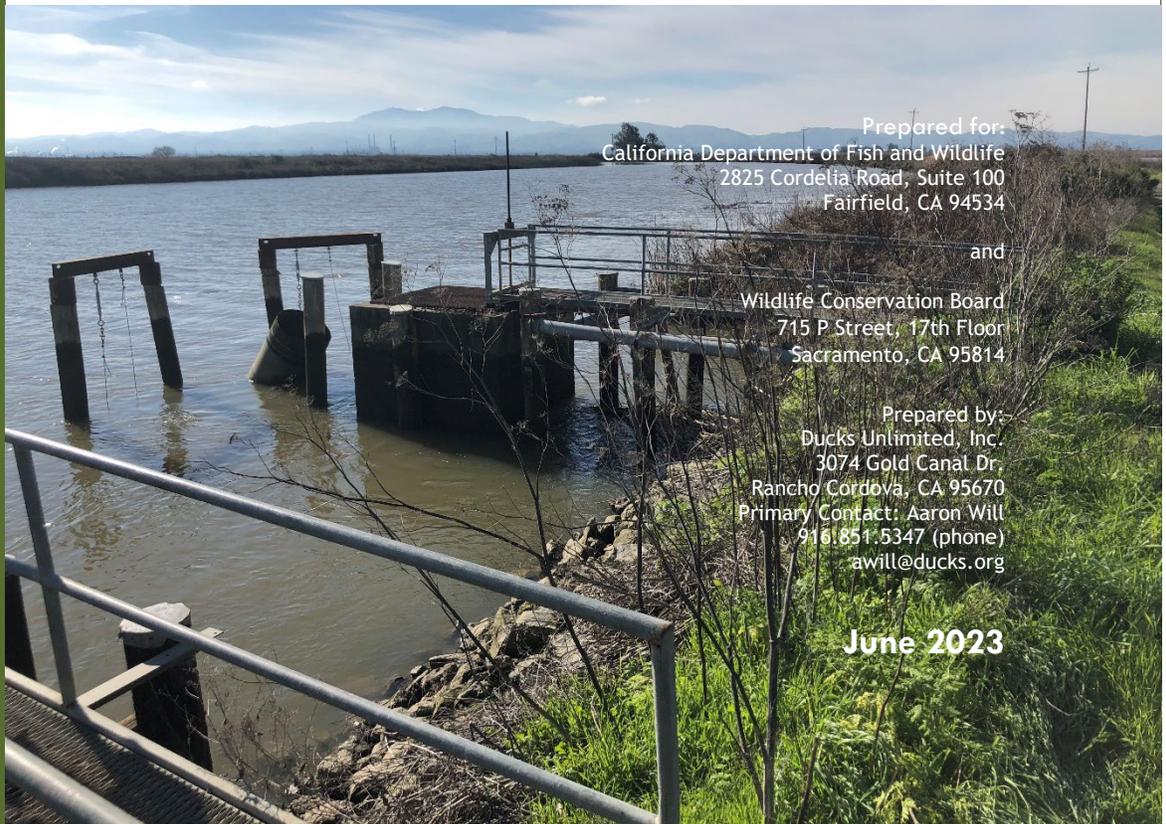




**GRIZZLY ISLAND WILDLIFE AREA  
MONTEZUMA SLOUGH  
FISH SCREEN REPLACEMENT PROJECT  
ADAPTIVE MANAGEMENT PLAN**



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**June 2023**

## TABLE OF CONTENTS

Section	Page
1	Introduction..... 3
	Project Background.....3
	Site History .....3
	Project Description .....4
	Project Goals and Objectives.....4
2	Adaptive Management ..... 4
	Phase 1: Plan .....5
	Phase 2: Do.....6
	Phase 3: Evaluate and Respond.....6
3	Best Available Science..... 8
4	Responsible Parties..... 8
5	References Cited..... 9

# 1 INTRODUCTION

## PROJECT BACKGROUND

California Department of Fish and Wildlife (CDFW) staff manage extensive waterways, intakes, drains and pumps to provide more than 12,000 acres of seasonal managed wetlands within the Grizzly Island Wildlife Area (GIWA). These wetlands are primarily operated for the benefit of waterfowl. CDFW staff conduct multiple biological surveys each year for a range of species to assess and improve management techniques. Habitat flooding operations include flood up during fall and winter months for wintering waterfowl and irrigations for vegetation management and leach cycles to draw salts out of the soil. Water diversions primarily occur between September and November at the beginning of the habitat flooding period but extend into the spring to maintain optimum water depths on the landscape. Most drainage from these managed wetlands occurs between February and May. Plants like alkali bulrush and fat-hen and other plants high in carbohydrates are encouraged. This carefully managed combination of high nutrient food and resting ponds sustains more than 100,000 waterfowl that winter at Grizzly Island each year.

The water supply for nearly half of the entire GIWA is provided through two 48-inch water control structures. These two intakes are located on the eastern boundary of the wildlife area and pull water via gravity and tidal fluctuation from the tidally influenced Montezuma Slough. The existing intakes are approximately 3.2 river miles upstream from the confluence of Montezuma Slough and the Sacramento River. The intakes pull water through the constructed exterior marsh levee via a crumbling corrugated metal pipe. The fish screened intakes are beyond their operational life cycle and need to be replaced in order for the GIWA to continue to operate. The current intake screens were installed in the early 1990's and re-addressed in 2005 and have had operational challenges from the beginning. The two intakes and associated water rights, S019011 & S019008 have a maximum annual diversion of 2,200.6-acre feet. Operations of the wildlife area frequently require diversions near the maximum allowance.

The existing intakes are beyond maintenance and repair for service and must be replaced entirely. For the past several years, these intakes have been band-aided, and jerry rigged into continued operation; however, fish protection has been severely compromised for several years. New intakes and screens are needed in order to deliver the habitat and wildlife values of the wildlife area while protecting anadromous fish within the Montezuma Slough system.

## SITE HISTORY

The Suisun Marsh historically consisted of tidally inundated islands separated by sloughs. Prior to human alteration, the Marsh contained 68,000 acres of tidal wetlands. Diking of the Marsh began in the mid-1860s for livestock grazing. Shortly after, the first duck clubs were established around the ponds. By the early 1900s, livestock grazing was being replaced by other agricultural activities. Increasing salinity and land subsidence caused agriculture to fail and be replaced by duck clubs. In 1950, CDFW established the GIWA to preserve wetlands and to protect wintering habitat for waterfowl but also shorebirds, and other waterbirds. The original levees constructed for farming now provide the infrastructure of the duck clubs and the GIWA.

The intakes at their current location appear to have been installed between 1975 and 1980 as part of the construction of a new north spur of Grizzly Ditch. Prior to the construction of the Grizzly Ditch North Spur, the Grizzly Ditch intakes appear to have been at the terminus of the ditch as it intersects with Montezuma Slough as evident on aerial photos from 1957 and 1968.

There is no known information as to why the intake location was moved to the north. Speculatively, the northern intake location is located along a straighter section of Montezuma Slough and may have been more desirable from an approach velocity criterion as opposed to the southern intake location as it is in a bend in Montezuma Slough where approach velocities are likely higher in the thalweg. However, as the northern section is located at a straight section known as the crossover, with bends in the channel both upstream and downstream, the result is a depositional effect of sediment at this northern intake location.

## PROJECT DESCRIPTION

The purpose of the proposed Montezuma Slough Fish Screen Replacement Project (project) is to meet the water delivery and operational needs of the GIWA, enhance interior water conveyance with the installation of additional water control structures, and protect native resident and anadromous fish populations located in Montezuma Slough.

The project would replace the existing deteriorated and outdated intake and fish screen facilities with modern technology and corrosive resistant design and would relocate the water intake and fish screen facilities to increase water delivery reliability and reduce maintenance needs. In its current location the water intake would convey water into a deteriorating interior ditch that is subject to berm failure. If the berms adjacent to the delivery ditch are further damaged, water delivery to much of GIWA could be temporarily compromised until the berms are repaired. The new location would bypass the interior ditch and deliver water directly into Grizzly Island Ditch. Grizzly Island Ditch is the main water conveyance throughout the GIWA and provides improved access for CDFW maintenance staff, thus improving the overall reliability of water delivery in the GIWA.

## PROJECT GOALS AND OBJECTIVES

The proposed intakes and fish screens must meet the short- and long-term needs of the GIWA and CDFW staff. GIWA has limited resources for maintenance and operations, and thus intakes must be low maintenance, long lived, easily and timely repaired, and have minimal cost to operate both from a financial and a staff resource allocations standpoint.

The objective is to replace the existing degraded screened intakes with a screened intake adequate to meet fish screen criteria, that achieves operational flexibility while not impacting GIWA staff resources and requiring minimal annual cost.

## 2 ADAPTIVE MANAGEMENT

Adaptive management is a structured approach to environmental management and decision-making in the face of uncertainty. It provides a pathway for undertaking actions when knowledge about a system is incomplete. Flexible strategies and feedback mechanisms allow for an approach to be modified as knowledge is gained, and uncertainty is reduced. Adaptive management makes learning more efficient and improves management practices.

Adaptive management fosters flexibility in management actions through an explicit process. It entails having clearly stated goals, identifying alternative management practices or objectives, framing hypotheses about ecological causes and effects, systematically monitoring outcomes, learning from the outcomes, sharing information with key players and decision-makers, and being flexible enough to adjust management practices and decisions (DISB, 2016). Conceptual models often are used in adaptive management programs to integrate available knowledge and to provide synthesis and a means of developing and exploring promising management actions before they are attempted as field experiments or pilot projects.

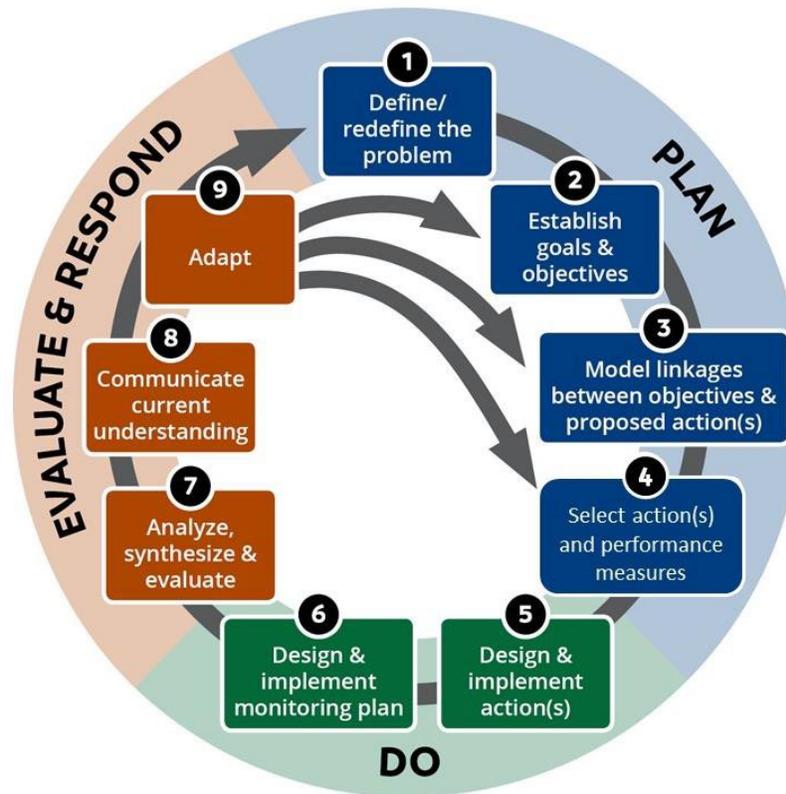
Adaptive management may reduce uncertainty when management actions are thought of as experiments. By using a structured design that includes appropriate controls or references, monitoring, and replication, observed outcomes can be disentangled from a welter of potentially confounding factors (Zedler, 2005). As a result, one can have a good idea of why a management action did or did not work as expected.

The Delta Reform Act requires that adaptive management be used in science-based management of the Delta and its resources. A state or local agency that proposes to undertake a covered action, prior to initiating the implementation of that covered action, is required to submit a written certification to the Delta Stewardship Council, with detailed findings demonstrating that the covered action is consistent with the Delta Plan (Water Code Section 85225). Policy G P1 of the Delta Plan requires that a covered action include adequate provisions to assure continued implementation of adaptive management (CCR Title 23 Section 5002(b)(4)).

The Montezuma Slough Fish Screen Replacement Project is the product of ongoing adaptive management at GIWA. CDFW staff evaluated the existing fish screens, identified deficiencies in the existing water intake and fish screen facilities, began working with Ducks Unlimited and established goals and objectives, and assessed potential actions

to meet objectives. The proposed modifications will implement the adaptive strategy, which includes upgrades to water control infrastructure, fish screens and relocation of the screened diversions. CDFW will continue to apply adaptive management during the life of the project to provide flexible, responsive, and effective management strategies.

Adaptive management involves three phases: plan, do, and evaluate and respond. See Figure 1. Adaptive management practices under each phase for the project are described in the following sections.



**Figure 1.** The adaptive management cycle as described in the Delta Stewardship Council’s Delta Plan. The shading represents the three broad phases of adaptive management (Plan, Do, and Evaluate and Respond), and the boxes represent the nine steps within the adaptive management framework. The circular arrow represents the general sequence of steps. The additional arrows indicate possible next steps for adaptation (e.g., revising the selected action based on what has been learned). These steps are explained in detail in Delta Plan Appendix C (Delta Stewardship Council 2013).

## PHASE 1: PLAN

Project construction, maintenance, and water diversion and fish screen operations would be conducted consistent with in-water work windows, diversion screening criteria, and approach velocities identified for delta smelt described in the Suisun Marsh Habitat Management, Preservation, and Restoration Plan. Informal routine inspection of the water intake and fish screen facilities would be conducted to identify any potential needs for maintenance, service, or repair. Inspections would be completed during operation of the fish screens and when water control structures are being adjusted to meet the flood up and drainage needs of the GIWA. Project goals and objectives include sufficient water diversions to meet GIWA water delivery needs; compliance with fish screening criteria, including approach velocity, sweeping velocity; and proper function of self-cleaning brush and removal of sediment and debris. Similar to current practices outlined in the GIWA Management Plan, specific monitoring protocols would not be applied, rather confirmation of expected outcomes would be assessed through field observations of fish screen function (CDFW 1988). CDFW staff will conduct appropriate maintenance such as anode protection replacement and periodic removal of debris, service, and/or repair actions to ensure objectives are met.

## PHASE 2: DO

The proposed project once constructed is the implementation of an adaptive management activity. As such, the Project itself is the “DO”. However, in the unlikely event that fish screen operations deviate from expected outcomes (i.e., water diversion, approach velocity, or fish protection are not adequately achieved), CDFW staff would conduct the following:

- Reference practices identified in the GIWA Land Management Plan,
- Implement wetland management activities described in the Suisun Marsh Habitat Management, Preservation, and Restoration Plan,
- Collaborate with the Suisun Resource Conservation District and the Suisun Marsh Adaptive Management Advisory Team.

Fish screen designers, water control infrastructure engineers, and other professionals will be consulted to design and implement appropriate actions considered under Phase 1. A monitoring plan that sufficiently identifies and addresses potential deficiencies should be designed and implemented. The monitoring plan should evaluate success of the proposed action and identify any areas for improvement. This may be included in current monitoring and maintenance plans implemented by CDFW.

## PHASE 3: EVALUATE AND RESPOND

The construction of the Project will require compliance monitoring as determined by the Suisun Marsh Plan, Biological Opinions and other subsequent environmental documents. These compliance monitoring aspects will include Salt Marsh Harvest Mouse surveys, pre-construction nesting bird surveys, and fish monitoring during in-water work for coffer dam installation. Adaptive monitoring post implementation will be linked to maintenance and operations of the fish screen facility. The monitoring plan will be designed and implemented to evaluate adequacy of the proposed action. Metrics evaluating the project’s ability to meet objectives identified under Phase 1 should be consistently analyzed to achieve adequate understanding of project success. Inadequacies as well as project achievements should be communicated to share lessons learned and facilitate adaptive practices. If inadequacies are identified, a collaborative approach involving CDFW, Suisun Resource Conservation District, and other partners (e.g., Ducks Unlimited) and utilizing best available science should be implemented to adapt, redefine the problem, and better protect and maintain natural resources in the Suisun Marsh.

While it is not anticipated that major modification to the site will be needed, an objective of this plan is to guide monitoring to identify any thresholds that may compromise the Project objectives, and to propose potential management responses or further focused monitoring efforts. Project objectives, the expected outcomes related to those objectives, the metrics by which progress towards meeting the objectives is measured, as well as thresholds for undertaking a management response if goals are not being met or problems occur which require intervention are presented in Table 1.

**Table 1. Performance Targets, Monitoring and Evaluation, and Management Response**

Performance Target	Trigger Level	Trigger Scenarios	Potential Evaluation Process	Potential Management Response
Uninterrupted operation of diversions for GIWA while protecting native anadromous fish	Approach velocity exceeds 0.2 CFS	Flows in Montezuma Slough increase over historic ranges.	Consider timing of diversions to presence of listed species and approach velocity criteria.	<ul style="list-style-type: none"> <li>• Restrict diversions operations to appropriate fish windows by not opening diversion.</li> <li>• Throttle diversion back by partially closing interior canal gate.</li> </ul>
	Operation Interruptions	Observation of significant rust.	Consider evaluating cathodic protection	<ul style="list-style-type: none"> <li>• Change anodes more frequently.</li> <li>• Consider treating materials with corrosive resistant coatings.</li> </ul>
		Flows through diversion are restricted.	Consider evaluating sediment deposition near fish screen in Montezuma Slough.	<ul style="list-style-type: none"> <li>• Consider dredging sediment around fish screen.</li> <li>• Considered lifting screen up, and back flushing water (drain) to mobilize sediment away from screens.</li> </ul>
			Inspect screens for excessive biomass accumulation on interior and exterior of rotational drum.	<ul style="list-style-type: none"> <li>• Pressure wash screens.</li> <li>• Consider changing automatic cleaning system brush heads.</li> </ul>

### 3 BEST AVAILABLE SCIENCE

As the largest contiguous estuarine marsh in the entire United States, Suisun Marsh plays a critical role in supporting ecosystem and life processes for many wetland-dependent species. The protection and management of wetlands within Suisun Marsh is vital to the long-term success of several listed and endangered species as well as non-listed wetland dependent species.

Throughout project planning and implementation, CDFW and Ducks Unlimited are committed to utilizing the best available science to design, construct, and manage the project. Adaptive management of the Project will be based on the utilization of input from monitoring data in conjunction with adaptive review of whether project goals and objectives are being achieved.

Ongoing research related to waterfowl biology and wetland habitat management continues to progress and provides greater insight on how to manage habitat. A list of current best available science is provided below.

- Flosi, G., S. Downie, J Hopelain, M. Bird, R. Coey, and B. Collins. 1998. California Salmonid Stream Habitat Restoration Manual, Fourth Edition. California Department of Fish and Game. Updated March 2004.
- Kimmerer, W.J. 2008. Losses of Sacramento River Chinook salmon and delta smelt to entrainment in water diversions in the Sacramento–San Joaquin Delta. *San Francisco Estuary and Watershed Science*, 6(2).
- Smith et al., 1995. A Guide to Wetland Habitat Management in the Central Valley. California Department of Fish and Game and California Waterfowl Association.
- Mefford, B., P.E. 2014. Pocket Guide to Screening Small Water Diversions. US Bureau of Reclamation. August.
- National Oceanic and Atmospheric Administration. National Marine Fisheries Service Southwest Region. 1997. Fish Screen Criteria for Anadromous Salmonids. January.
- Young, P.S., Swanson, C., Cech Jr, J.J. 2010. Close encounters with a fish screen III: behavior, performance, physiological stress responses, and recovery of adult Delta Smelt exposed to two-vector flows near a fish screen. *Transactions of the American Fisheries Society*, 139(3), 713-726.

### 4 RESPONSIBLE PARTIES

Ducks Unlimited is responsible for completing engineering design and obtaining the necessary environmental permits for the project. As the property owner, CDFW would be responsible for monitoring the site, following completion of construction activities, to verify that the project is maintained as a functioning fish screen to support seasonal wetlands. CDFW's general operation funds would be used to support ongoing monitoring and maintenance of the project. CDFW applies a service-based budgeting approach and allocates funding for lands and facilities, including management of wildlife areas.

## 5 REFERENCES CITED

- California Department of Fish and Wildlife (previously California Department of Fish and Game). (1988). *Grizzly Island Wildlife Area Management Plan*.
- Delta Stewardship Council. (2013). *The Delta Plan*. <https://deltacouncil.ca.gov/delta-plan/>.
- Delta Independent Science Board. (2016, January). *Improving Adaptive Management in the Sacramento-San Joaquin Delta*. <https://deltacouncil.ca.gov/pdf/isb/products/2016-02-19-adaptive-management-report.pdf>.
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