

CALFED WATERSHED PROGRAM MONITORING AND PERFORMANCE MEASUREMENTS

Information necessary to inform sound long-term management of the Bay-Delta watershed

The following is a partial outline of monitoring needs for the Watershed Program. It includes a set of parameters to measure to help determine the effectiveness of implementation of the CALFED Watershed Program Plan element of the CALFED Bay-Delta Program. The Watershed Program Plan outlines an approach to help attain the primary objectives of the CALFED Bay-Delta Program. To implement the approach, the Watershed Program Plan outlines the following Primary Objectives (Section 1.5 – Watershed Program Goals and Objectives, *p. 1-7 – 1-8*):

- **Facilitate and improve coordination, collaboration, and assistance among government agencies, other organizations, and local watershed groups.**
- **Develop watershed monitoring and assessment protocols.**
- **Support education and outreach.**
- **Integrate the Watershed Program with other CALFED program elements.**
- **Define the relationship between watershed processes and the goals and objectives of CALFED.**
- **Implement a strategy that will ensure support and long-term sustainability of local watershed activities.**

Many of the data needs for effective Program Plan implementation will be gathered by entities in partnership with the Program. Those include other CALFED Program Elements, grant funded partners, implementing agencies, and others involved with local watershed management in the greater Bay-Delta system. Some data may be gathered by the Program directly, or by special arrangement with specific programs through directed actions by the Program. The general monitoring needs outlined below are not an exclusive list. They trend heavily toward monitoring change in the physical resource, and will be necessary to fully assess Program effectiveness. Other data will also be necessary, however, that are more related to human activities, policies, programs and practices, but which nonetheless have a large impact on watershed condition and productivity. The latter type of measurement predominate in the Program performance measurements outlined below.

Assumptions:

- The state of natural resources and natural resource systems at any given time is the emergent result of cumulative management decisions at many scales in the context of natural variation in climate and other natural phenomena. Some of those decisions are directly related to natural resources, such as habitat restoration, stream alterations, or resource extraction activities. Other activities are not directly related, but can affect the state of the physical environment. Zoning decisions, economic expansion or retraction, changes in general recreational preferences, and transportation infrastructure design are examples of the latter.
- Virtually all subwatersheds in the Bay-Delta watershed are dominated by human activity. The effects of this single species are generated principally on the basis of individual management decisions on both privately and publicly held lands. Information generated through monitoring should be gathered and presented in a form that makes it directly useful and easily available to local decision makers (public or private) for use in routine management.
- Increased information and improved accessibility to additional information will promote decision making at all levels that is more likely to result in long-term sustainability of watershed resources. The sustained resource health will significantly further the achievement of CALFED's objectives.

- For effective watershed management to achieve CALFED objectives, knowledge of emergent conditions resulting from interactions of watershed components and processes is equally important as knowledge of discrete components and processes.
- Data should be gathered and presented in such a way as to make it available for direct use in decision making by as wide a range of data users as possible.

Areas of investigation:

- Ecological – Monitoring of status of biological components, systems and processes of the watershed.
- Physical – Monitoring of the physical status of landforms, water movement, geologic and geomorphic condition, chemical attributes, atmospheric condition, climate, and chemical characteristics.
- Social – Monitoring of human population dynamics, economic condition, management methods and effects, transportation, and other activities such as water management.
- Emergent – Monitoring of the dynamic relationships among the three above areas, including investigation of little known or inadequately understood processes. One particular area of interest is development of an understanding of complex processes that emerge as the result of interactions of other processes (the relationship between land use practices, the availability of large woody debris, sediment entrapment that forms gradual estuary channel banks, and the life cycle needs for emergence of certain aquatic insect larvae, for instance).

Suggested monitoring parameters:

Ecological:

- ✓ Habitat types*
- ✓ Habitat distribution and overlap
- ✓ Habitat continuity and sequence (temporal and spatial)
- ✓ Habitat relationships (i.e., gallery forest food production for aquatic biota)
- ✓ Biological diversity and vitality
- ✓ Biological relationships (i.e., pollinators, seed distributors, parasites, predator/prey relationships)

Physical:

- ✓ Erosion and sediment sources (including mass wasting)
- ✓ Soils mapping (usually USDA NRCS soil surveys)
- ✓ Other geologic processes such as seismic and volcanic
- ✓ Precipitation amount and distribution (spatial and temporal)
- ✓ Precipitation/runoff characteristics, including snowmelt
- ✓ Snowpack amounts and distribution (spatial and temporal)
- ✓ Permeability*
- ✓ Dendritic drainage pattern change
- ✓ Hydrograph and total stream discharge
- ✓ Geomorphic (channel form, floodplains, meanders, etc.)
- ✓ Nutrient cycling
- ✓ Soil and water chemistry
- ✓ Surface water/groundwater relationships

Social:

- ✓ Economic status and trends
- ✓ Economic activity and change in activity
- ✓ Transportation network construction and maintenance needs and methods
- ✓ Population density
- ✓ Population growth

- ✓ Watershed condition awareness
- ✓ Priority of watershed health in major decision making
- ✓ Recreation types and intensity
- ✓ Local environmental policy development/administration
- ✓ Availability of information and education on watershed condition
- ✓ Activity breadth and intensity of local watershed management efforts

Emergent:

- ✓ Vegetation effects on geomorphic stability (changes in floodplain and riparian corridor vegetation characteristics, including invasive species such as hyacinth and *arundo donax*)
- ✓ Animal effects on stream channel and levee stability (such as mitten crabs, beavers, burrowing rodents and grazing mammals)
- ✓ Effects on watershed processes of wildfire, urbanization, agriculture and other land uses
- ✓ Economic impacts on resource management and condition: (building booms, general recession, industry specific recession such as in agriculture, rapid shifts in recreation popularity, etc.)
- ✓ Resource conditions impacts on economics (loss of resources, increased availability of resources, water quality/quantity, etc.)

**Habitat type descriptions can have permeability indices developed for each (many indices exist for the CDFG WHR descriptions, for instance). Thus, monitoring of that type can serve a dual purpose. The other basic parameters for permeability are urbanization, standing water, and rock outcrop – all of which can be gathered rather inexpensively at fairly small scale resolution.*

The Watershed Program Plan describes a set of Desired Outcomes (Section 3.3, p. 3-3). Adequate data gathering will enable the Program to assess the degree to which these outcomes are realized, and the degree to which they contribute to CALFED's primary objectives. A wide range of data will also be necessary to verify Program assumptions and to adjust the Program through adaptive management to better assist with the attainment of the mission and objectives of CALFED.

The following Performance Measurements are intended as a beginning source of information to assess Program effectiveness. Coupled with information gathered in the areas outlined above, the data collected regarding Performance Measurement will provide the Program with invaluable feedback regarding effectiveness of Program implementation.

PERFORMANCE MEASURES FOR THE CALFED WATERSHED PROGRAM

<u>Track</u>	<u>Desired Outcome</u>	<u>Indicator</u>	<u>Metric</u>	<u>Target</u>	<u>Baseline</u>	<u>Sustain Progress</u>
Improved Coordination and Assistance	Improved collaboration between public and private parties	Agency and other organization participation in Program Plan implementation	Increase/decrease in number of active partnerships working to execute the Program Implementation Plan annually	Continuous increase in collaborative activities that help to implement the Program Plan	Minimal collaboration	Participation is more prevalent and more effective in reaching Program goals and objectives
		Increased partnership efforts to improve and maintain Bay-Delta system health	Number of new projects that involve multiple agency and non-agency participation	Widespread multi-level partnerships as default means of watershed management	Level of partnership efforts proposed in first Proposal Solicitation	Growing number and extent of partnership projects and management efforts
		Improved coordination of funding opportunities from government agencies	Number of coordinated inter-agency project solicitations with Program involvement	Full integration of agency funding opportunities for local watershed management programs	Segmented project solicitations among agencies and agency programs	Effective cooperation among funding agencies across programs
		Improved technical assistance delivery to local watershed management efforts	Annual number of agency py's committed to Program technical assistance for local watershed management	Full availability to meet technical assistance needs for local watershed management efforts in the Bay-Delta system	Two py available for fy 2001-2002	Regular and long term support for technical expertise available through the Program to meet local needs
Develop monitoring and adaptive management processes	Bay-Delta tributary watershed assessments	Extent of watershed assessments completed in the Bay-Delta system	Percent area of the Bay-Delta system with completed watershed assessments	Assessments completed for the entire Bay-Delta watershed	Assessment area completed as of August, 2002	Continued increase in the percent of Bay-Delta watershed with completed assessment
	Bay-Delta watershed monitoring	Program guidance to encourage open standards for watershed monitoring throughout the Bay-Delta system	Percent of Program supported projects using compatible monitoring methods that allow regional and cross-watershed comparisons	Widespread use of open standards for data collection in the Bay-Delta system	Wide divergence in monitoring methods throughout the Bay-Delta system	Growing convergence of open standards for monitoring of watershed conditions

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		Functional watershed data source to determine status and trends of natural resources in the Bay-Delta watershed	Level of confidence (of Program and Science Program) in science used to report on status and trends in the Bay-Delta watershed	High confidence level in data available, and in analyses made, of status and trends of natural resources	Low availability and/or compatibility of comprehensive data for full system analysis	Growing confidence in the accuracy of analyses of status and trends
	Effective Watershed Program Plan implementation	Presence and currency of an accurate tracking model and monitoring plan to inform Program management decisions	Adequacy of data deemed necessary to make effective Program management decisions	Highly calibrated model and supporting data for informing Program adjustment decisions	Shortage of information and lack of overall model	Increase in confidence and relevance of data supported model for assessment of the effectiveness of Program actions
Improved and Expanded Watershed Education and Public Outreach		Accurate and effective Program adjustments based on monitoring information	Improvement in overall performance assessment resulting from Program adjustments	Effective and productive Program adjustments based on feedback data and analysis	Little data available to assess assumptions and actions, and to guide Program performance audits	Increasing adequacy of Program implementation results, as shown by regular performance audits.
	Informed citizenry	Level of awareness in general public of watershed functions and characteristics	Percent of general public with medium to high knowledge of watershed functions and characteristics	High level of awareness among general public of the functions and characteristics of watersheds	Low recognition among the general public of watershed characteristics and functions	Increasing knowledge of watershed impacts of daily activities
	Sustainable watershed programs	Number of watershed management participants with specialized watershed management training	Number of people trained through Program supported activities annually	High level of local expertise in watershed management	Inconsistent levels of expertise available	Growing number of local areas with expertise, and growing diversity of expertise available locally

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		Durability of local partnerships for watershed management	Number of Program supported watershed management partnerships with greater than 5 years continuous activity.	All major tributary watersheds to the Bay-Delta with sustained watershed management partnerships	Long term efforts underway as of August, 2001	Annual increase in the mean longevity of local watershed management efforts in the Bay-Delta watershed
		Sufficient funding to meet the needs of local watershed management	Percent of requests for funding met annually	Meeting all appropriate requests for Program assistance	Percent of eligible requests funded in the 2002 Solicitation for Proposals	Decreasing gap between funds requested and funds allotted
		Local expertise in watershed management	Number of tribal, city and county governments with resident expertise in watershed management science and technology	Generally available local expertise in watershed management science and technology	Inadequate distribution of locally available watershed management expertise	Increased breadth and distribution of locally available expertise in watershed science and management
Improved Watershed Planning and Management	Improved watershed planning and management	Watershed management based on scientifically sound watershed management plans	Percent of Bay-Delta watershed implementing science based management plans	Systematic development of management plans based on adequate scientific data and assumptions	None	Increasing use of science in developing and assessing progress of watershed management plans for the Bay-Delta watershed
		Quality of watershed management projects proposed to the Watershed Program	Percent of Concept Proposals requested to complete full applications in response to Program Solicitations for Proposals	High percentage of concept proposals received that have potential to help implement the Watershed Program Plan	Percent of concept proposals requested to be fully developed in the first Solicitation in 2000.	Increasing percent of acceptance of concepts received by the Program

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		Continuity of local watershed management initiatives	Percent increase of local match commitments in response to Program Solicitations for Proposals	Significant reliance on locally generated funding to pursue local watershed management	Local match funds percentage in the first Solicitation from the Program in 2000	Increasing percent of investment of local funds in local watershed management
WATERSHED PROGRAM PERFORMANCE MEASURES WITH CALFED PROGRAM-WIDE APPLICATION						
<u>Track</u>	<u>Desired Outcome</u>	<u>Indicator</u>	<u>Metric</u>	<u>Target</u>	<u>Baseline</u>	<u>Sustain Progress</u>
Improved Watershed Stewardship	Improved watershed ecosystem maintenance and enhancement	Positive changes in characteristics of tributary hydrographs	Hydrograph adjustments towards selected “minimal disturbance” reference hydrographs in watersheds with Program support	Maximum reasonable correspondence between tributary hydrographs and reference hydrographs	Existing conditions as of August, 2001	Long term movement of hydrograph shapes toward reference hydrographs
		Water quality improvements throughout the Bay-Delta watershed	Number of tributary watersheds with unimpaired beneficial uses of water	All beneficial uses met in the major portion of the watershed	Existing conditions as of August 2001	Continued increase in number of unimpaired beneficial uses of water
		Wildlife habitat continuity and extent	Spatial distribution and contiguity of wildlife habitat in watersheds tributary to the Bay-Delta	None	Existing conditions as of August 2001	Trend toward expansion of available habitat quantity and connection
		Improved knowledge of the effects of implemented watershed projects on the health of the Bay-Delta system	Number of supported projects that produce significant direct scientific connections between implementation and physical effects in the watershed.	Measurable impacts from all Program supported projects intended to produce positive change in the Bay-Delta system	Zero effects prior to the first solicitation for proposals from the Watershed Program	Annual increase in the percent of supported projects that produce direct scientific evidence of impacts

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Maximize Multiple Benefits of CALFED Program Elements	Maximized benefits	Extent of Watershed Program supported activities that address multiple CALFED Program objectives	Number of projects and/or amount of funding that helps achieve objectives of three or more CALFED Programs	Full integration of other CALFED Program Elements into Watershed Program supported efforts	Inconsistent integration of Program objectives and the objectives of other CALFED Program Elements	Increasing number of Program supported activities that also support the objectives of other Program Elements.
		Increased interaction among the various Program Elements of the CALFED Program	Number of formal contacts and requests for consultation between Program Managers and Program activities	Full integration of Program Elements	None	Increasing interaction and active consultation among Program Elements
		Coordination of proposal solicitation and project management of projects from the multiple Programs	Percent of proposal solicitations done in concert or coordination with multiple Programs	Full integration of CALFED Program proposal solicitations	None	Increasing level of integration of proposal solicitations and funding decisions

Data Sources

Measurements and data collection for the performance measures outlined above will come from four significant sources.

- Direct measurements undertaken by the Program
- Measurements taken by supported projects, such as through grants
- Data collected directly and indirectly by other elements of the CALFED Bay-Delta Program
- Data collected by local, state and federal agencies.

The Program will undertake the gathering and sorting of the various data sets directly, and/or through contracting with government or non-government entities for assistance. The Program will work closely with other CALFED Program elements to ensure that data sharing is available, appropriate, and useable.

Additional data about the physical condition of the watershed will be collected from local monitoring efforts, state and federal programs, other Bay-Delta Authority elements, and projects supported with funding from the Watershed Program. In conjunction with the other Programs, and with the support of the Science Program, the Program will assist with long term assessment of status and trends in the greater Bay-Delta system.

Data Use

The information collected will be consolidated to form the foundation for an independent Program Performance Audit from an outside entity to be selected through a competitive bid process. The data, in conjunction with the results of periodic audits, will be used to guide performance management of the Program (adaptive management). The Program recognizes the difficulty of tracking progress in such a complex environment as watershed management. Complex causal processes, multiple physical and social variables, interactive effects and feedback loops, and non-linear responses all complicate direct assessment of Program impact on the Bay-Delta system. The Program will use a “weight of evidence” approach to assessment of correspondence of actions *vis a vis* system responses where it is not possible or reasonable to measure direct causation. In some cases, a relative impact may be estimated where direct impacts may be accompanied or assisted by actions taken by others.

The Program will also use the information to assess relative value received from the expenditure of Program resources, in order to help discern areas of future priority attention. The Program will develop a narrative assessment of the level of effort (financial and non-financial) expended; what was accomplished through the expenditure (both outputs and outcomes), and; the relation of effort to outcome. Additional information in any performance assessment will outline the elements of Plan implementation that are substantially within the Program (such as project grants, directed actions, and Program staff activities), and elements that are peripheral to, or entirely outside of, the Program’s influence (such as weather, state and federal policy shifts, and economic conditions).

Adjustment Process

When sufficient information accumulates to guide adjustment decisions, the Program will develop a summary report for review. The report will be circulated among the major Program partners at the BDPAC Watershed Subcommittee, the IWAT, the CBDA Board and the Science Program. The Program implementation partners will use the recommendations resulting from open discussions of the summary results to develop adjustments in the annual workplan for the Program, and in any appropriate long range plans for implementation. Any changes will also maintain consistency with the commitments made in the Record of Decision and supporting documents. As necessary, new performance measures, or adjustments to existing measures, will also be developed coincident with any changes in priority and planned actions.

The Program anticipates that this performance based assessment will allow the Program to respond positively to changes in condition in the many variables involved in watershed functions. The ongoing assessment process will help to keep the Program focused on the desired outcomes of Program implementation and on the major objectives of the overall CALFED Bay-Delta Program.