

## Section K: Data Management

The intent of the Data Management standard in the Proposition 84/1E Integrated Regional Water Management (IRWM) Program Guidelines is to ensure efficient use of available data, stakeholder access to data, and to ensure that the data generated by IRWM implementation activities can be integrated into existing State databases. The Regional Water Management Group (RWMG) has intentionally adopted existing statewide protocols for the regions' data management needs in order to ensure sustainable long-term support and standardization. This section describes how data from IRWM-funded projects is stored, validated, and shared in the Greater Monterey County IRWM planning region.

### K.1 DATA MANAGEMENT: INTRODUCTION

Throughout Monterey County, a great deal of valuable water quality data is collected, but not in an organized or collaborative way that is meaningful for all stakeholders in the region. Most data that is collected is program specific with outcomes intended for a particular question or purpose. The IRWM planning process can help to facilitate better information sharing and identify data needs that will help the RWMG, agencies and organizations, project proponents, and stakeholders in the region better understand water quality and habitat conditions.

The objective of adopting uniform data management principles for IRWM Plan projects is to create information that will be more accessible and useful for addressing regional questions about the health of water resources and to facilitate data sharing in the region. Complete standardization of all data types throughout the region would require substantial resources to be allocated by data generators and would also require creation of an entity for centralized data management. Efforts to completely standardize water quality monitoring data sets have been ongoing in the region for more than five years with limited success. Challenges to complete standardization include differences in monitoring or implementing organizations' long-term data storage objectives, technical capacities, and reporting requirements.

A less costly alternative with a greater chance for success is the adoption of similar data management documentation practices for IRWM Plan projects along with the rigorous standardization of the most critical information across projects and data types. Given resources currently available, it is not possible to centralize the management of the diverse data types that may include physical implementation, monitoring, restoration, design, inspection, education and outreach. Further, tasking an entity with managing data they did not collect is risky since they have a less intimate knowledge of that data and may be more prone to introducing errors during data management operations, such as quality assurance or duplicate detection and removal.

Ultimately, a more seamless integration of data sets that can be used to assess watershed health and address regional knowledge needs is desirable. Adopting common data documentation standards and standardizing key metadata fields is a sensible and useful step towards this goal at this time. The proposed structure will facilitate data discovery and sharing, lowering the costs associated with satisfying regional knowledge needs.

Because the Greater Monterey County IRWM Plan does not have an ongoing secure funding source for data management, the RWMG has opted to utilize existing State database frameworks including, for surface water quality, those developed by the California Surface Water Ambient Monitoring Program (SWAMP) and by the California Environmental Data Exchange Network (CEDEN). Wetland and riparian habitat conditions will be measured and documented using the California Rapid Assessment Methods (CRAM), and groundwater data will reside in GeoTracker using the Groundwater Ambient Monitoring and Assessment (GAMA) database.

## K.2 OVERVIEW OF DATA NEEDS

In 2006, the Monterey Bay National Marine Sanctuary (MBNMS) began an effort to coordinate disparate monitoring programs and to determine if the data was comparable enough to answer specific State non-point source (NPS) questions. This effort was called the “Central Coast Water Quality Data Synthesis, Assessment, and Management (SAM) Project.” The SAM Project facilitates region-wide water quality monitoring coordination, data management, and data analysis for addressing the sources, status, and trends of NPS pollution on the Central Coast via technical, scientific, and programmatic activities. Key goals of the project include enhancement of the regional water quality monitoring network and improving access to knowledge used for managing coastal watershed and nearshore marine systems. Findings of the SAM Assessment include the following recommendations to address key information gaps. These gaps apply to all of the watersheds draining to the MBNMS but are highly representative of information gaps and data needs for the Greater Monterey County IRWM Plan (MBNMS and SIMoN 2008).

- The absence of a region-wide standardized water quality data format for the Central Coast is an important barrier to regional water quality data analysis, information exchange, and coordination between monitoring organizations. A system should be created for automatic, seamless data integration that is based on the SWAMP formats and facilitates upward data flow toward a central location in CEDEN.
- The lack of coordination between monitoring organizations results in wasted resources and important data gaps that reduce our ability to understand the status and trends of water quality conditions. Two things that would help to identify opportunities to optimize resources are: 1) a regularly updated clearinghouse of information on all the Central Coast Water Quality Data Assessment existing programs; and 2) an annual water quality conference in the region to disseminate information and highlight the value of monitoring coordination efforts.
- Adequate detection of changes over time in water quality conditions requires that we: 1) maintain commitments to sustain long-term monitoring stations such as the Central Coast Ambient Monitoring Program (CCAMP) Coastal Confluences stations; 2) encourage standardized flow measurement as a regular part of water quality monitoring; and 3) allocate sufficient resources to data analysis.
- Encourage cooperation of watershed stakeholders to collect and share information about changes in land management practices in a standardized way that will be useful for comparison with water quality data.
- Develop a monitoring design with the express purpose of evaluating relationships between changes in land use management activities and water quality conditions at multiple watershed scales.
- Institutionalize a regional data node for ongoing data collection, analysis and multi-tiered reporting to facilitate the NPS pollution management objectives of regional stakeholders.

### K.2.1 Monitoring Programs

#### *Surface Water Quality*

There is quite a bit of water quality data collected in the Salinas Valley watershed, including two long-term regional programs: the Central Coast Regional Water Quality Control Board’s (RWQCB) CCAMP and the Central Coast Agriculture Preservation, Inc.’s Cooperative Monitoring Program. Other programs that measure water quality and have large spatial or temporal scale are described below. Very little water quality monitoring takes place along the Big Sur coast. One data set is from the MBNMS Citizen

Watershed Monitoring Network's Annual Snapshot Day, a single-day event that has been taking place since 2000, in which volunteers measure water quality at over 150 rivers and streams along the entire Central Coast, including the Big Sur region. Programs that are ongoing, have good potential to produce high quality data, and are known to have collected substantial data sets at fixed locations over a period of greater than three years are listed below:

- **Central Coast Ambient Monitoring Program (CCAMP)**  
Central Coast RWQCB  
<http://www.ccamp.org/>
- **Central Coast Long Term Environmental Assessment Network (CCLEAN)**  
Applied Marine Sciences  
<http://www.cclean.org/>
- **Ag Waiver Cooperative Monitoring Program**  
Central Coast Water Quality Preservation Inc. (CCWQP)  
<http://www.ccwqp.org/>
- **Elkhorn Slough Volunteer Monitoring Program**  
Elkhorn Slough National Estuarine Research Reserve (ESNERR)  
<http://www.elkhornslough.org/esnerr.htm>
- **Snapshot Day**  
MBNMS Citizen Watershed Monitoring Network/Coastal Watershed Council (CWC)  
<http://montereybay.noaa.gov/monitoringnetwork/events.html>  
<http://www.coastal-watershed.org/>
- **Marc Los Huertos Ambient Monitoring (MaLoHAM)**  
University of California Santa Cruz / California State University Monterey Bay  
<http://envs.ucsc.edu/shennan/Directory/Mark.html>  
<http://home.csumb.edu/l/loshuertosmarc/world/>
- **Central Coastal Watershed Studies (CCoWS)**  
California State University Monterey Bay  
<http://ccows.csumb.edu/index.htm>
- **National Water Information System**  
US Geological Survey (USGS)  
<http://waterdata.usgs.gov/nwis>
- **The Marine Pollution Studies Laboratory at Granite Canyon**  
University of California Davis  
<http://www.envtox.ucdavis.edu/GraniteCanyon/GraniteCanyon.htm>

### ***Habitat Condition***

If habitat condition monitoring is required by funding guidelines, CRAM will be used to document the habitat condition for Greater Monterey County IRWM Plan projects. CRAM is an approach that provides consistent, scientifically defensible, affordable information about the conditions of wetlands and riparian habitats throughout California. Large amounts of public and private funds are being invested in policies, programs, and projects to protect, restore, create, enhance, and manage wetlands and riparian habitats in California. Most of these investments have not been evaluated, because the ambient conditions of the habitats have not been monitored, or the monitoring methods have been inconsistent, and there is little

assurance of data quality. CRAM provides a means to measure and document habitat conditions and makes the results of the monitoring readily available to analysts and decision makers.

CRAM is designed to cost-effectively assess the performance of wetland and riparian restoration projects, mitigation projects, and the status and trends of ambient conditions within watersheds, regions of the state, and for the state as a whole. The use of CRAM for ambient monitoring will, over time, help wetland managers and scientists quantify the relative influence of anthropogenic stress, management actions, and natural disturbance on the spatial and temporal variability in reference conditions. This information can then be used in the design, management, and assessment of projects.

Specific applications of CRAM could include:

- Assessments of impacted wetlands to help determine appropriate mitigation measures;
- Preliminary assessments of wetland conditions and stressors to determine the need for intensive monitoring;
- Evaluation of wetland project performance under the Coastal Zone Management Act, Section 1600 of the California State Fish and Game Code, Sections 401 and 404 of the Clean Water Act, and local government wetland regulations; and
- Assessment of restoration or mitigation progress relative to ambient conditions, reference conditions, and expected ecological trajectories.

The Central Coast Wetlands Group (CCWG) is the Central Coast lead for the development and implementation of CRAM. Since 2002 they have assisted in the development of the riverine, estuarine, depressional and bar-built estuarine wetland modules. CCWG is the Central Coast monitoring coordinator, trainer and quality assurance (QA) manager of CRAM and eCRAM, the online repository for all CRAM data. Additionally, CCWG is an active member of the State Level 2 (Rapid Assessment) Committee of the California Wetlands Monitoring Workgroup. This Committee is tasked with overseeing the development and implementation of CRAM.

### ***Groundwater Quality***

The State Water Resources Control Board's (SWRCB) GAMA Program is California's comprehensive groundwater quality monitoring program. The GAMA Program was created by the SWRCB in 2000. It was later expanded by Assembly Bill 599 – the Groundwater Quality Monitoring Act of 2001. The main goals of GAMA are:

- To improve statewide groundwater monitoring; and
- To increase the availability of groundwater quality information to the public.

Most of the Greater Monterey County IRWM planning region with the exception of the Big Sur coast falls within the Monterey-Salinas Study Unit. Recharge to the groundwater system is primarily from stream-channel infiltration from the major rivers and their tributaries, and from infiltration of water from precipitation and irrigation. The primary sources of discharge are water pumped for irrigation and municipal supply, evaporation, and discharge to streams. Results of the GAMA study for this region can be found at: <http://pubs.usgs.gov/fs/2011/3089/>.

The most extensive source for ambient groundwater quality data in the region is the Monterey County Water Resource Agency's (MCWRA) monitoring program. The purpose of the ambient monitoring program is to provide long-term data to document and analyze water quality trends and conditions over time. Water quality samples are collected annually for the ambient monitoring program, primarily from agricultural production wells throughout the Salinas Valley Basin and from MCWRA-owned dedicated monitoring wells. Over 350 agricultural monitoring wells and 44 dedicated monitoring wells are

monitored. The same wells are sampled from year to year, unless abandoned, destroyed, or not operating. The data are stored locally in a Geographic Information System (GIS) relational database.

The Central Coast RWQCB is currently in the process of developing the Groundwater Assessment and Protection (GAP) component of CCAMP, referred to as CCAMP-GAP. The RWQCB's groundwater regulatory programs have, until now, dealt with groundwater pollution problems on an ad hoc basis; there has been no systematic, region-wide approach to assess and track the quality of Central Coast groundwater basins. CCAMP-GAP is intended to enable the RWQCB to develop a comprehensive monitoring program within the Central Coast Region. There are a number of organizations that currently implement groundwater monitoring programs with dedicated monitoring well networks within the Central Coast Region. CCAMP-GAP will leverage these existing individual programs into a coordinated regional monitoring program. Coordinating the groundwater data from local agencies into a regional database will significantly improve the ability to assess the data, streamline sharing of these data with the RWQCB and other agencies, and allow public access to the data (while keeping well location and ownership confidential). The data generated from CCAMP-GAP will be publicly available on the GeoTracker GAMA website.

Other sources of groundwater data can be found at <http://www.waterboards.ca.gov/gama/grid.shtml> or at <http://www.water.ca.gov/waterdatalibrary/>.

### K.3 TYPICAL DATA COLLECTION TECHNIQUES

When considering data collection, we first must determine what questions we are trying to answer. Many different types of data collection exist, be it water quality, habitat condition, biological, or groundwater quantity and quality. For surface water quality monitoring and biological monitoring, the RWMG has opted to use guidance developed by the SWRCB's SWAMP.<sup>1</sup> Monitoring techniques for habitat condition will follow CRAM. Groundwater monitoring will follow the GAMA Program. Chemical measurements typically include sediments, nutrients, bacteria, pesticides and herbicides, persistent organic pollutants, and trace metals. Additionally, a number of programs collect measurements that reflect ecosystem level health including toxicity, periphyton assays, bioassessments, and rapid condition assessments. Through cooperative agreements with local agencies, the United States Geological Survey (USGS) maintains, collects, processes and publishes stream flow data at specific sites throughout Monterey County and provides access to real-time or historical data sets via the web, accessible from USGS websites.

Below are data collection techniques for the previously mentioned programs and methods.

**SWAMP:** Typical data collection techniques for surface waters include both field measurements and laboratory analysis. Field measurements are either collected using meters or field kits for a common list of constituents including but not limited to water temperature, pH, conductivity, dissolved oxygen and turbidity. For an example of a field data sheet and complete list of SWAMP required fields go to: [http://swamp.mpsl.mlml.calstate.edu/wp-content/uploads/2009/04/swamp\\_sop\\_field\\_measures\\_water\\_sediment\\_collection\\_v1\\_0.pdf](http://swamp.mpsl.mlml.calstate.edu/wp-content/uploads/2009/04/swamp_sop_field_measures_water_sediment_collection_v1_0.pdf). There is a large list of possible analytes that are measured in surface waters that require laboratory analysis. Typical laboratory analysis includes fecal indicator bacteria, metals, nutrients, persistent organic pollutants, and turbidity. SWAMP provides guidance on methods and quality assurance; the guidance can be found at: [http://www.waterboards.ca.gov/water\\_issues/programs/swamp/docs/qapp/qaprp082209.pdf](http://www.waterboards.ca.gov/water_issues/programs/swamp/docs/qapp/qaprp082209.pdf).

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<sup>1</sup> See: [http://www.waterboards.ca.gov/water\\_issues/programs/swamp/tools.shtml#methods](http://www.waterboards.ca.gov/water_issues/programs/swamp/tools.shtml#methods).

Biological monitoring is helpful for determining the health of a system and whether it is able to sustain a diverse community of benthic macroinvertebrates. Standard operating procedures for determining a stream's physical/habitat condition and benthic invertebrate assemblages can be found at:

[http://swamp.mpsl.mlml.calstate.edu/wp-content/uploads/2009/04/swamp\\_sop\\_bioassessment\\_collection\\_020107.pdf](http://swamp.mpsl.mlml.calstate.edu/wp-content/uploads/2009/04/swamp_sop_bioassessment_collection_020107.pdf).

**CRAM:** The CRAM model is a standardized tool for assessing the ambient condition of wetlands and riparian habitats. CRAM software guides users through assessments that take less than half of a field day to complete. The CRAM user's manual can be downloaded at:

[http://www.cramwetlands.org/documents/2008-09-30\\_CRAM%205.0.2.pdf](http://www.cramwetlands.org/documents/2008-09-30_CRAM%205.0.2.pdf).

**GAMA:** The GAMA Priority Basin Project is grouped into 35 groundwater basin groups called "study units." Each study unit is sampled for common contaminants regulated by the California Department of Public Health (CDPH), and also for unregulated chemicals. Testing for these chemicals—usually at detection levels well below those achieved by most laboratories—will help public and private groundwater users to manage this resource. Results from the Monterey/Salinas study unit can be found at <http://pubs.usgs.gov/fs/2011/3089/>. Some of the chemical constituents that are sampled by the GAMA Priority Basin Project include:

- Low-level volatile organic compounds (VOCs)
- Low-level pesticides
- Stable isotopes of oxygen, hydrogen, and carbon
- Emerging contaminants (pharmaceuticals, perchlorate, chromium VI, and other chemicals)
- Trace metals (arsenic, selenium, lead, and other metals)
- Radon, radium, and gross alpha/beta radioactivity
- General ions (calcium, magnesium, fluoride)
- Nutrients, including nitrate, and phosphates
- Bacteria: total and fecal coliform bacteria

## **K.4 HOW STAKEHOLDERS CONTRIBUTE DATA TO THE DATA MANAGEMENT SYSTEM**

This section describes how project proponents in the Greater Monterey County IRWM planning region will contribute data to the Greater Monterey County IRWM Plan data management system.

### **K.4.1 Surface Water Quality and Biological Monitoring Data**

CEDEN will be the data management system used by all organizations collecting surface water quality and biological measurements in the Greater Monterey County IRWM planning region. CEDEN is a system designed to facilitate integration and sharing of data collected by many different participants. It is a growing statewide cooperative effort of various groups involved in the water and environmental resources of the state of California. This network is open to federal, state, county, and private organizations interested in sharing data throughout the state. The purpose of the CEDEN network is to allow the exchange and integration of water and environmental data between groups and to make it accessible to the public.

Integrating data from many different programs and data generators is one of CEDEN's main goals. To assist with this task, the Regional Data Centers (RDCs) have developed applications to support agencies, organizations, and groups who want to submit their data. These applications help improve data comparability within the CEDEN system by checking data prior to submittal. Standard templates have also been developed for use with the data checkers and to increase data comparability. These templates and associated documentation can be downloaded at:

[http://www.ceden.org/ceden\\_submitdata.shtml#templates](http://www.ceden.org/ceden_submitdata.shtml#templates).

For the Central Coast region, the Central Coast RWQCB developed a tool called the California Data Upload and Checking System (CalDUCs) which facilitates upload of the data templates and checks the data for erroneous information, thus ensuring the data is of known and sufficient quality. More information on these tools can be found at: <http://www.ccamp.info/CalDucs/index.html>. The RDC for projects in the Greater Monterey County region is located at Moss Landing Marine Laboratories. The first time an organization in this region submits data to CEDEN, or if the data is for a new project, the RDC at Moss Landing Marine Laboratories must be contacted to register the project (<http://www.ceden.org/mlml.shtml>).

CEDEN has established a list of “valid values” that are used for submitting, reporting, and exchanging data within the CEDEN system. Valid values are acceptable names and codes for analytes, projects, organism names, etc. The link to the accepted values lists can be found at: <http://www.ceden.us/Metadata/ControlledVocab.php>. These values will be updated periodically as new values are created. To submit values for inclusion into the CEDEN system, project proponents should contact their local RDC.

The Central Coast RDC at Moss Landing has been funded to provide the CCAMP (Central Coast RWQCB) tools for graphing and sorting data using CEDEN data until the end of 2012.

#### **K.4.2 Habitat Conditions**

Five CRAM field books have been produced for: estuarine, riverine, depressional, individual vernal pools, and vernal pool systems. Each field book has its own guidance and instructions for collecting data, completing field data sheets, definitions, and scoring. These field books can be downloaded at: <http://www.cramwetlands.org/documents/>.

eCRAM is an online data entry tool used to upload CRAM results. CRAM documentation is generally performed in the field with the eCRAM software installed on a tablet computer or laptop. An online version of the eCRAM software is also available. Project proponents must register before using online data entry (at <http://www.cramwetlands.org/register/>).

#### **K.4.3 Groundwater**

For those entities measuring groundwater, the RWMG has opted to use the GeoTracker GAMA database. GAMA collects data by testing the untreated, raw water in different types of wells for naturally occurring and man-made chemicals. GAMA compiles these test results with existing groundwater quality data from several agencies into a publicly accessible internet database, GeoTracker GAMA. GeoTracker GAMA is an online groundwater information system that provides access to water quality data and connects a user to groundwater basics and protection information. This online database integrates groundwater quality data from multiple sources, which are searchable by chemical or by location with results displayed on an interactive Google maps interface, found at <http://geotracker.waterboards.ca.gov/gama/>. GeoTracker GAMA currently integrates data from State and Regional Water Boards, California Department of Public Health, Department of Pesticide Regulation, Department of Water Resources, USGS, and Lawrence Livermore National Laboratory.

If a project work plan contains a groundwater ambient monitoring element, the project proponent will contact the SWRCB’s GAMA program for guidance on the submittal of ambient groundwater data. Prior to the project proponent implementing any sampling or monitoring activities, the State must be notified in writing as to the planned procedure for submittal of groundwater data to GAMA.



## **K.5 ENTITY RESPONSIBLE FOR MAINTAINING DATA IN THE DATA MANAGEMENT SYSTEM**

Each organization or project proponent that collects data related to habitat condition, biological monitoring, or water quality will be responsible for maintaining their own data management system and quality control. Primary data management responsibilities for surface water quality data lies with the data collecting organization. After appropriate quality assurance checks, the data will be uploaded into the CEDEN database through the Regional Data Center (which for this region is located at Moss Landing Marine Labs). Primary data management responsibilities for data related to habitat conditions and groundwater also lies with the data collecting organization. If this type of monitoring is required by funding source guidelines, the entity collecting the data will maintain their own data storage system for their organization in advance of uploading the data into the CRAM or GeoTracker GAMA statewide databases.

## **K.6 DESCRIPTION OF DATA VALIDATION OR QUALITY ASSURANCE/QUALITY CONTROL MEASURES**

While data management practices need not be equivalent for all projects included in the Greater Monterey County IRWM Plan, it is important that protocols and practices are documented in a methodical way such as a Quality Assurance Project Plan (QAPP), so that users of the data can assess its comparability with other data sources. IRWM Plan projects will be compatible with quality assurance protocols established for:

- SWAMP: [http://www.swrcb.ca.gov/water\\_issues/programs/swamp/qapp.shtml](http://www.swrcb.ca.gov/water_issues/programs/swamp/qapp.shtml)
- CRAM: [http://www.wrmp.org/docs/cram/CRAM\\_calibration\\_QAPP\\_final.pdf](http://www.wrmp.org/docs/cram/CRAM_calibration_QAPP_final.pdf)

## **K.7 DATA TRANSFER AND SHARING**

This section describes how data collected for IRWM Plan implementation will be transferred and/or shared between members of the RWMG and other interested parties throughout the region, including local, state, and federal agencies.

The CEDEN database will be updated every week with new data from the four RDCs around the state. The advanced query tool that exists on the CEDEN website currently allows the user to query multiple data types by project, site, analyte type together in different formats. Other tools such as a bioassessment reporting module and the ability to query the data by geographical area, watershed, county, etc. will be available in late 2012. Currently there is no planned date to release a graphing package or summary data on CEDEN. However, CEDEN is the data repository for many different portal applications built by the SWRCB on the “My Water Quality” website (<http://www.waterboards.ca.gov/mywaterquality/>). Data that is uploaded to CEDEN will be available in these and other applications that use CEDEN data.

The same situation is true for CRAM data. The California Wetlands Portal is an interactive tool that displays information about modern and historical wetland habitat in California (go to: <http://www.californiawetlands.net/tracker/>). Wetlands Portal catalogues planned, in progress, and completed wetland restoration, preservation, creation, and enhancement projects. CRAM data that is uploaded to the statewide database automatically populates this website to enable data sharing and dissemination.

GeoTracker GAMA is an online groundwater information system that gives the user access to water quality data and connects the user to groundwater basics and protection information. This online database integrates groundwater quality data from multiple sources, which are searchable by chemical or location with results displayed on an interactive Google maps interface:

[http://www.waterboards.ca.gov/gama/geotracker\\_gama.shtml](http://www.waterboards.ca.gov/gama/geotracker_gama.shtml)



#### **K.8 HOW THE DATA MANAGEMENT SYSTEM SUPPORTS THE RWMG EFFORTS TO SHARE COLLECTED DATA**

The intent and design of the Greater Monterey County IRWM Plan data management system focuses on a localized approach to data collection and management with the primary goal of uploading data of known quality into a statewide database with web tools for dissemination. It is not reasonable to expect every organization that has implementation projects to change the way they store and manage their data. In addition, the Greater Monterey County RWMG does not have the resources to develop and fund a centralized data storage system. The most logical system is to fully leverage and support the efforts and resources the SWRCB has put into the RDC that support the CEDEN and CRAM databases and the My Water Quality Portal. A significant amount of time and funding has developed SWAMP and CRAM protocols and quality assurance with the intent of being the recipient of many different sources of environmental data. These systems make data collection much more informative and valuable when it is easily accessible and available to the RWMG for resource management and decision-making.

#### **K.9 HOW DATA WILL GO TO LARGER DATA SETS**

As previously stated in section K.4 above, the data collected for IRWM Plan projects will be managed by each respective organization and then uploaded into a statewide data system, e.g., CEDEN, Wetlands Tracker or GeoTracker GAMA. See section K.4 for more details.