

DRAFT

**Proposed Strategy for San Joaquin River Basin
Water Quality Monitoring and Assessment**

March 2010

***The future direction and success of this Strategy depend on regional support.
U.S. EPA invites feedback on the Proposed Strategy and ideas for implementation
projects: A revised Strategy will be based on your input.***

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*This Draft Proposed Strategy also provides information supporting a Request for Proposals for further work. The application period is open through April 10, 2010 (EPA-R9-WTR3-10-003).
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The Draft Strategy is available at: <http://www.epa.gov/region09/water/watershed/index.html>.

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Executive Summary

Experience demonstrates that regional monitoring programs can greatly improve water quality monitoring and assessment. The information developed through regional programs is especially critical to California's efforts to improve available information to protect, manage and conserve its water resources. The goal of this strategy is to propose a path towards a San Joaquin Basin regional program through partnerships that evolve to assume responsibilities for administration and funding.

This Strategy describes activities to establish a regional monitoring program in the San Joaquin Basin, one of the hydrologic regions in the State Water Plan (see <http://www.waterplan.water.ca.gov/cwpu2009/index.cfm#volume3>). It is a step toward development of a program to better coordinate water quality monitoring and assessment, thereby improving the quality, accessibility and usefulness of the resulting information.

- The Strategy does not envision a program that initially engages in monitoring directly. Rather, the objective is to work with existing monitoring activities within the region on a voluntary basis.
- The focus is on surface water quality. However, the longer term goal must be to address the region's surface and ground water resources holistically.
- Regional support is needed to fully develop and sustain a program. EPA's role has been to fund initial planning and implementation.

The activities included in the Strategy are intended to suggest important technical and organizational solutions to make better use of existing water quality data collection and provide a mechanism to improve future data collection and assessment. These activities are options—some described in more detail than others-- that need further vetting with the public, managers and experts. By definition, a San Joaquin program must match the needs and priorities of the region because, ultimately, sustained implementation will depend on partnerships among groups within the region.

Regional monitoring programs all strive to provide timely and useful information but often differ with respect to their overall purposes – that is to say, with respect to the needs and uses for water quality information. Information may be needed to support water program decisions, answer research questions, track conditions and trends in the region, and so forth. Two major regional programs in California – the Southern California Coastal Water Quality Project (SCCWRP) and the San Francisco Bay Regional Monitoring Program (Bay RMP)—first approached regional monitoring out of interest in coordinating the efforts of dischargers but have over time successfully assumed other coordinating, research, and reporting roles.

Just as the purposes of programs differ, there is no single model for organizing regional monitoring and assessment. Because of the predominance of agriculture in the region, the San Joaquin differs from other established programs, which have an urban metropolitan basis and major point-source dischargers. Developing a fully functioning program in the San Joaquin will require time to build institutional and technical support, and to establish stable funding. The San Joaquin Strategy proposes an incremental approach, phasing in activities over a period of a decade or more.

The Strategy describes five elements to support a regional monitoring and assessment program: (1) coordination of sampling, (2) standardization of methods and quality assurance, (3) establishing a data

center for the San Joaquin region, (4) data analysis and interpretation, and (5) implementation (institutional arrangements and funding).

Near-term implementation activities should help resolve impediments to availability and usefulness of information and increase collaboration in existing data collection and assessment. Ability to ‘share and compare’ data is a major goal. Being able to exchange and integrate ‘comparable’ data contributes to better analysis and interpretation—that, is assessment. Although the Strategy discusses the elements individually, actual implementation projects should aim to integrate activities across elements. For example, work to coordinate monitoring activities could focus on developing ‘comparable’ data of particular relevance to an important assessment topic.

Considering the importance of the Sacramento-San Joaquin Delta and San Francisco Bay (Bay-Delta), immediate attention should also go to coordinating the San Joaquin regional effort with a broader monitoring and assessment framework for the Bay-Delta and the Central Valley watershed. This will require collaboration with programs operating in and beyond the San Joaquin region to address biological and flow conditions, as well as surface water quality. Leaders in this effort include the Interagency Ecological Program, the Delta Science Program, and the regional water quality monitoring program for the Delta, which is directed by the Central Valley Water Board.

The Strategy anticipates that longer-term program development and maintenance will necessarily be tailored to the needs and capabilities of future partners, and will be contingent on securing sustained funding.

1.0 Profile of the San Joaquin Region

The San Joaquin Region

- * With over two million acres of irrigated cropland the region’s agricultural output is valued at more than \$ 7.25 billion – making it one of the most productive agricultural areas in the country.
- * Agriculture water use is over 7 million acre feet (maf) annually.
- * The region has pioneered in innovative water quality improvement programs, such as the Grasslands Project (selenium), a basin-wide TMDL for salinity and boron, and the Irrigated Lands Program.
- * The urban population use averages 600,000 acre feet (af) annually—mostly ground water.

In this Strategy the region corresponds to the San Joaquin Hydrologic Region in the California Water Plan:

*<http://www.waterplan.water.ca.gov/cwpu2009/index.cfm#volume3>
See endnotes for information sources used for the regional profile.*

The San Joaquin River Basin (Basin), 32,000 mi² in extent, is the second-largest drainage area in California and contributes on average 15% of the inflow to the Delta (approximately 2.8 million acre feet). The region is distinguished by extensive and highly productive agriculture, and an urban population of over 2 million in communities located principally along the eastern side of the Valley and Sierra foothills.

High quality in-basin surface water comes from Sierra streams and in an ‘average’ year provides over 40% of supplies; groundwater and imports from the Delta, which have higher levels of salts and other chemical constituents, account for the balance. Agriculture in the Valley floor receives most of the Delta imports, and some irrigators, also pump groundwater. Effectively, groundwater and surface water intermingle in many situations, including irrigation practices that combine the sources and seepage of shallow groundwater into rivers, canals, and drains. These factors complicate understanding and controlling ‘surface water quality.’

On the Valley floor surface water supplies are highly managed with respect to the volume and routing of flows through constructed canals and ditches, and natural channels that have been re-engineered to convey water and/or drainage. Major interbasin water transfers have greatly altered the supply and quality of surface waters available for use within the region. Through the federal Central Valley Project, most of the flow of the San Joaquin River [1.3 million acre feet (maf) annual average] is diverted near Fresno, largely into the Tulare Basin for agricultural use. This deficit is made up by Central Valley Project supplies imported from the north: Agricultural growers on the Valley floor receive, on average, almost 2.0 million acre feet that is pumped from the Delta. Ground water accounts for a third of the Basin water supply, including drinking water for many communities.

Cumulative hydrologic modifications and surface water diversions have resulted in significant losses in natural habitat and species. Nevertheless, efforts are being made to sustain salmon runs on the River’s major tributaries, and to restore native salmon in the River itself. The San Luis wildlife refuge complex, combining managed wetlands and public wildlife refuges on the valley floor, is the largest contiguous freshwater wetland in California. Like the adjacent agricultural lands, these wetlands rely on water supply deliveries (rather than natural streamflow) and some use of groundwater.

Water quality — particularly the ability to maintain quality of ground and surface water throughout successive uses — is a significant issue for the region. The fact that the imported Delta water, which includes ‘recycled’ San Joaquin inflows, is saltier than the Sierra water transferred outside the Basin compounds problems from contaminants such as pesticides and trace elements such as selenium that occur naturally in the soils. Depleted flows, salinization of agricultural lands, pressures of accelerated urban growth, and increased knowledge about the toxic effects of chemical contamination, provide evidence that the system as a whole is suffering from extensive impairment. As a result, ambitious programs are being developed to address broad concerns about salt and nitrate buildup and other water contaminants. Examples are Central Valley Salinity Alternatives for Long-Term Sustainability (CV SALTS), the Irrigated Lands Regulatory Program, and adopting Total Maximum Daily Loads (TMDLs) for selenium, salinity, and Central Valley pesticides. More localized efforts focus on urban stormwater runoff, management of contaminated runoff from agricultural operations, and the assessment of habitat quality in creeks and streams.

2.0 Water Quality Monitoring and Assessment in the Region

Many kinds of activities—analyses to support management decisions, policy development, project planning, ‘on the ground’ or ‘in the stream’ management practices, and studies of beneficial use status and trend to name a few-- have need of information on water quality. Some of these activities—most often, activities subject to regulation-- have monitoring and reporting requirements; others depend on availability of data generated by others. The inventory of monitoring sponsored for this Strategy project demonstrates the diversity of purpose and monitoring design, including continuous monitoring conducted for water supply or modeling applications, periodic monitoring for discharge permit compliance, and

temperature monitoring for fisheries management. (The inventory can be viewed at <http://www.sanjoaquinmonitoring.org/programlist.php>.)

There are many ways to ‘measure’ water quality and thus many potential forms of data. Often, ‘surface water quality’ is represented by ‘chemical’ characteristics of the water itself, such as concentrations of metals and pesticides; sediment chemistry; or the presence of contaminants in biota such as fish tissue. Toxicity of water is another ‘litmus test’ of quality commonly used. In the San Joaquin system, physical data such as flow, dissolved oxygen and pH are important in conjunction with the chemical data. Aside from linking tissue concentrations of bioaccumulative contaminants such as selenium and mercury to effects on sensitive species, there has been less application of biological and/or habitat metrics that can be used to assess water quality.

While project or program data are useful for their specific purposes, they are less useful for answering broader, yet no less important, questions about how different parts of the system interact and influence each other, about more spatially extensive patterns and trends, and about whether the system as a whole is functioning to maintain key resources and uses. In other words, an important missing piece is a more comprehensive assessment of conditions over the region as a whole or a major subwatershed. Having a comprehensive assessment helps to plan, prioritize, and coordinate subsequent work. More focused assessments that deal with the sources and impacts of specific pollutants, or interactions of multiple pollutants in a subwatershed can ‘nest’ within the broader framework.

There are many factors that contribute to this inability to integrate separate sources of data to answer assessment questions such as an overall picture of watershed health, or of fisheries and wetland conditions resulting from a combination of contaminants and changes in river flow regimes. Impediments to these ‘big picture’ assessments include the following:

- Individual monitoring programs address more limited or targeted objectives that are not necessarily related to an overall watershed assessment
- There are no integrating objectives to guide basin-wide coordination that would allow an assessment of overall watershed condition
- Data gaps leave important locations or issues unaddressed
- Discontinuous long-term data collection hampers the tracking of trends
- Inadequate data access at the basin scale discourages attempts to aggregate data for more comprehensive analyses
- The lack of widely standardized and easily usable data formats limits progress toward entering all monitoring data into readily accessible databases
- Sampling delays caused by contracting obstacles hinder cost sharing and coordination
- Limited access to certain waterbodies can prevent important data from being collected

There is a growing frustration with the cumulative costs of separate data collection, storage, and assessment processes that yield information of limited use to water managers in addressing the larger and more pervasive issues in the region. It is also recognized that broader-scale assessments depend on improved coordination of monitoring programs and access to their data, and development of analytical frameworks for large-scale ecosystem assessment.

In California these problems are being addressed on several fronts:

- The State Water Resources Control Board’s Surface Water Ambient Monitoring Program (SWAMP).

The Surface Water Ambient Monitoring Program (SWAMP) mission is to establish a “state framework to coordinate consistent and scientifically defensible methods and strategies for improving water quality monitoring, assessment, and reporting” (SWAMP webinar July 2009, “Comparable Program Guide). SWAMP supports these activities both statewide and regionally, in conjunction with the regional water board programs.

- The California Water Quality Monitoring Council’s (CWQMC) work on a comprehensive strategy for collecting and making available water quality information statewide. This effort includes development of web portals to provide access to statewide monitoring data and assessment results, and coordination of monitoring and assessment methods. Relating this framework to regional issues and incorporating regional data are longer-term goals for this initiative.
- The California Environmental Data Exchange Network (CEDEN), a program supported by the State Water Board. The CEDEN aims at providing data management services to enable integration of monitoring data and assessment at the regional level. Programmatically located with the State Water Board, CEDEN is closely aligned with SWAMP and promotes data comparability consistent with SWAMP standards. The four existing CEDEN centers (at Moss Landing Marine Labs, UC Davis, the San Francisco Estuary Institute and the Southern California Coastal Waters Research Project) function as a federation of semi-independent entities – each with particular areas of expertise and database responsibilities.

In the San Joaquin Region there are a number of programs that involve monitoring throughout the Basin, but fewer that make use of information to conduct assessment on a large scale. For example, the Irrigated Lands Regulatory Program has prompted a prodigious amount of monitoring that has provided data for periodic reports on a subwatershed scale-- but not comprehensively basin-wide. Two efforts that do have use of broader assessment are the San Joaquin River Restoration Program and CV SALTS; in both cases, assessment is needed to support planning and implementation to solve specific but critical problems.

- The San Joaquin River Restoration Program. In the San Joaquin the U.S. Bureau of Reclamation leads a key ‘on the ground’ initiative, pursuant to a legal settlement, to restore flows and salmon runs to 153-miles of San Joaquin river channel between Friant Dam (the diversion point of water into the Tulare Lake Basin). Monitoring and assessment for this program are focused on the San Joaquin River between Friant Dam and the confluence with the Merced River, but success in restoring anadromous fish runs will also require a broader, basin-wide evaluation of the physical, chemical and biological conditions. This broad evaluation could provide a unique opportunity to reevaluate the variety of project-specific monitoring efforts and perhaps create a more regional approach that could potentially provide both project-specific information as well as basin wide assessment.
- CV SALTS (State Water Board, and Central Valley Water Board, in partnership with stakeholders). This is a comprehensive effort to address salinity and nitrate problems in the Central Valley that threaten the long-term viability of the regional economy. The issues cross all sectors and virtually all water programs —agricultural water supply and discharges, urban dischargers, domestic drinking water supply, industrial uses.

3.0. Groundwork for a Monitoring and Assessment Program

Work on a Strategy for improving basin-wide monitoring and assessment to support key water quality management decisions began in 2007 with stakeholder outreach. Subsequent development of a pilot

directory of current monitoring activities in the San Joaquin has provided valuable information for planning the Strategy.

As an important step in gathering information to guide development of the strategy, the project held a stakeholder workshop in Modesto on November 2007 to foster discussions about ways improve water quality monitoring and assessment in the San Joaquin River region. Participants included water quality monitoring experts and data users from local, state and federal agencies; non-governmental organizations; watershed groups; universities; and consultants. Participants validated the list of impediments to watershed scale assessment presented above and developed specific suggestions about how to improve the coordination of existing monitoring in the San Joaquin region. These suggestions provided important input to the monitoring strategy presented in the following sections. The workshop summary notes are available online at http://www.sanjoaquinmonitoring.org/documents/Workgroup_notes_11-28-07.pdf.

The Strategy endorses a set of core principles that reflect comments from San Joaquin stakeholder as well as the experience of similar efforts in other regions:

- Build on stakeholder direction and involvement
- Increase coordination to enhance existing monitoring efforts
- Inform better decisions by making more and better data more readily available
- Achieve greater cost-effectiveness by increasing standardization and coordination and by developing more relevant information
- Integrate with statewide monitoring design, assessment, and data integration frameworks

The Strategy has chosen an approach suited to the San Joaquin region, with its extensive agriculture, smaller proportion of point-source dischargers, and numerous decentralized monitoring efforts already underway. Interest in a ‘comprehensive’ regional monitoring and assessment program for the region over the longer term is tempered by the current reality of scarce resources and diverse interests. Thus, the Strategy proposes an incremental approach to implementation along interrelated tracks: Some work should concentrate on technical issues that would improve the coordination and standardization of key monitoring activities. Other work should help make data available and ensure that it is useful for assessments by sponsoring a data center and assessments related to broader questions of watershed condition and stewardship. The long-term goal is to build on incremental steps by expanding their scope and increasing the level of sustained institutional support for more comprehensive regional monitoring and assessment. At that point, a separate effort to develop a more structured regional monitoring design may be called for.

All work should be organized around explicit monitoring objectives or questions connected to management needs that will be refined over time and carried into assessments. Eventually, development of a set of basin-wide assessment questions could provide needed conceptual structure for coordinated regional monitoring designs. This work should also consider objectives and assessment questions that relate the San Joaquin region to the Delta. In the period since the workshop increasing public and agency attention to Delta water management and ecosystem restoration has underscored the importance of taking a watershed-wide perspective. The Bay-Delta Conservation Plan, the State Water Board review of the Bay-Delta Plan, and planning to restore anadromous fisheries in the San Joaquin River and tributaries would gain from a better understanding of how the San Joaquin Basin water quality and flows affect this system. Thus, in addition to addressing what is needed within the region, the Strategy considers how the region can participate in, and contribute to, integrated monitoring and assessment for the greater Bay-Delta system.

4.0. Elements of the Strategy

This section covers four of the elements of a monitoring and assessment program; the fifth component—implementation—is discussed in the following section. The logic underlying the four interrelated elements is to:

- Coordinate sampling for greater efficiency and better coverage;
- Promote comparability of data through standardization of methods and quality assurance;
- Facilitate data sharing and use through development of a data management center; and
- Promote data analysis and interpretation (that is, assessments of various kinds).

4.1. Coordinate sampling

Discussions with stakeholders reveal concern that the current situation, with a variety of programs and activities involved in monitoring, is inefficient and fails to produce useful information. Monitoring needs to be more strategic and coordinated. Three responses to this problem are considered in the Strategy: providing a central directory of current monitoring; working to coordinate sampling activities in the field; and aligning monitoring with respect to priority objectives.

4.1.1 Expand use of an online directory

The project has developed a prototype of an online directory of current monitoring activities in the Basin to facilitate monitoring coordination and integration (available at the project's website www.sanjoaquinmonitoring.org, and linked to the Central Valley Directory at <http://www.centralvalleymonitoring.org/>). This directory includes interactive maps that enable users to call up sampling points by monitoring program, watershed, agency, or parameter and also includes information on sampling frequency, anticipated study period, and contact information and links to additional information or data (when available). The directory's continued value will depend largely on monitoring organizations' willingness to keep information about their programs up-to-date and complete. To this end, the directory, for which participation is voluntary, has been designed to simplify the process of adding new entries or updating existing entries. Expansion of the directory to the entire Central Valley and improvements to streamline information retrieval have been initiated by the Central Valley Water Board. Opportunities for future improvements in the Directory may come through collaboration with the California Water Quality Monitoring Council and/or expanding regional monitoring programs.

The Strategy anticipates further refinements and uses of the Central Valley Monitoring Directory.

Recognizing the value of a web-based monitoring directory to organize and coordinate monitoring programs, the Central Valley Regional Water Quality Control Board provided funding to expand the prototype San Joaquin Monitoring Directory to cover the entire Central Valley. The beta version of the Central Valley Monitoring Directory is viewable online (www.centralvalleymonitoring.org) and is being redesigned to fully integrate the San Joaquin Monitoring Directory. The expanded directory was used during the development of a summary of monitoring activities for the Delta Regional Monitoring Program and current Water Board funding is intended to complete needed revisions and enhancements to allow broader public use of the directory within Region 5 as a planning and coordination tool by early 2010. The Central Valley Water Board SWAMP has committed to maintain the directory for three years and provide outreach and support for Central Valley groups interested in adding their monitoring efforts to the directory. Further enhancements to the existing directory and long-term maintenance will be discussed in a feasibility study to be released with the final product. The CEDEN group and statewide SWAMP have also indicated interest in using the concept statewide in connection with CEDEN's statewide network of regional data centers.

Further work might connect information displayed in the directory with California Water Quality Monitoring Council (CWQMC) web portals.

The online monitoring directory provides spatially oriented access to information about monitoring efforts in the watershed and can include links to databases. This is extremely useful for users who need to identify potential sources of data related to a particular geographic area.

The directory currently does not, however, readily support queries to identify and select data related to a particular assessment question, issue, habitat, or type of beneficial use. Thus, for example, someone interested in the overall status of riparian habitat or in water quality would be required, first, to determine which data sources to access and then to obtain each dataset individually from the relevant program websites. While the Directory helps by providing about all (or most) monitoring in the watershed, it is not organized in terms of issues / questions or habitat types.

On the other hand, the web portals currently being developed by the CWQMC are organized in terms of specific questions, issues, or habitats — for example, the status of wetlands, or whether it is safe to swim at beaches, lakes, and streams. Each portal will furnish map-based answers to commonly asked assessment questions (such as ‘are the fish safe to eat’).. The portals will also offer links to the sources of underlying data, metadata, other assessment products, and background information. While the CWQMC primarily uses a consistent, statewide framework for the organization and presentation of assessment products, its web portals also include the capability to search for and access data and information at a range of spatial scales, regional down to individual sites or locations.

There is thus an opportunity to link the online San Joaquin monitoring directory to the data access features of relevant web portals by identifying which studies or datasets are relevant to specific assessment questions. This would ensure that monitoring data generated by parties in the Basin are also accessible to users who enter through the CWQMC’s web portals and may be interested in narrowing their focus from the statewide to the regional scale.

4.1.2 Improve on-the-ground sampling coordination

In the field there are opportunities for coordinating sampling across programs. Benefits include potential cost-savings that might be redirected to fill data gaps or other monitoring program needs. Coordination can also set the stage for standardizing methods, expanded data sharing, and integrating priority setting across programs.

Participants in the November 2007 stakeholder workshop agreed that the number of separate monitoring programs, and the volume of samples and measurements being collected, make it all but certain that there are significant opportunities to improve efficiency by coordinating sampling across programs. They concluded that the primary benefit of such coordination was the potential reduction in duplication of effort and the cost savings this could provide. This could be accomplished through data sharing and some form of cost sharing or reimbursement to compensate programs that incur the initial cost of sampling, laboratory analysis, and data management and then make those data available to other programs.

The fact that two or more programs collect the same parameter at the same or nearby sites would make them candidates for coordinated or shared sampling, but this might not be feasible for a number of reasons. For example, accuracy and precision requirements could differ because of different management questions, as could the needed degree of replication and the frequency of sampling over time. For example, a scoping study to characterize the general extent of a problem might use inexpensive methods with low precision, whereas a study to assess regulatory compliance or define key modeling inputs might require much greater precision.

Initially coordination should be planned collaboratively, engaging stakeholders in defining and prioritizing initial efforts. As such efforts continue and mature, they may become routine parts of each individual program's management infrastructure and may be formally required for participation in certain regional efforts. For example, the U.S. Bureau of Reclamation and collaborating agencies have recently begun to coordinate their activities to measure and assess interim flow releases on the River. This effort could be used as a starting point for building coordination and standardization into the designs of involved programs.

Potential steps for coordination of sampling are:

- Establish technical workgroups
- Document existing sampling networks
- Identify opportunities for coordination
- Negotiate and implement agreements about regional coordination
- Identify the next set of targets and repeat process

Each step in this process should have one or more tangible outcomes that can be used to measure progress toward the goal of improved sampling coordination throughout the watershed. Products, the work processes of the technical group, and recommendations for refinements and next steps should be well documented.

4.1.3 Coordinate monitoring with respect to priority objectives

Monitoring can be coordinated around "objectives" that express relevant water quality or water management questions for the region. This approach is being used by the California Water Quality Monitoring Council to organize water quality information at a statewide level (see <http://www.swrcb.ca.gov/mywaterquality/>) . Another example is in some of the work done for the San Francisco Bay Regional Monitoring Program by the San Francisco Estuary Institute, in which a systematic list of water quality questions guides status and trends information; special studies are directed to specific questions. (See http://www.sfei.org/rmp/rmp_prog_info.html and the discussion of the 2010 monitoring program plan at <http://www.sfei.org/rmp/documentation/2010%20Program%20PlanFinal.pdf>.)

4.2 Standardize methods and quality assurance

Standardization of field methods and laboratory practices is an important step in help ensuring the 'comparability' of data. Ensuring comparability, to the greatest extent possible, is essential to improving the coordination and efficiency of monitoring.

With respect to field methods and lab practices, comparability is focused on similar requirements for accuracy and precision of data. Monitoring activities that have certain features in common can provide the basis for producing comparable data. Typically, the activities would have the same, or similar, uses for information (that is, management questions), and they would be measuring common parameters. Under these circumstances, the monitoring activities could have similar requirements for data accuracy and precision (data quality objectives).

The most effective approaches to ensuring comparability, such as those encouraged by NOAA's Status and Trends Program nationally and the Bight Program regionally in southern California, are performance-based. That is, they focus on comparability of results, not methods alone. Substantial differences in

accuracy and precision can exist even when programs use the same formal methods, and, conversely, goals related to accuracy and precision can be met even with different methods.

There is broad recognition among monitoring program managers and technical staff that different programs often use very different the field and laboratory methods, and that some of these differences are due to idiosyncrasies such as program traditions, personal preferences, and customary laboratory and field practices. Idiosyncratic differences-- that is, differences that do not reflect unique program needs -- limit the ability to achieve efficiencies of scale or to integrate data from different programs to address larger-scale or more complex questions.

While these discrepancies in field and lab methods are common knowledge, there is no mechanism in place to make the changes needed for comparability. The Strategy identifies the following process for addressing this situation:

- Prioritize needs for comparability
- Establish technical workgroups for high-priority categories of variables
- Document current methods
- Sponsor laboratory intercalibration studies
- Negotiate and implement agreements about needed methods adjustments
- Identify the next set of needs and repeat process

As with sampling coordination, it would be most effective to begin by working collaboratively, engaging stakeholders in defining the need for comparability and prioritizing initial efforts. Over time this process may become routine parts of each individual program's management infrastructure and may be formally required for participation in certain regional efforts.

4.3 Establish a regional data management center

A regional program should increase capacity to conduct assessments relevant to a range of management issues and scales, and to relate information from smaller subwatersheds within the region to broader regional assessments. The role of data management is to further this goal by making it possible to collect, store, transfer, integrate, and access data that meet established standards.

This Strategy considers several ways to upgrade data management. The first would establish a San Joaquin regional data center that, at a minimum, would help conform selected datasets to certain regional protocols and standards; this would improve the ability to input, access, and share data from a variety of programs at the regional scale. The second approach would provide for data management through a particular project, such as work to fill in regional information corresponding to one of the CWQMC statewide assessment questions. These are not mutually exclusive choices, and in fact there are advantages to pursuing both concurrently if resources permit. Both options draw on the CEDEN data centers being sponsored by the State Water Board.

4.3.1 Expand functions of a regional data management center

A data center bundles a range of data management activities, and provides assistance to data generators and users. As recently outlined in a draft document prepared by SFEI, a regional data center might assemble services and tools such as the following:

- Data upload and checking
- Storing and managing data and metadata in standard formats

- Supporting data exchange
- Supporting data access through query and download tools
- Providing technology to coordinate and transfer information
- Data audit

The center may also conduct analyses, modeling, and assessments that are beyond the capability of individual programs in support of regional management priorities.

These are examples of possible functions. Appropriate functions for the San Joaquin region should be determined through a process that brings together the priorities and needs of stakeholders, and the expertise of data managers. However, experience advises that data management focus on specific priority data sets where any known issues of quality and documentation (i.e., comparability) are expected to be resolvable.

4.3.2 Improve data management through a specific project

Working on data management for a specific project or workgroup task could help define and focus on practical issues. Also, with a specific project or task, the coordination requirements can be more readily defined and resolved. Several examples follow:

In collaboration with the CWQMC, the San Joaquin region might arrange to contribute regional information to one of the existing thematic ‘portals’ (such as wetlands)

Alternatively, in conjunction with the CWQMC the region might agree to develop a new theme that has both statewide and regional applicability. Several of the existing thematic workgroups have begun as regionally-focused initiatives that have provided the basis for a statewide approach to the theme.

In either case, this work has the potential to draw on the Monitoring Directory and to enhance the value of information identified there.

4.4 Conduct data analysis and interpretation

Coordination of sampling, methods standardization for comparability, and data management help to prepare for analyses addressing questions or management problems of importance to the region. The Strategy recommends that early on the San Joaquin program sponsor an assessment that serves as a test of the technical elements in the plan and at the same time provides a useful product. This study should have broad implications for science and policy, focus on a clearly stated objective (or question), and have significant stakeholder interest.

Two options include:

- An assessment of conditions within the San Joaquin watershed. This might take the form of update of the water quality components of Section IV, “State of the Watershed Report San Joaquin Watershed,” in the 2002 Watershed Management Initiative issued by the Central Valley Water Board. Or it might be modeled on broad scale assessments done by regional monitoring programs elsewhere;
- A more focused analysis on a significant problem or portion of the watershed.

In either case, since the assessment will have to rely on available data, initial screening is needed to determine what information may be available. There are a several programs at the regional, or nearly

regional, scale in the Basin with monitoring and assessment components. Using one of these programs for a case study has the merit of focusing work on issues of established regional significance and thus developing parameters, reporting and data access protocols, and other tools immediately relevant to regional goals. Among the possible candidates are the San Joaquin River Restoration Program (SJRRP), the Central Valley SALTS (Salinity Alternatives for Long-Term Sustainability), and the Irrigated Lands Regulatory Program. Also, all three programs are characterized by broad agency and stakeholder involvement.

5.0 Implementation

The elements of the Strategy described above combine technical and program development tasks, some of which are outgrowths of or complements to current efforts, while others represent new initiatives. The following activities offer a suggested implementation pathway for the Strategy, concentrating first on elements that are easier to implement, and that would more readily demonstrate proof of concept and add value to existing monitoring efforts.

5.1 Establish and maintain programmatic infrastructure

Organizing, managing, and maintaining the activities described above will require a regional capacity to fulfill a number of functions. While it would be premature to presume a specific management structure, it is possible to describe the functions that must be performed and present alternatives to accomplish these functions. Essential functions include:

- Creating and implementing a governance structure
- Engaging stakeholder participation
- Planning for and managing the elements of the Monitoring Strategy described above
- Developing a regional data management strategy
- Defining longer-term goals and plans for achieving these
- Developing both short- and longer-term funding sources

5.2 Evaluate alternative governance structures

The program must create a governance structure that fits its level of resources and priorities, comports with the ‘business and community culture’ of its participants, and carries forward the program goals. A range of solutions used elsewhere is summarized in the following examples. While there are of course many variations on these themes, these approaches capture the pros and cons of the major strategic approaches to program governance. They include:

- Centrally managed
- Loosely federated
- Federated partners coordinated by core entity

Centrally managed: In centrally managed efforts, a single entity sets policy and procedures, allocates funds, develops program designs, organizes and oversees implementation activities. While this entity may solicit input from program participants or outside sources, decision-making authority resides in a single locus. This governance structure is appropriate when there is a single source of funding or all participants belong to a single organization, when the effort includes only a few types of activities, or where important expertise is concentrated only or primarily in the managing entity. This governance structure, however, is

used much less today than in the past. Its top-down structure does comport well with increased reliance on local stakeholder participation, and the general priority of inclusiveness. Some large programs today have centralized technical support and administration but governance is more participatory.

Loosely federated efforts: These efforts involve parties that have agreed to work together through mutual self interest and may have agreed on a minimal set of common procedures or standards needed to achieve their shared goals. However, membership and participation are not required, nor is strict adherence to procedures and standards. Decisions are made on an ad hoc basis or through an informal consensus process, with little or any prescribed procedures.

Federated and coordinated entities: In more closely federated governance structures, the coordinating role of a core entity may be based on expertise, legal requirements, position in an organization, agreement of the participants, or control of funding. This entity sets policies to guide participants' efforts, typically focusing on a few key performance standards. The core entity usually also establishes policies for collaborative work and decisions requiring the concurrence of the coordinating entity. This model usually has an explicit governance structure that specifies a few key prerequisites for participation and that evolves over time.

Participants in the effort to establish a San Joaquin regional monitoring and assessment program might consider testing and adapting governance practices used elsewhere. In the San Joaquin region, the presence of well-established and diverse programs managed by separate entities (e.g., River Restoration Program, Irrigated Lands Regulatory Program) makes the creation or imposition of a centrally managed regional monitoring entity impractical. In the near term, due to its funding role and water program responsibilities, the U.S. EPA in partnership with the Central Valley Water Board can be expected to play a leading role in outreach, recruitment of key program partners, and linkage of the San Joaquin regional activities to development of a comprehensive monitoring program in the Bay-Delta. However, the goal is to promote a self-sustaining program through regional partnerships that evolve to assume responsibilities for administration and funding. Thus, informal (i.e., loosely federated) efforts to coordinate sampling and/or standardize methods standardization could over time develop into a formalized set of activities as partners gain experience with each other and relationships with other programs develop.

5.3 Consider options for funding

Current EPA funding is short term. Review of existing regional monitoring efforts reveals a variety of approaches for funding regional monitoring and assessment efforts over the longer term. These are neither mutually exclusive nor sequential: Some programs have employed more than one approach at one time.

Expanding via efficiencies. An "audit" of existing monitoring programs may reveal inefficiencies such as duplication of effort; oversampling in terms of more stations, parameters, or sampling frequency than needed to answer management questions; or using outmoded or inappropriate parameters. Current monitoring programs have often grown over time, with the result that portions of the monitoring program started years ago may no longer be producing useful information (e.g., questions may have been answered) and/or different aspects of the program are not well coordinated. Typically, eliminating outdated or redundant practices will not mean loss of management information. If done in conjunction with management agencies, these cost savings can then be reprogrammed to address regional priorities.

Adopting participation fees. Participants in a regional monitoring program may be assessed a fee for participation. Depending on how the program was established and its governance structure, such fees can either be negotiated or simply assessed by a management agency with the authority to do so. Fees can be

based on a variety of criteria, including amount (either relative or absolute) of loadings of certain pollutants, size of entity, or role to be played in the program.

Pay to play. Under a slightly different arrangement, participation is voluntary, but participants must “pay to play”, with increasing levels of contribution providing greater access to decision making about the overall scope or direction of the program as well as the design of specific monitoring elements. The motivation to participate voluntarily comes from expected benefits, such as the opportunity to tailor monitoring or assessment to specific information needs. However, whatever the level of contribution from individual participants, a single integrated program is developed and implemented.

Contributions for proposed work. Another voluntary funding approach is somewhat similar to an auction. In these cases, one or more participants submit a project proposal to the entire group. Members can decide individually whether to contribute money to the project, and how much funding to contribute. If the amount of funding contributed is adequate to support the project, it goes forward, but if the total contribution is less than required, then the project is not implemented. This approach is most suited to funding individual projects or programs that can be segmented into separate stand-alone components.

5.4 Undertake staged implementation

Implementation may begin by taking advantage of specific opportunities to test and improve practices. Concurrently, and using the experience gained from the initial projects, an effort should be made to organize and coordinate activities through a management structure.

5.4.1 Sponsor proof of concept activities

Initial implementation steps should focus on smaller-scale proof of concept efforts to validate key assumptions and demonstrate that proposed actions continue to have widespread support and utility to a cross section of stakeholders. These initial steps could include the following:

- Promoting utilization of the Central Valley Monitoring Directory, testing its effectiveness and agreeing with the CWQMC how the Directory could be most effectively linked to CWQMC’s system of web portals.
- Organizing one or more small ad hoc workgroups to address concerns stakeholders have expressed on many occasions about overlaps and duplication of sampling effort and about lack of comparability in monitoring results. The intent of this initial action would not be to conduct a comprehensive evaluation of all sampling designs. Instead it would be to identify methods and mechanisms to further coordination of sampling and the standardization of field and lab methods across programs and to demonstrate the feasibility of the broader Strategy goal.
- Collaborating with the Regional Water Board’s SWAMP staff on ways to integrate program activities with SWAMP’s regional and statewide efforts – for example, to develop standardized indicators and methods for water quality monitoring. A closer or more formal connection with SWAMP could provide a useful, longer-term institutional “home” for these efforts.
- Developing a working relationship with the CWQMC for the purposes of identifying how issues of concern in the Basin could be incorporated into the Council’s system of theme-based portals. This could be done in conjunction with CEDEN. For example, UC Davis has been identified as one of the regional data centers in the distributed CEDEN network and there may be opportunities for ensuring that monitoring data already being submitted to UC Davis are compatible with the statewide CEDEN protocols.
- Conducting discussions with the San Joaquin River Restoration Program about a water quality monitoring effort in the Lower San Joaquin River that would complement the SJRRP’s monitoring on the Upper River. These discussions should focus on identifying how water quality might affect habitat

quality for fish and other aquatic species, what sort of monitoring would produce useful information, and how a water quality monitoring program might be organized. One outcome of these exploratory discussions would be the establishment of a workgroup to further develop a water quality monitoring design for the lower river.

- Assessment of water quality within the San Joaquin Basin utilizing existing data. Conducting this assessment could further data sharing and integration, establish broadly supported assessment questions, and further document the need for better integration of existing efforts, while developing specific solutions.
- Prepare a State of the San Joaquin River Basin conference/workshop to convene a broad range of experts and interests to explore priority water quality issues and enhance collaboration. Such meetings should be a regular component of a regional monitoring program.

Efforts should be made to document, develop written protocols and agency agreements, and integrate early implementation activities.

5.4.2 Program development

The Program should transition from exploratory discussions and ad hoc activities to a more explicit organizational structure for the program. The second phase of implementation should focus on extending and formalizing the Monitoring Strategy's technical and management structure, based on results from the preliminary activities. These could include:

- Completing linkages between the Monitoring Strategy's online directory, CEDEN, and specific Monitoring Council web portals
- Formalizing efforts to improve sampling coordination and comparability, including implementation of methods intercalibration studies, as well as the application sampling, analysis, assessment, and data management standards developed by the Monitoring Council (and others) as appropriate
- Initiate partnership agreement establishing a regional monitoring program with sustainable funding plan, and in-basin technical and policy oversight structure.
- Participating regularly in activities of the CWQMC, particularly workgroups related to data management and themes that directly relate to key habitats and/or issues in the Basin
- Formalizing a working relationship with SWAMP
- Implementing core elements of the regional data management approach
- Implementing the Lower River water quality monitoring case study, including integrating data management and assessment with the SJRRP (or other partner(s) selected in Phase I)
- Choosing management structures appropriate for each of the main Monitoring Strategy elements. It may be that different management approaches are appropriate for different aspects of the overall Monitoring Strategy, with different entities playing a leading role for different elements. For example, the Regional Water Board and SWAMP might play the lead coordinating role for sampling coordination and improving comparability, while an interagency workgroup manages the Lower San Joaquin River water quality monitoring case study
- Depending on whether participants choose a loosely federated management approach, or one that includes a core coordinating entity, identifying who will play a coordinating role to ensure that the various elements of the Strategy continue to function effectively
- Developing a longer-term funding plan

5.4.3 Program management

This phase of program development will involve transition to a more permanent management structure in which roles, responsibilities, and funding sources are more stable and more fully defined. In some cases, this may involve preparing a Memorandum of Understanding (MOU), while in others the management

approach may simply evolve informally to a more stable structure. Successful regional monitoring and assessment programs provide multiple successful examples based on varying degrees of formality. The approach(es) chosen for the Monitoring Strategy will depend on the outcomes of the efforts over the next two to three years.

Note on information sources:

This Draft uses the following information sources to profile conditions in the San Joaquin River Basin:

- California Department of Water Resources. Draft Update for the California Water Plan 2009, (<http://www.waterplan.ca.gov/>), San Joaquin River Hydrologic Region. The Water Plan definition of the San Joaquin region does include the San Joaquin River delta (less than 4% of the San Joaquin regional area, but roughly half of the total Sacramento-San Joaquin River Delta area). A regional monitoring program for the Delta as a whole is being developed through the leadership of the Central Valley Water Board. Hydrologic region maps are available in draft form at the Water plan website, above.
- State Water Resources Control Board and Central Valley Water Board, Watershed Management Initiative, Section IV: State of the Watershed Report, San Joaquin River Watershed. The Watershed Management Initiative provides a good, general summary of water quality issues in the region but does not have quantitative measures (such as extent of impairments).