Science Support for the Surface Water Ambient Monitoring Program

by

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1 Background and Introduction

The Surface Water Ambient Monitoring Program (SWAMP) was implemented by the Water Boards in response to California Water Code Section 13192 (established by AB 982 Ducheny, 1999 Session). SWAMP was established to provide a comprehensive, unbiased assessment of all surface waters, coordinate all water quality monitoring programs and projects conducted by the State Board and the nine Regional Boards, and ensure that data are of high quality (i.e., meeting data quality objectives), comparable, and accessible. Implementation of SWAMP is challenging, given its broad mandates. Funding constraints made adjustments necessary to the way the program had been structured until recently.

- In early 2005, the San Francisco Estuary Institute (SFEI), based on its long-term experience administering the San Francisco Estuary Regional Monitoring Program for Water Quality in adaptive fashion, received a research contract from the State Water Resource Control Board to assist with re-tooling SWAMP. The original program goals, as stated in the 2000 Report to the Legislature (SWRCB, 2000), were as follows:
  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.

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

- Identify specific water quality problems preventing the Water Boards and the public from realizing beneficial uses of water in targeted watersheds.

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

These program goals have never been matched by commensurate funding, thereby requiring a hard look at what information needs can realistically be met by SWAMP, which ones either are now, or could be in the future, met by data-gathering activities conducted by other Water Board programs (e.g., grant effectiveness monitoring requirements; WDR and NPDES monitoring requirements; 13267 letters to dischargers; TMDL impairment assessments and implementation monitoring), and which data generated by other departments could be used to integrate into assessments of water quality, beneficial use condition, and stressors. The Water Boards recognized the opportunity to shape SWAMP according to national guidance by USEPA and to meet the call for a science-based statewide assessment of water quality and designated uses under Section 305(b) of the Clean Water Act. Furthermore, a re-tooled SWAMP could be the starting point for performance-based management and a means to meet short-term objectives. The pursuit of the broad and long-term goals could be phased over realistic time frames and occur with additional partners.

2 Objectives of Report

This report has two major objectives. It is designed to (1) document the work performed under SFEI's research contract and (2) provide a reference documenting the evolution of the SWAMP "Business Plan" that represents the culmination of more than two years of review and stakeholder decisions on how to implement key recommendations of the Scientific Planning and Review Committee (SPARC), which was convened in late 2005 as an external review body.

The overall project objectives for SFEI's research contract were to:

- identify realistic short-term monitoring objectives reflecting current fiscal realities
- develop a schedule for longer-term implementation based on anticipated resources
- identify collaborative data generation approaches
- develop and begin implementation of a broad managerial and technical stakeholder process for providing a monitoring program design that reflects the newly developed statewide monitoring strategy
- refine core indicators for water quality and beneficial use assessment
- build on and refine existing information management and exchange mechanisms
- develop a data analysis and assessment approach according to the selected suite of core indicators (transform data into information relevant to the refined management objectives and questions)
- ensure effective reporting and communication of results geared toward four distinct audiences: 1) water quality and grant/bond fund administrators; 2) the legislature; 3) public interest groups and program funders; and 4) technical experts

- establish a monitoring program evaluation process that builds on the lessons learned by the Regional Monitoring Program for Trace Substances for the San Francisco Estuary, the Interagency Ecological Program, the Southern California Bight Monitoring Program, and other regional monitoring efforts throughout the state.

3 Methodology and Report Organization

These objectives were sufficiently broad to take advantage of several leveraging opportunities that emerged during the three-year project period.

For example, additional resources became available through large grants awarded to SWAMP partners, such as SFEI, the Department of Water Resources/CalEPA, the Southern California Coastal Water Research Project, the Department of Fish and Game, the Office of Environmental Health Hazard assessment, and others, that generated sufficient momentum to expand and strengthen existing collaborations. Institute staff worked closely with the SWAMP coordinators and Regional Board liaisons as part of the "Roundtable" meetings to obtain direction and review of interim products on a regular basis. Staff also worked closely with the already established SWAMP Data Management and QA Teams, and with additional SWAMP Work Groups that were established as part of a review implementation process initiated by the Scientific Planning and Review Committee (SPARC) in 2006. From mid-2006 throughout the remaining project period, the SFEI project team adjusted its activities to bring the above objectives into alignment with the SPARC recommendations and to follow direction of Water Board management and SWAMP staff to assist with implementation of re-tooling efforts. In essence, while some of the original project objectives were limited to setting up an evaluation process, additional funding made it possible for this project to begin the implementation aspects, thereby accelerating a number of anticipated tasks that were originally not part of the project scope. The efforts conducted under this research contract dovetailed very well with a product Water Board staff submitted to USEPA after the contract with SFEI had started - the "Comprehensive Monitoring and Assessment Strategy to Protect and Restore California's Water Quality" or Strategy. The Strategy is organized according to USEPA's "Elements of a State Water Monitoring and Assessment Program". Many of the activities and interim products of this effort served to begin implementing key elements of the Strategy submitted to USEPA in October of 2005.

The research contract contained two major components: (1) assisting the Roundtable to re-structure SWAMP to meet fiscal realities and (2) reviewing the substantial bioaccumulation database of the past 35 years and proposing an appropriate monitoring approach to track risks from bioaccumulative pollutants to aquatic life and people.

For the first part, we used the same organization used in the Strategy , especially where task descriptions in the research contract could easily be applied to each of the ten elements. Our work as part of “re-tooling” SWAMP focused on:

a) revising monitoring objectives, identifying appropriate monitoring designs capable of addressing statewide as well as region-specific questions,

b) helping develop an assessment framework to ensure that SWAMP monitoring could be prioritized in relation to other data-gathering efforts directed by a variety of water quality programs within the Water Boards as well as those housed in other departments, and

c) developing effective data management and exchange mechanisms.

The second part of the report provides a summary of the bioaccumulation data review and initial options for a comprehensive SWAMP monitoring component capable of tracking risks to aquatic life and people exposed to bioaccumulative pollutants.

4
Project Activities and Outcomes

The following sections of the report describe the contributions staff made to re-tool the Program, conduct a comprehensive review of bioaccumulation monitoring throughout the state during more than three decades, and begin to implement key elements of the Water Quality Monitoring Strategy.

4.1
Toward Implementation of the Surface Water Monitoring Strategy

Based on the ten "Elements of a State Water Monitoring and Assessment Program" included in U.S. EPA guidance for implementing Section 106(e)(1) of the federal Clean Water Act, SWAMP staff began to formally document the efforts that had been underway since the implementation of SWAMP and the 2000 Report to the Legislature had been submitted

Ten 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

4.1.1 Monitoring Strategy

In October 2005, SWAMP submitted a Comprehensive Monitoring and Assessment Strategy to the U.S. Environmental Protection Agency to articulate its visions, goals, objectives, current status and implementation priorities. Some aspects incorporated in the Strategy resulted from outcomes and agreements reached at a workshop with program liaisons from all Water Boards, and scientific and data management support staff from a number of organizations involved in the program. The research contract with SFEI provided a vehicle to assist in workshop organization and follow-up assignments and contributed to the Monitoring Strategy. The document goes beyond addressing statutory obligations and also addresses statewide coordination of consistent, scientifically defensible methods and approaches to improve the monitoring, assessment, and reporting of California's water quality and beneficial uses. In addition to the 2005 workshop, numerous technical discussion papers and SWAMP Roundtable meetings contributed content to the Strategy document.

4.1.2 Monitoring Objectives

The 2005 SWAMP Workshop served as the starting point for ways to:

d) refine the original monitoring objectives listed in the Report to the Legislature (SWRCB 2000);

e) review program successes achieved during the first four years of monitoring, as well as programmatic and budget challenges, and

f) develop consensus on meeting both regional and statewide information needs under various budget scenarios.

Agreement was reached at the workshop and in a series of follow-up Roundtable meetings that assessment questions needed to be documented for different spatial scales before the existing approaches to data collection and monitoring design specific to each Region could be integrated into a statewide assessment framework and improved to reflect the new objectives. From 2001 till 2005, statewide concerted efforts had been directed primarily toward creating quality assurance and data management programs that were consistent among all of the Regions, while monitoring activities and approaches differed considerably. The workshop discussions resulted in a draft list of revised program goals and objectives. Details of the workshop outcomes are documented in the proceedings included in Appendix A.

The Roundtable used five overarching questions relating to statutory requirements in the Clean Water Act and the California Water Code to revise and narrow the list of original program objectives in the 2000 Report to the Legislature:

1) What is the condition/status of beneficial uses in each Region and the State as a whole?

2) What are trends in key indicators representative of beneficial uses?

3) What effects or impairments do various anthropogenic stressors cause?

4) What are the sources [pathways, and loadings] of pollutants of concern and other impairment factors, such as hydromodification, for various water bodies?

5) How effective are management actions [and policy decisions] in protecting and restoring beneficial uses?

The revised SWAMP Monitoring Objectives are:

6) Determine the condition/status of beneficial uses throughout the State without bias to known impairment

7) Assess trends in beneficial use condition using representative indicators

8) Identify which "man-induced alterations of the chemical, physical, biological, or radiological integrity of water" (CWA, Section 502(19)) are impairing beneficial uses, including pollution sources and pathways

9) Evaluate effectiveness of management actions and policies in restoring and protecting beneficial uses

4.1.3 Conceptual Models and Organizational Frameworks for Indicator Selection and Monitoring Designs

Indicators of water quality and beneficial use condition are an integral part of monitoring design (Element 3 of the Monitoring Strategy) and often are addressed concurrently with selecting appropriate sampling locations and frequency. Conceptual models of our current understanding of beneficial use conditions and pressures impacting them are useful tools that have been used extensively in the design of a variety of regional monitoring programs and in particular for the San Francisco Estuary Regional Monitoring Program for Water Quality.

The 2000 Report to the Legislature listed core water quality indicators based on a number of selection criteria but did not provide a framework for prioritizing them in terms of serving multiple information needs of various clients. The Roundtable, with input from the SPARC, decided to develop an assessment framework first, which could then serve as a tool to clearly identify appropriate indicators and monitoring designs.

The following principles were developed for a statewide assessment of water quality and beneficial use condition:

- Provide information for management decisions
- Specify clients, information needs, assessment questions
- Assessment questions link through to sampling plans
- Link client needs with legislative mandates
- Integrate regional studies into statewide assessment
- Statewide assessment is part of core program; context for regional studies
- Mine data for each assessment question that are of the appropriate type & quality
- Flexible: add, modify, prioritize questions & indicators
- Flexible: increasing detail, finer scale

The Roundtable systematically identified the core client needs and mandates and linked them conceptually to monitoring objectives, monitoring design (spatial and temporal scales), environmental attributes, indicators, and sampling plans to suggest a meaningful and realistic monitoring program that meets both statewide and regional assessment needs.

The core mandates and information uses were identified as:

- Standards development (CWA § 303[c])
- Standards attainment (§ 305[b])
- Impaired water body listing (§ 303[d])
- Cause and source identification (§ 303[d], 305[b])
- Management program implementation (§ 303, 314, 319, 402)
- Program effectiveness (§ 303, 305, 402, 314, 319)
- Basin planning activities (California Water Code)

The Roundtable agreed to use a matrix developed during the 2005 workshop to arrive at appropriate monitoring designs and reviewing core indicators. A first step along that path was to formulate more specific assessment questions for six water body types representing all of California's surface waters and four key beneficial uses common to all regions in the state that, if protected, would also assure protection of all other beneficial uses.

Since the workshop, this matrix (Table 4.1.3-1), has been used as one of the key organizing tools for developing appropriate monitoring designs, core indicators, and the long-term "business plan" for

SWAMP. It also represents a useful communication tool for prioritizing work efforts under various funding scenarios.

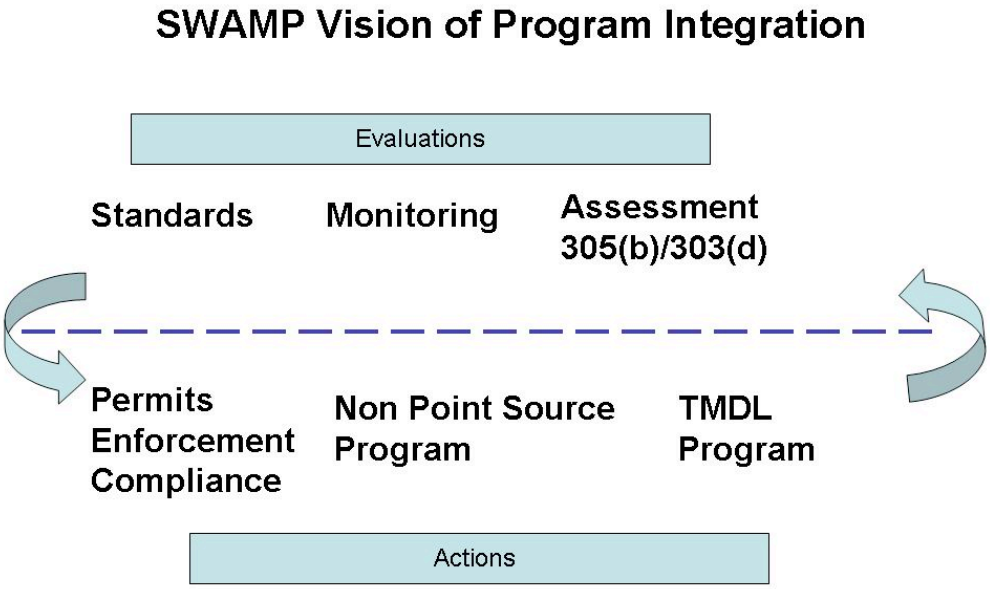
Table 4.1.3-1

Type of	**Beneficial Use**			
Water Body	Aquatic Life	"Fishable"	"Swimmable"	"Drinkable"
Wadeable Streams				
Large Rivers				
Lakes				
Coastal Waters				
Bays / Estuaries				
Wetlands				

The Roundtable members recognized that assessment questions would have to be fine-tuned on a regular basis as specific monitoring elements are designed. This became evident during the development of the bioaccumulation monitoring element covering the “Fishable” and “Aquatic Life” uses (see Section 5 of this report). In a series of Roundtable exercises spanning several months in 2005 and 2006, a set of core assessment questions was agreed to as a systematic tool that could be applied to designing monitoring elements for the various water body types and core beneficial uses. These guiding questions and more detailed information on how they were derived are included in Appendix.

One of the most notable outcomes of this exercise was that it became clear to the Roundtable participants that SWAMP cannot and should not be the program that collects all of the data needed to answer all the assessment questions. Data collection efforts conducted by other programs within the Water Boards, such as NPDES, the Irrigated Lands Program, Grants and Loans, the TMDL and Nonpoint Source Programs, and others, should instead be taken advantage of during assessment and reporting to meet the revised monitoring objectives. In addition, it became clear that other departments generate monitoring information that the Water Boards could use to answer questions common to several entities (e.g., the Department of Public Health needs to know if source waters are being protected as much as the Water Boards do). The Surface Water Ambient Monitoring Program could be the place where all data relevant to evaluating water quality condition and trends in beneficial uses are assessed and reported, regardless of whether or not the Program itself generated the data. A graphic depiction of SWAMP’s potential role in program integration is outlined in Figure 4.1.3-1.

Figure 4.1.3-1 Program Integration Opportunities through SWAMP



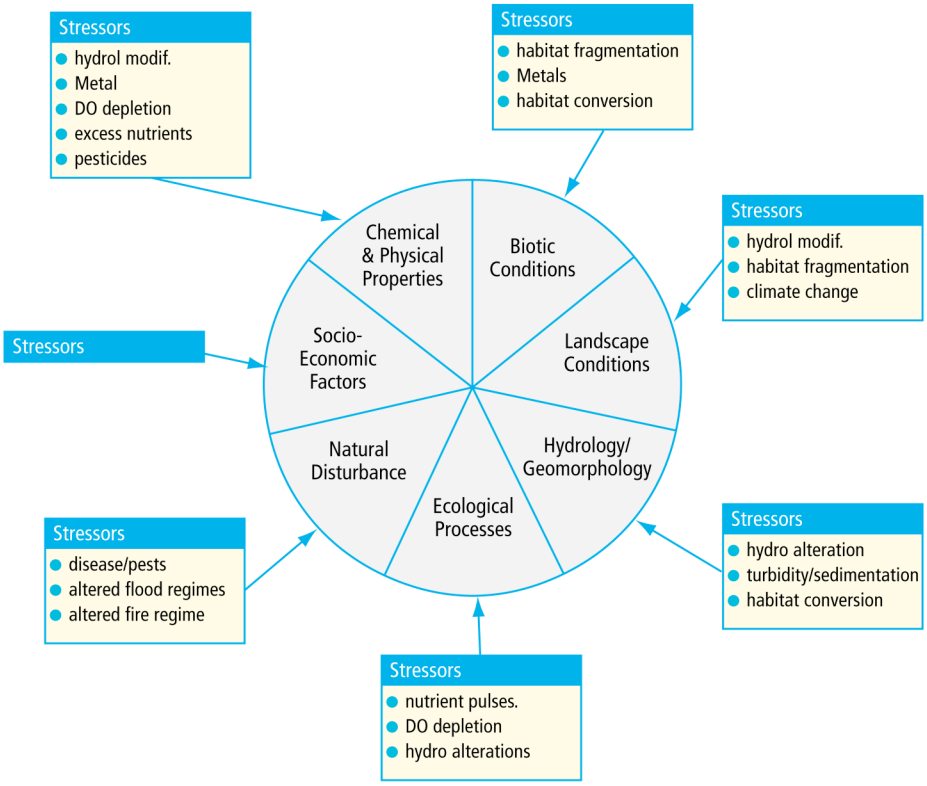
Programs have similar goals (i.e., Protect Beneficial Uses, Ensure Standards are met
Need to link management actions of programs to environmental responses

As SWAMP evolves and responds to emerging management needs and statutory requirements (e.g., Senate Bill 1070, 2006[1]), it can take advantage of several available organizational frameworks that have been widely circulated, customized for a variety of applications, and tested. It should be noted that the Roundtable has not yet gone through a systematic and rigorous process of refining a set of core and supplemental indicators. The indicator set listed in the Strategy is what is currently being used for assessment efforts of the four main beneficial uses. Much of the past and ongoing efforts have focused on developing appropriate indices of biological integrity, focusing on multiple species assemblages and deriving assessment scores for wetlands using a variety of physical habitat, landscape context, hydrological, and biotic indicators (California Rapid Assessment Method for Wetlands, www.cramwetlands.org).

Recently, the 18 Deputy Directors of CalEPA and the Resources Agency that oversee the implementation of the state's Watershed Management Strategic Plan, adopted a Watershed Assessment Framework. It is adapted from the USEPA Science Advisory Board's report "A Framework for Assessing and Reporting on Ecological Condition" (Young and Sanzone, 2002) and modified to include socio-economic attributes (Figure 4.1.3-2). As part of this research contract, staff participated in its development (http://www.watershedrestoration.water.ca.gov/watersheds/downloads/framework/WS_Framework.doc).

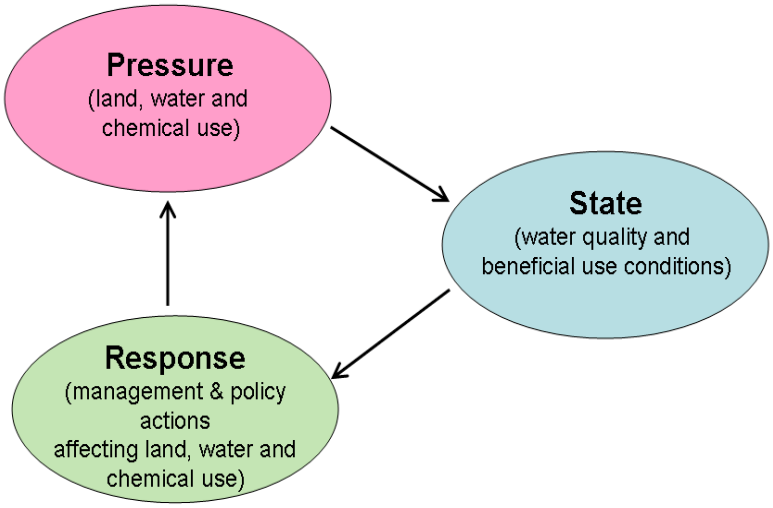
1 SB 1070 provides a mechanism for the public to find information on water quality and related ecosystem health, specifically via the Internet (applies to both data management and easy access); enhance monitoring efforts by increased coordination guided by the California Water Quality Monitoring Council; and demonstrate that programs are in fact effective in addressing issues they are designed for.

Figure 4.1.3-2



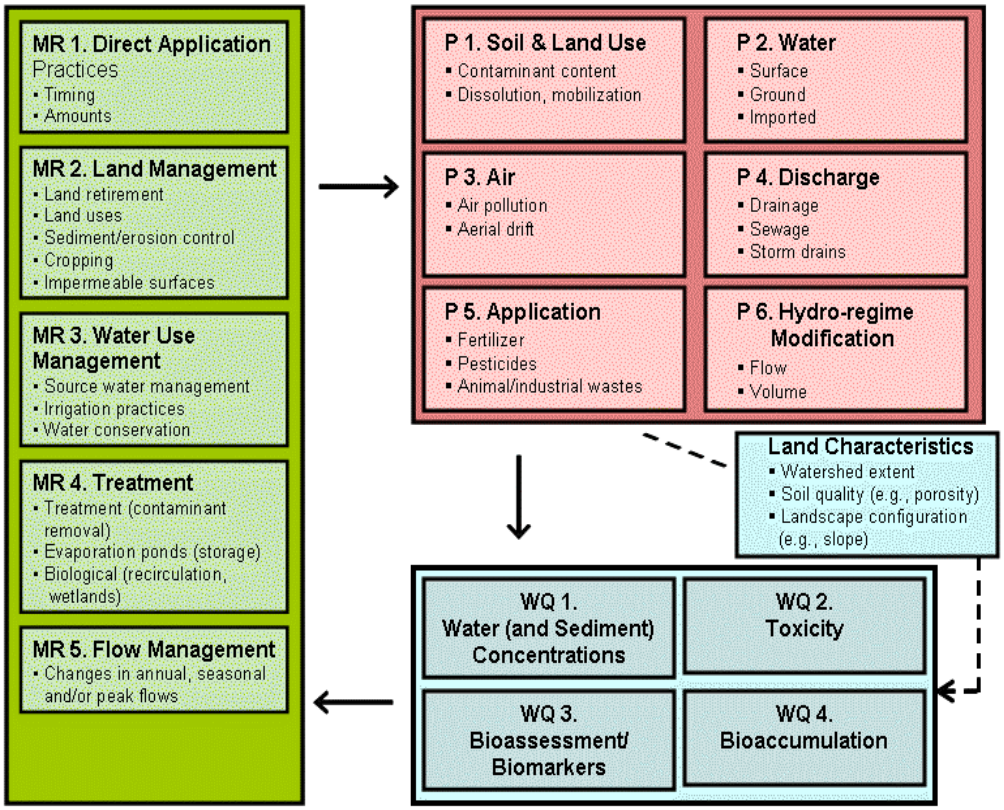
We also evaluated the extent to which another well known organizational framework for indicator selection could be applied to SWAMP – the "Pressure-State-Response" Model (Figure 4.1.3-3) developed by the Organization of Economic Cooperation and Development (1993). Leveraging federal funds through a 104(b) grant from USEPA, SFEI staff and our collaborators selected two test cases in the San Joaquin River basin that were particularly data-rich to demonstrate the utility of certain indicators for a variety of management uses and communication purposes (Jabusch et al. 2007). The full report can be found at: www.sfei.org

Figure 4.1.3-3



The PSR framework is based on a concept of causality: human activities exert pressures on the environment and change its quality and the quantity of natural resources or the condition of beneficial uses (the "state" box). Society responds to these changes through environmental, general economic and sectoral policies (the "societal response"). The latter form a feedback loop to pressures through human activities. In a wider sense, these steps form part of an environmental (policy) cycle which includes problem perception, policy formulation, monitoring, and management/policy evaluation. While the PSR model has the advantage of highlighting these links, it tends to suggest linear relationships and does not account for complex interactions among pressures or how they are reflected in beneficial use conditions. This makes it difficult to differentiate, for example, pressure and state components. Moreover, the PSR model does not account explicitly for natural variability (e.g. hydrology) or unintended water quality consequences of human actions. The model has also been criticized by some for not recognizing the underlying forces (i.e. population growth, consumerism, income inequalities) that lead to environmental pressures, and not recognizing how ecosystem changes impact human health and well-being (Rapport, 2006). Some projects have used modified versions of the PSR model, such as the Driving Force Pressure State Effects Action (DPSEA) model or the Driving Force Pressure State Impact Response (DSPIR) model, to take these factors into account (Kjellstrom and Corvalan, 1995; Smeets and Weterings, 1999). In our San Joaquin basin test case, we discovered that the PSR model, if used in conjunction with the Watershed Assessment Framework, is of value for identifying critical information gaps and as an organizing tool for generating weights of evidence. We also documented that it can be applied successfully in facilitating the evaluation of environmental concerns in relation to the development and subsequently monitoring of environmental policy and management activities (Barker, 2001). Figure 4.1.3-4 shows the PSR Model applied to the San Joaquin Basin example with candidate indicators listed in each of the framework components.

Figure 4.1.3-4

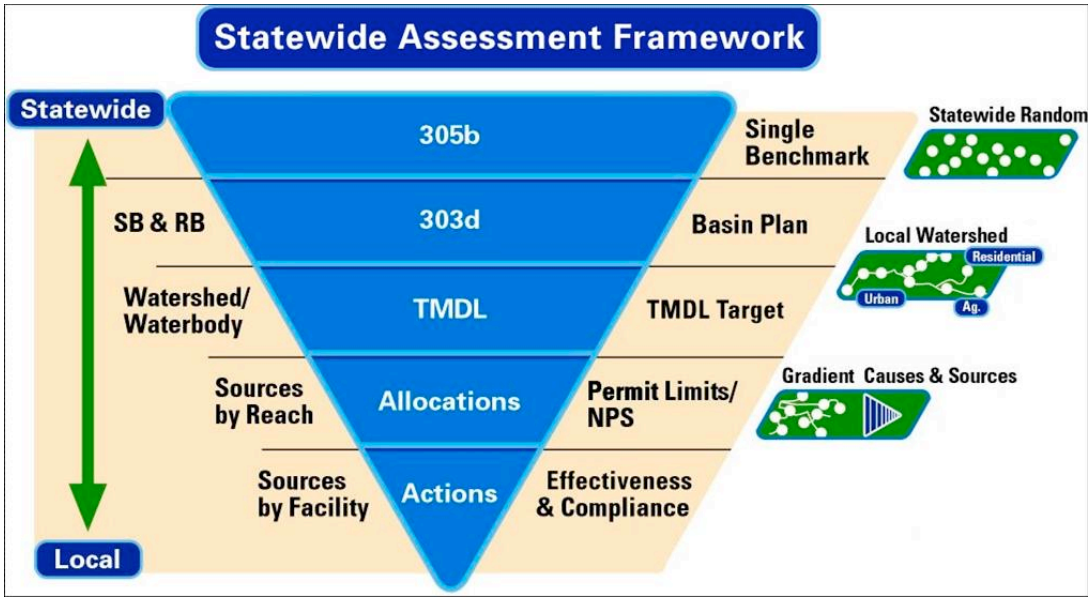


The model broadly categorizes water quality pressures, state, and management responses as follows: pressures (P1-P6, pink boxes) are direct and indirect sources of contaminants as well as other "controllable" factors that affect the amounts of a contaminant delivered to surface waters and the concentration of contaminant in the water. State is the condition of water quality and beneficial uses and is characterized by water quality (concentrations of constituents), toxicity, sublethal effects, and bioaccumulation (tissue levels of constituents) in the water (WQ1-WQ5, blue boxes). Management responses are practices that control the reduction of contaminant loads to waters and/or affect their concentrations in basin waters (MR1-MR5, green boxes). Uncontrollable factors such as ambient temperature or hydrology are omitted from this representation. Land characteristics are shown as a state component (blue) that mediates the link between the pressure and water quality state. While land characteristics affect water quality, indicators for this component were omitted for this demonstration case.

4.1.4
Re-Evaluating and Prioritizing Indicators of Condition, Pressure, and Risks to Chemical, Physical and Biological Integrity of Water

The Roundtable recognized that monitoring design and selection of indicators need be closely tied to the statutory mandates of the Clean Water Act and California Water Code, as described in Section 4.1.3 above. Based on these strategic considerations, SWAMP monitoring priorities in the near future will focus on determining statewide condition and trends for aquatic life in wadeable streams; fish contamination in lakes, bays, and coastal waters;; and to provide a statewide assessment context for regional studies of stressor causes and sources. . Since its inception, SWAMP has considered and incorporated relevant studies into its indicator development efforts. For example, the Program partnered with an ongoing study to develop sediment quality objectives and leveraged resources from the Ocean Standards Unit to eventually incorporate appropriate indicators into the monitoring program. Also, the Roundtable decided to take advantage of the large USEPA and US Fish and Wildlife Service investments in wetland inventories and assessment tool development and included in its assessment "tool box" the suite of wetland indicators already developed and tested as part of the California Rapid Assessment Methodology (www.cramweltands.org). Assessment priorities, will extend beyond the data SWAMP intends to generate itself to include information from other sources, such as the Clean Beaches Initiative, County Health Departments, State Department of Public Health, and others Monitoring designs will supplement regional efforts through appropriate stratification, clustering, proportional probability sampling for status and trends, through clustering regional gradients and networks around probabilistically selected sites from statewide designs, and through integration of regional data into statewide assessments. SWAMP will also be involved in developing criteria for regional assessments to ensure comparability. Figure 1.4-1 depicts the types of designs that are best suited for different spatial scales (from local to statewide) and for the different kinds of "client needs" and statutory mandates.

Figure 4.1.4-1



Indicators considered or implemented so far for monitoring and/or assessing the priority types of water bodies and beneficial uses are identified in Table 4.1.4-1

Table 4.1.4-1

	Beneficial Uses			
Water Body Type	**Aquatic Life**	**Fishable**	**Swimmable**	**Drinkable**
Wadeable Streams	**Benthic Macroinvertebrates, Periphyton, Nutrients, sediment toxicity (for 'integrator' site study)**			
Large Rivers	**Sediment Chemistry, Toxicity, Benthos**	**Body Burdens of Sportfish**	**Pathogen Indicators**	
Lakes	**Sediment Chemistry, Toxicity, Benthos**	**Body Burdens of Sportfish**	**Pathogen Indicators**	
Coastal Waters	**Sediment Chemistry, Toxicity, Benthos**	**Body Burdens of Sportfish**	**Pathogen Indicators**	
sBays / Estuaries	**Sediment Chemistry, Toxicity, Benthos**	**Body Burdens of Sportfish**	**Pathogen Indicators**	
Wetlands	**CA Rapid Assessment Method Indicators; Body Burdens of Sentinel Species**			

4.1.5
Data Management and Information Exchange

The focus of the SWAMP data management efforts is to facilitate generation of consistent data and enable data exchange in California to support assessment and reporting of water quality (including 303(d) and 305(b) under CWA). After a statewide evaluation of the CWA assessment process (1999-2001), SWAMP was directed to collect scientifically defensible surface water data to assess if the state is meeting water quality standards and protecting beneficial uses under the CWA. Monitoring is conducted in SWAMP through master contracts with the Department of Fish and Game and U.S. Geological Survey and Regional Water Board monitoring contracts. The SWAMP data management process initially focused on collaborating with pre-existing data management programs around the state (later named "Data Centers") and working together to develop statewide standards for data formats for contract laboratories.

SWAMP had a rare opportunity to work on a statewide scale with Regional Water Board project managers and analytical laboratories that generate environmental data. By focusing on developing clear analytical and data reporting expectations for projects, during the project design phase, and at the point where data are generated (in the field and laboratory), SWAMP secured the foundation for standard reporting formats, which will make data compilation and environmental assessments for all SWAMP projects comprehensive, comparable, and timely.

As with other program elements, SWAMP took advantage of already existing and emerging processes to collaborate and leverage resources. For example, the Roundtable decided to partner with the Department of Water Resources to develop the federated[1] web services technology of the Bay-Delta and Tributaries project (BDAT) that is part of the National Environmental Information Exchange Network. It also began to integrate data management approaches already established by the Data Centers around the State. SWAMP took the initiative to coordinate these efforts by holding regular meetings with affected entities. The SWAMP Roundtable established a work group that focused on the common goal of making systematically formatted environmental data publicly accessible. This group became known as the CEDEN workgroup (CEDEN, the California Environmental Data Exchange Network, is further described below). While monitoring data funded directly through SWAMP were the initial priority for data standardization among Regions and partners under contract, the workgroup, of which SFEI is a part, articulated a vision for expanding the range of information and data-sharing protocols to include all relevant data across the State. This vision has largely been implemented on an opportunistic basis by combining funds from several projects around the state to build this comprehensive, standardized database system, flexible enough to warehouse many kinds of environmental data around the State. 2007 was the first year that dedicated funds were allocated towards CEDEN.

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1 "A federated database system is a type of meta-database management system which transparently integrates multiple autonomous database systems into a single federated database. The constituent databases are interconnected via a computer network, and may be geographically decentralized. Since the constituent database systems remain autonomous, a federated database system is a contrastable alternative to the (sometimes daunting) task of merging together several disparate databases. A federated database (or virtual database) is the fully-integrated, logical composite of all constituent databases in a federated database system."

The CEDEN workgroup quickly adopted the DWR-BDAT federated (also often referred to as "distributed") database system technology and decided against the option of a centralized database. A federated system made the most sense for a statewide data management and exchange system, because it allows the Data Centers to maintain stewardship over regional data, accommodates flexible database architectures and management processes that serve regional needs, and still provide data to a centralized web service. The workgroup felt it was important to leave the task of project data management as close to the project managers and data generators as possible, so as to maintain the best integrity of the data (Van Alstyne *et al.,* 1994). Each Data Center provides regionally valuable and unique management and data access services related to local project and regulatory needs. By providing a distributed database service, the Data Centers would be able to provide standard data formats to the central federated web services and maintain their individual, regional services.

Without this cooperative vision, and the fact that SWAMP has statewide data management and reporting responsibilities, the sheer magnitude and complexity of this task would have made the coordination and resource leveraging that went into designing and implementing the expanded CEDEN architecture, laboratory reporting processes, and installation of the decentralized Data Center replication services (the federated system) would not have been possible.

The advantages of working collaboratively on a distributed data management system include:

- **Leveraging of data and technology standards.**
  Coordination among different programs towards a common data reporting and access goal provides more resources for building flexible, shared, and comprehensive data management services. A distributed data management system makes if easy to add more Data Centers, as the architecture is accommodating and can support many types of institutional participation. As a result, more information is made available, in standard formats.

- **Reducing the data reporting burden for project managers**.
  Reporting to a regional Data Center fulfills the required state and/or federal data reporting requirements to provide data to the various web services (the networks are linked).

- **Standardized data delivery format for data users**.
  Data users have the advantage of retrieving data from many sources in one consistent format saving a potentially huge task of data compilation and standardization at a later date. By having the web services be the required data repository for SWAMP, state grant, and other monitoring data, more information becomes available for use. By requiring sufficient QA/QC data associated with each project, the user will be able to evaluate if datasets are comparable, and

(http://en.wikipedia.org/wiki/Federated_database_system)

appropriate for answering the management questions being asked. The result is a higher degree of confidence in any given assessment.

- **Ensure appropriate metadata requirements.**
  Datasets/projects loaded into the web services network will be required to provide updated meta-data information to the meta-data server. Summary information about the dataset/project includes: project name, purpose, period of study, contact information, study details, and documentation/data-access information. *This is a pending task and is currently fulfilled by the California Environmental Resources Evaluation System (CERES), at the state level on in opportunistic fashion, based on funding availability.*

The initial charge of the SWAMP data management team at Moss Landing Marine Labs (MLML, Marine Pollution Studies Laboratory) was to coordinate consistent data reporting methods and strategies for improving data sharing, access, and comparability of environmental monitoring information for SWAMP throughout the State. The Water Boards, DWR, MLML, and Data Center staff from around the state worked together to share experience, develop and review database designs, and write standardized guidance and tools for reporting environmental data for the major monitoring efforts around the state. By working closely with the project leads and analytical laboratories, the CEDEN workgroup was able to build a set of analytical and reporting standards that are flexible, well documented, and complete enough to allow data users to evaluate if data from different data generators are comparable and appropriate for use in an environmental assessment of beneficial use and condition or risk assessments.

Technical database support has been provided through collaboration with the DWR-BDAT project[2]. This project already had a complex, federated data management system in place to accommodate the Interagency Ecological Program needs that compiled and standardized some types of environmental data from over 50 data generators in the San Francisco Bay-Delta region, and provided regulators, and the public, access to these data through the internet.

The SWAMP had similar data storage, access, and analytical objectives to the DWR-BDAT project, but on a statewide scale. Portions of the BDAT database were redesigned to include more types of environmental data and QA/QC information, in order to accommodate the variety of monitoring data from the Data Centers. The new system became the core architecture for SWAMP, the Data Centers, and CEDEN.

2 The BDAT project was started by the Interagency Ecological Program (IEP) in 1999 in support of the State Water Project. Data were used in forecast simulations in support of DWR Division of Operations and Maintenance decisions such as: weekly water quality forecasts in support of operating decisions, weekly Real-Time Data and Forecasting reports sent out to the water contractors, modeling and data analysis in support of legal hearings, verifying continued compliance with the objectives set forth in the State Water Resources Control Board's Decision 1641 and Suisun Marsh agreements, and Particle Tracking Modeling of historical conditions in support of the Pelagic Organism Decline research.

The Program's need for standard QA/QC and data reporting formats became a resource from which templates were developed for SWAMP Monitoring Plans and Quality Assurance Project Plans (QAPP) for all projects. These templates provide a standard structure from which to work out data management and analytical details before any samples are collected or data generated. Project sub-contractors receive clearly defined analytical and reporting expectations and are able to report standardized monitoring results in pre-defined electronic templates for the statewide program. Insuring that QA/QC and data reporting formats could accommodate all existing and future data types relevant for evaluating water quality and ecosystem health in a user-friendly way was a large undertaking, especially on a statewide scale.

The CEDEN workgroup and over 80 individual analytical labs worked out a myriad of details for reporting project information, sampling details, analytical results, and associated QA/QC data. The resulting standardized data reporting expectations, used by analytical laboratories around the state, formed the foundation of the SWAMP and CEDEN database structures, and has made it possible to compare project management quality objectives and monitoring results across the state.

The analytical and reporting guidance and tools developed by SWAMP in collaboration with the CEDEN workgroup include:

- **Quality Assurance Management Plan.**
  A statewide guidance document (developed by the SWAMP QA-team) that provides required SWAMP measurement quality objectives (MQOs) for most analytical methods employed by most environmental monitoring programs.

- **Monitoring Plan Template (used for all state grant projects).**
  The template enables grantees to consistently describe the purposes and outcomes of the monitoring project and provides context for how the project might inform local or state environmental management issues.

- **Quality Assurance Project Plan Templates.**
  The templates describe a project's required analytical quality control measures, measurement quality objectives, corrective actions (if warranted), and data reporting expectations.

- **Data Reporting Documentation.**
  The guidance provides detailed descriptions of how to report field and quality assurance data for most kinds of environmental data in the standard SWAMP format for loading into the Electronic Data Deliverable templates and/or the SWAMP databases.

- **Electronic Data Deliverable (EDD) Templates.**
  These are Excel files that contain fields and field descriptions and data reporting standard look-

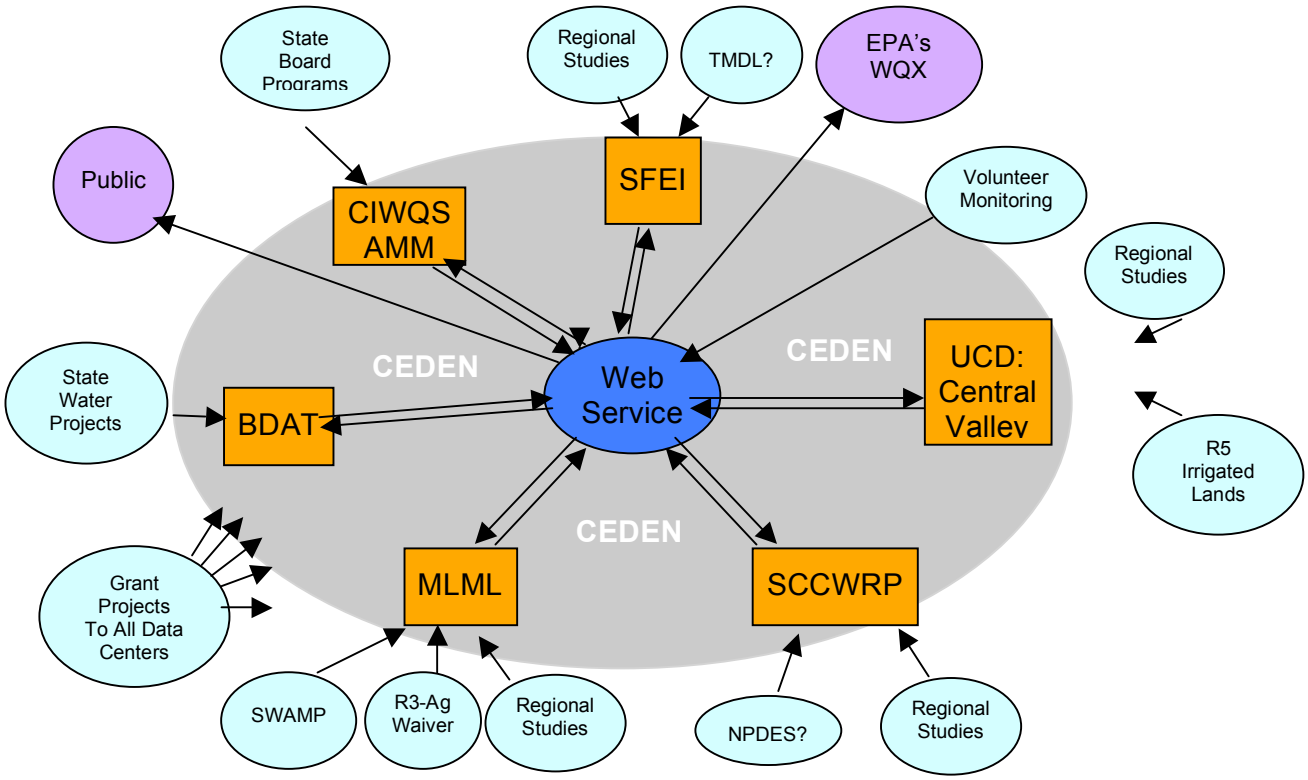
up tables for entering analytical results in SWAMP format. These files are used to load data into the SWAMP and Data Center databases and subsequently into CEDEN.

- **Data Loaders.**
  These are tools developed to assist in verifying and transferring analytical datasets from a laboratory into the SWAMP and/or Data Center databases for final verification, validation, and subsequent transfer to CEDEN.

Where SWAMP-comparability is required in the enabling legislation for bond funding, the State now requires applicable bond-funded grants (e.g. Prop 13, 40, 319(h), and 50, 84 grants) to complete Monitoring and Quality Assurance Project Plans (QAPP) using the SWAMP guidance. These documents must be approved by the State Board's Grant Manager and the QA-Officer prior to implementing any monitoring efforts. The templates include specific analytical and data reporting requirements that ensure that: (1) data can be analytically verified and validated by a data user (they require QA samples to be analyzed with each analytical batch to assess contamination, precision, accuracy, and sensitivity); and (2) data reporting formats are both SWAMP comparable, and (at a minimum) compatible with the California Environmental Data Exchange Network (CEDEN) database format standards.

The California Environmental Data Exchange Network (CEDEN) is a growing statewide cooperative effort of various state departments, regional Data Centers, and non-governmental organizations involved in data generation, use, and stewardship related to water and environmental resources of the State of California. This distributed database system is an expansion of the BDAT project, the National Environmental Information Exchange Network (NEIEN), SWAMP and Data Center coordination efforts and is open to federal, state, county and private organizations interested in sharing data throughout the state (Figure 1).

Figure 1. CEDEN distributed database system (including proposed expansion).



In January of 2003, EPA and USGS signed a Memorandum of Understanding to deliver data from USGS/NWIS (National Water Information System) and EPA's National Water Quality Exchange System[3] (WQX) in a common format to federal, state and tribal organizations as well as to the general public. Cal-EPA funded the DWR-BDAT Project to load data to the WQX. Through this effort, data that are stored in CEDEN are automatically exchanged with the national WQX system (provided that it has all the required elements), making SWAMP and Data Center data available through standardized state and national web service networks (NEIEN). Unprecedented amounts of standardized monitoring data from the California Data Centers will soon be available for use in regional, state, and national assessments.

Several programs, agencies, and educational institutions have collaborated in the SWAMP/CEDEN distributed data management effort: California Resources Agency in partnership with the California Environmental Protection Agency (CalEPA), the Department of Water Resources (DWR), the Water Boards, the Marine Pollution Studies Lab in Moss Landing (where the SWAMP data management and QA/QC teams are housed), UC-Davis, SFEI, and SCCWRP.

The Resources Agency's CERES system (http://ceres.ca.gov/) facilitates the overall process by cataloging the various environmental monitoring programs throughout the state.

3 For current access to these data and information on WQX visit: http://waterdata.usgs.gov/nwis. WQX web services include summary level information, monitoring stations, and results.

The USEPA is working with DWR and the USGS to integrate the state's environmental regulatory data with NEIEN (mentioned above). DWR manages data sharing for CEDEN and provides distribution services to support the EPA's WQX system.

Water Boards: The Water Boards, including the state SWAMP project managers and regional Water Board scientific staff (and contractors) participate in the Data Center and CEDEN workgroups. Through the SWAMP Roundtable, institutional and programmatic needs are communicated to CEDEN so that it may evolve and better adapt to meet changing regulatory and ambient monitoring requirements.

The other entities include the Data Centers:

DWR (Department of Water Resources): is the coordinator of CEDEN, manages data exchanges with WQX, and provides technical support for the implementation of the distributed Data Center data exchange processes among the Data Centers. The DWR-BDAT project is the Data Center for the State Water Project and other related efforts.

MLML (Moss Landing Marine Laboratories): MLML consists of the SWAMP data management team (mentioned above), is the Data Center for all SWAMP-funded projects, and the lead developer/coordinator of the SWAMP database development, documentation, and data reporting tools. MLML is responsible for training SFEI, UC Davis and SCCWRP on how to use the distributed databases and how data are to be merged into CEDEN.

SFEI (San Francisco Estuary Institute): SFEI is a non-profit organization that fosters the development of the scientific understanding needed to protect and enhance the San Francisco Bay and Estuary. SFEI is the Data Center for the San Francisco Bay Area and serves as a regional center for handling, processing and moving environmental monitoring data to CEDEN.

SCCWRP (Southern California Coastal Water Research Project): SCCWRP is a joint powers agency focusing on environmental research in southern California. SCCWRP is the Data Center for Southern California and serves as a regional center for handling, processing, and moving environmental monitoring data to CEDEN

UC-Davis (University of California, Davis - Aquatic Ecosystems Analysis Laboratory): UC-Davis has focused on biological and chemical water quality monitoring that helps State, local, and citizen organizations manage their watersheds through monitoring and analyses of waters, organisms, and habitats. They are the Data Center for the Central Valley Regional Water Quality Control Board's - Irrigated Lands Program and will be the regional center for handling, processing, and moving environmental monitoring data to CEDEN.

Region 3's - Agricultural-Waiver program flows data through Region 3's data management center, to the SWAMP Data Center (at MLML).

Additional Data Centers are emerging, foremost among them a North Coast Data Center at Humboldt State University.

The Data Center groups have been involved in providing advice, review, and collaboration for expanding and improving the database design, and developing the strategic vision for the SWAMP/CEDEN data management and coordination effort.

Each regional Data Center functions as an independent entity in terms of serving the needs of their local data providers and the conveyance of data from these providers. The Bay-Delta region was the first region where local and regional data from several data generators were compiled and formatted consistent with the agreed-upon data formatting standards and loaded into BDAT. The Data Centers are both assisting in updating the SWAMP/CEDEN database design, and redesigning their own regional data management processes and databases to be comparable with the infrastructure and technology of the CEDEN system for efficient data exchange between the Data Centers and CEDEN.

SFEI has participated in the SWAMP data management process since 2002, initially through a Special Study funded by the Regional Monitoring Program (RMP) related to monitoring biaccumulative contaminants in sport fish, and subsequently as an active Data Center and participant in the CEDEN workgroup, as funded by the three-year research contract with SWAMP. The Institute applied SWAMP funding to participate in the SWAMP database development and expansion, the development and implementation of the Data Center concept (as described above), and reformatting existing, prioritized environmental monitoring datasets from San Francisco Bay projects for inclusion into CEDEN to assist in data access for CWA assessments (Table 4.1.5-1). A significant amount of in-kind services (and additional funding) was provided by other SFEI projects in support of developing the SFEI Data Center and reformatting existing datasets into the new SWAMP formats. In-kind services came from the RMP (2002-current), Applied Pesticide Monitoring Program (2002-2004, APMP), and the Fish Mercury Project (2004-current, FMP – a CALFED Ecosystem Restoration Program Grant 2004: ERP-02D-P67).

Table 4.1.5-1 Databases from the following programs are being reformatted into the Data Center database formats and will be available through the SFEI Data Center and CEDEN as they become finalized.

RMP Status and Trends Data (1993-2006)

The Regional Monitoring Program for Water Quality is SFEI's largest program and monitors contamination in the Estuary. It provides water quality regulators information they need to manage the Estuary effectively. The RMP is an innovative collaborative effort between SFEI, the Regional Water Quality Control Board, and the regulated discharger community.

	No. Stations	No. Samples	Sampling Frequency	No. Parameters	No. Sample Results In Database
Water Chemistry	158	760	1-2x annualy	209	164,000
Sediment Chemistry	188	630	1-2x annualy	193	87,300
Bivalve Bioaccumulation	19	300	1-2x annualy	169	35,500
Toxicity (Water & Sediment)	77	440	1-2x annualy	19	1,600
QA Samples					305,600
Total					**594,000**

SWAMP Bioaccumulation Review Data (1970s-2005)

This database was compiled in support of the development of an improved bioaccumulation monitoring program for California through SWAMP. Data included in this database were compiled from three statewide bioaccumulation monitoring programs: the Toxic Substances Monitoring Program, State Mussel Watch Program, and Coastal Fish Contamination Program.

	No. Stations	No. Samples	Sampling Frequency	No. Parameters	No. Sample Results In Database
Tissue Bioaccumulation (various species and studies)	1846	4698	various studies	460	406,000
Total					**406,000**

PRISM (2004-2005)

The purpose of this study was to investigate potential sediment toxicity to freshwater and estuarine amphipods to sediments from six tributaries around the Estuary whose land uses include varying combinations of urban and agricultural practices

	No. Stations	No. Samples	Sampling Frequency	No. Parameters	No. Sample Results In Database
Sediment Chemistry & Toxicity	12	24	2x	172	5,700
QA Samples					4,300
Total					**10,000**

Aquatic Pesticides Monitoring Program (APMP) Data (2002-2004)

The Aquatic Pesticide Monitoring Program (APMP) is conducting a monitoring study to determine the fate and potential impacts of aquatic pesticides on beneficial uses in aquatic systems throughout the State of California.

	No. Stations	No. Samples	Sampling Frequency	No. Parameters	No. Sample Results In Database
Water	65	360	1 to 7x	81	1,300
Sediment	81	180	1 to 7x	27	2,000
Toxicity (Water & Sediment)	176	260	1 to 3x	4+	3,900
QA Samples					4,000
Total					**11,200**

4.1.6 Communication and Reporting

While the 2000 Report to the Legislature clearly identified the importance of making monitoring information publicly available, resources during the first few years of implementing SWAMP were primarily directed toward data generation and establishing a data management and quality assurance system that would make data from different sources easily accessible and comparable. The program re-tooling and prioritization process, beginning in 2005, included an effort to clearly identify target audiences and information "clients." The 2006 SPARC review, in particular, provided specific guidance based on their assessment that "…there is no consistent set of clients or audiences for the SWAMP products across all regions that can support the program and provide guidance on its future structure and direction. In addition, there are elements of the SWAMP monitoring efforts that, because they have no clear link to structured assessment or decision-making processes, have no readily identifiable audience or user." Legislation enacted since the initiation of the program in 2001 added another client base by requiring a large number of grant projects to comply with the SWAMP quality assurance and data management standards. Institute staff assisted in the development of a draft communication strategy based on the lessons learned over the past 15 years of the San Francisco Estuary Regional Monitoring Program for Water Quality, which has its own communication strategy. Key communication and outreach objectives for consideration by the SWAMP Roundtable included:

- Develop useful and consistent products targeted to defined clients
- Users of data and information understand SWAMP goals and program elements
- Clients endorse and support the program
- Develop and maintain a "signature" look for products that is recognized by clients
- The SWAMP staff and Roundtable participants are able to communicate the program's key messages in a comprehensive and consistent manner
- Data, information, and other SWAMP products are accessible and available in a timely manner

Several client groups were defined that had different, yet often overlapping, information needs. The overarching client is the public at-large, while recognizing that the best way to serve the public is to generate the information needed by Water Board program staff and dischargers to effect "change in behaviors" and improve water quality protection. Other client groups include US EPA (requiring monitoring information to report to Congress on the efficacy of Clean Water Act programs); the State Water Resources Control Board (for clean water program evaluations, standards development/adjustments); Regional Water Quality Control Boards (for program implementation tracking, permitting decisions); the regulated community (for adjustments in their own clean water programs, pollution prevention and reduction efforts);

other departments with statutory responsibilities related to public health and natural resources; grant recipients (for technical guidance, data access, interpretation, quality assurance); the state legislature (for high-level evaluation of policy performance related to clean water and healthy ecosystems and informed fiscal decisions and environmental policy development); and environmental stewardship and advocacy groups (for tracking efficacy of public expenditures and environmental outcomes).

Program products to be directed at these client groups range from technical reports, training courses and workshops, databases, web pages, and possibly decision-support tools, such as GIS-based modeling systems, forecasting tools, and "desktop watersheds" - virtual watersheds for scenario-planning and simulating anticipated effects of land and water use changes and risks to beneficial uses.

The consultant team that contributed to the communication elements of the SWAMP "business plan" worked with the SWAMP Roundtable following the SPARC review to implement the following actions:

- Provide a consistent SWAMP "look and feel" of technical documents, fact sheets, and web content
- Develop a series of fact sheets
- Publish a series of "signature" reports
- Publish a 2006 305(b) report (statewide water quality assessment)
- Revise the Quality Management Plan
- Finalize bioassessment and habitat assessment protocols

4.1.7 Programmatic Evaluation, General Support, and Infrastructure

Revising SWAMP's decision-making, scientific review, and coordination infrastructure was one of the task areas that the SPARC emphasized for SWAMP to become more effective in meeting its objectives and program goals. The State Water Resources Control Board introduced the Surface Water Ambient Monitoring Program in 2001 to meet Clean Water Act requirements and provide comprehensive information about the status of, and trends in, beneficial uses of California's surface waters. Furthermore, ambient monitoring information is designed to assist in evaluation and reporting the outcomes of tax-payer supported investments in the protection and restoration of watershed processes, functions, and valued natural resources. Monitoring is necessary to assess whether the goals expressed in the federal Clean Water Act and the California Water Code are being met and if not, whether policies and management actions designed to restore beneficial uses are effectively doing so. In addition, SWAMP recognizes the importance of coordination with other governmental and non-governmental entities, to stretch limited monitoring resources. Several challenges became apparent relatively early in the program, which included the lack of a consistent, statewide assessment framework (e.g., each Regional Water Board had different

criteria for listing water bodies as impaired), whole parts of the state had no data, and regional inconsistencies existed in sample collection, analysis, and quality assurance, thereby making data comparisons and statewide inferences difficult.

As part of SWAMP's triennial review and the California Environmental Protection Agency's effort to assess and enhance the scientific validity and the role of science in all agency programs, managers at the State Water Board convened a Scientific Planning and Review Committee (SPARC) in 2005. This external review committee held two workshops and submitted recommendations for how to improve the program in spring of 2006. The recommendations, based on the following findings of the SPARC, provided the impetus for drafting this strategy for improving the decision-making, review and coordination aspects of SWAMP.

- The SWAMP does not take advantage of available resources and existing programs.
- Decision-making and prioritization processes are inadequate for the challenges facing the SWAMP.

While all SPARC recommendations are interconnected to varying degrees, the SWAMP "Roundtable" members, comprised of State Water Board staff, Regional Water Board liaisons, and primary contractors, decided to develop individual strategies and work plans for implementing groups of closely related recommendations. The primary goal of this work effort was to *improve the organizational structure and review processes* for SWAMP with the following objectives:

- Identify means to develop strong connections with other local, regional, and state programs.
- Develop mechanisms for frequent extramural advice and evaluation.
- Build on the rich history of monitoring and assessment programs elsewhere.
- Revise existing management structure and decision-making and align it more closely with new program goals and approaches.

Our work with the SWAMP Roundtable and the SPARC began to address Elements 9 and 10 (Programmatic Evaluation and General Support and Infrastructure) in the USEPA guidance for implementing Section 106(e)(1) of the federal Clean Water Act (see Section 6 below). The SPARC identified five areas needing improvement that have ramifications for managing the program and allocating the appropriate resources to achieve desired outcomes:

10) The program lacks a formal infrastructure and processes to develop a statewide strategy and align the regions toward common program goals.

11) The program lacks policies and program direction when consensus-based decision-making breaks down.

12) The program's creativity, healthy opportunism, and the regional coordinators' ability to work

independently are valuable traits that should be protected, but they are inadequate for the program to have a more substantive impact, both at the state, as well as the regional and local levels.

13) No formal review process exists for evaluating if special studies and pilot projects are on track to achieve their goals, and little outside expertise and experience is brought in.

14) No systematic program-level approach exists to take advantage of large-scale monitoring efforts, and no infrastructure is readily discernible for collaboration, coordination, and integration with other monitoring programs and diffusion of ideas and insights.

Program Stakeholders

As an integral part of "Adaptive Management," SWAMP is envisioned to provide information about water body condition throughout the state to enable program managers and policy-makers to adjust and improve their responses to undesirable conditions and trends in beneficial uses. After the passage of the most recent Bond Acts, all grant recipients are required to produce "SWAMP-comparable" data, although no resources were dedicated to SWAMP to assist grant recipients to meet this requirement. Increasingly, NPDES permit holders and those regulated under Waste Discharge Requirements are also being asked to ensure that their monitoring data are SWAMP-comparable. Stakeholders of the program therefore include not only the nine Regional Water Boards and the State Water Board, but also public and private entities regulated under the Clean Water Act and the California Water Code, grant recipients, and the tax-paying public as a whole. As information provider to various audiences, SWAMP needs feedback from those it is intended to serve as to its relevance and information value. At this time, no formal mechanism exists for the various stakeholder groups to participate other than through Water Board-sponsored workshops and public hearings.

Shortly after passage of Assembly Bill 982, the State Water Board formed a Public Advisory Group (AB 982 PAG) that was comprised of a broad range of stakeholders comprised of the regulated community and environmental interest groups. This advisory group was formed to assist in the evaluation of program structure and effectiveness in matters related to the implementation of Clean Water Act section 303(d) requirements and other applicable regulations, as well as other monitoring and assessment programs. The PAG has not met since July 2003.

In September 2005, the U.S. EPA commented on the State's recently updated Monitoring Strategy, which follows the ten elements outlined in EPA's Guidance Document for the states' water quality monitoring and assessment programs. The roadmap outlined here begins to address the annual work plan requirements for Elements 9 and 10 of California's Surface Water Monitoring Strategy.

The Program identified six groups of "key clients" (see also Section 4.1.6 above), which could be defined as stakeholders in the program's success, its direction, and relevance.
They are:

15) U.S. Environmental Protection Agency (US EPA)

16) State Water Resources Control Board and staff

17) Regional Water Quality Control Boards and staff

18) Regulated Community

19) The Public (represented by legislators and often by environmental interest groups)

20) Grant Recipients

An additional group of stakeholders are represented by natural resource and public health trustee agencies and organizations that generate their own information relevant to addressing SWAMP objectives, or that use SWAMP information to develop their own programs and projects. All of these stakeholder groups are both potential information users of, and information contributors to, SWAMP and have an interest in helping shape decisions at three general levels of program detail outlined below. The target stakeholders, or clients, use SWAMP-generated information at different levels of detail for several purposes. These include:

21) Adjusting existing policies and programs or developing new ones based on science;

22) reporting to Congress and the State Legislature on environmental outcomes of water quality programs,

23) long-term and cumulative benefits of water quality attainment strategies in which the regulated community participates,

24) cumulative benefits of individual grant-funded beneficial use restoration and protection projects, and

25) providing accountability measures to the public.

The Roundtable further refined the audiences for various products SWAMP either directly generates or adds value to. By starting with statutorily required products, the Roundtable identified types of communication and information vehicles appropriate for each “link” in a client “chain.” For example, while Water Quality Assessment - 305(b) –Reports have the congressional representatives of the “general public” as the ultimate “client,” the initial link in the client chain is represented by SWAMP staff at the Water Boards, who use 305(b) reports to re-assess monitoring priorities and any necessary program adjustments. The next link in the chain might be represented by those who will place the narrative information in a geo-referenced context to better link water quality data to spatially defined water bodies. Thereafter, USEPA becomes the next link in the “client chain,” adding further value for use by policy-makers. Each product SWAMP generates may have slightly different links in the client chain, such as the “Impaired Waters List,” which also includes regulated and non-regulated dischargers affecting the integrity of water.

Program decisions tend to happen on three general levels:

26) Evaluation of monitoring program performance (has the program been effective at meeting goals?) and periodic adjustments to program goals and the associated assessment questions designed to inform management decisions.

27) Prioritization of annual work plan element and thus translating an overall monitoring strategy into concrete milestones.

28) Working out the technical and scientific details to keep the program relevant.

Four key roles of SWAMP have been identified that the Program has not adequately fulfilled since its inception. These are**:**

29) to take advantage of existing monitoring programs and to coordinate with them;

30) to conduct monitoring and assessment activities in areas where other monitoring programs do not generate information relevant to SWAMP;

31) to provide consistent guidance on data collection, analysis, and assessment at the local, regional, and state levels; and

32) to represent the place where all Water Board programs (TMDL, Waivers, NPDES, 401, etc.) obtain the necessary information to assess program effectiveness in terms of environmental outcomes.

Implementing the SPARC recommendations for improving review and advice, as well as decision-making processes listed below, are a key mechanism for effectively fulfilling these revised roles for SWAMP.

- Sufficient leadership and authority need to be invested in the SWAMP management team to align the regions toward common goals and to provide program direction in cases when consensus-based decisions cannot be obtained.
- Roles and responsibilities need to be clearly defined for all three decision levels in terms of how decisions are arrived at, what advice and review functions need to be filled by various stakeholder and expertise categories, and how decisions are documented and communicated.
- Initiative, creativity, and flexibility are important features for SWAMP to retain and enhance.

Implementing improvements to the technical review and organizational structure could happen in a manner depicted in Figure 4.1.7-1.

Proposed Organizational Structure and Functions

Figure 4.1.7-1 suggests what kind of organizational structure might insure that SWAMP becomes a more effective and integral part of performance-based management. The accompanying legend details proposed technical and scientific review and programmatic decision-making mechanisms and how to enhance visibility and relevance of SWAMP to Water Board programs (both within the State Water Board and among Regional Water Boards) and provide consistency among Regions through a statewide assessment framework. The proposed organizational structure indicates that effective implementation of SPARC recommendations to meet coordination, collaboration, and communication functions will require additional staff resources. It corresponds with the three levels of program decisions listed above and elevates the visibility of SWAMP as an important tool in performance-based management and its use in decision-making – both at the regional and statewide levels. The existing and emerging regional monitoring efforts (e.g., Southern California Bight, San Francisco Estuary RMP, Central Coast Ambient Monitoring Program, Sacramento River Watershed Program, San Joaquin, and Klamath River Monitoring Programs) can assist with coordination functions that cannot be achieved at a statewide level. However, the SWAMP organizational structure will have to accommodate communication and coordination requirements to take advantage of these regional efforts.

Figure 4.1.7-1 Envisioned Organizational Structure of SWAMP

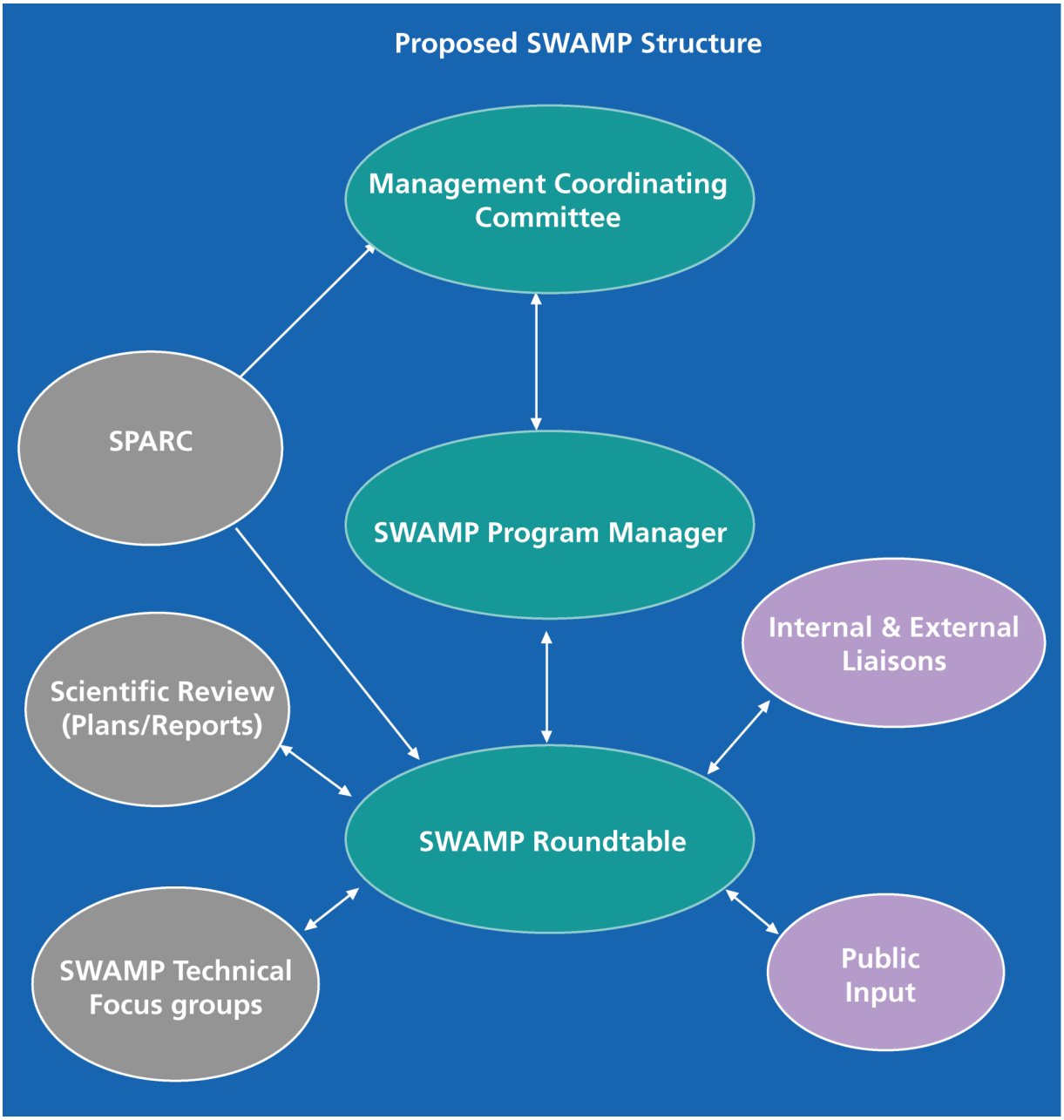


Figure 4.1.7-1 Legend:

MCC:

Management Coordination Committee – Executive staff from SWRCB and Regions. Considers SWAMP-related items when direction is required and addresses issues such as implementation of SPARC recommendations and setting general direction and goals for SWAMP on an as-needed basis. Assists SWAMP Program Manager in responding to legislative requests, justifying budgets, and conveying accomplishment of performance goals. When needed, reviews and formally endorses recommendations developed by the Roundtable, Technical Focus Groups, the Scientific Review Committee, the Internal and External SWAMP Liaisons, and appropriate stakeholder committee(s) yet to be established ("Public Input" bubble in figure). Recommendations to be endorsed by the MCC may include annual monitoring and study goals, priorities, and work plan content within the context of the statewide Surface Water Monitoring Strategy. Works with SWAMP manager to identify statewide needs, evaluates how regional priorities match, and identifies cross-programmatic resource efficiencies and needs. Endorses and champions budget change proposals, communicates with legislative staff, and evaluates funding options and program shifts based on resource allocations. Elevates SWAMP visibility, causes alignment of Regional Board and State Board program activities based on SWAMP information. Assists Program Manager in carrying new initiatives to legislature, EPA Water Division Chief, and Deputy Directors implementing Watershed MoU.

SWAMP Manager:

Directs day-to-day operations, supervises and coordinates activities of Roundtable Members and insures alignment of program activities between State Water Board and Regional Water Boards. Directs and organizes activities of Technical Focus Groups, Scientific Review Committee, the Internal and External SWAMP Liaisons, and appropriate stakeholder committee(s). Represents the main communication and information link between scientific and technical review and stakeholder groups, and the MCC. Program Manager has the ultimate decision-making authority in cases where consensus either within or among committees has not been achieved.

SWAMP Roundtable:

Conducts day-to-day coordination of monitoring, communication, tech transfer, and collaborative activities among Regions and SWAMP Headquarters in close collaboration and consultation with regional stakeholder and information client groups (dischargers, environmental interest groups, natural trustee agencies, watershed stewardship groups, etc.). Develops, reviews, and adjusts initial work plans internally, insures alignment of communication messages, develops new initiatives, products and tools. New: Interacts and communicates with stakeholder/client committee(s) yet to be established (see "Public Input" bubble in figure). Identifies and encourages stakeholder input at SWAMP MCC level (action alerts and MCC agenda recommendations). Develops annual advice and review schedule, plans and implements communication and reporting venues, such as the SWAMP Annual Meeting, web site and newsletter content, etc. – all in consultation with the appropriate level of stakeholder/client input. Directs activities of SWAMP Data Centers representing regional assistance centers for data and metadata management, initial data screening for quality assurance and control purposes, and data transfer and exchange.

New – California Water Quality Monitoring Council:

As SWAMP becomes more integrated into the Water Board's program structure, the broad range of information users interested in how SWAMP is informing policies and programs will need a mechanism for input and advice. Influencing management and policy adjustments may follow the successful models of the guidance committees of regional monitoring programs throughout the State, comprised of a broad range of information users and information generators (clients). Examples of these guidance committees are those of the Sacramento River Watershed Program, the RMP, CCAMP/SIMoN/CCLEAN, and the Southern California Bight Program that can be found on the programs' websites. Also, with the passage of Senate Bill 1070 in 2006, a Memorandum of Understanding was signed by both CalEPA and Resources Agency Secretaries to establish a California Water Quality Monitoring Council that will guide the implementation of SB 1070. This Council may endorse and provide the broad-based support of budgets and priorities, and leverage resources of other programs. The Council could take the place of the "place-holder" bubble in Figure 1, entitled "Public Input."

New - Scientific Review Committees:

Comprised of recognized scientific and technical experts from "client"/stakeholder groups and academia. Scientific Review Committees are convened to review monitoring plans and reports and combine the expertise and experience of individuals who together can represent the range of interdisciplinary knowledge of the variety of issues and challenges that converge in a complicated issue, a specific region (e.g., the Delta), or a circumstance where multiple issues interrelate. It is expected that many of these individuals will or will have participated in detailed analyses of narrower issues (e.g., on the Technical Focus Groups). Thus these committees will bring to bear expertise on SWAMP's most complicated and many-faceted issues, and bring continuity to that effort. The SRCs will be composed of experts appointed by the SWAMP Program Manager in collaboration with the Roundtable. Either the whole committee or members thereof review, advise, provide insights, and raise questions that help the Water Board anticipate upcoming issues; evaluate scientific practices or issues; and help develop scientifically sound programs to complement actions. The Committees provide feedback on program elements, such as data management, monitoring network design, and bioassessment, review work plan content developed by the Roundtable, and help identify appropriate means of implementing studies (competitive bidding, directed action). Committee members may be paid but may participate in studies or projects where those activities do not directly conflict with any specific advisory or review role.

Technical Focus Groups
New - **Internal Program Liaisons** are SWAMP staff capable of interfacing with Water Board program managers and their staff to identify critical decision points as new information is released that has policy implications or justifies adjustments in monitoring and information management approaches (e.g., listing/de-listing criteria, need for site-specific objective development, development of tiered aquatic life uses, development of sediment quality objectives, adjustments in water diversion permitting approaches, wetland and riparian habitat protection policies, adjustments to site-specific or watershed-based monitoring approaches).
New - ***External Program Liaisons*** can be the same staff as Internal Liaisons. They need to: (1) interface with the 18 departments implementing the Framework for Protecting California's Watersheds, and the CalEPA, Resources Agency, and Department of Public Health representatives implementing SB 1070, (2) communicate pertinent SWAMP information to higher levels, (3) identify information-gathering synergies between other State monitoring and assessment programs, such as the Department of Public Health's Source Water Monitoring Program, the Department of Fish and Game's Resource Assessment Program (Wildlife and Habitat Conservation Planning Branch), CALFED, and the Department of Forestry and Fire Protection's Fire and Resource Assessment Program, and (4) inform the activities of the Monitoring Council.
SPARC: Scientific Planning and Review Committee is a blue-ribbon panel of experts at the interface of science, management, and policy, charged with reviewing programmatic goals, relevance, accomplishments and challenges of SWAMP on a three- to five-year cycle. The SPARC reports to the MCC and interacts with the SWAMP Roundtable.

Almost all suggested steps for improving the organizational structure were implemented. In addition, formal procedures were put in place for more rigorous review of annual work plans, proposed special and pilot studies, and key reports.

4.2 Review of Bioaccumulation Database and Assessment of Trends

A substantial portion of this research contract was dedicated to a comprehensive review of bioaccumulation monitoring data generated under three historic State Board programs (the Toxic Substances Monitoring Program, the State Mussel Watch Program, and the Coastal Fish Contamination Program) and other major bioaccumulation studies since 1970. This effort resulted in a stand-alone report that was drafted, revised in response to comments from stakeholders and peer reviewers, and finalized in October 2007. As recommended by the SPARC (see Section xxx of this report), it will be published as a "signature" SWAMP product in 2008 (Davis et al. 2008. Bioaccumulation of Pollutants in California Waters: A Review of Historic Data and Assessment of Impacts on Fishing and Aquatic Life. California State Water Resources Control Board, Sacramento, CA). A concise summary of this review is included here to place it in the context of Monitoring Strategy implementation.

The objective of the bioaccumulation review was to evaluate how well the historic data from the State Board programs and from other major monitoring efforts since 1970 address the revised monitoring objectives of SWAMP and the assessment questions that were an outgrowth of the 2005 SWAMP workshop. This exercise has provided a substantial amount of information about present and historical impacts of pollutant bioaccumulation on fishing and aquatic life in California, to what extent certain

bioaccumulative pollutants have changed over time, and also highlights areas where improved sampling approaches can better address the assessment questions.

Net Impact of Pollutants on Fishing

Present concentrations of pollutants in many California water bodies are high enough to cause concern for possible effects on human health and to have a significant impact on the fishing beneficial use. Consumption advisories, 303(d) listings, and the bioaccumulation database as a whole provide three indices of the status of this impact. Consumption advisories exist for an increasing number of water bodies, but these represent only a fraction of the areas likely to need them. Lack of suitable data is a major impediment to developing advice for additional water bodies and communicating that advice to those segments of the fishing public that is exposed to pollutants. A USEPA evaluation of the 2002 303(d) List indicated that large portions of the state had not been assessed, especially rivers and coastline. Most of the lake area in the state (61%) had been assessed, and a relatively small percentage of the area (6%) was classified as impaired. Assessment of lakes, however, has focused primarily on the largest lakes, leaving the vast majority of smaller lakes unsampled. Many of these lakes are near population centers and are popular for fishing. Bays and estuaries had been thoroughly assessed (98% of the area) and 93% of the total area was impaired.

Evaluation of the most recent monitoring data (collected from 1998 – 2003) indicates that, for the locations sampled, 32% had low concentrations of pollutants, 42% had moderate concentrations, 18% had high concentrations, and 8% had very high concentrations **(Figure 1).** Concentrations in the low category are in a range where consumption is generally encouraged by the California Office of Environmental Health Hazard Assessment (OEHHA) (Klasing and Brodberg 2006). OEHHA is the agency responsible for managing health risks due to contaminated sport fish in California. Concentrations in the very high category are in a range where OEHHA discourages consumption (Klasing and Brodberg 2006). Lakes assigned to the moderate,high, or very high concentration categories were primarily affected by mercury, with PCBs also playing a lesser role.

Impacts of Specific Pollutants on Fishing and Aquatic Life

Mercury

Mercury contamination is common in California aquatic food webs, affecting both the fishing and aquatic beneficial uses in many areas of the state, with long-term trends indicating little change over the past few decades. Large regions of the state contain fish moderate, high, or very high concentrations of mercury. Twenty-three of the 298 locations (8%) sampled from 1998 – 2003 had a species with a median mercury concentration above 0.9 ppm, placing these sites in the very high category (Figure 2). Another 68% of the locations sampled from 1998 – 2003 had mercury concentrations in the moderate and high categories. Only 24% of the locations had concentrations in the low category. The number of locations with high or very high concentrations was greatest in the San Francisco Bay-Delta, Central Valley, and surrounding areas. The few good time series available for mercury in sport fish showed no clear trends

over the past three decades. Thus, the available evidence supports the hypothesis that the mercury problem may take decades to be resolved. TMDL implementation actions, mine clean-ups, and consumption advisories are important management actions that may improve the situation over different time-scales. Large-scale wetland restoration has the potential to exacerbate the mercury problem by increasing production of methylmercury, the most toxic and readily accumulated form. In the region with the most data regarding impacts on aquatic life, the San Francisco Bay-Delta, impacts on wildlife populations, including endangered species, from mercury contamination appear likely.

Other Persistent, Bioaccumulative Pollutants

Polychlorinated Biphenyls

Polychlorinated biphenyl (PCB) bioaccumulation in aquatic food webs in California has declined significantly since production was banned in the 1970s, but this persistent pollutant continues to have a negative impact on fishing and aquatic life in many parts of the state. Sport fish monitoring at 251 locations from 1998 – 2003 found that 4% of the locations had a species with median concentrations above 270 ppb, placing them in the very high concentration category (Figure 3). Thirty percent of the locations sampled had PCB concentrations in the moderate or high concentration categories. Most (66%) of the locations sampled had concentrations in the low category, with median concentrations for all species analyzed below 30 ppb. PCB concentrations in some areas also appear to be high enough to cause adverse impacts in wildlife. Concentrations are highest in water bodies near major urban centers, including the Bay Area, Sacramento, Los Angeles, and San Diego. PCB concentrations in San Francisco Bay are particularly high and appear to be unusually persistent. In general, PCB concentrations are steadily declining across the state (Figure 4). The 1979 ban on PCB sale and production and other regulations relating to disposal of PCBs appear to have generally been effective at reducing the impact of PCBs in California water bodies. In some locations, however, particularly San Francisco Bay, recovery from PCB contamination may take many decades.

DDT

Recent sport fish monitoring data (1998 – 2003) indicated that DDT concentrations in the vast majority of the state (249 of 252 locations sampled) were in the low concentration category, and, thus, are having little impact on fishing. Concentrations of DDT in aquatic food webs across the state have generally shown significant declines over the past 30 years in response to the use restrictions and federal ban in 1972. Prior to these management actions, DDT had severe impacts on populations of aquatic birds on the California coast, including brown pelicans and double-crested cormorants. These populations have rebounded in response to the decline in DDT contamination, though concentrations still remain above thresholds for concern in some cases. Long-term trends in sport fish from the Imperial Valley (Salton Sea) region indicate consistently high DDT concentrations during the last 20 years. The DDT ban has not been as successful in reducing concentrations in this region. Agricultural and urban runoff were the primary historical sources to California water bodies.

Dieldrin

Recent sport fish data indicated that dieldrin concentrations in most areas of the state (238 of 244 locations sampled) were in the low category and having little impact on fishing. Concentrations of dieldrin in aquatic food webs across the state have generally shown gradual declines over the past 30 years in response to use restrictions and the federal ban in 1987. Dieldrin concentrations in food webs have also generally been below thresholds for concern for impacts on aquatic life. Long-term trend monitoring in sport fish from the Imperial Valley (Salton Sea) region indicates only a recent decline. Overall, the dieldrin ban has been successful in reducing concentrations and impacts across the state, with locations of higher historical contamination improving more recently. Agricultural runoff into California water bodies has been the primary historical source of this pollutant.

Chlordane

Chlordane concentrations in all areas of the state (238 locations sampled) were low in recent sport fish sampling, and, thus, not impacting fishing. Chlordane concentrations measured in food webs have also been below thresholds for concern for impacts on aquatic life. Chlordanes have not been as persistent as other legacy pesticides. Dramatic declines in chlordanes were evident immediately after the 1988 ban. Long-term trend monitoring in sport fish across the state also indicates declines in chlordane concentrations. The chlordane ban has been quite effective in reducing impacts of this insecticide. Agricultural and urban runoff were the most prominent pathways for transport into California water bodies.

The review and data assessment documented the successful management of many pollutants that posed serious threats to wildlife and human health in the 1970s and 1980s. These programs were instituted just in time to document the rapid improvements in water quality that resulted from bans on PCBs and legacy pesticides, reductions in metals due to wastewater treatment, and other improvements. Many instances of severe contamination were identified, leading to clean-up actions and fish advisories to reduce exposure of humans and wildlife. These programs and other studies greatly advanced scientific understanding of bioaccumulation in California.

However, the dataset generated by the State Board bioaccumulation monitoring programs has several limitations with regard to answering the questions that are currently high priorities for water quality managers:

- many areas were not sampled adequately, including areas with significant fishing activity;
- the distribution of sampling locations varied over time;
- most of the sampling, though focused on sport fish, was not tailored to the development of consumption advice;
- the dataset was also not tailored to evaluation of risks to piscivorous wildlife through monitoring of prey species;

- long-term time series for detecting trends in sport fish or other wildlife contamination were lacking; and
- much of the sampling was biased toward characterization of polluted areas and tracking their recovery.

The evaluation performed in this report makes it evident that a sampling design that includes spatial randomization would be better suited to answering the SWAMP assessment questions related to statewide condition. Such a design would allow for an unbiased overall assessment of the condition of California water bodies. Indices of net impact during different time intervals would be directly comparable, since all areas would be sampled in a representative manner. A randomized design could be developed that samples different locations in proportion to the amount of fishing activity, an important feature with regard to development of consumption advice. A randomized design could also be augmented by other approaches, such as targeted sampling for long-term trends in particular locations or focused efforts to sample water bodies of particularly high interest. A combination of randomized and targeted sampling would provide an optimal approach for providing the information that water quality managers need from a bioaccumulation monitoring program in California.

4.3 Options for Implementing An Integrated Bioaccumulation Monitoring Element for SWAMP

This section of the report serves to document the steps taken as a result of the bioaccumulation review report toward an improved bioaccumulation monitoring program for California. Based on the review and assessment of the bioaccumulation database and the types of inferences that could be made, the SWAMP Coordinator asked SFEI to suggest options for future bioaccumulation monitoring.

The goal of this effort was to recommend an organizational structure, process, and preliminary design for a statewide bioaccumulation monitoring and risk reduction program for California. The report was intended to provide a starting point for the collaborative group process that is needed. In order to facilitate discussion and illustrate how the concepts described in this report would translate into a monitoring and risk reduction program, a preliminary design of a program was presented. It was anticipated that the stakeholder and peer review processes described in the preceding section would lead to a final design that differs from the preliminary design proposed in this report.

In response to uncertainty about future funding, this report section illustrates what the program could look like at three different levels of funding: $500,000 per year; $1.5 million per year; and $3.3 million per year. The two lower levels of funding were based on possible scenarios for the FY 2006/07 budget. The highest level of funding is proposed as an ideal scenario, where the amount of funding allocated to the

program is commensurate with the task of monitoring and reducing risks from bioaccumulation in a state as large and diverse as California.

In 2006, a Bioaccumulation Oversight Group (BOG), a subcommittee of the SWAMP Roundtable, was formed to plan and provide oversight for SWAMP bioaccumulation studies. In essence, the BOG represents one of the Technical Focus Groups described in the new organizational structure for SWAMP (Figure 8). Plans for bioaccumulation monitoring rapidly became more focused and, with input from BOG members, advanced beyond the preliminary considerations presented here. A long-term strategy was devised for performing statewide sampling by sequentially covering major water body types one by one. The first two years of sampling under the new program are focused on a survey of lakes and reservoirs across the state. A sampling plan for this lakes survey was developed and peer-reviewed (Bioaccumulation Oversight Group 2008). The lakes sampling plan and the long-term plan in development by the BOG supersede the initial monitoring options outlined below.

This chapter was presented as a stand-alone report and was reviewed by some BOG members, but not revised in response to review comments because of the developments described above. The options outlined below therefore solely represent the perspective of the author. Nevertheless, for the purpose of documenting the process used to arrive at a consensus approach and the rationale for some of the bioaccumulation design elements, we considered it appropriate to include the initial “options report” in its present form as a chapter here. It also contains ideas that may be useful if SWAMP is able to invest more substantial funding in bioaccumulation monitoring in the future, and to provide an opportunity for the California Water Quality Monitoring Council to evaluate multi-departmental collaboration efforts in areas where jurisdictional “grey zones” exist. If a strategy for funding the full integrated monitoring program can be found, California could create an excellent foundation for evaluating long-term progress in restoring the fishing and aquatic life beneficial uses, and in a 10 year period could achieve a significant reduction of risks and impacts to the health of Californians from consumption of contaminated fish.

Bioaccumulation of pollutants in many California water bodies is of a sufficient magnitude to cause concern for effects on the health of humans and wildlife and is having a significant and widespread impact on the fishing and aquatic life beneficial uses. Bioaccumulation monitoring will be a crucial element of adaptive management strategies to reduce these health risks and impacts on beneficial uses.

Bioaccumulation monitoring offers many advantages over monitoring of water or sediment. TMDLs for many contaminants of present concern (such as mercury and PCBs) are increasingly emphasizing the use of tissue targets. Bioaccumulation monitoring is therefore an essential indicator of the status of the fishing and aquatic life beneficial uses.

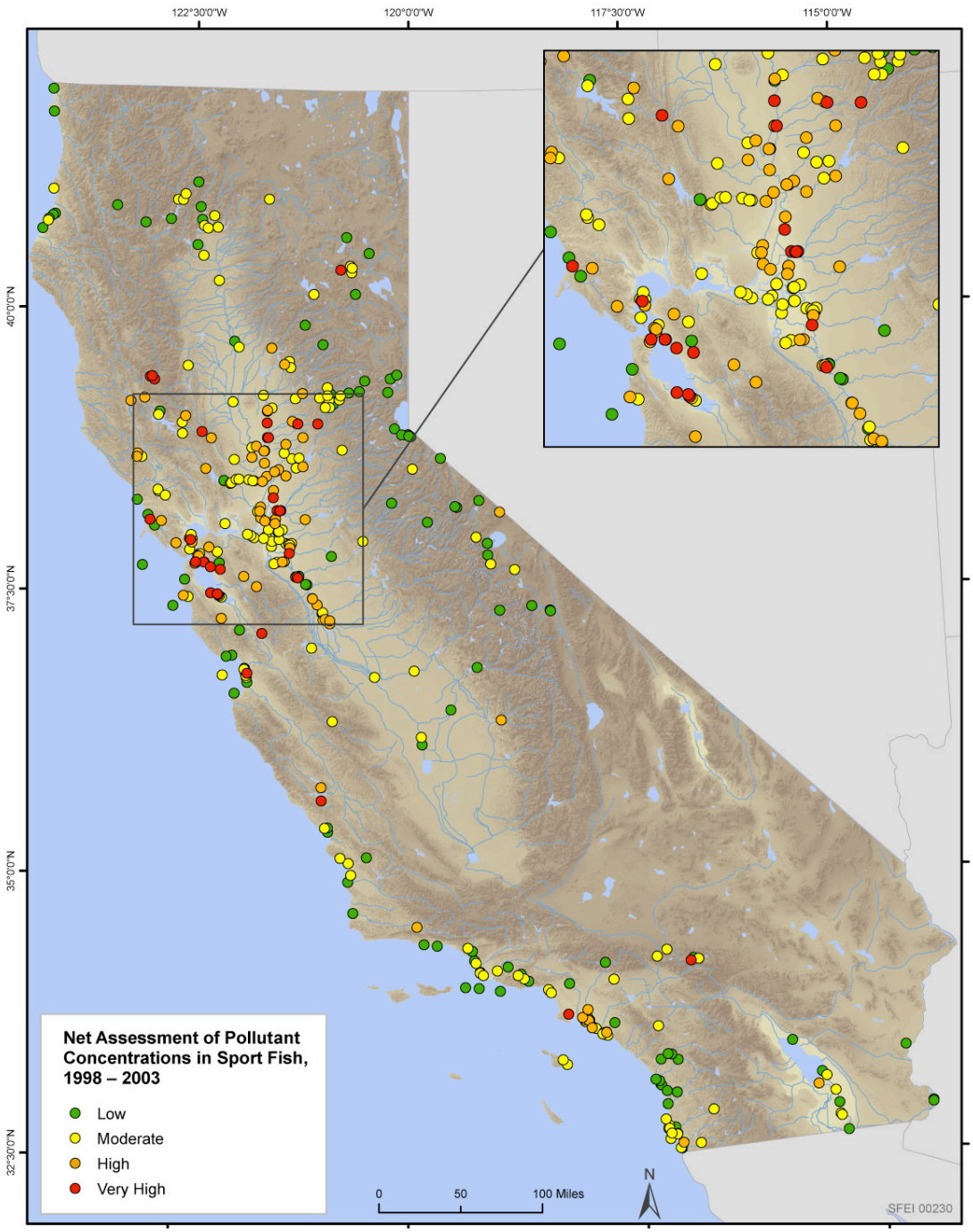
For bioaccumulative pollutants in California, the cause of the beneficial use impacts can be defined as biotic exposure to bioaccumulative pollutants. The goal for water quality managers can be defined as to reduce biotic exposure to bioaccumulative pollutants below thresholds of concern. The ultimate solution to the bioaccumulation problem is to reduce pollutant sources and concentrations in water and sediment of our

aquatic ecosystems. This solution would reduce exposure to all species, including sensitive wildlife species and humans. Bioaccumulation monitoring will be an essential part of adaptive management strategies to achieve this goal. However, contamination of our watersheds and aquatic ecosystems is so pervasive that, even with serious cleanup actions, concentrations of some toxic chemicals in fish are likely to remain above thresholds of concern for at least 50 to 100 years. Furthermore, without a framework in place for appropriate product stewardship that would prevent the manufacture and release into the environment of persistent bioaccumulative chemicals, it is likely that new, potentially harmful, compounds will find their way into the food web for the foreseeable future.

While managers work toward the long-term cleanup of the ecosystem, bioaccumulation monitoring can also provide a foundation for an alternative approach to significantly reducing human exposure to bioaccumulative pollutants in a much shorter time-frame. This alternative approach involves thorough monitoring, development of sound consumption advice, and effectively communicating the advice to anglers. Consumption advisories have been issued for some of the State's water bodies (Figure 4.3-1). However, consumption advice presently exists for only a small percentage of areas that need it. The most recent monitoring data indicate that most sampled locations are impacted by pollutants (Figure 4.3-2). On the other hand, concentrations in some places and some species are lower, and with an awareness of this information the public can more fully enjoy the health benefits of consuming clean fish.

Figure 4.3-1 Consumption advisories in California as of January 2006.

Figure 4.3-2 Bioaccumulative pollutants are currently having a widespread impact on the fishing beneficial use in California. Dot colors indicate degree of net impact at each location sampled. Based on concentrations of several chemicals (mercury, PCBs, DDTs, dieldrin, and chlordanes) from analysis of edible tissue in a variety of species from 1998 – 2003.

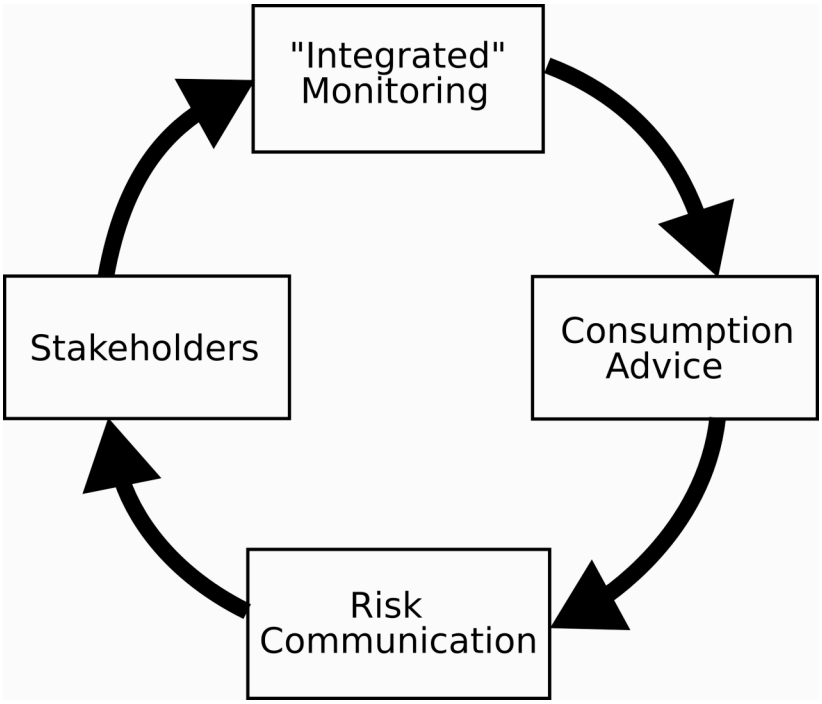


With a foundation of solid monitoring information, consumption advice can be developed that steers anglers toward fish species and fishing locations that are relatively low in chemical concentrations. In the near-term, this is the best available approach to reducing human exposure to pollutants in waterways while promoting the fishing beneficial use. Groups with relatively high rates of fish consumption will benefit the most from this project, including disadvantaged communities with their higher proportion of subsistence fishing.

We discussed with the BOG a program that combines long-term bioaccumulation monitoring with a near-term effort to reduce human health risks associated with sport fish consumption. The basic elements of this program would include: 1) stakeholder involvement, 2) monitoring bioaccumulation in sport fish and other indicator species, 3) advisory development, and 4) communication of risks back to stakeholders (Figure 4.3-3). The program would address environmental justice concerns by facilitating participation of community-based organizations and placing a high priority on communicating risks to disadvantaged populations. Sport fish monitoring would be closely integrated with stakeholder involvement, advisory development, and risk communication. With this program of integrated monitoring and risk communication, human exposure to bioaccumulative pollutants in California could be significantly reduced in the next 10 years.

Figure 4.3-3. “Integrated” sport fish monitoring combines stakeholder involvement, monitoring, development of consumption advice, and risk communication with the goal of achieving near-term reductions in human exposure in a manner that incorporates environmental justice principles.

Figure 4.3-3



A recommended organizational structure, process, and preliminary design of a statewide bioaccumulation monitoring and risk reduction program for California is described below and is intended to provide a starting point for the collaborative group process that is needed.

SWAMP would be the funding agency and would have the ultimate decision-making authority over program activities. The other groups involved would include a Stakeholder Committee, a Peer Review Panel, and contractors to implement the program.

Effective monitoring depends upon a clear understanding of the needs of the end-users of the information. The end-users of the information generated by a statewide bioaccumulation monitoring program would include organizations involved in protecting water quality, habitat restoration, resource management, and protecting human health.

The State and Regional Boards, through the SWAMP, would be the principal funder of the program, and therefore would have the ultimate authority for making decisions on the design and implementation of the program. However, a consensus-based approach that includes all of the stakeholders would be optimal in guiding the program. With this type of approach, all of the stakeholders have a voice in guiding a truly collaborative program.

Inclusion of community-based organizations (CBOs) as stakeholders in this manner is a fundamental requirement for incorporating environmental justice principles. The CBOs can be tremendously valuable partners in monitoring and risk communication. In addition to end-users of monitoring information, the Stakeholder Committee can also provide a hub for coordinating bioaccumulation monitoring with other monitoring, research, and restoration activities in California. Given the limited budget available for bioaccumulation monitoring, and the enormous challenge of characterizing status and trends in bioaccumulation across the entire State, coordination will be essential to achieving SWAMP's bioaccumulation monitoring goals and objectives.

The proposed level of investment and technical effort calls for a high caliber of peer review. Internal peer review should be provided by technical representatives of: the funding agency (the State Board and Regional Boards), other agencies that contribute funds or in-kind services, and stakeholder groups. External peer review for a program of this magnitude should be obtained from a panel of experts with national or international recognition as authorities in their fields.

In order to facilitate discussion and illustrate how the concepts described here would translate into a monitoring and risk reduction program, a *preliminary* design of a program is presented. The stakeholder and peer review processes described above will certainly lead to a final design that differs from the preliminary design proposed here, perhaps substantially. After the program is established, it will also be essential that it continue to evolve in response to changing management priorities and advances in understanding.

The Full Program

At the full level of funding ($3.3 million per year), the program could adequately address all of the objectives and assessment questions set forth for the program, including both those that have already been articulated and those that have not yet been articulated relating to advisory development, risk communication, and environmental justice. At this level the program would include:

33) A sport fish monitoring program that is integrated with advisory development and risk communication and addresses environmental justice issues through funded participation of representatives of affected communities.

34) A stepwise program for developing consumption advice that would result in complete coverage of the State in a ten-year period.

35) Risk communication efforts integrated into the program that could reduce human health risks significantly in a ten-year period without necessarily reducing fishing or fish consumption (through directing anglers to less contaminated fish species and locations).

36) Monitoring of sport fish at 70 sites per year, integrated into a statewide randomized design, in one of ten Focal Areas established to facilitate stakeholder involvement, advisory development, and risk communication.

37) Monitoring of sport fish at 35 sites per year with a Statewide randomized design that would determine the status of the fishing beneficial use throughout the State without bias to known impairment. After 5 years the precision of estimates of the areas or miles of each category of water body (large rivers, lakes, coastal waters, and bays and estuaries) falling into each designated level of support of the fishing beneficial use would be better than ± 14%.

38) Monitoring of sport fish at 35 targeted sites per year to be used in assessment of long-term trends and effectiveness of management actions.

39) Monitoring of bivalves at 5 targeted sites per year to supplement bivalve monitoring performed by other programs.

40) Monitoring of small fish at 50 targeted sites per year to be used in assessment of long-term trends in food web mercury, sources and pathways of mercury, and effectiveness of actions to manage mercury contamination.

41) Monitoring of bird eggs at 15 targeted sites once every three years to provide information on regional long-term trends in bioaccumulative contaminants, including emerging contaminants and expensive analytes such as dioxins.

42) A $300,000 allotment for pilot and special studies.

The full funding scenario includes a budget and activities that would be needed for a program that fully addresses the objectives and assessment questions set forth by SWAMP and the goal of achieving a near-term reduction of human exposure to bioaccumulative pollutants. The budget and some of the activities proposed may be beyond the scope of the SWAMP, and this is a topic that should be carefully considered by the Roundtable and possibly by the California Water Quality Monitoring Council. It may be possible for other agencies with interests in or mandates for water quality management and protection of human health to contribute resources to the program. It also appears that it will be possible to accomplish some of the monitoring through coordination with other national and regional monitoring programs.

If a strategy for funding the full program can be found, the State could create an excellent foundation for evaluating long-term progress in restoring the fishing and aquatic life beneficial uses, and in a 10 year period could achieve a significant reduction of risks and impacts to the health of Californians from consumption of contaminated fish.

A $1.5 Million Program

At a $1.5 million level of funding, the program could address a subset of the objectives and assessment questions established for the program. At this level the program would include:

43) Monitoring of sport fish at 40 sites per year, integrated into a statewide randomized design, in one of ten Focal Areas established to facilitate stakeholder involvement, advisory development, and risk communication (however, the stakeholder involvement, advisory development, and risk communication tasks would not be funded).

44) Monitoring of sport fish at 35 sites per year with a Statewide randomized design that would determine the status of the fishing beneficial use throughout the State without bias to known impairment. After 5 years the precision of estimates of the areas or miles of each category of water body (large rivers, lakes, coastal waters, and bays and estuaries) falling into each designated level of support of the fishing beneficial use would be better than ± 14%.

45) Monitoring of sport fish at 35 targeted sites per year to be used in assessment of long-term trends and effectiveness of management actions.

46) Monitoring of small fish at 25 targeted sites per year to be used in assessment of long-term trends in food web mercury, sources and pathways of mercury, and effectiveness of actions to manage mercury contamination.

47) Monitoring of bird eggs at 10 targeted sites once every three years to provide information on regional long-term trends in bioaccumulative contaminants, including emerging contaminants and expensive analytes such as dioxins.

48) A $70,000 allotment for pilot and special studies.

At this level of funding it would not be possible to include the advisory development program, risk communication, an environmental justice component, or bivalve monitoring. The number of sites sampled for sport fish, small fish, and bird eggs would be reduced, diminishing the value of the program in answering all of the program objectives. The allotment for pilot and special studies would also be reduced.

A $0.5 Million Program

At a $0.5 million level of funding the program could address a very small subset of the objectives and assessment questions established for the program. At this level the program would include:

49) Monitoring of sport fish at 40 targeted sites per year to be used in assessment of long-term trends and effectiveness of management actions.

At this level of funding it would not be possible to include the advisory development program, risk communication, an environmental justice component, bivalve monitoring, small fish monitoring, or bird egg monitoring. No funds would be available for pilot and special studies. Funding for peer review and archiving would be reduced.

5 References

Barker, T. 2001. Representing the Integrated Assessment of Climate Change, Adaptation and Mitigation. Tyndall Centre Working Paper No. 11.

Bioaccumulation Oversight Group. 2007. Sampling and Analysis Plan for a Screening Study of Bioaccumulation in California Lakes and Reservoirs. Surface Water Ambient Monitoring Program.

Connor, M., J. Davis, J. Leatherbarrow, and C. Werme. 2004. Legacy pesticides in San Francisco Bay: Conceptual Model/Impairment Assessment, prepared for the Clean Stuary Partnerhsip

Greenfield, B.K. and J. Davis. 2004. A simple mass balance model for PAH fate in the San Francisco Estuary (www.sfei.org/rmp/reports/pah/pah.fate.model.08114.pdf)

Klasing, S. and R. Brodberg. 2006. DRAFT Report: Development of guidance tissue levels and screening values for common contaminants in California sport fish: chlordane, DDTs, dieldrin, methylmercury, PCBs, selenium, and toxaphene. California Office of Environmental Health Hazard Assessment, Sacramento, CA.

Kjellstrom, T. and Corvalan, C. 1995. Framework for the development of environmental health indicators. World Health Statistics Quarterly 48(2): 144-54.

Organisation of Economic Cooperation and Development. 1993. Core Set of Indicators for Environmental Performance Reviews: A Synthesis Report by the Group on the State of the Environment. OECD. Paris.

Rapport, D. J., and Singh, A.. 2006. An eco-health based framework for State of the Environment Reporting. Ecological Indicators 6: 409-428.

State Water Resources Control Board. 2000. Proposal for a comprehensive ambient surface water quality monitoring program. Report to the Legislature, 37pp.

Smeets, E. and Weterings, R. 1999. Environmental Indicators: Typology and Review. European Environment Agency Technical Report 25. European Environment Agency, Copenhagen, DK.

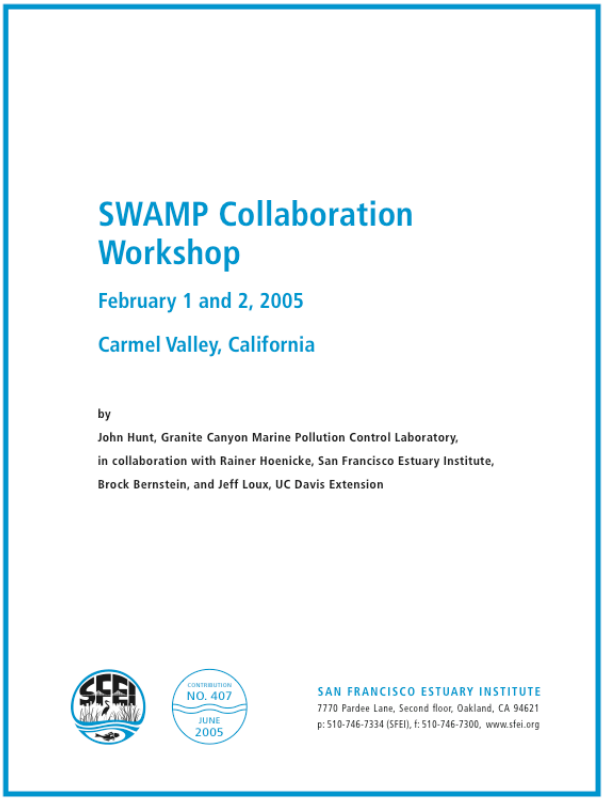
Young, T. and Sanzone, S. (eds.). 2002. A Framework for Assessing and Reporting on Ecological Condition. EPA-SAB-EPEC-02-009. U.S. Environmental Protection Agency, EPA Science Advisory Board, Washington, DC.

6 Appendix

6.1 Proceedings from the 2005 SWAMP Collaboration Workshop

6.2 Assessment Questions and User's Guide

6.1 Proceedings from the 2005 SWAMP Collaboration Workshop



SWAMP Collaboration Workshop

February 1 and 2, 2005

Carmel Valley, California

by

John Hunt, Granite Canyon Marine Pollution Control Laboratory,
in collaboration with Rainer Hoenicke, San Francisco Estuary Institute,
Brock Bernstein, and Jeff Loux, UC Davis Extension

CONTRIBUTION NO. 407 JUNE 2005

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SFEI Contribution #407, June 2005

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Meeting Summary

1. Background and Workshop Context

The Surface Water Ambient Monitoring Program (SWAMP) implementation structure is currently designed to have the State Water Resources Control Board in Sacramento provide an administrative and coordination function and the nine Regional Water Quality Control Boards implement monitoring and assessment activities according to annual workplans they submit to Sacramento for concurrence. Once a year, all SWAMP liaisons and key contractors involved in data management, quality assurance review, and other functions, come together in workshop format to discuss programmatic issues. On February 1 and 2, 2005, more than 40 people convened at Carmel Village. A list of attendees is attached in Appendix 1.

The purpose of the workshop was to:

1) Align all regions on assessment questions and monitoring objectives.
2) Learn from each other, share successes and challenges.

Facilitated large group sessions and small group discussions helped highlight what has worked well and not so well in the past, bring workshop participants to a similar level of understanding about why fiscal realities require a new look at the program, and where to start to accomplish goals most effectively. The workshop was organized by Val Connor, Chief of the Monitoring and Assessment Unit in the Division of Water Quality (State Water Resources Control Board), staff in her unit, and extended staff at the Marine Pollution Studies Laboratory in Moss Landing. The workshop was facilitated by Jeff Loux (UC Davis Extension), with assistance from Brock Bernstein, John Hunt (Granite Canyon Laboratory), and Rainer Hoenicke (San Francisco Estuary Institute).

1.1 Workshop Content and Desired Outcomes

The following section includes an introductory presentation by Val Connor of the SWRCB about the purpose of the workshop desired outcomes.

1. SWAMP Collaboration Workshop

- Round Table agreement on:

Program Goals and Objectives
Statewide Monitoring Questions
Regional Monitoring Questions
Plan next steps
Vision
Prioritize!
Not talking about $$$$ (yet)

2. Collaborative Process

- Facilitated Workshop (SWAMP "family")
- Draft Report
- RT review
- Stakeholder review (new advisory group)
- "Final" Report
- FY 05-06 work plans
- SPARC

3. Advisory Groups

AB 982 Public Advisory Group
12 from "regulated" community
12 from "environmental" groups
SWAMP Round Table (State and Fed. Agencies)
Scientific Planning and Review Committee (SPARC)
2005--combine into TRAMPs

4. Next 24 Months

Continue regional assessments
Continue statewide assessment
Find sustainable funding
Find solution to contracting bottlenecks
Intra- & Inter-agency Outreach/Education
Continue Training
Reporting (305b, RB assessments)
Public fact sheets
National Water Quality Monitoring Council
Complete database development
2nd. Edition QMP
2nd SPARC (external peer review)

5. Outstanding Issues -Insufficient Resources
Increase in SWAMP "partners"
Consistency/Comparability = Training
QA Coordination
Requesting/receiving data
Resistance to change
Contracting

Comments

In the near future, federal and state funding is likely to decrease, leaving the burden of developing water quality information to local agencies. It is important for SWAMP now to document current conditions for degradation.

Scale is key: SWAMP is looking for a nested approach, so that regional monitoring can provide information to statewide assessments.
This workshop is focused on monitoring; it is not designed to discuss or prioritize special studies.

1.2 SWAMP Status and Success

Val Connor also provided a broad perspective and review of where the monitoring program is now and what its successes have been since its inception:

SWAMP in Perspective

1. Scientific planning and review committee (SPARC) meeting in 2002:

SPARC Findings:
- Inadequate Funding (implicit recommendation: scale back)
- Have external scientific review of monitoring plans (regional and state)
- Key program objectives not met; including 305(b) reporting
  - Pick a parameter
  - Matrix of monitoring protocols
- Implement Quality Assurance Program

2. SWAMP proposal and strategy: Required by AB 982 (WC sec.13191)
- Comprehensive state program (surface water)
- Coordinate all Board ambient water quality monitoring programs/projects
- High quality data (QA)
- Comparable data
- Produce accessible information

3. The Geographic Challenge in California:
- 190 hydrologic units (655 hydrologic sub-areas)
- 211,000+ miles rivers and streams
- Over 10,000 lakes (1.6+ million acres)
- Over 1,300,000+ acres of bays and estuaries
- 1,609 miles of coastline

4. The Regulatory Challenge:
- CWA section 305(b) report
- CWA section 303(d) list, TMDLs

- Porter Cologne, Basin Plans
- Implementation, 319h
- CWA section 106(e)

5. SWAMP Plans in November 2000
- Proposed a cost efficient monitoring program to meet all CWA needs for all water types and pollutant sources.
- Requested
  - $59 to $115 million (but received $3.4 million)
  - 87 to 132 PYs, but received 17 PYs
  - Now <u>no</u> general funds. SWAMP funded by WDPF surcharge.

<u>SWAMP Successes</u>

1. There is still a SWAMP program (with staff and funding)
- Roundtable works well
- SWAMP "family" works well
- Increase in program recognition
- Increase in program responsibility (?)
- Increase in infrastructure/consistency
- State and regional vision emerging

2. Biological/Habitat Assessments
- External Peer Review/Summary (Barbour)
- Bioassessment Committee
- Performance-based Methods Comparison
- SWAMP Riffle-based sampling method
- Low gradient wadable stream proposal
- Reference Conditions (SN foothills, CV floor)
- IBIs (SoCal, NorCal, Eastern Sierra)
- CMAP
- Coordination with SCCWRP & Storm water permittees

3. SWAMP has established these consistent infrastructure components:
<u>Monitoring Framework</u>
- <u>Data Management</u>
- <u>Information Exchange Network</u>
- <u>Quality Assurance Program</u>
- <u>Tool Box and Training</u>

4. Monitoring Framework
- A Cornerstone goal of SWAMP is to provide a state framework to coordinate consistent and scientifically defensible methods and strategies for improving water quality monitoring, assessment, and reporting.

- The process of monitoring and assessment should principally be seen as a ***sequence of related activities*** that

  - ***start with the definition of information needs*** and
  - ***end with the use of the information product***.

5. Collaboration and Comparability
Many organizations spend enormous time and money on monitoring.
Data use compromised by critical differences among programs in project design, methods, data analysis and data management.
National, state, and regional monitoring strategy requires a framework for ***collaboration*** and ***comparability***.

The SWAMP path is now consistent with the national approach for design and collaboration.

- The Calif. Rapid Assessment Method (CRAM) is consistent with SWAMP RBA.

6. Method Comparability
Consistent and objective sampling, analysis and assessment methods:
Sampling: standard field protocols, SOPs in QMP, Training Module (CD)
Analysis: performance based, bioassessment, bacteria indicators;
Sampling Containers
Assessment: 303(d) Policy

7. Data Comparability
Inclusive of all types of water quality monitoring -
chemical, toxicity, bacteria indicators and field data
tissue, biological, habitat characteristics
Training: on-site, with user's guide

8. Station Information
Created link between Regional (basin plans), State (CalWater), and Federal (NHD) planning units
Each station contains Basin Number (HBASA),
- CalWater Number (2.2.1), and National Hydrography
- Dataset (NHD) Name and Number

9. Information Exchange Network
Database Integration & Access
SWAMP linked to Bay Delta and tributaries data base (BDAT), as are DWR,, IEP, CALFED, DFG, SRWP

10. CA Environmental Data Exchange Network (CEDEN)
Started with BDAT
Easy to implement by other partners
Architecture is distributed
Can support many types of institutional participation
FSR to link to CIWQS

11. Background-Data Element Standards
For projects using funds from Props. 13, 40, or 50 we will be using the standards required under AB 1747 or "SWAMP Standards"
All data shared through BDAT/ CEDEN will be mapped to the EDSC Standards.
CERES will be doing the metadata Cataloging for BDAT/CEDEN

12. Quality Assurance Program
QA Team: Bev Van Buuren, Revital Katznelson, Linda Deanovic, Stephanie Fong, George Nichol, Amara Vandervort

13. QA Team Values:
Develop comparability between programs/projects in order to answer big-picture questions
Help program create data that is defensible; data that is valid for future interpretation
Develop tools and systems to improve efficiency and that may be utilized by other programs/projects
Sensitivity to budget challenges with a creative approach to program requirements

14. QA Team Goals
Development of a progressive, innovatively cost-effective and well-defined program that is coherent and attractive to all stakeholders.
A key focus on how best to serve the dischargers and Regional Boards.
Provide new techniques for the QA profession and regulatory communities.

15. QA Program Components
Minimum Requirements:
Quality Management Plan
Intercomparison Studies and PE Tests
Laboratory Audits
QAPP Review
Data Verification/Validation Procedures
QA Communication Systems
QA Reports to Management

Recommended additions (baby steps!):
QC Sample Control Charts
QA Toolbox and Training
Corrective Action File
Expert Panel
Assessment of project plans from a QA-standpoint (e.g., process used to pick contract labs, field crew, etc.)
On-site audits of field sampling (crew and procedures)
MDL studies or low-level PE tests as appropriate
SOP review and approval

16. QAPP Implementation
Protocols
Audits (lab, field, regions)
Intercomparison Exercises
Performance Evaluation Studies
QMP revision
Data Verification/Validation
Toolbox

17. Tool Box and Training

SWAMP Training Tract
All SWAMP "partners" use of SWAMP "toolbox"
Introductory Monitoring Design
Advanced Monitoring Design
SWAMP Field Methods (CD rom)
Introductory Quality Assurance (repeat)
SWAMP Advisor
SWAMP Data Management (repeat)
SWAMP Collaboration Workshop
Annual mtg - CA Bioassessment Workgroup
SWAMP for Ag. Coalitions (repeat)
Monitoring Grant Project Effectiveness
Bioassessment; Bacteria Indicators, etc.

18. Monitoring Coordination (Consistent data quality and reporting)
Required by AB 982 (WC sec.13191)
Coordinate all Board ambient water quality monitoring programs/projects:
Grant projects, Ag Waivers, Aquatic Pesticide Program, Non-point source,
Volunteer monitoring, NPDES stormwater, NPDES point source, TMDL.

19. Status Program Coordination
FY 02-03:
TMDL Program-30 current projects
Grant Projects-880 projects over 5 years
FY 03-04
Statewide Assessments
Agriculture Waiver Program (R3 and R5)
Aquatic Pesticide Monitoring
Nonpoint Source Program
FY 04-05
Regional Storm Water Monitoring

31. Current Grant Projects
218 projects
77% have an ambient monitoring component
47% associated with a TMDL

33. CMAP
Partners: EPA and NPS Program
Status of biotic integrity of wadable streams
Ecological Assessment (EMAP)
Probabilistic Design
Stream order
Land Use (Ag., Urban and Forested)

34. Regional Watershed Monitoring
Rotating watersheds
Deterministic design to answer questions of water quality impact:
Land and water use
Beneficial uses

Previous data
Sampling at confluences
Reference sites
Access

Summaries of Additional Regional Successes

Regional Water Quality Control Board staff leads on SWAMP provided additional detail for each of their specific regions and subregions.

North Coast Regional Board1: Watershed assessments, rainbow trout endocrine assay development (with EPA support and approval), north coast macroinvertebrate IBI, and three fish consumption advisories.

San Francisco Bay Regional Board: Three watershed monitoring rotations have been completed, collaboration with partner agencies, intra-agency coordination, fish consumption report and advisories for regional reservoirs.

Central Coast Regional Board: Five year watershed monitoring rotation is complete. Data have gone out for use in: 2 rounds of 303d listing, ag waiver monitoring design, web site presentations to farmers, cooperative program designs, Tetra Tech nutrient criteria.

Los Angeles Regional Board: Continuing rotating watersheds; the Santa Clara stratified random design identified impaired tributaries, San Gabriel watershed study collaboration.

Central Valley Regional Board: Pit and Feather Rivers, locally directed monitoring, long-term collaborative monitoring.

RBA reference condition, sources of toxicity in small watersheds, lots of special projects, lawn care risk, endocrine disruption, TMDL, ag waiver.

Two rotations with all data on the web, data being used by coalition groups, waiver monitoring toxicity leading to TIEs, SWAMP compatible monitoring in ag watersheds, coordination with other groups under SWAMP umbrella, bacterial studies.

Monitoring data going into SWAMP data base.

Lahontan Regional Board: Region 6 is unique because specific sites are identified in Basin Plan for specific numerical objectives. IBI is being developed for E Sierra. SWAMP work defined pre-project condition for federal studies.

Colorado River Basin Regional Board: Relationships established within RB and with other agencies (Fed, state, local) for TMDL coordination, new Colorado River perchlorate methodology developed by partners.

Santa Ana Regional Board: Harbor toxicity studies completed, working on report. Working on lakes now, stream RBA next.

San Diego Regional Board: Rotating into last round of watersheds. Partnerships developed with County of SD, USFS, water district, stream team. Working on SoCAL IBI and SD Bay copper. Awareness of SWAMP has increased.

2. Program Clients

Workshop participants developed a list of "clients" or users of data and information generated by SWAMP. The list is not meant to be exhaustive or reflect any priority order:

- Regional Board staff: to make better regulatory decisions.
- Watershed stakeholders, e.g. the local Cattlemen's Association.
- Other agencies and tribes, such as the DFG, USFW, Coastal Commission.
- Environmental groups.
- Dischargers (who support the program with WDPFs) for information about source and receiving waters.
- Resource agencies executives.
- The academic community.
- Congress, who funds programs, adjusts the Clean Water Act, funds cleanup, implementation, and infrastructure investment.
- State Legislature, who determines funding priorities and adjusts state water laws.
- Users of water for its beneficial uses, e.g., fishers, swimmers, surfers.
- Consultants working for other clients.
- Land use decision makers, such as supervisors and town councils.
- K-12 educators.
- Citizens, the public, voters.

2.1 Issues Raised about SWAMP Clients

- Not all have equal access. Staff may jump faster for legislators than for individual citizen phone calls.

- The way data are presented is different for different users (websites, reports, 303d listings, press releases).
- Interest varies according to scale. Water users interested in local issues, Congress looks at larger scale.
- Different users evaluate information differently: academics (scientific validity) vs. citizens (political implications, regulatory action)
- It's important to minimize spin. QA, clear definitions, metadata access.
- Presentations are tailored to address public concerns.
- There are risks in offering interpretations to the public (as with fish consumption advisories)
- The data can say when there is a problem, but not when there isn't.

2.2 How SWAMP Data are Currently Used

- To determine whether an agency BMP improved WQ
- 303(d) listing State Board, EPA
- Fish and beach health advisories
- Discharge permit reporting
- For modifying monitoring programs
- To assess attainment of Basin Planning objectives
- Used by public prioritize governance issues
- Adaptive management of program design
- Provide model programs for storm water and other partners
- Extension outreach to growers
- Water quality criteria development
- Special studies data to academics to expanding knowledge
- To inform land use decision makers
- To combine SWAMP data with other programs to fill in the bigger picture
- For tribal resource management and regulatory attainment

2.3 Constraints affecting SWAMP

Political pressure by different users to change/influence monitoring.

Stakeholder efforts to shift monitoring burden to government.

Understaffing, insufficient PYs.

Upper management sets goals and deadlines without realizing what it takes to achieve.

Assignment changes, distractions and fire drills. Lack of consistency in agency priorities.

Non-technical people making technical decisions for the managers.

Funding for reactive rather than proactive activities. Funding goes to putting out fires.

Overall slow turn around time of information.

Need for real-time assessment of data, so corrective action can be taken.

Need for SWAMP consistent reporting by all labs. Currently 2 out of 60 are data consistent.

Delays and staff time spent on contract processing.

Size of the arena: SWAMP, by default, is responsible for managing 218 prop 40 contracts, PRISM, ag waiver, etc., with SWAMP data consistency. Huge unfunded coordination and oversight responsibility. Things could run amok.

Contract staff does not understand the process, legal advice doesn't understand how a contract works on the ground.

Data management complexity.

Coordination difficulties: takes much time, some groups resistant, academics holding data until publication.

Scale: it's a big state, with thousands of water bodies.

Variable scale of monitoring questions.

Sampling issues: access, private property, remoteness

Effort needed to standardize sampling methods. Moving target of changing protocols (RBA).

Temporal variability requires many samples over time to avoid snapshots

Inconsistency of funding levels requires much staff time to adjust contracts, hire and fire.

Need for guidance on developing assessment questions and methods.

Multiple and disparate objectives, affects political pressure, staffing levels.

Insufficient peer review, monitoring plan review.

Restrictions on contractor selection. Low bid restrictions.

Need to use QA process proactively to achieve better program

Hard to deliver information to satisfy all users

Developing communication, language, and trust with different communities.

2.4 Recommendations for Solutions to the above Problems

(that don't rely exclusively on increased funding)

- A reformed state contracting process, especially for SWAMP contracts. Longer term, more flexibility, no low-bid requirements.
- Increased communication with contracts office, user groups. RT as a good example.
- Increased communication with upper management.
- Peer review is not too expensive, and could be handled in QA process.
- QA funding is adequate to improve QA with current staff.
- Link multiple and disparate objectives with QA. As long as the QA/QC is documented well enough, data that were collected for very different purposes may nevertheless be suitable for comparisons and integration.
- QA could be modeled after CalFed Hg program, peer review, consistency
- Make decisions science-based.
- Formal training in monitoring design, from policy issues to sampling design.
- More collaborative effort, e.g., use the CalFed process in the Klamath.
- Better agreement as a program on the type of monitoring questions RBs should answer.
- Measuring basic process indicators rather than actual outcome indicators, indicates more uncertainty. Bottom up.

3. Monitoring Goals and Objectives

3.1 Group Exercise

Workshop participants split into four groups, each with a facilitator, to work through the following exercise:

One regional monitoring coordinator described the nuts and bolts of a monitoring design, such as: number of sites, site distribution, sampling frequency, parameters measured, etc. The rest of the group then took that information and discussed the possible reasons why that monitoring design was chosen. The object was to guess the specific monitoring objective that the design was meant to address, including beneficial uses of concern and legal mandates to be satisfied (e.g., 303[d] listing). The process evaluated assumptions and conceptual models underpinning monitoring design and essentially pointed out to

participants that often, if underlying assumptions and objectives are not clearly spelled out and thought of, the monitoring design may not be appropriate to meet the objectives.

3.2 Presentation and Discussion of Program Goals and Objectives

Purpose of discussion:

Go through the original program goals and objectives, as stated in the report to the legislature. Determine whether those goals still make sense. Identify other appropriate goals. Prioritize. Focus on concepts, not word crafting.

Presentation: SWAMP Monitoring Goals and Objectives

Val Connor refreshed people's memory on the original goals and objectives of the program and contents of the "Report to the Legislature" that outlined how the program could be implemented.

1. The Big Goal:
Primary goal of monitoring is to provide decision-makers with information that can be used to effectively improve or maintain water quality.
Review, refine, prioritize and coordinate the specific monitoring questions that frame state, regional, watershed and project assessments.

2. AB 982 Legal Mandates for SWAMP:
comprehensive environmental monitoring
provide the information to manage the State's water resources.
An umbrella program that monitors and interprets data
each hydrologic unit at least one time every five years.
without bias to known impairment.
consistent monitoring methods
centralized reporting requirements.
adaptable cooperative efforts,
clear monitoring objectives,
scientifically sound monitoring design
meaningful indicators
comparable methods
regular reporting
data management
focus on spatial status
temporal trends
determine the site-specific locations
areal extent,
water, sediments, and biota
widely applicable throughout the State
rotating basin framework
probabilistic monitoring in coastal waters.

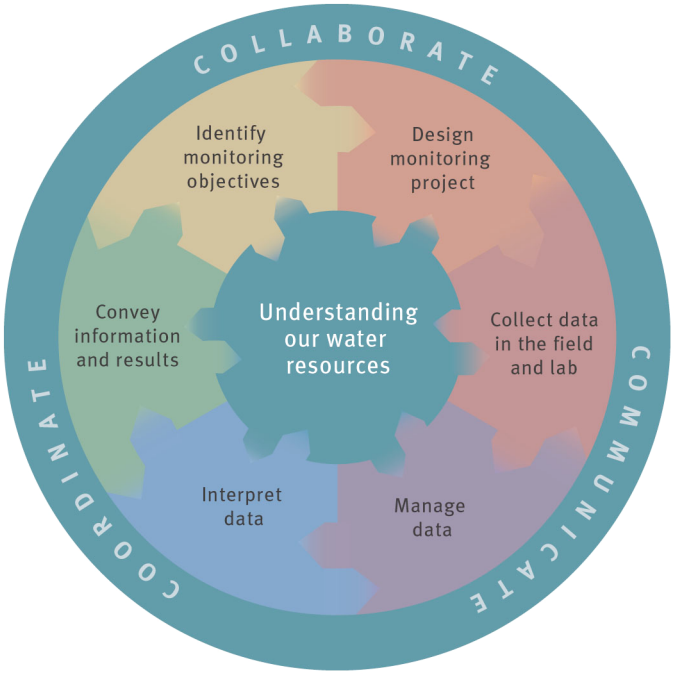
3. Implementation Strategy
Monitoring Program Strategy
Monitoring Objectives
Monitoring Design
Core Indicators of Water Quality
Quality Assurance
Data Management
Data Analysis/Assessment (CALM)
Reporting
Programmatic Evaluation
General Support and Infrastructure

4. Monitoring Framework

- A Framework for Ambient Water Quality Monitoring
- A Cornerstone goal of SWAMP is to provide a state framework to coordinate consistent and scientifically defensible methods and strategies for improving water quality monitoring, assessment, and reporting.

- The process of monitoring and assessment should principally be seen as a ***sequence of related activities*** that
  - ***start with the definition of information needs*** and
  - ***end with the use of the information product***.

5. Conceptual Model of Monitoring Framework:



6. Challenge: Nested Approach
Statewide scale
Regional scale
Watershed scale
Project scale

Special Studies
Tool development
Research

7. Coordination among State and Regional Components
Scale of questions, objectives and design
State program:
Asks broad questions: What % of state's water bodies are healthy?
Uses of program
Legislative and public reports
305b report
EPIC
Context for regional monitoring
Regional program's objectives and design more specific
Specific water body impairment: 303d list.
Evaluation of specific management/restoration efforts.

SWAMP Goals from Legislative Report:

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

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

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

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

Comments on Program Goals and Objectives

- The Water Boards' ability to compete for $10M/year in EPA 106[e] funds depends on having:

  coordinated board programs, a program strategy, well defined monitoring objectives, indicators, QA, data management, data assessment, reporting, external peer review, general support and infrastructure.
- Need to define what "all waters" means: a hydrologic unit is very different from a tiny named water body.

- EPA and program goals acknowledge that there are different objectives at different scales. They may sound contradictory, but may be applicable to different situations (scales).
- Should the goals have parallel construction?
- Start with the EPA 10 elements.
- Possible additional program goals: adequate sustainable funding, program effectiveness (objectives met).
- Goal refinement could start with the lists of objectives that we already have, or could start from scratch based on clients' information needs.
- One approach: SWAMP has its marching orders, in AB 982, we should just prioritize.
- Another approach: stakeholder guidance.
- All legislative and EPA goals are being being addresses in selected areas, but there are huge areas where no monitoring is done. It could be argued that the existing goals are fine, but the geographic scale is limited. We could change that to statewide distribution of samples.
- There may not be much disagreement about objectives, but disagreement about priorities.
- This workshop may want to eliminate redundancies and reframe the existing goals.

A workshop subgroup was assigned to re-word the existing SWAMP program goals and objectives to clarify them and eliminate redundancy.

DRAFT Revised SWAMP Goals

The following list of 18 program goals was derived from the original four program goals in the legislative report. The four legislative report goals each had multiple components, which were separated out for clarity, so that each could be evaluated individually.
The notations below in square parentheses [ ] are an attempt to align these SWAMP goals with the 10 EPA monitoring program elements. The round parentheses ( ) contain questions about specific wording that the subgroup wanted to refer to the RT.

SWAMP 1. Create a statewide ambient monitoring strategy that addresses all hydrologic units (all waters?) of the State (without bias to known impairment?). [EPA Monitoring Program Strategy]

SWAMP 2. Provide ambient monitoring data to support evaluation of the overall effectiveness of water quality programs in protecting beneficial uses. [EPA Monitoring Program Strategy]

SWAMP 3. Coordinate (with?) all Board ambient monitoring programs and projects. [EPA Monitoring Program Strategy]

SWAMP 4. Develop a comparable (consistent?) set of data quality objectives and data formats for Board ambient monitoring programs, grant-funded projects, and other ambient monitoring programs. [EPA Monitoring Program Strategy]

SWAMP 5. Identify specific water quality problems preventing the SWRCB, RWQCBs, and the public from realizing beneficial uses (in targeted watersheds?). [EPA Monitoring Objectives]

SWAMP 6. Monitor and assess each hydrologic unit periodically (at least once every 5 years?). [EPA Monitoring Design]

SWAMP 7. Consider data usefulness at multiple scales when developing monitoring designs. [EPA Monitoring Design]

SWAMP 8. Develop a set of indicators (and assessment thresholds?) appropriate for assessment of beneficial use attainment. [EPA Core Indicators of Water Quality]

SWAMP 9. Use monitoring, sampling, and analytical methods that produce comparable (consistent?) data. [EPA Quality Assurance]

SWAMP 10. Develop data quality assurance protocols. [EPA Quality Assurance]

SWAMP 11. Create a (centralized? comprehensive? Integrated?) data management system. [EPA Data Management]

SWAMP 12. Provide a statewide assessment of beneficial use attainment periodically (at specific intervals?). [EPA Data Analysis/Assessment]

SWAMP 13. At specific intervals, assess ambient monitoring data to support 305b reporting, 303d listing, attainment of basin plan objectives, and other statutory requirements. [EPA Data Analysis/Assessment]

SWAMP 14. Provide relevant, timely, and cost-effective information to the legislature, decision makers, stakeholders, and citizens about ambient water quality conditions. [EPA Reporting]

SWAMP 15. Secure adequate and sustainable funding (by ?). [EPA General Support and Infrastructure]

SWAMP 16. Evaluate effectiveness in attaining program objectives through external peer review (e.g. SPARC). [EPA Programmatic Evaluation]

SWAMP 17. Conduct periodic performance evaluations. [EPA Programmatic Evaluation]

SWAMP 18. (Strive to?) incorporate adaptive management principles. [EPA General Support and Infrastructure]

This revised set of monitoring goals was photocopied and distributed to the workshop participants at the beginning of the second day of the workshop. Participants were asked to provide comments. The comments received are included in Appendix 2.

3.3 Prioritization of Beneficial Uses and Water Body Types

- There was unanimous agreement that beneficial use categories make sense as part of the monitoring framework.
- The Roundtable has previously decided that four beneficial uses are of high priority: fishable, swimmable, drinkable, and aquatic life protection. The public is focused on these, and if these uses are supported then the others, such as industrial use, ag use, fisheries, and aesthetics will be also. There are exceptions like salt, boron, trash, and algae.
- There was general agreement among workshop participants for this approach, though it would need to be made clear to stakeholders and the public that all beneficial uses would be protected using this approach.
- Monitoring based on these beneficial may cover all assessment questions at the state level, but not necessarily at the regional/local level.
- Questions are asked differently at state, regional, or local levels. Need metrics for each scale.
- Monitoring based on beneficial uses can be an oversimplification of reality. A stream could support aquatic life for carp but not for trout.
- Regions can not answer questions phrased as “Is it safe to swim?” But can say whether there any evidence that it is not safe to swim.”
- Need to determine attributes and indicators needed for a statewide program. CMAP only examines wadeable streams for aquatic life use.
- Need to prioritize based on water body types (estuaries, wetlands, streams, lakes, etc.).

- Need to consider what other programs are monitoring to avoid duplication (e.g., pathogens).
- The level of certainty in assessments (305b) can range from 'we don't know' to 'yes we know'.
- Scale is inherent in monitoring questions. SWAMP must keep track of large scale questions while formulating small scale questions. Temporal scale and continuity critical to trend analysis.

Prioritization Matrix

A matrix below was produced to help prioritize monitoring objectives based on the combination of beneficial uses and water body types. The first numbers in each cell are the tallied votes of the SWAMP Roundtable members, the numbers in parentheses are the tallied votes of all other participants, including RT.

Type of Water Body	**Beneficial Use**				**Total**
	Aquatic Life	"Fishable"	"Swimmable"	"Drinkable"	
Wadable Streams	15 (27)	3 (3)	5 (5)	0 (0)	23 (35)
Large Rivers	9 (13)	1 (2)	0 (0)	1 (1)	11 (16)
Lakes	0 (4)	2 (5)	5 (6)	0 (1)	7 (16)
Coastal Waters	4 (9)	0 (2)	1 (4)	0 (0)	5 (15)
Bays / Estuaries	4 (12)	1 (4)	0 (0)	0 (0)	5 (16)
Wetlands	3 (11)	0 (0)	0 (0)	0 (0)	3 (11)
Total	35 (76)	7 (16)	11 (15)	1 (2)	54 (109)

Aquatic Life Protection in wadable streams got the most votes (28% RT, 25% total).

The Aquatic Life Protection overall was the highest priority beneficial use for monitoring (65% RT, 70% total).

Fishable and Swimmable were roughly equal: Fishable 13% RT, 15% total, and Swimable (20% RT, 14% total)

The water body monitoring priority by RT vote:

wadable streams > large rivers > coastal waters = bays/estuaries > wetlands > lakes.

The water body monitoring priority by total participant vote:

wadable streams > large rivers > bays/estuaries > wetlands > coastal waters > lakes.

Comments

Aquatic Life Protection

- Staff may be biased toward aquatic life because of science background.
- Aquatic life is more protective and covers other uses. (There was disagreement on this).
- R1 has tribes whose entire livelihood depends on Aquatic Life Protection.
- Swimable and drinkable and fishable may be more important to the public and legislature.
- Some second thoughts were expressed about having voted to prioritize aquatic life protection to fill data gaps. Swimable, drinkable, and fishable are important to the public.

Data Gaps and Drinking Water

- The vote reflects data gaps. Other programs cover swimable and drinkable
- While DHS and others covering drinkable, but surface waters are not usually drinking waters.
- CalFed has an entire drinking water program.
- Drinking water important but is not yet incorporated into a statewide program. Good example of need for SWAMP as an umbrella program.
- Source water protection is a legitimate goal for SWAMP program.
- DHS is in the State Board system.
- Lakes get coverage by drinking water agencies
- All counties monitor drinking water, so why expand SWAMP in that area? Does SWAMP have the authority to regulate drinking water?
- NRDC says CA is woefully inadequate, then the state gets $50M for drinking water.
- Fill data gaps by coordination with other groups.

Recreational Use (swimable)

- Swimmable is a hard parameter for sample counts and other methods problems

- Program would have to sample often for meaningful results, and probably cannot afford to.
- People decide to swim or not to swim based on aesthetics, not pathogens.

Coastal waters

- Coastal waters may not be a local issue for inland regions, but are important to citizens of the state.
- Marine coast is well monitored, but lakes are not, specifically for swimable.

Other

- If you protect small streams, you may protect large rivers. (Disagreement on this.)
- Fishable issues of concern are mostly legacy chemicals. Management actions are difficult, but you can post fish health advisories. R2 gets a lot of info from fishable, very important to public.
- There needs to be a public education component.
- The vote tally might reflect a restricted definition of wetlands.
- This discussion is only prioritizing where resources go in the short term.
- The CWA requires that SWAMP deal with all beneficial uses and all water bodies.
- Program can address all uses and water bodies by putting in place a strategy to address them all. The program then monitors the uses and waters for which there is enough immediate funding, and leaves the others as built-in placeholders. Inform stakeholders that the program has the objectives, and will address them if funding is provided.

4. Invited Presentations

To illustrate how three smaller-scale ambient monitoring programs have approached making them relevant to decision-makers, integrating them with other data-gathering efforts, and interpreting results, three case studies were presented and discussed. The slides of the presentations are included in Appendix 3.

Bruce Thompson (San Francisco Estuary Institute) provided an overview of the Regional Monitoring Program for Trace Substances (RMP) for the San Francisco Estuary and the Aquatic Pesticides Monitoring Program, entitled: *Recommendations for Successful Monitoring: Sampling Design and Program Function.*

Eric Stein (Southern California Coastal Water Research Project) presented a case study, entitled *San Gabriel River Watershed-wide Integrated Monitoring Program.*

The third case study, presented by Kenneth Belitz (USGS NAWQA Program), was entitled:

Balancing the Regional and the Local: Perspectives from he USGS NAWQA Program

Notes from presentations:

Recommendations for Successful Monitoring:

- The RMP started with fixed sites for trend analysis.
- A national Review Panel suggested revising the design to go to random sampling.
- SWAMP encouraged to contact Don Stevens and Tony Olsen – great resources.
- Getting assessment questions and sampling designs was a LENGHTY process.
- Participants (stakeholders), reg. agencies, and scientists working together.
- Different designs for RMP vs. Aquatic Pesticide Monitoring Program.
- APMP selected areas where pesticides were applied, not randomly, then randomized within the specific areas.
- Design depends on questions.
- Stakeholders want to make sure they have access to the same info that the reg. agencies have, at the same time.
- Science is the currency to allow agreement among stakeholders on designs and assessment.
- 50% of funds go to data collection and analysis, 15 to 20% goes to reporting.
- Peer review happens in design phase, and in reporting (anonymous peer review).
- The first external 5-year review cost $200K, second panel was $125K, but didn't work as well.

2. San Gabriel River Monitoring

- Previously couldn't answer fundamental questions because of different types of data, redundancies, no coordinated information management.
- Some parts intensively sampled for permit compliance, other areas had huge gaps
- Stakeholder group met monthly for a year.
- Tony Olsen helped with the probabilistic sampling design: Weighted probability design.
- Started with NHD layer and supplemented with local mapping for random sample draw.

- Bioassessment results downstream of discharge points not compared to upstream, but compared to results of watershed wide random site results.
- A 3-year pilot study was conducted to set up long term fish tissue study design.
- Cost of 5 elements might be less than dischargers were already paying for their compliance monitoring
- Scale – understanding what's going on at a specific site is helped by comparison to whole region.
- Scale – Opportunities in the random draw for sites to randomly fall in special study areas.
- Cost of planning process, stakeholder, data analysis about $50K plus agency time.
- May consider changing index period to summer to identify T, DO problems.
- Questions about increase frequency for trend sites: need to discuss with stakeholders.
- The program is interested in a time frame of many years.

3. Balancing the Regional and the Local

- Summary report written at the end of the "cycle" for each "study unit" (10 year cycles).
- Local analyses are at the bottom of a top-down process.
- Consistency in a robust design produces worthwhile results.
- There is a Data Synthesis Team, as part of USGS National Synthesis Teams
- "Study unit" perspective, USGS has 50 study units.
- Study units have between 7 and 12 FIXED sites.
- Fixed sites targeted on sites where USGS has gauges.
- Most study units sampled more frequently to study pesticides, storm hydrograph.
- Synoptic sampling at low flow to minimize variability.
- The same sites are used for overall characterization and special studies.
- USGS national hypothesis: Land use controls WQ. This affects sampling design.
- Urban base flow (chronic sprinkler runoff).
- NAWQA uses a national design; study unit staff can interpret it to address local questions.

- Sampling at even temporal intervals can inform storm questions if data are sorting by days after storm.
- Programmatic decision to maximize staff comfort levels, avoid storm water sampling designs.
- Multiple linear regression for explanatory factors.
- Consistency in design, sampling, analytes; even consistency in the added-on analysis.
- It doesn't matter if you randomize first or randomize last. You can randomly pick from a fixed design after the fact.
- NAWQA is a $60M program.
- Sufficiency: give the national team the data they want, and nothing more. Local team saves money, national team doesn't have a use for extraneous data.
- Rainfall integrates land use; the water is sourced in the landscape.
- Flexibility, you implement the national design, and then try to be flexible with the local analysis.
- Retrospective analysis is an expensive task.
- It's very hard to get large scale information from local studies.
- It's a challenge to integrate everything that everyone else knows. It's brain busting to try to get national trends from site-specific data.

Comments:

- NAWQA is model-based: land use affects water quality; EPA does not specify a hypothesis (probabilistic).
- Whether SWAMP should fund monitoring in areas already covered by NAWQA depends on the questions that the NAWQA data can answer. It may need to be augmented by additional data.
- The goal of biweekly monitoring was to assess seasonality, data were useful for storm analysis. The time parameter of interest was time after rain, not calendar.
- Hydrograph was separated into storm and base flow; storms were divided by intensity (large and small)
- All NAWQA study units now collect personal care/pharmaceuticals data.

- When asked about two parameters for a statewide SWAMP program, Dr. Belitz cautioned about limiting the analyte list. He cited the example of NAWQA missing MTBE.

5. Challenge of Monitoring over Multiple Scales

The presentations set the stage for discussion among workshop participants about meeting state-wide goals, while weaving ambient monitoring data from regions into a coherent picture.

- Comment: you can't design a program that integrates across scales. It's mutually exclusive. Different users ask different questions. We should accept that, and decide what the SWAMP program should be,
- The NAWQA approach would be difficult because of the need for lots of reconnaissance to characterize land use.
- NAWQA is doing one unit over 5 years, SWAMP is doing multiple units in one year.
- SWAMP could: 1) adopt NAWQA design, 2) overlay state design. 3) use common parameters.
- NAWQA advantage of fixed sites for trends, so you don't add random sites as extra cost.
- There are different questions, but SWAMP could characterize the whole system and then focus down. Find where common characterization questions overlap. Use the same models at different scales.
- There are advantages to doing things sequentially.
- It is becoming very important among <u>stakeholders to know how their watershed stacks up against the rest of the state</u>. A good use for nesting watershed studies within statewide framework.
- Comparison among watersheds depends on parameters measured and quality of land use layers.
- The CALVEG database covers localized areas of the state well but is not comparable across state.
- Could do a statewide comparison of ag supply water (conductivity?).
- Support for SF RMP model: probabilistic design, triad of indicators, 10 year timeframe.
- It will take $$, can't do now, but focus on triad for aquatic life use in streams, lakes, estuaries.

- CMAP is covering the RBA probabilistic monitoring, could build upon that.
- CMAP has 200 sites plus 50 new each year. CMAP is planned to be ongoing. There is NPS money to fund it. Evaluate after 5 years to see if data is useful for % impaired and NPS questions about land use. But it's just RBA.
- Once a year is not adequate for chemistry.

6. Framing Questions to Develop Monitoring Design

- The questions are implied in the legally mandated tasks.
- Draft SWAMP goal number 13 (above) addresses the mandates. Mandates need to be translated into assessment questions to get to monitoring design.
- The specific questions related to the beneficial uses are:
  1) status, 2) trends, 3) cause-and effect, 4) source identification, and 5) effectiveness of management actions.
- Apply these to each type of water body and each beneficial use.
- General agreement that these are the 5 key questions. Scale is important.
- Status, trends, and stressor source are CWA mandates; evaluation of management is mandated by Porter Cologne.
- Take these 5 big questions, then hammer out sub questions and vet with stakeholders.
- Sort the questions into bins by applicability. Prioritize the sub questions.
- Then go to specificity of scale, timing,
- These questions are common to many program development processes.
- To time implementation stages, think of triggers. Example: 1) realize there's a problem, 2) launch trend analysis, 3) go to cause and effect, 4) look at different levels of intensity, 5) paper conceptual model with stakeholders.
- What is SWAMP's first adaptive trigger?
- If you hit the 303d trigger, then it goes to someone besides SWAMP.
- 303d listing is not the only trigger
- Example: Identify fish tissue problem on regional scale, determine frequency for trends analysis. Depending on the trigger threshold for amount of change per year, you go to a more intense monitoring design.
- SWAMP has flexibility with regard to 305b policy.

6.1 Model Process for Developing Monitoring Designs

- Model process:

1) Ask the 5 questions for all water bodies and beneficial uses,

2) ask specific sub questions,

3) set priorities,

4) sequence over time,

5) choose the high priority questions as the basis for monitoring designs.

- Statewide could focus on 1 and 2; then regions could focus on 3, 4,and 5.
- Regions also want status and trends.
- Some special studies have statewide benefits, don't forget special studies at state scale.
- Status monitoring is now done differently from region to region, and not being done in a way that allows statewide analysis.
- Current SWAMP comprehensive state monitoring is based on six of the nine regions rotating monitoring through watersheds.
- It is difficult to compare region to region because of different geography.
- This debate is exactly what should inform the specific questions that drive design.

6.2 Review of the Need for Revising the Development of Monitoring Objectives

- The original objectives were not good enough because: 1) they were developed at the State Board w/ minimal Regional Water Board input, 2) there has been a funding roller coaster, and it's become a question of prioritization, 3) contract delays, you get your contract and the report is due, and
- External scientific reviewers will demand a rigorous process for setting monitoring objectives.
- Regional Boards have realized this will only work as a statewide program.

6.3 Concerns about Funding Monitoring to Address Statewide Questions

Some regions have large area, small monitoring allocations, no discharger funds, and are reluctant to give up SWAMP funds previously allocated to regional monitoring to address statewide questions. Those will have to wait for more money. If SWAMP

sets up statewide objectives that can't be met, then reviewers will be critical. Let the regions accomplish what they need to do.

Geographic diversity as a barrier for RB staff to develop a set of common questions.

While it's hard to imagine funding a statewide plan, there is no way to get additional funding without one.

Need to take a longer term perspective.

It will be a SWAMP focus this year to get program information out to the public, describing what SWAMP is, why it is necessary, what it can do, it's successes, and its vision.

NAWQA started with a pilot project and took three cycles to become a well run program.

See how a statewide can provide a backbone useful for the regions.

Build statewide program and then the regions decide how much they want to engage in that.

Regional questions can be staged and built up over time.

This workshop will write example questions, then work out all of them for statewide level, then figure out how it works for the regions.

Work top-down and bottom-up at the same time

6.4 Working Examples of Monitoring Objective Development

Monitoring designs can produce useful information when developed considering each of the following steps in sequence:

1) Determine what policy questions are of interest to the public, legislature, and stakeholders.
2) Determine the type of information needed to address those policy questions.
3) Develop assessment questions.
4) Determine the ecological attributes of concern.
5) Select indicators to characterize the condition of those attributes.
6) Identify the spatial scale of the resource to be assessed.
7) Identify the temporal scale of the relevant processes.
8) Develop monitoring objective.
9) Develop monitoring design.

10) Develop sampling plan.

The workshop participants worked through examples of this process.

Example 1: a status question.

General policy question: Do water bodies support the protection of aquatic life?

Information needed: water quality conditions and standards for comparison.

Assessment question: What proportion of wadeable streams is meeting reference conditions?

Or: What % of streams is fully supporting aquatic life beneficial use?

Or: Where are aquatic life beneficial uses not protected?

Or: How does aquatic life beneficial use support compare across regions?

Or: How does aquatic life beneficial use support compare among different types of water bodies; within regions; among land uses?

Or: What % are at risk?

Ecological attributes: wadable streams; but how defined?

Temporal definition: index period, time when water is flowing, perennial, ephemeral, intermittent. Spatial definition: natural, channelized, channel form; stream order; stream reach; habitat impacts; the riparian zone is wetland, but RB authority depends on WQ.

(CWA 502.19 defines pollution as "man-made or man-induced alteration of chemical, radiological, physical, biological integrity of water.")

(Porter Cologne authority (RBs) does not extend to habitat destruction or flow limits, but CWA does.)

This monitoring design process assumes that we're starting with no knowledge, but of course we know a lot about the system. It's still a useful process.

Indicators: chemical concentrations, health of (toxicity to) representative organisms, condition of benthic invertebrate communities.

Uncertainty: What degree of certainty is required?

Uncertainty depends on management decision threshold.

When you know uncertainty requirements, you can estimate the necessary sample size, and then cost, which allows you to go back and rethink decision requirements with managers.

These questions can be asked at the statewide level, then can be compared to questions asked (using similar language) at Regional Board level, to see where overlap occurs and where state and regions can support each other..

Comments on first example

The legislative mandates set the policy questions.

SWAMP does not have the funding to address all the information needs of the mandates.

Prioritization is part of the exercise. Sort big questions into more global or more subsidiary.

Example 2: A risk question

General policy question: Where should there be fish advisories?

Information needed: Chemical concentrations in edible fish from fishing areas.

Assessment question: In which water bodies do fish tissue concentrations exceed screening values?

Ecological attributes: Lakes used for fishing; relative fishing intensity, consumption.

Not many of the lakes have been assessed. This would be a useful statewide assessment.

Statewide bass advisory based on a statewide design. Land use: PCB urban, DDT rural, etc.

Should SWAMP use other agencies for this, like OEHHA?

OEHHA doesn't collect data, depends on others like SWAMP.

OEHHA can help with question definition and design for SWAMP fish contamination studies.

Similar Assessment Question: what's the relationship between land use and fish contamination?

Sequential studies: screening level, then more sophisticated risk assessment, then advisories.

Ecological attributes: lake elevation, salinity, reservoir, hot and cold, trout lake v bass lake.

Indicators: species, analytes, types of tissue.

Advantages of top down: when you select indicators, you check back against the original goal. After the indicator point, you go down the list to look at scale etc.

Comments on Monitoring Objective Development

- Keep with this process for different types of beneficial use and water bodies; develop monitoring questions, get priorities from Regional Boards based on local expertise.
- Ask the Regional Boards for top priorities.
- If the regions adopt this approach, do they need to start all over?
- Not a direction change, but adding a compatible statewide model.
- Develop a framework to plug what Regional Boards are doing into statewide assessments.
- Previous reviews of regional work plans found that many boards were doing similar things but using different language to describe them.
- SWAMP needs to find a way in which we structure work plans so a common approach can evolve.
- This exercise is to rigorously translate the policy language into monitoring designs, so the information needs of the legislature, CWA, etc., can be specifically addressed.
- This helps turn monitoring results into information reports to the funding agencies.
- A common language for assessment and monitoring helps identify where a statewide framework can support regional monitoring.
- This approach increases funding opportunities. EPA HQ and ORD need California to relate wetlands work to SWAMP framework.
- A consolidated framework would show that SWAMP is appropriate for EPA funding.
- SWAMP has done more than we think. There are parallels to NAWQA, statewide.
- What the Regions have been doing can fit right in.
- Val's proposal: SWRCB will work on statewide design and put it back to the Regional Boards.

- SCCWRP example of demonstration projects: The Regional Boards have flexibility to focus on streams, lakes, or estuaries, but the structure is the same, so it can inform a statewide assessment strategy.

Proposal: Form a small work group (Rainer with RT partners and volunteers). Take the monitoring question process and work through it for all combinations of the four priority beneficial uses and the priority water body types (from matrix). Detail the policy questions, assessment questions, attributes, indicators, and monitoring objectives. Send this out to everyone for review. That will be a product of this workshop.

(Volunteers: Ken Schiff, Terry Fleming, Mike Lyons, Chad Dibble. John Hunt assists.)

Comments on Proposal

- This will allow the Regional Boards to see what's being covered, what's not, and where Regional Board projects fit.
- It gives credibility to a long term plan.
- SWAMP can then take this to management and try to get it funded.
- It's a menu you can pick from, and maybe fund it piecemeal.
- All the boxes must be filled eventually, EPA will fund SWAMP to fill the boxes. Until California gets its act together, EPA is funding other states instead. SWAMP needs to speak the language of the funders.
- Do the Regional Boards need to do probabilistic sampling to get funding?
- EPA doesn't care how it's done, it just has to be done.
- HQ is making up its own performance measures, so SWAMP needs to take the initiative or else it will be stuck with incompatible performance measures.

7. Workshop Wrap-up

<u>To Do Items:</u>

1) Rainer's committee to write up monitoring objective development for priority beneficial uses and water bodies.

2) RT members will review revised SWAMP goals (above), and get comments back.

3) John will write the workshop summary.

4) Roundtable to think about priorities for monitoring objectives.

8. Final Comments

- SWAMP will try to make the two scales work together (regional - statewide, important to have a program that works on multiple scales, rather than two programs. Alignment necessary.
- Regional Boards would appreciate help in clarifying objectives if the working group sees opportunities for improvement during this process.
- Support was expressed for broad inferences from fixed sites, similar to NAWQA.
- Caution that NAWQA has a huge amount of ancillary data.
- The NAWQA approach could work for SWAMP over time, but it's not cheap.
- There is lots of commonality among monitoring programs across the state.
- There's an opportunity to adopt models and use data.
- Rainer's monitoring objectives development should not be limited. Do the 5 questions for all the combinations of the priority beneficial uses and water body types.
- EPA's Nonpoint Source Program would like to help with more support for SWAMP.
- Other programs are out there that are willing to lend support, too.
- Look to cross-institutional barriers.

Appendix 1

Adams, Mary	R3
Belitz, Ken	Invited Guest: USGS/NAWQA
Bernstein, Brock	Facilitator: National Fisheries Conserv. Ctr.
Bonnema, Autumn	MLML
Brodberg, Bob	OEHHA
Brown, Julie	DFG
Buford, Pam	R5-Fresno
Carpio-Obeso, Maria	R7
Chilcott, Jeanne	R5-Sacto
Clark, Ross	Calif Coastal Commission
Connor, Val	DWQ
Crane, Dave	DFG--WPCL
Deanovic, Linda	UCD QA Team
Dibble, Chad	R5--Sacto
Fairey, Rusty	MLML
Fleming, Terry	EPA--Invited guest
Fong, Stephanie	R5
Gorman, Kim	R6--S. Lake Tahoe
Hagan, Will	QA team
Heiman, Dennis	R5-Redding
Hoenicke, Rainer	Facilitator: SFEI
Holloran, Peter	Guest of John Hunt; UCSC PhD candidate
Holmes, Robert	R5--Sacto
Hunt, John	Facilitator: Granite Cyn/UCD
Ichikawa, Gary	DFG/MLML
Jackl, Billy	MLML
Lamerdin, Cassandra	MLML
Loux, Jeff	Facilitator: UCD Extension

Lyons, Michael	R4
Mason, Susan	MLML
Maxfield, Jesse	SWRCB/NPS
Mundell, Sean	MLML
Otis, Peter	R1
Paradies, Dave	R3-Fresno
Phillips, Bryn	UC Davis/Granite Canyon
Pranger, Lara	MLML
Pranger, Mark	MLML
Puckett, Max	DFG/Granite Canyon & DFG/MLML
Rasmussen, Del	DWQ
Reyes, Emilie	DWQ
Schiff, Ken	SCCWRP-invited guest
Sigala, Marco	MLML
Smith, Jimmy	R9
Stein, Eric	SCCWRP--invited guest
Stephenson, Mark	MLML/DFG
Suk, Tom	R6--S. Lake Tahoe
Swenson, Stacey	MLML
Taberski, Karen	R2
Thompson, Bruce	SFEI--Invited Guest
Turner, John	DFG/OSPR
van Buuren, Beverly	QA team
Vandervort, Amara	QA team
Vasquez, Martice	DFG--WPCL
Vitale, Pavlova	R8
Worcester, Karen	R3
Ziegler, Sam	Invited Guest: U.S. EPA

Appendix 2

Revised SWAMP Goals developed at the February SWAMP Workshop in Carmel Valley and Comments Received as of 5/4/05

The following list of 18 program goals was derived from the original four program goals in the legislative report. The four legislative report goals each had multiple components, which were separated out for clarity, so that each could be evaluated individually.
The notations below in square parentheses [ ] are an attempt to align these SWAMP goals with the 10 EPA monitoring program elements. The round parentheses ( ) contain questions about specific wording that the subgroup wanted to refer to the RT.

SWAMP 1. Create a statewide ambient monitoring strategy that addresses all hydrologic units (all waters?) of the State (without bias to known impairment?). [EPA Monitoring Program Strategy]

SWAMP 2. Provide ambient monitoring data to support evaluation of the overall effectiveness of water quality programs in protecting beneficial uses. [EPA Monitoring Program Strategy]

SWAMP 3. Coordinate (with?) all Board ambient monitoring programs and projects. [EPA Monitoring Program Strategy]

SWAMP 4. Develop a comparable (consistent?) set of data quality objectives and data formats for Board ambient monitoring programs, grant-funded projects, and other ambient monitoring programs. [EPA Monitoring Program Strategy]

SWAMP 5. Identify specific water quality problems preventing the SWRCB, RWQCBs, and the public from realizing beneficial uses (in targeted watersheds?). [EPA Monitoring Objectives]

SWAMP 6. Monitor and assess each hydrologic unit periodically (at least once every 5 years?). [EPA Monitoring Design]

SWAMP 7. Consider data usefulness at multiple scales when developing monitoring designs. [EPA Monitoring Design]

SWAMP 8. Develop a set of indicators (and assessment thresholds?) appropriate for assessment of beneficial use attainment. [EPA Core Indicators of Water Quality]

SWAMP 9. Use monitoring, sampling, and analytical methods that produce comparable (consistent?) data. [EPA Quality Assurance]

SWAMP 10. Develop data quality assurance protocols. [EPA Quality Assurance]

SWAMP 11. Create a (centralized? comprehensive? Integrated?) data management system. [EPA Data Management]

SWAMP 12. Provide a statewide assessment of beneficial use attainment periodically (at specific intervals?). [EPA Data Analysis/Assessment]

SWAMP 13. At specific intervals, assess ambient monitoring data to support 305b reporting, 303d listing, attainment of basin plan objectives, and other statutory requirements. [EPA Data Analysis/Assessment]

SWAMP 14. Provide relevant, timely, and cost-effective information to the legislature, decision makers, stakeholders, and citizens about ambient water quality conditions. [EPA Reporting]

SWAMP 15. Secure adequate and sustainable funding (by ?). [EPA General Support and Infrastructure]

SWAMP 16. Evaluate effectiveness in attaining program objectives through external peer review (e.g. SPARC). [EPA Programmatic Evaluation]

SWAMP 17. Conduct periodic performance evaluations. [EPA Programmatic Evaluation]

SWAMP 18. (Strive to?) incorporate adaptive management principles. [EPA General Support and Infrastructure]

Reviewer No.1: SWAMP 1: Strike "without bias." If you did "all waters" there wouldn't be any bias. Combine SWAMP 6 with SWAMP 1 or make sub-objectives. Combine SWAMP 4 with SWAMP 9. Combine SWAMP 12 and 13. SWAMP 5 could be a sub-header under SWAMP 13. Separate SWAMP 15-18 from the rest. They are part of implementation strategy.

Reviewer No.2: Sees only four overall goals. The rest appear to be objectives. Recommends to structure differently: SWAMP 1, 2, 14 and 15 seem to be goals and should be listed in that logical sequence as Goal 1,2,3,4. Put "objectives" in logical order also, with SWAMP 3, 4, 6, 7, 8, 10, 16, 17 and 18 representing "objectives" under Goal 1; combine SWAMP 4 and 5; SWAMP 4/5 text and SWAMP 12 should be "objectives" under Goal 2; SWAMP 11, 13 should be objectives under Goal 3.

Reviewer No. 3: SWAMP 1 – delete "all hydrologic units" and leave "all waters without bias to known impairment." SWAMP 3 – strike "with". SWAMP 4 – Develop comparable sets of…SWAMP 5 – Identify the specific WQ problems…in all watershed as time permits. SWAMP 8 – Develop sets of indicators and assessment thresholds… SWAMP 9 – Strike "consistent." SWAMP 11 – Create a fully accessible, comprehensive data management system. SWAMP 12 – Provide a statewide assessment of beneficial use attainment periodically (every five years?). SWAMP 14 – Add: Annual update, full report every five years (could stagger reports regionally). SWAMP 15 – Comment: Funding developed as was done for the San Gabriel watershed, integrating programs. SWAMP 17 – Conduct periodic program updates and accomplishments

Reviewer No. 4: Prioritize directives in the following order: (1) SWAMP 15; (2) SWAMP 3; (3) SWAMP 1; (4) SWAMP 7; (5) SWAMP 8; (6) SWAMP 4; (7) SWAMP 9; (8) SWAMP 10; (9)

SWAMP 6; (10) SWAMP 11; (11) SWAMP 2; (12) SWAMP 5; (13) SWAMP 12; (14) SWAMP 14; (15) SWAMP 18; (16) SWAMP 13; (17) SWAMP 16; (18) SWAMP 17. Modify SWAMP 11 to say: Create a comprehensive, accessible data management system. Modify SWAMP 12 to say: Provide a statewide assessment…at least every 5 years. SWAMP 13: At least every five years, assess ambient monitoring data to support 305(b) reporting… SWAMP 17: Evaluate effectiveness in attaining water quality program objectives – not to confuse with self-evaluations – through external peer review. SWAMP 17: Conduct periodic self evaluations.

Reviewer No 5: SWAMP 1: strike "all hydrologic units" and leave "all waters." SWAMP 3: strike "with." SWAMP 4: strike "consistent." SWAMP 5: leave "in targeted watersheds." SWAMP 6: leave "at least every five years." SWAMP 8: leave "and assessment thresholds." SWAMP 9: …that produce comparable, high-quality data. SWAMP 10: Develop and implement… SWAMP 11: Create ad centralized and comprehensive data management system. SWAMP 14: Provide relevant, concise, timely, and cost-effective info to the legislature, decision-makers, stakeholders, and citizens about ambient water quality conditions annually. SWAMP 17: Conduct periodic performance evaluations and implement corrective actions. SWAMP 18: Strive to incorporate adaptive management principles and influence management decisions.

Reviewer No. 6: SWAMP 3: Strike "with." Comment: This goal is a priority! How can we know where and what to sample if we don't know what's already happening?

6.2 Assessment Questions and User's Guide:

Assessment Questions for SWAMP Based on Relevant Monitoring Goals and Objectives

6.2
Assessment Questions
and User's Guide:

Assessment Questions for SWAMP Based on Relevant
Monitoring Goals and Objectives

Revised, September 15, 2006

Introduction

At the February 2005 workshop, a small workgroup developed a preliminary list of goals for SWAMP that combine those contained in the 2000 Report to the Legislature with those in various EPA documents. A subset of these general goals can be extended into more specific monitoring objectives and assessment questions, which in turn serve as the foundation for the types of monitoring and special-study designs suitable to answer them. Before the Roundtable participants can delve into a discussion about monitoring designs, the assessment questions need to be clearly laid out and organized. As one of the workshop follow-up assignments, another workgroup was charged with developing a draft document containing assessment questions for each of the four high-priority beneficial use categories (aquatic life, fishable, swimmable, drinkable). However, assessment questions associated with other beneficial uses, such as irrigation supply water for agriculture, can be derived following the same "template."

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Framing Questions to Develop Monitoring Designs

The Clean Water Act and the California Water Code contain mandates, most of which can be phrased as questions. They are:

1) What is the condition/status of beneficial uses in each Region and the State as a whole?
2) What are trends in key indicators representative of beneficial uses?
3) What effects or impairments do various anthropogenic stressors cause?
   [This question could also be expressed in reverse: What are the causes of beneficial use impairments? The former question implies a more proactive or preventive risk assessment approach, while the latter implies something akin to a TIE approach, searching for the cause of an already manifest impact. A major decision SWAMP has to make is: "Do we want to continue to focus on lists of pre-selected analytes and known categories of stressors, or does SWAMP want to focus more on anticipatory, risk-based monitoring and special studies?]
4) What are the sources (pathways, and loadings) of pollutants of concern and other stressors for various water bodies?
5) How effective are management actions [and policy decisions] in protecting and restoring beneficial uses? [Please note: At the workshop, the group framed these questions more simply in terms of status, trends, cause-effect, source identification, and effectiveness of management actions.]

These five overarching questions are at the same hierarchical level as Monitoring Objectives. More specific Assessment Questions can form the foundation for selecting appropriate environmental indicators, data quality objectives, monitoring designs, and data quality assessments.

Surface Water Monitoring Objectives

1) Determine the condition/status of beneficial uses throughout the State without bias to known impairment
2) Assess trends [in beneficial use condition] [using representative indicators]
3) Identify which "man-induced alterations of the chemical, physical, biological, or radiological integrity of water" (CWA, Section 502(19)) are impairing beneficial uses [Phrased this way, monitoring approaches can be broadened to assess multiple and interactive causes of impairment], including pollution sources and pathways.
4) Evaluate effectiveness of management actions [and policies] in restoring and protecting beneficial uses

Many of the goals and objectives drafted during the February 2005 Workshop for the Program as a whole are not directly related to generating assessment questions and don't need to be considered here, such as:

1) Communicate monitoring information in a timely and cost-effective manner and make it relevant to the legislature, decision-makers, stakeholders, and citizens.
2) Coordinate and integrate information from other related monitoring and assessment programs
3) Use methods that produce comparable data
4) Develop comparable sets of data quality objectives and consistent data formats for monitoring programs and grant-funded projects
5) Secure adequate and sustainable funding
6) etc.

Assessment Questions

The following questions correspond to the four objectives relevant to monitoring design and indicator selection issues, listed for each of the four high-priority beneficial uses (aquatic life; swimmable, fishable, drinkable) and water body types. Questions pertaining to other beneficial uses can easily be derived by using the same template.

Please keep in mind that at this stage, we are attempting to identify and develop questions that all regions might have in common with those the state water board would like to answer.

The short-term goal is to group the universe and hierarchy of potential questions in a manner where we can more easily identify those questions for which SWAMP could and should attempt to be the main information source. Other Water Board programs (e.g., NPDES, 401, TMDL, ASBS, Grants, WDR, Irrigated Lands, etc.) are encouraged to use the same framework to coordinate and link their own information-gathering efforts to SWAMP. The following example questions are arranged hierarchically, i.e., from the general to the increasingly specific.

A
Aquatic Life Use Support—All Water Body Types

A.1
Determine the condition/status of aquatic life beneficial use throughout the State

A.1.1 What are the extent and locations of water bodies which do not meet beneficial uses for aquatic life protection?

A.1.2 What are the extent and locations of at-risk water bodies?

A.1.3 What are the extent and locations of high-quality waters and watersheds with high physical, chemical, and biological integrity?

A.1.4 What is the proportion of water bodies in the State and each region for which evidence exists that they do and do not meet beneficial uses for aquatic life protection?

A.1.4.1 How is the (statistical) population of interest best defined (spatially and temporally)?

A.1.4.2 What attributes, indicators, and indices are reasonable representations or surrogates for beneficial use condition or the chemical, physical, biological, and radiological integrity of water?

COMMENTS:

Please use the space below to identify which of the questions are of value to you, so you are able to better prioritize water quality attainment steps and apply limited resources strategically, to work with other programs within your Regional Board or sister agencies (e.g. DHS, DFG, DWR, etc.) to assess information, etc.

A.2
Assess trends in the condition of aquatic life beneficial uses

A.2.1 Are conditions in water bodies or hydrologic units improving over time?

A.2.1.1 What metrics are needed to evaluate trends in biological integrity, physical habitat, and water chemistry?

A.2.1.2 What are appropriate time frames for evaluating trends

A.2.1.3 How precise do trend measurements need to be?

A.2.2 Have water bodies that previously supported aquatic life uses become impaired?

A.2.3 Have previously impaired water bodies been restored?

A.2.4 How is the proportion of water bodies meeting aquatic life uses changing over time?

COMMENTS:

A.3
Evaluate sources and pathways of man-made or man-induced stressors [evaluating and determining sources implies that we can trace them to a specific location and differentiate between symptoms and ultimate causes].

A.3.1 What stressors [including pollutants] are associated with impairments or threats to aquatic life uses? At what scale do we need this answer?

A.3.1.1 Where are these stressors located?

A.3.1.2 How are various land and water use activities associated with impairments and threats to aquatic life uses?

A.3.2 What are the largest sources and/or largest causes of impairments to aquatic life uses throughout each Region and the state as a whole? How accurate do we need to be when assigning causes?

A.3.3 What is the relative importance of pollutants from different sources [and locations] in terms of beneficial use impairment? What level of precision do we need in ranking sources/causes?

COMMENTS:

A.4
Evaluate effectiveness of management actions [and policy decisions]

A.4.1 What are the management actions that are being employed to address these problems?

A.4.1.1 Where are actions implemented to address them?

A.4.2 What are watershed-level benefits and trends associated with programs and projects?

A.4.2.1 What are watershed-level benefits and trends associated with management strategies and practices?

A.4.3 How are pollution patterns and trends affected by remediation, source control, or pollution prevention actions and policies regionally and statewide?

A.4.4 Are the causes of impairments being reduced as a result of the individual actions?

A.4.5 What are the locations and extent of resources expended?

A.4.6 How can locations and extent of Management Measure implementation best be associated with threatened and impaired water bodies?

A.4.6.1 How can improvement in water quality or beneficial use restoration best be linked to investments?

A.4.6.2 How can cost-effectiveness of implementation of management measures best be evaluated?

COMMENTS:

For this set of questions, please think about what SWAMP monitoring activities may be appropriate regionally and/or statewide, and what kind of assessment of data by other programs SWAMP may want/need to do in order to serve its clientele. Think of spatial scale issues.

B
Swimmable—Estuaries, Ocean, Lakes, Rivers, Wadeable Streams

B.1
Determine the condition/status of beneficial uses at beaches throughout the State

B.1.1 What are the extent and locations of water bodies that do not support direct water contact recreation?

B.1.2 What are the extent and locations of at-risk water bodies?

B.1.3 What are the extent and locations of high-quality beaches?

B.1.4 What is the proportion of beaches, coastline, and other areas designated for water contact recreation (extent and duration) throughout the State and regions for which evidence exists that they meet and do not meet body-contact water quality standards?

B.1.4.1. How do we best define population of interest (spatially and temporally)?

COMMENTS:

B.2
Assess trends

B.2.1 Are conditions at the beaches improving, degrading, or staying the same? At what temporal scale do we need the answer? At what spatial scale do we need to know the answer?

B.2.1.1 What metrics are needed to evaluate trends in body-contact water quality standards?

B.2.1.2 What are appropriate time frames for evaluating trends?

B.2.1.3 How precise do trend measurements need to be?

B.2.2 Have previously unimpaired beaches become impaired?

B.2.3 Have previously impaired beaches been restored?

B.2.4 How is the proportion of areas supporting water contact recreation changing over time?

COMMENTS:

B.3
Evaluate beneficial use impairment, including sources and pathways of impairment factors

B.3.1 What factors are associated with closures of areas designated for water contact recreation?

B.3.2. What are the largest sources and/or biggest causes of impairments throughout each Region and the state as a whole?

B.3.3 What is the relative importance of pollutants from different sources and locations in terms of recreational use impairment?

COMMENTS:

B.4
Evaluate effectiveness of management actions [and policy decisions]

B.4.1 What are the management actions that are being employed to address these problems?

B.4.2 What benefits of individual programs and projects within a given watershed are reflected in beach water quality indicators within the area of influence of the discharge point?

B.4.3 How are pollution patterns and trends affected by remediation, source control, or pollution prevention actions and policies regionally and statewide?

B.4.4 Are the causes of impairments being reduced as a result of the individual actions?

B.4.5 What are the locations and extent of resources expended?

B.4.6 How can locations and extent of Management Measure implementation best be associated with threatened and impaired waterbodies?

B.4.6.1 How can improvement in water quality or beneficial use restoration best be linked to investments?

B.4.6.2 How can cost-effectiveness of implementation of management measures best be evaluated?

COMMENTS:

C
DRINKABLE – Lakes/Reservoirs, Rivers, Wadeable Streams

C.1
Determine the condition/status of beneficial uses throughout the State

C.1.1 What are the extent and locations of drinking water quality impairments?

C.1.2 What are the extent and location of at-risk water bodies?

C.1.3 What are the extent and location of high-quality drinking water sources?

C.1.4 What is the proportion of lakes/reservoirs and river/stream miles (extent and duration) that do and do not meet drinking water quality standards throughout the State and the regions?

C.1.4.1 How do we best define the population of interest (spatially and temporally)?

C.1.4.2 What attributes, indicators, and indices are reasonable representations or surrogates for “safe” drinking water?

COMMENTS:

C.2
Assess trends

C.2.1 Are conditions in source water management areas and drinking water supply improving, degrading, or staying the same? At what temporal scale do we need to know the answer? At what spatial scale do we need to know the answer?

C.2.1.1 What metrics are needed to evaluate trends in drinking source water quality standards?

C.2.1.2 What are appropriate time frames for evaluating trends?

C.2.1.3 How precise do trend measurements need to be?

C.2.2 Have previously unimpaired water bodies become impaired?

C.2.3 Have previously impaired water bodies been restored?

C.2.4 How is the proportion of water bodies meeting drinking water standards changing over time?

COMMENTS:

C.3
Evaluate beneficial use impairment, including sources and pathways of impairment factors

C.3.1 What factors are associated with health warnings and drinking water supply interruptions?

C.3.2 What are the largest sources and/or biggest causes of impairments throughout each Region and the state as a whole?

C.3.3 What is the relative importance of pollutant loadings from different sources and pathways in terms of beneficial use impairment?

COMMENTS:

C.4
Evaluate effectiveness of management actions [and policy decisions]

C.4.1 What are the management actions that are being employed to address these problems?

C.4.2 What benefits of individual programs and projects within a given watershed are reflected in drinking water quality indicators within the area of influence of the discharge point?

C.4.3 How are pollution patterns and trends affected by remediation, source control, or pollution prevention actions and policies regionally and statewide?

C.4.4 Are the causes of impairments being reduced as a result of the individual actions?

COMMENTS:

D
Fishable—Ocean, Estuaries, Rivers, Wadeable Streams

D.1
Determine the status of the fishing beneficial use throughout the State

D.1.1 What are the extent and locations of water bodies with fishing as a beneficial use?

D.1.2 What are the extent and locations of water bodies with some indications that the fishing beneficial use may not be supported (screening-level evidence of fish contamination)?

D.1.3 What are the extent and locations of water bodies supporting the fishing beneficial use?

D.1.4 What is the proportion of water bodies in the State and each region where consumption advice is unnecessary; limited consumption is advised; or no consumption is advised (advisory-level evidence)?

COMMENTS:

D.2
Assess trends in the fishing beneficial use throughout the State

D.2.1 Are water bodies improving or deteriorating with respect to the fishing beneficial use?

D.2.2 Have water bodies fully supporting the fishing beneficial use become impaired?

D.2.3 Has full support of the fishing beneficial use been restored for previously impaired water bodies?

D.2.4 How is the proportion of water bodies where the fishing beneficial use is unimpaired changing over time (this skirts the detailed question about "fully, partially, or not supporting" the fishing BU and includes screening info)?

COMMENTS:

D3
Evaluate sources and pathways of factors impacting the fishing beneficial use

D3.1 What are the largest sources and/or largest direct and indirect causes of elevated tissue levels throughout each Region and the state as a whole?

D3.2 What is the relative importance of different pollutant sources and pathways in terms of impact on the fishing beneficial use on a regional and statewide basis?

COMMENTS:

D4
Evaluate effectiveness of management actions in improving the fishing beneficial use

D4.1 What are the management actions that are being employed to address these problems?

D4.2 How is the fishing beneficial use affected by remediation, source control, or pollution prevention actions and policies regionally and statewide?

COMMENTS:

Directions for filling out the Assessment Priorities Table.

This table has been created as one means of gauging regional assessment priorities, to facilitate development of the statewide assessment framework. The regional priorities will be used to develop the framework so that component monitoring designs provide the most useful data for assessments at both regional and statewide levels. This table will be used in conjunction with the accompanying text document that gives the specific wording of the SWAMP assessment questions. The text document provides space with each question for region-specific comments about indicators, water body types, additional beneficial uses to be considered, etc.

Note: The wording of the questions in the table was shortened and is not exact, but the numbering is the same as for the questions in the companion text document. The text document should be used for the specific assessment question wording.

Rules and Considerations

It is important that each regional monitoring coordinator approach this table with similar assumptions, so that the results can be directly compared and aggregated. Here are some of the ground rules established in Round Table discussions on September 14, 2006.

1) Assign priorities based on what you think SWAMP should do with it's own program resources (PY's and contracts). Some assessment questions may be of high importance, but if they are to be addressed by another entity (even in cooperation with SWAMP), a lower priority should be assigned. If SWAMP staff anticipate spending significant SWAMP resources to coordinate with, direct, or assess data from another entity's project, then a higher priority should be given.

2) Consider the level of SWAMP effort for BOTH monitoring and assessment. If you think SWAMP staff in your region should put significant effort into assessing data to answer one of the assessment questions, assign it as high a priority as you would if that effort were to be spent on monitoring.

3) Assign priority values for your regional priorities in the "regional column." In the "statewide column," assign priority values to reflect how important your region feels each assessment question should be for the state as a whole. You can comment in the text file, if necessary, to clarify wording, such as: stressor "associated" with an effect (which might make more sense at a statewide level), and stressor "caused" an effect (which might make more sense at a regional level).

4) Assume a 3- to 5-year timeframe. Priority should not be based on urgency. Logistics, funding, etc., may determine which assessment questions are tackled first, but assume the statewide framework will be designed to phase in the most important assessments over a 3- to 5- year timeframe.

5) The questions are set up in a hierarchy, reflected in the numbering (decimal points at the beginning of each question). If a more specific assessment question is of high priority, please make sure that the

same high priority is given to higher level questions in that category. For example, if Question A.3.1.2 (how is land use associated with impairments?) is of highest priority, assign it a "3" and also assign 3s to Questions A.3.1, A.3, and A. Please use your judgment here, of course, to make sure this all makes sense. Remember, your text comments in the text document will trump the numbers, but we want to have logical consistency in the math.

6) Some of the Assessment Questions do not lend themselves well to prioritization (for example: How precise do trend measurements need to be?). Feel free to enter "NA" where appropriate.

7) Please make sure to fill in your Region Number at the top of the column.

8) Please rename this file with your Region Number before filling it out and returning it.

9) Please submit one table per Region (R5: please use your best judgment).

10) Please return the completed table, and text file with comments, by Friday, September 22, 2006 as email attachments to John Hunt, Rainer Hoenicke, Terry Fleming, and Emilie Reyes. We'll compile the responses and send them around for final comments before they're included in the Business Plan tasks for statewide framework development.

Next Steps

Each one of these questions can be further broken down into subsets of increasing level of detail – all the way to the point of formulating specific hypotheses and refining existing conceptual models of the relationships between management intervention and desired environmental outcomes. A key challenge for SWAMP is to identify which questions should be addressed by SWAMP, which questions are already addressed by other programs within the Water Board and in other agencies and therefore require a focus on data exchange, assessment, reporting, and communication, and which questions should be addressed collaboratively.

Some questions can only be answered by short-term research efforts, others through long-term trend monitoring and change detection. Monitoring and study designs will differ based on how the questions are stated.

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