priority. However, existing resources are not sufficient for the SWAMP to monitor all waterbodies for all beneficial uses, so efforts have been focused on a few statewide assessments of key beneficial uses and supporting regional monitoring. Improving coordination with other Water Board programs and external partners also is identified as a priority throughout this Strategy.

As resources decrease, the need for coordination increases. It is important to note that implementation of the SWAMP's monitoring programs and coordination activities are not mutually exclusive. In fact, each has the potential to inform and enhance the other. For example, the monitoring design for a regional watershed assessment may be different than that for an NPDES discharger, but through coordination and appropriate monitoring design these types of programs can often be nested so that the information from the watershed program informs the NPDES assessment and vice versa. In addition, coordination of monitoring activities with other Water Board programs and partners allows opportunities for logistical and cost advantages (e.g., leverage resources, avoid duplication, share data). The SWAMP supports citizen monitoring throughout the state via the Clean Water Team. A Copy of the Comprehensive Monitoring and Assessment Strategy for the Citizen Monitoring Program is in Appendix A). The Clean Water Team is also critical in operating the California Water Quality Monitoring Collaboration Network.

Finally, the SWAMP has been a leader in developing the monitoring infrastructure (e.g., indicators, methods, quality assurance/quality control [QA/QC], and data management) necessary to support a robust monitoring program while also fostering data comparability and collaboration with monitoring partners. The continued development, maintenance, and implementation of the crucial monitoring infrastructure is another priority for the program.

The SWAMP's Core Implementation Priorities

Statewide & Regional Monitoring & Assessment	Coordination	Infrastructure & Tools
▪ Implement statewide and regional monitoring programs ▪ Guide development of assessment tools that transform data into information on beneficial use support in all state waters. ▪ Apply these assessment tools to monitoring data gathered by SWAMP and others to produce timely, high-quality information for resource management. ▪ Improve and strengthen SWAMP (via coordination, partnerships, peer review, training, funding, etc.) so that it fulfills its monitoring and assessment goals at statewide and regional scales.	▪ Engage Water Board regulatory and assessment programs to integrate SWAMP monitoring designs, data, and assessment tools into regional and statewide programs. ▪ Coordinate with the CWQMC to prioritize waterbody types and beneficial uses that SWAMP is responsible for assessing and collaborate with and provide guidance to partner organizations that assess those waterbody types and beneficial uses that are not assessed by SWAMP. Lead the CWQMC work groups on fish consumption safety and stream/lake/river ecosystem health, and develop the web portals to make data and assessments available to decision makers and the public.	▪ Implement Quality Assurance and Data Management Programs to support SWAMP statewide and regional monitoring programs, and to provide tools for partners to produce comparable data. ▪ Implement the SWAMP statewide assessment framework and standards for data comparability, that allow local entities to both contribute data to statewide assessments and view the results of those assessments as context for local monitoring and management.

List of Acronyms

ASBS	Areas of Special Biological Significance
ATL	Assessment Threshold Levels
BOG	Bioaccumulation Oversight Group
CalEPA	California Environmental Protection Agency
CalWQA	California Water Quality Assessment Database
CCAMP	Central Coast Ambient Monitoring Program
CEDEN	California Environmental Data Exchange Network
CFR	Code of Federal Regulations
CRAM	California Rapid Assessment Method
CSU	California State University
CWA	Clean Water Act
CWQMC	California Water Quality Monitoring Council
DDT	Dichloro-diphenyl-trichloroethane (a synthetic insecticide)
DMT	Data Management Team
DO	Dissolved Oxygen
EMAP	Environmental Monitoring and Assessment Program
FCG	Fish Contamination Goal
GAMA	Groundwater Ambient Monitoring and Assessment
GIS	Geographic Information System
IBI	Index of Biotic Integrity
MCL	Maximum Contaminant Level
MLML	Moss Landing Marine Laboratories
MOU	Memorandum of Understanding
MQO	Measurement Quality Objectives
MUN	Municipal and Domestic Supply Beneficial Use
NAWQA	National Water-Quality Assessment Program
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint Source
O/E	Observed/Expected
OEHHA	Office of Environmental Health Hazard Assessment
PCB	Polychlorinated biphenyls

PHab	Physical Habitat
PSA	Perennial Streams Assessment
QA	Quality Assurance
QAMP	Quality Assurance Management Plan
QAPP	Quality Assurance Project Plan
QAPrP	Quality Assurance Program Plan
QC	Quality Control
QMP	Quality Management Plan
RCMP	Reference Condition Management Plan
RDC	Regional Data Centers
REC 1	Water Contact Recreation Beneficial Use
RL	Reporting Limits
SCCWRP	Southern California Coastal Water Research Project
SFEI	San Francisco Estuary Institute
SPARC	Scientific Planning and Review Committee
SPoT	Stream Pollution Trends
SQO	Sediment Quality Objectives
SSO	Site-Specific Objective
SWAMP	Surface Water Ambient Monitoring Program
TAC	Technical Advisory Committee
TDS	Total Dissolved Solids
TIE	Toxicity Identification Evaluation
TMDL	Total Maximum Daily Load
UCD	University of California at Davis
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
WER	Water-Effect Ratio
WQX	Water Quality Exchange

Introduction

Adequate and accurate monitoring and assessment information is fundamental to preserving, enhancing, and restoring water quality. The information gathered from Water Board monitoring activities is critical to protect the beneficial uses of water, develop water quality standards, conduct federal Clean Water Act assessments, and to determine the effects of pollution and the success of pollution prevention and water quality improvement programs.

The federal Clean Water Act assigns states the primary responsibility for implementing programs to protect and restore water quality. The Clean Water Act (*Section 106[e]*) requires the U.S. Environmental Protection Agency (USEPA) to determine that a state has established and is operating appropriate methods, systems, and procedures necessary to monitor, and to compile and analyze data on, the quality of navigable waters. In fact, before USEPA will award *Section 106* grants, states must report their monitoring and assessment activities and submit that information in their obligatory *Section 305(b)* reports. However, SWAMP was envisioned to do more than simply fulfill statutory reporting obligations. The program was designed to reach beyond those federal requirements and coordinate a statewide monitoring and assessment framework to improve reporting of the Water Boards efforts and successes in preserving, enhancing, and restoring California's waters.

To meet the Clean Water Act objectives, the Water Boards should be able to answer the following questions:

- What is the overall quality of California's surface water?
- What are the trends in surface water quality over time?
- What are areas needing further protection?
- What are the causes of identified impairments?
- Are the Water Board programs effective?

This Strategy presents SWAMP's vision to fulfill California's Clean Water Act responsibilities and the Water Board's blueprint (outlined in the Strategic Plan 2002, 2008) for improving our monitoring, assessment and reporting activities, to foster a better informed public that translates into behavior changes that ultimately improve water quality.

This 5-year update of SWAMP's 2005 Strategy modifies the long-term implementation plan and its 10-year timeline. This SWAMP Strategy is built on the original SWAMP Strategy (2005), the SWAMP Scientific Planning and Review Committee (SPARC) report (SPARC, 2006), and reports from the California

Elements of a State Water Monitoring and Assessment Program

1. Monitoring Program Strategy
2. Monitoring Objectives
3. Monitoring Design
4. Core Indicators of Water Quality
5. Quality Assurance
6. Data Management
7. Data Analysis/Assessment
8. Reporting
9. Programmatic Evaluation
10. General Support and Infrastructure

Water Quality Monitoring Council (CWQMC, 2008 and 2010).

This document follows the format of USEPA's (2003) *Elements of State Water and Monitoring and Assessment Program*. This Strategy outlines SWAMP's activities in each of the 10 basic monitoring program elements. For each of the elements, we first report the current status of the program and then discuss our activities and plans to implement the Strategy. A summary of the vision statements, goals, objectives, and tasks is in Appendix B.

1 Strategy

SWAMP's mission is to provide resource managers, decision makers, and the public with timely, high-quality information to evaluate the condition of surface waters throughout California. There were three basic goals outlined in the original Strategy (SWAMP, 2005):

Goal 1.1 Develop SWAMP monitoring strategy for developing and implementing an integrated comprehensive statewide monitoring program in 10 years.

Goal 1.2 Implement the SWAMP monitoring strategy.

Goal 1.3 Promote coordination of monitoring activities and comparability of data.

Current Status

The SWAMP was created in 2000 in response to Assembly Bill 982 (Ducheny, Statutes of 1999) to fulfill the State Legislature's mandate for a unifying program that would coordinate all water quality monitoring conducted by the State and Regional Boards to assess attainment of all core beneficial uses in all waterbody types. The SWAMP monitoring strategy (SWAMP, 2005) was based on the USEPA's (2003) *Elements of a State Water Monitoring and Assessment Program* and the National Water Quality Monitoring Council framework. It is guided by a Roundtable[1] of experienced State and Regional Water Board monitoring coordinators, has continuing access to university and agency experts in chemistry, toxicology, ecology, and hydrology, and has undergone two formal scientific reviews by external national and international experts. In 2006, there was an overall program evaluation by the Scientific Planning and Review Committee (SPARC). The SPARC comments were incorporated into the SWAMP planning. The recommendations are formally adopted into this update of the SWAMP Strategy.

The first few years of the program were dedicated primarily to supporting Regional Water Board programs and developing the monitoring infrastructure and tools necessary to enhance data comparability and data sharing (SWAMP Quality Assurance Program and Data Management Program). The SPARC Report (2006) commended SWAMP's efforts to develop the monitoring infrastructure and to support Regional Water Board programs, and applauded the Regional Water Boards' entrepreneurial spirit and ability to leverage their efforts. However, it also recommended to SWAMP that it expand its efforts to develop robust statewide assessments and a statewide framework to provide information to multiple users for multiple uses. To meet these goals, the SWAMP needed to design and implement probability-based statewide surveys, prioritize its monitoring efforts to address declining

[1] The SWAMP Roundtable is the coordinating entity for the program. Participants include staff from the State and Regional Water Boards, the Department of Fish and Game, the Marine Pollution Studies Lab, Moss Landing Marine Laboratories, contractors and other interested entities.

budgets, and simultaneously seek to maximize the utility of data collected by the various Water Board programs.

In response to the SPARC (2006) review, SWAMP has shifted its strategy toward greater collaboration with partners. This includes greater integration of SWAMP monitoring and assessment activities with other Water Board programs and external partners. SWAMP initiated efforts on many statewide and regional fronts to align sites and schedules with partners who monitor similar waterbody types and beneficial uses. These partners include stormwater agencies, municipal wastewater dischargers, and irrigated lands regulatory programs. SWAMP is continuing its outreach and coordination with these groups. To further facilitate opportunities for collaboration, SWAMP has invited liaisons from other Water Board programs to attend SWAMP Roundtable meetings, and SWAMP liaisons strive to attend the Roundtables of other Water Board programs [Goal 1.3].

The California Water Quality Monitoring Council (CWQMC) was convened in 2008 as a result of Senate Bill 1070 (Kehoe, Statutes of 2006), which was passed by the Legislature and signed by the Governor in 2006. The CWQMC is tasked with coordinating water quality and related ecosystem monitoring efforts throughout California, with the goal of addressing as many water quality management needs for as many state waters as possible with available funding, including all waterbody types (such as streams, rivers, lakes, reservoirs, estuaries, coastal areas, and wetlands). In June, 2010, SWAMP and the CWQMC held a joint meeting to align strategies and strategy documents. It was agreed that the SWAMP should focus its limited funds for statewide assessments on two questions: “Is it safe to eat the fish?” and “Is aquatic life protected in freshwater streams?” By working with partners and within the CWQMC framework, this Strategy seeks to address as many water quality management needs for as many state waters as possible with available funding, including all waterbody types (such as streams, rivers, lakes, reservoirs, estuaries, coastal areas, and wetlands), and all core beneficial uses (swimmable, fishable, drinkable, and aquatic life support). This coordination allows SWAMP to focus its statewide monitoring on beneficial uses associated with fish consumption in major waterbody types and aquatic life use in streams.

Types and Extent of Waterbodies: California is a vast state with 158,700 square miles of surface area and a wide range of waterbodies.

WATERBODY CLASSIFICATION	EXTENT
Total Miles of Rivers and Streams	211,513
Perennial River Miles	64,438
Intermittent Stream Miles	124,615
Ditch and Canal Miles	22,059
Number of Lakes/Reservoirs/Ponds	10,141
Acres of Lakes/Reservoirs/Ponds	1,672,684
Miles of Shoreline	3,427
Acres of Wetlands	273,880

Core Implementation Priorities

Statewide & Regional Monitoring & Assessment

- Implement Statewide and Regional monitoring and assessment programs.
- Guide development of assessment tools that transform data into information on beneficial use support in all state waters.
- Apply these assessment tools to monitoring data gathered by SWAMP and others to produce timely, high quality information for resource management.
- Improve and strengthen the SWAMP so that it fulfills its monitoring and assessment goals at statewide and regional scales.

Coordination

- Engage Water Board regulatory and assessment programs to encourage active integration of SWAMP monitoring designs, data, and assessment tools into regional and statewide programs.
- Coordinate with the CWQMC to prioritize waterbody types and beneficial uses that SWAMP is responsible for assessing and collaborate with and provide guidance to partner organizations that assess those waterbody types and beneficial uses that are not assessed by SWAMP. Lead the CWQMC work groups on fish consumption safety and stream ecosystem health, and develop the web portals to bring those assessments to decision makers and the public.

Infrastructure & Tools

- Implement Quality Assurance and Data Management Programs to support SWAMP statewide and regional monitoring programs and provide tools for partners to produce comparable data.
- Implement the statewide assessment framework and standards for data comparability, that allow local entities to both contribute data to statewide assessments and view the results of those assessments as context for local monitoring and management.

Guiding Principles

- SWAMP monitoring evaluates the physical, chemical, and biological integrity of the State's waters.
- Monitoring at both statewide and regional levels is necessary to protect and restore water quality
- Monitoring of both high quality waters and waterbodies known or suspected to be degraded is essential to a robust ambient monitoring program.
- Monitoring is designed to support a network of information users that include state and local agencies, the regulated community, the interested public, and their elected representatives.
- Monitoring efforts are prioritized, and coordinated to maximize utility and minimize costs.
- SWAMP seeks to make the most efficient use of data collected by all Water Board programs, as well as the large amount of data collected by other agencies and the regulated community.

The implementation of the monitoring programs and coordination activities are not mutually exclusive. In fact, each has the potential to inform and enhance the other. The SWAMP monitoring infrastructure (e.g., indicators, methods, quality assurance/quality control [QA/QC], and data management) support SWAMP monitoring but also foster data comparability and collaboration with monitoring partners.

Objectives

Implementing the aforementioned priorities has been the focus of the statewide SWAMP effort for the past three years. Specific actions to continue implementation of these priorities involve multiple strategy elements.

Objective 1.1: Continue to refine and update the SWAMP Strategy [Goal 1.1]

- Integrate the SWAMP Strategy with the CWQMC's strategy to identify gaps in the State's assessment activities, and prioritize SWAMP statewide and regional monitoring to address those gaps and fulfill Clean Water Act requirements.
- Update the SWAMP Assessment Framework (*see Appendix C*) as new assessment tools and strategies become available.
- Update the SWAMP Needs Assessment (*see Appendix D*) as described under Element 10 – General Support and Infrastructure Planning (Objective 10.4).
- Update the SWAMP Strategy document at least every 5 years.

Objective 1.2: Implement the Strategy [Goal 1.2]

- Continue to work through the Roundtable to align the objectives and designs of Regional Board and statewide monitoring to increase opportunities for collaboration and leveraging (elements 2 and 3).
- Continue to support development of new indicators and assessment tools that can be used throughout the state by the various Water Board programs (element 4).
- Continue to build monitoring infrastructure to ensure comparability and enhance sharing of data among State and Regional Water Board programs (elements 5 and 6).
- Continue to perform monitoring at state and regional scales and prepare assessment reports that inform management, increase the visibility of the program and demonstrate the utility of the program (elements 7 and 8).
- Continue to evaluate the program to ensure that it remains technically sound and to ensure that the information being generated is meeting Water Board needs (element 9).
- Assess needs of the SWAMP on an annual basis to ensure there is adequate program staff to administer the program at the Water Boards and to maintain and enhance the expertise and capabilities of the SWAMP contract laboratories to allow continued high quality monitoring and assessment (element 10).

Objective 1.3: Institutionalize SWAMP's monitoring and assessment framework into other Water Board programs that require ambient surface water quality monitoring [Goal 1.3]

Clean Water Team

The Clean Water Team (CWT) works to build and support the State's Watersheds Stewardship through involvement by Citizen Monitoring in order to reduce and prevent water pollution and recover lost beneficial uses.

Citizen Monitoring is any monitoring activity of aquatic resources, aquatic habitat, and/or water quality that relies in whole or in part on participation by volunteers, students or non-paid staff. All across California and the nation, citizen monitors are monitoring the condition of streams, rivers, lakes, reservoirs, estuaries, coastal waters, wetlands, and wells. Their efforts are of particular value in providing quality data and building stewardship of local waters.

The CWT has been busy working at local levels to help create steering teams and consortiums. These steering teams and consortiums allow citizen monitoring groups and projects to grow through local networking and using shared resources of monitoring knowledge, skills and training. Self reliance and sustainability of these resources will foster the development of robust monitoring programs and promote the long term growth of citizen monitoring and watershed stewardship. To date there are seven organizations located throughout the state: Citizen Monitors of Orange County, Coastal Watershed Council, San Diego Citizen Watershed Monitoring Consortium, San Francisco Estuary Institute, Sierra Nevada Alliance, Sierra Streams Institute, and Stevens and Permanente Creeks Watershed Council.

The CWT assists these groups through six core functions: outreach and communication, technical assistance/quality assurance, training, loans of equipment, event support, and information management.

- Seek support at the State Board level to encourage programs to coordinate ambient monitoring efforts through SWAMP.
- Increase the usefulness and visibility of SWAMP information products to make them more valuable to decision makers and the public, thereby increasing support for the program;
- Meet with programs to understand their assessment needs and seek to optimize designs of statewide programs to maximize utility for Water Board programs
- Increase the number of Water Board programs that utilize SWAMP data, standards and guidance.

Objective 1.4: Coordinate with other Regional and State monitoring programs [Goal 1.3]

- Participate in the CWQMC to identify areas of potential coordination with other agencies within CalEPA and the Natural Resources Agency.
- Coordinate with existing and developing RMPs, including those in the Lake Tahoe basin, Klamath watershed, San Francisco Bay, Sacramento/San Joaquin

Delta, San Joaquin watershed, Central Coast, Los Angeles and San Gabriel Rivers watershed, and Southern California Bight.

- Support development of new RMPs to cover additional regions of the state.
- Continue to support citizen monitoring programs through the Clean Water Team.

2 Monitoring Objectives

Our vision is to clearly articulate monitoring objectives as attainable targets for producing the information needed to answer assessment questions at the statewide and Regional levels.

Goal 2.1 Define statewide monitoring objectives.

Goal 2.2 Define regional monitoring objectives.

Goal 2.3 Develop consensus on shared objectives.

Current Status

In November 2000, SWAMP submitted a comprehensive set of objectives to the State Legislature (SWRCB, 2000). In February 2005 the SWAMP Roundtable held a workshop to articulate monitoring objectives that could be applied at both State and Regional Water Board scales. There was consensus that the objectives of all Water Board programs could be framed around the protection of core beneficial uses: aquatic life, "swimmable", "fishable", and "drinkable". There are over 25 beneficial uses that vary by waterbody within each Region. However, the concept of core beneficial uses is useful as an organizing framework for monitoring around core uses shared by most waterbodies (Table 1). Protecting these "core beneficial uses" is likely to protect most other beneficial uses.

There also was consensus at the workshop that regardless of beneficial use or waterbody type the monitoring objectives of most Water Board programs could be framed around the following five key questions.

1. **What is the overall quality of waters in the Regions and the State?** CWA *Section 305(b)* requires that states determine the extent to which their waters meet the objectives of the CWA, attain applicable water quality standards, and provide for the protection and propagation of balanced populations of fish, shellfish and wildlife (*40 CFR 130.8*).
2. **To what extent is water quality changing over time?** The California Water Boards must assess and report on the extent to which control programs have improved water quality or will improve water quality for the purposes of "the protection and propagation of a balanced population of shellfish, fish, and wildlife and . . . recreational activities in and on the water" (*40 CFR 130.8[b][2] and 130.8[b][1]*). Under *Section 319(h)(11)* of the CWA, the California Water Boards must report on reductions in nonpoint source loadings and related improvements in water quality. Under *Section 314(a)(1)(F)*, a state must report on the status and trends of water quality in lakes. The California Water Boards should also be able to identify emerging environmental issues related to new pollutants or changes in activities within watersheds.
3. **What are the areas needing protection and what is the magnitude and extent of problems where they exist?** Under *Section 303(d)*, the California Water Boards must identify impaired waters. The California Water Boards should also identify waters that are

currently of high quality and should be protected from degradation per the State Water Board's Antidegradation Policy.

4. **What are the sources of stressors affecting water quality?** In order to protect and restore beneficial uses of waters, monitoring and assessment programs should identify the causes and sources of impairment. These causes of impairment (e.g., chemical contaminants, physical conditions, and biological contaminants) keep waters from meeting the water quality objectives adopted by the State to protect designated beneficial uses. The sources of impairment are activities, facilities, or conditions that generate the pollutants responsible for causing impairments. Sources of impairment include, for example, modification of hydrology, industrial and municipal wastewater treatment facility discharges, urban and agricultural runoff, and abandoned mine drainage. The California Water Boards should monitor to identify the causes and sources of impairment to support *Section 303(d)* listing / *305(b)* reporting, TMDL calculations, *Section 319* (nonpoint source control), *Section 401* (water quality certifications), and *Section 402* (point source permitting), as well as other projects and programs.
5. **How effective are water quality improvement projects and programs at protecting or restoring beneficial uses?** The California Water Boards should monitor to evaluate the effectiveness of specific projects and overall programs, including but not limited to *Section 319* (nonpoint source control), *Section 314* (Clean Lakes), *Section 303(d)* TMDLs, *Section 402* NPDES permits, *Section 401* water quality certifications, water quality standards modifications, compliance programs (Discharge Monitoring Report information) and generally to determine the success of management measures and water quality improvements projects, especially those implemented with state or federal funds.

SWAMP monitoring is built around these core uses and the five management questions. These are the five basic questions that should be asked by all the Water Board programs whether they be at the State or Regional Board level. The objectives of all SWAMP monitoring at the regional and statewide scales are framed around answering one or more of these five questions for a particular beneficial use and waterbody(s) combination.

The monitoring objectives for the Regional Water Board have been developed for each of the nine Regions and are updated annually (see Regional Fact Sheets, Appendix E). Regional Water Boards are often required to conduct *ad hoc* monitoring on short notice to address immediate threats to water quality. The SWAMP framework provides the flexibility to Regional Boards to address these issues.

The SPARC recommended that SWAMP focus its *statewide* assessment efforts on fewer waterbody/beneficial use combinations and coordinate with other monitoring programs to address other waterbody/beneficial use combinations. SWAMP responded by limiting its statewide efforts to two critical assessment needs: fish consumption safety in all fishable waters and aquatic life in freshwater rivers and streams (Table 1).

The goal of the SWAMP Bioaccumulation Monitoring Program is to address the "Fishable" use through surveys of contaminant concentrations in fish tissue throughout waters of the

state (lakes, coastal waters, rivers). The monitoring program has the following objectives: 1) determine the proportion of lakes, streams, and coastal sites in which edible fish tissues exceed thresholds for specified contaminants; 2) conduct screening of California waters to identify problem areas where additional monitoring should be conducted to determine whether a fish consumption advisory should be developed; and 3) determine, over the longer term, whether these proportions and contaminant concentrations are increasing or decreasing to evaluate the effectiveness of management actions in reducing contamination.

Table 1. SWAMP statewide monitoring programs organized according to waterbody / beneficial use combination

Waterbody Type	Core Beneficial Use			
	Aquatic Life	"Swimmable"	"Fishable"	"Drinkable"
Wadeable Streams	SWAMP – Statewide (Bioassessment & SPoT)		SWAMP – Statewide (Bioaccumulation)	
Large Rivers	SWAMP – Statewide (SPoT)			
Lakes				
Estuaries				
Ocean, Coastal, Bays				
Wetlands				

The goal of the Bioassessment Monitoring Program's Perennial Streams Assessment is to assess the "Aquatic Life" use in wadeable streams throughout the state. The objectives of the monitoring program are to 1) determine the percentage of California's perennial wadeable streams that are in good, fair, and poor ecological condition and identify high quality watersheds; 2) provide baseline data for assessing trends over time at both impaired and high quality waters; 3) determine the proportion of stream length associated with various stressors to ecological condition; and 4) determine the relative risks to ecological condition associated with these stressors.

The goal of the Stream Pollution Trends (SPoT) monitoring program is to assess trends in stressors that may be affecting aquatic life in rivers and streams. The objectives of the monitoring program are to 1) determine long-term trends in stream contaminant

concentrations and their biological impacts statewide; 2) relate water quality indicators to land-use characteristics and to the effectiveness of agency management efforts; and 3) establish a network of sites throughout the state to serve as a backbone for collaboration with local, regional, & federal monitoring programs.

The waterbody by beneficial use framework along with the five core management questions has been adopted by the CWQMC as an organizing principle in their efforts to coordinate and integrate monitoring and assessment activities within CalEPA and the Natural Resources Agency.

Objectives

SWAMP will use the beneficial use framework and the five management questions as an organizing framework to integrate SWAMP efforts with other Water Board programs and leverage monitoring and assessment efforts. The integration of SWAMP monitoring infrastructure within Water Board programs will result in better performance measure outcomes for all programs that address the question as to whether the programs are effective.

Objective 2.1: SWAMP will work with programs at the State and Regional Boards to determine how objectives of the three statewide programs can be refined to better support Water Board programs [Goal 2.1]

- BOG will continue to work with Regional Boards to make information accessible and useful to Water Board programs (methyl mercury, listings).
- The Bioassessment work group will work with Water Board programs determine how results from the perennial stream survey can be used to support the objectives of Water Board Programs (e.g., Assessment, Nonpoint Source, NPDES and Stormwater) and policies under development (e.g., Wetlands and Riparian Area Protection Policy, Hydromodification Policy).
- SPoT will continue to work with Regional Boards to evaluate effectiveness of programs to reduce pollutant concentrations and loads at the watershed scale.

Objective 2.2: Continue the evaluation and review of the specific monitoring objectives for Regional Water Board programs [Goal 2.2]

- Regional Water Board SWAMP coordinators will continue to prepare peer-reviewed monitoring plans that identify specific monitoring objectives for monitoring projects.
- Regional Water Board SWAMP coordinators will continue to make information available to staff working on *305(b)* and *303(d)* assessments.
- Regional Water Board SWAMP coordinators will continue to use objectives to coordinate/integrate/leverage resources within their Region.
- Regional Water Board SWAMP coordinators will work with programs to prioritize and refine objectives to meet Regional needs

Objective 2.3: Develop consensus on shared monitoring objectives with partner programs [Goal 2.3]

- SWAMP will continue to work with partner programs at the Water Boards to align monitoring objectives with the Clean Water Act objectives
- SWAMP will continue to work with its CWQMC work group partners to develop the Safe to Eat Fish Portal and the Healthy Streams Portal.
- SWAMP will continue to work through the CWQMC to identify agency efforts that can be used to address other waterbody/beneficial use combinations.

3 Monitoring Design

Our vision is to develop scientifically sound monitoring designs to guide efficient collection of data to meet SWAMP's monitoring objectives with available resources, and to coordinate monitoring designs among SWAMP programs, other Water Board programs, and other agencies and partners through the CWQMC. The goals expressed in the 2005 Strategy for monitoring design were:

Goal 3.1 Refine management questions for assessing core beneficial uses for all waterbody types.

Goal 3.2 Inventory management questions of existing programs and monitoring entities.

Goal 3.3 Develop strategy to answer assessment questions for each waterbody type.

Goal 3.4 Design cost-effective monitoring program(s).

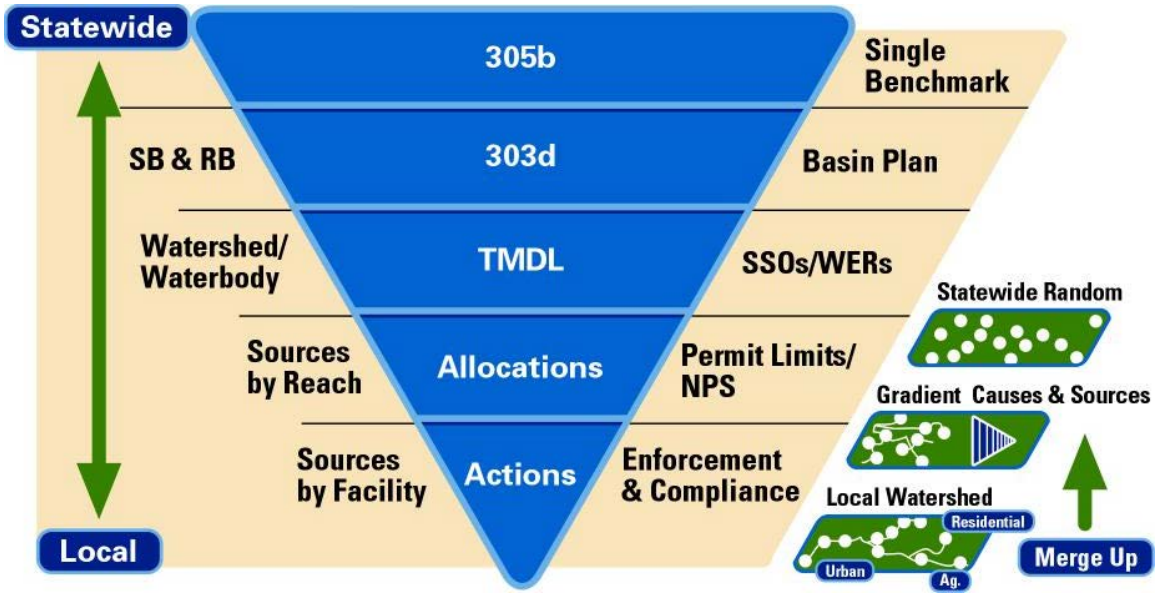
Goal 3.5 Develop and implement a suite of predictive tools to maximize our ability to effectively manage water quality.

Current Status

The SWAMP developed a set of objectives and management questions that are consistent with those of other Water Board programs [Goal 3.1] (See Monitoring Objectives section). However, even programs with similar monitoring objectives may need to approach the questions at different scales and may require different monitoring designs. For instance, the NPDES program may focus on differences upstream and downstream of a discharger, the Nonpoint Source (NPS) program may be concerned with restoration at the watershed scale. No single design can meet the needs of all Water Board programs. However, SWAMP has developed the monitoring infrastructure (indicators, methods, QA/QC, and data management) to allow data collected at different scales by various Water Board programs to be integrated (Figure 1). SWAMP is working with each of the major Water Board programs to identify and refine their monitoring questions so that different monitoring designs can be nested within a consistent statewide framework [Goal 3.1 & Goal 3.2].

A continuing goal of SWAMP is to integrate its monitoring designs so that data collected at certain sites and times can be used for more than one program. Beyond the logistical and cost advantages, there are informational advantages because statewide programs provide perspective for regional monitoring and regional programs provide finer detail for the statewide programs (Figure 1). This enhances the value of each assessment for resource management decision making. At a minimum such evaluation of monitoring design should be conducted to avoid duplication of Water Board efforts. The ultimate objective is to better refine the management questions and align monitoring efforts of SWAMP with those of other Water Board programs.

Figure 1. Statewide assessment framework that allows assessment of different monitoring questions at different spatial scales.



The monitoring performed by Regional Water Board programs is predominantly targeted monitoring. This design is good for evaluating trends at a particular location, for comparing conditions upstream-downstream of a particular source for compliance purposes, and for performing general gradient analyses. However, the results from targeted analyses cannot be generally extrapolated in space (upstream or to the watershed as a whole). Furthermore because monitoring funds tend to be limited, this type of monitoring tends to be located in known problem areas. As a result the information from targeted monitoring programs tends to give a biased (i.e., more polluted) picture of the state as a whole (Rehn and Ode, 2009).

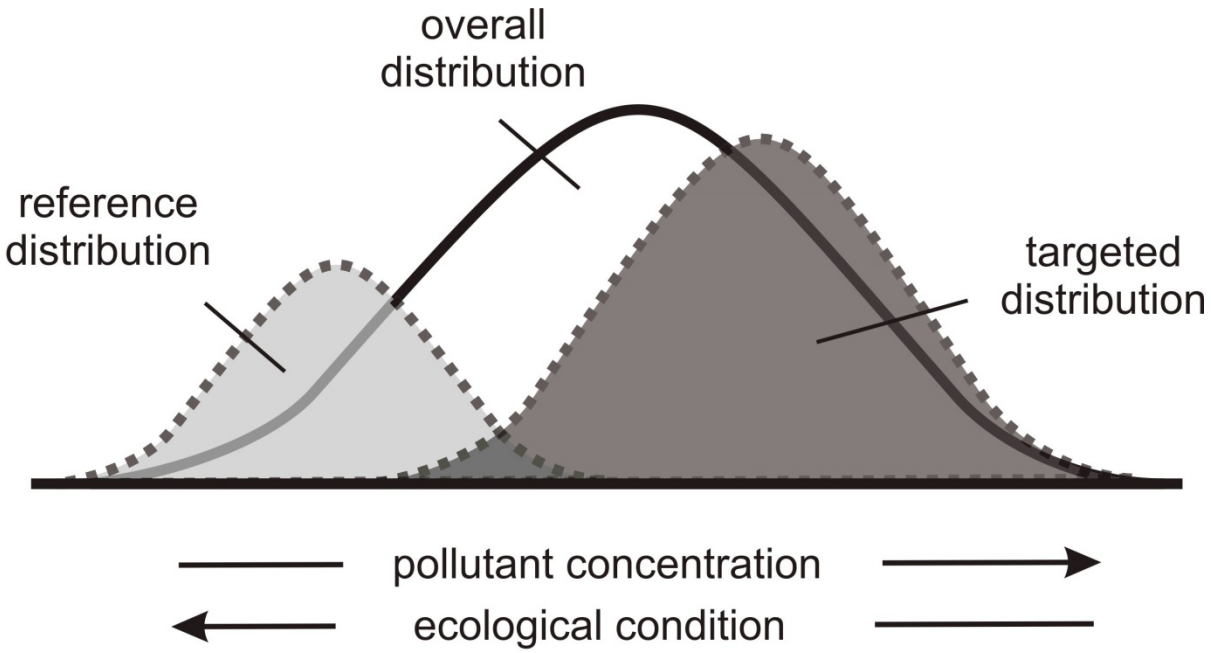
Probability-based monitoring designs are used to provide unbiased estimates of statewide or regional condition. They are better suited to answer questions about the status of a particular resource, such as "what percent of river miles are in poor condition" or "what percent of lakes have fish with tissue contamination levels above an Office of Environmental Health Hazard Assessment (OEHHA) threshold". They provide information on the overall condition of the resource across a state or region but are not designed to provide information about any particular waterbody.

While probability-based designs provide an unbiased estimate of the existing background condition, they are not optimal for defining the reference conditions. The concept of reference is critical to all Water Board programs because it provides context for evaluating narrative objectives. In a state as complex as California, both targeted and probability-based designs are likely to be necessary to define reference (Ode and Schiff, 2009).

In reality both targeted and probabilistic monitoring designs are required to generate the data necessary for the Water Boards to conduct an accurate assessment of the quality of waters (Figure 2). Targeted monitoring is used to assess conditions at areas at known or suspected

contamination. The statewide probability-based programs provide a large scale context within which Regional Water Board monitoring programs operate. Reference monitoring provides information on desired condition.

Figure 2. Theoretical distributions of monitoring variables across all sites (probabilistic and targeted surveys) and reference sites.



The SWAMP Perennial Steams Assessment (PSA) currently in the 11th year of implementation uses a probabilistic-design to monitor biological condition in streams throughout the state. The PSA design is integrated with USEPA's National Rivers and Streams Survey. In 2005, SWAMP worked with the Water Boards NPS program (2005-2009) to adjust the monitoring design to address a number of programmatic questions that the NPS program had such as the relationship between land use and biological condition. SWAMP has also worked with Regional Boards 4, 8 and 9 to encourage the Stormwater Monitoring Coalition in Southern California to nest their biological monitoring within the larger statewide PSA. The Lahontan Region (Region 6) has expanded the PSA monitoring in the Sierra.

SWAMP initiated a Reference Condition Management Program (RCMP) to evaluate reference conditions in perennial streams throughout the state. The RCMP also employs random sampling, but the sampling frame is carefully limited through geographic information system (GIS) analysis and reconnaissance to only those stream reaches that are minimally disturbed. In many areas of the state there are no natural areas, so that the best reference sites available are simply those that are the "least disturbed". Regional Boards 1, 2 and 6 are using a portion of their SWAMP allocations to leverage this effort.

The SWAMP Bioaccumulation Monitoring Program monitors fish contamination throughout the state by employing a design that integrates features of probabilistic and targeted designs. This program randomly samples waterbodies in distinct size class strata statewide, but also targets the most heavily fished locations. The design of the Lakes Bioaccumulation study was adjusted to provide information that would be useful to Regional Boards preparing the 303(d) list. The Los Angeles Region (Region 4) used its Regional SWAMP resources to expand and enhance the statewide Lakes Bioaccumulation fish contamination surveys to include additional lakes in the Region.

The SWAMP Stream Pollution Trends (SPoT) Monitoring Program uses an entirely targeted design to select sites near the base (discharge point) of large watersheds throughout the state. A targeted design is used to detect trends over time at a station and to develop an understanding of the relationships between land use, management activity, and stream pollution in large California watersheds. All of the Regions participated in site selection for the SPoT program to set up a network of long-term sites linked to Regional and stakeholder monitoring programs. The Central Valley Region (Region 5) used its Regional SWAMP resources, in collaboration with the Department of Water Resources, to increase sampling frequency and number of parameters monitored at SPoT sites within the Region.

Much of the targeted monitoring data generated through Regional Board regulatory programs (e.g. NPDES, Irrigated Lands or TMDL program) can be used to help assess the status of waterbodies at the local scale (as required under 303[d]). SWAMP does not intend to replace or supplant monitoring and assessment activities of other Water Board programs but to work with these programs to make more efficient use of the monitoring resources. Each of the statewide programs is designed to provide Water Board programs with background and context necessary to evaluate the data generated by local or regional programs. The San Gabriel Watershed Program (see box) provides an example of nesting of monitoring designs can lead to more efficient use of monitoring and resources [Goal 3.4]. SWAMP will continue to encourage similar efforts to develop watershed

San Gabriel River Regional Monitoring Program (SGRRMP)

The SGRRMP is a watershed-scale counterpart to existing larger-scale regional monitoring efforts in the southern California region that seek to address questions and concerns about regional conditions and trends (State Water Resources Control Board Surface Water Ambient Monitoring Program, USEPA's Western Environmental Monitoring and Assessment Program, and the Stormwater Monitoring Coalition). Incorporation of local and site-specific issues within a broader watershed-scale perspective was and remains one of the unique features of the SGRRMP. By considering ways to improve overall cost effectiveness of monitoring efforts in the watershed, the plan includes reductions of redundancies within and between existing monitoring programs. Efforts within the program include targeted monitoring of contaminants of concern and adjustment of monitoring locations and sampling frequencies to better respond to management priorities. The multi-level monitoring framework combines probabilistic and targeted sampling for water quality, toxicity, and bio-assessment.

monitoring programs such as those being formed for the Klamath, San Joaquin, Ventura, Los Angeles River, and San Luis Rey Watersheds.

SWAMP has also worked with other statewide programs. SWAMP uses the information generated by the state's Beach program to address the "swimmable" beneficial use at coastal beaches throughout the state. The GAMA program can help address issues related to the quality of drinking water. Both of these programs are using targeted designs to effectively monitor the entire population of high priority beaches or priority groundwater basins. Both the BEACH and GAMA program are actively working with the CWQMC on the data portals. SWAMP will continue to refine and integrate its monitoring designs and leverage support from partners to provide as much high quality information as possible with available funding [Goal 3.4].

SWAMP has explored detailed approaches to further integrate monitoring designs by using probabilistic monitoring with ecological indicators to test assumptions of non-impairment in upper reaches of watersheds where limited or no monitoring has occurred. Effective management of water quality will require a commitment not only to monitoring but also to the development of predictive tools or models. Models are needed to extrapolate measured water quality conditions to unmonitored, comparable areas. This ability to extrapolate or make predictions can be very useful for cost-effective assessment [Goal 3.5].

Objectives

Objective 3.1: Use SWAMP assessment framework based on beneficial uses and management questions to facilitate efficient coordination of SWAMP monitoring with other Water Board programs [Goal 3.1, Goal 3.2, Goal 3.3 & Goal 3.4]

- Make guidance available to other Water Board programs to best design monitoring to address objectives.
- Continue to coordinate with Water Board programs at the statewide level (e.g., NPS, TMDL, and Assessment).
- Work to align the design of SWAMP monitoring efforts with those of other Water Board programs.

Objective 3.2: Use SWAMP assessment framework based on beneficial uses and management questions to engage with the CWQMC and partner programs to optimize monitoring designs and achieve efficiencies through coordination of indicators, surveys, and analyses [Goal 3.1, Goal 3.2, Goal 3.3 & Goal 3.4]

- Build on the web-based Central Valley Monitoring Directory developed by the Aquatic Science Center, with funding from the Central Valley Water Board and USEPA.
- Determine whether partner program monitoring designs align with and/or compliment SWAMP designs.

- Continue working with and initiating new stakeholder-based regional monitoring programs and to align their designs with SWAMP to achieve efficiencies.
- Lead CWQMC work groups for aquatic life in streams and fish consumption safety so as to promote data comparability and integrated assessments.

Objective 3.3: Implement SWAMP monitoring at State and Regional Board scales to address beneficial uses at waterbodies throughout the state [Goal 3.3, Goal 3.4]

- Align, to the extent possible, the monitoring designs of the statewide and regional SWAMP programs to achieve the most efficient use of data collected (Figure 1).
- Work to integrate statewide monitoring of ecological indicators with local monitoring of known problem areas to best describe the extent of known impairments, identify previously unknown problems, and protect high quality waters.

Objective 3.4: Develop and implement a suite of predictive tools to maximize our ability to effectively manage water quality [Goal 3.5]

- SWAMP will investigate the use of models to extrapolate results from probability based surveys for use in 303(d) listings decisions for identifying both impaired and unimpaired waters.

4 Indicators

Our vision is to develop, select, and implement indicators and assessment thresholds that appropriately represent the condition of the environmental attributes and beneficial uses to be assessed, diagnose the causes and sources of impairment, and evaluate the effectiveness of management actions to improve water quality in California. The 2005 Strategy had the following four goals for indicator development.

Goal 4.1 Define core indicators for statewide monitoring and assessment for each designated use and for overall watershed health.

Goal 4.2 Recommend set of core and supplemental indicators for use at local watershed scale.

Goal 4.3 Develop indices for assessment of biological communities for different waterbody types.

Goal 4.4 Develop a set of locally appropriate indices of biological integrity (IBI) for wadeable streams.

Current Status

SWAMP uses and endorses the concept of core and supplemental indicators (Table 2) in Water Board programs at both Statewide and Regional scales. Core indicators are designed to evaluate the status or condition of waterbodies relative to beneficial uses of concern. Core indicators are appropriate statewide, but may not always be cost effective or necessary to include all in statewide monitoring programs.

Supplemental indicators are intended to be more diagnostic and are necessary when waters are known or suspected to be impaired, and effective management action requires an understanding of the causes and sources of the stressors responsible for the impairment. These indicators are often less directly tied to the beneficial uses and more closely related to the chemical/physical/biological mechanisms that either cause impairment or drive the fate and transport of stressors. Examples include toxicity identification evaluations (TIEs), endocrine disruption assays, flow measurement, hydrologic modeling, and GIS analyses. SWAMP and other Water Board programs have been involved with the continuing development of diagnostic indicators, most recently with advanced TIE methods and improved analysis of chemicals of emerging concern (such as pyrethroid pesticides and algal toxins).

Given the diversity in hydrology, land use, and Basin Plans among Regions, Regional Water Boards need the flexibility to pick and choose indicators that are applicable to their management question and appropriate for their Region. Use of SWAMP indicators and performance-based quality control provides data comparability so that Regional data can be combined with statewide data in integrated assessments.

Aquatic Life Use Indicators

Streams: SWAMP has invested substantial resources over the past five years in the development of ecological indicators (macroinvertebrate and algal bioassessment) and ecological metrics such as IBIs to produce biological objectives based on these indicators [Goal 4.3]. The statewide Bioassessment Monitoring Program interacted with the USEPA, the external scientific review committee, and expert groups (e.g., the Southwest Association of Freshwater Invertebrate Taxonomists [SAFIT]) to develop and refine bioassessment methods, metrics for combining taxonomic observations into indices for assessment, and biological objectives as part of standards development. SWAMP fostered the development of IBIs for North Coast, South Coast, the Central Valley, and Eastern Sierra and has developed observed/expected (O/E) models for the State [Goal 4.4].

SWAMP continues to implement and test the California Rapid Assessment Method (CRAM) in for use in their statewide stream surveys. The SWAMP developed and implemented a statewide reference condition management plan. This work will help define thresholds for ecological indicators being developed through SWAMP.

Bays and Estuaries: SWAMP also contributes data and coordinates with the State Water Board Ocean Standards Unit in the development of sediment quality objectives (SQOs) for bays and estuaries. The sediment quality objectives are based on synoptic measurement of a suite of sediment indicators including chemistry, toxicity, and benthic ecology, and define thresholds and narrative criteria for their interpretation and use in impairment designations. SWAMP endorses the use of the SQO triad for assessing sediment conditions.

Stream Pollution Trends (SPoT) Program: The SPoT program has adopted indicators from the U.S. Geological Survey (USGS) National Water-Quality Assessment Program (NAWQA) program, and has worked with its external scientific review committee to establish the specific list of indicators most useful for documenting trends in watershed activity and stream pollution over time. SPoT measures pesticides, metals, industrial compounds and toxicity in sediment collected from multiple points in depositional stream reaches low in the target watersheds.

Fish Consumption Use Indicators

The California Toxics Rule provides water quality criteria that can be used to protect fish consumption. However increasingly there is interest in assessing concentration of contaminants in fish tissue. With the exception of methyl mercury there are no water quality standards for fish tissue concentration. The Office of Environmental Health Hazard Assessment has developed fish contamination goals (FCGs) and a set of assessment threshold levels (ATLs) for some of the key bioaccumulative pollutants (mercury, DDT, PCBs, chlordane).The statewide Bioaccumulation Monitoring Program has implemented an analyte list comprised of persistent organic pollutants and trace metals of concern, including PCBs and mercury; and has established target fish and shellfish species which will serve as a foundation for future monitoring and trend analysis.

Swimming Use (REC 1)

There are well-defined water quality standards/thresholds for the evaluation of indicator bacteria for the protection of uses associated with water contact recreation (e.g., REC 1). SWAMP encourages the monitoring total coliform, fecal coliform and enterococcus at coastal beaches and monitoring of *E. coli* in freshwater to be consistent with the State Water Board plans to adopt *E. coli* as a statewide freshwater standard.

Drinking Water Use (MUN)

For uses related to drinking water (MUN), the Maximum Contaminant Levels (MCL) developed by the California Department of Public Health are the primary standards for evaluation. These MCLs are incorporated into all Regional Board Basin Plans.

Objectives

The SWAMP's objectives related to indicators are to coordinate with other State and Regional Water Board programs to continue the alignment of indicators, quality assurance and data management under the framework of the CWQMC; assist in the development of biological objectives based on ecological indicators; and assist in the development and implementation of sediment quality objectives. The SWAMP is committed to the CWQMC work group as a way to share guidance and information on indicators and their appropriate use.

Objective 4.1: Maintain and implement a set of appropriate monitoring indicators representative of the status of beneficial use support and diagnostic tools for Water Board programs [Goal 4.1, Goal 4.2, Goal 4.3, & Goal 4.4]

- Maintain a list of currently identified status indicators for the SWAMP and partner programs that are representative of ecological and human health attributes of concern.
- Continue assisting with the development of bioassessment methods, metrics, and thresholds for wadeable streams.
- Continue assisting with the development of diagnostic indicators, such as TIEs and analysis of chemicals of emerging concern.
- Keep track of indicator development efforts within the state (including SQOs in Delta, statewide nutrients, new criteria and rapid indicators for pathogens, and contaminants of emerging concern) to identify areas of coordination and partnership with the SWAMP.
- Utilize the State Water Board's Water Quality Goals database for standardizing numeric assessment thresholds.

Objective 4.2: Work within the CWQMC framework to assist in developing, standardizing and implementing indicators to be used by partner programs to assess all waterbody types in California [Goal 4.1 & Goal 4.2]

- Coordinate with CWQMC work groups to identify and share indicators and assessment thresholds and identify opportunities to align assessment and indicator development with other programs within the CalEPA and the Natural Resources Agency.

Table 2. The SWAMP recommended water quality indicators for general designated use categories (modified from USEPA, 2003)

Beneficial Uses	Indicators	
	Core	Supplemental/Diagnostic
Aquatic Life & Wildlife	**Conventionals** Temperature, Conductivity, pH, DO, nutrients **Toxics** Metals, Bioaccumulative, Pesticides **Toxicity** Water and/or Sediment **Biological Conditions** Invertebrates (streams) Chlorophyll (lakes, streams, estuaries) Algae Wetlands **Physical Habitat** PHab (streams) CRAM (wetlands)	Other chemicals of concern in water column or sediment TIEs Water and/or Sediment Health of organisms Landscape/Land use Flow
Fish/Shellfish Consumption	**Chemical Indicators** Mercury, Chlordane, DDTs, PCBs **Fecal Indicators (for shellfish)** Total and Fecal coliform	Other chemicals of concern in water column or sediment Landscape/Land use
Recreation	**Fecal indicators** Enterococci, total and fecal coliform (seawater) *E. coli*, enterococci (freshwater) **Other** Secchi depth (lakes) Nuisance plant Growth Chlorophyll *a* Microcystis/Microcystin	Landscape/Land use Other chemicals of concern in water column or sediment Flow Nutrients
Drinking Water	Trace metals Pathogens (Drinking Water Rule, Basin Plan language) Algae (microcystis) Nitrates Salinity Sediments/TDS	Other chemicals of concern in water column or sediment Nutrients Flow Landscape/Land use

5 Quality Assurance

Our vision is to develop, implement, and maintain the quality assurance tools and capabilities needed by SWAMP, and shared with partner programs, to allow comparable data from many sources to be used in comprehensive water quality assessments. The role of SWAMP's quality assurance program is to foster the production of data to inform decision-making (i.e., identifying water quality impairments, fish consumption advisories, TMDL targets, etc.). The goals for this element are as follows:

Goal 5.1 Implement Quality Assurance Team to provide technical oversight and direction to SWAMP QA activities.

Goal 5.2 Develop and document SWAMP Measurement Quality Objectives (MQOs) for each of the core indicators.

Goal 5.3 Evaluate the existing QA/QC program, including new methods and program changes, against SWAMP Quality Objectives.

Goal 5.4 Implement QA activities to produce data of high consistency/comparability among projects of different scales.

Goal 5.5 Implement QC procedures to produce defensible, credible data that meets SWAMP Quality Assurance Program Plan (QAPrP).

Goal 5.6 Integrate SWAMP QA/QC procedures in other State Water Board programs.

Current Status

In January 2005, SWAMP formed its QA Team, consisting of a QA Officer, QA Coordinator and several QA Specialists [Goal 5.1]. The QA Officer leads the team and reports to the SWAMP Program Coordinator and the Water Board QA Program Manager. The QA Team designates a liaison for each major project, Regional Water Board, and testing parameter. The QA Team holds monthly meetings with the QA work group, which consists of the SWAMP Coordinator, the Water Board QA Program Manager, and a representative from US EPA Region 9. The QA Team reports its progress to the SWAMP Roundtable several times each year. The QA Officer produces semi-annual reports to the SWAMP Program Coordinator and the Water Board QA Program Manager as well as other interested parties and organizations.

The initial SWAMP Quality Assurance Management Plan (QAMP) was finalized in 2002 [Goal 5.2]. In 2008, the QA Team, in conjunction with the Roundtable and stakeholders, released the Quality Assurance Program Plan (QAPrP) to replace the 2002 QAMP. The QA Team formed focus groups in May 2005 to address each program testing parameter. There are six focus groups consisting of toxicity testing, organic analytes, inorganic analytes, conventional analytes, bioassessment studies, and field measurements. Each group is used as a resource for sample collection, analysis, reporting, and data assessment [Goal 5.2].

The QA Team also reviews new and existing quality assurance project plans (QAPPs) for Regional Water Boards, bond fund grantees, and partner programs. Since January 2005, the QA Team has reviewed over 170 QAPPs. The QAPPs are compared with the SWAMP Measurement Quality Objectives (MQOs) and the USEPA 24-element QAPP requirements [Goal 5.3]. The QA Team also guided the development of an expert software system to help SWAMP and partner programs develop their QAPPs [Goal 5.6].

In addition, as part of a system-based approach, the QA Team has developed SWAMP-specific standard operating procedures for contract laboratory assessments (audits), data verification, data classification, corrective actions, communication of quality assurance program updates, and quality assurance policy and decision-making [Goal 5.4 & Goal 5.5]. All standard operating procedures are ground-tested prior to finalization and are re-assessed annually.

The QA Team creates and facilitates a framework within which all SWAMP programs and participating partner programs can generate data of known and documented quality, appropriate to project information needs, and comparable for integrated assessments [Goal 5.4 & Goal 5.5]. The QA Team accomplishes this by:

- developing and reviewing planning documents (such as Quality Assurance Project Plans);
- creating templates, checklists and other tools to guide partner programs in developing their QA planning documents;
- establishing MQOs for SWAMP measurement parameters;
- assisting in the development of expert system software;
- participates in kick-off meetings to ensure all parties are familiar with project QA requirements before the project begins;
- conducting laboratory and field audits and recommending corrective actions to improve performance;
- creating standard procedures for and assisting with data classification and verification;
- providing QA reports to management; and
- supporting State Water Board efforts to integrate SWAMP with other Water Board programs.

Within SWAMP, the QAPrP serves as an umbrella document for use by each of SWAMP's contributing projects. It describes the program's quality system in terms of organizational structure; the functional responsibilities of management and staff; the lines of authority; and the interfaces for those planning, implementing, and assessing all activities conducted.

While the focus is on data generated by the SWAMP program, the principles and procedures are applicable to the generation of ambient monitoring data by other State and Regional

Water Board programs. To date SWAMP has worked with the Stormwater Program to develop monitoring plans and QAPPs for their bioassessment monitoring; assisted the Central Valley Regional Water Board to develop QA/QC and data management procedures to meet their program needs; and initiated the effort to add marine matrices MQOs to the QAPrP in collaboration with the Ocean Standards Program [Goal 5.6].

Objectives

The SWAMP QA program conducts a range of continuing activities to provide guidance and facilitate the production of data of known and documented quality that is comparable within the SWAMP program at the Water Boards and with SWAMP's partners in other Water Board units and in the larger California monitoring community. The list of program priorities for the next three to five years includes the following:

Objective 5.1: Maintain the QA Team [Goal 5.1]

- Maintain a QA Team with regularly evaluated roles and responsibilities.
- The QA Team will continue to serve as technical experts to provide the program with oversight and direction and advice on needed standard operating procedures for QA, field and laboratory methods.

Objective 5.2: Develop and document SWAMP MQOs [Goal 5.2]

- The QA Team will maintain updated quality assurance documentation including the QAPrP, project QAPPs, and standard operating procedures. This will include developing, revising and documenting MQOs for all SWAMP field and laboratory parameters; developing field, laboratory and data QA methods for bioassessment; and defining reporting limits for chemistry laboratories.

Objective 5.3: Evaluate existing QA/QC program against SWAMP quality objectives [Goal 5.3]

- The QA Team will ensure that the data classification and verification system is up-to-date and documented in a standard operating procedure.
- The QA Team will ensure that the system is implemented as designed by developing tools and guidance for QAPP development and data classification.

Objective 5.4: Implement QA activities to produce comparable data among projects of different scales [Goal 5.4]

- Provide tools and guidance on develop project QAPPs that are consistent with the SWAMP QAPrP.
- Conduct training workshops, review and approve project and laboratory standard operating procedures, and participate in project kick-off meetings. This will ensure that all project participants understand the QA/QC procedures and activities for which they

are responsible and increase the likelihood that the problems are identified during the project so that corrective action can be implemented.

Objective 5.5: Implement QC procedures to produce defensible, credible data that meets SWAMP QAPrP [Goal 5.5]

- The QA Team will implement QC procedures to ensure the program is being implemented at all phases, from sample collection to analysis to data processing and management. QC activities will include laboratory and field audits, inter-laboratory comparisons/calibration and performance evaluation tests, and data classification and verification.

Objective 5.6: Guidance and tools for partner programs to facilitate data comparability and allow water quality assessments based on combined data sets [Goal 5.6]

- A major focus of the SWAMP program and specifically the QA Team over the next five years will be to work with other Water Board programs to ensure that their ambient monitoring data are collected and stored in a way that they can be combined with other data sets for broader-scale assessments such as 303(d) listing decisions. The State Water Board maintains a Quality Management Plan (QMP), which is the planning document that applies to all of the Water Board's quality systems and requires all Water Board programs to develop QA Program Plans to meet program needs. The State Water Board formed the QA Roundtable to coordinate the development of these plans and assess each programs' needs in terms of data quality objectives. Generally, each program must have data of sufficient quality to assess compliance with water quality standards designed to protect beneficial uses. SWAMP will work with the QA Roundtable to develop recommended reporting limits (RLs) that relate to beneficial use attainment. In addition, the QA Team will provide technical expertise to Water Board programs to develop comparable QA systems to fit their needs.

6 Data Management

Our vision is to manage the flow of data from initial measurement, through acquisition and storage in data management systems, to data output and assessment, so that accurate information is available in a timely manner to decision makers and the public. The original Strategy included the following goals.

Goal 6.1 SWAMP ambient monitoring data will be stored and checked for comparability in the SWAMP database.

Goal 6.2 Provide training and tools to facilitate the use of SWAMP data and information by the State Water Board (intra-agency) and non-State Water Board (Inter-agency) programs.

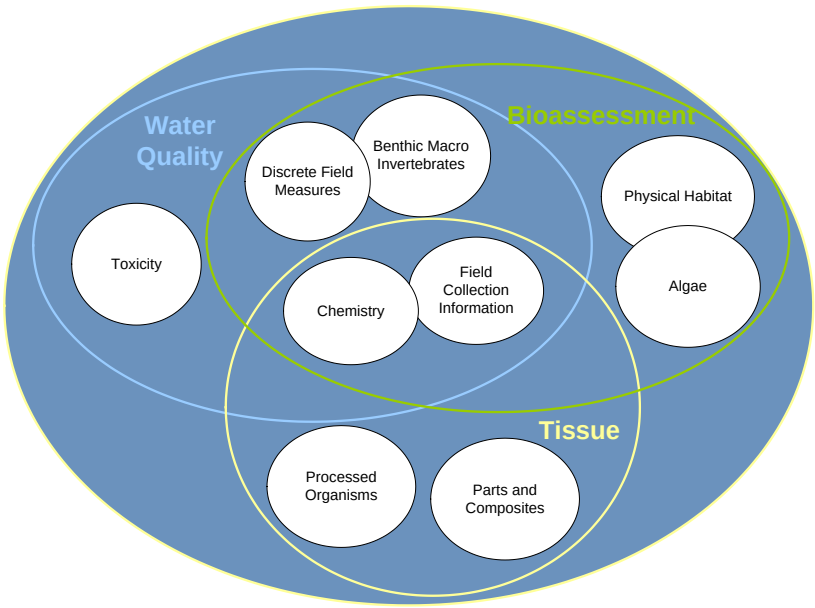
Goal 6.3 Integrate SWAMP data with information collected by the California Water Boards and non-Water Board Programs.

Current Status

Data generated by statewide and Regional SWAMP programs are submitted to the SWAMP database, managed by the Data Management Team (SWAMP DMT) [Goal 6.1]. Staff began development of the SWAMP data management system in 2001, based on a Microsoft Access®. A key component is identical temporary and permanent data tables designed to separate draft data from data of known and documented quality. The SWAMP data management system has continued to build off this initial MS Access-based model, however the permanent side of the database now resides in a MS SQL Server® database. The current v2.5 SWAMP database design has been in place since 2007.

Figure 3 shows the data types that the SWAMP database is able to store: water quality, tissue, and bioassessment. Tables for discrete field measurements, water column and sediment chemistry including bacteria indicators, and water column and sediment toxicity are fully functional. Tables for bioaccumulation including fish, bivalves, birds, and mammal tissue residue have been in place since 2008. Tables for bioassessment data including benthic macro invertebrates, algal, and habitat assessment are in production and will be fully functional in 2011.

Figure 3. SWAMP database v2.5 data elements



The SWAMP DMT provides technical support, tools and training for submitting data to the database [Goal 6.2]. The DMT

maintains the existing data and data systems and develops tools for retrieving data from the database. Data is entered into the SWAMP database either through data entry forms or loaded through specialized data loaders. Maintaining existing data in the SWAMP database makes up another large portion of the SWAMP DMT resources. The SWAMP DMT staff serves as project management liaisons for all SWAMP projects. This includes working with the appropriate regional board staff person to make sure the data sets are complete, classifying all results for data quality, and migrating project data to the permanent side of the database.

Table 3. Result counts from SWAMP database as of October 2010

	Samples	Field Results	Toxicity Tests	Lab Results	Tissue Results	Benthic Results
Initial Monitoring Effort (Temp[1])	16,339	1,225,834	101,157	976	27,891	268,426
Data of Known & Documented Quality[2]	45,062	108,712	669,201	6,675	74,840	462
TOTAL	**61,401**	**1,334,546**	**770,358**	**7,651**	**102,731**	**268,888**

[1] Data stored on the temporary side of the SWAMP database.
[2] Data have been verified against the SWAMP measurement quality objectives.

SWAMP participants can query the SWAMP database to access data for Water Board assessments [Goal 6.2]. Basic data access queries have been built to allow SWAMP users immediate access to both the temporary and permanent side of the database. SWAMP is actively engaged in the development and implementation of a number of assessment tools, such as the automated query tools for generating lines of evidence for the integrated CWA *Section 305(b)* and *303(d)* assessments. The DMT also provides information for the Water Board's annual performance report.

Data comparability within SWAMP, with other Water Board programs and with other agencies is another important goal for SWAMP [Goal 6.3]. The DMT has provided training sessions in data entry for field data collectors and in data formatting to laboratories. The DMT has created and periodically updates manuals for training on database use and analytical query tools to assist the State Water Board (intra-agency) and non-State Water Board (inter-agency) programs in accessing data and using the SWAMP database. The DMT also maintains a data management comparability help desk.

SWAMP also established four Regional Data Centers tasked with working with local data providers to submit data into the California Environmental Data Exchange Network (CEDEN), which was launched to the public in August 2010. Data stored in the SWAMP database are exported to CEDEN on a regular basis and made available to the public through online query tools. Data generated by partner programs are submitted to one of the four Regional Data

Centers (RDCs), operated by Moss Landing Marine Laboratories (MLML), the Southern California Coastal Water Research Project (SCCWRP), the San Francisco Estuary Institute (SFEI), and the University of California at Davis (UCD). Each of the RDCs receives data in SWAMP comparable formats and transfers data to the CEDEN, funded by SWAMP, to act as a clearing house for water quality data used in comprehensive assessments. CEDEN also will be a primary source of data for the CWQMC's *My Water Quality* web portals that present answers to key assessment questions asked by decision makers and the public. SWAMP is committed to the CWQMC work group and web portal approach as a way to share guidance and information on indicators and their appropriate use, leading to increased data sharing and comprehensive assessments based on data from multiple programs.

Objectives

The SWAMP DMT will continue to maintain and improve the SWAMP database system and products for all SWAMP data elements and will maintain and update the database as new technologies are developed. The DMT will continue to load SWAMP ambient monitoring data to the temporary side, verify and classify it, and then transfer it to the permanent side. The DMT also will continue to develop tools and training modules as well as coordinate the State Water Board and non-Water Board programs to facilitate the use of the SWAMP database and data to increase data comparability throughout California.

SWAMP will continue to work with the RDCs to improve and expand on current data tools as well as provide new tools and new data to help turn data into information. The RDCs will continue to work with programs to upload their data into the CEDEN system and to expand the types of data currently available through the CEDEN. CEDEN will provide automated services for grant recipients and smaller data generators to assist them in uploading their data to the system. CEDEN will continue to work with the SWAMP DMT and the State Water Board staff to provide data formats which are required for the integrated assessment report application and increase the use of this tool beyond SWAMP. CEDEN will provide exports of CEDEN data to the USEPA WQX system for use in currently available applications, and to help programs meet their Federal data submittal requirements. CEDEN also has plans to automate many of the Bioassessment analysis functions being developed by the SWAMP Bioassessment work group and the SWAMP DMT to expand the use of bioassessment data in regulatory purposes.

Objective 6.1: Develop and implement a data management system that maintains and documents the integrity of SWAMP data and metadata from initial measurement to final assessment, and efficiently retrieves data to answer SWAMP assessment questions [Goal 6.1]

- Maintain the SWAMP database capable of storing ambient monitoring data elements.
- Verify and classify all SWAMP data to clearly document quality.
- Develop effective methods for querying and extracting data from the SWAMP database and CEDEN in formats useful for answering assessment questions.

- Develop and update the Data Management Plan and business rules to manage data flow.

Objective 6.2: Facilitate data comparability within SWAMP, with other Water Board programs, with CWQMC partners, and with participating stakeholder monitoring programs [Goal 6.2]

- Work with the Water Board's Assessment Unit, SWAMP participants, and the Regional Data Centers to define the minimum data elements needed to submit data to CEDEN.
- Conduct training on input to SWAMP database.
- Staff the data management help desk.
- Maintain automated data checker applications for all entities submitting to the database.
- Initiate user group meetings to share data management information.
- Continue to work within the Regional Data Centers to incorporate new data types and to incorporate the best data management practices.

Objective 6.3: Facilitate data exchange within SWAMP, with other Water Board programs, with CWQMC partners, and with participating stakeholder monitoring programs [Goal 6.3]

- Maintain updated replicated databases at each Regional Data Center as well as the CEDEN master replicate.
- Efficiently export data between the SWAMP database and CEDEN.
- Expand CEDEN by using existing resources at the RDCs and leveraging professional contacts within a regional area and work with other programs to develop formats and crosswalks to allow for the exchange of data with CEDEN.
- Develop applications that allow users to query data on the web and allow for downloading of data in standard formats.
- Develop systems to extract data from CEDEN to populate the Water Board 305b/303d on line Integrated Assessment of water quality conditions and impaired waters in California.
- Develop systems to extract data from CEDEN to populate the CWQMC on-line web portals where information can be easily accessed by decision makers and the public.
- Make the CEDEN network self-sustaining.

7 Data Analysis and Assessment

Our vision is to provide a consistent science-based assessment framework that integrates data from SWAMP and partner programs to effectively answer assessment questions and inform water quality management decisions at the State and Regional levels. The original goals of the Strategy are as follows:

Goal 7.1 Develop a method for assessing standards attainment for listing purposes (303[d]).

Goal 7.2 Develop guidance to assist in 303(d) and 305(b) assessments, consistent with the 303(d) listing policy.

Goal 7.3 Contribute to statewide and regional assessments to achieve comprehensive assessment of all waterbodies for all beneficial uses.

Current Status

Assessment is the translation of monitoring data into information relevant to identified management issues. The overall focus of the SWAMP Strategy is that all Water Board activities contribute to identifying high priority assessment questions and providing answers to those questions to aid resource managers and the public in making informed policy decisions.

The SWAMP contributes to the determination of beneficial use support for all California waters under CWA *Section 305(b)*, and the identification of waters not supporting beneficial uses (i.e., impaired waters) as required by CWA *Section 303(d)* (see box). Both of these assessments are described in the biannual Integrated Report. The SWAMP provides data, tools and expertise to the State and Regional Water Board assessment units to develop lines of evidence for beneficial use support ratings and impairment designations consistent with the State Water Board's (2004) Policy for Developing California's Clean Water Act §303(d) List [Goal 7.1 & Goal 7.2]. The

Beneficial Use Support Categories	
1	1) A water that supports a minimum of one California Beneficial Use for each Core Beneficial Use that is applicable to the water; and 2) has no other uses impaired.
2	1) A water that supports some, but not all, of its California beneficial uses; and 2) has other uses that are not assessed or lack sufficient information to be assessed.
3	A water with water quality information that could not be used for an assessment, for reasons such as: monitoring data have poor quality assurance, not enough samples in a dataset, no existing numerical objective or evaluation guideline, the information alone cannot support an assessment, etc.
4A	1) A water segment where ALL its 303(d) listings are being addressed; and 2) at least one of those listings is being addressed by a USEPA approved TMDL.
4B	A water segment where ALL its 303(d) listings are being addressed by action(s) other than a TMDL.
5	A water segment where standards are not met and a TMDL is required, but not yet completed, for at least one of the pollutants being listed for this segment.

SWAMP funded the development of the California Water Quality Assessment Database (CalWQA) which is the primary tool use by 303(d) staff at the State and Regional Water Boards to develop the Integrated Report.

SWAMP conducts three priority statewide assessments [Goal 6.3]:

- The Bioaccumulation Monitoring Program has completed its first assessment of California lakes and is beginning its assessment of coastal waters.
- Bioassessment Monitoring Program: The PSA currently is in the middle of its 11th sampling year. They have produced the following reports: SWAMP recently completed a draft technical report that will provide source material for a series of management reports that will showcase the many potential applications of PSA data in Water Board management programs. The RCMP's programmatic plan has been peer-reviewed, finalized, and posted at the State Water Board's website. The RCMP will be further refined to define regionally appropriate stressor thresholds for screening and selecting reference sites and to establish alternate strategies for identifying appropriate reference sites in areas that lack a sufficient number or distribution of minimally disturbed candidate sites.
- Stream Pollution Trends (SPoT) Monitoring Program has completed its first two years of monitoring, with one of those years substantially limited due to funding shortfalls. Those data currently are being assessed to establish baselines for long-term trends and to investigate relationships between land use and stream pollutant concentrations and toxicity. A report on the first two years is due in 2011.

Regional SWAMP programs conduct a variety of assessments to determine compliance with Basin Plan objectives, categorize impaired waters, identify causes of impairment, locate and manage pollution sources, regulate discharges, and manage nonpoint sources such as urban stormwater and agricultural runoff [Goal 7.3]. These SWAMP assessments can be found on Regional Water Board websites (e.g., http://www.ccamp.org/). The regional assessments utilize SWAMP monitoring design, quality assurance, and data management tools to ensure that data are collected in a manner consistent with the statewide programs and can be combined for broader scale assessments.

The SWAMP is aligning many of its programs with the California Water Quality Monitoring Council's (CWQMC) approach to assessment. The CWQMC has formed work groups that are tasked with developing assessment questions around themes: Is it safe to eat fish and shellfish?; Is it safe to swim at my beach?; Is our water safe to drink?; and Are our ecosystems healthy? The work groups then identify and obtain data sets to answer the questions and develop web portals to convey the assessments to the public. The SWAMP has taken the lead on two work groups to develop CWQMC web portals that provide easily accessible assessments of the health of aquatic life in streams and the level of contaminants in sport fish and shellfish in all California waters. These work groups operate under the CWQMC guidelines to develop the two web portals, participate in the development of

thresholds for beneficial use support assessment, and establish report card formats for communicating water quality conditions.

The CEDEN data exchange network initially supported through SWAMP funding provides data for web portals addressing a range of beneficial uses and waterbody types (See Data Management section).

Objectives

Objective 7.1: Apply SWAMP tools and expertise to high priority assessments [Goal 7.1 & Goal 7.2]

- Provide guidance and tools to assist in CWA 305(b)/303(d) assessments including the translation/interpretation of narrative standards.
- Ensure that SWAMP data generated from statewide and Regional Board monitoring efforts is available for use in integrated report.
- Support the development and sharing of tools (such as automation software) to facilitate assessment of compliance with Basin Plan objectives.
- Support the development and sharing of tools (such as the Central Coast Ambient Monitoring Program's [CCAMP's] automation software) to assess impaired waterbodies and overall resource conditions (303d/305b).

Objective 7.2: Implement the three SWAMP statewide assessments [Goal 7.3]

- The Bioaccumulation monitoring program will continue its assessment of coastal waters and plan for subsequent assessment of large rivers.
- Assess the ecological condition of perennial streams and reference sites. PSA is currently (2008-2011) focused on increasing representation across California's major ecoregions. Highest priority for the RCMP will be given to sampling reference sites as needed to support the development of biological objectives.
- Assess trends in stream pollution and relationships with land use and management action. In 2010, the SPoT monitoring program will complete its first assessment of stream contamination and toxicity in large California watersheds. SPoT will begin its trend analysis with the second assessment in 2011.

Objective 7.3: Use CWQMC Portals as a framework for assessment [Goal 7.3]

- Coordinate SWAMP assessment strategy with the CWQMC to identify waterbody types, beneficial uses, and management questions that SWAMP will address.
- Integrate, where appropriate, data from different indicators and designs to generate efficient statewide assessments.

- Create a general and adaptable set of thresholds against which to compare all SWAMP measurements for report cards and policy action at the statewide and Regional levels.

Objective 7.4: Implement and assist with special assessments for identified resource management issues [Goal 7.3]

- Provide data for and assist with the development of Sediment Quality Objectives (SQOs).
- Provide monitoring expertise and guidance for assessment of Areas of Special Biological Significance (ASBS).
- Partner with other Water Board programs, the USEPA, and other agencies on shared assessments such as the National Surveys for Lakes, Streams, Coastal Waters, and Wetlands.

8 Reporting

Our vision is to make all SWAMP data available to the public, to translate SWAMP data into information useful for making resource management decisions, and to provide timely reports in formats most accessible to target audiences. To accomplish this, the SWAMP identifies target audiences, selects the most effective media to reach them, and provides a range of products from newsletters and fact sheets to interpretive reports and statutory documents, such as the Integrated Report (Clean Water Act (CWA) *Section 303(d)* list / *305(b)* Report), and the CWQMC's *My Water Quality* web portals.

Goal 8.1 Produce timely and complete water quality reports and lists as required by the Clean Water Act and consistent with current USEPA guidance.

Goal 8.2 Report to the public on water quality taking into account the needs of interested audiences. Use various formats and media such as brochures, fact sheets, report cards, oral presentations, and the Internet.

Goal 8.3 Produce technical reports and peer reviewed journal articles resulting from monitoring program activities.

Current Status

The SWAMP provides data and participates in assessments to compile reports and lists required under the Clean Water Act including [Goal 8.1]:

- The CWA *Section 305(b)* water quality assessment report, which characterizes the condition and quality trends of monitored waters within the state and is due on April 1 of even-numbered years. This is the primary state surface water quality assessment report to USEPA and draws upon information from SWAMP, the Nonpoint Source program, TMDLs, and other national, state and local assessments.
- The CWA *Section 303(d)*, which list identifies all impaired waters based on existing and readily available information. The list is also due on April 1 of even-numbered years.
- Development and submission of *Section 305(b)* water quality assessment reports and *Section 303(d)* lists of impaired waters can be integrated. The Integrated Report will satisfy CWA reporting requirements for both *Section 305(b)* water quality reports and *Section 303(d)* lists. The SWAMP represented a significant source of data in the 2010 Integrated Report. SWAMP data were used in the generation of 11,616 lines of evidence (LOEs, 52% of the total number), or individual data assessments, supporting the development of 2010 *303(d)* list.
- The annual data update requirement may be satisfied by uploading monitoring data to the national Water Quality Exchange (WQX) warehouse or updating the *305(b)* assessment information in the California Water Quality Assessment (CalWQA)

database which is compatible with the USEPA National Assessment Database. SWAMP funds were used to support the development of CalWQA.

- *Section 406* of the Clean Water Act, as amended by the Beaches Environmental Assessment and Coastal Health Act of 2000, requires states with *Section 406* grants to submit information on monitoring and notification programs for coastal recreation waters. Details on the California program are included in the Annual Clean Beach Initiative Report to the Legislature.

In addition the SWAMP provides data for a number of reports that satisfy California State requirements [Goal 8.2]:

- In 2009, the Water Boards released the first annual Performance Report. The second annual report was released in September 2010. The first two reports focus primarily on the Water Boards activities to protect water quality (e.g., number of permits issued, inspections conducted, enforcement actions issued). However the long-term vision is that the Performance Report also will measure the Water Boards performance in terms of environmental outcomes such as water quality improvement. Results from SWAMP's statewide assessments were used to report on ecosystem health in the Water Board's Annual Performance Report [Goal 8.2]. Those report cards were an initial step toward the long-term goal of reporting environmental outcomes.
- The California Water Quality Monitoring Council provides recommendations for improving monitoring and assessment through coordination among local, regional, state and federal agencies and other entities that collect water quality data in California. Their efforts focus on developing theme-based web portals for reporting water quality and associated ecosystem health information to answer questions important to resource managers and the public as a means for developing collaborative relations among monitoring entities and thereby improving the efficiency and effectiveness of monitoring, assessment, and reporting.

SWAMP provides and supports a variety of reports. Most of the reports are available to the public in paper and electronic form and include fact sheets, data reports, quality assurance reports, interpretative reports and the Integrated Report. These reports provide an analysis and interpretation of the data collected. Technical reports are summarized in fact sheets that capture key findings in a more accessible format [Goal 8.3].

Technical reports from the statewide SWAMP programs are available on the SWAMP website. The Bioaccumulation Program has published a review of historical data on bioaccumulation in fish and shellfish (Davis et al., 2007), as well as an assessment of edible fish contamination in California lakes (Davis et al., 2010). The Bioassessment Program has continued a series of reports on the ecological health of California streams (Ode and Rehn 2005; Ode, 2007) and will be producing a scientific report on the first 8 years of the PSA along with a series of management reports. They have also contributed to a series of reports on the development of bioassessment indicators and metrics. The SPoT program's first report is due in 2011. All of these programs have contributed data used in the Integrated

Report. SWAMP has also produced a number of reports on special studies [Goal 8.2 & Goal 8.3]. SWAMP reports can be found at: http://www.swrcb.ca.gov/water_issues/programs/swamp/reports.shtml.

SWAMP Regional programs have produced numerous reports to address Basin Plan priorities and local issues. These can be found at: http://www.swrcb.ca.gov/water_issues/programs/swamp/regionalreports.shtml.

SWAMP funds have also been used to develop reports to support specific programs. In 2008, the SWAMP worked with the Ocean Planning Unit to assess aquatic life use in Bays and Estuaries using the newly developed sediment quality objectives. This report was provided to the State Water Board to inform their decision to adopt the SQOs. SWAMP also supported monitoring of Areas of Special Biological Significance (ASBS). A report on the status of water quality in ASBSs is expected in late 2010. Also in 2008 SWAMP supported the assessment of the quality of estuarine wetlands throughout the state using the California Rapid Assessment Method (CRAM). This report supported the State of the State's Wetlands report (Natural Resources Agency, 2010). CRAM methods are currently being deployed as part of the SWAMP's Bioassessment Monitoring Program. It is hoped that this work will ultimately support CRAM development and Water Board efforts to formulate its riparian policy.

Objectives

Objective 8.1: Produce timely and complete water quality reports and lists as required by the Clean Water Act and consistent with current USEPA guidance [Goal 8.1]

- Contribute the necessary quantity and quality of SWAMP data for use in the Integrated Report including healthy streams.
- Assist in developing guidance for defining whether a waterbody has been adequately assessed and when there is sufficient information to assign a waterbody to Category 1 (fully supporting all beneficial uses).
- Participate in data analysis and preparation of the Integrated Report.

Objective 8.2: A web-based reporting system that effectively transfers information to decision makers and the public [Goal 8.2]

- A SWAMP website that posts SWAMP assessment products and draws target audiences.
- A CWQMC fish and shellfish consumption safety web portal maintained by the SWAMP Bioaccumulation Oversight Group (BOG).
- A CWQMC stream ecosystem health web portal maintained by the SWAMP Healthy Streams Partnership.
- A CEDEN system capable of exporting data through efficient query tools and able to support information delivery to the public through CWQMC web portals.

- An Integrated Report website that includes an interactive map that delivers detailed water quality assessment information to the public.
- Provide information for the Water Board's Annual Performance Report including recommendations for reporting environmental outcomes.

Objective 8.3: A SWAMP water quality reporting strategy that uses various formats to most effectively reach target audiences [Goal 8.2]

- Up-to-date SWAMP website providing access to all communication products.
- Regular manager's reports, fact sheets, brochures, and report cards summarizing state and regional assessments.
- Regular publication of the Monitor newsletter.
- Presentations to colleagues at the National Water Quality Monitoring Conference and other professional meetings and workshops.
- Email subscriptions and press releases to alert target audiences of product releases.
- A series of webinars to present assessment tools, program descriptions, monitoring results and assessments to a wide audience.

Objective 8.4: Effective communication with agency management [Goal 8.2]

- Presentations and briefings to management at the Water Boards and partner agencies.
- Presentations to the CWQMC.
- Liaison to Roundtable meetings for other Water Board units such as TMDL and NPS.
- Timely water quality reports to agency managers and decision makers.

Objective 8.5: Technical reports and peer reviewed journal articles resulting from SWAMP activities [Goal 8.3]

- Technical reports for all statewide and regional assessments available within two years of data collection.
- Support for publication in scientific journals as a form of external peer-review.

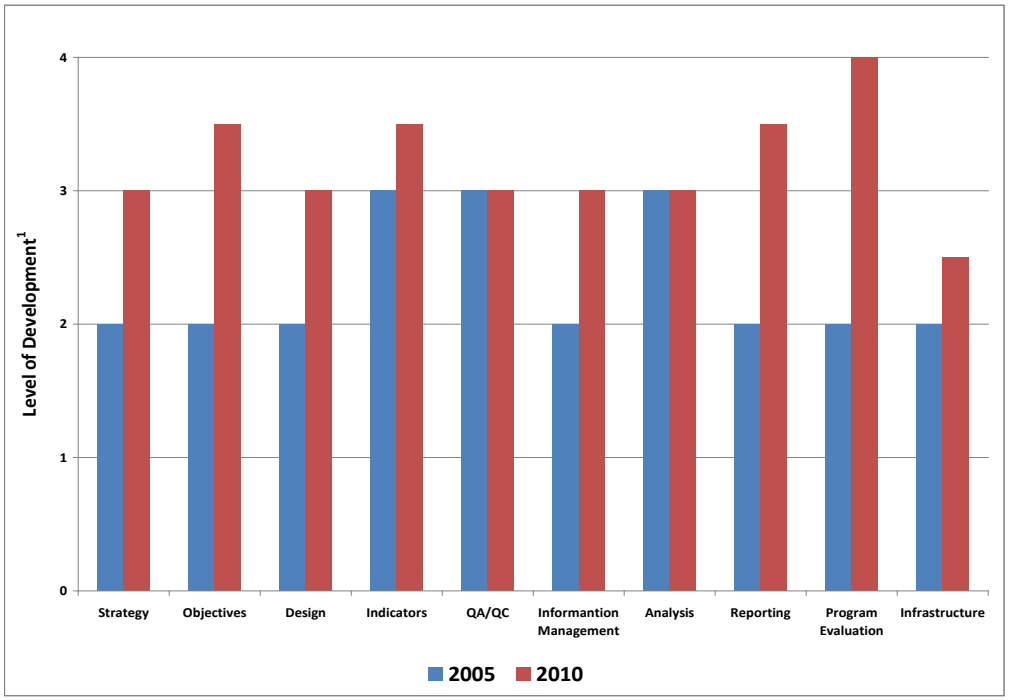
9 Programmatic Evaluation

Our vision is to conduct periodic reviews of each aspect of the program to determine its scientific validity, whether it is being implemented as designed and how well it serves the water quality decision needs of the state.

This will require the California Water Boards, in consultation with USEPA Region 9, to conduct periodic reviews of the SWAMP program to determine how well the program is being implemented and how well it serves the water quality decision needs for all State waters, including all waterbody types. This review must include an evaluation of the monitoring program strategy to determine how well each of the 10 elements is addressed and how to incorporate needed changes and additions into future monitoring cycles. This evaluation will take into consideration the effects of funding shortfalls on implementation of the monitoring program strategy.

In 2005, SWAMP was evaluated against the 10 monitoring program elements. In 2010, an evaluation by USEPA showed that the program made significant progress in each of the 10 elements (Figure 4 and Table 4).

Figure 4. Evaluation of the SWAMP's monitoring strategy (2005-2010)



[1] Level of Development: Levels 1 and 2 are not consistent with the *Elements* (USEPA, 2003) guidance, Level 3 programs are consistent with the Elements Guidance, and Level 4 represents an enhanced program.

Table 4. Summary of the SWAMP's progress toward meeting the ten monitoring program elements

Element	Evaluation of SWAMP 2010
Strategy	The SWAMP Strategy was revised to acknowledge formation of the California Water Quality Monitoring Council (CWQMC), which is a multi-agency work group. State Water Board does not have the resources to monitor all water resources within the State. The SWAMP Strategy is being integrated with the CWQMC to provide framework for increased coordination of monitoring and assessment.
Objectives	The original Strategy called for SWAMP to address four core beneficial uses (swimmable, fishable, aquatic life use, drinking water) in multiple waterbody types across the State. The SWAMP is now focusing on aquatic life use in streams and fish tissue contamination in lakes, coastal zone and rivers. The CWQMC is being used as a forum to coordinate with other State and federal agencies to generate data to assess beneficial uses in other waterbodies.
Design	The SWAMP implemented probabilistic monitoring statewide for aquatic life use in perennial streams and fish contaminants in lakes and coastal waters. Challenges remain in working with designs of other agencies to meet overall objectives.
Indicators & Thresholds	Refining biological indicators for streams including invertebrates, periphyton and riparian wetlands. Working with Department of Public Health on thresholds for bioaccumulation. Need to work with resource agencies to explore and develop other indicators for aquatic life use.
QA/QC	Developed statewide QA/QC program for the SWAMP activities performed by Regional Water Boards and Statewide surveys. Now integrating the SWAMP QA/QC procedures into other State Water Board programs or the programs of other State agencies. Emphasis is on defining appropriate levels of comparability.
Information Management	Developed data management structure for multiple data types (water quality, toxicity, sediment and tissue contaminants, physical habitat, macroinvertebrates). The SWAMP is not able to support all state ambient data needs. SWAMP is supporting development of the California Environmental Data Exchange Network as a tool for agencies to share data. SWAMP is also working with CWMQC to develop theme-based web portals built around four core beneficial uses as a means to communicate information to the general public. There are challenges associated with getting agreements to establish standardized formats for data exchange.
Analysis & Assessment	Significant effort has been invested on development of tools for use in 305b and 303d assessments. Challenges remain in institutionalizing use of biological endpoints in 303d listing in all nine Regional Water Boards across the State.
Reporting	Produced several statewide condition surveys (aquatic life use in perennial streams, fish contamination in lakes, sediment quality in coastal waters). The SWAMP also produced a diverse array of other products including regional reports, special studies, fact sheets, newsletters, press releases, and presentations at professional meetings. Link to the SWAMP statewide reports webpage.
Programmatic Evaluation	A programmatic peer review of the SWAMP was completed in 2005. Since then, peer reviews have been focused on particular aspects of the program (e.g., Bioaccumulation Survey and Reference Approach). These come at a cost, but are well worth it.
Infrastructure Planning	Funding for basic infrastructure is a challenge. Program needs evaluated during CWA *Section 106* negotiations and workplan development. The SWAMP is evaluating options for potential sources of funding to reduce its reliance on *Section 106* funds.

SWAMP should be evaluated as part of a continuous improvement feedback loop. This may include, for example, undertaking audits focused on implementation of the monitoring program objectives, quality assurance protocols, and laboratory and data assessment procedures.

Goal 9.1 Ensure that the program is being implemented as designed.

Goal 9.2 Ensure that the SWAMP program is meeting the needs of other Board programs (for example, the TMDL or NPS programs).

Goal 9.3 Ensure that the program is technically sound.

Current Status

Currently, the SWAMP program receives input, review and guidance from a number of entities that assist the program:

SWAMP Roundtable: Coordination of the SWAMP is achieved through monthly meetings of the SWAMP Roundtable. The Roundtable is composed of State and Regional Water Board staff and representatives from other agencies and organizations, including the Department of Fish and Game, the Marine Pollution Studies Laboratory, and the University of California. Interested parties, including members of other agencies, consultants or other stakeholders are welcome to participate. Roundtable members provide programmatic, technical, and logistical support and guidance on the implementation of the program. Generally, decisions are made by consensus. The strength of the current program resides in the Roundtable. Together, the skills, knowledge, abilities, and perspectives of the individual members combine to form a coordination entity stronger than its individual participants [Goal 9.1].

California Water Quality Monitoring Council: The CWQMC is co-chaired by the CalEPA and the Natural Resources Agency and is comprised of stakeholders from the regulated community, non-governmental organizations, and academia. The CWQMC serves as a review body for the SWAMP and recently reviewed a draft of the SWAMP Strategy revision, which will be appended to the CWQMC's comprehensive monitoring strategy [Goal 9.2].

Watershed Technical Advisory Committees: Some regions have elected to receive reviews and coordinate their watershed assessments by relying on locally appointed technical advisory committees (TACs). The TAC functions vary and may include planning and/or review. Although effective for individual regions, TACs' inconsistent implementation among regions limits their overall program value [Goal 9.3].

Scientific Planning and Review Committee: An external scientific panel, the Scientific Planning and Review Committee (SPARC) was organized by SWAMP to review monitoring objectives, design, approaches, indicators and other relevant topics. Committee members are representatives from federal and state agencies and academics with expertise in fields such as monitoring program management, monitoring design, ecology, chemistry, quality assurance, pathogens, toxicology, and statistics. The SPARC met in 2005 and produced a set of written recommendations, finalized in 2006. Since then, each of the three SWAMP

statewide programs has convened its own external scientific review committees to guide these programs [Goal 9.1, Goal 9.2 & Goal 9.3].

External Scientific Review for the three SWAMP statewide programs: The Bioaccumulation, Bioassessment, and Stream Pollution Trends monitoring programs each have convened external scientific review committees that meet as needed to review program objectives, designs, indicators and assessments. These committees are comprised of nationwide experts in the programmatic and technical aspects of relevant disciplines, and include managers of related federal programs such as USEPA Environmental Monitoring and Assessment Program (EMAP) and USGS NAWQA [Goal 9.3].

Objectives

Objective 9.1: Evaluate workplans, perform audits, and develop performance measures to ensure the program is implemented as designed [Goal 9.1]

- Review annual and/or multi-year workplans, including the Regional SWAMP workplans and monitoring plans, to ensure that all program elements are addressed in workplans.
- Use information from regional audits to document extent of compliance with elements.
- Develop program performance measures and report on them annually.

Objective 9.2: Evaluate the program to ensure it is meeting the needs of other Water Board programs [Goal 9.2]

- Annual evaluation by SWAMP.
- Annual evaluation by USEPA.
- Periodic evaluation by program offices.

Objective 9.3: Employ peer review to ensure that the program is technically sound and scientifically defensible [Goal 9.3]

- Continue technical review of all monitoring plans and technical reports.
- Develop and implement process to respond to the Scientific Planning and Review Committee (SPARC) recommendations.
- Conduct focused review of program elements to ensure they are implemented as designed and in a cost-effective manner.
- Participate in triennial review of the CWQMC comprehensive monitoring strategy as required by the enabling legislation (Senate Bill 1070, Kehoe, Statutes of 2006).

10 General Support and Infrastructure

Our vision is to provide the support needed to implement a coordinated and comprehensive monitoring and assessment program, and to maintain the infrastructure and program capabilities necessary to accomplish program goals.

Goal 10.1 Provide ongoing program coordination, administration and oversight.

Goal 10.2 Update the SWAMP needs assessment.

Current Status

SWAMP is currently funded at approximately 7 percent of the original estimate in the 2000 Needs Assessment. The lack of adequate resources has seriously limited what SWAMP is able to accomplish. It is highly unlikely that the program will ever have the resources described in 2000. This Strategy update reflects our current efforts to increase support for SWAMP by increasing the value and access to SWAMP information products, and to coordinate with partners who can assist with coverage of other Clean Water Act monitoring requirements.

SWAMP has since greatly reduced its monitoring scope and has targeted its statewide programs on two critical areas: contamination of edible fish and shellfish in all waterbody types, and aquatic life beneficial uses in streams. To meet the Clean Water Act requirements of assessing all waters for all beneficial uses, SWAMP needs to both seek additional funding and increase its coordination with partner programs that monitor areas where SWAMP cannot.

SWAMP has had partial success in both areas. The USEPA and the State Water Board have allocated CWA *Section106* funds to support the SWAMP statewide programs at their current levels. SWAMP Regional and infrastructure allocations have declined, and additional funding sources need to be identified. Our coordination efforts were greatly enhanced with the creation of the California Water Quality Monitoring Council. The CWQMC has recommended and begun implementation of a system of theme-based work groups to address the range of waterbody type/beneficial use combinations in need of assessment. SWAMP is taking responsibility for the Safe to Eat Fish and Shellfish work group and the Aquatic Ecosystem Health in Streams, Rivers, and Lakes work group. A web portal for the Safe to Eat Fish and Shellfish theme was released in 2010 and currently is being enhanced with new data and assessments. The Healthy Streams Partnership is developing the Aquatic Ecosystem Health in Streams, Rivers, and Lakes web portal for release in 2011.

The SWAMP also is actively recruiting partners in other Water Board programs, other CalEPA and Natural Resources agencies, the regulated community, and citizen monitoring organizations. By providing tools for data comparability and exchange, SWAMP is encouraging these entities to generate and contribute data that can be integrated into comprehensive assessments that would otherwise exceed SWAMP's scope. SWAMP's statewide programs share sites and indicators with partners to provide statewide perspective

for local programs and greater spatial detail for statewide assessments. SWAMP's Regional programs actively partner with local entities to leverage SWAMP funds and increase the information value of resulting assessments. SWAMP also is working with the State Water Board's Quality Assurance Program and the recently assembled QA Roundtable to develop Quality Assurance Program Plans for all Water Board programs that collect ambient surface water monitoring data.

One area in need of infrastructure improvement, as identified by both the Roundtable and the CWQMC, is the contracting process by which SWAMP accesses the capabilities of the University of California (UC) and California State University (CSU) to conduct monitoring, data management, and assessment. The State Legislature has begun to address this issue with the passage and signing of Assembly Bill 20 (Solorio, Statutes of 2009) that requires the Department of General Services, to establish a model contract with standard contract provisions for UC and CSU agreements. This may be one step toward streamlining a contract process that currently requires multiple reviews and results in lengthy delays.

Objectives

Objective 10.1: Increased visibility and usefulness of SWAMP information through targeted reporting and dissemination via the CWQMC web portals [Goal 10.1, Goal 8.2]

- By engaging partners and making monitoring information more accessible on the CWQMC web portals and other outlets, SWAMP intends to increase its outreach and make its programs more valuable to the public and decision makers (Element 8).

Objective 10.2: Provide ongoing program coordination, administration and oversight [Goal 10.1]

- Support Water Board staffing levels adequate to manage SWAMP contracting and administrative needs.
- Identify and implement the most effective method of contracting for the program.
- Maintain laboratory and field capability adequate to handle current and anticipated monitoring workload.
- Maintain the expertise and capabilities of SWAMP contract laboratories to allow continued high quality monitoring and assessment.
- Document the history of key SWAMP communications, decisions, budgets, and products to support SWAMP institutional memory.

Objective 10.3: Provide regional coordination [Goal 10.1]

- SWAMP Regional Coordinators will strive to coordinate monitoring among Water Board programs and other agencies and entities at a regional scale; however, resource constraints may limit their ability to do this in a comprehensive manner.
- Provide administrative oversight.

- Support travel required to attend the National Water Quality Monitoring Conference and other key opportunities to get review and insights for program improvement.
- Identify other state-funded monitoring that could be more professionally, efficiently, and cost-effectively conducted by the SWAMP.
- Work with the CWQMC to develop proposals to improve monitoring to determine effectiveness of state financed water quality improvement projects.

Objective 10.4: Update the SWAMP Needs Assessment [Goal 10.2]

As the SWAMP pursues this dual approach to program support, staff will need to identify current and future resource needs to fully implement the SWAMP Strategy. As part of an ongoing triennial review and planning process, the following needs should be assessed, considering current conditions and planned improvements:

- Identify the required number of staff needed for the SWAMP program implementation;
- Identify the laboratory support needed to conduct high quality analyses and manage data according to SWAMP procedures;
- Identify training needs for program implementation by field, laboratory, data management and data assessment staff;
- Identify annual monitoring needs of Regional Water Boards;
- Identify annual monitoring needs of the State Water Board;
- Prepare budget for upcoming year; and
- Forecast budget needs for three years.

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Appendices

A. Comprehensive Monitoring and Assessment Strategy for the Citizen Monitoring Program

B. Summary of Vision Statements, Goals, Objectives, and Tasks

C. SWAMP Assessment Framework

D. SWAMP Needs Assessment

E. Regional Fact Sheets

Appendix A

Comprehensive Monitoring and Assessment Strategy for the Citizen Monitoring Program

Comprehensive Monitoring and Assessment Strategy for Citizen Monitoring Programs

November 2009

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Funded through State Water Resources Control Board Grant Contract No. 06-308-250-0.

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The US EPA and State Water Resource Control Board's Non-point Source Program recognizes the value of citizen monitoring data and funded a program to enhance communications between citizen monitoring programs and state agencies as well as develop tools to incorporate citizen monitoring data into a statewide database. This Comprehensive Monitoring and Assessment Strategy was funded through SWRCB No. 06-308-250-0.

This document is based on the ten elements as found in "Elements of a State Water Monitoring and Assessment Program" (USEPA, 2003). Our document describes how citizen monitoring data can be incorporated into a statewide water quality database and the data used to assess attainment of beneficial uses of California's surface waters.

We recognize and are grateful for the development of online upload tools developed by Shelly Moore, SCCRWP, and Dave Paradies, CCAMP. Without these tools, citizen monitoring efforts would be severely underutilized throughout all of California.

The Technical Advisory Committee for this project has provided valuable insight and support of this project both in the development of the guidance documents as well as providing valuable data as to the condition of surface waters around the state.

The staff with the SWRCB, Clean Water Team and the California Water Monitoring Council have shown commitment and willingness to incorporate citizen monitoring data into the statewide process as well as ensure that communications with agency staff and support for citizen monitoring programs continue beyond the timeframe of this project.

For all, we are grateful.

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PREFACE

Water is California's most precious resource, and with a population of over 38 million people, the demand for clean water is growing exponentially. At the same time, the health and availability of water to its users is compromised due to urban and agriculture runoff, illegal dumping of pollutants, reduced permeability and habitat destruction.

The State Water Resources Control Board (SWRCB) and its nine Regional Water Quality Control Boards (RWQCB's) are tasked with the protection of California's water resources, but monitoring, assessing and reporting on the state of California's water quality is a monumental task. With 53 watersheds in the state, only one-half of the fresh water bodies are assessed by the SWRCB. This includes 15% of California's rivers, streams and creeks and about 50% of the lakes, pond and reservoirs. In addition, only 53% of California's wetlands and 42% of bays and estuaries are assessed (SWRCB, 2002)

To assist the state in meeting its water quality objectives, the Surface Water Ambient Monitoring Program (SWAMP) was formed in 1999 to "preserve, protect, enhance and restore the quality of California's water resources through monitoring programs, as well as to ensure proper allocation and efficient use of these waters."
(http://www.waterboards.ca.gov/water_issues/programs/swamp/**)**

During this same time period the SWRCB began to initiate a citizen monitoring program. The Clean Water Team (CWT) was developed to further the SWRCB's Non-Point Source efforts at a community level through citizen monitoring. As the SWRCB began to award grants for projects which incorporated citizen monitoring, the Clean Water Team (CWT) became very active in providing direct support to those organizations receiving grant funds. Later, the CWT's focus was directed to support citizen monitoring groups which were participating and contributing towards the state's Clean Water Act 303(d) list and Total Maximum Daily Load (TMDL) programs (Burres 2003). Due to organizational changes in the early 2000's the CWT was incorporated into SWAMP. Over this entire time period the number of citizen water quality monitoring groups across the state grew from just a few to well over 200. (Burres 2007 and 2008)

Data generated by the citizen monitoring (CM) groups, in part, has been used by the state to help fulfill some of the state's water quality objectives and the following goals of the Comprehensive Monitoring and Assessment Strategy to Protect and Restore California's Water Quality 2005 (SWRCB, 2005).

- Surface waters are safe for drinking, fishing, swimming, and support healthy ecosystems and other beneficial uses.
- Individuals and other stakeholders support our efforts and understand their role in contributing to water quality.
- Water quality is comprehensively measured to evaluate protective and restoration efforts.

Unfortunately, citizen data is not universally accepted, and the time that citizen groups put into planning, training, and collecting valuable data is underutilized. During this time of economic crisis and increased degradation of California's water quality, it is more important than ever for

the state to take advantage of the existing data and resources that citizen monitoring groups can provide. One way to facilitate this process is to integrate the data citizen groups generate into a statewide data sharing system.

To support the integration of citizen monitoring data to the statewide data sharing system, the California Citizen Water Quality Monitoring Program (CCWQMP) was created under SWRCB grant contract number 06-308-250-0 and will be reported on within this document funded under this same contract. The goals of the project are to:

a) Develop a process for volunteer data to be uploaded into a statewide database.
b) Help the Non-Point Source (NPS) program and other state and regional programs use citizen monitoring data more effectively.
c) Fill in data gaps with citizen data and create a more robust set of water quality information for California.
d) Use citizen data to when setting state policy(ies), evaluating program success(es), and when assessing both water quality status and trends.
e) Promote and support volunteer water quality monitoring programs throughout the state.

At the same time, citizen monitoring groups and the RWQCBs need to examine how citizen monitoring efforts will fit into the water quality goals and objectives of SWAMP and the California Water Quality Monitoring Council. This "Comprehensive Monitoring Strategy for Citizen Monitoring Programs" will provide a framework for the integration of citizen monitoring data.

BACKGROUND

The Federal Clean Water Act gives states and territories the primary responsibility for implementing programs to protect and restore water quality. In Section 106(e)(1), the Clean Water Act requires the US EPA to determine that a state is monitoring the quality of navigable waters and compiling and analyzing data on water quality. Before the US EPA will award Clean Water Act Section 106 grant funds, states must report their monitoring and assessment activities and submit that information into their obligatory Clean Water Act Section 305(b) report.

To meet these Clean Water Act requirements and provide comprehensive information on the status of beneficial uses of California's surface waters, state programs such as SWAMP are tasked with answering the following questions:

- What is the overall quality of California's surface waters?
- To what extent is surface water quality changing over time?
- What are the problem areas and areas needing protection?
- What level of protection is needed?
- How effective are clean water projects and programs?

The SWAMP program is also designed to go beyond the federal requirements and coordinate a statewide framework of high quality, consistent, and scientifically defensible methods and strategies to improve the monitoring, assessment and reporting of California's water quality. To

help states fulfill their federal requirements, the US EPA produced a document that identified ten elements in a State Water Monitoring and Assessment Program (US EPA, 2003).

The state's Citizen Monitoring groups already help provide data which contributes toward the State's Clean Water Act 305(b) Report, TMDLs, best management practices, storm water permits, and other local and state projects. This document will therefore examine *how* the efforts of over 200 citizen monitoring groups in California fit into the ten elements as presented in the Comprehensive Monitoring and Assessment Strategy to Protect and Restore California's Water Quality (SWRCB, 2005). In the future, this information may be integrated into the California Water Quality Monitoring Council's comprehensive strategy.

Figure 1.

Elements of a State Water Monitoring and Assessment Program
1. Monitoring Program Strategy
2. Monitoring Objectives
3. Monitoring Design
4. Core Indicators of Water Quality
5. Quality Assurance
6. Data Management
7. Data Analysis/Assessment
8. Reporting
9. Programmatic Evaluation
10. General Support and Infrastructure

The SWRCB currently monitors little over one-half of the state's water bodies. The agency simply does not have the monitoring resources to effectively evaluate all of the surface waters in the state. It is up to the SWRCB, SWAMP and other state agencies, therefore, to work with partners to identify and implement additional monitoring resources to satisfy the water quality goals of the Clean Water Act.

Citizen water quality monitoring groups are an additional, albeit underutilized, resource. There are currently over 200 citizen monitoring groups throughout the state, who collectively donate tens of thousands of hours of their time to monitor water quality every year. The cost of volunteer time is substantial. The assigned value of volunteer time in CA in 2007 was $21.97/hr (Independent Sector, 2009). In light of the current economic climate, it would benefit the state to examine its relationship with citizen monitoring groups. For example, a subset of thirty-five monitoring programs surveyed collect 7,726 data points per year. If we assume each result requires 2 hours of volunteer time that equates to a minimum of $339,480 per year worth of volunteer service.

To determine the quality and quantity of citizen monitoring data, 35 CM groups statewide responded to a survey developed by the California Citizen Water Quality Monitoring Program. Results showed that; the commitment of citizen groups was high; most groups monitored year-round, and the longevity of groups was an average of 11 years (Statement of Needs, 2008). The "workforce" of these groups was made up of approximately 66 citizen monitors per group. The number of sites monitored was also substantive; 54 sites/yr/group and an average of 257 data

points/yr/group. Three-fourths of the groups had documentation for quality assurance, and most groups were trained by regional or state experts. Furthermore, the objectives on which citizen groups focused were synonymous with state water quality monitoring objectives: pollution detection, land-use impacts, establishing base-line data, assessing best management practices, salmonid protection, and flood prevention. In addition to contributing data for the state's 303(d) listing and the 305(b) report, several groups were involved in Phase I and II Stormwater permit monitoring. Almost all groups surveyed were also involved in public outreach and education activities. This strongly supports a principle written into the Comprehensive Monitoring and Assessment Strategy to Protect and Restore California's Water Quality which states "The Water Boards will provide education and outreach opportunities so that Californians understand their responsibilities and abilities to protect water quality."

Citizen monitoring data can, and does, fill spatial and temporal gaps which address the state's water quality objectives. Compatibility of citizen data to that of state data is assured through state or regionally -approved QAPPs, in addition to the SWAMP protocol taught to citizen monitoring groups by state-approved trainers. Furthermore, most citizen groups who have approved QAPPs have been partially or totally dependent on state grants (i.e. Proposition 13, 40, 50, 84, 319h), and are required to submit their data to their RWQCB or SWRCB grant manager.

The state stands to benefit significantly by working with citizen monitoring programs and incorporating their data into one central database. An increase in statewide coordination between regional boards and these citizen water quality monitoring groups will greatly enhance the quantity and quality of monitoring data available to resource managers. This document is intended to incorporate citizen monitoring activities into the SWAMP Comprehensive Monitoring and Assessment Strategy and into and strategy produced by the California Water Quality Monitoring Council.

1. Monitoring Program Strategy

A monitoring strategy for citizen groups which addresses the state assessment framework outlined in this report is comprehensive in scope and covers monitoring objectives, monitoring design, core indicators of water quality, quality assurance, data management, data analysis/assessment, reporting, programmatic evaluation and general support and infrastructure.

Goals of a comprehensive strategy for citizen groups

- Individuals and other stakeholders support citizen monitoring efforts and understand their role in assessing water quality.
- Water quality is comprehensively measured to evaluate baseline conditions and restoration efforts.
- Citizen monitoring data is to be better utilized to support state water quality objectives (*see section 2.)*

Implementation Timeframe

- By December, 2009, the California Data Upload and Checker System (Cal DUCS) (produced under SWRCB Contract No. 06-308-250-0) will be available to all citizen groups for upload of their data into a SWAMP-compatible statewide database.

- A Communication and Outreach Committee made up of citizen water quality monitoring coordinators, RWQCBs, SWAMP and California Water Quality Monitoring Council will ensure;
    - Continued dialogue between the state and citizen monitoring groups
    - Development or enhancement of communication tools such as websites, webinars, newsletters and workshops

Evaluation

- Continued evaluation of the working relationship between citizen monitoring groups and state will be necessary. This may occur via annual (regional and/or state) citizen monitoring workshops, direct Regional Board feedback, presentations to the SWAMP Roundtable, and assessment and enhancement of monitoring programs.

2. Monitoring Objectives

The vision of SWAMP is "to define a complete set of monitoring objectives, based on beneficial use attainment and reflecting the full range of regulatory responsibilities and water quality programs for all water bodies" (SWAMP webpage "SWAMP History and Organization", 2009). In November 2000, SWAMP identified monitoring objectives critical to the design of a monitoring program that are efficient and effective in generating data that serve management decision needs.

Most monitoring objectives for citizen groups include:

- Helping to establish water quality status and trends,
- identifying impaired waters (303(d) listing) which is based on assessment of beneficial uses,
- evaluation of Best Management Practices (BMPs) and ecological restoration implementation.

The table below addresses how the work of CM groups relates to SWAMP regional goals and objectives.

Table 1. Regional Water Quality Control Board and CM Group objectives

SWAMP Goals and Objectives	Citizen Data Goals and Objectives[1]
• Employing a sampling design that allows the measurement and evaluation of **spatial and temporal trends** in watershed water quality,	Trend data to determine watershed health and to establish a baseline of water quality conditions.
• Using **standard sampling protocols**, SWAMP QAMP procedures and the SWAMP database to **provide statewide consistency and availability of data,**	Ensure use of the SWAMP Advisor and Upload tool (Cal DUCS)
• To monitor and assess the water quality of the regions watersheds with the primary	Collect necessary information to assess objectives for the beneficial use "COLD"

[1] Based on information from a statewide survey in which 35 citizen monitoring groups responded.

objective of **determining if the beneficial uses** are being protected.	(water quality monitoring in cold water waterbodies such as salmonid waterways) and "REC 1" (direct water contact recreation such as swimming beaches)
• Measure **environmental stressors, (i.e. pollutants), biological effects (toxicity tests), and ecological indicators (benthic community analysis)** to evaluate whether beneficial uses are being protected.	Toxicity tests at outfalls, lakes, streams, and bays; bioassessment combined with chemistry to determine if fresh water fish and swimmable waters are being protected
• Determine **if impacts are associated with specific land uses or water management**.	Develop a monitoring design to determine impacts from specific land uses.
• Generate data and associated information for the development of indices to evaluate ecological indicators (**Index of Biological Integrity for macro invertebrates**)	Benthic macro invertebrate (BMI) data was used in over ½ of groups along with physical habitat (P-HAB), chemistry and ambient measurements to determine watershed health. This data can be incorporated into indices and condition assessments.
• To develop **indices of biological integrity** for streams and rivers based on in stream benthic macro invertebrate and algae assemblages, to be used as a tool for evaluating biological integrity	Citizens monitor BMIs, algae, periphyton, P-HAB to determine biological integrity of streams and rivers
• Provide a **screening level assessment of water quality, based on a variety of chemical, physical and biological indicators**. Data is used to evaluate beneficial use support in the surface waters of the region.	Citizens collect chemical, physical, biological data to screen waterbodies.
• Assess whether **water quality conditions are getting better or worse over time.**	Long term data sets evaluate trend data taken for chemistry, bacteria, BMI, bank erosion, etc to measure positive or negative changes over time.
• Monitor surface water throughout the region to determine **ambient water quality** and whether beneficial uses are being impacted.	Ambient data is collected on a monthly to weekly basis to measure water quality conditions.
• **Coordinate all SWAMP activities** to maximize monitoring frameworks already in place and leverage existing resources,	There is high coordination within regional groups or "hubs" but not sufficient statewide coordination.
• **Target water bodies for monitoring where water quality information is scant**.	Through Cal DUCs there will be a system in place to determine where there are data gaps that can be filled.
• **To use ambient water quality data to determine the overall conditions of water bodies in the region for inclusion in the 305(b) Report and the 303(d) list of**	CM groups monitor same places throughout the year and submit data to RWQCB to be included in 303(d) list and 305 (b) Report

impaired water bodies.	
• To provide reliable, high quality information necessary **to produce 305(b) and 303(d) list *that are more comprehensive and more defensible*** than those of past years.	Some, but not all, citizen data is included in the evaluation of impaired water bodies. State agency data sets can be enhanced by CM data.
• Employing a sampling design that allows the measurement and evaluation of **spatial and temporal trends** in watershed water quality,	State agency data sets can be enhanced by CM data, especially with Google Earth which facilitates mapping monitoring sites.

The monitoring objectives used by citizen groups fall within the State's 28 beneficial use categories as found within the water quality control plans, aka basin plans. A large number of citizen monitoring groups monitor primarily for Primary Water Contact Recreation (REC-1) and/or Cold Freshwater Habitat (COLD). This bodes well with the inclusion of citizen data to populate the web portals being developed by SB 1070 California Water Quality Monitoring Council. The web portals currently include:

- Swimming Safety at Beaches (Safe to Swim)
- Human health risk associated with sport fish consumption (Safe to Eat Fish and Shellfish)
- Drinking water safety (Safe to Drink)
- Wetlands status (Wetlands)

The theme-based workgroups developed by the Statewide Monitoring Council are tasked with developing criteria for the inclusion of data collected by multiple sources including citizen monitoring programs. Until then, below is an example from the Central Coast Regional Water Quality Control Board of monitoring criteria for REC-1.

Is there evidence that it is unsafe to swim?
Are swimming conditions improving or getting worse?
Beneficial Use: Water Contact Recreation (REC-1)
Monitoring Objective(s): At sites throughout water bodies that are used for swimming, or that drain to areas used for swimming, screen for indications of bacterial contamination by determining percent of samples exceeding adopted water quality objectives and EPA mandated objectives. Central California Ambient Monitoring Program (CCAMP) data as well as data collected by local agencies and organizations will be used to assess shoreline and creek conditions.
Monitoring Approach: Monthly monitoring for indicator organisms (e.g. *E. coli*, fecal coliform…); compilation of other data sources
Assessment Limitations: CCAMP sampling approach does not meet the frequencies identified in the Central Coast Basin Plan of 5 times in a 30-day period.
Criteria:

- Fecal coliform exceeding 400 MPN/100 ml
- *E. coli* exceeding 235 MPN/100 ml
- Application of the binomial test to sample exceedence rate according to the SWRCB Listing Policy (2004), where

    - Null Hypothesis: Actual exceedance proportion is <=10%
    - Alternate Hypothesis: Actual exceedance proportion >25%
- Geometric mean of fecal coliform samples greater than 200 MPN/100mL

Interpretation: A minimum of five exceedances is required to determine impairment. If the site has exceedances, but there are fewer than five, site is considered partially impaired. The geomean criterion is compared to the geomean of data from the entire sampling year. If a site geomean exceeds the geomean criterion, the site is considered impaired. Trend data will be evaluated using non-parametric approaches, including Seasonal Mann-Kendall and Kruskall-Wallace tests, and by evaluating change in exceedance rate over time.

Based on the above criteria, if a CM group wants to tailor their monitoring objectives to have their data included in assessment of beneficial uses; then they need to design their monitoring plan to include some or all of the parameters listed under Monitoring Approach.

3. Monitoring Design

Like SWAMP, citizen monitoring groups utilize monitoring designs which maximize the ability to meet monitoring objectives with existing resources. Many citizen monitoring groups work with their Regional Board representatives to contribute data towards 303(d) listings and to a lesser extent, TMDLs. Remediation plans of impaired water bodies may include addressing a series of issues from pollutants to increased temperature and low flow rates.

Goals of the citizen monitoring integration program:

- To assist the state in filling in spatial and temporal gaps with citizen data.
- To help with long-term monitoring for temporal and spatial trends.
- To target water bodies for monitoring where water quality information is scant.
- To coordinate with other data collection efforts.
- To use ambient water quality data to determine the overall conditions of water bodies in the region for inclusion in the 305(b) Report and the 303(d) list.
- To see if water quality conditions are getting better or worse over time.

To help assist the state in filling in spatial and temporal data gaps, there needs to be a mechanism by which the individual designs of citizen groups can be nested into the statewide program, especially in the waterbodies with beneficial uses that include of swimming, drinking, and fishing. To do this, the following questions need to be addressed;

- *Spatial*
    - *Where do citizen groups monitor? Are the sites represented on a GIS layer?*
    - *Are sites on a 303(d) listed water body that might provide source tracking information?*
    - *Are there areas that are not monitored that should be?*
    - *Are there areas where multiple programs are monitoring that might be able to share resources?*
- *Temporal*
    - *Are sites monitored at appropriate times and frequencies to provide necessary information?*
    - *How often should sites be monitored to answer specific questions?*

- *Citizen monitoring programs should be aware of each Region's sampling design and monitor at Regional Board sites when they are not monitoring.*

- *Design coordination*
  - *Do citizen monitoring programs fill necessary data gaps in the SWAMP monitoring program?*
  - *Do neighboring monitoring programs coordinate with upstream programs?*
  - *Are methods and protocols comparable?*
  - *Is all necessary information being collected, ie. hardness with metals analysis, temperature and pH with ammonia measurements?*

Most citizen groups use a site-specific monitoring design which incorporates fixed stations and targeted monitoring. See the examples below;

Table 2. State Monitoring Designs used by Citizen Monitoring Groups

Monitoring design	Design definition	Examples from citizen group monitoring
Fixed station	Repeated long-term sampling or measurement of parameters at representative points for the purpose of determining environmental quality characteristics and trends.	Snapshot Day, outfall monitoring, World Water Day, and ambient data to determine need for the 303(d) listing
Targeted monitoring	Sampling at location-specific sites which are usually selected for monitoring based on a list of considerations and information needs.	Project effectiveness, ambient conditions for the 303(d) listing and 305(b) report.
Stratified random	A sampling method in which the population is separated into groups (strata) usually based on some internal similarities, then selecting a random sample within each stratum.	BMI by ½ of surveyed groups
Probability-based sampling	A sampling method in which randomness is built into the design so that properties of the sampled population can be assessed in terms of their likelihood of occurrence or existence.	No citizen programs identified.

4. Core Indicators of Water Quality

To evaluate the effectiveness of management actions to improve water quality in the state, SWAMP currently uses core indicators that denote the health of different waterbody types and their associated beneficial uses. Core indicators for each type of waterbody include physical/habitat, chemical/toxicological, and biological/ecological endpoints as appropriate. SWAMP also uses supplemental indicators when they have reasonable expectations that a specific pollutant is present in the watershed, when core indicators suggest impairment, or to support a special study, such as screening for potential pollutants of concern.

In fiscal year 2006-2007, SWAMP refined their core indicators to indentify and develop those that accurately indicate water quality at the federal, state, watershed and project scales. SWAMP intended for these refined indicators to better inform them of the relationship between water quality and the land use activity of the surrounding land and/or effects of landscape changes (ie. timber clear-cutting practices causing increased sediment deposits in salmonid breeding grounds). The indicators tested by SWAMP are also monitored by citizen groups. Table 3 cites the portion of surveyed groups who monitored the water quality indicator(s) specified by the state.

Table 3. 2007 Survey of 35 Citizen Monitoring Groups Statewide

Current SWAMP Indicators	**Indicator Description and Purpose**	**Portion of Surveyed CM Groups Monitoring this Indicator**
Conventional chemistry (DO, pH, etc.)	To assess general health.	80%
Nutrients	To determine attainment of beneficial uses	66%
Fecal Indicator Bacteria	Total coliform, fecal coliform, *E. coli* and enterococcus for MUN, REC-1, and REC-2	57%
Benthic macro-invertebrate community metrics	Fresh water macro-invertebrate communities (via IBI) is used to indicate watershed health, especially in waters that support fish.	51%
Lab analysis	Includes trace metal and organic analytes, including OP, OC, pyrethroid pesticides, PCBs, PAHs, etc. All measured in water, sediment, or tissue for watershed health.	Metals 37%
Sedimentation	Turbidity, TSS (SSC), pebble counts and other streambed metrics are used to determine sedimentation as it affects living organisms in the watershed, especially fish habitat.	11%
Toxicity testing	Toxicity done via bio-assays with fresh and salt water organisms to determine toxicity.	1%

Core Indicator Objectives

It is SWAMP's vision to develop and implement a set of monitoring indicators with assessment thresholds, which can be used to track the status and trends of water quality and to evaluate the effectiveness of management actions to improve water quality in the state. This type of information will also be used by the California Water Quality Monitoring Council to populate the online web portals.

This requires that a core set of indicators be defined for each water resource type. This includes water quality parameters with physical/habitat endpoints as appropriate, that reflect designated uses, and that can be used routinely to assess attainment with applicable water quality standards throughout the state. SWAMP's core set of indicators must also contribute to statewide tracking

of water quality indicators being implemented under the Environmental Protection Indicators for California project (EPIC). The EPIC project is responsible for maintaining an environmental indicator system to assist environmental programs in evaluating the outcomes of their efforts, and in identifying areas that require more attention.

Citizen groups already collect data for the first of EPIC's main quality indicators, "the assessment of aquatic life and swimming uses." They have also traditionally provided data for the state's TMDL program and for 303(d) listings. Common beneficial use categories addressed by citizen groups have been water contact recreation (REC-1; indicator; bacteria) and cold water fish (COLD; chemical, physical, biological indicators).

Citizen groups, with the help of their Regional Board representatives, can enhance their monitoring efforts by:

- Adopting the state's recommended core and supplemental indicators for use at a local watershed scale.
- Adopting indices for assessment of all beneficial uses as determined by SWAMP and the California Water Quality Monitoring Council.

5. Quality Assurance

One of the main challenges for the acceptance of citizen data is the lack of understanding of the level of quality of citizen monitoring data. Another challenge is the lack of standardization of the vocabulary monitoring groups use when collecting and entering data. Quality Assurance Project Plans (QAPPs) address both issues since QAPPs document project management, data generation and acquisition, assessment and oversight, and data validation and usability in a standard format. The collaborative process required between the data generators (citizen group), the grantor, and the official who must approve of the QAPP ensures a solid foundation for monitoring. This is followed up with quality control, a series of actions (i.e. audits of proper field and lab procedures, etc.) which ensure that the quality of data collected meets the highest standards. Writing a QAPP is labor intensive, but necessary for citizen groups to do if they want their data to be comparable with other statewide programs. Quality control requires consistent effort and oversight.

Citizen groups who are dependent upon state grants are required to create and follow a QAPP, but there are other citizen monitoring groups with no QAPP who collect long-time trend data which could also be useful to the state. These groups may not know about QAPPs, may not know who to go to for help in writing them, may think QAPPs are too difficult and/or time-consuming to write, and/or may think that the scope of the QAPP is out of reach for their monitoring program. SWAMP has developed and online tool called the SWAMP QAPP Advisor designed to help monitoring programs draft QAPPs specific to their projects and it includes all of the necessary QAPP elements.

The California Data Upload and Checking System is being developed to facilitate the transfer of water quality data from monitoring programs to the California Environmental Data Exchange Network. The current data upload tool being built for citizen groups includes a registration page which documents the presence or absence of a QAPP. The upload tool takes a "tiered" approach

for all data submitted as to the quality, complexity, and available documentation. "*Tier" breaks will be established as development of the upload tool evolves*. The upload tool is SWAMP-comparable and encourages the standardization of language used by varying data generators. By including these features, the obstacles of language standardization and QA/QC is addressed. This is an important first step towards making citizen data universally accepted and available.

Recommendations to encourage the continued improvement of citizen group QA/QC will be addressed in the new Cal DUCS for citizen monitoring data upload. The system will contain the following components;

- Technical oversight and direction by SWAMP so that citizen group data will comply with SWAMP's QA/QC program.
- QA/QC 'tiering' for citizen groups via Cal DUCS registration page
- Technical support via the SWAMP Help Desk to ensure quality data

In addition, it is highly recommended that citizen monitoring groups conduct annual or biannual field and lab audits. An interim audit checklist (SWAMP is currently developing one) has been developed by the Citizen Monitoring Program Technical Advisory Committee can be found in Appendix 1.

6. Data Management

How much data the state receives from citizen monitoring groups is dependent upon well planned and executed data management. Acquisition of statewide citizen monitoring data will be extremely successful if the data upload system is user-friendly, has support help, feeds a statewide database and provides online access to the data. Managing the data flow from citizen groups to the state via a central data repository requires the clear delineation of roles and responsibilities at local, regional and state levels.

Table 4. Data Management Roles and Responsibilities for state and CM groups

Organization	Data Responsibilities
Citizen monitoring programs	• Follow SWAMP comparable monitoring protocols. • Thoroughly document and manage data. • Become familiar with and include data management protocols for the upload tool. • Include the data management protocol in their QAPPs.
SWAMP/CWT or RWQCB	• Provide training and written instruction to citizen groups for upload tools.
California Environmental Data Exchange Network (CEDEN)	• Provide a Help Desk for questions about upload tools and IT information to operate Cal DUCS. • Transfer citizen data to statewide database in a timely manner.
California Water Quality Monitoring Council	• Flag data for use in SB1070 theme-based portals. • Disseminate data through online query tools. • Incorporate CM data into theme portals related to water quality conditions.

7. Data Analysis and Assessment

The Cal DUCS system has been developed to facilitate upload of citizen monitoring data into a statewide data management system. Once the data flow begins, access to the data is of the utmost importance to ensure that resource agencies, researchers and all monitoring programs have access to the statewide data set.

Once the flow of data is streamlined into a central statewide database, there will be many opportunities to use the data. It must be in a format conducive to answering various questions related to water quality conditions. SWAMP will use the data to assess attainment of beneficial uses. The Statewide Monitoring Council will use the data to populate the theme based web portals. Scientists will use the data to answer specific environmental questions related to their research. CM groups will use the data to compare conditions in their watersheds to those around the state.

Needs and recommendations of data analysis and assessment are the following;

- Identify the level of quality assurance required to utilize CM data.
- Identify the gaps in information that CM groups can fill for use by resource agencies.
- Develop guidance by the Statewide Monitoring Council to incorporate CM data into theme based web portals.
- Provide spatial assessment and tracking of management measures to better explain changing water quality conditions.
- Provide statistical tools for improved analysis and understanding of monitoring data.

8. Reporting

Citizen Monitoring programs each have their own means of reporting monitoring results based on grant requirements, monitoring objectives and information sharing. Those mechanisms will be program specific and most likely will remain that way. Examples of how citizen monitoring programs report their results include newsletters, annual reports, online summaries, workshops, and email Listserves, to name a few. However, by creating a mechanism to share regional data with a statewide audience, that data will become increasingly more valuable. A statewide database of comparable information will provide for more statistically rigorous and meaningful reporting.

As demonstrated by the Central Coast Regional Water Quality Control Board, the access to a larger collection of water quality data resulted in a significant increase of proposed waterbody listings for the next 305(b) report and 303(d) list. Without the compilation of multiple datasets, this would not have been possible. It goes without saying that access to additional monitoring data will provide a more comprehensive understanding of the conditions of both surface and ground water throughout the state.

The internet offers an opportunity to provide a large amount of up to date information that is accessible to the masses. The California Environmental Data Exchange Network (CEDEN) website and California Water Quality Monitoring Council's web portals will not only make data more accessible but it will make it much more valuable. Citizen monitoring groups will be more inclined to take the extra steps to ensure quality data and upload it through Cal DUCS knowing it will be used to better inform resource managers and improve water quality conditions. Online

tools such as maps and graphs will reduce the need for traditional annual reports and summaries. Statistical analysis available at the touch of a button will revolutionize the ability of resource managers to make timely management and policy decisions to better protect natural resources. This will increase efficiency and reduce the time it used to take to analyze and develop reports.

9. Programmatic Evaluation

As described in Section 5. Quality Assurance, it is recommended that each CM organization do a programmatic evaluation on an annual or bi-annual basis (Appendix 1). Programs should always be looking for ways to improve and strengthen their program to best meet their objectives. The Cal DUCS upload tools will provide a review of data management efforts and whether they meet the requirements of SWAMP comparable data. The upload templates identify the meta-data that is important to document for each result. The checker tools indicate the data meets the criteria for inclusion into a statewide database. These efforts will require CM programs to evaluate how they manage their data.

There must be support at the state level for the Cal DUCS upload tools. It is a new system that will require improvements and changes based on the various user groups and data upload needs. If the program isn't supported and recommendations by users implemented, the system will fail and the flow of data to a statewide database will cease. The Cal DUCS website provides opportunity for comments through a wiki (http://www.ccamp.info/ceden/php/ceden_menu.php). This type of evaluation is highly recommended because it provides a written list of suggestions to improve the upload tool. These recommendations can be addressed as time allows and will ensure the best upload process possible.

The Statewide Monitoring Council is just beginning its process to provide meaningful information and answers related to important environmental and societal questions. This process has a long way to go, but should seriously take advantage of the data available from CM programs. As the data upload framework is developed, CEDEN and the State Monitoring Council should build in tools that flag all data pertinent to a particular portal to facilitate mining of pertinent data. All websites should provide a mechanism for evaluation and suggestions from the user groups visiting the sites. There are many ways to evaluate and portray monitoring information. The websites should be as flexible as possible to accommodate the many questions and stories the data can provide.

Evaluation of the working relationship between CM groups and the state is important to continue the flow of information and data. CM monitoring programs need to have a contact at their Regional Board for questions and guidance. A Citizen Monitoring Communication and Outreach Committee has been established to facilitate dialogue among CM programs and between CM programs and agency staff (Communications Strategy, 2007). Even this committee will require some commitment from agency staff to coordinate meetings and ensure follow through with recommendations.

10. General Support and Infrastructure Planning for CM Groups

The SWAMP Comprehensive Strategy lists four overarching tactics "to promote an efficient increase in the amount of usable water quality information that is available." Two of these four tactics are particularly applicable to citizen water quality monitoring;

1. "Build stronger partnerships with agencies, watershed groups, ***citizen monitors***, and others to facilitate the sharing of information, the collection of comparable data, and the use of monitoring tools. This includes working closely with the newly-formed Nonpoint Source Tracking and Monitoring Council."

2. "Continue working with monitoring programs currently coordinated through the CA Environmental Data Exchange Network. This coordination will ***increase data comparability, increase the potential for true collaboration with other entities collecting ambient water quality information, and will make data available to the public."***

In order to build stronger partnerships and sustain viable citizen monitoring efforts, increased collaboration is necessary. Citizen monitoring is a valuable resource that has been underutilized by the state in its comprehensive monitoring strategy. Below is the breakdown of needs that are necessary to make this effort successful in the future:

- Identification of data needs by the state that citizen groups can accomplish and the knowledge that their data is being used.
- A communication infrastructure between citizen groups and between citizen groups and agency staff.
- Centralized resource stations by which to acquire and share reference materials, equipment, monitoring information, etc.
- Technical support for a data integration program (Cal DUCS) which allows data flow between citizen groups, RWQCBs and other data users.
- Online accessibility and analysis of current water quality data.

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Appendix 1 – Quality Assurance Checklist

California Citizen Monitoring Quality Assurance Checklist

In order for citizen data to be better utilized by the Water Board and other groups towards satisfying the state's water quality objectives, the quality control (QC) of how data is collected, analyzed, and stored by all citizen monitoring groups must be documented. Although many citizen monitoring groups already practice rigorous QA/QC protocol, this process is not practiced state-wide, and/or is practiced but not documented. In such cases, there is no assurance for potential data-users (ie. other citizen groups, NGOs, state and federal agencies) of the quality of citizen-generated data, or assurance that the state-approved protocol written in a QAPP has been followed. Thorough checklists help avoid the causes of unacceptable data (Table 5).

Ideally, citizen monitoring programs should be reviewed annually by an independent party who is familiar with SWAMP protocols. The categories included in the checklist below are; pre-field checks; field checks; post sampling activities; packaging and shipping; lab checks; and data management. Addressing these categories help to satisfy QA/QC requirements while increasing the validity of data and its usability.

Table 5. Most popular reason for bad data

MOST POPULAR REASONS FOR BAD DATA…
1. Non-functioning or improperly calibrated equipment
2. Lack of clear communication in the field
3. Lack of legible and complete data entry forms (i.e. legible numbers, correct sig figs, and UNITS)
4. Incorrectly labeled sample containers
5. Contaminated samples
6. Out-of-date reagents
7. Incorrect holding times of samples sent to lab
8. Incorrect temperature of samples in transit to lab
9. Lab errors
10. Monitoring sites don't accurately represent reach conditions (due to lack of access to private property)
11. Inconsistent and/or incorrect data entry
12. Insufficient data management system/lack of documentation

Lead reviewer	Date
Lab Manager	QA Officer
Organization	
Address	
City	
State	Zip Code
Phone	Email
Project website	
Project type (i.e. ambient, storm water, etc)	
Duration (on-going or one-time only)	
Project start date:	Project end date:
Project Purpose (why?)	
Study area (where?)	
Study design (how?)	
Circle data type; water quality sediment quality transect flow stream profiles benthic bioassessment toxicity physical habitat other_____	

STEP 1 = PRE-FIELD CHECKS	yes	no	n/a	Comments
1.1 QAPP (quality assurance plan program)				
a) Do you have a QAPP?				
b) Regional or State Water Board approved?				
c) When was QAPP last updated?				
d) Are the SOPs listed in your QAPP?				
e) Are sub-contractors aware of your QAPP?				
1.2 Instrument calibration & maintenance				
a) Are instruments properly calibrated according to SOPs?				
b) Are results and opened reagents kept in separate notebook?				
c) Is the expiration date on all reagents and standards?				
d) Are calibrations documented?				
e) Are SOPs for equipment followed?				
f) Are there back-up parts for instruments?				
1.3 Gear				
a) Are containers and chests used to hold gear clean?				
b) Are containers and chests used to hold gear labeled?				
c) Is sampling set up in a way to prevent contamination?				
d) Is spare gear packed?				
e) Is there a check list for gear in pack before it goes out?				
1.4 Field Data Sheets				
a) Are sheets specific to data type (ambient, toxicity, bio)				
b) Do data sheets have name, date, time, location (lat & long), equipment ID and sample ID?				
c) Is there a space for the results of field measurements?				
d) Is there a space for water and weather conditions?				
e) Is there a comment section?				
1.5 Permission to access sites				
a) Do samplers have permission to access sites?				
b) Do samplers have access to locked gates and other closed entries?				
1.6 Tidal and temporal flow				
a) Are creeks assessed for presence/absence of flow or water?				
1.7 Safety				
a) Do you take safety precautions while sampling?				
b) Do you have a safety plan for accidents in the field?				
c) Are flow conditions taken into consideration before going into the field?				
1.8 Instructions				
a) Are important instructions reviewed with volunteers before going out?				

STEP 2 = IN THE FIELD	yes	no	n/a	Comments
2.1 Field documentation				
a) Is *verbal* confirmation used between sampler and note-taker?				
b) Are all field sheets complete and all spaces filled (i.e. "0" or n/a)				
2.2 Decontamination procedures				
a) Are gloves worn?				
b) Is cross-contamination avoided between sites?				
c) Are clean surfaces used in the field?				
d) Are intermediate sampling devices cleaned between sampling sites?				
2.3 Sample containers				
a) Are containers clean and/or uncontaminated?				
b) Is appropriate container used for sample type?				
c) Is size of container correct?				
d) Are containers rinsed (if required) and filled to appropriate level?				
2.4 Sampling and field procedures				
a) Do you follow written protocols?				
b) Are samplers aware of holding times?				
c) Are samples properly preserved?				
d) Are samples collected in appropriate location of stream for project objective?				
e) Is sampling depth, flow, and velocity taken into account?				
f) Are water samples collected first and sediment samples second?				
g) Is each sample labeled with sample ID, date, location, and time?				
h) Is data flagged when instruments out of range?				
2.5 Quality control samples				
a) Are travel blanks included with samples?				
b) Are appropriate sources of H2O used for the blanks of each analyte?				
c) Are equipment blanks run when new equipment is used or equipment has just been cleaned?				
d) Are field blanks collected at a rate of 5% for the length of the project or for trace-metals, Hg, aqueous VOA, sediment VOA, aqueous DOC and bacteria?				
e) Are field blanks for all remaining analytes collected at the beginning of the sample period?				
f) Are field duplicates collected for at a rate of 5% for the length of the project or once per field event?				
g) Are samples collected for MS/MSD purposes first composited and then split?				
h) Are QA samples submitted "blind" to the laboratories?				
i) Are there SOPs that specifically describe field procedures for QC samples?				
j) Who is responsible for QA sample frequency and volume requirements?*				
k) Are copies of QC sample results available?				
2.6 Quality control samples (cont.)	**yes**	**no**	**n/a**	**Comments**
a) a) If QC samples identify a problem, are corrective actions taken prior to future sampling events?				
b) percentage of: dups____splits____blind____replicates___				
2.7 Aqueous sample collection				
a) Are containers rinsed 3X with site water prior to filling (excluding pathogen and preserved samples)				
b) Are whirl packs filled ¾ with pathogen samples?				
c) Are aqueous samples taken prior to other sample types?				
d) Is care taken not to disturb bottom sediment during sample collection?				
e) Are clean hands procedures used for trace metal and				

STEP 3 = POST SAMPLING SITE/FIELD ACTIVITIES	yes	no	n/a	Comments
3.1 Equipment count				
a) Is all equipment accounted for?				
3.2 Aquatic Introduced Species decontamination				
a) Is decontamination protocol in QAPP followed?				
3.3 Field Data Sheet Review				
a) Is form complete (i.e. have ALL spaces filled in, incl "0" or n/a)				
b) Is form legible (i.e. in neat print, numbers readable)				
c) Are numbers written to include all significant figures?				
d) Do data sheets have a proper storage location?				
e) Is there proper use of vocabulary (no abreviations)				

STEP 4 = PACKAGING AND SHIPPING	yes	no	n/a	Comments
a) Is there a chain of custody?				
b) Is a COC enclosed in each shipment?				
c) Verify holding time compliance				
d) Are courier services able to deliver to lab on time?				
e) Has receiving lab had problems with temp of samples?				
f) Verify sample preservation				
g) Are sample containers sealed with tape?				
h) Are glass bottles cushioned to prevent breakage?				
i) Are ice chests sealed before shipping?				

STEP 5 = LAB (independent)	yes	no	n/a	Comments
5.1 QAPP that includes;				
a) EPA approved methods?				
b) Follow QA from "Manual for Certification of Labs Analyzing Drinking Water" and "Standard Methods for Examination of water and waste water"				
c) Validation with certified lab (via cross checks)?				
d) Chain of custody				
e) Spikes				
f) Replicates				
g) Duplicates				
h) Splits				
i) Blanks				
j) QA dependency				
k) Proper number of blanks, dups, splits, standards sent (i.e for nitrates)				
5.2 How does lab follow- up with errors?* (i.e. out of range, false positives, etc)				
5.3 Is there a chain of custody?				
a) Verify holding time compliance?				
b) Verify sample preservation?				

STEP 6 = DATA MANAGEMENT	yes	no	n/a	Comments*
6.1 Oversight				
a) Is there a QA officer?				
b) Is there documentation from a QA officer?				
c) What is supervisory protocol (if interns are used?)*				
d) If consultant is used, what is their protocol?*				
6.2 Data entry				
a) Is data sheet complete?				
b) Is data checked for transcription errors?				
c) What % of data is hand-checked (for data entry)?				
d) What % is checked for lab data?				
6.3 What is checked? (circle all that apply) units, conversions, out-of-range numbers, same vocabulary, checks for duplicates, splits, QAPP- acceptable limits				
6.4 How are the following checked?*				
a) Verification (*i.e.*)				
b) Validation (*i.e.*)				
c) Precision (*The repeatability of a measurement.*)				
d) Accuracy (*The closeness of a measurement to the true value of the parameter measured.)*				
6.5 How are anomalies handled?* (i.e. out of range samples, non-detects, matrix spikes, replicates, outliers, etc.)				

Appendix 2 – Data Users

Citizen data is used by local groups, organizations, and state and federal agencies (Table 6). Audiences use this data for several purposes;

- To fulfill state water quality grants,
- to work with Fish and Game on salmonid restoration,
- to work with cities on NPDES permitting,
- to provide data for the 303d listing (and the 305b report),
- to establish ambient baseline data,
- to monitor e-coli to be used by the Department of Public Health,
- to keep track of river flow rates,
- and to educate the public about watersheds and citizen group project results.

As of 2007 there are over 200 citizen monitoring groups statewide with, on average, 66 volunteers per group who monitor an average of over 32 sites and over 232 data points per group. These groups are trained to meet SWRCB-approved protocol, including the creation of QAPPs. Citizen groups oftentimes provide data to several organizations and agencies at the same time. For example, the Friends of the Van Duzen River in Region 1 works with the SRWCB, CA Fish and Game, Friends of the Eel River, local community stakeholders, Mendocino Redwood Co. and Salmon Forever. In addition, they work with local school groups as part of their education and outreach program.

Table 6. Key Audiences for Citizen Water Quality Data

Key audience category	Key audience groups
Federal	• National Marine Sanctuary Program • National Estuary Program • National Marine Fisheries Service • Bureau of Land Management • US EPA • United States Geological Survey
State	• CA Department of Fish and Game • State Water Resources Control Board • CA Regional Water Quality Control Board • CA State Parks
Academia	• K-12 Watershed education • State Universities and Colleges • Cooperative Extension programs • Local High Schools • Local Elementary Schools
County	• County Environmental Health Departments • Resource Conservation Districts
Cities	• Public Works
Town	• Town Council • Town Parks
Non-government organizations	• Salmon Forever • Surfriders • Keeper Programs • National Resource Defense Council • Sierra Club
Other	• California Stormwater Quality Association • Bay Area Stormwater Management Agencies Association

Appendix B

Summary of Vision Statements, Goals, Objectives, and Tasks

Summary of Vision Statements, Goals, Objectives and Tasks

Element and Vision	Goals	Objectives	Tasks
1. Strategy SWAMP's mission is to provide resource managers, decision makers, and the public with timely, high-quality information to evaluate the condition of surface waters throughout California.	1.1: Develop SWAMP monitoring strategy for developing and implementing an integrated comprehensive statewide monitoring program in 10 years. 1.2: Implement the SWAMP monitoring strategy. 1.3: Promote coordination of monitoring activities and comparability of data.	1.1: Continue to refine and update the SWAMP Strategy [Goal 1.1]	• Integrate the SWAMP Strategy with the CWQMC's strategy to identify gaps in the State's assessment activities, and prioritize SWAMP statewide and regional monitoring to address those gaps and fulfill Clean Water Act requirements. • Update the SWAMP Assessment Framework as new assessment tools and strategies become available. • Update the SWAMP Needs Assessment as described under Element 10 – General Support and Infrastructure Planning (Objective 10.4). • Update the SWAMP Strategy document at least every 5 years.
		1.2: Implement the Strategy [Goal 1.2]	• Continue to work through the Roundtable to align the objectives and designs of Regional Board and statewide monitoring to increase opportunities for collaboration and leveraging (elements 2 and 3). • Continue to support development of new indicators and assessment tools that can be used throughout the state by the various Water Board programs (element 4). • Continue to build monitoring infrastructure to ensure comparability and enhance sharing of data among State and Regional Board programs (elements 5 and 6). • Continue to perform monitoring at state and regional scales and prepare assessment reports that inform management, increase the visibility of the program and demonstrate the utility of the program (elements 7 and 8). • Continue to evaluate the program to ensure that it remains technically sound and to ensure that the information being generated is meeting Water Board needs (element 9). • Assess needs of the SWAMP program on an annual basis to ensure there is adequate program staff to administer the program at the Water Boards and to maintain and enhance the expertise and capabilities of the SWAMP contract laboratories to allow continued high quality monitoring and assessment (element 10).
		1.3: Institutionalize SWAMP's monitoring and assessment framework into other Water Board programs that require ambient surface water quality monitoring [Goal 1.3]	• Seek support at the State Board level to encourage programs to coordinate ambient monitoring efforts through SWAMP. • Increase the usefulness and visibility of SWAMP information products to make them more valuable to decision makers and the public, thereby increasing support for the program; • Meet with programs to understand their assessment needs and seek to optimize designs of statewide programs to maximize utility for Water Board programs. • Increase the number of Water Board programs that utilize SWAMP data, standards and guidance.

Summary of Vision Statements, Goals, Objectives and Tasks

Element and Vision	Goals	Objectives	Tasks
		1.4: Coordinate with other Regional and State monitoring programs [Goal 1.3]	• Participate in the CWQMC to identify areas of potential coordination with other agencies within CalEPA and the Natural Resources Agency. • Coordinate with existing and developing RMPs, including those in the Lake Tahoe basin, Klamath watershed, San Francisco Bay, Sacramento/San Joaquin Delta, San Joaquin watershed, Central Coast, Los Angeles and San Gabriel Rivers watershed, and Southern California Bight. • Support development of new RMPs to cover additional regions of the state. • Continue to support citizen monitoring programs through the Clean Water Team.
2. Monitoring Objectives Our vision is to clearly articulate monitoring objectives as attainable targets for producing the information needed to answer assessment questions at the statewide and Regional levels.	2.1: Define statewide monitoring objectives. 2.2: Define regional monitoring objectives. 2.3: Develop consensus on shared objectives.	2.1: SWAMP will work with programs at the State and Regional Boards to determine how objectives of the three statewide programs can be refined to better support Water Board programs [Goal 2.1]	• BOG will continue to work with Regional Boards to make information accessible and useful to Water Board programs (methyl mercury, listings). • The Bioassessment work group will work with Water Board programs determine how results from the perennial stream survey can be used to support the objectives of Water Board Programs (e.g., Assessment, Nonpoint Source, NPDES and Stormwater) and policies under development (e.g., Wetlands and Riparian Area Protection Policy, Hydromodification Policy). • SPoT will continue to work with Regional Boards to evaluate effectiveness of programs to reduce pollutant concentrations and loads at the watershed scale.
		2.2: Continue the evaluation and review of the specific monitoring objectives for Regional Water Board programs [Goal 2.2]	• Regional Water Board SWAMP coordinators will continue to prepare peer-reviewed monitoring plans that identify specific monitoring objectives for monitoring projects. • Regional Water Board SWAMP coordinators will continue to make information available to staff working on 305(b) and 303(d) assessments. • Regional Water Board SWAMP coordinators will continue to use objectives to coordinate/integrate/leverage resources within their Region. • Regional Water Board SWAMP coordinators will work with programs to prioritize and refine objectives to meet Regional needs.
		2.3: Develop consensus on shared monitoring objectives with partner programs [Goal 2.3]	• SWAMP will continue to work with partner programs at the Water Boards to align monitoring objectives with the Clean Water Act objectives. • SWAMP will continue to work with its CWQMC work group partners to develop the Safe to Eat Fish Portal and the Healthy Streams Portal. • SWAMP will continue to work through the CWQMC to identify agency efforts that can be used to address other waterbody/beneficial use combinations.

Summary of Vision Statements, Goals, Objectives and Tasks

Element and Vision	Goals	Objectives	Tasks
3. Monitoring Design Our vision is to develop scientifically sound monitoring designs to guide efficient collection of data to meet SWAMP's monitoring objectives with available resources, and to coordinate monitoring designs among SWAMP programs, other Water Board programs, and other agencies and partners through the CWQMC.	3.1: Refine management questions for assessing core beneficial uses for all waterbody types. 3.2: Inventory management questions of existing programs and monitoring entities. 3.3: Develop strategy to answer assessment questions for each waterbody type. 3.4: Design cost-effective monitoring program(s). 3.5: Develop and implement a suite of predictive tools to maximize our ability to effectively manage water quality.	3.1: Use SWAMP assessment framework based on beneficial uses and management questions to facilitate efficient coordination of SWAMP monitoring with other Water Board programs [Goals 3.1, 3.2, 3.3 & 3.4]	• Make guidance available to other Water Board programs to best design monitoring to address objectives. • Continue to coordinate with Water Board programs at the statewide level (e.g., NPS, TMDL, and Assessment). • Work to align the design of SWAMP monitoring efforts with those of other Water Board programs.
		3.2: Use SWAMP assessment framework based on beneficial uses and management questions to engage with the CWQMC and partner programs to optimize monitoring designs and achieve efficiencies through coordination of indicators, surveys, and analyses [Goals 3.1, 3.2, 3.3 & 3.4]	• Build on the web-based Central Valley Monitoring Directory developed by the Aquatic Science Center, with funding from the Central Valley Water Board and USEPA. • Determine whether partner program monitoring designs align with and/or compliment SWAMP designs. • Continue working with and initiating new stakeholder-based regional monitoring programs and to align their designs with SWAMP to achieve efficiencies. • Lead CWQMC work groups for aquatic life in streams and fish consumption safety so as to promote data comparability and integrated assessments.
		3.3: Implement SWAMP monitoring at State and Regional Board scales to address beneficial uses at waterbodies throughout the state [Goals 3.3 & 3.4]	• Align, to the extent possible, the monitoring designs of the statewide and regional SWAMP programs to achieve the most efficient use of data collected. • Work to integrate statewide monitoring of ecological indicators with local monitoring of known problem areas to best describe the extent of known impairments, identify previously unknown problems, and protect high quality waters.
		3.4: Develop and implement a suite of predictive tools to maximize our ability to effectively manage water quality [Goal 3.5]	• SWAMP will investigate the use of models to extrapolate results from probability based surveys for use in 303(d) listings decisions for identifying both impaired and unimpaired waters.

Summary of Vision Statements, Goals, Objectives and Tasks

Element and Vision	Goals	Objectives	Tasks
4. Indicators Our vision is to develop, select, and implement indicators and assessment thresholds that appropriately represent the condition of the environmental attributes and beneficial uses to be assessed, diagnose the causes and sources of impairment, and evaluate the effectiveness of management actions to improve water quality in California.	4.1: Define core indicators for statewide monitoring and assessment for each designated use and for overall watershed health. 4.2: Recommend set of core and supplemental indicators for use at local watershed scale. 4.3: Develop indices for assessment of biological communities for different waterbody types. 4.4: Develop a set of locally appropriate indices of biological integrity (IBI) for wadeable streams.	4.1: Maintain and implement a set of appropriate monitoring indicators representative of the status of beneficial use support and diagnostic tools for Water Board programs [Goals 4.1, 4.2, 4.3 & 4.4]	• Maintain a list of currently identified status indicators for the SWAMP and partner programs that are representative of ecological and human health attributes of concern. • Continue assisting with the development of bioassessment methods, metrics, and thresholds for wadeable streams. • Continue assisting with the development of diagnostic indicators, such as TIEs and analysis of chemicals of emerging concern. • Keep track of indicator development efforts within the state (including SQOs in Delta, statewide nutrients, new criteria and rapid indicators for pathogens, and contaminants of emerging concern) to identify areas of coordination and partnership with the SWAMP. • Utilize the State Water Board's Water Quality Goals database for standardizing numeric assessment thresholds.
		4.2: Work within the CWQMC framework to assist in developing, standardizing and implementing indicators to be used by partner programs to assess all waterbody types in California [Goals 4.1 & 4.2]	• Coordinate with CWQMC work groups to identify and share indicators and assessment thresholds and identify opportunities to align assessment and indicator development with other programs within the CalEPA and the Natural Resources Agency.
5. Quality Assurance Our vision is to develop, implement, and maintain the quality assurance tools and capabilities needed by SWAMP, and shared with partner	5.1: Implement Quality Assurance Team to provide technical oversight and direction to SWAMP QA activities. 5.2: Develop and document SWAMP Measurement Quality Objectives (MQOs) for each of the core indicators. 5.3: Evaluate the existing QA/QC program, including	5.1: Maintain the QA Team [Goal 5.1]	• Maintain a QA Team with regularly evaluated roles and responsibilities. • The QA Team will continue to serve as technical experts to provide the program with oversight and direction and advice on needed standard operating procedures for QA, field and laboratory methods.
		5.2: Develop and document SWAMP MQOs [Goal 5.2]	• The QA Team will maintain updated quality assurance documentation including the QAPrP, project QAPPs, and standard operating procedures. This will include developing, revising and documenting MQOs for all SWAMP field and laboratory parameters; developing field, laboratory and data QA methods for bioassessment; and defining reporting limits for chemistry laboratories.
		5.3: Evaluate existing QA/QC program against SWAMP quality	• The QA Team will ensure that the data classification and verification system is up-to-date and documented in a standard operating procedure. • The QA Team will ensure that the system is implemented as designed by

Summary of Vision Statements, Goals, Objectives and Tasks

Element and Vision	Goals	Objectives	Tasks
programs, to allow comparable data from many sources to be used in comprehensive water quality assessments. The role of SWAMP's quality assurance program is to foster the production of data to inform decision-making (i.e., identifying water quality impairments, fish consumption advisories, TMDL targets, etc.).	new methods and program changes, against SWAMP Quality Objectives. 5.4: Implement QA activities to produce data of high consistency/comparability among projects of different scales. 5.5: Implement QC procedures to produce defensible, credible data that meets SWAMP Quality Assurance Program Plan (QAPrP). 5.6: Integrate SWAMP QA/QC procedures in other State Water Board programs.	objectives [Goal 5.3]	developing tools and guidance for QAPP development and data classification.
		5.4: Implement QA activities to produce comparable data among projects of different scales [Goal 5.4]	• Provide tools and guidance on develop project QAPPs that are consistent with the SWAMP QAPrP. • Conduct training workshops, review and approve project and laboratory standard operating procedures, and participate in project kick-off meetings. This will ensure that all project participants understand the QA/QC procedures and activities for which they are responsible and increase the likelihood that the problems are identified during the project so that corrective action can be implemented.
		5.5: Implement QC procedures to produce defensible, credible data that meets SWAMP QAPrP [Goal 5.5]	• The QA Team will implement QC procedures to ensure the program is being implemented at all phases, from sample collection to analysis to data processing and management. QC activities will include laboratory and field audits, inter-laboratory comparisons/calibration and performance evaluation tests, and data classification and verification.
		5.6: Guidance and tools for partner programs to facilitate data comparability and allow water quality assessments based on combined data sets [Goal 5.6]	• A major focus of the SWAMP program and specifically the QA Team over the next five years will be to work with other Water Board programs to ensure that their ambient monitoring data are collected and stored in a way that they can be combined with other data sets for broader-scale assessments such as 303(d) listing decisions. The State Water Board maintains a Quality Management Plan (QMP), which is the planning document that applies to all of the Water Board's quality systems and requires all Water Board programs to develop QA Program Plans to meet program needs. The State Water Board formed the QA Roundtable to coordinate the development of these plans and assess each programs' needs in terms of data quality objectives. Generally, each program must have data of sufficient quality to assess compliance with water quality standards designed to protect beneficial uses. SWAMP will work with the QA Roundtable to develop recommended reporting limits (RLs) that relate to beneficial use attainment. In addition, the QA Team will provide technical expertise to Water Board programs to develop comparable QA systems to fit their needs.

Summary of Vision Statements, Goals, Objectives and Tasks

Element and Vision	Goals	Objectives	Tasks
6. Data Management Our vision is to manage the flow of data from initial measurement, through acquisition and storage in data management systems, to data output and assessment, so that accurate information is available in a timely manner to decision makers and the public.	6.1: SWAMP ambient monitoring data will be stored and checked for comparability in the SWAMP database. 6.2: Provide training and tools to facilitate the use of SWAMP data and information by the State Water Board (intra-agency) and non-State Water Board (Inter-agency) programs. 6.3: Integrate SWAMP data with information collected by the California Water Boards and non-Water Board Programs.	6.1: Develop and implement a data management system that maintains and documents the integrity of SWAMP data and metadata from initial measurement to final assessment, and efficiently retrieves data to answer SWAMP assessment questions [Goal 6.1]	• Maintain the SWAMP database capable of storing ambient monitoring data elements. • Verify and classify all SWAMP data to clearly document quality. • Develop effective methods for querying and extracting data from the SWAMP database and CEDEN in formats useful for answering assessment questions. • Develop and update the Data Management Plan and business rules to manage data flow.
		6.2: Facilitate data comparability within SWAMP, with other Water Board programs, with CWQMC partners, and with participating stakeholder monitoring programs [Goal 6.2]	• Work with the Water Board's Assessment Unit, SWAMP participants, and the Regional Data Centers to define the minimum data elements needed to submit data to CEDEN. • Conduct training on input to SWAMP database. • Staff the data management help desk. • Maintain automated data checker applications for all entities submitting to the database. • Initiate user group meetings to share data management information. • Continue to work within the Regional Data Centers to incorporate new data types and to incorporate the best data management practices.
		6.3: Facilitate data exchange within SWAMP, with other Water Board programs, with CWQMC partners, and with participating stakeholder monitoring programs [Goal 6.3]	• Maintain updated replicated databases at each Regional Data Center as well as the CEDEN master replicate. • Efficiently export data between the SWAMP database and CEDEN. • Expand CEDEN by using existing resources at the RDCs and leveraging professional contacts within a regional area and work with other programs to develop formats and crosswalks to allow for the exchange of data with CEDEN. • Develop applications that allow users to query data on the web and allow for downloading of data in standard formats. • Develop systems to extract data from CEDEN to populate the Water Board 305b/303d on line Integrated Assessment of water quality conditions and impaired waters in California. • Develop systems to extract data from CEDEN to populate the CWQMC on-line web portals where information can be easily accessed by decision makers and the public. • Make the CEDEN network self-sustaining.

Summary of Vision Statements, Goals, Objectives and Tasks

Element and Vision	Goals	Objectives	Tasks
7. Data Analysis & Assessment Our vision is to provide a consistent science-based assessment framework that integrates data from SWAMP and partner programs to effectively answer assessment questions and inform water quality management decisions at the State and Regional levels.	7.1: Develop a method for assessing standards attainment for listing purposes (303[d]). 7.2: Develop guidance to assist in 303(d) and 305(b) assessments, consistent with the 303(d) listing policy. 7.3: Contribute to statewide and regional assessments to achieve comprehensive assessment of all waterbodies for all beneficial uses.	7.1: Apply SWAMP tools and expertise to high priority assessments [Goals 7.1 & 7.2]	• Provide guidance and tools to assist in CWA 305(b)/303(d) assessments including the translation/interpretation of narrative standards. • Ensure that SWAMP data generated from statewide and Regional Board monitoring efforts is available for use in integrated report. • Support the development and sharing of tools (such as automation software) to facilitate assessment of compliance with Basin Plan objectives. • Support the development and sharing of tools (such as the Central Coast Ambient Monitoring Program's [CCAMP's] automation software) to assess impaired waterbodies and overall resource conditions (303d/305b).
		7.2: Implement the three SWAMP statewide assessments [Goal 7.3]	• The Bioaccumulation monitoring program will continue its assessment of coastal waters and plan for subsequent assessment of large rivers. • Assess the ecological condition of perennial streams and reference sites. PSA is currently (2008-2011) focused on increasing representation across California's major ecoregions. Highest priority for the RCMP will be given to sampling reference sites as needed to support the development of biological objectives. • Assess trends in stream pollution and relationships with land use and management action. In 2010, the SPoT monitoring program will complete its first assessment of stream contamination and toxicity in large California watersheds. SPoT will begin its trend analysis with the second assessment in 2011.
		7.3: Use CWQMC Portals as a framework for assessment [Goal 7.3]	• Coordinate SWAMP assessment strategy with the CWQMC to identify waterbody types, beneficial uses, and management questions that SWAMP will address. • Integrate, where appropriate, data from different indicators and designs to generate efficient statewide assessments. • Create a general and adaptable set of thresholds against which to compare all SWAMP measurements for report cards and policy action at the statewide and Regional levels.
		7.4: Implement and assist with special assessments for identified resource management issues [Goal 7.3]	• Provide data for and assist with the development of Sediment Quality Objectives (SQOs). • Provide monitoring expertise and guidance for assessment of Areas of Special Biological Significance (ASBS). • Partner with other Water Board programs, the USEPA, and other agencies on shared assessments such as the National Surveys for Lakes, Streams, Coastal Waters, and Wetlands.

Summary of Vision Statements, Goals, Objectives and Tasks

Element and Vision	Goals	Objectives	Tasks
8. Reporting Our vision is to make all SWAMP data available to the public, to translate SWAMP data into information useful for making resource management decisions, and to provide timely reports in formats most accessible to target audiences. To accomplish this, the SWAMP identifies target audiences, selects the most effective media to reach them, and provides a range of products from newsletters and fact sheets to interpretive reports and statutory documents, such as the Integrated Report (Clean Water Act (CWA) Section 303(d) list / 305(b) Report), and the	8.1: Produce timely and complete water quality reports and lists as required by the Clean Water Act and consistent with current USEPA guidance. 8.2: Report to the public on water quality taking into account the needs of interested audiences. Use various formats and media such as brochures, fact sheets, report cards, oral presentations, and the Internet. 8.3: Produce technical reports and peer reviewed journal articles resulting from monitoring program activities.	8.1: Produce timely and complete water quality reports and lists as required by the Clean Water Act and consistent with current USEPA guidance [Goal 8.1]	• Contribute the necessary quantity and quality of SWAMP data for use in the Integrated Report including healthy streams. • Assist in developing guidance for defining whether a waterbody has been adequately assessed and when there is sufficient information to assign a waterbody to Category 1 (fully supporting all beneficial uses). • Participate in data analysis and preparation of the Integrated Report.
		8.2: A web-based reporting system that effectively transfers information to decision makers and the public [Goal 8.2]	• A SWAMP website that posts SWAMP assessment products and draws target audiences. • A CWQMC fish and shellfish consumption safety web portal maintained by the SWAMP Bioaccumulation Oversight Group (BOG). • A CWQMC stream ecosystem health web portal maintained by the SWAMP Healthy Streams Partnership. • A CEDEN system capable of exporting data through efficient query tools and able to support information delivery to the public through CWQMC web portals. • An Integrated Report website that includes an interactive map that delivers detailed water quality assessment information to the public. • Provide information for the Water Board's Annual Performance Report including recommendations for reporting environmental outcomes.
		8.3: A SWAMP water quality reporting strategy that uses various formats to most effectively reach target audiences [Goal 8.2]	• Up-to-date SWAMP website providing access to all communication products. • Regular manager's reports, fact sheets, brochures, and report cards summarizing state and regional assessments. • Regular publication of the Monitor newsletter. • Presentations to colleagues at the National Water Quality Monitoring Conference and other professional meetings and workshops. • Email subscriptions and press releases to alert target audiences of product releases. • A series of webinars to present assessment tools, program descriptions, monitoring results and assessments to a wide audience.
		8.4: Effective communication with agency management [Goal 8.2]	• Presentations and briefings to management at the Water Boards and partner agencies. • Presentations to the CWQMC. • Liaison to Roundtable meetings for other Water Board units such as TMDL and NPS. • Timely water quality reports to agency managers and decision makers.

Summary of Vision Statements, Goals, Objectives and Tasks

Element and Vision	Goals	Objectives	Tasks
CWQMC's My Water Quality web portals.		8.5: Technical reports and peer reviewed journal articles resulting from SWAMP activities [Goal 8.3]	• Technical reports for all statewide and regional assessments available within two years of data collection. • Support for publication in scientific journals as a form of external peer-review.
9. Programmatic Evaluation Our vision is to conduct periodic reviews of each aspect of the program to determine its scientific validity, whether it is being implemented as designed and how well it serves the water quality decision needs of the state.	9.1: Ensure that the program is being implemented as designed. 9.2: Ensure that the SWAMP program is meeting the needs of other Board programs (for example, the TMDL or NPS programs). 9.3: Ensure that the program is technically sound.	9.1: Evaluate workplans, perform audits, and develop performance measures to ensure the program is implemented as designed [Goal 9.1]	• Review annual and/or multi-year workplans, including the Regional SWAMP workplans and monitoring plans, to ensure that all program elements are addressed in workplans. • Use information from regional audits to document extent of compliance with elements. • Develop program performance measures and report on them annually.
		9.2: Evaluate the program to ensure it is meeting the needs of other Water Board programs [Goal 9.2]	• Annual evaluation by SWAMP. • Annual evaluation by USEPA. • Periodic evaluation by program offices.
		9.3: Employ peer review to ensure that the program is technically sound and scientifically defensible [Goal 9.3]	• Continue technical review of all monitoring plans and technical reports. • Develop and implement process to respond to the Scientific Planning and Review Committee (SPARC) recommendations. • Conduct focused review of program elements to ensure they are implemented as designed and in a cost-effective manner. • Participate in triennial review of the CWQMC comprehensive monitoring strategy as required by the enabling legislation (Senate Bill 1070, Kehoe, Statutes of 2006).
10. General Support and Infrastructure Our vision is to provide the support needed to implement a coordinated and comprehensive monitoring and assessment program, and to maintain the	10.1: Provide ongoing program coordination, administration and oversight. 10.2: Update the SWAMP needs assessment.	10.1: Increased visibility and usefulness of SWAMP information through targeted reporting and dissemination via the CWQMC web portals [Goal 10.1, Goal 8.2]	• By engaging partners and making monitoring information more accessible on the CWQMC web portals and other outlets, SWAMP intends to increase its outreach and make its programs more valuable to the public and decision makers (Element 8).
		10.2: Provide ongoing program coordination, administration and oversight [Goal 10.1]	• Support Water Board staffing levels adequate to manage SWAMP contracting and administrative needs. • Identify and implement the most effective method of contracting for the program. • Maintain laboratory and field capability adequate to handle current and anticipated monitoring workload.

Summary of Vision Statements, Goals, Objectives and Tasks

Element and Vision	Goals	Objectives	Tasks
infrastructure and program capabilities necessary to accomplish program goals.			• Maintain the expertise and capabilities of SWAMP contract laboratories to allow continued high quality monitoring and assessment. • Document the history of key SWAMP communications, decisions, budgets, and products to support SWAMP institutional memory.
		10.3: Provide regional coordination [Goal 10.1]	• SWAMP Regional Coordinators will strive to coordinate monitoring among Water Board programs and other agencies and entities at a regional scale; however, resource constraints may limit their ability to do this in a comprehensive manner. • Provide administrative oversight. • Support travel required to attend the National Water Quality Monitoring Conference and other key opportunities to get review and insights for program improvement. • Identify other state-funded monitoring that could be more professionally, efficiently, and cost-effectively conducted by the SWAMP. • Work with the CWQMC to develop proposals to improve monitoring to determine effectiveness of state financed water quality improvement projects.
		10.4: Update the SWAMP Needs Assessment [Goal 10.2]	As the SWAMP pursues this dual approach to program support, staff will need to identify current and future resource needs to fully implement the SWAMP Strategy. As part of an ongoing triennial review and planning process, the following needs should be assessed, considering current conditions and planned improvements: • Identify the required number of staff needed for the SWAMP program implementation; • Identify the laboratory support needed to conduct high quality analyses and manage data according to SWAMP procedures; • Identify training needs for program implementation by field, laboratory, data management and data assessment staff; • Identify annual monitoring needs of Regional Water Boards; • Identify annual monitoring needs of the State Water Board; • Prepare budget for upcoming year; and • Forecast budget needs for three years.

Appendix C
SWAMP Assessment Framework

SWAMP
Surface Water Ambient Monitoring Program

SWAMP Assessment Framework

B. Bernstein

Prepared for the Surface Water Ambient Monitoring Program

December 2010

California Water Boards

www.waterboards.ca.gov/swamp

Table of Contents

List of Acronyms

CEAP	Canadian Environmental Assessment Program
CEDEN	California Environmental Data Exchange Network
CEQ	Council on Environmental Quality
CRAM	California Rapid Assessment Method
CWQMC	California Water Quality Monitoring Council
DDT	Dichloro-diphenyl-trichloroethane (a synthetic insecticide)
DO	Dissolved Oxygen
EC	European Commission
NNE	Numeric Nutrient Endpoints
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint Source
NRC	National Research Council
OEHHA	Office of Environmental Health Hazard Assessment
PCB	Polychlorinated biphenyls
PHab	Physical Habitat
QAPrP	Quality Assurance Program Plan
QAPP	Quality Assurance Project Plan
SQO	Sediment Quality Objectives
SSO	Site-Specific Objective
SWAMP	Surface Water Ambient Monitoring Program
TDS	Total Dissolved Solids
TIE	Toxicity Identification Evaluation
TMDL	Total Maximum Daily Load
USEPA	U.S. Environmental Protection Agency
WER	Water-Effect Ratio

Introduction

This report is a companion document to the updated Surface Water Ambient Monitoring Program (SWAMP) *Comprehensive Monitoring and Assessment Strategy to Protect and Restore California's Water Quality* (Strategy). Its purpose is to present a framework for surface water monitoring and assessment for all Water Board programs (e.g., NPDES permitting, TMDL; see Strategy for a complete list) that will address the State Water Board's strategic goals through approaches that:

- Increase the amount of usable data and information regarding water quality and beneficial uses;
- Reliably and consistently translate data into useful information; and
- Coordinate the collection, assessment, and reporting of water quality information among Water Board programs, agencies, and stakeholders

The SWAMP was created in 2000 in response to the State Legislature's mandate to coordinate all ambient water quality monitoring conducted by the State and Regional Water Boards (Water Boards) to assess attainment of all core beneficial uses in all waterbody types. This broad mandate sought to address a set of fundamental problems undermining the overall effectiveness of ambient monitoring, including:

- A lack of standardized or comparable questions, indicators, methods (including field, laboratory, and quality assurance), assessment thresholds, data management procedures, and reporting processes for Water Board programs;
- Poor coordination among Water Board programs and among State and Regional Water Boards; and
- An inefficient and insufficiently rigorous process for developing statewide assessment reports required under the Clean Water Act sections 303(d) and 305(b).

The SWAMP has developed a number of standardized monitoring, assessment, quality assurance, and data management methods. These have contributed to an overarching infrastructure for organizing efforts to address the three fundamental problems listed above. While the SWAMP has assumed direct responsibility for several statewide assessments (e.g., perennial wadeable streams, sportfish tissue contamination), meeting the State Water Board's strategic goals will require focusing additional effort on integrating SWAMP policies and infrastructure into the larger context of other Water Board programs.

The audience for this report is Water Board management, the Water Board's program managers, the Executive Officers of the Regional Water Boards, and the caseworkers, that is, staff with the responsibility for fulfilling the Water Board's strategic goals and the management authority to ensure that the framework's procedures and recommendations are implemented. In particular, this report also speaks to SWAMP Coordinators at the Regional Water Boards who will have responsibility for implementing the principles of this Assessment

Framework at the regional level by fostering coordination of monitoring and assessment across Water Board programs.

Coordinating Water Board Monitoring

Water Board programs are structured around the protection of beneficial uses, with ambient water quality monitoring intended to assess the status of core beneficial uses for all waterbody types, as illustrated in the conceptual overview in Table 1. A primary SWAMP goal is to coordinate the collection and reporting of such monitoring information among Water Board programs. In support of this goal, the SWAMP has made great strides in developing the monitoring infrastructure (i.e., indicators, methods, standard operating procedures, quality assurance, data management) needed to assess beneficial uses in surface waters. These procedures are used by SWAMP staff at Regional Water Boards and by the SWAMP in its three statewide programs (Bioassessment, Stream Pollution Trends, and Bioaccumulation Monitoring Programs).

However, the SWAMP will never have the resources itself to monitor all of the state's water bodies for all core beneficial uses (i.e., all the cells in Table 1). Instead, there is a complex array of programs, both within the Water Boards and across multiple state and federal agencies, to protect and assess beneficial uses in various water bodies across the state at local, regional, and statewide scales. An evaluation of the major regional and statewide monitoring and assessment programs, using performance measures adapted from the U.S. Environmental Protection Agency's (USEPA's, 2003) *Elements of a State Water Monitoring and Assessment Program* (Appendix 3, CWQMC, 2008), identified significant problems related to the comparability of monitoring methods, the accessibility of data, the availability of consistent assessment approaches, coordination among programs (both within the Water Boards and across agencies), and the ability to readily access data for reporting. The California Water Quality Monitoring Council is addressing coordination with other state and federal programs to address these problems. Within this larger context, it is clear that the Water Boards could contribute substantially to resolving these problems and provide more information to managers and the general public by coordinating the monitoring and assessment activities of the various Water Board programs that deal with ambient water quality.

The SWAMP Assessment Framework presented here is an infrastructure for organizing key aspects of all Water Board monitoring and assessment for all beneficial uses and waterbody types (Table 1), even where they are not conducted by the SWAMP itself. In particular, it defines the SWAMP's role in supporting appropriate monitoring standardization and coordination across Water Board programs for all cells of Table 1. Each cell in Table 1 could be monitored, assessed, and reported on at a range of spatial scales, from local to regional and statewide. National efforts by federal agencies (e.g., USEPA, U.S. Geological Survey, U.S. Fish and Wildlife Service) may also provide information for specific cells.

Table 1. Water quality monitoring, assessment, and reporting planning matrix, illustrating the potential combinations of waterbody type and beneficial use categories that are or could be addressed by the Water Boards or its partners.

Waterbody Type	Core Beneficial Use			
	Aquatic Life	"Swimmable"	"Fishable"	"Drinkable"
Wadeable Streams				
Large Rivers				
Lakes				
Estuaries				
Ocean, Coastal, Bays				
Wetlands				

Assessment Framework Overview

Effective monitoring and assessment requires attention to several aspects of program design and implementation. Figure 1 illustrates which of these should be standardized at the statewide level (gray boxes) and which may use other, scale-dependent methods that are more appropriate to a particular region or locality (blue boxes). Within this overall context, the SWAMP's role is to ensure that standardized methods and/or relevant scale-dependent approaches are available for each beneficial use / waterbody type combination (Table 1):

- For the three statewide assessments it has primary responsibility for, the SWAMP will take the lead in developing such methods
- Where the SWAMP does not have primary responsibility, it should work in concert with the California Water Quality Monitoring Council and other Water Board programs to
    - Make such standardized approaches more readily available where they already exist
    - Help develop such standardized approaches where they do not yet exist

The role of Water Board managers, in both the State and Regional Water Boards, is then to implement needed standardization and coordination across all Water Board programs, with

SWAMP Coordinators in each Regional Water Board playing an organizing and facilitating role for such efforts at the regional level.

Figure 1 illustrates the main steps in the SWAMP's coordination function. Beneficial uses (Box 1) are defined in Basin Plans and these define a starting point for developing more program-specific questions for particular beneficial use / waterbody combinations (Box 2). Monitoring designs to address these more specific questions may differ depending on their scale and/or site-specific circumstances (Box 3). Even such site-specific monitoring designs, however, can often use standardized core indicators (Box 4) and standardized sampling, quality assurance, and data management methods (Boxes 5 and 7). The SWAMP has developed such standardized indicators and methods for the beneficial uses it has primary responsibility for, and will ensure that, where available, such standardized tools for all core beneficial uses (Table 1) are communicated to Water Board programs as needed. Even where site-specific assessment approaches (Box 8) are used, beneficial use status should be evaluated with respect to standardized thresholds and assessment endpoints (Box 6). Depending on the indicator, thresholds and endpoints may be strictly numeric, strictly narrative, or narrative statements supported by numeric thresholds. In several cases, the State Water Board is developing biological thresholds to assist programs in interpreting monitoring data. Finally, individual programs make the ultimate decision about how to use monitoring information and how it should be reported (Box 9).

Figure 1 also illustrates the critical importance of articulating assessment questions (Box 2). This piece of the monitoring and assessment puzzle provides the functional link between broader concerns about beneficial uses and the technical specifications of monitoring designs. Without clearly defined questions, monitoring programs can easily waste valuable resources collecting data that address the wrong question or no question at all. Thus, the development of a question-driven mindset throughout Water Board programs is an essential aspect of the SWAMP's assessment framework.

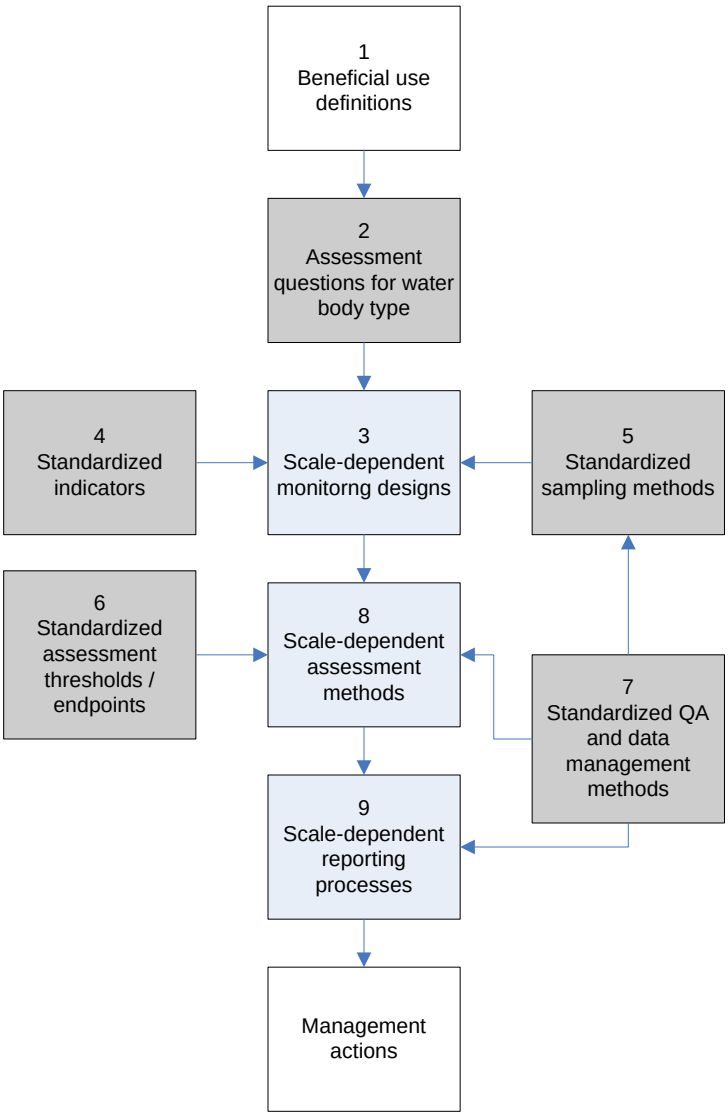

Figure 1. Key elements of monitoring design and assessment. Gray boxes are those elements for which SWAMP is responsible for ensuring the availability of standardized methods and/or approaches. Blue boxes are those elements that may use either standardized statewide methods or other methods that are more appropriate to a particular region or locality.

Question-Driven Monitoring

As Figure 1 illustrates, clearly stated assessment questions are an essential prerequisite for effective monitoring designs, something that is almost universally emphasized in guidance on monitoring and research design (e.g., CEAP, 2004; CEQ, 1997; EC, 2001; Gross, 2003; Hegmann et al., 1999; Henderson and O'Neil, 2004; Suter, 1996; USEPA, 1992, 1998; U.S.

Forest Service, 2005; Wood, 2002). Assessment questions can be framed at three levels of detail (Figure 2). At the highest level, the SWAMP and the California Water Quality Monitoring Council have adopted the following four questions associated with core beneficial uses (i.e., the top row of Table 1):

1. Is our water safe to drink?
2. Is it safe to swim in our waters?
3. Is it safe to eat fish and shellfish from our waters?
4. Are our aquatic ecosystems healthy?

For each of these questions there are is a second level of more specific assessment sub-questions about the status of beneficial uses that provide additional focus for monitoring design:

a. What is the quality of waters relative to beneficial uses (i.e., are uses impaired)?
b. To what extent are water quality conditions changing over time (i.e., are conditions getting better or worse)?
c. What are the areas needing protection and what is the magnitude and extent of problems where they exist?
d. What are the sources of stressors threatening uses (i.e. what's causing the problem)?
e. How effective are water quality improvement projects and programs at protecting or restoring beneficial uses (i.e., are solutions working)?

These two sets of broad assessment questions are universally applicable across all waterbody types and all spatial scales for each core beneficial use. They provide a common starting point and an important level of consistency across programs and regions.

However, there is one additional set of more detailed questions (Bernstein et al., 1993) that include the technical perspective needed to guide the design of monitoring programs to ensure they provide meaningful and useful information:

i. What is the management goal (e.g., no effects greater than X, no change from present condition, find problem areas, estimate percentage area in different conditions)?
ii. What monitoring strategy is suitable (e.g., measure one indicator, measure multiple indicators, track trends)?
iii. What degree of certainty and precision is required (e.g., qualitative information, minimal certainty/precision, extreme certainty/precision)?
iv. What reference conditions are appropriate (e.g., reference location, reference time, standards, model prediction)?
v. What spatial scale is appropriate (e.g. site-specific, regional, statewide)?

vi. What temporal scale is appropriate (e.g., immediate, months, year-to-year, years to decades)?

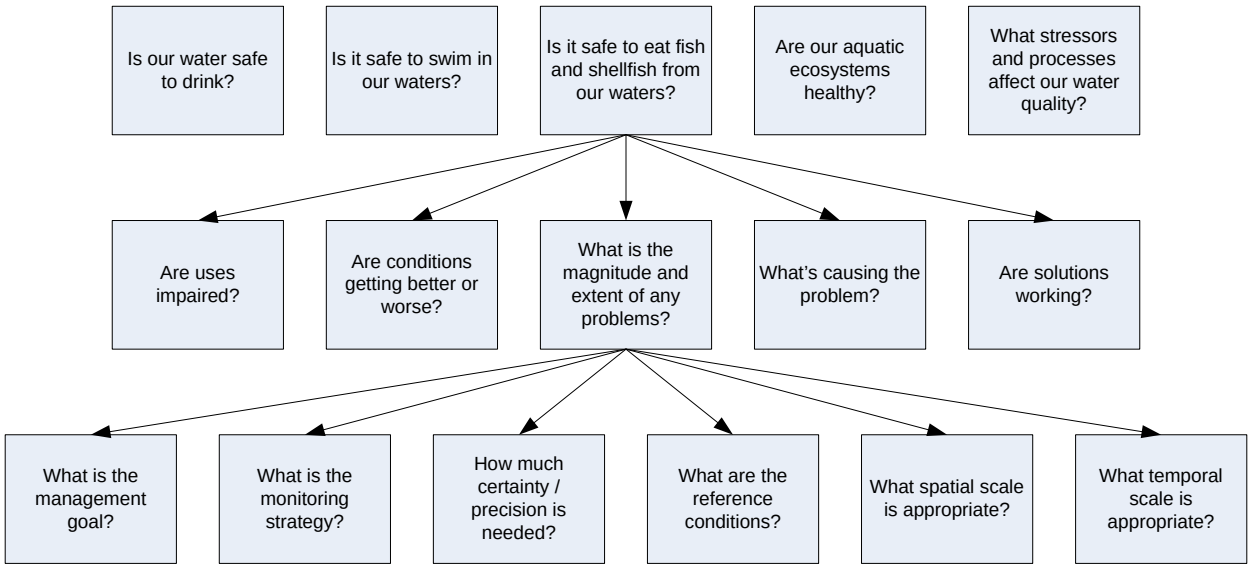

Figure 2. The three levels of questions needed to develop effective monitoring designs, showing how each question in a higher level must be addressed by all questions at the next lower level. The top two levels of questions are universally applicable to all waterbody types and all spatial scales. The lowest level of questions must be addressed separately for each monitoring design.

An example from a National Research Council (NRC) report on environmental monitoring (NRC, 1990) illustrates the difference between assessment questions at each of the three levels of detail, related to a planned dam development on a Canadian river:

1. What would be the impacts of a proposed dam on the fish resources of the river (equivalent to: Are our aquatic ecosystems healthy)?
2. Will spawning habitat be impacted (equivalent to: Are uses impaired)?
3. What percentage of the Arctic char spawning habitat would be lost given a 0.5 meter reduction in the water level of the river during the month of September? (partial detail needed for monitoring design)

Another example, from a different regulatory arena (offshore oil platform decommissioning), also illustrates the nested levels of management questions needed for effective monitoring design:

1. What is the impact of decommissioning on commercial fishing?
2. What is the impact of vessel traffic on commercial fishing operations in the immediate vicinity of the project?

3. Does vessel traffic associated with decommissioning reduce commercial fishing activity by more than 25% within five miles of the project during decommissioning?

By question-driven monitoring, the SWAMP thus means the integrated and systematic application of the three levels of questions described above. Monitoring programs at the statewide and regional scale are more likely to use standardized assessment questions and monitoring designs, and programs at more localized scales are more likely to add features tailored to their specific needs. A key part of the SWAMP's role is to work with Water Board programs, at statewide, regional, and local levels, to apply these questions to meet the specific needs of individual programs and their monitoring efforts (see Strategy for more detail.) A more consistent application of such question-driven monitoring design across Water Board programs will help ensure that data collected at certain sites and times can be used for more than one program. This will produce long-term logistical and cost benefits by reducing duplication of effort and enabling monitoring designs, indicators, and methods to be used more widely across programs and at different spatial scales (Figure 3). In addition, this will improve the value of assessments for decision making as programs at larger spatial scales provide needed context for interpreting monitoring results from those operating at smaller spatial scales. Conversely, more localized monitoring efforts should provide detail useful in understanding how broad patterns operating at statewide and regional scales play out at finer spatial scales.

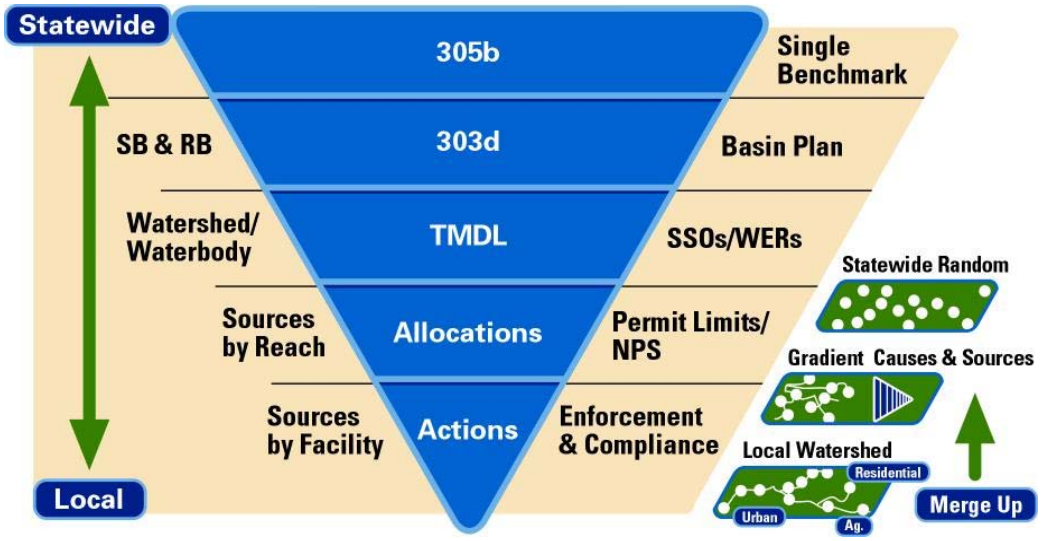

Figure 3. Water Board monitoring programs that use a question-driven approach to produce comparable data (i.e., based on standardized monitoring designs, indicators, and methods) can provide data that can serve the needs of multiple Water Board programs that operate at a range of spatial scales, from the local to statewide. SB and RB refer to State Water Board and Regional Water Boards, respectively; SSOs to site-specific objectives, WERs to water-effect ratios, and NPS to the Nonpoint Source.

Indicators, Methods, and Thresholds

One of the ultimate goals of the SWAMP assessment framework is to ensure the availability and use of standardized indicators, sampling methods, and assessment thresholds or endpoints (Figure 1) for each cell in Table 1. The SWAMP and other Water Board programs have made significant progress in defining indicators, methods, and assessment thresholds and in applying these to specific monitoring programs. For example, Table 2 (taken from Strategy) lists recommended water quality indicators for general designated use categories (see Strategy for more detail).

Standardized methods and assessment thresholds exist for many of these indicators. For example, the California Toxics Rule establishes thresholds for many chemical indicators for protecting aquatic and human health, the Office of Environmental Health Hazard Assessment (OEHHA) has developed fish contaminant goals and advisory tissue levels for protecting fish and shellfish consumption, and California Department of Public Health has developed standards to protect drinking water that are included in all Basin Plans. In addition, standardized monitoring approaches exist for the assessment of some categories of biological condition in some waterbody types. Some of these standardized monitoring and assessment elements have been developed by the SWAMP, some by other State Board programs and/or USEPA, and still others by broader collaborative efforts involving several state and federal agencies. Although such efforts include entities beyond the SWAMP, promoting their consistent use across all Water Board programs is a core responsibility of the SWAMP and the SWAMP Coordinators at the Regional Water Boards.

While indicators and assessment thresholds do exist for many of the beneficial use / waterbody combinations in Table 1, there are still important gaps to be filled:

- Not all indicators in Table 2 within a beneficial use category are equally applicable to all waterbody types.
- Indicators do not exist for all beneficial use / waterbody combinations.
- Some indicators do not yet have thresholds to guide the assessment of monitoring results.
- The minimum set of indicators needed to assess beneficial use protection for the integrated 303(d) / 305(b) report has not yet been identified.

Filling these gaps will be challenging. For example, in terms of aquatic life and wildlife, there are many kinds of ecosystems and populations within each waterbody type, with estuaries (as just one example) containing benthic infauna and macrofauna, a variety of fishes, birds (many threatened or endangered), and several habitats. Developing scientifically rigorous and practical assessment approaches that are applicable statewide is demanding. The State Water Board's ongoing efforts to develop consistent sediment quality objectives (SQO) for bays and estuaries, biological objectives for wadeable perennial streams, and numeric

nutrient endpoints (NNE) for estuaries and freshwater are representative of the type of multi-year commitment typically required.

Table 2. SWAMP recommended water quality indicators for general designated use categories (modified from USEPA, 2003).

Beneficial Use	Indicators	
	Core	**Supplemental/diagnostic**
Aquatic life and wildlife	**Conventionals** Temperature, conductivity, pH, DO, nutrients **Toxics** Metals, Bioaccumulative, Pesticides **Toxicity** Water and/or sediment **Biological conditions** Invertebrates (streams) Chlorophyll (lakes, streams, estuaries) Algae Wetlands **Physical habitat** PHab (streams) CRAM (wetlands)	 Other chemicals of concern in water column or sediment TIEs (water and/or sediment) Health of organisms Landscape/Land use Flow
Fish/shellfish consumption	**Chemical indicators** Mercury, chlordane, DDTs, PCBs **Fecal indicators (for shellfish)** Total and fecal coliform	Other chemicals of concern in water column or sediment Landscape/Land use
Recreation	**Fecal indicators** Enterococci, total and fecal coliform (seawater) *E. coli*, enterococci (freshwater) **Other** Secchi depth (lakes) Nuisance plant growth Chlorophyll *a* Microcystis/microcystin	Landscape/Land use Other chemicals of concern in water column or sediment Flow Nutrients
Drinking water	Trace metals Pathogens (Drinking Water Rule, Basin Plan language) Algae (microcystis) Nitrates Salinity Sediments/TDS	Other chemicals of concern in water column or sediment Flow Landscape/Land use

The SWAMP will play a range of roles in developing and applying standardized monitoring and assessment elements, including:

- Leading the development for those beneficial use / waterbody combinations that are the SWAMP's primary responsibility (e.g., biological objectives for wadeable perennial streams)
- Supporting the development of comprehensive monitoring and assessment approaches, and related permit requirements, for other Water Board programs (e.g., stormwater)
- Providing technical support to development efforts led by other agencies (e.g., wetlands monitoring and assessment)

In addition to these means of improving coordination and consistency across regions and programs, the SWAMP should use its role in reviewing quality assurance program plans to foster a more rigorous approach to the design of monitoring and assessment programs. Quality assurance is too often assumed to include only issues narrowly related to sampling and sample processing (e.g., laboratory methods, detection limits). Modern quality assurance and quality control approaches, however, focus more broadly on all aspects of the process that can affect the overall quality of the final product, the assessments that answer key management questions. Thus, if laboratory procedures follow standard methods but the wrong assessment threshold is used, the assessment is of poor quality. Or, if standard sampling methods are used but the monitoring design is unsuited to the question(s) that motivated the monitoring effort, the assessment is of poor quality. The SWAMP, along with Water Board managers, should emphasize that quality assurance encompasses all aspects of monitoring and assessment programs, and should be judged by the utility of the final assessment product.

The State Water Board has developed a Quality Management Plan that describes the Water Boards' quality assurance philosophy along with management policies and procedures. These will apply to programs (e.g., NPDES, Nonpoint Source) within the State Water Board and nine Regional Water Boards, as well as any contractors, other state or local agencies working as partners with the State or Regional Water Boards, grantees or contractors working for any of these organizations. All data collection activities, including biological, physical habitat, and chemical monitoring; the selection and use of data from secondary sources; and data analysis and modeling efforts, are to be guided by the principles of this overarching Quality Management Plan:

- The intended use of environmental data and the level of data quality necessary to support decisions made using that data will be established by State and Regional Water Board staff prior to the design and initiation of all data collection activities
- All State and Regional Water Board programs generating, using, or receiving environmental data will adhere to the policies outlined in the Quality Management Plan

- All data generated by or for the State and Regional Water Boards, include those produced by other agencies, contractors, grant recipients and regulated parties, will be of documented quality (with "quality" broadly defined as above)
- Adequate resources and staff will be provided by the Water Boards to meet the quality assurance and quality control requirements of the Quality Management Plan

Individual programs must develop specific Program Plans that implement the policies of the State Water Board's Quality Management Plan and that define quality objectives, decisions or goals, and measurement quality objectives that apply to all data generated under the program. The SWAMP has developed its Quality Assurance Program Plan (QAPrP, SWAMP 2008) and other State Water Board programs collecting ambient surface water data may use elements of the SWAMP QAPrP that are appropriate to their needs. Finally, individual projects may develop Quality Assurance Project Plans (QAPPs) that define details at the level of individual projects.

Data Management and Access

The SWAMP has developed a set of standardized formats and tables for storing and transmitting ambient monitoring data. Tables have been developed for chemical constituents (water, sediment, and tissue), toxicity results (water and sediment), biological communities (fish and macroinvertebrates), and habitat measures (grain size, physical habitat). These are used internally by the program and by those wishing to meet SWAMP comparability requirements.

The SWAMP has also developed the California Environmental Data Exchange Network (CEDEN) to support the storage of and access to surface water monitoring and assessment data for all Water Board programs across the state. CEDEN will enable Water Boards, permittees, and other data sources to upload their data to one of several regional data centers linked as a statewide data network. Users will then be able to use CEDEN to readily find and obtain data based on a variety of search criteria such as location, program, or constituent. In addition, an important part of the SWAMP's Strategy is to provide technical support to users through staff at the regional data centers. CEDEN is a critical prerequisite for the reporting element of the assessment framework described in the next section.

Reporting

As Figure 1 illustrates, monitoring and assessment activities report on information that will answer key management questions and assist in making decisions to protect water quality. Recognition of this ultimate use of monitoring data underlies all of the SWAMP's efforts at improving the designs, indicators, and assessment thresholds used in Water Board programs. At the statewide level, the integrated 305(b) / 303(d) report is the state's primary means of addressing needs for statewide assessment and for tracking trends in environmental condition over time. At regional and local scales, a variety of other reporting

processes are used to address scale-depending assessment and decision needs. For all such processes, ready availability of high-quality and consistent monitoring data and assessment results at a range of spatial scales is key to improving their efficiency, rigor, and credibility and for identifying, prioritizing, and managing risks to water quality and associated beneficial uses.

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Appendix D
SWAMP Needs Assessment

SWAMP
Surface Water Ambient Monitoring Program

Surface Water Ambient Monitoring Program (SWAMP) Needs Assessment

Prepared by the Surface Water Ambient Monitoring Program

December 2010

California Water Boards

www.waterboards.ca.gov/swamp

Table of Contents

List of Acronyms

AIS	Aquatic Invasive Species
BOG	Bioaccumulation Oversight Group
Cal/EPA	California Environmental Protection Agency
CDFG	California Department of Fish and Game
CEDEN	California Environmental Data Exchange Network
CSU	California State University
CWA	Clean Water Act
CWQMC	California Water Quality Monitoring Council
DDT	Dichloro-diphenyl-trichloroethane (a synthetic insecticide)
DMT	Data Management Team
IBI	Index of Biotic Integrity
MLML	Moss Landing Marine Laboratory
MOU	Memorandum of Understanding
MPSL	Marine Pollution Studies Laboratory
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint Source
OEHHA	Office of Environmental Health Hazard Assessment
PBDE	Polybrominated diphenyl ether
PCB	Polychlorinated biphenyls
PFC	Perfluorinated compound
ppm	parts per million
PSA	Perennial Streams Assessment
QA	Quality Assurance
QAMP	Quality Assurance Management Plan
QAPrP	Quality Assurance Program Plan
QAPP	Quality Assurance Project Plan
QC	Quality Control
RCMP	Reference Condition Management Program

RDC	Regional Data Center
SCCWRP	Southern California Coastal Water Research Project
SFEI	San Francisco Estuary Institute
SJSURF	San Jose State University Research Foundation
SOP	Standard Operating Procedure
SPoT	Stream Pollution Trends
SWAMP	Surface Water Ambient Monitoring Program
TMDL	Total Maximum Daily Load
UC	University of California
USEPA	U.S. Environmental Protection Agency

Executive Summary

This Needs Assessment was prepared in response to requirements stipulated in California Senate Bill 1070 (Kehoe, Statutes of 2006). This is a living document that will be evaluated and updated, as appropriate, as the vision described in the California Water Quality Monitoring Council's (2010) *Comprehensive Water Quality Monitoring Program Strategy for California* and the 2010 Update of the Surface Water Ambient Monitoring Program's (SWAMP) *Comprehensive Monitoring and Assessment Strategy to Protect and Restore California's Water Quality* takes shape and becomes more fully realized.

When the SWAMP was originally designed, it was envisioned to provide information for all the State Water Resource Control Board's decision-making needs. This included monitoring all waterbody types to assess attainment of all beneficial uses. In the November 2000 Report to the Legislature, it was estimated that full implementation of the SWAMP would cost between $59 and $115 million per year and require 87 to 132 staff positions. Funding for the program has never reached that level, and it is unlikely that the program will ever receive such resources. Furthermore, funding of SWAMP's regional monitoring programs has decreased in recent years. The lack of adequate resources has limited what the SWAMP is able to accomplish.

The SWAMP currently is funded at approximately $8 million per year and 17 staff positions, through an Ambient Water Monitoring Surcharge on waste discharge permit fees and Clean Water Act (CWA) *Section 106* Grant funds. In response to these funding and staffing constraints, the SWAMP has focused its resources on conducting three statewide assessments, supporting regional monitoring, enhanced coordination with Water Board programs and other partners, and the development and implementation of supporting infrastructure and tools. Collaboration with the California Water Quality Monitoring Council represents a key component of the SWAMP's efforts related to each of these priorities.

The approach taken for the development of this Needs Assessment was to describe current funding levels, program priorities and activities, and opportunities to enhance the existing program should additional funds become available. The SWAMP evaluates programmatic priorities and funding allocations on an annual and/or multi-year basis through the development of workplans at the State and Regional levels. In the event additional funds were to be allocated to the SWAMP, those funds would be used to enhance the existing monitoring and assessment programs, our ability to coordinate with Water Board programs and other partners, and/or the continued development of needed infrastructure and tools.

SWAMP Funding

The State Water Resources Control Board's (State Water Board) Surface Water Ambient Monitoring Program (SWAMP) provides information on ambient water quality and the beneficial uses of California's surface waters; coordinates a statewide framework of

consistent and scientifically defensible methods and strategies that improve monitoring, assessment, and reporting of water quality; and fulfills federal Clean Water Act (CWA) requirements (namely, impaired water bodies list and surface water quality assessment). When the SWAMP was originally designed, it was envisioned to provide information for all the State Water Board's decision-making needs. This included monitoring all waterbody types to assess attainment of all beneficial uses. It was estimated that to achieve this vision, the program would cost between $59 and $115 million per year and include 87 to 132 staff positions (November 2000 Report to the Legislature). Funding for the program has never reached that level, and it is highly unlikely that the program will ever receive such resources. Furthermore, funding of the SWAMP's regional monitoring programs has decreased in recent years. The lack of adequate resources has seriously limited what the SWAMP is able to accomplish.

The current program is funded at approximately $8 million and 17 staff positions, through an Ambient Water Monitoring Surcharge on waste discharge permit fees and CWA *Section 106* Grant funds. A summary of how the SWAMP funds are currently allocated is provided in Table 1. This represents a snapshot of the budget as of fiscal year 10/11; however, shifts in funding are subject to occur as priorities change. The infrastructure and support line item includes a number of activities including the Quality Assurance Team, Data Management Team, California Environmental Data Exchange Network, program coordination, and communications and reporting. Allocation of the *Section 106* Grant funds is negotiated on an annual basis and articulated through the development of a workplan. To a large degree, the *Section 106* Grant funds support the statewide monitoring and assessment, data comparability, and infrastructure and support. Contact expenditures associated with the Ambient Water Monitoring Surcharge are allocated primarily to support regional monitoring and assessment activities. Regional SWAMP workplans and monitoring plans are developed on an annual or multi-year basis.

Table 1. Summary of SWAMP Budget for Fiscal Year 10/11.

Program	Current Funding	
	PYs	Contract Expenditures
Statewide Monitoring	1.5	$2,968,170
Regional Monitoring	9.8	$3,227,800
Data Comparability	2.0	$253,200
Infrastructure and Support	3.7	$1,618,800
Total	**17**	**$8,067,970**

One area in particular need of improvement, as identified by both the SWAMP Roundtable[1] and the California Water Quality Monitoring Council, is the contracting process by which SWAMP accesses the capabilities of the University of California (UC) and California State University (CSU) to conduct monitoring, data management, and assessment. The current process impedes our ability to contract with these entities, which provide critical expertise and capabilities that allow for continued high quality monitoring and assessment, in an efficient and timely manner. The program relies heavily on contracting, as the resources allocated to the SWAMP are largely in the form of contract support. A significant amount of staff resources, particularly at the Regions, is devoted to contracting, leaving fewer resources for monitoring, assessment, reporting, and coordination. Streamlining the contracting process is critical for efficient use of program resources. The State Legislature has begun to address this issue with the passage and signing of California Assembly Bill 20 (Solorio, Statutes of 2009), which requires the Department of General Services to establish a model contract with standard contract provisions for UC and CSU agreements. This may be one step toward streamlining a contract process that currently requires multiple reviews and results in lengthy delays.

Given current resource limitations, the SWAMP has focused its statewide assessment efforts on a few waterbody/beneficial use combinations; collaborates with other monitoring programs and partners within the California Water Quality Monitoring Council framework to address other waterbody/beneficial use combinations; and has taken a lead role in developing the monitoring infrastructure needed to foster data comparability and collaboration with other monitoring partners. If additional funds were to be allocated to the SWAMP, those funds would be directed towards enhancing the existing programs. An overview of the SWAMP is provided in the following section. The discussion of each program element is followed by a list of potential ways the program could be enhanced with additional funding. Should additional funding become available, these lists would be evaluated, prioritized, and likely modified, based on programmatic direction and needs at that point in time.

Program Overview

The SWAMP was created in the year 2000 to fulfill the State Legislature's mandate for a unifying program that would (1) integrate the existing water quality monitoring of the State Water Board and Regional Water Quality Control Boards (Regional Water Boards) and (2) coordinate with monitoring programs of other agencies, dischargers, and citizens groups (SWRCB, 2000). The SWAMP was envisioned to meet the following four goals:

[1] The SWAMP Roundtable is the coordinating entity for the program. Participants include staff from the State and Regional Water Boards, the Department of Fish and Game, the Marine Pollution Studies Lab, Moss Landing Marine Laboratories, contractors and other interested entities.

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 State Water Board, Regional Water Boards, 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.

The 2010 update to the SWAMP's *Comprehensive Monitoring and Assessment Strategy to Protect and Restore California's Water Quality* (Strategy) identifies statewide and regional monitoring and assessments, coordination, and the development and implementation of infrastructure and tools as the SWAMP's core implementation priorities. Existing resources are not sufficient for the SWAMP to monitor all water bodies for all beneficial uses, so efforts have been focused on a few statewide assessments of key beneficial uses, supporting regional monitoring, and improving coordination with other Water Board programs (e.g., National Pollutant Discharge Elimination System [NPDES], Stormwater, Irrigated Lands Regulatory Program, Nonpoint Source [NPS]) and external partners. Finally, the SWAMP has taken a lead role in developing the monitoring infrastructure and tools (e.g., indicators, methods, quality assurance/quality control [QA/QC], and data management) necessary to support a robust monitoring program while also fostering data comparability and collaboration with monitoring partners. The continued development, maintenance, and implementation of the monitoring infrastructure and tools remain a priority for the program.

The SWAMP's Statewide monitoring and assessment programs are designed to provide information on the status and trends of California's waters. These programs help to answer broad questions, such as, "what percent of river miles are in good conditions?" or "what percent of lakes have fish tissue contamination levels above an Office of Environmental Health Hazard Assessment (OEHHA) threshold?". Regional monitoring activities are based primarily on targeted monitoring designs to answer questions pertaining to specific sites. Targeted designs are good for evaluating trends at a particular location, for comparing conditions upstream-downstream of a particular source for compliance purposes, and for performing general gradient analyses.

A continuing goal of the SWAMP is to integrate its monitoring designs so that data collected at certain sites and times can be used for more than one program. Beyond the logistical and cost advantages, there are informational advantages because Statewide programs provide perspective for regional monitoring, and regional programs provide finer detail for Statewide programs. This enhances the value of each assessment for resource management decision

making. At a minimum, such evaluation of monitoring design should be conducted to avoid duplication of Water Board efforts. The ultimate objective is to better refine management questions and align the monitoring efforts of the SWAMP with those of other Water Board programs.

The following sections provide brief summaries of the SWAMP's current activities related to statewide and regional monitoring and assessment programs, data comparability, infrastructure and support, and the California Environmental Data Exchange Network (CEDEN).

Current Statewide Monitoring and Assessment Programs

The SWAMP is currently conducting three statewide monitoring programs that assess bioaccumulation of contaminants in sport fish (Bioaccumulation Monitoring Program), ecological condition in perennial streams (Bioassessment Monitoring Program), and trends in sediment contaminant concentrations and toxicity at watershed integrator sites (Stream Pollutions Trends Monitoring Program). Each of the statewide programs is designed to provide Water Board programs with background and context necessary to evaluate the data generated by local or regional programs.

Bioaccumulation Monitoring Program

The Bioaccumulation Monitoring Program is a 5-year rotating, screening-level study that evaluates contaminant levels of methylmercury, PCBs, DDTs, dieldrin, chlordane, and selenium in sport fish in lakes and reservoirs, coastal waters, and rivers. The objectives of this monitoring program are to:

1. determine the proportion of lakes, streams, and coastal sites in which edible fish tissues exceed thresholds for specified contaminants;
2. conduct screening of California waters to identify problem areas where additional monitoring should be conducted to determine whether a fish consumption advisory should be developed; and
3. determine, over the longer term, whether these proportions and contaminant concentrations are increasing or decreasing to evaluate the effectiveness of management actions in reducing contamination.

This monitoring program is coordinated by Bioaccumulation Oversight Group (BOG). The BOG was formed to evaluate monitoring needs relative to bioaccumulation of toxics in fish and the effect that these have on beneficial uses related to fish consumption and the protection of aquatic life. The BOG is a coordinated effort, consisting of representatives from the State and Regional Water Boards, San Francisco Estuary Institute (SFEI), Moss Landing Marine Laboratory (MLML), OEHHA, U.S. Environmental Protection Agency (USEPA),

California Department of Fish and Game, U.S. Fish and Wildlife Service, U.S. Geological Survey, and California Department of Water Resources.

The Bioaccumulation Monitoring Program conducted 2-year screening studies of fish tissue contaminant levels in lakes and reservoirs in 2007 and 2008, coastal waters in 2009 and 2010, and one year or river sampling is planned for 2011. The results from the recent Lakes Study and past studies indicate that present concentrations of pollutants in fish collected from many of California's waterbodies are sufficiently high to cause concern for possible effects on human health and the fishing beneficial use. Results from the 2-Year Lakes Study (Davis et al., 2010) indicate that methylmercury poses the most widespread potential health risk to persons who consume fish caught in California lakes. Twenty-one percent (21%) of the lakes surveyed had at least one fish species with an average methylmercury level high enough (> 0.44 ppm) that OEHHA would consider recommending no consumption of contaminated species for the most sensitive population – women between 18 and 45 years of age and children between 1 and 17 years of age.

However, this screening study did not provide enough information for development of consumption guidelines, which would require monitoring a broader array of species, a larger number of fish, and a much higher level of funding. Consumption advisories exist for only a fraction of the waterbodies likely to need them. Many waterbodies with elevated contaminant levels in fish are near population centers and are popular fishing locations. Furthermore, consumption of contaminated fish is an environmental justice issue. Pollutant concentrations also pose a concern for sensitive wildlife species and aquatic life beneficial uses.

The following are recommendations for how additional funding could be used to augment the Bioaccumulation Monitoring Program (Davis et al., 2010):

- Follow-up sampling to develop consumption guidelines at lakes with highly contaminated fish,
- Focused evaluations of selected waterbodies to identify contaminant sources,
- Assessment of risks to wildlife from bioaccumulative contaminants,
- Evaluate emerging contaminants (e.g., polybrominated diphenyl ethers [PBDEs] and perfluorinated compounds [PFCs]), and
- Conduct trend monitoring.

Bioassessment Monitoring Program

One of the SWAMP's priorities has been to develop California's capacity to directly measure the biological integrity of the state's waterbodies. The SWAMP's current focus is on the bioassessment of wadeable perennial streams, using benthic macroinvertebrates as indicators of ecological condition. The SWAMP's Bioassessment Monitoring Program has two components: the Perennial Streams Assessment (PSA) and the Reference Condition

Management Program (RCMP). Together, these programs provide resource managers with a framework for interpreting monitoring data and have a wide range of applications.

The PSA is a survey of stream health that collects data on biological condition (benthic macroinvertebrates, algae), instream and riparian habitat condition, and water chemistry. The PSA is stratified into six major sub-regions of the State to permit both statewide and regional assessments. The program has collected and analyzed samples from each of the sub-regions and has produced a number of technical reports and fact sheets.

The PSA is designed to answer the following questions:

- What percent of California's perennial, wadeable streams are in good, fair, or poor ecological condition?
- What is the condition of streams in agricultural, urban, and forested land use areas?
- What is the relative risk of various stressors to biological condition?

Information obtained from this program will support the statewide assessment requirement stipulated in *Section 305(b)* of the federal Clean Water Act; determine relationships between stressors and effects for non-point source programs; examine trends related to particular stressors of concern; and provide a framework for prioritizing individual issues for further investigation. Data provided by this probability survey provides an important perspective for state and regional monitoring programs, as well as permit required site-specific monitoring. This information can be used to place targeted data in the context of the broader pattern within a region of interest.

The RCMP represents California's program for establishing and maintaining a network of "reference sites," and using this network to establish "reference conditions" for wadeable perennial streams throughout the State. Reference sites are segments of streams that represent the target state of stream condition for a region of interest (Ode et al. 2005) and provide a means of setting biological expectations for test sites (serve as a benchmark for comparison). The RCMP plays a central role in developing assessment thresholds for biotic integrity and in establishing biological objectives.

Identifying reference sites for California's perennial streams is complicated by its size, diverse ecological settings, and anthropogenic influences. Therefore, a statewide framework for consistent selection of reference sites must account for this complexity (Ode and Schiff 2009). This will require a substantial network of reference sites, distributed across the different geographic regions of the State, that are managed through an iterative process to ensure continued suitability of sites and ensure adequate representation of natural gradients. In addition, these sites must be monitored to document the range of biological and physical conditions that exist there and changes to the condition of these sites over time (Ode and Schiff 2009). Implementation of the RCMP will be phased over three to four years (2008 through 2011), with funds in early years allocated more toward development and refinement of the site selection/screening process with increasing proportion of resources going toward site sampling in later years.

The SWAMP Strategy (2010) seeks to follow USEPA recommendations to develop multiple indicators of biological condition. To date, SWAMP has focused most of its effort and resources on the development of benthic macroinvertebrate-based indicators. However, the program is also developing the capacity for algae, habitat, and riverine wetland-based assessments as additional indicators for use in the development of biological objectives. A preliminary algal Index of Biotic Integrity (IBI) has been developed in the Lahontan Region (Region 6). In addition, Proposition 50 Grant funds are currently supporting the development of preliminary algal IBIs in the Central Coast Region (Region 3) and Southern California (Regions 4, 8, and 9).

If additional funds were made available, the following are potential aspects of the program that could be enhanced:

- Increased sampling (data density) in certain regions of the State (enhanced regional assessments);
- Expand assessment into non-perennial streams and large rivers;
- Inclusion of additional analytes;
- Method development and standardization for additional indicators;
- Continued development of the SWAMP Statewide Algae Program;
    - Development of a SWAMP Algae Laboratory Standard Operating Procedure,
    - Development of a Quality Assurance Project Plan for algae,
    - Development of an algae Reporting Module within the SWAMP database to calculate indices,
    - Development of standard taxonomic effort and on-line tools for identification of algae,
    - Development of taxonomic master lists for algae for inclusion in the SWAMP database,
    - Additional sampling to collect data necessary to develop algal IBIs in portions of the state not covered by the preliminary IBIs already developed (Lahontan Region) or under development (Central Coast and Southern California),
    - Conduct study to identify the peak times of algal biomass; and
- Invest in the development of an enhanced stream network data layer that allows for improved differentiation between perennial and non-perennial streams.

Stream Pollution Trends Monitoring Program

The Stream Pollution Trends (SPoT) Monitoring Program focuses on aquatic life protection in streams. The overall goal of this program is to detect meaningful change in concentrations of

stream-borne contaminants and their effects in large watersheds at time scales appropriate to management decision making. The objectives of this monitoring program are to:

1. Determine long-term trends in stream contaminant concentrations and their biological impacts statewide;
2. Relate water quality indicators to land-use characteristics and to the effectiveness of agency management efforts; and
3. Establish a network of sites throughout the state to serve as a backbone for collaboration with local, regional, & federal monitoring programs.

California streams are affected by nonpoint-source pollution from multiple and changing land-use activities within their watersheds. Stream conditions are also expected to be affected by environmental and resource agency management actions designed to improve water quality. The SPoT Monitoring Program is the SWAMP's statewide program designed to measure trends in contaminants and their effects, and to link those trends to changes in land use and resource management activity.

Certain contaminants which sorb to sediment particles during transport through watersheds, will drop out of suspension when the water slows, and tend to accumulate in stream depositional areas. These contaminants remain fairly stable in sediments over intermediate time scales. Measuring stream sediment chemistry and toxicity at regular, seasonally-consistent intervals allows for the assessment of long-term trends, which indicate whether stream conditions are improving or degrading with land use change. This also provides a means to evaluate the effectiveness of water quality management programs.

Opportunities to enhance the SPoT monitoring program include:

- Include a rotating supplement that would sample at least two additional sites (at least three total) in at least 10 watersheds per year (as many as possible), with all three of the sites sampled three times per year. Evaluating spatial and temporal variability will be important in characterizing the level of uncertainty with which we can assess changes in pollutant concentrations and effects over time.
- Conduct toxicity testing at two temperatures concurrently (e.g., 23°C and 17°C). Place emphasis on this effort in urban and agricultural areas, as enhanced toxicity occurs at the lower temperature if due to a pyrethroid pesticide.
- Increase the number of watersheds that are sampled.

Regional Monitoring Programs

The SWAMP's regional monitoring programs are currently funded through the Ambient Water Monitoring Surcharge, on waste discharge permit fees. The Regional SWAMP monitoring programs conduct a variety of assessments to determine compliance with Basin Plan objectives, categorize impaired waters, identify causes of impairment, locate and manage

pollution sources, regulate discharges, and manage nonpoint sources such as urban stormwater and agricultural runoff. The regional programs vary across regions based on priorities, information needs and other factors within each Region. In many instances, regional monitoring activities are designed to leverage or expand upon the SWAMP's statewide monitoring and assessment programs. For example, the Lahontan Region (Region 6) has used its Regional SWAMP resources to expand the PSA monitoring in the Sierra Nevada, and the Los Angeles Region (Region 4) expanded and enhanced the Lakes Bioaccumulation fish contaminant screening surveys to include additional lakes in the Region. Fact sheets describing regional monitoring implemented by each of the Regional Water Quality Control Boards are included as Appendix E in the 2010 SWAMP Strategy.

Each of the regional programs is managed by a SWAMP Coordinator. These Coordinators fulfill a number of important roles including serving as a member of the SWAMP Roundtable; serving as a technical resource to Water Board staff and others concerning monitoring design, indicators and assessment thresholds, current monitoring activities, etc.; preparing peer-reviewed monitoring plans; and working with other Water Board programs and outside partners to prioritize and refine monitoring objectives and coordinate monitoring activities. However, the capacity of the regional SWAMP programs to conduct monitoring and coordinate their activities with Water Board programs and other partners is constrained due to resource limitation and has not been able to meet regional needs and concerns adequately. This constraint has been exasperated in recent years as SWAMP Regional allocations have declined.

The need exists for regional SWAMP programs to be able to monitor and assess a greater number of water bodies and beneficial uses. This will require additional funding and an increase in coordination with partner programs that monitor areas and waterbody/beneficial use combinations where SWAMP cannot. Although not conducted in a comprehensive manner across all regions, the SWAMP Regional programs are actively recruiting partners in other Water Board programs, other California Environmental Protection Agencies (Cal/EPA) and California Natural Resources Agencies, the regulated community, and citizen monitoring organizations and encouraging them to generate and contribute data that can be integrated into comprehensive assessments that would otherwise exceed SWAMP's scope.

Additional funds could be used to enhance the SWAMP Regional monitoring programs through:

- Increased coordination with Water Board programs and other partners to leverage resources within their Region;
  - Meet with programs to understand their assessment needs and seek to optimize monitoring designs to maximize utility for other Water Board programs,
  - Increase the number of Water Board programs that utilize SWAMP data, standards, and guidance,
  - Coordinate with existing and developing Regional Monitoring Programs,

  - Participate on California Water Quality Monitoring Council web portal work groups (support development of portals and identify areas of potential coordination),
  - Serve as technical resource for development of indicators, assessment thresholds, etc.;
- Increased scope of monitoring programs (e.g., number of sites, analytes, etc.); and
- Increase the capacity of the programs in applying new technology for water quality monitoring.

Data Comparability

Tremendous amounts of ambient data are collected by Water Board programs and other monitoring entities for a wide array of purposes. In many instances, these data are not comparable across programs, limiting our ability to bring data together from different sources to develop integrated assessments and creating the circumstance where the data have limited utility beyond their original, intended use.

The SWAMP's mission is to provide resource managers, decision makers, and the public with timely information to evaluate the condition of surface waters throughout California. The SWAMP accomplishes this through carefully designed, externally reviewed monitoring programs, and by assisting other entities statewide in the generation of comparable data that can be brought together in integrated assessments that provide answers to current management questions. Implementation of standards for data comparability would also allow local entities to both contribute data to statewide assessments and view the results of those assessments as context for local monitoring and management.

A major focus of the SWAMP is to work with other Water Board programs to ensure that their ambient monitoring data are collected and stored in a way that they can be combined with other data sets for broader-scale assessments such as CWA *Section 303(d)* listing decisions. Each of the SWAMP's core implementation priorities (monitoring and assessment, coordination, and infrastructure and tools) contain attributes related to data comparability. For example, through its Quality Assurance and Data Management Teams, the SWAMP has written a Quality Assurance Program Plan (QAPrP), set up data management and quality assurance help desks, developed the SWAMP Advisor (user friendly software to develop a Quality Assurance Project Plan), created data and Quality Assurance Project Plan (QAPP) templates, and conducted trainings to facilitate the production of comparable data. Opportunities exist to increase outreach and support from the QA Team and Data Management Teams to further support the integration of SWAMP-comparability with partner programs.

Increased comparability within and between data types, and development of tools to improve data integration is a key component of the California Water Quality Monitoring Council's (CWQMC) vision to maximize the efficiency and effectiveness of water quality and related ecosystem monitoring, assessment, and reporting (CWQMC, 2008). An important role for the

CWQMC is to help develop, promote, and implement statewide standardization of monitoring methods, assessment approaches, quality assurance protocols, and data formats. The CWQMC intends to work with individual work groups to identify those core program elements that require statewide standardization in order to support comprehensive assessments, and those that can vary regionally based on local needs. The SWAMP will continue to coordinate with the CWQMC and provide guidance to partner organizations concerning monitoring design, quality assurance and data management tools that foster data comparability (SWAMP, 2010).

Opportunities to enhance efforts related to data comparability should additional funds be made available are included in the Regional Monitoring Programs, Infrastructure and Support, and California Environmental Data Exchange Network sections of this document.

Infrastructure and Support

Quality Assurance and Data Management

The SWAMP's vision is to develop, implement, and maintain the quality assurance tools and capabilities needed to implement the SWAMP, share these tools with partner programs, and facilitate the generation and management of comparable data from multiple sources for use in comprehensive water quality assessments. The role of the SWAMP's quality assurance program is to foster the production of data to inform decision-making (i.e., identifying water quality impairments, fish consumption advisories, TMDL targets, etc.).

Under 40 CFR 130 4(b), state monitoring programs are to include the collection and analysis of physical, chemical, and biological data, and Quality Assurance/Quality Control (QA/QC) programs to ensure the data are scientifically valid. Specifically, Section 106-funded QA programs must describe how:

- Each study or monitoring program objective is defined in specific qualitative and quantitative terms and linked to a management decision or reporting requirement associated with the Clean Water Act; and
- The quality of data is assessed and validated to ensure that the quality objectives of the programs were met.

In January 2005, SWAMP formed its QA Team, consisting of a QA Officer, QA Coordinator and several QA Specialists. The QA Team creates and facilitates a framework within which all SWAMP programs and participating partner programs can generate data of known and documented quality, appropriate to project information needs, and comparable for integrated assessments. The initial SWAMP Quality Assurance Management Plan (QAMP) was finalized in 2002. In 2008, the QA Team, in conjunction with the Roundtable and stakeholders, released the Quality Assurance Program Plan (QAPrP) to replace the 2002 QAMP. The QA Team also reviews new and existing quality assurance project plans (QAPPs) for Regional Water Boards, bond fund grantees, and partner programs.

The QA Team formed focus groups in May 2005 to address each program testing parameter. There are six focus groups consisting of toxicity testing, organic analytes, inorganic analytes, conventional analytes, bioassessment studies, and field measurements. Each group is used as a resource for sample collection, analysis, reporting, and data assessment. In addition, as part of a system-based approach, the QA Team has developed SWAMP-specific standard operating procedures (SOPs) for contract laboratory assessments (audits), data verification, data classification, corrective actions, communication of quality assurance program updates, and quality assurance policy and decision-making.

With respect to data management, the SWAMP's vision is to manage the flow of data from initial measurement, through acquisition and storage in data management systems, to data output and assessment, so that accurate information is available in a timely manner to decision makers and the public. This is accomplished using standardized processes for loading data into the SWAMP database, documenting the quality of the data that is loaded, and then migrating data into a final "permanent" database where it becomes publically accessible through the California Environmental Data Exchange Network (CEDEN).

Data generated by statewide and Regional SWAMP programs are submitted to the SWAMP database, which is managed by the Data Management Team (SWAMP DMT). The SWAMP DMT also provides technical support, tools, and training for submitting data to the database. Where possible, data are made comparable by sharing common lookup values and business rules and by following documented data management procedures. Quality control samples are required with data submissions and verified against the SWAMP QAPrP, prior to migrating data to the permanent database.

Providing access to data, with tools that readily query needed data from the database, is essential for the ultimate usability of the SWAMP database to SWAMP participants. Another critical SWAMP function is providing training and tools for groups within the SWAMP, as well as groups trying to be SWAMP comparable. This is achieved by making data management documentation available through a SWAMP website and by providing trainings on the various aspects of data management. Finally, in order for the data management team to stay effective in data handling and aware of current data needs, their efforts must be coordinated through regular meetings with SWAMP data users and CEDEN partners.

Expenditures related to the SWAMP QA/QC and data management activities represent approximately 12% of the SWAMP's annual budget. Current funding levels for these activities are sufficient. Changes in programmatic needs will be addressed through prioritization of workload, rather than increasing funding levels.

Program Coordination

The SWAMP Program Coordination includes general programmatic and technical planning, as well as effective and efficient contracting and financial mechanisms to support Statewide and Regional SWAMP ambient monitoring activities. This coordination role covers a variety of activities such as technical and scientific planning assistance, contractual oversight and

management, program budgeting, financial tracking, planning or conducting workshops or meetings on a variety of technical topics, and through the preparation of various statewide technical reports and reporting templates, as needed. These objectives are met by contracting with San Jose State University Research Foundation (SJSURF—Moss Landing Marine Laboratory), who in turn subcontract for collaborative assistance with the California Department of Fish and Game (CDFG - MPSL), and UC Davis (Granite Canyon - MPSL). Effective and efficient implementation of the program coordination activities support the primary SWAMP program goal of producing credible, comparable, and scientifically defensible data that can then be used by the Regional and State Water Boards to assess ambient conditions of surface waters of the state, and to provide that data and findings to the general public via various reporting formats. Current funding levels allocated to program coordination are sufficient to meet programmatic needs.

Communications and Reporting

Our vision is to make all SWAMP data available to the public, to translate SWAMP data into information useful for making resource management decisions, and to provide timely reports in formats most accessible to target audiences. To accomplish this, SWAMP identifies target audiences, selects the most effective media to reach them, and provides a range of products from newsletters and fact sheets to interpretive reports and statutory documents, such as the Integrated Report (CWA *Section 303(d)* list / *305(b)* Report), and the CWQMC *My Water Quality* web portals. SWAMP reports can be found at: http://www.swrcb.ca.gov/water_issues/programs/swamp/reports.shtml. SWAMP Regional programs have produced numerous reports to address Basin Plan priorities and local issues. These can be found at: http://www.swrcb.ca.gov/water_issues/programs/swamp/regionalreports.shtml. Current funding levels allocated to communication and reporting are sufficient to meet programmatic needs.

Clean Water Team

Citizen Monitoring encompasses any monitoring activities related to aquatic resources, aquatic habitat, and/or water quality that rely in whole or in part on participation by volunteers, students, or non-paid staff. Their efforts are of particular value in providing quality data and building stewardship of local waters. The SWAMP supports citizen monitoring programs through the Clean Water Team (CWT). The CWT works to build and support the State's Watersheds Stewardship through involvement by Citizen Monitoring in order to reduce and prevent water pollution and recover lost beneficial uses. The CWT assists citizen monitoring organizations through six core functions: outreach and communication, technical assistance/quality assurance, training, loans of equipment, event support, and information management. Opportunities to enhance the CWT's support of citizen monitoring programs include:

- Training: Providing additional water quality monitoring workshops beyond current capacity.
- Training videos: Contract to produce training videos; purchase digital camera, software and supplies for in-house training video production.
- Equipment Loan Library: Obtain water quality monitoring meters, calibration supplies, and reagents. The CWT equipment library is 10 years old and in need of new equipment. Water quality meters and tools are needed to replace broken and outdated equipment. In addition to equipment, batteries and battery testers; calibration buffers, and solutions; reagents; and aquatic invasive species (AIS) decontamination supplies are also needed. Equipment is used for training, short term trials by monitoring programs, and longer term loans. The current need for equipment is high, due in part to the reduction of grant funds and the current state of the economy.
- Safety: Provide staff with proper field gear (e.g., waders, gloves, goggles) and AIS decontamination supplies.
- Laboratory access: Provide access to a laboratory for processing citizen monitoring water quality samples for analytes of SWAMP's interest (e.g., metals, pesticides)

California Environmental Data Exchange Network (CEDEN)

Assembly Bill 982 (Ducheny, Statutes of 1999) requires the SWAMP to make monitoring data easily accessible to all users including the public. SWAMP's ambient monitoring data are accessible to the public through CEDEN. CEDEN is a distributed database system comprised of a network of four Regional Data Centers (RDCs), which include Moss Landing Marine Laboratories Data Center, the Southern California Coastal Water Research Project (SCCWRP) Data Center, the SFEI Data Center, and the Central Valley Regional Data Center. The RDCs are assistance centers to receive, transform, process, and pass on data according to regional needs. Collectively, the RDCs provide six core services: upload and check data, store and manage data, exchange data, access data, coordinate and transfer technology, and integrate data. In addition, SWAMP collaborates with CEDEN in developing data analysis tools that meet the needs of State and Regional programs and the public.

The CEDEN complements and expands on SWAMP's goal of data integration for inter and intra agency programs. CEDEN also will be a primary source of data for the CWQMC's *My Water Quality* web portals that present answers to key assessment questions asked by decision makers and the public. The SWAMP is committed to the CWQMC work group and web portal approach as a way to share guidance and information on indicators and their appropriate use, leading to increased data sharing and comprehensive assessments based on data from multiple programs.

Until recently, the development and implementation of the CEDEN was supported primarily through the allocation of SWAMP funds. At present, CEDEN is being funded through a Grant that will expire in 2013. A key product of this grant will be the development of a long-term funding strategy that would facilitate CEDEN and the RDCs becoming self-sustaining from a funding perspective. Opportunities for program enhancement include:

- Increase outreach role on the part of RDCs to expand the amount and types of data currently available through CEDEN;
- Expand CEDEN by working with other programs to develop formats and crosswalks to allow for the exchange of data with CEDEN;
- Continued development of data checkers and upload tools to support data transfers and comparability with partner programs; and
- Develop additional data assessment and visualization tools; and

Collaboration with California Water Quality Monitoring Council

In November 2007, a Memorandum of Understanding (MOU) was signed by the Secretaries of the Cal/EPA and the California Natural Resources Agency to establish the California Water Quality Monitoring Council (CWQMC). The MOU was mandated by California Senate Bill 1070 (Kehoe, Statutes of 2006) and requires the boards, departments and offices within the Cal/EPA and the California Natural Resources Agency to integrate and coordinate their water quality and related ecosystem monitoring, assessment, and reporting.

California Senate Bill 1070 (Water Code Sections 13167 and 13181) and the MOU require that the CWQMC develop specific recommendations to improve the coordination and cost-effectiveness of water quality and ecosystem monitoring and assessment, enhance the integration of monitoring data across departments and agencies, and increase public accessibility to monitoring data and assessment information. While the CWQMC may recommend new monitoring or management initiatives, it will build on existing effort to the greatest extent possible.

The CWQMC recommended that issue-specific work groups, under the overarching guidance of the CWQMC, evaluate existing monitoring, assessment and reporting efforts and work to enhance those efforts to improve the delivery of water quality information to the user. The work groups also provide a venue for increased coordination among monitoring entities, to identify and fill data gaps, and improve monitoring efficiency. The CWQMC has formed work groups that are tasked with developing assessment questions around themes: Is it safe to eat fish and shellfish?; Is it safe to swim at my beach?; Is our water safe to drink?; and Are our ecosystems healthy? The work groups then identify and obtain data sets to answer the questions and develop web portals to convey the assessments to the public.

SWAMP is committed to the CWQMC work group and web portal approach as a way to identify opportunities for improved coordination of monitoring activities, share guidance and

information on indicators and their appropriate use, and ultimately lead to increased data sharing and comprehensive assessments based on data from multiple programs. In June, 2010, the SWAMP and the CWQMC held a joint meeting to align strategies and strategy documents. It was agreed that the SWAMP should focus its limited funds for statewide assessments on two questions: “Is it safe to eat the fish?” (Bioaccumulation Monitoring Program) and “Is aquatic life protected in freshwater streams?” (Bioassessment and SPoT Monitoring Programs) (Table). In addition to identifying those waterbody / beneficial use combinations that the SWAMP statewide assessments are currently addressing, Table 2 highlights those waterbody / beneficial use combinations for which CWQMC work groups have been established to develop a web portal and bring those assessments to decision makers and the public. The SWAMP has taken the lead in the effort to develop two of the web portals (Table 2). It should be noted that SWAMP’s regional monitoring programs address other waterbody / beneficial use combinations identified in Table 2; however, these efforts vary by region and have not been integrated into a statewide assessment.

The SWAMP will remain an active participant in the CWQMC. Personnel and contract resources associated with continued collaboration with the CWQMC are allocated across each of the program elements identified in Table 1 (statewide and regional monitoring and assessment, data comparability, and infrastructure and support). As resources become scarcer, the coordination and collaboration as envisioned by the CWQMC will be all the more important. As the workgroups mature and become fully functional, estimates of the resources needed to support the workgroups will need to be revised and incorporated into this Needs Assessment.

Table 2. SWAMP statewide monitoring and assessment programs and existing CWQMC work groups organized according to waterbody / beneficial use combination

Waterbody Type	Core Beneficial Use			
	Aquatic Life	"Swimmable"	"Fishable"	"Drinkable"
Wadeable Streams	SWAMP – Statewide (Bioassessment & SPoT) CWQMC[1]		SWAMP – Statewide (Bioaccumulation) CWQMC[1, 2]	
Large Rivers	SWAMP – Statewide (SPoT) CWQMC[1]			
Lakes	CWQMC			
Estuaries	CWQMC	CWQMC[2]		
Ocean, Coastal, Bays	CWQMC			
Wetlands	CWQMC[2]			

[1] CWQMC work groups for which the SWAMP has assumed a lead role.
[2] CWQMC web portals are live and available for viewing at the *My Water Quality* website.

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Appendix E
Regional Fact Sheets

North Coast Regional Water Board

During the first five years of the Surface Water Ambient Monitoring Program (SWAMP), the North Coast Regional Water Board focused on funding monitoring in each of our 6 watershed management areas. We established 80 rotating stations and 29 long-term trend monitoring stations on 49 rivers and streams throughout the North Coast Region. Due to funding constraints, we have spent most of our funding allocation on monitoring wadeable streams and large rivers, relying upon water column chemistry to assess whether the aquatic life beneficial use is supported. An interpretive report on this data is available through the State Water Board website.

Our Regional SWAMP efforts were initially coordinated to provide information to the North Coast Watershed Assessment Program and the Total Maximum Daily Load program as well as to provide information to managers and decision makers where limited or no data was previously available. These efforts provide almost all of the Regional ambient monitoring data that we use to assess the general health and condition of our waters. SWAMP data have proven to be especially valuable for assessing the many unpopulated areas of the Region where other entities are not actively monitoring. We also are using these data to prepare the 303(d) and 305(b) Integrated Water Quality Assessment Report. Over 60% of the "Lines of Evidence" used to evaluate the North Coast waterbodies for the Integrated Water Quality Assessment Report were based on Regional SWAMP data.

In addition, the North Coast Regional Water Board utilized SWAMP funding to investigate MTBE concentrations in two North Coast lakes and to conduct a screening study of estrogenic endocrine disrupting

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chemicals in two major rivers in the North Coast in conjunction with the Central Valley Water Regional Board.

Currently we are involved with the development of the Klamath River Water Quality Monitoring Group, a regional monitoring program comprised of members from Federal, State, County, Tribal agencies, and local non-governmental organizations. We also provide training, staff time, and equipment to local and Tribal entities throughout the Region to increase their involvement in data collection, analysis, and assessment.

The North Coast Regional Water Board is re-evaluating the direction of our Regional SWAMP efforts for fiscal year 2010-2011. We are evaluating all of the data collected to date by SWAMP and other entities to determine where additional information is needed and where additional investigations are warranted.

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San Francisco Bay Regional Water Board

During the first five years of SWAMP, the San Francisco Bay Regional Water Board's program focused on monitoring watersheds throughout the region on a rotating basis and conducting studies to measure the concentrations of contaminants in fish caught and consumed by fishers in places other than San Francisco Bay. Since the San Francisco Estuary Regional Monitoring Program (RMP) conducts monitoring in San Francisco Bay, we decided to concentrate our limited resources primarily on evaluating whether the beneficial use of aquatic life was protected in wadeable streams and whether it was safe to consume fish from water bodies other than San Francisco Bay. A description of the San Francisco Bay Region, as well as our regional SWAMP activity, monitoring goals and vision, and collaborative efforts are available in our regional fact sheet.

To assess whether aquatic life was protected in wadeable streams, we used a suite of indicators including bioassessments, physical habitat assessments, continuous basic water quality monitoring, water column chemistry and toxicity, and sediment chemistry and toxicity. In five years of monitoring we assessed whether aquatic life was protected in 34 wadeable streams. Three interpretive reports on the water quality condition of these streams can be found on the Regional Water Board SWAMP website. We also developed a trash assessment method, used this method to assess trash at 26 sites, in 14 water bodies, and documented this information in a technical report.

To assess whether it is safe to eat the fish, we conducted studies measuring contaminants in fish in Tomales Bay, along the San Mateo coast and in 10 lakes in the Region. A report interpreting the data

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is available online. To better inform the public of potential risks associated with eating fish from these reservoirs, we formed a committee consisting of the Office of Environmental Health Hazard Assessment (OEHHA), the California Department of Public Health, county environmental health departments, East Bay Regional Parks and other responsible parties to develop advisories for consuming fish, translating advisories in to several languages, and developing signs and other materials for education and outreach. In subsequent years, we collected additional data so that OEHHA could refine fish advisories for the lakes we sampled. All of the creek and fish data collected over this 5-year period was used in the 2006 and 2008 water quality assessment process and resulted in a total of 30 water bodies being listed as impaired.

In 2008 we modified our SWAMP creek strategy based on needs identified during previous monitoring. Our current strategy is to monitor water quality conditions and biotic assemblages, and the spatial and temporal variability of those conditions, at minimally disturbed reference sites and at urban sites that represent “best attainable” conditions. Our peer reviewed design is available online. The purpose of this monitoring is to: 1) provide context for creek monitoring that will be conducted by the Regional Monitoring Coalition, made up of storm water programs and the regional SWAMP; 2) collect data that can be used for developing bioassessment protocols, indices of biological integrity, biological objectives and nutrient criteria; and 3) identify long-term trends associated with climate change.

In 2010 we started a study to measure nutrients, chlorophyl a and the phytoplankton community in Suisun Bay in the spring/summer. Results of previous research has indicated that elevated levels of ammonium may be inhibiting diatom production and preventing the development of phytoplankton blooms that feed the food chain in the San Francisco Estuary. Results from our 2010 study showed relationships that were consistent with this hypothesis. In 2011-2012 we plan to conduct a more intensive study to measure these parameters, as well as primary production and nutrient uptake, at 4 different depths in Suisun Bay.

In addition to the studies conducted by the regional program, the San Francisco Bay Regional Water Board SWAMP spends significant staff resources coordinating monitoring in the region.

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This provides an opportunity to leverage SWAMP funding and to form coalitions that can provide consistent water quality information targeted at answering specific water quality management questions, while maximizing efficient use of resources. SWAMP staff has been working with a coalition of programs that collect bioassessment data, the Bay Area Macroinvertebrate Bioassessment Information Network (BAMBInet), to further develop information on water quality in wadable streams. BAMBInet meets to: 1) discuss and standardize bioassessment data, 2) input all regional bioassessment data in to one database, and 3) analyze regional data for the purpose of developing a Bay area Index of Biotic Integrity (IBI). Regional SWAMP staff is also working with storm water programs, as an outgrowth of the regional MS4 permit, to develop a watershed monitoring coalition (Regional Monitoring Coalition) so that watershed monitoring will be coordinated throughout the region and with SWAMP statewide.

To develop information on water quality in the San Francisco Estuary, SWAMP staff has been integral to the establishment and development of the San Francisco Estuary Regional Monitoring Program (RMP). The RMP is a world-class water quality monitoring program targeted at the highest priority questions faced by the San Francisco Bay Water Board and the regulated community. Currently, the RMP is working collaboratively with SWAMP to monitor contaminants in fish in bays and estuaries of the state. Regional SWAMP staff also plays an advisory role in TMDL monitoring, NPDES mandated monitoring and volunteer monitoring in order to provide consistency, enhance coordination and foster a comprehensive approach to water quality monitoring in the region.

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SWAMP Monitoring Strategy

Central Coast Regional Water Board

Watershed Monitoring

The Central Coast Ambient Monitoring Program (CCAMP) has been monitoring the Central Coast Region's five watershed areas on a rotational basis for over ten years, beginning in 1998. The CCAMP program design is focused on supporting regulatory decision-making with water-body scaled status assessments, and detecting change at both a watershed and sub-watershed scale. Our study design emphasizes relatively high data density with repeated visits to a network of fixed monitoring locations. Sites are typically placed at the lower ends of major tributaries and along the main stem, so that we can readily identify which tributaries are of greatest concern for regulatory attention.

Each of five Central Coast watershed areas are sampled on a five-year rotation. Conventional chemistry and flow are monitored monthly at approximately 30 watershed sites during each rotation year. In addition, 33 coastal stream confluences are monitored monthly on a continuous basis for the detection of trends. A subset of sites are sampled and on a less frequent basis for water and sediment toxicity, invertebrate bioassessment, and occasionally, bioaccumulation.

Special Studies

In addition to the CCAMP's basic watershed sampling mandate, the CCAMP participates in a variety of other Regional monitoring projects. The CCAMP conducted an assessment study of Central Coast harbors in collaboration with a U.S. EPA assessment of the Morro Bay National Estuary. In this study, harbors were evaluated

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using a probabilistic approach for sediment chemistry, sediment toxicity, benthic invertebrate assemblages, water column chemistry and fish and mussel tissue chemistry. A report of this study is available at: http://www.ccamp.org/ccamp/Reports.html. The Central Coast Regional Board is planning follow-up studies with the Office of Environmental Health Hazard Assessment (OEHHA), of several lakes that were identified by the State-wide SWAMP Bioaccumulation Program, as having elevated levels of chemicals in fish tissue. The Central Coast Regional Board also participated in research

Data Use

Data from the basic monitoring program is used for many purposes, including development of assessment reports, comprehensive 303(d) listing and 305(b) assessment, enforcement actions, NPDES permit requirements, watershed planning, grants prioritization, evaluation of Basin Plan objectives, and other Water Board staff activities. It is also heavily used by the public, consultants, and other agencies through our web site (www.ccamp.org). CCAMP Hydrologic Unit assessment reports and other related publications are available on the website at: http://www.ccamp.org/ccamp/Reports.html. Planned assessment reports include an overview of agricultural impacts in our region, and a general regional status report.

Data Management and Tool Development

CCAMP has invested significant staff time in development of data management and assessment tools. The website (www.ccamp.org) makes data available online through Google maps, and in chart and tabular form. We process all of our data electronically using a data checking and uploading tool that prepares it for delivery to SWAMP. This tool is also used by the Central Coast Cooperative Monitoring Program for Agriculture and by regional grants programs to deliver data to us in a format that we can move to our website and to SWAMP. This upload tool has been deployed for use by volunteer data gatherers and is now being adapted for CalFED and other grant data delivery through a grant with DFA. Other CCAMP software scans data for water quality exceedances and creates "Lines of Evidence" for submittal into the State's Water Quality Assessment Database to support the "Integrated Report" for 305(b) assessment and 303(d) listing/delisting. This software is also being adapted for use at a statewide level for the 2012 listing process.

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Leveraging

CCAMP leverages our program through coordinated monitoring design. For example, an additional network of 50 long-term trend sites are monitored through the Cooperative Monitoring Program for Agriculture, the agricultural industry's monitoring program to comply with regulatory discharge requirements. This adds to our ability to detect change and to understand agricultural impacts in our Region. Our single Phase 1 storm water permit has a similarly structured monitoring program. Major Monterey Bay area dischargers have coordinated with CCAMP in implementing the Central Coast Long-Term Environmental Assessment Network (CCLEAN). We also coordinate with the Monterey Bay National Marine Sanctuary program to bring data from other monitoring sources, including volunteer groups, local agencies, and universities, into a comparable format that can then be moved into the California Environmental Data Exchange Network, into the Integrated Report scanning tool, and eventually onto our website.

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SWAMP Monitoring Strategy

Los Angeles Regional Water Board

During the first five years of the Surface Water Ambient Monitoring Program (SWAMP), the Los Angeles Regional Water Board focused on funding monitoring in each of our 10 watersheds on a rotating basis. Due to funding constraints, we spent most of our resources on monitoring wadeable streams, relying on a triad of indicators to assess whether the aquatic life beneficial use is being supported (benthic macroinvertebrate community, water column toxicity, water column chemistry). We assessed 6 of the 10 watersheds: Calleguas Creek, Santa Clara River, Santa Monica Bay, Los Angeles River, San Gabriel River, Dominguez Channel. We also monitored a few estuaries (Calleguas Creek, Santa Clara River, Los Angeles River, San Gabriel River), harbors (Los Angeles/Long Beach Harbor, Port Hueneme), and marinas (Ventura Marina, Channel Islands Harbor) and lagoons to assess protection of aquatic life. We were only able to monitor one lake to assess protection of aquatic life (Lake Machado).

Following SWAMP's scientific review, we shifted our strategy to augment statewide SWAMP programs. In 2007, we sampled 32 lakes and reservoirs in the Los Angeles Region in conjunction with the statewide study of contamination in fish from lakes to assess whether it is safe to consume sportfish from these waterbodies. In 2008, we sampled 6 watersheds with the triad of indicators mentioned above in conjunction with the SWAMP Perennial Stream Assessment (PSA) initiated in 2008 and to begin early implementation of the PSA-based design adopted by the Southern California Stormwater Monitoring Coalition (due to begin in 2009). In 2008, we also contributed to the Bight'08 regional monitoring

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program to survey coastal waters in the Southern California Bight. In 2009, we are sampling in two watersheds (Santa Monica Bay, Santa Clara River) to help implement the Southern California Stormwater Monitoring Coalition watershed monitoring program and we expect to continue this support in 2010 and subsequent years.

In 2009, we contributed funding to augment the SWAMP's study of contamination in sportfish in coastal waters, bays and estuaries to assess whether it is safe to consume sportfish from these waterbodies. We also set aside funds to conduct follow-up work on lakes with high fish tissue contamination levels to provide sufficient data for the Office of Environmental Health Hazard Assessment (OEHHA) to evaluate the need for fish consumption advisories. This monitoring probably will begin in 2010.

In addition to routine SWAMP matters, staff time has been spent on planning activities associated with the periodic regional Bight surveys of coastal waters, bays and estuaries (1998, 2003, 2008) and coordinating development and implementation of watershed-wide monitoring programs (Calleguas Creek, San Gabriel River, Los Angeles River) that integrate NPDES-mandated monitoring, TMDL monitoring, SWAMP monitoring, volunteer monitoring and other efforts into more useful comprehensive monitoring programs with defined objectives.

The Los Angeles Regional Water Board produced reports on SWAMP monitoring for the Santa Clara and Calleguas Creek Watersheds, the Santa Monica Bay Watershed Management Area, the Dominguez Channel/Los Angeles-Long Beach Harbor Watersheds, and the San Gabriel River Watershed. These reports are available online. A fact sheet providing an overview of the Los Angeles Region also is available online.

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SWAMP Monitoring Strategy

Central Valley Regional Water Board

The Central Valley Regional Water Quality Control Board has four overarching goals for its SWAMP efforts:

- Evaluate ambient water quality, beneficial use protection and potential sources of impairment.
- Evaluate effectiveness of the Water Board water quality improvement policies.
- Coordinate internal and external monitoring efforts to leverage limited resources.
- Ensure timely availability of monitoring results.

During the first five years of SWAMP, the Central Valley Regional Water Board coordinated with and built off of existing frameworks within each individual basin (San Joaquin River, Upper and Lower Sacramento River, and Tulare Lake) in order to leverage limited resources. Separate approaches were developed based on each basin's unique characteristics, existing monitoring programs, and water quality issues. SWAMP resources were also used to purchase equipment and developed standard operating procedures to perform in-house water sample analyses for total coliform and *E. coli* bacteria.

Following the statewide SWAMP scientific review in 2005, Central Valley Water Board staff re-evaluated the program. The revised focus aims to better coordinate internal monitoring efforts and data assessments (including supporting the region's 303d/305b Integrated Report development), ensure regional efforts are aligned with the statewide strategy and assessment framework, and facilitate a region-wide program.

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To meet these objectives staff initiated region-wide trend monitoring that builds off of 30 Central Valley integrator sites identified by the statewide Stream Pollution Trends monitoring. The region-wide effort will allow seasonal evaluation at key sites, more detailed evaluation of the Sacramento, San Joaquin and Tulare Lake Basins on a rotating basis, and a consistent framework for coordination efforts. Key findings from earlier monitoring have been used to inform the current monitoring designs.

Coordination is still a primary goal of the Central Valley Water Board's SWAMP and includes but is not limited to:

- Staff support to coordinate the development of the Sacramento-San Joaquin Delta Regional Monitoring Program, as well as funding for Delta monitoring and tool development studies.
- Continued monitoring and data management support for the multi-agency Grassland Bypass Project.
- Coordinated trend monitoring with the Department of Water Resources in the upper Sacramento River Basin—focused on measuring ambient water quality at lower watershed integrator sites and coordinated with the statewide SWAMP Stream Pollution Trends.
- Safe to swim studies that monitor and assess bacteria concentrations at popular swimming holes throughout the Central Valley in coordination with local watershed groups—follow-up studies attempt to identify sources and specific pathogens at sites with elevated bacteria levels.
- Data management support for the Irrigated Lands Regulatory Program to streamline data transfers to CEDEN and improve data quality.
- Development of the web-based Central Valley Monitoring Directory to improve internal and external coordination.

The Central Valley SWAMP has created a five year plan that identifies and prioritizes projects for funding for fiscal years 10/11 through 14/15. This plan simplifies budgeting and aids transparency of how resources are allocated. The five year plan and detailed information on the Central Valley Water Board SWAMP, including links to over 40 water quality assessment reports, water quality data for the San Joaquin River Basin, and historic and current program information, is available on the Central Valley Water Board SWAMP website.

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SWAMP Monitoring Strategy

Lahontan Regional Water Board

The Lahontan Region is unique in that its Water Quality Control Plan ("Basin Plan") contains numerous site-specific numeric water quality objectives, most of which were adopted in the early 1970s but (prior to SWAMP) never monitored. The Region also is unique in that it has many interstate waters (which flow into the State of Nevada). The primary objectives of SWAMP monitoring at the Lahontan Region are to:

1. Determine whether ambient water quality at selected sites is in compliance with the chemical and physical water quality objectives contained in the Water Quality Control Plan for the Lahontan Region (Basin Plan) and the "California Toxics Rule".
2. Determine (to the extent to which funding is available) whether water flowing from the Lahontan Region into the State of Nevada meets Nevada's water quality objectives.
3. Develop and implement tools to assess the biological integrity of the Region's streams and rivers based on instream macroinvertebrate and algae assemblages (i.e., "bioassessment").

The available funding has allowed for chemical monitoring at about 30 sites throughout the Region on a quarterly basis. All data and a summary report on the first five years of work (i.e., years 2000-05) are available at the Region's SWAMP webpage.

In addition to ongoing, routine monitoring at the selected sites, the Region's SWAMP staff spends considerable time on other related tasks, such as: (1) designing and maintaining a user-friendly website

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to make monitoring data and assessment reports accessible to the public; (2) coordinating water and fish monitoring projects with other public agencies and NGOs; (3) testing for contaminants in fish tissue where screening studies indicate potential exceedances of human health thresholds; (4) coordinating bioassessment methods and approaches throughout the State; and (5) other special projects, such as monitoring the success of restoration efforts, developing biological objectives for use in assessing stream health, and assisting Water Board staff and others in using bioassessment techniques.

Due to funding limitations, the quality of many surface waters in the Lahontan Region remains unassessed. As funding allows, the Region would like to conduct additional targeted and probabilistic assessments of the regions 700+ lakes, 3,000+ miles of streams, and numerous wetlands.

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Colorado River Basin Regional Water Board

Colorado River Basin – Description

The Colorado River Basin Region covers approximately 13 million acres (20,000 square miles) in the southeastern corner of California. It includes all of Imperial County and portions of San Bernardino, Riverside, and San Diego Counties. The Colorado River Basin Region is located in the most arid area of California. The majority of the Region's surface waters are located in the Imperial Valley and East Colorado River planning areas, with a few situated in the Coachella Valley, Lucerne, Anza-Borrego, and Hayfield planning areas. Hence, the ambient surface water-monitoring program focuses on the water bodies in the Imperial Valley and the Lower Colorado River planning areas.

The Salton Sea Trans-boundary Watershed contains five of six, 303(d)-listed impaired surface water bodies. Water from the Colorado River has created an irrigated agricultural ecosystem throughout this watershed. Wildlife and aquatic species are dependent on habitat created and maintained through the discharge of agricultural return flows. Major water bodies in the watershed include the Salton Sea, Alamo River, New River, Imperial Valley Agricultural Drains, and Coachella Valley Storm Water Channel. San Felipe Creek and Salt Creek also occur in this watershed and provide critical habitat for the endangered species. The designated beneficial uses of the waters in the watershed include agricultural supply, aquaculture, cold freshwater habitat, groundwater recharge, hydroelectric power generation, industrial, municipal and domestic, rare and endangered species, warm freshwater habitat, water contact recreation, and non-contact recreation, and wildlife habitat.

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The water quality objectives for the region are specified in the Water Quality Control Plan.

Goals and Objectives

Goal. The goal of Region 7's SWAMP program is to monitor the surface water bodies within the Region's watersheds in order to evaluate if beneficial uses are being protected and to establish a baseline for water quality trend monitoring.

Objectives:
1. to identify impaired water bodies as required by Section 303 (d) of the Federal Clean Water Act
2. to collect additional information at sites that are known to or suspected of having water quality problems.
3. to evaluate the effectiveness of specific management practices (MP) employed to improve water quality of impaired water bodies
4. to coordinate and share information with other monitoring efforts at the region.

Methods of Achieving Objectives

The Regional Board selected 13 strategic sampling locations to assess water quality. The strategic sites are along the Lower Colorado River, New River, Alamo River, Whitewater River, and Salton Sea, which are the five surface water bodies of major interest in the Region. These water bodies are the focus on priority TMDLs for sediments, nutrients, selenium, pesticides, and pathogens. Physical, chemical, and biological parameters are used as water quality indicators. Monitoring data collected include conventional water quality parameters, organic chemistry, trace metals, bacteria indicators and aquatic toxicity at the water column. The monitoring data collected for sediments include organic chemistry, trace metals and sediment toxicity. The monitoring events are, most of the time, conducted biannually. Information gathered through the SWAMP Program is used to support Basin Planning activities and objectives, and will complement other past and present studies conducted at the Region.

SWAMP will provide a comprehensive view of changes that occur with MP implementation and will help with TMDL development.

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SWAMP Monitoring Strategy

Santa Ana Regional Water Board

Since the inception of the Surface Water Ambient Monitoring Program (SWAMP) in 2000, the Santa Ana Regional Water Board focused resources to obtain data in waterbodies that lacked the necessary data to determine compliance with water quality objectives. These waterbodies included Anaheim Bay, Huntington Harbor, Lake Elsinore, and Canyon Lake. In each of these waterbodies, we learned about their seasonal differences in biology, and toxicity and used the data to refine their status on the Clean Water Act's Section 303(d) list of impaired waterbodies.

Our current strategy is to evaluate streams in the region against the Southern California Index of Biological Integrity. For those streams that score "poor", prioritized actions such as additional monitoring may be done. To this end, we conduct bioassessment monitoring of our rivers and streams in the region using a probabilistic design. This monitoring is scheduled to be completed in 2011. We plan to use the findings from this study to identify the areas of concern in our region, which will aid in developing waste discharge requirements, specifying conditions for water quality certifications, updating the Integrated Report and in commenting on environmental documents.

We also plan to continually reach out to citizen groups, and non government entities that monitor waterbodies in our region to educate them about quality assurance, sampling and data management protocols, and where possible to establish partnerships that will allow our monitoring funding to extend to its fullest potential. For example, we are coordinating with and contributing funds to the multi-regional

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bioassessment monitoring being headed by the Southern California Coastal Water Research Project for the stormwater management agency coalition in Southern California. The coalition is a partnership of the Southern California stormwater agencies that, together with the Southern California Regional Boards, have embarked on a multi-regional monitoring study that aims to answer watershed related questions in Southern California's 15 watersheds. We plan on using this data to determine the water quality condition of streams in our four major watersheds, the major stressors to aquatic life, and pollutant trends. Further, we are in the nascent stages of developing and coordinating the regional monitoring program for the Upper and Middle Santa Ana River Watershed with our point source dischargers. The data generated will answer status and trends questions and will be assessed during the update of our Integrated Water Quality Assessment Report and, if applicable, to update the Clean Water Act Section 303(d) List of our region's impaired waters. The goal is to have improved monitoring coordination ensuring that management and protection of the Upper and Middle Santa Ana River watersheds is conducted appropriately.

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SWAMP Monitoring Strategy

San Diego Regional Water Board

The San Diego Region's SWAMP is designed to support and expand water quality assessments in the regions' waterbodies. The first several years of SWAMP monitoring in the San Diego region focused on perennial streams on a rotational basis. In 2007 and 2008, the program focused its efforts on bioassessment on high-quality and impaired sites in perennial streams. Since 2009, the San Diego Region's SWAMP supports several programs: (1) Probability-based surveys, (2) Improved monitoring coordination of watersheds and waterbodies, (3) An information management system, and (4) Special studies. It also will continue and increase leveraging with other San Diego Water Board programs, several dischargers, universities, and non-profit organizations in the San Diego region. In addition, the San Diego Region's SWAMP will focus some efforts to develop assessments in the form of watershed report cards.

Rotational Watershed Monitoring: From 2000-2005, the San Diego Regional Board has been monitoring the Region's 11 hydrologic units on a rotational basis. Water chemistry, water and sediment toxicity, benthic macroinvertebrate community, physical habitat, and on occasion tissue contamination, were assessed in perennial streams at multiple targeted sites twice during dry and wet season. Data from the rotational watershed monitoring were analyzed and watershed reports were produced for each hydrologic unit by the Southern California Coastal Water Research Project. In addition, a synthesis report was produced for an assessment of all 11 hydrologic units and for an evaluation of the current SWAMP program of the San Diego region. The synthesis report gives four main recommendations: (1) Use appropriate indicators;

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(2) Design a probability based study to address the ecological health of wadeable streams; (3) Improve integrative and coordinated regional monitoring to increase cost-efficiency, and (4) Build an information management system. All four recommendations are addressed in the SWAMP monitoring design since 2007.

Appropriate Indicators: In 2007 and 2008, the San Diego regions' SWAMP program focused its efforts on bioassessment (both with benthic macroinvertebrates and algae) in perennial streams. The study included sampling on Reference sites to protect high quality sites, and produce information on the development of bio-objectives. Sampling for Reference sites will continue in 2011. In 2008, targeted impaired sites within all 11 hydrologic units were sampled to compare past data with current conditions, and to include algae as additional indicators. The report on those data is currently under development.

Probability Survey for Perennial Streams: Since 2009, the SWAMP program of the San Diego region participates in the SMC study (a probability-based study in Southern California through the Stormwater Monitoring Coalition (SMC) by devoting regional SWAMP allocations towards the study to support eleven monitoring sites in perennial streams. For five years, SWAMP regional allocations will support the SMC study.

Improved Coordination in Watershed and Waterbodies: In 2010 and 2011, the San Diego Region's SWAMP funding supports the coordination of monitoring in the San Diego River watershed to develop a cost-effective and coordinated monitoring and assessment program. In 2011 and 2012, SWAMP allocations in the San Diego region will be used to develop a cost-effective and coordinated monitoring program for coastal wetlands.

Information Management System: Data from San Diego Region's SWAMP are disseminated to the public by a Regional Data Portal. The data portal was developed by funds from the Cleanup and Abatement Account. Monitoring data from dischargers, non-profit organizations, and other agencies in the San Diego region are included into the data portal. The San Diego Region's SWAMP website will link to the Regional Data Portal.

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Special Studies: Currently, the San Diego Region's SWAMP is focusing on Contaminants of Emerging Concern (CECs) for its special studies. In 2010, the San Diego Region's SWAMP started a study on the occurrence and extent of pharmaceuticals and personal care products (PPCPs) in areas with discharge of treated wastewater, with septic tanks, with untreated human waste water, and at Reference sites. In 2012, the occurrence of cyanobacteria and microcystin will be studied in different waterbodies in the San Diego region.

Monitoring of Freshwater Wetlands, and Non-Perennial Streams: From 2011-2013, the San Diego Region's SWAMP is funding a freshwater wetlands monitoring program. This probability-based monitoring program will focus on depressional wetlands in the San Diego region. Starting 2013, the San Diego Region's SWAMP will focus future funding on non-perennial streams in the region.

Collaborations: The Region 9 SWAMP program has leveraged the program considerably with collaboration efforts. The San Diego Region's SWAMP collaborated in a post-fire study in the San Diego region with the CA Department of Fish and Game and Chico State University, and in a coastal wetlands eutrophication study with the Bight '08 program and the Southern California Coastal Water Research Project. Additionally, the San Diego Region's SWAMP collaborates with several dischargers in the San Diego Region (municipal stormwater and agricultural dischargers), San Diego State University, and two non-profit organizations (San Diego Stream Team, and the San Diego Coastkeeper).

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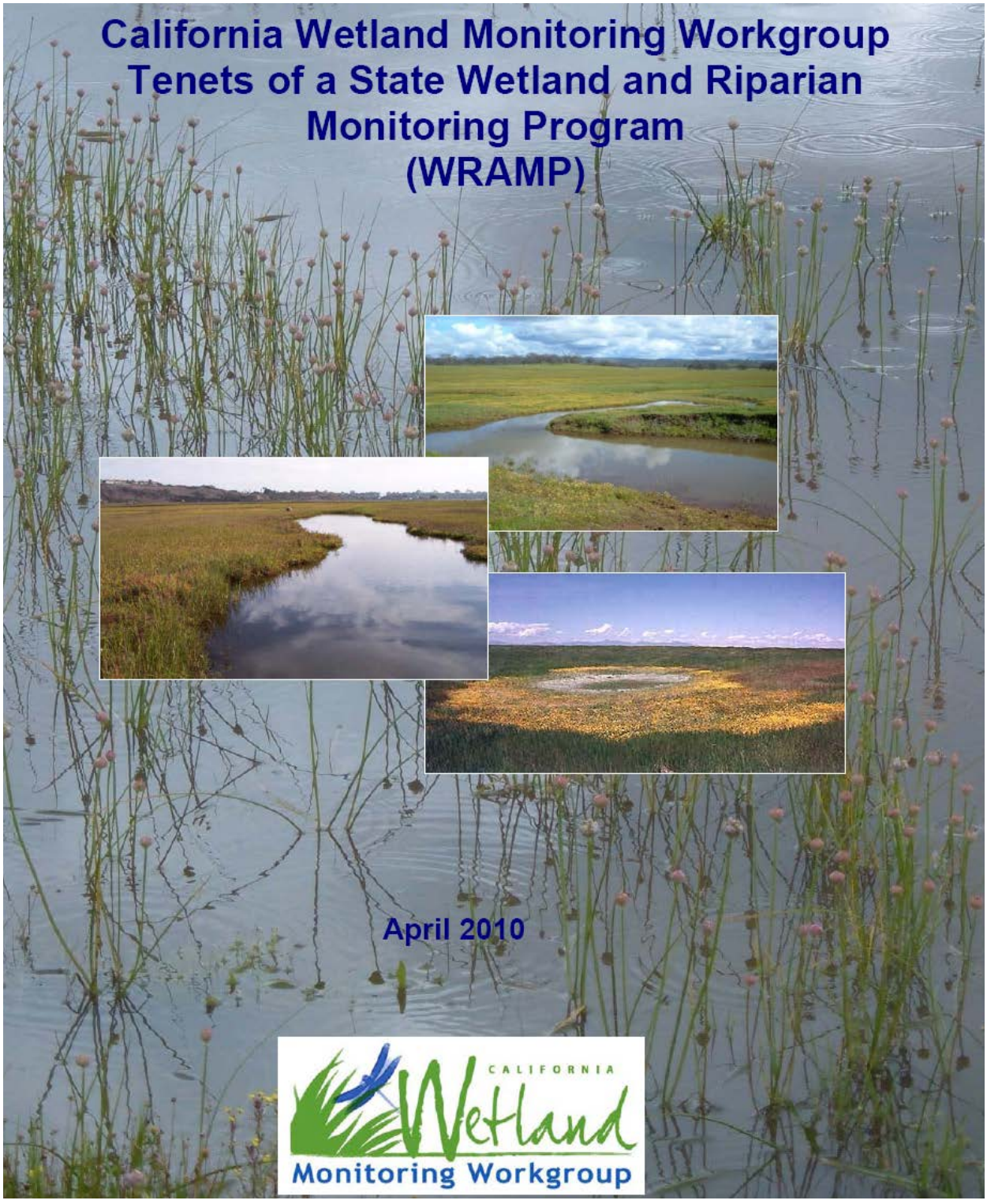
Appendix 6: California Wetland Monitoring Workgroup, Tenets of a State Wetland and Riparian Monitoring Program (WRAMP)



December 23, 2010

Executive Summary

Millions of dollars are spent annually in California by Federal, State, and local agencies to restore and protect wetlands and riparian resources; however, the State is unable to report on the health of wetlands and riparian areas because ambient conditions are not routinely or systematically assessed, projects are monitored in disparate ways, there is little assurance of data quality, and the existing data are not readily available.

The main challenge in coordinated wetland management is that the responsibility for assessing wetlands and managing data on extent and condition currently resides with at least half a dozen different agencies. Compilation of these data is hindered by the following technical factors and by the fact that *California lacks a central agency or group with the responsibility and authority to compile and manage data across wetland programs*.

- California lacks a coherent wetland definition and classification framework.
- There is no mechanism for design and coordination of consistent wetland monitoring.
- There is no consistent database or central data management system.
- Data management across programs and agencies is uneven and inconsistent.
- There are no standard agreed upon data protocols.
- Quality assurance processes are absent, unclear, or inconsistent.
- Data are often not geo-referenced.

Some wetland data can currently be found on several web sites, including BIOS, CERES, and CAL-ATLAS. However, none of these systems serves to compile wetland data across all agencies, not all data are available to the public, and the sites are not well integrated. In addition, there is a wealth of data that resides with non-governmental agencies and joint ventures that is difficult to access. There is currently no means or incentive for these organizations to share or disseminate their data. As a result, *wetland data are not readily available within and between agencies/organizations, are not of known quality or sufficiently comparable to permit regional or statewide assessments, and are often difficult to access by the public.*

The California Wetland Monitoring Workgroup (CWMW) was established in 2009 as a subcommittee of the California Water Quality Monitoring Council. A primary goal of the CWMW is to effectively function as the forum for statewide coordination of wetland and riparian monitoring and assessment and to provide a mechanism for cooperation among state and federal agencies, non-governmental organizations, and research institutions.

To achieve its primary goal of coordinated wetland monitoring, assessment, and reporting, the CWMW recommends that a Wetland and Riparian Area Monitoring Program (WRAMP) be developed to serve all State agencies and support the State's new Wetland and Riparian Area Protection Policy. The goal of the WRAMP is to produce regular reports on trends in wetland extent and condition and to relate these trends to management actions, climate change, and other natural and anthropogenic factors in way that informs future decisions.

The WRAMP should be based on the following tenets:

- Focus on public answers to basic questions: where are the wetlands and riparian areas; what is their health status; and are the policies, programs, and projects to restore and protect wetlands and riparian areas working?
- Minimize new program costs by leveraging existing programs and projects through their use of standardized core methodologies for mapping, assessment, quality assurance, data management, and reporting.
- Use the peer review process of the SWRCB to help assure the scientific credibility of core methodologies used in ambient assessment and project assessment.
- Implement the WRAMP through regional programs served by the Regional Data Centers of the SWRCB and delimited by the boundaries of its Regional Water Boards.
- Allow regions to augment the core methodologies to meet special local and regional information needs.
- Be coordinated statewide through the CWMW on an ongoing basis.

To date, substantial progress has been made to develop the WRAMP. Key accomplishments include:

- The CWMW developed a charter and effectively functions as the forum for statewide coordination of wetland and riparian monitoring and assessment.
- The CWMW serves as the primary inter-agency clearinghouse for technical memoranda produced by the Technical Advisory Team (TAT) for the Wetland and Riparian Area Protection Policy. The memoranda to date cover wetland and riparian definitions and wetland delineation.
- The CWMW produced an interagency technical bulletin on implementation of the California Rapid Assessment Method (CRAM) for projects.
- A Committee of the CWMW was formed to develop standardized mapping protocols and a classification system for wetland and riparian areas.
- A Committee of the CWMW was formed to coordinate further development and implementation of CRAM and other rapid assessment methods.
- Wetland and riparian area mapping protocols have been developed and piloted.
- Initial statewide ambient assessments were completed for riverine wetlands (in coordination with the SWAMP program) and estuarine wetlands using CRAM.
- The first iteration of the California Wetland Web Portal has been developed and launched.

Much additional work needs to be completed. The CWMW recognizes that wetlands and riparian areas vary significantly in natural form and function among the regions of the State, that each region has a community of experts best suited to account for this variability through data interpretation. Furthermore, some monitoring of wetlands and riparian areas is already happening, although these efforts are not standardized or well coordinated at this time. Based on these considerations, the CWMW recommends the following.

- The WRAMP should consist of a network of regional and local programs coordinated by the CWMW through their use of standard methods for mapping, data collection, data management, data analysis, and public reporting.

- To account for the natural regional variations in wetlands and riparian areas, the core assessment methodologies of the WRAMP should be calibrated to reference conditions in the Level 3 Ecoregions of CDFG.

Achieving the goals of the WRAMP will require a detailed strategy that includes elements for each major category of activity that has the potential to affect wetland area or condition - permitting programs, unauthorized activities, agricultural restoration, conservation programs, and grant or bond funded conservation and restoration activities. ***The Water Quality Monitoring Council should instruct the CWMW to develop a strategy that suggests the roles and responsibilities of local and State agencies, the associated costs per region and statewide, and alternative ways to meet the funding requirements.*** Implementation of the WRAMP strategy should be coordinated by a technical team (that is a subcommittee of the CWMW) that includes representatives from Federal and State agencies, Joint Ventures and other agencies (e.g. SCCWRP, SFEI, MLML) involved in regulating or managing wetlands. This technical team should oversee implementation of the following recommendations related to the major components of the WRAMP:

<u>Wetland Definition, Mapping, Classification, and Delineation</u>

- Adopt a common approach for wetland and riparian classification in California.
- Adopt a common approach for wetland and riparian mapping in California.
- Develop an analytical approach and data standards for reporting on wetland changes.

<u>Wetland Monitoring and Assessment</u>

- Conduct ambient assessments for all major wetland classes in all ecoregions.
- Develop consistent procedures for assessing the effect of projects.
- Facilitate the adoption of rapid assessment methods as a core tool.
- Develop a strategy for prioritization of research and use of intensive assessment methods.

<u>Data Quality Assurance and Quality Control</u>

- Develop a coordinated quality assurance/quality control (QAQC) plan.
- Develop consistent quality control and metadata requirements.

<u>Data Management, Outreach and Information Sharing</u>

- Establish a coordinated and integrated data management program.
- Establish a wetland data portal as a repository of all wetland data.

This document provides detailed recommendations for development and implementation of the WRAMP, including preliminary cost estimates. The WRAMP is the first step of a long-term strategy for ongoing coordination among wetland programs in California. Implementation of the WRAMP will allow for a public accounting of results of the investment in the restoration and protection of wetlands and riparian areas in California.

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ATTACHMENTS

California Wetland Monitoring Workgroup (WRAMP)
Tenets of a State Wetland and Riparian Monitoring Program

Issue

Millions of dollars are spent annually in California by Federal, State, and local agencies to restore and protect wetlands and riparian resources through longstanding public policies and programs, yet it is difficult to account for the effects of this investment. The State cannot report on the health of wetlands and riparian areas because ambient conditions are not routinely or systematically assessed, projects are monitored in disparate ways, there is little assurance of data quality, and the few existing data are not readily available.

The ability to track changes in wetland extent, distribution, and condition over time is fundamental to all wetland monitoring and assessment programs in the State. It provides the basic ability to report on status and trends and allows for the evaluation of the effectiveness of regulatory and management programs, including the Porter-Cologne Water Quality Control Act (Porter-Cologne), California Coastal Act, California Environmental Quality Act §15386 and §15381, McAteer-Petris Act, Public Resources Code §6000, Fish and Game Code §1600, US Clean Water Act §401 and 404, the California Wetlands Conservation Policy, and the Wetland and Riparian Area Protection Policy that is being developed by the State Water Resources Control Board (SWRCB). It also provides a foundation for monitoring the effects of climate change and other natural disturbances (e.g. fires and floods).

Development of a coordinated wetland and riparian monitoring and assessment programs is a key recommendation in the Natural Resource Agency's 2009 *State of the State's Wetlands Report (draft)* and is crucial for accurately assessing the Governor's "no net loss" policy, and is consistent with the central mandate of Senate Bill 1070. The ability to meet these goals and mandates will require both technical and administrative changes to the way wetland data are collected and managed.

Challenges

Responsibility for assessing wetlands and managing data on extent and condition currently resides with at least half a dozen different agencies. Compilation of these data is hindered by the following technical factors and by the fact that *California lacks a central agency or group with the responsibility and authority to compile and manage data across wetland programs*.

1. California lacks a coherent wetland definition and classification framework. Different state and federal agencies use one (or more) of several wetland definitions and classification systems, which impedes or prevents the collection, storage, assessment, and presentation of wetland data in a consistent framework.
2. There is no mechanism for design and coordination of consistent wetland monitoring. Each agency uses individual tools and monitoring approaches that may or may not be consistent or compatible with other agency programs.
3. Lack of a consistent database or central data management system. This makes it difficult to compile and share data across programs. Similarly, data compatibility between state and federal agencies is inconsistent.
4. Uneven data management across programs and agencies. The comprehensiveness and approach to data management are highly variable across agencies, varying from little to no organized data management to highly complex databases.
5. No standard data protocols. Each program is free to establish its own protocols, which are not consistent among programs. This makes data compilation and comparison across programs nearly impossible. Furthermore, when data protocols exist they are not readily available or clearly documented and metadata is typically absent.

6. Quality assurance processes are absent, unclear, or inconsistent. Agencies readily admit that there is uncertainty in their data, and the lack of common QA protocols makes it difficult to document the level of uncertainty in the data.
7. Data are often not geo-referenced. Information on wetland gains and losses is often not tied to a specific location. Therefore, it is difficult to determine if there is double counting over time within a given agency or over space and time between agencies.

Some wetland data can currently be found on several web sites, including BIOS, CERES, and CAL-ATLAS. However, none of these systems serves to compile wetland data across all agencies, not all data are available to the public, and the sites are not well integrated. In addition, there is a wealth of data that resides with non-governmental agencies and joint ventures that is difficult to access. There is currently no means or incentive for these organizations to share or disseminate their data. As a result, *wetland data are not readily available within and between agencies/organizations, are not of known quality nor sufficiently comparable to permit regional or statewide assessments, and are often difficult to access by the public.*

Institutional Foundations for Success

Much work has occurred over the past ten years that provides a strong foundation for addressing the above challenges, but there is still a lot that needs to occur. In 2002, a consortium of scientists and managers from around the state began developing a monitoring and assessment program modeled after USEPA's Level 1-2-3 framework for monitoring and assessment of wetland resources. The fundamental elements of this framework are as follows:

- Level 1: consists of wetland and riparian inventories and answers questions about wetland extent and distribution.

- Level 2: consists of rapid assessment, which uses cost-effective field-based diagnostic tools to assess the condition of wetland and riparian areas. Level 2 assessments answer questions about general wetland health.

- Level 3: consists of intensive assessment to provide data to validate rapid methods, characterize reference condition, and diagnose the causes of wetland condition observed in Levels 1 and 2. Level 3 assessments can be used to test hypothesis and provide insight into functions and processes.

Between 2002 and 2007 much progress was made in developing tools and partnerships to implement the Level 1-2-3 approach. Most notably the California Rapid Assessment Method for wetlands (CRAM) was developed, tested, and validated. Regional wetland monitoring and assessment methods were developed based on this framework. An example is the Integrated Wetland Regional Assessment Program (IWRAP) developed by the Southern California Wetlands Recovery Project (WRP). The IWRAP program was vetted and endorsed by the WRP member agencies, which represent the 17 main Federal and State agencies responsible for wetland regulation, restoration, and management in California.

In 2006, the Resources Agency was awarded a USEPA Wetlands Demonstration Pilot (WDP) grant to begin a phased implementation of a *statewide* wetlands monitoring program, modeled after the USEPA Level 1-2-3 approach. This program built on regional efforts and demonstrated implementation of the wetland and riparian assessment toolkit in various state agency (regulatory and non-regulatory) programs in the coastal regions of California. The WDP project also produced the first-ever assessment and report on the health of California's estuaries.

In 2008, the California Wetland Monitoring Workgroup (CWMW) was endorsed as a subcommittee of the California Water Quality Monitoring Council (see Appendix A: CWMW Charter). The CWMW evolved from the

WDP steering committee and includes both Federal and State agencies with responsibility for wetland management (see Appendix B: current Workgroup membership). The intent of the CWMW is to effectively function as the forum for statewide coordination of wetland and riparian monitoring and assessment. It provides the mechanism for cooperation among state and federal agencies, research institutions, and data center management organizations involved in tool development and implementation. The products of the CWMW are designed to implement the Water Quality Monitoring Council's vision for a coordinated methods and data management approach to water quality monitoring. Ongoing coordination of activities occurs through the various subcommittees of the CWMW operating under the Monitoring Council's overall guidance and approval.

Moving Towards a State Wetland and Riparian Area Monitoring Program (WRAMP)

The CWMW recommends that a Wetland and Riparian Area Monitoring Program (WRAMP) be developed to serve all State agencies and support the Wetland and Riparian Area Protection Policy (Policy). The objective of this Policy is to protect the beneficial uses of California's wetlands and riparian areas (http://www.swrcb.ca.gov/water_issues/programs/cwa401/wrapp.shtml). The WRAMP is based on the following tenets:

- Focus on public answers to basic questions: where are the wetlands and riparian areas, what is their health status, and are the policies, programs, and projects to restore and protect wetlands and riparian areas working?
- Minimize new program costs by leveraging existing programs and projects through their use of standardized core methodologies for mapping, assessment, quality assurance, data management, and reporting.
- Use the peer-review process of the SWRCB to help assure the scientific credibility of core methodologies used in ambient assessment and project assessment.
- Implement WRAMP through regional programs served by the Regional Data Centers of the SWRCB and delimited by the boundaries of its Regional Water Boards.
- Allow regions to augment the core methodologies to meet special local and regional information needs.
- Remain coordinated statewide through the CWMW on an ongoing basis.

The WRAMP consists of coordinated, comparable regional and statewide efforts that use standardized methods to monitor the effects of natural processes, climate change, and government policies, programs, and projects on the distribution, abundance, and condition of wetlands and riparian areas. The standardized methods will include (Figure 1):

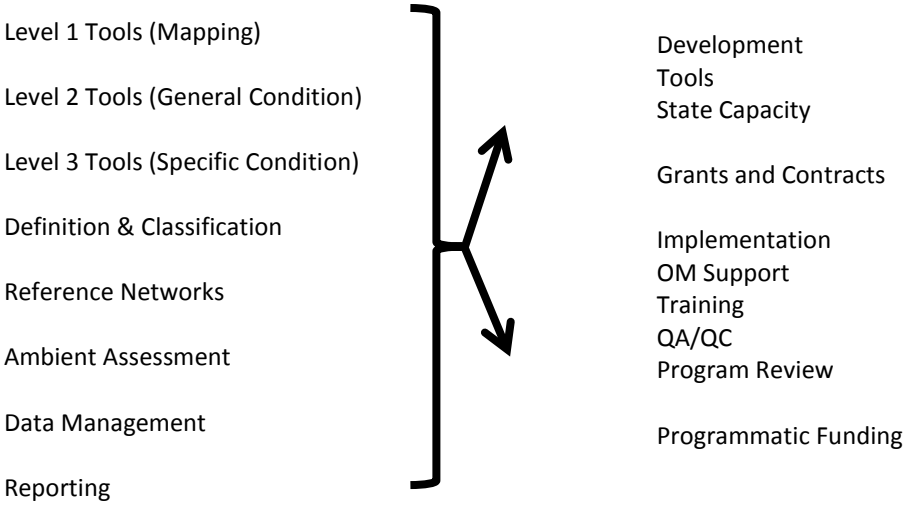
- definitions for wetlands and riparian areas
- a statewide classification system
- mapping and delineation protocols
- condition assessment protocols
- data transfer protocols and data quality control procedures
- analytical and reporting methods

The WRAMP will make wetland and riparian data available to the public through public information management systems. The WRAMP will be used to assess the individual and cumulative effects of local

management actions, such as wetland and riparian mitigation, enhancement, restoration, and creation, on ambient conditions for a variety of spatial scales, such as watersheds, regions, and statewide.

The primary strategy for achieving this vision is to apply the standard methods through existing State programs and projects, rather than develop a new stand-alone program. The Wetland and Riparian Area Protection Policy therefore directs the Regional Water Boards to collaborate with other State agencies and regional and local interests to develop the standardized practices and methods of the WRAMP.

Figure 1. WRAMP Strategic Elements



Organization

The CWMW recognizes that wetlands and riparian areas vary significantly in natural form and function among the regions of the State, that each region has a community of experts best suited to account for this variability through data interpretation, and that implementing the WRAMP for all regions of the State at the same time is not practical or necessary to achieve Policy goals. The CWMW also recognizes that some monitoring of wetlands and riparian areas is already happening, although these efforts are not standardized or well coordinated at this time. Much of the existing efforts are related to permits issued under Fish and Game Code §1600, US Clean Water Act §401 and 404, and Waste Discharge Requirements and conditional waivers issued pursuant to the Porter-Cologne Water Quality Control Act (Porter-Cologne). Based on these considerations, the CWMW recommends the following.

- The WRAMP should consist of a network of regional and local programs coordinated by the CWMW through their use of standard methods for mapping, data collection, data management, data analysis, and public reporting.
- To account for the natural regional variations in wetlands and riparian areas, the core assessment methodologies of the WRAMP should be calibrated to reference conditions in the Level 3 Ecoregions of DFG.

Achieving the goals of the WRAMP will require a detailed strategy that includes elements for each major category of activity that has the potential to affect wetland area or condition - permitting programs, unauthorized activities, agricultural restoration, conservation programs, and grant or bond funded conservation and restoration activities. *The Water Quality Monitoring Council should instruct the CWMW to develop a strategy that suggests the roles and responsibilities of local and State agencies, the associated costs per region and statewide, and alternative ways to meet the funding requirements* (see Appendix C).

Implementation of the WRAMP strategy should be coordinated by a technical team (that is a subcommittee of the CWMW) that includes representatives from the Natural Resources Agency and Cal/EPA, relevant Federal agencies, appropriate Joint Ventures, the Southern California Coastal Water Research Project (SCCWRP), the San Francisco Estuary Institute (SFEI), and the Moss Landing Marine Lab (MLML). The technical team should be overseen and report to the Monitoring Council. In addition, the products of this workgroup should be vetted through the California Water Quality Monitoring Council. Ongoing coordination will occur through the CWMW its various committees. Potential participating agencies are listed in Appendix D.

Specific Recommendations of the CWMW

Work has begun on the main elements of the WRAMP, and is summarized below. To facilitate implementation of the WRAMP, the following activities should be undertaken:

Wetland Definition, Mapping, Classification, and Delineation

1. Adopt a common approach for wetland and riparian mapping in California. To the extent possible, State agencies should use a common set of definitions and protocols to identify and map wetlands and riparian areas in California. This is essential for leveraging various mapping efforts to assess the regional and statewide distribution and abundance of these resources and to assess compliance with California's "no net loss" directive. The CWMW should be responsible for the definitions and mapping protocols, and DFG should be responsible for maintaining and updating wetland and riparian maps as guided by the CWMW. With input from the CWMW, the Technical Advisory Team

(TAT) advising the State Water Board on the development of the Policy has developed a proposed wetland definition for regulatory purposes which was circulated for vetting by other agencies and public review in June 2009. The Council should direct the CWMW to create a Mapping Committee to coordinate the development and implementation of mapping methods. The Mapping Committee should coordinate with other state mapping efforts, especially the vegetation mapping program of DFG, and the watershed mapping program of the California Interagency Watershed Mapping Committee.

The Department of Fish and Game should be responsible for maintaining and updating wetland and riparian maps, based on the advice and review of the CWMW, with input from the basemap user communities, and making them readily available to the public. *The ultimate goal should be the production of a statewide standard basemap of* aquatic habitats *(topography, lakes, rivers and creeks, wetlands, nearshore marine areas).*

Current activities:

- A technical memorandum on a wetland and riparian definition for regulatory purposes (Appendix E) has been produced by the Technical Advisory Team (TAT) for the Wetland and Riparian Area Protection Policy. (http://www.waterboards.ca.gov/board_info/agendas/2009/oct/100609_6%20att_wetlanddefinition_final3_.pdf)
- A Committee of the CWMW was formed to develop standardized mapping protocols and a classification system for wetland and riparian areas (Appendix F: Draft California Wetland Classification).
- Wetland and riparian area mapping protocols have been developed and piloted (Collins et al.)

2. Adopt a common approach for wetland and riparian classification in California. There should be one standardized basemap of wetlands and riparian areas. However, the wetlands and riparian areas shown on the map can be classified in different ways, depending on the purpose of the classification. For example, wetlands might be classified differently with regard to wildlife support and flood control. To support the Wetland and Riparian Area Protection Policy, the CWMW should develop a classification system that helps identify the beneficial uses of wetlands and riparian areas. This does not preclude developing other classification systems for other purposes. The Council should instruct the CWMW and its Mapping Committee to develop a classification system that supports the Wetland and Riparian Area Protection Policy, and to develop guidelines for developing other classification systems based on the standardized definitions and protocols for identifying and mapping wetlands and riparian areas. The goals is for every effort to map wetlands and riparian areas in California to classify them using the system developed for the Wetland and Riparian Area Protection Policy, although additional classification systems can also be used.

   Current activities:

   - Wetland and riparian maps have been developed for portions of California using an enhanced protocol based on the National Wetlands Inventory
   - A draft procedure to select or develop a classification system for California wetlands has been developed.

3. Develop an analytical approach and data standards for reporting on wetland changes. The data standards should be based on a standard wetland classification system and define how features such as open water or riparian ecosystem elements are identified and reported. These standards should be used across all wetland programs to allow for compilation and sharing of data across

programs. In additional the efficacy of survey-based vs. probability based methods should be compared, with a goal of recommending an approach for future adoption by the CWMW.

Current activities:

- No work has begun on this yet, but initial efforts will begin in 2010 under a new project funded by USEPA.

Wetland Monitoring and Assessment

1. Conduct ambient assessments for all major wetland classes in all ecoregions. The ambient condition of wetlands and riparian areas should be regularly assessed throughout the State. The Council should direct the CWMW to develop a technical plan of ambient assessment that can be incorporated into the Surface Water Ambient Monitoring Program (SWAMP) of the SWRCB. The SWRCB should be responsible for assessing the ambient condition of wetlands and riparian areas, with interagency coordination provided by the CWMW. The goal should be regular public reports on the health status and trends of wetlands and riparian areas to help assess and forecast the ecological effects of climate change and to assess the performance of the State's policies and programs to protect these natural resources.

   Current Activities:

   - Initial statewide ambient assessments have been completed for riverine wetlands (in coordination with the SWAMP program) and estuarine wetlands using CRAM.
   - Several regional programs have been developed with proposed ambient assessment procedures, e.g. IWRAP in southern California.
   - An ambient assessment for one subclass of depressional wetlands will be conducted for one California ecoregion during 2011 under a new project funded by the Natural Resources Agency.

2. Develop consistent procedures for assessing the effect of wetland projects. Every human action on the ground that changes the extent or condition of a wetland or riparian area should be tracked through a public information system. Activities should include permitted wetland fills, agricultural activities, restoration and conservation actions, and unauthorized activities (to the extent that agencies are aware). The Council should direct the CWMW to develop and guide a technical plan for using standard habitat definitions, mapping methods, assessment methods, reporting methods, and the California Wetland Portal (www.californiawetlands.net) to track such projects from their planning stages through their completion. It is essential that the wetland and riparian areas of the projects be mapped and assessed using the core methodologies developed by the CWMW. The plan should enable the State to compare projects to each other and over time, and to assess their cumulative effects on ambient condition. The goal is to understand the individual and cumulative benefits of wetland and riparian projects at a variety of scales from watersheds to regions and statewide.

   Current Activities:

   - The CWMW produced an interagency technical bulletin on implementation of the California Rapid Assessment Method (CRAM) for projects (Appendix G).

3. Use rapid assessment methods as a core tool. The high cost of monitoring and assessment has been their main deterrent. Comprehensive monitoring of the functions and services of wetlands and riparian areas has never been accomplished for any region of the State and would require more

people and money than have ever been available for such purposes. Nevertheless, the State needs to monitor and assess its wetlands and riparian areas. The CWMW recommends using cost-effective rapid assessment methods (RAMs) to assess ambient condition, and to combine rapid assessment with more intensive measures when they are needed to design projects or assess particular aspects of condition or project performance. The CWMW has developed a California Rapid Assessment Method (CRAM) (www.cramwetlands.org) is currently being used by some California Districts of the US Army Corps of Engineers and other organizations[1]. The Council should direct the CWMW to create a RAM Committee to coordinate RAM development and implementation for all state agencies. The goal is to consistently assess the effects of policies, programs, projects, and climate change on the general health of wetlands and riparian areas at a variety of scales from watersheds to regions and statewide.

Current Activities:

- A Committee of the CWMW was formed to coordinate further development and implementation of CRAM and other rapid assessment methods.

4. Develop a strategy for prioritization of research and use of intensive assessment methods. In technical terms, intensive assessment (IA) is the quantification of selected processes or health aspects of wetlands or riparian areas. IA is essential to answer questions about particular plant and animal species, water quality parameters, or other health aspects that are not individually assessed using RAMs. There are many more aspects of wetland and riparian health that might be assessed using IA than time and money allow. The Council should instruct the CWMW to develop and guide an approach to prioritize and develop IA methods. The goal is to provide standard methods of intensive assessment for key aspects of wetland and riparian health that RAMs do not adequately assess.

   Successful monitoring and assessment programs are supported by research to develop methods of data collection, management, analysis, interpretation, and reporting. Past research has brought the State to the threshold of a cost-effective program for monitoring and assessing wetlands and riparian areas; the program will need a research component to maintain scientific excellence. The Council should instruct the CWMW to develop and guide a plan to identify and prioritize immediate and medium range future research needs. The goal is to create a research component of the WRAMP that directly targets the highest priority needs for new or revised technical methodologies.

   All scientific measurement methods will need to be revised and updated periodically. Lack of provision for this ongoing maintenance has contributed to problems identified with previously developed RAMs and IBIs. The Council should direct the CWMW to conduct ongoing testing, review and refinement of core assessment methods, including identification and maintenance of a statewide reference wetland area network capable of supporting calibration of methods and validation of assessment data.

   Current activities: none thus far

[1] CRAM is proposed for use in regulatory decisions by the State Water Board, pending peer review and approval of the State Wetland and Riparian Protection Policy.

Data Quality Assurance and Quality Control

1. Develop a coordinated quality assurance/quality control (QAQC) plan. Having adequate assurances and control on data quality (QAQC) means the program generates reliable data that meet the needs of wetland and riparian regulators and managers in terms of representativeness, accuracy, and precision. The QAQC should include these five aspects:

    a. *Peer Review.* The Council should instruct the CWMW to develop and guide a peer review plan to help assure the propriety and scientific credibility of the core methodologies for wetland and riparian mapping and assessment. The CWMW should also develop guidelines for establishing technical committees that incorporate informal peer review into their work, and to define the role of scientific publication of monitoring methods and results in peer review. The goal is to assure that data generated by the Policy are "consistent with scientific knowledge, methods and practice" to inform management and regulation of wetlands and riparian areas, and to assess the performance of policies, programs, and projects designed to restore and protect these natural resources.

    b. *Training.* The Council should instruct the CWMW to develop and guide a plan for training agency staff and practitioners in the proper use of the core methodologies for mapping, data collection, data management, data analysis, data interpretation, and reporting. Training may occur via a variety of venues, but curricula and instructors should be coordinated to ensure consistent training throughout the user communities. The goal is to develop trainers and curricula that can be implemented through a large variety of educational programs. Training based on this model is already being offered on the use of CRAM (www.cramwetlands.org/training).

    c. *Auditing.* The Council should instruct the CWMW to develop and guide a plan of third-party audits of selected monitoring data and reports. The audits would focus on the use of core methodologies for mapping, data collection, and data analysis. The goal is to maintain the scientific integrity of WRAMP by identifying and correcting misuse and misapplication of its core methodologies, especially in the context of project design and regulatory decisions.

    Current activities:

    - Approximately half dozen CRAM 3-day practitioner trainings and well over a dozen 1-day agency trainings have been completed. The CRAM development team has developed a relationship with UC Extension for future implementation of training.
    - The State Water Board has initiated an external peer review of CRAM. A prior peer review was completed by the Corps of Engineers Engineering Research and Development Center.
    - A plan has been developed for regional audit teams in association with the Regional Data Centers; several proposals are in consideration for full funding of the audit teams.

2. Develop consistent quality control and metadata requirements. Wetland data should be accompanied by information on the source and quality of the data, estimates of confidence in the accuracy of the data, and any notations or explanatory information from the source agency. This will aid in data interpretation and compilation and allow for appropriate qualification of the data sufficient to be able to determine whether data from multiple sources can be combined in broader assessment efforts.

    Current activities: none thus far

3. Require that all wetland data be geo-referenced or associated with a map. Multiple agencies or programs often collect data on a given project. Requiring spatial attribution will allow mapping of wetland projects. This will reduce the potential for double counting of gains or losses, will aid in the assessment of cumulative effects, and will help support regional planning and assessment programs.

   Current activities: none thus far

Data Management, Outreach and Information Sharing

1. Establish a coordinated and integrated data management program. Data management is not only a main aspect of QAQC, it is fundamental to data sharing and integration across projects, programs, and regions of the State. The Council should direct the CWMW to create a Data Management Committee (as a subcommittee of the CWMW) to include representatives from the Natural Resources Agency and Cal/EPA, the Southern California Coastal Water Research Project (SCCWRP), the San Francisco Estuary Institute (SFEI), and the Moss Landing Marine Lab (MLML). The Data Management Committee will report to the CWMW and coordinate the development and implementation of a plan that assures WRAMP data meet minimum requirements of data quality and completeness to include:

   Current activities: none thus far

2. Establish a wetland data portal as a repository of all wetland data. A main goal of the WRAMP (and the Wetlands Monitoring Workgroup) is to make all data and information about wetlands and riparian areas readily available to agencies, the private sector, and the public. The primary mechanism for this communication should be the California Wetland Portal and its Regional Data Centers. The data centers will perform initial quality control and make the data available through the statewide data network. Ultimately, these data will be accessible to the public through the statewide wetland data portal. The workgroup should identify the most logical relationships between the California Wetland Portal and existing online data libraries, such as BIOS and CERES.

   The Monitoring Council should require that all data be submitted to the Regional Data Centers. Furthermore, the Monitoring Council should instruct the CWMW to develop and guide an outreach and training plan to encourage Portal use, and for gaining insight from the user community about how the Portal might be improved. The Goal is to maximize the value of the California Wetland Portal. Information on wetland change associated with the major activities that affect wetland area (permitting programs, unauthorized activities, agricultural restoration, conservation programs, and grant or bond funded conservation and restoration activities) should be tracked through the wetland portal[2]

Current activities:

- The first iteration of the California Wetland Portal was developed and launched (www.CaliforniaWetlands.net).
- Several Regional Data Centers have been established by the State Water Board (as part of the California Environmental Data Exchange Network or CEDEN) to allow for regional compilation of water quality data from multiple programs.

[2] Functionality of Wetland Tracker has not be integrated into the Wetland Portal

- Regional Board 2 (San Francisco) is requiring data from priority Section 401 certifications to be tracked through the wetland portal. Other regional boards are considering adopting this requirement as well.

Reporting

The goal of the WRAMP is to produce regular reports on trends in wetland extent and condition and to relate these trends to management actions in way that informs future decisions. This goal will be facilitated by the large amounts of data that would ultimately be generated on an ongoing basis by many partners throughout the State. Limited syntheses of core data could be automated through the Wetland Portal for a variety of scales from watersheds to regions and statewide. However, there should also be periodic reports authored by the CWMW or its member agencies that more broadly synthesize monitoring and assessment results. For example, the WRAMP should support regular reporting to USEPA pursuant to §305(b) and 303(d) of the US Clean Water Act. The program should also generate reports on net change in wetland and riparian extent and health pursuant to the California Wetlands Conservation Policy and the SWRCB Wetland and Riparian Area Protection Policy. Production of these kinds of reports will require dedicated analyses of monitoring results and much coordination among the responsible agencies. The recent report from CWMW on estuarine wetland condition is a successful example. The Council should instruct the CWMW to develop a plan indicating what periodic reports should be developed from the WRAMP, what the reporting interval should be, and how the reports will be accomplished. The goal is to publicly account for the public investment in the restoration and protection of wetlands and riparian areas.

Next Steps

Next steps in WRAMP development have been identified in Appendix H. These steps will yield further validation studies of CRAM, protocols for regional and statewide ambient assessment including phasing of implementation, online mapping tools for local data stewards, and pilot implementation of the Wetland and Riparian Area Protection Policy at the watershed scale.

A long-term strategy should ultimately be developed for ongoing coordination among wetland programs in California. *Ultimately, there should be a single group or agency with the authority to coordinate wetland monitoring activities and to compile, manage and report on wetland data in California*. An implementation work plan will need to be developed that includes funding strategies for the recommended actions. A list of implementation priorities for the WRAMP is included in Appendix H.

Cost Implications

Ultimately, the recommended changes to wetland data management would be integrated into existing agency programs, and therefore be included in their budgets. Successful implementation of the WRAMP would improve efficiency across programs and could ultimately lead to lower overall costs by eliminating duplicative monitoring and assessment efforts and consolidating data management through the Regional Data Centers (as is recommended by the Monitoring Council).

Funding will be required to support the initial efforts of the technical team to implement the recommendations. Additional ongoing funding will be required by the CWMW and the Monitoring Council to oversee and enhance monitoring, assessment and reporting coordination efforts and by the Regional Data Centers for data management, quality control, training, reporting, and periodic updates/upgrades. *It is recommended that the equivalent of one full-time position be funded at one of the State member agencies of the CWMW for ongoing coordination and management of the State's*

wetland data systems. In addition, the estimated initial and recurring *statewide* costs to implement each recommendation are summarized in Table 1. Detailed cost estimates are provided in Appendix I.

Table 1. Estimated Statewide Costs to Implement Recommendations

Program Element	***one-time initial costs***	***annual cost***	***total cost per cycle***	***yrs/cycle***
Wetland Status & Trends Mapping	$5,060,000	$315,000	$2,205,000	7
Revise Statewide Wetland Map	none	$420,000	$8,400,000	20
Wetland Condition Assessment	grant funded	$840,000	$5,880,000	7
Data Management (incl. QAQC)	$75,000	$1,212,500	$1,212,500	1
Reporting	grant funded	$20,000	$100,000	5
Total	**$5,135,000**	**$2,807,500**	**$17,797,500**	

The wetland mapping and condition assessments can also be implemented incrementally based on ecoregions and/or wetland classes. We estimate the unit cost for wetland mapping and condition assessment to be *$45,000/ecoregion/wetland class* and *$120,000/ecoregion/wetland class*, respectively. There are seven ecoregions and currently seven major wetland classes[3] recognized in California. The unit cost approach allows decision makers to implement mapping and assessment in a phased manner based on priorities. In addition, we recommend that the wetland and riparian mapping for the entire state be updated on a 20 year cycle, at cost of approximately $3,000 for each of the 2,800 USGS quadrangles in California.

Successful implementation of a coordinated wetland data management program will require sustainable funding and dedicated staff to coordinate among the key data providers and managers. The California Water Quality Monitoring Council has indicated that they will assume the lead role in developing a coordinated funding strategy for all elements of the State Water Quality Monitoring Program.

[3] The number of wetland classes may change over time as the TAT develops a recommended wetland classification system, and that system is refined over time.