

## Section 4.12

# Mosquitoes and Public Health

## Introduction

This section describes recent changes to the existing environmental conditions and regulatory setting of the Project area, summarizes the unchanged affected environment, and describes changed environmental effects related to mosquitoes and public health for the Project. This section contains a review and update of the 1995 DEIR/EIS mosquitoes and public health impact assessment, incorporated by reference in the 2001 FEIR. The mosquitoes and public health impacts of the Project most recently were analyzed in the 2001 FEIS, which also served as a basis for this analysis.

The 2001 FEIR and 2001 FEIS concluded that the Project alternatives would affect public health on and in the vicinity of the four Project islands. Since that time, there have been minor changes in the affected environment and regulatory setting. However, there have been no changes in the Project that result in new significant environmental effects or a substantial increase in the severity of previously identified significant effects on public health.

The 2001 FEIR and 2001 FEIS “Mosquitoes and Public Health” analysis has been updated here to reflect current environmental conditions on and around the Project islands. Information regarding mosquito breeding conditions and mosquito abatement activities on the Project islands has been updated, and a discussion of West Nile virus, which has emerged as a public health risk since the publication of the 2001 FEIR and 2001 FEIS, has been added. In addition, Mitigation Measure PH-1 has been updated to reflect guidelines for design and management of constructed wetlands recently published by the Central Valley Joint Venture, California Department of Health Services, and Sacramento-Yolo Mosquito and Vector Control District. These changes are minor and do not affect the results of the analysis reported in the 2001 FEIR and 2001 FEIS.

Identification of the Project’s specific places of use as part of the affected Project environment does not affect mosquitoes and public health in any way that alters the conclusions of the 2001 FEIR and 2001 FEIS. The Project will not have any direct effects on mosquitoes and public health in the places of use; the effects on mosquitoes and public health, if any, associated with the provision of Project water to the places of use are addressed in Chapter 5, “Cumulative Impacts,” and Chapter 6, “Growth-Inducing Impacts.”

# Summary of Impacts

Table 4.12-1 provides a summary and comparison of the impacts and mitigation measures for mosquitoes and public health from the 2001 FEIR, 2001 FEIS, and this Place of Use EIR.

**Table 4.12-1.** Comparison between Delta Wetlands Project 2010 Place of Use EIR and 2001 FEIR and 2001 FEIS Impacts and Mitigation Measures for Mosquitoes and Public Health

2001 FEIR and 2001 FEIS Impacts and Mitigation Measures	Differences between 2010 Place of Use EIR and 2001 FEIR and 2001 FEIS Impacts and Mitigation Measures
<b>ALTERNATIVES 1 AND 2</b>	
<p><b>Impact N-1:</b> Reduction or Elimination of Mosquito Abatement Activities during Full-Storage Periods on the Reservoir Islands (B)  <b>Mitigation:</b> No mitigation is required.</p>	<p><b>Impact PH-1:</b> Reduction or Elimination of Mosquito Abatement Activities during Full-Storage Periods on the Reservoir Islands (B and LTS)  <b>Mitigation:</b> No mitigation is required.                      No change.</p>
<p><b>Impact N-2:</b> Increase in Abatement Levels on the Habitat Islands and during Partial-Storage, Shallow-Storage, or Shallow-Water Wetland Periods on the Reservoir islands (LTS-M)  <b>Mitigation Measure N-1:</b> Coordinate Project Activities with SJCMAD and CCMAD.</p>	<p><b>Impact PH-2:</b> Increase in Abatement Levels on the Habitat Islands and during Partial-Storage, Shallow-Storage, or Shallow Water–Wetland Periods on the Reservoir Islands (LTS-M)  <b>Mitigation Measure PH-MM-1:</b> Develop an Integrated Pest Management Program and Coordinate Project Activities with SJCMVCD and CCCMVCD                      This impact has not changed. The mitigation measure has been updated to conform to current guidelines regarding design and management of constructed wetlands.</p>
<p><b>Impact N-3:</b> Increase in Potential Exposure of People to Wildlife Species that Transmit Diseases (LTS)  <b>Mitigation:</b> No mitigation is required.</p>	<p><b>Impact PH-3:</b> Increase in Potential Exposure of People to Wildlife Species that Transmit Diseases (LTS)  <b>Mitigation:</b> No mitigation is required.                      No change.</p>
<b>ALTERNATIVE 3</b>	
<p><b>Impact N-4:</b> Reduction or Elimination of Mosquito Abatement Activities during Full-Storage Periods on the Reservoir Islands (B)  <b>Mitigation:</b> No mitigation is required.</p>	<p><b>Impact PH-1:</b> Reduction or Elimination of Mosquito Abatement Activities during Full-Storage Periods on the Reservoir Islands (B and LTS)  <b>Mitigation:</b> No mitigation is required.                      No change.</p>
<p><b>Impact N-5:</b> Increase in Abatement Levels during Partial-Storage, Shallow-Storage, or Shallow-Water Wetland Periods on the Reservoir Islands and in the NBHA (LTS-M)  <b>Mitigation Measure N-1:</b> Coordinate Project Activities with SJCMAD and CCMAD.</p>	<p><b>Impact PH-2:</b> Increase in Abatement Levels during Partial-Storage, Shallow-Storage, or Shallow Water–Wetland Periods on the Reservoir Islands and in the NBHA (LTS-M)  <b>Mitigation Measure PH-MM-1:</b> Develop an Integrated Pest Management Program and Coordinate Project Activities with SJCMVCD and CCCMVCD                      This impact has not changed. The mitigation measure has been updated to conform to current guidelines regarding design and management of constructed wetlands.</p>
<p>Note: SU = Significant and unavoidable; LTS = Less than significant; LTS-M = Less than significant with mitigation; B = Beneficial.</p>	

# Summary of Changes, New Circumstances, and New Information

Changes in the affected environment, regulatory setting, and environmental effects of the Project related to mosquitoes and public health are described in the Existing Conditions section below. A summary of findings based on that consideration follows.

## Substantial Changes in the Project

Since the 2001 FEIR and 2001 FEIS were completed, there have been no substantial changes in the Project resulting in new significant effects or substantial increase in the severity of effects on public health.

## New Circumstances

New circumstances pertinent to the public health analysis are related to the advent of West Nile virus as a human health risk and changed conditions on and around the Project islands.

### West Nile Virus

Since the 2001 FEIR and 2001 FEIS, West Nile virus has emerged as a public health risk in the Project area. This mosquito-borne disease has sickened 2,765 humans, led to the death of 91 humans in California since 2003 (California Department of Public Health 2009a), and caused increased mosquito abatement activities throughout the state.

West Nile virus is now well established in all 58 counties of California. West Nile virus is a disease transmitted to humans, birds, horses, and other animals by infected mosquitoes. Mosquitoes get the disease from infected birds while taking blood, and can later transmit it when they bite humans or other animals. West Nile virus can cause encephalitis in humans. Most infections are mild, with flu-like symptoms. Severe infections may include neck stiffness, disorientation, coma, tremors, convulsions, muscle weakness, paralysis, and rarely, death. From 2006 through 2008, 45 cases of West Nile virus were reported in Contra Costa and San Joaquin Counties, with two deaths related to the virus in Contra Costa County and one death related to the virus in San Joaquin County (California Department of Public Health 2007, 2008, 2009b).

The advent of West Nile virus as a public health risk has affected the programs and operations of local mosquito and vector control districts (MVCDs). Tolerance thresholds for mosquitoes in populated areas are significantly lower, having been reduced in recent years by almost one-half (Sanabria pers. comm.).

The threat of West Nile virus has triggered MVCDs to increase surveillance, trapping, and adulticide application programs (Sanabria and Lucchesi pers. comm.). MVCDs in the Delta now have a heightened concern about two mosquito species in particular that are the chief vectors for West Nile virus in the Delta: *Culex pipiens* and *Culex tarsalis* (Lucchesi pers. comm.). Breeding conditions and other information for these species were described in the 2001 FEIR and 2001 FEIS and are hereby incorporated by reference.

## Changes in Mosquito Breeding Habitat and Mosquito Abatement Activities

The 2001 FEIR and 2001 FEIS used 1988 conditions to describe baseline conditions on and around the islands and to analyze the Project's effects on public health. The analysis for this document is based on updated (2008) baseline conditions.

Mosquito habitat conditions and, consequently, mosquito abatement activities on some of the Project islands have changed since the publication of the 2001 FEIR and 2001 FEIS. This is primarily because cropping and land use patterns on the Project islands have changed. A summary of recent mosquito breeding conditions and abatement activities undertaken on each Project island in 2008 by the Contra Costa County and San Joaquin County MVCDs are described in the Existing Conditions section below.

Conditions in the areas around the Project islands also have changed. Population in the secondary zone of the Delta has increased significantly over the past 20 years, and new residential development has placed more humans within the range of mosquitoes originating on the Project islands. For example, the city of Brentwood's population increased from 7,563 to 48,907 between 1990 and 2007 (California Department of Water Resources 1995; Contra Costa County 2009). Much of the city of Brentwood is located within 5 miles of Holland Tract—5 miles being the distance some mosquitoes are able to travel from production areas.

## New Information

There is no new information of substantial importance that would result in an increase in severity of effects on public health. However, since the publication of the 2001 FEIR and 2001 FEIS, new information and methods have been developed for mosquito management in constructed wetlands.

Public attitudes about wetlands have changed greatly in the last few decades, shifting from viewing wetlands as wasted land that should be reclaimed for commercial uses to recognizing the value of wetlands for habitat, recreational opportunities, and the benefits they provide in terms of flood control, water filtration, and groundwater recharge. This has led to a major increase in managed wetlands projects throughout California (Kwasny et al. 2004). To address public

health concerns about mosquito production in these managed wetlands, several groups have developed guides and habitat management strategies to reduce mosquito production in managed wetlands, and to facilitate greater cooperation among wetland habitat managers and MVCDs. MVCDs now are encouraging “integrated pest management” (IPM), which incorporates multiple strategies to achieve effective control of mosquitoes. These strategies include:

- source reduction—designing wetlands and operations to be inhospitable to mosquitoes;
- monitoring—implementing monitoring and sampling programs to detect early signs of mosquito population problems;
- biological control—use of biological agents such as mosquitofish to limit larval mosquito populations;
- chemical control—larvicides and adulticides; and
- cultural control—changing the behavior of people so their actions prevent the development of mosquitoes or the transmission of vector-borne disease.

Mitigation Measure PH-1 has been updated pursuant to current IPM practices and calls for modifications to the Habitat Management Plan in coordination with the Contra Costa County Mosquito and Vector Control District (CCCMVCD) and the San Joaquin County Mosquito and Vector Control District (SJCMVCD). The key sources of new information pertaining to mosquito management strategies used in the update of Mitigation Measure PH-1 include:

- Guidelines for Wetland Development, Central Valley Joint Venture, 2004;
- Best Management Practices for Mosquito Control on California State Properties, California Department of Public Health, June 2008; and
- Mosquito Reduction Best Management Practices, Sacramento-Yolo Mosquito and Vector Control District, 2008.

## Existing Conditions

This section discusses changes in the existing conditions or regulatory setting since the 2001 FEIR and 2001 FEIS.

## Regulatory Setting

Bacon and Bouldin Islands are located in San Joaquin County, and Webb and Holland Tracts are located in Contra Costa County. Regulatory conditions, including local regulations regarding public health established by San Joaquin and Contra Costa Counties that pertain to the islands that fall within their respective boundaries, are, for the most part, as they were presented in the 2001 FEIR and 2001 FEIS and are hereby incorporated by reference. Little has changed in relation to the rights and powers of MVCDs since publication of the

2001 FEIR and 2001 FEIS (Lucchesi pers. comm.); however, some minor changes have occurred in the operations of the MVCDs and are noted here.

The 2001 FEIR and 2001 FEIS refers to “mosquito abatement districts”; however, mosquito abatement districts are now known as “mosquito and vector control districts” Bouldin and Bacon Islands are within the jurisdiction of the SJCMVCD, and Holland and Webb Tracts are within the jurisdiction of the CCCMVCD.

CCCMVCD’s and SJCMVCD’s primary sources of revenue are property taxes and benefit assessments. The 2001 FEIR and 2001 FEIS referred to Contra Costa’s 1993 policy requiring landowners to either provide abatement or enter into a service contract with the District if abatement costs exceeded \$500 per mosquito production source as the CCCMVCD’s main enforcement tool. Today, the \$500 limit still functions as a rough enforcement threshold, but in general, if the CCCMVCD spends more money performing abatement activities on a certain parcel than they receive in taxes and benefit assessments from that parcel, they will begin to seek compensation from that landowner. The CCCMVCD has administrative citation authority and can issue citations from \$100 to \$1,000 per day for public health violations. Though they have citation authority, the CCCMVCD does not resort to citations very often, as most landowners are willing to cooperate when faced with the possibility of citation (Sanabria pers. comm.).

The SJCMVCD follows a similar citation process. The abatement process begins when a landowner has been contacted by the SJCMVCD and informed that a condition exists causing mosquitoes to breed on his or her land. The SJCMVCD uses a three-step process. First, the landowner/lessee is provided an “information sheet” that details information on mosquito prevention requirements. Second, a “notice to comply” form is used should the landowner/lessee not respond to the information provided in the information sheet. Finally, the last step would be a citation, or official notice to abate the public nuisance pursuant to the California Health and Safety Code §2272. The citation states that the landowner has 24 hours from service of the citation to abate the mosquito breeding condition or face civil penalties of up to \$1,000 per day for each day not in compliance. Usually the landowner is not charged for the mosquito control work being conducted; however, the SJCMVCD can recoup those costs during the “citation” phase should the Board of the SJCMVCD want to seek reimbursement (Lucchesi pers. comm.).

## Affected Environment

Existing public health conditions are, for the most part, as they were presented in the 2001 FEIR and 2001 FEIS and are hereby incorporated by reference. However, some changes in mosquito breeding habitat have occurred on the Project islands. The majority of changed conditions in mosquito breeding habitat and abatement activities on the Project islands are attributable to changed cropping and land use patterns. As described in the 2001 FEIR and 2001 FEIS

(hereby incorporated by reference), different cropping and land use patterns create differing amounts of suitable mosquito breeding habitat. The 2001 FEIR and 2001 FEIS used 1988 conditions to describe baseline conditions on the islands and to analyze the Project's effects on mosquito breeding conditions. Because cropping patterns and, consequently, mosquito breeding conditions have changed in 20 years, a baseline defined by 1988 conditions is no longer appropriate or relevant. Current cropping patterns on the islands in many cases are substantially different from 1988 patterns (see Table 4.8-2 in Section 4.8, Land Use and Agriculture). Changes in the affected environment since the 2001 FEIR and 2001 FEIS are presented below for each of the Project islands.

## Bacon Island

Bacon Island continues to be intensively farmed, but cropping patterns have changed since 1988. Alfalfa, corn, and wheat made up nearly 90% of the crops grown on Bacon Island in 2008. Potatoes are no longer grown or processed on the island. In 1988, the production of seed potatoes on Bacon Island accounted for 52.5% of San Joaquin County's production of the crop, and the ponds receiving tailwater from potato processing were regularly treated for mosquito production by the SJCMVCD. However, seed potatoes have not been produced on Bacon Island since 2003, and the SJCMVCD no longer needs to treat the potato processing tailwater ponds as regularly for mosquitoes, although the ponds still exist and occasionally produce mosquito populations (Lucchesi pers. comm.).

As described in the 2001 FEIR and 2001 FEIS, the SJCMVCD still receives occasional service requests from the resorts around Bacon Island. However, the SJCMVCD does not consider Bacon Island a problem mosquito production area because the island is managed for agricultural production and water is not used in a way that normally causes mosquito breeding (Lucchesi pers. comm.).

## Webb Tract

Corn production on Webb tract has nearly doubled since 1988. In 2008, 98% of the agricultural land on Webb Tract was planted in corn. During the winter months, fields on Webb Tract are flooded for duck habitat. However, the CCCMVCD still does not consider Webb Tract a problem mosquito source because the land manager takes precautions to minimize mosquito breeding habitat, like tilling the soil before flooding, which eliminates many of the conditions conducive to mosquito production. The CCCMVCD has a collaborative relationship with the land managers and is consulted regularly on how and when the fields are flooded. Webb Tract was inspected by the CCCMVCD 53 times in 2008, and required only one mosquito control treatment (Sanabria pers. comm.).

## Bouldin Island

The majority of Bouldin Island is now farmed for corn and rice. These two crops accounted for nearly 77% of the island's agricultural acreage in 2008. The acreage devoted to corn production has almost doubled since 1988, and rice is a new crop on the island since that time. The rice fields require surveillance and subsequent treatment for mosquito production approximately six times per year (Lucchesi pers. comm.).

After harvest, the corn fields on Bouldin Island are flooded to attract migrating waterfowl. The corn stubble that is left in the fields after harvest can start to decay after flooding if the weather is still hot. This causes the water to become anaerobic and serve as good mosquito breeding habitat. The SJCMVCD works with the land managers on Bouldin Island to postpone the introduction of floodwater until late October to avoid prime mosquito breeding conditions.

The SJCMVCD still receives occasional service requests from the resorts around Bouldin Island. However, because the SJCMVCD has a cooperative working relationship with the land managers, and because the rice and corn fields are managed for agricultural production, mosquito treatment on Bouldin Island is predictable. The SJCMVCD does not consider Bouldin Island a problem mosquito production source (Lucchesi pers. comm.).

## Holland Tract

Since 1988, all agricultural land on Holland Tract has been converted to pasture; corn and wheat are no longer grown on the island. During the period of 2002–2008, 2,884 acres of Holland Tract were used for pasture each year, an equivalent of approximately 60% of the island's total acreage; none of the island was used for crop production during this period (Delta Wetlands Properties 2008).

The CCCMVCD still considers certain areas of Holland Tract to be problem mosquito production areas, though the major problem areas on the island are not under Project applicant ownership. The CCCMVCD performs some mosquito abatement activities on Project applicant land, but does not consider those lands to be a problem mosquito source because the Project applicant collaborates with the CCCMVCD on timing and duration of flooding activities (Sanabria pers. comm.).

Other areas of Holland Tract produce problem numbers of mosquitoes, mainly because of the large amount of irrigated, non-leveled pasture. Non-leveled pastures can trap and hold water in depressions for long enough periods of time to create favorable mosquito breeding conditions. There is also a duck club on Holland Tract with very rudimentary flooding infrastructure that is occasionally a problem mosquito source area. Mosquitoes originating on Holland Tract have caused problems for residents of Bethel Island to the north of Holland Tract and for residents of Oakley to the west of Holland Tract. From January 1, 2008 through July 15, 2009, the CCCMVCD received 191 service request calls from

locations within a 5-mile radius of Holland Tract (Sanabria pers. comm.). The increase in service calls over 2001 numbers is likely due to population growth in adjacent areas described in the “New Circumstances” section above.

## Environmental Commitments

The environmental commitments, as described in Chapter 2, would not alter the impact findings related to mosquitoes or public health.

## Environmental Effects

### Methods and Significance Criteria

The mosquito and public health impact analysis considered several criteria for determining the significance of impacts related to these issues. The analysis took into account both relevant criteria contained in Appendix G of the State CEQA Guidelines (Association of Environmental Professionals 2009) and Project-specific criteria developed by the lead agency to address potential impacts unique to the Project’s location and elements.

The analytical approach, impact mechanisms, and significance criteria remain as presented in the 2001 FEIR and 2001 FEIS and are hereby incorporated by reference. To summarize, an alternative would be considered to have a significant impact if Project-related activities or changes to habitat would necessitate increased levels of mosquito abatement programs compared to existing conditions in order to maintain mosquito populations at pre-Project levels. Habitat changes that could result in a substantial decline of available mosquito breeding habitat or greater efficiency of MVCD abatement programs are considered to be beneficial impacts.

An alternative also would be considered to result in a significant impact if it would substantially increase potential exposure of people to wildlife-transmitted diseases considered a high health risk in the Delta area by the California Department of Public Health.

### Impacts and Mitigation Measures

The impacts on public health resulting from implementation of the Project were described in detail in the 2001 FEIR and 2001 FEIS and are briefly summarized in Table 4.12-1. Where there have been no changes to the impact analysis, the 2001 FEIR and 2001 FEIS is incorporated by reference. Although the baseline conditions for existing levels of mosquito abatement activities have changed in some cases, this does not substantially affect the severity of previously identified impacts. Certain changes in the affected environment, such as changes in

mosquito breeding conditions, have been incorporated into an updated analysis where relevant and are discussed below. None of these changes has resulted in new significant environmental effects or a substantial increase in the severity of previously identified significant effects on public health.

## Proposed Project (Alternative 2)

Alternative 2 involves storage of water on Bacon Island and Webb Tract (Reservoir Islands) and management of Bouldin Island and Holland Tract (Habitat Islands) primarily for wetlands and wildlife habitat. The Reservoir Islands would be managed primarily for water storage, with wildlife habitat and recreation constituting secondary uses.

As described in the 2001 FEIR and 2001 FEIS, impacts of Alternative 2 were analyzed for the period during which potential problem numbers of mosquitoes could be produced on the Project islands (May 1 through October 31). Because The Project applicant may rotate the sequence of filling the Reservoir Islands, the analysis was conducted for the Project operating regime that would create the greatest potential for production of problem numbers of mosquitoes.

The discussions of mosquito breeding conditions, relative changes in the need for mosquito abatement, and incidence of wildlife-transmitted diseases affecting humans under Alternative 2 presented in the 2001 FEIR and 2001 FEIS have not changed and are hereby incorporated by reference.

### **Impact PH-1: Reduction or Elimination of Mosquito Abatement Activities during Full-Storage Periods on the Reservoir Islands**

This impact has not changed since the 2001 FEIR and 2001 FEIS. During full-storage periods, mosquito production on the Reservoir Islands would be minimal. At full storage, water depths would exceed 10 feet over most of the islands and, because the water level would be at the riprapped levee slopes, reservoir edges would lack emergent vegetation that could be used as breeding areas by problem numbers of mosquitoes. Deep, open-water habitats are poor mosquito breeding areas because the wave action generated over large water bodies disrupts the ability of larvae to penetrate the water surface and because vegetation necessary for egg laying and cover for larvae is lacking (U.S. Fish and Wildlife Service 1992b). Implementation of Alternative 2 would substantially reduce mosquito production and, subsequently, the need for abatement on the Reservoir Islands during full-storage periods. Therefore, this impact is considered beneficial and less than significant.

### **Mitigation**

No mitigation is required.

**Impact PH-2: Increase in Abatement Levels on the Habitat Islands and during Partial-Storage, Shallow-Storage, or Shallow Water–Wetland Periods on the Reservoir Islands**

This impact has not changed since the 2001 FEIR and 2001 FEIS.

Implementation of Alternative 2 would result in an increase in mosquito breeding habitat on both the reservoir and Habitat Islands, at least during certain times of the year. Therefore, an increase in mosquito production likely would occur on the Habitat Islands and, during some years, on the Reservoir Islands under partial-storage, shallow-storage, or shallow water–wetland conditions. Substantially more people would be exposed to mosquitoes as a result of the recreation programs for hunting, boating, and other uses on the Project islands than are exposed under existing conditions (see the Recreation and Visual Resources analysis in the 2001 FEIR and 2001 FEIS for details on the recreation program). Increased exposure of people to mosquitoes would result in an increased need for abatement. Therefore, this impact is considered significant.

Implementation of Mitigation Measure PH-MM-1 would reduce Impact PH-2 to a less-than-significant level.

**Mitigation Measure PH-MM-1: Develop an Integrated Pest Management Program and Coordinate Project Activities with SJCMVCD and CCCMVCD**

This mitigation measure has been updated to incorporate new information that has become available since the publication of the 2001 FEIR and 2001 FEIS—specifically, new guidelines for wetland design and management, described above in the New Information discussion. Implementation of this mitigation measure will reduce the likelihood that Project operations will require an increase in abatement activities by the local MVCDs.

The Project applicant, DFG, and the Habitat Management Advisory Council (HMAC) will consult and coordinate with the SJCMVCD and CCCMVCD during all phases of the Project, including design, implementation, and operations, and the Habitat Management Plan will be updated in accordance with the best management practices identified in the Central Valley Joint Venture’s Technical guide to *Best Management Practices for Mosquito Control in Managed Wetlands* (Kwasny et al. 2004) and other guidelines listed above in the “New Information” discussion. The Project applicant will be responsible for coordination with SJCMVCD and CCCMVCD regarding mosquito control measures for the Reservoir Islands, and the Project applicant, DFG, and the HMAC will be responsible for coordination regarding the Habitat Islands.

Consultation and coordination with SJCMVCD and CCCMVCD will include the development of an IPM plan for mosquitoes that follows the guidelines of the *Best Management Practices for Mosquito Control in Managed Wetlands* (Kwasny et al. 2004) and other guidelines listed in the New Information section above, and contains a continual maintenance program. An example list of the types of BMPs that should be considered in the IPM plan follows.

### *Wetland Design Features*

- Design water delivery and drainage systems to allow for rapid manipulation of water levels within the wetlands. This could include construction of swales sloped from inlet to outlet to allow the majority of the wetland to be drawn down quickly, and independent inlets and outlets for each wetland unit.
- Ensure that shorelines, which may be vacillating, do not isolate from the main body of water sections that create pockets where mosquitoes would be free of competition and predation.
- Create basins with a high slope index, variable depths, and shallow and deep regions that provide open water zones adjacent to shallow vegetated zones.
- Install cross-levees to facilitate more rapid flood-up.
- Excavate deep channels or basins to maintain permanent water areas (deeper than 2.5 feet) within a portion of seasonal wetlands to provide year-round habitat for mosquito predators that can inoculate seasonal wetlands when flooded.

### *Water Management Practices*

- Delay flooding of some wetland units until later in the fall, and delay flooding units with greatest historical mosquito production and/or those closest to urban areas.
- Flood wetland units as quickly as possible.
- Ensure constant flow of water into wetlands to reduce water fluctuation from evaporation, transpiration, outflow, and seepage.
- Flood wetland as deep as possible at initial flood-up.
- Flood wetlands with water sources containing mosquitofish or other invertebrate predators. Water from permanent ponds can be used to passively introduce mosquito predators.
- Drain any irrigation water into locations with mosquito predators as opposed to adjacent seasonal wetland or dry fields.
- Avoid “pulses” of increased organic load to inhibit episodic fluctuation in mosquito population numbers during the months of April–October.
- Use flood and drain techniques as a method to eliminate larvae.

### *Vegetation Management Practices*

- Avoid continuous stands of emergent vegetation. These stands generate microhabitats that support mosquito productivity by providing refuge from predation, accumulation and concentration of organic foods, and interference with water circulation and wave action.
- Maintain aquatic vegetation in islands surrounded by deeper water. This breaks up the uniform microhabitat and provides variable physical and biological constraints on the mosquito population.

- Avoid plants that tend to mat the water surface. Promote plants in islands such as bulrush and cattails, which function as substrate for mosquito predators. Plants such as sago pondweed for example, are completely submergent and contribute little to mosquito refuge while providing good predator refuge and even waterfowl food.

#### *Wetlands Maintenance*

- Maintain levees, water control structures, and ditches regularly.
- Manage vegetation through periodic harvesting, thinning, discing, or burning to maintain open areas.
- Remove silt and detritus periodically to maintain regular wetland depth.

#### *Biological Controls*

- Encourage on-site predator populations by providing permanent water sources for mosquitofish. Such “dry season” predator reservoirs should be 18 inches or more in depth to reduce predation of mosquitofish by herons and egrets.
- Avoid use of broad spectrum insecticides that not only kill mosquitoes, but also eliminate their natural predators.
- Ensure mosquitofish have access to each basin.

#### *Consultation with CCCMVCD and SJCMVCD*

- Consult with CCCMVCD and SJCMVCD during the Project design phase to incorporate design and operational elements of the reservoir and Habitat Islands to reduce the mosquito production potential of the Project.
- Consult with CCCMVCD and SJCMVCD on the timing of wetland flooding.
- Regularly consult with SJCMVCD and CCCMVCD to identify mosquito management problems, mosquito monitoring and abatement procedures, and opportunities to adjust operations to reduce mosquito production during problem periods.
- Develop an access plan with the CCCMVCD and SJCMVCD to allow for monitoring and control of mosquito populations on the Project islands.
- Work with CCCMVCD and SJCMVCD to understand pesticides used for mosquito abatement, and their costs and environmental impacts.

If it is necessary for SJCMVCD and CCCMVCD to increase mosquito monitoring and control programs beyond pre-Project levels, the Project applicant will share costs with CCCMVCD and SJCMVCD or otherwise participate in implementing mosquito abatement programs.

### **Impact PH-3: Increase in Potential Exposure of People to Wildlife Species that Transmit Diseases**

This impact refers to wildlife disease vectors other than mosquitoes and has not changed since the 2001 FEIR and 2001 FEIS. According to area MVCDs, non-

mosquito disease vectors still are not considered a significant public health risk in the Delta (Sanabria and Lucchesi pers. comm.).

Under Alternative 2, the populations of wildlife species known to serve as hosts of wildlife-transmitted diseases affecting humans could increase on the Habitat Islands. Increased recreational use of these areas would increase the potential exposure of people to these species. However, transmission of wildlife-transmitted diseases such as Lyme disease, bubonic plague, and rabies is not considered a significant risk to public health in the Delta, and the increase in risk under Alternative 2 would be minor. Therefore, the potential change in risk to public health from exposure to wildlife species on the Habitat Islands is considered less than significant.

#### **Mitigation**

No mitigation is required.

## **Alternative 1**

As described in the 2001 FEIR and 2001 FEIS, Alternative 1 is very similar to Alternative 2, differing only with regard to operating criteria for diversion and discharge of stored water on the Reservoir Islands. The Reservoir Island operating criteria for Alternative 1 could lead to different frequencies of mosquito breeding habitat creation than under Alternative 2. The frequency with which mosquito breeding habitat would be created on Bacon Island probably would be decreased because partial-storage, shallow-storage, and shallow water-wetland periods would decrease. The frequency of these habitat conditions on Webb Tract probably would increase from May through August when the island could be managed for shallow-water wetlands, but decrease during September and October.

Although the frequency of creation of mosquito habitat could differ, impacts and mitigation measures under Alternative 1 are generally the same as those under Alternative 2. The impact associated with the incidence of wildlife-transmitted diseases would also be the same under Alternative 1.

## **Alternative 3**

Alternative 3 would include storage of water on all four Project islands, with secondary uses for wildlife habitat and recreation. The portion of Bouldin Island north of SR 12 would be managed as a wildlife habitat area (the NBHA) and would not be used for water storage.

The discussions of mosquito breeding conditions, relative changes in the need for mosquito abatement, and incidence of wildlife-transmitted diseases affecting humans under Alternative 3 presented in the 2001 FEIR and 2001 FEIS have not changed and are hereby incorporated by reference. As described in the 2001 FEIR and 2001 FEIS, wildlife species that could transmit diseases to humans are

not expected to be present on the Reservoir Islands under Alternative 3 because their habitats would be reduced substantially as a result of water storage. Habitats created on the NBHA may increase the populations of these species in that area, but that increase would be negligible relative to the reduction in populations resulting from water storage. Therefore, implementing Alternative 3 would not affect the incidence of wildlife-transmitted diseases affecting humans. The CCCMVCD and the SJCMVCD have confirmed that wildlife-transmitted diseases still are not considered a significant public health risk in the Delta (Sanabria and Lucchesi pers. comm.).

**Impact PH-1: Reduction or Elimination of Mosquito Abatement Activities during Full-Storage Periods on the Reservoir Islands**

This impact has not changed since the 2001 FEIR and 2001 FEIS. This impact is similar to Impact PH-1, described above under Alternative 2, although in the case of Alternative 3, all four Project islands would serve as Reservoir Islands. This impact is considered beneficial and less than significant.

**Mitigation**

No mitigation is required.

**Impact PH-2: Increase in Abatement Levels during Partial-Storage, Shallow-Storage, or Shallow Water–Wetland Periods on the Reservoir Islands and in the NBHA**

This impact has not changed since the 2001 FEIR and 2001 FEIS and is similar to Impact PH-2, described above. This impact is considered significant.

Implementation of Mitigation Measure PH-MM-1 would reduce Impact PH-4 to a less-than-significant level.

**Mitigation Measure PH-MM-1: Develop an Integrated Pest Management Program and Coordinate Project Activities with SJCMVCD and CCCMVCD**

This mitigation measure is described above under the impact analysis for Alternative 2.

## **No-Project Alternative**

The No-Project Alternative analysis remains largely as it was presented in the 2001 FEIR and 2001 FEIS and is hereby incorporated by reference. It is briefly summarized below, with consideration of changed cropping patterns incorporated. A new discussion is incorporated at the end of this section, regarding the intensive, for-fee hunting program that would be implemented under the No-Project Alternative.

Analysis of the No-Project Alternative anticipates an increase in corn cultivation on Holland and Webb Tracts. The 2001 FEIR and 2001 FEIS identify this as a potential impact, as it could involve increased fall flooding to control weeds in the cornfields, which could result in increases in mosquito production. This is no

longer considered an impact for Webb Tract, as corn production has already doubled on the island, with no substantial increase in mosquito abatement activities.

Populations of wildlife species that could transmit diseases to humans are not expected to increase under the No-Project Alternative. Increased agricultural production may reduce populations by disturbing or eliminating their habitats through plowing and removing vegetation. Therefore, implementing the No-Project Alternative would not affect the incidence of wildlife-transmitted diseases affecting humans.

An intensive, for-fee hunting program would be implemented under the No-Project Alternative, generating an additional 12,000 hunter-use days per year. The presence of an increased number of hunters on the Project islands is not anticipated to require increased mosquito abatement activities, as the hunting season does not generally coincide with mosquito season, and because mosquito production levels are anticipated to decline under the No-Project Alternative (see impact discussion below).

### **Reduction of Mosquito Abatement Activities because of Increased Agricultural Operations**

Under the No-Project Alternative, more intensive agricultural operations would be implemented on the four Project islands. The No-Project Alternative would increase the acreage of land cultivated for annual grains, perennial crops, orchards, and vineyards and reduce the acreage of irrigated pasture and marsh habitats, which have the potential to produce problem numbers of mosquitoes. This would result in a reduction of existing mosquito breeding habitat and consequently, a reduction in mosquito abatement activities on the Project islands.