From:	Lowell Jarvis
To:	comments_EIR@DeltaCouncil; Coolidge, Keith@DeltaCouncil; lauren.hashings@deltacouncil.ca.gov
Subject:	EIR Comments Verbally Presented at the Public Meeting in Clarksburg
Date:	Thursday, January 26, 2012 5:18:40 PM
Attachments:	Comments on the DSC.docx NSF WQI Fortran Program.pdf comp_strategy_report.pdf

---

Phil, Randy and Don:

I promised last week to email the DSC my comments electronically from the Clarksburg public meeting. Please find them attached.

Lowell Jarvis

Mr. Phil Isenberg, Chair January 25, 2012
and Members of the Delta Stewardship Council
Delta Stewardship Council
980 Ninth Street, Suite 1500
Sacramento, CA 95814

Re: Comments on Delta Stewardship Council (Council) Draft EIR

Dear Mr. Isenberg:

Thank you for the opportunity to comment on the draft EIR for the Delta Plan at the Council's public meeting held in Clarksburg on January 18, 2012. The Council is embarking on one of the most critically important issues for California's future, and I wish you success on your mission. I spoke at the public meeting and promised to submit my comments in writing. I had six basic comments and they are as follows:

1) Since the policies and recommendations of the Delta Plan will impact all residents in the Central Valley of California, in the spirit of full public participation, the Council could have held public meetings in other locations such as Chico, Grass Valley, Placerville, Sonora and Fresno.

2) Ostensively, there is a high regard for science in the DSC proceedings, yet a very basic scientific process is being ignored. This is the concept of "systems analysis". The Delta is an aquatic system within the much larger Delta watershed system. A real, meaningful discussion about Delta science is not possible without considering the physical, chemical, biological, and socio-economic roles and interconnections that the Delta watershed plays in the Delta's current and future environmental attributes.

3) The draft EIR contains the phrase "a more natural flow regime" in several locations in Chapter 3. A revised Delta flow standard that recognizes all of the current upstream user's water rights, contracts, licenses, and flow obligations, etc., identifies the flow requirements for a healthy, restored and sustainable environment in the Delta, and identifies any excess water that may be available for export from the Delta in normal, above normal and wet water years, would be

preferential. The above mentioned flow regime is a win-win-win for a larger group of water users rather than a win-win for a smaller group of water users. A natural flow regime may be inconsistent with the coequal goals of both water supply reliability and Delta restoration, be in conflict with the renewable energy mandate of 30 percent by 2020, as well as cause the critically unstable levees in the Delta to fail.

4) Once an isolated facility is constructed and in operation, there is the established fact that water will be transported through the Delta, but how can we be sure that the Delta ecosystem will be improved or restored, and by what standards? The draft EIR documents that I have read do not connect Delta flows and Delta ecosystem quality in a meaningful way. There is a general notion that more flow is better, but what about the other elements (stressors) that impact listed species? What ecosystem metrics will guide the State in determining Delta flow standards on a real time basis?

   The Council may want to consider using an index, similar to the National Sanitation Foundation's (NSF) Water Quality Index (WQI). The NSF WQI is limited to only 9 physical and chemical parameters, and the DSC would need to expand the index to monitor and assess the relevant Delta ecosystem indicator parameters. (I have attached a .pdf file that has the WQI programed in the WATFIV Version of Fortran.)

   The new index, which may be called the Bay Delta Ecosystem Quality Index (BDEQI), would be established by using the "Delphi Technique" of polling of recognized experts in the field of water quality, biological resources, principles of ecology, etc. The Delphi Technique experts would establish which physical, chemical and biological parameters are needed, the frequency of sampling, the weighting of the parameters, the percentage of quality for each parameter, and the relevant index equation, etc. The new index would employ "representative" sample locations, and may include some of the historical Delta water quality sampling locations.

   Once the BDEQI is established it would provide "baseline conditions" for the Bay Delta ecosystem and the index would continue to evaluate the conditions of the Bay Delta ecosystem. It could also

help the State to determine real-time required flows to help protect the Delta ecosystem. Also attached is the recently released *A Comprehensive Monitoring Program Strategy for California.* The principles in this document could be incorporated to protect the Delta estuary.

5) There is a need to discuss the before and after scenarios of the construction and operational impacts of the BDCP's north-south cross Delta water conveyance facility (Project). What changes will be brought about in the Delta ecosystem with the Project operation? How will changes in flow affect water temperature, dissolved oxygen, salinity, levee stability, agricultural practices, listed species survival rates, predation, and a whole host of water quality parameters on a seasonal basis in different portions of the Delta? How does the Project operation coordinate water supply reliability if the cold water pools have been drained and all the upstream water supplies have all been released in the spring because of the adherence to a natural flow regime in wet and dry water years?

6) Finally, I ask this question. If California had $20 billion dollars to spend on a water infrastructure project (the final costs may approach $100 billion dollars or more if levee improvements and off-stream storage reservoirs are also constructed to optimize the Project yields), is this the best use of funds guaranteeing the highest return on investment (ROI)? Should other alternatives also be developed and analyzed for their ROI? For example, an engineering evaluation could be done on a combination of the use of photovoltaics (PV) in the desert southwest and the use of reverse osmosis desalination (ROD) plants along the ocean. PV-ROD systems would generate water at higher rates in the summers when more water in needed, would be greenhouse gas neutral, help the State achieve the 30 percent renewable standard by 2020, not be subject to the myriad of biological fluctuations in the Delta, would be less subject to levee, earthquake, and sea level rise risks that now exist in the Delta, would not be impacted by the predicted climate change reductions in Sierra snowpack, would reduce the imbedded energy costs now associated

with pumping water over the Tehachapi, would not negatively impact the economies of northern California, and would not be subject to the reduced Delta yields in dry and below normal water years.

What if California invested $20 billion dollars on water recycling projects? My understanding is that up to 1 million acre-feet of water is potentially available in the southern California region, and only about 100,000 acre-feet of water are being reclaimed. How much more water could be reclaimed if the State invested in water reclamation projects in southern California?

Thank you for the opportunity to comment on this very important draft environmental Impact report. Good luck in achieving a successful outcome for economic sustainablity of all Californians.

Sincerely,

Lowell M. Jarvis
Retired State Scientist, (CARB, CDFA & SWRCB)
840 Lozanos Road
Newcastle, CA 95658

Attachments

```
$JOB WATFIV  L. M. JARVIS   NSF WQI PROGRAM
      INTEGER END, I, J,N
      REAL FCNUM, RMIN, VMAX, VMIN, BL, BU, VINC, GRID,
     * A, B, QLTY, EXTRM,  WQIM, WGHT, PRMTR, PART1, PART2, DATA
      REAL PART3, PART4, PART5, VINT
      CHARACTER*16 ID
C     FORTRAN IV PROGRAM TO COMPUTE NSF WATER QUALITY INDEX
C     INPUT DATA ON DEVICE 1
C     OUTPUT RESULTS ON DEVICE 3
C     INPUT DATA FORMAT = (4A4,1X,9F7.0).
C     DATA FROM ONE WATER SAMPLE IS PUT ON ONE CARD =
C     COLUMNS    CONTENT
C      1 - 16    WATER SAMPLE IDENTIFICATION
C     18 - 24    FECAL COLIFORMS (#/100ML)
C     25 - 31    PH
C     32 - 38    BODS (MG/L)
C     39 - 45    NO3 (MG/L)
C     46 -52    T-PO4 (MG/L)
C     53 - 59    TEMPERATURE DEPARTURE FROM EQUILIBRIUM ( CENT)
C     60 - 66    TURBIDITY (JTU)
C     67 - 73    TOTAL SOLIDS (MG/L)
C     74 - 80    DO ( % SATURATION )
C     THE VALUE MAY BE POSITIONED ANYWHERE WITHIN THE GIVEN COLUMN RANGE,
C     BUT A DECIMAL POINT MUST BE INCLUDED WITH THE NUMBER.
C     FOR EXAMPLE, DATA FROM A WATER SAMPLE TAKEN AT A HYPOTHETICAL
C     SAMPLING STATION ON THE HURON RIVER, WITH FECAL COLIFORMS = 100/10
C     PH = 7.7, BODS =15 MG/L, NO3 = 4.5 MG/L, T-PO4 = 0.9 MG/L,
C     DELTA TEMPERATURE =0.0 DEGREES CENTIGRADE (NO THERMAL POLLUTION),
C     TURBITY = 20 JTU, TOTAL SOLIDS = 150 MG/L, DO = 75% SATURATION,
C     WOULD BE CODED AS :
C     NOTE: IF FECAL COLIFORMS COUNT = 0, THE LOG(BASE 10) IS ARTIFICALL
C     SET EQUAL TO 0.
C
C
C
      DIMENSION VINT(9),VMIN(9),VMAX(9),VINC(9),GRID(9,21),PART1(45),
     *PART2(45),EXTRM(9),DATA(9),QLTY(9),WGHT(9),ID(4),RMIN(9),
     *PART3(45), PART4(45), PART5(9), PRMTR(18)
      EQUIVALENCE (GRID(1),PART1(1)),(GRID(46),PART2(1)),
     *(GRID(91),PART3(1)), (GRID(136),PART4(1)),
     *(GRID(181),PART5(1))
      DATA WGHT/0.16,0.11,0.11,0.10,0.10,0.10,0.08,0.07,0.17/
      DATA RMIN/5*0.0,-5.0,3*0.0/
      DATA PRMTR/' FEC','ALS ','   P', 'H   ',' BO','DS  ','   N',
     *'O3  ', '  PO','4-T ',' D T','EMP ','TURB','IDTY','TOTL','SLDS',
     *' DO ','%SAT'/
C
C     QUALIY FUNCTION STORAGE:
C          VINT(I) = # OF INTERVALS = # PTS - 1
C          VMIN(I) = SMALLEST PARAMETER VALUE
C          VMAX(I) = LARGEST PARAMETER VALUE
C          VINC(I) = INTERVAL SIZE IN MEASUREMENT UNITS
C     GRID(I,1) TO (I,21) = QUALITY RATING VALUES
C          EXTRM(I) = QUALITY RATING FOR PARAMETER VALUES OFF GRID
C     I=1 => FECAL COLIFORMS
C          I=2 => PH
C          I=3 => BODS
C          I=4 => NITRATES
C          I=5 => PHOSPHATES
C          I=6 => DELTA TEMPERATURE
```

```
C           I=7 => TURBIDITY
C           I=8 => TOTAL SOLIDS
C           I=9 => DO SATURATION
      DATA VINT/
     * 10.00, 20.00, 12.00, 20.00, 20.00, 8.00, 20.00, 20.00, 14.00/
      DATA VMIN/
     *  0.00, 2.00, 0.00, 0.00, 0.00, -5.00, 0.00, 0.00, 0.00/
      DATA VMAX/
     *  5.00, 12.00, 30.00, 100.00, 10.00, 15.00, 100.00, 500.00,140.0
      DATA VINC/
     *  0.50, 0.50, 2.50, 5.00, 0.50, 2.50, 5.00, 25.00, 10.00/
      DATA PART1/
     *100.00,  1.95, 99.81,100.00, 98.88, 51.71, 97.68, 79.33,  1.27,
     * 80.98,  2.60, 75.97, 63.26, 53.60, 78.93, 84.16, 84.67, 8.76,
     * 69.67,  3.28, 56.26, 49.54, 39.61, 94.91, 76.41, 86.91, 12.78,
     * 56.98,  5.66, 42.97, 41.63, 32.68, 74.33, 68.34, 86.53, 20.49,
     * 43.19,  8.41, 32.02, 35.82, 26.33, 42.75, 62.23, 85.38, 30.42/
      DATA PART2/
     * 29.22, 15.93, 24.81, 30.67, 22.18, 28.36, 56.68, 82.21, 42.34,
     * 20.83, 26.40, 19.12, 26.63, 18.51, 17.73, 52.45, 79.64, 58.42,
     * 14.06, 38.95, 15.12, 22.42, 15.74, 12.65, 48.07, 76.47, 74.42,
     *  8.94, 55.48, 11.59, 17.95, 13.70,  9.09, 44.73, 73.60, 87.47,
     *  6.13, 76.02,  9.16, 12.49, 12.51,  0.00, 41.70, 69.97, 95.12/
      DATA PART3/
     *  3.14, 91.90,  6.95,  8.98, 11.37,  0.00, 37.89, 67.19, 99.69,
     *  0.00, 91.88,  5.26,  7.61, 10.47,  0.00, 35.11, 63.48, 96.41,
     *  0.00, 85.71,  3.95,  6.25,  9.65,  0.00, 32.18, 60.09, 91.61,
     *  0.00, 71.33,  0.00,  6.07,  8.88, 0.00, 29.86, 56.76, 84.27,
     *  0.00, 49.03,  0.00,  4.05,  8.23,  0.00, 27.54, 53.47, 76.51/
      DATA PART4/
     *  0.00, 30.79,  0.00,  3.32,  7.81,  0.00, 25.71, 50.00, 0.00,
     *  0.00, 19.57,  0.00,  2.72,  7.39,  0.00, 23.94, 47.10,  0.00,
     *  0.00, 12.43,  0.00,  2.16,  6.84,  0.00, 22.16, 43.48,  0.00,
     *  0.00,  5.40,  0.00,  1.53,  6.54, 0.00, 20.23, 40.07,  0.00,
     *  0.00,  2.95,  0.00, 1.16,  6.14,  0.00, 18.43, 36.83,  0.00/
      DATA PART5/
     *  0.00,  1.33,  0.00,  0.68,  5.49,  0.00, 16.55, 32.37,  0.00/
      DATA EXTRM/
     *  2.00,  0.00,  2.00,  1.00,  2.00,  5.00,  5.00, 20.00, 50.00/
C
      WRITE(6,400)
  400 FORMAT('1'//'0',34X,'N S F  W A T E R  Q U A L I T Y  I N D E X',
     *'  C O M P U T A T I O N')
C
    1 READ(5,500,END=99) ID,(DATA(I),I=1,9)
  500 FORMAT(4A4,1X,9F7.0)
      I=1
      IF(DATA(I).LT.0.0) GO TO 98
      FCNUM=DATA(I)
      IF(DATA(I).NE.0.0) DATA(I)=ALOG10(FCNUM)
      DO 111 I=1,9
         IF (DATA(I).LT.RMIN(I)) GO TO 98
  111 CONTINUE
      I=2
      IF (DATA(2).GT.14.0) GO TO 98
C
      DO 2 I=1,9
         IF(DATA(I).GT.VMAX(I)) GO TO 24
         IF(I.NE.2) GO TO 22
         IF(DATA(I).LT.2.0) GO TO 24
```

```
37    22          N=VINT(I)
38              BL=VMIN(I)
39              DO 3 J=1,N
40                 BU=BL+VINC(I)
41               IF(DATA(I).LE.BU) GO TO 23
42                 BL=BU
43    3       CONTINUE
44    23        A=(GRID(I,J+1)-GRID(I,J))/VINC(I)
45              B=GRID(I,J)-A*BL
46              QLTY(I)=A*DATA(I)+B
47              GO TO 2
48    24        QLTY(I)=EXTRM(I)
49    2         CONTINUE
      C
50          WQIM=1.0
51          DO 4 I=1,9
52             WQIM=WQIM*QLTY(I)**WGHT(I)
53    4     CONTINUE
      C
54          WRITE(6,600) ID,WQIM,PRMTR,FCNUM,(DATA(I),I=2,9),DATA(I),QLTY
55    600  FORMAT('0'/'   SAMPLE : ',4A4,6X,'WQI =',F7.2/
          *' ',9X,9(5X,2A4)/
          *'   DATA',F16.0,2F13.1,F13.2,F13.3,2F13.1,2F13.0/
          *' ',12X,'10** ',F6.3/
          *'   QUALITY',9(3X,F10.2))
56          GO TO 1
      C
57    98    WRITE(6,700) ID,PRMTR(2*I-1),PRMTR(2*I)
58    700   FORMAT('0'/'  ERROR IN DATA FROM SAMPLE : ' ,4A4/
          *'   PARAMETER ',2A4,' IS OUT OF BOUNDS.')
59          GO TO 1
      C
60    99    STOP
61          END

      $ENTRY
```

A Comprehensive Monitoring Program Strategy for California

Recommendations of the

California Water Quality Monitoring Council

submitted to

Linda S. Adams

Secretary for Environmental Protection

and

Lester Snow

Secretary for Natural Resources

State of California

December 23, 2010

Members of the California Water Quality Monitoring Council

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

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

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

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

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

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

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

Representing the Public
Linda Sheehan
Executive Director
California Coastkeeper Alliance

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

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

December 23, 2010

A Comprehensive Monitoring Program Strategy for California

Recommendations of the

California Water Quality Monitoring Council

submitted to

Linda S. Adams

Secretary for Environmental Protection

Lester Snow

Secretary for Natural Resources

State of California

December 23, 2010

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

Table of Contents

Foreword ….. 7
The Problem 7
The Monitoring Council's Vision 8
"My Water Quality" Internet Portals 8
Legislative Mandates and Agency Agreements 10
The Role of SWAMP 12
Strategy Implementation 12

Chapter 1: Introduction 13
1.1 The Monitoring Council's approach clarifies the problem 13
1.2 Web portals foster solutions and improve efficiency 15
1.3 Implementing the Monitoring Council's Recommended Comprehensive Monitoring Program Strategy 15

Chapter 2: Philosophy and Approach 17
2.1 A philosophy of transparent, continual improvement 17
2.2 A five-part approach to monitoring, assessment, and data integration 18
2.2.1 A flexible organizational structure 19
2.2.2 Monitoring program performance measures 21
2.2.3 A single, global point of entry 23
2.2.4 Coordination of core monitoring program elements 25
2.2.5 Improved data management 26
2.2.6 Monitoring of state financed water quality improvement projects 29

Chapter 3: The Monitoring Council's Ten-Year Workplan 32
3.1 Theme-by-theme tasks 32
3.1.1 Prioritize targets for development 32
3.1.2 Establish and task workgroups 36
3.1.3 Design and implement web portal 37
3.1.4 Improve monitoring programs 37
3.2 Program-level workplan schedule 37
3.2.1 Start-up: Years 1 – 2 39
3.2.2 Development: Years 2 – 8 40
3.2.3 Long-term maintenance: Years 9 – 10 (and beyond) 41
3.3 Budget 41
3.3.1. Funding strategy 41
3.3.2. Estimated budgets 43
3.3.3. Contracting and implementation constraints 44

Chapter 4: Recommendations 46

References … 48

Appendices

Appendix 1: SB 1070 Requirements Matched to Recommended Comprehensive Monitoring Program Strategy Components 49

Appendix 2: California Water Quality Monitoring Council Annual Progress Report, December 2009 53

Appendix 3: Monitoring Council Governance 67

Appendix 4: Guidelines for Workgroups and the Development of *My Water Quality* Theme-Based Internet Portals 73

Appendix 5: SWAMP Monitoring and Assessment Strategy, Assessment Framework, and Needs Assessment 83

Appendix 6: California Wetland Monitoring Workgroup, Tenets of a State Wetland and Riparian Monitoring Program (WRAMP) 245

Figures and Tables

Figure 1. Schematic of the categories of monitoring programs that produce data relevant to the Safe to Swim web portal 14

Figure 2. Process of continuous improvement in statewide assessments 18

Figure 3. The Monitoring Council's global point of entry to monitoring and assessment information for all theme-based web portals (www.CaWaterQuality.net) 23

Figure 4. The main Safe to Swim portal page 24

Figure 5. The Aquatic Ecosystem Health web page 25

Figure 6. Schematic depiction of the CEDEN network 27

Figure 7. The Monitoring Council's data management workgroup 28

Figure 8. Parallel tracks needed to implement theme-based monitoring and assessment within the context of web portals 33

Figure 9. The process for integrating the design and implementation of individual theme-based web portals with their related monitoring and assessment programs. 38

Figure 10. Summary budget estimate for Monitoring Council activities and portal development over the ten-year period 44

Table 1. Respective roles of the Monitoring Council and the theme-specific workgroups on the six main monitoring program elements 20

Table 2. Benchmarks associated with each of the six monitoring program performance measures used to evaluate existing web-portals and their underlying monitoring and assessment programs 22

Table 3. Summary results of the prioritization of themes and subthemes 34

Table 4. Possible circumstances the Monitoring Council will face in establishing workgroups to address web portal development for each theme and subtheme 36

Table 5. Assumptions underlying the budget estimate in Figure 10 44

Foreword

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

The Problem

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

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

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

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

The Monitoring Council's Vision

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

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

"My Water Quality" Internet Portals

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

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

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

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

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

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

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

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

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

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

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

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

Legislative Mandates and Agency Agreements

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

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

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

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

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

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

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

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

The Role of SWAMP

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

Strategy Implementation

The MOU also established responsibilities for the two Agencies:

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

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

Chapter 1: Introduction

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

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

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

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

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

1.1 The Monitoring Council's approach clarifies the problem

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

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

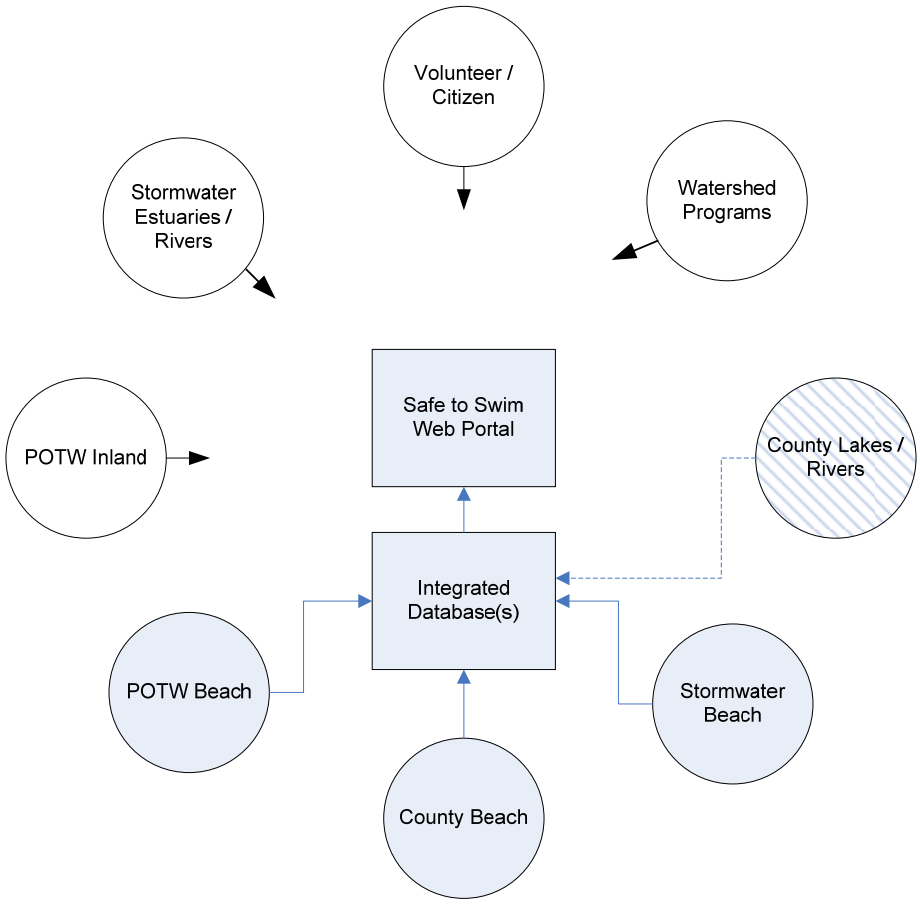

Figure 1. *Schematic of the categories of monitoring programs that produce data relevant to the Safe to Swim web portal. Past efforts at bringing monitoring data together in an integrated statewide database have focused on ocean beaches, and a few county-level monitoring programs at lakes and rivers.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

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

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

1.2 Web portals foster solutions and improve efficiency

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

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

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

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

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

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

Chapter 2: Philosophy and Approach

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

2.1 A philosophy of transparent, continual improvement

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

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

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

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

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

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

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

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

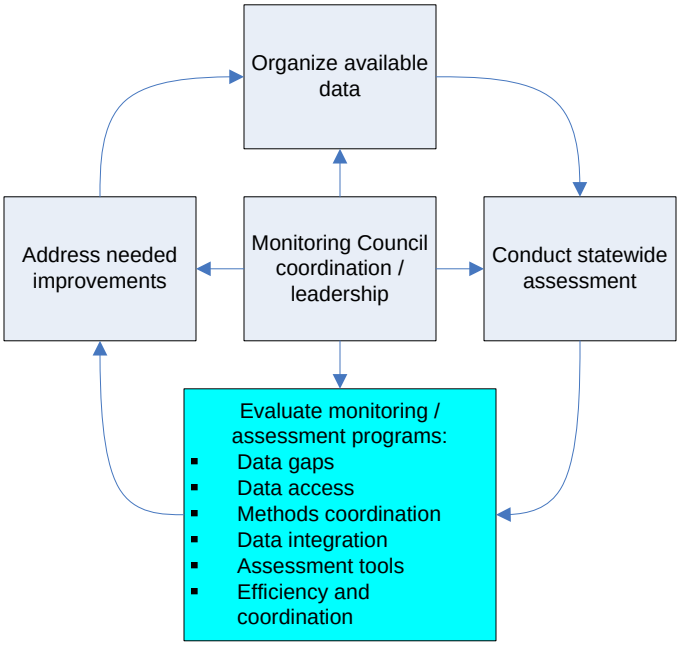

Figure 2. *The Monitoring Council's central role in promoting and organizing a process of continuous improvement in statewide assessments. Theme-specific workgroups have the primary responsibility for addressing functions in the four boxes around the periphery of the figure, with the key evaluation function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

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

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

2.2.1 A flexible organizational structure

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

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

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

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

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

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

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

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

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

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

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

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

2.2.2 Monitoring program performance measures

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

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

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

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

2.2.3 A single, global point of entry

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

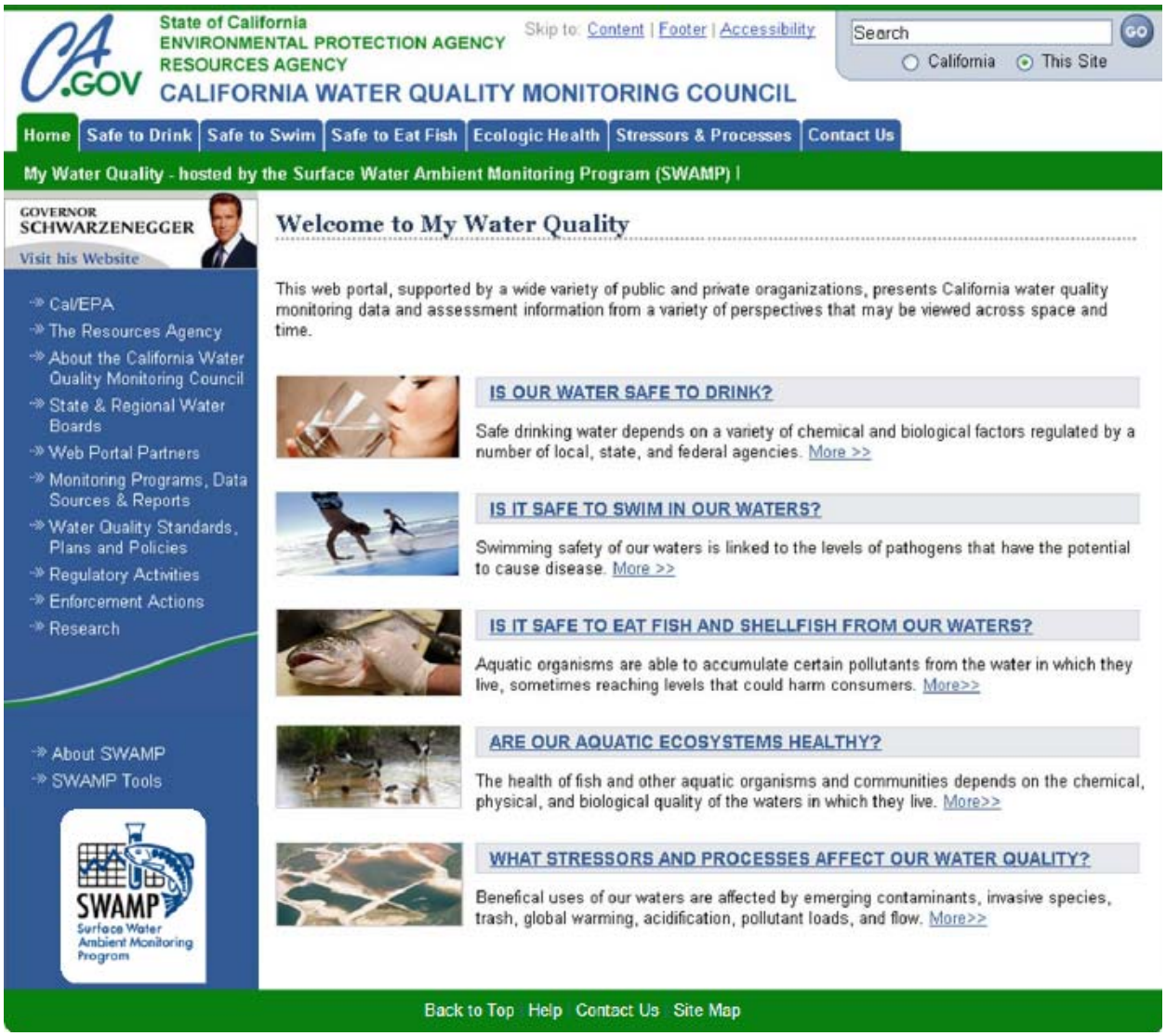

Figure 3. *The Monitoring Council's global point of entry to monitoring and assessment information for all theme-based web portals (www.CaWaterQuality.net)*

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

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

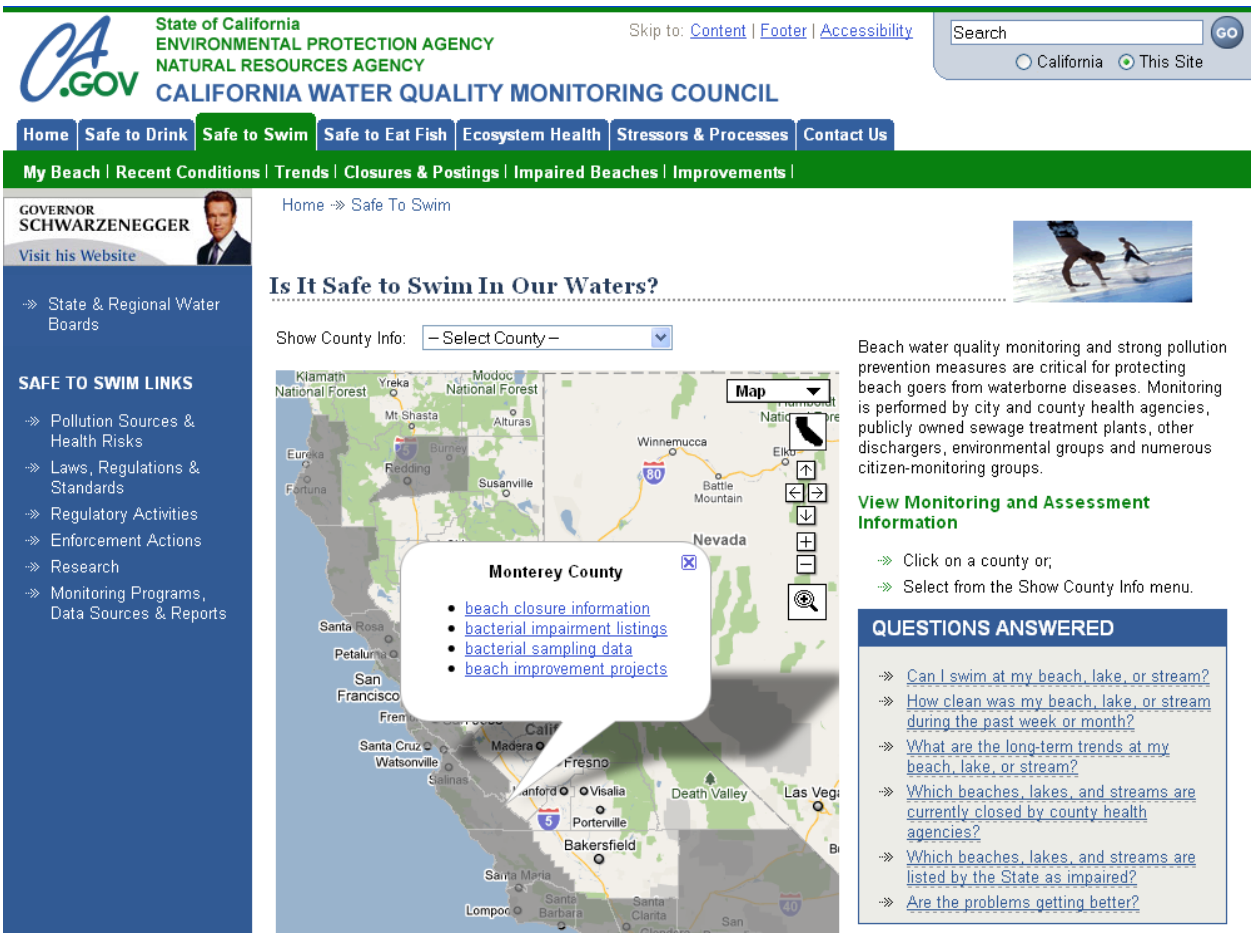

Figure 4. *The main Safe to Swim portal page provides a template for the home pages of individual theme or sub-them portals.*

2.2.4 Coordination of core monitoring program elements

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

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

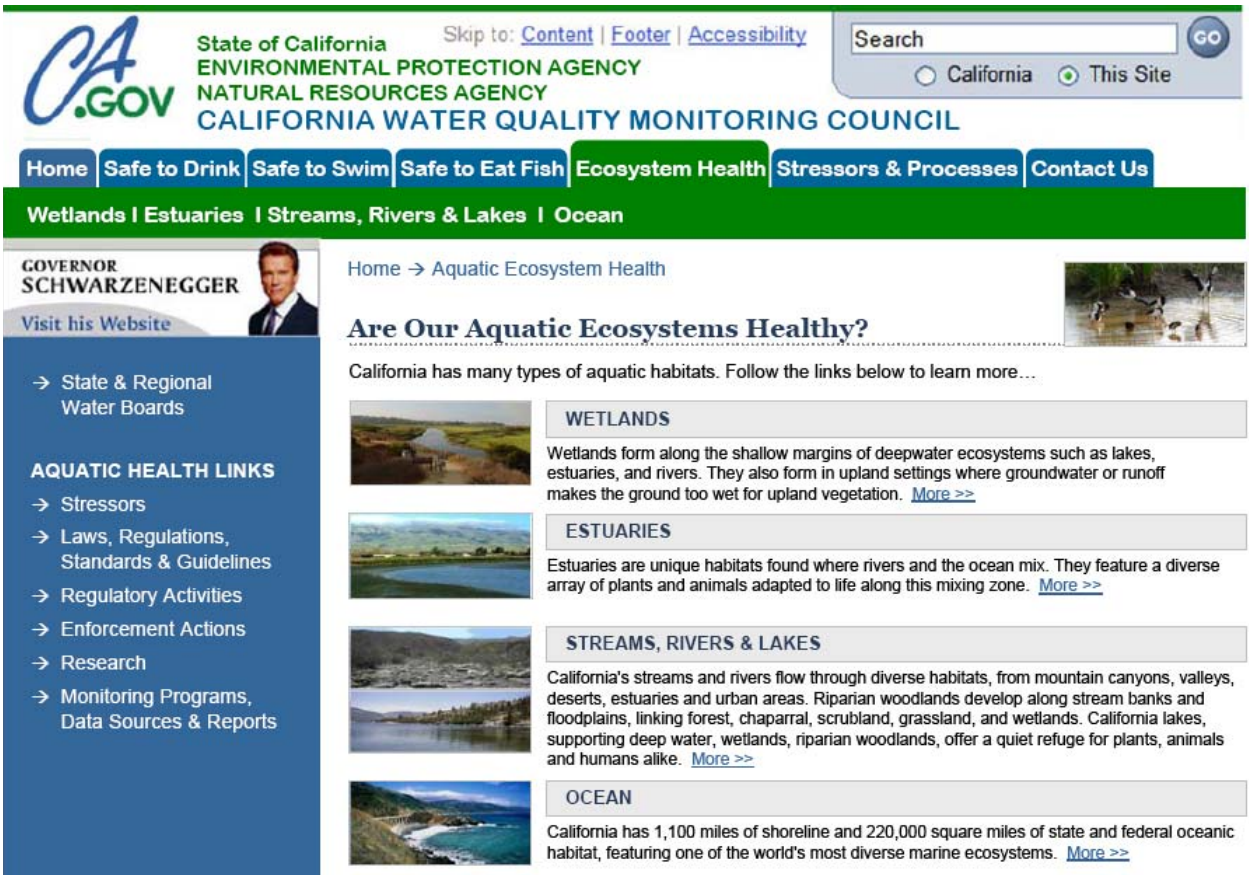

Figure 5. *The Aquatic Ecosystem Health web page provides access to a number of separate subtheme portals focused on different categories of aquatic ecosystems.*

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

2.2.5 Improved data management

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

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

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

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

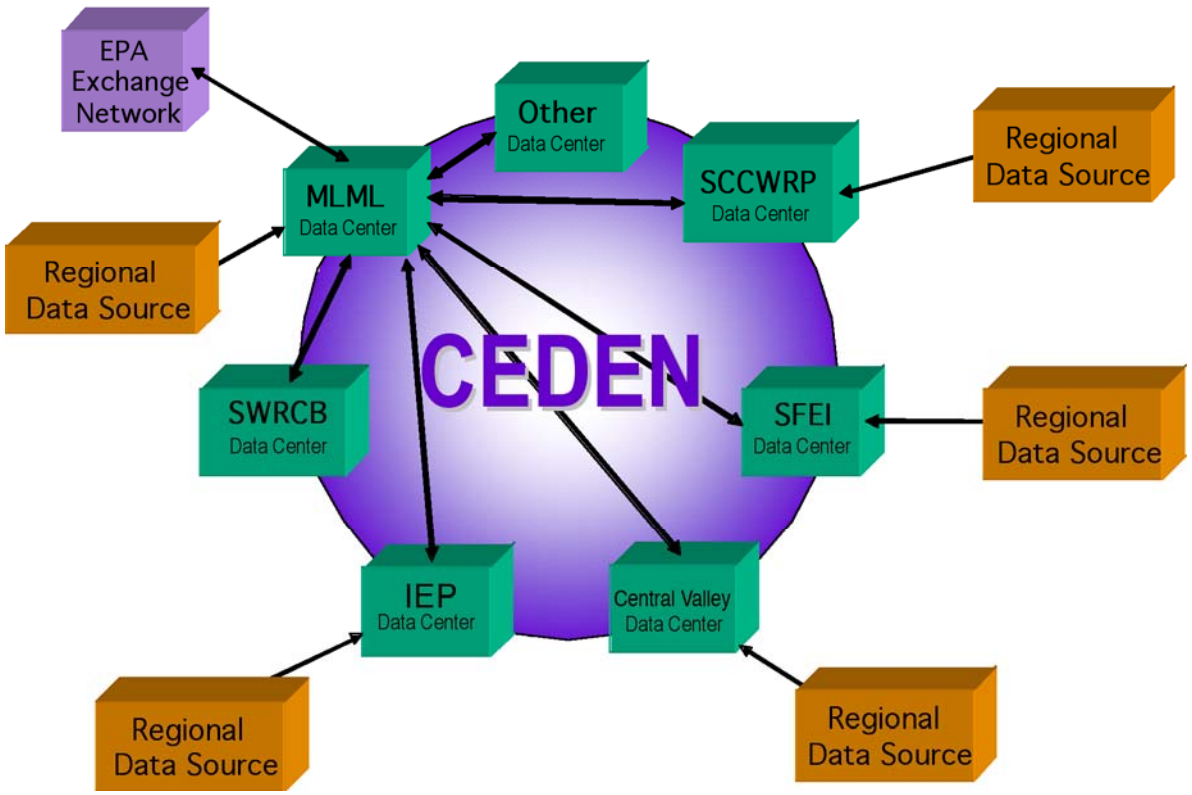

Figure 6. *Schematic depiction of the CEDEN network, illustrating the relationships of the regional data centers to each other, to regional data sources, and to the external EPA Exchange Network.*

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

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

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

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

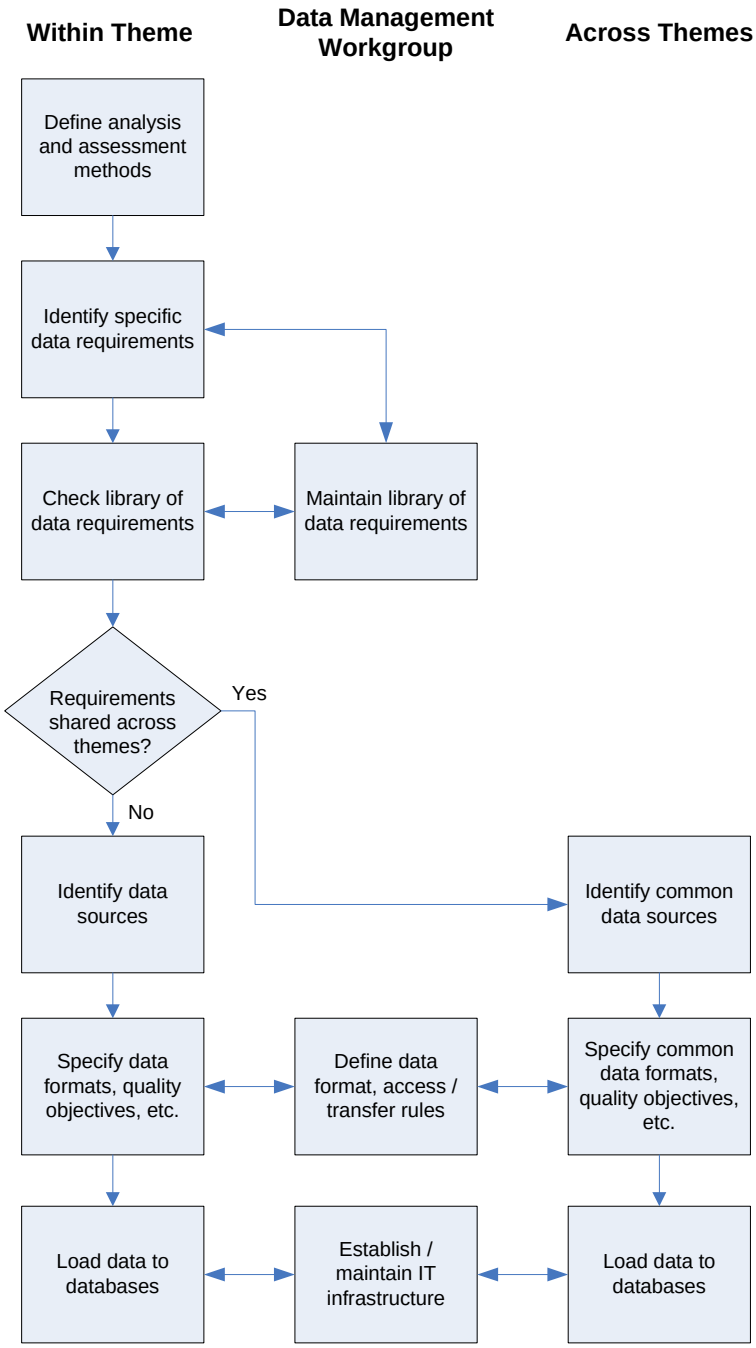

Figure 7. *The Monitoring Council's data management workgroup will support data management efforts of each theme-specific workgroup, as well as playing a coordinating role where data requirements cut across multiple themes.*

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

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

2.2.6 Monitoring of state financed water quality improvement projects

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

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

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

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

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

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

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

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

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

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

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

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

3.1 Theme-by-theme tasks

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

3.1.1 Prioritize targets for development

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

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

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

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

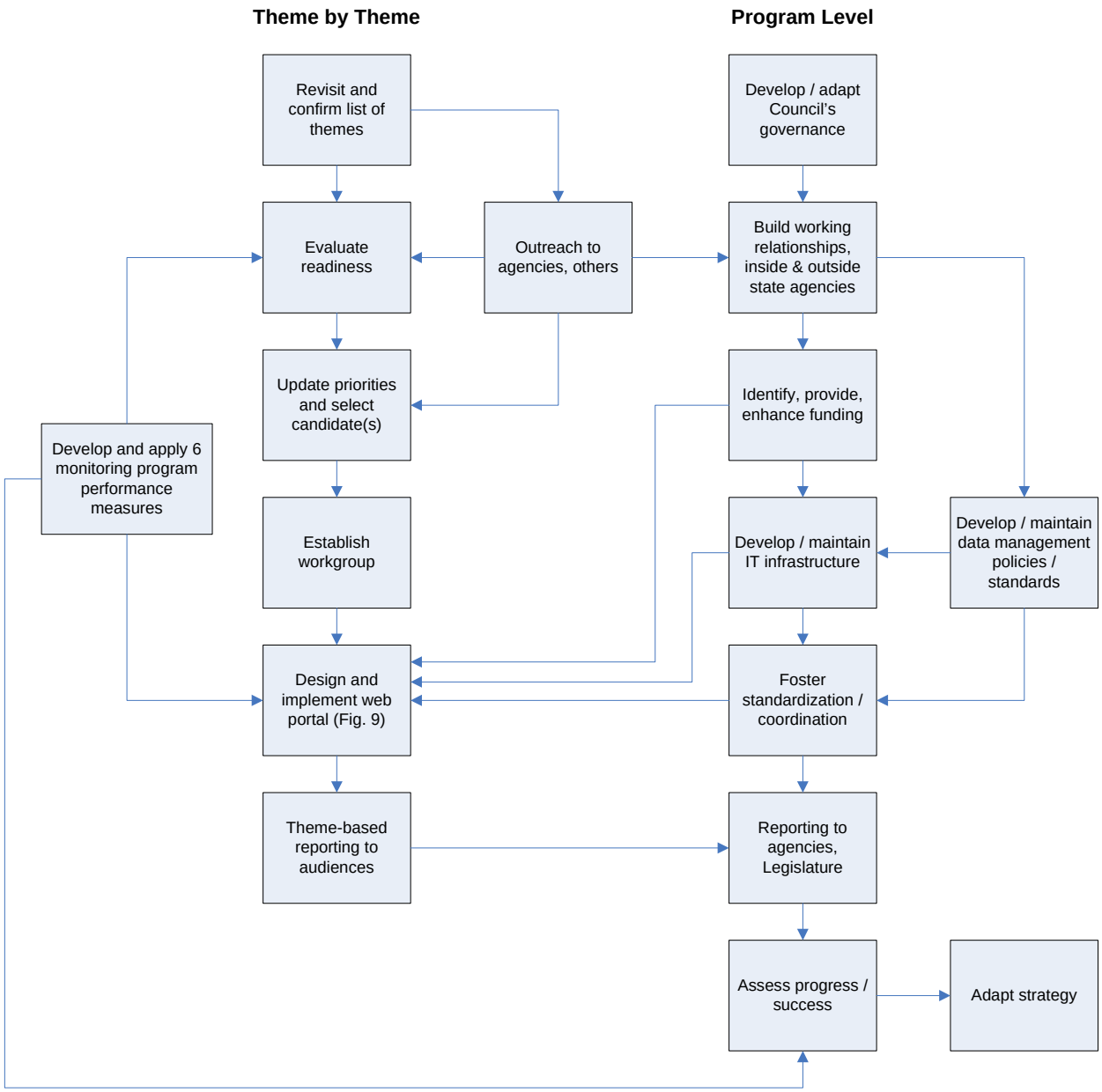

Figure 8. *Parallel tracks needed to implement theme-based monitoring and assessment within the context of web portals. The Comprehensive Monitoring Program Strategy focuses primarily on the right-hand side of the figure.*

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

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

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

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

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

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

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

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

3.1.2 Establish and task workgroups

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

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

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

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

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

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

3.1.3 Design and implement web portal

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

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

3.1.4 Improve monitoring programs

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

3.2 Program-level workplan schedule

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

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

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

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

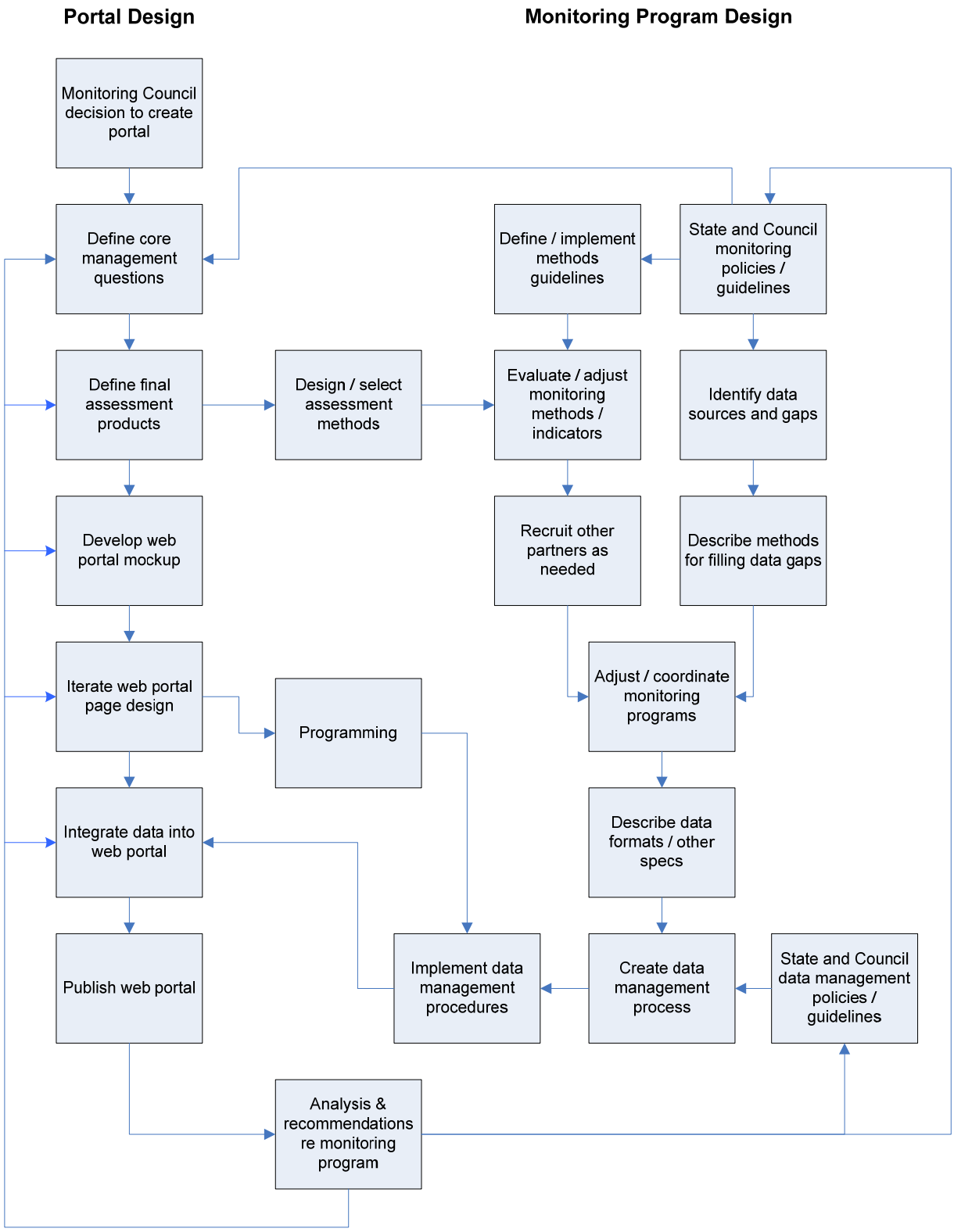

Figure 9. *The process for integrating the design and implementation of individual theme-based web portals with their related monitoring and assessment programs.*

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

3.2.1 Start-up: Years 1 – 2

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

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

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

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

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

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

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

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

3.2.2 Development: Years 2 – 8

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

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

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

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

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

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

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

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

3.3 Budget

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

3.3.1. Funding strategy

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

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

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

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

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

3.3.2. Estimated budgets

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

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

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

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

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

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

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

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

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

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

3.3.3. Contracting and implementation constraints

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

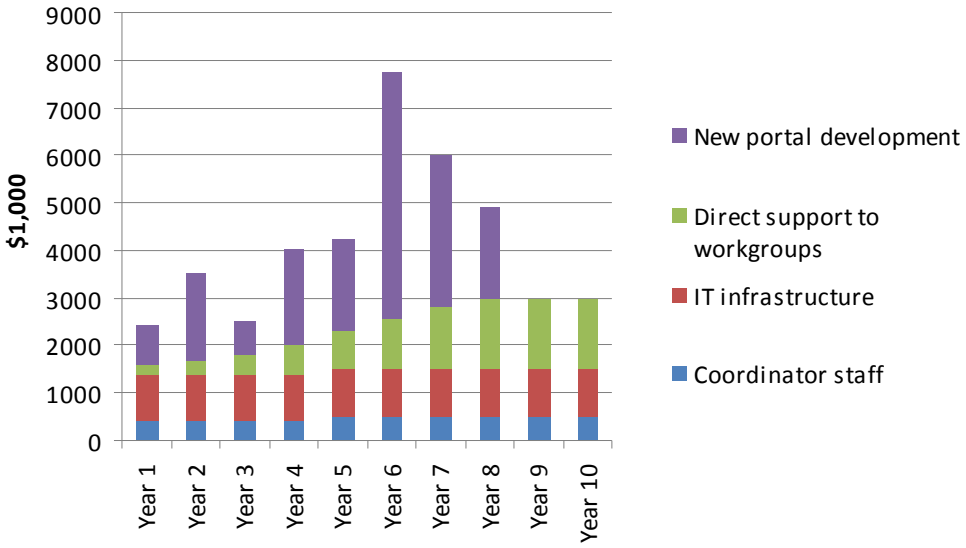

Figure 10. *Summary budget estimate for Monitoring Council activities and portal development over the ten-year period encompassed by the Comprehensive Monitoring Program Strategy.*

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

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

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

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

Chapter 4: Recommendations

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

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

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

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

References

California Water Quality Monitoring Council (CWQMC). 2008. *Maximizing the Efficiency and Effectiveness of Water Quality Data Collection and Dissemination*. Sacramento, CA. December 1, 2008.

California Water Quality Monitoring Council (CWQMC). 2009. *2009 Annual Progress Report of the California Water Quality Monitoring Council*. Sacramento, CA. December 30, 2009. See Appendix 2.

Natural Water Quality Committee (NWQC). 2009. *Summation of Findings, 2006-2009*, *Attachment A, Initial Recommendations for Monitoring ASBS Implementation Projects*. Draft, December 31, 2009.

Office of the Chief Information Officer for the State of California (OCIO). 2009. *Statewide Data Strategy Report*. Sacramento, CA. July 15, 2009.

Scientific Planning and Review Committee (SPARC). 2005. *Review of California's Surface Water Ambient Monitoring Program (SWAMP)*. Technical Report #486 of the Southern California Coastal Water Research Project (SCCWRP). May 2006.

U.S. Environmental Protection Agency (USEPA), Assessment and Watershed Protection Division, Office of Wetlands, Oceans and Watershed. 2003. *Elements of a State Water Monitoring and Assessment Program*. EPA 841-B-03-003. March 2003.