Technical Report 572

# California's Wetland Demonstration Program Pilot - A final draft project report for review by the California Resources Agency

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## EXECUTIVE SUMMARY

California's wetlands are an important natural resource, providing critical ecological services. Most of the State's threatened and endangered plants and animals depend on wetlands. The primary threats to wetlands are human activities that result in altered wetland hydrology, substrates, or biological communities; these activities include discharge of fill material, excavation, habitat fragmentation, and degradation from stressors (e.g., invasive species, excess sediment, altered hydrology, and contaminants). Over the last 20 years, billions of dollars have been invested in the protection and restoration of wetlands and riparian areas in California. Unfortunately, the effectiveness of these investments is uncertain because these areas are not systematically monitored. A comprehensive monitoring program is needed to sustainably manage these resources by: 1) creating tools that inform regulatory and management processes in order to make them more adaptive and performance based; 2) conducting ambient assessments to provide context for interpreting site-specific data and informing decision-making; 3) developing a consistent approach to project performance assessments; and 4) providing a common framework and platform for data management and dissemination.

In 2003, a consortium of scientists and managers began developing the conceptual framework and standardized methods to be used in a Statewide wetlands assessment program, modeled after the United States Environmental Protection Agency (USEPA) Level 1-2-3 framework for assessment of wetland resources (USEPA 2006). This toolkit includes standardized protocols to map wetlands and riparian areas (Level 1), the California Rapid Assessment Method (CRAM) for low-cost assessment of the overall condition of wetlands and riparian areas (Level 2), standardized intensive assessment protocols (e.g., indices of biological integrity, etc.) to validate CRAM and quantify functions of wetlands or particular aspects of their condition (Level 3), and public data management tools to track investments in wetlands and changes in their quantity and quality (www.wetlandtracker.org).

In 2006, the Resources Agency was awarded a three-year USEPA Wetland Demonstration Program (WDP) Pilot grant to begin phased implementation of a statewide wetland monitoring

program, building on the Level 1-2-3 framework and the standardized wetland monitoring toolkit. The WDP project consisted of a series of major monitoring activities designed to demonstrate the toolkit as integral to the State's enhanced capacity to manage, regulate and conserve wetlands and riparian areas. These activities include:

- Create a Statewide Steering Committee to provide interagency coordination on approaches and strategies for wetland monitoring and assessment
- Demonstrate new wetland and riparian mapping standards for updating the State's wetland inventory as a base map for tracking change, including wetland projects and the effects of climate change
- Develop State Agency capacity to implement CRAM through standardized training
- Develop State Agency capacity to track projects and manage wetland-related data through a publicly accessible data portal called the Wetland Tracker
- Demonstrate the toolkit by assessing the condition of estuarine wetlands statewide and riverine wetlands condition in three demonstration watersheds
- Report on the State of the State's Wetlands, based in part on the above WDP activities

The WDP project demonstrates significant advances in the State's capacity to monitor wetlands and riparian areas. Progress on toolkit development and implementation is summarized in Table E-1. Results of WDP activities utilizing the wetland assessment toolkit are summarized below and presented in detail in Appendices 1 and 2.

**Table E-1. Summary of the State's progress on implementing a comprehensive monitoring program, recommended next steps, and status of current funding to address these recommendations.**

| Area | Summary of Progress | Recommended Next Steps |
|---|---|---|
| **Programmatic** | • Improved coordination among agencies on wetland monitoring, now formalized through the State Wetland Monitoring Workgroup<br>• Wetland and riparian protection policy under development: Phase I includes definition and proposed classification of wetlands and components of a statewide wetland monitoring program | • Implement a statewide wetland monitoring program, consistent with USEPA guidance (the "10 elements letter" of 2006)<br>• Establish a long-term strategy to comprehensively assess wetlands ands riparian areas using existing programs<br>• Support standard wetland and riparian definitions for all state agencies<br>• Develop a funding strategy to support monitoring program implementation<br>• Support periodic (e.g., every three years) programmatic evaluations of the effectiveness of the wetland monitoring program<br>• Strengthen agency participation in the Statewide Wetland Monitoring Workgroup (SWMW) to provide ongoing mechanism for coordination and identification of common assessment needs and priorities<br>• Develop regional teams for areas of the State currently underserved by early implementation efforts (i.e., areas of the Central Valley, Lahontan, and Colorado River Basin Regional Water Quality Control Boards) |
| **Mapping** | • Drafted standardized operating procedures for the mapping of wetland and riparian habitat<br>• Continued update of statewide wetland inventory | • Vet and adopt state-sanctioned classification system and mapping standards for wetlands and riparian areas<br>• Adopt the USFWS National Wetland Inventory Status and Trends approach to future updates of the wetland inventory<br>• Clarify mechanism to cross-walk between state and federal classification systems for wetlands and riparian areas |
| **Rapid Assessment** | • Completed CRAM Users Manual for six wetland types<br>• Validated estuarine and riverine CRAM modules<br>• Developed publicly accessible eCRAM and statewide CRAM database<br>• Prepared draft CRAM guidance document for agency implementation<br>• Initiated SWRCB peer review of CRAM<br>• Developed CRAM training modules for agency staff and practitioners | • Vet draft California Rapid Assessment Methods (CRAM) guidance within agencies and develop a position on implementation<br>• Support the adoption and use of CRAM as a core component of all wetland monitoring<br>• Support the integration of CRAM as a component of an integrated aquatic resource assessment framework for the Surface Water Ambient Monitoring Program (SWAMP)<br>• Support the refinement or additional development as needed of all necessary CRAM modules consistent with results of the USACE peer review, the review underway by the State Water Resources Control Board (SWRCB), and any evaluations judged to be needed by the SWMW<br>• Extend CRAM validation to include depressional wetlands and thereafter all other wetland types for which CRAM has not yet been validated<br>• Establish full reference network for all wetland types statewide<br>• Develop performance curves for restoration projects based on CRAM<br>• Refine eCRAM to enhance data download and automated reporting features |

**Table E-1. Continued**

| Area | Summary of Progress | Recommended Next Steps |
|---|---|---|
| Project Tracking | • Developed statewide project tracking form<br>• Piloted project tracking in SF RWQCB<br>• Developing interagency guidance for implementation of tracking in South Coast | • Vet draft guidance for application of project tracking in agency programs<br>• Adopt standardized tracking of wetlands and riparian areas across all relevant state agencies<br>• Extend the project tracking tools to include "Notices of Intent" and other early documentation of projects proposed through CEQA |
| Quality Assurance | • Developed and met quality assurance standards for CRAM implementation in ambient surveys | • Develop a Quality Assurance (QA) process for using Wetland Tracker and CRAM for permitted and/or project-specific monitoring<br>• Create and maintain statewide technical CRAM oversight team and regional CRAM technical teams to implement QA process for project tracking and CRAM<br>• Support implementation of CRAM and wetland tracking training programs |
| Data Management | • Developed and launched wetland data information management platform, operational in three coastal regions and populated with a total of 315 projects<br>• Updated functionality of Tracker to enhance user experience | • Improve functionality of the Wetland Tracker (www.wetlandtracker.org) to serve as Statewide Wetland Data Portal<br>• Support the creation and ongoing maintenance for data centers to manage, synthesize and disseminate updated Statewide Wetland Inventory, project tracking, habitat tracking, and CRAM data via the Wetland Tracker<br>• Support data sharing between Wetland Tracker data and the existing databases of other federal and state agencies (e.g., USACE/EPA ORM-2 database) |
| Toolkit Proof of Concept | • Produced the State's first statewide report on estuarine wetlands<br>• Engaged in ongoing demonstration of CRAM in statewide perennial stream assessment<br>• Demonstrated toolkit for watershed assessment in three watersheds | • Continue to support the incorporation of CRAM into Statewide Perennial Stream Survey<br>• Fund watershed demonstration projects of the wetland toolkit in North Coast and inland regions of the State |

**Statewide Estuarine Wetland Assessment.** A statewide assessment of estuarine wetlands was conducted in 2007, using the wetland monitoring toolkit. The assessment consisted of: 1) a Level 1 profile of the extent and geographic distribution of estuarine wetlands; 2) a Level 2 (CRAM) statewide probability-based survey of the ambient condition of saline, perennially tidal estuarine wetlands; and 3) a Level 2 assessment of 30 completed estuarine wetland restoration projects.

CRAM assesses the condition of a standardized amount of wetland or riparian habitat called the Assessment Area (AA). Visible indicators of condition are used to score the AA for each of four attributes: Landscape Context (landscape connectivity and natural buffer), Hydrology (water source, hydroperiod, and hydrologic connectivity), Physical Structure (complexity of marsh topography and physical patch types), and Biological Structure (wetland plant community structure). All scores represent the percent of maximum possible, which represents the best achievable condition, based on statewide validation exercises. The attribute scores are summed into an overall index score for each AA. Likely sources of stress for each AA are recorded on a checklist that accompanies each attribute score.

The ambient survey design emphasized objective selection of each AA while accounting for the portion of total estuarine wetland area that the AA represents. This design is necessary because some AAs are part of large wetlands, therefore their scores represent a smaller portion of the total wetland area than an AA of the same size in smaller wetlands. The approach is called a probability-based survey. It depends on an accurate wetland map, which in this case was produced as part of the statewide Level 1 profile of estuarine wetlands. Based on this approach, 150 sites were distributed among four coastal regions: the North, Central, and South Coasts, and the San Francisco (SF) Estuary. Results were reported as the percentages of the total estuarine wetland area that fell within four categories of CRAM index or attribute scores: scores 82 to 100 = Category 1; scores 63 to 82 = Category 2; scores 44 to 63 = Category 3; and scores 44 to 25 = Category 4.

Land use practices along the California coastline have drastically decreased the amount of estuarine wetland and changed the sizes, shapes, and spatial relationships between wetlands. In urbanized estuaries, many wetlands are impacted by intensive land uses and bounded by levees, which diminish the hydrological and ecological connectivity among the wetlands and increase susceptibility to invasion and local catastrophic events. Based on the Level 1 profile, there are currently 44,456 acres of perennial, saline estuarine wetland in California. The statewide ambient survey results are strongly influenced by the SF Estuary, which has 77% of the State's estuarine wetlands. Eighty-five percent of the statewide acreage scored within the top 50% of CRAM index scores. Sixty-four percent had Landscape Context scores within the top category of possible scores, while 35% of acreage had scores for within the top category for Hydrology and Biological Structure attribute. Conversely, 62% of the acreage was found in the bottom two categories of CRAM physical structure scores. Anthropogenic modifications to the tidal and freshwater hydrology, sediment transport, and geomorphology of the marsh result in reduced integrity of marsh physical structure. CRAM index and attribute scores showed a general decrease from north to south. This difference was most pronounced for Hydrology and Physical Structure attributes (25 - 30 point difference from North to South Coast) and least for Landscape Context (<10 point difference North to South). This southward decrease in condition quality is related to a southward increase in coastal urbanization, which involves increasing amounts of diking and other fragmentation of estuarine wetlands. Dikes and levees, which restrict tidal exchange and extend the retention time of water in wetlands, were among the most frequent and most severe stressors identified statewide.

The CRAM index and attribute scores for restoration projects tended to be 5 - 20% lower than ambient scores for their region. Differences can be attributed to a number of factors including project age (i.e., how much time the restoration processes have been operating), and landscape context (the degree to which the project is embedded in urban land use). To understand the causes of low project scores relative to ambient condition, projects should be assessed with CRAM prior to impact or restoration, then re-assessed as the project matures. Data of this kind are essential to enabling wetland managers to track net change in wetland acreage and condition and to account for the large and ongoing public investment in wetland restoration.

CRAM scores and the accompanying stressor checklist suggest possible management actions to increase wetland condition within each coastal region. The stressors affecting the condition of estuarine wetlands originate in their watersheds or adjoining uplands. Altered runoff (increases due to urban drainage, decreases due to stream diversion or withdrawals, etc.) has changed estuarine salinity regimes. In some South Coast estuaries, erosion control or impoundment of sediment has significantly reduced the amount of sediment supply needed to sustain estuarine wetlands. In others areas, such as the North Coast, timber harvesting activities upstream have led to excessive sedimentation in stream reaches. In all regions, conversion of floodplains to developed land use has reduced their ability to filter runoff and buffer estuaries from upstream contaminants. Better management of urban and agriculture runoff through integration of Best Management Practices is necessary to reduce contaminant inputs to these systems, reduce toxicity of water and sediments, while assuring that sediment supplies are adequate to sustain estuarine wetlands, especially in the context of sea level rise.

Historical levees and dikes that have modified tidal circulation have caused a general decline in estuarine wetland condition. Careful removal, realignment, or re-engineering of operational and abandoned railroads and highways is required so that they no longer impede tidal circulation. Much of this infrastructure will need to be modified to accommodate rising sea levels and increased wave run-up; improved tidal exchange between estuarine wetlands and their estuaries should be a design criterion, coupled to plans for infrastructure repair and replacement. A statewide forecast of sea level rise across the coastal landscape would help preview estuarine wetland restoration constraints and opportunities.

Improving biotic conditions in the North Coast region requires controlling the invasive cordgrass *Spartina densiflora*. At the landscape scale, estuaries should be regarded as downstream extension of their watersheds. Improving the overall condition of estuarine wetlands will ultimately require changes in watershed management to assure adequate supplies of clean water and sediment, improved tidal circulation between the wetlands and their estuaries, and adequate lands to accommodate estuarine transgression due to sea level rise.

**Use of the Wetland Toolkit for Watershed Assessment.** Aquatic resource monitoring is a key component of watershed assessment. Wetlands, through use of the toolkit, can be seamlessly integrated into the assessment of all aquatic habitats within a watershed. With standard assessment methods, comparisons can be made among watersheds or to Statewide ambient condition. To demonstrate this, three watersheds were chosen representing South Coast (San Gabriel River watershed), Central Coast (Morro Bay Watershed), and the Bay Area (Napa River watershed). Assessment of riverine-riparian habitat within these watersheds consisted of, at minimum: 1) Level 1 inventory of wetlands; 2) Level 2 (CRAM) assessment of ambient condition of riverine-riparian habitat using; and 3) CRAM assessment of selected riverine-riparian projects. Each watershed had a distinct management community and baseline of existing data. These data are complemented by CRAM assessments of riverine-riparian habitat conducted as part of the 2007-08 Statewide Perennial Stream Assessment (PSA) of the State's Surface Water Ambient Monitoring Program (SWAMP). Examples are used from each dataset to illustrate toolkit use for riverine-riparian assessment.

The Napa River Watershed had detailed maps of wetlands and riverine-riparian habitat for present-day and historical conditions (pre-dating local Euro-American contact). These data were used to show changes in wetland and riparian extent over time. In this watershed, most of the seasonal and perennial depressional wetlands have been drained or filled to support agriculture and urbanization, while the amount of lacustrine wetland has been greatly increased by the construction of reservoirs for flood control, recreation, irrigation, and other consumptive uses. The acreage of riverine-riparian habitat has slightly increased due to the addition of irrigation and drainage ditches. However, the amount of riparian area wide enough to support the full complement of riparian functions, including terrestrial and riparian wildlife support, has decreased by almost 90%.

The results of the ambient surveys can be compared among demonstration watersheds and to the Statewide PSA. Median CRAM index scores for Morro Bay watershed (72 ±3), Statewide and Napa River watershed (67 ±3) fall into Category 2 (medium-high condition), whereas the median score for the San Gabriel River watershed falls into Category 3 (44 ±3; medium-low). These index scores and their component attribute scores reflect a gradient of urbanization within these watersheds. Completed restoration projects in Morro Bay watershed were used to show how projects can be compared to ambient condition at the watershed scale, and to track restoration progress and to establish performance curves. Seven of 10 projects in the Morro Bay watershed scored below the $50^{th}$ percentile of the both the Morro Bay watershed and the statewide ambient survey. Data of these types illustrate the cost-effectiveness of using CRAM to interpret the condition of a project relative to the gradients in condition within a watershed and statewide.

The San Gabriel River watershed provided the template to illustrate the merits of using the Level 1-2-3 toolkit (i.e., wetland resource extent/distribution, overall condition, and specific aspects of condition) to provide a complete assessment of wetland condition in the watershed. These data can help determine how policies and programs have affected conditions in a watershed and how they might influence future management actions. A comparison of Level 2 and Level 3 data indicates issues with contaminant loads and habitat impairment among three sub-regions based on watershed position. Information from Level 1 and Level 2 studies corroborates observations that watershed position is an important determinant of overall water quality in the San Gabriel River. A positive correlation between CRAM-benthic macroinvertebrate IBI scores and CRAM-SWAMP physical habitat scores provides weight of evidence indicating that biotic integrity is strongly dependant on habitat condition. By applying a hybrid sampling design that integrates probability-based surveys, overall condition assessment (Level 2), and more quantitative site assessments (Level 3), wetland status and trends assessment can be successfully incorporated into traditional water quality and biological monitoring programs to provide a more robust understanding of the relationship between ambient condition of aquatic resources and their beneficial uses.

## Full Text

ftp://ftp.sccwrp.org/pub/download/DOCUMENTS/TechnicalReports/572_WDP.pdf