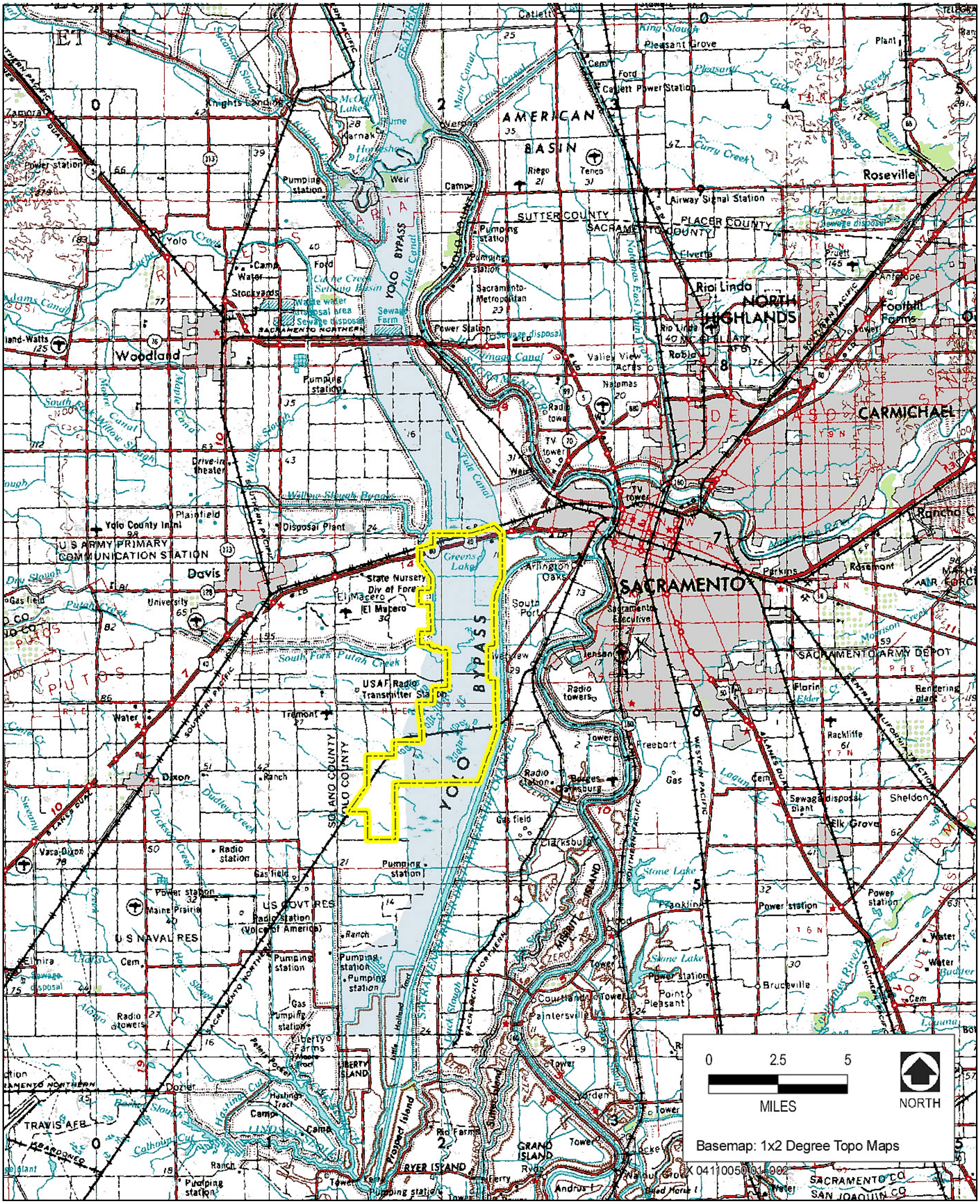
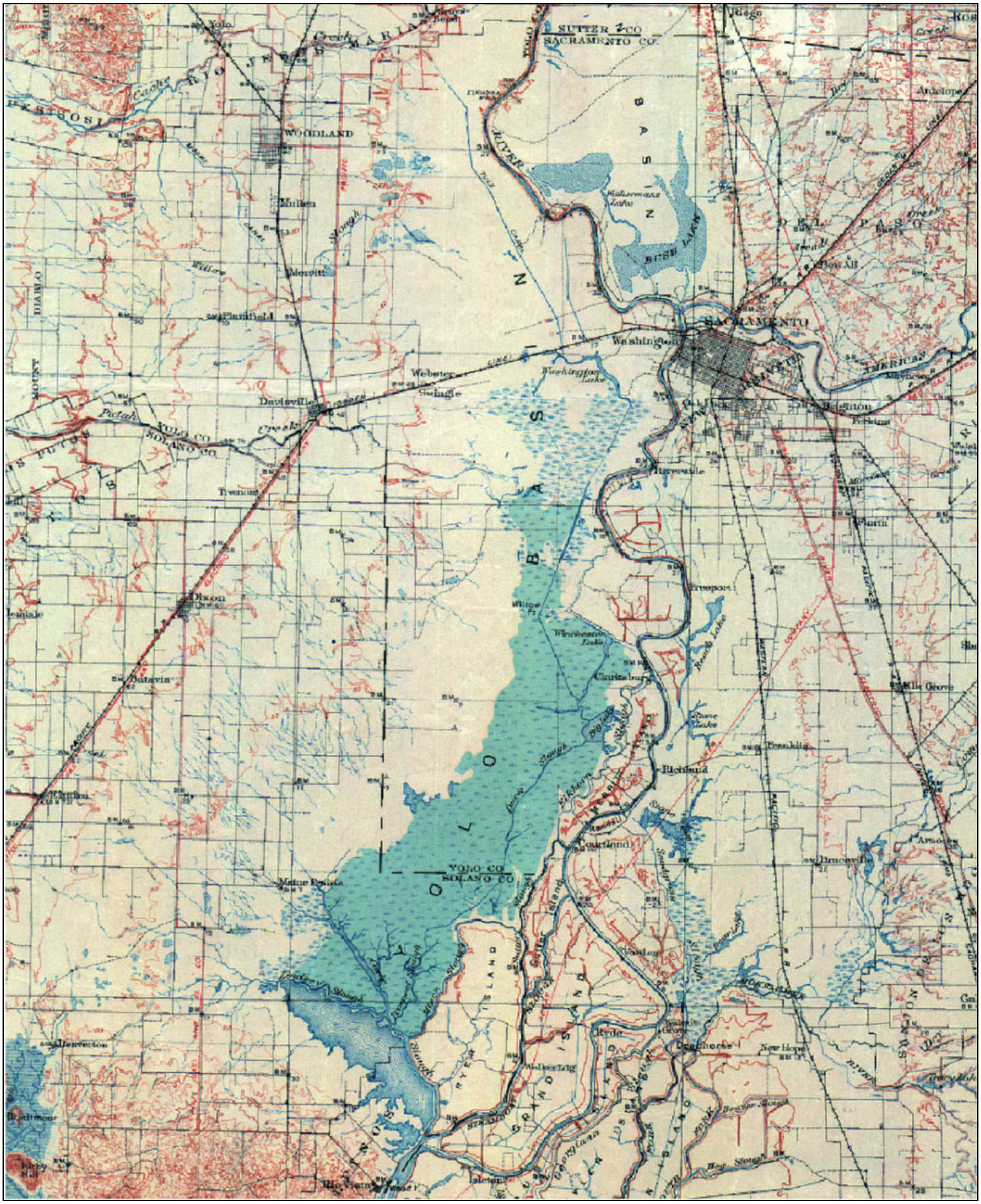


Source: U.S. Geological Survey

Map of the Yolo Bypass Wildlife Area (Yolo Bypass) **Exhibit 1-2**



Source: PWA 2005

Historic Map of the Yolo Basin (1903–1910) **Exhibit 1-3**

CURRENT WILDLIFE USE OF THE YOLO BYPASS WILDLIFE AREA

Over 200 species of birds have been seen on the Yolo Bypass Wildlife Area ranging from migratory arctic breeders in search of a more temperate winter home to species that breed locally and then fly south to the tropical climes of Central and South America. The brilliantly colored orioles, blue grosbeaks, and western kingbirds are still feeding their young when the first Alaskan shorebirds arrive on their Yolo wintering grounds. Following on the heels of the shorebirds are waterfowl, arriving in tremendous waves through the fall and winter in search of food and shelter. Thousands of northern pintails, American widgeons, mallards, snow geese, and white-fronted geese swarm onto the flooded rice and seasonal wetlands of the Yolo Bypass Wildlife Area with a backdrop of the Sacramento skyline (Yolo Basin Foundation and California Department of Fish and Game 2007). Several species of raptors including the rare Swainson's hawk can also be found foraging on fresh cut alfalfa or soaring over flooded fields in search of prey in the Yolo Bypass Wildlife Area.

Coyotes, raccoons, gray fox, and mule deer may occasionally be spotted at the Yolo Bypass Wildlife Area. Waterways are home to resident aquatic mammals, such as beaver, mink, and river otters. The extensive water system maintained on the Yolo Bypass Wildlife Area harbors large numbers of fish, amphibians, and invertebrates. Resident fish include many introduced species, such as catfish, largemouth bass, carp, and smaller species, such as inland silversides and threadfin shad. With the arrival of fall flows, native Chinook salmon travel upstream into the Yolo Bypass. Some return to their ancestral spawning grounds in Putah Creek, while others continue north to the Sacramento River and its tributaries. White sturgeon and striped bass also move into the Yolo Bypass on a seasonal basis. Habitat in the Yolo Bypass Wildlife Area ranges from managed seasonal wetlands to remnant riparian forests along Putah Creek. Further west on the higher parts of the Yolo Bypass Wildlife Area, flood inundation is less common and a unique vernal pool community has thrived in the presence of many years of cattle grazing. Rare species inhabit the vernal pool areas, including grasshopper sparrows, Ferris' alkali milk vetch, and conservancy fairy shrimp (Yolo Basin Foundation and California Department of Fish and Game 2007).

DEVELOPMENT OF THE YOLO BYPASS WILDLIFE AREA LAND MANAGEMENT PLAN

This LMP represents the commitment of DFG to manage the resources of the Yolo Bypass Wildlife Area in accordance with the laws of the United States and the State of California, incorporating the best available scientific information and professional judgment. It also incorporates the commitment of DFG to coordinate and cooperate with Yolo Bypass Wildlife Area neighbors, other local interests, and other conservation entities that are active throughout the region. This LMP proposes practical, science-based management and conservation of the natural resources, consistent with the necessary flood water conveyance purpose of the Bypass, including provisions for compatible agriculture and public recreation use. It is based on an ecosystem approach to habitat management consistent with the principles of the Ecosystem Restoration Program (ERP) included in the CALFED Bay-Delta Program (CALFED) as implemented by the California Bay-Delta Authority (CBDA) and DFG. This LMP is intended to contribute to habitat management that utilizes natural processes to create a sustainable system over the long term. This ecosystem-based management approach is intended to benefit both common and sensitive species of wildlife and plants. It may also contribute to the recovery of state and federally listed species. The LMP has been developed with guidance from the DFG's *Guide and Annotated Outline for Writing Land Management Plans*, February 2003 (updated in 2006) (California Department of Fish and Game 2003, 2006).

1.1 THE MISSION OF THE CALIFORNIA DEPARTMENT OF FISH AND GAME

The mission of DFG is to manage California's diverse fish, wildlife, and plant resources, and the habitats upon which they depend, for their ecological values and for their use and enjoyment by the public.

DFG manages fish, wildlife and plant species, and natural communities for their intrinsic and ecological value and their benefits to people. This includes the goal of habitat protection and maintenance in a sufficient amount and quality to ensure the survival of all native species using the area and natural communities that support those species. DFG is also responsible for the diversified use of fish and wildlife, including recreational, commercial, scientific, and educational uses.

1.2 PURPOSE OF WILDLIFE AREAS

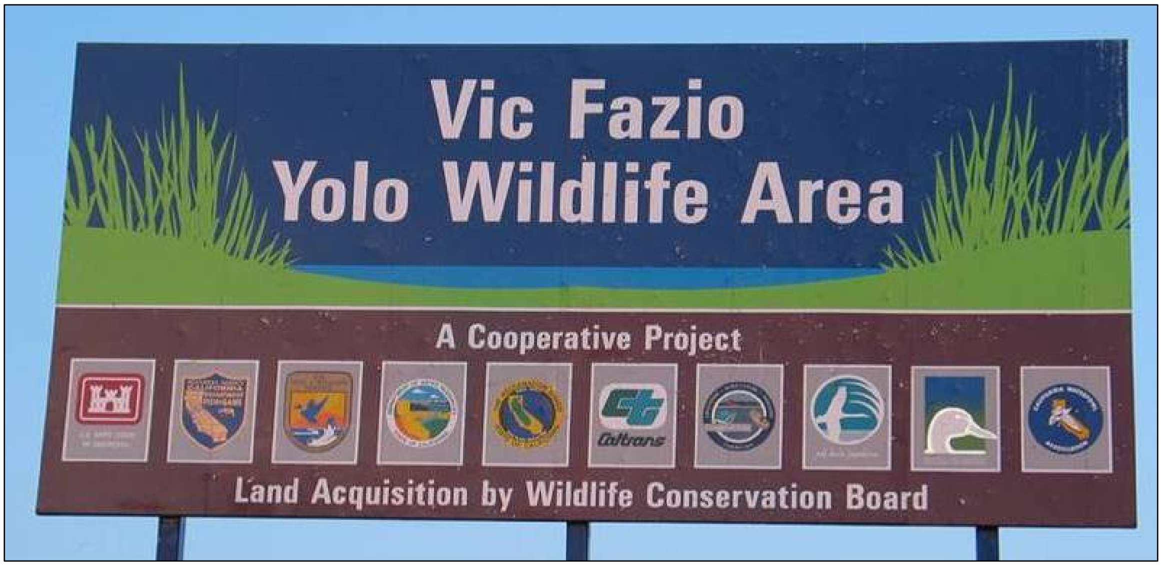
California is renowned as a land of magnificent natural scenery and a wealth of wildlife. Some of the state's most important sites for wildlife are designated DFG wildlife areas. These wildlife areas, including the Yolo Bypass Wildlife Area, provide habitat for a wide array of plant and animal species, including many that are listed for protection under state and federal endangered species acts or otherwise protected due to their rarity.

Consistent with its mission, DFG administers 108 state wildlife areas and ecological reserves encompassing approximately 650,000 acres of wildlife habitat. These areas are located throughout the state, with most located in central and northern California. Major facilities in the Central Valley include Upper Butte, Gray Lodge, Los Banos, North Grasslands, Grizzly Island, and Yolo Bypass Wildlife Area. DFG's stated purpose in managing these wildlife areas is: *"to protect and enhance habitat for wildlife species, and to provide the public with compatible, wildlife-related recreational uses."*

The protection and enhancement of habitat for wildlife is the principal natural resource management consideration for the Yolo Bypass Wildlife Area. Because DFG is also committed to providing appropriate public recreation uses within the Yolo Bypass Wildlife Area, this LMP also focuses on the management of wildlife-related recreation activities that are compatible with the diverse mosaic of habitats.

1.3 HISTORY AND PURPOSE OF YOLO BYPASS WILDLIFE AREA

Establishment of the current Yolo Bypass Wildlife Area in 2001 was a result of a 12-year-long cooperative effort to restore wetlands and associated habitats in the Yolo Basin that involved the DFG, Yolo Basin Foundation (Foundation); several local, state, and federal agencies; and other private-sector entities. Beginning in 1989, a broad coalition of conservationists; hunters; farmers; business people; elected officials; and local, state, and federal agencies worked to restore the wetlands of the Putah Creek Sinks located in the Yolo Bypass and provide outdoor education opportunities to the public. The Yolo Bypass Wildlife Area was founded by a community working together as it restored a critical link in the Pacific Flyway through cooperative, innovative partnerships.



1.3.1 THE YOLO BASIN FOUNDATION

The Foundation has its roots in the establishment of the Yolo Bypass Wildlife Area, a project achieved through public education and collaborative efforts of many people, agencies, and organizations. The Foundation was created in 1990 as a community-based organization to facilitate the creation of the Yolo Bypass Wildlife Area.

- The mission of the Foundation is to promote the stewardship and appreciation of wetlands and wildlife through education and innovative partnerships.

The Foundation's board of directors represents a diverse group of interests, from agriculture and waterfowl conservation to local government and the business community. The Foundation is universally credited with being the driving force behind the partnerships that created the Yolo Bypass Wildlife Area and continues as the communication link between many people and organizations involved in creating wetlands and managing land in the Yolo Bypass. The Yolo Bypass Wildlife Area, first opened to the public in 1997, is the physical embodiment of the Foundation's mission: *it restored a critical link in the Pacific Flyway through cooperative, innovative partnerships and is the principal focus of the Foundation's educational programs.*

A principal goal of the Foundation is facilitating environmental education at the Yolo Bypass Wildlife Area. In August 1997, the Foundation held the first of its *Discover the Flyway* teacher workshops, which introduced area teachers to the Yolo Bypass Wildlife Area and prepared them to bring their classes out for exciting and hands-on field studies. In its first year, the *Discover the Flyway* school program hosted 800 students between October 1997 and June of 1998. Since the pilot year, the school program has expanded to over 4,000 kindergarten through 12th-grade students annually. Foundation staff, interns, and dedicated volunteers assist students in hands-on learning activities at demonstration wetlands at the Yolo Bypass Wildlife Area Headquarters and lead students on exploratory walks throughout the Yolo Bypass Wildlife Area.

In addition, the Foundation facilitates the Yolo Bypass Working Group meetings, which provide a focused opportunity for farmers, land owners, and agencies within the Yolo Bypass to discuss Bypass related issues, as well as provide guidance and opinions on such issues. The Yolo Bypass Working Group meetings have been the primary forum to gather stakeholder input towards the development of this land management plan (see below for additional information on the Yolo Bypass Working Group).

1.3.2 HISTORY AND PURPOSE OF LAND ACQUISITIONS

The Wildlife Conservation Board (WCB) approved DFG's original acquisition of approximately 2,917 acres, establishing the Yolo Bypass Wildlife Area, recorded on December 31, 1991. The WCB approved the first expansion, consisting of approximately 390 acres, recorded on April 8, 1994, and the second expansion, approximately 182 acres of wetland area and 14 acres for a headquarters site, recorded on October 12 and September 29, 1994, respectively.

President Bill Clinton dedicated the Yolo Bypass Wildlife Area in November 1997, hailing the project as a national model for meeting the challenge of ***"trying to improve our economy and lift our standard of living while improving, not diminishing, our environment."*** *He also acknowledged the extraordinary collaboration and effort that have enabled the mosaic of seasonal and year-round ponds, grasslands, and riparian forest to thrive.*

The largest expansion consisted of the acquisition from two separate ownerships, the Glide Foundation and Los Rios Farms, totaling approximately 13,062 acres, recorded on December 14, 2001 (Glide Ranch) and February 1, 2002 (Los Rios Farms). The Glide Ranch consisted of three separate ranches, commonly known as the Causeway Ranch, Geiberson Ranch, and Tule Ranch. An initial option to purchase was first acquired by the Nature Conservancy, which immediately relinquished this option to the Wildlife Conservation Board who made this historic acquisition. Additional expansions included the 100-acre Parker Unit recorded on September 20, 2002 and the 119 acre Cowell Pond Unit approved on February 19, 2004. A description of all management units within the entire Yolo Bypass Wildlife Area is provided in Chapter 2, "Property Description."

The purpose of the acquisition resulting in the largest expansion of the Wildlife Area was expressly stated by the WCB on August 30, 2001 (Wildlife Conservation Board 2001):

> *"Expansion of the Yolo Bypass Wildlife Area will allow for the preservation of historic wetlands, wintering habitat for waterfowl, shorebirds, threatened and endangered species and other wetland associated species."*

The purchase was exempt from the California Environmental Quality Act (CEQA) under Section 15313 of the State CEQA Guidelines as a Class 13 Categorical Exemption for the acquisition of land for wildlife protection. The Notice of Exemption for the Glide Ranch and Los Rios Farms acquisition was filed with the State Clearinghouse on July 17, 2001.[1]

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[1] Pursuant to State CEQA Guidelines Section 15313, "Acquisition of Lands for Wildlife Conservation Purposes." Class 13 consists of the acquisition of lands for fish and wildlife conservation purposes, including preservation of fish and wildlife habitat; establishing ecological reserves under California Fish and Game Code Section 1580; and preserving access to public lands and waters where the purpose of the acquisition is to preserve the land in its natural condition.

1.4 LAND ACQUISITIONS AND ROLE OF THE WILDLIFE CONSERVATION BOARD

The various acquisitions of lands for the Yolo Bypass Wildlife Area were carried out by the WCB with funding from Propositions 12, Proposition 13, and the General Fund. (California Public Resources Code [Section 5096.310{7}{m}] designates funding to the WCB for various acquisition and restoration projects.) The WCB was created by legislation in 1947 to administer a capital outlay program for wildlife conservation and related public recreation. The WCB is an independent board with authority and funding to carry out an acquisition and development program for wildlife conservation (California Fish and Game Code Section 1300 et seq.).
The primary responsibilities of the WCB are to select, authorize, and allocate funds for the purchase of land and waters suitable for recreation purposes and for the preservation, protection, and restoration of wildlife habitat. The three main functions of the WCB are land acquisition, habitat restoration, and development of wildlife-oriented, public-access facilities. The acquisition program is administered pursuant to the WCB's original enabling legislation, the Wildlife Conservation Law of 1947 (Fish and Game Code Section 1300 et seq.), and land acquisition is a component of all WCB programs. The WCB acquires real property or rights in real property on behalf of DFG and can also grant funds to other governmental entities or nonprofit organizations to acquire real property or rights in real property. The acquisition activities are carried out in conjunction with DFG, with DFG recommending priorities for proposed acquisitions.

1.5 PURPOSE OF THE LAND MANAGEMENT PLAN

The stated purposes of the Yolo Bypass Wildlife Area Land Management Plan are to:

- guide the management of habitats, species, appropriate public use, and programs to achieve DFG's mission;
- direct an ecosystem approach to managing the Yolo Bypass Wildlife Area in coordination with the objectives of the CALFED ERP;
- identify and guide appropriate, compatible public-use opportunities within the Yolo Bypass Wildlife Area;
- direct the management of the Yolo Bypass Wildlife Area in a manner that promotes cooperative relationships with adjoining private-property owners;
- establish a descriptive inventory of the sites and the wildlife and plant resources that occur in the Yolo Bypass Wildlife Area;
- provide an overview of the Yolo Bypass Wildlife Area's operation, maintenance, and personnel requirements to implement management goals, and serve as a planning aid for preparation of the annual budget for the Bay-Delta Region (Region 3); and
- present the environmental documentation necessary for compliance with state and federal statutes and regulations, provide a description of potential and actual environmental impacts that may occur during plan management, and identify mitigation measures to avoid or lessen these impacts.

1.6 PLANNING PROCESS

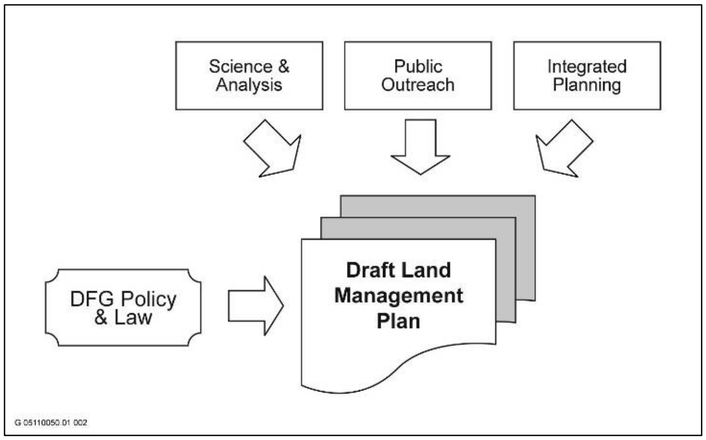
This LMP was prepared through a partnership between DFG and the Foundation and with the benefit of an extensive public-input program and substantial coordination with other public and private entities that operate in the immediate region. DFG provided overall guidance to the planning process and was responsible for all decisions regarding the content of the LMP. The Foundation was responsible for coordinating substantial stakeholder outreach and facilitating stakeholder input in the LMP development. The Foundation has been instrumental in the development of environmental education and interpretation programs at the Yolo Bypass Wildlife Area and facilitated the documentation of these programs in this plan. The Foundation's participation was funded in part through a CALFED ERP grant. The majority of the funding for the development of the land management plan consisted of Proposition 40 monies accessed through the WCB. The planning process was also coordinated with other resource agencies, stakeholders within the Yolo Bypass, including participants in the Yolo Bypass Working Group, and the public.

The planning process was guided by the general policy parameters that direct DFG, including compliance with all state and federal laws. DFG's mission, the purpose of the wildlife areas, and the purposes of the LMP, as stated in this chapter, provided broad direction for the development of this LMP. Finally, the objectives established through the CALFED ERP were considered as guidelines for this LMP. The ERP goals include recovering endangered and other at-risk species, maintaining ecological processes, restoring expanses of habitat to support species, limiting nonnative invasive species, and improving water and sediment quality. A list of applicable CALFED ERP targets and actions is provided in Appendix B to show the relationship between the CALFED ERP and the proposed LMP.

The planning process focused on the development of three major forms of input that all contributed to the LMP:

- Public input
- Science and analysis
- Integrated planning

Public input was obtained through an extensive public-outreach program as described below. **Science and analysis** was established through the development of a detailed property inventory for all of the units within the Yolo Bypass Wildlife Area. Information was obtained through a literature search, meetings with knowledgeable individuals, on-site field analysis, and review of various technical studies. **Integrated planning** included meetings with local, state, and federal districts and agencies that manage and regulate other public properties along the Yolo Bypass. Integrated planning was also generated through the Yolo Bypass Working Group meetings (discussed under "Public-Outreach Program" below). Exhibit 1-4 depicts the key information inputs to the planning process.



1.6.1 PUBLIC-OUTREACH PROGRAM

A public-outreach program was designed as a key element of the planning process to ensure that there would be ample opportunities for local interests and the general public to be a part of the development of this LMP. DFG made a commitment to the Yolo County Board of Supervisors and the Delta Protection Commission at the time of the Glide Ranch and Los Rios Farms purchases to involve Yolo Bypass stakeholders in the development of the LMP. It was recognized that a wide range of people considered themselves stakeholders in the planning process.

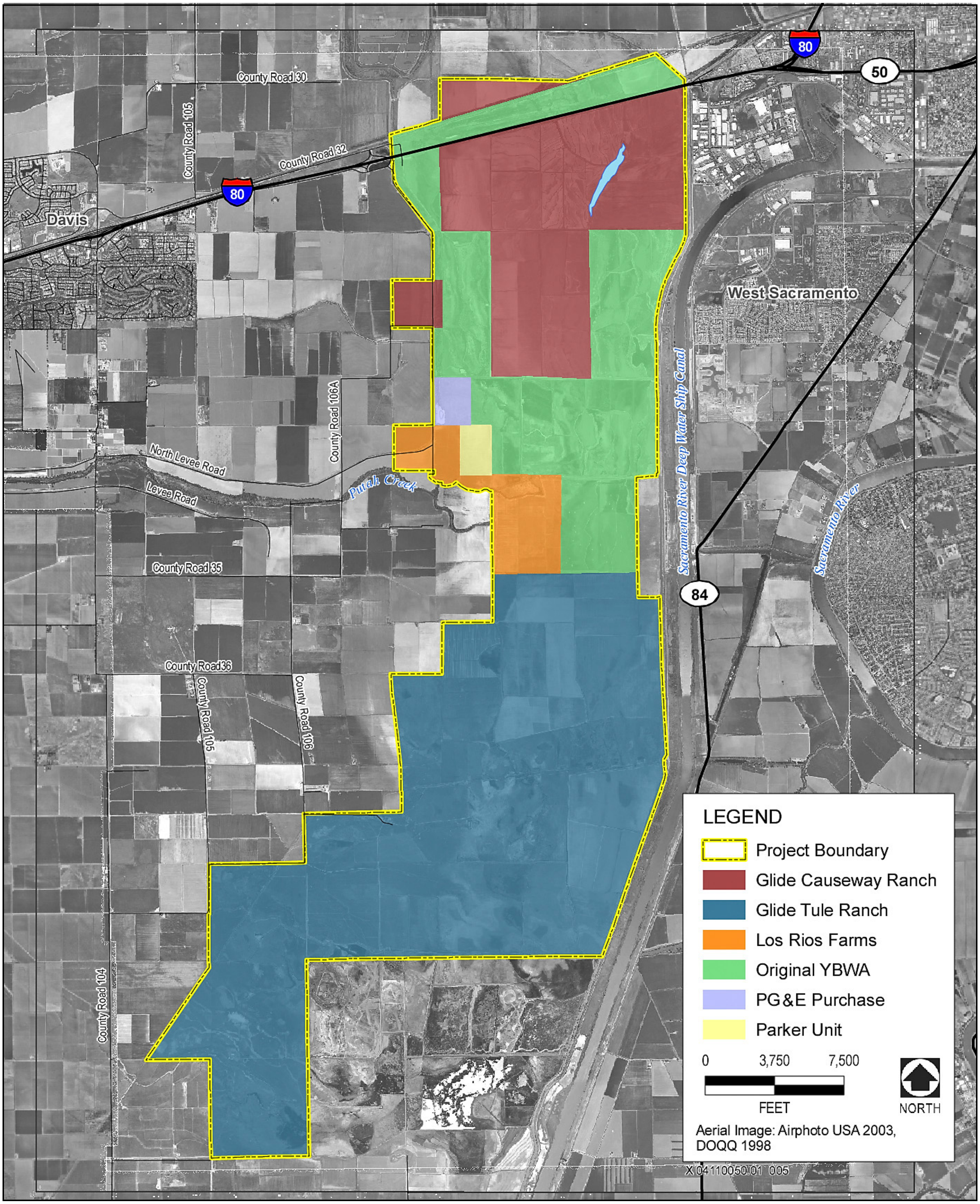
Substantial efforts were made to identify stakeholders, contact them, and solicit their ideas regarding the future of the Yolo Bypass Wildlife Area. The public-outreach program featured the following components:

- six focus group meetings conducted before initiation of LMP development (2002);

- a total of 37 Yolo Bypass Working Group Meetings (1999 to present; updates on developments at the Yolo Bypass Wildlife Area have been a frequent topic of discussion);

- one advertised public meeting for initial input (December 12, 2005, in Davis, attended by 30 persons); and

- five additional focus group meetings to receive input on the Preliminary Draft LMP (March and April, 2006).



Source: Department of Fish and Game, City of Davis 2005 CaSIL 1993

Land Acquisitions to the Yolo Bypass Wildlife Area **Exhibit 1-4**

Appendix A provides a summary of the comments received at the initial public meetings and examples of the various communication devices that were used to publicize the planning process.

YOLO BYPASS WORKING GROUP

The Foundation initiated the Yolo Bypass Working Group (Working Group) in 1998 under a CALFED ERP grant. This ad hoc stakeholder group has been very successful and continues to meet approximately every 2–4 months. More than 30 people representing a wide range of stakeholders with an interest in the Yolo Bypass regularly attend these meetings, including representatives from many local, state, and federal agencies. Participants include landowners and their tenants (farmers, ranchers, duck hunters), DFG, the California Department of Water Resources (DWR), State Reclamation Board, U.S. Fish and Wildlife Service (USFWS), California Department of Food and Agriculture, Natural Resources Conservation Service (NRCS), Sacramento-Yolo Mosquito and Vector Control District (SYMVCD), Dixon and Yolo Resource Conservation Districts (RCDs), Sacramento Area Flood Control Agency (SAFCA), Yolo County, Cities of West Sacramento, Woodland and Davis, California Waterfowl Association (CWA), Ducks Unlimited (DU), National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS), National Weather Service (NWS), Sacramento-Yolo Mosquito and Vector Control District (SYMVCD), and the Port of Sacramento.

The Working Group meetings serve as a forum to educate and inform all parties interested in the Yolo Bypass. Information on Bypass-related land use, flood management, resource policy, proposed projects, economics, and ecological issues is presented and openly discussed by members of the Working Group. Guest speakers have included representatives from USFWS (also a landowner/stakeholder), SAFCA, Northern California Water Association, DWR, DFG (also a landowner/stakeholder), State Reclamation Board, Port of Sacramento, U.S. Department of Agriculture's (USDA's) Farm Services Agency (FSA), NRCS, SYMVCD, U.S. Army Corps of Engineers (USACE), CWA, University of California, Davis (UCD), a variety of project proponents, and several technical consultants on ecological and hydrologic issues.

It should be noted that before the Working Group was formed, many landowners and other stakeholders were often not informed about issues and decision-making processes that directly affected the Yolo Bypass in general and their interests in particular. These meetings give local stakeholders the chance to provide direct input, helping to protect their interests, and guide projects proposed by others. The Working Group has been meeting regularly since 1998, supported during this entire period by CALFED ERP funding. The Working Group provided the guidance for the development of the document published by the Foundation in August 2001, "*A Framework for the Future: Yolo Bypass Management Strategy*" (Yolo Basin Foundation 2001), which can be viewed on the Foundation's website (www.yolobasin.org).

The group has identified and discussed numerous issues regarding natural resources and public uses in the Yolo Bypass. These issues are addressed in greater detail in Chapters 2, 3, and 4.

1.7 ENVIRONMENTAL ANALYSIS

An Initial Study (IS) pursuant to CEQA and the State CEQA Guidelines has been prepared in conjunction with the Draft LMP. This assessment evaluates the potential environmental impacts of the continued operation of the Yolo Bypass Wildlife Area under the provisions of the Draft LMP. The IS for the LMP is found in Appendix H, "Environmental Review." This assessment recommended that a Negative Declaration be approved for the project with a finding that the project would not have a significant impact on the environment.

1.7.1 RELATIONSHIP OF THIS LAND MANAGEMENT PLAN TO CALFED

The *CALFED Final Programmatic Environmental Impact Statement and Environmental Impact Report* (CALFED Final PEIS/EIR) provides a very broad, programmatic analysis of the general effect of implementing the multiple components of CALFED over a 30-year period (2000–2030) across two-thirds of the state of

California. The analysis of impacts in the CALFED Final PEIS/EIR is not intended to address any site-specific environmental effects of individual projects; therefore, the analyses of direct, indirect, and cumulative impacts contained in the CALFED programmatic document are not sufficiently detailed by itself to evaluate effects of the proposed LMP on the Yolo Bypass Wildlife Area. Preparation of the Draft LMP for the Yolo Bypass Wildlife Area included reviews of applicable chapters and sections contained in the CALFED Final PEIS/EIR and the Record of Decision (ROD) on the Final PEIS/EIR to develop background information, assess consistency of the proposed LMP with the CALFED Preferred Program Alternative, and provide mitigation guidance.

The LMP is intended to be consistent with the programmatic guidance contained in the CALFED programs and Final PEIS/EIR. Furthermore, it is intended to be consistent with the *Multi-Species Conservation Strategy* (MSCS), which is part of the comprehensive regulatory compliance strategy that is integrated with the CALFED Final PEIS/EIR.

Review of the resource sections of the CALFED Final PEIS/EIR included identification of mitigation strategies, which addresses potential significant impacts on special-status wildlife species, important wildlife use areas, and agricultural lands. These mitigation strategies serve as the basis for development of strategic elements that are incorporated into the LMP management goals and tasks, thereby avoiding potential significant impacts. (Refer to Chapter 5, “Management Goals,” of this Draft LMP for further discussion.)

1.8 ORGANIZATION OF THIS LAND MANAGEMENT PLAN

This LMP for the Yolo Bypass Wildlife Area is organized as follows:

- *Chapter 1, “Introduction,”* summarizes the purpose of the land acquisition for the Yolo Bypass Wildlife Area, acquisition history, purpose of the LMP, and the planning process; explains the scope and uses of this LMP; and describes the relationship of this LMP to CALFED.

- *Chapter 2, “Property Description and Management Setting,”* summarizes the most current information available to describe the geographical setting, property boundaries and easements, existing infrastructure, and management setting, including any legal constraints and existing agreements and descriptions of existing working partnerships with other agencies, and nonprofit groups. This chapter (along with Chapter 3) also will serve as part of the environmental setting of the IS.

- *Chapter 3, “Environmental Setting,”* describes the primary existing resource conditions on the property and includes a discussion on planning influences and considerations. It will also serve as the environmental setting of the IS.

- *Chapter 4, “Compatible Resource Management and Public Use,”* describes and evaluates opportunities and constraints associated with compatible resource management and public uses throughout the Yolo Bypass Wildlife Area.

- *Chapter 5, “Management Goals,”* describes the resource management direction of the LMP and the project description necessary for performing environmental review pursuant to CEQA. The chapter includes conceptual descriptions of management actions.

- *Chapter 6, “Operations and Maintenance,”* guides the budget preparation and work plans for the property; summarizes the number of existing staff employed at the property and any additional requirements for personnel; summarizes all estimated operations and maintenance costs associated with management of the property; identifies potential funding sources.

- *Chapter 7, “Future Revisions to the Plan,”* describes a process that will be implemented to update and accommodate revisions to the LMP.

- *Chapter 8, "Document Preparers,"* lists the agencies involved in preparation or review of the LMP and individuals who prepared this LMP.

- *Chapter 9, "References and Personal Communications,"* lists the sources of information cited throughout this LMP.

- *Appendix A, "Public-Outreach Summary,"* includes news releases for the public-input meetings; a summary of the December 12, 2005 and August 16, 2007 public scoping and comment meeting; including written comments received; a summary of focus group meetings to be held on March 27 and 30, and April 4 and 7, 2006; a list of public presentations; and a news release for the Draft LMP.

- *Appendix B, "Yolo Bypass Wildlife Area–Related Targets and Programmatic Actions from the CALFED Ecosystem Restoration Program Plan,"* presents the verbatim Yolo Bypass–Related CALFED Targets and Programmatic Actions that appear to be relevant to issues addressed in the Yolo Bypass Wildlife Area LMP.

- *Appendix C, "Yolo Bypass Wildlife Area–Hydraulic Modeling Workplan,"* presents a specific hydraulic modeling workplan for guiding the design of future restoration projects in the Yolo Bypass Wildlife Area and confirming achievement of performance criteria (i.e., confirmation that project-related adverse affects to flow conveyance will not occur).

- *Appendix D, "Existing Memorandums of Understanding and Agreements,"* presents existing Memorandums of Understanding and Agreements between DFG and the Yolo Basin Foundation (regarding public education programming and facilities); DFG, USACE, DWR, and The Reclamation Board (regarding flood control); DFG, State Reclamation Board, DWR, and USFWS (regarding management for flood control and endangered species); DFG and Dixon RCD (regarding management of agricultural leases), and the Mace Ranch Irrigation System and Water Delivery Agreement.

- *Appendix E, "Yolo Bypass Wildlife Area Program History and Overview,"* provides an overview of public use programs, site history, and a description of interpretive resources.

- *Appendix F, "Yolo Bypass Wildlife Area Agricultural Plan,"* presents the Agricultural Plan for the Yolo Bypass Wildlife Area.

- *Appendix G, "Species List for the Yolo Bypass Wildlife Area,"* presents a species list for the Yolo Bypass Wildlife Area.

- *Appendix H, "Environmental Review,"* presents the Initial Study / Negative Declaration for the Draft LMP.

2 PROPERTY DESCRIPTION AND MANAGEMENT SETTING

This chapter describes the existing geographic setting of the Yolo Bypass Wildlife Area, including the Wildlife Area boundaries, associated management units, and existing easements. Existing infrastructure and its management (i.e., water delivery and management, roads, levees, utilities, and houses and other structures) are also discussed. This chapter also describes the existing management setting of the Yolo Bypass Wildlife Area, including legal constraints and existing agreements.

2.1 GEOGRAPHICAL SETTING

The Yolo Bypass Wildlife Area is located within the historic Yolo Basin of the Sacramento Valley and is part of the California Department of Fish and Game's (DFG's) Bay-Delta Region. It lies almost entirely within the Yolo Bypass in Yolo County, between the cities of Davis and West Sacramento (Exhibits 1-1 and 1-2).

2.2 PROPERTY BOUNDARIES AND EASEMENTS

Exhibit 2-1 depicts the boundaries of the approximately 16,770-acre Yolo Bypass Wildlife Area. The northern boundary of the Yolo Bypass Wildlife Area is generally formed by the Union Pacific Railroad (UPRR) (formerly Southern Pacific Railroad) tracks that run parallel to and north of Interstate 80 (I-80). There is, however, a 182-acre portion of Yolo Bypass Wildlife Area that abuts the UPRR tracks on the north side. The eastern boundary is shaped largely by the East Toe Drain, which runs inside of the east levee of the Yolo Bypass (which is also the west levee of the Sacramento River Deep Water Ship Channel). This eastern boundary is the centerline of the open water in the East Toe Drain, except in an area approximately 3 miles due south of I-80 where the boundary turns west to avoid a small area of privately owned land. The western boundary of the Yolo Bypass Wildlife Area is generally defined by the west levee of the Yolo Bypass, except that the boundary also encompasses two properties outside of the Bypass levee. The southern boundary is approximately 8.7 miles south of I-80 on the east side and approximately 10 miles south of I-80 on the west side of the wildlife area (Exhibit 2-1).

The primary entrance to the Yolo Bypass Wildlife Area, which can be reached via the East Chiles Road exit of I-80, is approximately 2 miles east of Davis and 4 miles west of West Sacramento. The entry driveway intersects County Road 32B (aka east Chiles Road) at the west levee of the Yolo Bypass, immediately west of the west end of the Yolo Causeway (I-80 Bridge).

The Yolo Bypass Wildlife Area is composed of 17 separate management units throughout its approximately 16,770 acres (Exhibit 2-1). A brief description of each management unit is provided below.

2.2.1 UNIT DESCRIPTIONS

Existing cover types within the Yolo Bypass Wildlife Area include wetlands, riparian areas, grasslands and other uplands, vernal pools, open-water, and agricultural lands. There are flowage easements covering all of the Yolo Bypass Wildlife Area units within the Yolo Bypass that allow for water to be diverted from the Sacramento River during high flows for flood protection purposes. As a result, most of the Yolo Bypass Wildlife Area has been inundated by Bypass flows in approximately 71% of water years (as measured at the Lisbon Weir) (Yolo Basin Foundation 2001). Management units outside of the Bypass include an approximately 130-acre portion of the Northwest Unit called the Geiberson Ranch and the Pacific Flyway Center Unit (Exhibit 2-1). A general description of each management unit is provided below. Management units are organized by primary acquisitions/ previous ownership (i.e., Causeway Ranch, Original Yolo Bypass Wildlife Area, Los Rios Farms Complex, and Tule Ranch). Descriptions of the most recent acquisitions, the Parker Unit and the Cowell Pond Unit, are included in the Los Rios Farms Complex discussion. Descriptions of existing infrastructure, i.e., water management and delivery, roads, levees, utilities, and houses and other structures, are provided separately under Section 2.3, "Existing Infrastructure." Table 2.2-1 specifies the area and primary land use/cover type for each of the management units in the Yolo Bypass Wildlife Area. Additional details regarding planning influences and considerations, agricultural resources, soils and climate, hydrology and water resources, biological resources, cultural resources, and recreation and public access are provided in Chapter 3, "Environmental Setting."

CAUSEWAY RANCH

Causeway Ranch Unit (North)

The Causeway Ranch Unit (North) is approximately 182 acres and is located north of the UPRR trestle. This unit has two productive farm fields with a total of approximately 160 farmable acres. The balance of this unit consists of roads, ditches, and a narrow strip of trees and vegetation along the UPRR trestle on the eastern point of this unit. The same tenant has been farming this unit for many years. Recent crops have been sunflower, safflower, and corn.

Causeway Ranch Unit (Main)

The Causeway Ranch Unit (Main) is approximately 1,966 acres and is located immediately south of I-80 and, combined with the 1,000 Acres Unit described below, has 24 productive farm fields totaling approximately 2,785 acres and one field of approximately 22 acres dedicated exclusively to wildlife habitat. Crops grown in these two units have consisted of corn, hay, safflower, tomatoes, rice, wild rice, milo, and wheat. Planted acres have ranged from 1,837 acres to 2,760 acres with a 4-year average of 2,434 acres. A significant amount of this area has recently been planted in wildlife food plots and shorebird management areas in rotation with rice production.

The most notable feature of this unit is the approximately 25-acre Green's Lake. The lake is surrounded by riparian vegetation and is one of the very few mature riparian woodland areas existing within the Yolo Bypass. Green's Lake appears to be the remnant of a hydraulic connection between the historic north fork of Putah Creek and Lake Washington in West Sacramento.

1,000 Acres Unit

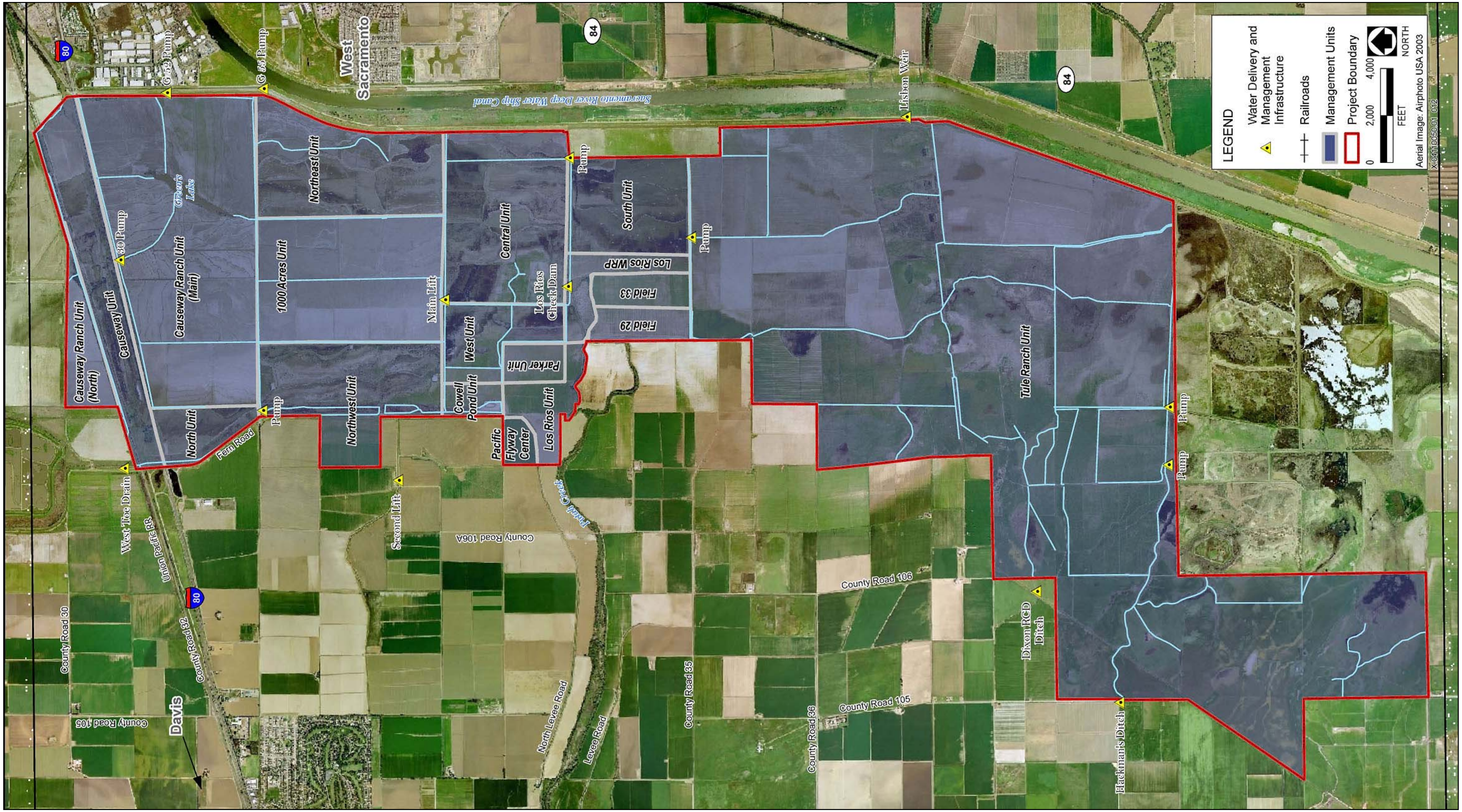
As its name implies, the 1,000 Acres Unit is approximately 1,000 acres. This management unit is located immediately south of the Causeway Ranch Unit (Main). Crops grown in these two units are described above under "Causeway Ranch Unit (Main)." In addition to supporting agricultural crops, portions of the 1,000 Acres Unit have also been managed specifically as shorebird habitat on a 3-year rotational basis (see Chapter 3, "Environmental Setting," for additional detail).

ORIGINAL YOLO BYPASS WILDLIFE AREA

The original Yolo Bypass Wildlife Area includes a series of early acquisitions that formed the original Yolo Bypass Wildlife Area.

Causeway Unit

The Causeway Unit is approximately 420 acres and lies between the UPRR trestle and I-80. The property consists of approximately 205 acres of grassland and riparian vegetation communities, approximately 95 acres of fallow land, and approximately 120 acres of farmable land on the eastern portion of this property. There is one permanent pond that was restored in 1996 by the U.S. Army Corps of Engineers (USACE). There is also an



Source: Department of Fish and Game, City of Davis 2005, CaSIL 1993

Yolo Bypass Wildlife Area **Exhibit 2-1**

Table 2.2-1
Management Units in the Yolo Bypass Wildlife Area

Management Unit (Subunit)	Area (acres)[1]	Land Use/Cover Type(s)
Causeway Ranch		
Causeway Ranch Unit (North)	182	Farmland
Causeway Ranch Unit (Main)	1,966	Farmland; Green's Lake; seasonal wetland and riparian vegetation communities
1,000 Acres Unit	1,000	Farmland
Original Yolo Wildlife Area		
Causeway Unit	420	Farmland; grassland and riparian vegetation communities
North Unit	182	Seasonal wetland, grassland, and riparian vegetation communities
Northwest Unit[2]	683	Seasonal and permanent wetland, farmland, grassland, and riparian vegetation communities
West Unit	255	Seasonal wetland and grassland vegetation communities
Northeast Unit	759	Seasonal and permanent wetland, grassland, and riparian vegetation communities
Central Unit	892	Seasonal and permanent wetland, grassland, and riparian vegetation communities
South Unit	488	Seasonal and permanent wetland, and grassland vegetation communities
Los Rios Farms Complex		
Los Rios Unit	230	Farmland
Los Rios WRP	153	Seasonal and permanent wetland, grassland, and riparian vegetation communities
Cowell Pond Unit	119	Seasonal and permanent wetland, grassland, and riparian vegetation communities
Pacific Flyway Center	69	Seasonal and permanent wetlands, riparian, and grassland communities; farmland and other
Parker Unit	100	Farmland
Field 29	132	Farmland
Field 38	140	Farmland
Tule Ranch		
Tule Ranch Unit	9,000	Farmland; pasture; seasonal and permanent wetland, grassland, vernal pool, and riparian vegetation communities
Total (approximate)	**16,770**	

Note: WRP = Wetland Reserve Program

[1] Areas are based on assessor's parcel number records obtained from DFG and calculated from property boundaries in geographic information system (GIS) database (compiled by EDAW in 2006), which reflect land area shown in 2003 aerial photography.

[2] Includes additional 160 acres that was part of the Glide acquisition.

extensive area of natural seasonal wetlands in the center of the unit. The balance of this land consists of scattered remnants of the old causeway structure, the structural foundation of the current I-80 Causeway, and the UPRR trestle. The farmed portion of this unit has recently supported sunflower and corn crops. DFG holds a conservation easement on the eastern half of this unit. California Department of Transportation (Caltrans) retains ownership of the property for 30 years as a potential borrow site. The landmark eucalyptus grove is located on the west side of the unit. A complex web of underground pipeline and fiber optic cable easements crosses the unit making active management for wildlife habitat difficult. Additionally, the numerous concrete slabs that were once part of a previous incarnation of the Yolo Causeway lie shallowly buried over several acres, making the area unmanageable and a potential hazard to vehicles and pedestrians.

North Unit

The North Unit is approximately 182 acres. Located immediately south of the Causeway Unit and adjacent to the west levee of the Yolo Bypass, this unit serves as the primary entry point into the Yolo Bypass Wildlife Area. It consists of approximately 131 acres of seasonal wetland, 10 acres of permanent wetland, and 38 acres of grassland vegetation communities with sparse areas of riparian scrub and woodland. This unit was originally restored from fallow agricultural land to seasonal wetlands in 1995 as part of the USACE Yolo Basin Wetlands project. California Waterfowl Association (CWA) completed a habitat improvement project in fall of 2005 using funds from a North American Wetlands Conservation Act (NAWCA) grant. The west side of the unit is a low area that was created when the levees were constructed decades ago, resulting in established wetlands. This existing wetland habitat pre-dates the establishment of the Wildlife Area. Parking Lot A is located on the north end of the unit.

Northwest Unit

The Northwest Unit is approximately 683 acres and is located south of the North Unit, adjacent to and largely within the west levee of the Yolo Bypass. Approximately 523 acres of this unit are part of the original Yolo Bypass Wildlife Area; the remaining 160 acres (130 acres of which are outside of the Yolo Bypass [aka the Geiberson Ranch]) were purchased as part of the Glide Ranch acquisition. The primary portion of the unit (i.e., the portion within the Bypass) consists of approximately 314 acres of seasonal wetlands with 57 acres of permanent wetland, 5 acres of riparian, and 55 acres of grassland vegetation communities. The auto tour loop is located within this unit. This unit was originally restored from fallow agricultural land to seasonal wetlands in 1995 as part of the USACE Yolo Basin Wetlands project. The southwest corner of this unit contains a 15-acre of restored riparian habitat with1,500 trees that were planted by the USACE in 1995. CWA completed an extensive habitat improvement project in fall of 2005 using funds from a NAWCA grant. The approximately 130-acre parcel outside the Yolo Bypass was part of the 2001 Glide acquisition and was known as the Giberson Ranch. This parcel is currently being farmed under a lease, as accepted by DFG as a condition of the sale. The west side north of the riparian area contains low-land tule marsh habitat that pre-dates the establishment of the Wildlife Area. The northwest side of the unit receives the agricultural and stormwater runoff from the South Davis Drain. Parking lots B, C, and D are located along the perimeter of this unit.

West Unit

The West Unit is approximately 255 acres. Located immediately south of the Northwest and 1,000 Acres units, this unit is part of the original Yolo Bypass Wildlife Area. It consists of approximately 196 acres seasonal wetland and 53 acres grassland vegetation communities. This unit was originally restored from fallow agricultural land to seasonal wetlands in 1995 as part of the USACE Yolo Basin Wetlands project. DU completed an extensive habitat improvement project in summer 2005 using funds from a NAWCA grant. This unit is part of the current hunt zone and contains one of the original Putah Creek Sinks.

Northeast Unit

The Northeast Unit is approximately 759 acres and is located immediately south of the Causeway Ranch Unit and east of the 1,000 Acres Unit. The eastern boundary of the Northeast Unit, the centerline of the East Toe Drain, is the same as a portion of the western Yolo Bypass Wildlife Area boundary. This unit is part of the original Yolo Bypass Wildlife Area and consists of approximately 476 acres of seasonal and 80 acres of permanent wetland, 127 acres of grassland, and sparse riparian vegetation communities. This unit was originally restored from fallow agricultural land to seasonal wetlands in 1995 as part of the USACE Yolo Basin Wetlands project. CWA completed an extensive habitat improvement project in fall 2003 using funds from a NAWCA grant. Hunting is allowed in this unit, featuring 16 double concrete pit blinds located on islands in seasonal wetlands. Parking lot H is located on the southwest corner of this unit. The Northeast Unit is also accessed from Parking lot F, located in the northeast corner of the Central Unit.

Central Unit

The Central Unit is approximately 892 acres and is located immediately south and east of the Northwest Unit. The cross canal defines the north border. This unit is part of the original Yolo Bypass Wildlife Area and consists of approximately 356 acres seasonal wetlands, 54 acres of permanent wetlands, and 354 acres grassland vegetation communities. This unit was originally restored from fallow agricultural land to seasonal wetlands in 1995 as part of the USACE Yolo Basin Wetlands project. DU completed an extensive habitat improvement project in fall 2004 using funds from a NAWCA grant. Hunting is allowed in this unit. Parking Lot F is located on the north east corner of this unit, lot G is located at the south east corner of this unit and lot E is located on the west side of this unit.

South Unit

The South Unit is approximately 488 acres and is located immediately south of the Central Unit. This unit is part of the original Yolo Bypass Wildlife Area and consists of approximately 272 acres of seasonal and 19 acres of permanent wetland, and 48 acres of grassland vegetation communities. This unit was originally restored from fallow agricultural land to seasonal wetlands in 1994 as part of the USACE Yolo Basin Wetlands project.
The entire unit has been primarily managed as sanctuary with no public use allowed.

LOS RIOS FARMS COMPLEX

Los Rios Unit

The Los Rios Unit is approximately 230 acres and is located north and south of Putah Creek within the Yolo Bypass. This unit, combined with several other parts of the Los Rios Complex, includes nine productive fields with a total of approximately 696 farmable acres. Recent crops in these units have been corn, barley, sorghum, safflower, melon, seed, and tomatoes.

Los Rios WRP Unit

The Los Rios WRP Unit is approximately 153 acres and is located east of the Los Rios Unit. The previous owner of this unit entered into a perpetual easement with the Wetland Reserve Program (WRP) of the U.S. Department of Agriculture Natural Resources Conservation Service (USDA NRCS). The unit currently consists of restored seasonal and permanent wetland, riparian, and grassland vegetation communities. CWA completed this restoration project in fall of 2005. Riparian vegetation will be planted in summer 2006. Hydraulic analysis was used to determine the extent of riparian vegetation allowable under the State Reclamation Board permit. This unit will be available for hunting beginning in the 2006–07 season. Putah Creek is the north boundary of this unit and often overflows its channel on the west side of this unit during high flows.

Cowell Pond Unit

The Cowell Pond Unit is approximately 119 acres and is located immediately south of the Northwest Unit and west of the West Unit. This unit is adjacent to the west levee of the Yolo Bypass. DFG had a long-term easement for wildlife habitat in this area before it purchased the land from Pacific Gas & Electric (PG&E). This unit contains a large but shallow holding pond that is part of the Mace Ranch Irrigation System. Water for the irrigation system moves out of the Bypass in a culvert through the west levee from this pond. This unit has not been farmed since the WCB purchased the conservation easement for the property in 1991. Over the years there has been annual cattle grazing activity.

Pacific Flyway Center Unit

The Pacific Flyway Center Unit is approximately 69 acres. Located outside of the Yolo Bypass levee, to the south and west of the Cowell Pond Unit, this unit has been identified as the preferred site for the proposed Pacific Flyway Center. The Pacific Flyway Center project involves construction of a visitor and environmental education center along with associated infrastructure and support facilities, restoration of 45 acres of habitat, and construction of a new site access road. DFG would operate and maintain the site as a visitor/educational center; the site could also serve as the main entrance to the Wildlife Area and would include facilities for administration of the Yolo Bypass Wildlife Area. (See Chapter 3, “Environmental Setting,” and Chapter 4, “Compatible Resource Management and Public Use,” for additional information on the Pacific Flyway Center.) Forty five acres of this unit were recently restored to seasonal and permanent wetland habitat and will be also managed for riparian and grass land communities. Approximately 15 acres of the site will remain in agricultural production. About 9 acres has been graded as a building site and parking lot. CEQA compliance for these activities was completed in early 2006 (California Department of Fish and Game 2006).

Parker Unit

The Parker Unit is approximately 100 acres and is located west and north of the Los Rios Unit. This unit has been farmed as part of the Los Rios Complex. It may possibly be restored to wetland habitat by CWA in the summer/fall of 2007 with NAWCA funds. This unit is not currently in the hunting zone.

Field 29 Unit

The Field 29 Unit is approximately 132 acres and is located south of a portion of the Los Rios WRP Unit. The western boundary of this unit forms a portion of the western boundary of the Yolo Bypass Wildlife Area. This unit has been farmed as part of the Los Rios Complex. A fork of Putah Creek forms the north boundary of this unit and another fork serves as the west boundary. This unit has recently been used to grow tomatoes, safflower or sudan and is currently within the hunting area.

Field 38 Unit

The Field 38 Unit is approximately 140 acres and is located south and west of the Los Rios WRP Unit. This unit has been farmed as part of the Los Rios Complex and lies within the hunting area.

TULE RANCH

Tule Ranch Unit

The Tule Ranch Unit is approximately 9,000 acres and is located completely within the Yolo Bypass, generally between County Road 105 and the Sacramento Deep Water Channel and approximately 4.5 miles south of I-80 to 10 miles south of I-80 in the southeastern portion of Yolo County. This unit has a maximum width (east/west) of 4.25 miles and maximum length (north/south) of 6 miles. The unit consists of a combination of annual rye grass pasture, row and field crops, wetlands, vernal pools, and riparian vegetation located along the waterways and in wetland areas. These waterways are extensive and are generally associated with the existing wetlands and/or ponds. Near the western boundary, along the natural shoreline of the Yolo Basin, uplands predominate in a landscape which still contains the natural topography of the region. These southern portions of the Tule Ranch Unit contain a fine assemblage of plants typical of vernal pools and playas. There are numerous swales that are often crossed by roads in this area. When this condition occurs, water can be impounded at these roads, creating vernal pool conditions. The property is currently leased for farming and cattle grazing; DFG assumed ownership of these leases as a condition of sale. The property contains numerous improvements, including a main residence, a garage, shop, a second residence, sheds, four barns, several storage buildings, fuel tanks, fencing, and corrals, all of which are located in the southwest quadrant and related to the cattle lease operation.

2.2.2 EASEMENTS AND RIGHTS-OF-WAY

Easements and rights-of-way are legally recorded documents that run with the deed of the property, and are, therefore, transferred with the property from owner to owner. Easements typically preserve the rights of an entity other than the landowner. Within the Yolo Bypass Wildlife Area there are generally three different types of easements. The first type includes easements for accessing levees, utilities, roadways, pipelines, etc. These easements exist for the purpose of maintaining, repairing, replacing, and installing levees, roads, railroads, power lines, utility lines, and pipelines needed for regional public works. The second type of easement that exists within the Yolo Bypass Wildlife Area is the conservation easement. A conservation easement is a legal agreement between a landowner and a land trust or government agency that permanently limits uses of the land to protect its conservation values. A discussion of each easement and/or right-of-way is provided below. Exhibit 2-2 depicts easements and rights-of-way within or running through the Yolo Bypass Wildlife Area. Easements and rights-of-way are discussed further under Section 2.4.1, “Legal Constraints and Existing Agreements,” below. The third type of easement is a flowage easement.

FLOWAGE EASEMENTS

The Yolo Bypass Wildlife Area lands located within the Yolo Bypass are restricted by easements held by the State Reclamation Board. These easements grant the state the right to inundate the land with floodwaters. They prevent landowners from building structures, berms, or growing vegetation that would significantly obstruct flow conveyance. The easement language varies slightly (Yolo Basin Foundation 2001). Reclamation Board regulations regarding vegetation maintenance standards for floodways and bypasses throughout the state include the following (CCR Title 23, Section 131 (g)).

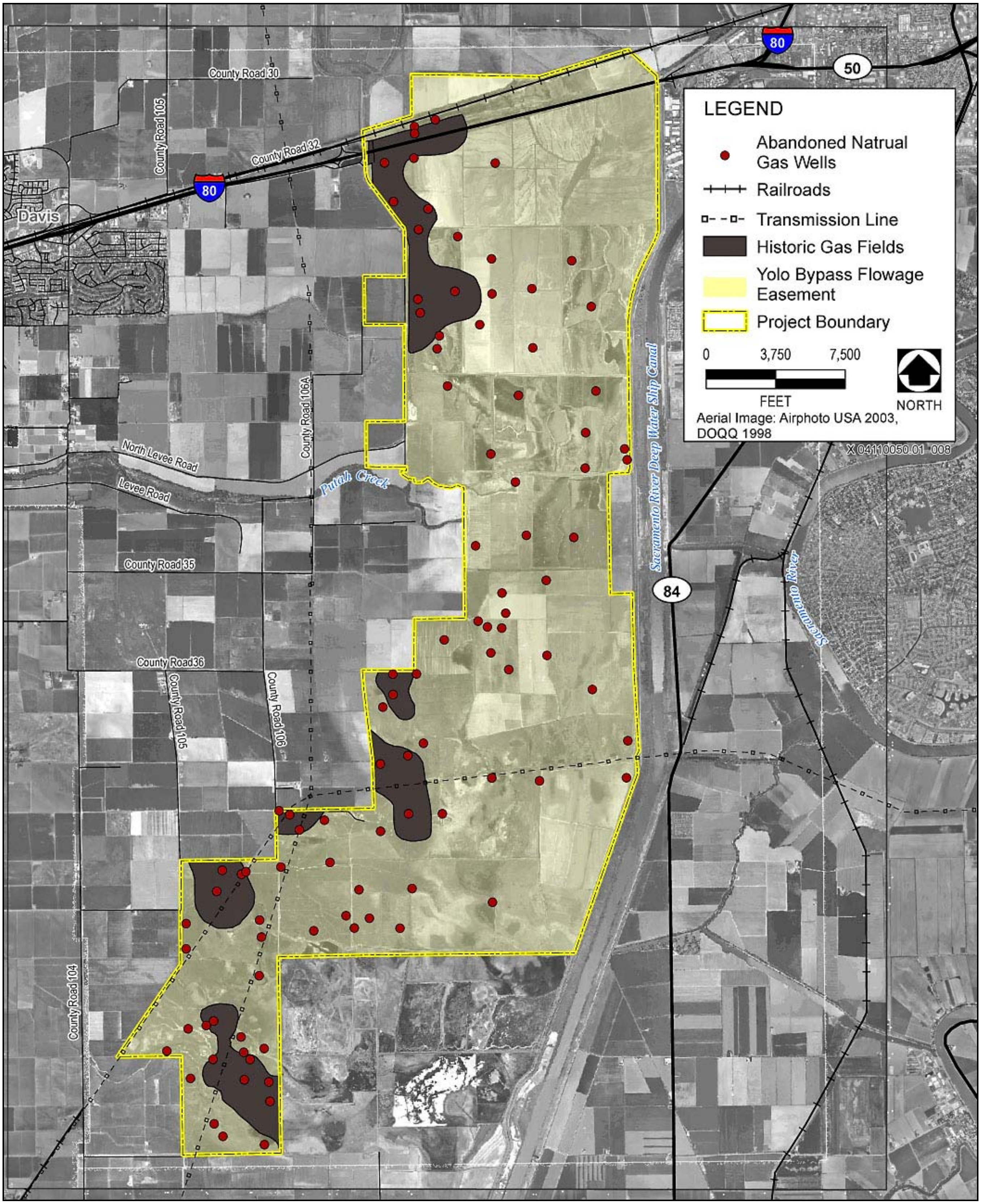
- Invasive or difficult-to-control vegetation, whether naturally occurring or planted, that impede or misdirect flood flows is not permitted to remain on a berm or within the floodway or bypass.

- The Reclamation Board may require clearing or pruning of trees and shrubs planted within floodways in order to minimize obstruction of flood flows.

DFG is required to obtain an encroachment permit from the Reclamation Board for projects such as building a pump tower, creating new wetlands, and proposing the planting of riparian vegetation. The permitting process may include conducting hydraulic modeling of the project to confirm the project would not adversely affect the conveyance of flood flows.

LEVEE EASEMENTS

The DWR and State Reclamation Board maintain easements for accessing levees. Both agencies conduct inspections on levees bounding the Yolo Bypass Wildlife Area. The DWR maintains the west side Bypass levees and Reclamation Districts 900, 899, 765, and 999 maintain portions of the east side levees (see Exhibit 2-4).



Source: Department of Fish and Game, SACOG 1005, City of Davis 2005, CASIL 1993

Easements and Rights-of-Way **Exhibit 2-2**

UNION PACIFIC RAILROAD RIGHT-OF-WAY

UPRR holds a right-of-way along the tracks that run through the Causeway Ranch Unit (North). Management activities in the UPRR right-of-way or modification of the trestle require UPRR approval.

CALIFORNIA DEPARTMENT OF TRANSPORTATION RIGHT-OF-WAY

Caltrans holds a right-of-way along the I-80 causeway and projects located in the right-of-way (Causeway Unit) may require Caltrans approval and/or an encroachment permit.

WETLAND RESERVE PROGRAM CONSERVATION EASEMENT

The prior owner of the Los Rios WRP Unit entered into a conservation easement with the WRP of the USDA NRCS on December 31, 2000. The WRP conservation easement is intended to perpetually restore and protect wetlands and precludes the use of this land for commercial agriculture.

PG&E EASEMENT

PG&E holds easements through the North Unit, Causeway Unit, Los Rios Farms Unit, Pacific Flyway Center Unit, and Tule Ranch Unit to allow for placement and necessary maintenance of transmission lines. Management activities in the PG&E easements area may require PG&E approval.

NATURAL GAS WELL EASEMENTS

There are numerous abandoned natural gas wells located throughout the Yolo Bypass Wildlife Area (Exhibit 2-2). All mineral, oil, and gas rights in the Causeway Ranch and Tule Ranch units have been retained by the previous owner (i.e., Colby Glide estate) (see below). The field location and easements of the wells and infrastructure must be determined prior to conducting substantial management activities in these areas. Additionally, an approved surface access agreement must be negotiated prior to accessing any mineral resources at the Yolo Bypass Wildlife Area.

OTHER EASEMENTS

In addition to UPRR and Caltrans rights-of-way, there are a number of gas pipelines and fiber optic cables running through the Causeway Unit. Gas pipelines such as the Kinder Morgan line are located in other units throughout the Yolo Bypass Wildlife Area. There is a Sacramento Metropolitan Utilities District (SMUD) pipeline along much of the east-side Toe Drain as far south as Lisbon.

2.3 EXISTING INFRASTRUCTURE

Existing infrastructure within the Yolo Bypass Wildlife Area includes water delivery and management facilities, roads, levees, utilities, houses and other structures. A discussion of each of these infrastructure components is provided below.

2.3.1 WATER RIGHTS, DELIVERY, AND MANAGEMENT

Water delivery and management in the Yolo Bypass Wildlife Area is largely dictated by existing water rights, delivery and easement agreements, and infrastructure. The delivery system is a complex system of canals, ditches, pumps including elevated pumps and control gates (Exhibit 2-1).

WATER RIGHTS AND DELIVERY AGREEMENTS

Water Rights

The primary sources of irrigation water for the Yolo Bypass Wildlife Area are the East Toe Drain and Putah Creek. Information on water rights associated with use of East Toe Drain and Putah Creek water by the original Yolo Bypass Wildlife Area (see Exhibit 1-4) can be found in the 1990 *Hydrologic Analysis of the Mace Ranch Portion of the Proposed Yolo Basin Wildlife Area* (Central Valley Habitat Joint Venture 1990) and two delivery and easement agreements.

Delivery and Easement Agreements

March 25, 1991 "Mace Ranch Irrigation System Grant of Easements and Water Delivery Agreement (see Appendix D)"

> This purpose of the agreement between Los Rios Farms, Inc., and Alhambra Pacific Joint Venture (now AKT) is to 1) allocate "pro rata" capacity in the Yolo Bypass Wildlife Area irrigation system, which functions both as a delivery and drainage system, 2) provide for the continued operation of the Mace Ranch Irrigation System, and 3) to allocate operation and maintenance (O&M) expenses and responsibility.
>
> Los Rios Farms and Alhambra Pacific Joint Venture (now AKT) and the Department of Fish and Game collectively own the Mace Ranch Irrigation System, which obtains water from the Toe Drain, Putah Creek, and various groundwater wells. Los Rios Farms is responsible for Irrigation System O&M, with parties to the agreement sharing in the capacity limitations. Sharing of available Putah Creek water is based on estimated annual water use. Each of the parties to the Agreement is to rely solely on their individual ground or surface water rights or contracts as the basis for their water diversions into the Irrigation System. Parties agree to maintain all their riparian, appropriative, or other water rights.
>
> Prior to each irrigation season, the Yolo Bypass Wildlife Area's manager estimates annual summer irrigation needs and coordinates with Los Rios Farms in order to determine shared irrigation system capacity for the coming irrigation season.

December 30, 1991 "Agreement and Grant of Easements"

> This purpose of this agreement between Alhambra Pacific Joint Venture (now AKT) and DFG is to convey, by Grant Deed, the property listed in "Exhibit A" (of the agreement) from PG&E to DFG for use as wildlife habitat, and to grant easements from DFG allowing PG&E to collect, transport, and use water and water rights retained by PG&E. As owner of the property, DFG is subject to the 3-25-91 "Mace Ranch Irrigation System Grant of Easements and Water Delivery Agreement." A series of DFG easements grant PG&E the ability to construct, access, maintain, and operate the Irrigation Facilities (including roads, wells, and ditches), the Second Putah Creek Dam, and other water conveyance facilities. Term 5 allows PG&E to extract groundwater and use or sell it on or off the property, while Term 9 states that PG&E has transferred to DFG all water rights to "Exhibit A" properties, or other Yolo Bypass properties DFG acquires which have a "proprietary or cooperative management interest", which are "reasonably necessary for wildlife habitat purposes." PG&E reserves that amount of water not used by DFG as reasonably necessary for wildlife habitat purposes.

DFG use of water is conditioned by the following:

- Term 9(a) allows DFG use of water for wildlife habitat purposes on other property within the Yolo Bypass.
- Term 9(b) requires DFG to use surface water first and only then allows use of groundwater. Groundwater can be pumped if there is a surface water delivery failure, or if surface supplies are insufficient or unsuitable, but cannot be pumped due to inadequate capacity in the existing surface water delivery facilities.
- Term 9(c) allows PG&E to deliver groundwater to DFG in lieu of DFG using surface water, and to use, sell, or transfer an equal amount of surface water.
- Term 9(d) allows DFG construction and operation of wells for domestic and “similar” uses.
- Term 9(e) states that if DFG requires groundwater for habitat purposes under 9(b), the wells and conveyance facilities listed in Exhibit B (existing Well Sites C1, C2, C3, 49SW, 57NW, 57SW, and proposed Well Sites #1 through #8) and Exhibit C (Putah Creek Temporary Dam and associated lands) can be used, with DFG responsible for payment of power costs and a prorated sum for well wear and tear.

The previous terms restrict the use of water by DFG from the Mace Ranch Irrigation System to wildlife habitat purposes only on those properties purchased from Alhambra Pacific Joint Venture in 1992 and any adjacent properties. These rights are now held by their successor, AKT Properties. This lien precludes DFG’s use of Mace Ranch Irrigation System water for agricultural purposes anywhere on the Yolo Bypass Wildlife Area. Additionally, the DFG may not use the 10 described wells located on DFG property. For these reasons, irrigation systems have been developed to independently deliver water for agricultural uses on the Wildlife Area.

Riparian Rights

The DFG has a riparian right to pump from the east side Toe Drain. This is accomplished at several pump stations. Other farmers in the area also receive irrigation water from the same source which is lifted into the Mace Ranch Irrigation System. As stated above, each of the parties to this system still retains their water rights to Putah Creek or the Toe Drain that they had prior to entering this agreement. In addition to the Toe Drain, DFG also has a riparian right on Putah Creek.

The approximately 9,000-acre Tule Ranch Unit has riparian water rights from the East Toe Drain, which is located at the eastern boundary of the unit. The water is delivered via a series of canals and lift pumps to all areas of the unit.

The Los Rios Farms Complex has a licensed appropriative water right issued by the State Water Resources Control Board (application No. 17201, Permit No. 10867, License No. 9707) for diversion of 196 acre-feet per annum (afa) from South Fork Putah Creek from April 1 to September 15 of each year for use on 120 acres within the southwest 1/4 of Section 22.

As additional wetlands are developed, there will be a need to develop additional water delivery systems to fully utilize the water available to the Wildlife Area, while being respectful of the water needs of local farmers.

Water Delivery and Management

A complex system of canals, elevated pumps, submersible pumps, and various other water control structures is maintained and used to flood and drain wetlands within the original Yolo Bypass Wildlife Area units according to established prescriptions. These actions are designed to generally mimic the natural flooding and drainage that once occurred in the Yolo Basin.

The primary source of irrigation water for the Yolo Bypass Wildlife Area is the East Toe Drain. The East Toe Drain pool is tidal water that is trapped behind the Lisbon Weir; it also includes limited amounts of drainage water from the Willow Slough Bypass and the Tule Canal.

Lisbon Weir, looking north (upstream) the East Toe Drain

The Lisbon Weir maintains the water level in this pool. The Lisbon Weir is located approximately 6.75 miles south of I-80 along the east levee of the Yolo Bypass. The Lisbon Weir has existed in one form or another for several decades. It currently consists of a porous rock berm and series of flap gates that pass water north during high tides and trap this water at low tide.

Water is diverted from the East Toe Drain and Putah Creek into the original Yolo Bypass Wildlife Area at the following three points (see Table 2.3-1):

- *Northeast Submersible Pump Station:* Three submersible pumps (50 horsepower [hp] each) lift water into the ditch that runs across the top of the northeast section. This provides water to the Northeast Unit of the Yolo Bypass Wildlife Area.

- *Main Lift Pump Station:* Four elevated low lift pumps (one at 75 hp and three at 60 hp) located at the Main Lift Station, lift water into the central ditch (aka the cross canal). This water is augmented by the Putah Check Dam when it is in place. This portion of the system feeds the Central Unit, the Northwest Unit, the West Unit and after a second lift (the 180 pump), the North and Causeway Units. This system also feeds the South Unit downstream of the Putah Creek Check Dam. The West Unit also has a low lift pump which is used for drainage. As previously discussed this Main Lift Station is an integral part of the Mace Ranch Irrigation System and the DFG is precluded from utilizing this water for agricultural purposes.

- *South Submersible Pump Station:* Two submersible pumps (50 hp each) pump water into the Central Unit and the South Unit. This pump station is used when the Los Rios Check Dam has been removed or to augment Putah Creek flows.

- *180 Pump Station:* One 20 hp elevated low lift pump floods wetlands in the North Unit, the Causeway Unit and also supplements wetland areas at the north end of the northwest unit. This pump is fed from the Mace Ranch Irrigation System along the western toe drain of the west exterior levee.

Table 2.3-1
Water Diversion and Delivery for the Original Yolo Bypass Wildlife Area

Unit Name	Primary Water Source	Water Pumped from	Water Supply Augmented by
Causeway Unit	East Toe Drain	East Toe Drain pool	--
North Unit	North Pump	Cross Canal connecting to West Toe Drain	180 Pump Station
Northeast Unit	Northeast Pump Station	East Toe Drain	--
Northwest Unit	Central Pump Station Los Rios Check Dam	Cross Canal connecting to East Toe Drain	180 Pump Station
West Unit	Main Lift Station Putah Creek Check Dam	Cross Canal connecting to East Toe Drain	Drainage of unit through west pump
Central Unit	Main Lift Station Putah Creek Check Dam South Pump Station	Cross Canal connecting to East Toe Drain	--
South Unit	Main Lift Pump Station Putah Creek Check Dam South Pump Station	--	--

Source: California Department of Fish and Game 2001

Water also enters the Yolo Bypass Wildlife Area directly from Putah Creek via the Putah Creek Check Dam. The dam is typically operated from April through the end of November. This water flows by gravity to the Northwest, Central, West, and South Units of the Yolo Bypass Wildlife Area.

Approximately 0.2 mile north of I-80 at the east level, the tenant uses a diesel pump to lift water from the Willow Slough Bypass. This water irrigates agricultural fields on the Causeway North Unit.

In addition to the pump stations described above, there are ten existing groundwater wells, none of which is currently in production. Only one has a motor, and this has been submerged during flood events. The status of the wells is currently unknown. Use of these wells was retained by the former owner of the property as a condition of sale as previously described. Water availability for the original Yolo Bypass Wildlife Area can become limited during the spring and summer months when adjacent agricultural lands are irrigated for crop production. This makes it difficult for DFG to irrigate seasonal wetlands quickly. Strategies to address this issue are presented in Chapter 5, “Management Goals.”

Causeway Ranch Unit (North). The sources of irrigation water for the Causeway Ranch (north) are the Willow Slough Bypass and the west toe drain of the Yolo Bypass. The water from these sources enters a borrow ditch along the UPRR trestle and flows east toward the East Toe Drain. Approximately 1 mile east of the west levee, the tenant uses a diesel pump to lift water from the borrow ditch for irrigation. The water level in the ditch is controlled using an earthen dam with a culvert and flashboard riser located on or adjacent to the Yolo Bypass Wildlife Area, approximately 1.6 miles east of the west levee. This pool of water is also used by the Swanston properties located north of the Yolo Bypass Wildlife Area. The lease tenant on this unit maintains the pump, dam, and ditches on this unit. DFG is not required to participate in any of the maintenance. It may be possible to receive delivered water from the Yolo County Flood Control and Water Conservation District through the Willow Slough Bypass.

Causeway Ranch (Main) and 1,000 Acres Units. The primary source of irrigation water for the Causeway Ranch (Main) and 1,000 Acres Units is the East Toe Drain, facilitated by the Lisbon Weir. Two primary pumping plants (G 52 and G 55) and two secondary pumping plants (G 32 and the 180 pump) serve the two units. The northernmost pumping plant (G 52 in the East Toe Drain) serves approximately 609.5 acres in the northeastern corner of the Causeway Ranch Unit. The G 55 pumping plant serves the balance of the approximately 1,847 acres in the two units. This pumping plant can serve approximately 940 acres by gravity. The balance of the two units is irrigated out of the Green's Lake pool by means of secondary pumping plants. The north-central portion of the Causeway Ranch Unit, comprising approximately 637 acres, is served by pumping plant G 32. The southwestern 80 acres of the 1,000 Acres Unit is served by the Mace Ranch Irrigation System making it unavailable for agricultural activities.

Since the DFG purchase of the Glide Ranch, significant improvements have been made to ensure that irrigation could continue on this property. These improvements were necessary to ensure adequate water for both agriculture and managed wildlife habitat and to increase land management options restricted by aforementioned agreements with the previous land owners.. The first improvements made were to the pump stands at pumping plants G 32 and G 52. These improvements consisted of new elevated permanent pump stands installed in fall 2002 and spring 2003 to raise the electrical panels above the floodplain (as required by PG&E). In fall 2003, new pumps were added to these pump stands to replace the seasonally installed pumps that were previously being rented from Los Rios Farms. These improvements allow for the post harvest flooding of rice, attracting thousands of migratory waterfowl and shorebirds on an annual basis.

Extensive improvements have been made to the irrigation delivery system in addition to the installation of replacement pump stations. These improvements have consisted of enlarging and cleaning the irrigation ditches and installing new turnouts, drainpipes, and rice boxes. The improvements to the ditches and control structures were necessary for the system to deliver and drain water in a timely manner, thus enabling proper water control. The proper control of water is critical for rice production and seasonal wetland flooding and minimizes the potential for production of mosquitoes. These improvements were financed largely by the rice rent revenues from 2002 and 2003. Furthermore, the lease tenant provided operators, fuel, and maintenance in exchange for the use of DFG's excavator, tractor, and scraper to accomplish several components of these improvements.

Los Rios Farms Complex. The Los Rios Farms complex consists of several properties that were owned by Los Rios Farms, PG&E Properties, and L. Parker. The source of water on these properties historically has been a combination of groundwater wells and Putah Creek. These properties are located on the north and south sides of Putah Creek and adjacent to the original Yolo Bypass Wildlife Area and include the following management units: Los Rios, Los Rios WRP, Cowell Pond, Parker, Field 29, and Field 38. Irrigation water is drawn from Putah Creek in several locations to serve these lands. The easternmost lift pump is located on Putah Creek approximately 1.65 miles west of the East Toe Drain and 0.8 mile north of the Tule Ranch Unit's northern boundary. This pump provides water to approximately 350 acres of land south of Putah Creek. Adjacent to this low lift pump is a well, which supplies water to the same acreage. On the north side of Putah Creek, there are three fields (parcels) inside the levee. The two eastern fields have been served either by a well (currently non-operational) or by a lift pump located approximately 1 mile upstream of the Los Rios Check Dam.

Tule Ranch. The Tule Ranch Unit consists of two distinct subunits in regard to agriculture and water management. The northeastern subunit consists of a mixture of irrigated crops and dry pasture and the southwestern subunit consists of irrigated pasture and dry pasture.

Tule Ranch (Northeastern Subunit). The northern portion of the northeastern subunit has historically received water from the East Toe Drain pool (above the Lisbon Weir) through a series of two lift pumps. The first lift station was located approximately 0.9 mile west of the East Toe Drain along the unit's north boundary, and the second was located approximately 1.65 miles west of the East Toe Drain along the unit's north boundary. Currently there are no lift pumps at either of these locations. A duck stamp proposal has been submitted and approved to rebuild the first lift station and should be completed in 2006 or 2007. Once the water is lifted, it will flow though a series of highline ditches to surrounding fields. The current lease tenant has constructed a ditch from the Los Rios Check Dam pool approximately .8 mile upstream of the dam to deliver water to the Tule Ranch. A lift pump located on Putah Creek approximately 1.65 miles west of the East Toe Drain and approximately 0.8 mile north of the Tule Ranch Unit's north boundary is lifting the water into the ditch. This lift station is described above as part of the Los Rios Farms system. The ditch has enabled parts of the northeastern subunit to be irrigated from the Mace Ranch irrigation system pool.

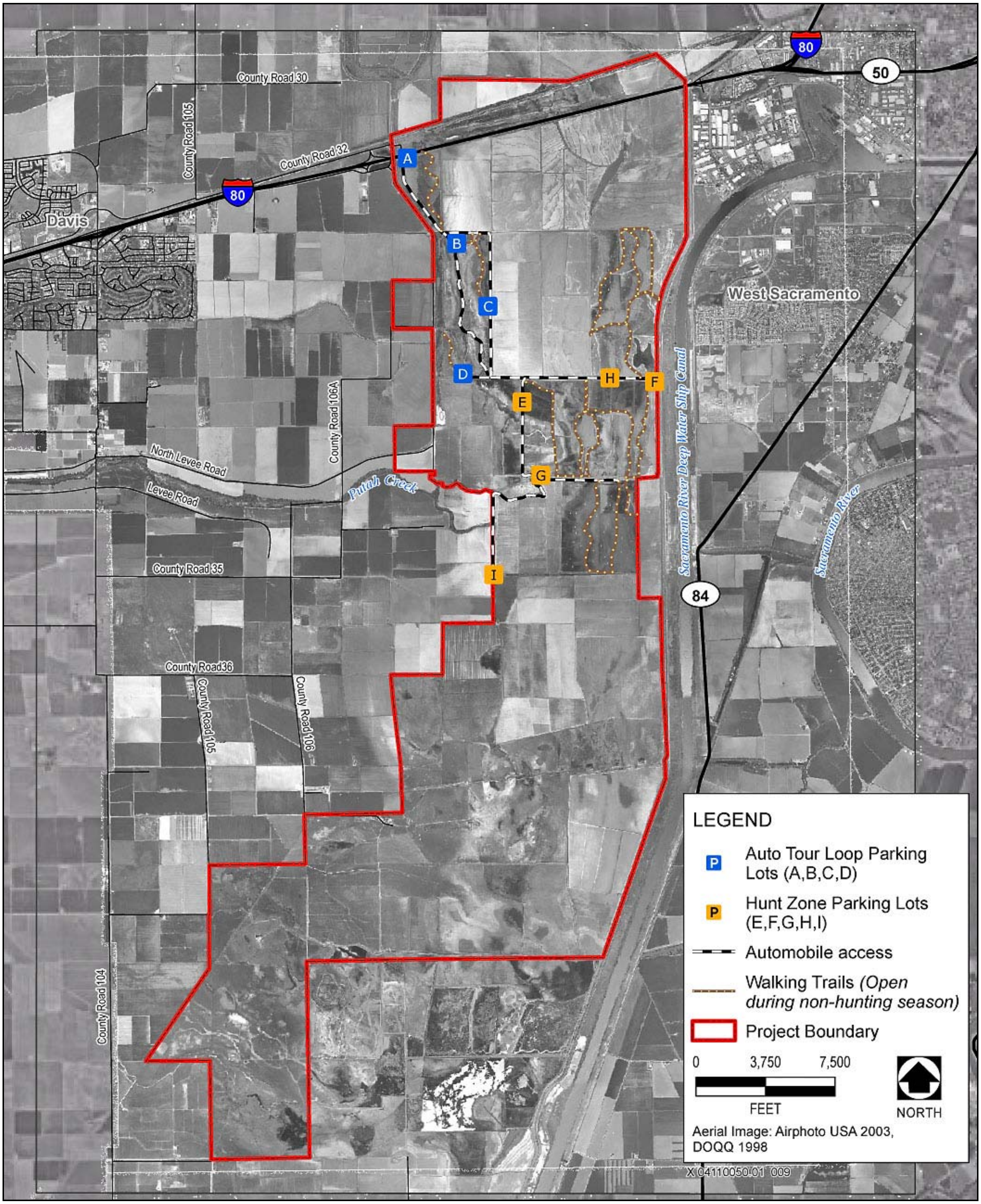
The northeastern subunit also has historically received water from the East Toe Drain below the Lisbon Weir. This southern portion of the northeastern subunit had two lift stations in the southern pool (as described below). These lifts were located approximately 0.2 mile and 1.65 miles west of the East Toe Drain, respectively. Currently only remnants of the western lift station remain. It is uncertain how long this facility has been out of use. No irrigated crops have been planted on this portion of the Tule Ranch Unit in recent years.

Tule Ranch (Southwestern Subunit). The southwestern subunit consists of irrigated and dry pasture. The irrigation water is first lifted directly from the East Toe Drain below the Lisbon Weir. The first lift station consists of two electric pumps located approximately 8.8 miles south of I-80 and 5 miles east of County Road 104. The first lift pumps water into a 2.5-mile canal that flows west to the second lift. The second lift consists of two pumps located approximately 8.8 miles south of I-80 and 2.5 miles east of County Road 104, respectively. These pools also receive drainage water from farms west of the Yolo Bypass Wildlife Area from the lands within Reclamation District (RD) 2068 and the Dixon Resource Conservation District (Dixon RCD). While the volume of water varies over the irrigation season, this drainage water reduces the total amount pumped from the East Toe Drain. Water from this system irrigates approximately 764 acres of pasture on the Tule Ranch.

In addition, water is provided to the Bull Sprig Outing, Senator Outing, H-Pond, Skyrakers, and Glide-In Ranch duck clubs per agreements that DFG inherited when it purchased the Tule Ranch. The water usage of the duck clubs approximates 330 acres of permanent wetlands and 1,290 acres of seasonal wetlands. Maintenance and power costs for the first and second lift stations and maintenance costs for approximately 3.3 miles of canals is shared by the DFG's southwest Tule Ranch Unit lease tenant and the duck clubs. Water usage ratios have been developed to determine the share for each property. A discussion of water delivery agreements for the duck clubs is provided below in Section 2.4.1, "Legal Constraints and Existing Agreements."

2.3.2 ROADS

Access to the Yolo Bypass Wildlife Area is provided via gravel roads. Nine miles of gravel roads are currently available for public use on the Yolo Bypass Wildlife Area, when Bypass flow water is not present. The gravel roads lead to nine parking lots (i.e., lots A–I) that allow access to the hiking trails and hunting sites in the Yolo Bypass Wildlife Area (Exhibit 2-3). All roads within the Yolo Bypass Wildlife Area are currently maintained by DFG. Approximately 10 miles of gravel roads on the Tule Ranch also provide access to several duck clubs located south of the Yolo Bypass Wildlife Area (see Section 2.4.1, "Legal Constraints and Existing Agreements," for additional information on access agreements). These clubs, as well as the south west Tule Ranch tenant will share in any future maintenance costs of these roads.



Source: Department of Fish and Game, City of Davis 2005, CaSIL 1993

Current Roads, Trails, and Parking Lots **Exhibit 2-3**

2.3.3 LEVEES

The Yolo Bypass is the largest feature of the SRFCP (Exhibit 2-4). In addition to 980 miles of levees along the Sacramento, Feather, and American Rivers and a number of smaller creeks and rivers, the SRFCP includes three flood relief structures and five overflow weirs that shunt excess flows from the main Sacramento River channel into the Butte Basin and two flood bypasses (Sutter and Yolo). Runoff from the entire Sacramento Valley watershed reaches the Sacramento–San Joaquin Delta via the lower Sacramento River and the Yolo Bypass. The design capacity of the Yolo Bypass (500,000 cubic feet per second at the southern end) is approximately 4.5 times greater than the capacity of the lower Sacramento River; consequently, the Yolo Bypass is relied upon as the principal means of draining the Sacramento Valley during major floods.

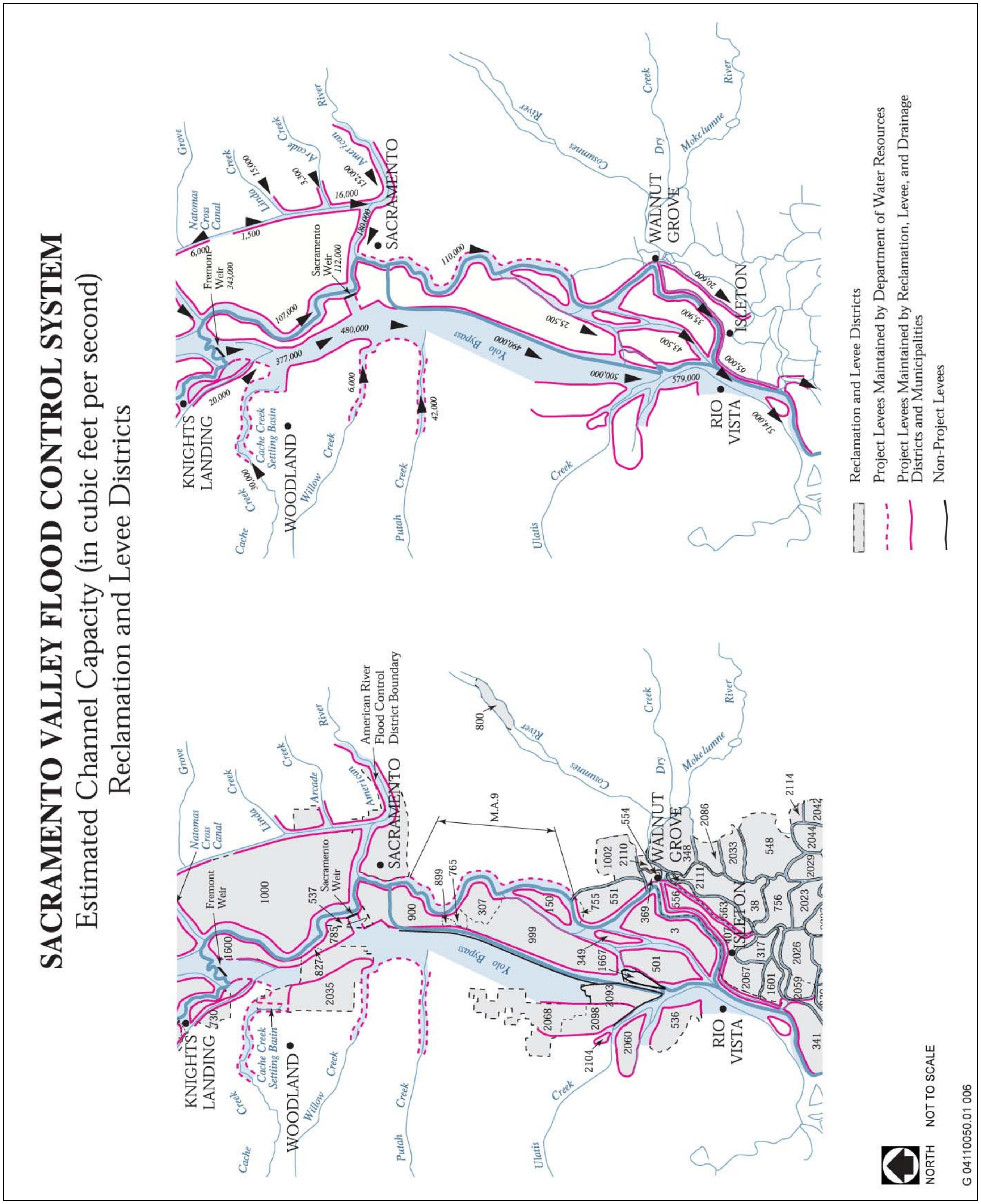
The Yolo Bypass is approximately 41 miles long and is bounded on the east side and along most of the west side by levees constructed by the U.S. Army Corps of Engineers (USACE). Construction of the levees began in 1917, and the Sacramento and Fremont Weirs (the two spillways that release water from the Sacramento River into the Bypass) were built in 1917 and 1924, respectively. The height and grade of the levees are designed to match the calculated water-surface profile of the design flow, with an extra allowance for freeboard. An 8-mile segment along the western boundary of the Yolo Bypass between the South Fork of Putah Creek and 1 mile north of County Road 155 has no levee. The natural ground elevation in this area is close enough to the design flood stage that a levee was considered unnecessary.

The conveyance capacity of the southern half of the Yolo Bypass (including the area within the Yolo Bypass Wildlife Area) was decreased by construction of the Sacramento River Deep Water Ship Channel. The channel was completed in 1963. Dredged material excavated during construction of the 30-foot-deep channel was used to build a second levee along the west side of the channel adjacent to the East Toe Drain. This levee extends from near the I-80 causeway (i.e., Causeway Ranch Unit) to the southern tip of Prospect Island. The second levee of the Sacramento River Deep Water Ship Channel is classified as a navigation levee and is not constructed or maintained to flood control levee standards. However, because it is higher than the original federal flood control levee on the east side of the channel, it constitutes the new east levee of the Yolo Bypass for practical purposes.

Berms and interior levees within the Yolo Bypass could potentially obstruct the conveyance of diverted river flows,. Land grading within the Bypass is restricted by the State Reclamation Board. Interior or restricted-height levees have historically been allowed within the Yolo Bypass to prevent inundation of selected areas from tidal fluctuations and small floods; however, the height of those levees, most of which existed when the Bypass was constructed, is limited to minimize flow obstruction during large floods. Generally berms no taller than 3 feet are allowed within the Yolo Bypass. Higher berms are approved on a case-by-case basis. Other major earthen berms, more or less perpendicular to flow, include the berms that support about half of the length of the I-80 causeway and the nearby UPRR causeway (Causeway Ranch Unit [North]) and portions of the embankment for the abandoned SNRR line that cuts diagonally across the Yolo Bypass a few miles to the south (Tule Ranch Unit).

2.3.4 UTILITIES

Utilities are limited throughout the Yolo Bypass Wildlife Area. The primary utilities located throughout the Yolo Bypass Wildlife Area include PG&E transmission lines running along the UPRR and SNRR track right-of-ways through the Causeway and Tule Ranch unit, respectively. An additional PG&E transmission line runs from north to south through the southwest portion of the Tule Ranch Unit. Exhibit 2-2 depicts utilities running through the Yolo Bypass Wildlife Area. Additional utilities include the several fiber optic cable and gas pipelines running through the Causeway Unit, lower voltage transmission lines running throughout several units to serve pump stations, the Kinder Morgan petroleum pipeline running through several units, and a SMUD pipeline running adjacent to much of the East Toe Drain on the east boundary of the Yolo Bypass Wildlife Area.



Source: California Department of Water Resources

Sacramento River Flood Control Project **Exhibit 2-4**

2.3.5 HOUSES AND OTHER STRUCTURES

There are four residences in the Yolo Bypass Wildlife Area (including the headquarters complex). Two residences are located at the historic Tule Ranch Headquarters on the Tule Ranch Unit. One of these homes date back to at least the early 1900's and may have some historical significance. The ranch headquarters also has a complex of corrals used to process livestock. Also found in the Tule Ranch Unit is a large barn (Umbrella Barn) thought to have been constructed in the 1930s. This barn could be used as an educational facility for interpretation of the adjacent vernal pools. The Tule Ranch headquarters may also serve as an interpretive facility that could allow students to experience the role that agriculture has played in the Yolo Basin. The third residence is located in the Pacific Flyway Center Unit and will be retained for use as a caretaker's residence. This house is currently being remodeled. A fourth residence is located within the headquarters complex on County Road 32B (see below).

Other structures in the Yolo Bypass Wildlife Area include a hunters' check station that is operated during the fall and winter hunting season. A trailer currently serves as the check station. The trailer is transported and placed on-site at the south end of the auto tour route near parking lot D, and removed with the onset of potential winter flooding. Portable toilets are placed in some parking lots of the Yolo Bypass Wildlife Area during the appropriate seasons. They are removed prior to flooding. Heavy concrete picnic tables are currently located at lots B, C, D, F and G. These can safely withstand flooding.

In addition, the Yolo Bypass Wildlife Area is currently administered from the DFG headquarters complex on Chiles Road 1 mile west of the Yolo Bypass. This 13-acre complex includes a 3-acre demonstration wetland, the aforementioned residence, maintenance shop, office building with a conference room, restrooms, display area and office space for employees of both DFG and the Yolo Basin Foundation. Three sheds provide space for storage of educational materials and miscellaneous supplies. Additionally, the site is the home of the Yolo Fish Screen shop, whose function is to fabricate, install, and maintain fish screen structures throughout the northern California area.

2.4 MANAGEMENT SETTING

This section describes the existing management setting of the property. The current management of the Yolo Bypass Wildlife Area operates under several legal constraints and existing agreements. These constraints and agreements are discussed in detail below.

2.4.1 LEGAL CONSTRAINTS AND EXISTING AGREEMENTS

SACRAMENTO RIVER FLOOD CONTROL PROJECT—PROJECT MODIFICATION AGREEMENT

DFG, DWR, the State Reclamation Board, and USACE have a management agreement (in lieu of an encroachment permit) that allows for project modifications as long as they are compatible with flood control. Under this agreement signed in 1994, DFG assumes responsibility for all claims of damage or liability. DFG is responsible for maintenance of lands within the boundaries of the project modification (i.e., The Yolo Bypass Wildlife Area). This maintenance is consistent with the purposes of public safety and is detailed in the draft USACE Operating Manual. In this agreement, the following statement appears: "DFG will endeavor to manage the Project Modification in a manner that will be compatible with agricultural practices" (U.S. Army Corps of Engineers 2003).

AGREEMENT UNDER SECTION 8618 OF THE CALIFORNIA WATER CODE

For purposes of managing the Yolo Bypass Wildlife Area, DFG entered into an agreement with the State Reclamation Board under Water Code Section 8168, for maintenance of the Yolo Bypass floodway.
This agreement make the Department of Fish and Game responsible for maintaining the Wildlife Area in a condition that is compatible with the flood control function of the Yolo Bypass.

Section 8618 of the California State Water Code states:

> All political subdivisions, agencies of the State, and municipal and quasi-municipal corporations may make agreements with the board obligating themselves to do or perform those things which are required of the State, political subdivisions thereof, or other local agencies by the act of Congress approved June 22, 1936, or any acts amending or adding to it, now or hereafter adopted.
>
> When an elimination, modification, or alteration of any authorized plan of flood control is made at the request of a political subdivision, agency of the State, or municipal or quasi-municipal corporation, the political subdivision, agency of the State, or municipal or quasi-municipal corporation may, in agreements made pursuant to this section, assume responsibility for all claims of damage or liability made against the State and its agencies or the United States and arising from the requested elimination, modification, or alteration of the authorized plan of flood control.

GLIDE RANCH/LOS RIOS FARMS ACQUISITION

Several assurances were conveyed to the Delta Protection Commission and the Yolo County Board of Supervisors during the 2001 acquisition of the Glide Ranch and Los Rios Farms. These assurances are as follows:

- Land Management Plan commitments:
  - In recognition of the importance of developing an LMP appropriate to local, state, and federal goals for the area, DFG committed to wide public involvement and an open process including coordination and involvement and input from stakeholder groups such as the Yolo Bypass Working Group (see Chapter 1 for a discussion on the planning process and Appendix A for a summary on public outreach).
  - No land use changes will be made until a land management plan is completed.
  - Upon acquisition (in 2001), existing agricultural leases will be maintained until the LMP is completed. At this time, the state will enter into a bid process to begin the renegotiation of the agricultural leases.
  - The management plan will be subject to treatment under the California Environmental Quality Act (CEQA) prior to DFG consideration.
  - The property will be managed in strict compliance with any conditions of the State Reclamation Board (see below for additional discussion).
  - There is no desire or intent to transfer any of the water associated with the property outside of Yolo County.
  - The payment of appropriate in-lieu fees is prescribed by state law. These include payments for county taxes and irrigation, drainage and reclamation district assessments. In addition, the DFG pledges to work with mosquito abatement districts and other special districts to address their concerns.
- All mineral, oil, and gas rights on the Glide Ranch properties (Tule Ranch and Causeway Ranch) will be retained by the previous owner (i.e., Colby Glide estate).
- Water delivery and road access agreements shall be maintained with neighboring duck clubs south of the Yolo Bypass Wildlife Area (see below for additional discussion).

Tule Ranch–Duck Club Agreements

Two types of existing agreements with duck clubs (located to the south of the Tule Ranch) were conveyed as part of the Wildlife Conservation Board's (WCB's) acquisition of the Tule Ranch. The first type of agreement allows the Bull Sprig and Skyrakers duck clubs to use the Yolo Bypass Wildlife Area road and to receive water from the Yolo Bypass Wildlife Area irrigation system. The second type of agreement allows H Pond and Channel Ranch duck clubs access to the appropriate Yolo Bypass Wildlife Area road. Two additional clubs, the Senator Outing Duck Club and the Glide-In Ranch Duck Club, did not appear to have agreements with the Glide Colby estate; however, they do use the Yolo Bypass Wildlife Area road and receive water from the Yolo Bypass Wildlife Area irrigation system. Agreements with each of these clubs will be updated and executed as soon as possible.

Tule Ranch–Bull Sprig Duck Club Agreement

The Bull Sprig Duck Club consists of approximately 120 acres, of which 100 acres are irrigated from the Yolo Bypass Wildlife Area irrigation system. This club receives both summer and fall water. Summer usage is typically 1 acre-foot per acre (af/acre) and fall water is typically 5 af/acre. The water is delivered to this club just west of the second lift station described above. The agreement states that the "Duck Club shall pay its pro rata share (based on percentage of total usage by all duck clubs) of all electric bills and its pro rata share of all expenses associated with regular maintenance of said pumps." The percentage of use, and thereby the pro rata share, for the duck club shall be determined relative to the overall water use in the Tule Ranch southwestern subunit. These percentages shall then be applied to the electricity and maintenance costs as outlined in the agreement.

The agreement also requires the duck club to pay its pro rata share of all expenses required to maintain its road access. The distribution of road maintenance costs needs to be considered in greater detail to determine the basis for the pro rata shares.

Tule Ranch—Skyrakers Duck Club Agreement

The Skyrakers Duck Club consists of approximately 340 acres, of which 240 acres are irrigated from the Yolo Bypass Wildlife Area irrigation system. This club receives both summer and fall water. Summer usage is typically 1 af/acre and fall water use is typically 5 af/acre. The water is delivered to this club just west of the second lift station. As with the Bull Sprig Duck Club, the agreement with the Skyrakers Duck Club requires the duck club to pay its pro rata share of electric bills and expenses associated with pump maintenance and road access (although road maintenance cost distribution needs to be considered in greater detail).

Tule Ranch–Channel Ranch Duck Club Agreement

The Channel Ranch Duck Club consists of approximately 191 acres. This duck club does not receive water directly from the Yolo Bypass Wildlife Area irrigation system but is at the downstream end of the drainage system of the various clubs. The agreement pertains to road access and requires that the duck club pay its pro rata share of all expenses required to maintain their road access. As with agreements with other duck clubs, the distribution of road maintenance costs needs to be considered in greater detail to determine the basis for the pro rata shares.

Tule Ranch–H Pond Duck Club Agreement

The H Pond Duck Club consists of approximately 480 acres, of which 250 acres receive water from the Yolo Bypass Wildlife Area irrigation system. The agreement also requires that the duck club pay its pro rata share of all expenses required to maintain their road access. As with agreements with other duck clubs, the distribution of road maintenance costs needs to be considered in greater detail.

Tule Ranch–Senator Outing Duck Club

The Senator Outing Duck Club consists of approximately 480 acres, of which 360 acres are irrigated from the Yolo Bypass Wildlife Area irrigation system. This club receives both summer and fall water; summer usage is typically 1 af/acre and fall water is typically 5 af/acre. The water is delivered to this club just west of the second lift station.

DFG has been unable to locate a previous agreement with the Glide Colby Estate to cover the use of the irrigation system or the road. Payment of a pro rata share should be handled as described above for other duck clubs.
The club currently uses the Yolo Bypass Wildlife Area road to access the property; however, there appears to be no agreement to cover this use or maintenance of the road.

Tule Ranch–Glide In Ranch Duck Club

The Glide In Ranch Duck Club consists of approximately 1,160 acres, of which 340 acres are irrigated from the Yolo Bypass Wildlife Area irrigation system. This club receives only fall water. Fall usage is typically 5 af/acre. The water is delivered to this club from a new lift station just east of the second lift station. As with the other duck clubs, the agreement with the Glide In Ranch Duck Club requires the duck club to pay its pro rata share of electric bills and expenses associated with pump maintenance. The club currently uses the Yolo Bypass Wildlife Area road to access the property; however, there appears to be no agreement to cover this use or maintenance of the road.

Williamson Act Contracts

Before the Glide Ranch was acquired by the WCB, portions of the ranch (i.e., Tule Ranch and Causeway Ranch) were under Williamson Act contract (entered into by Peggy Glide Colby and Thorton Glide on September 6, 1972). (The Geiberson Ranch portion of the Glide Ranch was not under Williamson Act contract.) Because the land was acquired by the State of California (i.e., WCB), a new Williamson Act contract was not required (pursuant to California Government Code Section 51295). However, as stated in Government Code Section 51292, it is the policy of the state that public agencies cannot locate public improvements in agricultural preserves unless specific findings can be made:

> The location is not based primarily on a consideration of the lower cost of acquiring land in an agricultural preserve. *(Section 51292[a])*
>
> If the land is agricultural land covered under a contract pursuant to this chapter for any public improvement, that there is no other land within or outside the preserve on which it is reasonably feasible to locate the public improvement. *(Section 51292[b])*

The first finding was made (by Yolo County Planning and Public Works Department), as the selection of the properties was based on their historic wetland nature and their location relative to the original Yolo Bypass Wildlife Area. The properties represented an expansion of the Yolo Bypass Wildlife Area and contain interrelated water systems and accesses.

This second required finding was also supported, as the purpose of the acquisition is both preservation of historic wetlands and expansion of the existing Yolo Bypass Wildlife Area, and the selected property is within the Bypass, is contiguous with the original Yolo Bypass Wildlife Area, and contains habitat acceptable for DFG’s needs for species of concern. Another location would not have met these criteria (Yolo County Planning and Public Works Department 2001).

Local Fees

A suite of fees have been requested from the DFG for the operation of the Yolo Bypass Wildlife Area. The current status of these requests are discussed below.

Yolo County Tax Assessments – DFG supports payment of County in lieu fees and budget requests have been made to make such payments; however, these budgetary requests have not been passed in the state legislature. DFG will continue to make budgetary requests to cover in-lieu fees for County taxes.

Yolo County Flood Control and Water Conservation District (Southeast Davis Drainage and Maintenance District [SDDMD]) – DFG has committed to make payment for benefits and services provided by SDDMD.

Yolo County Fire Assessments – The DFG has paid Yolo County Fire Assessment fees for the period from 1997-2003 based on commitments made at the time of the land acquisition. Assessments for years beyond the initial time period, however, are evaluated as to their validity under Proposition 218, including whether such assessments meet the "special benefit" requirement of California Constitution Article 13D Section 4(a) or are precluded from assessment as a general governmental service such as those designated in Article 13D Section 6(b)(5).

North Delta Water Agency Assessments – In Wildlife Management Areas, Fish and Game Code provides, by statute, for the payment of irrigation, drainage, or reclamation district assessments. (CA Fish and Game Codes, section 1504(a).) However, North Delta Water Agency's assessment does not fit into these statutorily pre-approved payment categories. Additionally, North Delta Water Agency's contract with DWR is unique and this makes any assessments unique as well. As a result, no conditions or commitments to pay these assessments were made at the time of the land acquisition. DFG will carefully analyze the legal and equitable grounds under which the DFG would owe such an obligation.

MEMORANDA OF UNDERSTANDING

Memoranda of Understanding Regarding Threatened and Endangered Species

The Yolo Bypass Wildlife Area Memorandum of Understanding (MOU) between DFG, the State Reclamation Board, DWR, and the U.S. Fish and Wildlife Service (USFWS) articulates an agreement between these agencies on construction and maintenance of the Yolo Bypass Wildlife Area within flood control constraints, as well as constraints of the federal and California Endangered Species Acts. The MOU states that "management of the Yolo Bypass Wildlife Area will take into consideration the specific habitat requirements of the giant garter snake and Swainson's hawk, but the area will not be specifically managed for any other listed or candidate species" (State Reclamation Board 1995). A copy of this MOU is provided in Appendix D. This agreement will be updated to add all the additional acreage acquired since 1994 within the Yolo Bypass.

Memorandum of Understanding between the California Department of Fish and Game and the Yolo Basin Foundation

In June 1997 the Foundation signed a MOU with DFG recognizing their long-term partnership to provide public outreach and educational programs. The MOU allows the Foundation use of the DFG facilities for office space and as a base for programs related to the Yolo Bypass Wildlife Area (California Department of Fish and Game 1997). A copy of this MOU is provided in Appendix D. Updating this agreement to reflect the current state of the partnership has been identified as a task in Chapter 5, "Management Goals."

SACRAMENTO-YOLO MOSQUITO AND VECTOR CONTROL DISTRICT

The Yolo Bypass Wildlife Area lies within the jurisdictional boundaries of the Sacramento-Yolo Mosquito and Vector Control District (SYMVCD). The SYMVCD is responsible for mosquito abatement and control of other vectors in the district. While a formal agreement or understanding does not exist between the DFG/ Yolo Bypass Wildlife Area and SYMVCD, the two parties do actively coordinate and collaborate regarding management activities. The SYMVCD was involved in the establishment of the Wildlife Area and developed a set of “best management practices” for the Wildlife Area, which included design and operations criteria. In consultation with SYMVCD, DFG implements a mosquito control plan that applies these and other best management practices (BMPs) including water management practices, vegetation management practices, wetland infrastructure maintenance, wetland restoration and enhancement features, and biological controls (Kwasny et al. 2004) and the California Rice Commission’s BMPs for mosquito control in flooded agricultural lands. In addition, SYMVCD coordinates with DFG regarding treatments and other activities that may occur on the Yolo Bypass Wildlife Area to avoid conflicts with public uses including school groups and other public activities. In reciprocation, DFG also informs SYMVCD of all water management activities throughout the year. Additional discussion on mosquito control and management is provided in Chapter 3, “Environmental Setting,” and Chapter 5, “Management Goals.”

DIXON RESOURCE CONSERVATION DISTRICT

At the time of the Glide/Los Rios acquisition, DFG committed to maintaining the existing leases on the Yolo Bypass Wildlife Area. An agreement was forged with the Dixon RCD to manage the existing agricultural leases in the Yolo Bypass Wildlife Area (see Appendix D). Dixon RCD manages contracts, annual reports, collects rents, and makes funds available for use in the Yolo Bypass Wildlife Area. The Dixon RCD retains 15% of the rental income for these services. This has proven to be an invaluable source of funding for the operation of the Yolo Bypass Wildlife Area. Additionally, it has allowed the DFG to maintain and actually increase the agricultural productivity of the property. This unique situation has inspired a renaissance of ideas to help integrate agriculture into the long term management of the Yolo Bypass Wildlife Area. At a time when the Yolo Bypass Wildlife Area budget was severely challenged, DFG was able to generate additional monies for the management of the Wildlife Area, while increasing agricultural productivity of the land, experimenting with wildlife friendly agricultural techniques, and immersing the wildlife area into the local agricultural community.

FARM SERVICE AGENCY

The USDA Farm Service Agency (FSA) administers farm commodity and conservation programs for farmers and makes and guarantees farm emergency, ownership, and operating loans. FSA’s responsibilities are organized into five areas: farm credit, farm programs, commodity operations, management, and state operations.

Currently there are six FSA farm designations on the Yolo Bypass Wildlife Area and there are four farm tenants. Under the new LMP, DFG plans to combine the six FSA farms into one FSA farm. Combining the FSA farms would make additional money available to the tenants based on the program history from the existing Yolo Bypass Wildlife Area. The goal of DFG would be to make 100% of the FSA program payments available to the tenants.

Upon the expenditure of federal North American Waterfowl Conservation Act (NAWCA) grants, property can no longer be used for commercial agricultural production. This, in turn, results in a reduction in income for the Wildlife Area. For this reason, NAWCA habitat restoration funds must be used judiciously with full knowledge of the long term impacts to the operation of the Yolo Bypass Wildlife Area.

FISH AND GAME CODE 1602 STREAMBED ALTERATION AGREEMENT

DFG regulates actions that substantially divert or obstruct the natural flow or that change the bed, channel, or bank of any river, stream, or lake, or use material from a streambed (California Fish and Game Code Sections 1600–1607). Los Rios Farms holds a Section 1602 Streambed Alteration Agreement for conducting routine maintenance of the Lisbon Weir on the East Toe Drain.

PUTAH CREEK WATER ACCORD

The seasonal instream flow and release pattern of Putah Creek from Monticello Dam to the East Toe Drain is regulated through the May 2000 Putah Creek Settlement Agreement (aka Water Accord) (Sacramento County Superior Court 2000). The Accord is intended to balance the competing uses for water between supply, demand, and maintenance of aquatic and riparian resource functions. The purpose of the Accord is to create as natural a flow regime as feasible and to maintain a living stream for the benefit of fish, wildlife, and plants from the Putah Diversion Dam to the connection at the East Toe Drain in the Yolo Bypass. The Accord focuses on the protection and enhancement of native resident and anadromous fish populations. It includes six primary elements, including four functional flow requirements. The four flow requirements pertain to rearing flows, spawning flows for native resident fishes, supplemental flows for anadromous fishes, and drought-year flows. The six Accord elements are as follows:

- Flows for resident native fish, which include important spawning and rearing components and guarantee a continuous flow to I-80;
- Flows that will attract and support salmon and steelhead;
- A drought schedule that provides enough water to maintain Putah Creek as a living stream but provides water users relief from other flow requirements;
- Creation of the Lower Putah Creek Coordinating Committee (LPCCC);
- Habitat restoration and monitoring funds for the creek;
- Creation of a Streamkeeper position for Putah Creek; and
- A requirement that Solano County Water Agency (SCWA) notify riparian water users of the amount of riparian water available in any given year and prevent illegal water diversions in excess of the amount of riparian water available.

SCWA is required to coordinate with the Yolo Bypass Wildlife Area regarding release of the fall anadromous fish attraction flows to allow DFG to remove the check boards at the Los Rios Check Dam within the Yolo Bypass Wildlife Area. Removing the check boards in coordination with the fall attraction flows helps to attract and enable salmon to migrate up into Putah Creek from the East Toe Drain. Additional information on the Accord is provided in Chapter 3, “Environmental Setting.”

3 ENVIRONMENTAL SETTING

This chapter summarizes the existing land uses, resource values, and local and regional plans that influence the management, operations, and visitor experiences at the Yolo Bypass Wildlife Area. The environmental setting chapter provides the baseline data for developing goals and tasks (Chapter 5) in this land management plan (LMP). It also constitutes the baseline conditions to compare with the proposed project (i.e., Chapter 5 goals and tasks) in accordance with State California Environmental Quality Act (CEQA) Guidelines Section 15125.

The chapter is divided into seven main sections. Section 3.1 discusses planning influences and considerations. Sections 3.2 through 3.7 address the six primary resource topics discussed in this LMP: Agricultural Land and Land Uses; Climate, Geology, Topography, and Soils; Geomorphology, Hydrology, and Water Resources; Biological Resources; Cultural Resources; and Recreation and Public Access.

One objective of this chapter is to briefly describe what is known about the historical setting and principal natural and human-caused changes in the Basin and Bypass that have occurred over time. A second objective is to describe the key physical, chemical, and biological conditions of the Yolo Bypass that define the Yolo Bypass Wildlife Area's existing characteristics as they relate to existing beneficial uses and potential restoration opportunities.

HISTORICAL CONTEXT

The historic setting of the Yolo Bypass Wildlife Area can be generally divided into two distinct conditions: 1) natural predisturbance conditions and 2) conditions and processes that have been affected by historic changes in the landscape.

Natural Predisturbance Conditions

The historic Yolo Basin was formed on the western floodplain of the Sacramento River. It was a vast floodplain influenced by seasonal high flows sustaining a diverse mosaic of natural communities. These communities provided habitat and stop-over areas to numerous species of fish and wildlife. Arguably, the most important ecological features were the wetlands and riparian ecosystems, which covered huge areas, supported high seasonal concentrations of wildlife and fish, and contained many endemic species. Before European colonization, the Yolo Basin intermittently received water, sediment, nutrients, other dissolved and suspended constituents, wood, organisms, and other debris from the Sacramento River and its many tributaries which then passed through to the Sacramento-San Joaquin Delta, the Suisun, San Pablo, and San Francisco Bays and ultimately to the Pacific Ocean. Hundreds of species of plants, wildlife, and fish evolved to take advantage of the hydrologic and geomorphic characteristics of this system and the Delta (CALFED Bay-Delta Authority 2000a).

The Mediterranean climate of the region ensures that the aquatic and riparian systems are highly dynamic, driven by strong annual patterns of wet winters and dry summers and longer multi-year periods of extreme wet and drought conditions. The high peaks of the Sierra Nevada intercept much of the moisture coming off the ocean and stores it as snow and ice that melts gradually, generating cold rivers that flow throughout the dry summers. During periods of high snowfall and rainfall prior to large scale changes, much of the Central Valley, including the Yolo Basin, became inundated, forming an extensive shallow lake that took months to drain through the narrows of the Bay-Delta system. In periods of drought, the Basin would be reduced to shallow pools and other seasonal wetland features (CALFED Bay-Delta Authority 2000a). The decreased outflow of the Sacramento San Joaquin Delta resulted in increased salinity due to the magnified influence of the San Francisco Bay system tides. Saline conditions were reported well into the Yolo Basin prior to the construction of Shasta Dam.

The productive floodplain marshlands and seasonal intervening waterways were extremely attractive to waterbirds. The abundant and diverse resident populations of ducks, geese, shorebirds, herons, and other birds were augmented by millions of ducks, geese, shorebirds, and cranes migrating south in fall and winter from summer breeding grounds in the north. The migratory birds would take advantage of the expanded wetlands that were the result of the winter rains and floods. Arguably, the Pacific Flyway, one of the major migratory routes for birds in North America, owes its existence to the Great Central Valley and its wetlands. No matter how severe the drought, there would be wetlands somewhere in the valley (CALFED Bay-Delta Authority 2000a).

Anadromous fish also found the region to be very favorable habitat when innundated. Chinook salmon (*Oncorhynchus tshawytscha*) migrated through or reared in the system, along with steelhead (*O. mykiss*), sturgeon (*Acipensier* spp.), and lamprey (*Lampetra* spp.) (CALFED Bay-Delta Authority 2000a).

The once abundant and migratory (i.e., semi-anadromous) delta smelt (*Hypomesus transpacificus*) could move up and down with the seasons, seeking favorable seasonal conditions for spawning and rearing of young. The short, 1- to 2-year life cycles of these fish suggests that appropriate spawning and rearing habitat conditions were consistently available at one or another location within the Delta system in most years, regardless of the prevailing climatic patterns. In contrast, the resident fishes were largely stream or floodplain spawners that did not necessarily find appropriate conditions for spawning and rearing of young every season. As a consequence, they adopted a life history strategy of living 5 or more years, enabling these species to spawn and exploit floodplains on those inconsistent occasions when the rivers flooded. Middens near Native American village sites throughout the Central Valley and Delta indicate that many of these fishes (e.g., thicktail chub [*Gila crassicauda*], Sacramento perch [*Archoplites interruptus*], Sacramento splittail [*Pogonichthys macrolepidotus*], hitch [*Lavinia exilicauda*], and Sacramento blackfish [*Orthodon microlepidotus*]) were extremely abundant and easy to harvest (CALFED Bay-Delta Authority 2000a).

How Historic Changes to the Landscape and Processes Have Affected Habitat and Species

The Yolo Basin ecosystem has been profoundly altered over time by human activity. The most considerable alteration of the ecosystem and loss of wetlands began with hydraulic gold mining operations in the mid-1800s that led to downstream deposition of sediments in the Delta and Bay, including the mineral byproducts of the mining operations. Shortly thereafter, levee building in the Central Valley began disconnecting the main rivers from their floodplains. In the 20th century, the construction of dams and reservoirs on the Sacramento, Feather, and American rivers dramatically changed the hydrology of the Yolo Bypass. Additionally, construction of Monticello Dam on Putah Creek in 1955 significantly altered the flooding patterns of this sometimes very powerful stream. Vast amounts of water was stored in these newly constructed reservoirs, and gradually released throughout the year. The operation of these reservoirs became the primary factor controlling flooding in the Yolo Bypass as the area was transformed into the primary flood control feature of the Sacramento Valley, the Yolo Bypass. Today, the Yolo Bypass provides flood protection for hundreds of thousands of acres of highly productive agricultural lands and for millions of people in surrounding urbanized and rural areas.

In more recent times, the lands within the Bypass have been used for farming and grazing with limited wetland management taking place on private waterfowl hunting club lands. The creation of the Yolo Bypass Wildlife Area has resulted in restoration and management of wetland, riparian, and grassland communities that provide habitat for a diverse assortment of plant, wildlife, and fish species and the creation of educational and interpretive programs, and partnerships to serve the public. The notable traditions of agriculture have also been maintained throughout the Yolo Bypass Wildlife Area, employing innovative wildlife friendly management strategies to achieve multiple resource objectives.

3.1 PLANNING INFLUENCES AND CONSIDERATIONS

Planning for the Yolo Bypass Wildlife Area encompasses issues that cross regional, local, and project area boundaries. This section identifies the federal, state, county, and local agency policies and other planning influences that affect the function and management planning of the Yolo Bypass Wildlife Area.

The Yolo Bypass Wildlife Area is unique in that a community-based organization, the Yolo Basin Foundation, recognized from the beginning that there is a complex web of policies and other influences that needed to be reconciled. The success of the Wildlife Area is based on this premise and management activities will continue in this mode into the future.

3.1.1 SACRAMENTO RIVER FLOOD CONTROL PROJECT

Flooding in the Yolo Bypass

Management of the Yolo Bypass Wildlife Area must be considered in the context of the Sacramento River Flood Control Project (SRFCP). The U.S. Army Corps of Engineers (USACE), in conjunction with the State of California, developed a flood control plan for the Sacramento River as part of the SRFCP, which included levee construction, channel improvements, and reservoir flood storage.

The Sacramento River levees were constructed by the USACE as part of the SRFCP. Construction and repair of the existing levees along the Sacramento River has been undertaken by the USACE over the years as part of its ongoing efforts to improve the regional protections provided by the SRFCP. “Project” levees in California must meet the standards for design and construction specified by the USACE in Engineering Manual 1110-2-1913 (U.S. Army Corps of Engineers 2000).

The Reclamation Board enforces appropriate standards for the construction, maintenance, and protection of flood control facilities in the Central Valley. The Reclamation Board must review and approve any activity that may affect “project works,” or physically change the “designated floodway” to ensure that the activity maintains the integrity and safety of flood control project levees and floodways and is consistent with the flood control plans adopted by The Reclamation Board and the California legislature. “Project works” are the components of a flood control project within The Reclamation Board’s jurisdiction that the Board or the legislature has approved or adopted. Project works include levees, bank protection projects, weirs, pumping plants, floodways, and any other related flood control works or rights-of-way that have been constructed using state or federal funds. Project works also include flood control plans. Rules promulgated in Title 23 of the California Code of Regulations (CCR Title 23, Division 1, Article 8 [Sections 111 through 137]) regulate the modification and construction of levees and floodways to ensure public safety. The flood season for the Sacramento River is November 1 through April 15.

Levee and floodway operation and maintenance are overseen by the California Department of Water Resources (DWR), which inspects the levees and issues a biannual report. The report covers the general condition of the levee, vegetation control, rodent control, and flood preparedness. The DWR, Division of Flood Management, Flood Operations Branch is responsible for the gathering, analysis, and dissemination of flood and water-related information and coordinates flood operations of Fremont and Sacramento Weir spills into the Yolo Bypass (see below).

STATE-FEDERAL FLOOD OPERATIONS CENTER

The mission of the Division of Flood Management is to prevent loss of life and reduce property damage caused by floods and to assist in recovery efforts following any natural disaster. The State-Federal Flood Operations Center (FOC), located in Sacramento, is a component of the Division's Flood Operations Branch. Year-round the FOC is the focal point for the gathering, analysis, and dissemination of flood and water-related information. During flood conditions the FOC provides a facility from which DWR can centrally coordinate operations and emergency response (California Department of Water Resources 2005).

As major storm systems approach California forecasters from the National Weather Service (NWS) and DWR forecast the location, amount, and timing of expected precipitation and make initial river forecasts. Once the storm arrives and runoff begins forecasts are updated and issued as necessary. Reservoir operators adjust flood control releases as inflows increase or downstream channels swell with runoff. Additionally, FOC personnel make high water notification calls to appropriate local flood system maintenance and emergency response agencies. Maintaining agencies are required to patrol their levees on a 24-hour basis as long as the water level is at or above monitor stage and until no threat remains to the levees.

Fremont Weir

FREMONT WEIR

Fremont Weir was completed in 1924. It is the first overflow structure on the river's west side (right bank), and its two-mile overall length marks the beginning of the Yolo Bypass. It is located about 15 miles northwest of Sacramento and eight miles northeast of Woodland. South of this latitude the Yolo Bypass conveys 80 percent of the system's floodwaters through Yolo and Solano counties until it rejoins the Sacramento River a few miles upstream of Rio Vista.
The weir's primary purpose is to release overflow waters of the Sacramento River, Sutter Bypass, and the Feather River into the Yolo Bypass. The project design capacity of the weir is 343,000 cfs (California Department of Water Resources 2003).

Sacramento Weir

SACRAMENTO WEIR AND BYPASS

The Sacramento Weir was completed in 1916. It is the only SRFCP weir "opened" or "closed" – all others overflow by gravity on their own. It is located along the west levee (right bank) of the Sacramento River approximately 4 miles upstream of the Tower Bridge, and about 2 miles upstream from the mouth of the American River. Its primary purpose is to protect the City of Sacramento from excessive flood stages in the Sacramento River channel downstream of the American River. The weir limits flood stages (water surface elevations) in the Sacramento River to SRFCP design levels through the Sacramento/West Sacramento area. The project design capacity of the weir is 112,000 cfs (California Department of Water Resources 2003).

The Sacramento Weir is 1,920 feet long and consists of 48 gates that divert Sacramento River and American River floodwaters to the west down the mile-long Sacramento Bypass to the Yolo Bypass. Each gate has 38 vertical wooden plank "needles" (4 inches thick by 1-foot wide by 6 feet long), hinged at the bottom and retained at the top by a hollow metal beam. The beam is manually released using a latch. Flood forecasters provide the necessary predictive information to weir operators who manage the number of opened gates in order to control the river's water surface elevation (California Department of Water Resources 2003).

DWR operates the weir according to regulations established by the USACE. The opening and closing criteria have been optimized to balance two goals: (1) minimize sediment deposition due to decreased flow velocities in the river channel downstream from the weir to the mouth of American River; and (2) to limit the flooding of agricultural lands in the Yolo Bypass only until after they have been inundated by floodwaters over Fremont Weir (California Department of Water Resources 2003).

The weir gates are not opened until the river reaches 27.5 feet at the I Street gage with a forecast to continue rising. This gage is about 1,000 feet upstream from the I Street Bridge, and about 3,500 feet downstream from the mouth of the American River. The number of gates to be opened is determined by the NWS/DWR river forecasting team (until all are opened) to meet either of two criteria: (1) to prevent the stage at the I Street gage from exceeding 29 feet, or (2) to hold the stage at the downstream end of the weir to 27.5 feet. Once all 48 gates are open, Sacramento River stages from Verona to Freeport may continue to rise during a major flood event. Project design stages are 41.3 feet at Verona, 31.5 feet at the south end of the Sacramento Weir, and 31 feet at the I Street gage (California Department of Water Resources 2003). Prior to water spill or release into the Bypass, the State-Federal Flood Operations Center (FOC) makes notification calls to entities with operations in the Bypass including the Yolo Bypass Wildlife Area (see below).

As discussed in Section 2.4.1, "Legal Constraints and Existing Agreements," the DFG, DWR, The State Reclamation Board, and USACE have a management agreement (in lieu of an encroachment permit) that allows for project modifications (e.g., wetland or other restoration projects) as long as they are compatible with flood control. Under this agreement, DFG assumes responsibility for all claims of damage or liability. DFG is responsible for the maintenance of lands within the boundaries of the project modification. This maintenance must be consistent with the purposes of public safety and is detailed in the USACE Operating Manual. Under the agreement, "DFG will endeavor to manage the Project Modification in a manner that will be compatible with flood control" (U.S. Army Corps of Engineers 2003).

3.1.2 CALFED BAY-DELTA PROGRAM

In 1995, the State of California and the federal government initiated a collaborative effort among state and federal resource management agencies and representatives from urban, agricultural, and environmental interests to attempt to resolve numerous water-related issues associated with the Sacramento River-Sac Joaquin River Delta and San Francisco Bay. The program was titled the CALFED Bay-Delta Program (CALFED). The mission of CALFED is to create a long-range, implementable solution for the Bay-Delta that focuses on four major problem areas: drinking water supply, water quality, levee system integrity, and environmental restoration. As part of CALFED, each of these issues has an established program and staff (CALFED Bay-Delta Program 2000a and 2000b).

In 1996, regional interested parties and CALFED staff developed overall objectives for CALFED that include achievement of ecosystem quality, water quality and supply reliability, and levee system integrity in the Bay-Delta and its watersheds. As part of this process, the Ecosystem Restoration Program (ERP) was created to identify a long-range set of specific ecosystem-related objectives and methods for implementation of those objectives. The result of that development process was the CALFED Ecosystem Restoration Program Plan (ERPP). The ERPP is a far-reaching document that outlines and describes a multitude of ecological improvement targets and actions intended to be implemented over the next several decades. It also delineates the area (known as the CALFED Study Area) where most of the prescribed CALFED ecologically based actions would occur.
The Yolo Bypass Wildlife Area is included in the CALFED Study Area in what is known as the Yolo Basin Ecological Management Zone.

As discussed in Chapter 1, “Introduction,” this LMP is based on an ecosystem approach to habitat management consistent with the principles of the CALFED ERP. Yolo Bypass Wildlife Area-related targets and programmatic actions from the CALFED ERPP are presented verbatim in Appendix B. Additionally, the ERP’s goals and objectives (CALFED Bay-Delta Program 2000a and 2000b) are to:

- achieve recovery of at-risk native species dependent on the Delta and Suisun Bay to establish large, self-sustaining populations of these species, support similar recovery of at-risk native species in the Bay-Delta estuary and the watershed above the estuary, and minimize the need for future endangered species listings by reversing downward population trends of native species that are not listed;

- rehabilitate natural processes in the Bay-Delta estuary and its watershed to fully support, with minimal ongoing human intervention, natural aquatic and associated terrestrial biotic communities and habitats in ways that favor native members of those communities;

- maintain or enhance populations of selected species for sustainable commercial and recreational harvest, consistent with the other ERP goals;

- protect or restore functional habitat types in the Bay-Delta estuary and its watershed in support of ecological and public values (such as species, biotic community, and ecological processes), health, recreation, aesthetic quality, and scientific research;

- prevent the establishment of additional nonnative invasive species and reduce the negative ecological and economic impacts of established nonnative species in the Bay-Delta estuary and its watershed; and

- improve or maintain water and sediment quality conditions that fully support healthy and diverse aquatic ecosystems in the Bay-Delta estuary and watershed and eliminate (to the extent possible) toxic impacts on aquatic organisms, wildlife, and people.

CONSISTENCY OF THE LAND MANAGEMENT PLAN WITH THE CALFED FINAL PROGRAMMATIC EIS/EIR RECORD OF DECISION

In launching “the most complex and extensive ecosystem restoration project ever proposed” (CALFED Bay-Delta Authority 2000a and 2000b), the CALFED Final Programmatic Environmental Impact Statement and Environmental Impact Report (CALFED Final PEIS/EIR) recognized that the Preferred Program Alternative could have potentially significant effects on biological resources and agricultural land and water use. This LMP has been developed to meet CALFED Program objectives (see Chapter 1 and Appendix B) and to be consistent with applicable mitigation strategies adopted as part of the Record of Decision (ROD) for the approval of the CALFED Program.

The CALFED Final PEIS/EIR also identified potential effects to special-status wildlife species and/or important wildlife use areas and developed mitigation strategies to avoid these impacts. A review of Section 6.2 of the CALFED Final PEIS/EIR, “Vegetation and Wildlife,” resulted in identification of one mitigation strategy that has been incorporated into the LMP:

- Mitigation Strategy 9: Avoid construction or maintenance activities within or near habitat areas occupied by special-status wildlife species or in important wildlife use areas when species may be sensitive to disturbance.

- All construction and maintenance activities at the Yolo Bypass Wildlife Area are designed and timed to avoid potential disturbances to habitat areas occupied by special-status wildlife species or in important wildlife use areas when species may be sensitive to disturbance. Because construction or maintenance activities identified in the LMP (i.e., tasks) will be directed to avoid these potential impacts, the proposed LMP is consistent with Mitigation Strategy 9.

The CALFED Final PEIS/EIR specifically identified potential effects of converting Prime, Statewide Important, and Unique Farmland to project uses. It also identified potential conflicts with local government plans and policies and potential incompatibilities with adjacent land uses. As a result, the CALFED Program developed mitigation strategies to reduce potential impacts to agricultural land and water use. A review of Section 7.1, "Agricultural Land and Water Use," resulted in identification of five mitigation strategies (described below) that have been incorporated into the LMP:

- Mitigation Strategy 4: Involve all affected parties, especially landowners and local communities, in developing appropriate configurations to achieve optimal balance between resource effects and benefits.

  The Yolo Bypass Working Group, initiated and facilitated by the Yolo Basin Foundation (Foundation), provides a focused forum and opportunity for farmers, landowners, and agencies with a role in the Yolo Bypass to discuss Bypass related issues, as well as provide guidance and opinions on such issues. DFG is a regular and important participant in the Working Group and the meetings have been a primary forum to gather stakeholder input towards the development of this LMP (see Chapter 1 for additional information on the Yolo Bypass Working Group). Therefore, this proposed LMP is consistent with Mitigation Strategy 4.

- Mitigation Strategy 10: Focus habitat restoration efforts on developing new habitat on public lands before converting agricultural lands.

  This proposed habitat restoration project would develop new habitat on public lands in DFG ownership; therefore, it is consistent with Mitigation Strategy 10.

- Mitigation Strategy 11: If public lands are not available for restoration efforts, focus restoration efforts on acquiring lands that can meet ecosystem restoration goals from willing sellers where at least part of the reason to sell is economic hardship (i.e., lands that flood frequently or where levees are difficult to maintain).

  The public lands which make up the Yolo Bypass Wildlife Area were acquired from willing sellers where at least part of the reason for selling was economic. Therefore, the proposed LMP is consistent with Mitigation Strategy 11.

- Mitigation Strategy 18: Minimize the amount of water supply required to sustain habitat restoration acreage.

  Lands in the Wildlife Area (including potential future restoration projects) are managed to minimize water use through maximum use efficiency. Therefore, the proposed LMP is consistent with Mitigation Strategy 18.

- Mitigation Strategy 19: Develop buffers and other tangible support for remaining agricultural lands. Vegetation planted on these buffers should be compatible with farming and habitat objectives.

  The Yolo Bypass Wildlife Area is managed with extreme consideration to be respectful of neighboring public and private properties that together support a wide range of wildlife species and provide for economic vitality through agricultural production. Integration of agriculture with habitat management is a primary objective for management at the Yolo Bypass Wildlife Area. The LMP identifies goals and tasks including continued effective communication with neighbors (though the Yolo Bypass Working Group and other means), working with farmer lease tenants (directly and through Dixon RCD), and to conform to standards such as, vector control and maintenance of flood flow conveyance that are outlined in the LMP. Additionally, the Yolo Bypass Wildlife Area is extremely supportive of surrounding agricultural land uses and operations. Therefore, the LMP is consistent with Mitigation Strategy 19.

3.1.3 SACRAMENTO AND SAN JOAQUIN RIVER BASINS CALIFORNIA COMPREHENSIVE STUDY

The Sacramento and San Joaquin River Basins California Comprehensive Study (Comprehensive Study) was a joint effort by The Reclamation Board and the USACE, in coordination with federal, state, and local agencies, groups, and organizations in California's Central Valley. Responding to the flooding of 1997, the California Legislature and the U.S. Congress directed USACE to develop a comprehensive plan for flood damage reduction and environmental restoration purposes for the Sacramento and San Joaquin River Basins. The effort was conducted in cooperation with The Reclamation Board. The Comprehensive Study is not a regulatory program per se, but consistency with its goals and objectives is important for any project affecting flood control in the Sacramento and San Joaquin River basins.

In December 2002, an interim report was released by the Comprehensive Study team (U.S. Army Corps of Engineers and State of California Reclamation Board 2002). The report identified the comprehensive plan as an approach to developing projects in the future to reduce damages from flooding and restore the ecosystem in the Sacramento-San Joaquin River basins. As described in the report, the comprehensive plan has three parts: (1) a set of principles to guide future projects, (2) an approach to develop projects with consideration for systemwide effects, and (3) an organization to consistently apply the guiding principles in maintaining the flood management system and developing future projects.

The Comprehensive Study has proposed a set of guiding principles to govern implementation of projects that propose modifying the Sacramento or San Joaquin River flood control systems. These principles have been developed to ensure that projects proposed to be implemented are consistent with the objectives established by USACE and The Reclamation Board. The following are the Comprehensive Study's guiding principles:

- recognize that public safety is the primary purpose of the flood management system;
- promote effective floodplain management;
- promote agriculture and open space protection;
- avoid hydraulic and hydrologic impacts;
- plan system conveyance capacity that is compatible with all intended uses;
- provide for sediment continuity;
- use an ecosystem approach to restore and sustain the health, productivity, and diversity of the floodplain corridors;
- optimize use of existing facilities;
- integrate with the CALFED Bay-Delta Program and other programs; and
- promote multi-purpose projects to improve flood management and ecosystem restoration.

The Yolo Bypass lies in the Lower Sacramento River Region of the Comprehensive Study.

3.1.4 CENTRAL VALLEY REGIONAL WATER QUALITY CONTROL BOARD

Pursuant to section 303(d) of the Clean Water Act, the Central Valley Regional Water Quality Control Board (RWQCB) is developing a Total Maximum Daily Load (TMDL) for methyl and total mercury in the Sacramento-San Joaquin Delta (Central Valley Regional Water Quality Control Board 2005).

The Delta methylmercury TMDL development and implementation is a two-part process: TMDL development and Basin Plan amendment.

TMDL development is currently underway and involves the technical analysis of methyl and total mercury sources, fate and transport of each, development of a proposed mercury fish tissue water quality objective and an aqueous methylmercury goal, and a description of the amount of reduction necessary to attain the proposed objective. A report produced for the TMDL development step was completed in August of 2005. This report contains preliminary implementation options for the control of mercury but does not formally propose regulations. Implementation options for the control of mercury include the following objectives:

- Reduce total mercury loads entering the Delta by at least 110 kilograms/year (kg/yr).
- Require responsible parties for point and non point sources of methylmercury to characterize their discharge by measuring methylmercury concentrations and loads. If their discharge concentrations are determined to be greater than the recommended aqueous goal, then responsible parties could be required to develop control measures to reduce their loads. (Wetlands are identified as a source of methylmercury.)
- Reduce methylmercury exposure to the fish eating public.

The Basin Plan Amendment focuses on the development of a Basin Plan amendment and a staff report for RWQCB consideration. The Basin Plan amendment staff report will propose a site-specific water quality objective for the Delta and an implementation plan to achieve the objective, all based on the foundation provided by the TMDL analysis. The Basin Plan amendment staff report will propose regulations to reduce mercury and methylmercury discharges. Potential amendments to the Basin Plan regarding methylmercuy and wetlands could affect management of the Yolo Bypass Wildlife Area. Additional discussion on the methylmercury TMDL for the Delta is provided in Chapter 3, “Environmental Setting.”

3.1.5 SACRAMENTO AREA FLOOD CONTROL AGENCY

The Sacramento Area Flood Control Agency (SAFCA), a “joint powers agency” of City of Sacramento, County of Sacramento, County of Sutter, American River Flood District, and Reclamation District 1000, has been coordinating regional flood control since its creation in 1989.

In March 2002, SAFCA entered into a Memorandum of Understanding (MOU) with the State Reclamation Board, DWR, the cities of Sacramento and West Sacramento and the counties of Sacramento, Yolo and Sutter to form the Sacramento River Corridor Planning Forum (Forum). Membership on the Forum is open to the public.
The Forum’s mission is to develop a Sacramento River Corridor Floodway Management Plan containing recommendations on flood management goals and policies, with guidelines for riparian habitat protection, public access and recreation, and riverfront development. The plan would also include recommendations for assessing and mitigating impacts of proposed projects. The Forum is looking at the Yolo Bypass with respect to proposals and studies to enhance the flood control system through its study area reach, which comprises the Sacramento River corridor from Fremont Weir south to the town of Courtland.

3.1.6 YOLO COUNTY GENERAL PLAN

The Yolo County General Plan designates the Yolo Bypass Wildlife Area lands as A-P (Agricultural Preserve). Zoning for Agricultural Preserve states that “the purpose of the Agricultural Preserve Zone shall be to preserve land best suited for agricultural use from the encroachment of nonagricultural uses. The A-P zone is intended to be used to establish agriculture preserves in accordance with the California Land Conservation Act of 1965, as amended. Uses approved on contracted land shall be consistent and compatible with the provisions of the Act” (Yolo County 1983).

Principal uses (allowable with only site plan review and approval of facilities, infrastructure, health and safety issues) include:

- Agriculture (not dairies, stockyards, slaughterhouses, hog farms, fertilizer works, or plants for the reduction of animal matter);
- One single-family dwelling;
- Parks, publicly owned, and
- Rural recreation (defined as the shooting of skeet, trap, and sporting clays; archery; gun, hunting, or fishing clubs; dude ranches; health resorts, incidental and dependent upon primary agricultural use, and/or directly dependent upon a unique natural resources feature; the use of public or private lands or structures for commercial staging of rafting, hiking, backpacking, bicycling, and/or touring excursion).

The Yolo County General Plan also includes several other goals and policies related to management and planning at the Yolo Bypass Wildlife Area including the following:

GENERAL PLAN GOALS AND POLICIES

- REC 1. Recreation Basic - Yolo County acquires, maintains and provides a variety of park, open and natural areas for recreational and leisure pursuits at the regional, community and neighborhood level through means of California statute, established land use controls, regulations, real property transfer, and the advice, guidance and cooperation of other jurisdictions and through coordination with other elements of this General Plan, as amended.

  It shall be the basic recreation policy of the County to:

  1. Protect and preserve as many of the County’s recreational and scenic resources as possible;
  2. Maintain diversified regional-type recreation facilities and programs;
  3. Assist in preserving the open space resources of the County;
  4. Cooperate with special districts, cities, adjacent counties, and state and federal agencies in the acquisition, development and administration of recreation facilities, resources and programs for joint use and mutual advantage;
  5. Cooperate with and encourage private individuals and organizations in the preservation, acquisition and administration of recreation resources;
  6. Assist local rural communities in obtaining a basic level of recreation service;

7. Encourage and assist in the development of bicycle and hiking trails in and to County parks and recreation areas;

8. Encourage greater understanding of the park system and the resources it protects by development of an interpretive program.

   - Pedestrians – Yolo County shall promote and ensure the provision of facilities and routes, where appropriate, for safe and convenient use by pedestrians including sidewalks, pedestrian access to all public facilities and transit stops, and to public areas in the community including waterfront projects and recreation hiking trails.

   - Bicycle Routes and Facilities – Encouragement and establishment of bike routes along trails, on levees, along railroad levees, along drainage canals, and along transmission right-of-ways where feasible.

   - Bikeways and Pedestrian Ways – Yolo County shall plan and promulgate adequate, safe bikeways and pedestrian ways, integrated with other transit modes and coordinated with all forms of development.

   - Physically Impaired (formerly Handicapped) – Require designs of buildings, sidewalks, and all other public facilities and transit/transportation modes to facilitate use by the physically impaired, including those in wheelchairs.

3.1.7 COLUSA BASIN DRAIN

The Colusa Basin watershed comprises nearly 1,620 square miles of mostly agricultural land in the north Sacramento Valley, and encompasses approximately 255 square miles in Yolo County. The Colusa Basin Drain is a man-made channel designed to convey irrigation return drainage to the Knights Landing outfall that discharges to the Sacramento River. Thirty-two ephemeral streams, seven of which lie in the Dunnigan Hills of Yolo County, supply the channel. The capacity of the Colusa Basin Drain is approximately 12,450 cfs and primarily conveys water from the Tehama-Colusa Canal (Yolo County Water Resources Association 2004).

The Tehama-Colusa Canal is 110.9 miles long and flows south from the Red Bluff Diversion Dam through Tehama, Glenn, and Colusa counties into Yolo County, terminating about 2 miles south of Dunnigan. The initial capacity of the canal is 2,530 cubic feet per second, diminishing to 1,700 cubic feet per second at the terminus in Yolo County (U.S. Bureau of Reclamation 2006). The water is used for irrigation by Central Valley Project (CVP) contractors, including the Dunnigan Water District. The Knights Landing Ridge Cut Canal was constructed to improve flow conditions during high flow events. All waters from the Colusa Basin Drain are directed through the Ridge Cut Canal into the Yolo Bypass during high flows in the Sacramento River.
The Colusa Basin Drain is listed as a water quality impaired water body due to a number of agricultural pesticide-related pollutants (Central Valley RWQCB 2002; Smalling et al. 2005). A recent proposal has been developed by groups representing Sacramento River water users to divert additional water from the Colusa Basin Drain into the Yolo Bypass on a more continuous year-round basis. This proposal is currently being evaluated for potential effects related to water quality and hydrology in the Yolo Bypass. Additional discussion on the Colusa Basin Drain and potential water quality implications is provided in Section 3.4, "Geomorphology, Hydrology, and Water Quality."

3.1.8 DELTA PROTECTION COMMISSION

The Delta Protection Commission (DPC) was created by the State Legislature in 1992 with the goal of developing regional policies for the Delta to protect and enhance the existing land uses in the Primary Zone: agriculture, wildlife habitat, and recreation. Working closely with local communities and local governments, the DPC adopted its Land Use and Resource Management Plan for the Primary Zone of the Delta (regional plan) in 1995. Local government incorporation of the policies in the DPC regional plan was completed in 1998. In 2000, the DPC became a permanent state agency. The policies in the regional plan were adopted as regulations in 2000 and approved by Office of Administrative Law on May 8, 2001. A large portion of the Yolo Bypass Wildlife Area is within the Primary Zone of the Delta.

LAND USE AND RESOURCE MANAGEMENT PLAN FOR THE PRIMARY ZONE OF THE DELTA

The DPC's Land Use and Resource Management Plan for the Primary Zone of the Delta (Delta Protection Commission 1995) include the following policies and recommendations applicable to the Yolo Bypass Wildlife Area LMP:

- **Environment Policy P-1:** The priority land use of areas of prime soil shall be agriculture. If commercial agriculture is no longer feasible due to subsidence or lack of adequate water supply or water quality, land uses which protect other beneficial uses of Delta resources and which would not adversely affect agriculture on surrounding lands, or viability or cost of levee maintenance, may be permitted. If temporarily taken out of agricultural production due to lack of adequate water supply or water quality, the land shall remain reinstateable to agricultural production for the future.

- **Environment Policy P-3:** Land managed primarily for wildlife habitat shall be managed to provide several interrelated habitats. Delta-wide habitat needs should be addressed in development of any wildlife habitat plan. Appropriate programs, such as "Coordinated Resource Management and Planning" and "Natural Community Conservation Planning" should ensure full participation by local government and property owner representatives.

- **Environment Recommendation R-1:** Seasonal flooding should be carried out in a manner so as to minimize mosquito production. Delta-wide guidelines outlining "best management practices" should be prepared and distributed to land managers.

- **Environment Recommendation R-4:** Feasible steps to protect and enhance aquatic habitat should be implemented as may be determined by resource agencies consistent with balancing other beneficial uses of Delta resources.

- **Environment Recommendation R-5:** Publicly-owned land should incorporate, to the maximum extent feasible, suitable and appropriate wildlife protection, restoration and enhancement as part of a Delta-wide plan for habitat management.

- **Environment Recommendation R-6:** Management of suitable agricultural lands to maximize habitat values for migratory birds and other wildlife should be encouraged. Appropriate incentives, such as conservation easements, should be provided by nonprofits or other entities to protect this seasonal habitat through donation or through purchase.

- **Environment Recommendation R-7:** Lands currently managed for wildlife habitat, such as private duck clubs or publicly owned wildlife areas, should be preserved and protected, particularly from destruction from inundation.

- **Land Use Policy P-2:** Local government General Plans and zoning codes shall continue to strongly promote agriculture as the primary land use in the Primary Zone; recreation land uses shall be supported in appropriate locations and where the recreation uses do not conflict with agricultural land uses or other beneficial uses, such as waterside habitat.

- **Land Use Policy P-8:** Local government policies regarding mitigation of adverse environmental impacts under CEQA may allow mitigation beyond County boundaries, if acceptable to reviewing fish and wildlife agencies, for example in approved mitigation banks. Mitigation in the Primary Zone for loss of agricultural lands in the Secondary Zone may be appropriate if the mitigation program supports continued farming in the Primary Zone.

- **Land Use Recommendation R-1:** A program by non-profit groups or other appropriate entities should be developed to promote acquisition of wildlife and agricultural conservation easements on private lands with the goal of protecting agriculture and wildlife habitat in the Delta.

- **Land Use Recommendation R-2:** Public agencies and non-profit groups have or propose to purchase thousands of acres of agricultural lands to restore to wildlife habitat. The amount, type, and location of land identified to be enhanced for wildlife habitat should be studied by wildlife experts to determine goals for future acquisition and restoration. Lands acquired for wildlife habitat should also be evaluated for recreation, access, research and other needed uses in the Delta. Habitat restoration projects should not adversely impact surrounding agricultural practices. Public-private partnerships in management of public lands should be encouraged. Public agencies shall provide funds to replace lost tax base when land is removed from private ownership.

- **Land Use Recommendation R-3:** Multiple use of agricultural lands for commercial agriculture, wildlife habitat, and, if appropriate, recreational use, should be supported, and funding to offset management costs pursued from all possible sources. Public agencies shall provide funds to replace lost tax base when land is removed from private ownership.

- **Agriculture Policy P-1:** Commercial agriculture in the Delta shall be supported and encouraged as a key element in the State’s economy and in providing the food supply needed to sustain the increasing population of the State, the Nation, and the world.

- **Agriculture Policy P-2:** Local governments shall identify the unique qualities of the Delta that make it well suited for agriculture. These qualities include: rich soil, ample supplies of water, long growing seasons, mild climate, and proximity to packaging and shipping infrastructure. The unique physical characteristics of the Delta also require that agricultural landowners maintain extensive levee systems, provide flood control, and have adequate drainage to allow the lands to be farmed.

- **Agriculture Policy P-8:** Encourage management of agricultural land which maximize wildlife habitat seasonally and year-round, through techniques such as sequential flooding in fall and winter, leaving crop residue, creation of mosaic of small grains and flooded areas, controlling predators, controlling poaching, controlling public access, and others.

- **Agriculture Recommendation R-1:** Programs to educate California and the U.S. about the value and diversity of California agriculture should continue. Education should provide information about various crops and about the different agricultural regions, such as the Delta.

- **Recreation and Access Recommendation R-2:** Support a scientifically-valid study of the carrying capacity of the Delta waterways for recreation activities without degradation of habitat values which minimize impacts to agriculture or levees.

- **Recreation and Access Recommendation R-6:** State and federal projects in the Primary and Secondary Zones should include appropriate recreation and/or public access components to the extent consistent with project purposes and available funding. State and federal agencies should consider private or user group improvements on publicly owned lands to provide facilities.

- **Water Policy P-1:** Local governments shall ensure that salinity in Delta waters allows full agricultural use of Delta agricultural lands, provide habitat for aquatic life, and meet requirements for drinking water and industrial uses.

- **Water Policy P-2:** Local governments shall ensure that design, construction, and management of any flooding program to provide seasonal wildlife habitat on agricultural lands shall incorporate "best management practices" to minimize mosquito breeding opportunities and shall be coordinated with the local vector control districts.

- **Water Recommendation R-3:** Programs to enhance the natural values of the State's aquatic habitats and water quality will benefit the Delta and should be supported.

- **Water Recommendation R-4:** Programs to regulate agricultural drainage in the Delta should be accompanied with education programs, be implemented over time, and should, where needed, provide financial assistance such as grants and interest-free loans to ensure compliance. Any regulation of Delta agricultural discharges must recognize that a) dischargers must be permitted to discharge back to the channels any dissolved solid loads that were derived from the channels in irrigation diversions and seepage inflows, and b) any net addition of dissolved carbon compounds must be compared to the addition of such compounds that would occur with any other land use option that would provide equal protection of the land and channel configuration and would consume no more water.

- **Water Recommendation R-5:** Water for flooding to provide seasonal and year-round wildlife habitat should be provided as part of State and federal programs to provide water for wildlife habitat.

DELTA COLLABORATIVE

In response to the Central Valley Regional Water Quality Control Board's development of a Total Maximum Daily Load (TMDL) value for mercury in the Delta, the Delta Protection Commission has convened a collaborative group to provide coordinated input into the Board's Delta mercury TMDL process. To date, the Collaborative has expressed a desire for integration of the Commission's Land Use and Resource Management Plan for the Primary Zone of the Delta (Plan), several "Delta visioning" processes and programs being undertaken by other entities, multi-species HCP/NCCPs, and other prominent Delta activities, into the process. To date, the Collaborative includes representatives from: CALFED Bay-Delta Authority, DFG, DWR, U.S. Department of Agriculture, Contra Costa Water Agency, Yolo County Planning, Resources, and Public Works, Sacramento County Sanitation District, San Joaquin County Public Works, San Joaquin County RCD, Yolo NCCP Joint Powers Agency, Foundation, The Nature Conservancy, Ducks Unlimited, HART Restoration, DCC Engineering, KSN Engineering, Environmental Justice Water Coalition, and Delta landowners/stakeholders.

DELTA RECREATION PLAN

The Delta Recreation Plan is currently under development. A draft aquatic-based component of the plan has been completed and consists of inventory and policy-level goals for aquatic-based recreational resources within the Delta (Delta Protection Commission 2006). Completion of the plan is subject to current funding limitations.

3.1.9 NORTH AMERICAN WATERFOWL MANAGEMENT PLAN

The North American Waterfowl Management Plan (NAWMP) was signed on May 14, 1986, by the Secretary of Interior for the United States and the Minister of Environment for Canada. The NAWMP provides a broad framework for waterfowl conservation and management in North America through the year 2000. Population objectives for key species were identified in it and habitat goals to sustain these populations were established. Although the 1986 agreement was originally only between the United States and Canada, a subsequent memorandum of understanding for the conservation of migratory birds and wetlands was signed by the national conservation agencies' directors of Canada, Mexico, and the United States on March 16, 1988. This international memorandum of understanding will also contribute to achievement of the international goals defined in the overall NAWMP.

On December 13, 1989, President Bush signed the North American Wetlands Conservation Act (NAWCA), which obligates annual appropriations for the implementation of the NAWMP. Funding for NAWCA includes interest from obligations held by the U.S. Treasury as part of the Federal Aid in Wildlife Act (Pittman-Robertson) (16 U.S.C. 669b) of September 2, 1937; Migratory Bird Act-related fines, penalties, and forfeitures; and direct appropriations.

The NAWMP seeks to restore and maintain the diversity, abundance, and distribution of waterfowl that occurred during 1970–79. Population objectives for 20 species of ducks, 18 species or subspecies of geese divided into 27 management populations, and 2 species of swans are identified. The NAWMP further seeks to assure sufficient habitat to support 62 million breeding ducks, a fall flight of 100 million ducks, and 6 million wintering geese and swans. Updating of the NAWMP will occur at five-year intervals beginning in 1990.

In the NAWMP, broad recommendations are made for wetland and upland habitat protection, restoration, and enhancement, as well as duck harvest, overall waterfowl population management, subsistence hunting and research. The major focus, however, is on ducks and their habitat. Two of the NAWMP’s seven habitat objectives relate to the general maintenance or rehabilitation of 34 major waterfowl habitats. Five of the seven priority objectives are specifically focused on seven habitat areas (six in the US; one in Canada) of the highest international priority. These seven areas are the focus of initial joint ventures that will receive priority planning and funding.

The Central Valley is one of the seven priority areas. Within the priority areas, mallards, northern pintails and American black ducks receive special attention where appropriate. The major strategy for implementing the NAWMP is to establish specific habitat joint ventures where agencies and private organizations collectively pool their resources to address waterfowl habitat problems. Each joint venture will develop implementation plans to address specific needs of each area.

CENTRAL VALLEY HABITAT JOINT VENTURE

The California Central Valley Habitat Joint Venture (recently renamed the Central Valley Joint Venture [CVJV]) was formally established by a working agreement signed in July, 1988. An Implementation Board comprised of representatives from the California Waterfowl Association, Defenders of Wildlife, Ducks Unlimited, National Audubon Society, Waterfowl Habitat Owners Alliance, and The Nature Conservancy guides the CVJV. Technical assistance and advice is provided to the Implementation Board by the DFG, U.S. Fish and Wildlife Service (USFWS), California Department of Food and Agriculture, and other organizations and agencies.

Upon completion of the CVJV objectives, the Central Valley will support 4.7 million wintering ducks, including 2.8 million pintails. The goal of the CVJV is to “protect, maintain, and restore habitat to increase waterfowl populations to desired levels in the Central Valley of California consistent with other objectives of the NAWMP.” Six objectives were developed by the Implementation Board to achieve this goal (Central Valley Habitat Joint Venture 1990):

1. Protect 80,000 additional acres of existing wetlands through acquisition of fee-title or perpetual conservation easements.

2. Secure an incremental, firm 402,450 acre-foot water supply that is of suitable quality and is delivered in a timely manner for use by National Wildlife Refuges (NWR), State Wildlife Areas (WA), and the Grasslands Resource Conservation District (GRCD).

3. Secure Central Valley Project (CVP) power for NWRs, WAs, GRCD, and other public and private lands dedicated to wetland management.

4. Increase wetland areas by 120,000 acres and protect these wetlands in perpetuity by acquisition of fee-title or conservation easement.

5. Enhance wetland habitats on 291,555 acres of public and private lands.
6. Enhance waterfowl habitat on 443,000 acres of agricultural lands.

The CVJV recently updated the Implementation Plan (Central Valley Habitat Joint Venture, in prep.). The new plan include goals and accomplishments for the conservation of breeding and wintering waterfowl, breeding and wintering shorebirds, grassland and riparian birds, and other waterbirds. Specific habitat objectives for the Yolo Basin with primary opportunity areas in the vicinity of the current Yolo Bypass Wildlife Area include:

1. Increase wetland areas in the Yolo Basin by 11,558 acres and protect these wetlands in perpetuity by acquisition of fee-title or conservation easement.
2. Achieve seasonal wetland area objectives in the Yolo Basin of 713 acres/year (enhancement objectives will increase to 963 acres/year when wetland restoration objectives are met for the Basin).
3. Secure 57,790 acre-feet of water when wetland restoration objectives in the Basin have been met.
4. Achieve agricultural enhancement objective of 11,000 acres, of which 8,000 is assumed to be corn with the remaining 3,000 acres assumed to be flooded rice. (Agricultural enhancement objectives are currently exceeded for the basin.)

Creation and management of the Yolo Bypass Wildlife Area is a key component of the CVJV’s habitat restoration goals and accomplishments for the Yolo Basin.

3.1.10 YOLO COUNTY HABITAT CONSERVATION PLAN/NATURAL COMMUNITY CONSERVATION PLAN

In the mid-1990s, Yolo County initiated development of a Habitat Conservation Plan (HCP). The purpose of this plan was to guide future development, agriculture, other land use, and natural resource conservation activities throughout the county in such a way that incidental take of special-status species resulting from development and land-use changes would be minimized and mitigated in accordance with the Section 10 of the federal Endangered Species Act. If approved by USFWS, this HCP would grant Yolo County the authority to implement all planned actions in the county without further USFWS consultation regarding special-status species.

A “final” HCP for Yolo County was published in 1996, but was subsequently tabled for further revision.
A revised draft HCP was published in January of 2001, and was also tabled in favor of pursuing a joint Habitat Conservation Plan/Natural Communities Conservation Plan (HCP/NCCP), which, if approved, would be a combined agreement between the county, USFWS, and DFG, and would include coverage under both the federal and state Endangered Species Acts. This HCP/NCCP is currently under development. The Yolo County Joint Powers Agency received USFWS funding in October 2005 to complete Phase II of the plan, to develop conservation strategies and designate areas for preservation. The Joint Powers Agency currently expects to finish Phase II in the spring of 2007 and complete the HCP/NCCP by 2008 (Yolo County Habitat/Natural Communities Conservation Plan Joint Powers Agency 2005).

It is hoped that the lands protected by the Yolo County HCP/NCCP will compliment the conservation efforts underway at the Yolo Bypass Wildlife Area. One important way it can do this is by insuring the long-term presence of agriculture on lands between the Davis city limits and the Yolo Bypass south of Interstate 80 (I-80). Yolo Bypass Wildlife Area staff will continue to communicate with the Joint Powers Agency and staff as the HCP/NCCP is developed.

3.1.11 AGRICULTURAL/IRRIGATED LANDS CONDITIONAL WAIVER PROGRAM

The California Water Code (Section 13269) authorizes the State Water Resources Control Board (SWRCB) and RWQCBs to conditionally waive waste discharge requirements (WDR) if that is in the public interest.
The RWQCBs have issued waivers for over 40 categories of discharges over the years. Senate Bill 390, signed into law on October 6, 1999, required the RWQCBs to review their existing wavers and to renew them or replace them with WDRs. To comply with SB 390, the RWQCBs adopted waivers to regulate most of the categorical discharges.

The Central Valley RWQCB has adopted conditional waivers for agricultural discharges. The agricultural waivers use different regulatory models, are conditional, and comply with SB 390. The RWQCBs are making extensive enrollment, education, and public outreach efforts in these regions.

On July 2003, the Central Valley RWQCB adopted a Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands (Conditional Waiver for Irrigated Lands) Resolution No. R5-2003-0105 (Discharges of water from managed wetlands in the Sacramento River watershed are also exempt from WDRs under the July 2003 Central Valley RWQCB conditional waiver covering “discharges from irrigated lands”. Irrigated Lands includes managed wetlands by definition). In January 2004, the SWRCB amended Resolution No. R5-2003-0105 and provided important guidance to move forward. The regulations provide for a watershed approach focused on a regional monitoring program to measure compliance with the waivers’ terms and conditions and rely on a locally driven outreach program to enhance and improve water quality. The conditional waivers were set to expire on December 31, 2005. In response to the pending expiration, the RWQCB provided a 6-month renewal of the waiver. The Central Valley RWQCB revisited the issue of adopting a revised conditional waiver at its June 2006 Board meeting. Minutes from the June meeting have not been posted so specifics regarding adoption of the revised conditional waiver are uncertain at this time. Refer to website: <http://www.waterboards.ca.gov/centralvalley> for additional information and future meeting minutes.

SACRAMENTO VALLEY WATER QUALITY COALITION

Water quality coalitions have been formed throughout the Central Valley in response to Conditional Waiver of WDR passed on July 11, 2003 by the RWQCB. Viewed by many as the most economical way to comply with the regulations, the coalitions’ goals are to represent farmers with irrigated cropland within a regional watershed so they do not need to file individual reports with the RWQCB. Coalitions can also minimize filing fees and monitoring requirements by individual farmers and land managers.

The Sacramento River watershed is the northern most hydrologic basin included in the Central Valley Conditional Waiver for Irrigated Lands Program and is represented by the Sacramento Valley Water Quality Coalition (SVWQC). The SVWQC was formed in 2002 to enhance and improve water quality in the Sacramento River watershed, while sustaining the economic viability of agriculture, associated values of managed wetlands and sources of safe drinking water. The SVWQC is comprised of more than 200 agricultural and wetland interests that have joined with local governments throughout the region to improve water quality for northern California farms, cities and the environment. The DFG is a participant in the SVWQC.

The SVWQC is dedicated to working with the RWQCB in developing a comprehensive approach to managing water quality on irrigated lands at the watershed level. This regional effort provides the framework necessary to meet water quality goals, help local subwatersheds meet regulatory requirements, and ensure that watershed management practices are broadly implemented through sustainable economic management measures.

In June 2003, the SVWQC submitted a Regional Plan for Action to the SWRCB and the Central Valley RWQCB. The plan was resubmitted in October 2003 as the General Report for the SVWQC with a Notice of Intent (NOI) to meet the newly adopted water quality regulations and obtain coverage under the Conditional Waiver for Irrigated Lands. More than 200 organizations throughout the Sacramento River watershed support the plan and are committed to implementing a regional strategy to address water quality. The SVWQC will evaluate a range of water quality parameters for the entire watershed rather than focusing only on specific water quality constituents, and will manage the region to meet the objectives in the Porter-Cologne Water Quality Control Act (Water Code 13000 et seq.).

On February 10, 2004, the Regional Board issued a Notice of Applicability (NOA) to the SVWQC verifying the NOI was complete and approved with conditions. The NOA required the SVWQC to submit a watershed evaluation report and a monitoring and reporting program plan for the Sacramento River watershed by April 1, 2004. To implement the plan and to meet the Conditional Waiver for Agricultural Lands requirements, the SVWQC has prepared and is submitting the following documents that will serve as the foundation for a phased water quality management program: (1) Sacramento River Watershed Evaluation Report; and, (2) Sacramento River Watershed Monitoring and Reporting Plan.

The quantitative data and analysis presented in the above-mentioned reports is designed to provide a consistent and comprehensive approach to watershed management. This approach will support farmers and wetland managers in meeting water quality goals and regulatory requirements. Together these plans satisfy the requirements of the Conditional Waiver for Irrigated Lands.

The reports will change as new information is developed during the interim program and throughout the 10-year implementation program proposed for the Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands. This long-term planning horizon supports an “adaptive management” approach at the local level, by allowing the time to evaluate options in order to make optimal decisions with limited resources to achieve desired results.

For purposes of compliance with the July Waiver, the DFG has joined the SVWQC. DFG continues to participate in the Coalition process and provides annual funding based on acres of managed wetlands at the Yolo Bypass Wildlife Area.

3.1.12 NATURAL RESOURCES CONSERVATION SERVICE PROGRAMS

WETLANDS RESERVE PROGRAM

The U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS), Wetlands Reserve Program (WRP) is a voluntary program to restore wetlands. Participating landowners have the opportunity to establish conservation easements in perpetuity or for a 30-year duration. Landowners also have the option to enter into restoration cost-share agreements where no easement is involved. In exchange for establishing a permanent easement, the landowner receives payment up to the agricultural value of the land and 100 percent of the restoration costs for restoring the wetlands. The 30-year easement payment is 75 percent of what would be provided for a permanent easement on the same site and 75 percent of the restoration cost. The voluntary agreements are for a minimum of 10-year duration and provide 75 percent of the cost of restoring the involved wetlands. Easements and restoration cost-share agreements establish wetland protection and restoration as the primary land use for the duration of the easement agreement. In all instances, landowners continue to control access to their land. Wetland restoration activities implemented in the Los Rios WRP Unit of the Yolo Bypass Wildlife Area were conducted through a perpetual WRP easement acquired by Los Rios Farms prior to acquisition by the State.

There is a 153-acre WRP restoration on the Yolo Bypass Wildlife Area that was constructed in 2005. This property is adjacent to Putah Creek and includes 11 acres of riparian restoration. The restoration plan underwent hydraulic analysis prior to construction and received an encroachment permit from the Reclamation Board. The management of this unit has been turned over to DFG.

CONSERVATION SECURITY PROGRAM

The Conservation Security Program (CSP) is a voluntary program that provides financial and technical assistance to promote the conservation and improvement of soil, water, air, energy, plant, and animal life, and other conservation purposes on Tribal and private working lands. Working lands include cropland, grassland, prairie land, improved pasture, and rangeland, as well as forested land that is an incidental part of an agriculture operation. The program provides equitable access to benefits to all producers, regardless of size of operation, crops produced, or geographic location. The Farm Security and Rural Investment Act of 2002 (2002 Farm Bill) (Pub. L. 107-171) amended the Food Security Act of 1985 to authorize the program. CSP is administered by USDA's NRCS.

One CSP enhancement activity in particular was developed on the Yolo Bypass Wildlife Area. Wildlife Habitat Management Enhancement, "EHM17-#11 Manage Fallow Cropland Areas for Shorebird Habitat" was developed on site and submitted to NRCS, who incorporated this practice into the CSP. This practice provides $125 per acre to manage fallowed cropland fields for winter shorebird migration by flooding from July 20 through September 15 to a depth of 3 inches. Additional information on managing shorebird habitat is provided in Section 3.5, "Biological Resources"

DIXON RESOURCE CONSERVATION DISTRICT

Formed as independent local liaisons between the federal government and landowners, resource conservation districts (RCDs) have always worked closely with the USDA NRCS. RCDs address a wide variety of conservation issues such as water quality, wildlife habitat restoration, soil erosion control, drainage, conservation education, and much more. The Dixon RCD covers over 114,000 acres and is involved in the operation and maintenance of an extensive drainage system, water quality issues, and assisting local farmers. Each district has a locally elected or appointed volunteer board of directors made up of landowners in that district. The DFG has an agreement with Dixon RCD to manage agricultural leases and other agriculture-related activities occurring in the Yolo Bypass Wildlife Area (see Appendix D). Dixon RCD staff has made invaluable contributions towards DFG's goal of integrating agriculture into the long-term management of the Wildlife Area.

3.1.13 YOLO BYPASS FISH PASSAGE AND FISH HABITAT IMPROVEMENT PLANNING

Several studies and planning efforts have been conducted to examine the feasibility of managing a portion of the Yolo Bypass to improve passage and habitat for aquatic species, particularly native fishes such as Chinook salmon, Sacramento splittail, and sturgeon (U.S. Army Corps of Engineers and the CALFED Bay-Delta Program 2002; Kirkland et al. 2005). Other recent planning efforts that have focused on Delta-wide fisheries and aquatic food web issues include: the Delta Smelt Action Plan (Resources Agency 2005), and the Pelagic Fish Action Plan (Resources Agency 2007). Ideas and concepts that have been developed for the Bypass range from modifying the hydrology of the Yolo Bypass to yield system-wide changes, to modifying a small portion of the Yolo Bypass topography to produce localized changes, to simply improving fish passage at physical impediments.

The most recent studies and planning efforts have been directed towards fish passage improvements at Fremont Weir and on Putah Creek in a way that is not intended to harm existing agricultural and/or managed wetlands operations at the Yolo Bypass Wildlife Area. Modifications to Fremont Weir, whether for fish passage or for fish habitat source flow, are outside the boundaries of the Yolo Bypass Wildlife Area and beyond the scope of this LMP. However, there is great concern that modifications to Fremont Weir to achieve managed spring floodplain inundation conditions could adversely affect existing agricultural, public use and managed wetland operations at the Yolo Bypass Wildlife Area. There is also concern that smaller flows which might be associated with providing multi-species fish passage at Fremont Weir could adversely affect existing agricultural and/or managed wetland operations and/or public use at the Yolo Bypass Wildlife Area. The Wildlife Area personnel would not take a lead role in improving fish passage beyond its northern and southern boundaries, but DFG would support fish passage improvement plans if they do not unduly interfere with other existing or planned functions of the Yolo Bypass Wildlife Area.

A Yolo Bypass Interagency Working Group (YBIWG) has been formed which will develop priorities for fisheries projects within the Yolo Bypass. This group includes representatives from National Oceanic and Atmospheric Administration, national marine Fisheries Service (NMFS), DWR, DFG, and USFWS. The agreed upon prioritized fishery opportunities have been developed are included in the following document:

YOLO BYPASS CONCEPTUAL AQUATIC RESTORATION OPPORTUNITIES

The following describes potential northern Yolo Bypass (above Little Holland Tract) aquatic restoration opportunities. The CALFED Ecosystem Restoration Program Implementing Agencies (DFG, USFWS, NMFS) in cooperation with the DWR, are evaluating the feasibility of implementing the following opportunities. These opportunities were developed through consultations with participating agencies of the Yolo Bypass Interagency Working Group. The YBIWG acknowledges key issues, interests, and concerns raised during previous discussions with stakeholders and evaluates potential restoration opportunities with these issues in mind.

The primary goal of the YBIWG is to improve conditions for native fish species (particularly State and federal Threatened and Endangered fish species and species of special concern) in the Yolo Bypass, thereby enhancing populations and recovery efforts while minimizing land management impact.

This document focuses, at a conceptual level, on the sequential development of potential restoration opportunities in the northern Yolo Bypass. The set of potential restoration opportunities is provided to foster discussion among public entities and stakeholders interested in the northern Yolo Bypass.

The YBIWG has identified the following potential restoration opportunities for further evaluation:

- **Putah Creek** – Lower Putah Creek stream realignment and floodplain restoration for fish passage improvement and multi-species habitat development on existing public lands.
- **Lisbon Weir** – Improve agriculture and habitat water control structure for fish and wildlife benefits.
- **Additional multi-species habitat development** – Identify areas of opportunity within the Yolo Bypass Wildlife Area, or other appropriate areas that could provide for controlled localized seasonal inundation on more frequent intervals.
- **Tule Canal Connectivity** – Identify passage impediments. Evaluate the feasibility of improving fish passage or removing fish passage impediments.
- **Multi-species fish passage structure** – Evaluate the feasibility of constructing a multi-species fish passage structure at the Fremont Weir.

Biological monitoring will be implemented as necessary and may be used to guide future actions and adaptive management.

Multi-species restoration opportunities discussed here are presented in a sequential order of completion. For the full value of the proposed restoration opportunities in the Yolo Bypass to be realized, the following ordered scheme should occur.

Step 1 – Putah Creek

Evaluate and develop a plan for the realignment and restoration of lower Putah Creek. The area proposed for restoration is within existing public lands. The realignment has the potential to create 130 to 300 acres of shallow water habitat. Benefits would include improved salmonid immigration and emigration to and from Putah Creek, an increase in avian (shorebird and waterfowl) habitat, increased aquatic and riparian habitat for other native species, as well as a significant enhancement to existing fish habitat in and around Putah Creek. Any potential actions would be consistent and coordinated with the Putah Creek Water Accord.

Goals:

- Improve passage, rearing, and emigration of adult and juvenile salmon and steelhead in Putah Creek
- Provide diverse aquatic and riparian habitats for shorebirds, ground nesting birds, waterfowl, plants, invertebrates, plankton, and spawning and rearing of native fish species

Step 2 – Lisbon Weir

Modify or replace Lisbon Weir to provide better fisheries management opportunities in Putah Creek and the Toe Drain, while improving the reliability of agricultural diversions and reducing maintenance requirements. A conceptual example of the synergistic benefits of these proposed restoration actions is the idea that improving Lisbon Weir's reliability for agricultural diversions could increase flexibility in water distribution, thereby allowing for greater attraction flows to be released down the realigned Putah Creek.

Goals:

- Improve irrigation water distribution system to benefit fish and wildlife
- Improve likelihood of adult fall-run Chinook immigration to Putah Creek
- Reduce delay and possible stranding of adult steelhead, Chinook salmon and sturgeon, when passable conditions to the Sacramento River exist
- Reduce delay of juvenile salmonid emigration within the Toe Drain

Step 3 – Additional multi-species habitat development

Expand existing shallow water habitat for various species including juvenile native fish. Additional multi-species habitat could be developed through the excavation of a low shelf along a limited portion of the Toe Drain and through small scale setback levees, or by other unidentified means. Restoration opportunities for the development of additional seasonal shallow water habitat, where opportunities exist, may occur on: 1) undeveloped lands within the Yolo Bypass Wildlife Area; 2) other undeveloped public lands within the Yolo Bypass; and 3) private lands where cooperative agreements between the implementing agencies and the landowners provides mutual benefits.

Goals:

- Increase rearing habitat available to juvenile steelhead, Chinook salmon, and splittail
- Increase shallow water habitat availability for multiple species (fish, wildlife, plankton, and others)

Step 4 – Tule Canal connectivity

Identify areas of stranding adjacent to the Fremont Weir. Evaluate the feasibility of improving connectivity between the Fremont Weir, the Fremont Weir scour ponds, and the Toe Drain to reduce stranding of adult and juvenile fish. Identify seasonal road crossings and agricultural impoundments in the northern Yolo Bypass that impact wetted habitat connectivity, immigration, and emigration of fish species utilizing the Yolo Bypass. Develop conceptual approaches for the modification of crossings and impoundments.

Goals:

- Reduce delay and stranding of adult steelhead, Chinook salmon, and sturgeon immigrating within the Yolo Bypass

- Reduce delay and overall losses of juvenile Chinook salmon and steelhead emigrating within the Yolo Bypass

Step 5 – Multi-species fish passage

Evaluate the feasibility and appropriateness of providing fish passage improvements in and along the Fremont Weir. Appropriate operational constraints would guide plan development and would ensure: 1) continued maintenance of flood conveyance capacity; 2) no substantial changes in timing, volume, and/or duration flow; and 3) minimal disturbance to existing land use and agricultural practices.

Restoration opportunities may include the addition of a new, controlled multi-species fish passage structure at the eastern edge of the Fremont Weir. Additionally, restoration opportunities may include improvements along the existing weir face and apron to facilitate sturgeon passage along the length of Fremont Weir without introducing any additional flows. Conceptual designs for this option could include rock ramps that would provide a gradual slope up the face of the weir. In addition to the installation of new fish passage structures, the existing fish ladder will be analyzed to determine if modifications could allow for a greater range of fish species passage.

Goals:

- When present in the northern Yolo Bypass, improve immigration and emigration (reduce delay and stranding) of adult and juvenile fish (steelhead, Chinook salmon, and sturgeon).

The YBIWG identified potential restoration opportunities with consideration given to the elimination or minimization of potential negative impacts to the following areas of concern:

- Flood control
- Agricultural operations
- State and federal wildlife area infrastructure investments
- Public and private waterfowl management operations
- Wildlife management operations
- Water quality
- Educational activities
- Recreation
- Vector control
- Welfare of selected fish species at various life stages.

The intent of the YBIWG is to keep all users and interest whole. Conceptual restoration opportunities were developed to be implemented with minimal impact to Yolo Bypass users. Restoration opportunities that significantly changed the timing and/or duration of flow, or that resulted in substantial new regulation of the Yolo Bypass, were eliminated from further consideration.

3.1.14 SACRAMENTO AREA COUNCIL OF GOVERNMENT'S REGIONAL BICYCLE, PEDESTRIAN, AND TRAILS MASTER PLAN

The Sacramento Area Council of Government's (SACOG) Regional Bicycle, Pedestrian, and Trails Master Plan is intended to guide the long-term decisions for the Bicycle and Pedestrian Funding Program, adopted by the SACOG Board of Directors in September 2003. The focus of both the Master Plan and the Funding Program is to provide facilities for walking and biking in the cities and towns of the region, and provide connections between cities and towns. The goal is to integrate local plans to create a seamless regional bicycle and pedestrian system. This approach prioritizes local projects by their contribution to the regional network, providing key connections and access between communities, counties and jurisdictions.

Specific goals identified for capital projects that relate to the Yolo Bypass Wildlife Area include:

1. Provide bicycle/pedestrian connections
   a. Between, through, and within all cities and towns of the six-county region.

It may be possible for bike paths to connect through or adjacent to the Yolo Bypass Wildlife Area at the Causeway Unit; however, the once proposed Union Pacific Rail Trail (old Southern Pacific east/west mainline in the Causeway Unit) through the Yolo Bypass to the I Street Bridge (in the City of West Sacramento) has been identified in the Regional Master Plan as: "Low Priority Rails-to/with-Trails."

3.1.15 CITY OF DAVIS

The City of Davis has several plans and programs related to public access at the Yolo Bypass Wildlife Area including the General Plan, Open Space Program, and City Bike Plan. Planning work within the Putah Creek watershed by the City of Davis has contributed synergistic support for the creation of the Yolo Bypass Wildlife Area. The City's policies support continued coordination. Bikeways connecting Sacramento and Davis are also goals of Davis planning efforts and will likely require coordination with the Yolo Bypass Wildlife Area and Bypass stakeholders.

The City of Davis also values habitat and wildlife preservation and as such is a continuing partner in support of the Yolo Bypass Wildlife Area and Pacific Flyway Center.

GENERAL PLAN

- **Policy POS 1.1 -** Use systematic and comprehensive planning to guide the development, operation and allocation of resources for all City parks, facilities, and recreation programs.

  - Actions

    Emphasize joint planning and cooperation with all public agencies as the preferred approach to meeting the parks, open space and program needs of Davis residents.

- **Policy POS 1.2** – Provide informal areas for people of all ages to interact with natural landscapes, and preserve open space between urban and agricultural uses to provide a physical and visual edge to the City.

  - Actions

    Incorporate existing habitat areas, including Putah Creek, Dry Slough, and Willow Slough, into the open space network, while maintaining the emphasis on wildlife and habitat preservation in these areas.

Within urban open space areas, provide habitat elements (e.g., roosting trees, nesting trees, etc.) for birds, such as songbirds, hawks, owls, and for other wildlife as appropriate.

Develop criteria regarding the types of locations where the City would like to establish new resource preservation, education and recreation areas and programs.

Establish criteria for location and design of natural habitat areas accessible to the public, including criteria for natural habitat areas that can complement and accommodate other open space uses such as viable wildlife habitat.

Set policies and criteria for the establishment of trails and picnic areas in natural open space areas.

- **Policy POS 3.3 -** Implement specific projects to augment the existing greenbelt/open space system.
  - Actions

  Develop, maintain and improve a trail, and other greenbelt type amenities, if possible, in the Second Street/I-80 Corridor.

COMPREHENSIVE BICYCLE PLAN

The purpose of the Bicycle Plan is to improve and encourage bicycle transportation in the City of Davis. This is an update of the 1993 Bikeway Plan, and is part of an effort to maintain a document that is current and meaningful to the city. Additionally, this Plan meets the requirements contained in Section 891.2 of the California Streets and Highways Code. A goal of the Bicycle Plan is to coordinate and cooperate with surrounding jurisdictions such as University of California at Davis, and Yolo and Solano counties, to create a continuous and interconnected bikeway network.

OPEN SPACE PROGRAM

Highlights of the City’s activities include:

- Wildlife habitat lands acquisition and site development program which includes the South Fork Preserve natural area on Putah Creek and the Davis Wetlands Project associated with the city’s water pollution control plant. The City’s activities on Putah Creek will eventually and directly interface with public use programs on the Wildlife Area.

- Active pursuit of state and federal grant funds, cooperative partnerships and other creative funding arrangements that have brought over twelve million new dollars to City of Davis open space projects over the last eight years.

- Open space components of the City’s internal network of greenbelts, parks and street corridors.

3.1.16 CITY OF WEST SACRAMENTO

The City of West Sacramento has plans and programs related to natural resources adjacent to and public access at the Yolo Bypass Wildlife Area including the General Plan and Access and Bike Plan. The City’s policies support coordination and values habitat and wildlife preservation.

GENERAL PLAN

Section V, Recreational and Cultural Resources, Goal E: To provide a network of pedestrian and bicycle pathways connecting parks and open space areas with other destination points within and beyond the city of West Sacramento.

Policies:

1. The City shall develop a system of pedestrian and bicycle pathways linking City parks, neighborhood shopping areas, and major open space areas with one another and with nearby residential areas.

3. The City shall develop and implement a Bicycle Route Master Plan to link parks, scenic areas, the riverfront, schools, the Central Business District, public facilities, and neighborhoods.

5. The City shall coordinate with SACOG and surrounding jurisdictions to ensure that bicycle pathways within the city connect with existing and planned facilities outside the city.

Section VI, Natural Resources Goals and Policies, Goal C: To protect sensitive native vegetation and wildlife communities and habitat in West Sacramento.

Policies:

7. The City shall seek to minimize the loss or degradation of wetland and riparian habitats at the following sites: Lake Washington and associated wetlands; Bee Lakes and associated riparian woodlands; riparian woodlands along the Sacramento River north of the I Street Bridge and south of the barge canal; and riparian woodlands along the Deep Water Ship Channel and the Yolo Bypass.

12. Public access and recreation facilities shall not eliminate or degrade riparian habitat values. Trails, picnic areas, and other developments shall be sited to minimize impacts on sensitive wildlife habitat or riparian vegetation.

ACCESS AND BIKE PLAN

The City of West Sacramento is currently updating the 1995 Pedestrian and Bicycle Master Plan. The new Bicycle, Pedestrian, and Trail Master Plan will identify ways to enhance and expand the existing network of pedestrian and bike travelways and recreational trails, connect gaps in the system, and improve problem areas. It may be possible for bike paths to connect through the Yolo Bypass Wildlife Area at ground level in the Causeway Unit.

3.1.17 LOWER PUTAH CREEK WATERSHED MANAGEMENT ACTION PLAN

The Lower Putah Creek Watershed Management Action Plan (WMAP) represents a three-phase program for enhancing watershed resources in the lower Putah Creek watershed (Lower Putah Creek Coordinating Committee 2005). The WMAP is a science and community based comprehensive approach to the protection and enhancement of resources in the lower Putah Creek riparian corridor, including tributaries, extending from Lake Berryessa to the Yolo Bypass. It is one of the first actions initiated by the Lower Putah Creek Coordinating Committee (LPCCC), through funding by a grant from the CALFED Bay-Delta Program. The LPCCC serves as the watershed group joining several primary stakeholders together to oversee implementation of the Putah Creek Accord and to begin planning for the enhancement and protection of Putah Creek's resources.

The goal is to develop a dynamic WMAP that landowner stakeholders can use as a framework and that will be updated with new information and new ideas to improve the watershed. Importantly, it is intended to provide landowners and management entities with a blueprint for actions to protect and enhance resources in the lower Putah Creek watershed in a manner that is compatible with and respectful of landowner priorities, interests and concerns.

Development and implementation of the WMAP is divided into three phases. Phase I, completed in 2005, includes comprehensive biological, physical, and cultural resource assessments. Phase II, completed in 2006, is the landowner stewardship component. It includes a summary of goals, objectives, and project ideas for management of the lower Putah Creek watershed, based primarily on Landowner Stewardship meetings and coordination. The final WMAP, anticipated to be completed in 2008, will be a result of both the information from the resource assessments and landowner guidance. It will include a set of landowner interests and concerns; and resource enhancement goals and objectives; and an implementation plan containing a prioritized set of restoration and enhancement actions. Phase III is the implementation phase of the WMAP. Implementation will follow the recommended goals, objectives, and project ideas in the WMAP and will depend on funding, stewardship actions, permits and regulatory approvals, and the support of resource agencies and other stakeholders.

A copy of Phase 1 of the WMAP can be found on the Lower Putah Creek Watershed Portal at the following web address: <http://www.watershedportals.org/lpccc/viewDoc_html?did=2898>.

3.1.18 YOLO COUNTY INTEGRATED REGIONAL WATER MANAGEMENT PLAN

The Water Resources Association of Yolo County is using Proposition 50 funds to develop the Yolo County Integrated Water Management Plan (IRWMP) with intentions to adopt this plan in 2007. The IRWMP will serve as a planning document to help guide water actions within Yolo County. These actions include programs, policies and projects which are divided into five areas:

1. Water supply and drought preparedness
2. Water quality
3. Flood and storm water management
4. Recreation
5. Riparian and aquatic ecosystem enhancement

A draft list of actions in all five areas listed above has been developed and will eventually be prioritized through a watershed based stakeholder developed work plan. There are also integrated projects. The Yolo Bypass Wildlife Area related actions are part of the Yolo Bypass Integrated Project. The implementation strategy for the integrated projects is currently being developed by the WRA Technical Advisory Committee. It is anticipated that various agencies will take the lead on specific actions as appropriate within the context of the integrated project. DFG may seek funding for Yolo Bypass Wildlife Area Land Management Plan related actions through the Yolo County IRWMP implementation process.

3.1.19 YOLO COUNTY WEED MANAGEMENT AREA

The Yolo County Weed Management Area (YCWMA) was formed in 1999 by federal, state, county and city agencies, private industry, and landowners that are concerned about the explosion of invasive plant species in Yolo County. The YCWMA promotes and coordinates efforts toward the management and control of the County’s noxious weeds through education and cooperation with landowner’s, agencies, organization, and the general public. The YCWMA uses an integrated approach in weed control and eradication. The DFG, through employees of the Yolo Bypass Wildlife Area have been an active partner since the inception of the Yolo County WMA.

Herbicides, hand removal, mechanical removal, mowing, burning, grazing, mulching, biological control, and revegetation are all methods employed to various extents on a project by project basis to achieve the most biologically sound, environmentally friendly, and cost effective, long-term weed control possible.

3.1.20 CALIFORNIA'S WILDLIFE ACTION PLAN

California's Wildlife Action Plan was prepared by the UC Davis Wildlife Health Center for DFG and published in 2007. This was written as a requirement to received funding from the State Wildlife Grants Program authorized by Congress in 2000. A number of conservation actions are identified in this plan. These are intended to restore and conserve wildlife. These actions are categorized as either Statewide Conservation Actions or Regional Conservation Actions. In this plan, the Yolo Bypass Wildlife Area is located within the Central Valley and Bay-Delta Region.

Below is a listing of conservation actions pertinent to the Yolo Bypass Wildlife Area LMP.

RECOMMENDED STATEWIDE CONSERVATION ACTIONS

Statewide conservation actions are those actions that are important across most or all regions. The following are recommended statewide conservation actions:

c. The state should develop policies and incentives to better integrate wildlife conservation into state and regional transportation planning. Wildlife considerations need to be incorporated early in the transportation planning process.

d. State and federal agencies should work with cities and counties to secure sensitive habitats and key habitat linkages.

e. State and local agencies should allocate sufficient water for ecosystem uses and wildlife needs when planning for and meeting regional water supply needs.

f. Federal, state, and local agencies should provide greater resources and coordinate efforts to eradicate or control existing occurrences of invasive species and to prevent new introductions.

g. Federal, state, and local agencies and nongovernmental conservation organizations, working with private landowners and public land managers, should expand efforts to restore and conserve riparian communities.

h. Federal, state, tribal, and local agencies and nongovernmental organizations, working with private landowners, should expand efforts to implement agricultural and rangeland management practices that are compatible with wildlife and habitat conservation.

j. The state and federal governments should give greater priority to wildlife and natural resources conservation education.

k. The state should strengthen its capacity to implement conservation actions and to assist local agencies and landowners with planning and implementation of wildlife and habitat restoration and conservation efforts.

n. To address habitat fragmentation and avoid the loss of key wildlife corridors, federal, state and local agencies, along with nongovernmental organizations, should support scientific studies to identify key wildlife habitat linkages throughout the state.

RECOMMENDED REGIONAL CONSERVATION ACTIONS

The following are Central Valley and Bay-Delta Regional conservation actions to restore and conserve wildlife:

c. Public land managers need to continue improving wildlife habitat for a variety of species on public lands.

e. Public agencies and private organizations need to collaboratively protect and restore habitat connectivity along major rivers in the Central Valley.

j. Water management agencies need to reestablish and maintain more natural river flows, flooding patterns, water temperatures, and salinity conditions to support wildlife species and habitats.

l. Public agencies and private organizations should conserve and restore water dependent habitats (including wetland, riparian, and estuarine) throughout the region. Design of these actions should factor in the likely effects of accelerated climate change.

m. Water management agencies, state and federal wildlife agencies, and other public agencies and private organizations need to collaboratively improve fish passage by removing or modifying barriers to upstream habitat.

n. To support healthy aquatic ecosystems, public agencies and private organizations, in collaboration with the California Bay-Delta Authority, need to improve and maintain water quality in the major river systems of this region.

3.2 AGRICULTURAL RESOURCES AND LAND USES

This section describes the agricultural resource and land use characteristics of the Yolo Bypass Wildlife Area. Existing infrastructure including water delivery and management systems are described in Chapter 2, "Property Description." Biological resources are described in Section 3.5.

The Yolo Bypass Wildlife Area is seen as a model for bridging the seemingly disparate fields of agriculture and wildlife management. The success of this management philosophy is epitomized by the land management scenes played out south of the Yolo Causeway. Commuters in the spring watch tractors endlessly discing rice stubble until a fine seed bed is created. Next, long land planes level these fields. The infrastructure is rebuilt, with rice checks pulled and ditches cleaned. Water floods the fields by late April and soon the airplane is flying back and forth, seeding each field. By early summer the Bypass is a sea of green as the young rice plants break the surface of the water. Multiple duck broods have migrated to this water from their upland nests. During the hot days of summer, the rice grows taller and matures by the end of the summer. In early autumn the harvesters are cutting the rice as hundreds of egrets and white-faced ibis feast on the exposed crayfish. Soon the rice will go to the dryers to be prepared for markets. Much will go to Asia, via the Sacramento River Deep Water Channel. By October, DFG takes over the fields and floods them once again. Within a few days, the fields begin to attract mallards that have come to the Yolo Bypass after breeding elsewhere. Pintail may accumulate in large numbers in November. By December spectacular flocks of snow geese, white-fronted geese, tundra swans, and innumerable pintail are slowing traffic on Interstate 80, as massive waves of wings roam over the flooded rice fields. Soon winter is upon us, and the rice stubble disappears under the floodwaters. Gone are the snow geese, instead replaced by rafts of scaup and canvasback. Below the water surface, white sturgeon may be roaming the floor of the Bypass, as well as Sacramento splittail engaged in spawning behavior in their ancestral floodplain. As winter turns to spring, the rice fields are once more exposed and eventually drained, with eager farmers in the wings, ready to till the earth once again.

The following text was developed through a review of existing literature, annual agriculture plans, and Yolo Bypass Wildlife Area staff information. These sources provided information on agricultural land characteristics throughout the Yolo Bypass Wildlife Area.

BACKGROUND

Agriculture has been an important land use in the Yolo Bypass since the seasonal wetlands and perennial marsh and riparian areas were first converted to farms in the mid-1800s. Indeed, the massive reclamation efforts of the 19th century were driven by the desire to create productive farmland. For many years, grazing was the primary use of agricultural lands in the Yolo Bypass. In the latter part of the 20th century with the rise in commodity prices, irrigation systems were developed and fields were engineered for the production of row crops such as tomatoes and sugar beets.

The nearly annual floods that flow through the Yolo Bypass severely limit the kinds of crops that can be grown. Orchards and winter crops are not an option, nor are long-term ventures such as alfalfa. The proximity of the Yolo

Bypass to the San Francisco Bay Delta brings a prevailing wind from the south during summer evenings. Although the daily appearance of this Delta Breeze makes life bearable in the Sacramento area, it limits the production of rice in favor of wild rice, or special varieties that are more adapted to the climate.

At the time of the acquisition of the Glide and Los Rios properties, one concern expressed by the agricultural community was the potential loss of farm land to wildlife habitat. The DFG made a commitment at that time to maintain the existing agricultural leases present on the property and to integrate agriculture into the long-term management of the Wildlife Area.

Agriculture and wildlife management are not that far apart. DFG wildlife areas commonly grow agricultural crops for the benefit of wildlife. The Yolo Bypass Wildlife Area utilizes agriculture to manage habitats while providing important income for the management and operation of the property. Many innovative, natural resource-compatible agricultural practices occurring in the Yolo Bypass Wildlife Area provide valuable habitat for a diverse assemblage of wildlife species. Rice is grown, harvested, and flooded to provide food for thousands of waterfowl. Corn fields are harvested to provide forage for geese and cranes. Working with local farmers, the Yolo Bypass Wildlife Area provides fields of milo, corn, and sudan grass specifically for wildlife forage purposes. Crops such as safflower are cultivated and mowed to provide seed for upland species such as ring-necked pheasant and mourning dove.

Much of the grassland in the southern portion of the Yolo Bypass Wildlife Area is managed with cattle grazing, resulting in spectacular blooms of wildflowers during the spring months. The predominance of nonnative annual grasses in that area can otherwise inhibit the production of the native plant community that includes several rare and endangered species. Whereas historically pronghorn antelope and tule elk grazed competing native grasses, exposing the emerging forbs to sunlight, grazing cattle provide this function today, eating the mostly nonnative competing grasses. Due to the aggressiveness of these nonnative grasses, an aggressive grazing strategy is needed to favor the production of native forbs. This can be accomplished through a carefully crafted agricultural lease that reflects the results of scientific grazing studies while still providing the potential for a lessee to make a profit on the Wildlife Area.

EXISTING AGRICULTURAL SETTING

Existing conditions related to agricultural resources within the Yolo Bypass Wildlife Area are described in greater detail below. Additional information on agriculture in regards to wildlife management is provided in Section 3.5, “Biological Resources.” Agricultural land characteristics throughout the Yolo Bypass Wildlife Area include lands designated by the California Department of Conservation (DOC) as being of prime, unique, or statewide importance (California Department of Conservation 2004).

3.2.1 AGRICULTURAL LAND CLASSIFICATION

The DOC uses the USDA’s modern classification when administering the Farmland Mapping and Monitoring Program (FMMP) to characterize the types and amounts of agricultural land in an area. The majority of land within the Yolo Bypass Wildlife Area has been classified by the DOC into one of five different agricultural land designations (DOC undated). Lands in the Yolo Bypass Wildlife Area are primarily characterized as:

- *Prime Farmland* – approximately 350 acres: Prime farmland is farmland with the best combination of physical and chemical features able to sustain long-term agricultural production. This land has the soil quality, growing season, and moisture supply needed to produce sustained high yields. Land must have been used for irrigated agricultural production at some time during the four years prior to the mapping date. Prime farmland is defined by DOC according to mapped soil types developed by the NRCS.

- *Unique Farmland* – approximately 6,600 acres: Unique farmland is farmland of lesser quality soils used for the production of the state’s leading agricultural crops. This land is usually irrigated, but may include nonirrigated orchards or vineyards as found in some climatic zones in California. Land must have been cropped at some time during the four years prior to the mapping date.

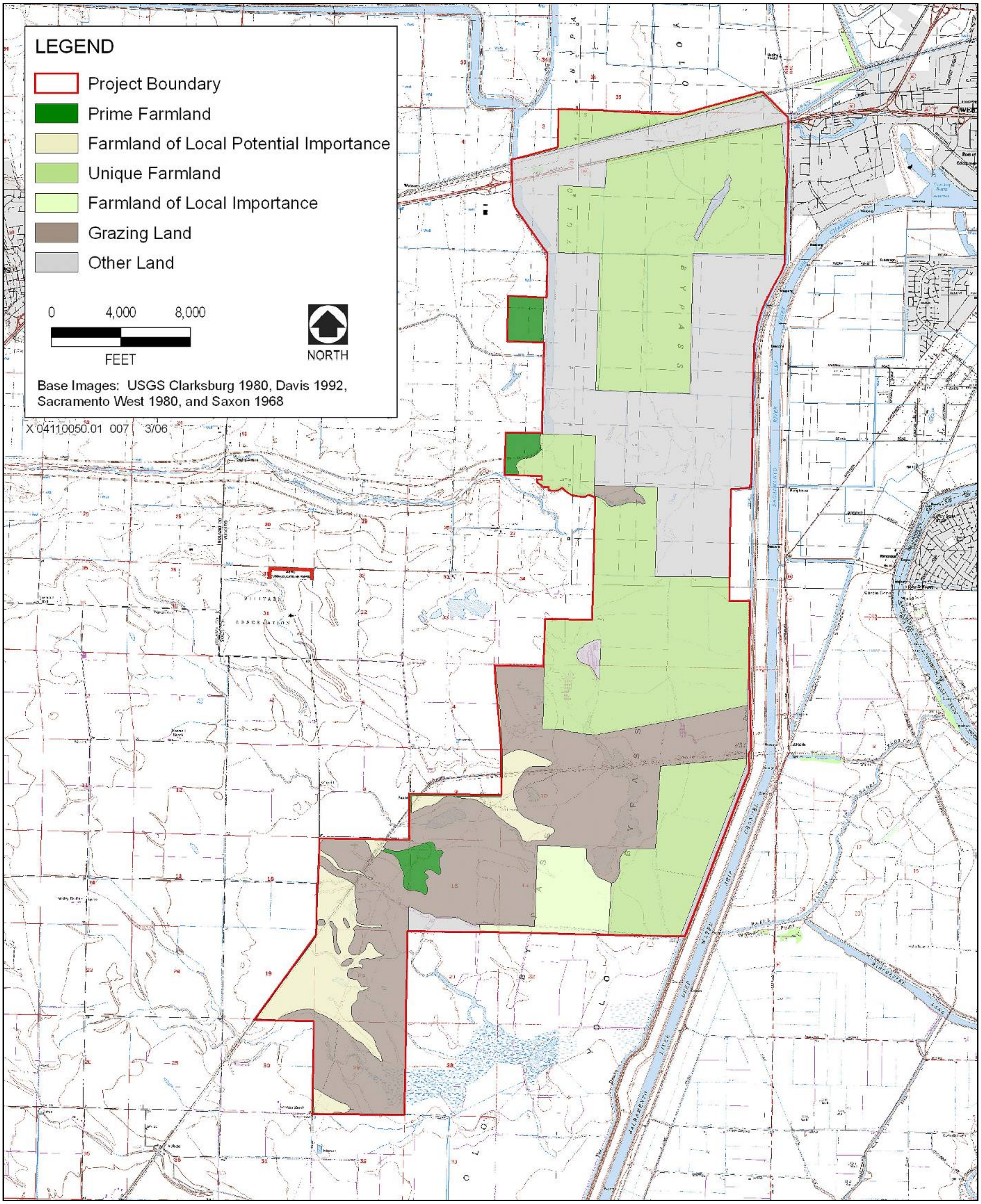
- *Farmland of Local Importance* – approximately 450 acres: Farmland of Local Importance is land of importance to the local agricultural economy as determined by each county's board of supervisors and a local advisory committee. Within Yolo County, these are soils that meet the criteria of Prime Farmland or Farmland of Statewide Importance but are not irrigated. It can also include other nonirrigated farmland as determined by the Board of Supervisors (DOC undated).
- *Potential Farmland of Local Importance* – approximately 950 acres: Potential Farmland of Local Importance denotes farmland that would otherwise meet the criteria of Farmland of Local Importance but is not currently farmed.
- *Grazing Land* – approximately 4,100 acres: Grazing land is land on which the existing vegetation is suited to the grazing of livestock. This category was developed in cooperation with the California Cattlemen's Association, University of California Cooperative Extension, and other groups interested in the extent of grazing activities.
- *Other Land* – approximately 4,320 acres: Other Lands include land not included in any other mapping category. Common examples include low density rural developments; brush, timber, wetland, and riparian areas not suitable for livestock grazing; confined livestock, poultry or aquaculture facilities; strip mines, borrow pits; and water bodies smaller than forty acres. Vacant and nonagricultural land surrounded on all sides by urban development and greater than 40 acres is mapped as Other Land. This designation does not include urban lands or water, which are mapped in separate categories.

These designations, including the total acreage and locations of each designation within the Yolo Bypass Wildlife Area are provided in Table 3.2-1 and shown in Exhibit 3.2-1.

Table 3.2-1
Yolo Bypass Wildlife Area – Agricultural Land Designations

Agricultural Land Designation	Approximate Acreage	Management Units
Prime Farmland	350	Northwest, Los Rios Farms, Pacific Flyway Center, and Tule Ranch
Unique Farmland	6,600	Causeway Ranch, 1,000 Acres, Los Rios, Parker, Field 29, Field 38, Tule Ranch
Farmland of Local Importance	450	Tule Ranch
Potential Farmland of Local Importance	950	Tule Ranch
Grazing Land	4,100	Tule Ranch, Los Rios WRP
Other Land	4,320	North, Northwest, West, Central, Cowell Pond, Causeway, Tule Ranch

Source: DOC undated; EDAW 2006



Source: FMMP 2002

Yolo Bypass Wildlife Area Agricultural Land Designations (DOC/USDA) **Exhibit 3.2-1**

Given the prevalence of land within the Yolo Bypass Wildlife Area suited to agriculture, many of the management units incorporate some form of agriculture at least on an occasional basis as a management tool. In general, agricultural activities contribute to Yolo Bypass Wildlife Area goals:

1. Maintain or enhance habitat for native wildlife and plants; and
2. Provide an income source for DFG management and operations of the wildlife area while helping to maintain agriculture as a viable economic activity in Yolo County.

3.2.2 YOLO BYPASS WILDLIFE AREA AGRICULTURAL LAND USES

Agricultural lands within the Yolo Bypass Wildlife Area are leased to local farmers and managed, under an agreement with DFG, by the Dixon RCD. Currently, there are four agricultural lease tenants in the Yolo Bypass Wildlife Area. These tenants work in cooperation with DFG to grow a variety of agricultural crops and to manage livestock grazing for wildlife and native plant habitat management. Revenues from these leases provide valuable operating income for the Yolo Bypass Wildlife Area. A description of these two activities is provided below. Exhibit 3.2-2 depicts agricultural land uses throughout the Yolo Bypass Wildlife Area. Crop production practice tables for the Yolo Bypass Wildlife Area are provided at the end of this section.

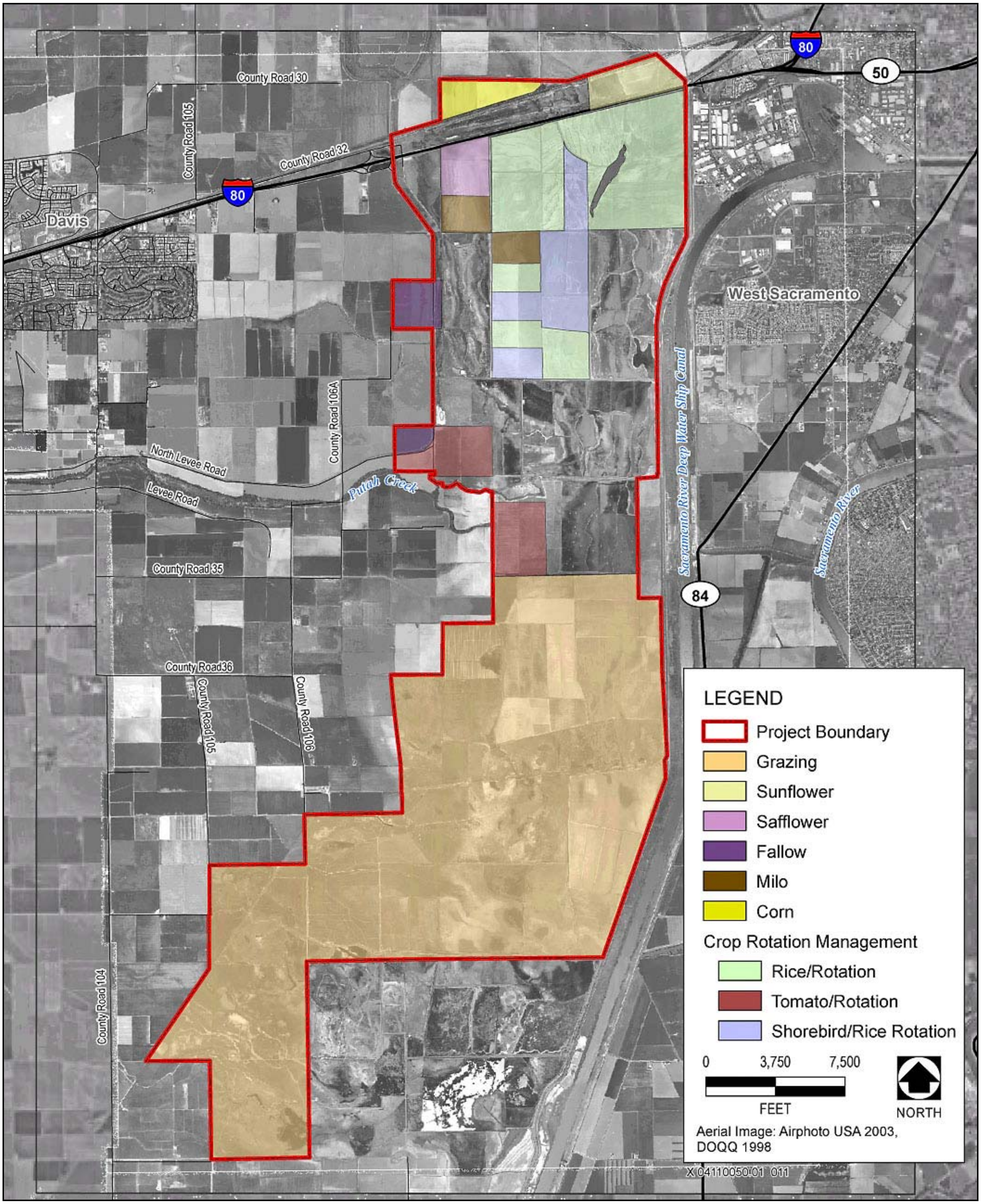
ROW AND TRUCK CROPS

Row and truck crops are grown across the northern half of the Yolo Bypass Wildlife Area (i.e., Causeway Ranch and Los Rios Farms Complex) and on the northern portion of the Tule Ranch. The primary crops grown include: rice, corn, millet, milo (grain sorghum), safflower, sunflower, and tomatoes. These crops are cultivated during the summer months. From fall to spring, some farmed areas are fallowed and flooded to provide a valuable source of forage for wildlife (Table 3.2-2) as well as seasonal wetland habitat. Three common crop rotations are:

1. Corn to safflower/sunflower to tomatoes;
2. White rice to white rice to wild rice or;
3. White rice to wild rice to shorebird habitat (fallowed rice fields that are flooded to a shallow depth during the growing season).

Table 3.2-2
Yolo Bypass Wildlife Area – Crop Forage Values for Wildlife

Crop	Target Species or Species Groups
Rice (Wild and Conventional)	Ducks, geese, cranes, ibis, egrets, shorebirds, terns
Tomatoes	Swainson’s hawk, shorebirds
Corn	Ducks, geese, cranes, shorebirds
Millet	Pheasants, waterfowl
Wheat	Provides nesting cover and winter green feed for a variety of species
Milo	Waterfowl and shorebirds
Safflower	Mourning dove, pheasant, curlews, plovers



Source: Department of Fish and Game, City of Davis 2005, CaSIL 1993

Yolo Bypass Wildlife Area Agricultural Land Uses (2005 Crop Year) **Exhibit 3.2-2**

Rotation strategies are designed to provide a diversity of wildlife habitat elements and to facilitate sustainable agricultural practices (e.g., maintain soil fertility and reduce herbicide application). Other crops, (e.g., millet, milo, safflower, and sunflower) are occasionally planted to provide supplemental sources of wildlife forage. These crops may be planted as part of one of the three above rotation strategies or may be periodically planted on fields designated solely for wildlife forage production. The total acreage of each crop grown during the last three years is provided below (Table 3.2-3).

Table 3.2-3
Yolo Bypass Wildlife Area – Crop Production Acreages 2004–2006

Crop	Year		
	2004	2005	2006
Wild Rice	829	570	270
Conventional Rice	871	0	0
Tomatoes	368	539	581
Corn	84	78	0
Sunflower	173	84.5	121
Misc./Wildlife Crops	995	60	699
Fallow/Shorebird	538	950	2,240

Source: Dixon RCD Annual Crop Plans for the Yolo Bypass Wildlife Area

GRAZING

Cattle grazing occurs primarily on an extensive portion of the Tule Ranch Unit in the southern end of the Yolo Bypass Wildlife Area. Additional grazing, specifically for vegetation management, occurs throughout many of the remaining portions of the Yolo Bypass Wildlife Area. Cattle are often used as an initial treatment of vegetation prior to discing or spraying with herbicide. Animals are brought onto the Yolo Bypass Wildlife Area in mid spring or early summer after the threat of flooding has passed and they are removed by January. Forage is provided in irrigated pasture, uplands within the Bypass and the annual grasslands-vernal pool complex. Vast areas within the Bypass grow sweet clover, a nutritious legume. This plant can also cause severe bloating or thinning of blood and must be utilized judiciously. During years that experience spring flooding, the vegetation in the Bypass dominated by curly dock and cocklebur, two plants very low in forage value.

The exact number of animals brought onto the Yolo Bypass Wildlife Area varies on an annual basis based on weather patterns and the total amount of available forage. There is currently no set stocking rate, utilization standard, or grazing monitoring program for the Yolo Bypass Wildlife Area. It is anticipated that standard AUM units will be the basis for future grazing strategies. The total acreage of unirrigated range and irrigated pasture grazed over the last three years is provided in Table 3.2-4.

Table 3.2-4
Yolo Basin Wildlife Area Grazing Acreages 2004–2006

Rangeland Type	Year		
	2004	2005	2006
Un-irrigated Range	7,131	7,568	6,793
Irrigated Pasture	764	764	1,083

Source: Dixon RCD Annual Crop Plans for the Yolo Bypass Wildlife Area

The following represent typical activities by crop on an average farm. Activities in the YBWA may differ due to seasonal flooding.

Additional products to those included in the table (s) may be used. For a complete list of products registered for each crop, contact the County Agricultural Commissioner.

Table 3.2-5
Crop Production Practices
(information compiled from UC Cooperative Extension Cost Studies and DFG input)

White & Wild Rice Production Activities			
		Date Range	**Special Considerations**
Groundwork (land preparation)		April–May	
Preplant Fertilization		April–May	
Planting		April–May	
Irrigation		May–Aug	flood
Fertilization		May–July	top-dress by air in production years
Harvest		Sept–Oct	
Post Harvest (groundwork)		Sept–Oct	not used in Yolo Bypass
Post Harvest Flooding		Oct–May	for waterfowl
***Pesticide/ Herbicide Product Options**	**Target Pest / Weed**	**Date Range**	**Special Considerations**
Copper Sulfate	Algae / Shrimp	May	after planting
Malathion SS	Midge	May	
Roundup	Levee Weeds	May–Aug	
Propanil, Grandstand	Weeds	May–June	broadleaf, sedges & grass weeds (white rice only)
Warrior	Weevil / Armyworms	May, July	after planting for weevil, in July for armyworms
Quadris	Diseases	July–Aug	
Possible Wildlife Benefited	**Use**	**Date Range**	**Special Considerations**
General Wildlife Species	Habitat and Food	Year-round	in fallow years as wildlife cover crop
Stilts and Avocets	Breeding Habitat	April–May	
	Brood Habitat	May–Oct	
Egrets and Ibis	Food	May–Sept	crayfish
Waterfowl and Shorebirds	Wintering Habitat	Oct–May	during post harvest flooding

* Organic rice is also grown in the YBWA with similar production activities to those listed below, except all practices comply with the USDA National Standards for Organic Food. For more information visit www.ams.usda.gov/nop/NOP/standards.html

* Not all of the pesticide/herbicide product options will be needed every year.

Table 3.2-5
Crop Production Practices

(information compiled from UC Cooperative Extension Cost Studies and DFG input)

Corn Production Activities

		Date Range	
Groundwork (land preparation)		Mar–April	
Preplant Fertilization		April–May	
Planting		April–May	
Cultivation		Mar, May	weed control
Irrigation		May–Aug	
Fertilization		May–Aug	
Harvest		Sept–Oct	
Post Harvest (groundwork)		Sept–Oct	

*Pesticide/ Herbicide Product Options	Target Pest / Weed	Date Range	
Roundup	Weeds	Feb	not typical in Yolo Bypass due to winter flooding
Weedar	Weeds	May	
Sevin Bait	Cutworms	May–June	
Comite	Mites	June	

Possible Wildlife Benefited	Use	Date Range	Special Considerations
Upland Game	Cover and Food	May–Sept	Ring-necked Pheasant & Mourning Dove
Ducks, Geese & Sandhill Cranes	Habitat	Oct–Mar	during post harvest flooding

* Not all of the pesticide/herbicide product options will be needed every year.

Sunflower Production Activities

	Date Range	Special Considerations
Groundwork (land preparation)	Mar–April	
Planting	April–May	
Fertilization	April–May	
Irrigation	April–July	
Pollinate	May–June	
Harvest	Aug–Sept	
Post Harvest (groundwork)	Sept–Nov	

Table 3.2-5
Crop Production Practices

(information compiled from UC Cooperative Extension Cost Studies and DFG input)

*Pesticide/ Herbicide Product Options	Target Pest	Date Range	Special Considerations
Asana	Moth	June–July	
Treflan	Weeds	Mar–April	pre-plant
Roundup	Weeds	Jan	not typical in Yolo Bypass due to winter flooding

Possible Wildlife Benefited	Use	Date Range	Special Considerations
Tria-colored Blackbird, upland game birds, Mourning Dove	Food source	Sept–Dec	Post harvest

* Not all of the pesticide/herbicide product options will be needed every year.

Safflower Production Activities

	Date Range	Special Considerations
Groundwork (land preparation)	Aug–Oct	in year preceding planting
Planting	Mar–May	
Fertilization	Mar–May	prior to planting
Irrigation	May–Aug	
Cultivation	May	
Fertilization	May–June	
Harvest	July–Sept	
Post Harvest (groundwork)	Aug–Oct	

*Pesticide/ Herbicide Product Options	Target Pest	Date Range	Special Considerations
Roundup	Winter Weeds	Feb	not typical in Yolo Bypass due to winter flooding
Treflan	Weeds	Mar–Apr	

Possible Wildlife Benefited	Use	Date Range	Special Considerations
Mourning Dove & Ring-necked Pheasant	Food	Mar–Aug	Unharvested food plots provide food and hunting opportunities.

* Not all of the pesticide/herbicide product options will be needed every year.

Table 3.2-5
Crop Production Practices

(information compiled from UC Cooperative Extension Cost Studies and DFG input)

Tomato Production Activities

		Date Range	**Special Considerations**
Groundwork (land preparation)		Mar–Apr	not typical in Yolo Bypass due to winter flooding
Fertilization		April–May	at planting
Planting		April–May	to meet contracted weekly delivery schedules
Fertilization		April–May	side dress at lay by and during planting
Irrigation		Apr–Sept	sprinkler to establish, then furrow
Fertilization		April–Aug	
Harvest		June–Sept	
***Pesticide/ Herbicide Product Options**	**Target Pest**	**Date Range**	**Special Considerations**
Roundup	Weeds	Jan	not typical in Yolo Bypass due to winter flooding
Vapam	Weeds	Feb–May	before planting
Devrinol / Telam	Weeds	Feb–May	Pre-emergent
Shadeout, Trilin, Sencor, Dual	Weeds	Feb–May	to seedlings and/or at lay by
Sevin 80	Flea Beetle	Feb–May	after seedling emergence
Sevin 5	Beetle / Cutworm	Feb–May	
Kocide / Dithane	Bacterial Speck	Feb–May	
Sulfur Dust	Russet Mite	Feb–May	
Asana	General Insect Ctrl	Feb–May	
Confirm	Worm	Feb–May	
Bravo	Blight / Fruit Protect	June, Sept	
Ethrel	Fruit Ripening Agent	June–Sept	prior to harvest
Possible Wildlife Benefited	**Use**	**Date Range**	**Special Considerations**
Swainson's Hawk	Foraging	May–June	Discing for preparation of fields exposes rodents and insects.

* Organic tomatoes are also grown in the YBWA with similar production activities to those listed below, except all practices comply with the USDA National Standards for Organic Food. For more information visit www.ams.usda.gov/nop/NOP/standards.html.

* Not all of the pesticide/herbicide product options will be needed every year.

Table 3.2-5
Crop Production Practices

(information compiled from UC Cooperative Extension Cost Studies and DFG input)

Wheat Production Activities			
		Date Range	**Special Considerations**
Groundwork (land preparation)		Aug–Oct	
Pre-Plant Fertilization		Aug–Oct	preplant
Planting		Oct–Dec	
Irrigation		April	
Fertilization		Oct–Dec, Feb	at planting & during growing season
Harvest		May–July	
***Pesticide/ Herbicide Product Options**	**Target Pest**	**Date Range**	**Special Considerations**
2, 4-D	Winter Weeds	Feb	
Possible Wildlife Benefited	**Use**	**Date Range**	**Special Considerations**
Ducks & Geese	Food	Oct–May	Birds foraging on green feed may affect yield.
Waterfowl, Pheasant	Nesting Habitat	April–July	
* Wheat Production on the Yolo Bypass has occurred in extended drought periods. Currently wheat is not in the crop rotation. * Not all of the pesticide/herbicide product options will be needed every year.			
Oat Hay Production Activities			
		Date Range	**Special Considerations**
Groundwork (land preparation)		Sept–Oct	
Pre-Plant Fertilization		Oct	
Planting		Oct–Nov	
Irrigation		Mar–May	
Harvest		May–June	
***Pesticide/ Herbicide Product Options**	**Target Pest**	**Date Range**	**Special Considerations**
2, 4-D	Winter Weeds	April	not typical on the Yolo Bypass
Possible Wildlife Benefited	**Use**	**Date Range**	**Special Considerations**
Egrets, Herons, Swainson’s Hawk	Food	Summer	irrigation provides rodent & insect food sources
Swainson’s Hawks, Egrets, Heron, Crows	Food	May–Aug	haying process provides food
* Not all of the pesticide/herbicide product options will be needed every year.			

Table 3.2-5
Crop Production Practices
(information compiled from UC Cooperative Extension Cost Studies and DFG input)

Rye Grass Hay Production Activities

		Date Range	Special Considerations
Pre-Plant Fertilization		Sept–Nov	
Planting		Sept–Nov	
Irrigation		Sept–Apr	quick applications to keep soil moist
Fertilization		Dec–Feb	after grazing or 1st cut
Harvest		Jan–Apr	75 days to 1st cut, then on 28–40 day cycle

*Pesticide/ Herbicide Product Options	Target Pest	Date Range	Special Considerations

Possible Wildlife Benefited	Use	Date Range	Special Considerations
Waterfowl, pheasant, Northern Harrier	Nesting Habitat	April–July	

* Rye Grass Hay is grown occasionally on the grazing lands in years when there is more vegetation than can be grazed in a timely manner. This hay is typically used by the tenant and no rent is charged above normal grazing rents, except where noted in Annual Crop Plans.

* Not all of the pesticide/herbicide product options will be needed every year.

Grain Sorghum (Milo) Production Activities

		Date Range	Special Considerations
Groundwork (land preparation)		Mar–May	
Planting		Apr–June	
Irrigation		May–Aug	
Fertilization		May–Aug	
Harvest		Sept–Nov	dependent on grain moisture content

*Pesticide/ Herbicide Product Options	Target Pest	Date Range	Special Considerations
2, 4-D	Weeds	May–Aug	dependent on plant height
Atrazine	Weeds	Apr–Aug	for grasses and broadleaves

Possible Wildlife Benefited	Use	Date Range	Special Considerations
Upland Game	Cover & Food		Ring-necked Pheasant & Mourning Dove
Ducks, Geese, Shorebirds, Sandhill Cranes	Habitat		During post-harvest flooding

* Not all of the pesticide/herbicide product options will be needed every year.

Table 3.2-5
Crop Production Practices

(information compiled from UC Cooperative Extension Cost Studies and DFG input)

Grazing Activities (compiled for 300 head cow/calf operation)

	Date Range	Special Considerations
Winter Range Feeding	Nov–Apr	
Summer Feeding	May–Oct	
Irrigation	May–Oct	for winter weed control
Calving		
Breeding	Dec–Feb	
Sale of Culls (Bulls & Cows)	March	time frames vary based on tenant's operation
Sale of Calves	May	time frames vary based on tenant's operation
Sale of Yearling Heifers	Sept	time frames vary based on tenant's operation

*Pesticide/ Herbicide Product Options	Target Pest	Date Range	Special Considerations

Possible Wildlife Benefited	Use	Date Range	Special Considerations
Establishment of Native Forb Communities and vernal pools			managing grazing to remove non-native grasses and control unwanted vegetation in wetlands
Mallard & Ring-necked Pheasant	Nesting		can be managed as dense nesting cover
Geese & Sandhill Cranes	Food		can be grazed as low pasture

* Not all of the pesticide/herbicide product options will be needed every year.

3.3 CLIMATE, GEOLOGY, TOPOGRAPHY, AND SOILS

This section describes the climate, geology, topography, and soil resource characteristics of the Yolo Bypass Wildlife Area (Wildlife Area). Agricultural soil resources (e.g., Prime Farmland) are described in Section 3.2, “Agricultural Resources and Land Uses.” Geomorphology, hydrology, and water quality are described in Section 3.4.

The following text was developed through a review of existing scientific literature and Yolo Bypass Wildlife Area staff information. These sources provided information on climate, geology, topography, and soils characteristics throughout the Yolo Bypass Wildlife Area.

3.3.1 CLIMATE

Yolo County has a Mediterranean climate characterized by hot, dry summers and temperate, wet winters. However, the county receives a marine air influence from the Delta regions to the south that moderates the temperature extremes of the Central Valley. During the summer months (June–August), average daily high temperatures are in the mid-90s Fahrenheit (ºF) and average daily low temperatures are in the mid-50s. During the winter months (December–February), average high temperatures are in the 50sºF and average lows are 38–40ºF. Virtually all precipitation falls as rain, between November and April in most years. Annual rainfall typically ranges from 16 to 22 inches, and the average annual air temperature is 60–62°F. The frost-free season is 230–280 days throughout the year (Yolo County Planning Department 2005).

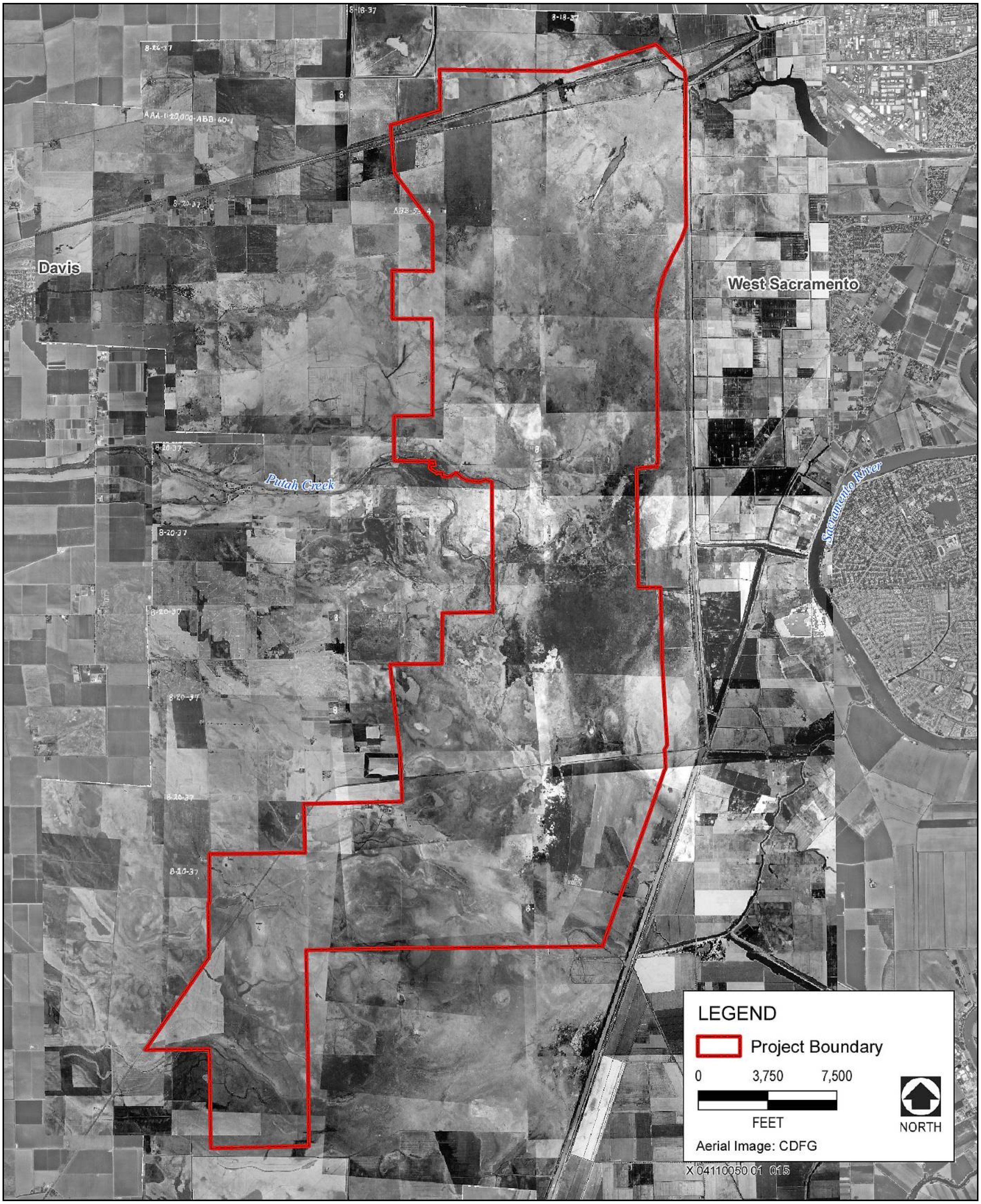
3.3.2 GEOLOGY

The Yolo Bypass Wildlife Area is located in the Yolo Basin on the west side of the Sacramento Valley, in the Great Valley geomorphic province of California. The Sacramento Valley forms the northern half of the Great Valley, which fills a northwest-trending structural depression bounded on the west by the Great Valley Fault Zone and the southern Coast Ranges, and to the east by the Sierra Nevada and the Foothills Fault Zone. Most of the surface of the Great Valley is covered with alluvium of Holocene and Pleistocene age, composed primarily of sediments from the Sierra Nevada and the Coast Ranges that were carried by rivers and deposited on the valley floor.

The Wildlife Area is underlain by Holocene-age (i.e., the last 10,000 years) Basin deposits, composed of fine-grained silt and clay, which overlie older Pleistocene-age alluvial fan deposits (Riverbank Formation) of the Sacramento River (Helley and Harwood 1985, Wagner et al. 1987). These periods of deposition correlate with periods of glaciation in the Sierra Nevada, the rise and fall in sea level, and climatic change. Additional information regarding the geomorphology and hydrology of the Yolo Wildlife Area is provided in Section 3.4.

3.3.3 TOPOGRAPHY

Historic landforms in the Yolo Wildlife Area include the floodplains and natural levees along the Sacramento River; the historic delta and distributary channels of Putah Creek (as depicted in Exhibit 3.3-1); the closed depression formations of the Putah Creek Sinks; the edge of the alluvial fan of Putah Creek extending into the Basin; and the Yolo Basin rims within and around its borders. Green’s Lake in the northern portion of the present-day Wildlife Area appears that it could be an oxbow lake that may have been formed over time as erosion and deposits of soil changed the course of the Sacramento River and perhaps Putah Creek. Historic maps seem to depict a connection between the north fork of Putah Creek, Green’s Lake, Lake Washington, and perhaps the Sacramento River.



Source: Department of Fish and Game

Yolo Bypass Wildlife Area Aerial Photo (1937) **Exhibit 3.3-1**

The alluvial fans, natural levees, and floodplains including the sinks of Putah Creek are composed of coarse sediment deposited by the flowing water of periodic overbank flooding of the Sacramento River and Putah Creek. The basins and basin rims are composed of fine sediment deposited by the ponded water of rainfall and flood overflows.

The current topographic features and landforms within the Wildlife Area are largely a product of anthropogenic alterations to the natural system. The construction of dams (upstream in the Sacramento River watershed and in Putah Creek) and levees, management of water releases, and grading of topography for purposes of conversion to agricultural lands has resulted in substantial changes to the current topography. Currently elevations range from approximately 5 feet above sea level at the bank of the East Toe Drain to 15 feet above sea level at the western edge of the Tule Ranch Unit. Primary topographic features now include human-made levees, trestles, and berms. Remaining natural topographic features include closed landform depressions, (e.g., Putah Creek Sinks, natural seasonal wetlands, vernal pools), remnant alluvial fan features that drain the western portion of the Tule Ranch to the East Toe Drain, and Green's Lake (i.e., remnant oxbow lake). Additional information regarding physical processes that formed the topographic features and landforms throughout the Yolo Bypass Wildlife Area is provided in Section 3.4, Geomorphology, Hydrology, and Water Quality."

3.3.4 SOILS

Six general soil associations have been identified in the Wildlife Area (Natural Resources Conservation Service 1972) (Exhibit 3.3-2). A soil association is a landscape that has a distinctive proportional pattern of soil types. It normally consists of one or more major soils and at least one minor soil; it is named for the major soils. The soils in one association may occur in another, but in a different pattern. Table 3.3-1 summarizes the natural vegetation and agricultural/land use characteristics of the soil associations identified in the Wildlife Area (Andrews 1972; Yolo County Planning Department 2005). A brief description of each soil association is provided below. In the NRCS characterization of each association described below, the terms for texture apply to the surface layer.

Table 3.3-1
Soil Association Characteristics of the Yolo Bypass Wildlife Area

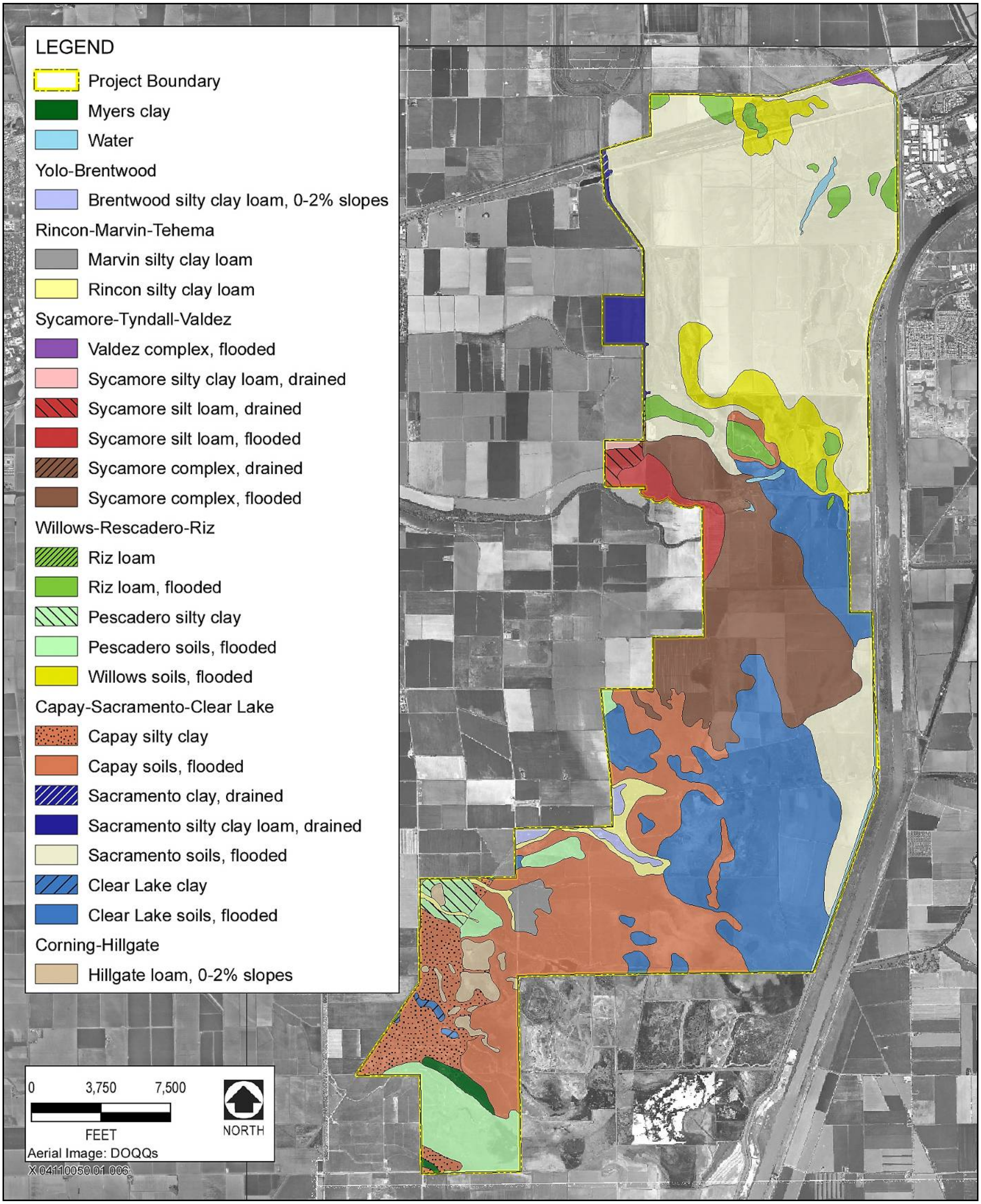
Soil Association	Natural Vegetation Characteristics[1, 2]	Agricultural and Other Land Use Characteristics[3]
Yolo-Brentwood	Annual grasses and forbs	Wide range of irrigated and nonirrigated crops
Rincon-Marvin-Tehema	Annual grasses and forbs with scattered oaks	Wide range of irrigated and nonirrigated crops
Sycamore-Tyndall-Valdez	Annual grasses and forbs	Irrigated crops and pasture and dry-farmed grain
Willows-Pescadero-Riz	Annual grasses, forbs, salt-tolerant plants	Alkali-tolerant irrigated crops and pasture and dry-farmed grain; wildlife habitat
Capay-Sacramento-Clear Lake	Annual grasses and forbs	Irrigated crops and pasture and dry-farmed grain
Corning-Hillgate	Annual grasses and forbs with scattered oaks and brush in places	Dry-farmed grain, pasture, rangeland, recreation, wildlife habitat

[1] Current vegetation of uncultivated and otherwise undisturbed soils; historic vegetation (prior to 1800s) characteristics would have been different, likely including native grasses and forbs, wetland plants and riparian trees and shrubs.

[2] Many of these soils have wetland soil characteristics (e.g., hydric).

[3] Primary uses may have changed in some of the associations as a result of reclamation and development of the irrigation system.

Sources: Andrews 1972: Yolo County Planning Department 2005



Source: SSURGO 2005, EDAW 2005

Soils Associations in the Yolo Bypass Wildlife Area

Exhibit 3.3-2

YOLO-BRENTWOOD ASSOCIATION

NRCS characterizes the Yolo-Brentwood Association as a “well-drained soil with nearly level topography, characterized by silt loams to silty clay loams, on alluvial fans.” These soils formed in alluvium derived from sedimentary rock. In uncultivated areas the vegetation is typically annual grasses and forbs. Minor soils of this association are the Myers, Reiff, Sycamore, and Zamora. The soils of this association are used chiefly for irrigated orchards, row crops, and field crops. The soils are also used for truck crops, irrigated pasture, dry-farmed grain, recreation areas, and wildlife habitat.

RINCON-MARVIN-TEHAMA ASSOCIATION

NRCS characterizes the Rincon-Marvin-Tehama Association as “well-drained and somewhat poorly drained soil with nearly level topography, characterized by silty clay loams to loams, and found on alluvial fans and basin rims.” These soils formed in alluvium derived from sedimentary rock. They have a subsoil of clay loam, silty clay loam, or silty clay. In areas not cultivated, the vegetation is mainly annual grasses and forbs, but Valley oaks may grow in scattered areas. Marvin soils are somewhat poorly drained and Tehama soils are well drained. Minor soils of this association are the Capay, Clear Lake, and Hillgate. The soils of this association are used chiefly for irrigated orchards, row crops, and field crops. The soils are also used for dry-farmed grain, for recreation areas, and as wildlife habitat.

SYCAMORE-TYNDALL-VALDEZ ASSOCIATION

This soil association occurs within the alluvial zone of Putah Creek. Most of the productive agricultural fields on the Wildlife Area contain these soils. NRCS characterizes the Sycamore-Tyndall-Valdez Association as “somewhat poorly drained soil with nearly level topography, characterized by very fine sandy loams to silty clay loams, on alluvial fans.” These soils formed in alluvium derived from mixed sources. In some areas drainage has been improved and the water table has been lowered. In uncultivated areas the vegetation is annual grasses and forbs. Lang is a minor soil in this association. Also included in this association are small, alkali-affected areas and a few small areas that have a silty clay substratum. The soils of this association are used chiefly for row crops, hay crops, orchards, irrigated pasture, and dry-farmed grain. The soils are also used for recreation areas and as wildlife habitat.

WILLOWS-PESCADERO-RIZ ASSOCIATION

NRCS characterizes the Willows-Pescadero-Riz Association as “poorly drained soil on nearly level topography, characterized by saline-alkali silty clay loams to clays, and located in basins.” These soils formed in alluvium derived from mixed and sedimentary rocks. In uncultivated areas the vegetation is annual grasses, forbs, salt grass, pickleweed, and other salt-tolerant plants. Minor soils of this association are the Lang, Laugenour, and Sacramento. The soils of this association are used chiefly for alkali-tolerant, irrigated row crops, field crops, and pasture plants, and as wildlife habitat. The soils are also used for dry-farmed grain and field crops, dryland pasture, and recreation areas.

CAPAY-SACRAMENTO-CLEAR LAKE ASSOCIATION

NRCS characterizes the Capay-Sacramento-Clear Lake Association as “moderately well drained to poorly drained soil located on nearly level topography, characterized by silty clays and clays, and located on basin rims and in basins.” These soils formed in alluvium derived from sedimentary rock under moderately good to poor drainage. In uncultivated areas the vegetation is annual grasses and forbs. Capay soils are moderately well drained, and Sacramento and Clear Lake soils are poorly drained. Minor soils of this association are the Lang, Laugenour, and Sacramento. Soils may be subject to ponding. The soils of this association are used chiefly for irrigated row crops, truck crops, field crops, dry-farmed field crops, and pasture. The soils are also used for recreation areas and as wildlife habitat.

CORNING-HILLGATE ASSOCIATION

NRCS characterizes the Corning-Hillgate Association as “well-drained soil on gently sloping to moderately steep topography, characterized by gravelly loams or loams, and located on terraces.” These soils formed in alluvium derived from sedimentary rock and mixed sources. They have a very slowly permeable subsoil at a depth between 10 and 30 inches. The vegetation is chiefly annual grasses and forbs, although a few oaks can grow and patches of brush can also occur. The depth to the clay subsoil in both the Corning and Hillgate soils ranges from 10 to 30 inches. Minor soils of this association are the Positas, San Ysidro, and Sehorn. Also found in this association are a few areas of soil that are moderately deep over clay subsoil, and a few severely eroded areas where the clay subsoil is exposed. The soils of this association are used chiefly for dry-farmed grain, pasture, range, and recreation areas, and as wildlife habitat.

The suitability of the soils for particular agricultural uses and their farmland classification (e.g., Prime Farmland) is described in more detail in Section 3.2, “Agricultural Resources.”

3.4 GEOMORPHOLOGY, HYDROLOGY, AND WATER QUALITY

This section describes the geomorphology, hydrology, and water quality conditions in the Yolo Bypass Wildlife Area. It provides an overview of the historical setting, including the principal natural and human-caused changes in the Yolo Basin/Bypass that have occurred over time. It also describes the key physical and chemical conditions of the Yolo Bypass that define the Yolo Bypass Wildlife Area's existing characteristics.

The following text was developed through a review of scientific literature and existing data sources, aerial photography, Yolo Bypass Wildlife Area staff information, and staff expertise. These sources provided information on the historic and existing geomorphic and hydrologic conditions and current water quality conditions in the Yolo Bypass Wildlife Area.

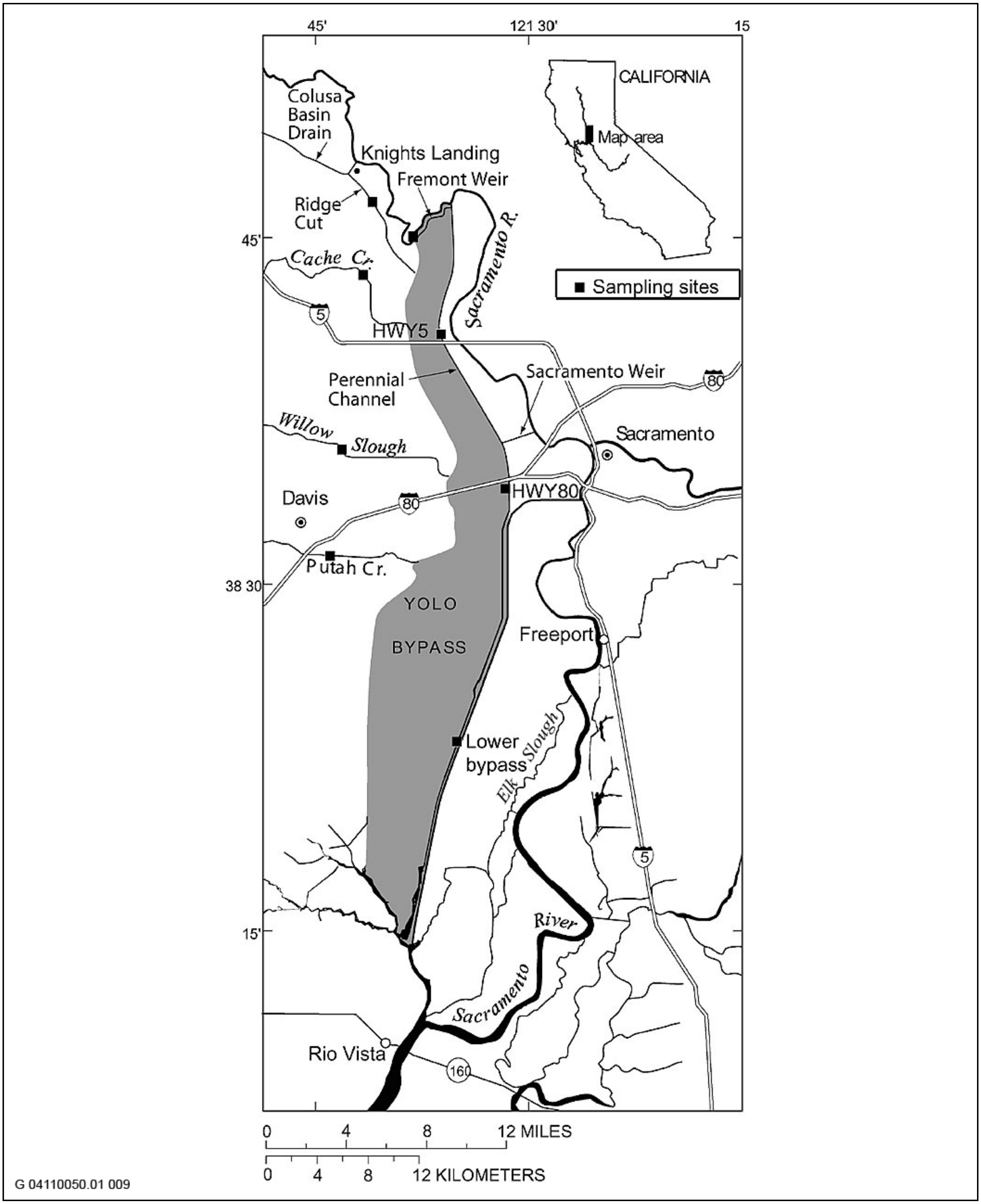
HISTORIC LANDSCAPE

The lower Sacramento River from Knights Landing to the Delta, along with its adjacent flood basins (Yolo Basin to the west and the American Basin to the east) formed a single geomorphic system shaped by tectonic subsidence, flood borne sedimentary processes, and a rising sea level following the end of the last Ice Age 10,000 years ago. The broad natural levees along the river were built up by the deposition of coarser sediments deposited during floods and supported a continuous miles-wide corridor of mixed riparian and valley oak riparian forests in the floodplain meander belt, transitioning to extensive tule marsh extending from the basins to the estuary, as described below. As the river meandered and banks eroded, large overhanging trees along the riverbank would fall into the channel creating structurally complex riverine habitat. This dynamic landscape provided high quality habitat for anadromous fish migrating between the estuary and the upper Sacramento River and for millions of migratory and resident birds and large and small mammals.

Geomorphology

The historic Yolo Basin (Basin) was a natural depression formed on the Sacramento Valley floor after the last Ice Age. It was defined to the north and east by the natural levees of the Sacramento River and its distributary channels, on the west by the edge of the coalesced alluvial fans of Putah Creek and Cache Creek, and to the south by the tidal tule marshes of the Sacramento River Delta (see Exhibit 1-3). The trough of the Basin was about 12 feet lower than the tops of the adjacent natural levees and was isolated from the river except during larger flood events that overtopped the natural levees (Phillip Williams and Associates 2005). The area most susceptible to overtopping was the reach affected by backwater from the Feather River, in the vicinity of the present Fremont Weir, as shown by Exhibit 3.4-1. Although overtopping of the natural levees in this area would occasionally form 'crevasses' that would erode and redistribute sediments, scouring was insufficient to create distributary channels through the Basin. Only where this influence was felt at the vicinity of Freeport (see Exhibit 3.4-1) would permanent crevasses form in the natural levee of the Sacramento River allowing the formation of stable distributary channels like Elk Slough (Exhibit 3.4-1).

The trough of the Basin therefore did not function as a true floodplain that directly interacted with the Sacramento River as it rose and fell during the winter and spring. Instead it formed a vast mosaic of wetlands that transitioned from seasonal wetlands in the north, through willow thickets, tule marshes, and backwater ponds, to the freshwater tidal marshes and slough channels of the estuary to the south. The wetlands were seasonally fed by runoff and groundwater discharges from the Sacramento River and from Putah and Cache creek alluvial fans to the west. The Basin was intermittently inundated by large flood overflows from the Sacramento, Feather, and American rivers and from Putah and Cache creeks. Based on historic maps it appears that permanent wetlands



Source: Schemel 2002

Current Map of Yolo Bypass **Exhibit 3.4-1**

formed in low-lying areas characterized by a high water table. Willow thickets grew around the margins and at the edges of the alluvial fans from about 5 to 10 feet above sea level. An extensive tule marsh occupied the Basin trough below elevations of about 5 feet above sea level, blending into the tidal tule marsh above Cache Slough (Exhibit 1-2) at elevations of about 3 feet above sea level. The non-tidal marsh functioned differently from the tidal portion as it was mapped with no distinct natural drainage channels and probably functioned with lower flows gradually filtering through the vegetation towards the estuary. This type of wetland would tend to accumulate alluvial sediment, gradually rising in elevation, and isolating floodplain ponds on its periphery.

Hydrology

The hydrology of the Sacramento River is dominated by the Mediterranean climate of the region with wet winters, dry summers, and long multi-year periods of extreme wet and drought conditions. The high peaks of the Sierra Nevada intercepted much of the moisture coming off the ocean and stored it as snow and ice that melted gradually, generating cold rivers that flowed throughout the dry summers. During periods of high snowmelt and rainfall, much of the Central Valley became inundated, forming an extensive inland sea that took months to drain downstream to the Bay-Delta system. In moderate flood years, the river frequently overtopped it banks spilling into the Yolo Basin. The Basin likely remained inundated in the southerly portions of the Basin until late spring. During the dry season, river flows were greater than 5,000 cubic feet per second (cfs) (Phillip Williams and Associates 2006).

The Sacramento River historically was the largest watercourse affecting the Yolo Basin from the north and east (Central Valley Habitat Joint Venture 1993). Cache Creek, Putah Creek, and Willow Slough were the major tributaries inflowing to the basin from the west. Flows slowly drained towards the south through a vast array of wetlands and non-tidal marshes into the tidal marshes of the north Delta. Permanent bodies of water persisted in the Cache Creek Sink and Putah Creek Sinks.

Historically, Putah Creek frequently overflowed its banks during high flow events in winter and spring (Central Valley Habitat Joint Venture 1993). Elevated ground water elevations within the Putah Basin contributed to seasonal floods that resulted in a meandering planform (i.e., condition of a stream as seen in aerial view) with a gently sloping alluvial fan that formed as a result of accumulated sedimentary deposits. Along the western edge of the Sacramento floodplain, Putah Creek meandered towards depressions (“sinks”) along the base of the Yolo Basin. This area is currently referred to as the Putah Creek Sinks. Putah Creek historically supplied substantial amounts of water to tule marshes within the Basin. Before construction of the Monticello Dam and the subsequent water regulation, the streams annual discharge into the Basin was approximately 359,000 acre-feet (Central Valley Habitat Joint Venture 1993). During dry flows, the reduced inflows and discharging groundwater resulted in intermittent deep pools within its lower reaches.

The Cache Creek Basin was geologically divided into upper, middle, and lower reaches by Clear Lake, the Vaca Range and the Sacramento Valley floor (Central Valley Habitat Joint Venture 1993). Little is known about the pre-European condition of lower Cache Creek, however, flows probably ranged from very little runoff during the summer months to approximately 40,000 cfs during the winter and spring events (Central Valley Habitat Joint Venture 1993). Historically, the creek transported large amounts of sediment to the valley floor, defining the northern boundary of the Yolo Basin, as its waters disappeared most of the year into the Cache Creek Sink.

Willow Slough has a small watershed and historically consisted of intermittent swales and sloughs which drained to the Yolo Basin between Putah and Cache creeks. The slough was fed by groundwater about four miles north of Putah Creek and terminated several miles southeast of the Cache Creek Sink.

HUMAN CHANGES TO THE LANDSCAPE

Modifications to Geomorphology

Regular flooding in the Sacramento Valley led to the construction of the Sacramento Flood Control Project that converted the natural Yolo Basin into the weir regulated Yolo Bypass. The history of this flood control system is discussed in Section 3.6, “Cultural Resources.”

The Bypass is 41 miles long and is surrounded completely on the east and partially on the west by levees constructed by the U.S. Army Corps of Engineers (USACE) (Yolo Basin Foundation 2001). Levee construction began in 1917 and the weirs were completed in 1917 (Sacramento Weir) and 1924 (Fremont Weir). The designs of the levees meet the calculated water-surface profile of the designed flow, with an extra buffer for freeboard. A small segment along the western boundary of the Bypass between Putah Creek and County Road (CR) 155 does not have a constructed levee due the sufficient height of the natural ground elevation.

In 1963, a deep water ship channel was constructed along the eastern edge of the Bypass. The material excavated for this channel was used to construct a second levee along the west side of the channel from the I-80 causeway to the southern tip of Prospect Island. This new levee was higher than the existing flood control levee, and thus serves as the new east levee for the Bypass. The construction of the ship channel decreased the designed conveyance capacity of the Bypass and increased the impacts of smaller flood events (Yolo Basin Foundation 2001).

There are a variety of small interior levees and berms constructed for local agricultural development that partially hinder the flood conveyance of the Bypass. These features have been used to prevent the inundation of particular areas from tidal fluctuations and small floods. The grading of land for such features is controlled by the Reclamation Board. Examples of major interior levees include the north levees of Little Holland Tract and Liberty Island.

In addition, the construction of causeways and bridge crossings along I-80, I-5, portions of the abandoned Sacramento North Railroad (SNRR) and the Southern Pacific Railroad (SPRR) also affected flood conveyance in the Bypass.

The flows in the Bypass produced from the 1986 and 1997 floods roughly equaled the capacity of the Bypass. Analysis of peak flows indicated that both of these floods approximately equaled that of a 70-year event (U.S. Army Corps of Engineers 1991; Yolo Basin Foundation 2001). Water surface elevations during the 1986 flood were only 2 to 3 feet below the crest of the east levee and 2 to 4 feet above the design water surface profile in some locations (U.S. Army Corps of Engineers 1996). In both the 1986 and 1997 floods, areas west of the Bypass along the unleveed section were inundated. As a result of these recent floods, some of the levees have incurred substantial wave damage including slipping and the creation of erosional shelves.

MODIFICATIONS TO HYDROLOGY

Flooding of newly developed agricultural land, aggravated by the cumulative effects of 19th century hydraulic mining led to the implementation of large-scale flood control projects within the entire Sacramento Basin (Central Valley Habitat Joint Venture 1993). In 1911, the State Reclamation Board was assigned to coordinate a basin wide plan for flood control for the entire Sacramento Valley. This project included the construction of a bypass capable of delivering 500,000 cfs of water through Cache Slough in the north delta and increasing the Sacramento River capacity to 100,000 cfs from Sacramento to Cache Slough (Central Valley Habitat Joint Venture 1993). Levees were constructed along both sides of the Yolo Bypass with project completion in 1948. The Yolo Bypass is the largest flood control bypass in California. It prevents flooding of the City of Sacramento and other nearby cities and farmland by diverting floodwaters through the Fremont and Sacramento Weirs and routing them directly to the Sacramento Delta, just north of Rio Vista, as shown by Exhibit 3.4-1 (Schemel et al. 1996).

The Central Valley Project (CVP) (1938) and the State Water Project (SWP) (1951) were also designed as part of the Sacramento Valley Flood Control system (Central Valley Habitat Joint Venture 1993). Their purpose was to improve the imbalance in water supply between the northern and southern parts of the state. This project included 20 reservoirs and 1,100 miles of canals in the Sacramento, Trinity, Feather, American, and San Joaquin river basins. The CVP featured reservoirs created by Shasta Dam on the Sacramento River, Whiskeytown Dam on Clear Creek, and Folsom Dam on the American River. The SWP featured the reservoir at Oroville on the Feather River.

In 1957 the U.S. Bureau of Reclamation constructed Monticello Dam on Putah Creek, located 10 miles upstream of Winters, California. The reservoir (Lake Berryessa) has a capacity of 1.6 million acre-feet, which is approximately four times the average annual runoff of Putah Creek. This large capacity has decreased the 100-year peak flow from 90,000 cfs (pre-dam) to 32,300 cfs (post-dam). The large decrease in peak flows and annual discharge has decreased sediment influx and capacity, essentially dried out the Putah Creek Sinks and prevented additional alluvial fan formation. Since the 1950’s, there has been no significant change in channel alignment downstream of Lake Berryessa (U.S. Army Corps of Engineers and CALFED Bay-Delta Program 2002).

Cache Creek drains approximately 1,290 square miles as it travels nearly 80 miles from its natural outlet from Clear Lake to its confluence with the Yolo Bypass. Flows have been controlled by the Indian Valley Reservoir on the north fork of Cache Creek since 1974 and by the Clear Lake Dam since 1913. Gravel mining, extensive grazing, and naturally erodible soils in the watershed contribute to a high sediment yield with an annual average suspended-sediment load of approximately 1.5 million tons per year (Jones et al 1972). The approximately two square-mile Cache Creek Settling Basin (constructed in 1937) was designed to catch this sediment before it entered the Yolo Bypass. In 1993 the USACE completed a reconstruction of the Settling Basin by enlarging it and removing several million cubic yards of sediment. Before this reconstruction, accumulated sediment had filled the Settling Basin, allowing substantial quantities of sediment to reach the Bypass (Central Valley Habitat Joint Venture 1993).

The Colusa Drain was connected to the Bypass via the artificial overflow channel Knights Landing Ridge Cut (Yolo Basin Foundation 2001). The Drain has a watershed area of 130 square miles, receiving input from all the creeks flowing from the Coast Range between Knights Landing and Stony Creek. The Drain transports drainage and irrigation water nearly 70 miles between Stony Creek and Knights Landing along the west side of the Sacramento River (Exhibit 3-2). The drain released water to the Sacramento River from a set of gates (constructed 1930) that maintain a constant upstream (drain side) water elevation of 25 feet (0 ft USACE datum = -3 ft MSL). The design allows for a backwater condition along the entire length of Knights Landing Ridge Cut which facilitates water for irrigation. To prevent water from flowing into the Bypass, a berm is constructed at the Bypass end of Knights Landing Ridge Cut. Flows entering the Sacramento River through the Colusa Basin Drain are measured by the DWR. When flows on the Sacramento River increase to 25 feet, the Colusa Drain closes and flows move through the Knights Landing Ridge Cut to the Bypass. These flows are not gaged but DWR does operate a second gage about halfway down the Drain where it crosses Highway 20.

3.4.1 EXISTING GEOMORPHOLOGY

SEDIMENT INPUT INTO THE YOLO BYPASS

Wright (2004) studied the changing trends of sediment yield within the Sacramento Basin for the period from 1957 to 2001. By examining the discharge and sediment yields on the Sacramento River upstream and downstream of the Fremont and Sacramento Weirs, which allow sediments to enter the Yolo Bypass, he was able to make the following conclusions:

- There is a very high probability of a decreasing trend in suspended-sediment discharge for a given flow.
- The annual suspended sediment yield has decreased by one-half from 1957 to 2001.
- During the largest flood events, peak sediment concentrations have decreased with time.
- The three largest reservoirs in the watershed have accumulated a mass of sediment of the same order of magnitude as the decreases in suspended-sediment yield from 1957 to 2001.

It has been suggested that this decreasing trend in suspended-sediment discharge is a result of reservoir sedimentation, bank protection measures, and the gradual depletion of stored hydraulic mining sediments. Although the data used to make these conclusions have been derived from the main stem of the Sacramento River; it is reasonable to suggest that the same trends will hold for sediment input into the Yolo Bypass through the Fremont and Sacramento Weirs.

If the balance between sediment supply and transport capacity has reached equilibrium, there should be a minimal change in sediment input into the Bypass in the future. However, changes in factors such as logging, levees, urbanization, and agricultural practices can have the potential to increase future sediment yield (Wright 2004).

3.4.2 EXISTING HYDROLOGY

SURFACE WATER HYDROLOGY

Current Operation of the Yolo Bypass

The Yolo Bypass provides a direct path from the confluence of the Sacramento and Feather Rivers and the Sutter Bypass to the Sacramento River Delta. Flow is diverted from the Sacramento River into the Bypass when the stage exceeds 33.5 feet (corresponding to 56,000 cfs at Verona). Diversion of the majority of Sacramento River, Sutter Bypass, and Feather River floodwaters to the Yolo Bypass from Fremont Weir controls Sacramento River flood stages at Verona. During large flood events, 80% of the Sacramento River flows are diverted into the Bypass. The Sacramento River at the Fremont Weir has natural levees on the unprotected right (south) bank, and out of bank flows disperse through a series of tree covered areas of higher ground dissected by distributary channels until reaching the upper end of the Fremont Weir. The high ground and distributary channels regularly shown on old maps of the area are considered natural apart from being maintained through the periodic removal of sand deposits by DWR.

The area between the Fremont Weir and the Sacramento River is one of high sediment deposition, as fast moving water from upstream meets slower moving water in the Yolo Bypass. Once water overtops the Sacramento River levees and the Fremont Weir, it flows into the Bypass. In high flow years, additional water can enter the Bypass via the Sacramento Weir. This weir is controlled so that flow can be released once the Sacramento River stage at Sacramento’s I Street Bridge reaches 27.5 feet (corresponding to 98,000 cfs). Because the design flood capacity of the American River (115,000 cfs) is 5,000 cfs higher than that of the Sacramento River channel past downtown Sacramento, the Sacramento Weir is a critical component of the project to keep flood control project runoff at safe water levels. The Sacramento Weir and Yolo Bypass are designed and managed to divert an equivalent volume of water from the Sacramento River as that joining it downstream from the American River, to maintain equal flood levels either side of the American River confluence. In practice, during large flood events, approximately 15% of the flow from the American River can pass upstream on the Sacramento River and enters the Sacramento Bypass (California Department of Water Resources 2003).

The weir gates are closed as rapidly as practicable once the stage at the weir drops below 25 feet. This provides “flushing” flows to re-suspend sediment deposited in the Sacramento River between the Sacramento Weir and the American River during the low velocity flow periods in that reach when the weir is open during the peak of the flood event (California Department of Water Resources 2003).

Once water has entered the Bypass it accumulates in the lower eastern side in the area occupied by the Tule Canal (from one mile south of the Fremont Weir to I-80) and the Toe Drain (from I-80 to Liberty Island). These constructed channels lie adjacent to the flood levees on the eastern boundary of the Bypass and collect water from the west side tributaries, primarily Knights Landing, Cache Creek and Putah Creek (Exhibit 3.4-2 depicts natural color bands from tributaries into the flooded Yolo Bypass). Water leaves the Yolo Bypass either via the Toe Drain or Liberty Cut at Prospect Slough via Shag Slough or over the southern end of Liberty Island to Cache Slough.

Flood Hydraulics of the Yolo Bypass

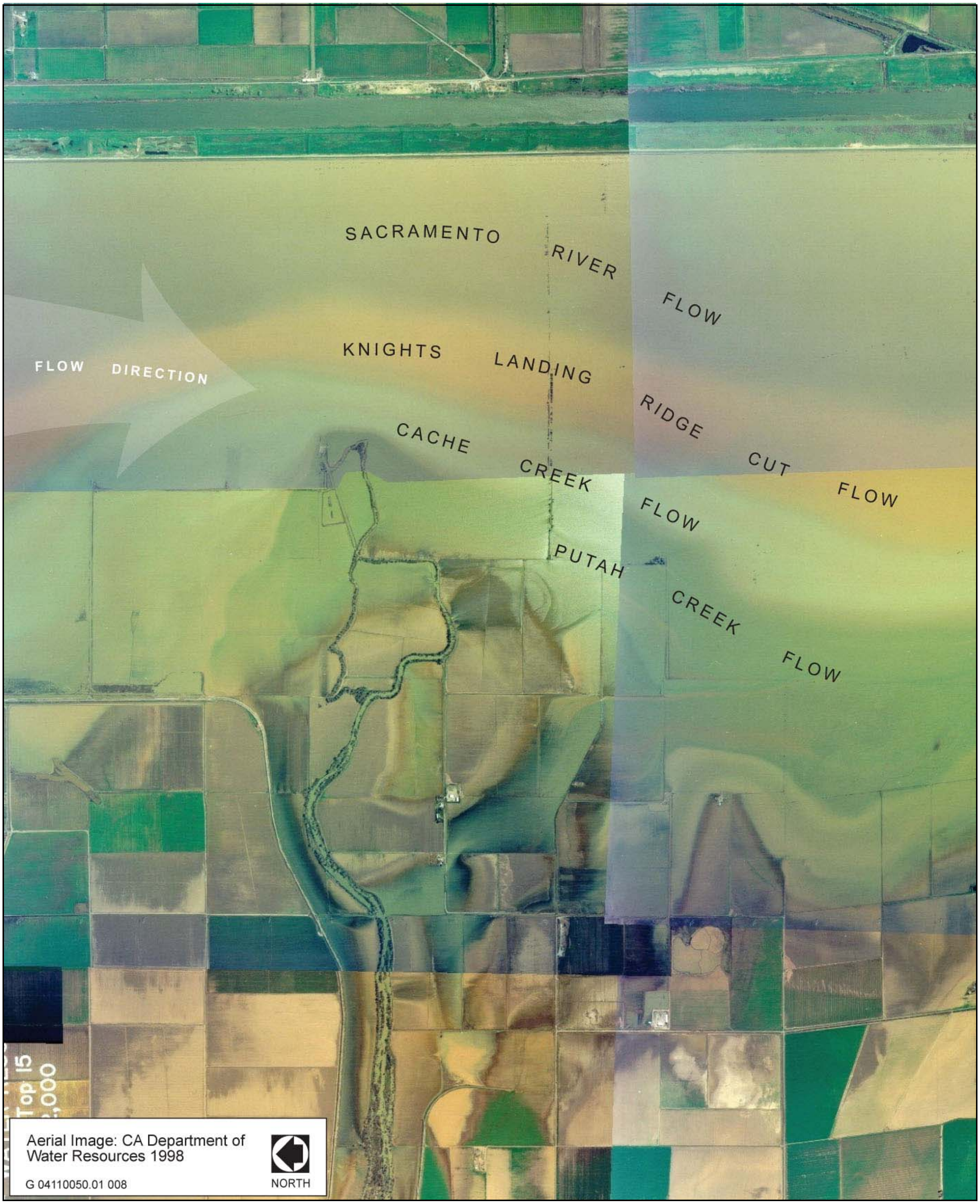
As part of the Sacramento River Flood Control Project, the flood conveyance of the Bypass has been defined for the 100-year flood event. By default, the design water surface profile is the standard by which any future land use modifications within the Bypass, to include those in the Yolo Bypass Wildlife Area, will be judged (U.S. Army Corps of Engineers 2003). The USACE is in the process of finalizing a two-dimensional hydraulic model (RMA2) of the Bypass for the purpose of assessing the impacts of proposed land use changes, such as ecosystem restoration within the Yolo Bypass Wildlife Area, on flood conveyance as well as cumulative impacts on flood conveyance (U.S. Army Corps of Engineers 2006). Typical Manning’s n values and designs flows for future modeling of the Bypass are provided below. Manning’s n values are relative values representative of roughness (resistance to the flow of water) in a channel due to vegetation or other features and are used to calculate measures of flow in rivers and creeks in terms such as velocity and river stage (elevation).

Table 3.4-1 displays the typical roughness conditions or Manning’s n values representative of each land use during the mid-to-late winter flood season within the Bypass. These values were developed based on engineering judgment and model calibration (January 1997 flood) during the USACE’s development of the hydraulic model of the Bypass (U.S. Army Corps of Engineers 2006). Roughness is also affected by the configuration patterns of vegetation. Trees grown in a linear fashion in line with predominant flows present less resistance than a line of trees grown perpendicular to the flow of flood waters.

Table 3.4-1
Land Uses and Flood Season Manning’s n Values

Land Use	Manning’s n Value
Open water	0.025
Fallow agricultural fields	0.030
Pasture	0.040
Native grass	0.045
Maintained levee slope	0.040
Tules	0.045
Mixed grassland/riparian	0.070
Riparian	0.085
Dense riparian	0.120
Bridge crossing	0.070

Source: U.S. Army Corps of Engineers 2006



Source: DWR 1998

Yolo Bypass Natural Color Bands **Exhibit 3.4-2**

Table 3.4-2 displays the boundary conditions for the hydraulic model during the design flood. Tributary inflows were computed by the USACE as the difference between the Bypass design flows upstream and downstream of a given tributary.

Table 3.4-2
Yolo Bypass Boundary Conditions

Inflow Boundary	Discharge (cfs)
Fremont Weir	343,000
Knights Landing Ridge Cut	19,000
Cache Creek (Settling Basin)	15,000
Sacramento Weir	100,000
Willow Slough Bypass	3,000

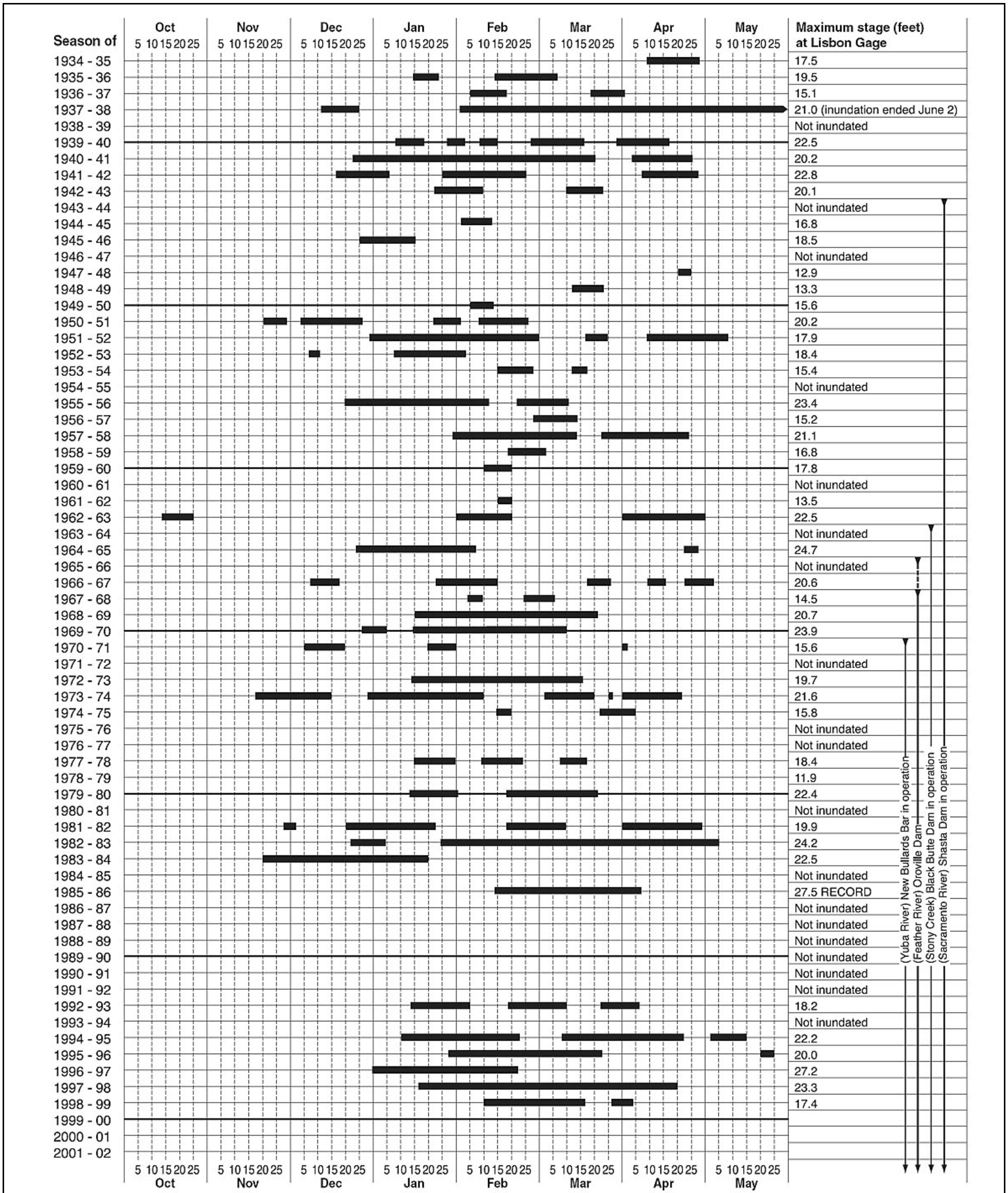
Source: U.S. Army Corps of Engineers 2006

Flood Inundation of the Yolo Bypass

In an effort to quantify the historical frequency, depth, and duration of inundation in the Bypass, stage data was analyzed from the Lisbon Weir. The Lisbon Weir is located in the Toe Drain in the southern section of the Bypass and DWR has recorded stage here since 1935. The stage at the gage site is tidally dominated and oscillates between 3–7 feet USACE (USACE datum). Flood flows entering the Bypass are initially contained within a small perennial channel at the northern end (that becomes the East Toe Drain further to the south), but begins to inundate the floodplain when the discharge exceeds 3,530 cfs or 11.5 feet (USACE datum). Exhibit 3.4-3 displays the times when the stage at Lisbon exceeded 11.5 feet during water years 1935–1999. Inundation occurred in 71% of the years and was uniformly distributed throughout this period. It should be noted that the record number of consecutive years with and without inundation, six years each, both occurred during the period from 1985–1999, which may indicate increased variability in flood hydrology during the recent period.

Exhibit 3.4-3a displays the duration of inundation for each water year from 1935–1999. The seasonal duration of inundation for this period varied from 0 to 135 days. Exhibit 3.4-3a also displays the maximum stage recorded for each year at the Lisbon gage. The stage during the February 1986 and January 1997 floods were both 2.5 feet higher than any other year on record. Exhibit 3.4-4 displays a correlation in the relationship between maximum stage and duration of inundation for the smaller floods during this period. This correlation shows that the higher the stage produced for a given small flood event, the longer the Bypass will be inundated. It is important to note that, in an effort to avoid exceeding the design stage, releases from reservoirs during major floods are typically controlled by increased duration rather than an increased release rate (Yolo Basin Foundation 2001).

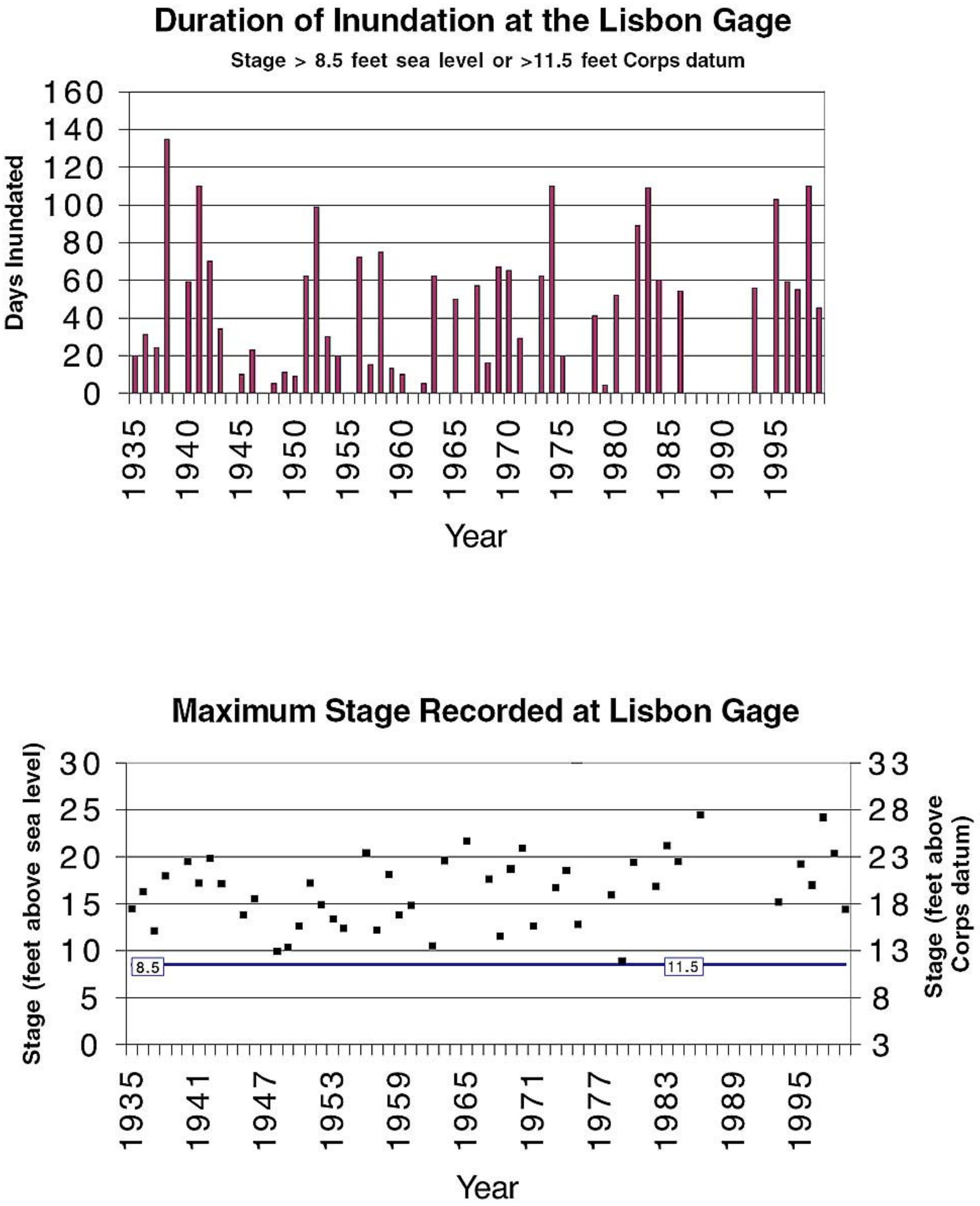
The timing of inundation is of utmost importance to agricultural interests within the Bypass. Inundation in late spring or early fall, although very rare, can have disastrous impacts on unharvested or newly planted crops. Additionally, flooding during this period may trigger the production of tremendous numbers of mosquitoes.
In late spring, inundation occurred after May 10th in only four years between 1935 and 1999 with three of the four occurring since 1990. This recent change has led some to suggest that changes in climate, hydrology or reservoir operations have occurred. The spring floods of 1998 produced the latest (June 10, 1998) and longest duration of inundation. This late spring flood caused substantial economic losses to farmers in the Bypass.
Early fall floods are extremely rare in the period of record, having occurred only once (October 14, 1962) prior to November 18.



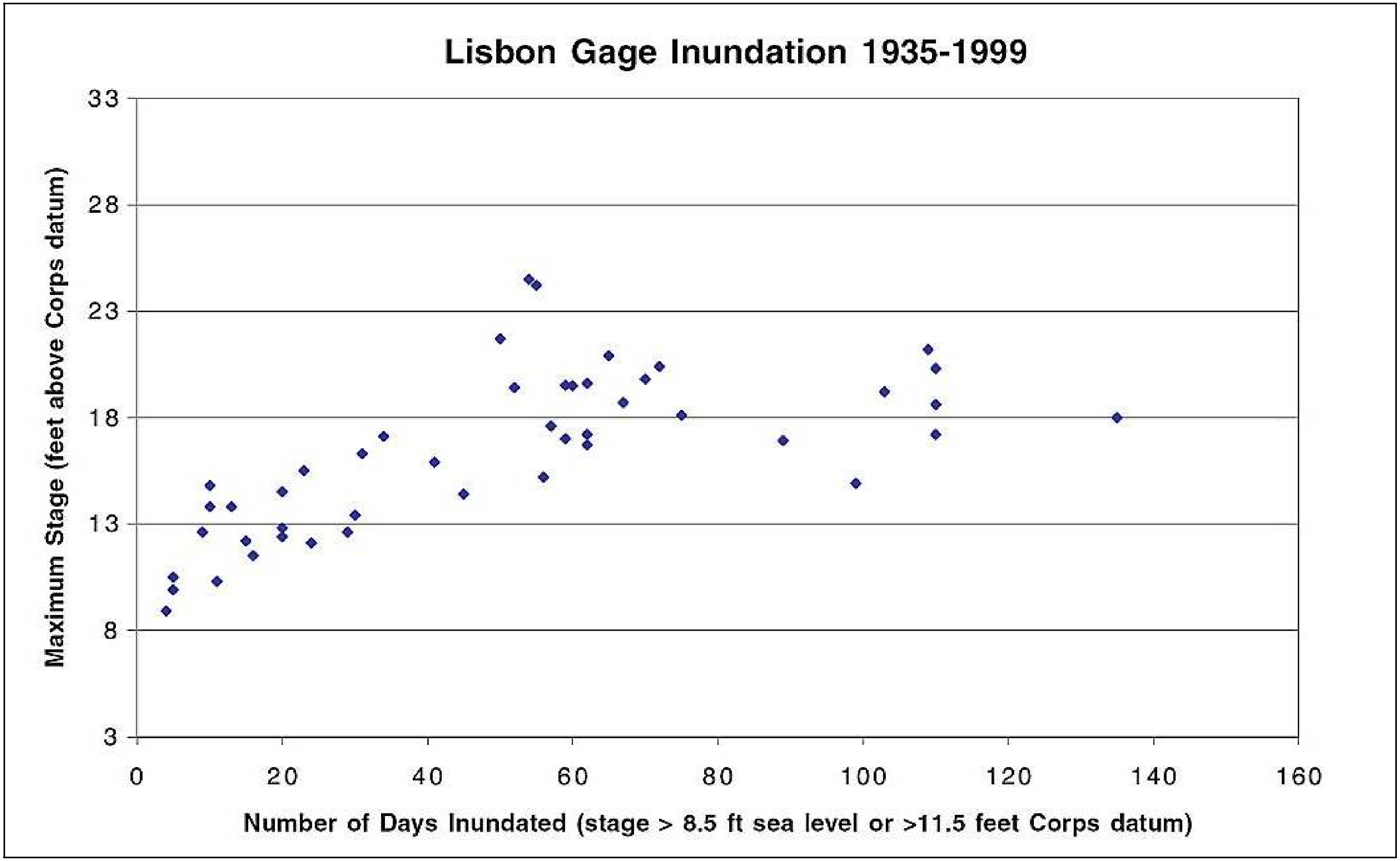
Data compiled from records of DWR stream gaging station "Yolo Bypass near Lisbon". Datum: 0 = 0 feet U.S.E.D. Period of record: 1914-present. Assumed overflow of Bypass at stage above 11.5' on the Lisbon gage. Source: State of California, Department of Water Resources.

Source: Yolo Basin Foundation 2001

Periods of Inundation at Lisbon Weir **Exhibit 3.4-3**



Duration of Inundation and Maximum Stage at the Lisbon Gage **Exhibit 3.4-3a**



Source: Yolo Basin Foundation 2001

Lisbon Gage Inundation 1935–1999

Exhibit 3.4-4

Recent Changes in Flood Inundation of the Yolo Bypass

The 15-year period from 1985 and 1999 has been marked by several record breaking hydrological events (Yolo Basin Foundation 2001). These include two record breaking floods and a record number of consecutive years with and without inundation. Due to these most recent events, many have hypothesized that flood operations have changed, climate has changed, or urbanization has substantially altered runoff. In an effort to determine whether the suspected changes have occurred, historic time series of peak flows, annual discharge, and inundation duration were examined. A linear regression analysis was performed on (duration and stage) (Exhibit 3.4-3a). Neither data set revealed a relationship confirming these changes have taken place.

An analysis of the "four rivers index," which combines hydrologic data for the Sacramento, American, Yuba, and Feather River systems to establish an annual indicator of water availability in the Sacramento Basin, was used to determine if climate change was responsible for the recent extreme hydrologic trends (Yolo Basin Foundation 2001). This analysis involves the correction of flows on the Sacramento, American, Yuba, and Feather rivers to account for changes in storage, diversion, and evaporation in reservoirs. Exhibit 3.4-5 displays the corrected runoff for the 1906–1999 water years. No long term trends were observed, but statistical analysis revealed that runoff variability has been greater in the last 30 years than the 30 years preceding (Dettinger et al. 1995).

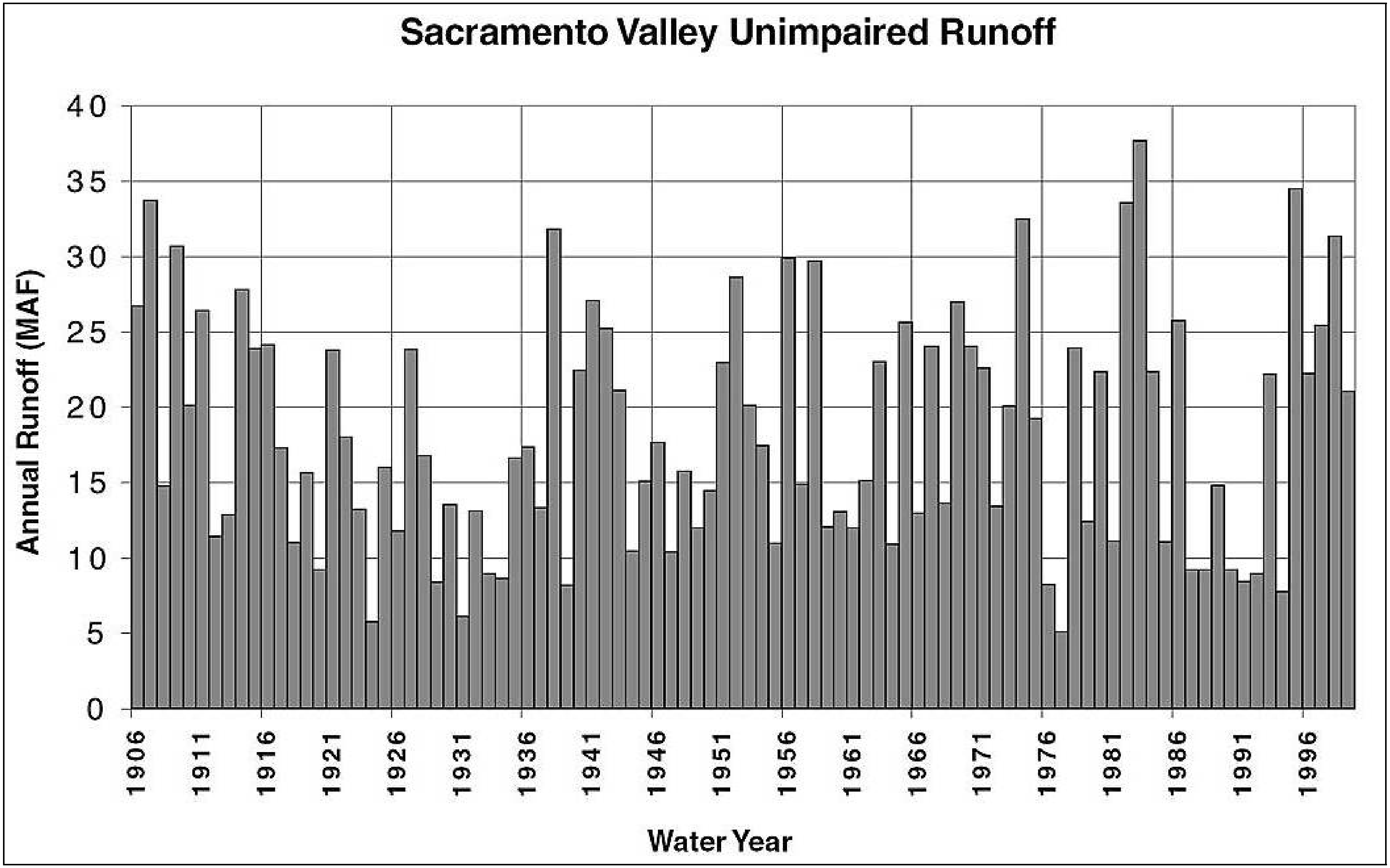
In an effort to examine the potential change in reservoir operations, the relationship between unimpaired runoff and the duration of inundation is plotted in Exhibit 3.4-6. The results of this graph show that the same relationship exists for the recent period as does for the years prior. If there were significant changes in reservoir operations, the trends would have likely changed over the period of record.

Folsom Reservoir has undergone considerable changes in its flood operations since the 1986 flood. After the 1986 flood, it was decided to increase the storage volume from 400,000 acre-feet to a variable volume up to 670,000 acre-feet (Yolo Basin Foundation 2001). During major floods, this increased capacity has lessened the peak flows and thus decreased the stage in the Bypass during those flood events. During medium flood events, the additional capacity in Folsom has allowed for an overall decrease in the combined peak flows released from all reservoirs. Overall, the results of these and other analyses indicate that flood management has not changed from 1985 to 1999.

Low Flow Inundation

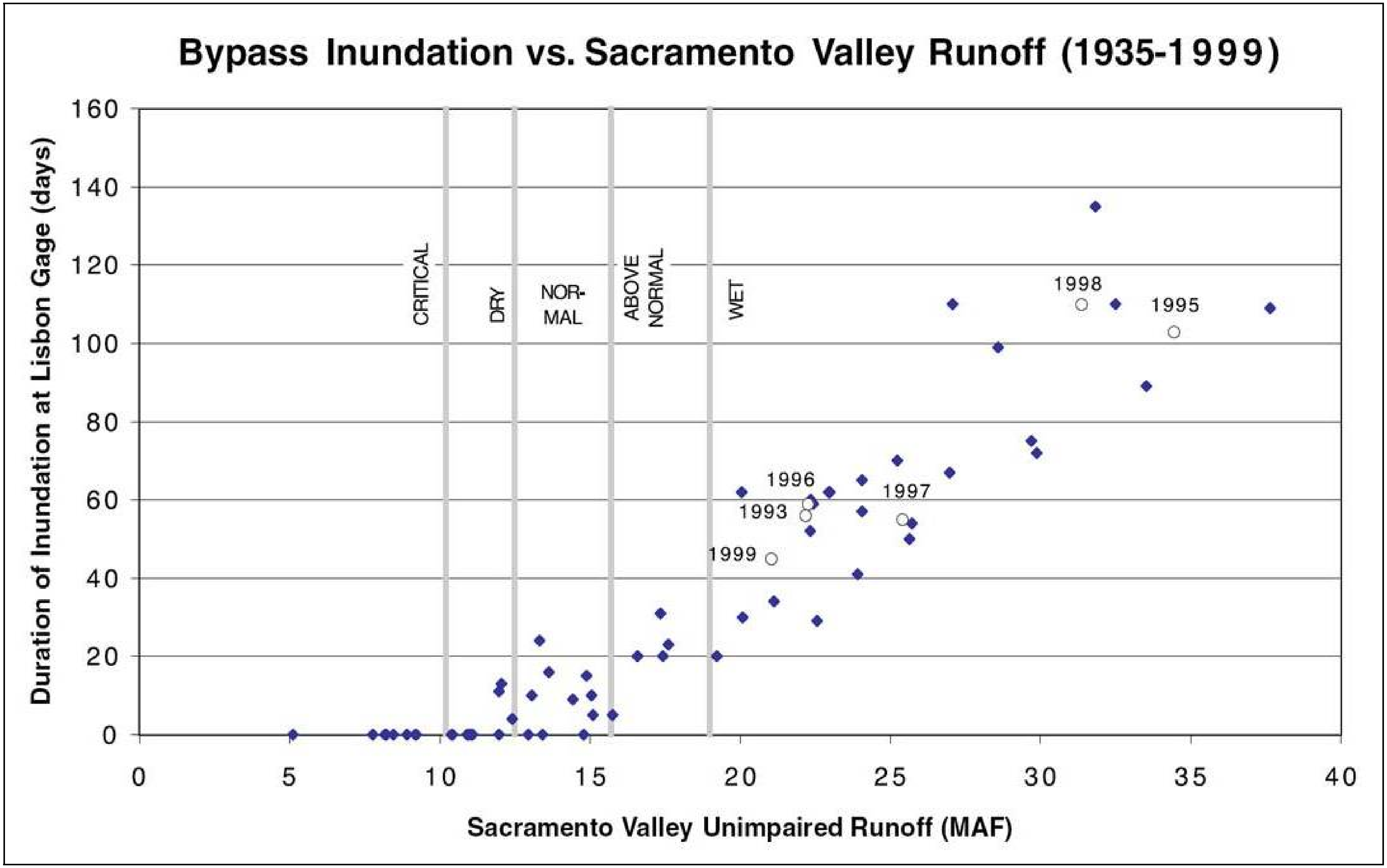
The major inputs to the Bypass are the Fremont and Sacramento Weirs, Knights Landing Ridge Cut, Cache Creek, Willow Slough, and Putah Creek. By comparing the magnitude and timing of the inundation in the Bypass at Lisbon Weir with the magnitude and timing of these inputs, the relative significance of each input for inundation potential can be identified. Exhibits 3.4-7 and 3.4-8 compare the maximum daily flows at the Sacramento and Fremont Weirs, Putah Creek, and Cache Creek to the inundation at Lisbon Weir for each water year from 1935 to 1999. Inundation at the Lisbon Weir showed a strong relationship with the years the Fremont Weir was active and there is also a relationship between the duration of the inundation and the magnitude of the weir flow. Flows through the Sacramento Weir were of a lesser magnitude, although there was a significant relationship between inundation at Lisbon and weir activity.

The timing of the Fremont Weir activity provides further evidence of its pivotal role in inundation of the Bypass. Exhibit 3.4-9 plots the periods of activity of the Fremont Weir from 1935 to 1999. A comparison of this chart to the equivalent chart of inundation events at the Lisbon Weir (Exhibit 3.4-3) reveals a direct correlation between Fremont Weir activity and Bypass inundation. There is a lag of approximately two days from the initial weir activity to inundation, and inundation may lag 5–10 days after weir activity ceases. Very short periods of weir activity do not necessary result in inundation at the Lisbon Weir.



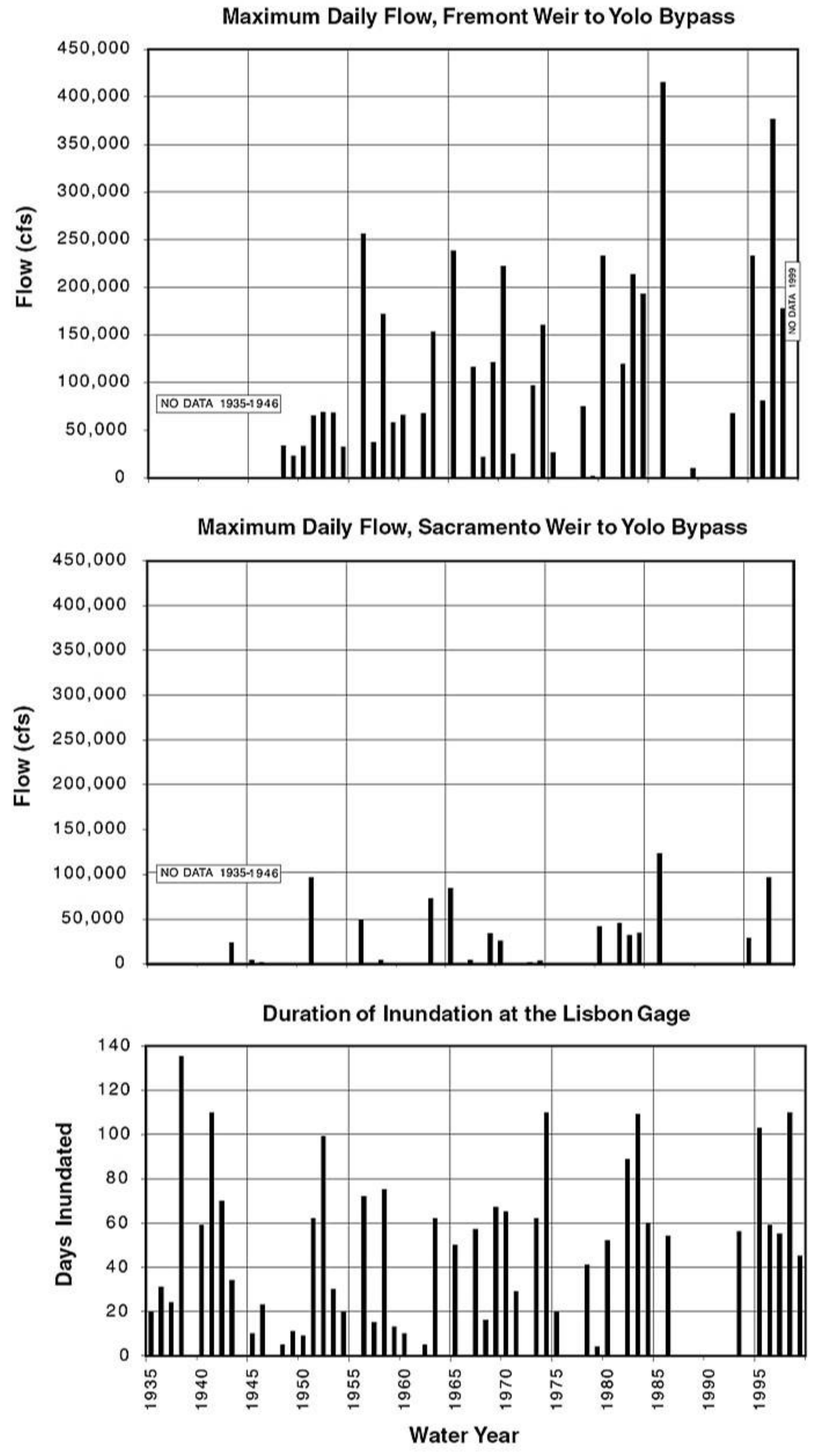
Source: Yolo Basin Foundation 2001

Annual Unimpaired Runoff – Four Rivers Index 1906–1999 **Exhibit 3.4-5**



Source: Yolo Basin Foundation 2001
Note: Relationship between Yolo Bypass inundation and Sacramento Valley unimpaired runoff, 1935–1999

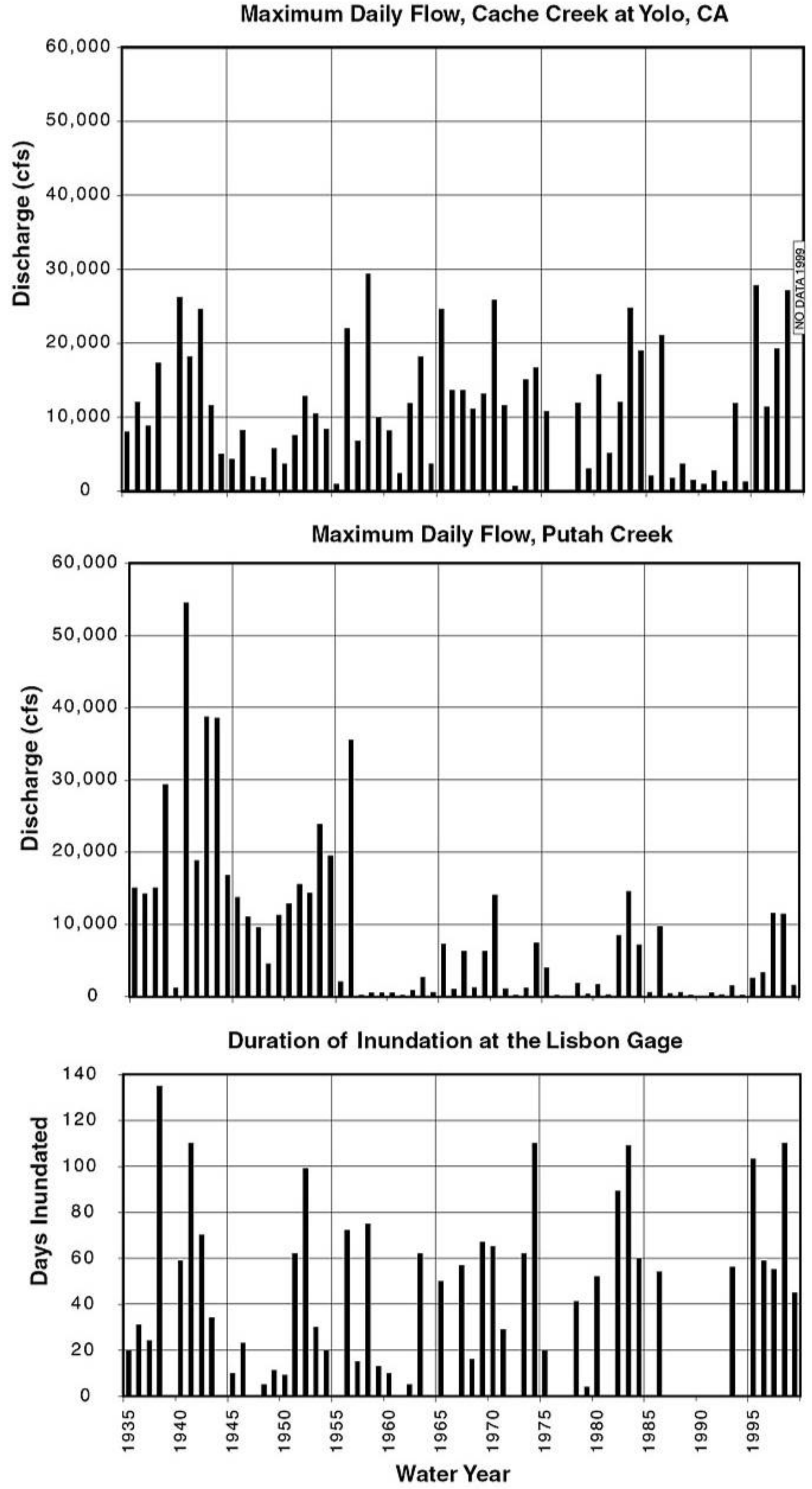
Bypass Inundation vs. Sacramento Valley Runoff 1935–1999 **Exhibit 3.4-6**



Source: Yolo Basin Foundation 2001

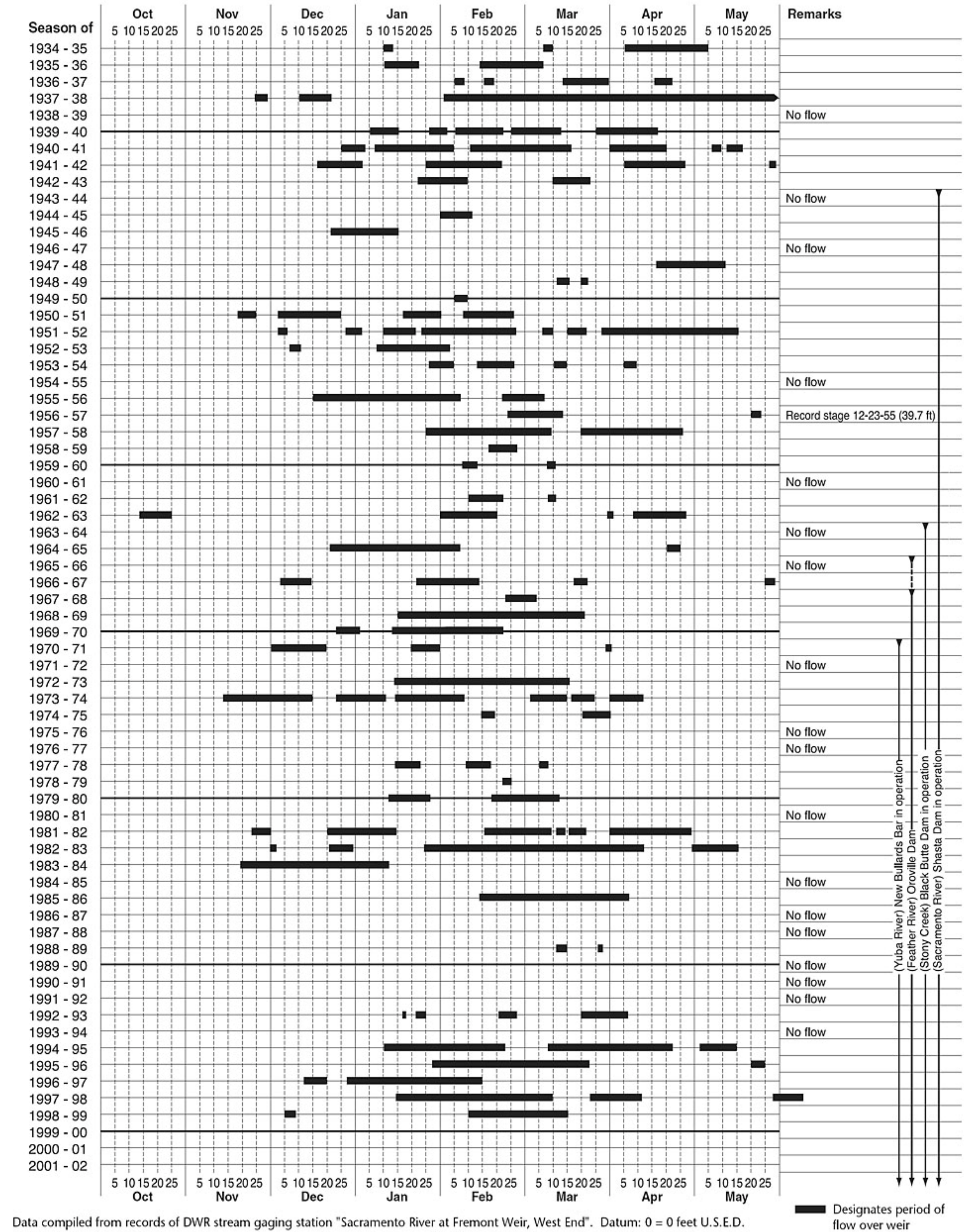
Note: Annual maximum daily flow at Fremont and Sacramento Weirs and duration of Yolo Bypass inundation during water years 1935–1999

Fremont and Sacramento Weir Maximum Daily Flow and Yolo Bypass Inundation 1935-1999 **Exhibit 3.4-7**



Source: Yolo Basin Foundation 2001
Notes: Annual maximum daily flow at Putah and Cache Creeks and duration of Yolo Bypass inundation during water years 1935–1999

Putah and Cache Creeks Maximum Daily Flow and Yolo Bypass Inundation 1935–1999 Exhibit 3.4-8



Data compiled from records of DWR stream gaging station "Sacramento River at Fremont Weir, West End". Datum: 0 = 0 feet U.S.E.D. Period of record: 1934-present. Crest elevation = 33.50 feet. Source: State of California, Department of Water Resources.

Source: Yolo Basin Foundation 2001

Periods of Fremont Weir Activity **Exhibit 3.4-9**

Daily flow hydrographs can be useful in identifying the relative contributions of the six sources of inflow to the Bypass. Inflows from Cache Creek, Fremont and Sacramento Weirs are gauged, and the data can be used without adjustment. Yolo Basin Foundation (2001) developed daily flow time series for ungaged sites and sites with missing data by estimating inflow using a variety of methods involving subtraction or addition of flows at upstream gages, watershed runoff correlations based on rainfall and drainage areas, and adjustments for seepage losses. Additional detail on these methodologies can be found in the Yolo Basin Foundation 2001 report. Selected results are summarized below.

Exhibit 3.4-10 shows hydrographs of daily flows during a moderately wet period from 1995 to 1998. Flows from the Fremont and Sacramento Weirs, Knights Landing, Cache Creek, Willow Slough, Putah Creek and the Bypass flow at I-5 are shown consecutively in the top four hydrographs with the hourly stage at Lisbon shown at the bottom. The Y axis scales are 12 times larger for the I-5 and Bypass flows than for the other tributaries. The smaller floods and low flows for this same period can be viewed more easily in Exhibit 3.4-11 with the Y axis expanded 10 times (Yolo Basin Foundation 2001).

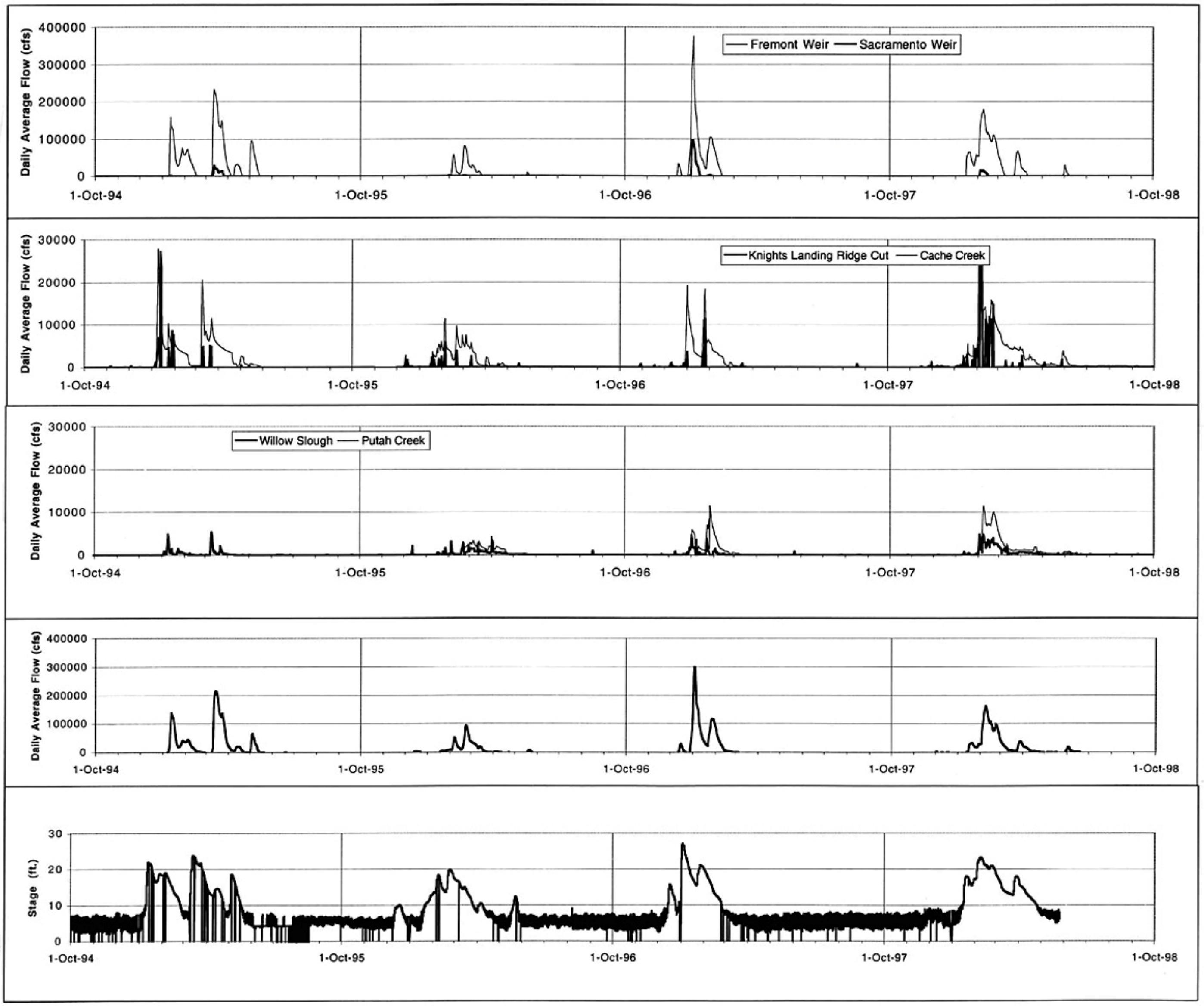
The examination of the Sacramento and Fremont Weir hydrographs reveal that Sacramento Weir is only active during periods when the Fremont Weir has been active. It also shows the Sacramento Weir flows are of a lesser magnitude and are shorter in duration than that of the Fremont. These relationships hold true for the entire period of record, revealing that the Sacramento Weir only contributes to the inundation already produced by Fremont Weir during large flood events.

The hydrographs reveal that Putah Creek tends to produce few high-flow events which are likely to occur in succession during wet years. This is likely due to the presence and operation of flows at the Monticello Dam (Lake Berryessa) and downstream at the Putah Diversion Dam (Lake Solano). Willow Slough is unregulated and produces a large number of small peak runoff events.

During dry periods when the weirs are not active, the four remaining tributaries have the potential to produce localized flooding within the Bypass. Exhibit 3.4-12 shows hydrographs of daily flows during a dry period from 1987 to 1990, when the weirs were not active (Yolo Basin Foundation 2001). The inputs from Putah Creek and Willow Slough were about 1,200 cfs and 1,500 cfs, respectively, in January 1985, while combined inputs from Cache Creek and Knights Landing Ridge Cut were approximately 5,000 cfs in January 1981 and January 1988. Putah Creek flows are often exceeded by Willow Slough inflows during small flood events when Lake Berryessa isn’t releasing.

The tributaries were also examined for their contribution to localized flooding by comparing the increase in stage at the Lisbon gage to the magnitude of peak flows during dry periods when the weirs were not active. Daily discharge from Cache Creek are matched with hourly stage at the Lisbon Gage during the 1988 water year (weirs not active) as displayed in Exhibit 3.4-13. The peak events in December and January increased the stage at Lisbon by about 1.5 feet over its normal range. The importance of the tributaries on localized flooding is further demonstrated in Exhibit 3.4-14 which plots the increases in stage at the Lisbon Gage against peak flows on Cache Creek for similar events. For every 2,000 cfs of increased flow on Cache Creek, the stage at Lisbon increases approximately 1 foot (Yolo Basin Foundation 2001).

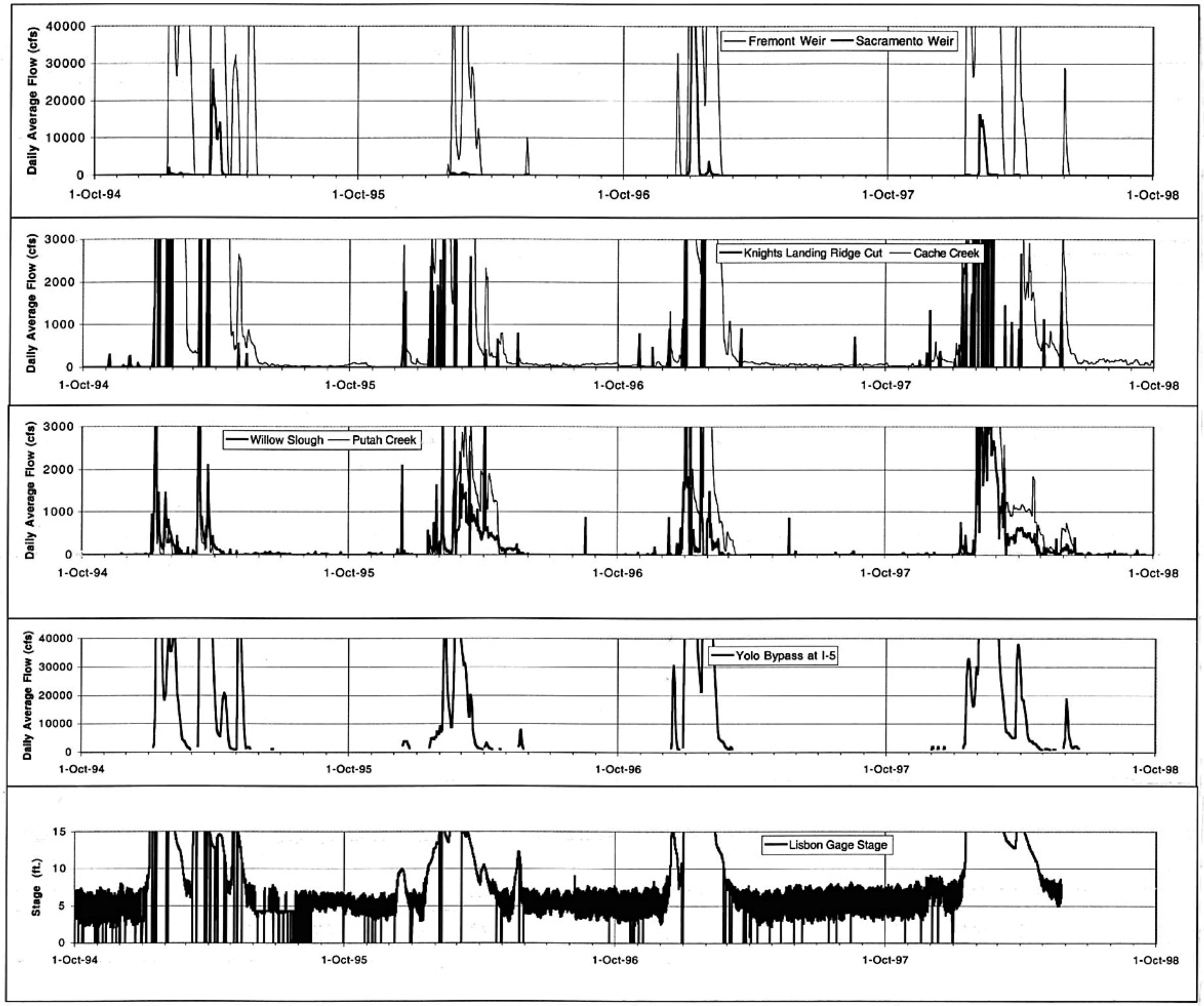
Local climatic conditions along with groundwater elevations can have implications on the extent of low flow inundation and creation of seasonal wetlands. Exhibit 3.4-15 displays the temperature, precipitation, and evapotranspiration regime from selected areas within the Yolo Basin. These data show that over the annual cycle, as temperature increases there is a corresponding increase in evapotranspiration and a decrease in precipitation.



Source: Yolo Basin Foundation 2001

Hydrographs of Inputs to Yolo and Stage at Lisbon Gage 1995–1998

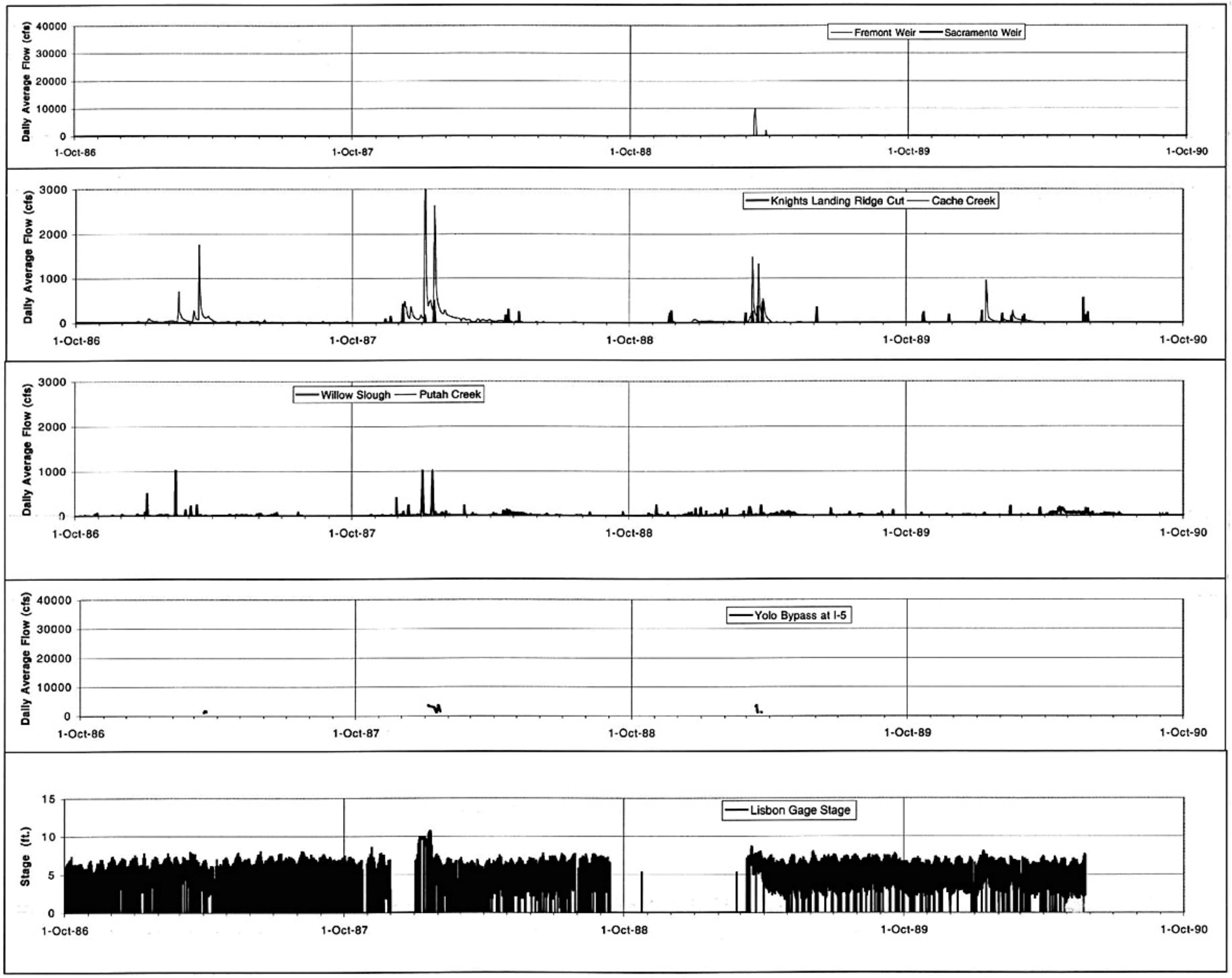
Exhibit 3.4-10



Source: Yolo Basin Foundation 2001

Hydrographs of Inputs to Yolo and Stage at Lisbon Gage 1995–1998
Expanded Scale

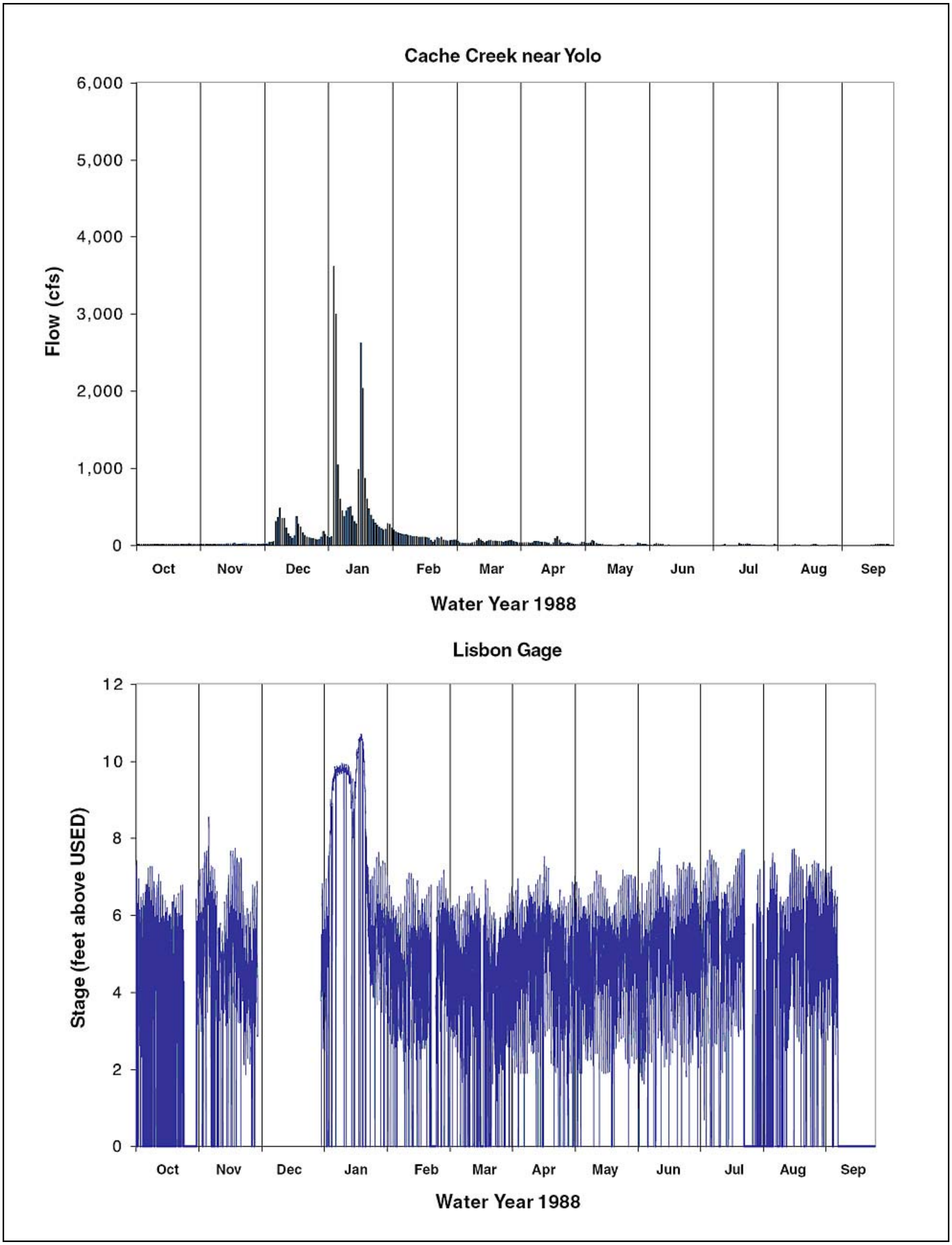
Exhibit 3.4-11



Source: Yolo Basin Foundation 2001

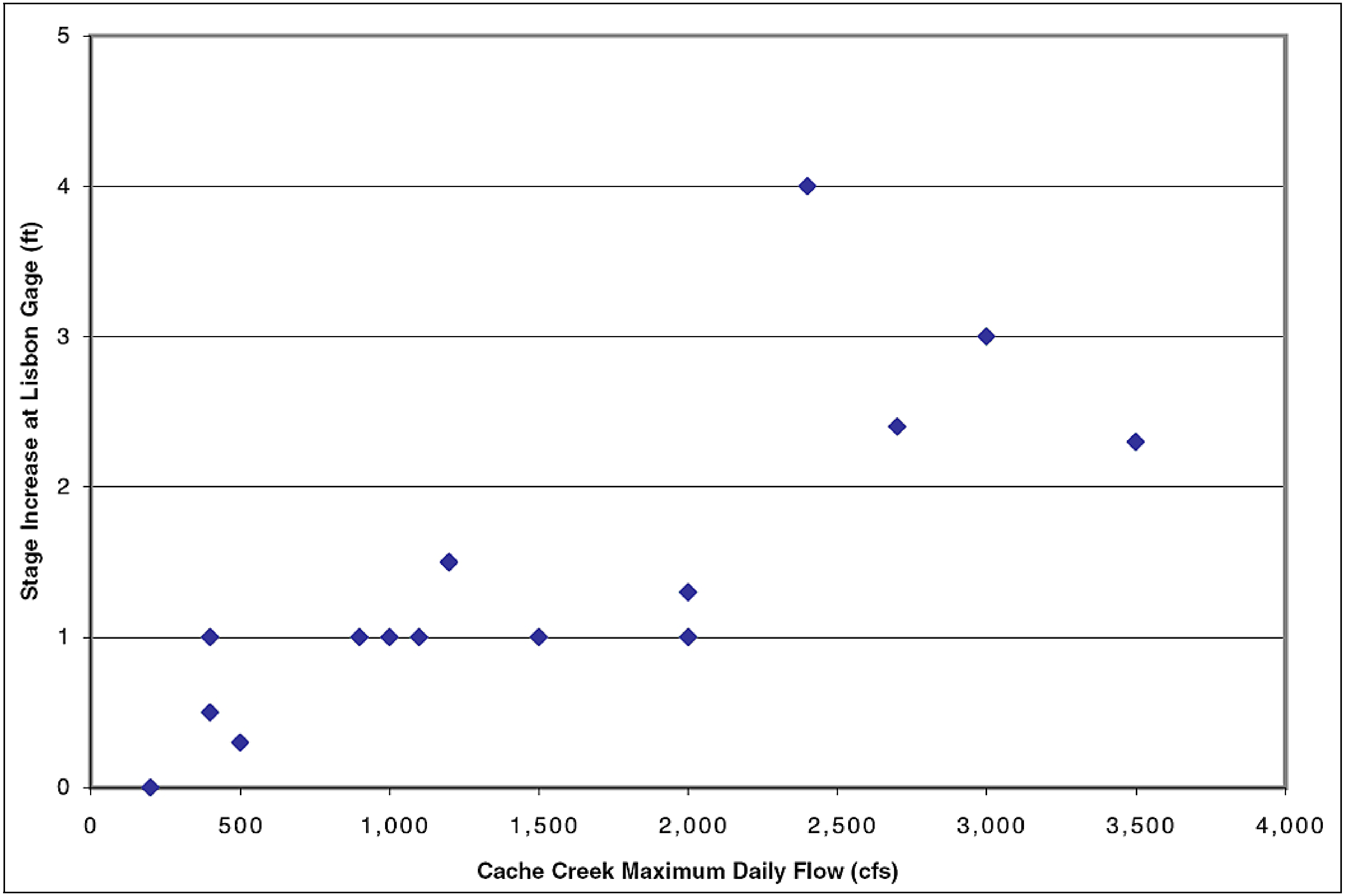
Hydrographs of Inputs to Yolo and Stage at Lisbon Gage 1987–1990

Exhibit 3.4-12



Source: Yolo Basin Foundation 2001

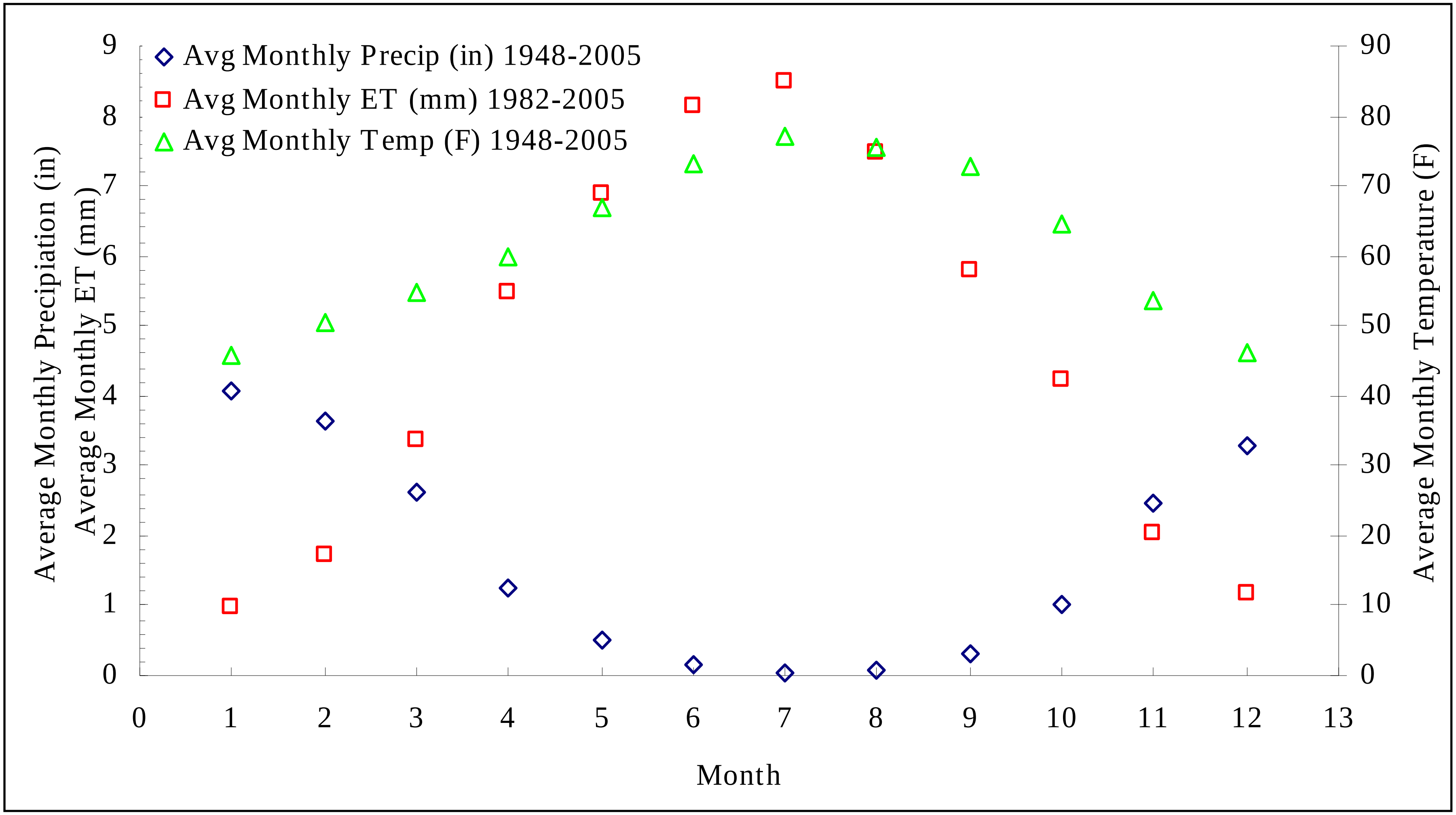
Cache Creek Flow and Lisbon Gage Stage 1988 **Exhibit 3.4-13**



Source: Yolo Basin Foundation 2001

Stage Increase at Lisbon vs. Cache Creek Maximum Daily Flow

Exhibit 3.4-14



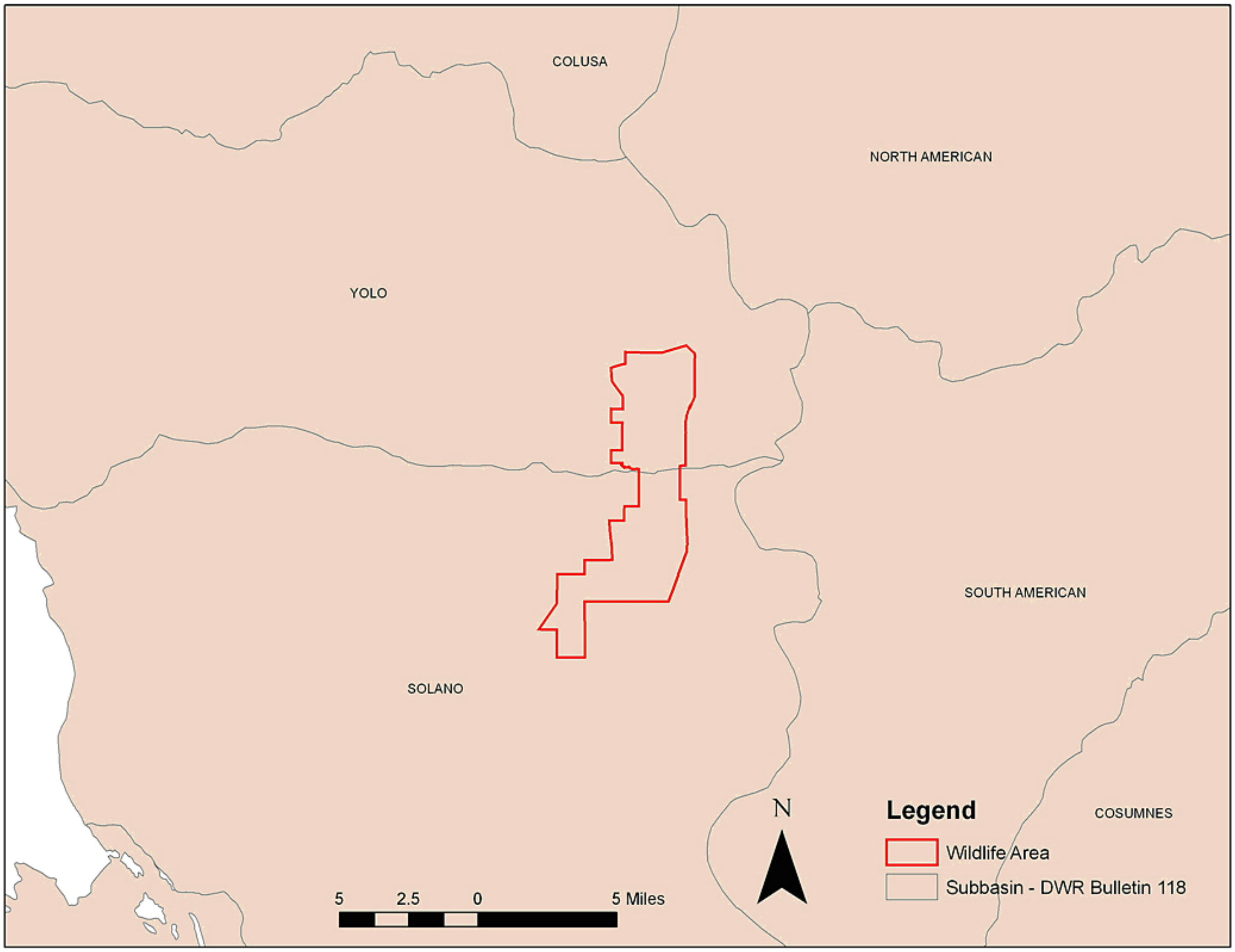
Source: PWA 2004

Average Monthly Evapotranspiration, Precipitation, and Temperature within the Yolo Basin

Exhibit 3.4-15

GROUNDWATER HYDROLOGY

The Yolo Bypass Wildlife Area is contained within the Sacramento Valley Groundwater Basin. Within this Groundwater Basin, the Yolo Bypass and Yolo Bypass Wildlife Area are located on the eastern edge of the Yolo and Solano Subbasins as mapped in DWR Groundwater Bulletin 118 as shown by Exhibit 3.4-16.



Source: DWR Groundwater Bulletin 118 2004

Groundwater Subbasins According to DWR Bulletin 118 **Exhibit 3.4-16**

Yolo Subbasin

The Yolo Subbasin is located primarily within Yolo County, bounded on the east by the Sacramento River, on the west by the Coast Range, on the north by Cache Creek, and on the south by Putah Creek. The Subbasin slopes gently from west to east with elevations ranging from 400 feet in the west to near sea level on the eastern edge.

The hydrogeologic formations relevant to the Yolo Bypass include flood basin deposits and recent stream channel deposits. The flood basin deposits consist of silts and clays and are generally between 100–150 feet thick with low permeability. The recent stream channel deposits consist of unconsolidated silt, fine- to medium-grained sand, gravel and cobbles (embedded in finer material) and are generally up to 150 feet thick with high permeability.

The channel deposits occur along the Sacramento River, Cache Creek, and Putah Creek and often lie above the saturated zone.

The subsurface flow within this Yolo Subbasin is obstructed from east to west by an anticlinal ridge oriented northwest to southeast. Subsurface outflow sometimes moves from the Yolo Subbasin into the Solano Subbasin to the south. Subsurface flow may also move beneath the Sacramento River to exchange with the South and North American River Subbasins.

Groundwater levels are impacted by periods of drought due to increased pumping and less surface water recharge, but recover quickly during wet years. Long term trends do not indicate any substantial decline, with the exception of localized pumping depressions in the vicinity of Davis, Woodland, and the Dunnigan/Zamora areas.

SOLANO SUBBASIN

The Solano Subbasin is bounded by Putah Creek to the north, the Sacramento River to the east, the North Mokelumne River to the southeast, and the San Joaquin River to the south. Elevations range from 120 feet in the northwest to sea level in the south.

The relevant hydrogeologic formations are similar to those of the Yolo Subbasin and occur along the Sacramento, Mokelumne and San Joaquin rivers and the upper reaches of Putah Creek. In the southern Delta region, the flood basin substrate contains a high proportion of peat, attesting to thousands of years of inundation. Over the past 150 years, as Delta islands have been drained and converted to agricultural use, the peat soils have subsided substantially.

The general subsurface flow direction is from northwest to southeast. Water level trends are similar to that of the Yolo Subbasin, but with large pumping depressions between Davis and Dixon.

3.4.3 WATER QUALITY

This section analyzes current water quality conditions in the Yolo Bypass Wildlife Area including the Yolo Bypass associated canals, Cache Creek, Willow Slough, Putah Creek and more generally in the greater Sacramento River drainage and Delta. Waters within and downstream of the Yolo Bypass Wildlife Area (i.e., Yolo Bypass) serve several beneficial uses, each of which has water quality requirements and concerns associated with it. These beneficial uses include habitat for fish and aquatic organisms, as well as a source of water for municipal, agricultural, recreational, and industrial uses. Water quality variables of particular concern in the Yolo Bypass are discussed in detail below.

GENERAL WATER QUALITY

Water quality in the Yolo Bypass, and more specifically the Yolo Bypass Wildlife Area, is influenced by a number of sources and processes. During flood events, water enters the Bypass from the Sacramento, Feather, and American rivers via the Fremont and Sacramento weirs. Other major inputs to the Bypass include, from north to south, the Knights Landing Ridge Cut (i.e., Colusa Basin Drain), Cache Creek, Willow Slough, and Putah Creek. Urban stormwater runoff and wastewater treatment facility discharges come from the University of California Davis campus and the cities of Davis and Woodland (City of Woodland 2005).

Basin Plan Beneficial Uses

Beneficial uses of water in the Yolo Bypass are legally designated by the Central Valley Regional Water Quality Control Board (Central Valley RWQCB) in the Sacramento-San Joaquin River Basin Plan (Basin Plan) (Central Valley RWQCB 1998). Beneficial use designations determine the applicable water quality objectives. In addition to the beneficial uses for the Yolo Bypass, there are additional and different beneficial uses for the water bodies in and near the Bypass and/or Yolo Bypass Wildlife Area such as Cache Creek, Putah Creek, and the Delta. Consequently these additional beneficial uses are also considered. Between these water bodies, almost every beneficial use designation applies. The various beneficial uses include:

- Agricultural Supply,
- Water Contact Recreation,
- Non-contact Water Recreation,
- Warm Freshwater Habitat,
- Cold Freshwater Habitat,
- Spawning, and
- Wildlife Habitat.

An additional beneficial use, municipal and domestic supply does not apply to the Bypass but does apply to Cache Creek and Putah Creek upstream and to the Delta downstream.

Impaired Water Bodies

Under Section 303(d) of the Clean Water Act (CWA), states are required to develop lists of water bodies that would not attain water quality objectives after implementation of required levels of treatment by point source dischargers (municipalities and industries).

Section 303(d) requires that the state develop a total maximum daily load (TMDL) for each of the listed pollutants. The TMDL is the amount of loading that the water body can receive and still be in compliance with water quality objectives. The TMDL is also a plan to reduce loading of a specific pollutant from various sources to achieve compliance with water quality objectives. The TMDL prepared by the state must include an allocation of allowable loadings to point and nonpoint sources, with consideration of background loadings and a margin of safety. The TMDL must also include an analysis that shows the linkage between loading reductions and the attainment of water quality objectives. EPA must either approve a TMDL prepared by the state or disapprove the state’s TMDL and issue its own. After implementation of the TMDL, it is anticipated that the problems that led to placement of a given pollutant on the Section 303(d) list would be remediated.

The Yolo Bypass is not listed as impaired; however, TMDLs are in various stages of development and implementation for water bodies both upstream and downstream of the Yolo Bypass Wildlife Area (Table 3.4-3).

Sacramento River–Yolo Bypass and Associated Canals

Water quality of the Sacramento River is closely monitored to assess suitability for potable, agricultural, and wildlife/fisheries uses. Water quality of the Sacramento River, from Knights Landing to the Delta, was determined to be impaired by diazinon, mercury, and unknown toxins by the U.S. Environmental Protection Agency (USEPA) under Section 303(d) of the CWA (U.S. Environmental Protection Agency 2003). In 2003, the Central Valley RWQCB adopted a TMDL limit on discharges of diazinon to the Sacramento and Feather rivers (Central Valley RWQCB 2003). TMDLs for mercury and other toxins are currently under development. Pesticides from agricultural use are also contaminants of concern to water quality of the Sacramento River. Maximum concentration levels (MCLs) for pesticides such as thiobencarb and molinate have been developed by the Central Valley RWQCB (Yolo County Water Resources Assessment 2004).

To determine the effect of incoming discharges on water quality of floodwaters within the Yolo Bypass and the Sacramento River, the U.S. Geological Survey (USGS) conducted studies during 2000 and 2004–2005 (the 2004–2005 focused specifically on pesticides in water and sediment) (Schemel et al. 2002; Smalling et al. 2005).

Table 3.4-3
Clean Water Act Section 303(d) List of Impaired Waters Associated with the Yolo Bypass

Water Body	Pollutant / Stressor	Priority	Potential Source(s)	TMDL Status
Sacramento River (Red Bluff to Knights Landing)	Unknown toxicity	Low	Unknown	No activity
Sacramento River (Knights Landing to the Delta)	Diazinon[1]	High	Agriculture	Adopted
	Mercury	Medium	Resource extraction	No activity
	Unknown toxicity	Low	Unknown	No activity
Feather River (Lake Oroville Dam to Confluence with Sacramento River)	Diazinon[1]	High	Agriculture, Urban Runoff/Storm Sewers	Adopted
	Group A Pesticides	Low	Agriculture	No activity
	Mercury	Medium	Resource extraction	No activity
	Unknown toxicity	Low	Unknown	No activity
Colusa Basin Drain	Azinphos-methyl	Medium	Agriculture	No activity
	Carbofuran/Furadan	Low	Agriculture	No activity
	Diazinon	Medium	Agriculture	Adopted
	Group A Pesticides	Low	Agriculture	No activity
	Malathion	Low	Agriculture	No activity
	Methyl Parathion	Low	Agriculture	No activity
	Molinate/Odram	Low	Agriculture – irrigation tailwater	No activity
	Unknown Toxicity	Low	Agriculture	No activity
Cache Creek	Mercury	Medium	Resource extraction	2nd draft staff completed
	Unknown toxicity	Low	Unknown	No activity
Lower Putah Creek	Mercury	Low	Resource extraction	No activity
Delta (eastern portion)	Mercury	Medium	Resource extraction	Draft staff report complete
	Unknown toxicity	Low	Unknown	No activity
	Chlorpyrifos and Diazinon	High	Agriculture, Urban Runoff/Storm Sewers	Draft staff report in progress
	DDT	Low	Agriculture	No activity
	Group A pesticides	Low	Agriculture	No activity

[1] Recommended for delisting

Source: City of Woodland 2005; Central Valley RWQCB 2002

Sampling of physical and chemical parameters in 2000 during high flows where runoff from agricultural fields and tributaries were deposited to the Bypass concluded that, after initial draining of the floodplain after a large storm, the concentration of chemical contaminants within the Bypass is influenced directly by discharges from Cache Creek and the Knights Landing Ridge Cut. High concentrations of nutrients and contaminants, perhaps from abandoned mines and agricultural fields, were detected at discharge points from these sources. Spring rains flushed accumulated nutrients to the tidal area of the Sacramento River. The study recommended the addition of fresh water to perennial reaches of the Bypass to increase habitat quality for aquatic species (Schemel et al. 2002). The City of Woodland discharges its wastewater effluent to the Tule Canal, which flows to the Yolo Bypass.

Sampling conducted during 2004–2005 resulted in the detection of thirteen current-use pesticides in surface water samples collected during the study. The highest pesticide concentrations detected at the input sites to the Bypass corresponded to the first high-flow event of the year. The highest pesticide concentrations at the two sites sampled within the Bypass during the early spring were detected in mid-April following a major flood event as the water began to subside. The pesticides detected and their concentrations in the surface waters varied by site. The highest number of pesticides was detected in the suspended sediments compared with bed sediments and surface water. With the exception of a few compounds, the same pesticides were detected in the sediment and the water, and correlate with the agricultural use in each of the different watersheds. Measured pesticide concentrations varied by site/source watershed; however, Knights Landing Ridge Cut (i.e., Colusa Basin Drain) and Willow Slough generally appeared to have the highest concentration inputs into the Bypass (Smalling et al. 2005).

Cache Creek

Erosion and groundwater discharge from marine sediments have resulted in release of boron and mercury to the Cache Creek watershed. Mercury contamination from past mining activities, erosion of naturally occurring mercury latent soils, geothermal springs, and atmospheric deposition near Clear Lake and at tributaries to Cache Creek have contaminated sediments and water (Central Valley RWQCB 2004). Elevated quantities of mercury travel through the creek channel during high flows. Consequently, mercury has been detected in the Yolo Bypass. The Cache Creek watershed is a significant source of mercury in the Sacramento-San Joaquin Delta (Central Valley RWQCB 2004). The Central Valley RWQCB adopted a TMDL to limit discharges of mercury to Clear Lake and Cache Creek. A fish consumption advisory is in effect for Clear Lake fish to protect human health due to concerns of bioaccumulation of mercury in fish tissue (Office of Environmental Health Hazard Assessment 1994). Clear Lake is also listed as impaired by elevated levels of nutrients. Cache Creek is also impaired by unknown toxicity (U.S. Environmental Protection Agency 2003).

Boron concentrations typically range from 0.7 milligrams per liter (mg/L) in the spring to 2.2 mg/L in the winter, and the average concentration during the irrigation season is less than 1.0 mg/L (Yolo County Water Resources Assessment 2004).

Willow Slough

The Yolo County RCD is initiating a program to monitor suspended sediment, nutrient, and water level at 4–6 sites along Willow Slough. Previous monitoring studies conducted by the County Department of Health Services and UCD noted invertebrate and algae impairment from unknown causes and sources. The City of Davis discharges its treated wastewater effluent to Willow Slough Bypass. The Central Valley RWQCB requires municipal dischargers such as the City of Davis to regularly perform effluent and receiving water toxicity testing for invertebrates and algae. Pesticide concentrations in Willow Slough waters have been measured to be above other Bypass tributary water bodies (Smalling et al. 2005).

Putah Creek

Much like the Cache Creek watershed, the Putah Creek watershed contains high concentrations of mercury and boron. During low flows in summer months, Putah Creek flow is dominated by effluent downstream of UCD wastewater treatment plant outfall. Lower Putah Creek, downstream of Lake Solano, is listed as impaired by mercury (originating from old mines in the upper watershed) on the US EPA 303(d) list (U.S. Environmental Protection Agency 2003). Water temperature monitoring by UCD documented seasonal warming profiles downstream of the Putah Diversion Dam (PDD), diurnal temperature fluctuations, and localized thermal stratification (Yolo County Water Resources Assessment 2004). Pesticide concentrations in Putah Creek were generally low relative to other sites in the 2004–2005 study. The only exception was concentrations measured in bed sediments, which were higher than at most other locations (Smalling et al. 2005).

Knights Landing Ridge Cut (Colusa Basin Drain)

The Colusa Basin Drain (Drain) watershed comprises nearly 1,620 square miles in the Sacramento Valley, and includes portions of Glenn, Colusa, and Yolo counties. There are 32 ephemeral streams that convey storm runoff to the Drain. The Drain is an artificial channel designed to convey irrigation drainage to the Knights Landing outfall gates for discharge into the Sacramento River. When the water level in the river exceeds the water level in the Drain, Drain water discharges into the Knights Landing Ridge Cut directly into the Yolo Bypass. The Knights Landing Ridge Cut, which consists of two excavated channels with a center island, has a discharge capacity of approximately 20,000 cfs. Water from the Drain is pumped into the Ridge Cut for irrigation at other times of the year, providing additional water into the upper Bypass during the summer-fall period. The Drain is listed as a water quality impaired water body due to a number of agricultural pesticide-related pollutants (Table 3.4-3) (Central Valley RWQCB 2002). Pesticide concentrations (in the 2004–2005 study) in Drain water were high relative to all other sample sites (Smalling et al. 2005), consistent with the impairment listing status noted above.

As discussed in Section 3.1 above, proposals have been developed to divert additional water from the Drain into the Yolo Bypass on a more continuous year-round basis. This potential project could have water quality implications for the Yolo Bypass Wildlife Area.

Groundwater Quality

Groundwater in the Yolo Basin is characterized by the presence of sodium magnesium, calcium magnesium, and/or magnesium bicarbonate. The groundwater quality is characterized as good for agricultural and municipal uses, although it is hard to very hard overall. Elevated concentrations of selenium, nitrate, and boron have been detected in groundwater along Cache Creek and the Cache Creek Settling Basin area. Brackish and saline waters are found in water bearing units underlying the Tehama Formation (California Department of Water Resources 2004). According to monitoring conducted in the Yolo Subbasin beneath the City of Davis and University of California, average concentrations of arsenic in the Tehama formation below 600 feet below ground surface are 0.04 mg/L (Yolo County Water Resources Assessment 2004.) This value exceeds the USEPA MCL of 0.01 mg/L that became effective as of January 23, 2006 (U.S. Environmental Protection Agency 2005). The existing California MCL for arsenic is 0.05 mg/L, as stated in the California Code of Regulations (Section 64431 - Maximum Contaminant Levels-Inorganic Chemicals).

POLLUTANTS OF CONCERN

Larry Walker Associates completed an evaluation of water quality conditions as a component of a water quality management plan for the Yolo Bypass (City of Woodland 2005). This plan included identification of pollutants of concern (POC) for the Bypass. POCs identified in the plan are consistent with many of those identified in the discussions above.

Yolo Bypass Water Quality Management Plan

The objective of the project was to develop a comprehensive water quality management plan for the Bypass. The general steps followed to develop the plan were to (City of Woodland 2005):

- Identify through review of existing information and stakeholder input current POCs for the Bypass;

- Conduct surface water quality monitoring to help quantify POCs and their major sources;
- Identify and evaluate effective, implementable control measures for reducing POC concentrations and loads;
- Investigate, if necessary, the applicability of current water quality criteria for the POCs and the feasibility of developing site-specific objectives (SSOs);
- Involve stakeholders regarding POCs and potential control measures; and
- Produce a Water Quality Management Plan containing a recommended implementation program to address POCs that are degrading surface water quality.

The POCs were identified by stakeholders after a cursory review of available data. The identified POCs were then monitored over a one-year period. Based on these monitoring results and stakeholder input, the POCs were prioritized as shown in Table 3.4-4.

Table 3.4-4
Yolo Bypass Water Quality Management Plan Pollutants of Concern

Pollutant of Concern	Priority		
	High	Medium	Low
Bacteria Total coliform Fecal coliform E. coli	X		
Boron	X		
Metals			
Aluminum	X		
Chromium			X
Copper			X
Lead			X
Mercury	X		
Selenium			X
Nitrate			X
Organic Carbon Total organic carbon Dissolved organic carbon		X	
Pesticides and Herbicides			
OCs (DDE and DDT)		X	
OPs (Chlorpyrifos and Diazinon)		X	
Carbamates (Diuron and Methomyl)			X
Salinity	X		
Total Suspended Solids (TSS)			X

Source: City of Woodland 2005

The discussion below focuses on high priority pollutants of concern identified in the water quality management plan that are also concerns related to management at the Yolo Bypass Wildlife Area.

Mercury

One water quality variable of particular concern regarding management activities at the Yolo Bypass Wildlife Area is methylmercury. Mercury occurs as a result of both natural and anthropogenic sources in the environment and continually cycles in the aquatic environments of the Sacramento River and San Joaquin River basins and Delta. The cycle involves different chemical forms and/or species of mercury as a result of both chemical and biological reactions in aerobic and anoxic microenvironments. On a world wide scale, mining sources are geographically localized and generally small but, in California's Central Valley, they are of great importance (Jones and Slotten 1996).

Historic gold-mining practices created the primary source of mercury in northern California rivers and the Delta. The mountain ranges that surround California's Central Valley and drain into the Sacramento and San Joaquin watersheds contain extensive mineral deposits. Discovery of gold deposits in the Sierra Nevada stimulated the California Gold Rush in 1848, and an abundance of mercury from hundreds of mercury mines in the Coast Ranges facilitated the rapid historic proliferation of gold-mining operations that used the mercury-amalgamation process to extract gold (Alpers and Hunerlach 2000). Hundreds of hydraulic gold-placer mines operated on the east side of the Central Valley (e.g., Feather River watershed). About 100,000 metric tons of mercury was produced by mercury-mining operations in the Coast Ranges, and about 12,000 metric tons of this were used in gold mining in California, with annual losses at mine sites ranging from about 10 to 30 percent of the mercury used (Alpers and Hunerlach 2000). Mercury mines in the Cache Creek and Putah Creek watersheds (both upstream of the Yolo Bypass) supplied much of the mercury amalgam for gold mining in the Sierras and other industrial uses. The majority of Coast Range mercury mines that supplied this practice has since been abandoned and remains unreclaimed. As a result of these two activities, bulk mercury contamination exists today on both sides of the Central Valley (Jones and Slotten 1996) and within the Yolo Bypass. A large proportion of the loads of mercury and methyl mercury in San Francisco Bay and the Delta are thought to originate in Cache Creek and pass through the Yolo Bypass (Domagalski et al. 2002).

Methylation of mercury is the key step in the entrance of mercury into the food web. Nearly 100% of the mercury that bioaccumulates in fish tissue is methylated. The rates of methylation are influenced by the bioavailability of inorganic mercury to methylating bacteria, the concentration and form of inorganic mercury, and the distribution and activity of methylating (i.e., sulfate-reducing) bacteria (Jones and Slotten 1996; Heim et al. 2003). Solid phase methylmercury concentrations vary seasonally; with the highest concentrations tending to occur during late spring and summer (Heim et al. 2003).

Gill et al. (2002) found that sediments appear to be a net source of methylmercury into the water column. Sinks or losses of total mercury and methylmercury include volatilization, sequestration (i.e., storage) in local soil, and biological uptake (i.e., accumulation in organisms' tissues). Demethylation of methylmercury is considered likely to be the major loss mechanism for this form. Stephenson et al. (2002), who employed a mass balance approach, suggests that the Delta is a sink for methyl mercury, due to photodemethylation (i.e., process of demethylation of mercury through sunlight exposure) or storage via bioaccumulation. Slotton et al. (2003) suggests that inorganic mercury newly delivered from upstream sources is more readily methylated and bioaccumulated than is inorganic mercury stored in the Delta and lower tributaries.

Wetlands support methylation processes and may export methylmercury to surrounding channels (Heim et al. 2003), however, recent research shows that there is still much to learn about methylmercury production and export processes from wetlands. Recent studies in the Delta indicate that some wetlands import and some export methylmercury (Stephenson, pers. comm., 2006). Two almost identical wetlands on Twichell Island that differ in depth and channel structure produce very different amounts of methylmercury (Stephenson, pers. comm., 2006). Biological findings indicate no distinct localized increase in net methylmercury bioaccumulation in wetlands versus adjacent upland areas within Delta subregions (Slotten et al. 2003). Some of the most well developed, highly vegetated wetland tracts have exhibited reduced levels of localized net mercury bioaccumulation (Slotten et al. 2003). Recent DFG studies indicate that permanent wetlands could serve as demethylation ponds for water draining from seasonal wetlands, where methyl mercury levels are increased (Stephenson, pers. comm., 2008).

Additionally, recent findings on methylmercury production rates suggest that there may be an inverse relationship between environmental conditions that support high concentrations of biologically available mercury (e.g., relatively clean inorganic sediments [typically not associated with wetlands]) and those that support high sulfate reduction rates (e.g., oxic-anoxic sediment interface with relatively high amounts of organic material [typically associated with wetlands]) (Marvin-DiPasquale, pers. comm., 2005). These results suggest that wetland restoration may result in localized mercury bioaccumulation at levels similar to, but not necessarily greater than, levels within their surrounding subregion.

Mercury research from the Delta and tributaries consistently indicates that sediment methylmercury concentrations, methylmercury formation and demethylation, organism uptake and bioaccumulation, and mass flux of methylmercury transfer from sediment to water are highly dynamic processes that can vary considerably, depending on the land use/community type (e.g., wetlands/marsh, agriculture, open water), location in the region, and a host of other factors (e.g., hydrologic factors, salinity, pH, temperature, organic matter, temporal-seasonal conditions) (Jones and Slotten 1996, Foe 2002, Gill et al. 2002, Stephenson et al. 2002, Choe and Gill 2003, Choe et al. 2003, Davis et al. 2003, Foe et al. 2003, Heim et al. 2003, Slotten et al. 2003, Wiener et al. 2003).

As discussed in Section 3.1.4, the Central Valley Regional Water Quality Control Board is developing a Total Maximum Daily Load (TMDL) for methyl and total mercury in the Sacramento-San Joaquin Delta. This action could affect the management of the Yolo Bypass Wildlife Area.

Toxic Chemicals

Toxic chemicals including pesticides have impaired water quality in many Central Valley and Delta waterways and have recently been studied in the Yolo Bypass (Smalling et al. 2005). High concentrations of some metals from point and nonpoint sources appear to be ubiquitous in these waterways. In addition to mercury (discussed above), high levels of other metals (i.e., aluminum, copper, cadmium, and lead) in Central Valley and Delta waters are also of concern. Additionally, in localized areas of the Delta, fish tissues contain elevated levels of dioxin as a result of industrial discharges (State Water Resources Control Board 1999).

As discussed above, pesticides are found throughout the waters and bottom sediments of the Bypass. The more persistent organochlorine pesticides (e.g., DDT) are generally found throughout the system at higher levels than the less persistent organophosphate compounds (e.g., diazinon). Pesticides have concentrated in aquatic life in the Delta, and the long-term effects are unknown. The effects of intermittent exposure of toxic pesticide levels in water and of long-term exposure to these compounds and combinations of them are likewise unknown (State Water Resources Control Board 1999).

Salinity

High salts content in water potentially impacts productivity of agricultural crops and may create problems for seasonal wetlands. Local groundwater aquifers are relatively high in salts content (City of Woodland 2005). Because the Yolo Bypass Wildlife Area relies primarily on surface water for irrigation and flooding, high salt content groundwater is not as much of a concern. Prior to the construction of Shasta Dam, salinity was indeed more of an issue in the Yolo Basin with saline conditions being reported in the vicinity of County Road 155.

Bacteria

The bacteriological quality of Bypass waters, as measured by the presence of coliform bacteria, varies depending upon the proximity of waste discharges and land runoff. Bacteria are not a primary water quality concern at the Yolo Bypass Wildlife Area.

Selenium

Varying concentrations of selenium have been found naturally occurring in soils in California's Central Valley and can be found in high concentrations in agricultural drain water. The two primary agricultural drains discharging to the Yolo Bypass, Knights Landing Ridge Cut and Willow Slough Bypass, have been measured to have relatively high total and dissolved selenium concentrations and have been identified as low priority pollutants of concern (see Table 3.4-4) (City of Woodland 2005). The City of Davis conducts ongoing food chain and avian egg monitoring for selenium bioaccumulation. No adverse effects have been detected during the last 7 years of monitoring (City of Davis, unpublished data) Some of the effects on organisms when selenium is present in aquatic environments are reproductive dysfunction, deformities, anemia, and death in many species of birds, fish, and mammals (Amweg et al. 2003).

Boron

Boron is an essential element for plant growth and is needed in relatively small amounts; however, if present in amounts appreciably greater than needed, it can become toxic. Boron toxicity can affect nearly all crops and vegetation types but, like salinity, there is a wide range of tolerance among crops (City of Woodland 2005). Currently, boron is not of primary concern to agricultural and/or wetland management at the Yolo Bypass Wildlife Area. However, boron concentrations do have the potential to effect management if concentrations increase.

A reconnaissance investigation (Setmire et al. 1990) conducted at the Salton Sea under the Department of the Interior's National Irrigation Water Quality Program (NIWQP) identified boron as a contaminant of concern for wildlife. A more detailed study, conducted as a follow-up found that ruddy duck liver concentrations of boron increased during the course of their winter stay at the Salton Sea (Setmire et al. 1993). Additionally, laboratory studies with mallards indicate that reproductive impacts can occur at dietary concentrations of boron that have been found in waterfowl food items in the San Joaquin Valley (Smith and Anders 1989).

3.5 BIOLOGICAL RESOURCES

This section discusses common and sensitive biological resources, including vegetation, wildlife, and fisheries resources that occur or have the potential to occur in the Yolo Bypass Wildlife Area.

The following text was developed through a review of scientific literature, existing data sources, and Yolo Bypass Wildlife Area staff information. These sources provided information on documented occurrences, regional distributions, and habitat associations of key plant, wildlife, and fish species.

HABITAT MANAGEMENT BACKGROUND

Protection and active management of wetland and upland communities, and agricultural lands at the Yolo Bypass Wildlife Area provides vital, high-quality habitat for hundreds of wetland dependent wildlife species. California has lost approximately 95 percent of these types of habitats due to reclamation efforts, reservoir construction, levee and channelization projects, livestock grazing, timber harvest, water pollution, introduction of nonnative invasive plant species, gravel and gold mining, and clearing for agricultural, residential, and industrial uses over the past 150 years (Riparian Habitat Joint Venture 2000). The restoration of wetland and, to the extent allowable, riparian woodland communities at the Yolo Bypass Wildlife Area is providing important habitat for numerous species. Two-hundred-eighty terrestrial vertebrate species are known to use the Yolo Bypass Wildlife Area at some point during their annual life cycles (Appendix G), over 95 of which are known to breed in the Yolo Bypass Wildlife Area. The Yolo Bypass Wildlife Area also provides suitable habitat for 23 additional species that may occur on site but have not yet been observed there. The Yolo Bypass Wildlife Area is also known to support 38 special-status wildlife species (Table 3.5-3), and many more are locally rare or have specialized habitat requirements that the Wildlife Area provides. The Wildlife Area also provides seasonal or permanent aquatic habitat for 44 species of fish, 8 of which are special-status species (Table 3.5-5). Hundreds of invertebrate species also inhabit the Wildlife Area, including five special-status invertebrates (Table 3.5-3). Under the ecosystem management approach, management of the Yolo Bypass Wildlife Area is intended to maximize benefits for the full suite of these species as opposed to management at the single-species level.

During the winter and early spring of some years, flooding of the Yolo Bypass brings dramatic changes to the Wildlife Area. The floods provide vast expanses of aquatic habitat, as well as fish and invertebrate prey that attract thousands of waterbirds annually. The National Audubon Society has classified the Yolo Bypass Wildlife Area as a Globally Important Bird Area because it supports globally significant numbers of waterfowl, continentally significant numbers of least sandpiper (*Calidris minutilla*) and northern pintail (*Anas acuta*), and nationally significant numbers of American white pelican (*Pelecanus erythrorhynchos*), canvasback (*Aythya valisineria*) and dunlin (*Calidris alpina*) (Yolo Audubon Society Checklist Committee 2004).

The timing, area, volume, and duration of flooding have lasting effects on the Yolo Bypass Wildlife Area after the waters have receded. Winter (i.e., December through February) floods, which occur approximately 60 percent of years, have the most ecological value to waterbirds. Spring floods (i.e., March through May), which occur only in the wettest years, occur after many waterbirds have migrated away from the site. Initially, many wading birds are attracted to the floodwaters each year, to prey upon large populations of mammals and reptiles seeking refuge from the high waters. In the long term, spring floods are known to decrease small mammal and associated predator populations due to drowning and relocation, and it is assumed that resident reptiles experience similar declines. Spring floods also destroy early-season bird nests at the Yolo Bypass Wildlife Area. Upland habitat quality is also decreased by spring flooding, which causes many nutritious legumes to be replaced by less nutritious cocklebur and dock, and can preclude the planting of wildlife forage and agricultural crops such as safflower, milo, millet, sunflower, and rice. These habitat changes are also known to delay and ultimately reduce pheasant reproduction in years with spring floods, and affect many other species of wildlife as well.

An additional important feature of the Wildlife Area is its breeding colony of over 100,000 Mexican free-tailed bats (*Tadarida brasiliensis*). These bats nest each summer under the Yolo Causeway and prey on insects throughout Yolo and Sacramento counties. The location of this colony in a protected Wildlife Area will help to ensure its long-term success.

3.5.1 VEGETATION RESOURCES

VEGETATION COMMUNITIES

Common vegetation communities found within the Yolo Bypass Wildlife Area are discussed below. Wildlife habitat characteristics are included in this discussion with additional description of wildlife guilds provided under Section 3.5.2, "Wildlife Resources." A crosswalk among community types and other common vegetation community classifications is provided in Table 3.5-1.

Table 3.5-1
Crosswalk Among Yolo Bypass Wildlife Area Community Types and Other Vegetation Classifications

Yolo Bypass Wildlife Area Community Types	CALFED MSCS NCCP Habitat Type [1]	DFG Holland Habitat Types [2]	Related Sawyer/Keeler-Wolfe Habitat Series [3]
Managed Seasonal and Permanent Wetland	Managed seasonal wetland, Seasonally flooded agricultural land	None	None
Natural Seasonal Wetland	Natural seasonal wetland	Vernal marsh (52500), Coastal and valley freshwater marsh (52410), Cismontane alkali marsh (52310)	Bulrush-cattail series, Saltgrass series, Sedge series, Spikerush series
Natural Perennial Wetland	Non-tidal freshwater permanent emergent	Coastal and valley freshwater marsh (52410)	Bulrush series
Riparian Woodland	Valley/foothill riparian	Great Valley willow scrub (63410), Great Valley cottonwood riparian forest (61410), Great Valley mixed riparian forest (61420), Great Valley valley oak riparian forest (61430), Elderberry savanna (63430)	Mixed willow series, Black willow series, Fremont cottonwood series, Mexican elderberry series, Narrowleaf willow series, Sandbar willow series, Valley oak series
Vernal Pool and Swale	Natural seasonal wetland	Northern claypan vernal pool (44120)	Northern claypan vernal pool series
Ditch	Seasonally flooded agricultural land	None	Mosquito fern series
Annual Grassland	Grassland	Non-native grassland (42200), Valley needlegrass grassland (42110), Valley wildrye grassland (42140)	California annual grassland series, Purple needlegrass series, Creeping ryegrass series

[1] CALFED Multi-Species Conservation Strategy - Natural Community Conservation Plan (CALFED Bay-Delta Program 2000b)

[2] Holland 1986

[3] Sawyer and Keeler-Wolfe 1995

Seasonal and Permanent Wetlands

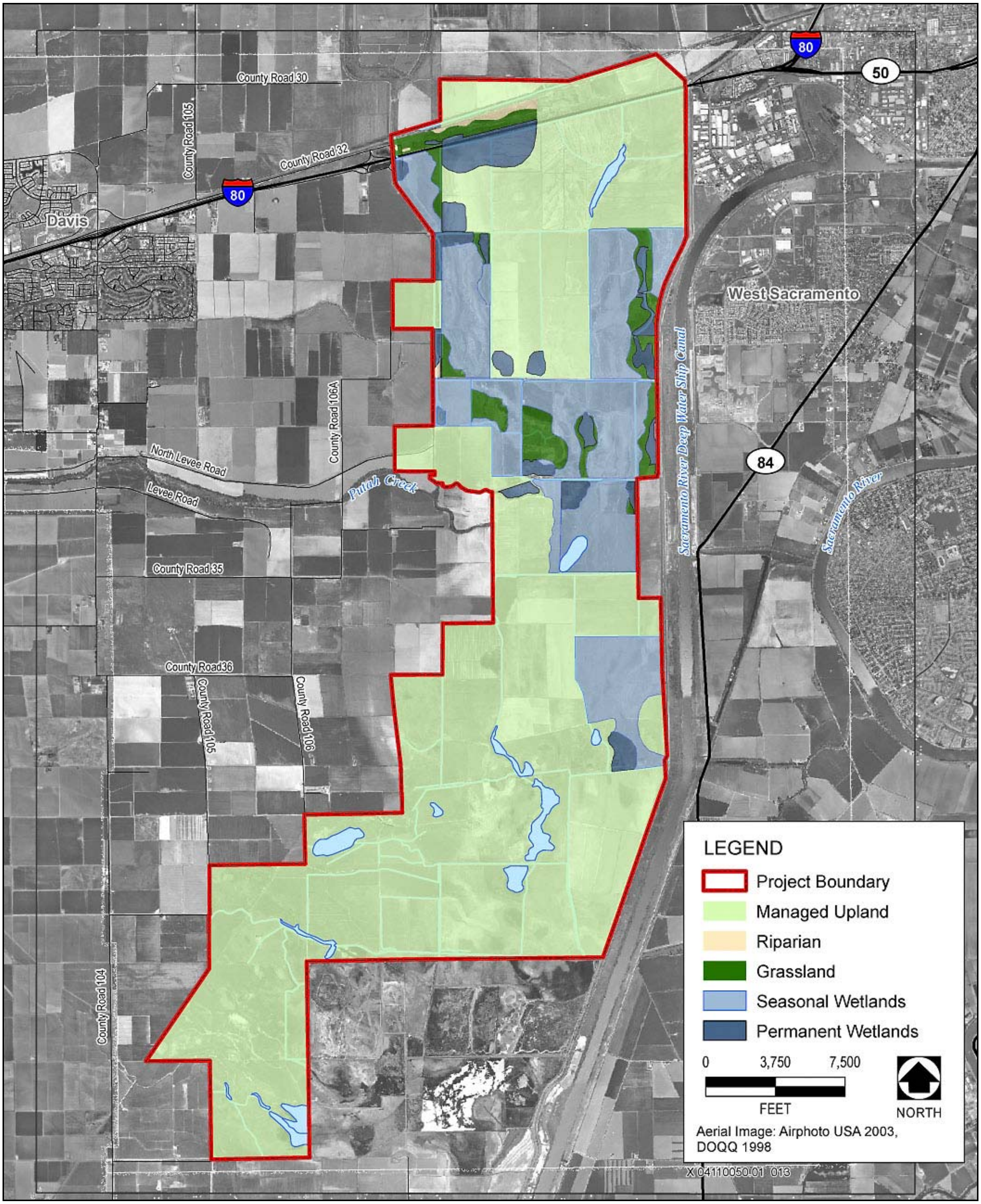
Wetlands have evolved as dynamic ecosystems, constantly changing due to the physical and chemical processes associated with floods, drought, and fire. Today, the Yolo Bypass is an engineered floodway; managed wetlands in the Yolo Bypass Wildlife Area are now enclosed by levees and berms, and flooded with water from irrigation conveyance systems. Whereas natural wetland hydrology was very dynamic, flooding cycles now used for wetlands can be predictable through strategic and innovative management. It is the task of the Yolo Bypass Wildlife Area management to emulate natural hydrology and re-create a dynamic, productive wetland system. With only an estimated 5 percent of the Central Valley's original wetlands remaining, it is also imperative that the remaining wetlands are managed such that they support the maximum abundance and diversity of wildlife (California Department of Fish and Game 1995). The Yolo Bypass Wildlife Area, geographically positioned in the heart of the Pacific Flyway where the Sacramento Valley meets the Delta, supports an extremely large concentration of wintering waterfowl, thus management has an enormous responsibility to provide optimum habitat. Furthermore, wetland management at the Wildlife Area can be conducted in such a manner that shorebirds, wading birds, breeding waterfowl, and other wetland-dependent wildlife also realize maximum benefits (California Department of Fish and Game 1995).

Wetland management techniques in the Yolo Bypass Wildlife Area are built upon the cursory prescriptions as described in *"A Guide to Wetland Habitat Management in the Central Valley"* (California Department of Fish and Game 1995) and have been adapted to specific environmental conditions within the Yolo Bypass and the need to remain compatible with the flood control function of the Yolo Bypass. The management of productive wetland habitat requires dynamic water management, as well as periodic soil and vegetation disturbances. Adequate water conveyance systems are essential for meeting water management objectives, thus pumps, delivery ditches, water control structures, and drainage systems must be maintained in functional condition. Discing and mowing are used to interrupt the natural evolution of wetland habitat and to set back plant succession from climax to early successional stages, stabilizing the marsh vegetation at a point which is the most productive of those elements required by waterfowl and other wetland-dependent species (California Department of Fish and Game 1995). It has also been demonstrated that manipulation of vegetation in seasonal wetlands can change the invertebrate community by increasing the proportion of midges while decreasing the number of mosquitoes. This result has the dual benefit of providing an important protein source to birds and fish while decreasing the chances of exasperating a potential public health issue by increasing mosquito production. Exhibit 3.5-1 depicts a map of managed seasonal and permanent wetlands in the Yolo Bypass Wildlife Area.

Habitat management activities are evaluated annually by the DFG Wildlife Area Habitat Committee (WAHC). The WAHC was established in 1991 to develop acreage and quality guidelines for wetland and upland habitats occurring on DFG's 14 major wetland wildlife areas. A habitat management plan is prepared each year and assessed by the WAHC. A site visit occurs during the summer months to monitor habitat conditions, develop recommendations for future efforts, and evaluate the success of planned field work.

Managed Seasonal Wetlands

Managed seasonal wetlands at the Yolo Bypass Wildlife Area occur primarily throughout the original Wildlife Area units (i.e., North, Northwest, West, Central, Northeast, and South) and are generally flooded in the fall beginning on September 1, with standing water maintained continuously throughout the winter until drawdown occurs in the following spring on April 1. A variety of annual plants germinate on the exposed mudflats of seasonal wetlands during the spring draw down. These plants are then managed through the timing, duration or absence of summer irrigations. These plants are collectively known as "moist-soil plants." These plants produce seeds that are important foods for waterfowl and other wetland-dependent wildlife. The target species for managed seasonal wetlands at the Yolo Bypass Wildlife Area is swamp timothy (*Crypsis vaginaflora*) because it provides tremendous numbers of nutritious seeds for consumption by migratory waterfowl, its branch structure is an excellent substrate for invertebrate production, and its low stature presents very little resistance to flood waters moving through the Yolo Bypass. Interestingly, this plan is considered undesirable in the vernal pool areas of the



Source: Department of Fish and Game, City of Davis 2005, CaSIL 1993

Yolo Bypass Wildlife Area Managed Permanent and Seasonal Wetlands **Exhibit 3.5-1**

Tule Ranch, where a native forb community predominates. A combination of moist-soil plants and robust emergent vegetation (e.g., cattails [*Typha*] and/or tules [*Scirpus*]) results from management practices employed in Yolo Bypass Wildlife Area seasonal wetlands. A primary objective of "moist-soil management" (i.e., seasonal wetland management) is to provide an abundance and diversity of seeds, aquatic invertebrates, and other moist-soil foods for wintering waterfowl and other wildlife. Although agricultural grains produced in the Wildlife Area (e.g., rice and corn) supplement the diets of waterfowl in winter, these foods lack many of the vitamins, minerals, and proteins essential for survival and subsequent reproductive success (Euliss and Harris 1987; Chabreck et al. 1989; Combs and Fredrickson 1996). The seeds of moist-soil plants provide waterfowl with the essential nutritional balance lacking in grains. Invertebrates are protein-rich by-products of moist-soil management that serve as an important food source for waterfowl and shorebirds during autumn, winter, and spring. (California Department of Fish and Game 1995).

Wildlife Values of Managed Seasonal Wetland Plant Communities

Diets of wintering waterfowl are diverse and include aquatic invertebrates, moist-soil plant seeds, and agricultural grains (Euliss and Harris 1987; Chabreck et al. 1989; Combs and Fredrickson 1996). Research in waterfowl nutrition has recognized variability in value among foods, whereas studies of waterfowl food habits (Combs and Fredrickson 1996) and foraging ecology (Euliss and Harris 1987; Euliss et al. 1991) have focused primarily on differences in abundance among foods. Winter diet restriction in waterfowl can affect timing of molt, body mass, mortality and pair formation (Demarest et al. 1997), and nest initiation date (Dubovsky and Kaminski 1994). Studies also have shown that food quality can affect egg production and timing of molt (Richardson and Kaminski 1992). Canvasbacks (*Athya valisineria*) have been documented to quickly regain lost body mass when fed a nutritionally balanced diet following short-term food deprivation, but continue to lose mass when fed unbalanced diets (California Department of Fish and Game 1995). Thus, diet quality is important not only in maintaining condition of wintering birds, but also in mitigating physiological effects of short-term food deprivation, such as periods immediately after long distance migrations. Given the maintenance and anabolic costs of migrating and wintering birds, wetland management prescriptions at the Yolo Bypass Wildlife Area that promote the production of nutritionally balanced foods is a primary objective.

The wildlife value of a moist-soil plant species is generally based on its seed production capability, the nutritional quality of its seeds, and the invertebrate habitat the plant community provides. Management practices at the Yolo Bypass Wildlife Area promote a diversity of highly valuable moist-soil plants, many of which are non native species. Swamp timothy, watergrass (*Echinochloa crus-galli*), and smartweed (*Polygonum amphibium*) are the most important moist-soil plants in the Central Valley, although smartweed is not commonly grown on the Wildlife Area. Seeds of these three plants, in aggregate and combined with agricultural and wildlife forage crops, provide waterfowl and other seed-eating wildlife with a nutritionally balanced diet. Additionally, a variety of other wetland plants are also needed to provide additional nutrition, cover, and thermal protection including sweet clover (*Melilotus alba* and *Melilotus indica*), and the emergent cattails and bulrushes. Some moist-soil plants are not good seed producers or produce seeds with modest nutritional value, but have a complex leaf structure and harbor rich invertebrate communities, thus are also valuable to wildlife at the Area (California Department of Fish and Game 1995).

Other species that may be found in managed seasonal wetlands that are less desirable for wildlife include nonnative plants such as dock (*Rumex* spp.); native plants like gumweed *(Grindelia camporum* var. *camporum*), joint grass (*Paspalus distichum*) and cocklebur (*Xanthium strumarium*), and nonnative invasive plants like perennial pepperweed (*Lepidium latifolium*).

Seasonal wetlands are important production areas for invertebrates that provide a food source for birds both during their aquatic stages and as adults. Larger predatory invertebrate larvae such as dragonfly nymphs help control undesirable invertebrate species such as mosquitoes. They are large enough to be eaten by herons and egrets. Midge (chironomidae) larvae are a critical component of the invertebrate community. Indeed, midge larvae provide much of the protein needed by waterfowl in the spring, by fish foraging on the flood plain in late winter, and by shorebirds throughout the year.

Habitat Values of Managed Seasonal Wetland Plant Communities

The vast majority of wetlands managed on the Yolo Bypass Wildlife Area are seasonal wetlands. Seasonal wetlands are the most productive type of wetland and they can be managed in a way that is compatible with flood protection. The target vegetation species in seasonal wetlands at the Yolo Bypass Wildlife Area is swamp timothy, making the seasonal wetlands very open and allowing efficient floodwater conveyance. When shallowly flooded, this is the preferred habitat of the northern pintail, which is important given the Pacific Flyway is the preferred wintering ground for sixty percent of the pintail on the continent. Over 100,000 waterfowl winter on the Yolo Bypass Wildlife Area on a routine basis, and many of these birds are pintail. The diminutive green-winged teal is also very numerous, preferring the same shallowly flooded seasonal wetlands. Mallard, gadwall, American widgeon round out the “big five” waterfowl species in the Central Valley.

On the shallow fringes, large numbers of shorebirds feed on invertebrates produced in the organic soup of the seasonal wetlands. Ground disturbances such as discing and mowing favor the production of midges, whose larvae provide a critical food source for shorebirds and waterfowl.

Low islands are disced prior to fall flood up to provide roosting areas for the large numbers of waterfowl crowding for a space on the dirt mounds. The “furniture” is well used throughout the winter and only the arrival of a peregrine falcon will clear the islands of waterfowl.

The deeper swales that cut through the seasonal wetlands not only help disperse water during flood up and draw down periods, they also provide deeper water habitat in the winter for diving ducks and white pelicans. In the spring, the swales can be maintained in a flooded state to present foraging areas for nesting shorebirds.

Mudflats are present on the upper edge of managed seasonal wetlands and in the Wildlife Area’s rice rotation that is specifically managed to support shorebirds. Shorebirds forage exclusively in mudflats and shallow open water habitats, which have declined substantially in California’s Central Valley due to the historical conversion of wetlands to agriculture. The on-site mudflats support abundant invertebrate populations, and thus provide important foraging habitat for large numbers of migrating and wintering shorebirds along the Pacific Flyway, including least sandpiper, western sandpiper, long-billed dowitcher, and dunlin. Shorebirds known to breed in the Wildlife Area’s upland communities also depend on mudflats to meet their foraging requirements. These species include American avocets, black-necked stilts, spotted sandpiper, and killdeer. Some dabbling ducks such as cinnamon teal also forage by skimming the mudflats’ surface. Terrestrial predators such as coyotes, raccoons, and skunks prey upon the nesting shorebirds, their young, and eggs in this habitat.

Water Drawdown and Soil Disturbance

Important moist-soil waterfowl food plants such as swamp timothy, smartweed, and watergrass are propagated on seasonal wetlands in the Yolo Bypass Wildlife Area. The primary factors that affect the type and abundance of moist-soil plants that are found in seasonal wetlands are the timing and duration of flooding and the disturbance of the soil. The seeds of these target plant species germinate best at a specific soil temperature under specific successional conditions. Therefore, as plants compete for dominance, prescribed wetland management favor specific plants (or groups of plants) by timing drawdowns to coincide with optimum germination conditions (primarily soil temperature), and discing periodically to maintain the successional stage required by the target vegetation (California Department of Fish and Game 1995). Therefore, seasonal wetlands are usually drawn down on April 1 to favor the germination of swamp timothy. Watergrass appears with later drawn down dates or with summer irrigations.

The rate of water drawdown affects moist-soil plant composition, seed production, and the duration of food availability to waterbird species. Slow drawdowns over 2 to 3 weeks cause invertebrates to become concentrated in the shallow water and allow waterfowl and shorebirds optimum foraging conditions for a prolonged period. This presents an ideal foraging opportunity for these birds who are about to embark on their annual journey to their northerly breeding grounds. These draw downs may also concentrate fish that were captured during the winter floods, presenting a productive feeding opportunity for resident wading birds. Slow drawdowns also may enhance seed production. Rapid drawdowns (i.e., 2 to 3 days) may produce extensive stands of waterfowl food plants if timed correctly, but lose the extended shallow water habitat associated with slow drawdowns. Rapid drawdowns late in the growing season are preferably followed by a summer irrigation to ensure a good seed crop. Although slow drawdowns are generally better for wildlife, there is no "right" or "wrong" way to drain a seasonal wetland. The rate of drawdown at the Wildlife Area is based on site-specific circumstances and may vary year to year. For example during a warm spring, it may be preferable to draw down faster in order to avoid the production of large numbers of mosquitoes.

Irrigation

Spring and summer irrigations are very important to seasonal wetland management throughout the continent. Most waterfowl food plants will not attain maximum seed production without at least one irrigation. Swamp timothy is a waterfowl food plant that may be grown successfully without irrigation; however, irrigations greatly enhance seed production if timed correctly and may stimulate an over story of watergrass. Summer irrigation of swamp timothy also tends to concentrate grasshoppers and rodents to the edge of the waterline, where they are quickly consumed by Swainson's hawks, white-faced ibis, egrets and herons. Large concentrations of Swainson's hawks foraging in irrigated seasonal wetlands are an annual spectacular phenomenon at the Wildlife Area. Irrigation schedules at the Yolo Bypass Wildlife Area for smartweed and watergrass may vary depending on annual weather patterns (California Department of Fish and Game 1995).

Summer Water

Southbound migratory shorebirds start arriving in the Central Valley during the last week of June, peaking in mid July to early August. They have already nested in their northerly breeding grounds and are already moving south. Some of these birds may be stopping over on their way to the San Joaquin Valley or more southerly wintering grounds, and some are here for the duration of the winter. At any rate, these birds are in need of nutrition in the form of invertebrates and require a habitat that provides varying shallow water depths and a sparseness of vegetation. Additionally, they require resting areas that provide some protection from predators. These habitat characteristics are provided in the fallowed rice fields managed for migratory shorebirds. The fields are prepared identically to rice fields but are not planted and are flooded from July 1 through August 31st. At this time, significant amount of vegetation has become established. The fields are then drained, the weeds disced and the field readied for rice production the following year. This management strategy has proven to have benefits for a variety of species including waterfowl, terns, gulls, wading birds and predators such as peregrine falcon.

Fall Flooding

The timing of fall flooding is based on many factors. Early fall flooding (i.e., August and September) is particularly important for shorebirds, mallards and early migrant pintails and is generally preferred if feasible. During the planning phases of the original Yolo Bypass Wildlife Area, September 1 was determined to be the optimal fall flood up date for seasonal wetlands. With the arrival of West Nile Virus in California, the Department has abided by the requests of the Sacramento Yolo Mosquito and Vector Control District and delayed the fall flood up until October 1st on a year by year basis. The shorebird management areas have been able to provide the necessary early flood water through the month of August for the arriving pintail and mallards, but there currently remains a deficit during September.

Water Depth

Water depth is an extremely important component in Wildlife Area seasonal wetland management. Dabbling ducks (e.g., mallards, pintails, green-winged teal) cannot effectively feed on the seeds and invertebrates found on pond-bottoms if the water is deeper than 12 inches. Water depths of 4–10 inches are preferred for feeding. Therefore, in order to provide feeding habitat for dabbling ducks, shallow water must be maintained. Shallow water habitat management is valuable to many other wildlife species as well. Shorebirds are particularly dependent on shallow water and seldom use habitats in which the water is deeper than 6 inches (California Department of Fish and Game 1995). Water depths of one inch or less are valuable for smaller shorebirds such as least and western sandpipers and even recently dried mudflats are important for certain species such as snowy plover. The complete absence of water in a plowed field has habitat value as well, attracting such birds as horned larks, mountain plover and various species of longspurs.

Managed Semi-permanent/Permanent Wetlands

Many of the Yolo Bypass Wildlife Area's resident wildlife species are highly dependent on semi-permanent and permanent wetlands during the late spring and summer when seasonal wetlands are dry. Generally, the two primary habitat requirements of wetland wildlife during this time period are sufficient cover and protection from predators, and an abundant food supply of aquatic invertebrates. Such invertebrates are the primary source of dietary protein for ducks and other wetland-dependent birds during the breeding season. For example, breeding ducks and shorebirds eat invertebrates almost exclusively, but herons eat other direct consumers of invertebrates such as fish and amphibians.

Managed Semi-permanent wetlands, commonly referred to as "brood ponds," are flooded during the spring and summer, but may experience a 2–6 month dry period each year. Semi-permanent wetlands in the Yolo Bypass Wildlife Area provide breeding ducks, ducklings, and other wetland wildlife with protection from predators and abundant invertebrate food supplies. Water depths of 6–12 inches are necessary to allow wildlife access to invertebrate forage; however, permanent deeper and larger areas (e.g., Green's Lake and ponds) are also important in that they provide open water.

Both managed semi-permanent and permanent wetlands provide ample protection from predators; however, semi-permanent wetlands can supply a much greater abundance of invertebrates. Invertebrate populations decline with prolonged flooding, thus a dry period of approximately 2 months each year is essential for maintaining abundant populations of invertebrates (California Department of Fish and Game 1995). During this dry period, excessive vegetation is cut or burned and worked back into the soil, in order to remain in compliance with flood control agreements, while adding large amounts of organic matter to fuel the production of invertebrates in successive years. Vegetation removal is often necessary in order to remain within the percent cover limits imposed by agreements with the Reclamation Board.

Permanent wetlands remain flooded throughout the year. Due to year-round flooding, permanent wetlands support a diverse, but usually not abundant, population of invertebrates. However, submerged aquatic vegetation such as pondweed (*Potomogeton* spp.) and arrowhead (*Sagittaria* sp.) may occur if adequate water clarity exists. The leaves and/or nutlets of these aquatic plants are commonly consumed by waterfowl, particularly gadwalls and canvasbacks. Other aquatic plants including water primrose (*Ludwigia peploides*) and parrot's feather (*Myriophyllum aquaticum*) are potentially invasive and can lead to choking the water column. Permanent wetlands are ultimately dominated by emergent plants such as cattail (*Typha* sp.) and bulrush (*Scirpus* sp.) which must periodically be thinned out in managed wetlands.

Habitat Values of Permanent Wetlands

Managed wetlands as wildlife habitat lie at the core of the Wildlife Area's focus. Permanent wetlands provide important deep water habitat for diving ducks such as ruddy ducks, scaup, goldeneye, as well as other aquatic species including pied-billed grebes, coots, and moorhens. The dense emergent cover commonly found on the edges of permanent wetlands are often the preferred breeding grounds for marsh wrens, red-winged blackbirds, and roosting areas for black-crowned night herons, white-faced ibis and egrets. Islands created in the permanent wetlands are the preferred nesting areas for many waterfowl and shorebirds. Muskrats, and beaver utilize the tules as building material for their domed homes. Otters swim effortlessly through the reeds, carving deep slides into the permanent ponds from adjacent ditches. Fish trapped in the permanent ponds following the winter floods live throughout the year in these ponds, with another chance for dispersal the following wet season.

Permanent Wetlands provide important brood habitat for resident waterfowl including mallard, cinnamon teal and gadwall. Waterfowl will nest within one mile of water, so with this in mind, permanent wetlands are situated less than one mile apart from each other. During the late spring and early summer months, dozens of young ducklings may be seen in the permanent wetlands. The hens often form large nursery groups consisting of ducklings from several broods.

Permanent marshes are important to resident waterfowl in mid- to late summer when local ducks are molting their flight feathers; the deep water and dense cover provide protection from predators (California Department of Fish and Game 1995).

Young willows and cottonwoods growing on the shoreline of permanent wetlands are controlled by DFG staff as maintenance to ensure that the flood carrying capacity of the Bypass is not diminished and are therefore always of low stature. This appears to be important habitat for yellowthroats, song sparrows and northern orioles.

Unmanaged Open Water Habitat (Floodwater Inundation)

Although not a managed habitat type and with a diminished influence of vegetation type, open water habitats provide similar habitat values to permanent wetlands. Winter floodwaters in the Yolo Bypass support thousands of migratory waterbirds each year, and are thus important to breeding populations throughout California and beyond. A wide variety of waterbirds forage in the open water habitat provided by seasonal flooding. These birds are distributed according to water depth and include American white pelican, double-crested cormorant (*Phalacrocorax auritus*), and diving ducks such as canvasback and scaup. If the flooding is not substantial, water levels day light out on the western edge, providing thousands of acres of shallow water habitat, albeit unmanaged. This edge is extremely valuable for wintering dabbling ducks, shorebirds, and wading birds. The abundant waterfowl and shorebirds onsite in turn attract many raptors, including American peregrine falcon.

After floodwaters recede, smaller areas of open water habitat remain in the Yolo Bypass Wildlife Area’s perennial wetlands and ponds. These areas support foraging waterbirds and raptors throughout the year, including species which breed in the uplands and marshes, such as pied-billed grebe (*Podilymbus podiceps*), mallard, gadwall, American avocet, and black-necked stilt. The perennial ponds also support reptiles such as northwestern pond turtle (*Actinemys marmorata marmorata*) and an introduced turtle species, the red-eared slider (*Trachemys scripta*), which forage in the open water, bask on floating logs and breed in adjacent uplands A discussion on fish species that utilize Yolo Bypass open water habitats is provided in Section 3.5.3 below.

Seasonal and Permanent Wetland Habitat Diversity

Wetland habitat diversity including variations in topography, water depths, and vegetation patterns are valuable in supporting a wide variety of wildlife species and can also more effectively resist the potentially adverse effects of plant diseases, mosquito production, and bird depredation. Diversified habitats also provide a variety of foraging opportunities throughout the fall and winter for a variety of target species. Even though some moist-soil plants are poor seed producers, when flooded they may support excellent assemblages of invertebrates. Waterfowl also utilize other plants (e.g., cattails and tules) for cover. An ideal seasonal wetland is dominated by waterfowl food plants, contains other moist-soil plants, and provides waterfowl, shorebirds, and wading birds with substantial cover.

Yolo Bypass Wildlife Area habitat improvements that were initiated in 2003 were designed to provide such habitat diversity. These enhancements were federally funded by the North American Wetland Conservation Act (NAWCA) monies matched by the acquisition dollars expended by the Wildlife Conservation Board for the expansion of the Wildlife Area. NAWCA funded improvements were carried out throughout several units on the

Wildlife Area and included adding much needed topographic variation, increasing connectivity of drainage swales, and constructing independent flooding and drainage capabilities. Through the expertise of DFG staff, Ducks Unlimited, and the California Waterfowl Association, a wetland enhancement project was constructed that improved manageability of the wetlands, allowing DFG to more effectively meet obligations to manage wetlands that are compatible with flood protection and mosquito abatement considerations. The end result are individually managed seasonal wetlands with meandering channels, deep pockets, sculptured islands, and shallow benches growing stands of lush watergrass. This complex diversity in topography and associated vegetation communities functions to provide a wide spectrum of microhabitat to meet the specific seasonal and life-stage requirements of a wide assortment of wildlife species.

Vegetation Control

As discussed above, wetland management techniques in the Yolo Bypass Wildlife Area are built upon the prescriptions as described in *"A Guide to Wetland Habitat Management in the Central Valley"* (California Department of Fish and Game 1995) and have been adapted to specific environmental conditions within the Yolo Bypass and the need to remain compatible with the flood control function of the Yolo Bypass. The need to ensure compatibility of managed wetlands with floodwater conveyance includes management of emergent vegetation to make certain that these communities will not conflict with necessary flow conveyance requirements of the Yolo Bypass. Specific criteria for managing emergent vegetation have been developed for the managed wetlands in the Yolo Bypass Wildlife Area, and are described in the U.S. Army Corps of Engineers Operating Manual for the Wildlife Area (U.S. Army Corps of Engineers 2003); these criteria include:

- no more than 5% emergent vegetation in seasonal wetlands;
- no more that 50% emergent vegetation in permanent wetlands (which make up approximately 5% of the total Wildlife Area acreage); and
- riparian vegetation allowed only in specifically designated areas as determined by hydraulic modeling.

For purposes of the operating manual, emergent vegetation includes cattails and bulrush. Acceptable seasonal wetland plants include swamp timothy, watergrass, and smartweed.

In addition to maintaining necessary flow conveyance functions, some plants can also reduce the value of a wetland to waterfowl if they become overly abundant. Tules and/or cattails can eventually "fill-in" a pond, eliminate open water, and exceed emergent vegetation criteria provided above. Any coverage greater than 50% in a permanent wetland is undesirable for waterfowl management. Of course, other species benefit from increased emergent cover such as white-faced ibis, marsh wren, and black-crowned night herons. The primary tools for tule/cattail control at the Yolo Bypass Wildlife Area are discing and mowing. Mowing can be most effective when followed by discing and 2–3 months of exposure to the sun, which is necessary in order to dry out and kill the tubers and rhizomes. Discing tules and cattails also disturbs the soil and provides favorable conditions for invasion by valuable moist-soil waterfowl food plants (California Department of Fish and Game 1995). Ideally, discing of emergent vegetation is preceded by burning, grazing, mowing and or an application of a broad spectrum herbicide to increase the effectiveness of the discing operation.

Discing is typically accomplished with either a "stubble disc" or a "finish disc." The depth of discing varies with soil structure, soil moisture, implement weight, tractor size, and tractor speed. Most stubble discs have blades that range from 26–36 inches in diameter; these make cuts that are 7 to 14 inches deep. Stubble discs are necessary for most types of pond-bottom discing, however, a finish disc and ring-roller can be used afterward to break up dirt clods to create a better seed bed and make walking easier under subsequent flooded conditions (California Department of Fish and Game 1995).

Finish discs, which typically have blades that range from 18–24 inches in diameter, usually make cuts that are 4–6 inches deep. Finish discs often suffice for discing low-growing vegetation such as pricklegrass and swamp timothy, but are less effective for controlling cattails, tules, and other robust wetland plants (California Department of Fish and Game 1995).

Wetland Management and Mosquito Control

With the arrival of the West Nile virus, public health concerns about mosquito production in wetlands, rice fields, or other rural sources have elevated substantially. The control of mosquitoes in the managed wetlands within the Yolo Bypass Wildlife Area is a primary concern, due to the close proximity of large urban populations in West Sacramento, Sacramento, and Davis. Seasonal and permanent wetlands at the Yolo Bypass Wildlife Area are managed in coordination with the Sacramento-Yolo Mosquito Vector Control District (SYMVCD) and with best management practices (BMPs) included in the CVHJV's Technical Guide to Best Management Practices for Mosquito Control in Managed Wetlands (Kwasney et al. 2004) and the operation manual (U.S. Army Corps of Engineers 2003) to minimize the production of mosquitoes. The term, "BMPs" is used to describe habitat management strategies that are generally defined as a practice or combination of practices determined to be an effective and practical means for reducing mosquito populations, production rates, or the timing of hatch. BMPs can be effectively classified into the following five categories:

- Water Management Practices,
- Vegetation Management Practices,
- Wetland Infrastructure Maintenance,
- Wetland Restoration and Enhancement Features, and
- Biological Controls.

A full discussion on BMPs that are used to reduce mosquito production in managed wetlands at the Yolo Bypass Wildlife Area can be found online at: <http://www.centralvalleyjointventure.org/images/CVJV_Mosquito_BMP_rev.pdf> (Kwasney et al. 2004). Wildlife Area staff in partnership with the SYMVCD was able to fund an mosquito BMP implementation project with funds made available through Senate Bill 1982. This project focused on the control of joint grass (*Paspalum dicitum*), through discing and herbicide application. Joint grass has been implicated as a plant which facilitates the production of large numbers of mosquitoes while providing little wildlife habitat value. First year monitoring has yielded promising results, with a significantly reduced number of mosquito larvae collected in the treated areas.

In response to elevated concern about West Nile Virus and Encephalitus, DFG agreed to temporarily delay the initial flood of seasonal wetlands. Continuous communication and coordination between Wildlife Area and SYMVCD staff regarding water level management, spraying operations, public use scheduling, research projects and planning and design of future wetlands are vital components of management at the Yolo Bypass Wildlife Area. The goals of both wetland managers and mosquito vector interests are not that different. Both seek effective management of water in wetlands that do not result in significantly increased mosquito numbers.

Annual Grassland

Grasslands are found across the majority of the 9,000-acre Tule Ranch unit and in scattered locations within other management units. The majority of annual grassland in California is are dominated by a variety of naturalized, nonnative grasses and forbs. Species composition in this community varies widely in response to a variety of micro-scale factors such as soil moisture, soil fertility, disturbance (e.g., gopher mounds), grazing pressure and soil depth. Most grasslands in the Yolo Bypass are dominated by Italian (annual) rye grass (*Lolium multiflorum Lam.*). Common, and occasionally dominant, species include a variety of naturalized nonnative grasses and forbs such as medusahead (*Taeniatherum caput-medusae*), soft chess (*Bromus hordeaceus*), filaree (*Erodium botrys*), Mediterranean barley (*Hordeum marinum* ssp. *gussoneum*), slender wild oats (*Avena barbata*), ripgut brome (*Bromus diandrus*), and rose clover (*Trifolium hirtum*). Native geophytes (bulbs) are also common in these habitats and include a variety of species in the genus *Brodiaea* as well as *Tritelia hyacynthina*, *Tritelia laxa*, and *Calochortus*.

Community composition in wetter sites is similar to vernal pools (discussed below). On shallower soils, grasses generally become less dominant and native forbs such as smooth goldfields (*Lasthenia glabrata* ssp. *glabrata*), owl's clover (*Triphysaria eriantha*), Fitch's tarweed (*Hemizonia fitchii*), blow wives (*Achyrachaena mollis*), California plantain (*Plantago erecta*), and others are more common. Annual grasslands may occasionally contain small areas of remnant perennial native grasses where purple needlegrass (*Nassella pulchra*) and, in more moist areas, creeping wildrye (*Leymus triticoides*) are important components of the grassland community. Purple needlegrass rarely occurs in pure stands; rather it is more commonly encountered as single individuals or scattered groups of several individuals surrounded by and interspersed with nonnative annuals. On saline or alkaline soils, saltgrass (*Distichlis spicata*) becomes a common or dominant component of the grassland. The Tule Ranch grasslands are grazed with cattle as a primary management strategy. This strategy has been proven to be a successful technique for the management of native forbs, resulting in spectacular wildflower blooms in recent years.

The grassland community in the Yolo Bypass Wildlife Area's Tule Ranch Unit provides high-quality breeding and foraging habitat that is relatively scarce in the region, due to habitat conversion to agriculture and the widespread habitat degradation by nonnative invasive plants. Managed (i.e., grazed) grasslands such as those found in the Tule Ranch Unit are especially important given the grassland-obligate wildlife that they support, such as grasshopper sparrow (*Ammodramus savannarum*), and the many grassland-associated wildlife that they support, such as the ground-nesting northern harrier, California horned lark (*Eremophila alpestris actia*), Western burrowing owl (*Speotyto cunicularia*) and western meadowlark (*Sturnella neglecta*). Historically, pronghorn antelope and tule elk grazed the grassland plants. However, today, grazing cattle provide this function and serve to control mostly nonnative competing grasses while providing income, which funds management of the Yolo Bypass Wildlife Area. Grasslands also provide important breeding and foraging habitat for upland game birds such as mourning dove and ring-necked pheasant, as well as nesting habitat for resident waterfowl such as mallard, cinnamon teal, and gadwall. In addition to their ecological value, these upland game bird and waterfowl species also provide income for Wildlife Area management in the form of hunting licenses. Grasslands also support abundant small mammals such as California ground squirrel (*Spermophilus beecheyi*), which in turn attract many avian, mammalian, and reptilian predators such as Swainson's hawk, burrowing owl (*Athene cunicularia*), coyote (*Canis latrans*), racers (*Coluber constrictor*),and gopher snake (*Pitupohis melanoleucus*). Large flocks of snow geese and white fronted geese are also attracted to winter grasslands on the Tule Ranch.

Natural Seasonal Wetland

Natural seasonal wetlands are found throughout the Tule Ranch Unit in the Yolo Bypass Wildlife Area. Depending on the duration of inundation, local soil factors, site history, and other characteristics, seasonal wetlands typically are dominated by species characteristic of one of three common natural wetland communities: freshwater marshes, alkali marshes, or freshwater seasonal (often disturbed) wetlands. Because these three communities are characterized by different dominant species and provide different wildlife habitat values, each is discussed separately below.

Freshwater Marsh

Freshwater marshes at Yolo Bypass Wildlife Area are usually dominated by robust native herbaceous species in two genera, *Typha* (cattails) and *Scirpus* (bulrush or tule), which frequently co-occur in large stands interspersed with areas of largely unvegetated open water that, during the dry summer months, may be dominated by nonnative swamp timothy and swamp grass (*Crypsis schoenoides*). Many of the native forbs characteristic of vernal pools in the region, such as coyote thistle (*Eryngium* spp.), gum plant (*Grindelia* sp.), Baker's Navarettia (*Navarettia bakeri*), and goldfields (Lasthenia spp.), may also be found in these natural wetland areas. These communities are typically found in areas subjected to prolonged flooding during the winter months and frequently do not dry down until early summer. Freshwater marsh occurs in small areas throughout the Tule Ranch primarily in the low elevation areas adjacent to East Toe Drain at the south end of the Wildlife Area. During wet springs the acreage of natural freshwater marsh increases significantly. A small area in the southeast corner of the Wildlife

Area is of such low elevation that it is subject to tidal fluctuations through a breech in the berm along the toe drain.

Alkali Marsh

Alkali marshes are commonly found in and around the Sacramento Delta at the fringes of freshwater marsh communities. They are the areas of seasonal inundation where rainfall ponds during the winter and evaporates in the late spring leaving behind layers of accumulated mineral salts leached from surrounding upland soils (many of which are slightly to moderately saline and alkaline, e.g., Pescadero clay soils). Typically, these areas are either unvegetated salt scalds or they contain a unique assemblage of low-growing plants adapted to periodic winter inundation, summer drought, and alkaline/saline soils. Dominant native plants in this community are saltgrass (*Distichlis spicata*) and alkali heath (*Frankenia salina*). Common native associates, depending on the degree of seasonal inundation and soil alkalinity include sea blite (*Suaeda* spp.), California coyote-thistle (*Eryngium aristulatum*), clustered field sedge (*Carex praegracilis*), Baltic rush (*Juncus balticus*), and pale spikerush (*Eleocharis macrostachya*). Species commonly associated with vernal pools may also be found in this community. Small alkali marsh communities can be found in the south and southwest portions of the Tule Ranch. The nonnative invasive plant tamarisk (*Tamarix* spp.) may be invasive in alkali marshes.

Portions of alkali marsh containing alkali-adapted plants (e.g., *Distichlis spicata*) are structurally similar to seasonal disturbed wetlands. Both plant communities provide lower quality habitat for wildlife than other wetland communities such as freshwater marsh or vernal pool, as they lack the hydrology and vegetation structure necessary to support most wetland-dependent wildlife species. The vegetated alkali marsh and seasonal disturbed wetlands on site do support more generalist wildlife, however, that are capable of breeding and foraging in both upland and wetland communities. These species include common garter snake (*Thamnophis sirtalis*), savannah sparrow (*Passerculus sandwichensis*), Northern Harrier (*Circus cyaneus*) , Mallard (*Anas platyrhinos*)and California vole (*Microtus californicus*).

Seasonal (Disturbed) Wetland

Seasonal wetlands are plant communities typically characterized by any number of seasonal wetland generalist plants, many of which are nonnative and adapted to frequent disturbance, and may be found throughout the Yolo Bypass Wildlife Area. Common species include mainly nonnative species such as rabbit’s foot grass (*Polypogon monspeliensis*), Italian ryegrass, curly dock (*Rumex crispus*), and hyssop loosestrife (*Lythrum hyssopifolia*), and invasive species, such as perennial pepperweed (*Lepidium latifolium*) and dallisgrass (*Paspalum dilitatum*). Some native species also occur, such as nutsedge (*Cyperus eragrostis*). Seasonal wetlands are often isolated wetlands that may have previously functioned more like vernal pools but, due to past disturbances and altered hydrology, now support species that are adapted to longer inundation periods or are more tolerant of repeated disturbance. Seasonal wetlands may also be inadvertently created in areas of claypan or hardpan soils where a lack of water infiltration results in seasonal ponding within areas of excavation or other ground disturbances.

Vernal Pool and Swale

Vernal pools and swales within the Yolo Bypass Wildlife Area are primarily found within the southwest portion of the Tule Ranch Unit. A recent survey of this area (Witham 2003) documented approximately 1,600 acres of vernal pool/grassland habitat as well as the presence of a distinct vernal pool subtype, playa pools. Playa pools are generally larger and deeper than other vernal pool types (several hectares in size and 1–2 meters deep) and defined by cut banks from repeated wave action during the winter and spring. Vernal pools typically support a suite of mostly endemic and sometimes rare plants in several genera including goldfields (*Lasthenia* spp.), popcorn flower (*Plagiobothrys* spp.), *Navarretia*, woolly-marbles (*Psilocarphus* spp.), *Downingia*, and *Limnanthes*. The nonnative Italian ryegrass is also widely distributed in vernal pools. The margins of playa pools support many of the same species as smaller vernal pools. Additionally, several rare grasses, including Colusa grass (*Neostapfia colusana*) and Crampton’s tuctoria (*Tuctoria mucronata*), although not confirmed to be present in Yolo Bypass Wildlife Area, have the potential to occur on the pool bottoms, which are otherwise typically sparsely vegetated. Vernal swales, because they hold water for relatively short periods of time, typically contain a mix of species found in both vernal pools and annual grasslands. Developing a refined grazing plan for the vernal pool areas throughout the Tule Ranch is a high priority for future management and will most certainly focus on the management of the nonnative Italian ryegrass.

Vernal pools are a unique, rare, and rapidly declining community in California. Because of the limited distribution of this community in the state and its continued decline due to land conversion for development and other uses, many vernal pool-associated wildlife species receive state or federal protection or are considered species of concern. The vernal pools at the Wildlife Area provide high-quality habitat for these species, due to the diversity in pool size, long inundation periods, and active vegetation management through grazing. Vernal pool and swale-obligate species known to breed in the Wildlife Area include vernal pool tadpole shrimp (*Lepidurus packardi*), vernal pool fairy shrimp (*Branchinecta lynchi*), conservancy fairy shrimp (*Branchinecta conservatio*), midvalley fairy shrimp (*Branchinecta mesovallensis*), and California linderiella (*Linderiella occidentalis*). Vernal pool tadpole shrimp, vernal pool fairy shrimp, and California linderiella may also inhabit vernal swales, provided that water remains ponded in the swales long enough for the shrimp to mature and reproduce (a minimum of 18 days for vernal pool fairy shrimp, 31 days for California linderiella, and 41 days for vernal pool tadpole shrimp). The vernal pools at the Wildlife Area also may provide suitable habitat for California tiger salamander (*Ambystoma californiense*) and possibly western spadefoot toad (*Spea hammondi*), although these species have not been documented on site. In addition to these species which are restricted to vernal pools and swales, a variety of more generalist wildlife forage and breed in these habitats as well, such as Pacific chorus frog, wetland-associated insects, shorebirds, and waterfowl.

Riparian Woodland

Riparian woodland was probably a dominant habitat type in the primal Yolo Basin, but are currently kept in check in order to maintain the flood conveyance capacity of the Yolo Bypass. Riparian woodland and associated riparian scrub habitats are primarily found adjacent to Green’s Lake, Putah Creek, and along the East Toe Drain within the Yolo Bypass Wildlife Area. Riparian scrub is a shrub-dominated community found typically found along stream margins and within the streambed on gravel bars and similar formations. This community is typically dominated by phreatophytes (i.e., water-loving plants) representative of early to mid successional stage vegetation communities within riparian areas in California’s Central Valley. Typical species include native plants such as creek dogwood (*Cornus sericea*), California rose (*Rosa californica*), Sandbar willow (*Salix exigua*), buttonbush (*Cephalanthus occidentalis* var. *californicus*), and arroyo willow (*Salix lasiolepis*), along with nonnative invasive species such as Himalayan blackberry (*Rubus discolor*), and potentially arundo (*Arundo donax*), and tamarisk (*Tamarix parviflora*). Native trees such cottonwood (*Populus fremontii*), alder (*Alnus rhombifolia*), and Oregon ash (*Fraxinus latifolia*) are occasionally found overtopping the shrub layer. Riparian woodland is a tree-dominated community found adjacent to riparian scrub on older river terraces where flooding frequency and duration is less. Common native overstory species in riparian communities include cottonwood, alder, valley oak (*Quercus lobata*), Oregon ash, black willow (*Salix gooddingii*), California sycamore (*Plantanus racemosa*), box elder (*Acer negundo*), and northern California black walnut (*Juglans californica* var. *hindsii*) hybrids (northern California black walnut readily hybridizes with cultivated English walnut [*J. regia*]). The understory is typically sparse in this community; although, native species such as California rose, California grape (*Vitis californica*), Santa Barbara sedge (*Carex barbarae*), mulefat (*Baccharis salicifolia*), California barley (*Hordeum brachyantherum* ssp. *californicum*), creeping wildrye and potentially blue elderberry (*Sambucus mexicana*), occur in tree canopy openings.

Although relatively small areas of riparian woodland and scrub communities are present on site, these areas provide very important habitat to a number of wildlife species, many of which are restricted to riparian communities. Riparian communities in California currently cover only a small fraction of their historic range, due to the widespread conversion of river floodplain to agriculture. As such, the riparian communities at the Wildlife Area provide important foraging habitat for many migrating and wintering birds in the Pacific Flyway, as well as breeding individuals from a variety of taxa. Cavity nesting species such as tree swallow, wood duck, and several woodpecker species benefit from the presence of riparian habitat. Mature stands of cottonwood/sycamore in the Central Valley are of primary importance to breeding red bats (*Lasiurus blossevillii*). Wildlife species known to forage in the on-site riparian communities include Cooper's hawk (*Accipter cooperii*), sharp-shinned hawk (*Accipiter striatus*), red-shouldered hawk, kingfisher, yellow warbler, willow flycatcher (*Empidonax traillii*), western grey squirrel (*Sciurus griseus*), and western aquatic garter snake. Recently, tricolored blackbird breeding colonies have also occurred in an on-site patch of buttonwillow trees.

Ditch

Ditches are found throughout most management units within the Yolo Bypass Wildlife Area. They typically contain a mixture of weedy herbaceous wetland and upland generalist plants. If frequently cleared, ditch banks may be largely unvegetated and contain only scattered upland weeds or, if unmaintained, they may be densely vegetated. A native species commonly found within ditches at the Yolo Bypass Wildlife Area is water primrose, a species that can eventually form dense stands that slow down the flow of water. Control measures are implemented at this point, which include application of herbicides or mechanical control. Additionally, ditches that are unmaintained and hold water for long period during the growing season may contain a mix of species more commonly found in perennial wetlands or freshwater marshes described above. Ditches serve as corridors, hydrologically connecting land management units.

Wildlife use of the ditches on site varies according to each ditch's pattern of water conveyance. Ditches that remain inundated throughout the summer months and are connected to rice fields or permanent wetlands provide very important habitat at the site, as these ditches and their associated infrastructure provide habitat for the state and federally-listed, threatened, giant garter snake. This aquatic species commonly travels through irrigation ditches, forages for amphibians and small fish, which may be present, and uses the dry associated banks for basking and thermoregulation. Ditches with suitable hydrology also support the foraging of other aquatic wildlife such as western aquatic garter snake, Pacific chorus frog, the nonnative bullfrog, and dabbling ducks such as mallard. Ditches are considered lower quality habitat for these species than perennial ponds, however.

Ditches that remain dry through most of the year and contain abundant vegetation may support foraging upland wildlife such as song sparrow (*Melospiza melodia*), white-crowned sparrow (*Zonotrichia leucophrys*), and American goldfinch (*Carduelis tristis*).

Agricultural Crops

Agricultural fields are found across the northern and central portions of the Yolo Bypass Wildlife Area (e.g., Causeway Ranch and 1,000 Acre units). These fields are generally planted in various annual row crops in the spring and summer months. The primary crop is rice but a variety of other crops are produced including corn, milo, tomatoes, sunflower and safflower. The rice, corn and milo fields are typically managed as flooded open water habitat in the winter months. During the winter months few, if any, plants are likely encountered in any of these fields, except for residual stubble and other by-products remaining after crop harvesting. A warm autumn may sprout a crop of such wildlife beneficial weeds as water grass.

Agricultural lands at the Wildlife Area are actively managed to benefit wildlife. This management results in the use of safflower fields by foraging mourning doves and ring-necked pheasants, which feed on the unharvested seeds; use of corn, milo, and millet fields by foraging sandhill cranes and waterfowl, which feed on the waste grains after the fields are flooded; use of grain fields by foraging waterfowl, which feed on the green shoots during the early growing season; and use of grain fields by some grassland bird species, which nest in the wheat and feed on associated insects and grains. In addition, the on-site rice fields support foraging white-faced ibis, which feed on the abundant invertebrates in the flooded fields; and tomato fields also support foraging Swainson's hawks and other raptors, which prey on the small mammals made more accessible by grading and harvesting activities. Post harvest flooding of rice fields attracts thousands of waterfowl and shorebirds on an annual basis.

SPECIAL-STATUS SPECIES

Based on queries of the California Natural Diversity Database (CNDDB 2006) and the California Native Plant Society (CNPS) Inventory of Rare and Endangered Plants of California (CNPS 2007: <http://cnps.web.aplus.net/cgi-bin/inv/inventory.cgi/BrowseAZ?name=LIST>), there are 24 special-status plant species known from the vicinity of the Yolo Bypass Wildlife Area (Table 3.5-2). Special-status plants are those plants listed as threatened or endangered under either the Federal or California Endangered Species Acts (ESA/CESA). The CNPS also maintains a list of rare and endangered plants. Although these plants carry no formal regulatory status, except for those plants also listed as threatened or endangered by the federal government or State of California, potential impacts to these species are generally analyzed under the California Environmental Quality Act (CEQA).
A discussion on the habitat requirements for each of these species and their potential for occurrence within the Yolo Bypass Wildlife Area is provided below.

Table 3.5-2
Special-status Plants Known to Occur or with Potential to Occur at Yolo Bypass Wildlife Area

Species	Status 1			Habitat and Blooming Period	Potential for Occurrence
	USFWS	DFG	CNPS		
Suisun Marsh aster *Aster lentus*	FSC	--	1B	Endemic to San Joaquin Delta, generally occurs in marshes and swamps, often along sloughs, from 0 to 3 meters in elevation. Blooms May–November	CNDDB documents occurrences south of the Yolo Bypass Wildlife Area at Lindsey Slough/Calhoun Cut.
Ferris' milkvetch *Astragalus tener* var. *ferrisiae*	FSC	--	1B	Meadows, valley and foothill grassland, subalkaline flats on overflow land in the Central Valley; usually seen on dry, adobe soil, 5 to 75 meters in elevation. Blooms April–May	Witham survey of Tule Ranch (2003) documented this species within the Tule Ranch boundary in the Yolo Bypass Wildlife Area.
Alkali milkvetch *Astragalus tener* var. *tener*	FSC	--	1B	Playas and vernal pools in valley and foothill grassland, alkali flats and flooded lands, from 0 to 60 meters in elevation. Blooms March–June	Witham survey of Tule Ranch (2003) documented this species within the Tule Ranch boundary in the Yolo Bypass Wildlife Area. CNDDB documents 27 other occurrences close by, including Calhoun Cut, Yolo County Grasslands park, Jepson Prairie, Woodland, and Davis area alkaline flats. The locality "0.5 miles W of R.R. tracks, Yolo Bypass area" is most likely within the Yolo Bypass Wildlife Area and may correspond with Tule Ranch.

Table 3.5-2
Special-status Plants Known to Occur or with Potential to Occur at Yolo Bypass Wildlife Area

Species	Status 1			Habitat and Blooming Period	Potential for Occurrence
	USFWS	DFG	CNPS		
Heartscale *Atriplex cordulata*	FSC	--	1B	Alkaline flats and scalds in the Central Valley, sandy soils in Chenopod scrub, valley and foothill grassland, meadows, from 1 to 375 (600) meters in elevation. Blooms April–October	Witham survey of Tule Ranch (2003) documented suitable habitat for this species within the Tule Ranch boundary in the Yolo Bypass Wildlife Area, however the species was not encountered during her survey. CNDDB documents occurrences at Gridley Ranch, Jepson Prairie, alkaline flats between Davis and Woodland, and Calhoun Cut.
Brittlescale *Atriplex depressa*	FSC	--	1B	Alkali scalds or alkaline clay and playas, in chenopod scrub, meadows, and valley and foothill grassland, rarely associated with riparian, marshes, or vernal pools, from 1 to 320 meters in elevation. Blooms May–October	CNDDB documents occurrences of this species on alkaline flats between Woodland and Davis, just north of Davis, and at Dozier Station (Jepson Prairie).
San Joaquin spearscale *Atriplex joaquiniana*	FSC	--	1B	Alkali meadow, chenopod scrub, seeps in valley and foothill grassland, often in seasonal alkali wetlands or alkali sink scrub, from 1 to 835 meters in elevation. Blooms April–October	Witham survey of Tule Ranch (2003) documented suitable habitat for this species within the Tule Ranch boundary in the Yolo Bypass Wildlife Area; however, the species was not encountered during her survey. CNDDB documents occurrences at Liberty Island, alkaline flats between Davis and Woodland, just north of Davis, and Yolo County Grasslands Park.
Lesser saltscale *Atriplex persistens*	FSC	--	1B	Alkaline vernal pools, from 10 to 115 meters in elevation. Blooms June–October	Witham survey of Tule Ranch (2003) documented suitable habitat for this species within the Tule Ranch boundary in the Yolo Bypass Wildlife Area, however the species was not encountered during the survey. CNDDB documents occurrences at Jepson Prairie.
Bristly sedge *Carex comosa*	--	--	2	Coastal prairie, marshes and swamps, valley and foothill grassland, on lake margins and wet places, from 0 to 625 meters in elevation. Blooms May–September	CNPS documents this species within the 12 quad search performed, however no location information was provided. This species is known to occur in the Delta along sloughs and in marshes.

Table 3.5-2
Special-status Plants Known to Occur or with Potential to Occur at Yolo Bypass Wildlife Area

Species	Status 1			Habitat and Blooming Period	Potential for Occurrence
	USFWS	DFG	CNPS		
Palmate-bracted bird's beak *Cordylanthus palmatus*	E	E	1B	Chenopod scrub, alkaline areas in valley and foothill grassland, usually on Pescadero silty clay, which is alkaline, from 5 to 155 meters in elevation. Blooms May–October	CNDDB documents an occurrence of this species at the City of Woodland reserve and Yolo County Park along County Road 102.
Dwarf downingia *Downingia pusilla*	--	--	2	Margin of vernal lakes and pools (mesic sites) in valley and foothill grassland, from 1 to 485 meters in elevation Blooms March–May	Witham survey of Tule Ranch (2003) documented suitable habitat for this species within the Tule Ranch boundary in the Yolo Bypass Wildlife Area; however, the species was not encountered during the survey. CNDDB documents occurrences at Barker Slough, Calhoun Cut, Dozier area, Jepson Prairie, the Rio Linda area, and Elk Grove.
Fragrant fritillary *Fritillaria liliacea*	FSC	--	1B	Coastal scrub, coastal prairie, valley and foothill grasslands, often on serpentine (often clay in grasslands), from 3 to 410 meters in elevation Blooms February–May	Witham survey of Tule Ranch (2003) documented suitable habitat for this species within the Tule Ranch boundary in the Yolo Bypass Wildlife Area; however the species was not encountered during surveys. CNDDB documents occurrences at Jepson Prairie.
Bogg's Lake hedge hyssop *Gratiola heterosepala*	--	E	1B	Freshwater marshes and swamps, vernal pools, lake margins, usually on clay soils, from 5 to 2,400 meters in elevation Blooms April–August	Witham survey of Tule Ranch (2003) documented suitable habitat for this species within the Tule Ranch boundary in the Yolo Bypass Wildlife Area; however the species was not encountered during surveys. CNDDB documents occurrences at Jepson Prairie, the Rio Linda area, and Mather County Park.
Rose-mallow *Hibiscus lasiocarpus*	--	--	2	Freshwater marshes and swamps, generally found on wetted river banks and low peat islands in sloughs, known from the Sacramento-San Joaquin Delta watershed, from 0 to 120 meters in elevation Blooms June–September	CNDDB documents occurrences of this species in Snodgrass and Lost Sloughs, as well as near I-80 at the W. El Camino Avenue on ramp.

Table 3.5-2
Special-status Plants Known to Occur or with Potential to Occur at Yolo Bypass Wildlife Area

Species	Status 1			Habitat and Blooming Period	Potential for Occurrence
	USFWS	DFG	CNPS		
Carquinez goldenbush *Isocoma arguta*	FSC	--	1B	Alkaline soils, flats, near drainages, on low benches, on tops an sides of mounds in swale habitat, lower hills, in valley and foothill grassland, from 1 to 20 meters in elevation. Blooms August–December	Witham survey of Tule Ranch (2003) documented suitable habitat for this species within the Tule Ranch boundary in the Yolo Bypass Wildlife Area, however the species was not encountered during surveys. CNDDB documents occurrences near Dozier along Hwy 113 and at Jepson Prairie.
Northern California black walnut *Juglans hindsii*	FSC	--	1B	Riparian forest/woodland on deep alluvial soil, from 0 to 400 meters in elevation. Blooms April–May	CNDDB documents occurrences along the Sacramento River between Rio Vista and Freeport.
Delta tule pea *Lathyrus jepsonii* var. *jepsonii*	FSC	--	1B	Freshwater and brackish marshes, usually on marsh/slough edges, generally restricted to the Sacramento-San Joaquin Delta, from 0 to 4 meters in elevation. Blooms May–September	CNDDB documents occurrences at Snodgrass, Barker, Lindsey, Hass, and Cache Sloughs, Delta Meadows Park, and Calhoun Cut.
Legenere *Legenere limosa*	FSC	--	1B	Vernal pool bottoms, from 1 to 880 meters in elevation. Blooms April–June	Witham survey of Tule Ranch (2003) documented suitable habitat for this species within the Tule Ranch boundary in the Yolo Bypass Wildlife Area; however, the species was not encountered during surveys. CNDDB documents occurrences near Calhoun Cut, Jepson Prairie, Elk Grove, Gibson Ranch (Rio Linda), and Robla.
Heckard's peppergrass *Lepidium latipes* var. *heckardii*	FSC	--	1B	Grasslands, alkaline soils, edges of vernal pools, in valley and foothill grassland, from 3 to 200 meters in elevation. Blooms March–May	Witham survey of Tule Ranch (2003) documented this species within the Tule Ranch boundary in the Yolo Bypass Wildlife Area. According to CNDDB, this species also occurs north of Davis, at Jepson Prairie, and in Haas Slough (Dozier).
Mason's lilaeopsis *Lilaeopsis masonii*	FSC	R	1B	Freshwater and brackish marsh, riparian scrub, generally found in tidal zones on muddy or silty soils formed through river deposition or bank erosion, from 0 to 10 meters in elevation. Blooms April–November	CNDDB documents occurrences of this species in Barker, Lindsey, Cache, and Snodgrass Sloughs as well as in Calhoun Cut.

Table 3.5-2
Special-status Plants Known to Occur or with Potential to Occur at Yolo Bypass Wildlife Area

Species	Status 1			Habitat and Blooming Period	Potential for Occurrence
	USFWS	DFG	CNPS		
Delta mudwort *Limosella subulata*	--	--	2	Riparian scrub, freshwater and brackish marsh, generally on mud banks of the delta in marshy or scrubby riparian associations, from 0 to 3 meters in elevation. Blooms May–August	CNDDB documents occurrences of this species in Barker Slough as well as in Calhoun Cut.
Baker's navarretia *Navarretia leucocephala* ssp. *bakeri*	FSC	--	1B	Vernal pools, swales, meadows and seeps in cismontane woodland, lower montane coniferous forest, and valley and foothill grassland, on adobe or alkaline soils, from 5 to 1,740 meters in elevation. Blooms April–July	Witham survey of Tule Ranch (2003) documented this species within the Tule Ranch boundary in the Yolo Bypass Wildlife Area. CNDDB documents occurrences of this species at Glide Ranch and Jepson Prairie.
Colusa grass *Neostapfia colusana*	T	E	1B	Usually in large or deep vernal playa pools (flowering on drying pool bottoms), on adobe soils, from 5 to 200 meters in elevation. Blooms May–August	Witham survey of Tule Ranch (2003) documented suitable habitat for this species within the Tule Ranch boundary in the Yolo Bypass Wildlife Area, however the species was not encountered during her survey. CNDDB documents occurrences at Jepson Prairie and at Yolo County Grasslands Park.
Sanford's arrowhead *Sagittaria sanfordii*	FSC	--	1B	Marshes and swamps, shallow, slow-moving, freshwater habitats, ponds, ditches, from 0 to 619 m in elevation. Blooms May–October	CNDDB documents occurrences in Sacramento along the American River, in Morrison Creek, and northern Sacramento sites.
Crampton's Tuctoria/Solano grass *Tuctoria mucronata*	E	E	1B	Usually in dry bottoms of large or deep vernal playa pools in valley and foothill grassland (flowering on drying pool bottoms), 5 to 10 meters in elevation. Blooms April–September	Witham survey of Tule Ranch (2003) documented suitable habitat for this species within the Tule Ranch boundary in the Yolo Bypass Wildlife Area; however, the species was not encountered during surveys. CNDDB documents occurrences west of Jepson Prairie and at Yolo County Grasslands Park.

Legal Status Definitions

U.S. Fish and Wildlife Service (USFWS)

E	Endangered
T	Threatened
FSC	Federal Species of Concern

California Department of Fish and Game (DFG)

E	Endangered
T	Threatened
R	Rare

California Native Plant Society (CNPS) Categories

1A	Plants presumed extinct in California
1B	Plant species considered rare, threatened, or endangered in California and elsewhere
2	Plant species considered rare, threatened, or endangered in California but more common elsewhere
3	Plants about which we need more information – a review list
4	Plants of limited distribution – a watch list

Aster lentus

Suisun marsh aster (*Aster lentus*) is a perennial in the sunflower (Asteraceae) family. It grows in marshes along tidal streams in the Sacramento-San Joaquin Delta, frequently at or very near the water line mixed with tules, cattails, and other emergent vegetation. It may be found in the Yolo Bypass Wildlife Area within perennial wetlands and similar habitats. Suisun marsh aster is listed as a federal species of concern and has been placed on List 1B by the CNPS.

Astragalus tener var. *ferrisiae*

Ferris' milkvetch (*Astragalus tener* var. *ferrisiae*) is a small annual in the pea (Fabaceae) family. It occurs in moist and slightly alkaline habitats such as vernal pools, vernal marshes, and grasslands in the Sacramento Valley and is known from only six sites, one of which is the Tule Ranch (Witham 2003). Ferris' milkvetch is a federal species of concern and has been placed in List 1B by the CNPS.

Astragalus tener var. *tener*

Alkali milkvetch (*Astragalus tener* var. *tener*) is closely related to Ferris' milkvetch and has similar habitat requirements; however, alkali milkvetch is more widely distributed throughout the Bay Area, Sacramento Valley, and San Joaquin Valley. Witham (2003) detected several occurrences of this plant on the Tule Ranch, including one large population containing approximately 300 plants. Alkali milkvetch is a federal species of concern and has been placed on List 1B by CNPS.

Atriplex spp.

Four different special-status species in the genus *Atriplex* are known from the vicinity of the Yolo Bypass Wildlife Area. These four species are: heartscale (*Atriplex cordulata*), brittlescale (*Atriplex depressa*), San Joaquin spearscale (*Atriplex joaquiniana*), and lesser saltscale (*Atriples persistens*). All are annuals in the amaranth (Amaranthaceae) family (formerly considered part of Chenopodiaceae) and distributed throughout the Central Valley and Bay Area in saline or alkaline habitats. *Atriplex cordulata* and *A. joaquiniana* both grow up to 40cm in height or taller and may be found in a variety of vernally mesic saline or alkaline habitats including salt scalds, grasslands, and alkali flats. *A. depressa* and *A. persistens* are both low growing, rarely exceeding 20cm in height. *A. depressa* shares similar habitat requirements with *A. cordulata* and *A. joaquinana* and may frequently be found growing in association with these species; *A. persistens* is more commonly found growing on the drying bottoms of large, alkaline vernal pools. Although none of these species have been found in the Yolo Bypass Wildlife Area, all have the potential for occurrence. All four species are federal species of concern and have been placed on List 1B by CNPS.

Carex comosa

Bristly sedge (*Carex comosa*) is an herbaceous, grass-like perennial in the sedge (Cypreaceae) family. It is found throughout the Delta along sloughs, river channels, pond margins, and marshes. It also inhabits similar habitats in other parts of the United States with the exception of the Great Basin. Bristly sedge may be found along perennial wetlands, the Toe Drain, and ditches within the Yolo Bypass Wildlife Area. This plant has been placed on List 2 by CNPS.

Cordylanthus palmatus

Palmate-bracted birds' beak (*Cordylanthus palmatus*) is an annual in the figwort (Scrophulariaceae) family and can reach 30 cm in height. It grows in vernally mesic alkaline or saline grassland or scrub habitats in scattered localities in the Sacramento and San Joaquin Valleys and at Livermore in the Bay Area. Locally, it is frequently found growing on Pescedaro saline-alkaline silty clay soils in association with saltgrass (*Distichlis spicata*), tarplant (*Hemizonia* spp.), pickleweed (*Salicornia subterminalis*), and alkali-heath (*Frankenia salina*) near

Woodland, California. *Cordylantus palmatus* is a hemiparasite, forming connections with the roots of a host plant. Although *Cordylanthus* has photosynthetic capability, it also receives nutrients from its host plant. Although not found during surveys by Witham (2003), suitable habitat is found on the Fireman's Club in the Tule Ranch unit of the Wildlife Area. Palmate-bracted birds' beak is listed by the State and U.S. Fish and Wildlife Service as an endangered species. It is placed on List 1B by CNPS.

Downingia pusilla

Dwarf downingia (*Downingia pusilla*) is a diminutive annual in the bellflower (Campanulaceae) family. It is widely distributed in vernal pools and wet grasslands throughout the Central Valley and north Bay areas as well as Central Chile. This species occurs in sparsely vegetated micro-habitats. Witham (2003) did not locate this species during her surveys; however, the species is difficult to locate if surveys are not timed specifically to detect it. Suitable habitat is found on the Tule Ranch unit. Dwarf downingia has been placed on List 2 by CNPS.

Fritillaria liliacea

Fragrant fritillary (*Fritillaria liliacea*) is an herbaceous perennial in the lily family (Liliaceae). It may be found in grassland or scrub habitats, often on clay soils. Locally, this species is usually found growing on the tops of mima-mounds or other upland areas within vernal pool grasslands. Although this species has not been located on the Tule Ranch unit (Witham 2003) suitable grassland habitat exists in the Tule Ranch unit and in other management units in the wildlife area. *Fritillaria liliacea* is found at the Jepson Prairie. Fragrant fritillary has been placed on list 1B by CNPS and is a federal species of concern.

Gratiola heterosepala

Bogg's Lake hedge-hysssop is a diminutive annual in the figwort (Scrophulariaceae) family. It grows on the margins and bottoms of deeper vernal pools as well as lake margins, marshes, ponds, and similar habitats at scattered locations in the Central Valley, northern Coast Ranges, central Sierra Foothills, and Modoc Plateau. Although this species has not been located in the Project area, suitable habitat for this species is found in the Tule Ranch unit. Bogg's Lake hedge-hyssop is listed by the State of California as endangered and has been placed on List 1B by CNPS.

Hibiscus lasiocarpus

California hibiscus (*Hibiscus lasiocarpus*) is a robust, shrub-like perennial in the mallow (Malvaceae) family. It grows alongside creeks, streams, rivers, and marshes in California's Central valley from Butte County south to San Joaquin County (as well as similar habitats in the central, southern, and southeastern United States). This species may be found along the Toe Drain and within perennial wetlands in the Yolo Bypass Wildlife Area. California hibiscus has been placed on List 2 by CNPS.

Isocoma arguta

Carquinez golden-bush (*Isocoma arguta*) is a perennial sub-shrub in the sunflower (Asteraceae) family. It typically grows on alkaline soils in open grasslands, on the tops and sides of mima-mounds in vernal pool grasslands, or near drainages in the Delta. This species has not been located in the Yolo Bypass Wildlife Area; although, suitable habitat does exist on the Tule Ranch an in similar grassland habitats. Carquinez golden-bush has been placed on List 1B by CNPS and is a federal species of concern.

Juglans californica var. *hindsii*

Northern California black walnut (*Juglans californica* var. *hindsii*) is a large tree in the walnut (Juglandaceae) family. It was formerly found throughout riparian areas in northern California and has served as rootstock for cultivated English walnuts. Northern California black walnut readily hybridizes with other walnuts, including other rootstock and English walnut, and this propensity has reduced the genetic purity of extant native walnut stands and contributed to the increasing rarity of genetically pure individuals. Northern California black walnut may be found along riparian areas of Putah Creek and the Toe Drain. This species is a federal species of concern and has been placed on List 1B by CNPS.

Lathyrus jepsonii var. *jepsonii*

Delta tule pea (*Lathyrus jepsonii* var. *jepsonii*) is an herbaceous, perennial vine in the pea (Fabaceae) family. It is found only in the Sacramento-San Joaquin Delta where it grows within and above the upper tidal zone, frequently mixed among shrubby vegetation, such as California rose, Himalayan blackberry, or sandbar willow. Within the Yolo Bypass Wildlife Area, it is possible that this plant may be found along the edges of perennial or seasonal wetlands and the Toe Drain. Delta tule pea is listed as a federal species of concern and has been placed on List 1B by CNPS.

Legenere limosa

Green’s legenere (*Legenere limosa*) is a diminutive annual in the bellflower (Campanulaceae) family. It grows in the bottoms of larger vernal pools, frequently with species such as pale spikerush (*Eleocharis macrostachya*) and rayless goldfields (*Lasthenia glaberrima*). It may also be found with the related dwarf downingia. This species has not been located on the Yolo Bypass Wildlife Area although it may grow in suitable habitats within the Tule Ranch and similar vernal pool or seasonal wetland habitats. Green’s legenere is a federal species of concern and has been placed on List 1B by CNPS.

Lepidium latipes var. *heckardii*

Heckard’s peppergrass is a small annual in the mustard (Brassicaceae) family. It is known from eight locations across California, one of which is the Tule Ranch, and tends to be found in vernally wet alkali grasslands where it co-occurs with plants such as annual rye grass, dwarf pepperweed (*Lepidium latipes* var. *latipes*), smooth goldfields (*Lasthenia glabrata* ssp. *glabrata*), annual hairgrass (*Deschampsia danthonioides*), and others. Recent vegetation surveys (Witham 2003) documented this species in several locations throughout Tule Ranch. Heckard’s peppergrass has been placed on List 1B by CNPS and is a federal species of concern.

Lilaeopsis masonii

Mason’s lilaeopsis (*Lilaeopsis masonii*) is a tiny perennial in the carrot (Apiaceae) family. It is found primarily on mudflats and similar habitats within the tidal zone of marshes and rivers within the Sacramento-San Joaquin Delta. This species may occur along the Toe Drain. Mason’s lilaeopsis is listed as a federal species of concern and has been placed on List 1B by CNPS.

Limosella subulata

Delta mudwort (*Limosella subulata*) is a diminutive perennial in the figwort (Scrophulariaceae) family found in the Sacramento-San Joaquin delta and on the east coast of the United States. Similar to Masons’ lilaeopsis, it is frequently found in microhabitats where bank sloughing and other similar disturbances have created localized areas of saturated fine sediment (clay and silty clay) deposition below the average high tide level. This species may occur along the Toe Drain. Delta mudwort has been placed on List 2 by CNPS.

Navarretia leucocephala ssp. *bakeri*

Baker’s navarretia (*Navarretia leucocephala* ssp. *bakeri*) is a diminutive annual in the phlox (Polemoniaceae) family. As with other *Navarretia leucocephala* subspecies, it grows throughout vernal pools as well as seasonally wet grasslands. In contrast to the more widely distributed, and occasionally sympatric, *N. leucocephala* spp. *leucocephala*, the corolla tube is smaller, the corolla lobes are more linear, and the corolla tube is included within the calyx tube. Witham (2003) found that most habitats within the Tule Ranch are suitable for this species. Somewhat notably, it was the not only the sole *Navarretia* species found during her surveys but also the only member of the phlox family found on the Tule Ranch. CNPS has placed Baker's navarretia on List 1B, and it is listed as a federal species of concern.

Neostapfia colusana and *Tuctoria mucronata*

Colusa grass (*Neostapfia colusana*) and Crampton's tuctoria (*Tuctoria mucronata*) are small, annual plants in the grass (Poaceae) family. They are part of a larger group of related vernal pool grasses, most of which were formerly placed in the genus *Orcuttia*. These species tend to be found in larger, deeper vernal pools where they grow on the drying pool bottoms, frequently later into the summer than many other vernal pool plants. They are widely distributed throughout suitable habitats within the Central Valley; although, they are uncommon wherever they are found. Both species are known from the vicinity of the Yolo Bypass Wildlife Area and, although not detected during recent surveys (Witham 2003), they could occur in suitable habitat within the Tule Ranch unit. Both species are listed by the State of California as endangered, and CNPS has placed both species on list 1B. Colusa grass is federally listed as threatened and Crampton's tuctoria is federally listed as endangered.

Sagittaria sanfordii

Sanford's arrowhead (*Sagittaria sanfordii*) is an aquatic perennial in the water plantain (Altismataceae) family. It grows in shallow, slow-moving streams, drainage canals, ditches, and pond or lake margins throughout the Central Valley as well as scattered localities on the north and central California coast where it can form large, mono-specific clumps of plants or be interspersed with a variety of other similar vegetation such as common water plantain (*Alisma plantago-aquatica*). It may be found in suitable habitats throughout most management units within the Yolo Bypass Wildlife Area. Sanford's arrowhead is a federal species of concern and has been placed on List 1B by CNPS.

3.5.2 WILDLIFE RESOURCES

The Yolo Bypass Wildlife Area supports a diverse assemblage of communities that provide valuable wildlife habitat for a variety of species guilds. The communities are described in Section 3.5.1, "Vegetation Resources." Two additional features, open water and mudflat, are not vegetation communities but provide important foraging habitat for many wildlife species and are key components of the Yolo Bypass Wildlife Area's ecological value. Primary species guilds and key wildlife species that utilize each of the communities are discussed below.

SPECIES GUILDS

The Yolo Bypass Wildlife Area lies within a central portion of the Pacific Flyway, the major pathway for migratory bird species on the West Coast. Many of the species that inhabit the Wildlife Area are there during the fall and winter months, when the Central Valley becomes home to an abundance of birds. The most conspicuous groups of wintering birds include waterfowl, shorebirds and wading birds, and raptors. Other groups that utilize the Wildlife Area include upland game species, cavity-nesting birds, and neotropical migratory birds.

Waterfowl

A significant feature of the Yolo Bypass Wildlife Area is the abundance and variety of wintering waterfowl that migrate down the Pacific Flyway each year. Large numbers of ducks, geese, and swans winter in the Wildlife Area after migrating from northern breeding areas. Waterfowl populations are a highly valued and diversified biological resource. They are of high interest to a variety of recreational users of the Wildlife Area, particularly hunters and bird watchers. Species that occur in high abundance include northern pintail (*Anas acuta*), northern shoveler (*Anas clypeata*), mallard (*Anas platyrhynchos*), gadwall (*Anas strepera*), American wigeon (*Anas americana*), cinnamon and green-winged teal (*Anas cyanoptera* and *A. crecca*), lesser scaup (*Aythya affinis*), tundra swan (*Cygnus columbianus*), snow goose (*Chen caerulescens*), and white-fronted goose (*Anser albifrons*). Some species, such as mallard, gadwall, and Canada goose (*Branta canadensis*) are year-round residents and breed locally in wetlands and nearby uplands.

Natural wetland areas have declined by approximately 95% in California and as a result,, waterfowl breeding and wintering populations have declined from historical levels. Therefore, the Wildlife Area is a critical link in the chain of wetlands that make up the Pacific Flyway, contributing to the preservation of wintering and breeding waterfowl populations.

A peak in the number of waterfowl in the Wildlife Area occurs in December–April, when large numbers are attracted to the seasonally flooded wetlands. During periods of water inundation in the Bypass, less abundant diving species such as canvasaback (*Aythya valisineria*), scaup (*Aythya* spp.), and goldeneye (*Bucephala* spp.) can be present. These species may also be present in the deeper areas of seasonal and permanent ponds. A secondary peak in waterfowl abundance occurs in late summer and is correlated with the presence of breeding ducks, their young and early migrants. Primary nesting species a the Wildlife Area include mallard, gadwall, and cinnamon teal. Grazing, upland cover plantings, and maintenance of properly spaced brood ponds are strategies used for nesting waterfowl. Semi permanent wetlands and permanent wetlands provide brood cover for ducklings for the first few weeks of their lives.

Seasonal flooding of wetlands is the primary wetland management strategy in the Yolo Bypass Wildlife Area for migratory waterfowl. In addition, agricultural activities provide high quality foraging habitat for some waterfowl species. Pintail, tundra swans, snow geese, and white-fronted geese can often be seen foraging in large numbers in rice fields.

The periodic flooding that occurs during high flow events results in deeper water and a subsequent increase in diving ducks, such as canvasback and scaup.

Shorebirds and Wading Birds

The Yolo Bypass Wildlife Area has become one of the premier shorebird areas in the Central Valley. With managed seasonal wetlands providing shallow water, mud flats, and island mounds, hundreds of thousands of shorebirds and wading birds annually migrate through, winter, and/or breed in the Yolo Bypass Wildlife Area. These species are a significant component of the Wildlife Area and are of high interest to recreational bird watchers.

Shorebirds and wading birds that breed in or nearby the Wildlife Area include American avocet (*Recurvirostra Americana*), black-necked stilt (*Himantopus mexicanus*), killdeer (*Charadrius vociferus*), spotted sandpiper (*Actitis macularia*), Virginia rail (*Rallus limicola)*, white-faced ibis (*Plegadis chihi*), black-crowned night heron (*Nycticorax nycticorax*), great blue heron (*Ardea herodias*), and snowy and great egret (*Egretta thula* and *Ardea alba*). Since the opening of the Wildlife Area, a heronry (nesting colony of herons and egrets) has become established nearby. In addition large numbers of ibis, egrets, and black-crowned night herons from nesting colonies elsewhere in the region use the Wildlife Area during summer months, feeding primarily on crayfish, fish and amphibians. A considerable number of black-crowned night herons and white-faced ibis roost on the Wildlife Area in dense cattail thickets or willows.

A high diversity of shorebirds rely on the Wildlife Area to provide habitat during migration and winter. Species regularly observed in during these periods include western and least sandpiper (*Calidris maurim* and *minutilla*), long- and short-billed dowitchers (*Limnodromus scolopaceus* and *griseus*), dunlin (*Calidris alpina*), greater and lesser yellowlegs (*Tringa melanoleuca* and *flavipes*), whimbrel (*Numenius phaeopus*), long-billed curlew (*Numenius americanus*), and Wilson's phalarope (*Phalaropus tricolor lobatus*). Species that occur more rarely in the Wildlife Area include ruff (*Philomachus pugnax*), pectoral sandpiper (*Calidris melanotos*), and red-necked phalarope (*Phalaropus lobatus*).

On a regional scale, there have been substantial losses of historic habitat used by these species, resulting in smaller, detached patches of suitable habitat for nesting and foraging. Available information suggests that their populations are declining. Riparian habitats suitable for use by colonial-nesting species, such as egrets, have been lost or fragmented on the Wildlife Area. The aforementioned heron rookery is located on property owned and managed by the Sacramento-Yolo Port District.

Managed seasonal wetlands with complex diverse topography combined with innovative rice/shorebird habitat rotations in the Wildlife Area provide critical foraging, nesting, and loafing habitat for an abundance of shorebird and wading bird species. Maintaining existing and restoring additional suitable seasonal and permanent wetland, and riparian communities, and reducing the effect of factors that can suppress breeding success in the Yolo Bypass Wildlife Area is critical to maintaining healthy shorebird and wading bird populations in the region.

Neotropical Migratory Birds

Many species of neotropical migratory birds migrate through or breed in the Yolo Bypass Wildlife Area. The neotropical migratory bird guild includes species that breed in North America and winter in Central and South America. Representative species that breed and/or migrate through the Wildlife Area include western kingbird (*Tyrannus verticalis*), western wood-pewee (*Contopus sordidulus*), tree swallow (*Tachycineta bicolor*), barn swallow (*Hirundo rustica*), Bullock’s oriole (*Icterus bullockii*), Wilson’s warbler (*Wilsonia pusilla*), yellow warbler (*Dendroica petechia*), and blue grosbeak (*Guiraca caerulea*).

Regionally, there have been substantial losses of historic habitat used by neotropical migratory species, and available information suggests that population levels for many of these species are declining. Continued management of existing habitat and restoration of additional suitable wetland, riparian, and grassland habitats in the Yolo Bypass Wildlife Area is important to maintaining healthy neotropical migrant bird populations. Opportunities to increase length and density of riparian vegetation along Putah Creek and the East Toe Drain will also benefit species in this guild. Protection and restoration of nesting habitat helps reduce nest parasitism and predation by creating habitat conditions that render neotropical birds less susceptible to these stressors. Management of upland habitat to provide variations in height and density of vegetation, food crops, and water has proven to be beneficial to many neotropical migratory song birds.

Raptors

A wide variety of wintering and/or breeding raptors utilize the Yolo Bypass Wildlife Area, including red-tailed hawk (*Buteo jamaicensis*), white-tailed kite (*Elanus leucurus*), rough-legged hawk (*Buteo lagopus*), ferruginous hawk (*Buteo regalis*), prairie falcon (*Falco mexicanus*), peregrine falcon (*Falco peregrinus anatum*), kestrel (*Falco sparverius*), barn owl (*Tyto alba*), great horned owl (*Bubo virginianus*), short-eared owl (*Asio flammeus*), and northern harrier (*Circus cyaneus*). Of these, Swainson’s hawk (*Buteo swainsoni*), red-tailed hawk, kestrel, northern harrier, white-tailed kite, barn owl, and great horned owl are known to nest in the Wildlife Area.

All of these raptor species can be seen foraging and hunting for prey in recently flooded wetlands and in fresh cut alfalfa fields. Management strategies for raptors include optimizing foraging opportunities by managing for a food base consisting of rodents and large insects. Rodent numbers are highly dependent on the timing, magnitude, and duration of flooding in the Yolo Bypass. Maintaining high humidity in pond/wetland bottoms helps to develop high grasshopper numbers. Discing, mowing, and summer irrigations attract large numbers of Swainson’s hawks feeding on grasshoppers. Fall preparation of agricultural fields also attracts wintering raptors and often provides important foraging opportunities for Swainson’s Hawks, shortly before their autumn journey to Mexico and Central America.

Cavity-nesting Birds

Cavity-nesting birds, such as kestrels, tree swallows, and wood ducks (*Aix sponsa*) can be seen throughout the Wildlife Area. Providing nesting boxes for these cavity-nesters benefits these species in the Wildlife Area, as shown by the success of a series of next box projects.

Swallows are summer migrants, occurring in the Wildlife Area from late winter to early fall (February–October), with peak abundance generally in June and July. Large post and pre-breeding mixed flocks of swallows can occur in the spring and summer, particularly when flying insect populations associated with wetlands and agricultural fields are abundant.

Upland Game Birds

The Yolo Bypass Wildlife Area provides habitat for several upland game birds of great interest to recreational hunters. The primary upland game bird species that utilize the Wildlife Area are mourning dove (*Zenaida macroura*) and ring-neck pheasant (*Phasianus colchicus*). Tenant farmers grow fields of safflower that provide abundant foraging opportunities. Safflower is also left unharvested and mowed to provide additional foraging prospects for these species. These management strategies have resulted in improved upland game bird hunting throughout the Wildlife Area. Spring floods can significantly affect pheasant nesting and recruitment success thereby limiting populations in subsequent years.

SPECIAL-STATUS SPECIES

Special-status wildlife species are legally protected or are otherwise considered sensitive by federal, state, or local resource conservation agencies and organizations. Special-status wildlife species addressed in this section include:

- species listed as threatened or endangered under the ESA/CESA;
- species identified by USFWS or DFG as species of special concern;
- species fully protected in California under the California Fish and Game Code; and
- species identified as priorities for recovery under CALFED’s MSCS.

Table 3.5-3 includes 43 special-status species that are known (38) or have potential (5) to occur regularly in the Yolo Bypass Wildlife Area. The table also provides information on each species’ regulatory status, habitat requirements, and potential for occurrence, and each species is discussed further in the text that follows. Migratory birds described as “winter” visitors may occur in small numbers throughout the year, but do not breed in the area and are most common in winter. A map of special-status species occurrences in the Wildlife Area that have been documented in the CNDDB is provided in Exhibit 3.5-2.

Invertebrates

Vernal pool crustaceans

Vernal pool crustaceans are restricted to vernal pools, swales, and other seasonal pools. Eggs of these species lie dormant during most of the year in the form of cysts, which are capable of withstanding extreme environmental conditions, such as heat, cold, and prolonged desiccation. The cysts hatch when the pools fill with rainwater, and the young rapidly develop into sexually mature adults. Not all of the cysts hatch with the first rainfall; some remain dormant to hatch during subsequent events or in later years. Eggs are dispersed from one pool to another on the feet of birds and mammals, which move between the pools. The vernal pools in the Tule Ranch Unit of the Wildlife Area are known to support five special-status vernal pool crustaceans; suitable habitat on site is restricted to this unit. Species known to occur on site include the federally endangered vernal pool tadpole shrimp (*Lepidurus packardi*), federally endangered conservancy fairy shrimp (*Branchinecta conservatio*), federally threatened vernal pool fairy shrimp (*Branchinecta lynchi*), and two federal species of concern: midvalley fairy shrimp (*Branchinecta mesovallensis*) and California linderiella (*Linderiella occidentalis*). The first four of these species are listed as species to be maintained under CALFED's MSCS.

Table 3.5-3
Special-Status Wildlife Known or with Potential to Occur Regularly at Yolo Bypass Wildlife Area

Species	Status[1]			Habitat	Potential for Occurrence
	USFWS	DFG	MSCS		
Invertebrates					
Vernal pool tadpole shrimp *Lepidurus packardi*	E	--	m	Inhabit vernal pools and seasonal wetlands, which range from 2 m^2 to over 350,000 m^2.	Known to occur in vernal pools in the Tule Ranch Unit, which provide suitable habitat.
Vernal pool fairy shrimp *Branchinecta lynchi*	T	--	m	Typically inhabit vernal pools and seasonal wetlands less than 200 m^2 and less than 5 cm deep; they may also occur in larger, deeper pools.	Known to occur in vernal pools in the Tule Ranch Unit, which provide suitable habitat.
Conservancy fairy shrimp *Branchinecta conservatio*	E	--	m	Large vernal pools and seasonal wetlands, ~ 1 acre in size.	Known to occur in vernal pools in the Tule Ranch Unit, which provide suitable habitat.
Midvalley fairy shrimp *Branchinecta mesovallensis*	SSC	--	m	Small vernal pools and seasonal wetlands less than 202 m^2 in area (average area 67 m^2), with average depth of 10 cm (range 5–15 cm).	Known to occur in vernal pools in the Tule Ranch Unit, which provide suitable habitat.
California linderiella *Linderiella occidentalis*	SSC	--	--	Vernal pools and seasonal wetlands from 1 to 52,500 m^2 in area (average area 1,283 m^2), with average depth of 19 cm (range 3–151 cm).	Known to occur in vernal pools in the Tule Ranch Unit, which provide suitable habitat.
Reptiles					
Giant garter snake *Thamnophis gigas*	T	T	r	Inhabits slow-moving streams, sloughs, ponds, marshes, flooded rice fields, irrigation and drainage ditches, and adjacent upland areas.	Known to occur in the northwestern portion of the Wildlife Area. Suitable habitat is present throughout the site in wetlands, rice fields, irrigation channels, riparian areas, and adjacent uplands.
Northwestern pond turtle *Actinemys marmorata marmorata*	SSC	SSC	m	Inhabits slow-moving streams, sloughs, ponds, irrigation and drainage ditches, and adjacent upland areas.	Known to occur in suitable habitats throughout the site, including: wetlands, rice fields, irrigation channels, riparian areas, and adjacent uplands.
Amphibians					
California tiger salamander *Ambystoma californiense*	T	SSC	m	In winter, breeds in vernal pools and seasonal wetlands with a minimum 10-week inundation period. In summer, aestivates in grassland habitat, primarily in rodent burrows.	Could occur. Not documented on site, but suitable habitat is present in vernal pools within the Tule Ranch Unit, and the Wildlife Area is within the species' known range.
Western spadefoot toad *Spea hammondii*	--	SSC	m	In winter, breeds in vernal pools and seasonal wetlands with a minimum 3-week inundation period. In summer, aestivates in grassland habitat, in soil crevices and rodent burrows.	Could occur. Not documented on site, but suitable habitat may be present in vernal pools within the Tule Ranch Unit, and the Wildlife Area is within the species' known range.

Table 3.5-3
Special-Status Wildlife Known or with Potential to Occur Regularly at Yolo Bypass Wildlife Area

Species	Status[1]			Habitat	Potential for Occurrence
	USFWS	DFG	MSCS		
Birds					
American white pelican *Pelecanus erythrorhynchos*	--	SSC	--	Forages in open water. Although individuals may be present year-round, this species does not breed in the Central Valley.	Known to forage on site throughout the year, occasionally in numbers significant to the nation-wide population.
Double-crested cormorant *Phalacrocorax auritus*	--	SSC	m	Forages in open water. Breeds colonially in rock ledges and trees.	Known to forage on site throughout the year. No breeding colonies are present on site.
Great blue heron *Ardea herodias*	--	--	m	Nests colonially in tall trees. Forages in fresh and saline marshes, shallow open water, and occasionally cropland or low, open, upland habitats.	Known to breed in trees just outside of the Wildlife Area. Known to forage in wetlands, and uplands and agricultural fields throughout the site. No breeding colonies are present on site, but suitable nesting habitat is present.
Great egret *Ardea alba*	--	--	m	Nests colonially in tall trees. Forages in fresh and saline marshes, shallow open water, and occasionally cropland or low, open, upland habitats.	Known to forage in wetlands, uplands, and agricultural fields throughout the site, which provide suitable habitat. Breeding colonies have been recently documented on site.
Snowy egret *Egretta thula*	--	--	m	Nests colonially in dense marshes and low trees. Forages in fresh and saline marshes, shallow open water, and occasionally irrigated cropland or wet upland habitats.	Known to forage in wetlands throughout the site, which provide suitable habitat. No breeding colonies are present on site, but suitable nesting habitat is present.
Black-crowned night-heron *Nycticorax nycticorax*	--	--	m	Nests colonially in dense marshes, groves of low trees, and dense shrubs. Forages in fresh and saline marshes and in shallow open water at the edge of marsh vegetation.	Known to forage in wetlands throughout the site, which provide suitable habitat. Roosts in large numbers in willow trees and cattail marsh. No breeding colonies are present on site, but suitable nesting habitat is present.
White-faced ibis *Plegadis chihi*	--	SSC	m	Forages in wetlands and irrigated or flooded croplands and pastures. Breeds colonially in dense freshwater marsh.	Known to forage in flooded croplands and wetlands throughout the site, especially in summer months. No breeding colonies are present on site but there has been a breeding colony just north of the Causeway Unit.
Osprey *Pandion haliaetus*	--	SSC	m	Forages exclusively in fish-bearing waters.	Known to forage on site during the winter floods, which provide suitable foraging habitat. Unlikely to nest because foraging habitat is marginal during the dry summer breeding season.

Table 3.5-3
Special-Status Wildlife Known or with Potential to Occur Regularly at Yolo Bypass Wildlife Area

Species	Status[1]			Habitat	Potential for Occurrence
	USFWS	DFG	MSCS		
White-tailed kite *Elanus leucurus*	SSC	FP	m	Nests in woodlands and isolated trees; forages in grasslands, shrublands and agricultural fields.	Known to nest and forage in open habitats throughout the site, which provide suitable habitat.
Bald eagle *Haliaeetus leucocephalus*	T PFD	E FP	m	Winter visitor to the Central Valley floor. Forages primarily in fish-bearing waters, but also in open terrestrial habitats.	Known to forage on site during the winter months.
Northern harrier *Circus cyanus*	--	SSC	m	Nests and forages in open habitats including marshes, grasslands, shrublands and agricultural fields.	Known to nest and forage in open habitats throughout the site, which provide suitable habitat.
Sharp-shinned hawk *Accipiter striatus*	--	SSC	--	Winter visitor to the Central Valley floor. Forages primarily in riparian woodlands and other wooded habitats.	Known to forage in riparian habitat along the toe drains and Putah Creek, which provide suitable winter foraging habitat.
Cooper's hawk *Accipter cooperii*	--	SSC	m	Nests and forages primarily in riparian woodlands and other wooded habitats.	Known to forage in riparian habitat throughout the Wildlife Area, especially along Putah Creek, which provide suitable foraging habitat. Not known to nest on site.
Swainson's hawk *Buteo swainsoni*	SSC	T	r	Nests in riparian woodlands and isolated trees; forages in grasslands, shrublands and agricultural fields.	Known to nest and forage in open habitats throughout the site, which provide suitable habitat. Several nests on site along Putah Creek and in scattered large trees throughout the Wildlife Area.
Ferruginous hawk *Buteo regalis*	--	SSC	--	Winter visitor to the Central Valley. Forages most commonly in grasslands and shrub-steppe; also forages in agricultural fields.	Known to forage in upland habitats throughout the site, which provide suitable winter habitat when not flooded.
Golden eagle *Aquila chrysaetos*	--	FP	m	Nests and forages in a variety of open habitats including grassland and cropland, but most common in foothill and shrub-steppe habitats. Rare breeder in the Central Valley foothills; breeds in cliffs, rock out crops, and large trees.	Known to forage in upland habitats throughout the site, which provide suitable habitat. The site is unsuitable for nesting.
Merlin *Falco columbarius*	--	SSC	--	Winter visitor to California. Forages in a wide variety of habitats, bit in the Central Valley is most common around agricultural fields and grasslands.	Known to forage throughout the site in winter. Suitable habitat is provided by on-site wetlands, and uplands when not flooded.
American peregrine falcon *Falco peregrinus anatum*	--	E FP	m	Nonbreeding visitor to the Central Valley. Forages in a wide variety of habitats, but is most common near water, where shorebirds and waterfowl are abundant.	Known to hunt the abundant shorebirds and waterfowl present from mid-summer to late winter.
Prairie falcon *Falco mexicanus*	--	SSC	--	Currently presumed to be a non-breeding visitor to Yolo County. Forages most commonly in grasslands and shrub-steppe; also forages in agricultural fields.	Known to forage throughout the site, which provides suitable habitat when not flooded.

Table 3.5-3
Special-Status Wildlife Known or with Potential to Occur Regularly at Yolo Bypass Wildlife Area

Species	Status[1]			Habitat	Potential for Occurrence
	USFWS	DFG	MSCS		
Greater sandhill crane *Grus canadensis tabida*	--	T FP	r	Winter visitor to the Central Valley. Forages primarily in moist croplands with rice or corn stubble; also frequents grasslands and emergent wetlands.	Known to forage in the agricultural habitats and wetlands throughout the site, which provide suitable winter foraging habitat.
Long-billed curlew *Numenius americanus*	--	SSC	m	Forages in cropland, grassland, wetland, and mudflat habitats. Although individuals may be present throughout the year, this species does not breed on the Central Valley floor.	Known to forage in agricultural, upland, wetland, and mudflat habitats throughout the site, which provide suitable foraging habitat.
California gull *Larus californicus*	--	SSC	m	Forages in open water, wetland, and cropland habitats, as well as landfills. Although individuals may be present year-round, this species does not breed in the Central Valley.	Known to forage year-round throughout the site and especially during the winter floods, which provide suitable foraging habitat.
Black tern *Chlidonias niger*	--	SSC	m	Nests in freshwater marsh and rice habitats, forages for fish and insects in open water, rice, and marsh. This species is present in Yolo County primarily during migration.	Known to forage in the wetland and rice habitats throughout the site during migration; numbers increasing in recent years.
Burrowing owl *Athene cunicularia*	SSC	SSC	m	Nests and forages in grasslands, shrublands, deserts and agricultural fields, especially where ground squirrel burrows are present.	Known to nest and forage in upland habitats throughout the site, which provide suitable habitat, and most commonly in the Tule Ranch Unit.
Short-eared owl *Asio flammeus*	--	SSC	m	Winter visitor and rare nesting species to Yolo County. Forages in open habitats including marshes, grasslands, shrublands and agricultural fields.	Known to forage in marsh and upland habitats throughout the site, and occasionally nests.
Little willow flycatcher *Empidonax traillii brewsteri*	--	E	r	Migrates through the Central Valley during spring and fall. Forages in riparian willow scrub.	Known to forage in low numbers in riparian habitats along Putah Creek and the toe drains, which provide suitable foraging habitat during migration.
Loggerhead shrike *Lanius ludovicianus*	SSC	SSC	--	Nests and forages in grasslands, agricultural fields, open woodlands and shrublands.	Known to nest and forage in upland habitats throughout the site, which provide suitable habitat, and most commonly in the Tule Ranch Unit.
California horned lark *Eremophila alpestris actia*	--	SSC	--	Nests and forages in open habitats with sparse vegetation including grasslands and fallow agricultural fields.	Known to nest and forage in sparsely vegetated habitats throughout the site, which provide suitable habitat.
Bank swallow *Riparia riparia*	--	T	R	Forages primarily over water. Nests in vertical banks and cliffs with fine textured or sandy soils near streams, rivers, lakes, and ocean.	Known to forage in low numbers over wetland habitats in summer. Suitable nesting habitat is not present.

Table 3.5-3
Special-Status Wildlife Known or with Potential to Occur Regularly at Yolo Bypass Wildlife Area

Species	Status[1]			Habitat	Potential for Occurrence
	USFWS	DFG	MSCS		
California yellow warbler *Dendroica petechia brewsteri*	--	SSC	r	Nests in riparian woodland and riparian scrub habitats. Forages in a variety of wooded and shrub habitats during migration.	Known to forage in low numbers in riparian habitats along Putah Creek and the toe drains, which provide suitable foraging habitat during migration.
Grasshopper sparrow *Ammodramus savannarum*	--	--	m	Nests and forages in dense native grasslands containing diverse assemblages of grasses and forbs. This species is rare and localized in Yolo County.	Known to forage and presumed to breed in the Tule Ranch Unit, which provides suitable habitat. Territorial males have been observed singing on site.
Tricolored blackbird *Agelaius tricolor*	SSC	SSC	m	Nests colonially in tules, cattails, willows, thistles, blackberries, and other dense vegetation. Forages in grasslands and agricultural fields.	Recorded breeding once (2005) colonially in a patch of button willow trees on the Tule Ranch, while foraging in agricultural fields and uplands.
Mammals					
Pallid bat *Antrozous pallidus*	--	SSC	--	Typically roosts in caves or rock crevices; however, colonies of ~12 individuals occasionally roost in buildings or tree cavities. Forages in grassland, shrub and wooded habitats.	Unlikely to breed on site due to marginal breeding habitat, but may forage on site. Old buildings may provide roosting habitat.
Townsend's big-eared bat *Corynorhinus townsendii*	--	SSC	--	Typically roosts in caves; however, colonies of <100 individuals occasionally roost in buildings. Forages in all but alpine and subalpine habitats, but prefers mesic forests.	Unlikely to breed on site due to marginal habitat, but may forage on site. Old buildings may provide roosting habitat.

[1] Legal Status Definitions

U.S. Fish and Wildlife Service (USFWS)

E Endangered
T Threatened
PFD Proposed for delisting
SSC Species of special concern

California Department of Fish and Game (DFG)

E Endangered
T Threatened
FP Fully Protected
SSC Species of special concern

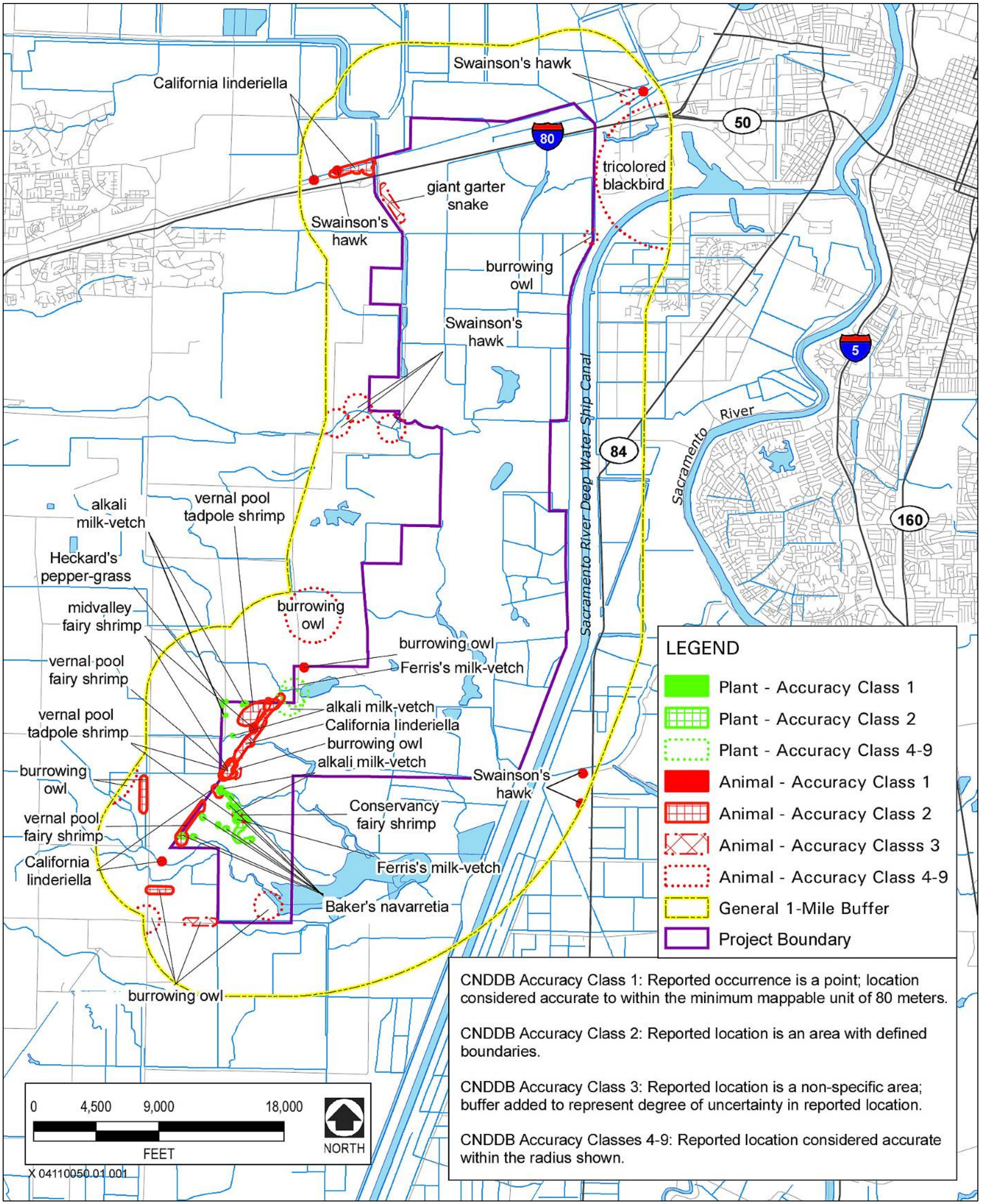
CALFED Multi-Species Conservation Strategy (MSCS)

R Recovery: CALFED is expected to undertake all actions within the ERP ecological management zones and program scope necessary to recover the species so that its long-term survival in nature is assured.

r Contribute to recovery: CALFED will make specific contributions to the species' recovery; however, CALFED actions will have a limited effect on the species in a limited portion of its range.

m Maintain: CALFED will take actions to maintain the species by improving habitat conditions where practicable and by avoiding, minimizing, and compensating for any adverse effects. This designation is less rigorous than "contribute to recovery," and CALFED actions are expected to have minimal effects on the species.

Source: Compiled by EDAW in 2005



CNDDB Accuracy Class 1: Reported occurrence is a point; location considered accurate to within the minimum mappable unit of 80 meters.

CNDDB Accuracy Class 2: Reported location is an area with defined boundaries.

CNDDB Accuracy Class 3: Reported location is a non-specific area; buffer added to represent degree of uncertainty in reported location.

CNDDB Accuracy Classes 4-9: Reported location considered accurate within the radius shown.

Source: CNDDB 2005, CaSIL 1998

Map of CNDDB Recorded
Special-status Species Occurrences in the Yolo Bypass Wildlife Area **Exhibit 3.5-2**

Reptiles

Giant garter snake

Giant garter snake (*Thamnophis gigas*) inhabits sloughs, marshes, low-gradient streams, flooded rice fields, ponds, irrigation and drainage ditches, and adjacent upland habitats. This snake forages primarily at the interface between open water and emergent aquatic vegetation, and is most often found in habitats with slow flowing or standing water, permanent summer water, mud bottoms, earthen banks, and an abundance of prey such as small fish, frogs and tadpoles. Giant garter snakes use upland habitat with grassy or shrubby banks for basking and thermoregulation. They also use upland burrows and soil or rock crevices as nighttime refugia, daytime escape cover, and winter aestivation sites. Giant garter snakes typically emerge from winter retreats from late March to early April and can remain active through October. The timing of their annual activities is subject to varying seasonal weather conditions. Cool winter months are spent in dormancy or periods of reduced activity. While this species is strongly associated with aquatic habitats, individuals have been noted using burrows as far as 165 feet from marsh edges during the active season and retreats more than 800 feet from the edge of wetland habitats while overwintering. Giant garter snakes have been observed in the northwest portions of the Wildlife Area, and suitable habitat for this species exists in many marsh, pond, rice, ditch, and upland edge habitats on site, while the western external levee of the Bypass provides the high ground necessary to survive the winter floods. Unknown until recently, the Yolo Bypass Wildlife Area population was verified as part of a survey of Yolo County giant garter snake distribution in 2005 (Hansen, in prep. 2006). During this study, 41 giant garter snakes (20 male and 21 female) were detected within the Wildlife Area. Dispersal was detected between Wildlife Area wetlands and privately managed rice lands outside the levee of the Yolo Bypass. Using mark-recapture techniques, this population was estimated at 57 individuals with a 95% confidence interval ranging from 45 to 84. As such, this population is comparable with estimates provided for southern American Basin (i.e., Natomas Basin) populations (Hansen 2005; Hansen, in prep. 2006; Jones and Stokes 2006). The dynamics of this population and the effects of periodic inundation within the Yolo Bypass on its health and distribution are unknown. Giant garter snake is state and federally listed as threatened, and CALFED has pledged to contribute to the recovery of this species.

Northwestern pond turtle

Northwestern pond turtle (*Actinemys marmorata marmorata*) occurs in ponds, marshes, rivers, streams, and irrigation ditches supporting aquatic vegetation. Adjacent upland areas are also used for basking and thermoregulation, egg-laying, and aestivation. Features which improve habitat quality for this species include emergent and submergent aquatic vegetation for cover, as well as rocks, logs, and open mud banks for basking. This species is widely distributed throughout the Yolo Bypass Wildlife Area and is believed to breed on site. Northwestern pond turtle is a California species of special concern, and is listed as a species to be maintained under CALFED’s MSCS.

Amphibians

California tiger salamander and western spadefoot toad

California tiger salamander (*Ambystoma californiense*) and western spadefoot toad (*Spea hammondii*) breed in suitable aquatic habitats (e.g., vernal pools) during wet winter conditions, and aestivate in adjacent grassland habitat after the pools have dried. Although vernal pools are the preferred habitat for these species, other aquatic habitats may be used, provided that they are free of predatory fish and hold water long enough to sustain reproduction. California tiger salamanders require pools that are large enough to retain water during the ten weeks required for larval development and metamorphosis (Jennings and Hayes 1994). Western spadefoot larvae can complete development in as little as three weeks, but may require up to twelve weeks depending on pool conditions (Jennings and Hayes 1994; Feaver 1971). The vernal pools and adjacent uplands in the Wildlife Area’s Tule Ranch Unit may provide suitable habitat for both species, although cursory sampling efforts in 2001 failed to document either species. Other seasonal wetlands throughout the Wildlife Area may also be used by these species, provided that their habitat requirements are met. Both species are California species of special concern and are listed as species to be maintained under CALFED's MSCS. California tiger salamander is also federally listed as threatened.

Birds

Non-breeding Waterbirds

The Wildlife Area provides important foraging habitat for waterbirds, including several special-status species, although no special-status waterbirds are known to nest on site. The special-status waterbirds in this section include some species that only occur in the Central alley during winter and the fall and spring migrations. Other included species are present during the late spring and summer breeding season and may nest elsewhere in the Central Valley, but do not breed on site due to lack of suitable habitat or regional location.

Non-breeding residents

Double-crested cormorant

Double-crested cormorant (*Phalacrocorax auritus*) forages for fish in open water and nests colonially in rock ledges or groves of trees. This species is abundant at the Yolo Bypass Wildlife Area throughout the year. Cormorants occasionally forage in ditches and permanent wetlands during the summer nesting season, but the more limited fish resources in summer make the site unlikely to support a breeding colony of cormorants. Double-crested cormorant is a California species of special concern and is listed as a species to be maintained under CALFED's MSCS.

Great blue heron, great egret, snowy egret, and black-crowned night-heron

These four species are common in the Wildlife Area, and forage in marshes and shallow open water habitats throughout the site. Great blue heron (*Ardea herodias*) and great egret (*Ardea alba*) also forage less frequently in the grasslands and agricultural fields on site, while snowy egret (*Egretta thula*) and black-crowned night-heron (*Nycticorax nycticorax*) are unlikely to forage in these upland habitats. Although they do not currently nest on site, suitable nesting habitat is available in the Wildlife Area for all four species. A great blue heron and egret rookery is present in a grove of tall trees just outside the Wildlife Area along the Sacramento River Deep Water Ship Channel, and these individuals forage and roost in the Wildlife Area. Large numbers of black-crowned night herons roost in willows on the Wildlife Area during the non breeding season. CALFED has pledged to maintain the colonial rookeries of these four species, under its MSCS.

White-faced ibis

White-faced ibis (*Plegadis chihi*) forage in wetlands, mudflats, and irrigated or flooded croplands and pastures. This species typically nests in dense colonies in large stands of emergent marsh. Individuals from breeding colonies in ponds north of the Causeway Unit forage in the Wildlife Area during summer, when they feed on crayfish in the site's wetlands and flooded rice fields. Smaller numbers of birds forage on site throughout the year. This species may roost in large numbers in cattail marshes during the late summer. White-faced ibis is a California species of special concern and is listed as a species to be maintained under CALFED's MSCS.

Black tern

Black tern (*Chlidonias niger*) nests semicolonially in marsh vegetation and occasionally rice fields, and forages for fish and insects in these habitats and the adjacent open water. This species inhabits inland California and the Delta during summer, and forages primarily in marine habitats in winter. This species regularly forages throughout the marsh, rice, and open water habitats of the Wildlife Area during its spring migration. It may be possible to accommodate nesting black terns within the rice production fields with small islands. Black tern is a California species of special concern, and is listed as a species to be maintained under CALFED's MSCS.

Winter visitors

American white pelican

American white pelican (*Pelecanus erythrorhynchos*) forages for fish in open water and is abundant at the Yolo Bypass Wildlife Area throughout the year. Birds forage on site throughout the year, especially in mid-summer, when birds from distant breeding colonies and non-breeding birds arrive in the Central Valley. American white pelican does not nest in the Central Valley. American white pelican is a California species of special concern.

Long-billed curlew

Long-billed curlews (*Numenius americanus*) forage in wetlands, mudflats, and irrigated or flooded croplands and pastures. This species does not breed on the floor of the Central Valley, but non-breeding individuals forage in the Wildlife Area throughout the year. This is one of the first species to migrate with some individuals arriving as early as June. The largest aggregations are often of post-breeding birds in late summer. Long-billed curlew is a California species of special concern and is listed as species to be maintained under CALFED's MSCS.

Greater sandhill crane

Greater sandhill crane (*Grus canadensis tabida*) is a winter visitor to the Central Valley that forages primarily in moist croplands with rice or corn stubble, as well as grasslands and emergent wetlands. In winter, this species is most densely concentrated in counties south of Yolo County, in agricultural regions and large preserves that support vast fields of suitable habitat. Water levels in the agricultural fields and wetlands in the northern management units of the Yolo Bypass Wildlife Area are managed to provide high-quality foraging habitat for cranes and similar species. As a result, cranes forage casually in the Wildlife Area on a regular basis.

California gull

California gull (*Larus californicus*) forages in open water, wetland, and cropland habitats, as well as landfills. Although this species does not breed in the Central Valley, individuals forage in the Wildlife Area throughout the year. California gulls are most common on site during the winter floods. California gull is a California species of special concern and is listed as a species to be maintained under CALFED's MSCS.

Breeding Raptors

The Wildlife Area provides high-quality habitat for four special-status raptors that are known to nest on site. Section 3503.5 of the California Fish and Game Code provides protection for all raptor nests, including those of the species below. Their nests are also protected by the Migratory Bird Treaty Act.

Northern harrier

Northern harrier (*Circus cyanus*) nests and forages in a variety of open habitats including marshes, grasslands, low shrublands, and agricultural fields. This raptor nests on the ground and preys on a variety of prey, particularly small mammals (e.g., rabbits, mice, voles) and small birds. Harriers are common in the Wildlife Area and they nest and forage throughout the site. Northern harrier is a California species of special concern, and is listed as a species to be maintained under CALFED's MSCS.

Swainson's hawk and white-tailed kite

These two species nest in large and medium-sized trees such as oak and cottonwood and forage in grasslands, low shrublands, seasonal wetlands and agricultural fields. Portions of Yolo, Sacramento, and San Joaquin counties contain optimal nesting and foraging habitat conditions with their landscapes of scattered trees, riparian strips, open fields and manipulated agricultural fields that are mowed, irrigated and disced on a somewhat regular basis. These counties support the majority of Swainson's hawks (*Buteo swainsoni*) that breed in the state. Swainson's hawk and white-tailed kite (*Elanus leucurus*) nests and foraging activity have been observed throughout the Yolo

Bypass Wildlife Area. These species are particularly abundant when the discing, mowing, and summer irrigation of the site's agricultural fields and seasonal wetlands expose numerous grasshoppers and small mammals for prey. Kettles of 50–100 Swainson's hawks can be seen foraging at the edge of ponds during the fall flood up and just prior to the hawks leaving on their southern migration. A significant number of nesting pairs use the trees of the Wildlife Area and Putah Creek. Swainson's hawk is state listed as threatened and is a federal species of concern; it is estimated that the 700 to 1,000 breeding pairs in California represent less than 10% of the historical population. CALFED has pledged to contribute to the recovery of this species. White-tailed kite is a federal species of concern and a fully protected species under the California Fish and Game Code. White-tailed kite is also listed as a species to be maintained under CALFED's MSCS.

Western burrowing owl

Western burrowing owl (*Athene cunicularia*) forages in grasslands, low shrublands and agricultural fields. It nests and roosts in underground burrows, often those created by medium-sized mammals such as ground squirrels. Several burrowing owl nests have been documented in the Wildlife Area's Tule Ranch Unit; the species may also nest in other locations throughout the site. Burrowing owls are known to forage throughout the upland and agricultural habitats on site. These animals appear to be opportunistic, often appearing in unlikely places such as remote pipe crossings and piles of discarded pipe or concrete. Winter and spring flooding displaces several Burrowing owls each year, sending them to the edge of the flood waters, sometimes in impressive numbers.
A series of artificial burrow structures were placed on the Tule Ranch in late 2006. A substantial number of these structures were occupied in early 2007. Western burrowing owl is a California species of special concern and a federal species of concern, and is listed as a species to be maintained under CALFED's MSCS.

Non-breeding Raptors

The Wildlife Area provides important winter foraging habitat for a variety of birds of prey. The raptors in this section include some species that only occur in the Central Valley during winter and the fall and spring migrations. Other included species are present during the late spring and summer breeding season and may nest elsewhere in the Central Valley, but do not breed on site due to lack of suitable habitat or regional location.

Non-breeding residents

Osprey

Osprey (*Pandion haliaetus*) forages exclusively for fish over open water, and is most commonly seen at the Yolo Bypass Wildlife Area during migration in August. Osprey is a California species of special concern and is listed as a species to be maintained under CALFED's MSCS.

Cooper's hawk

Cooper's hawk (*Accipter cooperii*) is a bird of riparian woodlands and other wooded habitats, where it preys primarily on birds and to a lesser extent, small mammals. This species has been observed foraging in the Wildlife Area during fall and winter months, but is not known to nest on site. Cooper's hawk generally requires more extensive woodland for nesting than that present at the Wildlife Area. Cooper's hawk is a California species of special concern and is listed as a species to be maintained under CALFED's MSCS.

Winter visitors

Bald eagle

Bald eagle (*Haliaeetus leucocephalus*) is a winter visitor to the Central Valley floor. This species forages primarily over open water, and occasionally occurs at the Yolo Bypass Wildlife Area during the winter months. Bald eagle is federally listed as threatened, although it has been proposed for delisting. Bald eagle is also state listed as endangered, is a fully protected species under the California Fish and Game Code, is federally protected by the Bald Eagle Protection Act of 1940, and is listed as a species to be maintained under CALFED's MSCS.

Sharp-shinned hawk

Sharp-shinned hawk (*Accipiter striatus*) nests and forages primarily in riparian woodlands and other wooded habitats, where it preys primarily on small birds. This species has been observed foraging in the Wildlife Area, but is a winter visitor that does not nest on the Central Valley floor. Sharp-shinned hawk is a California species of special concern.

Ferruginous hawk

Ferruginous hawk (*Buteo regalis*) forages in upland habitats and preys primarily upon rabbits, as well as other small mammals and birds. This raptor is a winter visitor to the Central Valley, and is known to forage occasionally throughout the upland habitats of the Yolo Bypass Wildlife Area. Ferruginous hawk is a California species of special concern.

Golden eagle

Golden eagle (*Aquila chrysaetos*) nests and forages in a variety of open habitats including grassland and cropland. This species is most common, however, in foothill and shrub-steppe habitats, where it preys upon jackrabbits, other mid-sized mammals, and upland game birds. Golden eagle is a rare breeder in the foothill fringes of the Central Valley. This species is known to forage occasionally in upland habitats throughout the Wildlife Area in winter. Golden eagle is a fully protected species under the California Fish and Game Code, is federally protected by similarity of appearance under the Bald Eagle Protection Act of 1940, and is listed as a species to be maintained under CALFED’s MSCS.

Merlin, American peregrine falcon, and prairie falcon

These three falcons are primarily winter visitors to the Central Valley, and are known to forage in the Yolo Bypass Wildlife Area. Merlin (*Falco columbarius*) forages in a variety of habitats and feeds primarily on small shorebirds and passerines. American peregrine falcon (*Falco peregrinus anatum*) forages primarily in mudflats and open water, where it preys upon waterfowl and shorebirds, and hence also occurs on-site from mid summer through spring, a time period corresponding with the presence of migratory shorebirds.

Peregrine Falcons have become more common on the Wildlife Area since the initiation of shorebird management activities in 2002. Prairie falcon (*Falco mexicanus*) forages in upland habitats, where it preys upon small mammals and less frequently birds. Merlin and prairie falcon are California species of special concern. American peregrine falcon is state listed as endangered and is a fully protected species under the California Fish and Game Code. American peregrine falcon is also listed as a species to be maintained under CALFED’s MSCS.

Short-eared owl

Short-eared owls (*Asio flammeus*) forage in a variety of open habitats including marshes, grasslands, low shrublands, and agricultural fields, and are known to forage throughout the Wildlife Area during the non-breeding seasons of late summer through early spring. Short-eared owls have been sighted during the spring and summer months in some years and are presumed to occasionally nest on the Wildlife Area. Shore-eared owls are irruptive and will nest in more southerly locations when their prey are numerous. At the Yolo Wildlife Area, the prey is primarily California voles, whose numbers fluctuate according to the severity of the previous winter floods. Short-eared owl is a California species of special concern, and is listed as species to be maintained under CALFED’s MSCS.

Breeding Songbirds

In addition to protections afforded to special-status species, the nests of these neotropical migrants are also protected by the Migratory Bird Treaty Act.

Loggerhead shrike

Loggerhead shrike (*Lanius ludovicianus*) nests and forages in grassland, shrub-steppe, open woodland/savannah, riparian, and agricultural habitats with scattered shrubs and trees. This species nests and forages throughout the Wildlife Area, with the Tule Ranch Unit providing the highest quality habitat. Loggerhead shrike is a California species of special concern and a federal species of concern.

California horned lark

California horned lark (*Eremophila alpestris actia*) inhabits flat plains with short vegetation (often less than 10 centimeters high) or bare ground, and is found in both grassland and fallow agricultural areas. California horned lark is a year-round resident of the Yolo Bypass Wildlife Area, and is known to breed in sparsely vegetated patches throughout the site. California horned lark is a California species of special concern.

Grasshopper sparrow

Grasshopper sparrow (*Ammodramus savannarum*) nests and forages in dense native grasslands containing diverse assemblages of tall grasses and forbs. They have been seen in seasonal wetlands during the summer months for several years but their stronghold on the Wildlife Area appears to be the Tule Ranch. The Tule Ranch Unit of the Yolo Bypass Wildlife Area provides diverse, high-quality habitat for this species with vegetation heights close to two feet. Grasshopper sparrows have become a significant feature of this unit in recent years. They have regularly been observed foraging and are presumed to breed, as territorial males have regularly been observed singing on site. This rare remnant of diverse native grassland is one of only a handful of breeding sites in Yolo County for this rare and localized species; the few other sites are in the western foothills. Grasshopper sparrow is listed as a species to be maintained under CALFED's MSCS.

Tricolored blackbird

Tricolored blackbird (*Agelaius tricolor*) nests in dense colonies in a variety of habitats, including freshwater marsh, riparian scrub, and other vegetation that provides dense cover for protection from predators. Tricolored blackbird colonies range in size from fewer than 25 individuals to more than 100,000, and colony locations often change from year to year. This species forages in grasslands, pastures and agricultural fields. Tricolored blackbirds were observed breeding on the Wildlife Area for the first time in 2005. Their colony was located among the branches of buttonwillow trees on the Tule Ranch. Tricolored blackbird flocks also forage in the Wildlife Area's upland communities and agricultural areas. Tricolored blackbird is both state and federally listed as a species of special concern, and is listed as a species to be maintained under CALFED's MSCS.

Non-breeding Songbirds

The Wildlife Area provides important foraging habitat for many songbird species that do not nest on site. The songbirds in this section include two species that only occur in the Central Valley during migration and one summer resident that nests elsewhere in the Central Valley but does not breed on site due to lack of suitable habitat.

Non-breeding resident

Bank swallow

Bank swallow (*Riparia riparia*) is a neotropical migrant that nests in vertical banks and cliffs near water, and forages for insects over water. The Wildlife Area does not contain vertical banks for bank swallow nesting, and the nearest nesting colonies are along Cache Creek in Yolo County, and along the Sacramento River at the border of Yolo and Sutter Counties. A few individuals from these colonies are known to forage over the Wildlife Area's wetlands after cessation of breeding in late summer. Bank swallow is state listed as threatened and CALFED has pledged to undertake all actions within the ERP ecological management zones and program scope necessary to recover this species.

Migration visitors

Little willow flycatcher

Little willow flycatcher (*Empidonax traillii brewsteri*) nests in montane riparian willows and migrates through the Central Valley in spring and fall. During migration, this species is known to forage in the Wildlife Area's riparian communities along Putah Creek and the toe drains of the Sacramento River levees. Little willow flycatcher is state listed as endangered and CALFED has pledged to contribute to the recovery of this species.

California yellow warbler

California yellow warbler (*Dendroica petechia brewsteri*) nests and forages in riparian woodland and riparian scrub habitats, where it gleans insects from the riparian foliage. This species is currently present in Yolo County only during migration. Yellow warbler has declined dramatically in California's Central Valley with the loss of riparian habitat, and the species has not been known to breed in Yolo County since 1974 (Gaines 1974). California yellow warbler is a California species of special concern and CALFED has pledged to contribute to the recovery of this species.

Mammals

Pallid bat, Red Bat, and Townsend's big-eared bat

These three species forage over a wide variety of grassland, wetland, shrub, and wooded habitats, although Pallid bat (*Antrozous pallidus*) is most common in grassland and other arid habitats and Townsend's big-eared bat (*Corynorhinus townsendii*) is most common in mesic forests. These two species typically have maternity roost in small colonies of 12–200 individuals in caves and rock crevices, while the red bat (*Lasiurus blossevillii*) is usually solitary. Bridges, buildings, and tree cavities are also occasionally used for roosting. Townsend's big eared bats are unlikely to breed at the Wildlife Area due to the marginal maternity roosting habitat present for this species. Pallid bats have the potential to breed on site although unlikely. Red bats may utilize trees on the Wildlife Area for both roosting and breeding. All of these species may forage and night-roost in the Wildlife Area. Pallid bats, red bats and Townsend's big-eared bats are California species of special concern.

Mexican Free-tailed Bat

Although not a species of special concern, the large colony of Mexican Free-tailed Bats (*Tadarida basiliensis*) that roosts and breeds under the Yolo Causeway is of significant conservation value. Over 100,000 of these individuals can be seen leaving their daytime roost during summer months.

3.5.3 FISHERIES RESOURCES

This section summarizes the current conditions for fisheries resources in Yolo Bypass Wildlife Area. It discusses native and nonnative fish use of the Yolo Bypass Wildlife Area, aquatic habitats, and special-status fish species. The primary sources of information for this section were published reports on the fish, fisheries, ecology, and natural history of the Yolo Bypass and associated habitats.

The Yolo Bypass provides vital fish spawning, rearing, and/or migratory habitat for a diverse assemblage of native and nonnative fish species (Table 3.5-4) (Moyle 2002a; Sommer et al. 2001). Native and nonnative species can be separated into anadromous (i.e., species that spawn in fresh water after migrating as adults from marine habitat) and resident species.

Native anadromous species that occur or have the potential to occur in the Yolo Bypass Wildlife Area include four runs of Chinook salmon (*Oncorhynchus tshawytscha*), steelhead trout (*O. mykiss*), green and white sturgeon (*Acipenser medirostris* and *A. transmontanus*), and Pacific lamprey (*Lampetra tridentata*). Native resident species include delta smelt (*Hypomesus transpacificus*), Sacramento pikeminnow (*Ptychocheilus grandis*), Sacramento splittail (*Pogonichthys macrolepidotus*), Sacramento sucker (*Catostomus occidentalis*), Sacramento perch (*Archoplites interruptus*), hardhead (*Mylopharodon conocephalus*), and rainbow trout (*O. mykiss*). Nonnative anadromous species include striped bass (*Morone saxatilis*) and American shad (*Alosa sapidissima*). Nonnative resident species include largemouth bass (*Micropterus salmoides*), smallmouth bass (*Micropterus dolomieu*), white and black crappie (*Pomoxis annularis* and *P. nigromaculatus*), channel catfish (*Ictalurus punctatus*), white catfish (*Ameiurus catus*), brown bullhead (*Ictalurus nebulosus*), bluegill (*Lepomis macrochirus*), green sunfish (*Lepomois cyanellus*), and golden shiner (*Notemigonus crysaleucas*). Several of the resident species (i.e., Sacramento splittail and delta smelt) can show a strong migratory life history pattern.

Table 3.5-4
Fish Species in the Yolo Bypass Wildlife Area

Common Name	Scientific Name	Common Name	Scientific Name
American Shad	*Alosa sapidissima*	Redear Sunfish	*Lepomis microlophus*
Bigscale Logperch	*Percina macrolepida*	River Lamprey	*Lampetra ayersii*
Black Bullhead	*Ameiurus melas*	California Roach	*Hesperoleucus symmetricus*
Black Crappie	*Pomoxis negromaculatus*	Sacramento Blackfish	*Orthodon microlepidotus*
Bluegill	*Lepomis macrochirus*	Sacramento Pikeminnow	*Ptychocheilus grandis*
Brown Bullhead	*Ameiurus nebulosus*	Sacramento Sucker	*Catostomus occidentalis*
Channel Catfish	*Ictalurus punctatus*	Shimofuri Goby	*Tridentiger bifasciatus*
Chinook Salmon	*Oncorhynchus tshawytscha*	Smallmouth Bass	*Micropterus salmoides*
Common Carp	*Cyprinus carpio*	Splittail	*Pogonichthys macrolepidotus*
Delta Smelt	*Hypomesus transpacificus*	Spotted Bass	*Micropterus punctulatus*
Fathead Minnow		Steelhead Trout	*Oncorhynchus mykiss*
Golden Shiner	*Notemigonus crysoleucas*	Striped Bass	*Morone saxatilis*
Goldfish	*Carassius auratus*	Threadfin Shad	*Dorosoma petenense*
Green Sunfish	*Lepomois cyanellus*	Threespine Stickleback	*Gasterosteus aculeatus*
Hardhead	*Mylopharodon conocephalus*	Tule Perch	*Hysterocarpus traski*
Hitch	*Lavinia exilicauda*	Wakasagi	*Hypomesus nipponensis*
Inland Silverside	*Menidia beryllina*	Warmouth	*Chaenobryttus gulosus*
Largemouth Bass	*Micropterus salmoides*	Western Mosquitofish	*Gambusia afinis*
Pacific Lamprey	*Lampetra tridentata*	White Catfish	*Ameiurus catus*
Pacific Staghorn Sculpin	*Leptocottus armatus*	White Crappie	*Pomoxis annularis*
Prickly Sculpin	*Cottus asper*	White Sturgeon	*Acipenser transmontanus*
Red Shiner	*Cyprinella lutrensis*	Yellowfin Goby	*Acanthogobiusflavimanus*

Source: Moyle 2002a; Sommer et al. 2001

Throughout the Yolo Bypass, the use of different aquatic habitats by various fish species is influenced by variations in permanent habitat conditions, seasonal inundation of the floodplain (i.e., Yolo Bypass), and by the habitat requirements, life history, daily and seasonal movements, and behavior of each species. Altered flow regimes, flood control, and floodwater conveyance activities along much of the Yolo Bypass have affected available habitat and ecological processes (see Section 3.4, “Geomorphology, Hydrology, and Water Quality,” for additional information on physical processes). Historically, seasonal flooding covered various lands adjacent to the Sacramento River and tributaries and provided important spawning and rearing habitat for many fish species, including Sacramento splittail and juvenile Chinook salmon and steelhead. Levee and flood control facility (i.e., Fremont Weir and Sacramento Weir) construction has caused a reduction in the overall amount of seasonal flooding and shallow-water habitat in the Sacramento River system. In winter and spring, however, agricultural fields and wetland habitats throughout the Yolo Bypass often flood during high flows and are used by Sacramento splittail for spawning and rearing, and by Chinook salmon and steelhead for rearing (Sommer et al. 2001, 2003).

AQUATIC HABITATS

Primary aquatic habitats throughout the Yolo Bypass Wildlife Area include the Yolo Bypass floodplain during seasonal flooding events, Putah Creek, East Toe Drain, and permanent wetlands. General characteristics of each of these aquatic habitats are provided below.

Yolo Bypass Floodplain

Similar to other Sacramento-San Joaquin Delta habitats, there are more introduced species than native species in the Yolo Bypass floodplain (Table 3.5-4) (Sommer et al. 2003). Introduced species are one of the major environmental issues in the Delta, where they frequently dominate the fauna on a year-round basis (Bennett and Moyle 1996) and in fact make up approximately 90 percent of the biomass in the Delta. However, unlike other Sacramento-San Joaquin Delta habitats, the floodplain is seasonally dewatered during late spring through autumn. This prevents introduced fish species from establishing year-round dominance except in perennial water sources (Sommer et al. 2003). Moreover, many of the native fish are adapted to spawn and rear in winter and early spring (Moyle 2002a) during the winter flood pulse. Introduced fish typically spawn during late spring through summer when the majority of the floodplain is not available to them.

Recent surveys demonstrate that the Yolo Bypass provides habitat for a wide variety of fish species (Table 3.5-4). Sampling to date has shown that the floodplain is used by at least 42 fish species including seasonal fish and fish that are year-round residents in perennial water sources. Examples include federal and state-listed species (steelhead trout, delta smelt, spring-run (state-listed only) and winter-run Chinook salmon) and sport fish (striped bass and white sturgeon) (Sommer et al. 2003).

The native minnow Sacramento splittail is perhaps the most floodplain-dependent species in the Sacramento-San Joaquin Delta (Sommer et al. 1997). For much of the year, splittail reside in the San Francisco Estuary (Estuary); however, in autumn and winter they seasonally migrate upstream to spawn in the Sacramento-San Joaquin Delta and its tributaries.

Studies by Sommer et al. (1997) demonstrated that the Yolo Bypass provides some of the most important habitat for this species. Their sampling data indicated that adults move onto the floodplain in winter and early spring to forage and spawn among flooded vegetation. DWR has conducted both a pilot study and a more expanded investigation of splittail spawning behavior, first using the small ¼ acre wetland at the DFG demonstration wetlands on Chiles Road, and again in a 10-acre pond in the North Unit within the Yolo Bypass Wildlife Area.

Splittail rear in the Yolo Bypass and emigrate to the river channels and estuary as floodwaters recede. As one indication of the importance of the floodplain habitat to splittail, Sommer et al. (1997) showed that larval production of splittail for two floodplain habitats (Yolo and Sutter bypasses) was substantially higher than in surrounding river channels.

Juvenile Chinook salmon represent another good example of the value of the floodplain habitat to native fish. There are four races of Chinook salmon in the Sacramento Valley: winter, spring, late-fall and fall-run (Yoshiyama et al. 2000). Historical data indicate that all races have declined in abundance since the 1950s, however, the spring, winter and late-fall runs have shown the largest declines. There are multiple causes for these long-term reductions, including habitat loss, habitat degradation, water diversions and oceanic conditions. These declines led to the federal listing of winter-run Chinook as "endangered" in 1991 and spring-run as "threatened" in 1999.

Although there are multiple races, most young Chinook salmon emigrate from upstream riverine spawning habitats during winter and spring, then enter the Sacramento-San Joaquin Delta (Fisher 1994). In low flow periods, downstream migrants are confined to the Sacramento River and similar Delta channels. During flood pulses the Yolo Bypass floodplain provides an alternative migration corridor.

The results of Sommer et al. (2001) indicated that this seasonal floodplain habitat potentially provides better rearing conditions than the adjacent Sacramento River channel. They noted two major advantages of floodplain: 1) increased area of suitable habitat and 2) increased food resources.

Young Chinook salmon typically prefer habitat that is shallow and has low velocity (Everest and Chapman 1972). Sommer et al. (2001) estimated that complete inundation of the Yolo Bypass floodplain creates a wetted area approximately ten times larger than the comparable reach of the Sacramento River.

Moreover, they observed that the river channel lacked the broad, low velocity shoal (areas with mean depth typically < 2 meters) areas preferred by young salmon because flows are confined to deep, narrow rip-rapped channels. By contrast, Sommer et al. (2001) noted that the Yolo Bypass has extensive shoals and substantial habitat complexity.

Another important attribute of floodplain habitat is an enhanced food web. Sommer et al. (2001) found that drift insects (primarily chironomids) were 10 to 100 times more abundant in the floodplain than the adjacent Sacramento River channel during 1998 and 1999 flood events. Sommer et al. (2001) also observed that the higher drift insect abundance was reflected in the diets of juvenile salmon; Yolo Bypass salmon had significantly more prey in their stomach than salmon collected in the Sacramento River. However, they noted that the increased feeding success may have been partly offset by significantly higher water temperatures on the floodplain habitat, resulting in increased metabolic costs for young fish. The higher water temperatures were a consequence of the broad shallow shoals, which warm faster than deep river channels. Through bioenergetic modeling, Sommer et al. (2001) concluded that floodplain salmon had substantially better feeding success than fish in the Sacramento River, even when the prey data were corrected for increased metabolic costs of warmer floodplain habitat.

In his study, Sommer et al. (2001) found that improved rearing conditions potentially allowed juvenile salmon to grow substantially faster in the Yolo Bypass floodplain than the adjacent Sacramento River. They showed that the mean salmon size increased significantly faster in the seasonally-inundated Yolo Bypass floodplain than the Sacramento River, suggesting better growth rates.

Although these results suggest that several habitat measures may be better for young salmon in the Yolo Bypass, floodplain habitat carries stranding risks. The relative importance of stranding mortality is difficult to evaluate because there is currently no reliable estimate of the total number of salmon which migrate through the Sacramento River and its tributaries. However, the Yolo Bypass floodplain has been graded for agriculture using laser leveling technology, resulting in an exceptionally well drained topography. Observations indicate that highly efficient drainage may promote successful emigration of young salmon (Sommer et al. 2003). Sommer et al. (2001) examined this issue by doing paired releases of juvenile coded-wire-tagged salmon in the Yolo Bypass and Sacramento River to obtain comparative survival data for fish migrating through each habitat type. They found that the Yolo Bypass floodplain release groups had somewhat higher survival indices than Sacramento River fish in both 1998 and 1999; however, the sample size (n=2) was too low to demonstrate statistical significance.

Although preliminary results suggest that growth of juvenile salmon in the Bypass may be accelerated, because of the low sample size, these results should be considered with caution. It is unknown exactly how significantly the Bypass contributes to overall Central Valley escapement.

Recent analysis of juvenile salmon utilizing the Bypass indicates higher methylmercury levels in these fish when compared to juvenile salmon that used the Sacramento River to get to the Delta. Further study is needed as well as analysis of methylmercury levels in splittail using the Yolo Bypass. Splittail spend their entire lives within the Bay-Delta ecosystem and therefore may have a higher propensity to contribute towards the bioaccumulation of methylmercury up the food chain.

Other Benefits of Floodplain to Aquatic Communities

Floodplain inundation may also provide benefits to organisms downstream in the brackish portion of the Delta (i.e., estuary). At the base of the estuarine food web, phytoplankton are responsible for most of the primary production in the estuary (Jassby et al. 1996). However, to the detriment of the organisms dependent on phytoplankton, there has been a major long-term decline in phytoplankton biomass in the estuary as a result of multiple factors including introduction of new benthic grazers (i.e., Asian clam) (Alpine and Cloern 1992), water exports and low outflow (Jassby et al. 1995), and climate change (Lehman 2000). Modeling studies by Jassby and Cloern (2000) suggest that phytoplankton produced in the Yolo Bypass may be an important source of organic carbon to the Estuary, at least during flood events. Moreover, Yolo Bypass is probably also a major pathway for detrital material, an important additional source of organic carbon to the food web of the phytoplankton-deficient Estuary. This conclusion is supported by Schemel et al. (1996), who found that the Yolo Bypass is the major pathway for organic matter to the Estuary in wet years.

Putah Creek

The reach of Putah Creek within the Yolo Bypass Wildlife Area (i.e., Putah Creek Cross Channel) consists of a historic channel that is seasonally dammed by the Los Rios Check Dam. The creek channel in this reach is approximately 40 feet wide on average. The riparian corridor above the dam is less than 5 trees wide although many of these trees are substantial in height. Below the Los Rios Check Dam, the channel has very few trees and steep banks. There is also an approximately one mile stretch of Putah Creek that is lined with a narrow band of tall riparian trees. This stretch is currently cut off from perennial flow. The Los Rios Check Dam is a 12-foot-high, 30-foot-long concrete box culvert with hardware to hold large flashboards that serves as a seasonal check dam in the Yolo Bypass to create a head of water for irrigation pumping for neighboring agricultural lands and to flood the seasonal wetlands in the Yolo Bypass Wildlife Area. The Los Rios Check Dam is also managed to facilitate the migration of fall-run Chinook salmon into lower Putah Creek by removing boards in fall/winter in conjunction with pulse flow releases from the Putah Diversion Dam (PDD). The boards are typically removed in the fall/winter as soon as the irrigation season ends and upon the arrival of Chinook salmon in the East Toe Drain (based on DWR fike trap sampling) and replaced in April of the following year (for agricultural and wildlife habitat uses). Replacement of the check dam in April could impede emigration of late hatching young fall-run Chinook salmon.

Habitat and fisheries conditions in this reach of lower Putah Creek have been affected and shaped by several factors, including historic agricultural activities in the Yolo Bypass Wildlife Area, upstream flood control grading and vegetation removal, construction and operation of the Solano Project and, in May 2000, settlement and implementation of the historic Putah Creek Settlement Agreement (aka Water Accord) (Sacramento County Superior Court 2000). Due to hydrologic connectivity to the reach of Putah Creek in the Yolo Bypass Wildlife Area, the following discussion from the Lower Putah Creek Watershed Management Action Plan (Lower Putah

Creek Coordinating Committee 2005) provides a description on the segment of Putah Creek from the East Toe Drain in the Yolo Bypass Wildlife Area, upstream to the PDD.

Stream Conditions Prior to Water Accord (1960s to 2000)

Construction and operation of the Solano Project had major effects on flows and sediment conditions downstream of the PDD. In general, the Solano Project substantially decreased total annual discharges through lower Putah Creek compared with pre-project conditions (Jones & Stokes 1992). Following operation of the project, the minimum normal and dry year annual releases required (by a 1970 State Water Resource Control Board decision) were about 22,000 acre-feet and 19,000 acre-feet, or 6 percent and 5 percent of the estimated pre-project discharges, respectively. The Solano Project also modified summer hydrological conditions, extending streamflow throughout summer, such that median flows in August through October were higher than during pre-project conditions, and flows were generally present from the PDD to the Yolo Bypass in most years. However, significant periods of reduced flows in the lowest reaches of Putah Creek occurred at various times since the Solano Project became operational. The 1987–1992 drought years were the driest 6-year period on record for the Putah Creek drainage. At the same time, surface water diversions and increased groundwater pumping were further reducing Putah Creek flows due to a shortage of surface water supplies. The reduced releases during drought years, coupled with reduced recharge from the adjacent groundwater table, resulted in the complete dewatering of long stretches of the creek, major fish die-offs, and raised concern for fish habitat and other beneficial functions of Putah Creek.

The impoundment of gravel upstream of the dams has resulted in a lack of gravel substrate in Putah Creek downstream of the PDD. In addition to the reduction in sediment movement downstream following completion of the Solano Project, gravel mining occurred along Putah Creek during the 1960s and 1970s (USFWS 1993). Channel surveys in 1972 indicated that mining had left a wide, relatively flat channel with a few artificial berms and levees (Jones & Stokes 1992).

Vegetation clearing activities in the creek channel by state and federal agencies continued through the 1960s and early 1970s. After 1975, when vegetation clearing policies were changed (USFWS 1993), the creek bed stabilized, riparian woodland cover increased, and a seemingly more natural stream channel was created (Moyle 1991).

Fisheries Prior to Water Accord (1960s to 2000)

About 40 species of fish have been reported from lower Putah Creek below the PDD, including 17 permanent residents (LPCCC 2003, Moyle 1991, Marchetti and Moyle 2001). The fish species could be divided into four categories: anadromous fish, resident native fish, introduced resident game fish, and introduced resident non-game fish. Sightings of anadromous fish, including spawning activity by small numbers of Chinook salmon, occurred when there were adequate late fall and winter flows in Putah Creek, the Yolo Bypass, and the Sacramento River (Lower Putah Creek Coordinating Committee 2003).

Native resident fishes in the creek included mainly Sacramento blackfish, hitch, prickly sculpin, riffle sculpin, Sacramento pikeminnow, Sacramento sucker, three-spine stickleback, and tule perch (USFWS 1993). Introduced game species in the creek provided many opportunities for angling. These included species such as brown trout, largemouth bass, smallmouth bass, bluegill, green sunfish, warmouth, white and black crappie, white catfish, channel catfish, black bullhead, and common carp (USFWS 1993, Moyle 1991). Other nonnative species included Western mosquitofish, inland silverside, goldfish, bigscale log perch, fathead minnow, golden shiner, and red shiner (USFWS 1993).

Putah Creek Water Accord

From 1987 to 1992 the worst 6-year drought on record hit the region. Lake Berryessa was drawing down at a rate of about 200,000 net acre-feet per year. In summer 1989, long stretches in the downstream reaches of lower Putah

Creek began drying up and major fish die-offs of fish began occurring (Moyle et al. 1998). Attempts to negotiate a permanent solution to the problem resulted in several legal actions over a period of approximately 10 years.

On May 23, 2000, a settlement (the Accord) was reached. It created a new permanent release schedule intended to balance the competing uses for water between supply, demand, and maintenance of aquatic and riparian resource functions. The purpose of the Accord is to create as natural a flow regime as feasible and to maintain a living stream for the benefit of fish, wildlife, and plants from the PDD to the connection at the East Toe Drain in the Yolo Bypass. The Accord focuses on the protection and enhancement of native resident and anadromous fish populations. It includes six primary elements, including four functional flow requirements. The four flow requirements pertain to rearing flows, spawning flows for native resident fishes, supplemental flows for anadromous fishes, and drought-year flows. The six Accord elements are as follows (a discussion on release schedules is provided below):

1. Flows for resident native fish, which include important spawning and rearing components and guarantee a continuous flow to I-80;

2. Flows that will attract and support salmon and steelhead;

3. A drought schedule that provides enough water to maintain Putah Creek as living stream but provides water users relief from other flow requirements;

4. Creation of the Lower Putah Creek Coordinating Committee (LPCCC) and the streamkeeper position;

5. Habitat restoration and monitoring funds for the creek; and

6. A term requiring Solano County Water Agency (SCWA) to notify riparian water users of the amount of riparian water available in any given year and to prevent illegal water diversions in excess of the amount of riparian water available.

Rearing Flows

This is a baseline flow regime designed to maintain a year-round living stream from the PDD to the East Toe Drain. It is intended to provide cool-water habitat for native fishes for at least several miles below the PDD, even under the worst drought conditions. It also provides enough water to support introduced fishes (e.g., largemouth bass, catfishes, and bluegill) in the lower reaches. These flows overcome past limitations in which the stream dried up during summer in extreme drought years, except for a few large pools and a short section below the PDD (Moyle 2002b).

Spring Pulse Flows

Spring pulse flows consist of a short pulse in February–March, lasting three consecutive days, followed by a month-long release of higher than baseline flows. The purpose of these flows is to promote emigration of juvenile salmon and to provide spawning opportunities for native fishes in winter and spring if there was insufficient rain to provide for them naturally. Native fishes, such as Sacramento sucker, are stimulated to spawn by hydrological changes that deepen spawning riffles and flood shoreline habitat for rearing. The pulse would bring the fish upstream and the increased flows would allow them to spawn and rear. Dr. Moyle predicted that these flows, in combination with baseline rearing flows, would greatly increase the abundance and distribution of native fishes in the creek (Moyle 2002b).

Supplemental (Pulse) Flows

Supplemental flows are designed to primarily benefit the migration of fall-run Chinook salmon. The Accord includes a requirement for a minimum flow beginning in November and a 5-day pulse flow to occur at an optimal time (based on monitoring) in November or December to attract and enable adult fall-run Chinook salmon to migrate up Putah Creek from the East Toe Drain. The Accord also specifies a minimum flow that follows the pulse flow and continues through the end of May. The springtime minimum flows are designed to benefit juvenile salmon for rearing and to enable them to return back to the East Toe Drain and sea (Moyle 2002b).

When salmon are detected in the East Toe Drain during the fall, and DFG personnel as well as local farmers are through utilizing the pool of water trapped behind the Los Rios Check Dam, a well orchestrated sequence of events takes place. Los Rios Farms schedules the removal of the boards. SCWA coordinates with Yolo Bypass Wildlife Area regarding release of the fall attraction flows which is timed to coincide with the removal of the boards from the Los Rios Check Dam. Removing the check boards in coordination with the fall attraction flows helps to attract and enable salmon to migrate up into Putah Creek from the East Toe Drain.

The supplemental flow regime, although designed primarily to benefit salmon, seems to benefit lampreys and may be adequate for rearing juvenile steelhead as well. Adult steelhead may make it up the stream under high winter flows (Moyle 2002b).

Drought Year Flows

These flows are to be implemented during severe droughts, when all flows but the minimum flows can be eliminated for 2 years. During droughts, normal flow regimes outlined in the subsections above are not in effect every year. Droughts are defined as periods in which the total storage in Lake Berryessa is less than 750,000 cfs on April 1 of any given year. Severe droughts are defined as periods in which Lake Berryessa holds less than 400,000 acre-feet of water on April 1. Under the drought year flow regime, normal flows are implemented in every third year of an extended drought unless the drought is severe. During extended (e.g., 3 or more years) severe droughts, normal flows are not implemented until the first year immediately after Lake Berryessa storage exceeds 400,000 acre-feet.

The drought year flow regime seeks to strike a reasonable balance between human water demands and the minimum needs of fishes during droughts. While the stream and its fish will not receive more than minimum flows during most drought years, periodically they regain priority for water if the drought continues. The drought regime also recognizes that during drought conditions, native fish can persist under minimal flow conditions without reproducing. Native fishes can persist if competition and predation from introduced fishes is limited or if suitable habitat refuges exist for the native fishes (Marchetti and Moyle 2001). Even before the settlement, small numbers of native fishes managed to persist through extreme drought conditions that dried up most of the creek. The minimum flows provided under the new schedule are expected to enable native fishes to have a higher level of persistence than prior to the Accord.

The drought schedule requires that a continuous flow be maintained in the reach from PDD to I-80 (a 15-mile stretch) at all times. Thus, the reaches of Putah Creek closer to the Diversion Dam, which are the reaches dominated by resident native fishes, will not go dry, protecting native fish from lengthy droughts. The nonnative species, which tend to dominate in the reaches nearer to and below I-80, will not receive as much protection from the drought year flow schedule. However, introduced fish may repopulate those reaches from upstream populations following the end of drought cycles (Moyle 2002b).

Fisheries after Water Accord (2000 to Present)

Fisheries response to the Accord flow releases is still currently being evaluated; however, based on initial data, several improvements have been noted. The most noteworthy result of the new flow releases is that fall-run Chinook salmon are migrating up Putah Creek to spawn. An estimated 70 adult fall-run Chinook salmon migrated up lower Putah Creek in fall 2003, resulting in the largest salmon run in the past 40 or more years (Putah Creek Council 2003).

East Toe Drain

The tidally influenced East Toe Drain provides perennial aquatic habitat for several fish species. The East Toe Drain is characterized by a wide (50 to 150 feet) and fairly deep (more than 5 feet) channel with no canopy and little bank or overhead vegetation. Portions of the Toe Drain bank in this Yolo Bypass Wildlife Area are riprapped. The channel is homogeneous with little habitat complexity and generally low fish habitat value.
The Lisbon Weir is located in the East Toe Drain adjacent to the Tule Ranch Unit. The Lisbon Weir is a rock weir used to capture water at high tide to maintain a higher elevation pool for irrigation source water.

Fish studies in the East Toe Drain show that this aquatic feature likely functions as year-round habitat for resident species, as a migration corridor (e.g., fish movement into Putah Creek and onto the seasonally inundated floodplain), and potentially as spawning habitat for striped bass and American shad (Harrel and Sommer 2003). Resident species are primarily nonnative and include common carp, channel catfish, white catfish, striped bass, threadfin shad, black crappie, white crappie, Sacramento blackfish, and Sacramento sucker (Harrel and Sommer 2003).

Permanent Wetlands

Permanent wetlands in the Yolo Bypass Wildlife Area provide perennial aquatic habitat for a diverse assemblage of fish species (dominated by nonnative species). Three of the permanent wetland ponds in the Yolo Bypass Wildlife Area were surveyed in 2001 to examine the functional role of perennial floodplain ponds for fishes in a regulated and highly invaded temperate river-floodplain system (Feyrer et al. 2004). Fish sampling resulted in the collection of 18 different species, all of which were nonnative with the exception of one native fish species, Sacramento blackfish (Feyer et al. 2004). The most abundant species sampled included threadfin shad, common carp, inland silverside, and white and black crappie.

Fish assemblages in these aquatic habitats likely change over time between floodplain inundation events. Immediately following inundation events, the species composition is likely shuffled with native and nonnative species becoming more balanced. As the permanent wetlands become isolated and more stable, interactions between the native and nonnative species likely play an important role. Negative interactions between native and nonnative species, such as predation (Turner and Kelley 1966; Bennett and Moyle 1996) and/or competition (Marchetti 1999) are likely to be major factors affecting native fish use of the perennial floodplain ponds between inundation events. Predation is an important factor structuring fish assemblages in similar habitats (Rodriguez and Lewis 1994; Tejerina-Garro et al. 1998) and considered to be a primary mechanism. Additionally, predation is generally enhanced where the visual environment (i.e., reduced turbidity in the stabilized environment) is optimal.

SPECIAL-STATUS SPECIES

Special-status fish species are legally protected or are otherwise considered sensitive by federal, state, or local resource conservation agencies and organizations. Special-status fish species addressed in this section include:

- species listed as threatened or endangered under the state or federal Endangered Species Acts;
- species identified by USFWS, NMFS, or DFG as species of special concern;
- species fully protected in California under the California Fish and Game Code; and
- species identified as priorities for recovery under CALFED’s MSCS.

A total of nine special-status fish species occur or have the potential to occur in the Yolo Bypass and/or lower Putah Creek and are described below (see also Table 3.5-5). Of the nine species, Central Valley steelhead Evolutionarily Significant Unit (ESU), Central Valley spring-run Chinook salmon ESU, Sacramento River winter-run ESU, green sturgeon, and delta smelt are listed as a federally threatened or endangered species.
The USFWS de-listed Sacramento splittail from its federally threatened status on September 22, 2003. NMFS determined that listing is not warranted for Central Valley fall-/late fall-run Chinook salmon. However, it is still

designated as a Species of Concern because of concerns over specific risk factors. The two remaining species (hardhead and Sacramento perch) are considered Species of Special Concern by DFG and/or federal Species of Concern by USFWS. Brief descriptions follow for the special-status species with potential to occur in the Yolo Bypass and/or lower Putah Creek.

Table 3.5-5
Special-status Fish Species Potentially Occurring in the Yolo Bypass Wildlife Area

Species	Status[1]			Habitat	Potential to Occur in the Yolo Bypass Wildlife Area
	USFWS/ NMFS	DFG	MSCS Goals		
Central Valley steelhead *Oncorhyncus mykiss*	T	--	R	Requires cold, freshwater streams with suitable gravel for spawning; rears seasonally inundated floodplains, rivers, tributaries, and Delta.	Occurs in the Sacramento River and tributaries. Occurs seasonally in the Yolo Bypass Wildlife Area.
Sacramento winter-run Chinook salmon *Oncorhyncus tshawytscha*	E	E	R	Requires cold, freshwater streams with suitable gravel for spawning; rears seasonally inundated floodplains, rivers, tributaries, and Delta.	Occurs in the Sacramento River and tributaries. Occurs seasonally in the Yolo Bypass Wildlife Area.
Central Valley spring-run Chinook salmon *Oncorhyncus tshawytscha*	T	T	R	Requires cold, freshwater streams with suitable gravel for spawning; rears seasonally inundated floodplains, rivers, tributaries, and Delta.	Occurs in the Sacramento River and tributaries. Juveniles occasionally occur seasonally in the Yolo Bypass Wildlife Area.
Central Valley fall/late fall–run Chinook salmon *Oncorhyncus tshawytscha*	--	SSC	R	Requires cold, freshwater streams with suitable gravel for spawning; rears seasonally inundated floodplains, rivers, tributaries, and Delta.	Occurs in the Sacramento River and tributaries. Occurs seasonally in the Yolo Bypass Wildlife Area.
Green sturgeon *Acipenser medirostris*	T	--	R	Requires cold, freshwater streams with suitable gravel for spawning; rears seasonally inundated floodplains, rivers, tributaries, and Delta.	Occurs in the Sacramento River and tributaries. Has potential to occur in the Yolo Bypass Wildlife Area.
Delta smelt *Hypomesus transpacificus*	T	T	R	Spawns in tidally influenced freshwater wetlands and seasonally submerged uplands; rears seasonally inundated floodplains, tidal marsh, and Delta.	Occurs in the Sacramento River downstream of its confluence with the American River. Has potential to occur seasonally in the Yolo Bypass Wildlife Area.
Sacramento splittail *Pogonichthys macrolepidotus*	DT	SSC	R	Spawning and juvenile rearing from winter to early summer in shallow weedy areas inundated during seasonal flooding in the lower reaches and flood bypasses of the Sacramento River including the Yolo Bypass.	Occurs in the Sacramento–San Joaquin River Delta and Sacramento River and tributaries. Occurs seasonally in the Yolo Bypass Wildlife Area and breeds successfully.

Table 3.5-5
Special-status Fish Species Potentially Occurring in the Yolo Bypass Wildlife Area

Species	Status [1]			Habitat	Potential to Occur in the Yolo Bypass Wildlife Area
	USFWS/ NMFS	DFG	MSCS Goals		
Hardhead *Mylopharodon conocephalus*	--	SSC	m	Spawning occurs in pools and side pools of rivers and creeks; juveniles rear in pools of rivers and creeks, and shallow to deeper water of lakes and reservoirs.	Occurs in freshwater portions of Sacramento River and tributaries. Occurs seasonally in the Yolo Bypass Wildlife Area.
Sacramento perch *Archoplites interruptus*	--	SSC	r	Spawning has been reported to extend from spring to late summer, depending on location and water temperature; among aquatic plants or congregating in shallow waters in schools among or near inshore vegetation.	Historically occurred in Sacramento and San Joaquin rivers and tributaries; depleted in native range, and now are restricted to a few locations, principally ponds and reservoirs where they are stocked. Not known to occur in the Yolo Bypass Wildlife Area.

[1] Legal Status Definitions

Federal Listing Categories (USFWS & NMFS)
E Endangered (legally protected)
T Threatened (legally protected)
DT Recently delisted from threatened status
SC Species of Concern

State Listing Categories (DFG)
E Endangered (legally protected)
T Threatened (legally protected)
FP Fully Protected (legally protected, no take allowed)
CSC California Species of Concern (no formal protection)

Multi-Species Conservation Strategy Goals
R Recovery. Recover species' populations within the MSCS focus area to levels that ensure the species' long-term survival in nature.
r Contribute to recovery. Implement some of the actions deemed necessary to recover species' populations within the MSCS focus area.
m Maintain. Ensure that any adverse effects on the species that could be associated with implementation of CALFED actions will be fully offset through implementation of actions beneficial to the species (CALFED 2000b).

Source: Data compiled by EDAW in 2006

Steelhead

The Central Valley steelhead ESU (*Oncoryhnchus mykiss*) is a federally threatened species. The Central Valley steelhead includes all naturally spawned populations of steelhead in the Sacramento and San Joaquin rivers and their tributaries (McEwan and Jackson 1996). Steelhead have a complex life history, including the capability to be anadromous or resident (called rainbow trout) (Moyle 2002a). Anadromous species spend most or a portion of their adult life in the ocean and then migrate back into freshwater to reproduce. Spawning and rearing habitat for steelhead typically occurs in perennial streams with clear, cool to cold, fast-flowing water with a high dissolved oxygen content and abundant gravels and riffles (McEwan and Jackson 1996). After spending 1–4 years in the ocean, adult steelhead return to their home streams to spawn (Moyle 2002a). Migration into freshwater begins in August and peaks in September–October, after which the steelhead hold until flows are sufficiently high to enable migration into tributaries (Moyle 2002a). Spawning begins in late December and peaks in February–March (Busby et al. 1996). Steelhead eggs hatch in 3–4 weeks (at 50–59°F), and fry emerge from the gravel 2–3 weeks later (Moyle 2002a). After steelhead fry emerge from spawning gravels, they continue to grow and mature in freshwater for 1–3 years before emigrating to the ocean (Moyle 2002a). Unlike salmon, steelhead do not necessarily die after spawning and can spawn more than one time. In central California, most spawning steelhead are 3 years old, with one year spent in the ocean (Busby et al. 1996). Steelhead have been captured in Yolo Bypass fish sampling (Sommer et al. 2001).

Chinook salmon

Threatened or endangered Chinook salmon with potential to occur in the Yolo Bypass Wildlife Area consist of three ESUs, the fall-run, winter-run, and spring-run Chinook. Chinook are relatively common within the Sacramento–San Joaquin River system. Adult and juvenile Chinook may move through the portions of the Yolo Bypass and Putah Creek on their way to and from the ocean (i.e., adult migration and juvenile rearing and emigration).

Winter-run Chinook salmon is listed as an endangered species under both CESA and ESA (59 FR 440). Designated critical habitat for winter-run Chinook includes the Sacramento River adjacent to the project study area. Winter-run Chinook return to the upper Sacramento River between December and July, but delay spawning until the spring and summer (April–August) (Moyle 2002a). Juveniles typically spend 5–9 months in the river and Sacramento–San Joaquin River Delta (Delta) before entering the ocean (Moyle 2002a).

Spring-run Chinook salmon is listed as a threatened species under CESA and ESA (50 FR 50394). Designated critical habitat was proposed for spring-run Chinook in December 2004 with a final determination September of 2005. Spring-run Chinook salmon enter the Sacramento River system between March and September and move upstream into the headwaters, where they hold in pools until they spawn between August and October (Moyle 2002a). Juveniles typically emigrate from the tributaries from mid-November through June; however, some juveniles spend a year in the streams and emigrate as yearlings the following October (Moyle 2002a).

Fall-run Chinook salmon ESU is a federal Species of Concern. Fall-run Chinook salmon is the most widely distributed and most numerous run occurring in the Sacramento and San Joaquin rivers and their tributaries (McEwan and Jackson 1996). After spawning, eggs generally hatch in 6–12 weeks, and newly emerged larvae remain in the gravel for another 2–4 weeks until the yolk is absorbed. Fall-run juveniles typically rear in fresh water for up to 5 months before migrating to sea. Fall-run Chinook salmon have historically spawned in Putah Creek and, after decades of sparse occurrences; have returned to spawn in lower Putah Creek in recent years (Lower Putah Creek Coordinating Committee 2005).

Green Sturgeon

Green sturgeon has recently has been listed as threatened by NMFS (71 FR 17757). Green sturgeon occur in the lower reaches of large rivers, including the Sacramento–San Joaquin River basin, and in the Eel, Mad, Klamath, and Smith rivers (Moyle et al. 1992). Green sturgeon adults and juveniles occur throughout the upper Sacramento River, based upon observations incidental to winter-run Chinook monitoring at the Red Bluff Diversion Dam in Tehama County (NMFS 2005). Green sturgeon spawn predominantly in the upper Sacramento River. They are thought to spawn every 3–5 years (Tracy 1990). Their spawning period is March to July, with a peak in mid-April to mid-June (Moyle et al. 1992). Juveniles inhabit the estuary until they are approximately 4–6 years old, when they migrate to the ocean (Kohlhorst et al. 1991). Green sturgeon have been recorded in the toe of the Yolo Bypass and Cache Slough downstream and there is potential for this species to occur in the Wildlife Area due to the hydrologic connectivity between these areas (and the Sacramento River) and Yolo Bypass.

Delta Smelt

Delta smelt occur in the Sacramento-San Joaquin Delta where, for most of the year, they are typically associated with the freshwater edge of the salt-water/fresh water mixing zone, in the portion of the water column that has relatively low water velocities. The species moves inland to areas of flooded terrestrial vegetation for spawning. Spawning season varies from year to year and may occur from February to July, but mainly from April through May (Moyle 2002a). The lower Yolo Bypass is a known spawning area for this species (USFWS 2004). Delta smelt was federally listed as a threatened species in March 1993 (58 FR 12854). Critical habitat for the species was designated in December 1994 and includes the Delta and Sacramento River up to the City of Sacramento (59 FR 65256). Delta smelt are tolerant of a wide range of salinity and typically rear in shallow, fresh or slightly brackish waters of the estuary (Moyle 2002a). Delta smelt have been captured in the Yolo Bypass (Sommer et al. 2001).

Sacramento splittail

Sacramento splittail (*Pogonichthys macrolepidotus*) has been de-listed from its federal threatened status but remains a California Species of Special Concern. This large cyprinid (minnow family) is endemic to California and occurs in sloughs, lakes, and rivers of the Central Valley (Moyle 2002a). Sacramento splittail spawn and rear on terrestrial vegetation and debris on floodplains inundated by high spring flows (i.e., late February through April) (Moyle 2002a). In wet years, Sacramento splittail are commonly found in the Putah Creek Sinks, in the region where Putah Creek crosses the Yolo Bypass, and, as discussed above, the Yolo Bypass provides valuable spawning and rearing habitat for splittail (Sommer et al. 1997; 2001).

Hardhead

Hardhead (*Mylopharodon conocephalus*) is a California Species of Special Concern. It is a large minnow that resembles pikeminnow. It prefers clear, deep pools and runs with sand-gravel-boulder substrates and slow water velocities. Most of the streams in which it occurs have summer temperatures in excess of 60°F. However, hardhead tends to be absent from streams that have been severely altered by humans and where introduced species, especially sunfish, predominate (Moyle 2002a). Hardhead is widely distributed in low to mid-elevation streams in the main Sacramento-San Joaquin river drainage. Despite its widespread distribution, hardhead populations are increasingly isolated from one another, making them vulnerable to local extinctions (Moyle 2002a). As a result, hardhead is much less abundant than it once was (Moyle 2002a). Hardhead is no longer present in lower Putah Creek (Moyle et al. 1998). Hardhead have not been captured in the Yolo Bypass (Sommer et al. 2001).

Sacramento perch

Sacramento perch (*Archoplites interruptus*) is a federal Species of Concern and a California Species of Special Concern. It is the only native centrarchid (sunfish) in California. Historically, Sacramento perch was found below 300 feet in elevation throughout the Central Valley, the Pajaro and Salinas rivers, and Clear Lake (Moyle 2002a). Along with the Sacramento pikeminnow (formerly squawfish), it was the dominant piscivorous (fish-eating) fish in waters of the Central Valley. However, Sacramento perch has been extirpated from most of its former range because of the introduction of 11 species of sunfish (Moyle 2002a). Adults do not remain on nests and unguarded eggs are vulnerable to predation. Sacramento perch formerly inhabitated sloughs, slow-moving rivers, and lakes; however, it is now mostly found in reservoirs and farm ponds. Sampling during the 1980s and 1990s indicated that Sacramento perch were no longer present in lower Putah Creek (Moyle et al. 1998). They were re-introduced into the creek in 1997 but failed to become established. However, a small population exists in a pond that drains into Putah Creek (Moyle et al. 2003). Sacramento perch have not been captured in the Yolo Bypass (Sommer et al. 2001).

SENSITIVE HABITATS

The East Toe Drain and Putah Creek, including the portion within the Yolo Bypass Wildlife Area, has been designated as Essential Fish Habitat (EFH) by the Pacific Fishery Management Council (PFMC) to protect and enhance habitat for coastal marine fish and macroinvertebrate species that support commercial fisheries. This is in addition to the critical habitat designations noted above. EFH is defined as waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity. Under the Pacific Coast Salmon Fisheries Management Plan (Pacific Fishery Management Council 2003), the East Toe Drain and Putah Creek, including the reaches within Yolo Bypass Wildlife Area, have been designated as EFH for fall-run Chinook salmon.

3.6 CULTURAL RESOURCES

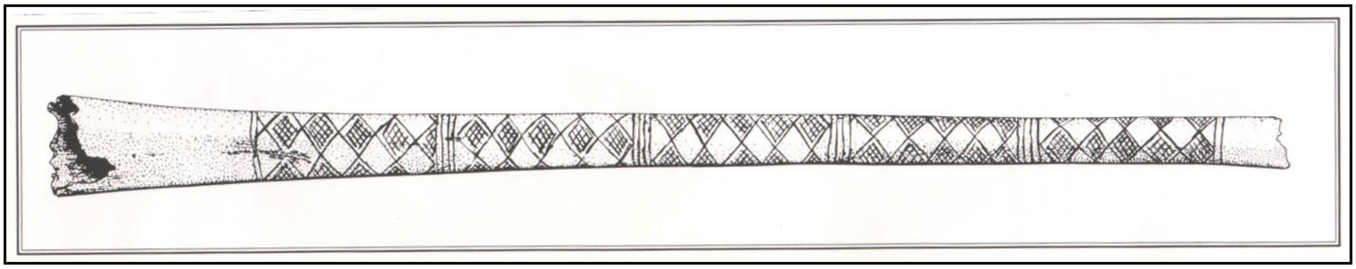
The Yolo Basin is rich in cultural history. From the earliest Native American inhabitants to those farming and residing there in recent times, the Yolo Basin has been an important part of people's being and livelihood. This section provides information on the prehistoric, ethnographic, and historic settings, previous cultural resource investigations in the property and surrounding vicinity, and resources that have been documented and recorded in the Yolo Wildlife Area.

The following text was developed through a cultural records search, review of literature and existing data sources, Yolo Wildlife Area staff information, Foundation program information, and EDAW staff expertise.

3.6.2 ETHNOGRAPHIC SETTING

The Yolo Basin is within the ethnographic territory of the Patwin. The word "Patwin" literally means "the people" in the native tongue. Although native people did not identify themselves as Patwin, this name is used to describe a series of linguistically and culturally related groups who occupied a portion of the lower Sacramento Valley west of the Sacramento River and north of Suisun Bay. Major sources of information on these groups include the works of Bennyhoff (1977), Johnson (1978), Kroeber (1925), McKern (1922 and 1923), Powers (1877), and Work (1945). These people spoke dialects of a single historically related language. Use of the Patwin language extended southward to the Sacramento-San Joaquin Delta system. There were numerous dialects, which were historically recorded including Hill, River, Cache Creek, Lake, Tebti, Dahcini and Suisun (Shipley 1978). Powers (1877) identified 14 tribes based upon linguistic differences, while Merriam, using linguistic and geographic boundaries identified 10 tribes within three broad distinct dialect divisions (Patwin, Win, and Pooewin). Kroeber (1932) later reorganized the groups along three linquistic-political lines, Hill (southwest) and River (southeast and southern). The southern group or Pooewin claimed the Yolo Basin, however, no known ethnographic village locales are within this area (Johnson 1978). Because of reoccurring seasonal flooding, the area would have most likely been used during the drier summer months.

The Patwin were politically organized into tribelets that consisted of one primary and several satellite villages. Each tribelet maintained its own autonomy and sense of territoriality. Villages were located along rivers and major creeks, often near the juncture with other waterways or in the vicinity of foothill settings. Structures within these villages were usually earth covered, semi subterranean elliptical (River Patwin) or circular (Hill Patwin) in form (Kroeber 1932a). All except the individual family dwellings were built with the assistance of everyone in the village. Ethnographic accounts indicate that one's paternal relatives built single-family homes within the settlements (Johnson 1978).



Incised sandhill crane bone found adjacent to the Sacramento River (i.e., Brazil Mound) six miles east of the Yolo Bypass Wildlife Area

Through the skilled use of the natural materials available within their range, the Patwin exploited a wide variety of edible resources. Netting and cordage was of particular importance in fishing and hunting activities and wild hemp (*Apocynum cannabinum*), and milkweed (*Asclepias* sp.) provided particularly suitable fibers for the production of fishing nets and lines. Anadromous fish such as sturgeon (*Acipenser* spp.) and chinook salmon

(*Oncorhynchus tshawytscha*) were part of the staple Patwin diet (Johnson 1978) and were typically caught in large numbers using stone and wood weirs and cordage nets.

In general, the Patwin territory was well watered which supported a wide variety of animal life available for hunters including tule elk, deer, antelope, bear, various species of duck, geese, turtles, and other small animals. While hunting and fishing were clearly important subsistence activities among the Patwin, as with many Native American groups throughout the region, their primary staple food was the valley oak (*Quercus lobata*) acorn. The oak groves themselves were considered as “owned” communally by the particular tribelet. Other commonly exploited floral food resources included; buckeye (*Aesculus* spp.), pine nuts, juniper (*Juniperus* sp.), manzanita (*Arctostaphylos* spp.), and black berries (*Rubus ursinus*), wild grape (*Vitis californica*), and tule (*Scirpus* spp.) roots. Various seeds such as sunflower (*Helianthus* spp.), clover (*Melilotus* spp.), bunchgrass (*Festuca* spp.), and wild oat (*Avena fatua*) were also gathered and ground into course flours. As with the oak groves, particularly fruitful tracts of seed-bearing lands were controlled by individual families or the tribelets themselves (Powers 1877; Kroeber 1932).

One of the more distinctive aspects of the Patwin culture was the Kuksu or “big-head” dances cult system, also found in other tribes through much of north central California. Within each cult were secret societies, each with its own series of dances and mythologies centered on animal figures such as Sede-Tsiak (Old Man Coyote) or Ketit (Peregrine Falcon). The Patwin were unique in possessing three secret societies. In the central California cult system, almost all groups possessed the Kuksu but the Patwin also had the “ghost dance” (way saltu) and Hesi societies (Krober 1932). Each secret society engaged in specific spiritual activities such as the way saltu society stressed curing and shamanistic functions (Johnson 1978).

3.6.3 HISTORIC SETTING

This historical resources section was prepared by Dave Feliz, Yolo Bypass Wildlife Area manager using a multitude of resources including interviews with the players themselves, their descendants or friends. Research was conducted in the Yolo County Library – Davis Branch, the Yolo County Archives, the State Library Archives, and online. Historical knowledge is key to preserving place names and the character of an area so that people can understand the historical context as well as the scientific context of the Yolo Bypass Wildlife Area.

EARLY EXPLORATION AND SETTLEMENT

Various Spanish explorers, (i.e., Pedro Fages in 1772 and Jose Canizares in 1776), searching for sites for inland missions, visited the Central Valley in the 1700s. Francisco Eliza sailed into the unexplored Sacramento River in 1793. Expeditions were also conduced in the early 1800s, and included those of Gabriel Moraga, Jose Antonio Sanchez and Father Narciso Duran. These explorers were followed by trappers of the Hudson Bay Company, beginning with Jedidiah Strong Smith in the late 1820s and Joseph Walker and Ewing Young in the 1830s (Hoover et al. 1990).

Historic development within the Central Valley commenced in 1839 when John Sutter established a trading post. Later, in 1841, he was granted 11 leagues by the Mexican government, where he established New Helvetia and Sutter’s Fort, now known as Sacramento (Hoover et al. 1990).

Although various trappers, traders, and missionaries had ventured into and near the project site and vicinity since at least the first decade of the 19th century, considerable historic-era developments did not occur until the Mexican period. Within present-day Yolo County, there were 11 grants of land made by the Mexican Government between 1842 and the American conquest in 1846. Of those 11 land grants, only five were confirmed by the United States. While no grants were within the Yolo Wildlife Area, the nearest was Rancho Rio de Los Putos, located on the banks of Putah Creek. According to Hoover et al. (1990), the name Los Putos and Putah appear to be Spanish approximations of the local Native American groups. The grant for four leagues (17,755 acres) was to

William Wolfskill, who was living in Los Angeles, and it was his brother John who began planting vines and trees.

One of the first settlers in the area was Frederick Babel, a farmer, who arrived in 1849, near the town of Clarsksburg. Apparently Babel Slough east of the Yolo Bypass Wildlife Area was named for this early family. Another early settler was J. H. Glide who purchased a large portion of the Yolo Wildlife Area in the 1870s (additional discussion on the Glide Family is provided below). During the early 20th century farmers and ranchers were attracted by the rich fertile soil; however, farming was difficult because of yearly flooding that occurred until the 1920s when higher levees and a system of canals brought flooding more under control (Hoover et al. 1990).

LAND RECLAMATION AND FLOOD CONTROL

Most immigrants traveling to the gold fields of the Sierra Nevada foothills from San Francisco in the mid 19th century sailed through the Delta waterways upriver to Sacramento, marveling at the rich tule marshes and forests surrounding the Sacramento River. Some of these travelers realized that the true gold of California lay in these soils. Settlements and farms were established on the natural levees of the Sacramento River, and often the Yolo Basin was utilized as open rangeland. Seasonal flooding by the Sacramento River repeatedly devastated the burgeoning community of Sacramento, underscoring the need for flood protection. Lands that drained rapidly were quickly reclaimed, but long term flooding prevented further reclamation efforts within the basins themselves.

Laying down the tules in preparation for burning. The spotter on the roof is looking for deep holes.
Photo credit: Sacramento Archives & Museum Collection Center

The Swamp Land Act of 1850 ceded all overflow lands to the State to facilitate their reclamation. Limitations to acreage were capped at first at 320, then 640 acres, which were made available by the State for one dollar an acre. If a purchaser could certify he had spent two dollars an acre in reclamation, his purchase price was refunded, and he was given deed to the land. In an attempt to increase this acreage limit, the Board of Reclamation was created in 1861, which authorized the formation of reclamation districts to accomplish the task of more wholesale reclamation efforts. Thirty-two reclamation districts were formed at this time. One project completed during this period was the construction of an eleven and a half mile drainage canal along the trough of the Yolo Basin to Cache Slough. This first incarnation of the Tule Canal was completed in November 1864 at a cost of eighteen thousand dollars. Its intent was to drain the Cache Creek Sinks area, Lake Washington, and Big Lake, near Clarksburg. Winter overflow was drained earlier, making the land available for pasture. The Tule Canal remains to this day along parts of the eastern edge of the Yolo Bypass and is an integral part of the irrigation system of the Yolo Bypass.

More local control of reclamation and flood control efforts was desired, and by 1866 this control was turned over to the counties. At this time, acreage restrictions were removed, clearing the way for speculators. Military script from the Civil War was received at face value, although it could be obtained for a few cents on the dollar. In this way land agents acquired properties sometimes exceeding 100,000 acres. It was charged that the only expense incurred by the purchaser of the Yolo Basin was that of paying witnesses to testify that the land had been reclaimed, so that the owners could get a refund on the amount paid, although less than one sixth of the property actually was reclaimed.

The devastating flood of 1862 was a wake up call to the new settlers of the Sacramento Valley. Extensive levee building projects were initiated with a general strategy of raising all levees along the Sacramento River to contain its flows. It was thought that the increased velocity of the constrained river would wash debris in the river bed out to the Delta and San Francisco Bay, a common scenario in the Mississippi River system. Much of this debris came from hydraulic mining activities, especially prevalent on the Yuba and Bear Rivers. The debris clogged river channels, forcing water overland with disastrous results. The flood of 1878 was one of the worst in valley history and hit Yolo County especially hard: “It is a tale of devastating grain fields, vineyards and orchard; of drowning cattle and houseless settlers seeking refuge in the hills and shelter under the roofs of their more fortunate neighbors” (Yolo Democrat 1879).

A pattern of significant floods followed by periods of increased levee building activity continued for twenty years until a new flood protection paradigm was embraced. This alternative vision included utilization of the natural basins that paralleled the Sacramento River for flood control. This concept was long advocated by William S. Green, Colusa County surveyor, newspaper editor, state assemblyman, ardent states rights advocate, state library trustee, surveyor, General of California, State Treasurer and unofficial “father of California irrigation.” Observing that the Sacramento River channel regularly overflowed its banks and moved water onto the floodplain, he suggested the intentional diversion of these waters into the basins and developed a plan to construct this proposal. The idea was embraced by others of the period including Mr. Treadwell of Woodland who proposed digging a channel from the confluence of the Feather and Sacramento Rivers through the trough of the Yolo Basin, passing east of Maine Prairie and continuing on to Suisun Bay. The *Sacramento Bee* joined in the chorus insisting that a bypass canal should be the primary means of flood control.

By 1897 the Elkhorn Weir was constructed which diverted Sacramento River flows into the Yolo Basin. Located on the west bank of the Sacramento Rive six miles below the mouth of the Feather River, this weir remained in operation until 1917.

Early in the 20th century, the U.S. Geological Survey recognized the wisdom of Green’s observations and proposals and confirmed that the Sacramento River Channel was inadequate to handle massive flows.
The Sacramento River Flood Control Project was adopted as part of the Flood Control Act of 1917, making the federal government responsible for flood control. Construction of the main levees along the Yolo Bypass began that same year.

Water flowing over the Fremont Weir

The Fremont Weir was constructed in 1929, creating a fixed wall to serve as the main inlet to the newly constructed Yolo Bypass. This concrete structure is 10,000 feet long and has an elevation of 33.5 feet at its crest. To this day, whenever the Sacramento River reaches this elevation at the weir, water begins to flow into the Yolo Bypass.

Two features of the Yolo Bypass that were not part of the original design but were included in the construction were the Sacramento Weir and Sacramento Bypass. The weir was built by the city of Sacramento in 1916 to divert the flows of the American River into the Yolo Bypass and has the capacity to move 112,000 cubic feet per second of water. It is manually opened by DWR when the Sacramento River reaches an elevation of 28 feet. After the weir is opened, the Sacramento River curiously flows backwards from the mouth of the American River to the Sacramento Bypass due to the overwhelming flow of the American River.

The Yolo Bypass was designed so that erosion and deposition could be minimized. Rather than run down the middle of the Yolo Basin trough, it was constructed upslope to maintain an elevational gradient from north to south, rapidly delivering water to the Delta. Until the 1940s there was no levee between the current Interstate 80 and Putah Creek, and today there is no levee south of Putah Creek for approximately 6 miles. It was determined that the high ground associated with the alluvial fan of Putah Creek would contain most flows, and this exposed section of land had such poor agricultural potential that sediment deposition could only improve its alkali soils. Ironically, the alkali soils contribute significantly to the biological richness of the area and were an important factor that led to acquisition of the Tule Ranch by the Department of Fish and Game in 2001.

CROSSING THE WETLANDS

Water was the primary means of transport in the mid 19th century. Areas in close proximity to navigable waters served as nuclei for the emerging farming communities. Maine Prairie, near the south end of the Yolo Bypass, owed its existence to its location along the south bank of Cache Slough. For several years it was one of the busiest shipping ports in northern California. The flood of 1862 devastated Maine Prairie, bringing water up to 12 feet deep to its streets. The town’s fate was sealed with the arrival of the railroad in California and Maine Prairie faded into memory. A letter from Maine Prairie in 1875 captures the profound changes occurring in the Yolo Basin:

> *“I wish I could remain here the balance of my days. But it is not to be. I am preparing to take my departure. Farewell thou beautiful Maine Prairie. With tearful eyes, and heart I bid you “adieu.” No longer will I be able to sail down the fair bosom of the peaceful water of Cache Slough, and buy fish from Chinese fishermen and on our return swear we ketched every one of them. Never again will I be able to stand all day long in three feet of water in tule during hunting seasons.”*

Until the spanning of the Yolo Bypass by a causeway, there was no year round route across the wetlands of the Yolo Basin. A ferry crossing of the Sacramento River near its confluence with the Feather River accessed the high ground emanating from the alluvial fan of Cache Creek. This crossing of the wetlands was so important that a settlement was established at this location and declared the first county seat. The town of Fremont was short lived too, however, due to the power of the flood waters of 1851 which wiped it off the map.

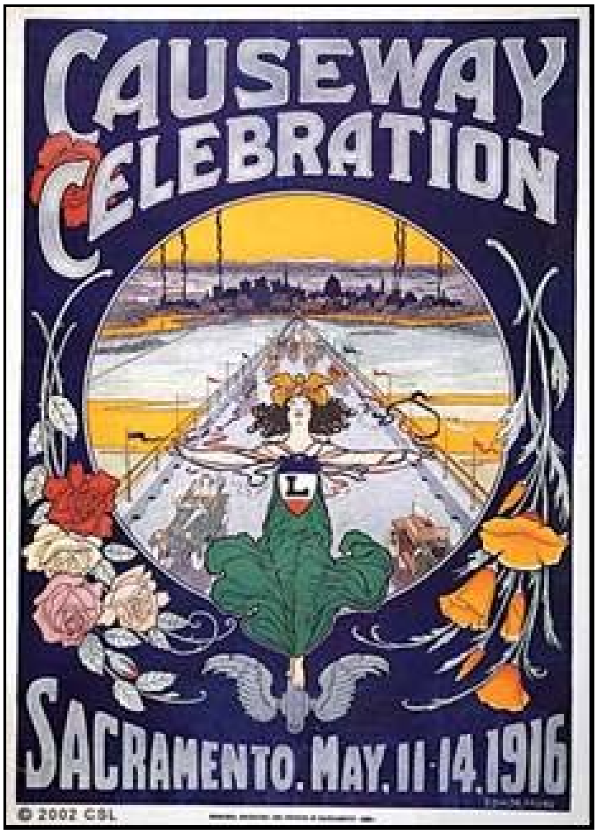
During flood periods, boats were often used to cross the tule marshes of the Yolo Basin by individuals and in some years, ferries provided transportation services between Davisville and Sacramento. In 1868 the *Daily Bee* (forerunner to the *Sacramento Bee*) reported the following:

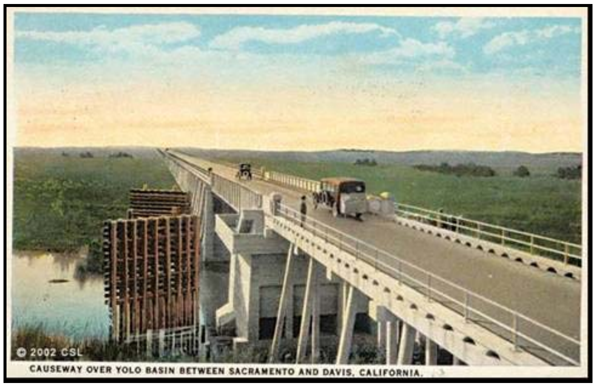
> *"Almost Drowned - About 9 o'clock this morning John and Bill HOLMES, with their Whitehalf boat, started from Washington, Yolo County, with four passengers and some freight for the Tule House, on the west of the overflowed district. The water was rough, and when out about a mile they discovered that they could not proceed with safety with so much freight, and the danger became so imminent that they had to throw overboard two kegs of nails, one of lead, etc.; but about the time this was done the boat capsized and all were precipitated into the water. They clung to the boat and began to hallo loudly - so loudly that persons on that side and on this, also, heard them. W. S. HUNT, who was in Washington of this city, and Mr. HOYT, were among the first to give the alarm; and the result was that three boats started to the rescue. They found all clinging to the boat, but some of them were nearly lifeless - as they had been in the water for about an hour and were chilled. They brought them ashore and put them to the fire, rubbed them and administered restoratives. All are now doing well, save DOOLY, one of the passengers, who remains very low."*

One ingenious dry land route was the Yolo Plankroad. This wood plank road extended from the Sacramento River to the Tule House, and was four and one-half miles long. It was built in 1855 and crossed the Yolo Basin about 3 miles north of Washington, ending about 5 miles southeast of Woodland at the Buckeye Road. This road was located near the far northern boundary of the current Wildlife Area. The wooden plank road was built to enable travel across the tules during the winter and spring months, but even this route was often interrupted by winter floods. On the west side, the Tule Plankroad ended at the Tule House, a structure built on stilts which served as a early stage stop and hotel. This site is currently near the southeast corner of the City of Davis Wetlands. The Tule House was also the site of a dairy operated by a Mr. Enos. With 80 to 100 cows, Mr. Enos specialized in manufacturing cheese and is reputed to have made some of the finest cheese in California. His cattle spent the summer foraging in the tule range of the Yolo Basin. Unfortunately, the Tule House was destroyed in the flood of 1862. The ill conceived plank road was replaced by the Tule Jake Road which allowed travel across the Yolo Basin during the dry season. The course of this road through the tules was uncertain; its path following the tracks of the first wagon to make it through

Crossing the Yolo Basin on the Tule Jack Road in 1913
Photo courtesy of Bud Rossi

Construction of the Yolo Causeway – 1915





The newly constructed Yolo Causeway – 1916
Photos Credit: California State Library

The Modern Day Yolo Causeway over a Flooded Bypass

Message rocks on west side of Yolo Bypass

CAUSEWAY

In the 1890s the first commercial automobiles began to arrive in the Sacramento region and by July 1911, in what can only be called an “Auto Frenzy,” Sacramentans and others in the region were buying seventy-five autos per day. This large influx of automobiles required a network of paved roads to allow for travel, leading to construction of new roads throughout the region. Perhaps the best symbol of the growing network would be the completion of the Yolo Causeway in 1916.

The completion of this wood and concrete viaduct was dedicated with the “Causeway Celebration” on May 11 through 14. The Causeway would be a key local component in the completion of a National Road linking by automobile, the east and west coasts, right through Sacramento and Davis and across the center of the nation, identified as the “Lincoln Highway” (Sacramento History Project 2006). This structure was replaced by a six lane structure in 1963, and the former crossing was buried in place, and remains to this day just under the surface of the Causeway Unit.

The present day I-80 passes through the Causeway Unit of the Yolo Wildlife Area in the same approximate location of the first causeway built back in the early 1900s.

In 1994 the Yolo Causeway was officially designated the “Blecher-Freeman Memorial Causeway.” Roy P. Blecher and W. Michael Freeman were veteran California Highway Patrol officers shot to death during an enforcement stop on Route 80 near the Yolo Causeway in the early morning hours of December 22, 1978 at the hands of an armed felon.

Today the Causeway is used by over ten million people per year, many commuting on a daily basis between Yolo County and the Sacramento Area. During winter mornings, they are often greeted by thousands of waterfowl feeding in the rice fields in the Yolo Bypass.

On the west side of the Yolo Bypass immediately south of the Causeway lie the message rocks. These rocks are located on the western slope of the exterior levee of the Bypass and for many years have been rearranged by local fraternities, sororities or other groups to spell out messages or depict symbols.

RAILROAD

The area where the Wildlife Area headquarters is located on Chiles Road was once part of the Swingle Ranch, established by George Hutton Swingle in 1858. Mr. Swingle purchased 1,900 acres and operated a dairy on site. When the Central Pacific Railroad requested to split the property with the construction of the new railroad, Mr. Swingle obliged. For many years, the train stop in this area was known as the Swingle Station and was an important agricultural export point.

The railroad was constructed between 1866 and 1868 and was purchased by the Central Pacific Railroad in 1871, following construction of the transcontinental route. The Southern Pacific acquired the line in 1884; however, under public resentment of a possible monopoly, the route west from Sacramento continued to operate under the corporate California Pacific Railroad. Union Pacific later purchased all of the Southern Pacific Lines in 1996.

Trestles being rebuilt in 1950s

The remains of another rail system pass through the Yolo Wildlife Area. First organized in 1913, the Oakland, Antioch, and Eastern Railway provided high speed passenger service between San Francisco and Sacramento. The system was reorganized into the San Francisco-Sacramento Railroad in 1919 and was purchased by the Sacramento Northern in 1928, forming a route 184 miles in length, extending service from Sacramento to Chico. This was an electric train that interestingly, was placed on a barge to cross the Suisun Bay. To get across the Yolo Bypass, the train traveled on trestles. These trestles collapsed in 1951. The tracks were rebuilt upon large mounds, bridged by shorter trestle spans.

These mounds still exist on the Tule Ranch in the vicinity of the Lisbon Weir. Passenger service was discontinued in 1940. In 1953, Sacramento-Northern's ferry (the Ramon), which was used to transfer trains across Suisun Bay, was also retired (Bay Area Electric Railroad Association 2006) and the route north to Sacramento became a secondary line. The Yolo Shortline continues to operate on the route from Woodland to West Sacramento, while other segments have been taken over by Sacramento Regional Transit, Bay Area Rapid Transit, and the Western Railway Museum (Vantine n.d.).

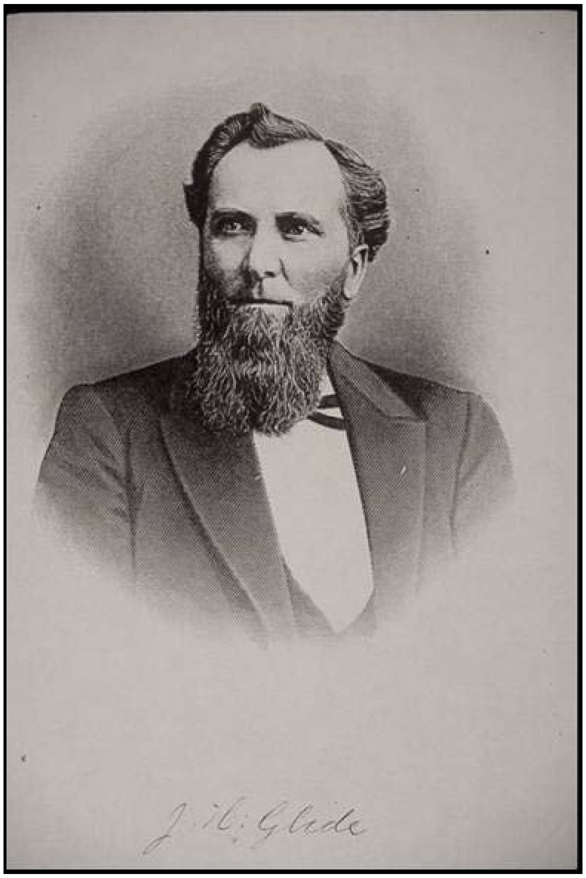


Photo of J.H Glide

THE GLIDE FAMILY

Joseph Henry Glide came to California from England in 1854, and was a prominent resident of Sacramento. He described himself as a capitalist who was largely interested in swamp and overflow lands. Mr. Glide developed ranches in several counties, including extensive holdings in the Yolo Basin. For a time, he operated the Freeport Ferry which crossed the Sacramento River 1 ¾ miles north of Freeport. In 1871 he married Elizabeth "Lizzie" Helen Snider who was 17 years younger. Their son Thornton S. Glide was born in 1881. Joseph H. Glide constructed systems of levees in the Yolo Basin, reclaiming this land for grazing. His ranches specialized in pure-bred shorthorn cattle and French merino sheep. Mr. Glide was the first person to bring registered shorthorn and Hereford cattle into Yolo County. Mr. Glide was one of the first three original exhibitors at the California State Fair. He died in 1916, at which time his widow took over the responsibility of managing his large business. She did so very successfully.

Joseph H. Glide had homesteaded on property west of Davis where he developed a home ranch for the various Glide properties. This home ranch was given to Thornton as a wedding present in 1908 when he married Margaret

Sinclair. In 1910 Thornton purchased his father's shorthorn herd and formed Hillcrest Stake Farms. A year later, he purchased his brother Joseph Henry's herd of shorthorns. These were the cattle grazing the Glide property in the Yolo Basin. Much of the farm work on the ranch was accomplished through the use of powerful Percheron horses. These draft animals remained on the lower portions of the Tule Ranch into the 1950s.

The Umbrella Barn was built over 100 years ago

It was probably Thornton who constructed the "Umbrella barn" about a mile north of the southwest corner of the ranch. This magnificent structure was built around 1913 on the highest point of the ranch. The presence of square nails in the barn dates it to an era prior to 1906, the last year these nails were sold. The intent was to provide refuge for the livestock during high water. Mr. Glide was well known in Davis for his blue Cadillac which he used to haul livestock in a trailer. Thornton S. Glide continued the family management of the property until his death in 1955.

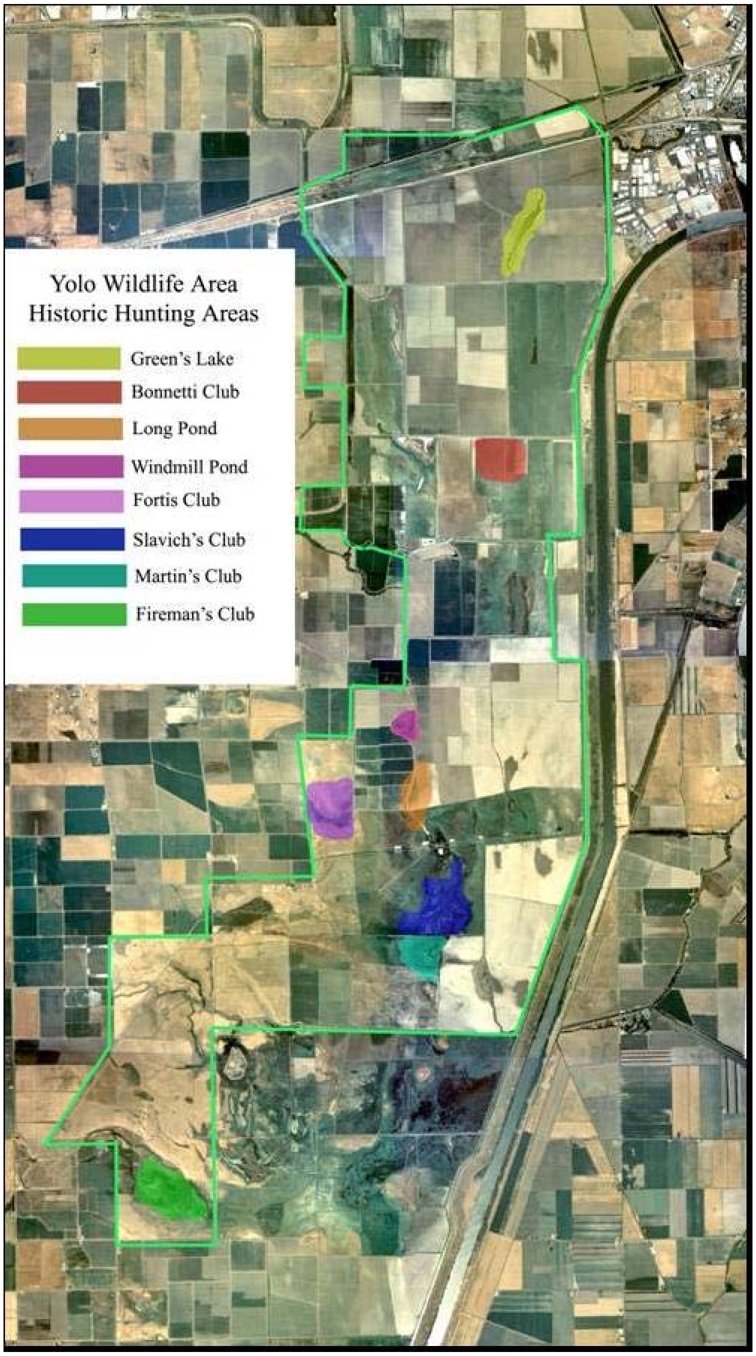
Thornton "Tony" (pronounced "Tawny") Snider Glide, Jr. was born at the home ranch and was a rancher from a young age. He married Katrina "Scatter" Dangberg Glide in 1954 and the couple is still fondly remembered in the Yolo/ Solano countryside. Upon the death of his mother in 1959, Tony and his sister Peggy Glide Colby assumed control of the 20,000 acre farming and grazing operation. Just as his parents, Tony and Katrina lived on the home ranch west of Davis while Mrs. Colby lived in Pasadena. Tony and Katrina Glide held the Tule Ranch very dearly and considered it the traditional home of the Glide properties. Tony pursued a series of unique arrangements to help take care of the Tule Ranch property. Tony passed away on July 10, 1995, followed shortly by Katrina nine days later. Most assets were placed in a trust and, in 2001, the Tule Ranch, Causeway Ranch and Geiberson Ranch was acquired from the Glide Trust (see Chapter 2, "Property Description").

Photo of Thorton S. Glide Jr.

WATERFOWL AND HUNTING

The natural resources of the Yolo Basin sustained native people for centuries. Among the most valuable of these resources were the enormous numbers of waterfowl that annually came to the marshes of the Yolo Basin to spend the fall and winter months.

Beginning in the middle of the 19th century, waterfowl hunters plied through the wetlands and harvested a seemingly endless supply of waterfowl. These birds became a major food source for the new settlers of the region. Many of the finest restaurants in the San Francisco Bay Area and Sacramento served wild fowl provided to them by market hunters. A number of accounts help characterize some of the past hunting times that current hunters may appreciate.



Historic Yolo Bypass Hunting Areas in the Yolo Bypass Wildlife Area

One of the most well known market hunters was a man named John Patterson who was born in the town of Washington, which today is part of West Sacramento. He sold birds to merchants in San Francisco. One receipt from 1903 documents Mr. Patterson being paid $13.20 for 73 teal of two species, three mallards, one canvasback, four sprig, one wigeon, and four lesser white geese. Patterson did most of his hunting in the Yolo Bypass in a spot he referred to as the "dobe hole." He often shipped his birds to the Bay Area by flagging down west bound trains at the Swingle Station, once located near the corner of Roads 32A and 105.

Patterson carved fine decoys out of redwood. They usually depicted male pintail or "bull sprig" as they are still known to hunters. He also made boats out of redwood, specially built to ply the big water of the Yolo Basin and Sacramento River. It was not uncommon for Mr. Patterson to row from Broderick to Rio Vista and back in order to hunt waterfowl in the Delta. Mr. Patterson carved decoys until the day he died in 1937.

Seth "Tiny" Barry hunted ducks with John Patterson and followed Patterson's decoy style of bull sprig with high necks and an alert posture. Tiny hunted the tule swamp west of Sacramento, more specifically at Green's Lake. This lake is found in the Causeway Ranch Unit of the Yolo Bypass Wildlife Area. Tiny would take his family out to Green's Lake and camp in an elevated shack.

Milton "Chick" DeRiso hunted from sink boxes in the Yolo Basin starting in the 1930s. He recalled his father telling him to record the huge flights of waterfowl in his mind, because "You'll never see that again!" He also remembered crossing the Yolo Basin in a Model T Ford on the Tule Jake road.

Many of these early hunters used the Anchor Drug Store on K Street in Sacramento as a source of hunting equipment and a general meeting place, similar to the role Broadway Bait currently serves for local hunters. Anchor Drug was run by Mr. Joseph Garibaldi and later his son, Amiel "Ame" Garibaldi.

A hunting program was managed on the Glide property for many years. In the later years, Tony Glide would hand out hunting permits free of charge that were good for the entire year. These permits were valid only for pheasant and there were a limited number handed out each year. Soon the number of permits numbered 200. People would call earlier in the season to try to get their permits, much to the annoyance of Mrs. Glide. Most of this activity was in pursuit of ring-necked pheasants, but some hunters enjoyed other privileges. Of course there were also a few individuals who tried to access the property illegally for hunting activity. Over the years, the Glide property was patrolled by a series of interesting characters.

One of the ranch managers from the 1930s was a gentleman named Melt Mason. Mr. Mason was a cattle man who also patrolled the ranch for poachers. One morning he came upon a group of hunters from Sacramento hunting illegally in a pond. As Mr. Mason approached on horseback, the hunters saw him coming and shot his horse out from under him.

Tony Glide ran a pheasant hunting program on the west side of the duck club road from the Road 106 gate to the Umbrella Barn. Some of this area was farmed in milo, corn or other crops and after harvest was opened for hunting.

Wayne Brock reports that one time he was hunting the cornfield across from the Senator Outing duck club with the county sheriff. They had a great morning and killed 12 birds, a legal limit in those days. The game patrolman Warren Sievers saw all those birds and on the spot declared that “from now on the limit on the ranch is 4 birds.”

Other hunters had the special privilege of hunting waterfowl on the Ranch. The Wildlife Area property was home to several hunting areas that were loosely organized as duck clubs prior to the land’s acquisition by the state. Many were located on the Glide Tule Ranch and existed primarily due to the good graces of Tony Glide. In the lower sinks area were the Martin Brother’s pond and Slaviches’ pond. Bob and Don Martin did much of the farming on the Tule Ranch. Bob Martin flew a Piper Cub airplane and was a frequent sight flying low over the marshes of the Yolo Basin. Their pond was just north of the current southern boundary of the Tule Ranch near the toe drain.

The north pond in this area was hunted by the Slaviches. Dink Slavich was the patriarch of this clan, later hunting with sons Ed and Don Slavich. Dink originally hunted with “old man Garibaldi,” perhaps one of the proprietors of the aforementioned Anchor Drug Store in Sacramento. Slavich’s pond has been referred to as “the best duck pond in the country.” In 2004, Dick Goodell, a long time hunter on the Glide In Ranch declared he saw more ducks in this area than he’d ever seen in his life.

Bill Fairfield at Dawson’s in 2006

In earlier times, no one wanted to respond to wildfires in the Yolo Bypass. For the Dixon firemen, it was beyond the frontier of Solano County, for the City of Davis, it was too far out of town. It was No Man’s Land. With Bill Fairfield at the helm, the volunteer firemen of Dixon began to respond to wildfires in the area, at times battling ferocious blazes that raced through the Bypass fed by north winds. Tony Glide was so enamored with their efforts that he gave them control over an entire section of land with the assurance that “nobody will bother you out here.”
Mr. Fairfield ran the hunting program and anybody in the fire department could hunt ducks or pheasants on the property. Over the years, probably 60 to 70 people utilized this property. The deal was based solely on the word of Tony Glide and Bill Fairfield.

Mr. Fairfield formed the “No Man’s Land” Fire District and was in charge of operating the newly christened “Fireman’s Duck Club.” Whenever a fire broke out on the Ranch, Tony would personally call Mr. Fairfield and their trucks would be on the way. They fought the fire that eventually burned down the Sacramento Northern trestles. They also responded to medical emergencies and assisted with the evacuation of livestock during flood events. Mr. Fairfield modeled the Fire District's badge after that of Los Angeles County, and gave one to Tony Glide.

As for the club, the firemen set out to create levees and install water control structures to capture water in the historic slough found on the property. The end result was, as Bill Fairfield described, a "duck hunter's paradise."

The remains of the Fireman's Clubhouse

The firemen sank a handful of barrels to serve as duck blinds. They got a line on a caboose that was reasonably priced. This was hauled to the southwest corner of the property and served as the clubhouse. Later a trailer was brought in, connected to the caboose in an L shaped fashion and now they had a duck club headquarters with sleeping quarters in the caboose and the kitchen and social area in the trailer. Ironically, both the caboose and trailer were lost in a fire. They were replaced by a house built on pilings to stay above the floodwaters. Many good times were enjoyed in these structures until Bill Fairfield's retirement from the fire department in 1985. At that time, the relationship between the No Man's Land Fire District and the Dixon Fire Department was severed. The platform and pilings of the Fireman's Duck Club still remain in the southwest corner of the Tule Ranch.

North and east of the Tule Ranch headquarters lies the Fortis Club. Pete Fortis was farming land west of the ranch boundary, and his drain water would come onto the ranch. These wet areas improved the cattle forage, and soon Mr. Fortis and Tony had an arrangement. If he continued to irrigate parts of the ranch with his drain water, Mr. Fortis could use part of the ranch for duck hunting. Such was born the Fortis Club.

A little further north there is a small grove of mostly eucalyptus trees with an unusual treehouse structure. This treehouse belonged to Mr. Jack Howarth who was a veterinarian in Davis. Mr. Howarth built the tree house and hunted ducks in a pond approximately 200 yards north of the grove. This was known as the Windmill Pond and it still exists, though the windmill does not.

Directly east of the main lift in current ponds 6D and 2A of the Central Unit, was the Bonnetti Club. Like many of the hunting clubs, the clubhouse consisted of trailer houses brought in for the season. These men also hunted around Green's Lake.

Tony Glide was much more tolerant of hunting on the Tule Ranch than Mrs. Glide. When Wayne Brock visited Mrs. Glide in the hospital prior to her death, she said," If I outlive Tony, your hunting is all done." Sure enough Tony passed away first and the hunting stopped. Warren Sievers no longer checked permits and the Slavich's hunting days were through on the ranch.

Immediately south of the Tule Ranch near the toe drain are a cluster of private duck hunting clubs that share a close working relationship with the ranch and the Department of Fish and Game. Many are in state wetland easement programs and most get their water from the Tule Ranch irrigation system. These clubs were once part of the original Glide property. The first club established in this area was the Senator Outing duck club, reputedly they once had a senator among their members. This club was formed by Chris Fulster Sr. who also produced unique sheet metal decoys that were attached to a stake and pressed into the mud. Later he established the Glide In Ranch club to the east against the toe drain. His son Mr. Chris Fulster Jr., has hunted ducks in the Yolo Basin for 50 years or more. As the proprietor of Broadway Bait in Sacramento, Mr. Fulster has filled a niche once occupied by the Anchor Drug Store in an earlier time.

Other clubs in this area include the Skyrakers, H- Pond Channel Ranch and Bull Sprig which counts longtime Tule Ranch cattle man Bob Brown as one of its members.

The Skyraker's Duck Club once counted Roy Regals as a member. Mr. Regals is forever remembered as "Wrong Way Regals" because of one play in the 1929 Rose Bowl. As Center for the University of California, Mr. Regals picked up a fumble and, after being hit and spun around, began running for the wrong end zone. He was fortunately stopped by his own players, but Cal lost to Georgia Tech by a score of 8 to 7.

With the state acquisition of the Glide property, one of the last vestiges of Yolo Basin wetlands was made available for public use. In 2003, Green's Lake was once again the scene of waterfowl hunting as it had been for many years.

3.6.4 CULTURAL RESOURCES OF THE YOLO WILDLIFE AREA

EDAW's research into cultural resource issues for the Yolo Wildlife Area began with a record search of known pertinent cultural resource information as it relates to the Yolo Wildlife Area. This search was conducted by the Northwest Information Center (NWIC) of the California Historical Resources Information System (CHRIS). The record search included, but was not necessarily restricted to, a review of select publications and sources listed in the following:

- *National Register of Historic Places (National Park Service 1996)*
- *California Register of Historical Resources (State of California 1976)*
- *California Points of Historical Interest (State of California 1992 and updates)*
- *California Historical Landmarks (State of California 1996)*
- *Historic Spots in California (State of California 1990)*
- *Directory of Properties in the Historical Resources Inventory (State of California)*
- *NWIC Historic Resources Map*
- *California Place Names (Gudde 1969)*
- *California Department of Transportation Bridge Inventory*
- *1852 GLO Plat Maps (T8N,R3E and R4E; and T7N,R3E and R4E)*
- *Courtland 15' USGS Quad, 1908*
- *Davisville 15' USGS Quad Map, 1907*

Historic maps provide limited information on structures and features located within the Yolo Wildlife Area. A review of the 1852 GLO Plat maps do not indicate the presence of historic roads, structures, or other features, but do indicate that at that time a large portion of the Yolo Wildlife Area was characterized by swamp and overflow lands. The 1908 15' USGS Courtland quadrangle shows a structure in the eastern edge of Section 9, which matches the location of the Glide Ranch, now known as the Tule Ranch. A north south road is also depicted in Sections 3 and 34. With the exception of the Southern Pacific Railroad no features or structures are depicted within the Yolo Wildlife Area.

The directory of Properties in the Historical Resources Inventory lists the Olson Family house at the east end of Road 34A, and the location appears to match that depicted on the 1908 USGS Courtland quadrangle mentioned above.

Several studies, which are summarized in Table 3.6-1, have been conducted within and directly adjacent to the Yolo Bypass Wildlife Area. All of these documents and reports are on file at the NWIC. With the exception of a few all have been linear surveys which have resulted in the inventory of only a very small percentage of the area.

Table 3.6-1
Summary of Previous Cultural Investigations in the Vicinity of the Yolo Bypass Wildlife Area

Report Title	NWIC File Number	Author and Date	Distance to Project Area	Management Unit
Investigations Within the Yolo Wildlife Area				
Archaeological Site Record CA-YOL-117	---	Johnson (1968)		Causeway
Sacramento Metropolitan Area Cultural Resources Survey, Sacramento and Yolo Counties, California (Contract No. DACW0590P2429)	S-12191	Glover and Bouey (1990)		Northeast, Causeway Ranch North
Archaeological Survey of the Supplement to the Sacramento Metropolis Area Cultural Resources Survey, Sacramento and Yolo Counties, California	S-12467	Berg and Bouey (1991)		Northwest, Los Rios
Addendum to the Report on the Archaeological Survey for the Proposed SMUD Gas Pipeline between Winters and Sacramento, Yolo and Sacramento Counties, California	S-15334	Waechter (1993)		Northeast, Causeway, Causeway Ranch, Tule Ranch
Report on the Third Phase of Archaeological Survey for the Proposed SMUD Gas Pipeline between Winters and Sacramento, Yolo and Sacramento Counties, California	S-15403	Waechter (1993)		Causeway, Tule Ranch
Cultural Resources Monitoring Report for the SMUD Cogeneration Pipeline Project	S-17674	Woodward-Clyde Consultants (1995)		Causeway, Tule Ranch
Archaeological Surveys: Sacramento River and Major and Minor Tributaries, Bypass Revetment Project	S-17955	True and Jensen (1974)		Causeway Ranch
Cultural Resources Assessment within Reclamation Districts 537, 900, 765, 999 and Maintenance Area 4, Yolo County, California	S-19740	Peak (1997)		Northeast
Cultural Resource Inventory Report for the Williams Communications, Inc. Fiber Optic Cable System Installation Project, Pittsburg to Sacramento, California	S-22464	Jones and Stokes Associates, Inc. (1999)		Tule Ranch, Causeway
Volumes I, II, and III: Final Cultural Resources Inventory Report for the Williams Communications, Inc. Fiber Optic Cable System Installation Project, Point Arena to Robbins and Point Arena to Sacramento, California	S-22736	Jones and Stokes Associates, Inc. (2000)		Causeway
Cultural Resources Survey for the Level (3) Communications Long Haul Fiber Optics Project, Segment WS01: Sacramento to Oakland	S-22817	Nelson, Carpenter and Costello (2000)		Causeway
Cultural Resources Assessment Report SFPP, L.P. Proposed Concord to Sacramento Pipeline Project	S-25311	Martin and Self (2002)		Tule Ranch, Causeway North
Cultural Resources Assessment Report Proposed Construction Yards Nos. 1, 2, 3, and 4, SFPP L.P. Concord to Sacramento Pipeline Project	S-28381	Martin, Brown, and Self (2004)		Causeway

Table 3.6-1
Summary of Previous Cultural Investigations in the Vicinity of the Yolo Bypass Wildlife Area

Report Title	NWIC File Number	Author and Date	Distance to Project Area	Management Unit
Investigations Adjacent to Yolo Wildlife Area				
Cultural Resources Reconnaissance: Sacramento River Deep Water Ship Channel (Collinsville to Sacramento)	S-5055	Seldomridge and Seldomridge (1976)	¼ mile	
Southport GPA/EIR. (letter report)	S-5699	Putman (1982)	¼ mile	
Intensive Cultural Resource Survey and Literature Review for the Sacramento Deep Water Ship Channel Project, Yolo and Solano Counties, California	S-7295	Werner (1985)	¼ mile	
Sacramento Deep Water Ship Channel, Cultural Resources Survey and Literature Review, Yolo and Solano Counties, California	S-7448	Werner (1985)	¼ mile	
A Cultural Resources Study for Environmental Impact Report for Industrial Planned Development 37 of the Port of Sacramento, Yolo County, California	S-11920	Derr (1990)	¼ mile	
A Cultural Resources Study for the Riviera Lakes EIR, Yolo County, California	S-12650	Cultural Resources Unlimited (1991)	¼ mile	
A Cultural Resources Study for Villages of Southport ADEIR, Bevan Road at Jefferson Boulevard, West Sacramento, Yolo County, California	S-13551	Cultural Resources Unlimited (1991)	¼ mile	
Archaeological Survey Report of the proposed Southport Wastewater Treatment Plant, West Sacramento, California	S-16932	Supernowicz (1993)	¼ mile	
An Archaeological Assessment within Reclamation District 2035, Yolo County, California COE Water Basin System Designation SAC 05 DACW05-97-P-0465	S-20005	Shapiro (1997)	¼ mile	
An Addendum Archaeological Assessment within Reclamation District 2035, Yolo County, California COE Water Basin System Designation SAC 05 DACW05-97-P-0465	S-20006	Shapiro, and Syda (1997)	¼ mile	

Source: Northwest Information Center, Sonoma State University, Rohnert Park 2006

These investigations have resulted in the identification of five resources (two prehistoric archaeological sites, an historic farmhouse with associated outbuildings, the remains of the historic Sacramento Northern Railroad, and the route of the Southern Pacific Railroad) within the Yolo Wildlife Area.

None of these resources have been evaluated for CRHR significance to the CRHR or NRHP eligibility.

Umbrella Barn in the Tule Ranch Unit

All of the formerly documented resources are summarized below (by site record), and a complete list of resources by management unit is presented in Table 3.6-2.

CA-YOL-172

When recorded in 1991 the site appeared to have been extensively impacted by farming operations. The investigators indicated the presence of flaked stone artifacts, baked clay, and a burned bone fragment. Density of the material was quite light, averaging 4 specimens per 10 meters square (Bouey and Bethard 1991). While a formal assessment has not been conducted, impacts from farming coupled with the paucity of the archaeological deposit suggests that the site may lack the necessary integrity to be considered significant/eligible. Because of ongoing agricultural impacts in the vicinity of the locale, it is recommended that the site be formally evaluated for significance/eligibility.

CA-YOL-117

In 1964 this site appeared as a low mound, approximately 5 feet above the surrounding area. Excavations conducted in 1964, prior to the area being leveled for farming, resulted in the recovered of four burials, and artifacts associated with the Emmergent Period (Johnson 1971). Given the continued impacts from farming operations beginning in the 1950s and the impacts of salvage excavations in 1974, it is doubtful that further archaeological remains are present, and if so the integrity may have been extremely compromised. Because of ongoing agricultural impacts in the vicinity of the locale, it is recommended that the site be formally evaluated for significance/eligibility.

Table 3.6-2 Cultural Resources Documented in the Yolo Bypass Wildlife Area			
Management Unit	Cultural Resources	Significance/Eligibility	Management Recommendation
Causeway Ranch Unit	Southern Pacific/Union Pacific Railroad	Not evaluated	No further management
Causeway Unit	Southern Pacific/Union Pacific Railroad	Not evaluated	No further management
	CA-YOL-117	Excavated	Confirm no remains are present
North Unit	--	--	--
Northwest Unit	--	--	--
1,000 Acres Unit	--	--	--
Northeast Unit	CA-YOL-172	Recommended Not Eligible	No further management
Central Unit	--	--	--
PG&E Purchase	--	--	--
West Unit	--	--	--
Pacific Flyway Center	--	--	--
Los Rios Unit	--	--	--
Parker Unit	--	--	--
Tomato Field 29	--	--	--
Tomato Field 38	--	--	--
Los Rios WRP	--	--	--
South Unit	--	--	--
Tule Ranch Unit	Sacramento Northern Railroad	Recommended Not Eligible	No further management
	Glide Ranch Complex (Tule Ranch HQ)	Not evaluated	Continued management
	Umbrella Barn	Not evaluated	Continued management
	Treehouse	Not evaluated	Continued management
	Fireman’s	Not evaluated	Continued management

CA-YOL-195H (P-57-000422)

Portions of the Sacramento Northern Railroad have been documented both within and outside of the project area (see Scott 1999; Jones and Stokes 2000; Martin et al. 2001; and Martin 2004). Within the Yolo Wildlife Area, the route appears as an earthen berm with associated trestle remains. All of the rails and ties have been removed and many of the rails can be found throughout the area, used for such purposes as fence posts, cattle chutes, and pump station support structures. Research has indicated that the integrity of the earth work has been severely impacted by erosional processes. A low density historic artifact concentration was discovered near the Saxon Rail Stop during pipeline construction associated with the Kinder Morgan Concord to Sacramento Pipeline Replacement Project. The remains were documented, but not assessed for significance (Martin 2004). As mentioned above, since the route was abandoned, portions have either been completed dismantled or others have been subsumed by modern transportation systems (e.g., BART and Sacramento Regional Transit). A record documenting a portion of the route within the Yolo Wildlife Area indicated that because of a lack of integrity the railway does not appear to meet the criteria for inclusion into the National Register of Historic Places (Martin et al. 2001). Therefore, pending the discovery of previously undocumented constituents (i.e., significant archaeological deposits), which may qualify the resource for significance, no further management is required.

P-57-000400

Within the project area the route of the historic Southern Pacific Railroad has been previously documented (Syda 1999), with the route extending to the west to Cordelia prepared by Nelson et al. (1999). While the researchers note that the route has been rebuilt several times during its history, thereby compromising the integrity, it does maintain the original setting. Undoubtedly the route qualifies for eligibility under Criteria a, b, and c for inclusion in the NRHP, and elsewhere portions of the route (i.e., rail segments and depots) are listed on the NRHP.

Glide Ranch (Olson Family House)

A record prepared in 1979 documents a one-story vernacular farm house with rectangular gabled roof and a shed-roofed porch across the front, and that the building was in a state of decay at this time. The exterior is clad with shiplap siding. A well constructed water tank tower structure and corrugated metal structures were associated with the residence in 1979. The record also indicates that although the property is referred to as the Olson residence the property was originally purchased by J. H. Glide in 1879, and that the structure was built shortly thereafter in the 1880s. Beginning in the early 20th century the residence was occupied by the Olson family (Historic Environment Consultants 1980). None of the structures have been evaluated for significance/eligibility. This structure is not on the Wildlife Area property.

3.7 RECREATION AND PUBLIC USE

This section describes the numerous recreation and public use activities and opportunities currently available at the Yolo Bypass Wildlife Area. Primary recreation and public use activities include environmental education and interpretation programs, hunting, fishing, wildlife viewing, nature photography, and hiking.

The following text was developed through a review of literature, relevant websites, program information, the Yolo Bypass Wildlife Area Program History and Overview (Appendix E), maps, and Yolo Bypass Wildlife Area and Foundation staff information.

3.7.1 HISTORY OF PUBLIC ACCESS AND USE IN THE YOLO BYPASS WILDLIFE AREA

The Yolo Bypass Wildlife Area was created through a broad coalition of conservationists, hunters, farmers, business people, elected officials, and local, state, and federal agencies. Work to establish the Yolo Bypass Wildlife Area began in 1989, over 8 years prior to its opening to the public in 1997. Since the inception of the Yolo Bypass Wildlife Area, 24,000 students have participated in the Discover the Flyway program and tens of thousands of visitors from throughout the region have used the area for hunting, fishing, walking, hiking, wildlife viewing, nature photography, and a broad range of environmental education activities for all ages of students, as well as for teachers and the general public. A trail and road network present in the Yolo Bypass Wildlife Area supports these activities.

The Yolo Bypass Wildlife Area is increasingly recognized as a national model for sound ecologically-based integrated resource management and exemplary partnership among many agencies and stakeholders. The Yolo Bypass Wildlife Area is managed by the DFG with education programs and public outreach provided by the Foundation. This mutually beneficial partnership was memorialized in June of 1997 when the Foundation and DFG signed a Memorandum of Understanding (MOU) with DFG recognizing their long-term partnership to provide public outreach and educational programs. The MOU allows the Foundation to use DFG facilities for office space and as a base for programs related to the Yolo Bypass Wildlife Area (California Department of Fish and Game 1997). A copy of this MOU is provided in Appendix D.

3.7.2 EXISTING PUBLIC USE ACTIVITIES AND OPPORTUNITIES

Public access and use of the Yolo Bypass Wildlife Area is an important aspect of its continued success. Visitors come to the Yolo Bypass Wildlife Area with expectations of a certain quality and type of experience that are to be met by use of the public lands, waters, and other facilities. It is the scenic beauty and the abundant presence of wildlife that provide visitors with a high quality, natural outdoor experience. This opportunity is even more valuable, given the proximity of the Yolo Bypass Wildlife Area to the greater Sacramento urban area, providing urban residents with a nearby opportunity to escape urban life and experience a connection with nature, while enjoying first class wildlife viewing opportunities and gaining an understanding of compatible farming and floodway management.

EXISTING FACILITIES

Based on an evaluation of appropriate and compatible uses, DFG has designated different units within the Yolo Bypass Wildlife Area for various public use activities (see Chapter 4, "Compatible Resource Management and Public Uses," for additional detail). Exhibits 3.7-1 and 3.7-2 illustrate the main publicly accessible land areas and facilities. Some lands within the Yolo Bypass Wildlife Area are available and open for activities conducted on foot, such as hunting and wildlife viewing. No overnight camping is allowed within the Yolo Bypass Wildlife Area. Some lands are designated as wildlife sanctuaries and are completely closed to the public. Flood protection is the primary purpose of the Yolo Bypass and all interior lands (i.e., inside SRFCP levees) are closed during flooding (e.g., during Fremont Weir overtopping and/or west side tributary flooding and/or when access roads are impassable).

BUILDINGS AND STRUCTURES FOR PUBLIC USE PROGRAMS

Headquarters

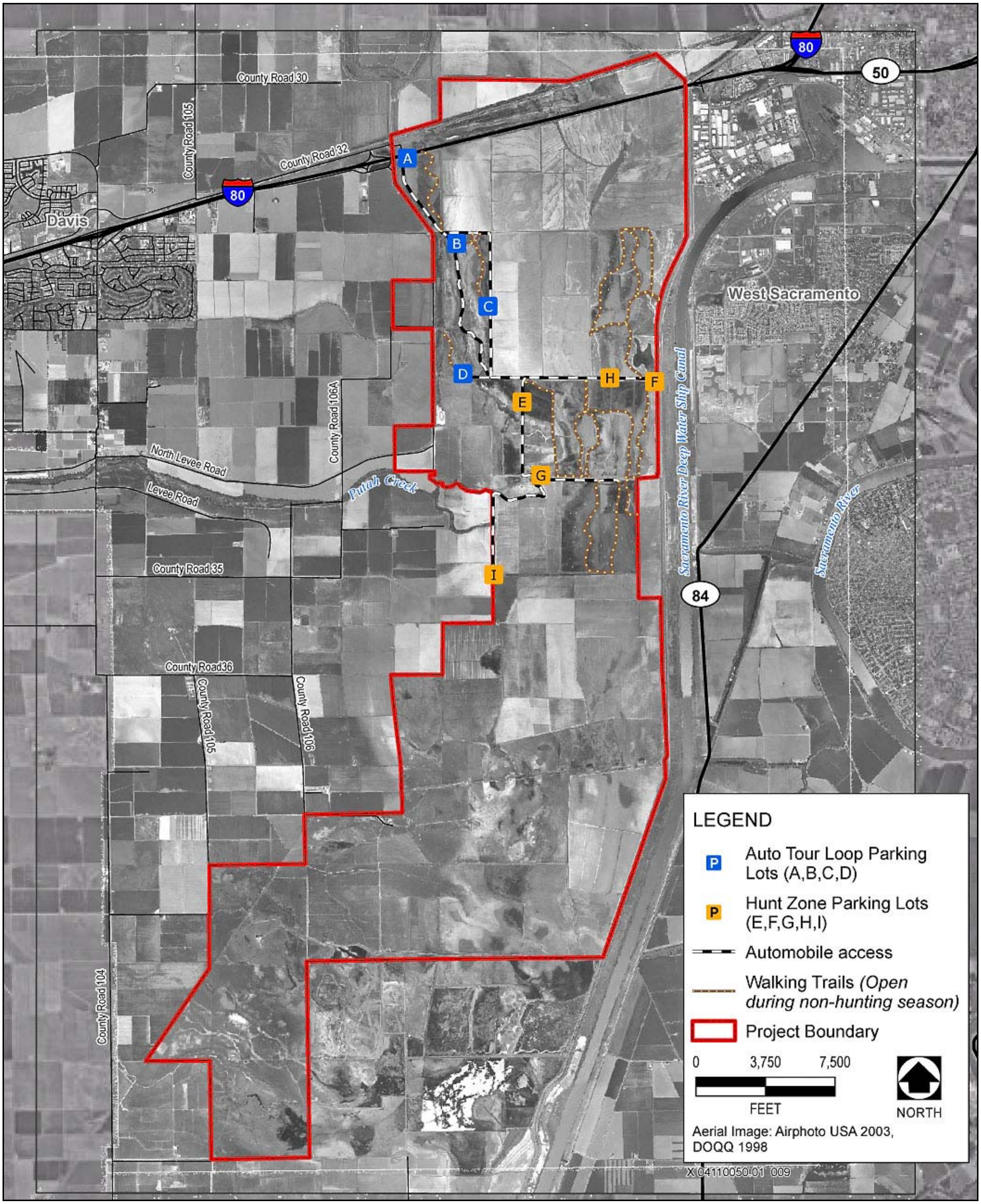
The Yolo Bypass Wildlife Area is currently administered from the DFG headquarters complex at 45211 County Road 32B (aka Chiles Road) one mile west of the Yolo Bypass Wildlife Area. This complex includes a 3-acre demonstration wetland, a residence, maintenance shop, conference room, and office space for employees of both the DFG and Foundation.
The headquarters building conference room serves as a popular place for meetings and workshops for resource agencies. During the winter the room it is used as an activity and lunch room for Discover the Flyway students. It also serves that purpose for special activities such as Marsh Madness and Nature Bowl. The porch surrounding the headquarters building provides cover for activity stations, lunch and for greeting field trip participants.

The headquarters entry way provides a small area for brochures and other program information. It is also used for interpretive displays such as mounted Tule elk antlers, waterfowl suspended from the ceiling and a display case with historic decoys, an insect collection and other wildlife artifacts. The California native landscaping surrounding the building also serves an educational purpose.

The Foundation is headquartered in a 40' by 20' modular office unit behind the DFG Headquarters office. The Foundation program office is located in the headquarters building. The administrative and management staff works in the office unit. Three sheds provide space for storage of educational materials and miscellaneous supplies.

The Yolo Demonstration Wetlands

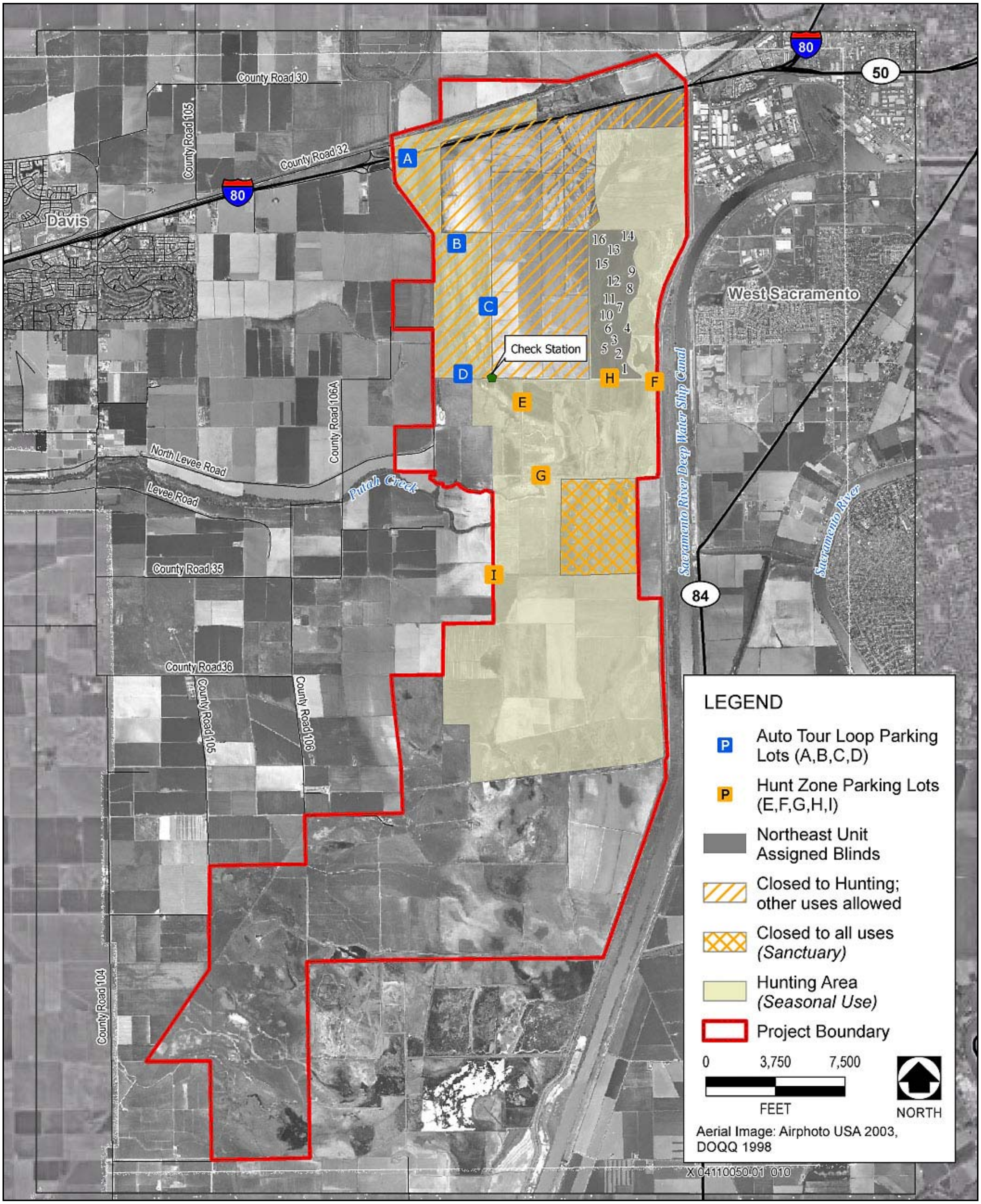
The 3-acre demonstration area was restored from a fallow farm field to a microcosm of Central Valley wetland habitats in the summer of 1998. The land was graded by a volunteer tractor operator, trees were donated by the USACE, and the



Aerial Image: Airphoto USA 2003, DOQQ 1998

Source: Adapted by EDAW 2007

Current Public Use Map of the Yolo Bypass Wildlife Area (2006) **Exhibit 3.7-1**



Source: Adapted by EDAW 2007

Hunting Map of the Yolo Bypass Wildlife Area (2006) **Exhibit 3.7-2**

water system materials were provided by DFG. The installation of the irrigation system was completed by Yolo Basin and DFG staff and a group of boy scouts as an Eagle Scout project. The habitats represented include a seasonal wetland, permanent wetland, willow thicket, riparian forest, native grassland and oak woodland. In 1999 the Foundation and DFG completed a nature trail with a series of five signs interpreting the habitats and the goals of restoration. A Davis area Rotary Club donated an information kiosk located on the edge of the demonstration area. There are two field guides to the plants and animals of the Yolo Bypass Wildlife Area that can be used on a walk through the area. The success of this habitat project is reflected in the fact that over 100 species of birds have been observed on site.

Tule Ranch Headquarters

In addition to two residences, the Tule Ranch Headquarters also includes a complex of corrals used to process livestock. Also found on the Tule Ranch Unit is a large barn thought to have been constructed in the 1930's. This barn known locally as the Umbrella barn may be used as an educational facility for the interpretation of the adjacent vernal pools in the future. The ranch headquarters may also serve as an interpretive facility that will allow students to experience the role agriculture has played in the Yolo Basin.

Hunter Check Station

A mobile hunter check station is operated at the Yolo Bypass Wildlife Area during the autumn and winter hunting season. The check station opens at least two hours before sunrise and provides a base from which to manage the daily hunting activity. Permits are sold and information about the hunting program is exchanged with the public. Currently, a trailer is transported and placed at the southern end of the auto tour route. This trailer is removed at the onset of winter flooding.

Pacific Flyway Center (Proposed Facility)

The proposed Pacific Flyway Center to be constructed on the 69-acre Pacific Flyway Center unit just outside the bypass levee would include visitor parking, exhibit areas, and multi-use meeting spaces for a variety of educational opportunities for school children and visitors from throughout the community and region. Public exhibit areas would depict the natural history of the Yolo Basin and its place in the Pacific Flyway, as well as interpretation of the role of agriculture and flood protection in habitat creation and resource conservation. In June 2006, about 45 acres of the site were restored to representative Central Valley habitats including seasonal and permanent wetlands, riparian forest, and uplands. This complex will serve as demonstration wetlands to educate visitors about the managed and natural habitats found throughout the Wildlife Area with the added benefit that it is located outside the Bypass and not subject to flooding. A 250-foot border surrounds one half of the site to provide demonstration farm fields and an agricultural buffer between the site and adjacent field. There is a three-bedroom residence on this property.

Roads and Parking

Eight miles of gravel roads are currently available for public use. Nine parking lots are located along various parts of the roads and several of the parking areas provide access to the hiking trails and hunting sites at the Yolo Bypass Wildlife Area (Exhibits 3.7-1 and 3.7-2). The roads also allow access through the auto tour route to observe the many types of wildlife attracted to this area.

Trails

The Yolo Bypass Wildlife Area provides approximately 16 miles of unpaved, improved trails for walking and hiking and are mostly used by visitors participating in other primary activities such as hunting, fishing, wildlife viewing, or participating in scheduled programs. Trail locations can be seen on Exhibit 3.7-1. Certain areas are closed to non-hunters during hunting season on open hunting days (Saturday, Sunday, and Wednesday). Trails restricted during the hunting season are all within the designated hunting area and are illustrated on Exhibit 3.7-2. Currently, the only trails and/or roads open to bicycle use are located in the Causeway Unit (See also Chapter 4, “Compatible Resource Management and Public Use”). Additionally, bicycle use in the hunting area is allowed for hunting access purposes. There are currently no trails open for equestrian use.

Signs

The Yolo Bypass Wildlife Area uses four categories of signage to regulate public use and access. These categories include directional, regulatory, informational, and interpretive signs. Some directional signs are located at various intersections inside the Yolo Bypass Wildlife Area to help visitors navigate within the area. Regulatory signs at parking lots inform visitors of allowable activities and restrictions within the respective areas. Signs such as the Yolo Bypass Wildlife Area nameplate adjacent to I-80 inform visitors of the existence of the Yolo Bypass Wildlife Area and to acknowledge the many agencies and organizations that worked to create and formalize the Yolo Bypass Wildlife Area. Interpretive signs/kiosks are located at the DFG Headquarters site and include interpretation of Central Valley habitats and the Yolo Demonstration Wetlands. An additional sign is located at the entrance to the existing auto route and serves as a place to post a map of publicly accessible roads and paths, DFG regulations, and notes regarding upcoming events.

EXISTING RECREATIONAL AND EDUCATIONAL ACTIVITIES

This section provides a description of the various recreational and educational activities currently available at the Yolo Bypass Wildlife Area. The Yolo Bypass Wildlife Area is a unique example of a place where these activities can co-exist with carefully managed multiple land use objectives such as agriculture, flood control, and habitat for native species.

Hunting

Hunting is one of the main forms of recreation currently available within the Yolo Bypass Wildlife Area. Waterfowl and pheasant hunting are the most popular, however, visitors also participate in hunting of other upland game species including dove. See Exhibit 3.7-2 for a map of designated hunting areas throughout the Yolo Bypass Wildlife Area.

September 1 is the traditional beginning of the hunting season and is the opening day of the dove season. This is typically a very busy hunt day at the Wildlife Area. Waterfowl season usually opens in mid October and runs until the end of January or early February. At the Yolo Bypass Wildlife Area, the hunting season often ends or is interrupted by seasonal flooding of the Yolo Bypass.

Table 3.7-1 below lists the game species hunted at the Yolo Bypass Wildlife Area along with hunting seasons, required permits, licenses, stamps and tags.

Table 3.7-1
Yolo Bypass Wildlife Area Hunting Seasons

Species	Days[1]	Required Licenses
Waterfowl, coots, moorhens and snipe	Saturdays, Sundays & Wednesdays	Resident hunting license and daily permit Federal Duck Stamp State Duck Stamp
Pheasant	First 9 days of season and then Saturdays, Sundays and Wednesdays	Resident hunting license and daily permit Upland Game Stamp Daily permit
Dove	Daily during September and only waterfowl and pheasant hunt days during the late dove season	Resident hunting license Upland Game Stamp and daily permit

1 Closed Christmas Day when falls on Saturday, Sunday, or Wednesday hunt day

Source: California Department of Fish and Game 2002a, 2002b, 2002c

The Yolo Bypass Wildlife Area currently maintains 16 duck blinds and one fully accessible blind on the approximate 3,000 acres available for waterfowl hunting. DFG currently allows 40 hunters to roam free plus up to 16 parties in designated blinds on any given hunting day. With the recent acquisition of additional lands, the Wildlife Area will someday have a capacity of over 200 hunters with 38 acres per hunter, at any one time to ensure a safe and positive hunting experience.

Pheasant hunting is currently allowed on approximately 5,000 acres of the Yolo Bypass Wildlife Area. Five designated parking lots are available for use by hunters. Hunters are allowed to use shotguns and archery for hunting. They may also use dogs to assist in hunting. Steel shot is required for waterfowl, coot and moorhen hunting. Lead shot is allowed for pheasant, dove and snipe. In 2005 DFG issued 3,066 hunting permits to the Yolo Bypass Wildlife Area. A hunter check-in station is operated by DFG during the autumn and winter hunting season. Hunting results from the Yolo Bypass Wildlife Area are summarized in Table 3.7-2 below.

Table 3.7-2
Yolo Bypass Wildlife Area Hunting Results (1997-98 through 2005-06)

Year	Total Hunters	Junior Hunters	Ducks Killed	Geese Killed	Pheasants Killed	Total Waterfowl Killed
1997–98	575	36	767	19	19	786
1998–99	1,297	76	1,380	16	43	1,396
1999–00	1,939	123	1,980	56	53	2,036
2000–01	2,198	161	1,988	66	91	2,054
2001–02	2,096	148	2,081	21	176	2,102
2002–03	1,371	70	882	8	271	890
2003–04	3,280	256	3,799	117	606	3,916
2004–05	3,819	244	4,971	199	189	5,170
2005–06	3,066	157	3,147	113	267	3,037

Source: DFG 2006

The Yolo Bypass Wildlife Area also hosts junior pheasant hunts and post season youth waterfowl hunt days (i.e., junior waterfowl hunts). Generally, there are 3 junior hunting days each year. All junior hunters must have successfully completed a hunter education course, possess a valid Resident Junior Hunting License, and be 15 years of age or younger. State and federal duck stamps are not required.

Fishing

Fishing is also popular and several opportunities are provided within the Yolo Bypass Wildlife Area. Primary game species present include sturgeon, catfish, black bass, and striped bass. Primary fishing locations include the East Toe Drain and along Putah Creek near the Los Rios Check Dam. Access can be obtained through parking Lot F (Toe Drain) and Lot G (Putah Creek). The East Toe Drain can also be reached from outside the Yolo Bypass Wildlife Area on the West Sacramento (east) side of the drain, although this area is not in the Yolo Bypass Wildlife Area. Sturgeon and striped bass are both anadromous fish (i.e., fish that spend all or part of their adult life in salt water and return to freshwater streams and rivers to spawn) that can be caught in the Toe Drain during their upstream migration from San Francisco Bay. Adult sturgeon are generally in the rivers throughout the winter months and adult striped bass are typically present in April and May. All of the game fish species present in the Yolo Bypass Wildlife Area offer great recreational opportunities. Valid California Fishing Licenses are required at all times.

Wildlife Viewing

Many species of birds and mammals may be observed in the Yolo Bypass Wildlife Area. Visitors may see a multitude of birds of prey, shorebirds, waterfowl and other migratory birds with over 200 known species having been identified within the area. Typical species include ibis, pelicans, cormorants, great blue herons, orioles, blue grosbeaks, and western kingbirds. The innovative shorebird management strategies implemented at the Yolo Bypass Wildlife Area have made the Wildlife Area a key shorebird viewing area in the Central Valley, attracting birdwatchers from throughout northern California. Mammals that can be seen in the area include coyotes, raccoons, gray fox, mule deer, beaver, mink, and river otters. The extensive water system maintained on the Yolo Bypass Wildlife Area also harbors large numbers of fish, amphibians, and invertebrates.

Public wildlife viewing is currently allowed year round along the existing auto tour route and along existing open trails as well as through scheduled tours and educational programs. Wildlife viewing is also permitted within designated hunting areas during non-hunting seasons. Flooding in the Yolo Bypass closes all public use. See Exhibit 3.7-1 for location of existing open trails.

Environmental Education and Interpretive Programs

Getting people in the outdoors is at the heart of the Yolo Bypass Wildlife Area's mission. The Foundation and DFG collaborate in managing and staffing a wide variety of environmental education and interpretation programs including the Discover the Flyway program for schools, Marsh Madness Youth Days, Nature Bowl, public tours, docent program, Flyway Nights lecture series, California Duck Days, Project Wet, and other workshops. Yolo Basin Foundation is the primary organization for developing, establishing, staffing and acquiring funding for Yolo Bypass Wildlife Area's education and interpretation programs. DFG provides facilities, staff support, and expertise in its shared role with the Foundation.

Yolo Basin Foundation

The Foundation is a community-based nonprofit organization dedicated to the appreciation and stewardship of wetlands and wildlife through education and innovative partnerships. It was founded in 1990 to lead the effort to establish the 3,700-acre Yolo Bypass Wildlife Area.

One of the principal goals of the Foundation is the facilitation of environmental education with the Discover the Flyway school program. Foundation staff, DFG staff, interns and volunteers assist students, teachers and parents with hands on learning activities in the Demonstration Wetlands and lead exploratory walks on the Wildlife Area.

The Foundation is the sponsoring non-profit organization for California Duck Days, publishes the Yolo Flyway Newsletter, brings wetland education to classrooms with “Wild about Wetlands” learning kits, introduces the public to natural places in the community through public field trips, and hosts the popular Flyway Nights speaker series. The Foundation also hosts and facilitates the Yolo Bypass Working Group, which provides an opportunity for farmers, landowners and agencies with interests in the Yolo Bypass to discuss Bypass related issues as well as provide guidance and opinions on such issues.

Staffing is the largest expense associated with Yolo Bypass Wildlife Area programs. Seven part-time employees provide the wide array of programs available. The staff positions include an executive director, associate executive director, development director, program coordinator, office manager and two education associates. There is a part time volunteer coordinator who is funded through both DFG and the Foundation. During the school year there are usually a few interns from UC Davis or other area colleges assisting as well.

Funding for Foundation programs is provided through individual and business memberships as well as by a wide variety of private sector sponsors including CWA, Davis Sunrise Rotary Club, Dean Witter Foundation, Environmental Law Section of the Sacramento Bar Association, First Northern Bank, Intel Corporation, Rumsey Community Foundation, NEC Corporation. There are two giving clubs, the Yolo Basin Club and Yolo Flyway Club for donors of $300 to $2,500. Bucks for Ducks, a dinner and auction, is the Foundation’s fundraising event held every October since 1991.

Public sector sponsors include USBR, USFWS, U.S. EPA, Central Valley Joint Venture, City of Davis. Yolo Basin Foundation has two service contracts with CBDA, one for the Yolo Bypass Working Group through December 2006 and the Pacific Flyway Center through December 2007. Public funding for educational programs is decreasing in general and the Foundation has had to rely more heavily on the private sector.

The Foundation has received numerous awards for its work in conservation efforts and environmental education, including the California Department of Fish and Game Conservation Award (1994 and 2002), the U.S., Department of Interior Wetlands Conservation Award (1995), Outstanding Implementation Award from the Friends of the San Francisco Estuary (1996), Governor’s Environmental and Economic Leadership Award (2000), City of Davis Environmental Recognition Award (2002), and Western Section of the Wildlife Society Conservationist of the Year Award (2007).

Educational Programs

The Foundation in collaboration with DFG offers a number of informative environmental education programs aimed at training teachers and educating students. The environmental education programs have been developed with the understanding that teachers bear, in large part, the responsibility of building the foundation that children will need to become well rounded, original thinkers who can make a difference in the world they live in. The programs have been developed in a way that makes it easy for teachers to incorporate them into their school curriculum.

The Foundation's environmental education program seeks to foster:

- **Awareness:** to help people acquire an awareness and sensitivity to the natural environment and the interactions, which occur in the Wildlife Area.
- **Knowledge:** to provide a variety of experiences in and acquire a basic understanding of the environment in the Wildlife Area, including how it functions, how it is managed, and what plants and animals live there.
- **Attitude:** to help students understand the value of the natural environment and to motivate them to actively participate in environmental improvement and protection; to see positive examples of how wildlife habitat can coexist with flood control, agriculture and the surrounding urban area.
- **Skills:** to help acquire the tools for identifying, understanding, and solving environmental problems.
- **Participation:** to provide an opportunity to be involved with Wildlife Area restoration activities, and with the resolution of environmental problems in the community.
- **Impact:** to provide a format for the public to enjoy the Wildlife Area with minimal impact on its wildlife.

The Foundation, in close cooperation with DFG has developed a document (Appendix E), which provides an overview of public use programs, site history, and a description of interpretive resources (Yolo Basin Foundation and California Department of Fish and Game 2007).

Discover the Flyway School Program

The Discover the Flyway school program is an education and outreach program that includes teacher workshops, a curriculum guide, classroom field trips, the Wild About Wetlands classroom kits, and volunteer training sessions. The program focuses on hands-on, interactive learning experiences for K–12 students that create a connection between ecological processes and the Yolo Bypass Wildlife Area.

The Foundation trains hundreds of teachers and hosts over 4,000 students and parents annually from Sacramento, Yolo, Solano, El Dorado, and Placer Counties. There are over 60 participating schools from 15 school districts and numerous private schools. The program operates four days a week during the school year and includes structured small group activities at the Demonstration Wetlands as well as tours of the Yolo Bypass Wildlife Area.

In the past few years the Foundation has put considerable effort into recruiting classroom teachers from underserved schools. These schools are identified as Title I schools based on participation in the state-wide school free breakfast and lunch program. These schools often lack the resources for field trip transportation. The Foundation has found corporation and foundation sponsors to cover the expenses associated with the extra outreach. These sponsorship funds are also used to maintain a bus fund to cover the bus costs that enables students to attend a field trip.

Program activities correlate to the California State standards for science or social studies enabling teachers to incorporate a field trip to the Yolo Bypass Wildlife Area into their daily curriculum. Before bringing students on a Discover the Flyway field trip, teachers attend a required one time only Discover the Flyway Workshop, where they are given the materials and instruction needed for a successful and education packed field trip experience tailored to their grade level. All field trips are facilitated and directed by highly trained Foundation staff, interns, and volunteers. A four-dollar per student donation to assist with program expenses is requested. However, if students cannot afford this or teachers are unable to collect the full amount the class is still welcome to participate. No one is prevented from participating due to cost.

Discover the Flyway Teacher Workshops

The Discover the Flyway one-day teacher workshops are geared for teachers in grades K–12 who are interested in providing a learning resource for their students that aids in an understanding and appreciation of the natural world in their community. The workshops familiarize teachers with various wetland habitats in the context of the Yolo Bypass Wildlife Area and provide suggestions and lessons for hands-on learning activities. Teachers are given a handbook with curriculum related activities that includes activity themes, background information, and instructions.

In the summer of 2005 teachers were introduced to the Foundation's new curriculum with third through fifth grade units: "Living with Water, the Story of Yolo Basin and its People" The third grade curriculum, Patwin Life: A Circle of Seasons was successfully implemented in the 2005–2006 school year. Teacher workshops for 2006 will include introduction of the fourth grade agriculture oriented curriculum, "Yolo Basin: Feeding the People."

Discover the Flyway Class Field Trips

After completion of the workshop the Foundation offers teachers staff support and use of field equipment for classroom field trips. Teachers are then encouraged to schedule a field trip to bring their students to the Wildlife Area with active support by Foundation staff and volunteers. After scheduling a trip teachers work with Foundation staff to select 3 to 4 grade level appropriate field activities to be done by the students under guidance of a trained volunteer, when they arrive at the Yolo Demonstration Wetlands. After an orientation by a Foundation staff person and completion of the 3 to 4 activities, the students eat lunch and then head out for an hour or two of exploring in a wild setting at the Wildlife Area.

Wild About Wetlands classroom kits are another resource available to teachers. The kits hold full instructions and materials for numerous wetlands related activities that are geared toward preparing students for a trip to the Wildlife Area. They can be checked out by teachers who participate in a Discover the Flyway Workshop. California Waterfowl Association (CWA) has assisted the Foundation with maintenance and distribution of the kits for many years.

Marsh Madness

The Foundation and the CWA co-host Marsh Madness Youth Days at the Yolo Bypass Wildlife Area several times a year. This program targets underserved elementary schools with limited resources in both metropolitan and rural areas.

CWA provides volunteers, equipment, lunch, and plans the activities. The Foundation provides the school outreach and bus transportation. DFG provides the facility and helps with set up. Each Marsh Madness Day brings 60 students to the Wildlife Area to spend the day learning about wetlands, wildlife, and conservation. The students receive small group instruction and hands-on experience identifying birds, searching for signs of animal life, examining pond water, studying wetland plants, and much more. Their day includes discussions about conservation, hunting, and other outdoor issues. Everyone is treated to a lunch buffet including foods from wetlands such as rice, cranberries, duck, elk and tule roots.

Nature Bowl

Nature Bowl is a cooperative team competition for 3rd through 6th grade students sponsored by the DFG, California State University Sacramento, American River Natural History Association, American River Nature Center, Effie Yeaw Nature Center, Placer Nature Center, Sacramento Zoo, and the Foundation. This engaging event introduces students to environmental issues, reinforces key concepts, increases critical thinking skills, and encourages student involvement in community conservation efforts. Students take part in fun activities such as Nature Investigations, Nature Relay, Team Problems, Bell-Ringers, Enviro-mercials and Nature Games. Questions and activities focus on local and regional environmental science and issues, and correlate with the science content standards. The Nature Bowl serves as a model for teachers to use in their environmental education instruction. Teams can be coached by teachers, parents, youth leaders, or high school students. DFG and the Foundation provide some guidance to team coaches during the months that teams prepare for the event. DFG and the Foundation host the Nature Bowl semi-finals each March at the Wildlife Area Headquarters.

Volunteers

Yolo Bypass Wildlife Area volunteers have the unique opportunity to participate in specialized trainings as well as go on informative field trips both at the Yolo Bypass Wildlife Area and surrounding areas. Volunteers work within the Foundation programs and are all also signed up as DFG volunteers. Introductory workshops for volunteers are held throughout the year as needed. Volunteers serve in a variety of positions as described below:

Flyway Assistants

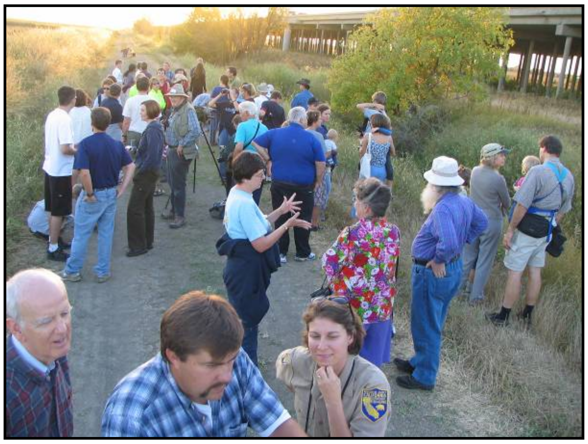
Flyway Assistants assist with Discover the Flyway field trips. They lead learning stations at the Demonstration Wetlands, assist with field equipment, help develop program tools, and join with staff to lead Yolo Bypass Wildlife Area walks.

Field Trip Ambassadors

Field Trip Ambassadors accompany the local wildlife and habitat experts who serve as volunteer leaders for public tours of the Yolo Bypass Wildlife Area and quickly become experts themselves on local birds and the natural history of this unique and multi-functional ecosystem. They are available to assist the leader, give beginners individual guidance and also promote the Foundation’s role by providing a brief introduction to the organization as well as by providing membership sign up sheets, newsletters and program flyers to tour participants.

Special Events/Administration

Throughout the year, the Foundation organizes special events such as California Duck Days, and participates in community events, Volunteers are the number one resource for making these events a success. Special Events/ Administration volunteers are often involved with large mailings, event set-up, fund-raising assistance, as well as interpretive display staffing. Volunteers also assist Foundation staff with various administrative tasks in the office.



Public Outreach

Public outreach events include monthly tours of the Yolo Bypass Wildlife Area, bat viewing tours, vernal pool tours, Flyway Nights lectures and California *Duck Days*, an annual celebration and awareness-raising event that has been held at the Yolo Bypass Wildlife Area since 2003. The Yolo Flyway is a newsletter that is published three times a year with educational articles, updates on activities, and a schedule of upcoming activities. The Foundation also hosts and facilitates Yolo Bypass Working Group meetings as a forum for stakeholder and public discussion of Yolo Bypass issues.

Yolo Bypass Wildlife Area Tours

Public tours of the Yolo Bypass Wildlife Area are offered on the second Saturday of each month from September through June. Tours meet at parking lot A in the Yolo Bypass Wildlife Area, focus on a variety of specialty topics, and are led by experienced naturalists, often associated with Yolo Audubon Society. DFG staff also lead trips. The tours provide opportunities to view the abundant wildlife that inhabit the seasonal and permanent wetlands, riparian areas, and uplands present in the Yolo Bypass Wildlife Area throughout the year. Depending on the season, migrating and resident waterfowl, shorebirds, songbirds, raptors, and wading birds may also be viewed. These tours are open to anyone, are always advertised in the local media and are a good introduction to the Wildlife Area. They are geared toward any level of bird watcher or nature enthusiast.

Vernal Pool Open House

The vernal pool open house is co-sponsored by DFG and the Foundation and provides an opportunity for the public to visit the unique vernal pools at the Tule Ranch in the southern part of the Wildlife Area. The vernal pool open house typically takes place in April during the peak of the wildflower viewing season, and trips are led by volunteers, often associated with the Jepson Prairie Docent Program. Training to become a Jepson Prairie docent is very applicable to the Wildlife Area's vernal pool program and is made available to all volunteers.

Bat Tours

Bat tours are offered six to seven times during the spring and summer months and are co-sponsored by the California Native Bat Conservancy. Bat tours offer a presentation on the benefits and wonders of bats followed by a guided tour, just before sunset, into the Wildlife Area. During the tour, participants have the opportunity to view what is perhaps the largest colony of Mexican free-tailed bats in California emerge from their roosting area on the underside of the Yolo Causeway bridge. In the spring and summer of 2005, between fifty and one hundred people attended each trip.

Flyway Nights Lecture Series

The Flyway Nights Lecture Series takes place at the Yolo Bypass Wildlife Area Headquarters Building. On the first Wednesday of each month from November through April at 7 p.m. the general public is invited to Foundation sponsored lectures presented by local and regional experts. Topics are generally wetland related and feature local issues relating to wetlands and wildlife. The program has included experts on snakes and amphibians, mammals, hawks, rice growing, local geology, butterflies, and dragonflies. There is usually a full house present on these evenings.

California Duck Days

California Duck Days is a wetland festival hosted at the Yolo Bypass Wildlife Area with the mission to educate and inspire the public about wetlands and wildlife of the Central Valley in a fun, relaxed atmosphere. The event is a partnership of regional organizations and agencies (including the Foundation, Yolo Audubon, CWA, City of Davis, and Yolo County RCD) and has been held annually since 1994. The event includes an evening reception, field trips, workshops, exhibits, and a show of wetland related artwork by area high school students. Duck Days is a family friendly event that attracts visitors from throughout the region and out of state to learn about and appreciate the natural environment of the Central Valley. The event also showcases wildlife friendly farming techniques by organizing field trips to area farms. The festival provides a platform for a broad range of diverse conservation perspectives, including farmers, birding enthusiasts, and hunters, and encourages wetland conservation by promoting regional wetland stewardship on public and private land.

Yolo Bypass Working Group

The Foundation initiated the Yolo Bypass Working Group in 1998 under a CALFED Ecosystem Restoration Grant as a communication and educational forum. This ad hoc stakeholder group has been very successful and continues to meet approximately every three months. The 37th meeting was held in June 2006. Over 30 people representing a wide range of stakeholders with an interest in the Yolo Bypass regularly attend these meetings. Participants include landowners (farmers, ranchers, duck hunters), DWR, State Reclamation Board, DFG, USFWS, State Department of Food and Agriculture, NRCS, Dixon and Yolo RCDs, SAFCA, Yolo County, City of West Sacramento, CWA, DU, NMFS, National Weather Service, SYMVCD, Port of Sacramento, and others. DFG and the Foundation host the meetings at the Wildlife Area headquarters conference room. Grant funds cover the costs for contracting a facilitator. The presence of the facilitator has created an atmosphere of trust and relaxed exchange of information that has been praised by the stakeholders.

The 2000 Governor's Environmental and Economic Leadership Award was presented to the Yolo Basin Foundation in recognition of the Yolo Bypass Working Group for outstanding contributions in the area of environmental restoration and rehabilitation.

In August 2001 the Foundation published a document prepared with Working Group participants entitled: *A Framework for the Future: The Yolo Bypass Management Strategy*. This document can be found on the Yolo Basin Foundation website, www.yolobasin.org.

Funding to support the Yolo Bypass Working Group beyond the finish of the Calfed grant in December 2006 is being pursued through several grant proposals. It is anticipated that the Working Group will play a key role in the implementation of the Yolo County Integrated Regional Water Management Plan now in the draft stage.

The Importance of Public Access in the Future

Encouraging public access in its many forms will allow generations of Central Valley inhabitants to come to understand the lessons of the Yolo Bypass Wildlife Area: that wildlife habitat, flood control, agriculture, and urban life can successfully co-exist. In the current planning vocabulary it is a clear, understandable example of this important aspect of creating a sustainable community.

The Yolo Bypass Wildlife Area is considered a community treasure as articulated at a recent Yolo County Board of Supervisors meeting. As the human population grows in the coming decades the habitat values and public access opportunities will continue to increase in importance. In the not to distant future the Yolo Bypass Wildlife

Area will become a valued landmark. Increasing numbers of commuters and other travelers crossing the I-80 Causeway will look forward to the glimpse of wildness that the Yolo Bypass Wildlife Area gives them. Much like Central Park in New York City and the American River Parkway in Sacramento, the Yolo Bypass Wildlife Area will be a treasured community symbol.

4 COMPATIBLE RESOURCE MANAGEMENT AND PUBLIC USE

The Yolo Bypass Wildlife Area is a living example of the successful meshing of flood control, wildlife habitat, public use, and agriculture. Compatible use is one of the messages that school children are introduced to when visiting the Yolo Bypass Wildlife Area. The Yolo Bypass Wildlife Area is unique among wildlife areas in that it is managed almost entirely within an engineered floodway and agriculture produces both wildlife habitat and operating income. On a fall day, students will see rice being harvested while egrets and ibis eat what is left behind in the field. They will see fields being disked and perhaps 30 Swainson's hawks following the tractor, feasting on mice and grasshoppers. Later in the fall and throughout the winter they will see thousands of pintails loafing in the flooded rice while hunters pass by on the road after a morning hunt. Autumn sounds include geese crying in the distance, the whistle of a thousand pintails and perhaps a shot fired by a late morning hunter. In the spring they will see rice being seeded by a low flying airplane while listening to the cries of nesting stilts and killdeer. In the late spring, students will see ducklings swimming behind their parents in a permanent wetland while other wetlands are dry to prepare for disking to remove tules and cattails as required to meet flood control requirements.

DFG manages wildlife areas to protect and enhance aquatic and terrestrial habitats for plant, wildlife, and fish species and to provide the public with compatible recreational and educational uses. The key consideration for these activities at the Yolo Bypass Wildlife Area is compatibility with the primary function of the Yolo Bypass, which is flood control. In the past decade the most common public uses at the Yolo Bypass Wildlife Area included environmental education and interpretation, hunting, fishing, wildlife observation, and other uses such as photography and painting, and these uses are projected to continue to be popular. This chapter includes an evaluation of the compatibility of different resource management objectives with various existing and potential new public uses at the Yolo Bypass Wildlife Area, and the potential of those public uses to adversely affect management of diverse habitat.

4.1 EVALUATION OF RESOURCE MANAGEMENT AND PUBLIC USE

The planning process included an evaluation of the public's demand for use of the Yolo Bypass Wildlife Area and the compatibility of such use with resource management activities and objectives including seasonal floodwater conveyance, protection, and enhancement of wildlife habitat, and continued agriculture. This compatibility evaluation focused on five principal factors:

- the potential for land management to conflict with necessary flood control operations;
- the potential for conflicts between resource management activities and other objectives (i.e., flood control, vector control, wildlife resources, fisheries resources, and agriculture);
- the potential for public uses to unreasonably adversely affect habitat and the fish and wildlife that inhabit the area;
- the potential for resource management and public uses to adversely affect adjacent land uses; and
- the anticipated resources required by DFG to manage the resources and public uses.

Information was obtained through analysis of existing information and through public outreach. The information-gathering process for this LMP also involved interviews and focus group meetings with representatives of various interest groups and meetings with DFG and State Reclamation Board staff members familiar with flood control operations, agricultural activities, and recreation use of the Yolo Bypass.

The mission of the DFG and function of the Yolo Bypass Wildlife Area are focused on natural resource management. In addition, the Yolo Bypass Wildlife Area is a low-lying area that is subject to frequent flooding. All public uses to consider are, therefore, limited by these constraints. Permanent buildings within the greater portion of the Yolo Bypass Wildlife Area between levees would be subject to frequent flood damage and are fundamentally precluded by regulations of the Federal Emergency Management Agency (FEMA) and the State Reclamation Board. Other permanent developed recreation features would also be subject to frequent inundation and likely damage. Developed recreation uses, such as traditional team sports, are not consistent with the DFG mission and functions of the Yolo Bypass Wildlife Area and are not allowed.

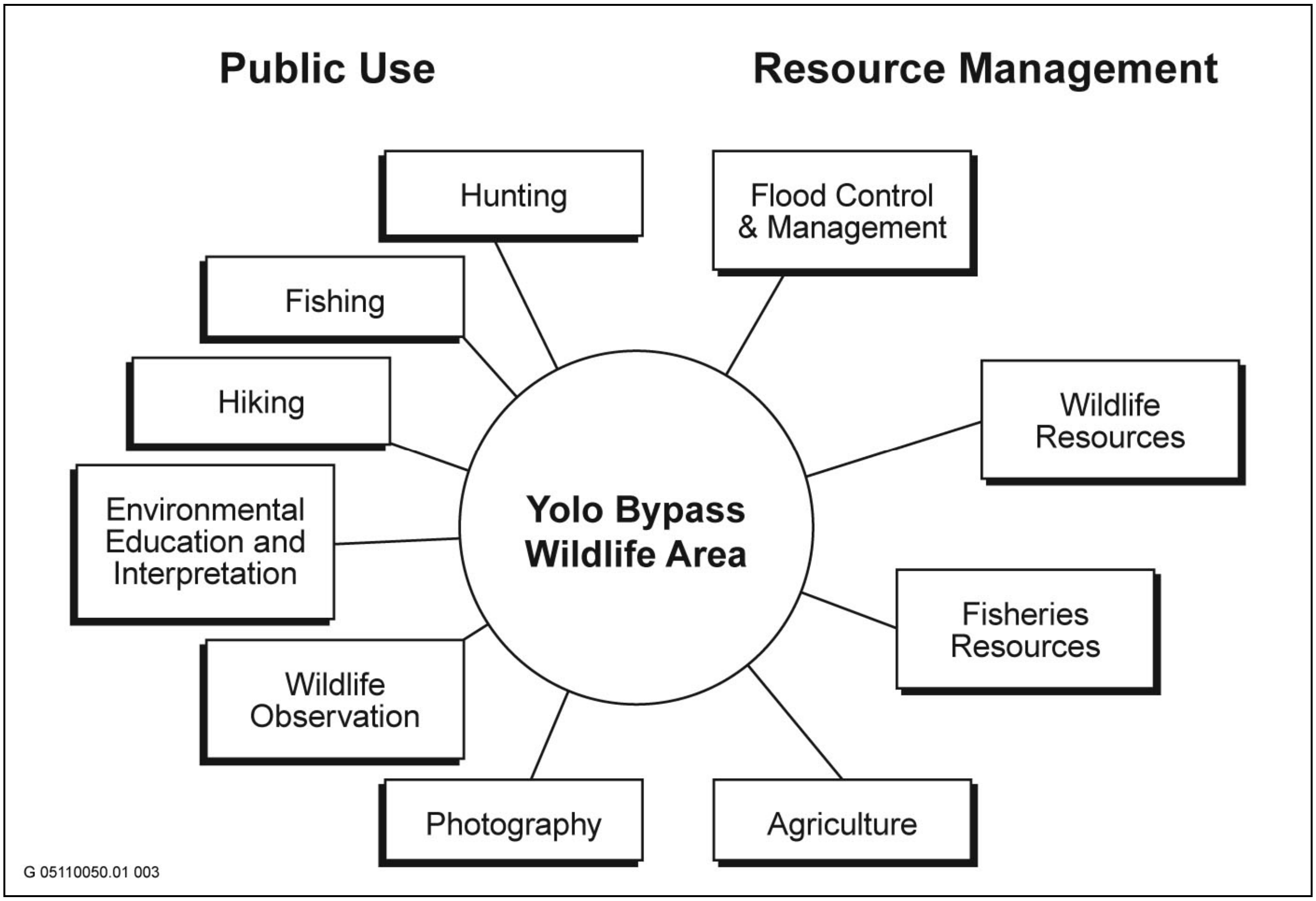
The potential public use of the Yolo Bypass Wildlife Area is additionally affected by the limited access to many of the management units. No paved roadways exist in the Yolo Bypass Wildlife Area and the limited gravel and dirt roadways available are restricted to use during non-flooded and, typically, dry periods. Access is further limited by the presence of sensitive habitats (i.e., wetlands), agricultural activities that occur throughout the Yolo Bypass Wildlife Area, and use restrictions limiting the type and/or timing of recreation activities. The management of these access limitations function to regulate the level of human activity within certain units and help to ensure that agricultural activities and the habitat value of the Yolo Bypass Wildlife Area are not substantially diminished by public use. Management also minimizes conflicts between various public uses, such as nature observation and hunting. Another factor that limits access for all uses is the availability of DFG staff resources. Access requires road maintenance, opening and closing of gates, garbage pickup, portable toilets, and law enforcement.

As depicted in Exhibit 4.1-1, four (4) resource management and six (6) primary public-use activities were determined to be compatible uses that could be supported in the management of the Yolo Wildlife Area. Compatible resource management activities in the Yolo Wildlife Area include flood control and management, protection and enhancement of wildlife resources, protection and enhancement of fisheries resources, and agriculture. Primary public uses include environmental education and interpretation, hunting, fishing, hiking, wildlife viewing, and photography. Existing beneficial uses and site improvements, including investments in infrastructure, were also considered in the evaluation. Exhibits 4.1-2 and 4.1-3 depict resource management activities and public uses occurring in the Yolo Wildlife Area.

4.1.1 RESOURCE MANAGEMENT

FLOOD CONTROL AND MANAGEMENT

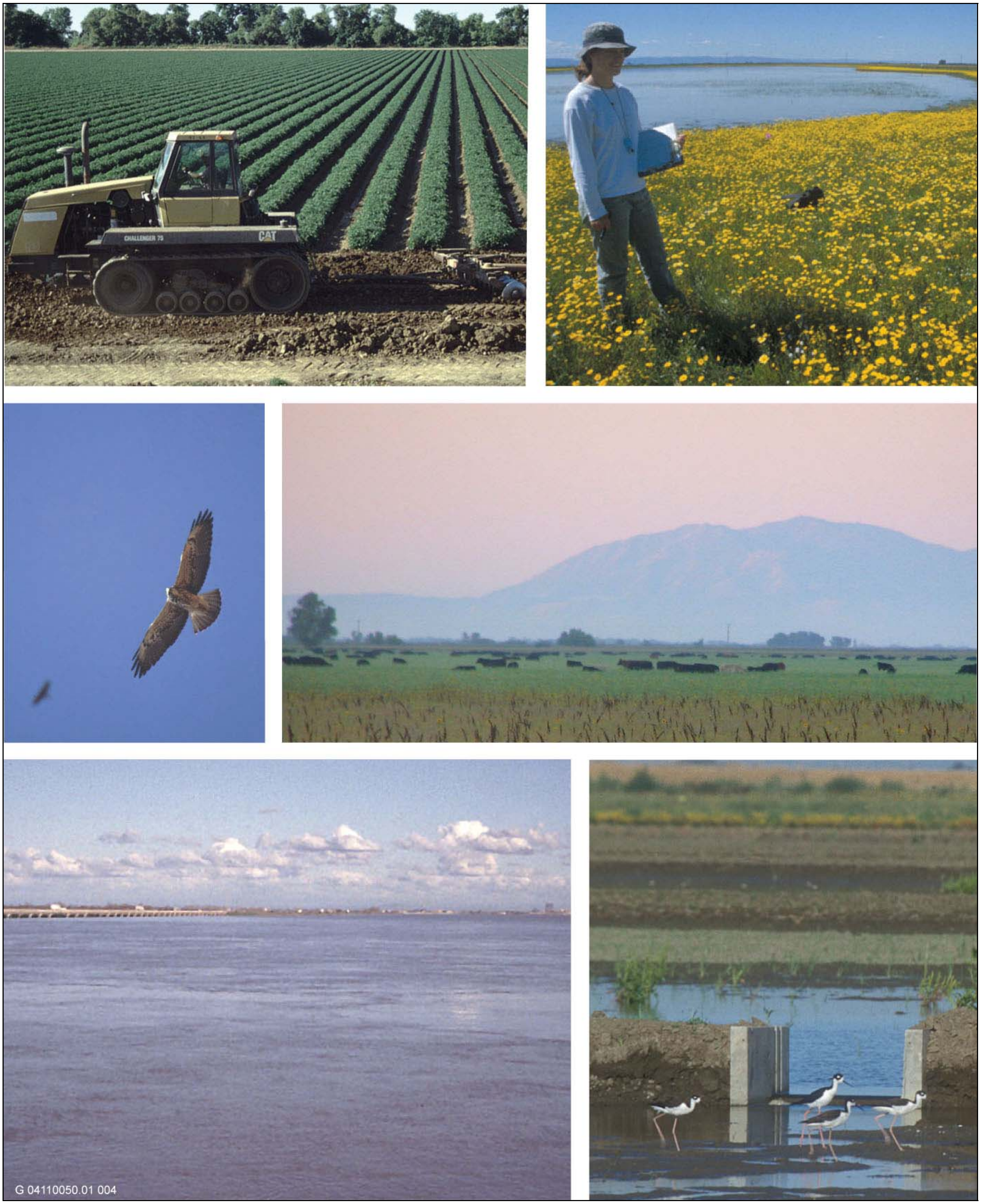
The Yolo Bypass Wildlife Area is being managed with the recognition that the primary purpose of the Yolo Bypass is flood protection for the people of the Sacramento Valley. Flood flow design criteria for the Yolo Bypass indicate a specific water surface elevation when flood flows are at capacity. These criteria are maintained through the management of vegetation and hard structures in the Bypass in such a way that this water surface elevation is not increased. Emergent and riparian vegetation is maintained at acceptable levels as prescribed through the Supplement to the Standard Operation and Maintenance Manual for the Yolo Basin Wetlands (U.S. Army Corp of Engineers 2003). This prescription was developed through application of a hydraulic



Compatible Resource Management Activities and Public Uses in the Yolo Wildlife Area Exhibit 4.1-1

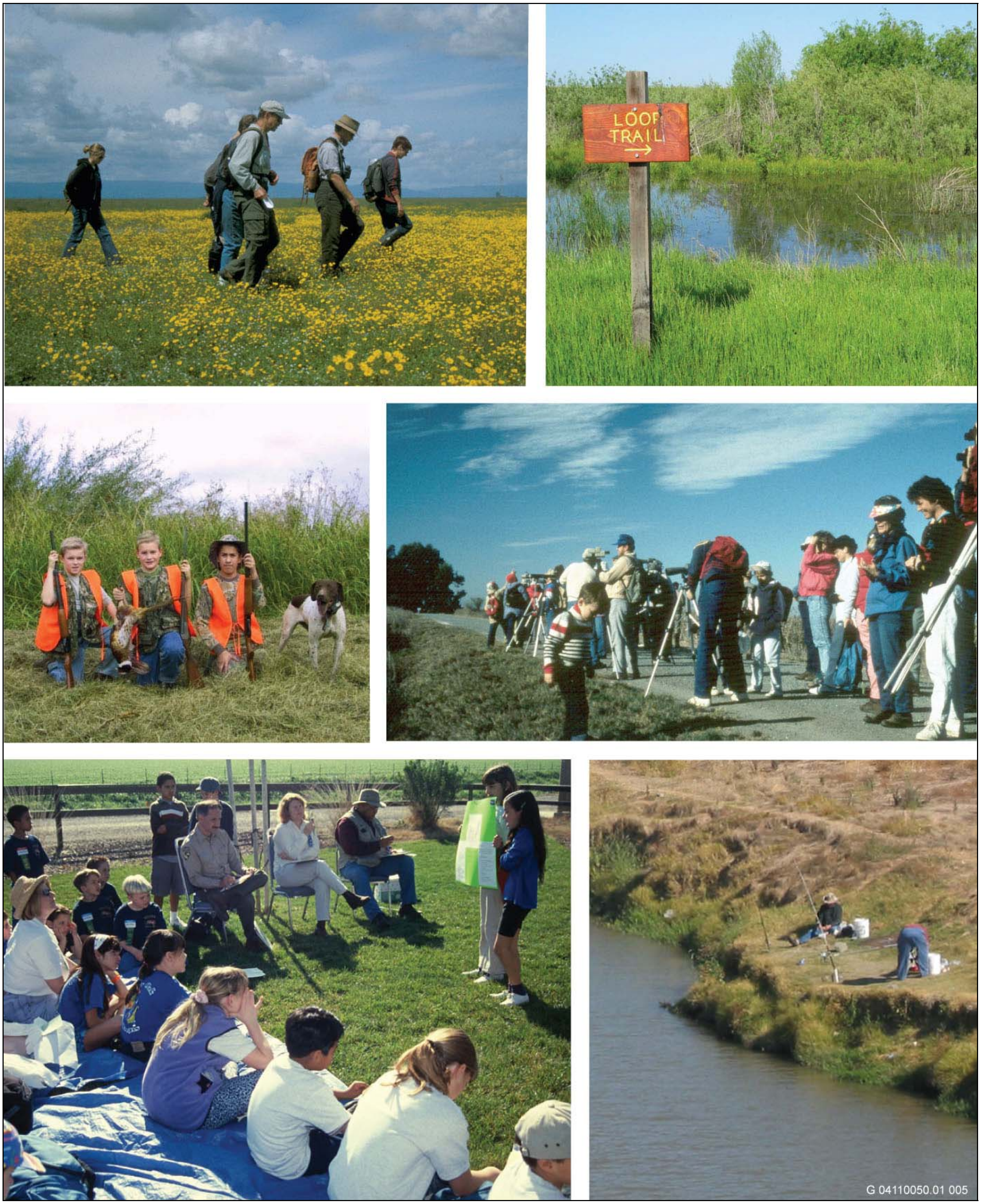
model. Anticipated topographic and vegetative changes were inputted into the model to predict their effect on water surface elevation. The primary tool for maintaining acceptable levels of emergent vegetation is timing and duration of flooding, and maintenance of existing vegetation through mechanical and chemical treatments. Generally, prevention is the best policy. Prevention of establishment of substantial stands of emergent vegetation and riparian vegetation is achieved by draining seasonal wetlands as close as possible to April 1. Management for floodwater conveyance will continue to be an overriding priority for the Yolo Bypass Wildlife Area.

Recently, USACE has updated and improved a two-dimensional (2-D) detailed hydraulic model for the Yolo Bypass for determining flood conveyance impacts that may result from proposed ecosystem restoration projects. The new Yolo Bypass 2-D model (U.S. Army Corps of Engineers 2006) provides the State Reclamation Board, DFG, and other restoration proponents with a useful tool to effectively evaluate the hydraulic effects on flood capacity of the Bypass, including the Yolo Bypass Wildlife Area. As the regulating agency, the State Reclamation Board will require DFG to provide hydraulic modeling of any future proposed restoration or any land-use modification projects in the Yolo Bypass Wildlife Area, which must confirm that the proposed project would meet performance criteria and not adversely affect the flood conveyance capacity. These modeling requirements apply to construction of any earthen structures that exceed 3 feet in height. Since most restoration efforts do not require berms above three feet, it is the management of these restoration projects that are subject to hydraulic modeling. Additional discussion on hydraulic modeling requirements is provided in Chapter 5, “Management Goals” and Appendix C.



Photos Source: Dave Feliz

Resource Management Yolo Bypass Wildlife Area **Exhibit 4.1-2**



Photos Source: Dave Feliz

Public Uses of the Yolo Bypass Wildlife Area **Exhibit 4.1-3**

PROTECTION AND ENHANCEMENT OF WILDLIFE RESOURCES

The Yolo Bypass Wildlife Area provides important staging and wintering habitat for numerous species of waterfowl, shorebirds, and other birds migrating along the Pacific Flyway. These species are associated primarily with shallow flooded fields, ponds, wetlands, and mudflats. They are most abundant in the Yolo Bypass Wildlife Area in fall and winter, when managed inundation for waterfowl also increases the availability of habitat for shorebirds (Page et al. 1992).

The Yolo Bypass Wildlife Area also supports numerous species of raptors (e.g., northern harrier, red-tailed hawk, kestrel), songbirds (e.g., oriole, towhee, bluebird), and mammals (e.g., otter, raccoon, skunk, beaver, gray fox). Though not part of specific management objectives, the Yolo Bypass Wildlife Area appears to be especially important to the Swainson's hawk, a state-listed threatened species that uses the floodplain as foraging habitat.

The Yolo Bypass Wildlife Area is a key component of the habitat restoration planned as part of the CALFED ERP, and is a vital element of the Central Valley Habitat Joint Venture's habitat restoration goals associated with implementation of the North American Waterfowl Management Plan (NAWMP). Millions of dollars in grant funding from the North American Wetlands Conservation Act (NAWCA) have been invested in creating the infrastructure to manage wetland ecosystems at the Yolo Bypass Wildlife Area. NAWCA was passed, in part, to support activities under the NAWMP. Accordingly, these grants are intended to support the conservation of wetlands and associated upland habitats needed by waterfowl and other migratory birds in North America. Importantly for Yolo Bypass Wildlife Area land use considerations, the wetlands created are required to be managed in perpetuity.

The stated purpose of the most recent land acquisition for the Yolo Bypass Wildlife Area was "to allow for the preservation of historic wetlands, wintering habitat for waterfowl, shorebirds, threatened and endangered species and other wetland associated species." Managing for fish and wildlife and their associated habitats on which they depend on, as well as compatible public uses, will be an ongoing priority for the Yolo Bypass Wildlife Area.

Flooding Effects on Recreational Activities

Flooding also has the potential to affect wildlife dependent recreational activities. Significant flooding during the hunting season (i.e., mid-October to mid-January) requires the Yolo Bypass Wildlife Area to discontinue access to these areas, resulting in lost hunting time. When the Wildlife Area is closed due to flooding other public uses are prevented especially school field trips.

Flooding Effects on Wildlife Resources

Flooding of the Bypass can affect management operations and thus, related wildlife resources. Floods damage infrastructure, requiring repairs and additional maintenance. Ditches and canals sometimes fill with sediment and need to be excavated to maintain flow capacity. In addition, debris deposited on fields needs to be removed; roads, field levees, gates, pipes, and pumps may need to be repaired. Permanent structures, such as pump stands can also be damaged by high water. Floods and their timing can adversely affect plant species composition (e.g., promotes growth of undesirable plant species like cocklebur), which may adversely affect waterfowl, pheasants, and other nesting birds (Yolo Basin Foundation 2001).

PROTECTION AND ENHANCEMENT OF FISHERIES RESOURCES

The Yolo Bypass Wildlife Area provides important year-round and seasonal aquatic habitat for a diverse assemblage of native and nonnative fish species when the Yolo Bypass floods. In more than half of all water years, excess floodwaters enter the Yolo Bypass (including the Yolo Bypass Wildlife Area) from the main channel of the Sacramento River, creating up to 60,000 acres of shallow water habitat for native fish populations (Sommer et al. 2002). The importance of Yolo Bypass spring floodplain inundation for native fish passage, spawning and rearing, as well as estuary food web processes have been well documented (Schemel et al. 1996; Sommer et al. 1997; Sommer et al. 2001a; Sommer et al. 2001b; Sommer et al. 2002). Management for floodwater conveyance and the subsequent fisheries benefits generated by this flooding are part of the working environment at the Yolo Bypass Wildlife Area.

Recent studies and planning efforts have been conducted to examine the feasibility of managing a portion of the Yolo Bypass to improve habitat for multiple aquatic species, particularly native fishes such as Chinook salmon, Sacramento splittail, and green sturgeon (U.S. Army Corps of Engineers and the CALFED Bay-Delta Program 2002; Kirkland et al. 2005). Habitat improvement concepts are generally focused on winter and early spring floodplain inundation in one or more low-lying areas throughout the Bypass and fish passage improvements at Fremont Weir and on Putah Creek.

There is interest in pursuing habitat improvement for aquatic species (see Appendix A) and the Yolo Bypass Wildlife Area is generally supportive of such projects. However, Yolo Bypass Wildlife Area land use changes to benefit fish spawning, rearing, and passage in Putah Creek must be compatible with existing agricultural and/or managed wetland operations. As discussed above, the Yolo Bypass Wildlife Area is impacted by spring flooding in many ways, including decreased breeding success for ground nesting birds, decreased forage value of grazed areas, reduction of acreage available for farming and subsequent reduction of income for the Wildlife Area. Additionally, spring floods dramatically increase the establishment of emergent riparian vegetation, which requires subsequent vegetation control measures in order to remain compatible with habitat management strategies derived from hydraulic analysis. Future designs for created fish habitat on Yolo Bypass Wildlife Area land must be cooperatively planned with DFG as a primary lead agency with oversight authority. This would ensure that future proposals are mutually compatible with waterbird habitat management, agricultural activities, and other resource management functions of the Yolo Bypass Wildlife Area. As the lead implementing agency for CALFED’s Ecosystem Restoration Program, DFG must approve any CALFED funded proposed aquatic ecosystem restoration activities to insure consistency with ecosystem planning.

Proposals related to improving fish passage at Fremont Weir are not considered in this LMP as the Fremont Weir is located outside of the geographic boundaries of the Yolo Bypass Wildlife Area. However, because modifications to Fremont Weir could effect management and operations at the Yolo Bypass Wildlife Area, the effects on the Yolo Bypass Wildlife Area would need to be considered in any discussions regarding potential project planning and implementation. These discussions would need to be inclusive of other stakeholders in the Yolo Bypass due to the potentially profound impacts to rice farming, grazing, wetland management, and flood protection. As always, the flood protection function of the Yolo Bypass should be maintained as a top priority.

Potential opportunities exist to restore and enhance fish habitat in the Yolo Bypass Wildlife Area along Putah Creek and along the East Toe Drain at the southeast end (Tule Ranch unit) of the Yolo Bypass Wildlife Area. Opportunities along Putah Creek include potential realignment of the creek channel to improve passage, geomorphic processes, and floodplain connectivity. The prospect of habitat enhancement in Putah Creek is especially attractive given the habitat improvement achievements upstream and the recent return of small chinook salmon runs in the creek.

Opportunities along the East Toe Drain include the potential creation of managed seasonal floodplain areas and tidal channels in the Tule Ranch Unit. These opportunities are consistent with particular project components/ alternatives identified in past studies (U.S. Army Corps of Engineers and the CALFED Bay-Delta Program 2002;

Kirkland et al. 2005). For the Putah Creek channel considerations, proposed changes must be compatible with existing agreements, primarily the Putah Creek Settlement Agreement (Putah Creek Accord) which established minimum flow requirements in the Putah Creek channel to maintain a living stream for fish and riparian resources from the Putah Diversion Dam to the Toe Drain (Sacramento County Superior Court 2000; Moyle 2002). In order to determine if potential fish habitat restoration and enhancement opportunities are feasible, additional studies and coordination with local stakeholders including the Lower Putah Creek Coordinating Committee would be required.

AGRICULTURE

Agriculture, including rice, row crops, and ranching, is an important component of the management of the Yolo Bypass Wildlife Area (see Exhibits 3.2-1 and 3.2-2). Agricultural operations provide important wildlife habitat benefits, critical income for Wildlife Area operations, maintain vegetation in a desired and compatible state, and contribute toward the local farming economy. Since the acquisition of the Glide and Los Rios properties, Wildlife Area staff has creatively incorporated agriculture into the management of the Area. Agricultural operations are expected to continue to have a significant presence at the Yolo Bypass Wildlife Area.

Flooding Effects on Agricultural Operations

Late spring flooding in the Bypass has a substantial detrimental effect on farming operations. Floods affect crops in a variety of ways. Floods in April–June can damage or destroy crops planted during dry periods in March–May. When this flooding happens, it is usually too late to replant those fields with a different crop. If the ground remains too wet to work until May or June, the shortened season results in limited crop options and decreased yields (Yolo Basin Foundation 2001). The reduction of agricultural productivity on the Wildlife Area translates into a reduction of income generated for the management of the Wildlife Area.

Flooding Effects on Infrastructure

The maintenance of infrastructure, including roads, canals, drainage ditches, diversion structures, pumps, and wells, is done on an as-needed basis, often in response to flood damage. Roads are sometimes eroded and require regrading or rebuilding. Some canals and ditches fill with sediment deposited from floods and require periodic excavation to maintain necessary flow capacity. East-west trending canals and ditches often create eddies and other hydraulic disturbances that can cause erosion and deposition of sediments and deposition of flood debris, such as tree limbs, agricultural vegetation, and irrigation pipes, in fields and canals. Such debris conditions can necessitate extensive cleanup efforts (Yolo Basin Foundation 2001).

4.1.2 PUBLIC USE

The following public activities are entirely compatible with the ecosystem restoration goals of the Yolo Bypass Wildlife Area and the flood control function of the Yolo Bypass.

ENVIRONMENTAL EDUCATION AND INTERPRETATION

The Yolo Bypass Wildlife Area, in partnership with the Foundation, supports popular and extensive environmental education and interpretation programs. Field trips for classes ranging from local elementary schools to area colleges and universities allow for a “hands-on” appreciation of the ecosystem including wildlife, fisheries resources, vegetation, cultural resources, agriculture and flood hydrology.

Each year, through the Discover the Flyway school program, the Foundation trains hundreds of teachers and hosts over 4,000 K–12 students and parents from Sacramento, Solano, Yolo, Placer and El Dorado counties. Since the program began in 1997 over 20,000 students have had the opportunity to visit the Yolo Bypass Wildlife Area through this program. Foundation and DFG staff, interns and volunteers assist students in hands-on learning activities as they lead students on exploratory Yolo Bypass Wildlife Area walks (Yolo Basin Foundation and California Department of Fish and Game 2007).

Unique education programs like Marsh Madness, which targets underserved schools, and Nature Bowl are also offered. In addition, the Foundation provides community programs such as the Flyway Nights speaker series, and monthly tours of the Yolo Bypass Wildlife Area. The Yolo Basin Foundation is the sponsoring non-profit organization for California Duck Days. It publishes the Yolo Flyway newsletter and brings wetlands education to the classroom with the Wild About Wetlands kits. The Yolo Bypass Wildlife Area partnership with the Yolo Basin Foundation and support of environmental education programs will continue to be a priority and is memorialized in a Memorandum of Understanding (see Appendix D). An document was recently prepared by the Foundation and DFG that identifies the history and overview of programs in the Wildlife Area (Yolo Basin Foundation and California Department of Fish and Game 2007) (see Appendix E).

Pacific Flyway Center

The proposed Pacific Flyway Center, initiated and coordinated by the Foundation in partnership with DFG and WCB, would be a unique visitor and education center located on a 69-acre site in the Yolo Bypass Wildlife Area outside of the SRFCP levees. This facility would allow the Foundation’s and DFG’s educational and public outreach programs to expand to meet the needs of future generations.

The proposed Pacific Flyway Center would be a 12,000 square foot educational facility that would serve as the new headquarters of the Yolo Bypass Wildlife Area, while hosting 5,000 school children a year who would learn about the Pacific Flyway. The Flyway Center would highlight the Yolo Bypass Wildlife Area and utilize the management of this area to illustrate the mission of the DFG. A central theme of the programming for this project would be the value of wetlands in the Central Valley as a critical component of the Pacific Flyway. Farming for both people and wildlife would be highlighted as a critical habitat component of the area as well as for its tremendous economic value. The building would contain exhibition spaces, meeting rooms, site observation areas, multipurpose educational facilities, and parking. A separately funded adjacent 45-acre restored habitat area would serve as an “outdoor classroom” complimenting the educational function of the Pacific Flyway Center building.

HUNTING

Hunting has historically been a popular seasonal use of the Yolo Bypass Wildlife Area. There is approximately 5,000 acres currently open for hunting; principal game species include several species of ducks and geese, ring-necked pheasants, and mourning doves. The public hunting program includes accessible hunting facilities (e.g., roads and blinds) and a junior hunt program for kids. The hunting season runs from the opening of dove season (i.e., September) through January (or flood inundation). The Yolo Bypass Wildlife Area currently has a daily capacity ranging from 35–75 hunters in the free roam area (depending on acreage flooded and local agricultural activities), plus assigned blinds. The Yolo Bypass Wildlife Area currently manages a total of 16 blinds in the Northeast Unit (see Exhibits 2-1 and 3.7-2).

Much of the Yolo Bypass Wildlife Area is closed to all non-hunting purposes from two weeks before waterfowl season to one week after waterfowl season. Areas designated for wildlife viewing purposes are open on most days throughout the year. Travel is restricted to designated roads and parking lots. Roads may not be passable for large vehicles such as motor homes, and such vehicles are not permitted. Bicycles and hunting dogs are allowed in the hunting areas during hunting season.

Opportunities for increases in blinds and expansion of designated hunting areas exist in limited areas throughout the Yolo Bypass Wildlife Area and will be developed as funding for their construction, operation, and maintenance becomes available. Currently one blind is available with Americans with Disabilities Act (ADA) access for limited mobility hunters.

FISHING

Fishing in the Yolo Bypass Wildlife Area focuses on the adjoining East Toe Drain, although there are potential additional fishing opportunities in Green's Lake, Putah Creek, and permanent wetlands (see Exhibits 2-1 and 4.1-2). Fishing for sturgeon, striped bass, black bass, bluegill, green sunfish, and catfish in the East Toe Drain tends to attract the most interest. The Yolo Bypass Wildlife Area has limited opportunities for "walk-in" fishing; most activity is on the Toe Drain from the east levee of the Sacramento River Deep Water Ship Channel outside of the Yolo Bypass Wildlife Area boundary. Access to fishing opportunities will continue to be provided. There are additional opportunities to install ADA–accessible fishing piers at select locations along the East Toe Drain, including sites accessible only from West Sacramento.

HIKING

While hiking opportunities are limited at the Yolo Bypass Wildlife Area, due to sensitive habitats and agricultural operations, there are opportunities available along wildlife viewing tour routes and in the grassland areas of the Tule Ranch Unit (see Exhibit 2-1 and 3.5-1). All trails are located on the crest of berms created for the impoundment of water in managed wetlands. The attractiveness of hiking is greatly enhanced by the opportunity for wildlife viewing and general appreciation of the beauty of the expansive basin. There is a popular hiking trail connecting parking lot B and C. Another trails leaves from lot D. Miles of hiking routes are available from lot F except during hunting season. Trails are not paved and often are not graveled as well.

WILDLIFE VIEWING

The opportunity for wildlife viewing is substantial. The rich environment of seasonal and permanent wetlands, agricultural fields, upland grasslands, vernal pools, and riparian forest supports a very wide range of wildlife species. The potential for bird watching is especially great due to the wide variety of and abundance of avian species that frequent the area in different seasons. Opportunities exist to expand and create new wildlife viewing tour routes that would expand wildlife observation options in the Yolo Bypass Wildlife Area. Wildlife viewing accessibility is seasonal in many areas, essential to avoiding conflicts with hunters, livestock, and agricultural activity. It is possible to provide some limited bicycle access for wildlife viewing purposes.

PHOTOGRAPHY

The Yolo Bypass Wildlife Area offers opportunities for photography of wildlife species and the general environment. The expansive mosaic of habitats and abundant wildlife provides a substantial and diverse range of photographic possibilities. The potential exists to develop photographic blinds for public use.

OTHER PUBLIC USES

The public-outreach component of the planning process identified interest in several other public use considerations, including:

- establishing equestrian trails,
- establishing an access route from West Sacramento,
- allowing bicycle access and establishing connections with regional bicycle-trail planning efforts, and
- allowing overnight camping.

The potential for the use of portions of the Yolo Bypass Wildlife Area for these recreation uses was reviewed. It was determined that regional equestrian trails could pass through the area but horse riding would not be considered a primary recreational activity at the Yolo Bypass Wildlife Area. Additional bicycle access uses could potentially be accommodated and they may be considered on an individual basis. These types of uses would likely require the establishment of a partnership with another agency for development and operation of such facilities. The DFG is happy to consider involvement in regional trail planning efforts but will not take the lead on such efforts. Overnight camping is currently not being allowed because of the flood hazards inherent in a flood control channel.

Other public-use options were evaluated as part of the planning process but were determined to be incompatible with the Yolo Bypass Wildlife Area for various reasons. These included:

- off-road vehicle use - potentially detrimental to the unique and sensitive habitat and the wildlife resource;

- buildings - not physically suitable to the frequently flooded environment;

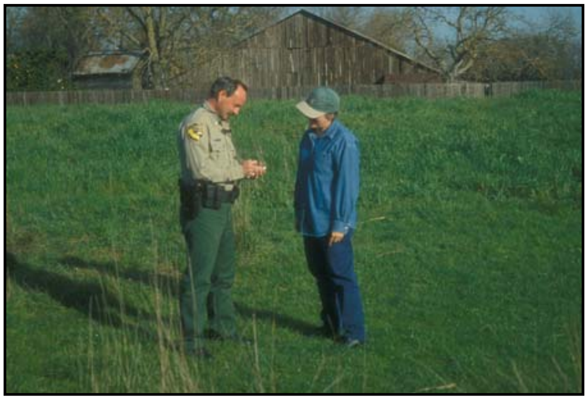
- unlimited equestrian and bicycle use - potentially detrimental to the unique and sensitive habitat and the wildlife resource;

- dog trials - incompatible with Wildlife Area purpose;

- parachuting - potentially detrimental to the unique and sensitive habitats and the wildlife resource; and

- developed park and sports facilities – incompatible with DFG mission.

4.2 WILDLIFE AREA REGULATIONS



The regulations guiding public use of the Yolo Bypass Wildlife Area are provided in Title 14 (“Natural Resources”) of the California Code of Regulations. Division 1 of Title 14 includes regulations that have been formally adopted by the California Fish and Game Commission, reviewed and approved by the Office of Administrative Law, and filed with the Secretary of State. The current regulations applicable to the Yolo Bypass Wildlife Area include Regulations for General Public Use Activities (Section 550), which are applicable to all wildlife areas. They also include Hunting, Firearms, and Archery Equipment and Permit Requirements (Section 551), which contain hunting regulations that relate to all wildlife areas as well as use regulations that apply specifically to the Yolo Bypass Wildlife Area. In addition, standard hunting and fishing regulations apply to the Yolo Bypass Wildlife Area.

Although the regulations that govern public use of the Yolo Bypass Wildlife Area are expected to change over time, a summary of the current regulations is provided to inform the reader about the current situation. The following summary of the regulations that apply to the Yolo Bypass Wildlife Area does not reflect all requirements in detail. The most current and complete regulations should be consulted for any determination related to the use of the Yolo Bypass Wildlife Area.

4.2.1 GENERAL PUBLIC-USE ACTIVITIES

These general requirements set basic standards for protection of all wildlife areas and protection of public safety. The Regional Manager has authority to establish additional regulations for wildlife areas that are not otherwise provided in Sections 550 and 551. The following regulations for general public-use activities are currently applicable to all wildlife areas, including the Yolo Bypass Wildlife Area. Where regulations require a specific action by DFG to be applicable, the status of any such action is noted in italics.

- DFG may specify entry locations, limit entry, or close wildlife areas to protect resources or public safety. Specified public notice is required of such entry limitations or closure. Entry locations, limitations, and closures have been established and may vary depending on seasonal management activities and flood control/management conditions.

- Use permits are required for organized events or gatherings.

- Motor-driven vehicles are not permitted except on public roads, parking areas, or other routes designated by DFG.

- Trailers are not permitted on the Yolo Bypass Wildlife Area

- Drivers must comply with all posted traffic signs.

- DFG may restrict the use and operations of boats in Yolo Bypass Wildlife Area waterways.

- Certain activities are not permitted for the protection of the Yolo Bypass Wildlife Area and protection of public safety. These prohibited uses include:

    - damage or removal of property owned by others;
    - deposit of litter, rubbish, toxic substances, or other materials;
    - damage to plant materials;
    - removal of soil, sand, gravel, rock, etc.;
    - collection, disturbance, or removal of bottles or other artifacts;
    - livestock grazing, except by lease; Existing leases for grazing and farming have been maintained
    - taking fish or frogs for commercial purposes.

- Hunting and fishing are permitted subject to regular open seasons and regulations and the special provisions of Section 551.

- Dogs are allowed only for hunting or only when under immediate control. DFG may prohibit or restrict the use of dogs (with the exception of assistance dogs).

- DFG may eject a person from the Yolo Bypass Wildlife Area for specified reasons.

- Users are responsible for knowing area-specific regulations in Section 550.

- Access to the Yolo Bypass Wildlife Area is closed between sunset and sunrise.

- Access to the Wildlife Area is closed when the Fremont Weir spills and/or when the Area is flooding from other local sources.

4.2.2 HUNTING, FIREARMS, AND ARCHERY EQUIPMENT AND PERMIT REQUIREMENTS

This section contains general regulations related to hunting and firearms that apply to wildlife areas in general. It also contains specific regulations that apply to the Yolo Bypass Wildlife Area. These specific regulations are in addition to the other requirements of Sections 550 and 551. They are intended to respond to the unique characteristics of the Yolo Bypass Wildlife Area. The general regulations applicable to all wildlife areas include:

- Raptors may be used to take legal game in accordance with general hunting regulations.

- Possession and use of firearms and archery equipment is permitted only for hunting purposes.

- Hunting Regulations for Waterfowl, Upland Game, and State and Federal Areas that apply to the Yolo Bypass Wildlife Area can be obtained from:

  California Fish and Game Commission
  1416 Ninth Street
  Sacramento, California 95814
  Online at: http://www.fgc.ca.gov/html/regs.html

As previously noted, it is anticipated that the current regulations will change in the future as DFG continues to monitor the public use of the Yolo Bypass Wildlife Area and proposes appropriate responses to changed circumstances.

4.3 COORDINATION TO SUPPORT RESOURCE MANAGEMENT AND PUBLIC USE

Because the Yolo Bypass Wildlife Area is part of a mosaic of publicly managed habitat within the larger Yolo Bypass, coordination with other agencies is a key to providing the best and most cost effective resource management and public-use opportunities in the Yolo Bypass Wildlife Area and throughout the Yolo Bypass in general. While the various agencies have different functional niches and procedures, a cooperative environment has been established through an inclusive approach to both the creation and management of the Wildlife Area by the Foundation and DFG. This environment has been maintained by the scope and tone of the Yolo Bypass Working Group meetings. Additional technical work groups have also been established to focus on more specialized topics (e.g., hydraulic, fisheries resources). The need for a permanent management-coordination organization has not been established.

Coordinated planning and regulatory consistency is an important objective for the Yolo Bypass Wildlife Area. This includes coordinated flood management and control, resource and agricultural management planning, and consistency between the public use regulations that currently apply to the Yolo Bypass Wildlife Area. Coordination with the Sacramento Yolo Mosquito and Vector Control District is very important as control of mosquitoes, especially with the arrival of West Nile virus, is crucial due to the proximity of a large urban population. Coordinated planning also includes being consistent with the regulations that govern the public use of other publicly and privately managed properties. The development of a comprehensive planning effort for the entire Yolo Bypass offers the opportunity to make resource management and public use of the Yolo Bypass Wildlife Area and the Yolo Bypass as a whole as seamless as possible. Support for this type of effort is incorporated into this LMP. As with any relationship, communication is the vehicle by which cooperation is achieved. Management of the Wildlife Area will continue to speak frequently with flood protection and vector control personnel, local farmers, and other resource management agencies on a daily basis.

4.4 SUPPORT OF RESOURCE ENHANCEMENT AND PUBLIC USE

As the population of Yolo, Sacramento, and Solano counties, which surround the Yolo Bypass Wildlife Area, and of California in general continues to increase, the demand for public recreation use will continue to grow. With increased access and use, stresses placed on natural resources of the Yolo Bypass Wildlife Area will likely also increase. This LMP anticipates the opportunities and issues that may arise and identifies the management actions that will be required to address them to adequately support compatible resource enhancement and public recreation use of the Yolo Bypass Wildlife Area. A complete program of goals and follow-up tasks to achieve the goals is contained in Chapter 5.

4.4.1 REGULATION ADJUSTMENTS

As the circumstances surrounding the Yolo Bypass Wildlife Area change over time, adjustment of the regulations that govern public uses may be required. The revision of these regulations requires approval of the California Fish and Game Commission. A review of the regulations by Yolo Bypass Wildlife Area management staff every three years coincides with the review cycle of the Fish and Game Commission and is appropriate to ensure that regulations remain current.

4.4.2 PUBLIC INFORMATION

A common theme raised during public outreach for the Yolo Bypass Wildlife Area LMP was that additional information sharing is needed to enable people to make better use of the Yolo Bypass Wildlife Area for compatible recreation uses. Information to improve public knowledge of resource management and public-use opportunities in the Yolo Bypass Wildlife Area should be a coordinated effort among DFG, the Foundation, and other public land management agencies and organizations. It should include:

- online information regarding public access locations, compatible resource management, and public use opportunities;

- a hard-copy brochure and posted maps to identify public-access lands and compatible public uses throughout the Yolo Bypass Wildlife Area; and

- a signage program for improving public access and identifying Yolo Bypass Wildlife Area key regulations.

4.4.3 COORDINATED ECOSYSTEM RESTORATION EFFORTS

The Yolo Bypass Wildlife Area LMP is based on an ecosystem approach to habitat management consistent with the principles of the CALFED ERP. Although the Yolo Bypass Wildlife Area is not managed specifically for any special-status species, this LMP is intended to contribute to the recovery of special-status species as well as the maintenance of other native and game species using specific management techniques along with natural processes to create a sustainable system over the long term (refer to Appendix B, “Yolo Bypass Wildlife Area–Related Targets and Programmatic Actions from the CALFED Ecosystem Restoration Program Plan”). In addition to CALFED, the Yolo Bypass Wildlife Area is committed to coordinated ecosystem restoration efforts with other organizations throughout the Yolo Bypass and in the region.

4.4.4 REGIONAL TRAIL CONNECTIONS AND ACCESS IMPROVEMENTS

Improved and expanded trail connections and public access opportunities are needed to support regional planning efforts and compatible public uses. This need was commonly expressed as part of public-outreach meetings that were included in the planning process. Consistent with the purposes of this LMP, improvements should include:

- additional land access points where a substantial public-use potential exists;
- low impact parking areas and pedestrian use of low impact access roads at key locations; and
- incorporation of access roads and/or trails in future restoration project areas, when compatible.

The primary purpose of the Yolo Bypass Wildlife Area is the conservation of habitat for wildlife, and very limited public access improvements are proposed. The Yolo Bypass Wildlife Area is composed of frequently flooded property with sensitive habitats and agricultural leases, and access is limited in this area. In compliance with applicable state and federal laws, DFG will accommodate the accessibility of the Wildlife Area for persons with disabilities, including potential planned facilities. To fully support compatible public uses and concurrently protect habitat and wildlife resources, designated staffing and an operations and maintenance budget will be required.

4.4.5 COOPERATION WITH STAKEHOLDERS

During the public-outreach component of the planning process, stakeholders expressed concerns that resource management and public use of the Yolo Bypass Wildlife Area could result in effects on adjoining lands. In response to these concerns, Chapter 5 includes a number of strategies to mitigate the types of concerns that were raised.

These actions will include direct communication with neighbors, continued communication through the Working Group, signage throughout the Yolo Bypass Wildlife Area, access controls, and coordinated management of existing lands and design of future restoration projects.

5 MANAGEMENT GOALS

The goals in this chapter provide broad guidance for management and are accompanied by practical tasks intended to achieve the goals. The central focus of this Land Management Plan (LMP) is the use of an ecosystem-based approach to management of the diverse mosaic of managed and natural habitat communities in the Yolo Bypass Wildlife Area (Wildlife Area). The goals are drawn from nine years of adaptive management and the information generated through the planning process, and express the direction that ongoing operation of the Yolo Bypass Wildlife Area will take. It is important to note, however, that implementation of many of the tasks identified in this plan is dependent upon having adequate staff and operations and maintenance budget. Thus, additional Wildlife Area personnel and budget are required to accomplish the tasks identified in this chapter. These personnel needs are described in Chapter 6, “Operations and Maintenance.”

The management goals and tasks described in this chapter were evaluated for their potential impact on the environment in accordance with the provisions of the California Environmental Quality Act (CEQA). An Initial Study was prepared in accordance with the State CEQA Guidelines, which is included as Appendix H. This Initial Study concluded that this LMP, as proposed, would not have a potentially significant impact on the environment. Accordingly, a proposed Negative Declaration finding that the project will not have a potentially significant impact on the environment has been prepared.

The CEQA document analyzes impacts resulting from the programmatic implementation of this LMP. The details of specific projects that may be developed consistently with this LMP are not yet known. Any future projects that may involve environmental effects will need to be evaluated in light of the IS/ND to determine if additional project-specific CEQA analysis is necessary. The type of additional CEQA review completed would be determined based on CEQA Guidelines Sections 15162–15164. Permits, consultations and/or approval actions may also be required to approve specific future projects. Examples of potential future permit requirements include the following:

- U.S. Fish and Wildlife Service (USFWS) – federal Endangered Species Act (ESA) consultation and issuance of take authorization;

- National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS) – federal Endangered Species Act consultation and issuance of take authorization;

- U.S. Army Corps of Engineers (USACE) – Section 404 Clean Water Act (CWA) permit for discharge or fill of waters of the U.S., Section 10 Rivers and Harbors Act permit for work in navigable waters of the U.S., approval of modification of USACE levees;

- California Department of Fish and Game (DFG) – internal consultation regarding California Endangered Species Act (CESA) compliance and streambed alteration agreement (Section 1602 of DFG Code);

- California Department of Water Resources (State Reclamation Board) – encroachment permit to work on or adjacent to levee and in designated floodways, approval/authorization of new or restored levees;

- California State Lands Commission – consultation/permit regarding possible secondary impacts to surrounding lands underlying rivers and streams; and

- Regional Water Quality Control Board – National Pollutant Discharge Elimination System construction stormwater permit (Notice of Intent to proceed under the statewide General Construction Permit), potential discharge permit for wastewater, general order for dewatering, CWA Section 401 clean water certification if Clean Water Act (CWA) Section 404 permit is required or if isolated wetlands subject to the Porter-Cologne Act will be affected.

Prior to ground disturbance in areas that have experienced development or disturbance and could contain hazardous materials, a hazardous materials assessment will be conducted. If hazardous materials are detected, the appropriate agencies or companies will be consulted to ensure that people and the environment are not exposed to hazardous materials.

Habitats are managed in accordance with the operations and maintenance manual for the project modifications (as updated in supplement, U.S. Army Corps of Engineers 2003) to the Sacramento River Flood Control Project, and pursuant to the MOU between DFG, State Reclamation Board, USFWS, and DWR regarding threatened and endangered species.

5.1 DEFINITION OF MANAGEMENT TERMS

This LMP has been developed in accordance with the California Department of Fish and Game's (DFG's) *Guide and Annotated Outline for Writing Land Management Plans*, February 2003 (updated 2006) (California Department of Fish and Game 2003, 2006). The Guide organizes management information and guidelines into elements, goals, and tasks, establishing a hierarchy of management direction for the Yolo Bypass Wildlife Area. Elements relate to the broad categories of consideration, goals define objectives within the elements and tasks establish specific actions to attain the goals. Goals are based on the Fish and Game Code, policies of the California Fish and Game Commission, and the goals and objectives of the CALFED ERP (for which DFG is an implementing agency). In addition, it is the policy of the California Fish and Game Commission to protect and preserve all native species diversity including those species experiencing a significant decline that, if not halted, would lead to their designation as threatened or endangered. Similarly, the goals of the CALFED ERP include achieving the recovery of at-risk native species that depend on the Delta and reversing downward population trends of native species that are not listed. Together these elements, goals, and tasks express the policy direction that will guide the management of the Yolo Bypass Wildlife Area.

A terminology for describing management is part of DFG's standardized format for management plans. The terms defined below are used throughout this LMP to describe the current and planned management of the Yolo Bypass Wildlife Area.

ELEMENTS

- An **element** is any biological unit, public-use activity, facility maintenance program, or management coordination program (as defined below) for which goals have been prepared and presented within this LMP.

- The **biological element** refers to ecosystems for which specific management goals have been developed within this LMP.

- The **agricultural resources element** refers to agricultural activities.

- The **public-use element** refers to recreational and other public uses.

- The **cultural resources element** refers to preservation of cultural resources.

- The **facility maintenance element** refers to the program of maintenance and administrative tasks that supports the attainment of goals for the biological and public-use elements.

- The **scientific research and monitoring element** refers to scientific research and monitoring that supports the attainment of goals for the biological and public-use elements.

- The **fire management element** refers to the planning and implementation of fire management that supports the attainment of the goals for the biological and public use elements.

- The **management coordination element** refers to coordination with management programs that are supportive of and compatible with the activities of other public agencies.

GOALS

- A **biological goal** is a statement describing management and its intended long-term results for a biological element.

- An **agricultural resources goal** is a statement describing management and the resulting type and level of agricultural activities for the agricultural element.

- A **public-use goal** is a statement describing management and the resulting type and level of public use (which is intended to be compatible with the goals for biological elements).

- A **cultural goal** is a statement describing management and its intended results for a cultural resources element.

- A **facility maintenance goal** is a statement describing management and the resulting type and level of facility maintenance (which is intended to support attainment of the goals for the biological and public-use elements).

- A **scientific research and monitoring goal** is a statement describing management of procedures for or types of scientific research and monitoring conducted at Yolo Bypass Wildlife Area.

- A **fire management goal** is a statement describing a desired component of fire management planning and coordination of activities occurring before, during, or after fires.

- A **management coordination goal** is a statement describing the desired type and level of management coordination activities that are required to achieve the biological element and public use goals previously specified within this LMP.

TASKS AND ADAPTIVE MANAGEMENT

- **Tasks** are individual projects or work elements that implement the goals and are useful in planning operation and maintenance budgets.

- **Adaptive management** is a dynamic strategy in which management efforts are monitored regularly to assess their status and effectiveness. Monitoring results are then evaluated and used to update management goals and implementation strategies (i.e., tasks). An adaptive management strategy has been applied to all elements within this LMP.

5.2 GOALS AND TASKS FOR ELEMENTS

Elements, goals and tasks are described here in detail. The accompanying chart of assigned staff hours necessary to complete these tasks are described in chapter 5. This chart summarizes many of these tasks and is therefore not an identical task list.

5.2.1 BIOLOGICAL ELEMENTS

White-faced Ibis at sunrise

The biological elements of the Yolo Bypass Wildlife Area include management for species guilds and natural communities. The species guilds have been grouped into nine sub-elements: waterfowl, shorebirds and wading birds, upland game species, raptors, cavity-nesting birds, neotropical birds, other waterbird species, special-status species, and nonnative species not beneficial to wildlife.

A more general discussion of the natural communities of the Yolo Bypass Wildlife Area have been grouped into five sub-elements: seasonal and permanent wetlands, agriculture, riparian, grasslands, upland, and aquatic ecosystems. Each of these sub-elements has its own set of goals and tasks. These sets of goals and tasks are not focused on particular species of plants and animals, but instead are more broadly focused on achieving ecosystem level benefits. More specifically, these are intended to create, maintain and enhance wetlands, agricultural lands, riparian areas, grasslands and uplands, and aquatic ecosystems to sustain habitats for native plants and animals and provide other desired ecosystem services. At all times these habitats are to allow for necessary conveyance of flood flows. Chapter 3, “Environmental Setting,” contains additional information regarding biological resources within the Yolo Bypass Wildlife Area.

At the Yolo Bypass Wildlife Area, there are opportunities to manage for species guilds and maintain, enhance, and/or restore all of these natural communities, including those that provide habitat for special-status and game species. These opportunities include:

- maintenance, enhancement, and/or restoration of communities for use by:
  - large numbers of wintering waterfowl by propagating adequate food supplies and presenting them appropriately at the appropriate time;
  - breeding waterfowl by providing nesting cover and appropriately spaced brood water;
  - shorebirds and wading birds, including both migratory and resident species, by propagating adequate invertebrate food supply, and providing appropriate water depths for foraging activities throughout the year;
  - breeding shorebirds and wading birds including avocets, stilts, phalaropes, killdeer, rails, ibis, black crowned night herons, moorhens, great blue herons, and snowy and great white egrets by providing appropriate nesting habitat;
  - a variety of other resident and migratory species including raptors, grebes, loons, rails, and songbirds;
  - ground nesting birds such as meadowlark, short-eared owls, harriers, and terns by providing adequate cover and prey base;
  - cavity-nesting birds, such as kestrels, tree swallows, and wood ducks by providing large trees for nesting or nest boxes;
  - neotropical migratory birds by providing riparian habitat when appropriate;

- management of seasonal and permanent wetlands, and agricultural lands to minimize mercury methylation as prescribed by the most current research - monitoring of mercury levels within wetland units will judge effectiveness and direct adaptive management;

- management of seasonal and permanent wetlands and agricultural lands to minimize mosquito populations and outbreaks of disease through implementation of agreed upon “best management practices” as described in Kwasny et.al. (2004);

- management of agricultural lands to generate critical income for the operation of the Wildlife Area while utilizing agriculture as a wildlife management tool, providing important wildlife habitat values;

- maintenance, enhancement, and/or restoration of seasonal and permanent wetland, vernal pool and grassland, and riparian communities;

    - management activities to support all vernal pool species including special-status plant species including Ferris’ milk-vetch, alkali milk vetch, Baker’s navarretia, Heckard’s pepper-grass, and potentially suitable habitat for nearly two dozen other special-status plants. Management activities will follow accepted scientific principles and may include selective use of herbicides, appropriate grazing practices, and the ecological use of fire. Translocation of plants or their introduction to the Wildlife Area will follow scientific precepts and hypothesis testing;

    - management activities to support the distribution, among all Yolo Bypass Wildlife Area habitats, 46 special-status and priority wildlife and fish species identified in the CALFED Bay-Delta Program (CALFED) *Multi-Species Conservation Strategy (MSCS),* and the presence of potentially suitable habitat for eight additional special-status wildlife and fish species (among the special-status wildlife occurring in the Yolo Bypass Wildlife Area are five vernal pool crustaceans, giant garter snake, northwestern pond turtle, Swainson’s hawk, burrowing owl, loggerhead shrike, tricolored blackbird, American white pelican, Chinook salmon, steelhead, and Sacramento splittail);

- management activities to support the presence of a breeding colony of more than 100,000 Mexican free-tailed bats and other bat species;

- restoration and enhancement of freshwater tidal marsh adjacent to the East Toe Drain below Lisbon Weir;

- restoration and enhancement of Putah Creek and associated aquatic habitats and ecological processes in the seasonal floodplain by creating a south flowing channel alignment from the creek through the sinks of the Tule Ranch and entering the East Toe Drain in a tidal area south of Lisbon Weir; and

- enhancement of habitats through removal and management of nonnative invasive species that do not benefit wildlife species or that impact special status plants.

There are also a number of important constraints on the management of the Yolo Bypass Wildlife Area’s biological element. These constraints include:

- Seasonal flooding resulting from the operation of regional flood control systems and overflow from local creeks and sloughs;

- availability of staff and funding;

- the need to ensure compatibility of biological resource management activities and floodwater conveyance including management of emergent vegetation;

- the need to ensure compatibility of biological resource management activities and public uses;

- human disturbance to wildlife habitat or agricultural operations;
- vector management (i.e., mosquito control) requirements;
- adverse effects of spring flooding on management and operations, wildlife nesting, and farming;
- potentially inadequate water quantity available for summer irrigation;
- methylation of mercury in wetlands and agricultural lands; and
- potential management conflicts between agricultural practices and wildlife management activities and the ecological requirements of special status plant and animal species.

Chapter 3, “Environmental Setting,” contains additional information regarding biological resources within the Yolo Bypass Wildlife Area.

5.2.1.1 MANAGEMENT FOR SPECIES GUILDS

The Yolo Bypass Wildlife Area is one of the primary wintering, breeding, and migratory stopover areas along the Pacific Flyway. The Wildlife Area supports vast numbers of birds on a year-round and seasonal basis. The broad diversity of species guilds supported by the Yolo Bypass Wildlife Area is tied, in part, to the diversity of communities that provide habitat within the Wildlife Area. These managed communities, which include seasonal and permanent wetlands, agricultural fields, riparian woodlands, and grasslands provide a diverse matrix of nesting and foraging habitats for several guilds and support a rich assemblage of terrestrial and aquatic invertebrates as well as cultivated crops and natural vegetation that form the forage base for shorebirds and wading birds, waterfowl, upland game species, raptors, cavity-nesting birds, neotropical migratory birds, and a variety of other waterbirds.

In recognition of the vital habitat values provided by the Yolo Bypass Wildlife Area, the National Audubon Society has named it a Globally Important Bird Area. As California’s Great Central Valley continues to grow and natural areas are converted to housing and commercial developments, the importance of large, contiguous areas with a diverse variety of habitats such as the Yolo Bypass Wildlife Area will increase. To preserve these values, the YBWA is managed using an ecosystem approach to benefit the full suite of wildlife guilds utilizing the wildlife area as opposed to a management approach focused on a single species or single group of species.

The Species Guilds sub-element includes goals for management of multiple communities to provide habitat and benefit several guilds of bird species. An additional goal is also provided for the Mexican free-tailed bat colony present under the Yolo Causeway. These goals are based on the stated purpose of land acquisition by the Wildlife Conservation Board (WCB) (Wildlife Conservation Board 2001); on the CVHJV’s habitat restoration goals under the North American Waterfowl Management Plan (NAWMP); and on the California Fish and Game Code, the policies of the California Fish and Game Commission, and the goals and objectives of the CALFED Ecosystem Restoration Program (ERP) (for which DFG is an implementing agency).

These tasks are based on nine years of experience in adaptively managing these communities on the original 3,700-acre Yolo Bypass Wildlife Area and five years of managing the newly acquired Glide and Los Rios properties. Actions proposed must comply with the federal and California Endangered Species Acts (ESA and CESA) and other regulations aimed at the protection of special-status species and sensitive habitats, including the current Memorandum of Understanding (MOU) with the U.S. Fish and Wildlife Service (USFWS), California Department of Water Resources (DWR), and the State Reclamation Board regarding the management of special-status species at the Yolo Bypass Wildlife Area.

Wetland management techniques are built upon the prescriptions as described in *“A Guide to Wetland Habitat Management in the Central Valley”* (California Department of Fish and Game 1995) and have been adapted to specific environmental conditions within the Yolo Bypass and the need to remain compatible with the flood control function of the Yolo Bypass.

Species Guilds Goal 1 (SG-1): *Manage and maintain habitat communities for waterfowl species.*

Northern Pintail

A significant feature of the Yolo Bypass Wildlife Area is the abundance and variety of wintering waterfowl that migrate down the Pacific Flyway each year. Waterfowl populations are a highly valued and diversified biological resource. Large numbers of ducks, geese, and swans winter in the Wildlife Area after migrating from northern breeding areas. Abundant species include northern pintails, northern shovelers, mallards, gadwalls, American wigeons, cinnamon and green-winged teals, scaups, ring-necked ducks, snow gees, tundra swans, and white-fronted geese. Some species, such as mallards, cinnamon teal, gadwalls, and Canada geese, are also yearlong residents and breed locally in wetlands and nearby uplands. Waterfowl are a significant component of the Wildlife Area, and are of high interest to recreational hunters and bird watchers.

A peak in the number of waterfowl in the Wildlife Area occurs in December–April, when large numbers of species in this guild are present and seasonal wetlands are flooded. A secondary peak in summer correlates with the presence of breeding ducks that nest throughout the Wildlife Area, primarily mallard and cinnamon teal. During periods of water inundation in the Bypass, diving species such as canvasaback, scaup, and goldeneye can be present in significant numbers.

The propagation of beneficial plants and subsequent fall flooding of seasonal wetlands is the primary wetland management strategy in the Yolo Bypass Wildlife Area for migratory waterfowl. The post harvest flooding of agricultural crops, primarily rice, has effectively attracted thousands of wintering waterfowl to the Yolo Bypass Wildlife Area. Grazing, upland cover plantings, and the maintenance of properly spaced brood ponds are some strategies used for nesting waterfowl. In addition, agricultural activities provide high quality habitat for species in this bird guild.

The tasks listed below identify specific management activities intended to benefit resident and migratory waterfowl species.

Tasks:

1. Manage seasonal and permanent wetlands and other communities to provide habitat for resident waterfowl species.

    a. Draw down flooded seasonal wetlands in the spring (April 1) to promote growth of swamp timothy as a forage crop.

        i. include summer irrigation (as necessary) throughout 33% of the seasonal wetlands in order to increase seed yield, stimulate germination and propagation of water grass and provide foraging opportunities for Swainson’s hawk.

    b. Disc, mow, burn, and/or graze vegetation as necessary to promote desirable species, eliminate species not valuable for wildlife (e.g., cocklebur), promote a higher quality seed bed for the following year and to maintain required ratios of open water and emergent vegetation after fall flood up.

    c. Maintain shallowly flooded shorebird management areas in August to attract early arriving waterfowl.

    d. Flood seasonal wetlands beginning September 1 in anticipation of the arrival of migratory waterfowl.

    e. Flood rice fields as early as possible after harvest is completed to attract migratory waterfowl.

    f. Disc islands in seasonal wetlands prior to flood up in order to provide loafing areas for waterfowl and shorebirds.

    g. Construct linear islands with disc ridger prior to flood up in order to increase loafing areas for waterfowl and shorebirds.

    h. Maintain permanent ponds and other brood water at no more than one mile intervals to promote increased waterfowl chick survival in the Yolo Bypass Wildlife Area.

        i. Space managed brood waters at no more than one mile intervals.

        ii. Perform periodic irrigation in upland swales to increase brood water and promoted production of important prey species for waterfowl chicks.

2. Manage upland vegetation to provide desired nesting habitat.

    a. Plant fields of wheat combined with vetch to provide high quality nesting habitat the following year.

    b. Control invasive weeds such as perennial pepperweed and starthistle.

    c. Perform scattered irrigations in upland areas to increase humidity and subsequent invertebrate numbers for the benefit of ground nesting birds such as mallard and ring-necked pheasant. These irrigations must be conducted quickly and drained thoroughly to prevent production of large numbers of mosquitoes.

    d. Continue to enhance upland areas with the construction of topographic features such as swales to create microhabitats and more effectively move water on and off the field.

3. Maintain a sanctuary area where public access is prohibited in order to provide safe haven for migratory waterfowl.

    a. Flood sanctuary area within the month of September.
    b. Maintain permanent sanctuaries without changing locations.
    c. Do not consider non-hunting areas open for other public uses as sanctuary.

4. Monitor waterfowl populations periodically to assess management techniques and species response; apply adaptive management techniques as appropriate.

    a. Conduct monthly surveys of waterfowl numbers, twice monthly during the months of September through March.

    b. Acquire survey data collected by USFWS during annual mid-winter surveys.

    c. Conduct annual surveys of representative upland areas for nesting waterfowl.

Species Guilds Goal 2 (SG-2): *Manage and maintain habitat communities for shorebird and wading bird species.*

American avocet, a common breeding species at the Yolo Bypass Wildlife Area

The Yolo Bypass Wildlife Area has become one of the premier shorebird areas in the Central Valley. With managed seasonal wetlands providing shallow water, mud flats, and island mounds, and the development and implementation of a fallow shorebird management phase introduced to the rice rotation, hundreds of thousands of shorebirds and wading birds annually migrate through the Wildlife Area, spend the winter, and perhaps breed in the Yolo Bypass Wildlife Area. Some shorebird and wading bird species are year-round residents. Representative species of breeding shorebirds and wading birds include American avocets, black-necked stilts, spotted sandpipers, Wilson's phalarope (rarely), killdeer, pied-billed grebe, sora and Virginia rail, white-faced ibis, great blue heron, common moorhen, great and snowy egret, and black-crowned night heron. All of these species are a significant component of the Wildlife Area avifauna and are of high interest to recreational bird watchers.

Common wintering species include greater yellowlegs, dowitcher, least sandpiper, and black-bellied and semipalmated plover. During the late winter, these species are joined by dunlin, western sandpiper, and marbled godwit.

Habitat characteristics valuable for shorebirds when presented at the proper seasonal period and timing include:

- shallow open water with varied topography or a sloped pond bottom;
- a forage base of invertebrate populations, and dense concentrations of invertebrate prey necessary to feed shorebirds; and
- bare islands for roosting and nesting.

The tasks listed below identify specific seasonal management activities intended to benefit shorebird species. These techniques have been tested and adapted as needed on the 3,700-acre Yolo Bypass Wildlife Area over the last nine years.

Tasks:

1. Manage seasonal wetlands for shorebird species.

    a. *Spring:* Draw down flooded seasonal wetlands in spring (April 1) to promote growth of swamp timothy while providing important mudflat habitat for migratory and resident shorebirds. Provide bare islands for nesting which become raised mounds upon draw down. Water maintained in low lying swales will provide foraging areas for breeding shorebirds.

    b. *Summer:* Provide mudflat habitat in July and August during the peak of shorebird migration.

        1. Drain permanent wetlands in midsummer.

            a. Permanent wetlands are periodically drained in midsummer on a 4–6 year cycle in order to perform important vegetation control activities. When drained, open areas will contain concentrated numbers of fish and invertebrates, which will be available for consumption for a large variety of water birds. Timing these draw downs with the arrival of migratory shorebirds in July will provide excellent shorebird foraging habitat.

2. Flood newly disced areas in July.

   a. Areas can be opened up through burning, mowing, grazing, followed by discing and flooded for shorebird use.

3. Hold winter water until late drawdown in June.

   a. While still experimental at this time, a June drawdown provides the required density of prey species but will also result in an increased amount of emergent vegetation and undesirable plant species such as cocklebur (*Xanthium* strumarium) and joint grass (*Paspalum distichum*). These areas also provide good brood water for waterfowl.

c. *Winter:* Flood and maintain shallow water for shorebird foraging. Maintain bare islands for loafing.

2. Manage agriculture for shorebird species through newly developed shorebird/rice rotation.

   a. *June:* Prepare fallow rice field for planting, including rough discing, finish discing, land planning (if necessary), construction of contour ridges, and installation of water control structures.

   b. *July 1:* Flood shallow unplanted rice fields which have been disced at least twice.

   c. *July 1 through end of August:* Maintain shallow water.

   d. *September 1:* Drain fields, disc weeds and prepare field for rice planting to occur in the following spring.

Black-necked stilts in fallow rice field managed for shorebirds

3. Monitor shorebird populations periodically to assess management techniques and species response; apply adaptive management techniques as appropriate.

4. Perform field preparation of some agricultural fields in the fall in order to present disced field habitat for species that utilize this habitat such as horned larks, longspurs, and mountain plover.

5. Provide staggered timing of rice shore bird rotation so that there are always some fields in the shorebird rotation.

Species Guilds Goal 3 (SG-3): *Maintain and enhance habitat for upland game species.*

Primary upland game bird species include mourning doves and ring-neck pheasants. Ring-necked pheasant numbers fluctuate in the Yolo Bypass based on the severity of flooding. Successive years without serious flooding result in spectacular numbers of pheasants. Tenant farmers grow fields of safflower that greatly benefit mourning dove with abundant foraging opportunities. Safflower is also left unharvested and mowed to provide additional foraging prospects for these species. These management strategies have resulted in improved upland game bird hunting throughout the Wildlife Area.

Ring-necked pheasant

Turkeys are a recent addition to the avifauna of the Yolo Bypass Wildlife Area. Found primarily moving up and down Putah Creek and adjacent agricultural fields, turkey may soon become a prominent fixture at the Wildlife Area and perhaps could be considered for inclusion in an upland game hunting program.

California quail are occasionally seen along Putah Creek and the Toe Drain. They are not expected to become common enough to include in an upland game hunting program.

The tasks listed below identify specific management activities intended to benefit upland game species.

Tasks:

1. On an experimental basis, dedicate two fields to provide all habitat requirements within discreet areas in accordance with Diverse Upland Habitat Unit (DUHU) techniques being developed on several state wildlife areas.
2. Annually plant nesting cover including legumes that will improve nesting habitat for upland game species.
3. Consider providing nesting structures for mourning dove.
4. Annually plant grain field to provide foraging areas for upland game and hunting opportunities for upland game hunters.
5. Control invasive weeds such as perennial pepperweed and starthistle.
6. Perform scattered irrigations in upland areas to increase humidity and subsequent invertebrate numbers for the benefit of ground nesting birds such as mallard and ring-necked pheasant. These irrigations must be conducted quickly and drained thoroughly to prevent production of large numbers of mosquitoes.
7. Continue to enhance upland areas with the construction of topographic features such as swales to create micro habitats and more effectively move water on and off the field.

Soaring Swainson’s hawks

Species Guilds Goal 4 (SG-4): *Manage and maintain habitat communities for raptors.*

The Yolo Bypass Wildlife Area is a very important location for wintering birds of prey including white-tailed kites, rough-legged hawks, prairie falcons, merlins, peregrine falcons, kestrels, ferruginous hawks, barn owls, great horned owls, short-eared owls, northern harriers, and large numbers of red-tailed hawks. Breeding raptor species in the Wildlife Area include Swainson’s hawks, red-tailed hawks, kestrels, northern harriers, white-tailed kites, barn owls, burrowing owls and great horned owls. Swainson’s Hawks are especially abundant through much of Yolo County and the Wildlife Area lies in middle of an abundant local population. Over a dozen nests have been found on or adjacent to the Wildlife Area. Discing, mowing, and summer irrigations attract large numbers of Swainson's hawks feeding on grasshoppers. Fall preparation of agricultural fields also attracts wintering raptors.

Discing often attracts several Swainson's hawks

Management strategies for raptors include optimizing foraging opportunities by managing for a food base consisting of rodents and large insects. Although rodent numbers are highly dependent on the timing, magnitude, and duration of flooding in the Yolo Bypass, they seem to quickly reinvade the floodplain. The propagation of grain fields increases local numbers of rodents, providing an increased prey base. Encouraging the proliferation of sweet clover and maintaining high humidity in pond/wetland bottoms helps to develop high grasshopper numbers, an important food item for Swainson's Hawks. Recent development of shorebird management areas has locally increased numbers of shorebird predators, including peregrine falcon and merlin.

The tasks listed below identify specific management activities intended to benefit these bird species.

Tasks:

1. Manage for rodents and large insects to provide adequate prey items in order to benefit foraging raptor species.

   a. Maintain moist pond-bottom conditions to promote the development of high grasshopper populations.

   b. Manage discing, mowing, and summer irrigation to attract large numbers of Swainson's hawks, which feed on grasshoppers.

   c. Manage fall flooding of agricultural fields to attract wintering raptors.

   d. Plant food plots that will not only provide food for birds, but rodents as well. Legumes and grain crops such as vetch, clovers, wheat, sunflower, milo, corn, and safflower are recommended.

   e. Consider the adverse effects of intentional spring flooding on rodent numbers and subsequent raptor use.

2. Monitor populations of raptors to assess management techniques and species response; apply adaptive management techniques as appropriate.

   a. Identify correlative factors such as Bypass flood dates, annual rainfall totals, or rodent numbers.

   b. Conduct bi weekly raptor surveys throughout the year.

Species Guilds Goal 5 (SG-5): *Manage and maintain habitat communities for cavity-nesting bird species.*

Cavity-nesting birds, such as kestrels, tree swallows, and wood ducks can be seen throughout the Wildlife Area. Providing nesting boxes for these cavity-nesters benefits these species in the Wildlife Area. Swallows are summer migrants, occurring in the Wildlife Area from late winter to early fall (February–October), with peak abundance generally in June and July. Large post-breeding flocks of swallows can occur in the late summer, particularly when flying insect populations associated with wetlands and agricultural fields are abundant.

The tasks listed below identify specific management activities intended to benefit cavity-nesting bird species.

Tasks:

1. Utilizing interested volunteers, provide and maintain nesting boxes for cavity nesters such as American kestrels, tree swallows, barn owls, and wood ducks in appropriate habitats.

2. Restore and enhance riparian vegetation for cavity nesters where compatible with flood management.

3. Monitor populations of cavity-nesting bird species periodically to assess management techniques and species response; apply adaptive management techniques as appropriate.

Species Guilds Goal 6 (SG-6): *Manage and maintain communities for neotropical bird species.*

Many species of neotropical migratory birds migrate through or breed in the Yolo Bypass Wildlife Area. The neotropical migratory bird guild comprises bird species that breed in North America and winter in Central and South America. Representative species of the neotropical migratory bird guild are western kingbirds, western wood-pewees, swallows, orioles, warblers, blue grosbeaks and yellow-breasted chats.

Regionally, there have been substantial losses of historic habitat used by neotropical migratory species, and available information suggests that population levels for many of these species are declining. Continued management of existing and restoration of additional suitable wetland, riparian, and grassland habitats in the Yolo Bypass Wildlife Area is important to maintaining healthy neotropical migrant bird populations. Protection and restoration of nesting habitat helps reduce nest parasitism and predation by creating habitat conditions that render neotropical birds less susceptible to these stressors.

Upland habitat management that includes providing community variations in height, density of vegetation, food crops, and water has proven to be beneficial to many neotropical migratory song birds. Opportunities to increase length and density of riparian vegetation along Putah Creek and the East Toe Drain will also benefit species in this guild. Riparian areas act as corridors for migratory songbirds.

The tasks listed below identify specific management activities intended to benefit neotropical migratory bird species.

Tasks:

1. Maintain and enhance riparian vegetation along Putah Creek and the East Toe Drain to serve as corridors for resident and migratory songbirds and nest sites for a variety of species. Due to the increased roughness created by riparian vegetation in the floodway, any increase in acreage of riparian vegetation would require hydraulic modeling to guide design and confirm achievement of performance criteria, and approval from the State Reclamation Board.

2. It has been shown that rows of trees growing parallel to the two external levees of the Bypass can protect these levees from erosion due to wave action. Approval and establishment of appropriate tree lines should be pursued.

3. Manage upland habitat to include variations in height, density of vegetation, food crops, and water to benefit a diverse array of resident ground nesting shorebirds, songbirds, raptors and owls as well as game species such as ring-necked pheasant.

4. Monitor populations of neotropical bird species periodically to assess management techniques and species response; apply adaptive management techniques as appropriate.

Species Guilds Goal 7 (SG-7): *Manage and maintain communities for a variety of other waterbird species including grebes, rails, bitterns, ibis and songbirds associated with emergent marsh vegetation.*

Common moorhen feeding chicks

Emergent marsh vegetation communities provide valuable habitat for a number of water bird species. The tasks listed below identify specific management activities intended to benefit these bird species.

Tasks:

1. Maintain appropriate and consistent water levels to maintain high quality habitat for floating nest builders such as pied-billed grebe.

2. Maintain varying amounts of thatch within emergent marsh vegetation in order to attract such nesting species as white-faced ibis, black-crowned night herons, tri-colored blackbirds, and yellow headed blackbirds.

3. Time spring drawdown in some ponds so young grebes, moorhens, coots, and ibis are not stranded.

Mexican free-tailed bats leaving their roost under the Yolo Causeway

Species Guilds Goal 8 (SG-8): *Maintain and enhance foraging opportunities for the presence of breeding colonies of bats roosting under the Yolo Causeway.*

An important feature of the Wildlife Area is its breeding colony of over 100,000 Mexican free-tailed bats. These bats nest each summer under the Yolo Causeway and prey on insects throughout Yolo and Sacramento counties. The location of this colony in a protected Wildlife Area will help to ensure its long-term success. The tasks listed below identify specific management activities intended to benefit the Mexican free-tailed bat colony.

Tasks:

1. Establish baseline data on roosting bat species and population density under the Yolo Causeway.
   a. Conduct acoustic surveys of roosting bats for species identification.
   b. Conduct area measurements of active roosting habitat to establish population density information.
   c. Determine location of foraging areas for Causeway population of bats.
   d. Submit survey results to the CNDDB.

2. Support bat diversity.

   a. After determining which species of bats are roosting under the Yolo Causeway (in addition to the Mexican free-tailed bat, the little brown bat, and the big brown bat), evaluate existing management practices (and constraints) within areas of foraging habitat provided by the Wildlife Area to evaluate if alternative management practices would be suitable for encouraging bat species diversity. Target new adaptive management practices to bat species, which may currently be using the area in small numbers.

   b. If pallid bats, a species which feeds almost entirely from the ground, are determined to be roosting under the Yolo Causeway, evaluate if foraging habitat could be managed (within other management constraints) to encourage populations of its most common prey including crickets, beetles, and grasshoppers.

   c. If Townsend’s big-eared bats, a species particularly susceptible to human disturbance, are determined to be roosting under the Yolo Causeway, reduce human disturbances in this area.

   d. Control public access to bat colonies as needed to protect roosting and nesting bats.

   e. Protect and enhance scattered riparian vegetation near bat colony.

3. Protect existing bat maternity roost sites under the I-80 Causeway against unauthorized public disturbance by maintaining existing conditions that make it difficult for the public to gain access to these roosting areas.

4. Coordinate with California Department of Transportation (Caltrans) to ensure that their inspections, bridge maintenance activities, and bat colony management actions are consistent with Yolo Bypass Wildlife Area management goals and tasks regarding the maternity roosts under the I-80 Causeway, and to ensure that bat colony management policies are consistent between the two agencies.

5. Encourage preservation of bat colonies as a beneficial natural resource by maintaining and enhancing existing education and outreach programs.

   a. Expand presentation facilities and/or increase the frequency of bat-related educational presentations to accommodate existing levels and anticipated increased levels of public interest in this natural resource.

   b. Encourage bat protection by members of the public who visit the wildlife area by emphasizing their benefits to the ecosystem and the human population, by emphasizing the compromised status of many bat species populations, and by emphasizing regulatory protections that apply to bat species (e.g., Fish and Game Code Sections 1002 and 4150; and Title 14 California Code of Regulations Chapter 3 and Chapter 1 Section 251.1).

6. Monitor bat population species and density periodically to track population trends and assess management techniques and species response; apply adaptive management techniques as appropriate.

5.2.1.2 SPECIAL-STATUS SPECIES

The Special-Status Species sub-element includes goals for management of special-status species that may occur on the Yolo Bypass Wildlife Area. These goals are based on the California Fish and Game Code, the policies of the California Fish and Game Commission, and the goals and objectives of the CALFED Ecosystem Restoration Program (ERP) (for which DFG is an implementing agency).

Giant Garter Snake

DFG currently manages the Yolo Bypass Wildlife Area under a multi-agency MOU with the USFWS, DWR, and the State Reclamation Board. The MOU specifically states that “DFG will take into consideration the specific habitat requirements of the giant garter snake and Swainson’s hawk, but the area will not be specifically managed for any other listed or candidate species. Consideration of the habitat needs of the giant garter snake and Swainson’s hawk will not impair management in accordance with the operations and maintenance manual for the project modifications (as updated in supplement, U.S. Army Corps of Engineers 2003) to the Sacramento River Flood Control Project." As such, the following goal is not intended to direct species management. Rather, it is intended to promote management of the communities in a manner that increases general habitat quality, which may benefit many species, including special-status wildlife, fish, and plant species. This goal is specifically intended to not conflict with the existing multi-agency MOU for the Yolo Bypass Wildlife Area.

Special Species Goal 1 (SS-1): *Without specifically managing for special-status species, the communities at the Yolo Bypass Wildlife Area should be managed in a way that generally improves overall habitat quality for species abundance and diversity while not discouraging the establishment of special-status species.*

Several special-status animals are currently known or have the potential to use the ecosystems at the Yolo Bypass Wildlife Area. Comprehensive surveys for all these species have not been conducted; thus their distribution at Yolo Bypass Wildlife Area could be more extensive than documented in the California Natural Diversity Database (CNDDB). Therefore, the results of surveys for these species would determine the need for and scope of the other tasks listed below.

Tasks:

1. Conduct surveys of wildlife, fish, and vegetation communities. The highest priority is to survey for special-status animals and plants that could be present in the ecosystems at the Yolo Bypass Wildlife Area but that are not yet known to occur, such as California tiger salamander, western spadefoot toad, Colusa grass, Crampton's tuctoria, and Bogg's Lake hedge-hyssop. It is also important to survey for other special-status species known to occur in the ecosystems at the Yolo Bypass Wildlife Area but for which much information is lacking, such as giant garter snake and vernal pool crustaceans. Submit observation records to the CNDDB.

2. Monitor populations of special-status species periodically to assess overall habitat integrity, detect changes in distribution and abundance, and detect positive and adverse effects of management activities, human use, and/or nonnative species. Conduct surveys prior to management activities as appropriate to avoid effects.

3. Monitor special-status species use of the floodway in the face of rising and receding floodwaters.

4. Expand the purview of the MOU to address all special-status species currently known to occur in the Yolo Bypass Wildlife Area and include the entire acreage of the expanded Wildlife Area.

5. Upon certification of the operations and maintenance manual for the project modifications (as updated in the supplement, U.S. Army Corps of Engineers 2003) to the Sacramento River Flood Control Project, fulfill reporting requirement described within.

5.2.1.3 NONNATIVE INVASIVE SPECIES

The Nonnative Invasive Species sub-element includes goals for management of nonnative invasive species not beneficial to wildlife or that could impact special status plants. These goals are based on the California Fish and Game Code, the policies of the California Fish and Game Commission, and the goals and objectives of the CALFED Ecosystem Restoration Program (ERP) (for which DFG is an implementing agency).

The Yolo Bypass Wildlife Area contains several invasive weeds that are in need of control efforts. Yellow star thistle tends to occur in disturbed upland areas including parking lots and roads. It appears to thrive during non-flood years. Perennial pepperweed is pervasive in the higher portions of the wetland areas and throughout the uplands. Cattle grazing has effectively kept perennial pepperweed controlled on the Tule Ranch, allowing native forbs to thrive. Most ditches in the Yolo Bypass are eventually choked with water primrose. Many of these ditches are shared with lessees, who contribute towards the control of this invasive aquatic weed. Control measures may include mechanical removal with an excavator or chemical control through the use of aquatic herbicides. Many management activities are coordinated within the Yolo Weed Management Area.

Invasive Species Goal 1 (IS-1): *Prevent the introduction and spread of invasive nonnative species that have no benefit to wildlife or that impact special status plants.*

This goal is based on the need to avoid the potential consequences of the introduction and spread of invasive species, and on a related goal of the CALFED ERP (for which DFG is an implementing agency).
The establishment of additional invasive nonnative species could cause substantial adverse modifications to ecosystems. Thus, a goal of the CALFED ERP is to prevent the establishment of additional nonnative invasive species. The tasks listed below represent a strategic approach toward attaining this goal.

Tasks:

1. Inventory habitats within the Yolo Bypass Wildlife Area for infestations of invasive plants. Monitor these infestations and identify correlative factors such as flooding or vegetation manipulation.
   a. Monitor occurrences of star thistle throughout all upland habitats.
   b. Monitor occurrences of perennial pepperweed in grassland and wetland communities.
   c. Monitor abundance and distribution of water primrose in the wetlands and irrigation infrastructure on the Yolo Bypass Wildlife Area.
2. Prioritize infestations for treatment based on the risks that individual infestations pose to ecosystem services, public infrastructure, and other resources within the Yolo Bypass Wildlife Area, and based on the likelihood that the infestation can be treated and maintained in a cost-effective manner.
   a. Monitor hot spots of introduction (e.g., sites along roads, trails, ditches, and canals, near parking areas, and in turnoffs) to enable early detection and rapid eradication of invasives.
   b. Monitor upstream populations of *Arundo* and water hyacinth along Putah Creek to insure they do not spread to the Wildlife Area. Encourage the eradication of these colonies through participation in the Yolo County Weed Management Area.
   c. Continue monitoring of Iberian star thistle population established on the Tule Ranch.
3. Manage and control invasive and other nonnative species through specified grazing practices, controlled flood-up and drawdown procedures, use of pesticides, and other conventional agricultural practices.
   a. During the rosette growth stage of star thistle, apply Transline® for control of this invasive weed.
   b. Apply Telar® to perennial pepperweed stands during early growth stages in spring.
   c. Utilize grazing as a tool to control perennial pepperweed in the grazing areas of the Tule Ranch.
   d. Utilize grazing as a means of controlling perennial pepperweed in pastures and as an initial treatment in preparation for discing or Roundup® application for the control of jointgrass.
   e. Evaluate the effectiveness of monitoring and control methods periodically; adjust methods as needed.
   f. Coordinate with and support regional control efforts including the efforts of the Yolo County Weed Management Area.
   g. Continue coordination with Yolo County for the control of Iberian star thistle on the Tule Ranch.

h. Coordinate with DWR Division of Flood Management, Sacramento Flood Maintenance Office on management of invasive species on and adjacent to levees.

i. Provide education and outreach regarding impacts associated with invasive plants and control efforts.

j. Share results of control efforts with other Wildlife Areas and private habitat managers in the area.

k. Coordinate control efforts with needs of local farmers who share the use of the Mace Ranch Irrigation System.

l. Coordinate all actions with the DFG pesticide use programs. Ensure that all actions comply with the ESA and CESA and other regulations aimed at the protection of special-status species and sensitive habitats as well as current county and state regulations regarding the application of pesticides.

m. Maintain a consistent level of expertise in regards to pesticide use techniques and chemical effectiveness by requiring current pesticide applicator's certification for at least two on-site employees.

n. Consider and avoid unintentional effects to non-target plant species.

o. Avoid adverse effects to native forbs in Tule Ranch grassland communities as a result of herbicide applications for the control of star thistle.

p. Avoid adverse effects to agricultural crops in the area through drift in the air or water.

q. Coordinate herbicide treatments to avoid contact with visitors. Clearly identify dates, locations, and times of herbicide treatments to inform the public and facilitate closure of herbicide treatment areas.

Management goals for various species guilds have already been discussed. The following goals are less focused on particular groups of plants or animals, but instead establish broader-ecosystem wide goals.

5.2.1.4 SEASONAL AND PERMANENT WETLAND COMMUNITIES

Seasonal and permanent wetlands were once one of the dominant community types within California's Great Valley. Seasonal and permanent wetlands on the Yolo Bypass Wildlife Area can be divided into two separate groups: those that are actively managed to achieve maximum benefit to wildlife and those that are natural or are passively managed. The Yolo Bypass Wildlife Area is unique in that it preserves a large, contiguous block of land with representative examples of each wetland type. The Wildlife Area is further unique in that these wetland types are interspersed among one another, creating a diverse habitat matrix of various wetland types.

Actively managed seasonal and permanent wetlands are generally found in the original Yolo Bypass Wildlife Area, were reconstructed from bare ground, and are intensively managed by the DFG via a complex system of pumps, canals, and water control structures to flood and drain wetlands according to established prescriptions. Additionally, vegetation is disturbed by mowing, discing, or water management in order to maximize the habitat value of these lands.

Passively managed wetlands on the Yolo Bypass Wildlife Area include natural alkali marshes, vernal pools, and seasonal marshes. These areas are less intensely managed although usually some water control is still required to impound water. For example in the somewhat alkali area on the Fireman's Club, natural sloughs which were once on the shoreline of the vast Yolo Basin, subject to inundation during high water, complete with a tidal influence. Absent of this natural hydrology, this slough has two embankments built across its width, with water control structures installed. Water is delivered from the west into the slough, where it is backed up by the water control structure. Many of the vernal pool areas are affected by previous road construction efforts. Natural swales sweep to the southeast, draining small watersheds. When the swale encounters a road embankment, the water is

Natural slough of the Fireman's Club looking west

Flooded swale on the Tule Ranch

2004 wetland enhancement project workers

impounded, creating vernal pool conditions. These interruptions in the natural topography of the Tule Ranch are quite effective at creating the conditions necessary for the survival of these rare plants and animals of the vernal pools.

Within the heart of the Bypass on the southeast portion of the Tule Ranch remain low lying areas that were not leveled for agricultural purposes, but were instead utilized as open range for cattle and waterfowl hunting. Historically, small berms were constructed to impound water and the existing irrigation system was modified to deliver water to these "sinks." These wet areas were utilized as duck hunting clubs, named after their principle hunters. This was the location of the Martin's Pond and Slaviches. Currently, these low areas are the first place to flood and the last to drain, resulting is some of the same plant communities found further west in the vernal pool communities.

One field, adjacent to the toe drain is so low in elevation that it is subject to tidal inundation through a break in the west berm of the toe drain. This emerging fresh water tidal wetland represents a unique habitat type found no where else on the Wildlife Area.

The Seasonal and Permanent Wetland Ecosystems sub-element includes goals for management of these communities to maintain or enhance wetland species abundance and diversity (including special-status species), to prevent the spread of nonnative invasive species not beneficial to wildlife, and to restore and enhance degraded communities.

Seasonal and Permanent Wetland Ecosystems Goal 1 (SPW-1): *Following accepted scientific principles and practices, restore and enhance wetlands to conditions that provide desired ecological functions.*

Tasks:

1. Evaluate opportunities, constraints, and potential restoration benefits to identify feasible wetland restoration projects for intensely managed wetlands as well as the described more passively managed wetland areas. Potential restoration project sites may include the Tule Ranch Unit, Parker Unit, Los Rios Unit, South Unit, and Causeway Ranch.

2. Pursue funding and develop plans for identified restoration projects that include goals, techniques, costs, monitoring, an adaptive management process, and a schedule. Funding programs to pursue may

include the following:

a. North American Wetlands Conservation Act,

b. State Duck Stamp Program,

c. Upland Game Stamp Program,

d. U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) Farm Bill Programs,

e. USFWS State Wildlife Grant Program, Federal Aid in Wildlife Restoration Program,

f. Central Valley Project, Wildlife Habitat Augmentation Plan,

g. Neotropical Migratory Bird Conservation Act Grants Program,

h. Riparian Joint Venture,

i. Ducks Unlimited, Wetland Restoration Program,

j. Department of Fish and Game Minor/Major Capital Outlay proposals,

k. DFG Comprehensive Wetlands Program,

l. Wildlife Conservation Board Inland Wetlands Conservation Program,

m. Other programs authorized under future bond acts,

n. DWR grants available for mitigation of water projects and levee maintenance activities,

o. Funding available through Yolo County Integrated Regional Water Management Plan,

p. Funding available through the Sacramento River Watershed Program,

q. Funding from grant programs administered by U.S. Environmental Protection Agency,

r. Funding from grant programs administered by National Oceanic and Atmospheric Administration,

s. Funding from grant programs administered by the National Fish and Wildlife Foundation,

t. Funding from grant programs administered by US Bureau of Reclamation,

u. Funding that becomes available as a result of programs to improve the Sacramento River Flood Control System by expanding the Yolo Bypass (including Sacramento Area Flood Control Agency),

v. Funding from the Yolo County NCCP.

3. Cooperate with development and implementation of existing restoration plans for wetland ecosystems by the CALFED ERP, North American Waterfowl Management Plan, Partners in Flight, United States Shorebird Conservation Plan, Waterbird Conservation for the Americas, Yolo County NCCP and other programs that are consistent with the goals of this LMP.

4. Coordinate habitat restoration acreages with goals developed for the Yolo Basin component of the Central Valley Joint Venture.

5.2.1.5 RIPARIAN COMMUNITIES

As with seasonal and permanent wetlands, riparian communities were once extensive in California's Central Valley. Historically, riparian areas occurred in broad bands within the floodplains of the streams and rivers draining from the Coast Ranges, Sierra Nevada, and Cascades. These rivers and streams flowed into the Sacramento and San Joaquin Rivers, which supported even broader bands of riparian communities. The vast majority of this community in the Central Valley has been lost to flood control projects, agriculture, and urban development. The riparian communities that remain are often restricted to the immediate stream border and are frequently less diverse due to the alteration of flood regimes, river flows, and the disturbance processes that create new riparian habitat and permit the succession of immature riparian communities into mature communities.

Within the Yolo Bypass Wildlife Area, riparian communities are restricted to narrow bands along Putah Creek, the East Toe Drain, and adjacent to some permanent wetlands. Despite the limited extent, riparian areas provide valuable wildlife habitat, particularly given their close proximity to grasslands, wetlands, and other communities within the Yolo Bypass Wildlife Area. As with many other riparian areas in the Central Valley, these communities are threatened by invasive plants, such as giant reed and alteration of hydrologic regimes.

Riparian habitat presents the greatest amount of hydraulic roughness to flood flows in the Yolo Bypass. For this reason, any potential riparian restoration projects require approval and permitting from the State Reclamation Board. Hydraulic analysis must be performed to guide the design of future restoration projects in the Wildlife Area and confirm achievement of performance criteria (i.e., confirmation that project-related adverse affects to flow conveyance will not occur). This analysis must be performed on a detailed restoration plan indicating locations, types and numbers of trees, as well as a description of the project's management. A hydraulic modeling workplan for guiding the design of future restoration projects in the Yolo Bypass Wildlife Area can be found in Appendix C.

Fragmented riparian vegetation along Putah Creek where it empties into the Yolo Bypass

The Riparian Community sub-element includes goals for management to maintain or enhance riparian species abundance and diversity and to restore and enhance degraded communities to provide desired ecological functions. Constraints to achieving these goals are primarily related to the maintenance of necessary flow conveyance throughout the Bypass.

Riparian Goal 1 (R-1): *Maintain and enhance riparian communities for native species diversity and abundance (including special-status species).*

A diverse abundance of native species including several special-status species are currently known or have the potential to be using riparian communities at the Yolo Bypass Wildlife Area. Comprehensive surveys for these species have not been conducted; thus their distribution at Yolo Bypass Wildlife Area could be more extensive than documented. Therefore, the results of surveys for these species would determine the need for and scope of the other tasks listed below.

Tasks:

1. Conduct surveys for wildlife and vegetation of riparian communities. The highest priority is to survey for special-status animals and plants that could be present in riparian ecosystems at the Yolo Bypass Wildlife Area but that are not yet known to occur, such as Northern California black walnut, California hibiscus, yellow-billed cuckoo, Mason's lilaeopsis, and Delta mudwort. It is also important to survey for other special-status species known to occur in riparian ecosystems. Regular monitoring of Swainson's hawk nesting efforts on or adjacent to the Wildlife Area should be continued.

2. Monitor populations of special-status species periodically to assess overall habitat integrity, detect changes in distribution and abundance, and detect positive and adverse effects of management activities, human use, and/or nonnative species.

3. After appropriate hydraulic analysis and receipt of Reclamation Board approval, improve habitat in the riparian ecosystems at the Yolo Bypass Wildlife Area through enhancement of existing riparian areas and establishment of new riparian habitats as permitted. Maintain and enhance riparian vegetation along Putah Creek and the East Toe Drain to provide nest trees and brush for resident and migratory songbirds, wading birds, and raptors.

4. Manage habitats in accordance with the operations and maintenance manual for the project modifications (as updated in supplement, U.S. Army Corps of Engineers 2003) to the Sacramento River Flood Control Project, pursuant to the MOU between DFG, State Reclamation Board, USFWS, and DWR regarding threatened and endangered species.

Riparian Goal 2 (R-2): *Restore and enhance riparian communities to conditions that provide desired ecological functions.*

This goal is based on DFG concerns and the goals and objectives of the CALFED ERP (for which DFG is an implementing agency). The preservation, enhancement, and restoration of riparian areas is a primary concern of DFG, as evidenced by the California Riparian Habitat Conservation Program (Chapter 4.1 of the Fish and Game Code). It is also a goal of the ERP to restore large expanses of riparian habitats. In addition to providing habitat for fish and wildlife species, restoring additional riparian vegetation along the Toe Drain would have the added benefit of protecting the east side levee from erosion by wind waves, if it can be accommodated without impeding conveyance or cutting into freeboard. This appears to be consistent with the USACE Operating Manual for the SRFCP, which states in Section IV 4-05b that "brush and small trees may be retained on the waterward slopes (of levees) where desirable for the prevention of erosion and wave wash" and that "where practicable, measures shall be taken to retard bank erosion by planting willows or other suitable vegetation on areas riverward of levees." A band of trees along the west side levee might also provide erosion protection if it can be accommodated without affecting other flood control parameters. As always, implementation of this concept would require approval of the Reclamation Board.

Opportunities for riparian community restoration and enhancement exist along the East Toe Drain, Putah Creek, and adjacent to permanent wetlands (e.g., Green's Lake) in certain areas. The tasks listed below represent a strategic approach toward restoring and enhancing riparian habitat in these areas.

Tasks:

1. Evaluate opportunities, constraints, and potential restoration benefits to identify feasible riparian restoration projects that would support the goals of this LMP. Riparian restoration projects may include new restoration areas or enhancement of existing restoration areas (e.g., seasonal and permanent wetlands) with riparian vegetation.

2. Pursue funding and develop plans for identified restoration projects that include goals, techniques, costs, monitoring, an adaptive management process, and a schedule.

3. Cooperate with development and implementation of restoration plans for riparian ecosystems by the CALFED ERP and other programs that are consistent with the goals of this LMP.

4. Design and manage riparian restoration and enhancement projects that would not conflict with necessary flood flow conveyance requirements of the Yolo Bypass. Ensure that proposed projects would not result in adverse effects on local or downstream flood hydrology and would comply with the requirements of the State Reclamation Board. Project planning will include necessary hydraulic modeling to guide design and confirm achievement of performance criteria. A work plan for hydraulic modeling is provided in Appendix C.

5.2.1.6 GRASSLAND AND UPLAND COMMUNITIES

Nonnative rabbit's foot grass

Grasslands across the Great Central Valley and other parts of California have been drastically altered over the last 300 years. During this timeframe, the native grassland flora, which consisted of a variety of perennial grasses, bulbs, and annual wildflowers, has been replaced by a variety of nonnative annual grasses and forbs of Eurasian origins. The shift from perennial to annual grasses as the dominant component of the grassland community has modified grassland community structure from a comparatively open and structurally diverse community to one characterized by dense vegetation with fairly homogenous structure. The Yolo Bypass Wildlife Area has not escaped this shift, with its grasslands dominated by the proliferation of annual rye grass.

Because of unique soil types and the propensity for upland areas to experience periods of soil saturation, a portion of the grasslands within the Yolo Bypass Wildlife Area are characterized by a higher occurrence of native wildflowers than many other grassland communities in the Central Valley. Grassland habitat structure within the Yolo Bypass Wildlife Area generally consists of nonnative Italian ryegrass with a diverse assemblage of native forbs supplementing the floral community on the western part of the Tule Ranch. Remnant native perennial grasses make their appearance on higher ground in this area, particularly along the eastern end of the Dixon ridge, an innocuous geographic feature dominated by Myers Clay soils.

The Grassland and Upland Ecosystems sub-element includes goals for management of this community to maintain or enhance grassland species abundance and diversity and to restore and enhance degraded communities to provide desired ecological functions.

Grassland and Upland Goal 1 (GU-1): *Maintain and enhance grassland and upland communities for diversity and abundance of native species (including special-status species).*

A diverse abundance of species including several special-status species are currently known or have the potential to be using grassland and upland ecosystems at the Yolo Bypass Wildlife Area. Comprehensive surveys for these species have not been conducted; thus their distribution at Yolo Bypass Wildlife Area could be more extensive than documented. Therefore, the results of surveys for these species would determine the need for and scope of the other tasks listed below.

Western meadowlark - common resident of upland communities

Tasks:

1. Conduct surveys for wildlife and vegetation in grassland and upland communities. The highest priority is to survey for special-status animals and plants that could be present in grassland and upland communities at the Yolo Bypass Wildlife Area but that are not yet known to occur, such as heartscale, San Joaquin spearscale, Colusa grass and Carquinez goldenbush. It is also important to survey for other special-status species known to occur in grassland and upland ecosystems at the Yolo Bypass Wildlife Area but for which much information is lacking, such as Ferris' milk-vetch, alkali milk-vetch, grasshopper sparrow, burrowing owl, and California horned lark.

2. Monitor populations of special-status species periodically to assess overall habitat integrity, detect changes in distribution and abundance, and detect positive and adverse effects of management activities, human use, and/or nonnative species.

3. Improve habitat for special-status species in the grassland ecosystems at the Yolo Bypass Wildlife Area through the adaptive management of livestock grazing, limited herbicide application, native grass plantings, and other management techniques.

4. Support existing populations of burrowing owls and increase breeding populations through the installation of artificial burrows.

5. Ensure that actions comply with the federal and California Endangered Species Acts and other regulations aimed at the protection of special-status species.

Grassland and Upland Goal 2 (GU-2): *Restore and enhance grassland and upland communities to conditions that provide desired ecological functions.*

This goal was selected because it could help DFG meet the LMP goal regarding native species abundance and diversity in grassland and upland ecosystems. The tasks listed below represent a strategic approach toward attaining this goal.

Tasks:

1. Evaluate opportunities, constraints, and potential restoration benefits to identify feasible grassland and upland restoration projects.

2. Pursue funding and develop plans for identified restoration projects that include goals, techniques, costs, monitoring, an adaptive management process, and a schedule.

3. Cooperate with development and implementation of restoration plans for grassland and upland ecosystems by the CALFED ERP and other programs that are consistent with the goals of this LMP.

4. Enhance grasslands and uplands through grazing, native grass plantings, and other management techniques.

AQUATIC ECOSYSTEMS

The Yolo Bypass provides vital fish spawning, rearing, and/or migratory habitat for a diverse assemblage of anadromous and resident fishes. Both native and nonnative species are common; however, as with most other aquatic habitats in California, nonnative species frequently dominate and compete with native fishes for spawning, rearing, and feeding habitat. Additionally, nonnative fishes frequently prey upon native fishes, particularly juveniles which are susceptible to predation by higher level predators including black bass, striped bass, and other nonnative fish. However, many nonnative fishes provide significant angling opportunities, and the potential ecological impacts of nonnative fishes must be weighed against their value as a popular recreational resource.

While aquatic habitats in the Yolo Bypass Wildlife Area share many characteristics with similar habitats in the Central Valley, the Wildlife Area is unique in that it is managed as a large floodplain that is hydrologically connected to the Sacramento River (i.e., the Yolo Bypass) and the Sacramento-San Joaquin Delta. Historically, these floodplains were common the Central Valley and Delta and provided important spawning and rearing habitat for many native fishes. In addition to providing important habitat elements for many species of native fish, nonnative fish are less likely to make use of floodplain habitats because the spawning season for most nonnative fishes does not coincide with floodplain availability (i.e., inundation) and because floodplains are ephemeral in nature, thereby preventing the establishment of resident populations of nonnative fish. The relative lack of competition from nonnative fish, as well as the habitat complexity, flow regimes, and food web benefits provided by floodplains are particularly important to declining species such as Sacramento splittail and Chinook salmon.

In addition to supporting valuable floodplain habitat, the Yolo Bypass Wildlife Area also encompasses the lowermost segment of Putah Creek down to its confluence with the East Toe Drain. The reach of Putah Creek within the Wildlife Area (i.e., Putah Creek Cross Channel) consists primarily of a straight treeless ditch that is seasonally dammed by the Los Rios Check Dam. The one mile long riparian corridor above the Los Rios Check Dam is an extremely narrow swath with very few trees and steep banks.

The Los Rios Check Dam is currently being managed to optimize the migration of Chinook salmon into lower Putah Creek by removing boards in fall/winter in conjunction with pulse flow releases from the PDD. This action, along with upstream improvements have resulted in the recent return of small runs of fall-run Chinook salmon in the creek. The boards are typically removed in the fall/winter as soon as the irrigation season ends and upon the arrival of Chinook salmon in the East Toe Drain (based on DWR fyke trap sampling) and replaced in April of the following year (for agricultural and wildlife habitat uses).

Researcher conducting radio telemetry studies of spawning Sacramento splittail

The Aquatic Ecosystems sub-element includes goals for management of this habitat to maintain or enhance aquatic species abundance and diversity (including game species and special-status species), to maintain or enhance game species populations, and to restore and enhance degraded habitats to provide desired ecological functions.

Aquatic Ecosystems Goal 1 (AE-1): *Maintain and enhance aquatic ecosystems for diversity and abundance of native species (including special-status species).*

The California Endangered Species Act (Chapter 1.5 of the Fish and Game Code) declares that all state agencies shall seek to conserve threatened and endangered species. It is the policy of the California Fish and Game Commission to protect and preserve all native species experiencing a significant decline that, if not halted, would lead to their designation as threatened or endangered. DFG is also guided by the understanding that it is the desire of the State of California to recover salmon and anadromous trout populations to self-sustaining levels. Similarly, the goals of the CALFED ERP include achieving the recovery of at-risk native species dependent on the Delta and reversing downward population trends of native species that are not listed. The tasks listed below represent a strategic approach toward attaining this goal.

Tasks:

1. Monitor use of aquatic habitats at the Yolo Bypass Wildlife Area by special-status fish species.

2. Improve habitat for special-status fish species using aquatic habitats at the Yolo Bypass Wildlife Area (see Aquatic Ecosystems Goal 3 below).

3. Identify sites (e.g., permanent wetlands, ponds, Green's Lake) for reintroduction of native fish species (e.g., Sacramento perch).

4. Ensure that actions comply with the ESA and CESA and other regulations aimed at the protection of special-status species and are in accordance with the MOU between DFG, USFWS, DWR, and the State Reclamation Board.

Aquatic Ecosystems Goal 2 (AE-2): *Maintain and enhance habitat for game fish species.*

It is the policy of the California Fish and Game Commission that DFG shall emphasize programs that ensure continued sport fishing opportunities, enhance such opportunities, and prevent their loss. It is also commission policy that DFG work toward stabilizing and then restoring the declining native fishery of the Delta.
The enhancement of fisheries for white sturgeon and the maintenance of fisheries for striped bass and nonnative warm water fish are objectives of the CALFED ERP. The tasks listed below represent a strategic approach toward upholding these policies and objectives.

Tasks:

1. Monitor and assess management, human use, invasive nonnative species, and other effects on habitat for desired game species.

2. Evaluate access points, angling use, and regulations periodically; recommend changes as warranted to maintain and enhance aquatic habitats and populations of game species.

3. Improve habitat structure in permanent wetlands for the benefit of game fish species.

Aquatic Ecosystems Goal 3 (AE-3): *Restore and enhance aquatic ecosystems to conditions that provide desired ecological functions.*

Substantial achievements have been made to restore habitat and improve flow regimes throughout the lower Putah Creek watershed. These efforts have resulted in the historic return of small Chinook salmon spawning runs in the lower creek in recent years. Continued efforts are ongoing to address remaining limiting factors through additional collaborative restoration planning and implementation. The DFG supports the continued restoration efforts in the lower Putah Creek watershed, especially those opportunities that exist in the lowermost segment of Putah Creek that runs through the Yolo Bypass Wildlife Area.

This goal includes tasks to restore and enhance aquatic habitat and passage in the segment of Putah Creek flowing through the Wildlife Area, restoration of intertidal marsh habitat adjacent to the East Toe Drain, and reintroduction of rare native species including Sacramento perch into appropriate water bodies throughout the Wildlife Area.

The restoration of aquatic habitat at the Yolo Bypass Wildlife Area could contribute to attainment of this LMP's goals regarding habitat for special-status and game species. Opportunities exist to enhance habitat and improve fish passage along Putah Creek and at the southeast portion of the Tule Ranch Unit adjacent to the East Toe Drain. The tasks listed below represent a strategic approach toward enhancing habitat and improving fish passage in these areas.

Tasks:

1. Identify opportunities to restore aquatic ecosystems at the Yolo Bypass Wildlife Area. Cooperate with development and implementation of restoration plans for aquatic ecosystems by the CALFED ERP and other programs that are consistent with the goals of the Yolo Bypass Wildlife Area and this LMP. Potential projects may include the following:

    a. Creating a new realigned Putah Creek channel through the Tule Ranch Unit (Putah Creek from above the Los Rios Check Dam to the East Toe Drain below the Lisbon Weir).

    b. Exploring the potential for restoration of intertidal marsh habitat and/or seasonal managed floodplain habitat at the southeast portion of Tule Ranch adjacent to the East Toe Drain for the benefit of native fish species such as splittail. Certain bird species such as black rail may also benefit.

    c. Independent of Goal 1, consider improving coordination and enhancement of spring passage of Chinook salmon smolts emigrating from Putah Creek through the Los Rios Check Dam to the East Toe Drain.

        i. Coordinate annual replacement of the check dam after the arrival of spring water releases from the Solano Diversion Dam intended to move salmon smolts from Putah Creek into the toe drain.

        ii Consider the construction of a fish passage facility at the check dam to move adult salmon upstream and smolts downstream.

    d. Restore native fish to Green’s Lake and permanent ponds including Sacramento perch. Stocking of this fish species may also serve as a biological control agent for mosquitoes.

2. Continue coordination and enhancement of fall passage of Chinook salmon immigrating from the East Toe Drain through the Los Rios Check Dam to Putah Creek. Currently, when fish are detected in the Toe Drain, based on fyke trapping results conducted by the DWR, a sequence of events is initiated. If local farmers and Wildlife Area staff are through utilizing the check dam for irrigation and flood up, its removal is scheduled. A release of water from the Putah Diversion Dam is directed to arrive at the Los Rios Check Dam at the same time the flash boards are being removed. The combined flows from the Diversion Dam coupled with the head of water released from the check dam act as an attraction flow to entice salmon into Putah Creek.

    a. Consider the construction of a fish passage facility at the Los Rios Check Dam to allow passage of adult salmon upstream and juveniles downstream while still maintaining the Los Rios Check Dam in place.

    b. Improve Lisbon Weir for both the passage of anadromous salmon into Putah Creek and increased water capture efficiency for irrigation purposes.

3. Pursue funding and develop plans for additional potential aquatic ecosystem restoration projects.

4. Design and manage restoration and enhancement projects that would not conflict with necessary flood flow conveyance requirements of the Yolo Bypass, as determined through the application of hydraulic analysis. A work plan for hydraulic modeling is provided in Appendix C.

5. Ensure that actions comply with the ESA and CESA and other regulations aimed at the protection of special-status species and/or sensitive habitats.

6. Design and operate restoration and enhancement projects in coordination with the SYMVCD. Project design and operation shall include technical BMPs for mosquito control in managed wetlands developed by the CVJV (Kwasny et al. 2004).

5.2.2 AGRICULTURAL RESOURCES ELEMENT

Harvesting of milo

Agriculture has been an important land use in the Yolo Bypass since the seasonal wetlands and perennial marsh and riparian areas were first converted to farms in the mid-1800s. For many years, grazing was the primary use of agricultural lands in the Yolo Bypass. In the latter part of the 20th century, irrigation systems were developed and fields were engineered for the production of row and truck crops. The local climate and nearly annual floods that flow through the Yolo Bypass severely limit the kinds of crops that can be grown. Orchards and winter crops are not an option, nor are long term ventures such as alfalfa. The proximity of the Yolo Bypass to the San Francisco Bay system brings a cool prevailing wind from the south during summer evenings. Although the daily appearance of this Delta Breeze makes life bearable in the Sacramento area, it limits the production of rice to wild rice, or special varieties that are more adapted to the climate.

Row and truck crops are currently grown across the northern half of the Yolo Bypass Wildlife Area (i.e., Causeway Ranch and Los Rios Farms Complex) and on the northern portion of the Tule Ranch. The primary crops grown include: rice, corn, millet, milo (grain sorghum), safflower, sunflower, and tomatoes. These crops are cultivated during the summer months. From fall to spring, farmed areas are fallowed and grain crops are flooded to provide a valuable source of forage for wildlife as well as seasonal wetland habitat. Three common crop rotations are: 1) corn to safflower/sunflower to tomatoes; 2) wild rice to wild rice to conventional rice; or 3) rice to rice to shorebird habitat (fallowed rice fields that are flooded to a shallow depth during July and August).

Rotation strategies are designed to provide a diversity of wildlife habitat elements and to facilitate sustainable agricultural practices (e.g., maintain soil fertility and reduce herbicide application). Other crops, (e.g., millet, milo, safflower, and sunflower) are occasionally planted to provide supplemental sources of wildlife forage. These crops may be planted as part of one of the three above rotation strategies or may be periodically planted on fields designated solely for wildlife forage production.

Cattle grazing occurs primarily on an extensive portion of the Tule Ranch Unit in the southern end of the Yolo Bypass Wildlife Area. Additional grazing, specifically for vegetation management, occurs throughout many of the remaining portions of the Yolo Bypass Wildlife Area. Cattle are often used as an initial treatment of vegetation prior to discing or spraying with herbicide. Animals are brought onto the Yolo Bypass Wildlife Area in mid spring or early summer after the threat of flooding has passed and they are removed by November. Forage is provided in irrigated pasture, uplands within the Bypass, and the annual grasslands-vernal pool complex.

GOALS

Given the prevalence of land within the Yolo Bypass Wildlife Area suited to agriculture, many of the management units incorporate some form of agriculture at least on an occasional basis as a management tool. In general, agricultural activities contribute to Yolo Bypass Wildlife Area goals. Listed below are several goals and tasks identified for the agricultural element. Because of the tightly interrelated and coordinated nature of agricultural activities with other management in the Yolo Bypass Wildlife Area, several of these tasks may be redundant with those identified in other elements throughout this chapter.

Agricultural Resources Goal 1 (AR-1): *Use agricultural techniques to maintain and enhance habitat for native wildlife and plants.*

Snow geese and cattle sharing the irrigated pasture

DFG wildlife areas commonly grow agricultural crops for the benefit of wildlife. The Yolo Bypass Wildlife Area utilizes agriculture to manage habitats while providing important income for the management and operation of the property. Many innovative, natural resource-compatible agricultural practices occurring in the Yolo Bypass Wildlife Area provide valuable habitat for a diverse assemblage of wildlife species. Rice is grown, harvested, and flooded to provide food for thousands of waterfowl. Corn fields are harvested to provide forage for geese and cranes. Working with local farmers, the Yolo Bypass Wildlife Area provides fields of milo, corn, and sudan specifically for wildlife forage purposes. Crops such as safflower are cultivated and mowed to provide seed for upland species such as ring-necked pheasant and mourning dove. Much of the grassland in the southern portion of the Yolo Bypass Wildlife Area is managed with cattle grazing, resulting in spectacular blooms of wildflowers during the spring months. The predominance of nonnative annual grasses in that area can otherwise inhibit the production of the native plant community that includes several rare and endangered species. Whereas historically pronghorn antelope and tule elk grazed competing native grasses, exposing the emerging forbs to sunlight, grazing cattle provide this function today, eating the mostly nonnative competing grasses. Due to the aggressiveness of these nonnative grasses, an aggressive grazing strategy is needed to favor the production of native forbs.

Tasks:

1. Manage and control invasive nonnative plant species through specified grazing practices, controlled flood-up and drawdown procedures, use of pesticides, and other conventional agricultural practices.

2. Enhance grasslands and uplands through grazing, native grass plantings, and other management techniques.

3. Work with adjacent property owners to limit aerial seeding of Italian ryegrass in areas that would support native alkali grassland under natural conditions.

4. Improve habitat for special-status species in the grassland ecosystems at the Yolo Bypass Wildlife Area through the adaptive management of livestock grazing, limited herbicide application, native grass plantings, and other management techniques.

5. Manage for rodents and large insects to provide adequate prey items in order to benefit foraging raptor species.

    a. Plant food plots that will not only provide food for birds, but rodents as well. Legumes and grain crops such as vetch, clovers, wheat, sunflower, milo, corn, and safflower are recommended.

    b. Manage discing, mowing, and summer irrigation to attract large numbers of Swainson’s hawks, which feed on grasshoppers.

    c. Manage fall flooding of agricultural fields to attract wintering raptors.

6. Annually plant grain fields to provide foraging areas for upland game and hunting opportunities for upland game hunters.

7. Manage seasonal and permanent wetlands and other communities to provide habitat for resident waterfowl species.
    a. Disc, mow, burn, and/or graze vegetation as necessary to promote desirable species, eliminate species not valuable for wildlife (e.g., cocklebur), promote a higher quality seed bed for the following year and to maintain required ratios of open water after fall flood up.
    b. Flood rice fields as early as possible after harvest is completed to attract migratory waterfowl.
8. Manage upland vegetation to provide desired nesting habitat.
    a. Plant fields of wheat and vetch to provide high quality nesting habitat the following year.
9. Manage agriculture for shorebird species through newly developed shorebird/rice rotation.
    a. *July 1:* Flood shallow unplanted rice fields which have been disced at least twice.
    b. *July 1 through end of August:* Maintain shallow water.
    c. *September 1:* Drain fields, disc weeds and prepare field for rice planting to occur in the following spring.
10. Perform field preparation of some agricultural fields in the fall in order to present disced field habitat for species that utilize this habitat such as horned larks, longspurs, and mountain plover.

Agricultural Resources Goal 1 (AR-2): *Manage agricultural lands to contribute to the agricultural community, to maintain agriculture as a viable economic activity in Yolo County, and to provide revenue for continued operation of the Wildlife Area.*

At the time of the acquisition of the Glide and Los Rios properties, one concern expressed by the agricultural community was regarding the loss of farm land to wildlife habitat. DFG made a commitment at that time to maintain the existing agricultural leases present on the property and to integrate agriculture into the long term management of the Wildlife Area. The Yolo Bypass Wildlife Area is now seen as a model for bridging the seemingly disparate fields of agriculture and wildlife management. Practices used in agriculture and wildlife management are not that far apart. The success of this management philosophy is best epitomized by the land management approaches implemented in the Yolo Bypass Wildlife Area where agricultural lands are leased to local farmers and managed, under an agreement with DFG, by the Dixon RCD. These tenants work in cooperation with DFG to grow a variety of agricultural crops and to manage livestock grazing for wildlife and native plant habitat management.

Revenues from agricultural leases provide valuable operating income for the Yolo Bypass Wildlife Area. These revenues are viewed as vital for continued operation and management of the Wildlife Area. The DFG has an agreement with Dixon RCD to manage agricultural leases and other agriculture-related activities occurring in the Yolo Bypass Wildlife Area. Dixon RCD staff has made invaluable contributions towards DFG’s goal of integrating agriculture into the long-term management of the Wildlife Area.

Integration of agriculture into the long term management of the Wildlife Area contributes to attainment of this LMP’s goals regarding contribution to the local agricultural community while providing habitat for wildlife species. The tasks listed below are intended to represent DFG’s approach toward continued contribution to the local agricultural community.

Tasks:

1. Work with local farmers to grow agricultural crops that mutually benefit the farmer lease tenants, the agricultural community, and the Wildlife Area.

2. Manage agricultural lands to provide an income source for DFG management and operations of the Wildlife Area.

3. Administer agricultural leases as necessary in cooperation with staff from the Dixon RCD.

    a. Annually plan agricultural activities throughout the Wildlife Area including production fields and wildlife food plots.

    b. Coordinate desires of lessees with limitations of Mace Ranch Irrigation System and its other users.

    c. Plan for administration of Farm Service Agency funds to lessees and reciprocal services to be provided to Wildlife Area.

    d. Periodically inspect agricultural activities throughout the year.

    e. Plan for the post harvest treatment of agricultural fields.

4. Maintenance of water management infrastructure including pumps, water control gates, and water distribution system performed by DFG, agricultural lease tenants, and cooperatively by members of the Mace Ranch Irrigation System.

5. Meet or correspond with adjacent landowners and tenants as needed individually or through the Yolo Bypass Working Group to maintain communication about regional agricultural issues, management needs of the Yolo Bypass Wildlife Area, determine adjacent landowners' access and management needs, and convey useful information regarding activities.

6. Work with local agriculture community to provide information on wildlife friendly farming approaches used the Wildlife Area.

7. Collaborate with adjacent landowners and tenants regarding DFG management activities that may affect their operations. Resolve potential issues by proactively working with adjacent landowners and tenants.

8. Collaborate with adjacent special districts including Dixon RCD, Reclamation District 2068 and Yolo RCD.

5.2.3 CULTURAL RESOURCES ELEMENT

Cultural resources at Yolo Bypass Wildlife Area are limited. DFG is not aware of any significant historical or archaeological resources at the Yolo Bypass Wildlife Area. Consequently, there are few opportunities or constraints on the management of cultural resources at the Yolo Bypass Wildlife Area. Nonetheless, significant historical or archaeological resources may be present and could potentially be affected by public uses or management actions, particularly ground-disturbing activities in areas not yet surveyed. Potential ground-disturbing activities include levee maintenance by DWR and restoration of ecosystems by DFG or other agencies in collaboration with DFG. (See also Public Use Goal 7 below for additional goals related to cultural resources.)

Chapter 3, "Environmental Setting," contains additional information regarding cultural resources of the Yolo Bypass Wildlife Area.

Cultural Resources Goal 1 (CR-1): *Catalog and preserve all cultural resources that have yielded or have the potential to yield information important to the prehistory or history of the Yolo Bypass Wildlife Area or that otherwise would meet significance criteria according to the California Register of Historical Resources (CRHR).*

This goal is based on CEQA requirements and on DFG's intent to provide long-term stewardship of cultural resources at the Yolo Bypass Wildlife Area. The tasks listed below represent a strategic approach toward providing such stewardship.

Tasks:

1. Maintain library of printed cultural resource reports from the vicinity.
2. Conduct cultural resource surveys as necessary before significant ground-disturbing activities (e.g., excavations below normal plow depths) at undisturbed sites.
3. Complete and submit site records to the State Historic Preservation Officer (SHPO) to establish and submit culturally significant resources that may be eligible for inclusion in the National Register of Historic Places (NRHP) or the CRHR.
4. When facility improvements or restoration efforts are proposed and may affect historical or archaeological resources, consult the State CEQA Guidelines for guidance on compliance with regulations. Consult with the California Native American Heritage Commission as appropriate.
5. Maintain historic structures present on site including the Tule Ranch main residence and the umbrella barn.

5.2.4 AUTHORIZED-PUBLIC-USE ELEMENT

It is the policy of the California Fish and Game Commission that lands under its administration be available to the public for wildlife-dependent recreational use whenever such uses will not unduly interfere with the primary purpose for which such lands were acquired. The Yolo Bypass Wildlife Area was acquired for the primary purpose of providing habitat for resident and migratory bird species. Various compatible, wildlife-dependent uses authorized and ongoing at the Yolo Bypass Wildlife Area are listed below.

The Yolo Bypass Wildlife Area presents a unique opportunity to affect the environmental awareness of unlimited numbers of people due to the proximity of its spectacular wildlife numbers to the urban environment of the Sacramento area. This mix of humanity and the natural world lie at the heart of the Yolo Bypass Wildlife Area and illustrate the mutual goals shared by the Yolo Basin Foundation (Foundation) and the DFG. Each organization has extended themselves towards achieving a common desire of getting people into the habitats of the Yolo Basin and appreciating what they experience there. This successful working relationship is memorialized in a MOU between the DFG and Foundation (see Appendix D) and has resulted in nine years of visitors enjoying docent lead walks, guest speakers, educational field activities, hunting adventures, special events, as well as the spectacle of thousands of waterfowl lifting off from the Wildlife Area's rice fields at the north end or the aroma of thousands of acres of wildflowers on some of California's last remaining wild prairie at the south end.

Opportunities for public uses at the Yolo Bypass Wildlife Area include hunting, angling, walking, hiking, vehicle touring for wildlife observation, nature study, and environmental education and interpretation. There is also significant potential for gathering of native plant materials for cultural uses. Other types of nature study include photography, drawing, and painting.

There are currently also several important constraints on public use of the Yolo Bypass Wildlife Area. These constraints include:

- limited availability of staff and funding for operations such as opening and closing of gates, garbage collection, visitor use coordination, and law enforcement.
- limited availability of staff and funding for maintenance of roads, trails, parking lots, fencing, and signs.
- limited public access to Yolo Bypass Wildlife Area management units, due to a lack of roads, ditch crossings, and parking lots.
- other management activities such as farming, presence of heavy equipment for farming and habitat maintenance can present safety problems for smaller vehicles, pedestrians, and bicyclists.
- environmental factors such as flooding that prevents access and presents significant safety risks to the public.
- access to the Yolo Bypass Wildlife Area from the West Sacramento side is limited by the lack of Toe Drain crossings and the east side levee access is controlled by local reclamation districts, primarily RD 900 and RD 999:
    - access to the Yolo Bypass Wildlife Area from the west levee of the Yolo Bypass south of the entrance gate is controlled by the DWR and thus not available to the public.
- roads are graveled with large size gravel to withstand flooding making for rough terrain. Ungravelled levees can have large cracks during the dry season. These factors present safety risks for bicycling.
- potential effects of human disturbance on wetlands, agricultural areas, riparian areas, grasslands and uplands, and aquatic ecosystems of the Yolo Bypass Wildlife Area.
- potential effects of human disturbance to wildlife including frightening wildlife, flushing of wildlife from habitat, disturbance while roosting, and noise disturbance.
- potential effects of human disturbance to wildlife during breeding and nesting season.
- the need to prevent access to sanctuary areas which are closed to public use.
- potential effects on cultural resources.
- incompatibility of various public uses (for example hunting and wildlife viewing cannot be accommodated in the same area).
- the need to exclude public use during pesticide applications for agriculture, vector control, and invasive species management.
- conflicts between vehicle traffic, bicycles, and pedestrians.

Chapter 3, “Environmental Setting,” contains additional information regarding public uses of the Yolo Bypass Wildlife Area.

Public-Use Goal 1 (PU-1): *Increase existing and provide new long-term opportunities for appropriate wildlife-dependent activities by the public.*

The Yolo Bypass Wildlife Area is located along the heavily traveled I-80 corridor and within the growing Sacramento metropolitan area, making it among the most accessible wildlife areas in the state. As the region’s population grows and the need for open space activities increases, the Yolo Bypass Wildlife Area will become an increasingly important place for the public. DFG acquired the Yolo Bypass Wildlife Area, in part, to provide opportunities for wildlife-related activities. Uses that have been actively managed for the non-hunting public include wildlife observation and nature study by foot and vehicle on trails and roads.

There is a five-mile driving loop for observation of wildlife from vehicles. This route is open all year except during flooding. There are several turnouts along this route. Other roads are open to non-hunter vehicle access except during the hunting season. The potential exists to improve this tour route by enlarging its length and modifying it to improve wildlife viewing. The current route loops back in a linear fashion creating a long, narrow natural area. Wildlife is often frightened away by the first vehicle in the morning. A loop that encompasses a larger area with increased wildlife cover will encourage wildlife use adjacent to viewing areas. Research conducted at the Sacramento River National Wildlife Refuge has shown that vehicles cause the least disturbance to wildlife when compared to both people on foot or on bicycles, thus improving the wildlife viewing experience and minimizing disturbance to wildlife. It is recognized that many people would rather enjoy the experience by being outside of their vehicles. It is anticipated that the future tour loop will include both an area in which people are required to stay within their vehicles and areas where hiking is encouraged.

Trails are located primarily on the raised areas between ponds. Some trails are marked by signs and are mowed once a year to keep them more accessible. Most trails leave from a designated parking lot. Some trails are open all year but those located in hunt areas are closed to non-hunters during hunting season. There is one maintained trail with limited interpretive signs that starts at parking lot D. The potential exists to expand marked trails and provide more signage. Picnic tables are currently located at parking lots B, C, D, F, and G. Portable toilets are also located at these same lots. An accessible portable toilet is currently provided at parking lot C.

Bird watching in the Yolo Bypass

The population of West Sacramento is growing and the Yolo Bypass Wildlife Area is increasingly seen as a resource for the city's residents. There is some interest in making the Wildlife Area accessible from the east side levees. DFG and Foundation staff has met with representatives of the city to explore this option. East side access would have to overcome some complex problems including crossing the East Toe Drain. Currently much of the east side of the Wildlife Area is open for hunting during waterfowl season. Conflicts with this use would also have to be resolved. There has also been some interest expressed in providing equestrian access from the east side. DFG will cooperate in discussions to explore the potential for regional equestrian trail linkages, but it is not anticipated that equestrian use of trails will be encouraged at the Wildlife Area.

Tasks:

Tasks for maintaining and improving wildlife observation:

1. Expand existing northern auto tour route to encompass portions of the Causeway Ranch and 1,000 Acre units.

2. Evaluate potential to develop a new southern auto tour route in the same manner for the Tule Ranch Unit.

3. Designate about half of the length of each tour route for vehicle access only while encouraging out of vehicle wildlife viewing from parking lots and turnouts on at least half the length of the tour routes.

4. For all wildlife viewing areas, manage existing routes and design future habitat enhancements to provide adequate vegetative screening to protect wildlife while providing viewing areas into created openings, highlighting slough channels, islands, and wildlife resting areas.

5. Develop interpretive signage for wildlife viewing roads and trails.

6. Develop viewing blinds, observation towers, and board walks where appropriate.

Tasks for maintaining and improving angling:

7. Develop maps and signs that indicate fishing access points.

8. Post fishing regulations in appropriate locations.

9. Build access points for anglers with limited mobility along East Toe Drain.

10. Coordinate with DFG "Fishing in the City" program to provide additional angling opportunities.

11. Expand spring bow fishing program to include all areas within the hunting area during the non hunting season.

Pre junior hunt safety meeting

Tasks for maintaining and improving hunting:

12. Continue current hunting program.

13. Expand hunting opportunities as habitat and access is improved on the Tule Ranch and Causeway Ranch units.

14. Consider use of boats in specified areas.

15. In the interest of maintaining a historical use of the Yolo Bypass, consider means of allowing boat access from the Yolo Bypass Wildlife Area to the Bypass during flooding periods, without incurring any liability to the State of California.

16. Continue to work with local farmers to grow agricultural food plots in order to provide improved hunting opportunities.

17. Locate waterfowl sanctuary areas to enhance hunting experience while providing adequate resting areas.

18. Maintain physical separation of hunting areas from non-hunting areas during hunting season. Open hunting areas to other uses following end of hunting season.

19. Evaluate feasibility of moving all hunting to Tule Ranch area with potential check station at the Tule Ranch Headquarters. This would separate wildlife viewing areas from hunting areas in a north-south direction rather than the current east-west situation.

20. Communicate with neighboring duck clubs to identify Yolo Bypass Wildlife Area management strategies that may affect waterfowl hunting opportunities on their properties. Coordinate Yolo Bypass Wildlife Area management strategies to provide mutual benefits (e.g., managed movement and spread of local bird densities, location of sanctuaries) for the Yolo Bypass Wildlife Area and neighboring lands.

21. Continue recruitment of new hunters by providing hunter safety instruction on a regular basis at the Wildlife Area headquarters.

22. Continue encouragement of young hunters through participation in junior hunt programs for waterfowl and pheasants.

23. Conduct late summer "clean up day" to ready the Wildlife Area for the upcoming hunting season and maintain good relationship with the hunters.

24. Consider providing falconry opportunities for the purpose of taking upland game and waterfowl on the Yolo Bypass Wildlife Area in accordance with falconry regulations and season dates adopted by the State Fish and Game Commission.

Tasks applicable to all uses include:

25. Evaluate use levels and visitor satisfaction periodically.

26. Evaluate the hunting, angling, and wildlife viewing programs and Wildlife Area regulations periodically to identify changes that are warranted to maintain consistency with the goals of this LMP.

Public-Use Goal 2 (PU-2): *Support and expanded public use of the* Yolo Bypass Wildlife Area *for environmental education and interpretation.*

School children learn about pond invertebrates

This goal is based on policies of the California Fish and Game Commission and the mission of the Foundation. It is the policy of the California Fish and Game Commission that, to the maximum extent feasible, DFG shall disseminate information to the public regarding conservation, protection, and management of the state's fish and wildlife resources. It is also a policy that DFG shall encourage education programs that increase the public's respect and concern for wild animals, and their knowledge of the interrelationships between wild animals, their environment, and their human neighbors. As stated in the Foundation's mission, the foundation is "dedicated to the stewardship and appreciation of wetlands and wildlife through education and innovative partnerships." DFG and the Foundation have a unique and very successful partnership at the Yolo Bypass Wildlife Area that supports a diverse education program.

The objective of the program is to encourage the public's awareness of the presence and importance of wetlands in their environment and increase their understanding of issues that impact these ecosystems by providing various educational opportunities for the public through school programs, field experiences, and special programs.
The programs provide easily accessible field oriented learning opportunities to the large regional student/teacher population and the general public.

The primary feature of the environmental education program at the Yolo Bypass Wildlife Area is entitled "Discover the Flyway." This program is operated cooperatively with DFG Wildlife Area staff.

The objective of the Discover the Flyway program for schools is to make wetlands and their stewardship, in the context of the Yolo Basin, a consistent educational component in the schools of the Sacramento region.

The Discover the Flyway program takes an ecosystem approach to educating teachers and students about wetlands: ecosystem relationships, habitats, species composition, human and natural threats, and compatible land uses.

These programs have developed over that last decade to a point where 4,000 K–12 students and hundreds of teachers and parents participate in the Discover the Flyway Program. The participants come from at least

15 school districts in Sacramento, Yolo, Solano, Placer, and El Dorado Counties. Significant numbers of students from private schools and home school networks also participate.

Training workshops provide teachers with the experience to successfully lead classroom and field studies in the Yolo Bypass Wildlife Area. The program offers teachers, subsequent to participating in their first workshop, staff support and equipment for classroom field trips to the Yolo Demonstration Wetlands (located at the DFG Headquarters site) and the Wildlife Area.

The workload associated with this program includes advertising and outreach, teacher and volunteer training, scheduling class visits and volunteers, working with the teacher to plan pre trip activities, 3–4 field activities, and post visit activities. The Wild About Wetlands Kits, with a wide range of classroom activities, are available for teachers to check out prior to their visit. The kits need regular maintenance and updating.

The Foundation provides a staff person to lead the field trip, volunteers to run activity stations, and binoculars and scopes. DFG maintains the Demonstration Wetlands at the Headquarters site, provides the maintenance needed for trail access at the Wildlife Area, coordinates the use of volunteers, provides a portion of the education tools and materials and assists in the development of new programs.. Foundation staff coordinates with DFG to determine where to take the students. Trips are scheduled four days of the week. One day is set aside to allow for road and habitat maintenance. Pesticide use is coordinated so that spraying activities do not take place while students are present.

School children learning about "migration madness"

Tasks:

Tasks to support kindergarten through 12th grade environmental education:

1. Provide Teacher Training Workshops at least four times a year.

2. Maintain Wild About Wetlands kits for pre and post trip activities.

3. Provide and maintain curriculum materials and field equipment.

4. Provide other workshops and educational activities:

    a. Project Wet: This is a K–12 teacher workshop on water topics offered in cooperation with DFG.

    b. Salmonids in the Classroom: This project sponsored by DFG and local fly-fisher groups, offers teachers curriculum and aquarium supplies to grow salmon eggs to the fry stage and release them in the Sacramento River.

    c. Introduction to Watershed Education: This is a workshop co-hosted with the Water Education Foundation to teach 8th–12th grade teachers how to measure and monitor for parameters of water quality, including nutrients, and bioassessment.

    d. Nature Bowl: This is an event for 3rd–6th graders held at the Yolo Bypass Wildlife Area to promote learning about natural systems and the local environment. The event is co-sponsored with DFG and Yolo County Office of Education.

    e. Marsh Madness: The Foundation works with CWA to target under served schools twice a year for a full day of field activities. Bus transportation and a wetlands lunch buffet are provided. CWA provides the lunch, tables and chairs, and volunteers for the day.

5. Creation and maintenance of curriculum workbook with activities adapted to the State science framework and environmental education guidelines. The Foundation is also implementing a new curriculum that meets state social studies standards for 4th–6th grade.

Public education extends beyond K–12 students to include all ages. There are multiple education programs for the general public.

Tasks to support environmental education for people of all ages:

Spring field trip to vernal pools

6. Foundation volunteers are scheduled to lead monthly public field trips to the Yolo Bypass Wildlife Area

7. Scheduling and providing publicity for monthly Flyway Nights Lecture Series.

8. California Duck Days – DFG and YBF host the annual California Duck Days Wetlands Festival in partnership with a volunteer steering committee. The steering committee, in addition to DFG and Foundation staff, includes representatives from Central Valley Joint Venture, City of Davis, CWA, Yolo and California Audubon, and Conaway Ranch. This a huge effort requiring the scheduling of dozens of volunteers, arranging for field trip and workshop leaders, and preparing the Wildlife Area headquarters site for the event.

9. Publicizing and scheduling of summer and spring guided tours at sunset to view the flyout of thousands of Mexican free-tail bats from under the Causeway.

10. Publicizing and scheduling guided spring tours and open house events to view the Tule Ranch vernal pools.

    a. Special tours for other organizations (USACE [watershed training course four times/year], American River Conservancy docents, Sacramento Zoo staff, Elkhorn Slough docents, visiting dignitaries from other countries, and many others.)

    b. Jepson Prairie/Tule Ranch vernal pool docent training course.

11. Other events hosted by others in which DFG and the Foundation participate require varying amounts of preparation and presence:

    a. Salmon Festival at Nimbus Hatchery

    b. Earth Day at the Sacramento Zoo

    c. International Migratory Bird Day

    d. Celebrate Davis Chamber of Commerce event

    e. Sandhill Crane Festival

   f. Make presentations to various service clubs, chambers of commerce, university classes, educational conferences

12. Educational Materials for Loan:
    a. Wild About Wetlands kits
    b. Birds of Yolo Bypass Wildlife Area PowerPoint
    c. Books and videos
    d. Soil testing kits
    e. Binoculars

YOLO FLYWAY

New Species Discovered in Yolo Bypass

Yolo Wildlife Area Management Plan Is On Its Way

Bucks for Ducks

October 13, 2006

Vets Memorial Center, Davis

Yolo Flyway newsletter is published quarterly

13. Outreach and communication includes "Yolo Flyway" newsletter three times a year, press releases, articles in regional newspapers and periodicals, public service announcements on television and radio, listserve announcements and maintenance of information presented on the Yolo Basin Foundation website.

14. Develop and distribute interpretive materials including brochures, plant and wildlife and tour guides, interpretive displays and signs.

15. Develop new programs as time and budget allows.

Public-Use Goal 3 (PU-3): *Coordinate public access to and use of facilities including tour routes, parking areas, Putah Creek, the planned Pacific Flyway Center, and other areas to accommodate a variety of different user groups.*

Opportunities exist to maintain and expand tour routes throughout the Yolo Bypass Wildlife Area and to coordinate with and participate in regional trail planning efforts. Constraints include increased disturbance of wildlife and other natural resources as a result of increased public use.

Access Tasks:

Entrance to Yolo Bypass Wildlife Area

1. Provide a large sign marking the Yolo Bypass Wildlife Area entrance.

2. Improve physical and design aspects of Yolo Bypass Wildlife Area entrance, with the goal of making this area more inviting (potential improvements include creating a scenic wetland area at the entrance and increasing the ability to pass water under this road during periods of high water flows).

3. Provide Watchable Wildlife signs on I-80 and County Road 32b.

4. Coordinate with Watchable Wildlife program, visitor and convention bureaus and others to provide for accurate Yolo Bypass Wildlife Area descriptions and directions in printed materials and on the web.

Roads

5. Maintain access routes to all open facilities and parking lots.

6. Maintain and improve existing tour loop.

7. Develop a new southern auto tour route.

8. Construct all roads with natural/gravel surface with minimal maintenance requirements.

School children on Wildlife Area trail

Trails

9. Evaluate the feasibility of a walking trail along Putah Creek on Yolo Bypass Wildlife Area property that could join a similar trail coming from Mace Blvd. developed by the City of Davis.

10. Continue to allow off-season, walking access to hunting areas and evaluate potential to expand this opportunity to new hunt areas.

11. Expand signage on trail network.

12. Evaluate the feasibility of connecting the Causeway Ranch with the Davis Wetlands through a trail system.

Bicycling

13. Continue to allow bicycle access to the Causeway Unit.

14. Evaluate, develop, and consider implementing a plan for allowing bicycle use on specified parts of the tour routes.

15. Continue to monitor the use of bicycles in the hunting area during hunting season.

16. Cooperate with regional trail development efforts to create bicycle access across the Yolo Bypass through the Causeway Unit at ground level.

17. Evaluate efforts to provide bicycle access to the Pacific Flyway Center and participate as infrastructure is developed and funding permits.

Wildlife Area boundary sign in winter

Signage

Compatible public uses of the Yolo Bypass Wildlife Area are facilitated by signage that informs the public of the boundaries, laws, and regulations applicable at Yolo Bypass Wildlife Area; encourages public use; reduces conflicts among uses; increases the safety of users; and discourages unauthorized uses. The tasks listed below are intended to promote the use of such signage.

18. Maintain signs and bulletin boards at the Yolo Bypass Wildlife Area Headquarters, parking lot A and any other entrances that may be developed in the future with wildlife area maps and regulations, interpretive materials, and safety information.

19. Work with California Department of Transportation (Caltrans) and Yolo County to install signage on I-80 to direct visitors to the entrance of the Yolo Bypass Wildlife Area.

20. Start a monitoring and maintenance schedule for all signage.

21. Inventory existing boundary signage and fencing, and install new signs and fencing where necessary.

22. Provide sign board in parking lot A that provides a comprehensive display of public use opportunities at the Yolo Bypass Wildlife Area. This will include a map showing currently available public use areas.

23. Provide signs marking tour routes, trails, and bicycle access areas.

24. Provide signs marking areas that are temporarily closed for nesting, maintenance, or other reasons.

25. Develop a plan for interpretive features including signs, blinds, and board walks.

26. Develop, construct, install and maintain interpretive signs.

Operations

27. Rent and maintain portable toilets.

28. Provide garbage cans.

29. Provide picnic tables in some visitor areas.

30. Provide for the opening and closing of gates to control access.

31. Improve ditch and creek crossings as needed for public use.

32. Continue to open entrance gates at sunrise (except on hunting days) and closing gates at sunset.

Other Uses

33. Evaluate the feasibility of providing canoeing or fishing opportunities at Green’s Lake and Putah Creek.

34. Evaluate coordinating with the City of Davis regarding put-ins and take-outs of boats on Putah Creek.

Regional trail systems and coordination of access

35. Cooperate with the City of West Sacramento in assessing feasibility of access from the east side.

36. Cooperate with agencies promoting regional hiking, bicycle, and equestrian trail connections including Caltrans, Delta Protection Commission, Yolo County, City of Davis, and City of West Sacramento.

37. Evaluate the feasibility of establishing a regional trail along abandoned Sacramento Northern Railroad easement that traverses the Tule Ranch.

Public-Use Goal 4 (PU-4): *Continue to foster community partnerships*

DFG and the Foundation will continue to work together and coordinate as provided in the MOU. The relationship of these two organizations is an excellent example of a well-functioning public-private partnership. The benefits of the public-private partnership include the ability of each to take advantage of different funding sources to develop and implement programs at the Yolo Bypass Wildlife Area. The tasks listed below represent a strategic approach toward fostering community partnerships.

Tasks:

1. Update the MOU between the Yolo Basin Foundation and the DFG to reflect the current operating relationship and expansion of the Wildlife Area acreage and programs.

2. Coordinate press releases and other forms of outreach.

3. Collaborate in developing new program areas.

4. Coordinate with other non-profit groups (e.g., Foundation, DU, CWA, Yolo and Sacramento Audubon Societies, Audubon California, Putah Creek Council, CVHJV) that promote wildlife-dependent education and interpretation, and recreational or hunting opportunities that can provide additional support to DFG's management of the Yolo Bypass Wildlife Area.

5. Encourage and cooperate with the long-term continuation of the Yolo Bypass Working Group.

Public-Use Goal 5 (PU-5): *Continue and expand the volunteer program.*

Volunteering is a vital element of many activities carried out by DFG and the Foundation. The volunteer program will continue to be supported and opportunities will be identified to expand programs. Volunteers assist with Discover the Flyway activities and support other educational programs in a variety of ways. Monthly public field trips are lead by volunteers. Nature Bowl, Marsh Madness, and California Duck Days rely on volunteer labor to be successful. Volunteers help maintain educational materials, photograph events, provide administrative help in the Foundation office, maintain Foundation press files, and provide help with entering information into the organization's database. Volunteers provide construction skills as needed. The Foundation provides training for volunteers involved with the Discover the Flyway program several times a year. Volunteer recognition activities include special field trips and an annual volunteer dinner. Volunteers wear nametags to identify them as volunteers. All volunteers are registered as DFG volunteers and the DFG volunteer handbook is utilized for the administration of the volunteer program. . Foundation and DFG staff maintain records of volunteer hours.
Over the last decade volunteers have provided thousands of hours of labor that has been critical to the success of educational programs at the Yolo Bypass Wildlife Area. Last year volunteers provided 3500 hours of donated labor.

A group of Wildlife Area volunteers inside the Umbrella Barn

Tasks:

1. Use the existing DFG volunteer handbook and YBF volunteer materials to provide consistent direction for volunteers.

2. Expand existing volunteer materials.

3. Sign up all volunteers as DFG volunteers to take advantage of the benefits of being a volunteer for the state including workers compensation coverage and the ability to count these volunteer efforts as "in kind" contributions on grant applications.

4. Continue to coordinate with the Foundation to jointly plan use of volunteers including the development of

volunteer job descriptions.

5. Recruit new volunteers through regional media, community organizations, local colleges, professional associations, conservation organizations, and at public events.

6. Expand volunteer training opportunities.

7. Expand volunteer recognition program.

8. Continue tracking of volunteer hours for use as inkind labor contribution for state and federal grant programs.

Public Use Goal 6 (PU-6): *Minimize competition and conflicts among users and facilitate compatibility between public uses.*

Conflicts between various uses groups have potential to arise due to compatibility issues. The tasks listed below are intended to reduce conflicts among user groups.

Tasks:

1. Encourage hunter safety through monitoring and enforcement of regulations.

2. Inform the public of Wildlife Area use designations and use restrictions through outreach, signage, and DFG's web site.

3. Periodically evaluate management of access locations, tour routes, parking areas, and associated regulations to identify changes that are warranted to maintain consistency with the goals of this LMP.

4. Identify potential conflicts with other recreational uses and resolve such conflicts.

5. Inform the public of times and locations where hunting is allowed and of all other restrictions and applicable regulations through outreach, signage, and DFG's web site.

6. Have DFG and/or YBF personnel available on-site during high use times to monitor visitor activities and provide information as needed to visitors.

7. Include a DFG contact person's name, phone number, and e-mail address on signage for questions, comments, and suggestions regarding compatible uses of the Yolo Bypass Wildlife Area.

8. Conduct periodic reviews of public uses of the Yolo Bypass Wildlife Area; evaluate patterns of usage, rules, regulations, guidelines, and materials to ensure compatibility of public uses.

Public-Use Goal 7 (PU-7): *Support use of the Yolo Bypass Wildlife Area by Native Americans for activities such as gathering native plant materials for cultural purposes.*

Gathering of limited quantities of native plant materials can be compatible with the goals of the Wildlife Area. The tasks listed below are intended to ensure that such uses are authorized only when compatible and when they take place in a manner that minimizes conflicts with other uses.

Modern day Native American gathering tules

Tasks:

1. Develop access plans for and issue permits to native peoples whose activities are compatible with the goals of the LMP. Any authorization for access would include standard liability clauses.

2. Allow limited gathering of materials for educational and craft purposes by the public.

Public-Use Goal 8 (PU-8): *Facilitate safe use of the Yolo Bypass Wildlife Area by informing the public of potential risks, and also develop an emergency response plan.*

Although risks are inherent in any physical activity, informing the public of potential risks and reducing access to unsafe areas should increase the safety of users. The tasks listed below express this intent.

Tasks:

1. Continue to close the Yolo Bypass Wildlife Area when the Yolo Bypass is flooding (e.g., Fremont Weir and/or Sacramento Weir overtopping and/or west side tributaries flooding).

2. Identify areas where warning signs are needed.

3. Post warning signs at identified locations and indicate on these signs whom to contact during an emergency.

4. Coordinate with the SYMVCD regarding timing of pesticide applications.

5. Restrict access to unsafe areas such as construction zones and at times, active farming areas.

6. Develop an emergency response plan.

   a. Work with local, regional, and state agencies to integrate the Yolo Bypass Wildlife Area into emergency communications and response plans.

   b. Work with Yolo County and local fire districts to improve coordination of emergency services.

5.2.5 UNAUTHORIZED-PUBLIC-USE ELEMENT

Disposal of waste, construction of unauthorized structures, camping, use of generators and fires, and other illegal activities have the potential to occur in the Yolo Bypass Wildlife Area. These unauthorized uses damage the Yolo Bypass Wildlife Area's ecosystems, affect special-status and game species and their habitats, and interfere with authorized uses. The limited availability of staff and funding substantially constrains management of unauthorized uses.

Unauthorized-Public-Use Goal 1 (UPU-1): *Prevent unauthorized use of the Yolo Bypass Wildlife Area.*

Preventing unauthorized uses would prevent the adverse effects caused by those uses. The tasks listed below are intended to reduce the frequency and effects of unauthorized uses.

Tasks:

1. Prohibit activities that are inconsistent with the Yolo Bypass Wildlife Area mission in the Wildlife Area regulations.

2. Require CEQA analysis and surface agreements for access to the area for mineral extraction.

3. Discourage dumping of trash or waste within the Yolo Bypass Wildlife Area by providing and servicing trash receptacle.
4. Patrol the Yolo Bypass Wildlife Area and enforce regulations that prohibit unauthorized uses.
5. Maintain adequate signage on boundaries to satisfy lawful enforcement of Wildlife Area regulations.
6. Use signage and written notifications to foster cooperation.
7. Issue citations and/or pursue legal action when voluntary cooperation cannot be obtained.
8. Enforce laws through DFG Wildlife Protection personnel and request assistance from the Yolo County Sheriff’s Department as necessary to enforce laws.
9. Issue citations to violators illegally using the Yolo Bypass Wildlife Area and seek remediation from unauthorized users.
10. Restore ecosystems damaged by unauthorized uses as necessary.

5.2.6 FACILITIES ELEMENT

Platform of elevated pump station

Facilities at the Yolo Bypass Wildlife Area include the public access roads, hunting blinds, check stations, water management–related infrastructure, and other facilities listed below. Sacramento River Flood Control Project levees on the east and west boundaries of the Wildlife Area are maintained by the DWR and Reclamation Districts. These facilities support flood protection.

There are also a number of important constraints on construction and maintenance of facilities at the Yolo Bypass Wildlife Area. These constraints include:

- limited availability of staff and funding;
- flooding of the Yolo Bypass limits access for construction and maintenance of facilities in the Bypass;
- flooding has the potential to cause damage to roads, crossings, water distribution system, and pumps;
- the DWR and State Reclamation Board easement for flood flow conveyance; and
- potential effects on conveyance of flood waters.

Chapter 2, “Property Description,” contains additional information regarding facilities at the Yolo Bypass Wildlife Area.

Winter flooding in 2006

Facilities Goal 1 (F-1): *Management and operation of the Yolo Bypass Wildlife Area in coordination with state and federal flood operations in the Yolo Bypass.*

Facilities throughout the Yolo Bypass Wildlife Area require construction, maintenance, and removal in response to initiation of flood flow conveyance in the Yolo Bypass. The tasks listed below are intended to address facilities construction, maintenance, and removal needs. A discussion on the Sacramento River Flood Control Project, the State-Federal Flood Operations Center, and operation of Fremont Weir and Sacramento Weir is provided in section 3.1, "Planning Influences and Considerations."

Tasks:

1. Upon notification call by DWR Division of Flood Management, implement and follow the following flood response protocol:

   a. Remove hunter check station, portable restrooms, and other movable structures as necessary.

   b. Close gates at Wildlife Area access points.

   c. The most critical areas are those structures which adjoin the Toe Drain/canals. When water in these areas reaches the level of the water in the ponds, remove all check boards.

   d. Pull all the boards in irrigated agricultural fields (or as many as can be safely reached). Screw gates should also be opened. This may increase sedimentation in the pipes but it will also help to decrease the potential for the flash boards floating away and being lost.

   e. Pull boards in internal structures to allow water in the cells to equalize prior to flooding to reduce erosion effects.

   f. If internal structures are not pulled prior to a flood event, then the progression typically is from east to west; pull external boards, open screw gates, and then follow the water as it moves to the west.

   g. Close and cap alfalfa valves to prevent sedimentation.

   h. Close pipeline in the Causeway Ranch Unit to prevent sedimentation in the pipe. Mark screw gate and alfalfa valve locations in order to relocate when floodwater recedes.

   i. Open screw gate structure at central lift station and pull boards on the structure immediately west of the station.

   j. Leave control box heaters on at pump stations as this will help dry out any moisture that may occur.

   k. Decision needs to be made regarding pulling central lift pumps and west pump– generally the pumps should be pulled in severe events.

   l. After the waters recede:

      1. Clean out bowls at the submersible pump stations.

2. Dry pump motors that may have received moisture during the flood event before putting back in operation.

Cleaning out mud from pump station sump

Facilities Goal 2 (F-2): *Construction, maintenance, and removal of facilities.*

Facilities throughout the YWBA require construction, maintenance, and removal for various purposes. The tasks listed below are intended to address facilities construction, maintenance, and removal needs.

Tasks:

1. Maintenance of hunting blinds and the hunter check station performed by DFG.

2. Maintenance of water management infrastructure including pumps, water control gates, and water distribution system performed by DFG, agricultural lease tenants, and cooperatively by members of the Mace Ranch Irrigation System.

3. Maintenance of gravel roads on an ongoing basis.

4. Construction and maintenance of new access roads.

5. Maintenance of gates and fences.

6. Construction of new gates and fences.

7. Maintenance of signs.

8. Maintenance for other facilities:

    a. Yolo Bypass Wildlife Area Headquarters 13-acre site with office building, residence, equipment, landscaping, parking lot,, fences, gravel road, and shop buildings and related facilities, fish screen shop, various portable buildings including one used by DFG wardens as base station, and portable office unit owned by YBF;

    b. Yolo Demonstration Wetlands located at the Yolo Bypass Wildlife Area Headquarters;

    c. Kiosk at Yolo Fruit Market operated jointly with the Foundation;

    d. House on Pacific Flyway Center site;

    e. Tule Ranch Headquarters compound; and

    f. Tule Ranch Umbrella barn.

9. Work with the Foundation to develop interpretive signs and other features such as kiosks, shade structures, blinds, and boardwalks to enhance the value for visitors.

Facilities Goal 3 (F-3): *Effectively manage existing facilities and/or structures for resource protection, safety, and prevention of unauthorized uses.*

Management of facilities/structures for resource protection, safety, and prevention of unauthorized uses will contribute to the attainment of goals for biological and public use elements. The tasks listed below are intended to facilitate effective management of Yolo Bypass Wildlife Area facilities.

Tasks:

1. Regularly monitor the condition and use of existing facilities/structures.

2. Take actions as needed to keep desired facilities/structures in good repair.

3. Schedule preventative maintenance of all facilities and structures.

4. Take actions to demolish and remove those structures that are unauthorized or have become unsafe or undesirable.

Facilities Goal 4 (F-4): *Construct, operate and maintain the Pacific Flyway Center and other associated facilities.*

Tasks:

1. Construction of the Pacific Flyway Center is a goal of DFG. The continuing efforts to establish the center will be supported.

2. Participate in program development phase, schematic design phase, and construction phase in partnership with the Foundation.

3. Determine what needs to be accomplished to change location of entrance to the Wildlife Area if needed.

4. Move administrative and interpretive functions to the Pacific Flyway Center.

5. Operate and maintain the Pacific Flyway Center.

6. Manage the approximately 15 acres of farm land on the Flyway Center site to be a demonstration of wildlife friendly farming.

7. Work with the Foundation to fund, construct, update and maintain exhibits and other interpretive features of the Pacific Flyway Center.

8. Maintain gates and access road to Flyway Center.

Facilities Goal 5 (F-5): *Maintain equipment necessary for future management of the Wildlife Area.*

Habitat management activities require the use of a staggering variety of equipment, tools, and vehicles. Each of these elements must be maintained, repaired and replaced as necessary. These items range from large farm tractors and implements to commercial vehicles, welders, generators, wood working tools, incinerators, boats, all terrain vehicles, compressors, and hand tools.

Tasks

1. Repair and maintenance of heavy equipment including various tractors and implements.

2. Maintenance and operation of commercial vehicles.

   a. Maintain current compliance with Department of California Highway Patrol Biennial Inspection of Terminals (BIT) Program.
   b. Maintain commercial vehicles through regular BIT inspections.
   c. Tractor Operator Laborer to maintain current commercial driver's license.
   d. Provide commercial vehicle driving services to other Department of Fish and Game facilities as necessary.
3. Maintenance and operation of wheeled vehicles other than commercial vehicles.
4. Maintenance and operation of shop facility.
5. Maintenance and operation of miscellaneous tools and equipment.
6. Maintain office equipment including computers, printers, copy machine, plotter, telephone system.

Facilities Goal 6 (F-6): *Consider the construction and operation of an outdoor shooting range for bi-annual use by local game warden squad for periodic firearm use qualification process.*

Range construction, operation and maintenance shall consider the following tasks:

Tasks

1. Implementation of Environmental Protection Agency (EPA) best management practices for the management of lead at outdoor shooting facilities.
2. Operation of the shooting range will not proceed until after development of a shooting range use protocol in accordance with National Rifle Association (NRA) standards as detailed in the NRA Range Source Book. This protocol shall designate a point of contact within DFG's Wildlife Protection Branch and a Range Master shall be designated for each instance of use. This operations plan and subsequent use is to be approved by the Yolo Bypass Wildlife Area Manager.
3. Construction of the shooting range shall conform to standards and guidelines established by the Occupational Safety and Health Administration, the National Association of Shooting Ranges (NASR) and the Sporting Arms and Ammunition Manufacturers' Institute (SAAMI), with the intention of controlling hazards and prevention of exposures to hazardous substances in shooting range facilities.
4. Maintenance of the shooting range shall be the responsibility of the Wildlife Protection Branch.

5.2.7 ADMINISTRATION ELEMENT

Administration of the Yolo Bypass Wildlife Area includes maintaining and providing records of management actions and expenditures, allocation of staff time, procurement of needed supplies and equipment, solicitation of grant monies to supplement operating income, habitat management activities, and agriculture management activities and/or leases.

Administration Goal 1 (A-1): *Maintain current data on the management and resources of the Yolo Bypass Wildlife Area.*

Current data on the management and resources of the Yolo Bypass Wildlife Area will support attainment of goals for biological, cultural, public use, and facility elements. The tasks listed below are intended to promote maintenance of needed data.

Tasks:

1. Regularly update geographic information system (GIS) data sources as information becomes available.
2. Maintain accurate financial records regarding expenditures, staff, maintenance, and other administrative duties.
3. Facilitate the planning and paying of Wildlife Area expenses.
4. Administer agricultural leases as necessary in cooperation with staff from the Dixon Resource Conservation District (RCD).
    a. Annually plan agricultural activities throughout the Wildlife Area including production fields and wildlife food plots.
    b. Coordinate desires of lessees with limitations of Mace Ranch Irrigation System and its other users.
    c. Plan for administration of Farm Service Agency funds to lessees and reciprocal services to be provided to Wildlife Area.
    d. Periodically inspect agricultural activities throughout the year.
    e. Plan for the post harvest treatment of agricultural fields.
5. Document facilities needs in a DFG maintenance and capital outlay database.
6. Prepare annual and periodic status reports as defined in the future Chapter 6, “Operations and Maintenance.”
7. Perform scheduling function for conference room.
8. Participate in habitat planning efforts for areas close to the Wildlife Area.
9. Supervise permanent and seasonal staff.
10. Actively pursue funding to help facilitate implementation of the LMP.

5.2.8 FIRE MANAGEMENT ELEMENT

Burning of emergent vegetation in a permanent pond

Fires within the Yolo Bypass Wildlife Area are rare, but there is the potential for natural (e.g., lightning) or human-caused fires to be started. Additionally, at the Yolo Bypass Wildlife Area, there are opportunities to employ fire as a habitat manipulation tool. Fires at the Yolo Bypass Wildlife Area may have both adverse and beneficial effects on the attainment of the goals of this LMP. For example, fires can have benefits to native vegetation and may contribute to attainment of the goals for the biological element. Conversely, fires also may damage facilities, injure staff and visitors, and thus may interfere with the attainment of goals for public use and facilities.

The Yolo Bypass Wildlife Area lies within two special fire districts. Land north of Putah Creek is part of the East

Davis Fire District and lands to the south of Putah Creek are in the No Man's Land Fire District. Each of these fire districts collects assessments from property owners within their districts and contracts with the City of Davis for emergency services. Per the terms of Proposition 218, it is the policy of the DFG to not pay assessments to special districts unless DFG is receiving "special services." Proposition 218 specifically states that fire and ambulance services are not considered "special services" and therefore, the DFG pays no assessments to either the No Man's Land or East Davis Fire Districts. Nevertheless, the DFG would consider it mutually beneficial to cooperate with these fire districts in the event of an emergency.

There are a number of constraints on fire management at the Yolo Bypass Wildlife Area. These constraints include:

- Availability of staff and funding;
- potential adverse effects on air quality,
    - the geographic position of the Wildlife Area is such that prevailing Delta breezes tend to move fire smoke into the Sacramento metropolitan area;
- public safety;
- facilities; and
- public use.

Fire Management Goal 1 (FM-1): *Develop and implement a wildfire plan for the Yolo Bypass Wildlife Area.*

In 1994, the California State Board of Forestry and the California Fish and Game Commission adopted a *Joint Policy on Pre, During, and Post-fire Activities and Wildlife Habitat* (California State Board of Forestry and California Fish and Game Commission 1994). This joint policy describes multiple measures that both the California Department of Forestry and Fire Protection (CDF) and DFG should undertake to protect lives and property with consideration of natural resources. These measures would be implemented before, during, and after fires. The tasks listed below are intended to facilitate implementation of fire protection measures.

Tasks:

1. Meet biannually if necessary with CDF representatives to discuss fire-related issues relevant to the Yolo Bypass Wildlife Area, including vegetation management, recent fires in the Yolo Bypass Wildlife Area, current contact information, and procedures.

2. Coordinate with CDF to develop a wildland fire response plan for the Yolo Bypass Wildlife Area. This plan would give protection of life and property the highest priority during fire response, but would also give careful consideration to effects on the natural resources of the Yolo Bypass Wildlife Area. This plan should identify fire suppression tactics that could have long-term effects on ecosystems (e.g., use of retardant). Those tactics should be avoided or modified whenever feasible to avoid or minimize long-term effects on the ecosystems of the Yolo Bypass Wildlife Area. The plan should also identify critical areas where emergency revegetation or mechanical or structural measures may be contemplated to prevent excessive erosion or flooding after a fire. The potential effect of such practices on special status plants should be considered.

3. Design and implement vegetation management activities at fire breaks along existing roads and parking lots.

4. Train a DFG biologist to serve the role of resource specialist or agency representative through the Incident Command System (ICS).

    a. As part of the ICS, make available a local plant, wildlife, and fisheries specialist from DFG's staff to provide advice during fires and for post fire rehabilitation that threaten wildlife habitat at the Yolo Bypass Wildlife Area.

5. Following a fire or fire suppression, implement emergency revegetation, mechanical, and structural measures within those previously defined critical areas that were affected.

6. Coordinate fire suppression activities and cooperate with local fire districts.

5.2.9 SCIENTIFIC RESEARCH AND MONITORING ELEMENT

Scientific research and monitoring contributes to sound management of wetlands, agricultural areas, riparian areas, grasslands and uplands, and aquatic ecosystems both in and beyond the Yolo Bypass Wildlife Area. It is also a key component of successful adaptive management programs. Monitoring results of management actions is the key feed back feature of an adaptive management approach to land management. There are unlimited possibilities within innumerable disciplines to conduct research that may affect management decisions. However, current and/or recent studies on fisheries resources, hydraulic analysis, resource assessments, mosquito abatement, and water quality conducted at or near the Yolo Bypass Wildlife Area have especially relevant ramifications. The status of these "big five" topics are summarized below:

FISHERIES

Previously described research regarding use of the Yolo Bypass by native fish during seasonal flooding events has sparked significant interest in managing this floodplain of the Sacramento River for these species. Additional research should be conducted to adequately describe the use of the Bypass by Chinook salmon, Sacramento splittail, and white and green sturgeon. Management options should be investigated with complete respect for ongoing wetland habitat projects already established with the broad support of Bypass stakeholders and land owners.

HYDRAULIC ANALYSIS

With the development of the RMA 2 model by the USACE, a tool now exists to more accurately predict the hydraulic effects of proposed land management actions. Continued application of this model to planned restoration efforts will further improve the long-term management of land use in the Yolo Bypass.

RESOURCE ASSESSMENT

DFG is preparing a field-verified vegetation map of the Yolo Bypass Wildlife Area. However, detailed inventory data are lacking for portions of the Yolo Bypass Wildlife Area. For example, plant species lists based on field surveys do not exist for the entire Yolo Bypass Wildlife Area (e.g., areas within the Tule Ranch Unit). Although the species list for the Yolo Bypass Wildlife Area (see Appendix G) is field-based and comprehensive for all species on-site, field verification is needed to determine the presence of several expected amphibian, reptile, and mammal species. There is also no formal ongoing monitoring of invasive plant populations, special-status plant populations or their habitats, wildlife responses to Yolo Bypass Wildlife Area's innovative management of agriculture, or any monitoring that could be used to evaluate the effects of public use on ecosystems at Yolo Bypass Wildlife Area.

MOSQUITO ABATEMENT

With the arrival of West Nile Virus, it is imperative that the operation of the Yolo Bypass Wildlife Area is conducted in a manner that is not dangerous to the local community which it serves. Research into the effects of ground disturbance upon the production of mosquito larvae has been promising, with broad ramifications for wetland managers with potential mosquito production conflicts. Continued research regarding the fine tuning of established “Best Management Practices” for wetlands will further the collaborative relationship the Yolo Bypass Wildlife Area shares with the Sacramento Yolo Mosquito and Vector Control District.

Mercury

Although much is uncertain in regards to the role wetlands play in the methylation of mercury, certain wetland characteristics appear to minimize this concern. Projects should be designed to minimize the potential for mercury methylation as much as possible. Appropriate project features include open-water swales, active drainage and water movement to promote aerobic (i.e., oxygen rich) conditions, and tailwater detention basins for post-flood demethylation. Extensive research is being conducted to help understand the finer nuances of methylation processes in wetlands.

The Central Valley RWQCB is currently in the process of developing a mercury and methylmercury TMDL for the Delta. Characterization of existing conditions and potential development of BMPs are two potential requirements of the TMDL. Development and implementation of experimental BMPs to address mercury methylation holds great potential to better understand and address wetland restoration throughout the region.

Thus, additional research and monitoring could benefit management and attainment of goals for biological and public use elements.

Many opportunities exist at the Yolo Bypass Wildlife Area for scientific research and monitoring. These include:

- basic resource assessment to document what currently exists on the Yolo Bypass Wildlife Area; and
- monitoring of all of the following:
    - wildlife and natural community responses to the management of wetlands, agricultural areas, riparian areas, uplands and grasslands, and aquatic ecosystems;
    - floodplain processes (e.g., hydrology, geomorphology, fisheries resources, and primary production); and
    - mercury methylation processes in managed wetlands and agriculture;
- development and monitoring of experimental BMPs to reduce/minimize mercury methylation processes;
- monitoring of mosquito control BMPs;
- management of public use activities in a natural setting;
- implementation of agricultural techniques that provide wildlife habitat benefits;
- importance of agricultural buffer areas to wildlife habitat management areas;

- compilation of existing background information by this and other reports;

- coordination with other branches of DFG that are conducting data collection and mapping activities;

- coordination with other resource agency departments including DWR, California Department of Conservation, and California Department of Food and Agriculture on monitoring, mapping, and other types of data collection;

- coordination with federal agencies such as NOAA, NMFS, USGS, USFWS, USACE on data collection and mapping;

- coordination with private organizations such as California Waterfowl Association, Ducks Unlimited, CA Audubon, and Point Reyes Bird Observatory on data collection;

Proximity of the Yolo Bypass Wildlife Area to universities, colleges, and other academic institutions presents opportunities to:

- actively promote the Wildlife Area to local academic institutions as a resource available for research activities; and

- establish long term working relationships with local academic institutions.

There are also a number of important constraints on scientific research and monitoring of the Yolo Bypass Wildlife Area. These constraints include:

- limited availability of staff and funding;
- public use of much of the Wildlife Area; and
- seasonal flooding.

Scientific Research and Monitoring Goal 1 (SRM-1): *Support appropriate scientific research and monitoring and encourage or conduct research that contributes to adaptive management strategies and management goals of the Yolo Bypass Wildlife Area.*

This goal is based on the need for data from monitoring and scientific research to attain many of the goals of this LMP, and on the policies of the California Fish and Game Commission. It is the policy of the California Fish and Game Commission that research shall be performed to provide scientific and management data necessary to promote the protection, propagation, conservation, management, or administration of fish and wildlife resources; whenever possible and advantageous, the services of the University of California, California State University, or other academic or research institutions, or federal, state, or local agencies shall be used. The tasks listed below are intended to promote continuance of appropriate scientific research related to the Yolo Bypass Wildlife Area.

Tasks:

1. Prepare an annual Wildlife Area Habitat Management Work Plan Summaries and submit summaries to the DFG Wildlife Area Habitat Committee (WAHC), and DFG headquarters staff for evaluation.

    a. Implement recommendations for habitat improvement provided by the WAHC.

2. Develop a prioritized list of research needs.

3. Review and evaluate proposed research projects using the following criteria:

  a. Potential for research results to improve management of the Yolo Bypass Wildlife Area, other wildlife areas, or other ecosystems;
  b. Potential for conflicts between the research and compatible public uses;
  c. Potential for conflicts between the research and any biological goals stated in this LMP; and
  d. Scientific rigor in the proposed research design, methods of study, and scope of inference.
4. Provide letters or permits to researchers specifying dates and times of authorized access, and information on regulations and area restrictions.
5. Require that researchers provide copies of data and/or published papers, and contact researchers to ensure that this requirement is fulfilled.
6. Encourage long-term studies of the following:
  a. Ecology of managed wetlands;
  b. Agroecology;
  c. Wildlife friendly agricultural practices;
  d. Vernal pool ecology and management;
  e. Native grassland ecology and management, including management of grazing to enhance native species diversity;
  f. Invasive species management;
  g. Trends in abundance of migrant and/or wintering waterfowl and shorebirds, in support of regional population monitoring throughout the Pacific Flyway;
  h. Trends in abundance, reproduction, survival, and/or habitat use by special-status species (e.g., giant garter snake), game species, or other species of regional interest (e.g., grasshopper sparrow);
  i. Mercury methylation processes in managed wetlands and crops, development and monitoring of experimental demethylation BMPs, and effects of methyl mercury on birds and other wildlife; As part of the LMP planning process a focus group meeting was held to discuss mercury / methylmercury research needs and opportunities (see Appendix A). Several needs and opportunities were identified. Follow-up meetings should be convened to continue these discussions.
7. Conduct high-priority surveys, including surveys for special-status species, as time and budget permit;
8. Investigate public use patterns and effectiveness of public use programs;
9. Investigate effectiveness of environmental education programs; and

10. Encourage sharing of scientific information through the Yolo Bypass Working Group.

5.2.10 MANAGEMENT COORDINATION ELEMENT

The creation and expansion of the Yolo Bypass Wildlife Area involved significant and complex coordination and partnership building with many agencies and organizations. The management of the Yolo Bypass Wildlife Area has continued in a spirit of cooperation and coordination. The result is a successful public private partnership with the DFG managing the Wildlife Area and the Yolo Basin Foundation managing many of the public use programs. The Wildlife Area is a successful model of cooperation between many agencies and organizations and the same approach should continue through the life of this LMP.

There are opportunities for continued management coordination at the Yolo Bypass Wildlife Area including:

- ongoing flood management activities with DWR, the State Reclamation Board, USACE, and the Sacramento Area Flood Control Agency (SAFCA);
- coordination of land use activities in the Yolo Bypass with the Yolo Bypass Working Group;
- coordination with the development and execution of the Yolo County Habitat Conservation Plan/Natural Community Conservation Plan (HCP/NCCP);
- ongoing wetland management activities coordinated with mosquito abatement by SYMVCD;
- law enforcement by the Yolo County Sheriff’s Department;
- land use planning by Yolo County and cities of West Sacramento and Davis including General Plans and open space planning;
- water supply planning by Yolo County Water Resource Association through the Integrated Regional Water Management Plan;
- fisheries and flow on Putah Creek with the Lower Putah Creek Coordinating Committee;
- ongoing regional recreational planning by local agencies (e.g., Yolo County, Sacramento County, the City of West Sacramento, the City of Davis);
- regional invasive-plant control efforts by the California Department of Food and Agriculture and Yolo County Agricultural Commissioner’s Office;
- fire-management planning by CDF and local fire districts;
- activities of the DWR-Broddrick Maintenance Yard for levee maintenance;
- State Reclamation Board 2-dimensional Hydraulic Model;
- water supply and drainage with RD 2068;
- mercury monitoring and research with CVRWQCB, USGS, UC Davis, and others;
- hazardous waste storage and disposal program administered by Yolo County;
- Yolo County emergency response planning;

- activities of California Bay-Delta Authority programs, particularly the CALFED ERP; and
- regional (i.e., Yolo Bypass) ecosystem restoration planning including DWR/Aquatic Restoration Project Implementation.

Management Coordination Goal 1 (MC-1): *Coordinate with federal, state, and local agencies regarding plans and projects that may affect habitats and/or management at the Yolo Bypass Wildlife Area.*

It is the policy of the California Fish and Game Commission that to provide maximum protection of fish and wildlife and their habitats. DFG shall review and comment on proposed flood management, ecosystem restoration, and water development projects or other projects affecting habitat in the Yolo Bypass Wildlife Area, and shall recommend and seek the adoption of proposals necessary or appropriate for the protection and enhancement of fish and wildlife and their habitat. The tasks listed below are intended to foster improved interagency coordination on issues pertinent to management of the Yolo Bypass Wildlife Area.

Tasks:

1. Review, coordinate, and provide comments and recommendations on federal, state, and local government plans and proposed projects as appropriate for the purpose of determining the consistency of such plans with the goals of DFG’s LMP.
2. Coordinate with Yolo County NCCP proponents to make them aware of habitat restoration efforts at the Wildlife Area and coordinate proposed actions to compliment each other’s efforts such as insuring the long-term presence of agricultural lands between the Davis city limits and the Yolo Bypass south of I-80.
3. Coordinate with the Yolo County program to survey, control, and monitor invasive plant species.
4. Collaborate with or submit proposals for CALFED-funded projects that could contribute both to the attainment of the goals of this LMP and to the attainment of CALFED goals, objectives, targets, and milestones.
5. Support the implementation of research, monitoring, and restoration actions compatible with the goals of this LMP by the California Bay-Delta Authority and other CALFED implementing agencies.

Management Coordination Goal 2 (MC-2): *Coordinate with flood control agencies regarding flood control and management in the Yolo Bypass.*

The primary function of the Yolo Bypass is flood control and management. DFG shall continue to coordinate with flood control agencies (i.e., DWR, the State Reclamation Board, and USACE) regarding all potential restoration projects and other activities that could affect flood flow conveyance in the Yolo Bypass. DFG will also review and comment on proposed flood management and water development projects or other projects that could affect habitat and/or management in the Yolo Bypass Wildlife Area. As necessary, DFG will also reconsider appropriate elements in the LMP if new flood control alternatives are developed in the future. This would be part of the overall adaptive management process for implementing the LMP. The tasks listed below are intended to foster coordination with flood control agencies regarding management of the Yolo Bypass.

Tasks:

1. Review, coordinate, and provide comments and recommendations on plans and proposed projects as appropriate to determine the consistency of such plans with the goals of DFG’s LMP. DFG biologists in the Sacramento Valley Central Sierra Region shall serve as the lead in coordinating ecosystem restoration components of future flood protection improvement efforts.

2. Coordinate with DWR, the State Reclamation Board, USACE and, where appropriate, local flood control agencies, reclamation districts, and SAFCA regarding the design and operation of restoration and enhancement projects that have the potential to conflict with necessary flood flow conveyance requirements. All projects should continue to be designed and operated to continue to have no impact on existing flood flow conveyance requirements of the Yolo Bypass. Additionally, design and operation of habitat restoration and enhancement projects shall consider affects on the Yolo Bypass design flow as well as its current capacity and on the ability to maintain the project at reasonable costs in conformance with USACE operation and maintenance manuals. Project planning may include necessary hydraulic modeling to guide design and confirm achievement of performance criteria (i.e., avoid potential adverse effects on necessary flow conveyance). All hydraulic modeling should be conducted in coordination with appropriate flood control and management agencies. A work plan for hydraulic modeling is provided in Appendix C.

3. Participate in ecosystem restoration components of any overall improvements to the Lower Sacramento Flood Control System.

4. Continue public outreach programs that describe the compatible nature of appropriate wetland management activities with flood protection efforts.

Management Coordination Goal 3 (MC-3): *Coordinate with other law enforcement agencies.*

The jurisdictions of multiple law enforcement organizations overlap at the Yolo Bypass Wildlife Area, and thus coordination among them should lead to more effective law enforcement; this should also support attainment of the goals of this LMP for public-use elements. The tasks listed below are intended to foster coordination with the appropriate law enforcement agencies.

Tasks:

1. Meet on an annual basis with local Wildlife Protection squad prior to waterfowl hunting season to review Wildlife Area regulations, work schedules, exchange contact information and intricacies of public hunting program.

2. Continue ongoing communication with Wildlife Protection staff throughout the year.

3. Meet regularly with law enforcement staff from the California Highway Patrol and Yolo County Sheriff’s Department and other agencies as appropriate to coordinate law enforcement activities and explore options for cooperative programs.

4. Pursue joint funding requests with other law enforcement entities to address law enforcement concerns.

Management Coordination Goal 4 (MC-4): *Coordinate with local public-service agencies including the SYMVCD and the Yolo County Health Department.*

Section 1507 of the California Fish and Game Code contains language regarding the control of mosquito production of managed wetlands in DFG’s wildlife areas. Control of mosquito production in wetlands and agricultural fields (e.g., rice fields) shall be a priority for DFG. As described in Section 1507, mosquito production should be controlled in a manner that:

- maintains or enhances habitat values for waterfowl and other wildlife;
- minimizes financial costs to DFG and SYMVCD;
- reduces the need for chemical treatment or other nonecological mosquito control; and

- increases coordination and communication between DFG and SYMVCD, and the California Department of Health Services.

The tasks listed below are intended to foster coordination of mosquito and vector control activities.

Tasks:

1. In consultation with SYMVCD, continue to implement a mosquito control plan that applies BMPs and any other necessary management practices as identified in the *Central Valley Habitat Joint Venture, Technical Guide to Best Management Practices for Mosquito Control in Managed Wetlands* (Kwasny et al. 2004) and the California Rice Commission's BMPs for mosquito control.

2. Communicate regularly with SYMVCD. Coordinate mosquito and vector control activities. Meet annually with mosquito abatement agencies to discuss needed infrastructure improvements, identify areas of high mosquito productivity, schedules of summer irrigations and fall flood up, and scheduling of public use activities.

3. Conduct annual meeting with private wetland managers in the Yolo Bypass and SYMVCD staff to coordinate fall flood up of wetlands, target habitat infrastructure improvements and firm up contact information.

4. Coordinate with Yolo County Health Department as necessary.

5. Apply for grants and matching funds with SYMVCD to implement BMPs.

6. Jointly conduct research to measure land management effects on mosquito production.

Management Coordination Goal 5 (MC-5): *Maintain relationships with neighbors and tenants to address management issues.*

Activities of neighbors, agricultural and duck club interests, and tenants in the Yolo Bypass Wildlife Area all affect ecosystems and public uses at the Yolo Bypass Wildlife Area. Maintaining relationships with neighbors and tenants can thus contribute to attainment of most goals of this LMP. This can best be done through continued involvement and leadership within the Yolo Bypass Working Group, as well as through personal communication over the phone and in person.

The tasks listed below are intended to foster improved relationships between DFG and Yolo Bypass Wildlife Area neighbors and tenants.

Tasks:

1. Meet or correspond with adjacent landowners and tenants as needed individually or through the Yolo Bypass Working Group to maintain communication about management needs of the Yolo Bypass Wildlife Area, determine adjacent landowners' access and management needs, and convey useful information regarding activities.

2. Collaborate with adjacent landowners and tenants regarding DFG management activities that may affect their operations. Resolve potential issues by proactively working with adjacent landowners and tenants.

3. Collaborate with adjacent special districts including Reclamation District 2068, Dixon RCD, Yolo RCD, No Man's Land Fire District, East Davis Fire District, South Davis Drainage District, and other neighboring special districts.

4. Area Manager and appropriate staff should attend annual site visits to duck hunting clubs conducted by DFG headquarters staff as part of the implementation of various wetland easement programs.

5. Meet at least annually with duck club owners and SYMVCD to discuss fall flood-up schedule and summer irrigations.

6. Meet annually with SYMVCD to target field work in areas that have a high propensity to produce large numbers of mosquitoes to prevent abatement issues later during flood up.

7. Coordinate flooding of duck clubs through the Tule Ranch Irrigation System.

    a. Review, modify, and exercise agreements with adjacent duck hunting clubs regarding the delivery of water and use of Wildlife Area roads as necessary.

    b. Review billing process.

    c. Collect fees on an annual basis for water delivery and road use.

Management Coordination Goal 6 (MC-6): *Coordinate activities associated with managing cholera, avian flu, and other disease outbreaks.*

Continued preparedness training is necessary as increasing numbers of wildlife diseases appear in North America. The Department of Fish and Game will have the lead on surveillance of wild bird populations for the presence of avian influenza. Additionally, regular visual monitoring of birds for the presence of avian botulism and avian cholera will continue.

Tasks:

1. Conduct regular visual monitoring of birds for the presence of botulism in the summer and avian cholera in the winter.
    a. Submit carcass samples to Wildlife Investigations Laboratory for evaluation.
    b. Conduct clean up operations as necessary in order to remove carcasses.
    c. Incinerate carcasses as they arrive.
    d. Improve circulation of water or other management activities to prevent spread of the disease.

2. Conduct regular monitoring of harvested birds at the hunter check station for the presence of avian flu.

3. Participate in disease related work groups.

4. Coordinate with county and state public health agencies, and UC Davis.

5. Participate in Incident Command System (ICS) activities.

6 OPERATIONS AND MAINTENANCE

The purpose of this Chapter is to indicate staffing, funding and other resources to operate and maintain the Yolo Bypass Wildlife Area (Wildlife Area). Implementation of this Land Management Plan (LMP) will require additional staffing and resources than are currently allocated to the Yolo Bypass Wildlife Area, to accomplish the tasks indicated in Chapter 5. This LMP proposes proactive application of an ecosystem approach to the management of the multiple natural communities and habitats present at the Yolo Bypass Wildlife Area at a more intensive level than in the past. This will require a commitment of additional budgetary resources if the goals of this LMP are to be achieved.

In addition to financial resources, this LMP will require periodic revision to ensure that it is kept current, reflecting goals met, and changing needs and understanding. It is fully expected that the ongoing, adaptive management of the Yolo Bypass Wildlife Area and advancement of scientific knowledge regarding the area will result in new techniques and opportunities for more effective management of habitat. Suggested procedures to help keep this LMP current and relevant are included in this chapter.

6.1 OPERATIONS AND MAINTENANCE TASKS TO IMPLEMENT PLAN

Table 6.1-1 summarizes and synthesizes operations and maintenance requirements (i.e., tasks identified in Chapter 5, “Management Goals”) to implement the LMP. Estimated hours by staff position is also included in the table.

6.2 EXISTING STAFF AND ADDITIONAL PERSONNEL NEEDS

The Yolo Bypass Wildlife Area is currently staffed by four permanent employees and five part time temporary employees. Their duties are described below:

Position	Duties
Wildlife Habitat Supervisor II	Give direction to maintenance staff, California Department of Fish and Game’s (DFG’s) principle representative at Working Group meetings; Coordination of scientific research; Management of agricultural leases; Budget planning and management; Grant proposal preparation; Contract Management; Representative for Wildlife Area for media exposure; Writing articles for newsletter and local media; Presentation of public programs to a variety of audiences; Communication with local elected officials; Representative of Wildlife Area working with various governmental agencies and non governmental organizations; Creation of annual habitat management plans; Grant application writer; Permit application writer; Presentations to local schools; Occasional operation of heavy equipment; Maintains compliance with various agreements for management; Author of land management plans; Wildlife Area photographer.
Wildlife Habitat Supervisor I	Lead person for field staff; operation of heavy equipment; Surveys of local wildlife populations; Procurement of supplies and equipment; Maintenance of Wildlife Area electronic equipment; Assists in planning of field activities; Coordination with farmers sharing irrigation system; Operation of Wildlife Area irrigation system; Lead person for hunter check station.
Tractor Operator Laborer	Lead for operation and maintenance of heavy equipment and implements; Construction and fabrication of equipment utilizing metal and wood technologies; Lead for operation of shop facility; Lead for hunter check station;
Fish and Wildlife Technician	Construction and fabrication of equipment utilizing metal and wood technologies; Lead for maintenance of vehicles and residences; Operation and maintenance of heavy equipment; Lead for application of herbicides; Liaison for adjacent duck hunting clubs and Tule Ranch operations; Lead for hunter check station; Installation and maintenance of water control structures.
Scientific Aids Total of 3 personnel years	Greeting visitors to administrative facility; Administration of procurement procedures; Tracking of expenditures; Maintenance of office records; Maintenance of Demonstration Wetlands area; Operation of heavy equipment; General construction activities; Application of herbicides; Operation of hunter check station; Volunteer coordinator; Instructor for Wildlife Area education program; Coordinator of teacher workshops.

To ensure appropriate support of the Yolo Bypass Wildlife Area and performance of the tasks identified in this LMP, a combination of additional site management, maintenance, interpretive and administrative staffing is required. The staffing team developed here includes all permanent personnel needed to operate the Yolo Wildlife Area and implement the land management plan. The staffing program proposed in this LMP incorporates permanent staffing augmented by seasonal labor although seasonal labor tasks are not itemized. It is anticipated that an additional 6 personnel years of seasonal employee time (Scientific Aids, Seasonal Aids) will be needed in order to implement this plan.

DFG standard staffing levels for wildlife areas varies according to the intensity of management undertaken. Intensely managed areas should be staffed with one field person per 1,000 acres for the first 10,000 acres. Approximately 10,000 of the 16,770 acre Yolo Bypass Wildlife Area will be intensely managed. Application of the standard indicates that 10 field staff personnel are justified. These ten field staff positions will consist of 1 Wildlife Habitat Supervisor II, 1 Wildlife Biologist, I Wildlife Habitat Supervisor I, 2 Wildlife Habitat Assistants, 3 Tractor Operator Laborers, and 2 Fish and Wildlife Technicians.

Additional staff will include an Interpreter II, an Interpreter I, and an Office Technician. All of the personnel will be supervised by a Senior Biologist Supervisor (Wildlife). The duties of the proposed staff will consist of the following:

Title	Duties
Senior Biologist Supervisor (Wildlife)	Representative for Wildlife Area with elected officials, local events and media, procurement of funding for future activities, supervision of all Wildlife Area employees, DFG's principle representative at Working Group meetings; Management of agricultural leases; Budget planning and management; Grant proposal preparation; Contract Management; Representative for Wildlife Area for media exposure; Writing articles for newsletter and local media; Presentation of public programs to a variety of audiences; Representative of Wildlife Area working with various governmental agencies and non governmental organizations. This person will have the principal responsibility for implementation of this LMP.
Wildlife Habitat Supervisor II	Planning and implementation of wildlife habitat management activities. Supervise field staff. Oversee procurement of equipment and supplies. Coordination with other land management entities in the Yolo Bypass.
Wildlife Biologist	Plant and wildlife surveys, analysis of biological benefits of management, assist in planning of habitat construction and maintenance activities, coordination of scientific research on Wildlife Area.
Wildlife Habitat Supervisor I	Lead person for field staff, procurement of supplies for habitat management activities, planning of field work
Wildlife Habitat Assistant	Water management, habitat management activities, operation of heavy equipment, check station operation.
Tractor Operator Laborer	Operation and maintenance of heavy equipment, vehicles, and various tools and machinery, check station operation.
Fish and Wildlife Technician	Assist wildlife habitat management activities, check station operation, vehicle and equipment maintenance.
Fish and Wildlife Interpreter II	Administration and supervision of Wildlife Area volunteer program. Lead DFG representative for development of new curriculum, interpretive programs and public use management. Coordinate public use programs with outdoor recreation and interpretive programs developed by other groups.
Fish and Wildlife Interpreter I	Participate in Wildlife Area interpretive and education programs, represent Wildlife Area in public festivals and special events.
Office Technician	Administration of procurement activities, budget tracking, communication with visitors over the phone, via email and in person.

Implementation of the LMP involves completing the tasks described in Chapter 5. The duties of each position translate into hours spent towards each of these tasks. The following chart distributes hours towards each of the above positions to complete the described tasks. These tasks are summarized and synthesized from the detailed descriptions provided in Chapter 5.

6.3 ESTIMATED OPERATIONS AND MAINTENANCE COST AND FUNDING SOURCES

6.3.1 ESTIMATED COSTS

The proposed staffing of the Yolo Bypass Wildlife Area required in order to fully implement this land management plan (e.g., salary [not including benefits]), is estimated to be approximately $801,000 in 2006 dollars.

STAFFING

The annual cost of the proposed staffing program is provided in Table 6.3-1.

6.3.2 FUNDING SOURCES

OPERATIONS AND MAINTENANCE

Current funding sources for operation and maintenance include:

- Federal Aid in Wildlife Restoration Act (Pittman-Robertson Act),
- Agricultural lease revenues,
- The Tobacco Tax and Health Initiative (Proposition 99),
- The Environmental License Plate Fund,
- Mitigation funds,
- Funding under CALFED Bay-Delta Program, and
- The Central Valley Project Improvement Act.

Additionally, substantial in kind contributions are received from the Yolo Basin Foundation.

CAPITAL IMPROVEMENTS / RESTORATION AND ENHANCEMENT

On a project basis, funding sources for capital improvements / restoration and enhancement could include:

- North American Wetlands Conservation Act (NAWCA) funding (approximately $8 million in NAWCA funding is currently available for restoration activities in the Yolo Bypass Wildlife Area);

- California Endangered Species Tax Check-Off Fund;

- U.S. Fish and Wildlife Service support under the Federal Endangered Species Act Section 6 provisions for cooperation with the states;

- Wetlands Conservation Fund;

- IRWMP-DWR Bond fund;

- State Duck Stamp Program;

- Upland Game Stamp Program;

- U.S. Department of Agriculture (USDA), Natural Resources Conservation Service (NRCS) Farm Bill Programs;
- USFWS State Wildlife Grant Program, Federal Aid in Wildlife Restoration Program;
- Central Valley Project, Wildlife Habitat Augmentation Plan;
- Neotropical Migratory Bird Conservation Act Grants Program;
- Riparian Habitat Joint Venture;
- Ducks Unlimited, Wetland Restoration Program;
- Department of Fish and Game Minor/Major Capital Outlay proposals;
- DFG Comprehensive Wetlands Program;
- Wildlife Conservation Board Inland Wetlands Conservation Program;
- Other programs authorized under future bond acts;
- DWR grants available for mitigation of water projects and levee maintenance activities;
- Funding available through Yolo County Integrated Regional Water Management Plan;
- Funding available through the Sacramento River Watershed Program;
- Funding from grant programs administered by U.S. Environmental Protection Agency;
- Funding from grant programs administered by National Oceanic and Atmospheric Administration;
- Funding from grant programs administered by the National Fish and Wildlife Foundation;
- Funding from grant programs administered by US Bureau of Reclamation;
- Funding that becomes available as a result of programs to improve the Sacramento River Flood Control System by expanding the Yolo Bypass (including Sacramento Area Flood Control Agency);
- Funding from the Yolo County NCCP;
- Farm Service Agency payments to tenants;
- AB 1982 : Funding to implement mosquito best management practices; and
- DFG deferred maintenance fund.

Table 6.1-1
Operations and Maintenance Requirements (hours by staff position) to Implement Plan

Element / Sub-element	Goal	Tasks	Senior Biologist Super (Wildlife) (1)	Wildlife Habitat Super II (1)	Wildlife Biologist (1)	Wildlife Habitat Super I (2)	Wildlife Habitat Assist (2)	Tractor Operator Laborer (2)	Fish and Wildlife Tech (2)	Fish and Wildlife Interpret II (1)	Fish and Wildlife Interpret I (1)	Office Tech (1)
5.2.1 BIOLOGICAL ELEMENT												
5.2.1.1 Management for Species Guilds	**Species Guilds Goal 1 (SG-1):** *Manage and maintain habitat communities for waterfowl species.*	1. Manage seasonal and permanent wetlands and other communities to provide habitat for resident waterfowl species.	22	4	4	135	283	308	205			
		2. Manage upland vegetation to provide desired nesting habitat.	16	16	11	42	100	206	115			6
		3. Maintain a sanctuary area where public access is prohibited in order to provide safe haven for migratory waterfowl.	8		5	6	5					
		4. Monitor waterfowl populations periodically to assess management techniques and species response; apply adaptive management techniques as appropriate.	4	5	70	10						15
	Species Guilds Goal 2 (SG-2): *Manage and maintain habitat communities for shorebird and wading bird species.*	1. Manage seasonal wetlands for shorebird species.	16	6		20	75		40			
		2. Manage agriculture for shorebird species through newly developed shorebird/rice rotation.	16			13	30	90				
		3. Monitor shorebird populations periodically to assess management techniques and species response; apply adaptive management techniques as appropriate.			24							
		4. Perform field preparation of some agricultural fields in the fall in order to present disced field habitat for species that utilize this habitat such as horned larks, longspurs, and mountain plover.				6	20	60				
		5. Provide staggered timing of rice shore bird rotation so that there are always some fields in the shorebird rotation.				2	5					
	Species Guilds Goal 3 (SG-3): *Maintain and enhance habitat for upland game species.*	1. On an experimental basis, dedicate two fields to provide all habitat requirements within discreet areas in accordance with Diverse Upland Habitat Unit (DUHU) techniques being developed on several state wildlife areas.	8	5	8	16	10	16				
		2. Annually plant nesting cover including legumes that will improve nesting habitat for upland game species.				24	25	60				5

Table 6.1-1
Operations and Maintenance Requirements (hours by staff position) to Implement Plan

Element / Sub-element	Goal	Tasks	Senior Biologist Super (Wildlife) (1)	Wildlife Habitat Super II (1)	Wildlife Biologist (1)	Wildlife Habitat Super I (2)	Wildlife Habitat Assist (2)	Tractor Operator Laborer (2)	Fish and Wildlife Tech (2)	Fish and Wildlife Interpret II (1)	Fish and Wildlife Interpret I (1)	Office Tech (1)
		3. Provide nesting structures for mourning dove.				5	16		20	10		
		4. Annually plant grain field to provide foraging areas for upland game and hunting opportunities for upland game hunters.		5		36	50	85	45			5
		5. Control invasive weeds such as perennial pepperweed and starthistle.		4		16	85	20	60			5
		6. Perform scattered irrigations in upland areas to increase humidity and subsequent invertebrate numbers for the benefit of ground nesting birds such as mallard and ring-necked pheasant. These irrigations must be conducted quickly and drained thoroughly to prevent production of large numbers of mosquitoes.	4	4	5	14	20		20			
		7. Continue to enhance upland areas with the construction of topographic features such as swales to create micro habitats and more effectively move water on and off the field.	4	6		24	25	60	20			
	Species Guilds Goal 4 (SG-4): *Manage and maintain habitat communities for raptors.*	1. Manage for rodents and large insects to provide adequate prey items in order to benefit foraging raptor species.	8	12	75	44	70	100	80			
		2. Monitor populations of raptors and to assess management techniques and species response; apply adaptive management techniques as appropriate.	4	2	20	5						
	Species Guilds Goal 5 (SG-5): *Manage and maintain habitat communities for cavity-nesting bird species.*	1. Provide and maintain nesting boxes for cavity nesters such as American kestrels, tree swallows, barn owls, and wood ducks in appropriate habitats.			5	8	10		60		12	
		2. Restore and enhance riparian vegetation for cavity nesters where compatible with flood management.			5	8	10		9			
		3. Monitor populations of cavity-nesting bird species periodically to assess management techniques and species response; apply adaptive management techniques as appropriate.			14	5			10			
	Species Guilds Goal 6 (SG-6): *Manage and maintain communities for neotropical bird species.*	1. Maintain and enhance riparian vegetation along Putah Creek and the East Toe Drain to serve as corridors for resident and migratory songbirds and	8	6	16	24	6		15			

Table 6.1-1
Operations and Maintenance Requirements (hours by staff position) to Implement Plan

Element / Sub-element	Goal	Tasks	Senior Biologist Super (Wildlife) (1)	Wildlife Habitat Super II (1)	Wildlife Biologist (1)	Wildlife Habitat Super I (2)	Wildlife Habitat Assist (2)	Tractor Operator Laborer (2)	Fish and Wildlife Tech (2)	Fish and Wildlife Interpret II (1)	Fish and Wildlife Interpret I (1)	Office Tech (1)
		nest sites for a variety of species.										
		2. Pursue approval and establishment of appropriate tree line.	2		2							
		3. Manage upland habitat to include variations in height, density of vegetation, food crops, and water to benefit a diverse array of resident ground nesting shorebirds, songbirds, raptors and owls as well as game species such as ring-necked pheasant.	6	4	6	32	8	5	16			
		4. Monitor populations of neotropical bird species periodically to assess management techniques and species response; apply adaptive management techniques as appropriate.		4	24		5					
	Species Guilds Goal 7 (SG-7): *Manage and maintain communities for a variety of other waterbird species including grebes, rails, and songbirds associated with emergent marsh vegetation.*	1. Maintain appropriate and consistent water levels to maintain high quality habitat for floating nest builders such as pied-billed grebe.				36	10					
		2. Maintain varying amounts of thatch within emergent marsh vegetation in order to attract such nesting species as white-faced ibis, black-crowned night herons, tri-colored blackbirds, and yellow headed blackbirds.			5	4		10	5			
		3. Time spring drawdown in some ponds so young grebes, moorhens, coots, and ibis are not stranded.			2	2		2	2			
	Species Guilds Goal 8 (SG-8): *Maintain and enhance foraging opportunities for the presence of breeding colonies of bats roosting under the Yolo Causeway.*	1. Establish baseline data on roosting bat species and population density under the Yolo Causeway.	4	5	30	9	25				5	
		2. Support bat diversity.		5	12	8	24		8			
		3. Protect existing bat maternity roost sites under the I-80 Causeway against unauthorized public disturbance by maintaining existing conditions that make it difficult for the public to gain access to these roosting areas.				4	8		8			
		4. Coordinate with Caltrans to ensure that their inspections, other bridge maintenance activities, and bat colony management actions are consistent with Yolo Bypass Wildlife Area management goals and tasks regarding the maternity roosts under the I-80	8	4	8							

Table 6.1-1
Operations and Maintenance Requirements (hours by staff position) to Implement Plan

Element / Sub-element	Goal	Tasks	Senior Biologist Super (Wildlife) (1)	Wildlife Habitat Super II (1)	Wildlife Biologist (1)	Wildlife Habitat Super I (2)	Wildlife Habitat Assist (2)	Tractor Operator Laborer (2)	Fish and Wildlife Tech (2)	Fish and Wildlife Interpret II (1)	Fish and Wildlife Interpret I (1)	Office Tech (1)
		Causeway, and to ensure that Yolo Wildlife Area management activities are consistent with Caltrans bat colony management policies.										
		5. Encourage preservation of bat colonies as a beneficial natural resource by maintaining and enhancing existing education and outreach programs.							25		80	
		6. Monitor bat population species and density periodically to track population trends and assess management techniques and species response; apply adaptive management techniques as appropriate.		2	20				20			
5.2.1.2 Special-Status Species	**Special Species Goal 1 (SS-1):** *Without specifically managing for special-status species, the communities at the Yolo Wildlife Area should be managed in a way that generally improves overall habitat quality and diversity while not discouraging the establishment of special-status species.*	1. Conduct surveys of wildlife and vegetation communities. The highest priority is to survey for special-status animals and plants that could be present in wetland ecosystems at the Yolo Wildlife Area but that are not yet known to occur, such as California tiger salamander, western spadefoot toad, Colusa grass, Crampton's tuctoria, and Bogg's Lake hedge-hyssop. It is also important to survey for other special-status species known to occur in wetland ecosystems at the Yolo Wildlife Area but for which much information is lacking, such as giant garter snake and vernal pool crustaceans. Submit observation records to the CNDDB.	8		32	20			40			
		2. Monitor populations of special-status species periodically to assess overall habitat integrity, detect changes in distribution and abundance, and detect positive and adverse effects of management activities, human use, and/or nonnative species.		6	40				50			
		3. Monitor special-status species use of the floodway in the face of rising and receding floodwaters.		2	10				10			
		4. Evaluate management in light of MOU between DFG, State Reclamation Board, USFWS, and DWR regarding threatened and endangered species.	8	18	16							

Table 6.1-1
Operations and Maintenance Requirements (hours by staff position) to Implement Plan

Element / Sub-element	Goal	Tasks	Senior Biologist Super (Wildlife) (1)	Wildlife Habitat Super II (1)	Wildlife Biologist (1)	Wildlife Habitat Super I (2)	Wildlife Habitat Assist (2)	Tractor Operator Laborer (2)	Fish and Wildlife Tech (2)	Fish and Wildlife Interpret II (1)	Fish and Wildlife Interpret I (1)	Office Tech (1)
		5. Upon certification of the operations and maintenance manual for the project modifications (as updated in supplement, U.S. Army Corps of Engineers 2003) to the Sacramento River Flood Control Project, fulfill reporting requirement described within.	36	32	16	20						
5.2.1.3 Nonnative Invasive Species	**Invasive Species Goal 1 (IS-1):** *Prevent the introduction and spread of invasive nonnative species that have no benefit to wildlife.*	1. Inventory habitats within the Yolo Wildlife Area for infestations of invasive plants not beneficial to wildlife.		4		56	20					
		2. Prioritize infestations for treatment based on the risks that individual infestations pose to ecosystem services, public infrastructure, and other resources within the Yolo Bypass Wildlife Area, and based on the likelihood that the infestation can be treated and maintained in a cost-effective manner.	2	6	8	12	12	40	12			
		3. Manage and control invasive and other nonnative species through specified grazing practices, controlled flood-up and drawdown procedures, use of pesticides, and other conventional agricultural practices.	34	65	60	130	175	77	153			10
5.2.1.4 Seasonal and Permanent Wetland Communities	**Seasonal and Permanent Wetland Ecosystems Goal 1 (SPW-1):** *Restore, enhance and manage wetlands to conditions that provide desired ecological functions.*	1. Evaluate opportunities, constraints, and potential restoration benefits to identify feasible wetland restoration projects that would support the goals of this LMP.	80	32	16	24						
		2. Pursue funding and develop plans for identified restoration projects that include goals, techniques, costs, monitoring, an adaptive management process, and a schedule.	180	32	12							
		3. Cooperate with development and implementation of existing restoration plans for wetland ecosystems by the CALFED ERP, North American Waterfowl Management Plan, Partners in Flight, United States Shorebird Conservation Plan, Waterbird Conservation for the Americas, Yolo County NCCP and other programs that	38	24	12	12						

Table 6.1-1
Operations and Maintenance Requirements (hours by staff position) to Implement Plan

Element / Sub-element	Goal	Tasks	Senior Biologist Super (Wildlife) (1)	Wildlife Habitat Super II (1)	Wildlife Biologist (1)	Wildlife Habitat Super I (2)	Wildlife Habitat Assist (2)	Tractor Operator Laborer (2)	Fish and Wildlife Tech (2)	Fish and Wildlife Interpret II (1)	Fish and Wildlife Interpret I (1)	Office Tech (1)
		are consistent with the goals of this LMP.										
		4. Coordinate habitat restoration acreages with goals developed for the Yolo Basin component of the Central Valley Joint Venture.	2	12	12	16						
5.2.1.5 Riparian Communities	**Riparian Goal 1 (R-1):** *Maintain and enhance riparian communities for native species diversity and abundance (including special-status species).*	1. Conduct surveys for wildlife and vegetation of riparian communities. The highest priority is to survey for special-status animals and plants that could be present in riparian ecosystems at the Yolo Wildlife Area but that are not yet known to occur, such as Northern California black walnut, California hibiscus, yellow-billed cuckoo, Mason's lilaeopsis, and Delta mudwort.	6		24				10			
		2. Monitor populations of special-status species periodically to assess overall habitat integrity, detect changes in distribution and abundance, and detect positive and adverse effects of management activities, human use, and/or nonnative species.	8	32	24	32	14	80	30			
		3. After appropriate hydraulic analysis and receipt of Reclamation Board approval, improve habitat in the riparian ecosystems at the Yolo Bypass Wildlife Area through enhancement of existing riparian areas and establishment of new riparian habitats as permitted. Maintain and enhance riparian vegetation along Putah Creek and the East Toe Drain to provide nest trees and brush for resident and migratory songbirds, wading birds, and raptors.	2	14	20	60	60	60				
		4. Manage habitats in accordance with the operations and maintenance manual for the project modifications (as updated in supplement, U.S. Army Corps of Engineers 2003) to the Sacramento River Flood Control Project, pursuant to the MOU between DFG, State Reclamation Board, USFWS, and DWR regarding threatened and endangered species.		10	10	40	40	40	20			

Table 6.1-1
Operations and Maintenance Requirements (hours by staff position) to Implement Plan

Element / Sub-element	Goal	Tasks	Senior Biologist Super (Wildlife) (1)	Wildlife Habitat Super II (1)	Wildlife Biologist (1)	Wildlife Habitat Super I (2)	Wildlife Habitat Assist (2)	Tractor Operator Laborer (2)	Fish and Wildlife Tech (2)	Fish and Wildlife Interpret II (1)	Fish and Wildlife Interpret I (1)	Office Tech (1)
	Riparian Goal 2 (R-2): *Restore and enhance riparian communities to conditions that provide desired ecological functions.*	1. Evaluate opportunities, constraints, and potential restoration benefits to identify feasible riparian restoration projects that would support the goals of this LMP. Riparian restoration projects may include new restoration areas or enhancement of existing restoration areas (e.g., seasonal and permanent wetlands) with riparian vegetation.		5	4	20	24	24				
		2. Pursue funding and develop plans for identified restoration projects that include goals, techniques, costs, monitoring, an adaptive management process, and a schedule.		6	12	20						
		3. Cooperate with development and implementation of restoration plans for riparian ecosystems by the CALFED ERP and other programs that are consistent with the goals of this LMP.		20	20	20						
		4. Design and manage riparian restoration and enhancement projects that would not conflict with necessary flood flow conveyance requirements of the Yolo Bypass. Ensure that proposed projects would not result in adverse effects on local or downstream flood hydrology and would comply with the requirements of the State Reclamation Board. Project planning will include necessary hydraulic modeling to guide design and confirm achievement of performance criteria. A work plan for hydraulic modeling is provided in Appendix C.		10	20	20	40					
5.2.1.6 Grassland and Upland Communities	**Grassland and Upland Goal 1 (GU-1):** *Maintain and enhance grassland and upland communities for diversity and abundance of native species (including special-status species).*	1. Conduct surveys for wildlife and vegetation in grassland and upland communities. The highest priority is to surveys for special-status animals and plants that could be present in grassland and upland communities at the Yolo Wildlife Area but that are not yet known to occur, such as heartscale, San Joaquin spearscale, and Carquinez goldenbush. It is also important to survey for other special-status species known to occur in grassland and upland			36	20	20		25			

Table 6.1-1
Operations and Maintenance Requirements (hours by staff position) to Implement Plan

Element / Sub-element	Goal	Tasks	Senior Biologist Super (Wildlife) (1)	Wildlife Habitat Super II (1)	Wildlife Biologist (1)	Wildlife Habitat Super I (2)	Wildlife Habitat Assist (2)	Tractor Operator Laborer (2)	Fish and Wildlife Tech (2)	Fish and Wildlife Interpret II (1)	Fish and Wildlife Interpret I (1)	Office Tech (1)
		ecosystems at the Yolo Wildlife Area but for which much information is lacking, such as Ferris' milk-vetch, alkali milk-vetch, grasshopper sparrow, burrowing owl, and California horned lark.										
		2. Monitor populations of upland and grassland species periodically to assess overall habitat integrity, detect changes in distribution and abundance, and detect positive and adverse effects of management activities, human use, and/or nonnative species.			20	10			20			
		3. Improve habitat for upland and grassland species in the grassland ecosystems at the Yolo Wildlife Area through the adaptive management of livestock grazing, limited herbicide application, native grass plantings, and other management techniques.	8	25	8	25	60	30	30			
		4. Support existing populations of burrowing owls and increase breeding populations through the installation of artificial burrows.			4	12	25	30	40			
		5. Ensure that actions comply with the federal and California Endangered Species Acts and other regulations aimed at the protection of special-status species, including MOU between DFG, State Reclamation Board, USFWS, and DWR regarding threatened and endangered species.			18							
	Grassland and Upland Goal 2 (GU-2): *Restore and enhance grassland and upland communities to conditions that provide desired ecological functions.*	1. Evaluate opportunities, constraints, and potential restoration benefits to identify feasible grassland and upland restoration projects that would support the goals of this LMP.	8	8	20							
		2. Pursue funding and develop plans for identified restoration projects that include goals, techniques, costs, monitoring, an adaptive management process, and a schedule.	36	16	16							
		3. Cooperate with development and implementation of restoration plans for grassland and upland ecosystems by the CALFED ERP and other programs that	16	16	12							

Table 6.1-1
Operations and Maintenance Requirements (hours by staff position) to Implement Plan

Element / Sub-element	Goal	Tasks	Senior Biologist Super (Wildlife) (1)	Wildlife Habitat Super II (1)	Wildlife Biologist (1)	Wildlife Habitat Super I (2)	Wildlife Habitat Assist (2)	Tractor Operator Laborer (2)	Fish and Wildlife Tech (2)	Fish and Wildlife Interpret II (1)	Fish and Wildlife Interpret I (1)	Office Tech (1)
		are consistent with the goals of this LMP.										
		4. Enhance grasslands and uplands through grazing, native grass plantings, and other management techniques.			12	50	35	40	75			
5.2.1.7 Aquatic Ecosystems	**Aquatic Ecosystems Goal 1 (AE-1):** *Maintain and enhance aquatic ecosystems for diversity and abundance of native species (including special-status species).*	1. Monitor use of aquatic habitats at the Yolo Wildlife Area by special-status fish species.			52				30			
		2. Improve and maintain habitat for special-status fish species using aquatic habitats at the Yolo Wildlife Area (see Aquatic Ecosystems Goal 3 below).			18	20	25	20	25			
		3. Identify sites (e.g., permanent wetlands, ponds, Green’s Lake) for reintroduction of native fish species (e.g., Sacramento perch).			14							
		4. Ensure that actions comply with the ESA and CESA and other regulations aimed at the protection of special-status-species and are in accordance with the MOU between DFG, USFWS, DWR, and the State Reclamation Board.	8		8							
	Aquatic Ecosystems Goal 2 (AE-2): *Maintain and enhance habitat for game fish species.*	1. Monitor and assess management, human use, invasive nonnative species, and other effects on habitat for desired game species.	8	20	50	30	10		25			
		2. Evaluate access points, angling use, and regulations periodically; recommend changes as warranted to maintain and enhance aquatic habitats and populations of game species.	8	20	24	50	50		35			
		3. Improve habitat structure in permanent wetlands for the benefit of game fish species.		10	24	25	40	40	30			
	Aquatic Ecosystems Goal 3 (AE-3): *Restore and enhance aquatic ecosystems to conditions that provide desired ecological functions.*	1. Identify opportunities to restore aquatic ecosystems at the Yolo Wildlife Area. Cooperate with development and implementation of restoration plans for aquatic ecosystems by the CALFED ERP and other programs that are consistent with the goals of the Yolo Wildlife Area and this LMP. Potential projects may include the following:	36	10								

Table 6.1-1
Operations and Maintenance Requirements (hours by staff position) to Implement Plan

Element / Sub-element	Goal	Tasks	Senior Biologist Super (Wildlife) (1)	Wildlife Habitat Super II (1)	Wildlife Biologist (1)	Wildlife Habitat Super I (2)	Wildlife Habitat Assist (2)	Tractor Operator Laborer (2)	Fish and Wildlife Tech (2)	Fish and Wildlife Interpret II (1)	Fish and Wildlife Interpret I (1)	Office Tech (1)
		a. Create a new realigned Putah Creek channel through the Tule Ranch Unit (Putah Creek from above the Los Rios Check Dam to the East Toe Drain below the Lisbon Weir).	36	32	70	48	40	80	35			
		b. Explore the potential for restoration of intertidal marsh habitat and/or seasonal managed floodplain habitat at the southeast portion of Tule Ranch adjacent to the East Toe Drain for the benefit of native fish species such as splittail. Certain bird species such as black rail may also benefit.	40	25	38	36	25	120	75			
		c. Independent of Goal AE-1, consider improving coordination and enhancement of spring passage of chinook salmon smolts emigrating from Putah Creek through the Los Rios Check Dam to the East Toe Drain.	16		25							
		i. Coordinate annual replacement of the check dam after the arrival of spring water releases from the Solano Diversion Dam intended to move salmon smolts from Putah Creek into the toe drain.	4	8	5	13			25			
		ii. Consider the construction of a fish passage facility at the check dam to move adult salmon upstream and smolts downstream.	8		16	8						
		d. Restore native fish to Green's Lake and permanent ponds including Sacramento perch. Stocking of this fish species may also serve as a biological control agent for mosquitoes.	4	8	16	16			20			
		2. Continue coordination and/or timing of fall passage of chinook salmon immigrating from the East Toe Drain through the Los Rios Check Dam to Putah Creek.	4	4	8	10			8			
		a. Consider the construction of a fish passage facility at the Los Rios Check Dam to allow passage of adult salmon upstream and juveniles	8	16	25	10	15		12			

Table 6.1-1
Operations and Maintenance Requirements (hours by staff position) to Implement Plan

Element / Sub-element	Goal	Tasks	Senior Biologist Super (Wildlife) (1)	Wildlife Habitat Super II (1)	Wildlife Biologist (1)	Wildlife Habitat Super I (2)	Wildlife Habitat Assist (2)	Tractor Operator Laborer (2)	Fish and Wildlife Tech (2)	Fish and Wildlife Interpret II (1)	Fish and Wildlife Interpret I (1)	Office Tech (1)
		downstream while still maintaining the Los Rios Check Dam in place.										
		3. Pursue funding and develop plans for identified aquatic ecosystem restoration projects that include goals, techniques, costs, monitoring, an adaptive management process, public outreach, and a schedule.	60	30	31	20						
		4. Design and manage restoration and enhancement projects that would not conflict with necessary flood flow conveyance requirements of the Yolo Bypass, as determined through the application of hydraulic analysis.	2	12	12	20	20					
		5. Ensure that actions comply with the ESA and CESA and other regulations aimed at the protection of special-status species and/or sensitive habitats.	8		4							
		6. Design and operate restoration and enhancement projects in coordination with the SYMVCD. Project design and operation shall include technical BMPs for mosquito control in managed wetlands developed by the CVHJV (Kwasny et al. 2004).	16	8	8	16						
5.2.2 AGRICULTURAL RESOURCES ELEMENT												
	Agricultural Resources Goal 1 (AR-1): *Manage agricultural lands to maintain and enhance habitat for native wildlife and plants.*	1. Manage and control invasive and other nonnative species through specified grazing practices, controlled flood-up and drawdown procedures, use of pesticides, and other conventional agricultural practices.	8	4		40	10	60	81			
		2. Enhance grasslands and uplands through grazing, native grass plantings, and other management techniques.		25	8	30	25	40	50			
		3. Work with adjacent property owners to limit aerial seeding of Italian ryegrass in areas that would support native alkali grassland under natural conditions.		18		20	20					
		4. Improve habitat for special-status species in the grassland ecosystems at the Yolo Bypass Wildlife Area through the adaptive management of livestock grazing, limited herbicide application,				10	20	60	60			

Table 6.1-1
Operations and Maintenance Requirements (hours by staff position) to Implement Plan

Element / Sub-element	Goal	Tasks	Senior Biologist Super (Wildlife) (1)	Wildlife Habitat Super II (1)	Wildlife Biologist (1)	Wildlife Habitat Super I (2)	Wildlife Habitat Assist (2)	Tractor Operator Laborer (2)	Fish and Wildlife Tech (2)	Fish and Wildlife Interpret II (1)	Fish and Wildlife Interpret I (1)	Office Tech (1)
		native grass plantings, and other management techniques.										
		5. Manage for rodents and large insects to provide adequate prey items in order to benefit foraging raptor species.										
		6. Annually plant grain field to provide foraging areas for upland game and hunting opportunities for upland game hunters.	4			24	25	80	20			5
		7. Manage seasonal and permanent wetlands and other communities to provide habitat for resident waterfowl species.										
		8. Manage upland vegetation to provide desired nesting habitat.				16	25	60	16			
		9. Manage agriculture for shorebird species through newly developed shorebird/rice rotation.		16	8	40	41	43	41			
		10. Perform field preparation of some agricultural fields in the fall in order to present disced field habitat for species that utilize this habitat such as horned larks, longspurs, and mountain plover.			4	36	10	65	28			
	Agricultural Resources Goal 1 (AR-2): *Manage agricultural lands to contribute to the agricultural community, to maintain agriculture as a viable economic activity in Yolo County, and to provide revenue for continued operation of the Wildlife Area.*	1. Work with local farmers to grow agricultural crops that mutually benefit the farmer lease tenants, the agricultural community, and the Wildlife Area.	24	26	4	35	40	40	15			
		2. Manage agricultural lands to provide an income source for DFG management and operations of the Wildlife Area.				40	20	20				
		3. Administer agricultural leases as necessary in cooperation with staff from the Dixon RCD.	56	90	12	60	10					81
		4. Maintenance of water management infrastructure including pumps, water control gates, and water distribution system performed by DFG, agricultural lease tenants, and cooperatively by members of the Mace Ranch Irrigation System.	16	21	10	80	40		16			16
		5. Meet or correspond with adjacent landowners and tenants as needed individually or through the Yolo Bypass Working Group to maintain communication about regional	36	14	6	16						

Table 6.1-1
Operations and Maintenance Requirements (hours by staff position) to Implement Plan

Element / Sub-element	Goal	Tasks	Senior Biologist Super (Wildlife) (1)	Wildlife Habitat Super II (1)	Wildlife Biologist (1)	Wildlife Habitat Super I (2)	Wildlife Habitat Assist (2)	Tractor Operator Laborer (2)	Fish and Wildlife Tech (2)	Fish and Wildlife Interpret II (1)	Fish and Wildlife Interpret I (1)	Office Tech (1)
		agricultural issues, management needs of the Yolo Wildlife Area, determine adjacent landowners' access and management needs, and convey useful information regarding activities.										
		6. Work with local agriculture community to provide information on wildlife friendly farming approaches used in the Wildlife Area.					20				20	
		7. Collaborate with adjacent landowners and tenants regarding DFG management activities that may affect their operations. Resolve potential issues by proactively working with adjacent landowners and tenants.	24	6	4	8	4	8	4			
		8. Collaborate with adjacent special districts including Dixon RCD and Yolo RCD.	48	25								
5.2.3 CULTURAL RESOURCES ELEMENT												
	Cultural Resources Goal 1 (CR-1): *Catalog and preserve all cultural resources that have yielded or have the potential to yield information important to the prehistory or history of the Yolo Wildlife Area or that otherwise would meet significance criteria according to the California Register of Historical Resources (CRHR).*	1. Maintain library of printed cultural resource reports from the vicinity.		8								
		2. Conduct cultural resource surveys as necessary before significant ground-disturbing activities (e.g., excavations below normal plow depths) at undisturbed sites.		8								
		3. Complete and submit site records to the State Historic Preservation Officer (SHPO) to establish and submit culturally significant resources that may be eligible for inclusion in the National Register of Historic Places (NRHP) or the CRHR.	8	4								
		4. When facility improvements or restoration efforts are proposed and may affect historical or archaeological resources, consult the State CEQA Guidelines for guidance on compliance with regulations.		4								
		5. Maintain historic structures present on site including the Tule Ranch main residence and the umbrella barn.		8	8	16			35			

Table 6.1-1
Operations and Maintenance Requirements (hours by staff position) to Implement Plan

Element / Sub-element	Goal	Tasks	Senior Biologist Super (Wildlife) (1)	Wildlife Habitat Super II (1)	Wildlife Biologist (1)	Wildlife Habitat Super I (2)	Wildlife Habitat Assist (2)	Tractor Operator Laborer (2)	Fish and Wildlife Tech (2)	Fish and Wildlife Interpret II (1)	Fish and Wildlife Interpret I (1)	Office Tech (1)
5.2.4 AUTHORIZED-PUBLIC-USE ELEMENT												
	Public-Use Goal 1 (PU-1): *Increase existing and provide new long-term opportunities for appropriate wildlife-dependent activities by the public.*	**Tasks for maintaining and improving wildlife observation:**										
		1. Expand existing northern auto tour route to encompass portions of the Causeway Ranch and 1,000 Acre units.		35	16	80	35	160	40	2	2	
		2. Evaluate potential to develop a new southern auto tour route in the same manner for the Tule Ranch Unit as funding permits.		16	16	100	160	300	40	12	2	
		3. Designate about half of the length of each tour route for vehicle access only while encouraging out of vehicle wildlife viewing from parking lots and turnouts on at least half the length of the tour routes.		4	8		10	10		2	2	
		4. For all wildlife viewing areas, manage existing routes and design future habitat enhancements to provide adequate vegetative screening to protect wildlife while providing viewing areas into created openings, highlighting slough channels, islands, and wildlife resting areas.		8		20	20	20		2	2	
		5. Develop interpretive signage for wildlife viewing roads and trails.		8		8	25		4		100	
		6. Develop viewing blinds, observation towers, and board walks where appropriate.		8		16	20	45			40	
		Tasks for maintaining and improving angling:										
		7. Develop maps and signs that indicate fishing access points.				20	4				18	4
		8. Post fishing regulations in appropriate locations.				4			8		10	
		9. Build access points for anglers with limited mobility along East Toe Drain.		21		24	20	75	32		16	
		10. Coordinate with DFG fishing in the city program to provide additional angling opportunities.			4				8		25	
		11. Expand spring bow fishing program to include the designated hunting area during non hunting seasons.		4	4				8		6	
		Tasks for maintaining and improving hunting:										
		12. Continue current waterfowl hunting program operating a staffed hunter	24	60	60	250	375	110	300		32	24

Table 6.1-1
Operations and Maintenance Requirements (hours by staff position) to Implement Plan

Element / Sub-element	Goal	Tasks	Senior Biologist Super (Wildlife) (1)	Wildlife Habitat Super II (1)	Wildlife Biologist (1)	Wildlife Habitat Super I (2)	Wildlife Habitat Assist (2)	Tractor Operator Laborer (2)	Fish and Wildlife Tech (2)	Fish and Wildlife Interpret II (1)	Fish and Wildlife Interpret I (1)	Office Tech (1)
		check station on all available waterfowl hunting days.										
		13. Expand hunting opportunities as habitat and access is improved on the Tule Ranch and Causeway Ranch units.		16	24	45	75	45	16			
		14. Consider use of boats in specified areas.		8	8				16		2	
		15. In the interest of maintaining a historical use of the Yolo Bypass, consider means of allowing boat access from the Yolo Wildlife Area to the Bypass during flooding periods, without incurring any liability to the State of California.	16	8	8						4	
		16. Continue to work with local farmers to grow agricultural food plots in order to provide improved hunting opportunities.		8		16	15		4			
		17. Locate waterfowl sanctuary areas to enhance hunting experience while providing adequate resting areas.		4		16	16		4			
		18. Maintain physical separation of hunting areas from non-hunting areas during hunting season. Open hunting areas to other uses following end of hunting season.		8	8		20	24	24			
		19. Evaluate feasibility of moving all hunting to Tule Ranch area with potential check station at the Tule Ranch Headquarters. This would separate wildlife viewing areas from hunting areas in a north-south direction rather than the current east-west situation.	3	8	8	8						
		20. Communicate with neighboring duck clubs to identify Yolo Wildlife Area management strategies that may affect waterfowl hunting opportunities on their properties. Coordinate Yolo Wildlife Area management strategies to provide mutual benefits (e.g., managed movement and spread of local bird densities) for the Yolo Wildlife Area and neighboring lands.	8	16		35			16			

Table 6.1-1
Operations and Maintenance Requirements (hours by staff position) to Implement Plan

Element / Sub-element	Goal	Tasks	Senior Biologist Super (Wildlife) (1)	Wildlife Habitat Super II (1)	Wildlife Biologist (1)	Wildlife Habitat Super I (2)	Wildlife Habitat Assist (2)	Tractor Operator Laborer (2)	Fish and Wildlife Tech (2)	Fish and Wildlife Interpret II (1)	Fish and Wildlife Interpret I (1)	Office Tech (1)
		21. Continue recruitment of new hunters by providing hunter safety instruction on a regular basis at the Wildlife Area headquarters.		8		8				5	10	16
		22. Continue encouragement of young hunters through participation in junior hunt programs for waterfowl and pheasants.		8		16	16	24	16		8	
		23. Conduct late summer “clean up day” to ready the Wildlife Area for the upcoming hunting season and maintain good relationship with our hunters.	8	12	12	35	24	20	24	16	16	16
		24. Consider providing falconry opportunities for the purpose of taking upland game and waterfowl on the Yolo Bypass Wildlife Area in accordance with falconry regulations and season dates adopted by the State Fish and Game Commission.	1	4	12	12						
		Tasks applicable to all uses include:										
		25. Evaluate use levels and visitor satisfaction periodically.		4	8						16	16
		26. Evaluate the hunting, angling, and wildlife viewing programs and Wildlife Area regulations periodically to identify changes that are warranted to maintain consistency with the goals of this LMP.		8	4	8				16	8	8
	Public-Use Goal 2 (PU-2): *Support and expanded public use of the Yolo Wildlife Area for environmental education and interpretation.*	**Tasks to support kindergarten through 12th grade environmental education:**										
		1. Provide Teacher Training Workshops at least four times a year.		4						25	80	16
		2. Maintain Wild About Wetlands kits for pre and post trip activities.							8		40	8
		3. Provide and maintain curriculum materials and field equipment.							8		35	8
		4. Provide other workshops and educational activities:								5	25	8
		a. Project Wet: This is a K–12 teacher workshop on water topics offered in cooperation with DFG.								16	36	16
		b. Salmonids in the Classroom: This project sponsored by DFG and local fly-fisher groups, offers teachers curriculum and aquarium supplies to								12	16	4

Table 6.1-1
Operations and Maintenance Requirements (hours by staff position) to Implement Plan

Element / Sub-element	Goal	Tasks	Senior Biologist Super (Wildlife) (1)	Wildlife Habitat Super II (1)	Wildlife Biologist (1)	Wildlife Habitat Super I (2)	Wildlife Habitat Assist (2)	Tractor Operator Laborer (2)	Fish and Wildlife Tech (2)	Fish and Wildlife Interpret II (1)	Fish and Wildlife Interpret I (1)	Office Tech (1)
		grow salmon eggs to the fry stage and release them in the Sacramento River.										
		c. Introduction to Watershed Education: This is a workshop co-hosted with the Water Education Foundation to teach 8th–12th grade teachers how to measure and monitor for parameters of water quality, including nutrients, and bioassessment.								8	25	4
		d. Nature Bowl: This is an event for 3rd–6th graders held at the Yolo Wildlife Area to promote learning about natural systems and the local environment. The event is co-sponsored with DFG and Yolo County Office of Education.							16	8	24	35
		e. Marsh Madness: The Foundation works with CWA to target under served schools twice a year for a full day of field activities. Bus transportation and a wetlands lunch buffet are provided. CWA provides the lunch, tables and chairs, and volunteers for the day.							16	16	16	8
		5. Working with the Yolo Basin Foundation, creation and maintenance of curriculum workbook with activities adapted to the State science framework and environmental education guidelines. The Foundation is also implementing a new curriculum that meets state social studies standards for 4th–6th grade.								30	80	16
		Tasks to support environmental education for people of all ages:										
		6. Monthly public field trips to the Yolo Wildlife Area.									8	4
		7. Monthly Flyway Nights Lecture Series.								8	16	10
		8. Facilitate California Duck Days hosted by DFG and YBF, the annual California Duck Days Wetlands Festival in partnership with a volunteer steering committee.		12	12	12	12	20	16	36	65	40

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Operations and Maintenance Requirements (hours by staff position) to Implement Plan

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		9. Summer and spring guided tours at sunset to view the flyout of thousands of Mexican free-tail bats from under the Causeway.								16	16	4
		10. Guided spring tours and open house events to view the Tule Ranch vernal pools.	16	8			8			48	48	18
		11. Events hosted by others in which DFG and the Foundation participate:										8
		a. Salmon Festival								12	12	4
		b. Earth Day at the Zoo								12	12	2
		c. International Migratory Bird Day								12	12	2
		d. Celebrate Davis								12	8	6
		e. Sandhill Crane Festival	25	8							40	
		f. Make presentations to various service clubs, chambers of commerce, university classes, educational conferences	25	8							40	
		12. Educational Materials for Loan:									8	8
		13. Outreach and communication includes “Yolo Flyway” newsletter three times a year, press releases, articles in regional newspapers and periodicals, public service announcements on television and radio, listserve announcements and website.	20		8					16	16	20
		14. Develop and distribute interpretive materials including brochures, plant and wildlife and tour guides, interpretive displays and signs.		4	8					16	40	36
		15. Develop new programs as time and budget allows.		8							40	16
	Public-Use Goal 3 (PU-3): *Coordinate public access to and use of facilities including tour routes, parking areas, Putah Creek, the planned Pacific Flyway Center, and other areas to accommodate a variety of different user groups.*	**Entrance to Yolo Wildlife Area**										
		1. Provide a large sign marking the Yolo Bypass Wildlife Area entrance.		6	6	10	10	80				
		2. Improve the Yolo Wildlife Area entrance with signage, landscaping and road improvements.		8		24	45	45	16	4	16	4
		3. Provide Watchable Wildlife signs on I-80 and County Road 32b.		8							16	4
		4. Coordinate with Watchable Wildlife program, visitor and convention bureaus and others to provide for accurate Yolo Wildlife Area		6							16	6

Table 6.1-1
Operations and Maintenance Requirements (hours by staff position) to Implement Plan

Element / Sub-element	Goal	Tasks	Senior Biologist Super (Wildlife) (1)	Wildlife Habitat Super II (1)	Wildlife Biologist (1)	Wildlife Habitat Super I (2)	Wildlife Habitat Assist (2)	Tractor Operator Laborer (2)	Fish and Wildlife Tech (2)	Fish and Wildlife Interpret II (1)	Fish and Wildlife Interpret I (1)	Office Tech (1)
		descriptions and directions in printed materials and on the web.										
		Roads										
		5. Maintain access routes to all open facilities and parking lots.						80	20			
		6. Maintain and improve existing tour loop.				20	20	80	20			
		7. Develop a new southern auto tour route.	2		20	60	60	100				
		8. Construct all roads with natural/gravel surface with minimal maintenance requirements.						80				
		Trails										
		9. Coordinate with the City of Davis to complete a walking trail along Putah Creek on Yolo Wildlife Area property that could join a similar trail coming from Mace Blvd.		8							8	4
		10. Continue to allow off-season, walking access to hunting areas and consider expanding these opportunities to new hunt areas.		4		4	25		8		8	4
		11. Expand trail network with signage				16	25		24		16	
		12. Evaluate the feasibility of connecting the Causeway Ranch with the Davis Wetlands through a trail system.	16								8	
		Bicycling										
		13. Continue to allow bicycle access to the Causeway Unit.					24		20			
		14. Evaluate, develop, and implement a plan for allowing bicycle use on specified parts of the tour routes.	16	8							16	
		15. Continue to monitor bicycle use in the hunting area during hunting season.					4					
		16. Cooperate with regional trail development efforts to create bicycle access across the Yolo Bypass through the Causeway Unit at ground level.	8	4							4	
		17. Evaluate efforts to provide bicycle access to the Pacific Flyway Center and develop facilities as time and funding permits.	8	4							4	
		Signage: Compatible public uses of the Yolo Wildlife Area are facilitated by signage that informs the public of the boundaries, laws, and regulations applicable at Yolo Wildlife Area; encourages public use; reduces conflicts among uses; increases the safety of users; and discourages unauthorized uses. The tasks listed below are intended to promote the use of such signage.										

Table 6.1-1
Operations and Maintenance Requirements (hours by staff position) to Implement Plan

Element / Sub-element	Goal	Tasks	Senior Biologist Super (Wildlife) (1)	Wildlife Habitat Super II (1)	Wildlife Biologist (1)	Wildlife Habitat Super I (2)	Wildlife Habitat Assist (2)	Tractor Operator Laborer (2)	Fish and Wildlife Tech (2)	Fish and Wildlife Interpret II (1)	Fish and Wildlife Interpret I (1)	Office Tech (1)
		18. Maintain signs and bulletin boards at the Yolo Wildlife Area Headquarters, parking lot A and any other entrances that may be developed in the future with wildlife area maps and regulations, interpretive materials, and safety information.		4		4			6		16	16
		19. Work with California Department of Transportation (Caltrans) to install signage on I-80 to direct visitors to the entrance of the Yolo Wildlife Area.	4								8	
		20. Start a monitoring and maintenance schedule for all signage.				8	8				4	4
		21. Inventory existing boundary signage and fencing, and install new signs and fencing where necessary.				8	25		65			4
		22. Provide sign board in parking lot A that provides a comprehensive display of public use opportunities at the Yolo Wildlife Area. This will include a map showing currently available public use areas.				16	4		4		8	4
		23. Provide signs marking tour routes, trails, and bicycle access areas				8	16		16		8	
		24. Provide signs marking areas that are temporarily closed for nesting, maintenance, or other reasons.							8		4	
		25. Develop a plan for interpretive features including signs, blinds, and board walks.	8	8						50	45	8
		26. Develop, construct, install and maintain interpretive signs.				8	15		24		20	
		Operations										
		27. Rent and maintain portable toilets.				32						16
		28. Provide garbage cans.							4			
		29. Provide picnic tables in some visitor areas.				4			8			
		30. Provide for the opening and closing of gates to control access.				8	100		300			
		31. Improve ditch and creek crossings as needed for public use.		8		36	16	45	16			
		32. Continue to open entrance gates at sunrise (except on hunting days) and closing gates at sunset.					100		100			

Table 6.1-1
Operations and Maintenance Requirements (hours by staff position) to Implement Plan

Element / Sub-element	Goal	Tasks	Senior Biologist Super (Wildlife) (1)	Wildlife Habitat Super II (1)	Wildlife Biologist (1)	Wildlife Habitat Super I (2)	Wildlife Habitat Assist (2)	Tractor Operator Laborer (2)	Fish and Wildlife Tech (2)	Fish and Wildlife Interpret II (1)	Fish and Wildlife Interpret I (1)	Office Tech (1)
		Other Uses										
		33. Evaluate the feasibility of providing canoeing or fishing opportunities at Green's Lake and Putah Creek.	8	4	4	4					4	
		34. Evaluate coordinating with the City of Davis regarding put-ins and take-outs on Putah Creek.	4	4		4				4	4	4
		Regional trail systems and coordination of access										
		35. Cooperate with the City of West Sacramento in assessing feasibility of access from the east side.	4	8	4						4	
		36. Cooperate with agencies promoting regional hiking, bicycle, and equestrian trail connections including Caltrans, Delta Protection Commission, Yolo County, City of Davis, and City of West Sacramento.	8	8							4	
		37. Evaluate the feasibility of establishing a regional trail along abandoned Sacramento Northern Railroad easement that traverses the Tule Ranch.									6	
	Public-Use Goal 4 (PU-4): *Continue to foster community partnerships, especially with the Yolo Basin Foundation.*	1. Update the MOU between the Yolo Basin Foundation and the DFG to reflect the current operating relationship and expansion of the Wildlife Area acreage and programs		8								4
		2. Coordinate press releases and other forms of outreach with Yolo Basin Foundation and DFG Media liaisons.	8	8							24	25
		3. Collaborate in developing new program areas.	10								22	4
		4. Coordinate with other non-profit groups (e.g., Foundation, DU, CWA, Yolo and Sacramento Audubon Societies, Audubon California, Putah Creek Council, CVHJV) that promote wildlife-dependent education and interpretation, and recreational or hunting opportunities that can provide additional support to DFG's management of the Yolo Wildlife Area.	8	16	4	8				40	48	
		5. Encourage and cooperate with the long-term continuation of the Yolo Bypass Working Group.	30	10								16

Table 6.1-1
Operations and Maintenance Requirements (hours by staff position) to Implement Plan

Element / Sub-element	Goal	Tasks	Senior Biologist Super (Wildlife) (1)	Wildlife Habitat Super II (1)	Wildlife Biologist (1)	Wildlife Habitat Super I (2)	Wildlife Habitat Assist (2)	Tractor Operator Laborer (2)	Fish and Wildlife Tech (2)	Fish and Wildlife Interpret II (1)	Fish and Wildlife Interpret I (1)	Office Tech (1)
	Public-Use Goal 5 (PU-5): *Continue and expand the volunteer program.*	1. Use the existing DFG volunteer handbook and YBF volunteer materials to conduct volunteer program.	4	6		16				1440	160	87
		2. Expand existing volunteer materials.				20	20				3	12
		3. Sign up all volunteers as DFG volunteers to take advantage of the benefits of being a volunteer for the state including workers compensation coverage and the ability to count these volunteer efforts as “in kind” contributions on grant applications.				20						20
		4. Continue to coordinate with the Foundation to jointly plan use of volunteers including the development of volunteer job descriptions.				20	20					20
		5. Recruit new volunteers through regional media, community organizations, local colleges, professional associations, conservation organizations, and at public events.				20						20
		6. Expand volunteer training opportunities.				20	20					8
		7. Expand volunteer recognition program.				20	20					2
		8. Continue tracking of volunteer hours for use as in-kind labor contribution for state and federal grant programs.										16
	Public Use Goal 6 (PU-6): *Minimize competition and conflicts among users and facilitate compatibility between public uses.*	1. Encourage hunter safety through monitoring and modification of Wildlife Area regulations.		8		6						8
		2. Inform the public of Wildlife Area use designations and use restrictions through outreach, signage, and DFG’s web site.					16		8		8	16
		3. Periodically evaluate management of access locations, tour routes, parking areas, and associated regulations to identify changes that are warranted to maintain consistency with the goals of this LMP.	4	6	4							
		4. Identify potential conflicts with other recreational uses and resolve such conflicts.		6	8							
		5. Inform the public of times and locations where hunting is allowed and of all other restrictions and applicable				12	20		10	16	6	16

Table 6.1-1
Operations and Maintenance Requirements (hours by staff position) to Implement Plan

Element / Sub-element	Goal	Tasks	Senior Biologist Super (Wildlife) (1)	Wildlife Habitat Super II (1)	Wildlife Biologist (1)	Wildlife Habitat Super I (2)	Wildlife Habitat Assist (2)	Tractor Operator Laborer (2)	Fish and Wildlife Tech (2)	Fish and Wildlife Interpret II (1)	Fish and Wildlife Interpret I (1)	Office Tech (1)
		regulations through outreach, signage, and DFG's web site.										
		6. Have DFG, YBF personnel and volunteers available on-site during high use times to monitor visitor activities and provide information as needed to visitors.		8	20		35		20	10	40	100
		7. Provide information about the Wildlife Area while responding to phone inquiries and visitors to administrative area and Pacific Flyway Center.	8	24								80
		8. Conduct periodic reviews of public uses of the Yolo Wildlife Area; evaluate rules, regulations, guidelines, and materials to ensure compatibility of public uses.		8	8							8
	Public-Use Goal 7 (PU-7): *Support use of the Yolo Bypass Wildlife Area by Native Americans for activities such as gathering native plant materials for cultural purposes.*	1. Develop access plans for and issue permits to native peoples whose activities are compatible with the goals of the LMP. Any authorization for access would include standard liability clauses.	4	4						4	4	
		2. Allow limited gathering of materials for educational and craft purposes by the public.			12	12	12					
	Public-Use Goal 8 (PU-8): *Facilitate safe use of the Yolo Wildlife Area by informing the public of potential risks, and also develop an emergency response plan.*	1. Continue to close the Yolo Wildlife Area when the Yolo Bypass is flooding and communicate the status of the Wildlife Area to the public.				8						8
		2. Identify areas where warning signs are needed.				20	20		20			
		3. Post warning signs at identified locations and indicate on these signs whom to contact during an emergency.						80	60			
		4. Coordinate with the SYMVCD regarding timing of pesticide applications.		8	4	16				4		
		5. Restrict access to unsafe areas such as construction zones and at times, active farming areas.				4	8		4			
		6. Develop an emergency response plan with cooperation of local fire districts and Yolo County.	8	8		40						24

Table 6.1-1
Operations and Maintenance Requirements (hours by staff position) to Implement Plan

Element / Sub-element	Goal	Tasks	Senior Biologist Super (Wildlife) (1)	Wildlife Habitat Super II (1)	Wildlife Biologist (1)	Wildlife Habitat Super I (2)	Wildlife Habitat Assist (2)	Tractor Operator Laborer (2)	Fish and Wildlife Tech (2)	Fish and Wildlife Interpret II (1)	Fish and Wildlife Interpret I (1)	Office Tech (1)
5.2.5 UNAUTHORIZED-PUBLIC-USE ELEMENT												
	Unauthorized-Public-Use Goal 1 (UPU-1): *Prevent unauthorized use of the Yolo Wildlife Area.*	1. Prohibit activities that are inconsistent with the Yolo Wildlife Area mission in the Wildlife Area regulations.		4		4						
		2. Require CEQA analysis and surface agreements for access to the area for mineral extraction.		6								
		3. Discourage dumping of trash or waste within the Yolo Bypass Wildlife Area by providing and servicing trash receptacle.		12		39	45		128			4
		4. Patrol the Yolo Bypass Wildlife Area and enforce regulations that prohibit unauthorized uses.				40	80					
		5. Maintain adequate signage on boundaries to satisfy lawful enforcement of Wildlife Area regulations.				4	20		32			
		6. Use signage and written notifications to foster cooperation.				20		20				
		7. Issue citations and/or pursue legal action when voluntary cooperation cannot be obtained.					40					
		8. Enforce laws through DFG Wildlife Protection personnel and request assistance from the Yolo County Sheriff's Department as necessary to enforce laws.					40					
		9. Issue citations to violators illegally using the Yolo Bypass Wildlife Area and seek remediation from unauthorized users.					12					
		10. Restore ecosystems damaged by unauthorized uses as necessary.			8	4	25	16				
5.2.6 FACILITIES ELEMENT												
	Facilities Goal 1 (F-1): *Management and operation of the Yolo Wildlife Area in coordination with state and federal flood operations in the Yolo Bypass.*	1. Upon notification call by DWR Division of Flood Management, implement and follow agreed upon flood response protocol.	16	8		53	71	40	65		4	4
	Facilities Goal 2 (F-2): *Construction, maintenance, and removal of facilities.*	1. Maintenance of hunting blinds and the hunter check station performed by DFG.				16	50	8	25			
		2. Maintenance of water management		16		75	55		20			16

Table 6.1-1
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		infrastructure including pumps, water control gates, and water distribution system performed by DFG, agricultural lease tenants, and cooperatively by members of the Mace Ranch Irrigation System.										
		3. Maintenance of gravel roads on an ongoing basis.				35	25	125	30			8
		4. Construction and maintenance of new access roads.				45	40	120	15			
		5. Maintenance of gates and fences.				12	15		40			4
		6. Construction of new gates and fences.				20		10	40			
		7. Maintenance of signs.				8	30		50			4
		8. Maintenance for other facilities including Yolo Demonstration Wetlands, kiosk at Yolo Fruit Market, residences and Tule Ranch facilities.		8	8	81	150	16	205		8	54
		9. Work with the Foundation to fund, construct, update and maintain exhibits and other interpretive features of the Pacific Flyway Center.		18	4						80	16
	Facilities Goal 3 (F-3): *Effectively manage existing facilities and/or structures for resource protection, safety, and prevention of unauthorized uses.*	1. Regularly monitor, maintain and replace as necessary the condition and use of existing facilities/structures.	16	8	4		65	35	40		16	8
		2. Take actions as needed to keep desired facilities/structures in good repair.		6							8	
		3. Schedule preventative maintenance of all facilities and structures.		2		20						
		4. Take actions to demolish and remove those structures that are unauthorized or have become unsafe or undesirable.	4	10		25			40	30	25	40
	Facilities Goal 4 (F-4): *Construct, operate and maintain the Pacific Flyway Center and other associated facilities.*	1. Construction of the Pacific Flyway Center is a goal of DFG. The continuing efforts to establish the center will be supported.	1	4	4	12						
		2. Participate in program development phase, schematic design phase, and construction phase in partnership with the Foundation.		4	4	12				4	8	
		3. Determine what needs to be accomplished to change location of entrance to the Wildlife Area if needed.			2	4						
		4. Move administrative and interpretive functions to the Pacific Flyway Center.								4	4	4
		5. Operate and maintain the Pacific	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD

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Operations and Maintenance Requirements (hours by staff position) to Implement Plan

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		Flyway Center.										
		6. Manage the approximately 15 acres of farm land on the Flyway Center site to be a demonstration of wildlife friendly farming.				10		4	20			
		7. Work with the Foundation to fund, construct, update and maintain exhibits and other interpretive features of the Pacific Flyway Center.	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
		8. Maintain gates and access road to Flyway Center.							28			
	Facilities Goal 5 (F-5): *Maintain equipment necessary for future management of the Wildlife Area.*	1. Maintain all heavy equipment including tractors, implements, and farm equipment.				24		80	40			16
		2. Maintain all vehicles including regular inspection of commercial vehicles.				24		20				16
		3. Maintenance and operation of wheeled vehicles other than commercial vehicles.				24	36					16
		4. Maintenance and operation of shop facility.				12						2
		5. Maintenance and operation of miscellaneous tools and equipment.				6				7		
		6. Maintain office equipment including computers, printers, copy machine, plotter, and telephone system.										4
	Facilities Goal 6 (F-6): *Consider the construction and operation of an outdoor shooting range for bi-annual use by local game warden squad for periodic firearm use qualification process. Range construction, operation and maintenance shall consider the following(tasks):*	1. Implementation of Environmental Protection Agency (EPA) best management practices for the management of lead at outdoor shooting facilities.	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
		2. Operation of the shooting range will not proceed until after development of a shooting range use protocol in accordance with National Rifle Association (NRA) standards as detailed in the NRA Range Source Book. This protocol shall designate a point of contact within DFG's Wildlife Protection Branch and a Range Master shall be designated for each instance of use. This operations plan and subsequent use is to be approved by the Yolo Bypass Wildlife Area Manager.	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD

Table 6.1-1
Operations and Maintenance Requirements (hours by staff position) to Implement Plan

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		3. Construction of the shooting range shall conform to standards and guidelines established by the Occupational Safety and Health Administration, the National Association of Shooting Ranges and the Sporting Arms and Ammunition Manufacturers' Institute, with the intention of controlling hazards and prevention of exposures to hazardous substances in shooting range facilities.	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
		4. Maintenance of the shooting range shall be the responsibility of the Wildlife Protection Branch.	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
5.2.7 ADMINISTRATION ELEMENT												
	Administration Goal 1 (A-1): *Maintain current data on the management and resources of the Yolo Wildlife Area.*	1. Regularly update geographic information system (GIS) data sources as information becomes available			72	40	25					
		2. Maintain accurate financial records regarding expenditures, staff, maintenance, and other administrative duties.	80	30		25						386
		3. Develop and maintain Wildlife Area operating budget	40	20		10						30
		4. Administer agricultural leases as necessary in cooperation with staff from the Dixon Resource Conservation District (RCD).		25								120
		5. Document facilities needs in a DFG maintenance and capital outlay database.		8		8						8
		6. Prepare annual and periodic status reports as defined in Chapter 6.	8	8		8						36
		7. Perform scheduling function for conference room.										16
		8. Participate in habitat planning efforts for public habitat areas close to the Wildlife Area.	25	8	8	8						
		9. Supervise permanent and seasonal staff.	74	35								
		10. Actively pursue funding to help facilitate implementation of the LMP.	100	24		16						4

Table 6.1-1
Operations and Maintenance Requirements (hours by staff position) to Implement Plan

Element / Sub-element	Goal	Tasks	Senior Biologist Super (Wildlife) (1)	Wildlife Habitat Super II (1)	Wildlife Biologist (1)	Wildlife Habitat Super I (2)	Wildlife Habitat Assist (2)	Tractor Operator Laborer (2)	Fish and Wildlife Tech (2)	Fish and Wildlife Interpret II (1)	Fish and Wildlife Interpret I (1)	Office Tech (1)
5.2.8 FIRE MANAGEMENT ELEMENT												
	Fire Management Goal 1 (FM-1): *Develop and implement a wildfire plan for the Yolo Wildlife Area.*	1. Meet biannually if necessary with CDF representatives to discuss fire-related issues relevant to the Yolo Wildlife Area, including vegetation management, recent fires in the Yolo Wildlife Area, current contact information, and procedures.	6	10	8	22	8	12	10			
		2. Coordinate with CDF to develop a wildland fire response plan for the Yolo Bypass Wildlife Area.	4	6		10	8	12	6			
		3. Design and implement vegetation management activities at fire breaks along existing roads and parking lots.			10				10			
		4. Train a DFG biologist to serve the role of resource specialist or agency representative through the Incident Command System (ICS).			8							
		6. Coordinate fire suppression activities and cooperate with local fire districts.	4	4		24						
5.2.9 SCIENTIFIC RESEARCH AND MONITORING ELEMENT												
	Scientific Research and Monitoring Goal 1 (SRM-1): *Support appropriate scientific research and monitoring and encourage or conduct research that contributes to adaptive management strategies and management goals of the Yolo Wildlife Area.*	1. Prepare annual Wildlife Area Habitat Management Work Plan Summaries and submit summaries to DFG Wildlife Area Habitat Committee (WAHC) for evaluation.	6	10	6	12						16
		a. Implement recommendations for habitat improvement provided by the WAHC.				24	65	85	20			
		2. Develop a prioritized list of research needs.	4	6		4						
		3. Review, evaluate and administer approved research projects.	16		40	8						8
		4. Provide letters or permits to researchers specifying dates and times of authorized access, and information on regulations and area restrictions.		4	2							2
		5. Require that researchers provide copies of data and/or published papers, and contact researchers to ensure that this requirement is fulfilled.		4								
		6. Encourage long-term studies that benefit management.	1	2	2							

Table 6.1-1
Operations and Maintenance Requirements (hours by staff position) to Implement Plan

Element / Sub-element	Goal	Tasks	Senior Biologist Super (Wildlife) (1)	Wildlife Habitat Super II (1)	Wildlife Biologist (1)	Wildlife Habitat Super I (2)	Wildlife Habitat Assist (2)	Tractor Operator Laborer (2)	Fish and Wildlife Tech (2)	Fish and Wildlife Interpret II (1)	Fish and Wildlife Interpret I (1)	Office Tech (1)
		7. Conduct high-priority surveys, including surveys for special-status species, as time and budget permit.	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
		8. Investigate public use patterns and effectiveness of public use programs.	4								24	15
		9. Investigate effectiveness of environmental education programs.	6								16	8
5.2.10 MANAGEMENT COORDINATION ELEMENT												
	Management Coordination Goal 1 (MC-1): *Coordinate with federal, state, and local agencies regarding plans and projects that may affect habitats and/or management at the Yolo Wildlife Area.*	1. Review, coordinate, and provide comments and recommendations on federal, state, and local government plans and proposed projects as appropriate for the purpose of determining the consistency of such plans with the goals of DFG's LMP.	93	36	50	8	25					16
		2. Coordinate with Yolo County NCCP proponents to make them aware of habitat restoration efforts at the Wildlife Area and coordinate proposed actions to compliment each other's efforts.				12						
		3. Coordinate with the Yolo County program to survey, control, and monitor invasive plant species.				12		6				
		4. Collaborate with or submit proposals for CALFED-funded projects that could contribute both to the attainment of the goals of this LMP and to the attainment of CALFED goals, objectives, targets, and milestones.		12	12	12						
		5. Support the implementation of research, monitoring, and restoration actions compatible with the goals of this LMP by the California Bay-Delta Authority and other CALFED implementing agencies.		12	12	12						2
	Management Coordination Goal 2 (MC-2): *Coordinate with flood control agencies regarding flood control and management in the Yolo Bypass.*	1. Review, coordinate, and provide comments and recommendations on regional plans and proposed projects such as the Yolo County Integrated Regional Water Management Plan as appropriate.	20		25							
		2. Coordinate with DWR, and the State Reclamation Board, USACE, and, where appropriate, local flood control agencies, reclamation districts, and	4	25	8	16						

Table 6.1-1
Operations and Maintenance Requirements (hours by staff position) to Implement Plan

Element / Sub-element	Goal	Tasks	Senior Biologist Super (Wildlife) (1)	Wildlife Habitat Super II (1)	Wildlife Biologist (1)	Wildlife Habitat Super I (2)	Wildlife Habitat Assist (2)	Tractor Operator Laborer (2)	Fish and Wildlife Tech (2)	Fish and Wildlife Interpret II (1)	Fish and Wildlife Interpret I (1)	Office Tech (1)
		SAFCA regarding the design and operation of restoration and enhancement projects that have the potential to conflict with necessary flood flow conveyance requirements. All hydraulic modeling will be conducted in coordination with appropriate flood control and management agencies. A work plan for hydraulic modeling is provided in Appendix C.										
		3. Participate in ecosystem restoration components of any overall improvements to the Lower Sacramento Flood Control System.		20		20						
		4. Continue public outreach programs which describe the compatible nature of appropriate wetland management activities with flood protection efforts.	6	8	8	8					8	6
	Management Coordination Goal 3 (MC-3): *Coordinate with other law enforcement agencies.*	1. Meet on an annual basis with local Wildlife Protection squad prior to waterfowl hunting season to review Wildlife Area regulations, work schedules, exchange contact information and intricacies of public hunting program.	4	4	4	4	4	4	4		4	4
		2. Continue ongoing communication with Wildlife Protection staff throughout the year.		8		8						8
		3. Meet regularly with law enforcement staff from the California Highway Patrol and Yolo County Sheriff's Department and other agencies as appropriate to coordinate law enforcement activities and explore options for cooperative programs.	4									
		4. Pursue joint funding requests with other law enforcement entities to address law enforcement concerns.	8									
	Management Coordination Goal 4 (MC-4): *Coordinate with local public-service agencies including the SYMVCD and the Yolo County Health Department.*	1. In consultation with SYMVCD, continue to implement a mosquito control plan that applies BMPs and any other necessary management practices as identified in the Central Valley Habitat Joint Venture, Technical Guide to Best Management Practices for	6	8	8	16						

Table 6.1-1
Operations and Maintenance Requirements (hours by staff position) to Implement Plan

Element / Sub-element	Goal	Tasks	Senior Biologist Super (Wildlife) (1)	Wildlife Habitat Super II (1)	Wildlife Biologist (1)	Wildlife Habitat Super I (2)	Wildlife Habitat Assist (2)	Tractor Operator Laborer (2)	Fish and Wildlife Tech (2)	Fish and Wildlife Interpret II (1)	Fish and Wildlife Interpret I (1)	Office Tech (1)
		Mosquito Control in Managed Wetlands (Kwasny et al. 2004) and the California Rice Commission's BMPs for mosquito control.										
		2. Communicate regularly with SYMVCD. Coordinate mosquito and vector control activities. Meet annually with mosquito abatement agencies to discuss needed infrastructure improvements, identify areas of high mosquito productivity, schedules of summer irrigations and fall flood up, and scheduling of public use activities.		10	8	20						
		3. Conduct annual meeting with private wetland managers in the Yolo Bypass and SYMVCD staff to coordinate fall flooding of wetlands, target habitat infrastructure improvements and firm up contact information.	10	6	6	8						
		4. Coordinate with Yolo County Health Department as necessary.	4	7								8
		5. Apply for grants and matching funds with SYMVCD to implement BMPs.	2		12	12						
		6. Jointly conduct research to measure land management effects on mosquito production.			12	8			16			
	Management Coordination Goal 5 (MC-5): *Maintain relationships with neighbors and tenants to address management issues.*	1. Meet or correspond with adjacent landowners and tenants as needed individually or through the Yolo Bypass Working Group to maintain communication about management needs of the Yolo Wildlife Area, determine adjacent landowners' access and management needs, and convey useful information regarding activities.	16	20		16						
		2. Collaborate with adjacent landowners and tenants regarding DFG management activities that may affect their operations. Resolve potential issues by proactively working with adjacent landowners and tenants.										
		3. Collaborate with adjacent special districts including Reclamation District 2068, Dixon RCD, Yolo RCD, No Man's Land Fire District, East Davis Fire District, South Davis Drainage	8	8		16						

Table 6.1-1
Operations and Maintenance Requirements (hours by staff position) to Implement Plan

Element / Sub-element	Goal	Tasks	Senior Biologist Super (Wildlife) (1)	Wildlife Habitat Super II (1)	Wildlife Biologist (1)	Wildlife Habitat Super I (2)	Wildlife Habitat Assist (2)	Tractor Operator Laborer (2)	Fish and Wildlife Tech (2)	Fish and Wildlife Interpret II (1)	Fish and Wildlife Interpret I (1)	Office Tech (1)
		District, and other neighboring special districts.										
		4. Area Manager and appropriate staff should attend annual site visits to duck hunting clubs conducted by DFG headquarters staff as part of the implementation of various wetland easement programs.	8			8						
		5. Meet at least annually with duck club owners and SYMVCD to discuss fall flood-up schedule and summer irrigations.	8	8	4	4						
		6. Meet annually with SYMVCD to target field work in areas that have a high propensity to produce large numbers of mosquitoes to prevent abatement issues later during flood up.	8	8	4	8						
		7. Coordinate flooding of duck clubs through the Tule Ranch Irrigation System.		16		8			16			14
	Management Coordination Goal 6 (MC-6): *Coordinate activities associated with managing cholera, avian flu, and other disease outbreaks.*	1. Conduct regular visual monitoring of birds for the presence of botulism in the summer and avian cholera in the winter.		12	12							
		2. Conduct regular monitoring of harvested birds at the hunter check station for the presence of avian flu.		12	12							
		3. Participate in disease related work groups.		12	12							
		4. Coordinate with county and state public health agencies, and UC Davis.		6	6							
		5. Participate in Incident Command System activities.		6	8							
TOTAL HOURS (by staff position)			2040	2040	2040	4080	4080	4080	4080	2040	2040	2040

Table 6.3-1
Proposed Staffing Program for the Yolo Bypass Wildlife Area

Position	Senior Biologist Supervisor (Wildlife)	Wildlife Habitat Supervisor II	Wildlife Biologist	Wildlife Habitat Supervisor I	Wildlife Habitat Assistant	Tractor Operator Laborer	Fish and Wildlife Technician	Fish and Wildlife Interpreter I	Fish and Wildlife Interpreter II	Office Technician	Total
Number	1	1	1	1	2	3	2	1	1	1.5	
Top Salary	$5,864	$4,896	$3,908	$4,073	$3,558	$3,763	$3,276	$3,908	$4,969	$2,998	
Total Monthly Salary	$5,864	$4,896	$3,908	$4,073	$7,116	$11,289	$6,552	$3,908	$4,969	$4,497	**$57,072**
Total Annual Salary	$70,368	$58,752	$46,896	$48,877	$85,393	$135,469	$78,631	$46,896	$59,628	$53,964	**$684,874**
Total Annual Salaries											**$801,303**
Equipment Needed											
Vehicle	1	1	1	1	1	1	1	1	1	1	**10**
Office Space	1	1	1	1				1	1	1	**7**
Computer	1	1	1	1				1	1	1	**7**

7 FUTURE REVISIONS TO PLAN

All planning documents eventually become dated and require revision so that they can continue to provide practical direction for operational and maintenance activities. A common and unfortunate situation is that the revision of planning documents is often neglected for budgetary or staff constraints, or other reasons. To address this problem, this section incorporates a suggested hierarchy of revision procedures in which the level of process and required involvement is proportionate to the level of change that is proposed. This Land Management Plan (LMP) reflects the best information available during the planning process, but it is understood that new information will become available over time and adjustments will be required to keep this LMP current. Such new information may include:

- feedback generated by adaptive management of the Yolo Bypass Wildlife Area (Wildlife Area);
- other scientific research that directs improved techniques of habitat management;
- research that directs improved management of agricultural resources;
- documented threats to fish and wildlife species and their habitats;
- future modeling results;
- management of related facilities in the Yolo Bypass (e.g., flood management); or
- new legislative or policy direction.

When the new information dictates a change to this LMP, it is important that there is an appropriate process established. Public outreach and public input will be necessary in proportion to the proposed policy change established by this LMP. Unless a reasonable and clear revision process exists, this LMP could become outdated and irrelevant. If the appropriate procedure for a particular, proposed revision is not apparent, the determination of which of the following procedures to use shall be made by the regional manager in consultation with the Lands and Facilities Branch.

7.1 MINOR REVISIONS

A process is required to accommodate minor revisions to this LMP. Minor revisions may include the addition of new property to the Yolo Bypass Wildlife Area or the adoption of limited changes to the goals and tasks through adaptive management, based on other scientific information or legislative direction. This procedure will be applicable to revisions that meet the following criteria:

- No change is proposed to the overall purposes of this LMP;

- California Environmental Quality Act (CEQA) documentation (if required) is prepared and approved;

- Appropriate consultation occurs within the region and with the Lands and Facilities Branch;

- Appropriate consultation with other agencies occurs;

- Adjoining neighbors are consulted regarding the revision, if the revision is related to a specific location or the acquisition of additional area; and

- An information presentation regarding the proposed revision is made to the Working Group.

The minor revision may be prepared by the staff members assigned to the Yolo Bypass Wildlife Area or with other California Department of Fish and Game (DFG) resources, and requires approval by the regional manager.

7.2 MAJOR REVISIONS

A major revision or a new LMP requires a procedure comparable to the initial LMP planning process, but also proportionate to the level of policy change that is proposed. This procedure will be applicable to revisions that meet the following criteria:

- Substantial revision and/or a new policy direction is proposed to this LMP or the adoption of a completely new plan is proposed;
- Appropriate CEQA documentation is prepared and approved;
- Appropriate consultation occurs throughout DFG;
- Appropriate coordination and consultation with other agencies occurs;
- A public outreach program is conducted that is proportional to the level of the proposed revision; and
- An information presentation regarding the proposed revision or plan is made to the Working Group.

The major revision or new plan may be prepared using available DFG resources. The major revision or new plan requires recommendation by the regional manager and approval by the director of DFG.

If the appropriate procedure for a particular, proposed revision is not apparent, the determination of which of these procedures to use shall be made by the regional manager in consultation with the Lands and Facilities Branch.

7.3 FIVE-YEAR PLAN STATUS REPORTS

Periodic evaluation is important to help ensure that the purposes and goals of the LMP are being met. Chapter 5, “Management Goals,” contains many specific tasks that involve monitoring of the Wildlife Area and evaluation of the adequacy of management of the area. Cumulatively, these efforts will provide feedback regarding the success of the overall management effort. Periodic and detailed analysis of these feedback data will be necessary to assess the status of this LMP, however.

An exhaustive review of the achievement of the goals of the LMP should be prepared every 5 years following the date of adoption of the LMP or subsequent revisions. A status report documenting this review should, at minimum, include:

- evaluation of the achievement of the purposes and goals of the LMP;
- evaluation of the completion or annual completion, as appropriate, of each task contained in this LMP;
- fiscal evaluation of the program;
- evaluation of the effectiveness of DFG’s coordination efforts with CALFED, local governments, and other property management and regulatory agencies involved in the Yolo Bypass;
- notation of important new scientific information that has bearing on the management of the Wildlife Area; and
- recommendation for revisions to this LMP to incorporate new information and improve its effectiveness.

The status report should be prepared or coordinated by the Area Manager. It should be submitted to the DFG Bay-Delta Region for review and comment, then should be approved by the Regional Manager and submitted to the Director of DFG. This report should serve as a basis for revision of this LMP and appropriate adjustment to ongoing management practices.

8 DOCUMENT PREPARERS

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9 REFERENCES AND PERSONAL COMMUNICATIONS

CHAPTER 1, “INTRODUCTION”

CALFED Bay–Delta Program. 2000a (July). *Final Programmatic Environmental Impact Statement and Environmental Impact Report.* Including portions of the Ecosystem Restoration Program Plan. Including the Multi-Species Conservation Strategy, Technical Appendix. Sacramento, CA.

———. 2000b (August 28). *Final Programmatic Environmental Impact Statement and Environmental Impact Report. Programmatic Record of Decision.* Sacramento, CA.

California Department of Fish and Game. 2003. *Guide and Annotated Outline for Preparing Land Management Plans.* State of California, The Resources Agency, Department of Fish and Game. Sacramento, CA.

California Department of Fish and Game. 2006. *Guide and Annotated Outline for Preparing Land Management Plans (Updated).* State of California, The Resources Agency, Department of Fish and Game. Sacramento, CA.

Thompson, J. 1957. *The Settlement Geography of the Sacramento–San Joaquin Delta, California.* Prepared for Ph.D. thesis. Stanford University. Stanford, CA. University Microfilm International, Ann Arbor, MI.

Wildlife Conservation Board. 2001 (August 30). Wildlife Conservation Board meeting minutes. Sacramento, CA.

Yolo Basin Foundation. 2001 (August). *A Framework for the Future: Yolo Bypass Management Strategy*. Davis, CA. Prepared by Jones & Stokes (J&S 99079). Sacramento, CA.

Yolo Basin Foundation and California Department of Fish and Game. 2007. *Yolo Wildlife Area Program History and Overview.* Prepared by Yolo Basin Foundation and California Department of Fish and Game. Davis, CA.

CHAPTER 2, “PROPERTY DESCRIPTION”

California Department of Fish and Game. 1992. *Management Plan for the Yolo Bypass Wildlife Area*. Sacramento, CA.

California Department of Fish and Game. 1997. Memorandum of Understanding between California Department of Fish and Game and Yolo Basin Foundation recognizing long-term partnership to provide public outreach and educational programs. Davis, CA.

California Department of Fish and Game. 2001. *Yolo Bypass Wildlife Area, Water Management Activities Synopsis.* Prepared by Land and Facilities Branch, Sacramento, CA.

California Department of Fish and Game. 2006. Initial Study / Mitigated Negative Declaration for the Pacific Flyway Center. Prepared by EDAW, Sacramento, CA.

Central Valley Habitat Joint Venture. 1990. *Hydrologic Analysis of the Mace Ranch Portion of the Proposed Yolo Basin Wildlife Area.* Prepared by Jones and Stokes Associates, Sacramento, CA.

Kwasny, D. C., M. Wolder, and C. R. Isola. 2004. *Central Valley Habitat Joint Venture, Technical Guide to Best Management Practices for Mosquito Control in Managed Wetlands.*

Sacramento County Superior Court. 2000. *Settlement Agreement and Stipulation Among Solano County Water Agency Solano Irrigation District, Maine Prairie Water District, Cities of Vacaville, Fairfield, Vallejo, and Suisun City, and Putah Creek Council, City of Davis, and the Regents of the University of California.*

State Reclamation Board. 1995. Memorandum of Understanding between The State Reclamation Board, California Department of Fish and Game, California Department of Water Resources, and U.S. Fish and Wildlife Service regarding Threatened and Endangered Species in the Yolo Basin Wetlands Project. Original MOU was signed in 1994, additional concurrence signed in 1995.

U.S. Army Corps of Engineers. 2003. *Supplement to the Standard Operation and Maintenance Manual, Sacramento River Flood Control Project (as revised 1995) for the Yolo Basin Wetlands, Project Modifications Works, Yolo County, CA.*

Yolo County Planning and Public Works Department. 2001. Letter to the Honorable Tom Stallard from John Bencomo and Linda Caruso regarding recommended actions on Zone File 2001-092 Authorization for Williamson Act Successor Agreements for the T. S. and K. D. Glide Foundation and the Peggy Glide-Colby Estate. Woodland, CA.

CHAPTER 3, "ENVIRONMENTAL SETTING"

Alpers, C. N. and Hunerlach, M. P. 2000. Mercury Contamination from Historic Gold Mining in California. U.S. Geological Survey Fact Sheet FS-061-00. Sacramento, CA.

Alpine, A. E. and J. E. Cloern. 1992. Trophic interactions and direct physical effects control phytoplankton biomass and production in an estuary. *Limnology and Oceanography* 37(5):946–955.

Amweg, E. L., D. L. Stuart, and D. P. Weston. 2003. Comparative bioavailability of selenium to aquatic organisms after biological treatment of agricultural drainage water. *Aquatic Toxicology* 63: 13–25.

Andrews, W. F. 1972. *Soil Survey of Yolo County, California.* USDA Soil Conservation Service in cooperation with the University of California Agricultural Experiment Station. U.S. Government Printing Office, Washington, DC.

Atwater, B. F., S. C. Conard, I. N. Dowden, C. W. Hedel, R. L. MacDonald, & W. Savage. 1979. History, landforms, and vegetation of the estuary's tidal marshes in T. J. Conomos, Ed. San Francisco Bay: The Urbanized Estuary. Proceedings of the 58th Annual Meeting of the Pacific Division of the American Association for the Advancement of Science, San Francisco, CA.

Bennett, W. A. and P. B. Moyle. 1996. Where have all the fishes gone?: interactive factors producing fish declines in the Sacramento-San Joaquin Estuary. Pages 519–542 in: J.T. Hollibaugh (Editor). *San Francisco Bay: The Ecosystem*. Pacific Division of the American Association for the Advancement of Science, San Francisco, CA.

Bennyhoff J. A. and D. A. Fredrickson. 1969. A Proposed Integrative Taxonomic system for Central California Archaeology in *Toward a New Taxonomic Framework for Central California Archaeology.* edited by Richard E. Hughes.

Bennyhoff, J. A. 1977. Ethnogeography of the Plains Miwok. Davis: *University of California, Center for Archaeological Research at Davis, Publication 5.*

Bennyhoff, J. A. and R. E. Hughes. 1987. Shell Bead and Ornament Exchange networks between California and the Western Great Basin. *American Museum of Natural History Anthropological Papers* Vol 64, Pt. 2. New York.

Borcalli & Associates, Inc. 2000. Water Management Plan. Prepared for Yolo County Flood Control and Water Conservation District (YCFCWCD). October 2000. Sacramento, CA.

Bouey, P. and Bethard. 1991. *Archaeological Site Record for CA-YOL-117.* On file at the Northwest Information Center, California State University, Sonoma, Rohnert Park, CA.

Busby, P. J., T. C. Wainwright, G. J. Bryant, L. J. Lierheimer, R. S. Waples, F. W. Waknitz, and I. V. Lagomarsino. 1996. *Status review of west coast steelhead from Washington, Idaho, Oregon, and California.* U.S. Dep. Commer., NOAA Tech. Memo. NMFS - NWFSC-27, 261 p.

CALFED Bay–Delta Program. 2000a (August 28). *Final Programmatic Environmental Impact Statement and Environmental Impact Report. Programmatic Record of Decision.* Sacramento, CA.

CALFED Bay–Delta Program. 2000b (July). *Final Programmatic Environmental Impact Statement and Environmental Impact Report.* Including portions of the Ecosystem Restoration Program Plan. Including the Multi-Species Conservation Strategy, Technical Appendix. Sacramento, CA.

California Department of Conservation. 2004. Important Farmland Categories. Available <http://www.consrv.ca.gov/dlrp/FMMP/mccu/map_categories.htm>. Accessed on February 10, 2006.

California Department of Fish and Game Website, accessed by Petra Unger, Senior Botanist, EDAW on March 13, 2006. URL = http://www.creec.org/.

California Department of Fish and Game. 1995. *A Guide to Wetland Habitat Management in the Central Valley*. Sacramento, CA.

California Department of Fish and Game. 2002a. Hunting and Other Public Uses on State and Federal Lands California Regulations, 2002. Sacramento, CA. July 2002.

California Department of Fish and Game. 2002b. Mammals and Furbearers California Regulations, 2002. Sacramento, CA. July 2002.

California Department of Fish and Game. 2002c. Resident and Migratory Upland Game Birds California Regulations, 2002. Sacramento, CA. July 2002.

California Department of Fish and Game. 2006. California Sportfishing Regulations. Site accessed March 3, 2006 by I. Mayes, Environmental Planner, EDAW, Inc. URL = http://www.fgc.ca.gov/html/fishregs.html.

California Department of Water Resources. 2003. Fact Sheet, Sacramento River Flood Control Project, Weirs and Flood Relief Structures. State of California, The Resources Agency, Department of Water Resources, Division of Flood Management, Flood Operations Branch. Sacramento, CA.

California Department of Water Resources. 2004. California's Groundwater Bulletin 118. Sacramento River Hydrologic Region, Sacramento Valley Groundwater Basin, Yolo Subbasin. Last update February 27, 2004. Available at: <http://www.groundwater.water.ca.gov/bulletin118/basin_desc/>. Accessed September 11, 2004.

California Department of Water Resources. 2005. Fact Sheet, State-Federal Flood Operations Center. State of California, The Resources Agency, Department Of Water Resources, Division of Flood Management, Flood Operations Branch. Sacramento, CA.

California Fish and Game Code (CFCG). 2006. Chapter 6: Fish and Wildlife Protection and Conservation. Site accesses March 3, 2006 by I. Mayes, Environmental Planner, EDAW, Inc. URL = http://www.leginfo.ca.gov/cgi-bin/calawquery?codesection=fgc&codebody=&hits=20.

California Native Plant Society (CNPS). 2007. Electronic Inventory of Rare and Endangered Plants. Database Search for the Yolo Bypass Wildlife Area. Available at <http://www.cal.net/~levinel/cgi-bin/cnps/sensinv.cgi>.

California Natural Diversity Database (CNDDB). 2006. Electronic database search for the Yolo Bypass Wildlife Area.

California Regional Environmental Education Community (CREEC) website. Site accessed by Petra Unger, Senior Botanist, EDAW on March13, URL = http://www/yolobasin.org.

Central Valley Habitat Joint Venture. 2006. *Central Valley Joint Venture Implementation Plan (2006 Plan Update).* Sacramento, CA.

———. 1990. *Central Valley Habitat Joint Venture Implementation Plan, A Component of the North American Waterfowl Management Plan.* Sacramento, CA.

———. 1993. Suitability analysis for enhancing wildlife habitat in the Yolo Basin (JSA 90-285). Sacramento, CA. Prepared by Jones and Stokes, Sacramento, CA.

Central Valley Regional Water Quality Control Board. 1998. Water Quality Control Plan (Basin Plan) for the Sacramento River and San Joaquin River Basins. Fourth Edition. September 15, 1998. Sacramento, CA.

———. 2002. Watershed Management Initiative Plan Chapter. State of the Watershed Report - Cache Creek Sub-Watershed. December 1, 2002. Sacramento, CA.

———. 2002. 2002 CWA Section 303(d) List of Water Quality Limited Segment, Central Valley Regional Water Quality Control Board. Approved by U.S. Environmental Protection Agency July 2003. Available: <http://www.swrcb.ca.gov/ctmdl/docs/2002reg5303dlist.pdf>. Accessed March 2, 2006.

———. 2004. Cache Creek, Bear Creek, and Harley Gulch TMDL for Mercury. Staff Report. February 2004. Sacramento, California.

———. 2005. Sacramento – San Joaquin Delta Estuary TMDL for Methyl & Total Mercury, Staff Report. Rancho Cordova, CA.

Central Valley RWQCB. *See* Central Valley Regional Water Quality Control Board.

Chabreck, R. H., T. Joanen, and S. L. Paulus. 1989. Southern coastal marshes and lakes. Pages 249–277 in L. M. Smith, R. L. Pederson, and R. M. Kaminski, editors. Habitat Mark H. Sherfy Chapter 1. *Habitat management for migrating and wintering waterfowl in North America.* Texas Tech University Press, Lubbock, TX.

Choe, K. Y. and Gill, G. A. 2003. Distribution of particulate, colloidal, and dissolved mercury in San Francisco Bay estuary. 2. Monomethyl mercury. Limnology and Oceanography 48: 1547–1556.

Choe, K. Y., Gill, G. A., and Lehman, R. 2003. Distribution of particulate, colloidal, and dissolved mercury in San Francisco Bay estuary. 1. Total mercury. Limnology and Oceanography 48: 1535–1546.

City of West Sacramento. 2006. Site accessed March 3, 2006 by I. Mayes, Environmental Planner, EDAW, Inc. Available: <http://www.ci.west-sacramento.ca.us/cityhall/departments/comdev/Documents/>.

City of Woodland. 2005. Yolo Bypass Water Quality Management Plan Report. Prepared by Larry Walker Associates. Prepared for City of Woodland, CA.

Combs, D. L., and L. H. Fredrickson. 1996. Foods used by male mallards wintering in southeastern Missouri. *Journal of Wildlife Management* 60:603–610.

Davis, J., Yee, D., Collins, J., Schwarzbach, S., and Luoma, S. 2003. Potential for Increased Mercury Accumulation in the Estuary Food Web In: Larry R. Brown, editor. Issues in San Francisco Estuary Tidal Wetlands Restoration. San Francisco Estuary and Watershed Science. Vol. 1, Issue 1 (October 2003), Article 4.

Delta Protection Commission. 1995. *Land Use and Resource Management Plan for the Primary Zone of the Delta.* Adopted February 23, 1995. Reprinted May 2002.

Delta Protection Commission. 2006. *Aquatic Recreation Component of the Delta Recreation Strategy Plan.* Prepared by the Dangermound Group and LSA Associates.

Demarest, D. W., R. M. Kaminski, L. A. Brennan, and C. R. Boyle. 1997. Body-mass, survival, and pairing consequences of winter-diet restriction in wood ducks. *Journal of Wildlife Management* 61:822–832.

Dettinger, M. D., Ghil, M., and Keppenne, C. L., 1995. Interannual and interdecadal variability in United States air temperatures, 1910–87. *Climate Change,* 31:35–66.

Dixon RCD. *See* Dixon Resource Conservation District.

Dixon Resource Conservation District. 2004. 2004 Annual Crop Plan for the Yolo Basin Wildlife Area. Dixon, CA.

Dixon Resource Conservation District. 2005. 2005 Annual Crop Plan for the Yolo Basin Wildlife Area. Dixon, CA.

Dixon Resource Conservation District. 2006. 2006 Annual Crop Plan for the Yolo Basin Wildlife Area. Dixon, CA.

Domagalski, J. L., Alpers, C. N., Slotton, D. G., Suchanek, T. H., and S. M. Ayers. 2002. Mercury and Methylmercury Concentrations and Loads in Cache Creek Basin, California, January 2000 through May 2001: U.S. Geological Survey Scientific Investigations Report. 2004–5037.

Dubovsky, J. A., and R. M. Kaminski. 1994. Potential reproductive consequences of winter-diet restriction in mallards. *Journal of Wildlife Management* 58:780–786.

Euliss, N. H., Jr., and S. W. Harris. 1987. Feeding ecology of northern pintails and green-winged teal wintering in California. *Journal of Wildlife Management* 51:724-732.

Euliss, N. H., Jr., R. L. Jarvis, and D. S. Gilmer. 1991. Feeding ecology of waterfowl wintering on evaporation ponds in California. *Condor* 93:582–590.

Everest, F. H. and D. W. Chapman. 1972. Habitat selection and spatial interaction by juvenile chinook salmon and steelhead trout in two Idaho streams. *Journal of the Fisheries Research Board of Canada* 29(1):91–100.

Feaver, P. E. 1971. *Breeding pool selection and larval mortality of three California amphibians*: Ambystoma tigrinum californiense *Gray,* Hyla regilla *Baird and Girard, and* Scaphiopus hammondii *Girard.* MA Thesis, Fresno State College, Fresno, California.

Feyrer, F., T. Sommer, S. C. Zeug, G. O'Leary, and W. Harrell. 2004. Fish assemblages of perennial floodplain ponds of the Sacramento River, California (USA), with implications for the conservation of native fishes. *Fisheries Management and Ecology*, 11, 335–344

Fisher, F. W. 1994. Past and present status of Central Valley Chinook salmon. *Conservation Biology* 8:870–873.

Foe, C. 2002. Mercury mass balance for the freshwater Sacramento-San Joaquin Bay-Delta Estuary. Draft Final Report to the California Bay Delta Authority. Sacramento, CA.

Foe, C., M. Stephenson, and S. Stanish. 2003. Pilot Transplant Studies with the Introduced Asiatic Clam, Corbicula fluminea, to Measure Methyl Mercury Accumulation in the Sacramento-San Joaquin Delta Estuary. In CALFED Final Report titled "An Assessment of Human Health and Ecological Impacts of Mercury in the Bay-Delta Watershed."

Gaines, D. 1974. A new look at the nesting riparian avifauna of the Sacramento Valley, California. *West. Birds* 5: 61–80.

Gill, G. A., Lehman, R., Choe, K. Y., and Han, S. 2002. Sediment-water exchange and estuarine mixing fluxes in the San Francisco Bay-Delta watershed. Draft Final Report to the California Bay Delta Authority. 139 pp.

Harrell, W. C. and T. R. Sommer. 2003. Patterns of Adult Fish Use on California's Yolo Bypass Floodplain. Pages 88–93 in P. M. Faber, editor. *California riparian systems: Processes and floodplain management, ecology, and restoration.* 2001 Riparian Habitat and Floodplains Conference Proceedings, Riparian Habitat Joint Venture, Sacramento, California.

Heim, W. A., Coale, K., and Stephenson, M. 2003. Methyl and total mercury spatial and temporal trends in surficial sediment of the San Francisco Bay-Delta. Final Report to the California Bay Delta Authority.

Helley, E. J., and D. W. Harwood. 1985. *Geologic Map of the Late Cenozoic Deposits of the Sacramento Valley and Northern Sierran Foothills, California.* USGS MF-1790.

Historic Environment Consultants. 1980. *Historic Resources Inventory for the Olson Family House.* Manuscript on file at the Northwest Information Center, California State University Sonoma, Rohnert Park, CA.

Holland, R. F. 1986. *Preliminary Descriptions of the Terrestrial Natural Communities of California.* Sacramento, California: State of California Department of Fish and Game.

Hoover, M. B., H. E. Rensch, E. G. Rensch, and W. N. Abeloe. 1990. *Historic Spots in California.* Fourth Edition, revised by Douglas E. Kyle, Stanford University Press, Stanford.

Jassby, A. D. and J. E. Cloern. 2000. Organic matter sources and rehabilitation of the Sacramento-San Joaquin Delta (California, USA). *Aquatic Conservation: Marine and Freshwater Ecosystems* 10(5):323–352.

Jassby, A. D., et al. 1995. Isohaline position as a habitat indicator for estuarine populations. *Ecological Applications* 5:272–289.

Jassby, A. D., J. R. Koseff, and S. G. Monismith. 1996. Processes underlying phytoplankton variability in San Francisco Bay. Pages 325–350 in: J. T. Hollibaugh (Editor). *San Francisco Bay: The Ecosystem*. Pacific Division of the American Association for the Advancement of Science, San Francisco, CA.

Jennings, M. R., and M. P. Hayes. 1994. *Amphibian and reptile Species of Special Concern in California*. Final report submitted to California Department of Fish and Game, Inland Fisheries Division, Rancho Cordova, California, under Contract 8023.

Johnson, P. J. 1971. *Archaeological Site Survey for CA-YOL-117*. On file at the Northwest Information Center, California State University, Sonoma, Rohnert Park, CA.

Johnson, P. J. 1978. Patwin: in R. F. Heizer, Vol. Ed., *Handbook of North American Indians*, Vol. 8: California: 350–360. Smithsonian Institution, Washington, D.C.

Jones, A. and Slotton, D. 1996. Mercury Effects, Sources, and Control Measures. A Special Study of the San Francisco Estuary Regional Monitoring Program, San Francisco Estuary Institute. Richmond, CA.

Jones, B. L., Hawley, N. L., Crippen, J. R. 1972. Western tributaries of the Sacramento River, California. USGS Water Supply Paper. 1798-J.

Jones & Stokes Associates. 1992. Final Hydraulic, Hydrologic, Vegetation, and Fisheries Analysis for the U.S. Fish and Wildlife Service Putah Creek Resource Management Plan. (JSA 91–196). Sacramento, CA. Prepared for USFWS. As Cited in: USFWS. 1993. *Reconnaissance planning report: fish and wildlife resource management options for Lower Putah Creek, California*. 128 pp. Sacramento, CA.

———. 2000. *Site Document prepared for site P-48-000541 (CA-YOL-195H)*. Prepared by Jones and Stokes, Sacramento. On file at the Northwest Information Center, California State University, Sonoma, Rohnert Park, CA.

Kelley, R. L. 1989. *Battling the inland sea: floods, public policy, and the Sacramento Valley, 1885–1986*. University of California Press, California. 395 pp.

Kirkland, M., R. Beckwith, T. Greene, and Z. Matica. 2005. *Aquatic Restoration Planning in the Yolo Bypass Floodplain*. Poster presentation at the Seventh Biennial State of the San Francisco Estuary Conference. Oakland, CA.

Kohlhorst, D. W., L. W. Botsford, J. S. Brennan, and G. M. Cailliet. 1991. Aspects of the structure and dynamics of an exploited central California population of white sturgeon (*Acipenser transmontanus*). Pages 277 to 283 In P. Williot, editor. *Acipenser: Actes du premier colloque international sur l'esturgeon*. CEMAGREF, Bordeaux, France.

Kroeber, A. L. 1925. Handbook of the Indians of California. *Bureau of American Ethnology Bulletin* 78. Smithsonian Institution, Government Printing Office, Washington, D.C.

Kroeber, A. L. 1932. The Patwin and Their Neighbors. *University of California Publications in American Archaeology and Ethnology,* 29(4):253–423. Berkeley, CA.

Kwasny, D. C., M. Wolder, and C. R. Isola. 2004. *Central Valley Habitat Joint Venture, Technical Guide to Best Management Practices for Mosquito Control in Managed Wetlands.*

Lehman, P. W. 2000. The influence of climate on phytoplankton community biomass in San Francisco Bay Estuary. *Limnology and Oceanography* 45(3):580–590.

Lower Putah Creek Coordinating Committee. 2003. Lower Putah Creek Coordinating Committee Database of Electrofishing Samples and Other Fish and Non-Fish Observations in Lower Putah Creek from 1991 to 2002. Sampling was conducted primarily by Thomas R. Payne and Associates and by Dr. Peter Moyle and research associates in the Department of Wildlife and Fisheries Biology, University of California, Davis, CA. Access 2000 database with Visual Basic database application, programmer Avry Deton, AD Consultants. October 10, 2003 version.

———. 2005. *Lower Putah Creek Watershed Management Action Plan, Phase 1 – Resource Assessments.* Prepared for the Lower Putah Creek Coordinating Committee. Prepared by EDAW, Inc., Sacramento, CA.

Marchetti M. P. 1999. An experimental study of competition between the native Sacramento perch (*Archopolites interruptus*) and introduced bluegill (*Lepomis macrochirus*). *Biological invasions* 1, 1–11.

Marchetti, M. P., and P. B. Moyle. 2001. Effects of flow regime on fish assemblages in a regulated California stream. *Ecological Applications* 11:530–539.

Martin, L. 2004. *Continuation Record prepared for site P-48-000541 (CA-YOL-195H)*. Prepared by William Self Associates, Orinda, CA. On file at the Northwest Information Center, California State University, Sonoma, Rohnert Park, CA.

Martin, L., S. Hill, and S. Huster. 2001. *Site Document prepared for site P-48-000541 (CA-YOL-195H)*. Prepared by William Self Associates, Orinda, CA. On file at the Northwest Information Center, California State University, Sonoma, Rohnert Park, CA.

Marvin-DiPasquale, Mark C. Water Resource Division, U.S. Geological Survey, Menlo Park, CA. March 21, 2005—Interview conversation with EDAW and NHI staff regarding recent Delta methylmercury research.

McEwan, D. and T. A. Jackson. 1996. Steelhead Restoration and Management Plan for California. California Department of Fish and Game, Inland Fisheries Division. Sacramento, CA.

McKern W. C. 1922. Functional families of the Patwin. *University of California Publications in American Archaeology and Ethnology* 13(7):235–258.

Moratto, Michael J. 1984. *California Archaeology*. Academic Press, San Francisco, CA.

Moyle, P. B. 1991 (unpublished). *A history of the fisheries in Lower Putah Creek*. Department of Wildlife and Fisheries Biology. University of California, Davis, CA. 11 pp.

Moyle, P. B. 2002a. *Inland Fishes of California, Revised and Expanded*. University of California Press, Berkeley CA.

Moyle, P. B. 2002b. December 9. Letter to Ms. Diane Windham, Recovery Coordinator, Central Valley Area, National Marine Fisheries Service, 650 Capitol Mall, Suite 8300, Sacramento, CA 95814. Letter to National Marine Fisheries Service providing explanation of the scientific justification for the current regime of flows in lower Putah Creek.

Moyle, P. B., P. J. Foley, and R. M. Yoshiyama. 1992. *Status of green sturgeon,* Acipenser medirostris, *in California.* Final Report submitted to National Marine Fisheries Service. University of California, Davis. Davis, CA.

Moyle, Peter B., M. P. Marchetti, J. Baldridge, and T. L. Taylor. 1998. Fish Health and Diversity: Justifying Flows for a California Stream. *Fisheries* Vol. 23, No. 7: 6–15.

Moyle, Peter B., P. Crain, and K. Small. 2003 (unpublished). Analysis of Lower Putah Creek Fisheries Data from 1991 though 2002. Department of Wildlife and Fisheries Biology. University of California, Davis, CA.

Myrick, D. F. 1992. *Railroads of Nevada and Eastern California. Volume 1, the Northern Roads.* University of Nevada Press, Reno, NV.

National Marine Fisheries Service. 2005. Green Sturgeon (*Acipenser medirostris*) Status Review Update. Prepared by Biological Review Team, Santa Cruz Laboratory, Southwest Fisheries Science Center. Santa Cruz, CA.

Natural Resources Conservation Service. 1972. *Soil Survey of Yolo County*. Reprinted 1990.

Nelson, J., H. Davis, S. Dies, K. Syda. 1999. *Site Document prepared for site P-48-000549*. Prepared by Jones and Stokes Associates, Sacramento, CA. On file at the Northwest Information Center, California State University, Sonoma, Rohnert Park, CA.

Office of Environmental Health Hazard Assessment. 1994. Methyl mercury in sport fish: answers to questions on health effects. Office of Environmental Health Hazard Assessment, California Environmental Protection Agency. Available at: http://www.oehha.ca.gov/fish/pdf/HGfacts.pdf.

Pacific Fishery Management Council. 2003. *Pacific Coast Salmon Plan, Fishery Management Plan for Commercial and Recreational Salmon Fisheries off the Coasts of Washington, Oregon, and California.* As revised through Amendment 14 (adopted March 1999). Portland, OR.

Philip Williams and Associates. 2005. *An overview of the Potential for Achieving Large Scale, System-Wide, Ecological Restoration Benefits with a Modified Yolo Bypass.*

Philip Williams and Associates. 2006. (Draft) *An Evaluation of the Feasibility of Restoring Freshwater Tidal Wetlands to Calhoun Cut Ecological Reserve.*

Powers, T. W. 1877. Tribes of California. *Contributions to North American Ethnology* 3. Washington, D.C.: U.S. Geographical and Geological Survey of the Rocky Mountain Region.

Putah Creek Council. 2003. Putah Creek Council e-mail announcements of salmon observations on lower Putah Creek between October and December 2003.

Resources Agency (State of California). 2005. *Delta Smelt Action Plan*. State of California Resources Agency, California Department of Fish and Game, California Department of Water Resources.

Resources Agency (State of California). 2007. *Pelagic Fish Action Plan*. State of California Resources Agency, California Department of Fish and Game, California Department of Water Resources.

Riparian Habitat Joint Venture. 2000. The riparian bird conservation plan: a strategy of reversing the decline of riparian associated birds in California. *California Partners in Flight.* Available: <http://www.prbo.org/CPIF/Riparian/Riparian.html>.

Rodriguez, M. A. and W. M. Lewis Jr. 1994. Regulation and stability in fish assemblages of neotropical floodplain lakes. *Oecologia* 99, 166–180.

Sacramento County Superior Court. 2000. *Settlement agreement and stipulation among Solano County Water Agency Solano Irrigation District, Maine Prairie Water District, Cities of Vacaville, Fairfield, Vallejo, and Suisun City, and Putah Creek Council, City of Davis, and the Regents of the University of California.*

Sacramento History Project. 2006. Sacramento History Online, Historic Sacramento Photograph and Document Archive. Available: <http://www.sacramentohistory.org/>. Accessed March 15, 2006.

Sawyer, J. O. and T. Keeler-Wolfe. 1995. *A manual of California vegetation*. California Native Plant Society, Sacramento, CA.

Schemel, L. E., S. W. Hagar, and D. Childers. 1996. The supply and carbon content of suspended sediment from the Sacramento River to San Francisco Bay. Pages 237–260 in: J. T. Hollibaugh (Editor). *San Francisco Bay: The Ecosystem*. Pacific Division of the American Association for the Advancement of Science, San Francisco, CA.

Schemel, L. E., M. Cox, S. Hager, T. Sommer. 2002. *Hydrology and Chemistry of Floodwaters in the Yolo Bypass, Sacramento River System, California, During 2000.* U.S. Geological Survey Water Resources Investigations Report 02-4202. September 2002. Menlo Park, CA.

Scott, B. 1999. *Site Document prepared for site P-48-000541 (CA-YOL-195H)*. Prepared by Jones and Stokes, Sacramento, CA. On file at the Northwest Information Center, California State University, Sonoma, Rohnert Park, CA.

Setmire, J. G., J. C. Wolfe, and R. K. Stroud. 1990. Reconnaissance investigation of water quality, bottom sediment, and biota associated with irrigation drainage in the Salton Sea area, California, 1986–1987. U.S. Geological Survey, Water-Resources Investigation Report 89-4102. 68 pp.

Setmire, J. G., R. A. Schroeder, J. N. Densmore, S. L. Goodbred, D. J. Audet, and W. R. Radke. 1993. Detailed study of water quality, bottom sediment, and biota associated with irrigation drainage in the Salton Sea area, California. U.S. Geological Survey. Water Resources Investigations Report 93-4014. 102 p.

Shipley, W. F. 1978. Native Languages of California. in R. F. Heizer, Vol. Ed., *Handbook of North American Indians, Vol. 8: California:* 80–90. Smithsonian Institution, Washington, D.C.

Slotten, D. G., S. M. Ayers, T. H. Suchanek, R. D. Weyand, A. M. Liston, C. Asher, D. C. Nelson, and B. Johnson. 2003. The Effects of Wetland Restoration on the Production and Bioaccumulation of Methyl mercury in the Sacramento-San Joaquin Delta, California. In CALFED Final Report titled *"An Assessment of Human Health and Ecological Impacts of Mercury in the Bay-Delta Watershed."*

Smalling, K. L., Orlando, J. L., and Kuivila, K. M. 2005. Analysis of Pesticides in Surface Water and Sediment from Yolo Bypass, California. 2004–2005: U.S. Geological Survey Scientific Investigations Report 2005–5220, 20 p.

Smith, G. J. and V. P. Anders. 1989. Toxic effects of boron on mallard reproduction. *Environ. Toxicol. Chem*. 8:943–950.

Solano County Water Agency. 1998. *Lake Solano Sediment Removal and Management Study*. Phase I final report. November. West Sacramento, CA. Prepared by Northwest Hydraulic Consultants.

Sommer, T. R., M. L. Nobriga, W. C. Harrell, W. Batham, and W. J. Kimmerer. 2001. Floodplain rearing of juvenile chinook salmon: evidence of enchanced growth and survival. *Canadian Journal of Fisheries and Aquatic Sciences* 58(2):325–333.

Sommer, T. R., W. C. Harrell, M. L. Nobriga and R. Kurth. 2003. Floodplain as habitat for native fish: Lessons from California's Yolo Bypass. Pages 81–87 In P. M. Faber, editor. *California riparian systems: Processes and floodplain management, ecology, and restoration*. 2001 Riparian Habitat and Floodplains Conference Proceedings, Riparian Habitat Joint Venture, Sacramento, CA.

Sommer, T., B. Harrell, M. Nobriga, R. Brown, P. Moyle, W. Kimmerer, and L. Schemel. 2001. California's Yolo Bypass: evidence that flood control can be compatible with fisheries, wetlands, wildlife, and agriculture. *Fisheries* 26:6–16.

Sommer, T., R. Baxter, and B. Herbold. 1997. The resilience of splittail in the Sacramento-San Joaquin Estuary. *Transactions of the American Fisheries Society* 126:961–976.

State Water Resources Control Board. 1999. Environmental Impact Report for Implementation of the 1995 Bay-Delta Water Quality Control Plan. Sacramento, CA.

Stephenson, M., Coale, K., Gill, G., Foe, C., Marvin-DiPasquale, M. 2002. Conceptual model and working hypotheses of mercury cycling and transport in the Bay-Delta ecosystem and its tributaries. Draft Final Report to the California Bay Delta Authority. 28 pp.

Stephenson, Mark. Marine Pollution Studies Lab, California Department of Fish and Game, Moss Landing, CA. February 16, 2006—interview conversation with EDAW and DFG regarding recent methyl mercury research.

Syda, K. 1999. *Site Document prepared for site P-48-000549*. Prepared by Jones and Stokes Associates, Sacramento, CA. On file at the Northwest Information Center, California State University, Sonoma, Rohnert Park, CA.

Tejerina-Garro F. L., Fortin R. & Rodriguez M. 1998. Fish community structure in relation to environmental variation in floodplain lakes of the Araguaia basin. *Environmental Biology of Fishes* 51, 399–410.

Tracy, C. 1990. *Memorandum: Green sturgeon meeting and comments*. State of Washington Department of Fisheries 11 p.

Turner J. L. & Kelley D. W. (eds) 1966. *Ecological studies of the Sacramento-San Joaquin Delta. Part II, Fishes of the Delta.* California Department of Fish and Game Fish Bulletin 136, 168 pp.

U.S. Army Corps of Engineers. 1991. Draft environmental assessment/initial study, Yolo Basin wetlands, Sacramento River, California. Appendix 8, Office Report, basis of hydraulic analysis. October. Sacramento, CA.

U.S. Army Corps of Engineers. 1996. *Reconnaissance Report, Little Holland Tract, California*. January. Sacramento District, Sacramento, CA.

U.S. Army Corps of Engineers. 2000 (April 30). *Design and Construction of Levees.* Engineering Manual 1110-2-1913.

U.S. Army Corps of Engineers. 2003. *Supplement to the Standard Operation and Maintenance Manual, Sacramento River Flood Control Project (as revised 1995) for the Yolo Basin Wetlands, Project Modifications Works, Yolo County, CA.*

U.S. Army Corps of Engineers. 2006. Office Report: Yolo Bypass 2-D Hydraulic Model Development and Calibration (Draft). U.S. Army Corps of Engineers Sacramento District.

U.S. Army Corps of Engineers and CALFED Bay-Delta Program. 2002 (December). *Habitat Improvement for the Native Fish in the Yolo Bypass.* Prepared by Natural Heritage Institute, California Department of Water Resources, California Department of Fish and Game, Yolo Basin Foundation, Northwest Hydraulic Consultants, Gus Yates, Peter Kiel, and Jones and Stokes.

U.S. Army Corps of Engineers and State of California Reclamation Board. 2002 (December). *Sacramento and San Joaquin River Basins California Comprehensive Study*. Interim report. Sacramento District, Corps of Engineers and The Reclamation Board, Sacramento, CA.

U.S. Department of Interior, Bureau of Reclamation. 2006. General description of the Sacramento Canals Unit of the Central Valley Project—Sacramento River Division. Available: <http://www.usbr.gov/dataweb/html/sacramento.html>. Accessed on February 27, 2006.

U.S. Environmental Protection Agency. 2003. 2002 Clean Water Act Section 303(d) List of Water Quality Limited Segments. Approved July 2003.

———. 2005. USEPA List of Drinking Water Contaminants and MCLs. Available online at URL: <http://www.epa.gov/safewater/mcl.html>. Updated February 4, 2005. Accessed on February 7, 2005.

U.S. Fish and Wildlife Service. 1993. *Reconnaissance Planning Report – Fish and Wildlife Resource Management Options for Lower Putah Creek, California. Report to Congress. Including Appendix A (maps) – Land Use and Habitat Cover Types of the Lower Putah Creek Planning Area.* Sacramento Field Office, Sacramento, California.

U.S. Fish and Wildlife Service. 2004. *Biological Opinion Issued for Delta Smelt on the Revised CVP/SWP Operating Plan.* Prepared for the Regional Environmental Officer, Bureau of Reclamation, Mid-Pacific Regional Office, Sacramento, CA. Prepared by Acting Field Supervisor, U.S. Fish and Wildlife Office, Sacramento, CA.

Wagner, D. L., C. W. Jennings, T. L. Bedrossian, and E. J. Bortugno. 1987. *Geologic Map of the Sacramento Quadrangle.* California Division of Mines and Geology, Regional Geologic Map Series, Map No. 1A.

Wiener, J., Gilmour, C., and Krabbenhoft, D. 2003. *Mercury Strategy for the Bay-Delta Ecosystem: A Unifying Framework for Science, Adaptive Management, and Ecological Restoration*. Final Report to the California Bay-Delta Authority. Sacramento, CA.

Witham, C. 2002. *Vegetation Survey of the Tule Ranch, Yolo Bypass Wildlife Area*.

Work, J. 1945. *Fur Brigade to the Bonaventura: John Works California Expedition, 1832–1833, for the Hudson's Bay Company.* A.B. Maloney (ed.). California Historical Society, San Francisco, CA.

Wright, S. A., D. H. Schoellhamer. 2004. Trends in the Sediment Yield of the Sacramento River, California, 1957–2001. San Francisco Estuary & Watershed Science.

Yolo Audubon Society Checklist Committee. 2004. *Checklist of the Birds of Yolo County, California*. Yolo Audubon Society, Davis, CA.

Yolo Basin Foundation. 2001 (August). A Framework for the Future: Yolo Bypass Management Strategy. Davis, CA. Prepared by Jones & Stokes (J&S 99079). Sacramento, CA.

Yolo Basin Foundation Website. Site accessed by Petra Unger, Senior Botanist, EDAW on March13, Available: http://www/yolobasin.org.

Yolo Basin Foundation and California Department of Fish and Game. 2007. *Yolo Wildlife Area Program History and Overview.* Prepared by Yolo Basin Foundation and California Department of Fish and Game. Davis, CA.

Yolo County Habitat Conservation Plan/Natural Communities Conservation Plan Joint Powers Agency. 2005.

Yolo County HCP/NCCP JPA. *See* Yolo County Habitat Conservation Plan/Natural Communities Conservation Plan Joint Powers Agency.

Yolo County Planning Department. 2005. *Background Report for the Yolo County General Plan Update.* Prepared by Jones & Stokes, Cotton Bridges Associates, Inc., Fehr & Peers Associates, Inc., House Agricultural Consultants, and Applied Development Economics.

Yolo County Water Resources Association. 2004 (August). *Draft Integrated Regional Water Management Plan.* Volume 1. Woodland, CA.

Yolo County. 1983. *Yolo County General Plan.* Prepared by the Yolo County Community Development Agency. Davis, CA.

Yoshiyama, R. M., E. R. Gerstung, F. W. Fisher, and P. B. Moyle. 2000. Chinook salmon in the California Central Valley: an assessment. *Fisheries* 25(2):6–20.

CHAPTER 4, "COMPATIBLE RESOURCE MANAGEMENT AND PUBLIC USE"

Kirkland, M., R. Beckwith, T. Greene, and Z. Matica. 2005. *Aquatic Restoration Planning in the Yolo Bypass Floodplain*. Poster presentation at the Seventh Biennial State of the San Francisco Estuary Conference. Oakland, CA.

Moyle, P. B. 2002 (December 9). Letter providing scientific justification of Accord flow regime, to Ms. Diane Windham, Recovery Coordinator, Central Valley Area, National Marine Fisheries Service, Sacramento, CA.

Page, G. W., W. D. Shuford, J. E. Kjelmyr, and L. F. Stenzel. 1992. *Shorebird Numbers in Wetlands of the Pacific Flyway: A Summary of Counts from April 1988 to January 1992.* Point Reyes Bird Observatory. Stinson Beach, CA.

Sacramento County Superior Court. 2000. *Settlement Agreement and Stipulation Among Solano County Water Agency Solano Irrigation District, Maine Prairie Water District, Cities of Vacaville, Fairfield, Vallejo, and Suisun City, and Putah Creek Council, City of Davis, and the Regents of the University of California.*

Sommer, T., R. Baxter, and B. Herbold. 1997. The resilience of splittail in the Sacramento–San Joaquin Estuary. *Transactions of the American Fisheries Society* 126: 961–976.

Sommer, T. R., W. C. Harrell, M. L. Nobriga, R. Brown, P. B. Moyle, W. J. Kimmerer, and L. Schemel. 2001a. California's Yolo Bypass: Evidence that flood control can be compatible with fisheries, wetlands, wildlife, and agriculture. *Fisheries* 26(8):6–16.

Sommer, T. R., M. L. Nobriga, W. C. Harrell, W. Batham and W. J. Kimmerer. 2001b. Floodplain rearing of juvenile Chinook salmon: evidence of enhanced growth and survival. *Canadian Journal of Fisheries and Aquatic Sciences* 58(2):325–333.

Sommer, T., L. Conrad, G. O'Leary, F. Feyrer, and W. Harrell. 2002. Spawning and rearing of splittail in a model floodplain wetland. *Transactions of the American Fisheries Society* 131:966–974.

Schemel, L. E., S. W. Hagar, and D. Childers. 1996. The supply and carbon content of suspended sediment from the Sacramento River to San Francisco Bay. Pages 237–260 in J. T. Hollibaugh (ed.), *San Francisco Bay:*

The Ecosystem. Pacific Division of the American Association for the Advancement of Science. San Francisco, CA.

U.S. Army Corps of Engineers. 2003. *Supplement to the Standard Operation and Maintenance Manual, Sacramento River Flood Control Project (as revised 1995) for the Yolo Basin Wetlands, Project Modifications Works, Yolo County, CA.*

———. 2006. *Yolo Bypass RMA-2 2-D Hydraulic Model*. Sacramento, CA.

U.S. Army Corps of Engineers and CALFED Bay-Delta Program. 2002 (December). *Habitat Improvement for the Native Fish in the Yolo Bypass.* Prepared by Natural Heritage Institute, California Department of Water Resources, California Department of Fish and Game, Yolo Basin Foundation, Northwest Hydraulic Consultants, Gus Yates, and Peter Kiel.

Yolo Basin Foundation. 2001 (August). *A Framework for the Future: Yolo Bypass Management Strategy*. Davis, CA. Prepared by Jones & Stokes (J&S 99079). Sacramento, CA.

Yolo Basin Foundation and California Department of Fish and Game. 2007. *Yolo Wildlife Area Program History and Overview.* Prepared by Yolo Basin Foundation and California Department of Fish and Game. Davis, CA.

CHAPTER 5, “MANAGEMENT GOALS”

CALFED Bay–Delta Program. 2000a (July). Final Programmatic Environmental Impact Statement and Environmental Impact Report. Including portions of the Ecosystem Restoration Program Plan. Including the Multi-Species Conservation Strategy, Technical Appendix. Sacramento, CA.

———. 2000b (August 28). Final Programmatic Environmental Impact Statement and Environmental Impact Report. Programmatic Record of Decision. Sacramento, CA.

California Department of Fish and Game. 2003. *Guide and Annotated Outline for Preparing Land Management Plans.* State of California, The Resources Agency, Department of Fish and Game. Sacramento, CA.

———. 2006. *Guide and Annotated Outline for Preparing Land Management Plans.* State of California, The Resources Agency, Department of Fish and Game. Sacramento, CA.

California State Board of Forestry and California Fish and Game Commission. 1994. *Joint Policy on Pre-, During, and Post-fire Activities and Wildlife Habitat*.

Kwasny, D. C., M. Wolder, and C. R. Isola. 2004. *Central Valley Habitat Joint Venture, Technical Guide to Best Management Practices for Mosquito Control in Managed Wetlands.*

Wildlife Conservation Board. 2001 (August 30). Wildlife Conservation Board meeting minutes. Sacramento, CA.

Form A

Notice of Completion & Environmental Document Transmittal

Mail to: State Clearinghouse, P. O. Box 3044, Sacramento, CA 95812-3044 (916) 445-0613
For Hand Delivery/Street Address: 1400 Tenth Street, Sacramento, CA 95814

SCH # __________

Project Title: Yolo Bypass Wildlife Area Land Management Plan

Lead Agency: California Department of Fish and Game
Contact Person: Dave Feliz, Area Manager
Mailing Address: YBWA Headquaters - 45211 County Rd. 32B
Phone: 530-757-2431
City: Davis
Zip: 95616
County: Yolo

Project Location:

County: Yolo
City/Nearest Community: Davis or W.Sacramento
Total Acres: 16,770
Cross Streets: Chiles Rd.
Zip Code: 95616
Assessor's Parcel No. available upon request
Section: ______
Twp. 8N
Range: 03E
Base: ______
Within 2 Miles: State Hwy #: Hwy 80
Waterways: Yolo Bypass
Airports: None
Railways: UPRR Railroad
Schools: W. Sac or Davis schools and university

Document Type:

CEQA:
☐ NOP
☐ Early Cons
☒ Neg Dec
☐ Mit Neg Dec
☐ Draft EIR
☐ Supplement to EIR (Note prior SCH # below)
☐ Subsequent EIR (Note prior SCH # below)
☐ Other ______

NEPA:
☐ NOI
☐ EA
☐ Draft EIS
☐ FONSI

Other:
☐ Joint Document
☐ Final Document
☐ Other ______

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Local Action Type:

☐ General Plan Update
☐ General Plan Amendment
☐ General Plan Element
☐ Community Plan
☐ Specific Plan
☐ Master Plan
☐ Planned Unit Development
☐ Site Plan
☐ Rezone
☐ Prezone
☐ Use Permit
☐ Land Division (Subdivision, etc.)
☐ Annexation
☐ Redevelopment
☐ Coastal Permit
☒ Other Land Management Plan

Development Type:

☐ Residential: Units ____ Acres ____
☐ Office: Sq.ft. ____ Acres ____ Employees ____
☐ Commercial: Sq.ft. ____ Acres ____ Employees ____
☐ Industrial: Sq.ft. ____ Acres ____ Employees ____
☐ Educational ____
☒ Recreational Wildlife Area
☐ Water Facilities: Type ____ MGD ____
☐ Transportation: Type ____
☐ Mining: Mineral ____
☐ Power: Type ____ MW ____
☐ Waste Treatment: Type ____ MGD ____
☐ Hazardous Waste: Type ____
☐ Other: ____

Project Issues Discussed in Document:

☒ Aesthetic/Visual
☒ Agricultural Land
☒ Air Quality
☒ Archeological/Historical
☒ Biological Resources
☐ Coastal Zone
☐ Drainage/Absorption
☐ Economic/Jobs
☐ Fiscal
☒ Flood Plain/Flooding
☐ Forest Land/Fire Hazard
☒ Geologic/Seismic
☒ Minerals
☒ Noise
☐ Population/Housing Balance
☒ Public Services/Facilities
☒ Recreation/Parks
☐ Schools/Universities
☒ Septic Systems
☒ Sewer Capacity
☒ Soil Erosion/Compaction/Grading
☒ Solid Waste
☒ Toxic/Hazardous
☒ Traffic/Circulation
☒ Vegetation
☒ Water Quality
☒ Water Supply/Groundwater
☒ Wetland/Riparian
☒ Growth Inducement
☒ Land Use
☒ Cumulative Effects
☐ Other ____

Present Land Use/Zoning/General Plan Designation:

Project Description: *(please use a separate page if necessary)*

The project is the Land Management Plan (LMP) for the Yolo Bypass Wildlife Area (Wildlife Area). The purpose of the Wildlife Area is to protect and enhance habitat for wildlife species, and to provide the public with compatible, wildlife-related recreational uses. This LMP provides a description of the Wildlife Area and its environment which provides habitat for special-status species, game species, and other native and nonnative species. It also includes an evaluation of public uses that are compatible with the purpose of the Wildlife Area. This LMP is a general policy guide to the management of the Wildlife Area. It does not specifically authorize or make a precommitment to any substantive physical changes to the Wildlife Area.

Note: The State Clearinghouse will assign identification numbers for all new projects. If a SCH number already exists for a project (e.g. Notice of Preparation or previous draft document) please fill in.

September 2005

Reviewing Agencies Checklist

continued

Lead Agencies may recommend State Clearinghouse distribution by marking agencies below with and "X". If you have already sent your document to the agency please denote that with an "S".

X Air Resources Board
X Boating & Waterways, Department of
_____ California Highway Patrol
_____ Caltrans District #________
_____ Caltrans Division of Aeronautics
_____ Caltrans Planning
_____ Coachella Valley Mountains Conservancy
_____ Coastal Commission
_____ Colorado River Board Commission
X Conservation, Department of
_____ Corrections, Department of
X Delta Protection Commission
X Education, Department of
_____ Office of Public School Construction
_____ Energy Commission
_____ Fish & Game Region # _______
X Food & Agriculture, Department of
_____ Forestry & Fire Protection
_____ General Services, Department of
_____ Health Services, Department of
_____ Housing & Community Development
_____ Integrated Waste Management Board
X Native American Heritage Commission

_____ Office of Emergency Services
_____ Office of Historic Preservation
X Parks & Recreation
X Pesticide Regulation, Department of
_____ Public Utilities Commission
X Reclamation Board
X Regional WQCB # 5
X Resources Agency
_____ S.F. Bay Conservation & Development Commission
_____ San Gabriel & Lower Los Angeles Rivers & Mountains Conservancy
_____ San Joaquin River Conservancy
_____ Santa Monica Mountains Conservancy
_____ State Lands Commission
_____ SWRCB: Clean Water Grants
X SWRCB: Water Quality
_____ SWRCB: Water Rights
_____ Tahoe Regional Planning Agency
_____ Toxic Substances Control, Department of
X Water Resources, Department of

X Other Yolo County Board of Supervisors
X Other Sacramento County Board of Supervisors

Local Public Review Period (to be filled in by lead agency)

Starting Date ____________________

Ending Date ____________________

Lead Agency (Complete if applicable):

Consulting Firm: EDAW, Inc for CA Dept. Fish and Game
Address: 2022 J Street
City/State/Zip: Sacramento, CA 95814
Contact: Chris Fitzer
Phone: (916) 414-5800

Applicant: California Department of Fish and Game
Address: YBWA Headquaters - 45211 County Rd. 32B
City/State/Zip: Davis, CA 95616
Phone: (530) 530-757-2431

Signature of Lead Agency Representative ____________________ Date 7/20/07

Authority cited: Section 21083 and 21087, Public Resources Code. Reference: Section 21161, Public Resources Code.

Notice of Determination

Appendix D

To:

☒ Office of Planning and Research

For U.S. Mail:
P.O. Box 3044
Sacramento, CA 95812-3044

Street Address:
1400 Tenth St.
Sacramento, CA 95814

☒ County Clerk
County of: Yolo
Address: Yolo County Administration Building
625 Court Street, Room B-05 Woodland CA 95776

From:

Public Agency: CA Department of Fish and Game
Address: Bay Delta Region, (Region 3) 7329 Silverado Trail, Napa
CA 94558
Contact: Mr. Dave Feliz
Phone: 530 - 757-2431

Lead Agency (if different from above):

Address:

Contact:
Phone:

SUBJECT: Filing of Notice of Determination in compliance with Section 21108 or 21152 of the Public Resources Code.

State Clearinghouse Number (if submitted to State Clearinghouse): 2007072099

Project Title: Yolo Bypass Wildlife Area Final Land Management Plan (LMP)

Project Location (include county): City of Davis and West Sacramento, approximately 16,770 acres within the Yolo Bypass in Yolo County, California.

Project Description:

This LMP proposes continuation of an ecosystem-based approach to management of the diverse mosaic of natural communities. The purpose of the Wildlife Area is to protect and enhance habitat for wildlife species, and to provide the public with compatible, wildlife-related recreational uses. The Wildlife Area provides habitat for special-status species, game species, and other native and nonnative species.

This is to advise that the California Department of Fish and Game has approved the above described project on
☒ Lead Agency or ☐ Responsible Agency

________ and has made the following determinations regarding the above described project:
(Date)

1. The project [☐ will ☒ will not] have a significant effect on the environment.
2. ☐ An Environmental Impact Report was prepared for this project pursuant to the provisions of CEQA.
   ☒ A Negative Declaration was prepared for this project pursuant to the provisions of CEQA.
3. Mitigation measures [☐ were ☒ were not] made a condition of the approval of the project.
4. A mitigation reporting or monitoring plan [☐ was ☒ was not] adopted for this project.
5. A statement of Overriding Considerations [☐ was ☒ was not] adopted for this project.
6. Findings [☐ were ☒ were not] made pursuant to the provisions of CEQA.

This is to certify that the final EIR with comments and responses and record of project approval, or the negative Declaration, is available to the General Public at: California Department of Fish and Game Bay-Delta Region Headquarters 7329 Silverado Trail Napa, CA 94558

Signature (Public Agency) ________ Title Deputy Director

Date 6-3-08

Date Received for filing at OPR ________

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Authority cited: Sections 21083, Public Resources Code.
Reference Section 21000-21174, Public Resources Code.

Revised 2005

Exhibit N

Yolo Basin Foundation – Discover the Flyway 2016-17 School Statistics

Category	Details	Numbers 15-16 / 16-17
		153 / 181
	Schools	57 / 58
	Districts includes "private"	19 / 17
	Counties	5 / 5
Field Trips	Teaching Days	129 / 138
	Volunteer Hours	3073 /3049
Participants	Students	3715 / 3656
	% Title 1	35% / 44%
	Teachers	150 / 172
	Docents	57 / 51
	Interns (UC Davis)	3 / 1
Transportation Grants	# of busses	45 / 53
	# of students	1344 / 1474

Exhibit O

Habitat and resource use by waterfowl in the northern hemisphere in autumn and winter

J. BRIAN DAVIS[1]*, MATTHIEU GUILLEMAIN[2], RICHARD M. KAMINSKI[1], CELINE ARZEL[3], JOHN M. EADIE[4] & EILEEN C. REES[5]

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[3]Section of Ecology, University of Turku, 20014 Turku, Finland.
[4]Department of Wildlife, Fish and Conservation Biology, University of California,
One Shields Avenue, Davis, California 95616, USA.
[5]Wildfowl & Wetlands Trust, Martin Mere, Burscough, near Ormskirk, Lancashire L40 0TA, UK.
*Correspondence author. E-mail: bdavis@cfr.msstate.edu

Abstract

A particular aim of avian ecologists, especially those studying waterfowl *Anatidae*, in the 20th and early 21st centuries has been to elucidate how organisms use habitats and intrinsic resources to survive, reproduce and ultimately affect fitness. For much of the 20th century, research was mainly on studying species during the breeding season; however, by the 1970s, the focus had changed to understanding migratory waterfowl throughout their annual cycle and range in Europe and North America. Autumn and winter are considered the non-breeding seasons, but habitat and resource use through these seasons is crucial for completing spring migration and subsequent breeding. Here we review the literature on autumnal and winter habitat use by Nearctic and Palearctic waterfowl to determine characteristics of important landscapes and habitats for the birds during autumn migration and in winter. Selection of habitats and resources is discussed (when literature permits) in relation to Johnson's (1980) model of hierarchical habitat selection. Habitat use by selected species or groups of waterfowl is also reviewed, and important areas for future research into habitat ecology are identified. We suggest that the greatest lack of understanding of waterfowl habitat selection is an ongoing inability to determine what habitats and intrinsic resources, at multiple scales, are truly available to birds, an essential metric in quantifying "selection" accurately. Other significant challenges that impede gaining knowledge of waterfowl ecology in the northern hemisphere are also described. Nonetheless, continued technological improvements and engagement of diverse interdisciplinary professional expertise will further refine understanding of waterfowl ecology and conservation at continental scales.

Key words: autumn, habitat use, migration, selection, waterfowl, winter.

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Understanding how wildlife and especially birds use habitats and resources to survive and reproduce (*i.e.* promote fitness; *sensu* Kaminski & Elmberg 2014) has long been the subject of ecological research (Darwin 1859; Lack 1944; Morrison *et al.* 1992). Studies of waterfowl habitat use and selection are well represented within the substantial avian literature (Block & Brennan 1993; Kaminski & Elmberg 2014). David Lack's (1966) early reference to habitat selection remains valid today, and visionaries such as Lack and also Fretwell (1972) further hypothesised that non-breeding habitats and resources may be important limiting factors for birds of the northern hemisphere, especially migratory species such as waterfowl. Conditions at non-breeding habitats (*e.g.* winter wetlands) correlate with waterfowl recruitment (Heitmeyer & Fredrickson 1981; Nichols *et al.* 1983; Kaminski & Gluesing 1987; Raveling & Heitmeyer 1989; Guillemain *et al.* 2008). However, understanding habitat use and selection by seasonally mobile waterfowl remains challenging, because technology, logistics, economics and other constraints impede monitoring and assessment of resource availability, exploitation and biological outcomes for individuals and populations, from local to flyway scales and cross-seasonally (Elmberg *et al.* 2014; Kaminski & Elmberg 2014; Sedinger & Alisauskas 2014).

The number of waterfowl species and different populations, and their abundance and geographic distribution in the Holarctic, makes waterfowl dominant fauna of aquatic and terrestrial systems in the northern hemisphere (Raveling 2004). Many waterfowl species are largely tied to freshwater systems but several use agricultural, estuarine and marine environments (Bellrose 1980; Baldassarre 2014). Some waterfowl habitats are relatively stable and seasonally predictable relative to hydrology (*e.g.* estuarine and lacustrine wetlands; Cowardin *et al.* 1979), whereas other habitats provide food and other resources temporarily but are characteristically dynamic, such as harvested agricultural lands, riverine and palustrine wetlands (Tourenq *et al.* 2001; Fredrickson 2005; Baldassarre & Bolen 2006; Mitsch & Gosselink 2007; O'Neal *et al.* 2010).

Here, classic and contemporary literature that revealed habitat and associated resource use by Holarctic waterfowl during autumn and winter is reviewed, with emphasis on the latter season of the annual cycle. The review does not provide an exhaustive summary of habitat and resource use by each species or group of waterfowl, but gives an overview focusing on habitat use by non-breeding waterfowl from macro- to finer spatial scales, when available information permitted such coverage (*sensu* Johnson 1980; Kaminski & Elmberg 2014). Space limitations required us to review a selected group of waterfowl species and tribes, but planning is underway to address non-breeding seasonal ecology of lesser known taxa (*e.g. Cairini* sp., *Dendrocygnini* sp. and *Anas fulvigula*) and better known or more widely distributed Nearctic species in a future publication (*e.g. A. americana, crecca, clypeata, strepera, rubripes* and *Branta canadensis*). We begin with a conceptual overview of autumn migration applicable to Nearctic and Palearctic waterfowl, followed by a review of selected eco-regions important to non-breeding waterfowl in the Holarctic and the aforementioned review of selected species or groups of ducks, geese and swans. Finally, currently perceived challenges in studying habitat selection by non-breeding waterfowl are conveyed to stimulate further research and conservation of these birds and their habitats in the northern hemisphere and worldwide.

Hierarchical habitat use and selection

Kaminski & Elmberg's (2014) conceptual review of hierarchical habitat selection (*sensu* Johnson 1980), indicated that habitat use and selection by migratory birds, such as most waterfowl, can be envisioned as a multi-stage, spatio-temporal process from macro- to micro-scales throughout the birds' annual cycle and range. Migratory waterfowl seemingly make 1st order selection of geographic regions, such as those important to and used by the birds during breeding and non-breeding seasons (Johnson 1980; Baldassarre & Bolen 2006). Within 1st order occupied regions, waterfowl make 2nd order selections of wetland systems (Cowardin *et al.* 1979) and possibly associated landscapes for some species adapted to terrestrial habitats (*e.g.* arable lands). Next, waterfowl make 3rd order selections of local, site-specific wetlands or other locations in their seasonal home range, and finally 4th order selections of microhabitats where individuals may roost, forage or engage in other activities to acquire food or other resources, including mates (Wiens 1973; Johnson 1980; Kaminski & Weller 1992; Baldassarre & Bolen 2006). A reversal of this process from micro- to macro-habitats also can be envisioned, as birds depart micro-habitats to disperse or migrate to different regions.

Autumn migration

Avian migration involves complex physiological, behavioural, genetic and ecological influences at individual and flock levels, which can influence population dynamics and demography (Dingle & Drake 2007). Numerous publications focus on avian migration (*e.g.* Dingle 1996; Dingle & Drake 2007; Newton 2007; Stafford *et al.* 2014), but a disproportionate number address passerines, while relatively few consider waterbirds. This reality is surprising given the well-known migratory nature of most Holarctic waterfowl (Arzel *et al.* 2006).

Migration involves large-scale movements from breeding to non-breeding grounds and vernal returns to breeding grounds (Salewski & Bruderer 2007; Zink 2011). Autumnal migration may be considered endogenously and exogenously influenced seasonal movements of birds between breeding and non-breeding areas (Alerstam & Lindström 1990; Dingle 1996; Salewski & Bruderer 2007). A perplexing aspect of autumn migration in waterfowl is that timing of departure in birds is especially complicated (O'Neal *et al.* 2010; Krementz *et al.* 2012). Long-migrant passerines typically exhibit a time-minimisation strategy (Dänhardt & Lindström 2001; O'Neal *et al.* 2010), and although geese and swans refuel at staging sites for shorter periods in autumn than in spring (Madsen 1980; Luigujõe *et al.* 1996; Beekman *et al.* 2002), some ducks, such as larger-bodied species like Mallard *Anas platyrhynchos*, may remain at mid-migration stopovers for weeks or longer despite harsh weather conditions that seemingly would stimulate migration (Bellrose & Crompton 1970; O'Neal *et al.* 2010; Schummer *et al.* 2010; Krementz *et al.* 2012; Dalby 2013). Moreover, autumn migration and winter habitat use are further complicated by habitat availability and quality and human-related disturbance (*e.g.* Väänänen 2001; Roshier *et al.* 2006; Legagneux *et al.* 2009; O'Neal *et al.* 2010; St. James *et al.* 2013).

Life histories of waterfowl vary considerably among species and confound simple explanations of migration patterns. For instance, although body size influences migration and habitat use (Raveling 2004), American Black Duck *Anas rubripes* (1,100 g; Zammuto 1986; Baldassarre 2014) overlaps in time and space with American Green-winged Teal *A. crecca carolinensis* (318 g; Zammuto 1986), the smallest dabbling duck species, during migration and winter (Bellrose 1980, Baldassarre & Bolen 2006). Conversely, Blue-winged Teal *A. discors* (363 g; Zammuto 1986), although ~12% heavier than Green-winged Teal, winter at more southerly latitudes (≤ 30°N; Thompson & Baldassarre 1990). Clearly, waterfowl migration patterns do not strictly follow ecological generalisations such as Bergmann's Rule (Bergmann 1847).

Many Palearctic waterfowl converge from Fenno-Scandian and Russian breeding grounds toward the Baltic Sea, where they use various habitats as staging sites before gradually moving south during winter. Some birds such as Eurasian Teal *A. crecca crecca* move by successive small flights in early autumn, whilst Mallard lag behind and move later in less numerous but longer flights (Dalby 2013). Others, such as Northern Pintail *A. acuta*, may be nomadic and seek newly flooded but ephemeral habitats in autumn (Bellrose 1980), whereas Mallard may have protracted migrations (Bellrose 1980; Krementz *et al.* 2012).

Movements, site fidelity and turnover rates of waterfowl during autumn-winter are likely to reveal patterns of habitat suitability and trade-offs made by waterfowl during these periods of the annual cycle (Rodway 2007). Winter site fidelity is known to be strong in geese and swans (Owen 1980) but of lesser importance in ducks, which exhibit greater spatio-temporal plasticity in habitat use (Mulhern *et al.* 1985; Robertson & Cooke 1999). Moreover, interspecific comparisons of winter philopatry are confounded by vast differences in the size of regions investigated (Robertson & Cooke 1999). In Europe, studies of individually-marked Eurasian Teal highlighted significant wintering site fidelity among and within winters (Guillemain *et al.* 2009; Guillemain *et al.* 2010a), suggesting that birds were able to evaluate site quality and adapt their use of traditional wintering areas, perhaps resulting in increased individual fitness. Of course, such traditions may be jeopardised if abrupt habitat changes occur. Indeed, the ecology of waterfowl migration in the northern hemisphere remains a frontier for future scientific investigation (Arzel *et al.* 2006).

Selected important Holarctic regions for non-breeding waterfowl

Eastern United States

The eastern U.S. historically has been an important region for migrating and wintering waterfowl, particularly lacustrine and estuarine coastal wetlands and deepwater habitats (Cowardin *et al.* 1979; Bellrose 1980). The region of the Atlantic Coast Joint Venture (ACJV) encompasses 17 states in the Atlantic Flyway and is the most densely human-populated area in the conterminous U.S., wherein about 35% of the population resides (ACJV 2009).

Landscape diversity in this region includes ~22% agricultural land and 25% wetlands, which together support ~37 native species of waterfowl (ACJV 2009). Considering 2nd order habitat selection within this region, estuarine systems of coastal Maine are important to wintering American Black Duck, Common Eider *Somateria mollissima* and scoters *Melanitta* sp. that use sheltered ice-free areas for foraging and loafing (ACJV 2005), while fringes of saltmarshes and mudflats are important to Mallard and other dabbling ducks (Jorde *et al.* 1984). Barrier beaches, back-barrier coastal lagoons and salt marshes of Long Island and New Jersey provide additional important winter habitats for American Black Duck and Brent Geese *Branta bernicla* (ACJV 2005; Plattner *et al.* 2010). Farther south exists the Chesapeake Bay, the largest estuary in the conterminous U.S. with a watershed that drains 165,760 km^2, along with North Carolina Sounds, natural and artificial lakes and reservoirs, flooded bottomland hardwoods, Carolina bays and estuarine and salt marshes that provide habitat for a diversity of ducks, geese and swans (Hindman & Stotts 1989).

Additionally, South Carolina and Georgia provide habitat for wintering dabbling, diving and sea ducks (Gordon *et al.* 1989; ACJV 2005). South Carolina alone winters ~30% of all dabbling ducks in the Atlantic Flyway including Green-winged Teal, Northern Shoveler *Anas clypeata*, Mallard, American Wigeon *A. americana* and Northern Pintail (Gordon *et al.* 1989). In Florida, the St. John's and Indian Rivers basins provide important waterfowl habitat, supporting nearly 400,000 ducks during winter (ACJV 2005). Freshwater lakes, such as Lake Okeechobee, also provide important wintering habitats for many waterfowl, including Lesser Scaup *Aythta affinis*, Ring-necked Duck *A. collaris*, American Wigeon, and Blue-winged Teal (Johnson & Montalbano 1989).

Mississippi Alluvial Valley

Largely forested prior to settlement by Europeans in the 19th century, flood control for agriculture and human inhabitation influenced a nearly 80% loss of lowland forests in the Mississippi Alluvial Valley (MAV) by the late 20th century, with only highly fragmented tracts remaining today (MacDonald *et al.* 1979; Klimas *et al.* 2009). The MAV contains flooded croplands, wetlands, deep water habitats and aquaculture ponds that are important to migrating and wintering ducks and geese (Cowardin *et al.* 1979; Christopher *et al.* 1988; Reinecke *et al.* 1989; Stafford *et al.* 2006; Kross *et al.* 2008; Feaga 2013). Swans (*e.g.* Trumpeter Swans *Cygnus buccinator*) are rarely sighted in winter in the MAV (R.M. Kaminski, pers. obs.; MAV Christmas Bird Counts unpubl. data).

Within the flooded agricultural landscape (including the aquaculture ponds), migrating and wintering waterfowl use 2nd order lacustrine (*e.g.* oxbow and watershed lakes, reservoirs), palustrine (*e.g.* forested and moist-soil wetlands) and riverine systems in the MAV (*e.g.* Mississippi River and tributaries; Cowardin *et al.* 1979; Mitsch & Gosselink 2007). Considering 3rd order habitat use of agricultural lands and wetlands within 2nd order systems, Reinecke *et al.* (1992) reported that over half of the Mallard observed during aerial surveys across most of the MAV used flooded rice and soybean fields during winters 1987–1990. Subsequently, during the early 2000s, Pearse *et al.* (2012) reported that greatest densities of Mallard in the Mississippi portion of the MAV during winter were observed in habitat complexes composed of 50% flooded cropland, 20% hardwood or scrub-shrub wetlands, 20% moist-soil and other emergent wetlands and 10% permanent water bodies (*e.g.* rivers, lakes, ponds). Greatest densities of other dabbling duck species were also associated with a similar habitat composition (Pearse *et al.* 2012).

Waterfowl associations with flooded cropland might be expected given that the MAV is now largely an agricultural landscape. Despite losses of natural wetlands in the MAV and continentally (Mitsch & Gosselink 2007), migrating and wintering waterfowl have adapted to flooded agricultural lands and make significant use of them in the MAV to meet nutritional and other physiological needs (Delnicki & Reinecke 1986; Reinecke *et al.* 1989; O'Neal *et al.* 2010). Indeed, ricelands in the MAV are critical for meeting seasonal requirements of waterfowl using this region (Stafford *et al.* 2006). In the late 1970s and early 1980s, Delnicki & Reinecke (1986), studying food use and body weight, estimated that rice represented > 41% of total food intake by Mallard. However, because rice, soybean, and other seed crops are planted and harvested earlier nowadays in the MAV than during the 20th century, deterioration of waste seed occurs because of germination, decomposition and consumption by non-waterfowl species after harvest but before major wintering flocks arrive in the MAV (Stafford *et al.* 2006; Foster *et al.* 2010; Petrie *et al.* 2014). Reduction in waste rice from harvest through late autumn–early winter in the MAV is estimated at 71–99% (Manley *et al.*; Stafford *et al.* 2006). Despite reduced availability of waste rice in harvested fields in the region, flooded rice fields however have structural characteristics similar to natural wetlands (Elphick 2000; Huner *et al.* 2002; Marty 2013). The mid-winter population goal for the Lower Mississippi Valley Joint Venture of the North American Waterfowl Management Plant (LMVJV) is > 7.8 million dabbling ducks, and winter-flooded rice fields provide ~11% of all food energy available to dabbling ducks in flooded habitats in the LMVJV (Petrie *et al.* 2014). Approximately 20% of the 748,668 ha of ricelands is winter-flooded in the LMVJV (Petrie *et al.* 2014). If the LMVJV rice fields were able to produce a second harvested crop intra-seasonally as in Louisiana and Texas (*i.e.* ratoon crop, Marty 2013), the amount of food available to dabbling ducks from the flooded fields in the LMVJV would increase 12-fold (Petrie *et al.* 2014). Development of rice varieties and other crops with ability to ratoon at latitudes within the MAV would increase substantially the abundance of waste grain following harvest and benefit migrating and wintering waterfowl (Wiseman *et al.* 2010; Petrie *et al.* 2014; Marty 2013).

Despite dominant coverage of agricultural land in the MAV, Mallard and other waterfowl use 3rd and 4th order wetland sites in the MAV (Reinecke *et al.* 1989). Reinecke *et al.* (1992) reported that Mallard used forested wetlands (3–11%) and moist-soil wetlands (3–29%) within and among winters. Additionally, Davis & Afton (2010), working in the Louisiana portion of the MAV, reported that radio-marked female Mallard selected forested wetlands and suggested that continued restoration and establishment of these habitats should benefit females. However, they did not report any relationships between Mallard winter survival or other correlates of fitness that might implicate benefits resulting from female use of forested wetlands. Subsequently, Lancaster (2013), working in the Mississippi portion of the MAV, investigated habitat-related survival of radio-marked female Mallard. Greatest rates of winter survival (≥ 75%) were exhibited by females that used habitat complexes composed mostly of forested and emergent wetlands (86% combined) and 12% cropland, which was notable considering that most of the MAV landscape now is cropland (Lancaster 2013; Kaminski & Davis 2014). Thus, although Mallard may be considered habitat generalists, they also use certain habitats disproportionately, affording increased fitness prospects consistent with the concept of habitat suitability (*sensu* Fretwell 1972; Kaminski & Elmberg 2014).

Considering 4th order microhabitats, Mallard and Wood Duck *Aix sponsa* differentially used flooded hardwood bottomlands in the Interior Flatwoods and MAV in Mississippi during winter. Mallard used microhabitats that contained less woody understory cover, whereas Wood Duck were associated with microhabitats of increased understory vegetation (Kaminski *et al.* 1993). Within moist-soil wetlands in the MAV, dabbling ducks of several species foraged in experimental plots with water depths ranging from 3–16 cm (Hagy & Kaminski 2012). Such a range of depths may facilitate forage acquisition by a diversity of species using a common habitat, at least until food depletion occurs (Greer *et al.* 2009; Hagy *et al.* 2014).

In addition to flooded croplands and natural wetlands in the MAV, aquaculture ponds for production of Channel Catfish *Ictalurus punctatus* and bait fish have become important staging and wintering habitats used by dabbling and diving ducks since their construction in the 1970s (Christopher *et al.* 1988; Reinecke *et al.* 1989; Wooten & Werner 2004). Species of waterfowl commonly using catfish ponds include Lesser Scaup *Aythya affinis*, Ruddy Duck *Oxyura jamaicensis* and Northern Shoveler, along with lesser abundances of Mallard, Gadwall *A. strepera*, and introduced resident Giant Canada Geese *Branta canadensis maxima* (Christopher *et al.* 1988; Dubovsky & Kaminski 1992; Vest *et al.* 2006, Feaga 2013). Dubovsky & Kaminski (1992) estimated that 150,000 ducks used catfish ponds in Mississippi, with an average of 100,000 individuals using ponds weekly in the mid-1980s. Wooten & Werner (2004) collected Lesser Scaup from Arkansas baitfish ponds and reported scaup primarily ingested *Chironomidae* larvae, but ~25% of collected birds contained fish biomass or bones.

Because of competition from foreign markets, infrastructural and other costs, catfish aquaculture has declined in the MAV (U.S. Department Agriculture 2010). There were 64,000 ha of ponds in Mississippi, Louisiana and Arkansas in 2001, but only 25,000 ha remained in operation in those states by 2012 (Lehnen & Krementz 2013). Feaga (2013) reported that migrating and wintering waterfowl and other waterbirds occurred in densities on catfish production impoundments (~130 birds/ha) similar to idled impoundments (~120 birds/ha). However, different bird communities existed in production *versus* idled production ponds, the latter now managed to provide emergent vegetation, mudflats and shallow wetland areas < 30 cm during summer–winter wetland birds (Feaga 2013; Kaminski & Davis 2014). Diving and dabbling ducks and American Coot *Fulica americana* were primary users of production aquaculture impoundments (Dubovsky & Kaminski 1992; Feaga 2013), whereas idled impoundments were used by over 40 species of ducks, shorebirds, waders and other waterbirds (Feaga 2013; Kaminski & Davis 2014).

Louisiana-Texas Gulf Coast

The coastal tallgrass prairies of Louisiana and Texas once covered over 1 million ha (Chabreck *et al.* 1989; Hobaugh *et al.* 1989). They have slight topography, relatively impervious soils and thus seasonal wetlands (Smeins *et al.* 1991; Petrie *et al.* 2014). Winter rains and tropical storms in summer–autumn periodically inundate basins and provide habitat for numerous migrating and wintering waterfowl (Petrie *et al.* 2014).

Fresh and intermediate brackish marshes have been among the greatest wetland losses in the coastal prairies; ~100,000 ha of non-farmed freshwater wetlands have been lost in the coastal plains of Texas since the mid-1940s (Moulton *et al.* 1997). Conversion of rice agriculture to cotton and soybean production has further reduced important habitats for waterfowl (Anderson & Ballard 2006). Gulf coastal wetlands are critical to several guilds of wintering waterfowl (Weller 1964; Chabreck *et al.* 1989; Hobaugh *et al.* 1989; Marty 2013), and an estimated 19% of all waterfowl wintering in the U.S. use marshes in the Louisiana Gulf Coast (Michot 1996; Bolduc & Afton 2004). The Texas Mid-Coast once wintered 78% of the Northern Pintail in the Central Flyway (Ballard *et al.* 2004). Contemporary estimates of midwinter population goals for the Gulf Coast JV region include > 5.6 million dabbling ducks (Petrie *et al.* 2014).

Considering 2nd and 3rd order habitat selection, freshwater and intermediate marshes along the Gulf of Mexico are perhaps the most important wetland habitats for waterfowl in the region (Chabreck *et al.* 1989; Batzer & Baldwin 2012). Brackish marshes are the most extensive habitat and considered historical habitats for wintering Snow Geese *Anser caerulescens* (Chabreck *et al.* 1989; Batzer & Baldwin 2012), but salt marsh habitats are generally regarded as less favourable to waterfowl in Gulf coastal systems (Williams III & Chabreck 1986; Batzer & Baldwin 2012). In addition to these, lakes (*e.g.* Grand, White), bays (*e.g.* Atchafalaya, Terrebonne) and off-shore habitats have been important historically for scaup and other diving and sea ducks in the Gulf region (Harmon 1962; Afton & Anderson 2001).

Scaup wintering off-shore in Louisiana have comprised 50–86% of the total wintering population and were much more abundant off-shore than in in-shore habitats in January (Kinney 2004). Kinney (2004) flew transect surveys and determined that only about 15% of scaup were detected in some years by traditional Midwinter Waterfowl Surveys. One hypothesis for scaup wintering farther off-shore is that Surf Clams *Mulinia lateralis* were historically a preferred food for the species (Harmon 1962; Kinney 2004) and recent increases in hypoxic areas in the near-shore waters of the Gulf may be causing scaup to venture farther off-shore for food.

Along the Texas Gulf Coast, the Laguna Madre is a large shallow lagoon that contains ~80% of the seagrass communities along the Texas coast (Ballard *et al.* 2010). The dominant species is Shoal Grass *Halodule wrightii* and ~80% of the continental Redhead *Aythya americana* population winters in the region, primarily because of seagrasses (Division: Angiospermae) and associated habitats (Weller 1964; Mitchell *et al.* 1994; Michot *et al.* 2006; Ballard *et al.* 2010). Several studies have documented the importance of proximate inland freshwater ponds to Redhead and other ducks including Lesser Scaup (Adair *et al.* 1996; Michot *et al.* 2006; Ballard *et al.* 2010). The proximity of coastal ponds to seagrass foraging areas on the Gulf Coast is important, as Redhead were never observed using ponds > 5.7 km from the shoreline or > 8.1 km from the nearest foraging area (Ballard *et al.* 2010). Thus, proximity of freshwater ponds to seagrass beds in the Laguna Madre is an example of a critical synergistic habitat association, particularly in drier winters (Ballard *et al.* 2010).

United States Great Plains

The Playa Lakes Region (PLR) contains 60,000–100,000 playa lakes or shallow wetlands that generally occur at the bottom of large watersheds and are formed by wind and water dissolution processes (Smith 2003; Venne *et al.* 2008). Playa wetlands range in size from < 1 ha to > 300 ha, extend from Wyoming and Nebraska to Texas and New Mexico, and are habitat to a wide diversity of life forms including waterfowl (Playa Lakes Joint Venture 2014). Historic native grassland has largely been replaced with arable crops, and subsequent erosion of topsoil has contributed to sedimentation of ~90% of all playas in the Southern High Plains (SHP; Venne *et al.* 2008). Moreover, ~80,000 playas throughout the Great Plains states are currently incapable of recharging the Ogallala aquifer (Playa Lakes Joint Venture 2014). Historically, one-third of the Central Flyway Northern Pintail population (~300,000 birds) used playa lakes in the SHP, but this population has declined 47% since 1977 (Bellrose 1980; Luo *et al.* 1997; Haukos 2004; Moon *et al.* 2007). Concomitantly, body condition of pintail in the PLR has declined considerably since the mid-1980s (Moon *et al.* 2007).

The SHP is a southern extension of the PLR and is a critical region to waterfowl, once containing 25,000–30,000 wetlands (Smith 2003; Baldassarre & Bolen 2006; Venne *et al.* 2008). Obenberger (1982) studied several species of dabbling ducks from autumn–late winter 1980–1982 and reported that ducks generally had a bimodal migration. Migration phenology of Northern Pintail and Green-winged Teal peaked in November, and autumn abundances were at least double their greatest numbers during vernal peaks. Nearly 30 years later, Baar *et al.* (2008) conducted similar research in the SHP and observed that duck use of playas was much more intermittent, protracted or less intensive compared to previous decades. Baar *et al.* (2008) offered two possible explanations for these patterns. First, abundance of playa wetlands, irrigation ponds and tailwater reservoirs were greatly reduced, and playas have become more rainfall dependent (Smith 2003; Baar *et al.* 2008). Second, playas have been subjected to significant sedimentation, with negative impacts to hydrologic patterns and function (Smith 2003). Moon & Haukos (2006) attributed declining body condition of Northern Pintail to harassment and stress, resulting from increased movements by hunters pursuing waterfowl and Ring-necked Pheasant *Phasianus colchicus* (Baar *et al.* 2008).

Generally, evidence suggests that important waterfowl foods, such as waste agricultural or natural seeds, are becoming depleted in early winter in the SHP (Baldassarre & Bolen 1984; Bolen *et al.* 1989; Smith & Sheeley 1993; Moon & Haukos 2006). As a consequence, exploitation of these environments by dabbling and other ducks may be more limited during late winter and spring (Baar *et al.* 2008) compared with prior decades (Obenberger 1982). Dedicated conservation programmes have been championed and are needed in the SHP (Haukos & Smith 2003; Smith 2003).

Central Valley of California

California always has been one of the most important regions for wintering waterfowl in North America (Gilmer *et al.* 1982; Miller 1986; Heitmeyer *et al.* 1989; Fleskes *et al.* 2005; Miller *et al.* 2010). The state has lost ~95% of its historic wetlands (Central Valley Joint Venture 2006) but continues to support millions of non-breeding waterfowl. Within California, the Central Valley provides critical wetland and agricultural habitat for migrating and wintering waterfowl and was the focus of one of the original Joint Ventures of the North American Waterfowl Management Plan (NAWMP 1986). The Central Valley encompasses ~4.1 million ha, stretching 724 km north to south and 64 km east to west. The valley is dominated by two riverine systems – the Sacramento River and the San Joaquin River, which meet at the Delta then flow into the Pacific Ocean past the Suisun Marsh, one of the largest contiguous brackish marshes in the western United States.

The hydrology of the valley determines the main habitat types and influences seasonal and inter-annual patterns of waterfowl use (Fleskes 2012). However, hydrology has been altered drastically from agriculture and urban growth and caused considerable changes in distribution of waterfowl habitats. Before the 1849 Gold Rush, the valley contained > 1.6 million ha of wetland habitat (Central Valley Joint Venture 2006). Most of these wetlands were seasonal, inundated by riverine flooding in the valley, bordered by expansive riparian and grassland habitats, which may have supported 20–40 million waterfowl during migrations and winter.

Seasonal and permanent wetlands in the Central Valley are distributed in four sub-regions: the southern San Joaquin Valley (including Tulare Basin, which held the now dry Tulare Lake, once the largest freshwater lake west of Mississippi; Fleskes 2012), the northern Sacramento Valley, the Delta and the Suisun Marsh. Historically, many waterfowl wintering in California would migrate first to Tulare Lake, a vast shallow complex of seasonal and permanent marshes. As winter progressed birds moved north, through the San Joaquin Valley, Delta and Suisun Marsh into the Sacramento Valley. Prior to land conversion, ~40% of waterfowl habitat occurred in the San Joaquin Valley (including Tulare Basin), while the remaining 60% occurred in the Sacramento Valley, Delta and Suisun Marsh (Fleskes *et al.* 2005). By approximately 1900, the Tulare lakebeds were effectively drained by diversion of water for agriculture, and the lakebeds now remain dry in all but extremely wet years. Wetlands in the San Joaquin and Sacramento Valleys were also converted to agricultural land, leading to cotton, orchard, vegetable and rice production in the Sacramento Valley. In the Delta, islands were leveed to grow corn, barley and other grain crops, some of which have value to ducks and geese.

Brackish marsh wetlands in the Suisun Marsh historically were significant to wintering waterfowl, but populations of dabbling ducks and geese there have declined. The Suisun Marsh currently provides wintering habitat for > 60,000 waterfowl, of which dabbling ducks are the most numerous (55,000), followed by diving ducks, geese, sea ducks, and swans (Ackerman *et al.* 2014). Following decades of considerable landscape changes, the Central Valley is left with merely 162,000 ha of wetlands nested within a largely agricultural matrix.

Most existing wetland habitat in the valley is managed and comprises seasonal, semi-permanent and permanent wetlands. Seasonal wetlands are flooded in autumn for waterfowl and other waterbirds and drawn down in late winter. Many wetlands are managed as waterfowl hunting clubs or state and federal wildlife areas or refuges. Seasonal wetlands provide critical foraging habitat for non-breeding waterfowl. These wetlands are managed annually using several methods (*e.g.* disking, irrigation and water management) to promote moist-soil plants such as Watergrass *Echinochloa crusgalli*, smartweed *Polygonum* sp. and Swamp Timothy *Crypsis schoenoides* (Heitmeyer *et al.* 1989). Semi-permanent wetlands are flooded from autumn to early July, while permanent wetlands are flooded throughout the year (Central Valley Joint Venture 2006). Semi-permanent and permanent wetlands produce less food, but provide important roosting and brood habitat for locally breeding ducks, mostly Mallard and Gadwall.

The most significant change to waterfowl habitats in the Central Valley over recent decades has been the development of rice agriculture, particularly in the Sacramento Valley. Planted rice acreage has increased from nearly 41,000 ha (1930s) to almost 243,000 ha, and now averages > 202,000 ha (Petrie *et al.* 2014). Waste grain remaining in fields after harvest provides a valuable food source for wintering waterfowl (Eadie *et al.* 2008). Along with the increase of planted rice, there has been a significant change in management of residual rice straw after harvest. Before the 1990s, fire was the primary method for rice straw disposal.

However, with air quality concerns, the Rice Straw Burning Reduction Act of 1991 mandated that burning of straw be reduced and currently less than 10% of all harvested rice fields are currently burned. As an alternative, rice growers turned to post-harvest flooding, accompanied by disking, rolling or chopping of straw. The result was that flooded rice fields provided valuable foraging habitat to a diversity of dabbling ducks and geese. At the peak, > 141,000 ha of harvested rice fields were flooded in autumn, nearly 70% of the planted rice acreage (Central Valley Joint Venture 2006; Petrie *et al.* 2014).

Waterfowl wintering in the Central Valley have responded strongly to these changes at both 2nd and 3rd orders of habitat selection. Timing and distribution of 2nd order selection by waterfowl have been altered considerably with the draining of Tulare Lake and increase of rice agriculture in the northern reaches of the valley. Fleskes *et al.* (2005) reported that the total area of croplands intentionally flooded in winter increased by 157% in the Sacramento Valley and 58% in the Delta, but declined by 23% in the San Joaquin Valley between 1973 and 2000, leaving only 3% of the total winter-flooded agricultural land in the latter region. In response, birds have shifted winter distributions northward. Fleskes *et al.* (2005) conducted extensive surveys and radio-telemetry in 1998–2000 and compared results to data from 1973–1982 (Heitmeyer *et al.* 1989; Miller *et al.* 1993; Miller *et al.* 1995). The recent research indicated that the percentage of dabbling ducks using the Tulare basin and the San Joaquin Valley declined, especially in late winter, while use increased in the Sacramento Valley. Cinnamon Teal *Anas cyanoptera* were an exception and did not shift northward. In contrast to dabbling ducks, the percentage of diving ducks using the San Joaquin and Tulare Basins increased concurrently with a decrease in diving ducks using the Suisun Marsh and Delta. Use of the Suisun Delta and San Joaquin Valley declined for geese, with concomitantly large increases in the Sacramento Valley. Thus, the Central Valley has experienced substantial shifts in the distributions of all waterfowl, reflecting significant changes at the 2nd order level of habitat selection.

Most of these distributional shifts of waterfowl in the Central Valley have been driven by the large-scale changes in habitat availability and 3rd (and possibly 4th) order levels of habitat selection. Currently, dabbling ducks in the Central Valley rely on three major habitat types: 1) flooded harvested rice fields, 2) managed seasonal wetlands, and 3) flooded and unflooded harvested corn fields (Central Valley Joint Venture 2006). Geese in the valley also use unflooded rice fields and uplands. Petrie *et al.* (2014) estimated that winter-flooded rice fields provided 44% of all food energy available to dabbling ducks in flooded habitats in the Central Valley, while flooded and unflooded rice fields provided 49% of all food energy available to dark geese but 73% of all food energy for white geese. These results were corroborated by Fleskes *et al.* (2005); they reported the importance of agricultural habitat (relative to managed wetlands) for Northern Pintail, Mallard and Greater White-fronted Geese *Anser albifrons* was greater than 20–30 years ago, presumably as birds increased their use of flooded rice fields.

In addition to the above patterns, the importance of managed wetlands has increased in the Suisun Marsh. Most waterfowl that winter in Suisun Marsh are dabbling ducks, which primarily use managed wetland habitats provided by duck hunting clubs and state wildlife areas (Ackerman *et al.* 2014). Coates *et al.* (2012) radio-marked and relocated 330 female Northern Pintail in the Suisun Marsh to estimate resource selection during non-breeding months and found strong evidence for selection of managed wetlands. Ackerman *et al.* (2014) reanalysed Northern Pintail telemetry data to examine habitat selection. They compared spatial patterns of habitat use by ducks to availability of habitats at two spatial scales and found that Northern Pintail strongly selected managed wetland habitats at both small and large scales. Further, Northern Pintail avoided tidal marshes, bays, sloughs and some other habitats (Ackerman *et al.* 2014). These results have important implications for Northern Pintail given current efforts to restore large portions of the Suisun Marsh to tidal wetlands. The consequences for dabbling ducks using the marsh have not yet been thoroughly assessed, and loss of managed wetlands in the Suisun Marsh remain a concern for waterfowl managers (Ackerman *et al.* 2014).

Patterns of habitat selection by waterfowl in the Central Valley represent large-scale shifts in the area and type of habitats available; as a consequence, significant changes in 2nd and 3rd order habitat selection have occurred by many species of ducks and geese. Most remaining wetlands are intensively managed to produce seed-producing moist-soil plants. The decline of Northern Pintail has resulted in management of seasonal wetlands toward more densely vegetated marshes favoured by Mallard. This technique has reduced amount of sparse and short vegetation which is likely more representative of seasonal flooded wetlands sought historically by Northern Pintail. The greatest recent change in the Central Valley has been the considerable increase in rice acreage, especially in the Sacramento Valley. This change has led to a northern shift from the San Joaquin Valley by most species (2nd order habitat selection) and a substantial increase in use of flooded and unflooded rice fields as foraging habitat (3rd order). Indeed, rice landscapes have become so important to wintering waterfowl that decline or loss of this agriculture would seem catastrophic to Northern Pintail and likely other wetland-dependent birds (Petrie *et al.* 2014). Nearly half of all duck-use-days in the U.S. portion of the Pacific Flyway occur in the Central Valley, and loss of rice would have continental impacts on Northern Pintail and other waterfowl using ricelands (Petrie *et al.* 2014). However, the future of flooded rice as winter habitat for waterfowl is in question with recent record droughts, water requirements for in-stream flows to meet needs of several species of federally endangered fish, and ever-growing urban demands. Petrie *et al.* (2014) estimated that > 75,000 ha of additional managed moist-soil wetlands would be required to replace the waterfowl food value provided by existing ricelands in the Central Valley. While rice agriculture is unlikely to disappear from the valley, the total acreage and the way it is managed post-harvest are uncertain.

Understanding the shifting mosaic of available winter habitats and bird responses will be an ongoing research need to guide conservation initiatives.

Pacific Coast

San Francisco Bay is the largest estuary along the west coast of the continental U.S. and historically important migration and wintering grounds for sea and other diving ducks (Conomos *et al.* 1985; Hothem *et al.* 1998). More than 85% of the tidal wetlands of the Bay have been lost to agriculture and development in the 20th Century (Nichols *et al.* 1986; Hothem *et al.* 1998). Anthropogenic changes and impacts have affected numerous waterfowl and other birds, including Canvasback *Aythya valisineria* whose overwintering numbers dropped by 50% during the 1970s–1990s (Hothem *et al.* 1998). Despite habitat modifications, San Francisco Bay may harbour nearly 50% of the total population of several diving duck species during winter (Accurso 1992; Brand *et al.* 2014). Given the history of mining in California, the position of the San Francisco Bay makes it susceptible to accumulating contaminants such as mercury, cadmium and selenium (Heinz *et al.* 1989; Hothem *et al.* 1998).

Farther up the northern California coast, the coastal lowlands are important migration and wintering areas for > 20 species of waterfowl, with populations ranging from 25,000–100,000 birds per day from autumn through spring (Pacific Coast Joint Venture 2004). Humboldt Bay is particularly important for brant because of its extensive Common Eelgrass *Zostera marina* beds. An estimated > 40% of the Pacific Flyway population of brant use Humboldt Bay as a migratory stopover from late February through to mid-April.

Inter-mountain West and Great Salt Lake

The Inter-mountain West region comprises two regions of special importance to non-breeding waterfowl: Southern Oregon Northeastern California (SONEC), including the Klamath Basin, and the Great Salt Lake. The SONEC region covers approximately 10% of the Great Basin, although waterfowl habitat comprises a much lower percentage (Petrie *et al.* 2013). Historically, peak waterfowl abundance occurred during autumn and spring migration. Migrating waterfowl in autumn likely would have experienced dry conditions and were probably restricted to a few large complexes of permanent or semi-permanent wetlands (Petrie *et al.* 2013). Few birds remained over winter because of the below-freezing winter temperatures. Today, nearly all autumn and winter waterfowl habitat in SONEC occurs on public land. Two refuges are of particular significance: Lower Klamath National Wildlife Refuge (Lower Klamath) and the Tule Lake National Wildlife Refuge (Tule Lake). Although these refuges account for only a fraction of the region, they support a significant portion of the waterfowl that use SONEC in autumn and winter (Kadlec & Smith 1989; Fleskes & Yee 2007). In fact, the Klamath Basin is recognised as a region of continental significance to North American waterfowl populations (NAWMP Plan Committee 2004).

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Management of waterfowl habitats on Lower Klamath and Tule Lake refuges depends on water supplies. Increasing demands for water within the Klamath Basin by farmers, native communities and endangered fish have hindered refuges from obtaining sufficient water for waterfowl. A recent analysis using bioenergetics models (TRUEMET) indicated that food resources at Tule Lake were adequate to meet energy needs of diving ducks and swans, but were insufficient for dabbling ducks and geese. Food for dabblers was exhausted in early autumn, well before traditional peak migration in November (Petrie *et al.* 2013). Thus, dabbling duck numbers at Tule Lake have declined significantly since the 1970s. The SONEC region is also critical during spring migration, especially for Northern Pintail. Over 70% of habitat use by radio-marked Northern Pintail in SONEC (outside of the Lower Klamath) occurred on privately-owned habitats, primarily flood-irrigated agriculture (Fleskes *et al.* 2013).

The Great Salt Lake (GSL) is one of the largest wetland complexes in western U.S. and is recognised internationally for its importance to migratory waterfowl (NAWMP Plan Committee 2004). As many as 3–5 million waterfowl migrate through the GSL annually (Petrie *et al.* 2013). The GSL is surrounded by >190,000 ha of wetlands maintained by fresh water from rivers that flow into the basin. The surrounding marshes are extensive and provide rich diversity of invertebrate and plant food resources (Petrie *et al.* 2013). Waterfowl use of the GSL is greatest during late summer – early autumn and also in spring. Peaks occur in September, with birds arriving from northwestern and mid-continent Canada and Alaska, and some from the Prairie Pothole Region. Banding data indicate that many ducks that migrate through the GSL spend the winter in the Central Valley of California and west coast of Mexico (Petrie *et al.* 2013). Use of GSL by waterfowl is lowest in mid-winter but increases during spring. Dynamic ebbs and flows of water and fluctuating lake salinities are significant in maintaining this productive wetland system (Petrie *et al.* 2013).

The Inter-mountain West Joint Venture estimated 17.4 million waterfowl-use-days of the GSL during winter of which dabbling ducks accounted for 74% (Northern Pintail = 39% of dabbling duck use-days; Green-winged Teal = 23%; Mallard = 21% and Northern Shoveler = 11%), while diving ducks comprised 19% of total waterfowl-use-days during winter, with Common Goldeneye *Bucephala clangula* representing 91% of all diving duck use (Petrie *et al.* 2013). Bioenergetics analyses of food supplies in the GSL needed to support migratory waterfowl suggested that seed resources required by dabbling ducks were depleted during autumn migration by late October (Petrie *et al.* 2013). Yet, there may have been > 1 million dabbling ducks alone in the GSL in October and November. These results suggest that dabbling ducks are obtaining unknown but critical energy supplies from perhaps aquatic invertebrates, submerged aquatic vegetation, tubers, or a combination of these (Petrie *et al.* 2013). Petrie *et al.* (2013) concluded that improved understanding and estimation of the spatiotemporal variability of wetland resources and waterfowl resource selection

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in the GSL system were needed to refine assumptions about the foraging guilds.

Europe

As in North America, substantial changes in land use and management have occurred in Europe since the early 20th century, where landscapes at staging and wintering areas for waterfowl are now a matrix of agricultural land and other habitats greatly transformed by humans (*e.g.* industrial and residential zones) which envelop small protected areas of remaining wetlands (Thomas 1976; Owen *et al.* 1986; Tamisier & Grillas 1994; Guglielmo *et al.* 2002). Autumn-migrating Western Palearctic waterfowl largely concentrate in a flyway corridor along the Baltic and North Sea coasts (*e.g.* Scott & Rose 1996; Söderquist *et al.* 2013; Calenge *et al.* 2010). Here, the global concerns of sea level rise and other loss of habitat associated with climate change are serious concerns for waterbirds in coastal wetland habitats (*e.g.* Clausen & Clausen 2014), which are further threatened by eutrophication (*e.g.* declines in seagrass beds, Clausen *et al.* 2012) and the encroachment of vegetation that is less nutritious for waterfowl (*e.g.* Common Cord-grass *Spartina anglica*; Percival *et al.* 1998). In contrast, climate warming and increased fertilisation of grasslands in northwest Europe may have enhanced terrestrial habitats for geese, where several populations are flourishing, and some are short-stopping or becoming partly non-migratory (*e.g.* Greylag Geese *Anser anser*, Voslamber *et al.* 2010; Barnacle Goose *Branta leucopsis*, Ganter *et al.* 1999). Hunting restrictions also have likely enhanced the abundance and influenced the distribution and timing of migration of swans and some goose populations. Further south along the flyway, wintering waterfowl, especially ducks (*e.g.* Eurasian Wigeon *Anas penelope*), have largely switched from using marine habitats to freshwater wetlands during daylight hours as the latter have increasingly been managed as nature reserves since the 1950s (*e.g.* Owen & Williams 1976; Guillemain *et al.* 2002). Reserves nowadays not only provide safety from hunting and other human disturbance, but habitats are managed specifically for waterfowl. Yet despite active habitat management, there is an increasing awareness that alien species (*e.g.* Red Swamp Crayfish, *Procambarus clarkia* and Water Primrose *Ludwigia* sp. and Swamp Stonecrop *Crassula helmsii*) are a threat to protected U.S. habitats and European wetlands (*e.g.* Dandelot *et al.* 2005; Meineri *et al.* 2014).

Along the Mediterranean coasts, primary wintering habitats of waterfowl are brackish lakes, lagoons and temporary wetlands. Wetlands of the Mediterranean region have been reduced by 80–90% by urban population growth and conversion to agriculture (Toral & Figuerola 2010). Fortunately, some of these are now rice fields which, as in North America, provide valuable resources to wintering waterfowl (*e.g.* Tamisier & Grillas 1994) and help compensate lost wetland habitats (*e.g.* Tourenq *et al.* 2001; Rendón *et al.* 2008). In the Camargue, southern France, portions of remaining natural wetlands are protected and most are on private estates, wherein temporary and seasonal wetlands are flooded beyond natural hydroperiods to attract waterfowl for hunting and observing.

This practice is detrimental to wetland biodiversity in general, but it has greatly promoted hydrophyte beds on which waterfowl forage (Tamisier & Grillas 1994). Such management is mostly beneficial to herbivorous species (*e.g.* Gadwall) but the other dabblers also benefit from seeds spread as bait in these properties (Brochet *et al.* 2012). Hunting management practices could likely be responsible for considerable improvement of wintering body condition of Common Teal (up to 12%) and other dabbling ducks in past decades (Guillemain *et al.* 2010b).

Habitat resources of selected northern hemispheric waterfowl

Dabbling ducks

Mallard

Mallard challenge clear distinctions of autumn migration and subsequent winter habitat distributions because of great seasonal and annual variation in settling by individuals or sub-populations within flyways. The breadth of habitats occupied by Mallard in North America is particularly fascinating. In the Sacramento Valley of California, Mallard use agriculturally dominated and largely treeless environments, where patches of seasonally flooded and emergent wetlands and flooded rice fields mostly occur, notwithstanding the Butte Sink wherein riparian wetlands consisting of willow *Salix* sp., California Sycamore *Platanus recemosa*, Buttonbush *Cephalanthus occidentalis* and other woody and herbaceous species exist (Gilmer *et al.* 1982; Heitmeyer *et al.* 1989; Eadie *et al.* 2008; Elphick *et al.* 2010). In Central U.S., Mallard use Gulf coastal and interior wetlands, cattle ponds, irrigation and flood-control reservoirs, playa lakes, seasonal wetlands, riparian and flooded forest wetlands, rivers and irrigation canals, plus flooded and dry agricultural lands including grain and legume crops within their geographic ranges from the Gulf Coast to southern Canada (Jorde *et al.* 1984; Chabreck *et al.* 1989; Miller *et al.* 2000; Link *et al.* 2011). In the Atlantic Flyway, Mallard use coastal and inland freshwater emergent marshes and managed wetlands developed from 18th century rice fields (Gordon *et al.* 1989, 1998). Perhaps most intriguing is the winter residency of some Mallard along the sandbar flats of the Missouri River in North Dakota, where these birds tolerate frequent inhospitable winter conditions while largely subsisting on Rainbow Smelt *Osmerus mordax* (Olsen & Cox, Jr. 2003; Olsen *et al.* 2011).

The MAV is considered the ancestral wintering grounds of North American Mallard (Nichols *et al.* 1983; Reinecke *et al.* 1989; Heitmeyer 2006). Nichols *et al.* (1983) examined winter distributions of Mallard and found support for the flexible homing hypothesis, given that Mallard wintered farther south in United States during wetter and colder winters (also see Green & Krementz 2008). Mallard typically migrate in autumn from latitudes of central Missouri after cumulative days of temperatures of ≤ 0°C, snow cover and ice conditions (*i.e.* weather severity index (WSI) of ≥ 8; Schummer *et al.* 2010). A quadratic and cumulative WSI model explained ≥ 40% of the variation in changes in relative abundance of Mallard and other dabbling ducks in Missouri during autumns–winters 1995–2005 (Schummer *et al.* 2010, 2014).

Recent capture-recapture results suggest similar patterns in Europe (Dalby 2013). Interestingly, satellite-marked Mallard in the Mississippi Flyway (Krementz *et al.* 2012) revealed patterns of incremental migrations similar to those described by Bellrose (1980).

Mulhern *et al.* (1985) investigated use and selection of wetlands by Mallard broods in Saskatchewan and found that broods used structurally different wetlands, but use was in proportion to availability of wetland types and thus not selective. How this apparent plastic habitat use by brooding ducks may ramify into habitat use subsequently during autumn and winter unearths interesting questions: 1) What drives individuals to seek and use diverse habitats? 2) What are survival and fitness outcomes related to these decisions? 3) What non-breeding habitat complexes are associated with greatest survival rates of individuals? 4) Where do these birds breed, and what are their reproductive outcomes? For example, do more competitive or fit Mallards occupy the MAV, the supposed region of greatest habitat quality for the species (Nichols *et al.* 1983), whereas other Mallard distribute to other regions? Alternatively, perhaps the regions occupied have little influence on fitness prospects, so long as adequate food, freshwater and potential mates are available. As previously mentioned, evidence exists that habitat complexes used by the greatest densities of Mallard and those individuals with greatest winter survival rates in the MAV differ in habitat composition (Pearse *et al.* 2012; Lancaster 2013; Kaminski & Davis 2014). Drivers of differential habitat use are not always clear but are likely related to foraging, weather, disturbance or a combination of these and other factors related to survival during winter. For example and relative to 3rd and 4th order selection, Mallard used irrigation canals in Nebraska agricultural landscapes over nearby natural riverine wetlands during harsh winters because canals were climatically more suitable than other habitats (Jorde *et al.* 1984). Additionally, Mallard may exercise trade-offs by selecting habitats of perhaps lesser foraging quality but prone to fewer disturbances which contribute to greater survival. Krementz *et al.* (2012) postulated that Mallard may forego wintering in the Grand Prairie region of Arkansas to avoid this area because of intense hunting pressure.

Northern Pintail

Similar to their reliance on rice in California's Sacramento Valley, ~52% of all locations (*n* = 7,022) of radio-marked Northern Pintail females were in rice habitats, which included active (18% use) and fallow rice fields (34% use) along the coast of Texas (Anderson & Ballard 2006). Many radio-marked female pintail that were located > 64 km from the Texas rice prairies flew to rice field habitats at some point during winter, which demonstrated the importance of flooded ricelands to pintail in this region (Anderson & Ballard 2006). In Louisiana, Cox, Jr. and Afton (1997) found extensive use of sanctuaries by radio-tagged Northern Pintail during hunting seasons, but less so before and after legal waterfowl seasons. Female pintail used flooded rice and fallow fields nocturnally where combined these habitats accounted for 68–93% of nocturnal use by the birds (Cox, Jr. & Afton 1997).

In California, Fleskes *et al.* (2007) attributed greater survival of Northern Pintail to increased area of flooded rice habitats. Other landscape factors important to pintail survival, such as the size and management of sanctuaries, types of feeding habitats (*e.g.* rice, wetlands) and the juxtaposition of these, may also have been important (Fleskes *et al.* 2007). Nonetheless, contemporary (1998–2000) survival estimates (87–93%) of adult female Northern Pintail in the Suisun Marsh and Sacramento and San Joaquin Valleys were greater than in any other region of North America (Fleskes *et al.* 2007). Clearly, sanctuaries adjacent to rice and other agricultural habitats are critical to survival and habitat use by Northern Pintail throughout their wintering range (Cox, Jr. & Afton 1997; Fleskes *et al.* 2007).

Wood Duck

The North American Wood Duck is the only *Aix* species in the Nearctic (Birds of North and Middle America Check list; http://checklist.aou.org/). Wood Duck are also unique among North American waterfowl, because they are the only species with migratory and non-migratory populations (Baldassarre 2014). Wood Duck have been widely studied in North America since their near extirpation in the early 20th century (Bellrose & Holm 1994). Migration routes of Wood Duck are not well defined, given the substantial overlap in breeding and winter ranges (Baldassarre 2014). Given their broad occupancy of geographic areas, Wood Duck use diverse freshwater wetlands, although they avoid brackish and marine systems (Bellrose & Holm 1994; Baldassarre 2014). Despite being a forested wetland specialist, wherein Wood Duck forage on red oak *Quercus* sp. acorns and aquatic invertebrates (Heitmeyer *et al.* 2005; Foth *et al.* in press), Wood Duck also use flooded croplands where they forage on waste agricultural seeds (Delnicki & Reinecke 1986; Bellrose & Holm 1994; Barras *et al.* 1996; Kaminski *et al.* 2003). Much of the non-breeding information about Wood Duck is derived from eastern populations and birds using the MAV and southern Atlantic Flyway (Arner & Hepp 1989; Reinecke *et al.* 1989; Peterson 2014), but much remains to be learned about non-breeding Wood Duck use and selection of unique habitats in regions such as the Central Valley of California and even xeric environments in Nevada that lack traditional expansive bottomland hardwood forests (Baldassarre 2014).

Diving Ducks

Ducks that are among the more ecologically pelagic have historically used estuarine or freshwater systems, usually along coastlines, shorelines of lakes and major rivers (Bellrose 1980). The significance to diving ducks *Aythya* sp. of myriad bays of North America, including Chesapeake and San Francisco Bays, has been recognised for centuries (Audubon 1840; Haramis 1991a,b; Perry *et al.* 2007). Unfortunately, these systems are often plagued by anthropogenic effects of shoreline development, boat traffic, increased sediments and nutrients and other factors (Perry *et al.* 2007; Lovvorn *et al.* 2013). Knowledge of niche overlap and "carrying capacity" of habitats by these ducks is necessary to understand relations between birds and potential invertebrate or other prey (Lovvorn *et al.* 2013).

Diving ducks wintering in Chesapeake Bay from 1950–1995 comprised 23% of Atlantic Flyway and 9% of North American populations of these ducks (Perry & Deller 1995; Perry *et al.* 2007). Some species wintering in Chesapeake Bay have been more adversely affected than others. For example, Redhead and Canvasback that feed on submerged aquatic vegetation (SAV), seeds and tubers have been impacted more than species that forage in slightly deeper water on invertebrates, particularly Lesser Scaup (Perry *et al.* 2007). Increased nutrients and sedimentation have lessened SAV in shallower reaches of Chesapeake Bay (Perry *et al.* 2007). Moreover, recently expanding hypoxic zones may be negatively impacting sessile prey of diving ducks (Perry *et al.* 2007) and have been linked to decreased body mass and survival in Canvasback (Haramis *et al.* 1986).

Pollutants and invasive species are thought to be especially problematic for diving ducks such as scaup and Canvasback (Lovvorn *et al.* 2013). In San Francisco Bay, Hothem *et al.* (1998) found that mercury and selenium levels in late winter had accumulated in scaup and Canvasback to levels that impair reproduction in game-farm Mallard (Heinz *et al.* 1989). Invasive species, such as Asian Clam *Potamocorbula amurensis*, which has displaced the former bivalve prey community (*e.g. Macoma balthica*), are considered a second primary concern for diving ducks in the Bay (Richman & Lovvorn 2004; Lovvorn *et al.* 2013). Asian Clams may harbour greater levels of selenium than other bivalve species (Richman & Lovvorn 2004), which could be especially problematic to Lesser and Greater Scaup as they comprised as much as 43–47% of all waterfowl in the Bay. Richman and Lovvorn (2004) collected Lesser Scaup in winters 1998–2000 and found that 98% of clams consumed by scaup were Asian Clams. Asian Clams apparently provide scaup with a profitable food source, because they mostly are distributed in the top 5 cm of sediments where scaup intake rates are greatest (Richman & Lovvorn 2004). Additionally, Lesser and Greater Scaup and Surf Scoter *Melanitta perspicillata* wintering in San Francisco Bay had decreased body mass and fat and increased foraging effort, causing them to disperse from upon food limitation. There also was substantial niche overlap and opportunistic use of dominant prey species by these ducks (Lovvorn *et al.* 2013). Lovvorn *et al.* (2013) concluded that scaup and scoter did not exploit a substantial fraction of food above local profitability thresholds before abandoning the habitat, and encouraged future research to better understand thresholds of energetic profitability for diving ducks.

Despite vast size and dynamics of San Francisco Bay, adjacent habitats in the region provide vital resources for some species using the Bay. Specifically, estuarine intertidal and subtidal mudflats and salt ponds provide additional food and water for diving ducks (Dias 2009; Brand *et al.* 2014). Brand *et al.* (2014) found that diked salt ponds, salt pans and managed seasonal wetlands in South San Francisco Bay collectively provided enough food energy to sustain 79% of the energy and nutrients required by diving ducks when birds were at maximum numbers, and basically 100% of the nutrients when average bird abundances prevailed. Managed ponds serve as important roosting and foraging habitats in this region. Ponds that intake, circulate or discharge water directly to or from the Bay or adjacent sloughs supported > 95% of the diving duck abundance (Brand *et al.* 2014). However, greater bird and invertebrate abundances and prey energy density occurred in meso-haline (*i.e.* 5–30 ppt) rather than low-hypersaline (*i.e.* 31–80 ppt) circulation ponds (Brand *et al.* 2014). Ruddy Duck *Oxyura jamaicensis* exercise dietary flexibility in these same wetland complexes, feeding on amphipods *Amphipoda* sp. or polychaetes *Polydor*a sp. depending on prey occurrence or abundance among different wetland types (Takekawa *et al.* 2009; Brand *et al.* 2014). Thus, similar to identifying important habitat complexes for Mallard or other dabbling ducks (Pearse *et al.* 2012; Lancaster 2013), maintaining diverse foraging wetlands in ecosystems like San Francisco Bay is imperative for supporting waterfowl and other wetland dependent birds using this system (Brand *et al.* 2014).

A primary difference between historical and contemporary habitat use for some diving ducks, such as Ring-necked Duck in the U.S., has been a shift away from traditional winter habitats to open-water lakes because of a proliferation of invasive plants such as Hydrilla *Hydrilla verticillata* and other species that form dense floating mats (Johnson & Montalbano 1984; Roy *et al.* 2013). Some of the greatest wintering concentrations of Ring-necked Duck may occur in managed impoundments of coastal and inland Louisiana (Roy *et al.* 2013). Ring-necked Duck use small marshes adjacent to open water, whereas Canvasback, Redhead and scaup typically use open-water areas only (Korschgen 1989; Roy *et al.* 2013). Elsewhere herein, Stafford *et al.* (2014) provided a detailed account of scaup habitat use during late winter and spring migration. Diverse coastal and interior wetlands of south-central Louisiana are critical to diving ducks such as Redhead and Canvasback (Hohman & Rave 1990; Hohman *et al.* 1990). Canvasback in the Mississippi River Delta and at Catahoula Lake in Louisiana, both important wintering areas to these species (Hohman *et al.* 1990), consumed about 97% plant matter at each site, with below-ground plant biomass composing 94% aggregate dry mass (Hohman & Rave 1990). Mudflats with tubers or water that permitted Canvasback to tip-up and feed were important components of used habitats (Hohman & Rave 1990). Similar to plant-eating Canvasback, the importance of Shoal Grass *Halodule wrightii* to Redhead and several avian guilds has long been mentioned (Cornelius 1977; Michot *et al.* 2008). Redhead wintering in the Chandeleur Sound of Louisiana and Laguna Madre, Texas consumed as much as 74% dry mass of shoalgrass (Michot *et al.* 2008). Conserving *Halodule* beds arguably is the most critical conservation priority within the winter range of Redheads, particularly given that most of the North American population of the species winters along coastal habitats of Texas and Louisiana (Michot *et al.* 2008).

Sea ducks

North America

There are 15 species of North American sea ducks (Tribe: Mergini) and arguably they are the least understood taxa of waterfowl (Bellrose 1980; Goudie *et al.* 1994; Silverman *et al.* 2013). Evidence suggests that 10 of these species are in decline, including eight of 12 species that winter off the Atlantic coast of North America, a primary wintering area for this tribe (Sea Duck Joint Venture 2004; Zipkin *et al.* 2010). Eleven species of sea ducks commonly winter in Pacific coastal regions, nine of which commonly occur in the Puget Sound of Washington state (Faulkner 2013). Sea duck declines are occurring concomitantly with uncertainty about their habitat preferences (Zipkin *et al.* 2010). Shoreline development and associated pollution and climate change are potential negative influences on sea ducks in North America (Zipkin *et al.* 2010). Recent proposals for wind turbines along the Atlantic coast and threats from offshore energy development will also challenge sea ducks, so further understanding of habitat selection by these ducks is imperative (Zipkin *et al.* 2010).

Spatial distribution of sea ducks is generally determined by winter weather conditions and habitat diversity (Zipkin *et al.* 2010). At greater spatial winter ranges, food availability, local environmental conditions, habitat suitability, ocean depths and water temperatures influence sea ducks' use of habitats (Lewis *et al.* 2008; Zipkin *et al.* 2010; Dickson 2012). Northern seas are hostile during winter, with below freezing temperatures, wind, ice and limited daylight because the sun is below the horizon for two months (Systad *et al.* 2000). Sea ducks, however, remain in these rigorous environments during winter and forage on molluscs, echinoderms, crustaceans and other invertebrates. These foods are depauperate in energy density, so sea ducks must forage voraciously to maintain positive energy balances (Systad *et al.* 2000).

Surf Scoter *Melanitta perspicillata* and White-winged Scoter *M. deglandi* in the Pacific Flyway use soft-bottom habitats and forage on bivalves (Bourne 1984; Richman & Lovvorn 2003; Lewis *et al.* 2008). Scoters encounter considerable variation in clam densities and potentially face an exhaustible food supply (Lewis *et al.* 2008). However, Lewis *et al.* (2008) found that scoters in Baynes Sound (British Columbia) did not switch winter prey or move extensively to foraging sites, suggesting clam density was relatively high there (Kirk *et al.* 2007).

Sea ducks in the eastern U.S. have been monitored by the Atlantic Flyway Sea Duck Survey (AFSDS) in at least nine bays and sounds off of the Atlantic coast to quantify winter distributions and population indices (Migratory Bird Data Center 2009; Zipkin *et al.* 2010). Zipkin *et al.* (2010) modelled effects of bottom depths, monthly averages of sea surface temperature, and ocean floor topography for five species of wintering sea ducks. The North Atlantic Oscillation (NAO; *i.e.* fluctuation in sea surface pressure across the northern Atlantic Ocean between areas of high (Azores High) and low (Icelandic Low) pressure: Ottersen *et al.* 2001; Stenseth *et al.* 2002; Hurrell *et al.* 2003; Zipkin *et al.* 2010) was the only environmental covariate that had a significant influence on all five species; its effect was negative for the three scoter species and positive for Common Eider and Long-tailed Duck *Clangula hyemalis* (Zipkin *et al.* 2010). These results suggest that climatic conditions along the Atlantic coast during migration and winter may have direct or indirect influences on sea duck distributions, perhaps as prey are re-distributed (Zipkin *et al.* 2010). Scoters predominated inshore during cold, snowy winters and Common Eider and Long-tailed Duck were more abundant inshore during wet, mild winters (Zipkin *et al.* 2010). Sea surface temperature (SST) negatively affected Long-tailed Duck and White-winged Scoter abundance but positively affected Common Eider, although there was some interaction of effects between NAO and SST on birds' habitat distribution. Overall, sea ducks may respond to a combination of local habitat conditions and broader-scale weather patterns (Zipkin *et al.* 2010). Collectively, scoters used flatter bottom sites, which seemed consistent with knowledge that Black Scoter *Melanitta americana*, Surf Scoter and White-winged Scoter preferred sandier basins along the Atlantic shoreline (Stott & Olson 1973; Zipkin *et al.* 2010). In contrast, Common Eider used rugged substrates, but Long-tailed Duck have not yet been linked to bottom substrates (Perry *et al.* 2007; Zipkin *et al.* 2010).

Other important habitats for non-breeding sea ducks in central and eastern North America include the Great Lakes and Chesapeake Bay (Schummer *et al.* 2008). Mixed species of Bufflehead *Bucephala albeola*, Common Goldeneye and Long-tailed Duck use inshore areas of Lake Ontario and forage on energy-dense *Amphipoda* and larvae of *Chironomidae*, both abundant in the shallow-water zone near shore (Schummer *et al.* 2008). Despite concentrated mixed flocks of ducks, Schummer *et al.* (2008) did not detect declining abundances of macroinvertebrates during winter. They concluded that exploitative competition was likely not occurring and interference competition appeared below thresholds that would cause birds to spatially segregate. Overall, winter forage did not appear to limit habitat use of these species in Lake Ontario during winter (Schummer *et al.* 2008).

Chesapeake Bay is considered one of the most important areas for several species of scoters and Long-tailed Duck (Sea Duck Joint Venture 2004; Ross *et al.* 2009), but little is known about the birds' use of the system. Surf Scoter *M. perspicillata* is thought to forage preferentially in subtidal, sandy soft sediment habitats > 6 m deep (Ross *et al.* 2009), but will also use hard-substrates (Lewis *et al.* 2007; Perry *et al.* 2007). Long-tailed Duck in the upper Chesapeake Bay primarily consume bivalves (Perry *et al.* 2007), likely procuring food from soft-sediment areas (Žydelis & Ruskete 2005; Ross *et al.* 2009). Ross *et al.* (2009) suggested that limited availability of hard substrate bottom in Chesapeake Bay might dictate habitat use patterns among these sea ducks in the upper Chesapeake compared to other regions. Further concerns are linked to declining water quality since the 1960s in the lower region of Chesapeake Bay (Ross *et al.* 2009). Excessive sedimentation and nutrient loading have caused eutrophication and oxygen depletion, negatively affecting portions of the Bay's substrate, and are linked to dramatic declines in seagrass beds (Chesapeake Bay Program 2007; Ross *et al.* 2009). These consequences are problematic because seagrasses supply important substrates for bivalves compared to bare ground under the Bay (Peterson 1982; Peterson *et al.* 1984; Ross *et al.* 2009).

Europe

Recent count data indicate that most European sea duck populations, with the exception of Common Goldeneye, are now in decline (Hearn & Skov 2011; Skov *et al.* 2011). Common Goldeneye winter extensively in freshwater habitats along coastlines, whereas other sea ducks tend to have an offshore distribution. The Baltic Sea is the key wintering area for most European sea ducks, and it is a region of major concern. Recent surveys indicate that Long-tailed Ducks, Velvet Scoter and Steller's Eider have declined by 65%, 55% and 66%, respectively, with declines in Common Eider (51%), Common Scoter (47%), Red-breasted Merganser *Mergus serrator* (42%) and Greater Scaup (26%) also recorded (Skov *et al.* 2011). Declines have similarly been reported in other European countries, notably in Britain and the Netherlands, which are also important wintering grounds for European sea duck populations. Generally, wintering sea ducks aggregate in shallow coastal waters or over offshore banks where they can dive for food on the sea floor. In winter, > 90% of sea ducks use areas amounting to < 5 % of the Baltic Sea (Bellebaum *et al.* 2012), where they forage primarily on Blue Mussel *Mytilus edulis*.

Ecosystem changes that have a negative effect on habitat and food resources during the non-breeding season (*e.g.* extraction of sand and gravel, dredging of shipping channels or coastal development), are potentially the most important explanation for the decline in arctic-breeding sea duck populations (Skov *et al.* 2011). Moreover, shipping and offshore wind farms may permanently displace sea ducks from favoured feeding grounds (Petersen *et al.* 2006; Skov *et al.* 2011). Among sea duck species, the Long-tailed Duck is particularly sensitive to wind farms (Petersen *et al.* 2006), and plans for offshore wind farm construction exist in all Baltic countries. Traffic along the major shipping routes (which cross or pass close to Long-tailed Ducks wintering sites) is also predicted to increase (Skov *et al.* 2011). Oil illegally discharged from ships continues to kill tens of thousands of birds each year, despite enforcement of international regulations (Larsson & Tydén 2005; Skov *et al.* 2011; Brusendorff *et al.* 2013), and other hazardous chemicals are suspected of having a negative impact on Baltic wildlife (including sea ducks) when birds ingest bivalves or organisms that filter polluted sea water (*e.g.* Pilarczyk *et al.* 2012; *cf.* Skov *et al.* 2011). Additionally, sea duck food resources in the Baltic Sea have changed substantially in recent decades concomitantly with nutrient loading. Increase of nutrient loads after 1950 might explain rising bivalve biomass in shallow waters, which in turn may have stimulated sea duck population growth. But decreases in nutrient loads (nitrogen and phosphorous) have occurred in some coastal regions since the 1990s, whereas nutrient levels remain high in other parts of the Baltic Sea. Declines in nutrient loads along the coastline and subsequent effects on sea duck food quality need further investigation. Nevertheless, Skov *et al.* (2011) stressed the importance of eutrophication in spatio-temporal variability in food supply for and abundance of waterbirds in the Baltic Sea, with control of eutrophication being a plausible reason for the decrease of several benthic species in Danish waters.

Phytoplankton composition also has changed in the Baltic, perhaps through the increase in water temperatures in recent decades or overfishing leading to a decrease in food quality for filter-feeding bivalve mussels. In addition, in warmer waters mussels metabolise their own reserves during winter instead of hibernating, which could decrease the quality of mussels for bivalve feeders (Waldeck & Larson 2013). Lastly, overexploitation by commercial mussel fisheries (*e.g.* in the Wadden Sea) may cause food shortages for bivalve feeding species such as Common Eiders (Skov *et al.* 2011).

Concomitant with warming temperatures of the Baltic Sea, ice coverage has decreased and permitted access to new wintering areas for waterfowl. Common Goldeneye and some *Aythya* species are shifting northward in their wintering distribution in the Baltic Sea (Skov *et al.* 2011; Lehikoinen *et al.* 2013). The limited degree of northward shift in the distribution of seaduck feeding offshore suggests reduced food availability in the northern Baltic area, which is now partly ice-free in winter. Nevertheless, populations of some species including Common Eider have relocated to the southwest Baltic Sea from previous wintering quarters in northwest Denmark. Lastly, European sea duck populations also may be directly or indirectly affected by commercial fishing and the use of gillnets for fishing (Žydelis *et al.* 2009).

Geese

Geese and agriculture

As for ducks, habitat modifications influence distribution, movement and resource exploitation in geese. Geese are generally more adept at exploiting farm crops than most duck species (Owen 1980), so their autumn and winter habitat use is largely driven by and has changed markedly in response to variations in farming practices, both in North America and Europe, during the 20th and 21st centuries. For example, Pacific Flyway Greater White-fronted Geese commonly stage in the SONEC, and then migrate and winter in the Sacramento and San Joaquin Valleys (Ely 1992; Ackerman *et al.* 2006; Ely & Raveling 2011). Approximately 80% of foraging flocks of White-fronted Geese used harvested barley, wheat or oat fields from early September to mid-October in SONEC, 1979–1982, then switched to potato fields by mid-October–late November of those years (Frederick *et al.* 1992; Ely & Raveling 2011). When White-fronted Geese migrated to the Sacramento Valley in autumn and winter, they primarily used complexes of rice field habitats (Ely & Raveling 2011). After White-fronted Geese departed the Sacramento Valley for the San Joaquin Valley, green forage, waste corn and other grain and vegetable crops were available to the geese, but birds disproportionately used corn relative to its availability (Ely & Raveling 2011). The future of Greater White-fronted Geese in the San Joaquin Valley is uncertain because corn acreage declined there by 20%, largely because of urbanisation (Ackerman *et al.* 2006; Ely & Raveling 2011). Changes in agricultural practices and crops produced are commodity-market driven and largely beyond the control of wildlife biologists, thus challenging to conservation planning (Ely & Raveling 2011; Skalos 2012; Petrie *et al.* 2014).

Another striking example of dynamic habitat use by geese within agricultural landscapes comes from the North American Snow Geese and Ross' Geese *Chen rossii* (Ankney 1996; Abraham *et al.* 2005). White goose use of waste grain is well documented in the literature (Alisauskas *et al.* 1988; Ankney 1996; Alisauskas 1998; Abraham *et al.* 2005). Recent research has sought to identify winter origins of white geese migrating through Nebraska's Rainwater Basin, a region of continental significance to autumn and spring migrating waterfowl and Sandhill Crane *Grus Canadensis* (Krapu *et al.* 1984; Alisauskas & Ankney 1992; Alisauskas 2002; Stafford *et al.* 2014). Henaux *et al.* (2012) used stable isotope analysis and found flexibility in diets and regional landscape use by Snow Geese. They determined origins of wintering Snow Geese harvested in the Rainwater Basin as follows: Louisiana (53% and 9% in 2007 and 2008, respectively), Texas Gulf Coast (38% and 89%, respectively), Arkansas (9% and 2%, respectively). However, no birds from the Playa Lakes region were detected. Beyond annual variability in their winter origins, differences in diet also helped to characterise their winter habitat use. Snow Geese relied on rice and wheat fields (C_3 plants isotopic signature) as well as corn and grain sorghum (C_4 plants). Geese collected from Texas and Louisiana were generally characterised by using estuarine and marsh habitats *versus* uplands typical of Arkansas and playa eco-regions (Alisauskas & Hobson 1993).

General plasticity of North American white geese in exploiting agricultural and marsh habitats (Bateman *et al.* 1988; Alisauskas 1998; Jefferies *et al.* 2004) creates complex challenges in arresting the growth of overabundant populations in the 21st century (Batt 1997; Jefferies *et al.* 2004; Abraham *et al.* 2005). However, dwindling rice acreage in Texas may influence white goose population levels. For example, rice acreage was ~203,152 ha and white geese numbered > 1.2 million in 1979; whereas ~378,000 geese were counted and only > 54,000 ha of rice existed in Texas in 2013 (K. Hartke, Texas Parks and Wildlife, unpubl. data). The contemporary estimate of rice acreage is the lowest ever for Texas since records originated *ca.* 1948 (K. Hartke, Texas Parks and Wildlife, unpubl. data).

Similarly, contemporary estimates of geese wintering in the Western Palearctic are 4.8 million, up from 3.3 million in 1993 (Fox *et al.* 2010). Most species exhibit signs of exponential increase, whereas others (*e.g.* the Greenland White-fronted Goose *Anser albifrons flavirostris*, Red-breasted Goose *Branta ruficollis* and Dark-bellied Brent Goose *Branta bernicla*) have declined in recent years (Fox *et al.* 2010). Although reduced hunting pressure on geese in some regions probably played an important role, increases in most species of European geese have likely resulted from exploitation of grains and root and grass crops, similar to patterns in North America (Abraham *et al.* 2005; Fox *et al.* 2010). Since the 1950s, wild geese wintering in the western Palearctic have partially or completely switched from feeding on natural vegetation to managed pastures and agricultural croplands (Madsen 1998; Jensen *et al.* 2008; Hake *et al.* 2010). Agricultural producers in Europe have been concerned with losses of wheat and oilseed as goose and swan populations have increased (Dirksen & Beekman 1991; Rees *et al.* 1997). Several measures have attempted to deter geese from crops, including providing supplemental feed in accommodation fields to influence movements of and use by geese, scaring of birds, fencing habitats and adjusting farming strategies, such as growing barley varieties that mature and are harvested before varieties used previously (Hake *et al.* 2010).

Black Brant and estuarine-marine systems

Besides agricultural lands, estuarine and marine wetland systems are critical to many waterfowl, including Black Brant in North America (named Brent Goose in Europe). Important autumn staging areas for brant include shallow marine waters along shorelines, within lagoons or behind barrier beaches (Shaughnessy *et al.* 2012; Lewis *et al.* 2013). Some of the important habitats for the nine-month non-breeding period of brant include the Northeast Pacific United States, the lagoons along the west coast of Baja California, areas of Mexico and Atlantic coastal habitats (Smith *et al.* 1985; Lewis *et al.* 2013, Martínez Cedillo *et al.* 2013). Pacific Black Brant solely use natural habitats during winter and avoid agricultural lands (Ward *et al.* 2005; Lewis *et al.* 2013). As mentioned, the unifying food resource for Holarctic brant is eelgrass (Moore *et al.* 2004; Moore & Black 2006; Shaughnessy *et al.* 2012; Lewis *et al.* 2013). Macrogreen Algae *Ulva* sp. beds also serve as important food in coastal areas in the Atlantic Flyway (Lewis *et al.* 2013). Brant exhibit different foraging strategies in Atlantic coastal states of New York, New Jersey and Virginia, where brant select eelgrass, cordgrass *Spartina* sp. or exploit grasses and clover in upland habitats (Smith *et al.* 1985). Smith *et al.* (1985) attributed diet switching by brant from eelgrass to other foods because of eelgrass declines. However, brant foraged on cultivated grass and clovers in New York, despite an increasing trend in availability of SAV in the state. They attributed differential feeding strategies among regions to the birds' winter philopatry and social organisation.

Brant have been negatively affected by loss of eelgrass habitats in the North American Atlantic Flyway and Europe (Vickery *et al.* 1995; Ganter *et al.* 1997; Ward *et al.* 2005; Shaughnessy *et al.* 2012). Brant in those regions use eelgrass where available, but birds also exploit salt marsh habitat. Moreover, European birds have moved inland to use golf courses and pastures with cattle (Vickery *et al.* 1995; Ganter *et al.* 1997; Ward *et al.* 2005; Shaughnessy *et al.* 2012). Lovvorn & Baldwin (1996) recognised the value of habitat complexes for wintering brant in Western Europe that include intertidal flats, bays and other permanent wetlands that provide sea grasses, as well as nearby farmlands containing waste grains and natural seeds. This complex of suitable habitats allow brant to move and forage among them and thereby enhance their survival (Lovvorn & Baldwin 1996). However, synergistic effects of climate change, possible negative effects on sea level rise and declining eelgrass communities are emerging concerns for waterfowl ecologists conserving brant (Shaughnessy *et al.* 2012).

Swans

Migratory swans

Of the five swan species and subspecies in the northern hemisphere, the Tundra Swan (a.k.a. Whistling Swan) *C. c. columbianus* and Trumpeter Swan of North America and the Bewick's Swan *C. c. bewickii* (conspecific with the Tundra Swan) and Whooper Swan *C. cygnus* in Eurasia are all migratory, whereas the Mute Swan *C. olor* is relatively sedentary in its native Europe and in North America where it has colonised (*e.g.* Petrie & Francis 2003). Trumpeter Swans were widespread in North America prior to 1900 (Rogers & Hammer 1998; Engelhardt *et al.* 2000), but hunting caused their numbers to drop nearly to extinction by the early 20th century, and use of established migration routes waned (Gale *et al.* 1987; Mitchell & Eichholz 2010). Legal protection from persecution (since the 1918 Migratory Bird Treaty) and more recent conservation measures (*e.g.* habitat protection and reintroduction programmes) saw Trumpeter Swan numbers recover to ~16,000 birds by 1990, and > 34,000 free-ranging swans were estimated in 2005 (Moser 2006; Mitchell & Eichholz 2010). Whooper Swan numbers have also increased in Europe in recent decades (Wetlands International 2014), and the Tundra Swan – the most numerous and widely distributed of North American swans – is likewise increasing. Indeed, agricultural foraging opportunities are thought to have contributed to a near doubling of Tundra Swan numbers (to > 200,000 birds) between 1955–1989, leading to regulated hunting of the species in some states (Serie & Bartonek 1991). In contrast, although the Northwest European Bewick's Swan population similarly rose from ~16,000 birds in the mid-1980s to a peak of ~29,000 individuals in the mid-1990s, its numbers are now in decline (Rees & Beekman 2010), with several poor breeding seasons in recent years probably a major contributing factor.

The Eastern Population of Tundra Swans, which breeds across northern Canada and north of the Brooks Range in Alaska, migrates to the U.S. eastern seaboard (allocating about half their time between boreal forest and northern prairie-Great Lakes habitats during autumn migration; Weaver 2013), whereas the Western Population, which breeds in coastal regions of Alaska south of the Brooks Range, migrates to western North America to winter mainly on the Pacific coast from Vancouver Island to central California, and the inland valleys of California (Bellrose 1980; Ely *et al.* 2014). The Northwest European Bewick's Swan population also migrates along a well-defined corridor, from breeding grounds in the Russian arctic along the arctic coast and across Karelia to autumn staging sites on the Baltic (particular Estonian wetlands) and wintering grounds in northwest Europe. Whooper Swans are thought to migrate on a broader front (Garðarsson 1991; Matthiasson 1991), but like the arctic-nesting swans they show strong fidelity to staging and wintering sites (Bellrose 1980; Black & Rees 1984; Rees 1987).

Historically, migratory swans fed on SAV during autumn and winter, often reflecting regional and seasonal variation in availability and dietary requirements. For Tundra Swans, this included Arrowhead *Sagittaria* sp., Sago Pondweed *Potamogeton pectinatus* and Wild Celery *Vallisneria americana* (Bellrose 1980), with Bewick's Swans also favouring pondweeds (*Potamogeton pectinatus* and *P. perfoliatus*) along with hornworts *Ceratophyllum* sp., watermilfoil *Myriophyllum* sp., stoneworts *Chara* sp. and other emergent vegetation (Rees 2006). However, wetland drainage and intensification of farming (including increased use of fertiliser on grasslands and more extensive planting of arable crops) has resulted in a large-scale movement of swans from wetland habitats to agricultural land. In Europe, Whooper Swans were recorded feeding on cereals and potatoes as early as the 19th century, but changes in agriculture saw an increase in their use of arable habitats during the second half of the 20th century (Kear 1963; Laubek *et al.* 1999). More recently, Tundra Swans were first observed in grain fields in the mid 1960s (Nagel 1965; Tate & Tate 1966; Munro 1981), and Bewick's Swans have been utilising arable habitats since the early 1970s (review in Rees 2006). Trumpeter Swans typically use freshwater marshes, ponds, lakes, rivers and brackish estuaries with abundant pondweed (Gale *et al.* 1987; LaMontagne *et al.* 2003; Mitchell & Eichholz 2010), but also forage on arable land in winter and early spring (Babineau 2004; Mitchell & Eichholz 2010), where they avoid soybean and prefer winter wheat and corn (Varner 2008). In the mid-west U.S., swans use reclaimed surface mine wetlands close to agricultural fields, which rarely freeze and are relatively undisturbed compared to reservoirs (Varner 2008; Mitchell & Eichholz 2010). The drivers of swan exploitation of arable lands remain unclear; however, historic and novel food availability, nutrition and foraging efficiency in croplands may be influences (Rees 2006). Several studies have described seasonal variation in the swans use of farmland, with birds generally moving from harvest waste (*e.g.* cereal stubbles, potatoes and sugar beet) to growing cereals (*e.g.* winter wheat) and then to pasture as the winter progresses, which has been attributed to a combination of food availability and changes in dietary requirements (*e.g.* Laubek 1995; Rees *et al.* 1997). Weaver (2013), studying habitat use by 63 satellite-tagged Tundra Swans, found seasonal differences in habitat selection. Tundra Swans selected open water over wetlands in autumn, but agriculture was used substantially less during autumn migration (despite representing 45% and 80% of Tundra Swan habitats in the Great Lakes and Northern Prairies, respectively, at this time) than in winter, when swans selected agriculture lands, and wetlands were used less than their availability. Weaver (2013) concluded that if adequate aquatic habitats were available, swans may not have made forays to agricultural fields, although agricultural seeds provided alternative foods of similar energy value (Kaminski *et al.* 2003), and recommended that wetland conservationists interested in managing non-breeding Tundra Swans should conserve and restore wetlands within agricultural landscapes < 8 km of known roosts and aim to protect open water habitats, especially those containing SAVs. Detailed studies of Bewick's Swan feeding ecology have also illustrated the importance of aquatic habitats for swans arriving in autumn, with swans feeding on below-ground Fennel Pondweed tubers at the Lauwersmeer, Netherlands, preferably in shallow waters and sandy sediments rather than in areas of deeper water, likely reflecting increased effort and energy costs (*e.g.* up-ending as opposed to head-dipping for food) required to feed in deeper waters or where the tubers are in clay (Nolet *et al.* 2001). Further analysis of the timing of the swans' switch from feeding on pondweed tubers to feeding on sugar beet in fields around the Lauwersmeer found that most swans switched habitats when the net energy gain from staying on tubers fell below that from feeding on beet alone. However, the swans would attain a substantially increased energy and total nutrient gain by feeding on both beet and tubers, and there was evidence from van Eerden (1997) that mixed exploitation of tubers and beet does occur in the Lauwersmeer area. Overall, swans seemingly switch to the beet fields long after they would first benefit from doing so due to energy gain alone (Nolet *et al.* 2002).

Mute Swans

Mute Swan movements tend to be relatively localised (< 50 km radius; Birkhead & Perrins 1986), although some long-distance flights have been recorded (*e.g.* those at more northerly latitudes heading south in cold winters). They frequent a wide range of lowland wetland habitats throughout the year, including freshwater lakes, estuarine wetlands, commercial fishponds, sea lochs and shallow coastal waters, where they feed primarily on SAV, and are also commonly found on rivers and canals in urban areas where they rely on bread and other provisions from humans (Birkhead & Perrins 1986; Sears 1989; Gayet *et al.* 2011). They also use farmland, for instance moving to agricultural fields and improved grasslands during winter (Birkhead & Perrins 1986), but tend to be more widely dispersed than the migratory species (Rees *et al.* 1997). In parts of the United Kingdom, where three swan species (Bewick's, Whoopers and Mutes) coincide in winter, segregation across habitats has been recorded, with Whooper and Mute Swans predominately using permanent inland waters and improved pasture, whereas Bewick's Swans were mostly on arable land (Rees *et al.* 1997), indicating a range of habitats are important for foraging by these swan species.

On studying effects of patch size and isolation on Mute Swan habitat use in France, Gayet *et al.* (2011) found that the swans' winter distribution and occurrence on fishponds was influenced by pond structure more than surrounding landscape and other features. Specifically, fishponds drained and cultivated for grain the previous year provided crop residues utilised by the swans the following winter. Understanding habitat selection of Mute Swans is important because they are perceived as having negative influences on other waterfowl, through territorial behaviour or intensive grazing on aquatic macrophytes, sometimes within their European range but particularly where they have been introduced to North America (Conover & Kania 1994; Petrie & Francis 2003; Gayet *et al.* 2011), with a Mute Swan control programme instigated in Maryland in 2005 (Hindman & Tjaden 2014; Hindman *et al.* 2014).

Future challenges and needs

Planning and implementing conservation strategies for waterfowl and their habitats are challenging because some species are declining or remain below long-term averages (*e.g.* Scaup, Northern Pintail American Wigeon), whereas others have become superabundant (*e.g.* Snow Goose) despite some using similar resources (*e.g.* agricultural fields used by Northern Pintail and Snow Geese) in autumn and during migration. Wiens (1989) discussed habitat quality in terms of "fitness potential", whereby habitat quality may be assessed through demographic, physiological and behavioural approaches. Nonetheless, Norris & Marra (2007) alluded to the difficulty in understanding habitat selection in migrating species, particularly in identifying spatio-temporal connectivity of individuals or populations among stages of the annual cycle. Indeed, there is strong research and conservation interest in determining the extent of migratory connectivity among birds occupying specific wintering and breeding areas (Norris & Marra 2007; Guillemain *et al.* 2014; Kaminski & Elmberg 2014). Here we consider some challenges hindering understanding of habitat use and selection by waterfowl during the non-breeding season and suggest future needs for research. We recognise there are other ecological, economic, bio-political and human dimensional considerations, but believe that addressing the following five issues will advance science and stewardship of waterfowl and their habitats in the Holarctic and worldwide.

(1) *Habitat and resource availability*. Resources available for migrating and non-breeding waterfowl are typically dynamic and unpredictable. Indeed, many migratory birds (*e.g.* Svalbard Barnacle Geese) seemingly cannot assess local resource conditions from afar and must "sample" habitats upon settling in them, though others (*e.g.* Svalbard Pink-footed Geese *Anser brachyrhyncus*) appear to use conditions at one site as an indicator of conditions that they might encounter at the next (Tombre *et al.* 2008). Habitat and other environmental dynamics may result in patchily distributed food and other resources within and across seasons, inter-annual site-specific changes in potential foraging areas (*e.g.* ploughed *versus* flooded field; 4th order selection), natural inter-annual droughts or flooding, weather that may dictate where birds winter and exploit resources, disturbance from hunting and other human-related factors, physiological and behavioural dynamics and other scenarios (Fig. 1). During winter, some species like Northern Pintail, Mallard, teal and diving ducks move inter-regionally, likely in search of suitable habitats (*sensu* Fretwell 1972; Cox, Jr. & Afton 1996; Heitmeyer 2006; Caizergues *et al.* 2011; Gourlay Larour *et al.* 2013). Interpreting true migration from movements to and fro (*i.e.* foraging flights) can be challenging (Dingle & Drake 2007) and documenting habitat selection across broad landscapes in brief intervals may be even more equivocal.

Arguably, one of the greatest current challenges waterfowl habitat researchers face relative to identifying true selection involves an inability to determine true habitat and resource availability at scales influencing biological outcomes for the birds (Kaminski

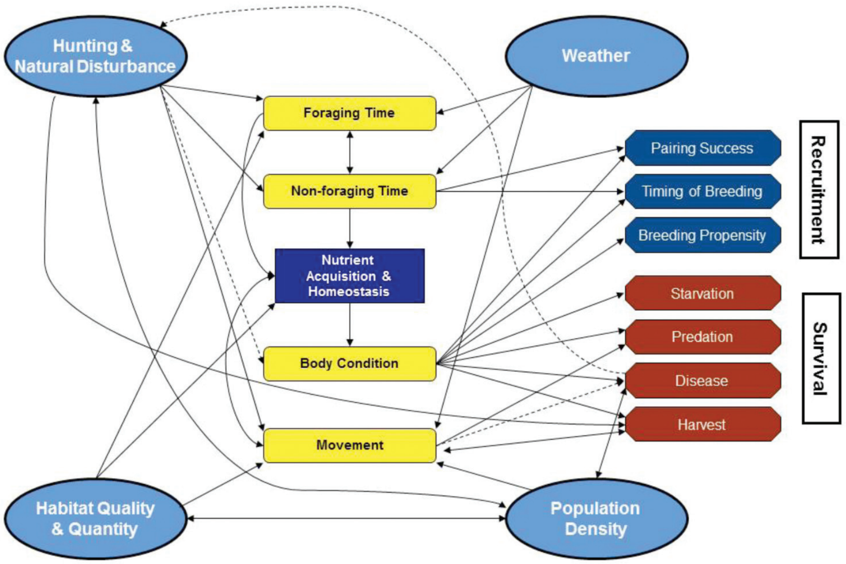

Figure 1. A synthesis of primary and secondary factors that influence survival and potential fitness of Holarctic waterfowl.

& Elmberg 2014). For example, non-breeding waterfowl that exploit agricultural environments (thousands of hectares of agricultural land in one region alone) may suddenly move from dry to shallowly flooded fields during autumn–winter (Reinecke *et al.* 1989). Mallard commonly feed in dry fields in southern Canada and the northern U.S. prairies, but not in the MAV where they utilise puddled fields. This typical scenario is further complicated during winters of below average temperatures; then, Mallard use dry agricultural fields in winter as wetlands freeze and foods become inaccessible. These and other scenarios create great resource variability across regions, temporal variability within regions, and basically constrain researchers' efforts to categorise and estimate available resources. We concur that recent analysis of habitat use by mid-continent Mallard (Beatty *et al.* 2013) is statistically robust, but may be ecologically tenuous because they could not estimate full availability of agricultural lands possibly accessible by Mallard. Despite broad spatial and temporal scaled information obtainable from satellite-tracked birds (Krementz *et al.* 2012; Beatty *et al.* 2013), sample sizes of marked birds are often small because of funding limitations (Lindberg & Walker 2007). This limitation constrains determining selection of habitats, because a small cohort of individuals is assumed to represent the greater population. Moreover, when making inferences of resource selection beyond one or two variables, sample sizes must be increased significantly (Lindberg & Walker 2007). Given the challenges in capturing environmental variability across vast landscapes, we suggest long-term studies (*i.e.* ≥ 5 years) should be invoked to reflect patterns of waterfowl resource selection amid environmental stochasticity.

Habitat conservation for non-breeding waterfowl is justified on the assumption that certain important habitats and intrinsic food resources are limited and thereby ramify individual and population implications (NAWMP 2012). However, to our knowledge (and as emphasised by Stafford *et al.* 2014), true resource limitation has not been demonstrated empirically by relating food or other resource abundance to biological outcomes for waterfowl. Indeed, further understanding these scenarios is required for assessing whether true resource limitation exists and is affecting individuals and populations (Neu *et al.* 1974; Johnson 2007; Stafford *et al.* 2014).

(2) *Populations important to study*. Individuals of some species (*e.g.* Mallard), are widespread in North America during autumn and winter (Bellrose 1980). Some Mallard winter along sandbars and adjacent agricultural lands along the Missouri River in North Dakota (Olsen & Cox, Jr. 2003), while others predominately occupy the southern U.S. (Nichols *et al.* 1983; Reinecke *et al.* 1989). We typically regard the former region as "breeding grounds", yet some Mallard remain there during winter. Although some resources (*e.g.* agriculture) in all these geographic regions get exploited by Mallard, basing habitat selection on a cohort of a species in one region may not reflect important resource components elsewhere in the species' range. Thus, what cohorts of birds should be studied? Comparative studies of conspecifics across geographic regions would be interesting and valuable; thus, studying non-breeding resource use and in regions with the greatest abundance of individuals of a species is a suggested approach. The genetic variability among individuals in these regions should reveal patterns of resource exploitation important to subsequent breeding success. The greater challenge and future research endeavour is to discover if population cohorts of a species that occupy ecologically disparate landscapes during non-breeding seasons contribute differently to population recruitment for the species. Conversely, analysis of bands recovered over a large geographical area have demonstrated that some population boundaries in western Europe were largely artificial (Guillemain *et al.* 2005), so that habitat selection studies should be conducted at much greater geographic scales.

(3) *Functional use of habitats*. Understanding the range of benefits that birds derive from different habitats is also a critical need. Time-budget studies have been conducted at sites across the Holarctic for decades, but new technology such as unmanned aircraft (drones) or GPS accelerometers would help to quantify the birds' activities at local and micro-habitat scales, which in turn would improve our knowledge of the functional values of habitats frequented by waterfowl.

(4) *Remoteness and difficulty in accessing habitats*. Inhospitable conditions and remoteness of habitats pose challenges to studying birds such as sea ducks (Silverman *et al.* 2013) and other arctic-nesting waterfowl. Establishing true habitat selection

among sea ducks in remote environments, especially when trying to link movements or habitat use in relation to food, is particularly problematic. Researchers hypothesise that serious challenges face wintering sea ducks, including marine (boat) traffic, wind-power development and aquaculture practices (Skov *et al.* 2011; Silverman *et al.* 2013). Despite inherent difficulties in investigating birds and habitats in marine environments, recent research has greatly advanced understanding of non-breeding ecology of sea ducks, albeit continued efforts are essential to sustain these birds (Faulkner 2013; Silverman *et al.* 2013).

(5) *Cumulative resource use.* Lastly, there exists a lack of understanding of how cumulative use of resources during the non-breeding period may influence reproduction and recruitment (*i.e.* Heitmeyer & Fredrickson 1981; Kaminski & Gluesing 1987). Indeed, body condition is an important factor in waterfowl survival and fitness. For example, Devries *et al.* (2008) found that female Mallard which arrive in better condition on breeding grounds in the Canadian prairie-parklands hatched eggs 15 days earlier than those in relatively poor condition. Guillemain *et al.* (2008) also observed more juveniles during autumn in southern France when body condition of females was greater at the end of the previous winter. Gunnarsson *et al.* (2005) used stable-carbon isotopes to demonstrate that Black-tailed Godwits *Limosa limosa* wintering in high quality sites in Europe were more likely to use higher-quality breeding habitats and have greater reproductive success than birds using poorer-quality habitats (see also Norris & Marra 2007).

These and related metrics are useful for understanding cross-seasonal carry-over effects (Harrison *et al.* 2011; Sedinger & Alisauskas 2014), but difficulty lies in the fact that autumn staging and migration immediately follow the breeding season, and are temporally furthest from the next breeding season. Hence, "back-dating" and identifying resources used by birds following their arrival on the breeding grounds, in relation to previous habitat use, are paramount needs. For example, if body condition of a cohort of Mallard in Nebraska in late March was known and these birds were subsequently sampled on the breeding grounds, linking March condition and breeding success seems reasonable (*i.e.* Devries *et al.* 2008). However, how should we consider body condition in relation to future fitness prospects in a cohort of birds examined months earlier, during autumn–winter?

No doubt, fitness is partly a result of some cumulative use of resources during an animal's annual cycle. The greatest uncertainty seems to be in understanding at what point in the non-breeding phase of the cycle a potential shortfall (or indeed windfall) of resources might influence future fitness prospects. There are likely bottlenecks or thresholds related to resource use during the year which could impose disproportionate impacts on subsequent fitness; these may vary considerably between years and across species, and deserve further investigation.

As an alternative to indexing body condition or some other fitness metric, perhaps coordinated inter-regional aerial transect surveys of waterfowl during autumn–spring migration could be conducted (*sensu* Pearse *et al.* 2008) to determine "hot spots" of waterfowl use, thereby identifying and characterising complexes of wetlands and uplands used by the majority of waterfowl (Pearse *et al.* 2012). Aerial survey data could be incorporated with GIS layers to illustrate habitat features and describe high and low priority habitats for North American waterfowl during winter and migration (*e.g.* Pearse 2007), analogous to the "thunderstorm maps" used by waterfowl breeding ground JV programmes (Loesch *et al.* 2012). Clearly, we must be creative in engaging diverse human expertise and reliable technologies to understand the ecology of waterfowl throughout their annual cycle and range, then use this knowledge to conserve important habitats for birds across the Holarctic region and worldwide.

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References

Abraham, K.F., Jefferies, R.L. & Alisauskas, R.T. 2005. The dynamics of landscape change and snow geese in mid-continent North America. *Global Change Biology* 11: 841–855.

Accurso, L.M. 1992. Distribution and abundance of wintering waterfowl on San Francisco Bay, 1988–1990. M.Sc. thesis, Humboldt State University, Arcata, California, USA.

Ackerman, J.T., Takekawa, J.Y., Orthmeyer, D.L., Fleskes, J.P., Yee, J.L. & Kruse, K.L. 2006. Spatial use by wintering greater white-fronted geese relative to a decade of habitat change in California's Central Valley. *Journal of Wildlife Management* 70: 965–976.

Ackerman, J.T., Herzog, M.P., Yarris, G.S., Casazza, M.L., Burns, E. & Eadie, J.M. 2014. Chapter 5: Waterfowl ecology and management. *In* P.B. Moyle, A. Manfree & P.L. Fiedler (eds.), *Suisun Marsh: Ecological History and Possible Futures,* pp. 103–132 and maps 10 & 11. University of California Press, Berkeley, California, USA.

Adair, S.E., Moore, J.L. & Kiel, W.H., Jr. 1996. Winter diving duck use of coastal ponds: an analyses of alternative hypotheses. *Journal of Wildlife Management* 60: 83–93.

Afton, A.D. & Anderson, M.G. 2001. Declining scaup populations: a retrospective analysis of long-term population and harvest survey data. *Journal of Wildlife Management* 65: 781–796.

Alerstam, T. & Lindström, Å. 1990. Optimal bird migration: the relative importance of time, energy and safety. *In* E. Gwinner (ed.), *Bird Migration: Physiology and Ecophysiology,* pp. 331–351. Springer, Berlin, Germany.

Alisauskas, R.T. 1998. Winter range expansion and relationships between landscape and morphometrics of midcontinent Lesser Snow Geese. *Auk* 115: 851–862.

Alisauskas, R.T. 2002. Arctic climate, spring nutrition, and recruitment in midcontinent Lesser Snow Geese. *Journal of Wildlife Management* 66: 181–193.

Alisauskas, R.T. & Ankney, C.D. 1992. Spring habitat use and diets of midcontinent adult Lesser Snow Geese. *Journal of Wildlife Management* 57: 43–54.

Alisauskas, R.T. & Hobson, K.A. 1993. Determination of Lesser Snow Goose diets and winter distribution using stable isotope analysis. *Journal of Wildlife Management* 57: 49–54.

Alisauskas, R.T., Ankney, C.D. & Klaas, E.E. 1988. Winter diets and nutrition of midcontinental lesser snow geese. *Journal of Wildlife Management* 52: 403–414.

Anderson, J.T. & Ballard, B.M. 2006. *Survival and Habitat Use of Female Northern Pintails Wintering Along the Central Coast of Texas*. Final report to Ducks Unlimited, Inc., Ridgeland, Mississippi, USA.

Ankney, C.D. 1996. An embarrassment of riches: too many geese. *Journal of Wildlife Management* 60: 217–223.

Arner, D.H. & Hepp, G.R. 1989. *Beaver Pond Wetlands: a Southern Perspective*. Texas Tech University Press, Lubbock, Texas, USA.

Arzel, C., Elmberg, J. & Guillemain, M. 2006. Ecology of spring-migrating *Anatidae*: a review. *Journal of Ornithology* 147: 167–184.

Atlantic Coast Joint Venture (ACJV). 2005. North American Waterfowl Management Plan. Atlantic Coast Joint Venture Waterfowl Implementation Plan Revision: June 2005. Hadley, Massachusetts, USA.

Atlantic Coast Joint Venture (ACJV). 2009. Atlantic Coast Joint Venture Strategic Plan: Updated July 2009. Hadley, Massachusetts, USA.

Audubon, J.J. 1840. *The Birds of America*. J.J Audubon & J.B. Chevalier, New York, USA.

Baar, L., Matlack, R.S., Johnson, W.P. & Barron, R.B. 2008. Migration chronology of waterfowl in the Southern High Plains of Texas. *Waterbirds* 31: 394–401.

Babineau, F.M. 2004. Winter ecology of Trumpeter Swans in southern Illinois. M.Sc. thesis, Southern Illinois University Carbondale, Carbondale, Illinois, USA.

Baldassarre, G.A. 2014. *Ducks, Geese, and Swans of North America*. Johns Hopkins University Press, Baltimore, Maryland, USA.

Baldassarre, G.A. & Bolen, E.G. 1984. Field-feeding ecology of waterfowl wintering on the Southern High Plains of Texas. *Journal of Wildlife Management* 48: 63–71.

Baldassarre, G.A. & Bolen, E.G. 2006. *Waterfowl Ecology and Management*. Krieger Publishing Company, Malabar, Florida, USA.

Ballard, B.M., Thompson, J.E., Petrie, M.J., Chekett, M. & Hewitt, D.G. 2004. Diet and nutrition of northern pintails wintering along the southern coast of Texas. *Journal of Wildlife Management* 68: 371–382.

Ballard, B.M., James, J.D., Bingham, R.L., Petrie, M.J. & Wilson, B.C. 2010. Coastal pond use by redheads wintering in the Laguna Madre, Texas. *Wetlands* 30: 669–674.

Barras, S.C., Kaminski, R.M. & Brennan, L.A. 1996. Acorn selection by female Wood Ducks. *Journal of Wildlife Management* 60: 592–602.

Bateman, H.A., Joanen, T. & Stutzenbaker, C.D. 1988. History and status of midcontinental snow geese on their Gulf Coast winter range. *In* M.W. Weller (ed.), *Waterfowl in Winter,* pp. 495–515. University of Minnesota Press, Minneapolis, Minnesota, USA.

Batt, B.D. 1997. *Arctic Ecosystems in Peril: Report of the Arctic Goose Habitat Working Group*. Arctic Goose Joint Venture Special Publication. U.S. Fish & Wildlife Service, Washington D.C., USA and Canadian Wildlife Service, Ottawa, Ontario, Canada.

Batzer, D.P. & Baldwin, A.H. 2012. *Wetland Habitats of North America: Ecology and Conservation Concerns*. University of California Press, Berkley, California, USA.

Beatty, W.S., Kesler, D.C., Webb, E.B., Raedeke, A.H., Naylor, L.W. & Humburg, D.D. 2013. Quantitative and qualitative approaches to identifying migration chronology in a continental migrant. *PloS ONE* 8: e75673.

Beekman, J.H., Nolet, B.A. & Klaassen, M. 2002. Skipping swans: differential use of migratory stop-over sites in spring and autumn in relation to fuelling rates. *Ardea* 90: 437–460.

Bellebaum, J., Larsson, K. & Kube, J. 2012. Research on sea ducks in the Baltic Sea. Uppsala University – Campus Gotland, Visby, Sweden. http://seaducks.hgo.se/?q=system/files/dokument/Reserach%20on%20Sea%20Ducks.pdf.

Bellrose, F. 1980. *Ducks, Geese and Swans of North America*. Stackpole Books, Harrisburg, Pennsylvania, USA.

Bellrose, F.C. & Crompton, R.D. 1970. Migrational behavior of mallards and black ducks as determined from banding. *Illinois Natural History Survey Bulletin* 30: 167–234.

Bellrose, F.C. & Holm, D.J. 1994. *Ecology and Management of the Wood Duck*. Stackpole Books, Mechanicsburg, Pennsylvania, USA.

Bergmann, C. 1847. Über die verlhältnisse der wärmeökonomie der thiere zu ihrer grösse. *Göttinger Studien* 3: 595–708.

Birkhead, M.E. & Perrins, C.M. 1986. *The Mute Swan*. Croom Helm, London, UK.

Black, J.M. & Rees, E.C. 1984. The structure and behaviour of the Whooper Swan population wintering at Caerlaverock, Dumfries and Galloway, Scotland: an introductory study. *Wildfowl* 35: 21–36.

Block, W.M. & Brennan, L.A. 1993. The habitat concept in ornithology. *Current Ornithology* 11: 35–91.

Bolduc, F. & Afton, A.D. 2004. Relationships between wintering waterbirds and invertebrates, sediments and hydrology of coastal marsh ponds. *Waterbirds* 27: 333–341.

Bolen, E.G., Baldassarre, G.A. & Guthery, F.S. 1989. Playa lakes. *In* L.M. Smith, R.L. Pederson & R.M. Kaminski (eds.), *Habitat Management for Migrating and Wintering Waterfowl in North America*, pp. 341–365. Texas Tech University Press, Lubbock, Texas, USA.

Bourne, N. 1984. *Clam Predation by Scoter Ducks in the Strait of Georgia, British Columbia, Canada*. Canadian Technical Report of Fisheries and Aquatic Science No. 1331. Department of Fisheries & Oceans Fisheries (Research Branch), Pacific Biological Station, Nanaimo, British Columbia, Canada.

Brand, L.A., Takekawa, J.Y., Shinn, J., Graham, T., Buffington, K., Gustafson, K.B., Smith, L.M., Spring, S.E. & Miles, A.K. 2014. Effects of wetland management on carrying capacity of diving ducks and shorebirds in a coastal estuary. *Waterbirds* 37: 52–67.

Brochet, A.L., Mouronval, J.B., Aubry, P., Gauthier-Clerc, M., Green, A.J., Fritz, H. & Guillemain, M. 2012. Diet and feeding habitats of Camargue dabbling ducks: What has changed since the 1960s? *Waterbirds* 35: 555–576.

Brusendorff, A.C., Korpinen, S., Meski, L. & Stankiewicz, M. 2013. HELCOM actions to eliminate illegal and accidental oil pollution from ships in the Baltic Sea. *In* A.G. Kostianoy & O.Y. Lavrova (eds.), *Oil Pollution in the Baltic Sea,* pp. 15–40. Springer, Heidelberg, Germany.

Caizergues, A., Guillemain, M., Arzel, C., Devineau, O., Leray, G., Pilvin, D., Lepley, M., Massez, G. & Schricke, V. 2011. Emigration rates and population turnover of teal *Anas crecca* in two major wetlands of western Europe. *Wildlife Biology* 17: 373–382.

Calenge, C., Guillemain, M., Gauthier-Clerc, M. & Simon, G. 2010. A new exploratory approach to the study of the spatio-temporal distribution of ring recoveries: the example of Teal (*Anas crecca*) ringed in Camargue, Southern France. *Journal of Ornithology* 151: 945–950.

Central Valley Joint Venture. 2006. *Central Valley Joint Venture Implementation Plan-Conserving Bird*

Habitat. U.S. Fish & Wildlife Service, Sacramento, California, USA.

Chabreck, R.H., Joanen, T. & Paulus, S.L. 1989. Southern coastal marshes and lakes. *In* L.M. Smith, R.L. Pederson & R.M. Kaminski (ed.), *Habitat Management for Migrating and Wintering Waterfowl in North America,* pp. 249–277. Texas Tech University Press, Lubbock, Texas, USA.

Chesapeake Bay Program. 2007. Bay trends and indicators. http://www.chesapeakebay.net/indicators.htm.

Christopher, M.W., Hill, E.P. & Steffen, D.E. 1988. Use of catfish ponds by waterfowl wintering in Mississippi. *In* M.W. Weller (ed.), *Waterfowl in Winter,* pp. 413–418. Minnesota Press, Minneapolis, Minnesota, USA.

Clausen, K.K., Clausen, P., Fælled, C.C. & Mouritsen, K.N. 2012. Energetic consequences of a major change in habitat use: endangered Brent Geese *Branta bernicla hrota* losing their main food resource. *Ibis* 154: 803–814.

Clausen, K.K. & Clausen, P. 2014. Forecasting future drowning of coastal waterbird habitats reveals a major conservation concern. *Biological Conservation* 171: 177–185.

Coates, P.S., Casazza, M.L., Halstead, B.J. & Fleskes, J.P. 2012. Relative value of managed wetlands and tidal marshlands for wintering Northern Pintails. *Journal of Fish and Wildlife Management* 3: 98–109.

Conomos, T., Smith, R. & Gartner, J. 1985. Environmental setting of San Francisco Bay. *Hydrobiologia* 129: 1–12.

Conover, M.R. & Kania, G.S. 1994. Impact of interspecific aggression and herbivory by Mute Swans on native waterfowl and aquatic vegetation in New England. *Auk* 111: 744–748.

Cornelius, S.E. 1977. Food and resource utilization by wintering redheads on lower Laguna Madre. *Journal of Wildlife Management* 41: 374–385.

Cowardin, L.M., Carter, V., Golet, F.C. & LaRoe, E.T. 1979. *Classification of Wetlands and Deepwater Habitats of the United States*. U.S. Department of the Interior, Fish & Wildlife Service, Washington D.C., USA.

Cox, R.R., Jr. & Afton, A.D. 1996. Evening flights of female Northern Pintails from a major roost site. *The Condor* 98: 810–819.

Cox, R.R., Jr. & Afton, A.D. 1997. Use of habitats by female Northern Pintails wintering in southwest Louisiana. *Journal of Wildlife Management* 61: 435–443.

Dalby, L. 2013. Waterfowl duck distributions and a changing climate. Ph.D. thesis, Aarhus University, Aarhus, Denmark.

Dandelot, S., Verlaque, R., Dutartre, A. & Cazaubon, A. 2005. Ecological, dynamic and taxonomic problems due to *Ludwigia* (*Onagraceae*) in France. *Hydrobiologia* 551: 131–136.

Dänhardt, J. & Lindström, Å. 2001. Optimal departure decisions of songbirds from an experimental stopover site and the significance of weather. *Animal Behaviour* 62: 235–243.

Darwin, C. 1859. *The Origin of Species*. Penguin Books, New York, USA.

Davis, B.E. & Afton, A.D. 2010. Movement distances and habitat switching by female Mallards wintering in the Lower Mississippi Alluvial Valley. *Waterbirds* 33: 349–356.

Delnicki, D. & Reinecke, K.J. 1986. Mid-winter food use and body weights of Mallards and Wood Ducks in Mississippi. *Journal of Wildlife Management* 50: 43–51.

Devries, J.H., Brook, R.W., Howerter, D.W. & Anderson, M.G. 2008. Effects of spring body condition and age on reproduction in Mallards (*Anas platyrhynchos*). *Auk* 125: 618–628.

Dias, M.P. 2009. Use of salt ponds by wintering shorebirds throughout the tidal cycle. *Waterbirds* 32: 531–537.

Dickson, D.L. 2012. *Movement of King Eiders from breeding grounds on Banks Island, Northwest Territories, to moulting and wintering areas*. Technical Report Series No. 516, Canadian Wildlife Service, Edmonton, Alberta, Canada.

Dingle, H. 1996. *Migration: The Biology of Life on the Move*. Oxford University Press, New York, USA.

Dingle, H. & Drake, V.A. 2007. What is migration? *Bioscience* 57: 113–121.

Dirksen, S. & Beekman, J.H. 1991. Population size, breeding success and distribution of Bewick's Swans, *Cygnus columbianus bewickii*, wintering in Europe 1986–87. *Wildfowl* (Supplement No. 1): 120–124..

Dubovsky, J. & Kaminski, R.M. 1992. Waterfowl and American coot habitat associations with Mississippi catfish ponds. *Proceedings of the Annual Conference of Southeastern Association of Fish and Wildlife Agencies* 46: 10–17.

Eadie, J.M., Elphick, C.S., Reinecke, K.J. & Miller, M.R. 2008. Wildlife values of North American ricelands. *In* S. Manley (ed.), *Conservation of Ricelands of North America,* pp. 8–90. Ducks Unlimited, Inc., Memphis, Tennessee, USA.

Elmberg, J., Hessel, R., Fox, A.D. & Dalby, L. 2014. Interpreting seasonal range shifts in migratory birds: a critical assessment of 'short-stopping' and a suggested terminology. *Journal of Ornithology* 155: 1–9.

Elphick, C.S. 2000. Functional equivalency between rice fields and seminatural wetland habitats. *Conservation Biology* 14: 181–191.

Elphick, C.S., Parsons, K.C., Fasola, M. & Mugica, L. 2010. Ecology and conservation of birds in rice fields: a global review. *Waterbirds* 33 (Special Publication 1): 246 pp.

Ely, C.R. 1992. Time allocation by Greater White-fronted Geese: influence of diet, energy reserves and predation. *The Condor* 94: 857–870.

Ely, C.R. & Raveling, D.G. 2011. Seasonal variation in nutritional characteristics of the diet of Greater White fronted Geese. *Journal of Wildlife Management* 75: 78–91.

Ely, C.R., Sladen, W.J.L., Wilson, H.M., Savage, S.E., Sowl, K.M., Henry, B., Schwitters, M. & Snowdon, J. 2014. Delineation of Tundra Swan *Cygnus c. columbianus* populations in North America: geographic boundaries and interchange. *Wildfowl* 64: 132–147.

Engelhardt, K.A., Kadlec, J.A., Roy, V.L. & Powell, J.A. 2000. Evaluation of translocation criteria: case study with Trumpeter Swans *Cygnus buccinator*. *Biological Conservation* 94: 173–181.

Faulkner, H. 2013. Influence of aquaculture on winter sea duck distribution and abundance in south Puget Sound. M.Sc. thesis, The Evergreen State College, Olympia, Washington, USA.

Feaga, J.S. 2013. Winter waterbird use and food resources of aquaculture lands in Mississippi. M.Sc. thesis, Mississippi State University, Mississippi State, Mississippi, USA.

Fleskes, J. 2012. Climate change impacts on ecology and habitats of Central Valley waterfowl and other waterbirds. http://www.werc.usgs.gov/Project.aspx?ProjectID=204.

Fleskes, J.P., Yee, J.L., Casazza, M.L., Miller, M.R., Takekawa, J.Y. & Orthmeyer, D.L. 2005. *Waterfowl Distribution, Movements and Habitat Use Relative to Recent Habitat Changes in the Central Valley of California: A Cooperative Project to Investigate Impacts of the Central Valley Joint Venture and Changing Agricultural Practices on the Ecology of Wintering Waterfowl.* U.S. Geological Survey, Western Ecological Research Center, Dixon, California, USA.

Fleskes, J.P. & Yee, J.L. 2007. Waterfowl distribution and abundance during spring migration in southern Oregon and northeastern California. *Western North American Naturalist* 67: 409–428.

Fleskes, J.P., Yee, J.L., Yarris, G.S., Miller, M.R. & Casazza, M.L. 2007. Pintail and Mallard survival in California relative to habitat, abundance, and hunting. *Journal of Wildlife Management* 71: 2238–2248.

Fleskes, J.P., Skalos, D.A. & Farinha, M.A. 2013. Changes in types and area of postharvest flooded fields available to waterbirds in Tulare Basin, California. *Journal of Fish and Wildlife Management* 4: 351–361.

Foth, J. R., Straub, J., Kaminski, R.M., Davis, J.B. & Leininger, T. In press. Aquatic invertebrate abundance and biomass in Arkansas, Mississippi and Missouri bottomland hardwood forests during winter. *Journal of Fish and Wildlife Management* 00: 000–000.

Foster, M.A., Gray, M.J. & Kaminski, R.M. 2010. Agricultural seed biomass for migrating and wintering waterfowl in the southeastern United States. *Journal of Wildlife Management* 74: 489–495.

Fox, A.D., Ebbinge, B.S., Mitchell, C., Heinicke, T., Aarvak, T., Colhoun, K., Clausen, P., Dereliev, S., Faragó, S. & Koffijberg, K. 2010. Current estimates of goose population sizes in western Europe, a gap analysis and an assessment of trends. *Ornis Svecica* 20: 115–127.

Frederick, R.B., Clark, W.R. & Takekawa, J.Y. 1992. Application of a computer simulation model to migrating White-fronted Geese in the Klamath Basin. *In* D.R. McCullough & R.H. Barrett (eds.), *Wildlife 2001: Populations,* pp. 696–706. Elsevier Applied Science, New York, USA.

Fredrickson, L.H. 2005. Contemporary bottomland hardwood systems: structure, function and hydrologic condition resulting from two centuries of anthropogenic activities. *In* L.M. Smith, R.L. Pederson & R.M. Kaminski (eds.), *Ecology and Management of Bottomland Hardwoods Systems: The State of our Understanding,* pp. 19–35. University of Missouri-Columbia, Puxico, Missouri, USA.

Fretwell, S.D. 1972. *Populations in a Seasonal Environment*. Princeton University Press, Princeton, New Jersey, USA.

Gale, R.S., Garton, E.O. & Ball, I.J. 1987. *The History, Ecology and Management of the Rocky Mountain Population of Trumpeter Swans*. U.S. Fish & Wildlife Service, Montana Cooperative Wildlife Research Unit, Missoula, Montana, USA.

Ganter, B., Prokosch, P. & Ebbinge, B.S. 1997. Effect of saltmarsh loss on the dispersal and fitness parameters of Dark bellied Brent Geese. *Aquatic Conservation: Marine and Freshwater Ecosystems* 7: 141–151.

Ganter, B., Larsson, K., Syroechkovsky, E.V., Litvin, K.E., Leito, A. & Madsen, J. 1999. Barnacle Goose *Branta leucopsis*: Russia/Baltic. *In* J. Madsen, G. Cracknell & A.D. Fox (eds.), *Goose Populations of the Western Palearctic – A Review of Status and Distribution,* pp. 270–283. Wetlands International Publication No. 48, National Environmental Research Institute, Ronde, Denmark.

Garðarsson, A. 1991. Movements of Whooper Swans *Cygnus cygnus* neckbanded in Iceland. *Wildfowl* (Special Supplement No. 1): 189–194.

Gayet, G., Guillemain, M., Fritz, H., Mesleard, F., Begnis, C., Costiou, A., Body, G., Curtet, L. & Broyer, J. 2011. Do Mute Swan (*Cygnus olor*) grazing, swan residence and fishpond nutrient availability interactively control macrophyte communities? *Aquatic Botany* 95: 110–116.

Gilmer, D.S., Miller, M.R., Bauer, R.D. & LeDonne, J.R. 1982. California's Central Valley wintering waterfowl: concerns and challenges. *Transactions of the North American Wildlife and Natural Resources Conference* 47: 441–452.

Gordon, D.H., Gray, B.T., Perry, R.D., Prevost, M.B., Strange, T.H. & Williams, R.K. 1989. South Atlantic coastal wetlands. *In* L.M. Smith, R.L. Pederson & R.M. Kaminski (eds.), *Habitat Management for Migrating and Wintering Waterfowl in North America,* pp. 57–92. Texas Tech University Press, Lubbock, Texas, USA.

Gordon, D.H., Gray, B.T. & Kaminski, R.M. 1998. Dabbling duck-habitat associations during winter in coastal South Carolina. *Journal of Wildlife Management* 62: 569–580.

Goudie, R., Brault, S., Conant, B., Kondratyev, A., Petersen, M. & Vermeer, K. 1994. The status of sea ducks in the North Pacific rim: toward their conservation and management. *Transactions of the North American Wildlife and Natural Resources Conference* 59: 27–49.

Gourlay-Larour, M.-L., Pradel, R., Guillemain, M., Santin-Janin, H., L'hostis, M. & Caizergues, A. 2013. Individual turnover in common pochards wintering in western France. *Journal of Wildlife Management* 77: 477–485.

Green, A.W. & Krementz, D.G. 2008. Mallard harvest distributions in the Mississippi and Central Flyways. *Journal of Wildlife Management* 72: 1328–1334.

Greer, D.M., Dugger, B.D., Reinecke, K.J. & Petrie, M.J. 2009. Depletion of rice as food of waterfowl wintering in the Mississippi Alluvial Valley. *Journal of Wildlife Management* 73: 1125–1133.

Guglielmo, C.G., O'Hara, P.D. & Williams, T.D. 2002. Extrinsic and intrinsic sources of variation in plasma lipid metabolites of free-living Western Sandpipers (*Calidris mauri*). *Auk* 119: 437–445.

Guillemain, M., Fritz, H. & Duncan, P. 2002. The importance of protected areas as nocturnal feeding grounds for dabbling ducks wintering in western France. *Biological Conservation* 103: 183–198.

Guillemain, M., Sadoul, N. & Simon, G. 2005. European flyway permeability and abmigration in Teal *Anas crecca*, an analysis based on ringing recoveries. *Ibis* 147: 688–696.

Guillemain, M., Elmberg, J., Arzel, C., Johnson, A. & Simon, G. 2008. The income–capital breeding dichotomy revisited: late winter body condition is related to breeding success in an income breeder. *Ibis* 150: 172–176.

Guillemain, M., Fuster, J., Lepley, M., Mouronval, J.B. & Massez, G. 2009. Winter site fidelity is higher than expected for Eurasian Teal *Anas crecca* in the Camargue, France. *Bird Study* 56: 272–275.

Guillemain, M., Devineau, O., Brochet, A.-L., Fuster, J., Fritz, H., Green, A.J. & Gauthier-Clerc, M. 2010a. What is the spatial unit for a wintering Teal *Anas crecca*? Weekly day roost fidelity inferred from nasal saddles in the Camargue, southern France. *Wildlife Biology* 16: 215–220.

Guillemain, M., Elmberg, J., Gauthier-Clerc, M., Massez, G., Hearn, R., Champagnon, J. & Simon, G. 2010b. Wintering French Mallard and Teal are heavier and in better body condition than 30 years ago: effects of a changing environment? *Ambio* 39: 170–180.

Guillemain, M., Van Wilgenburg, S.L., Legagneux, P. & Hobson, K.A. 2014. Assessing geographic origins of Teal (*Anas crecca*) through stable-hydrogen (δ^2H) isotope analyses of feathers and ring-recoveries. *Journal of Ornithology* 155: 165–172.

Gunnarsson, T.G., Gill, J.A., Newton, J., Potts, P.M. & Sutherland, W.J. 2005. Seasonal matching of habitat quality and fitness in a migratory bird. *Proceedings of the Royal Society of London Series B* 272: 2319–2323.

Hagy, H.M. & Kaminski, R.M. 2012. Winter waterbird and food dynamics in autumn-managed moist-soil wetlands of the Mississippi Alluvial Valley. *Wildlife Society Bulletin* 36: 512–523.

Hagy, H.M., Straub, J.N., Schummer, M.L. & Kaminski, R.M. 2014. Annual variation in food densities and factors affecting wetland use by waterfowl in the Mississippi Alluvial Valley. *Wildfowl* (Special Issue 4): 436–450.

Hake, M., Månsson, J. & Wiberg, A. 2010. A working model for preventing crop damage caused by increasing goose populations in Sweden. *Ornis Svecica* 20: 225–233.

Haramis, G., Nichols, J., Pollock, K. & Hines, J. 1986. The relationship between body mass and survival of wintering Canvasbacks. *Auk* 103: 506–514.

Haramis, G.M. 1991a. Canvasback *Aythya valisineria*. *In* S. Funderburk, S. Jordan, J. Mihursky & D. Riley (eds.), *Habitat Requirements for Chesapeake Bay Living Resources, Revised 2nd Edition,* pp. 17.1–17.10. Chesapeake Research Consortium, Solomons, Maryland, USA.

Haramis, G.M. 1991b. Redhead *Aythya americana*. *In* S. Funderburk, S. Jordan, J. Mihursky and D. Riley (eds.), *Habitat Requirements for Chesapeake Bay Living Resources, 2nd ed. revised,* pp. 18.1–18.10. Chesapeake Research Consortium, Solomons, Maryland, USA.

Harmon, B.G. 1962. Mollusk as food of lesser scaup along the Louisiana coast. *Transactions North American Wildlife and Natural Resource Conference* 27: 132–138.

Harrison, X.A., Blount, J.D., Inger, R., Norris, D.R. & Bearhop, S. 2011. Carry-over effects as drivers of fitness differences in animals. *Journal of Animal Ecology* 80: 4–18.

Haukos, D.A. & Smith, L.M. 2003. Past and future impacts of wetland regulations on playa ecology in the Southern Great Plains. *Wetlands* 23: 577–589.

Haukos, D.A. 2004. *Analyses of selected mid-winter waterfowl survey data (1955–2004)*. U.S. Fish & Wildlife Service, Albuquerque, New Mexico, USA.

Hearn, R. & Skov, H. 2011. A brief overview of the status of European seaducks and actions required for their conservation. www.wwt.org.uk/blog/wp-content/uploads/2011/12/Seaducks-briefing-note-Dec-11.pdf.

Heinz, G.H., Hoffman, D.J. & Gold, L.G. 1989. Impaired reproduction of mallards fed an organic form of selenium. *Journal of Wildlife Management* 53: 418–428.

Heitmeyer, M. & Fredrickson, L.H. 1981. Do wetland conditions in the Mississippi Delta hardwoods influence Mallard recruitment? *Transactions of the North American Wildlife and Natural Resources Conferences* 46: 44–57.

Heitmeyer, M.E., Connelly, D.P. & Pederson, R.L. 1989. The Central, Imperial and Coachella Valleys of California. *In* L.M. Smith, R.L. Pederson & R.M. Kaminski (eds.), *Habitat Management for Migrating and Wintering Waterfowl in North America,* pp. 475–505. Texas Tech University Press, Lubbock, Texas, USA.

Heitmeyer, M.E., Cooper, R.J., Dickson, J.G. & Leopold, B.D. 2005. Ecological relationships of warm-blooded vertebrates in bottomland hardwoof ecosystems. *In* L.H. Fredrickson, S.L. King & R.M. Kaminski (eds.), *Ecology and Management of Bottomland Hardwood Systems: the State of Our Understanding*, pp. 281–307. University of Missouri-Columbia, Gaylord Memorial Laboratory Special Publication No. 10, Puxico, Missouri, USA.

Heitmeyer, M.E. 2006. The importance of winter floods to mallards in the Mississippi Alluvial Valley. *Journal of Wildlife Management* 70: 101–110.

Hénaux, V., Powell, L.A., Vrtiska, M.P. & Hobson, K.A. 2012. Establishing winter origins of migrating Lesser Snow Geese using stable isotopes. *Avian Conservation and Ecology* 7: 5.

Hindman, J.L. & Stotts, V.D. 1989. Chesapeake Bay and North Carolina Sounds. *In* L.M. Smith, R.L. Pederson & R.M. Kaminski (eds.), *Habitat Management for Migrating and Wintering Waterfowl in North America,* pp. 27–55. Texas Tech University Press, Lubbock, Texas, USA.

Hindman, L.J. & Tjaden, R.L. 2014. Awareness and opinions of Maryland citizens toward Chesapeake Bay Mute Swans *Cygnus olor* and management alternatives. *Wildfowl* 64: 167–185.

Hindman, L.J., Harvey, W.F & Conley, L.E. 2014. Spraying corn oil on Mute Swan *Cygnus olor* eggs to prevent hatching. *Wildfowl* 64: 186–196.

Hobaugh, W.C., Stutzenbaker, C.D. & Flickinger, E.L. 1989. The rice prairies. *In* L.M. Smith, R.L. Pederson & R.M. Kaminski (eds.), *Habitat Management for Migrating and Wintering Waterfowl in North America,* pp. 367–383. Texas Tech University Press, Lubbock, Texas, USA.

Hohman, W.L. & Rave, D.P. 1990. Diurnal time-activity budgets of wintering Canvasbacks in Louisiana. *Wilson Bulletin* 102: 645–654.

Hohman, W.L., Woolington, D.W. & Devries, J.H. 1990. Food habits of wintering Canvasbacks in Louisiana. *Canadian Journal of Zoology* 68: 2605–2609.

Hothem, R.L., Lonzarich, D.G., Takewaka, J.E. & Ohlendorf, H.M. 1998. Contaminants in wintering Canvasbacks and Scaups from San Francisco Bay, California. *Environmental Monitoring and Assessment* 50: 67–84.

Huner, J.V., Jeske, C.W. & Norling, W. 2002. Managing agricultural wetlands for waterbirds in the coastal regions of Louisiana, USA. *Waterbirds* (Special Publication 2): 66–78.

Hurrell, J.W., Kushnir, Y., Ottersen, G. & Visbeck, M. 2003. An Overview of the North Atlantic Oscillation. *In* J.W. Hurrell, Y. Kushnir, G. Ottersen & M. Visbeck (eds.), *The North Atlantic Oscillation: Climatic significance and nvironmental Impact,* pp. 1–35. American Geophysical Union, Washington D.C., USA.

Jefferies, R., Rockwell, R. & Abraham, K. 2004. The embarrassment of riches: agricultural food subsidies, high goose numbers and loss of Arctic wetlands a continuing saga. *Environmental Reviews* 11: 193–232.

Jensen, R.A., Wisz, M.S. & Madsen, J. 2008. Prioritizing refuge sites for migratory geese to alleviate conflicts with agriculture. *Biological Conservation* 141: 1806–1818.

Johnson, D.H. 1980. The comparison of usage and availability measurements for evaluating resource preference. *Ecology* 61: 65–71.

Johnson, F.A. & Montalbano, F. 1984. Selection of plant communities by wintering waterfowl on Lake Okeechobee, Florida. *Journal of Wildlife Management* 48: 174–178.

Johnson, F.A. & Montalbano, F. 1989. Southern reservoirs and lakes. *In* L.M. Smith, R.L. Pederson & R.M. Kaminski (eds.), *Habitat Management for Migrating and Wintering Waterfowl in North America,* pp. 93–116. Texas Tech University Press, Lubbock, Texas, USA.

Johnson, M.D. 2007. Measuring habitat quality: a review. *The Condor* 109: 489–504.

Jorde, D.G., Krapu, G.L., Crawford, R.D. & Hay, M.A. 1984. Effects of weather on habitat selection and behavior of Mallards wintering in Nebraska. *The Condor* 86: 258–265.

Kadlec, J.A. & Smith, L.M. 1989. The great basin marshes. *In* L.M. Smith, R.L. Pederson & R.M. Kaminski (eds.), *Habitat Management for Migrating and Wintering Waterfowl in North America,* pp. 451–474. Texas Tech University Press, Lubbock, Texas, USA.

Kaminski, R.M. & Davis, J.B. 2014. *Evaluation of the Migratory Bird Habitat Initiative: Report of findings*. Forest and Wildlife Research Center, Research Bulletin WF391, Mississippi State University, Mississippi, USA.

Kaminski, R.M. & Elmberg, J. 2014. An introduction to habitat use and selection by waterfowl in the northern hemisphere. *Wildfowl* (Special Issue 4): 9–16.

Kaminski, R.M. & Gluesing, E.A. 1987. Density- and habitat-related recruitment in mallards. *Journal of Wildlife Management* 51: 141–148.

Kaminski, R.M. & Weller, M.W. 1992. Breeding habitats of nearctic waterfowl. *In* B.D.J. Batt, A.D. Afton, M.G. Anderson, C.D. Ankney, D.H. Johnson, J.A. Kadlec & G.L. Krapu (eds.), *Ecology and Management of Breeding Waterfowl* pp. 568–589. University of

Minnesota Press, Minneapolis, Minnesota, USA.

Kaminski, R.M., Alexander, R.W. & Leopold, B.D. 1993. Wood duck and mallard winter microhabitats in Mississippi hardwood bottomlands. *Journal of Wildlife Management* 57: 562–570.

Kaminski, R.M., Davis, J.B., Essig, H.W., Gerard, P.D. & Reinecke, K.J. 2003. True metabolizable energy for wood ducks from acorns compared to other waterfowl foods. *Journal of Wildlife Management* 67: 542–550.

Kear, J. 1963. The history of potato-eating by wildfowl in Britain. *Wildfowl Trust Annual Report* 14: 54–65.

Kinney, S.D. 2004. Estimating the Population of Greater and Lesser Scaup during Winter in off-Shore Louisiana. M.Sc. thesis, Louisiana State University, Baton Rouge, USA.

Kirk, M.K., Esler, D. & Boyd, W.S. 2007. Foraging effort of Surf Scoters (*Melanitta perspicillata*) wintering in a spatially and temporally variable prey landscape. *Canadian Journal of Zoology* 85: 1207–1215.

Klimas, C., Murray, E., Foti, T., Pagan, J., Williamson, M. & Langston, H. 2009. An ecosystem restoration model for the Mississippi Alluvial Valley based on geomorphology, soils and hydrology. *Wetlands* 29: 430–450.

Korschgen, C.E. 1989. Riverine and deepwater habitats for diving ducks. *In* L.M. Smith, R.L. Pederson & R.M. Kaminski (eds.), *Habitat Management for Migrating and Wintering Waterfowl in North America,* pp. 157–180. Texas Tech University Press, Lubbock, Texas, USA.

Krapu, G.L., Facey, D.E., Fritzell, E.K. & Johnson, D.H. 1984. Habitat use by migrant Sandhill Cranes in Nebraska. *Journal of Wildlife Management* 48: 407–417.

Krementz, D.G., Asante, K. & Naylor, L.W. 2012. Autumn migration of Mississippi Flyway mallards as determined by satellite telemetry. *Journal of Fish and Wildlife Management* 3: 238–251.

Kross, J.P., Kaminski, R.M., Reinecke, K.J. & Pearse, A.P. 2008. Conserving waste rice for wintering waterfowl in the Mississippi Alluvial Valley. *Journal of Wildlife Management* 72: 1383–1387.

Lack, D. 1944. The problem of partial migration. *British Birds* 37: 122–130.

Lack, D. 1966. *Population Studies of Birds*. Clarendon Press, Oxford, UK.

LaMontagne, J.M., Jackson, L.J. & Barclay, R.M. 2003. Compensatory growth responses of *Potamogeton pectinatus* to foraging by migrating Trumpeter Swans in spring stop over areas. *Aquatic Botany* 76: 235–244.

Lancaster, J.D. 2013. Survival, habitat use and spatiotemporal use of wildlife management areas by female mallards in Mississippi's alluvial valley. M.Sc. thesis, Mississippi State University, Mississippi State, Mississippi, USA.

Larsson, K. & Tydén, L. 2005. Effects of oil spills on wintering Long-tailed Ducks *Clangula hyemalis* at Hoburgs bank in central Baltic Sea between 1996/97 and 2003/04. *Ornis Svecica* 15: 161–171.

Laubek, B. 1995. Habitat use by Whooper Swans *Cygnus cygnus* and Bewick's Swans *Cygnus columbianus bewickii* wintering in Denmark: increasing agricultural conflicts. *Wildfowl*, 46: 8–15.

Laubek, B., Nilsson, L., Wieloch, M., Koffijberg, K., Sudfelt, C. & Follestad, A. 1999. Distribution, numbers and habitat choice of the NW European Whooper Swan *Cygnus cygnus* population: results of an international census in January 1995. *Vogelwelt* 120: 141–154.

Legagneux, P., Inchausti, P., Bourguemestre, F., Latraube, F. & Bretagnolle, V. 2009. Effect of predation risk, body size, and habitat characteristics on emigration decisions in Mallards. *Behavioral Ecology* 20: 186–194.

Lehikoinen, A., Jaatinen, K., Vähätalo, A.V., Clausen, P., Crowe, O., Deceuninck, B., Hearn, R., Holt, C.A., Hornman, M. & Keller, V. 2013. Rapid climate driven shifts in wintering distributions of three common waterbird species. *Global Change Biology* 19: 2071–2081.

Lehnen, S.E. & Krementz, D.G. 2013. Use of aquaculture ponds and other habitats by autumn migrating shorebirds along the lower Mississippi River. *Environmental Management* 52: 417–426.

Lewis, T.L., Esler, D. & Boyd, W.S. 2007. Foraging behaviors of Surf Scoters and White-winged Scoters during spawning of Pacific herring. *The Condor* 109: 216–222.

Lewis, T.L., Esler, D. & Boyd, W.S. 2008. Foraging behavior of Surf Scoters (*Melanitta perspicillata*) and White-winged Scoters (*M. fusca*) in relation to clam density: inferring food availability and habitat quality. *Auk* 125: 149–157.

Lewis, T.L., Ward, D.H., Sedinger, J.S., Reed, A. & Derksen, D.V. 2013. *Brant (Branta bernicla)*. *In* A.Poole (ed.), *The Birds of North America Online*. Cornell Laboratory of Ornithology, Ithaca, New York, USA.

Lindberg, M.S. & Walker, J. 2007. Satellite telemetry in avian research and management: sample size considerations. *Journal of Wildlife Management* 71: 1002–1009.

Link, P.T., Afton, A.D., Cox, R.R., Jr. & Davis, B.E. 2011. Daily movements of female Mallards wintering in southwestern Louisiana. *Waterbirds* 34: 422–428.

Loesch, C.R., Reynolds, R.E. & Hansen, L.T. 2012. An assessment of re-directing breeding waterfowl conservation relative to predictions of climate change. *Journal of Fish and Wildlife Management* 3: 1–22.

Lovvorn, J.R. & Baldwin, J.R. 1996. Intertidal and farmland habitats of ducks in the Puget Sound region: a landscape perspective. *Biological Conservation* 77: 97–114.

Lovvorn, J.R., De La Cruz, S.E., Takekawa, J.Y., Shaskey, L.E. & Richman, S.E. 2013. Niche overlap, threshold food densities and limits to prey depletion for a diving duck assemblage in an estuarine bay. *Marine Ecology Progress Series* 476: 251–268.

Luigujõe, L., Kuresoo, A., Keskpaik, J., Ader, A. & Leito, A. 1996. Migration and staging of the Bewick's swan (*Cygnus columbianus*) in Estonia. *Gibier Faune Sauvage* 13: 451–461.

Luo, H.-R., Smith, L.M., Allen, B. & Haukos, D.A. 1997. Effects of sedimentation on playa wetland volume. *Ecological Applications* 7: 247–252.

MacDonald, P.O., Frayer, W.E., Clauser, J.K. & Forsythe, S.W. 1979. *Documentation, Chronology and Future Projections of Bottomland Hardwood Habitat Loss in the Lower Mississippi Alluvial Plain*. Ecological Services, U.S. Department of the Interior, Fish & Wildlife Service, Vicksburg, Mississippi, USA.

Madsen, J. 1980. Occurrence, habitat selection and roosting of the pink-footed goose at Tipperne, Western Jutland, Dermark, 1972–1978. *Dansk Ornitologisk Forenings Tidsskrift* 74: 45–58.

Madsen, J. 1998. Experimental refuges for migratory waterfowl in Danish wetlands. II. Tests of hunting disturbance effects. *Journal of Applied Ecology* 35: 398–417.

Manley, S.W., Kaminski, R.M., Reinecke, K.J. & Gerard, P.D. 2004. Waterbird foods in winter-managed ricefields in Mississippi. *Journal of Wildlife Management* 68: 74–83.

Martínez Cedillo, I., Carmona, R., Ward, D.H. & Danemann, G.D. 2013. Habitat use patterns of the Black Brant *Branta bernicla nigricans* (Anseriformes: Anatidae) in natural and artificial areas of Guerrero Negro, Baja

California Sur, Mexico. *Revista de Biologia Tropical* 61: 927–935.

Marty, J.R. 2013. Seed and waterbird abundances in ricelands in the Gulf Coast Prairies of Louisiana and Texas. M.Sc. thesis, Mississippi State University, Mississippi State, Mississippi, USA.

Mathiasson, S. 1991. Eurasian Whooper Swan *Cygnus cygnus* migration, with particular reference to birds wintering in southern Sweden. *Wildfowl* (Special Supplement No. 1): 201–208.

McKelvey, R.W. & MacNeill, A.C. 1981. Mortality factors of wild swans in Canada. *In* G.V.T. Matthews & M. Smart (eds.), *Proceedings of the Second International Swan Symposium,* pp. 312–318. International Waterfowl and Wetland Research Bureau, Slimbridge, UK.

Meineri, E., Rodriguez Perez, H., Hilaire, S. & Mesleard, F. 2014. Distribution and reproduction of *Procambarus clarkii* in relation to water management, salinity and habitat type in the Camargue. *Aquatic Conservation: Marine and Freshwater Ecosystems* 24: 312–323.

Michot, T., Woodin, M. & Nault, A. 2008. Food habits of Redheads (*Aythya Americana*) wintering in seagrass beds of coastal Louisiana and Texas, USA. *Acta Zoologica Academiae Scientiarum Hungaricae* 54: 239–250.

Michot, T.C. 1996. Marsh loss in coastal Louisiana: implications for management of North American *Anatidae*. *Gibier Faune Sauvage* 13: 941–957.

Michot, T.C., Woodin, M.C., Adair, S.E. & Moser, E.B. 2006. Diurnal time activity budgets of Redheads (*Aythya americana*) wintering in seagrass beds and coastal ponds in Louisiana and Texas. *Hydrobiologia* 576: 113–128.

Migratory Bird Data Center. 2009. http://mbdcapps.fws.gov/mbdc/databases/afsos/aboutafsos.html.

Miller, M.R. 1986. Northern pintail body condition during wet and dry winters in the Sacramento Valley, California. *Journal of Wildlife Management* 50: 189–198.

Miller, M.R., Orthmeyer, D.L., Casazza, M.L., McLandress, M.R. & Connelly, D.P. 1993. *Survival, Habitat Use and Movements of Female Northern Pintails Radio-marked in the Suisun Marsh, California*. National Fish & Wildlife Foundation and California Waterfowl Association, Sacramento, California, USA.

Miller, M.R., Fleskes, J.P., Orthmeyer, D.L., Newton, W.E. & Gilmer, D.S. 1995. Survival of adult female northern pintails in Sacramento Valley, California. *Journal of Wildlife Management* 59: 478–486.

Miller, M.R., Garr, J.D. & Coates, P.S. 2010. Changes in the status of harvested rice fields in the Sacramento Valley, California: implications for wintering waterfowl. *Wetlands* 30: 939–947.

Miller, O.D., Wilson, J.A., Ditchkoff, S.S. & Lochmiller, R.L. 2000. Consumption of agricultural and natural foods by waterfowl migrating through central Oklahoma. *Proceedings of the Oklahoma Academy of Science* 80: 25–31.

Mitchell, C.A., Custer, T.W. & Zwank, P.J. 1994. Herbivory on shoalgrass by wintering redheads in Texas. *Journal of Wildlife Management* 58: 131–141.

Mitchell, C.D. & Eichholz, M.W. 2010. *Trumpeter swan (Cygnus buccinator)*. *In* A.Poole (ed.), *The Birds of North America Online*. Cornell Laboratory of Ornithology, Ithaca, New York, USA.

Mitsch, W.J. & Gosselink, J.G. 2007. *Wetlands*. John Wiley and Sons, Inc., Hoboken, New Jersey, USA.

Moon, J.A. & Haukos, D.A. 2006. Survival of female northern pintails wintering in the Playa Lakes Region of northwestern Texas. *Journal of Wildlife Management* 70: 777–783.

Moon, J.A., Haukos, D.A. & Smith, L.M. 2007. Declining body condition of northern pintails wintering in the Playa Lakes Region. *Journal of Wildlife Management* 71: 218–221.

Moore, J.E., Colwell, M.A., Mathis, R.L. & Black, J.M. 2004. Staging of Pacific flyway Brant in relation to eelgrass abundance and site isolation, with special consideration of Humboldt Bay, California. *Biological Conservation* 115: 475–486.

Moore, J.E. & Black, J.M. 2006. Historical changes in Black Brant *Branta bernicla nigricans* use on Humboldt Bay, California. *Wildlife Biology* 12: 151–162.

Morrison, M.L., Marcot, B.G. & Mannan, R.W. 1992. *Wildlife-Habitat Relationships: Concepts and Applications*. Island Press, Washington D.C., USA.

Moser, T.J. 2006. *The 2005 North American Trumpeter Swan Survey*. Division of Migratory Bird Management, U.S. Fish & Wildlife Service, Denver, Colorado, USA.

Moulton, D.W., Dahl, T.E. & Dall, D.M. 1997. *Texas Coastal Wetlands; Status and Trends, Mid-1950s to Early 1990s*. U.S. Fish & Wildlife Service, Albuquerque, New Mexico, USA.

Mulhern, J.H., Nudds, T.D. & Neal, B.R. 1985. Wetland selection by Mallards and Blue-winged Teal. *Wilson Bulletin* 97: 473–485.

Munro, R.E. 1981. Field feeding by *Cygnus columbianus columbianus* in Maryland. *In* G. V. T. Mathews and M. Smart (eds.), *Second International Swan Symposium,* pp. 261–272. IWRB, Sapporo, Japan.

Nagel, J. 1965. Field feeding of Whistling Swans in northern Utah. *Condor* 67: 446–447.

Neu, C.W., Byers, C.R. & Peek, J.M. 1974. A technique for analysis of utilization-availability data. *Journal of Wildlife Management* 38: 541–545.

Newton, I. 2007. *The Migration Ecology of Birds*. Elsevier, London, UK.

Nichols, F.H., Cloern, J.E., Luoma, S.N. & Peterson, D.H. 1986. The modification of an estuary. *Science* 231: 567–573.

Nichols, J.D., Reinecke, K.J. & Hines, J.E. 1983. Factors affecting the distribution of Mallards wintering in the Mississippi Alluvial Valley. *Auk* 100: 932–946.

Nolet, B.A., Langevoord, O., Bevan, R.M., Engelaar, K.R. Klaassen, M., Mulder, R.J.W. & Van Dijk, S. 2001. Spatial variation in tuber depletion by swans explained by differences in net intake rates. *Ecology* 82: 1655–1667.

Nolet, B.A., Bevan, R.M., Klaassen, M., Langevoord, O. & Van Der Heijden, Y.G.J.T. 2002. Habitat switching by Bewick's Swans: maximization of average long-term energy gain? *Journal of Animal Ecology* 71: 979–993.

Norris, D.R. & Marra, P.P. 2007. Seasonal interactions, habitat quality, and population dynamics in migratory birds. *The Condor* 109: 535–547.

North American Waterfowl Management Plan. 1986. *North American Waterfowl Management Plan. A Strategy for Cooperation*. U.S. Department of the Interior, Washington D.C., USA and Environment Canada, Ottawa, Ontario, Canada.

North American Waterfowl Management Plan (NAWMP). 2012. People conserving waterfowl and wetlands. http://nawmprevision.org/.

North American Waterfowl Management Plan Committee. 2004. *North American Waterfowl Management Plan 2004. Implementation Framework: Strengthening the Biological Foundation*. Canadian Wildlife Service, Ottawa, Ontario, Canada, U.S. Fish & Wildlife Service, Washington D.C, USA and Secretaria de Medio Ambiente y Recursos Naturales, Mexico City, Mexico.

O'Neal, B.J., Stafford, J.D. & Larkin, R.P. 2010. Waterfowl on weather radar: applying ground truth to classify and quantify bird movements. *Journal of Field Ornithology* 81: 71–82.

Obenberger, S.M. 1982. Numerical response of wintering waterfowl to macrohabitat in the Southern High Plains of Texas. M.Sc. thesis, Texas Tech University, Lubbock, Texas, USA.

Olsen, R.E. & Cox, R.R., Jr. 2003. Body size and condition of male Mallards during mid-winter in North Dakota, USA. *Waterbirds* 26: 449–456.

Olsen, R.E., Cox, R.R., Jr., Afton, A.D. & Ankney, C.D. 2011. Diet and gut morphology of male Mallards during winter in North Dakota. *Waterbirds* 34: 59–69.

Ottersen, G., Planque, B., Belgrano, A., Post, E., Reid, P.C. & Stenseth, N.C. 2001. Ecological effects of the North Atlantic oscillation. *Oecologia* 128: 1–14.

Owen, M. & Williams, G. 1976. Winter distribution and habitat requirements of Wigeon in Britain. *Wildfowl* 27: 83–90.

Owen, M. 1980. *Wild Geese of the World: their Life History and Ecology*. Batsford, London, UK.

Owen, M., Atkinson-Willes, G.L. & Salmon, D.G. 1986. *Wildfowl in Great Britain – Second edition.* Cambridge University Press, Cambridge, UK.

Pacific Coast Joint Venture. 2004. Strategic Plan. https://projects.atlas.ca.gov/frs/download.php/15218/PCJV_StrategicPlan_2004.pdf.

Pearse, A.T. 2007. Design, evaluation, and applications of an aerial survey to estimate abundance of wintering waterfowl in Mississippi. Ph.D. dissertation, Mississippi State University, Mississippi State, Mississippi, USA.

Pearse, A.T., Dinsmore, S.J., Kaminski, R.M. & Reinecke, K.J. 2008. Evaluation of an aerial survey to estimate abundance of wintering ducks in Mississippi. *Journal of Wildlife Management* 72: 1413–1419.

Pearse, A.T., Kaminski, R.M., Reinecke, K.J. & Dinsmore, S.J. 2012. Local and landscape associations between wintering dabbling ducks and wetland complexes in Mississippi. *Wetlands* 32: 859–869.

Percival, S., Sutherland, W. & Evans, P. 1998. Intertidal habitat loss and wildfowl numbers: applications of a spatial depletion model. *Journal of Applied Ecology* 35: 57–63.

Perry, M. & Deller, A. 1995. Waterfowl population trends in the Chesapeake Bay area. *In* P. Hill & S. Nelson (eds.), *Proceedings of the 1994 Chesapeake Research Conference. Toward a Sustainable Coastal Watershed: The Chesapeake Experiment,* pp. 490–500. Chesapeake Research Consortium, Edgewater, Maryland, USA.

Perry, M.C., Wells-Berlin, A.M., Kidwell, D.M. & Osenton, P.C. 2007. Temporal changes of populations and trophic relationships of wintering diving ducks in Chesapeake Bay. *Waterbirds* 30: 4–16.

Petersen, I.K., Christensen, T.K., Kahlert, J., Desholm, M. & Fox, A.D. 2006. *Final Results of Bird Studies at the Offshore Wind Farms at Nysted and Horns Rev, Denmark*. National Environmental Research Institute, Ministry of Environment, Copenhagen, Denmark.

Peterson, C.H. 1982. Clam predation by whelks (*Busycon* spp.): experimental tests of the importance of prey size, prey density and seagrass cover. *Marine Biology* 66: 159–170.

Peterson, C.H., Summerson, H. & Duncan, P. 1984. The influence of seagrass cover on population structure and individual growth rate of a suspension-feeding bivalve, *Mercenaria mercenaria*. *Journal of Marine Research* 42: 123–138.

Peterson, T.G. 2014. Wintering waterfowl use of Delta National Forest, Mississippi. M.Sc. thesis, Mississippi State University, Mississippi State, Mississippi, USA.

Petrie, M., Vest, J. & Smith, D. 2013. Intermountain West Joint Venture Implementation Plan-Waterfowl. http://iwjv.org/resource/2013-implementation-plan-chapter-4-waterfowl.

Petrie, M., Brasher, M. & James, D. 2014. *Estimating the Biological and Economic Contributions that Rice Habitats Make in Support of North American Waterfowl*. The Rice Foundation, Stuttgart, Arkansas, USA.

Petrie, S.A. & Francis, C.M. 2003. Rapid increase in the lower Great Lakes population of feral mute swans: a review and a recommendation. *Wildlife Society Bulletin* 31: 407–416.

Pilarczyk, B., Tomza-Marciniak, A., Pilarczyk, R., Kavetska, K., Rząd, I., Hendzel, D. & Marciniak, A. 2012. Selenium status in sea ducks (*Melanitta fusca*, *Melanitta nigra* and *Clangula hyemalis*) wintering on the southern Baltic coast, Poland. *Marine Biology Research* 8: 1019–1025.

Plattner, D.M., Eichholz, M.W. & Yerkes, T. 2010. Food resources for wintering and spring staging black ducks. *Journal of Wildlife Management* 74: 1554–1558.

Playa Lakes Joint Venture. 2014. Priority habitats. http://pljv.org/about/habitats.

Raveling, D.G. 2004. *Waterfowl of the World: A Comparative Perspective*. University of Missouri-Columbia, Gaylord Memorial Laboratory, Puxico, Missouri, USA.

Raveling, D.G. & Heitmeyer, M.E. 1989. Relationships of population size and recruitment of pintails to habitat conditions and harvest. *Journal of Wildlife Management* 53: 1088–1103.

Rees, E.C. 1987. Conflict of choice within pairs of Bewick's Swans regarding their migratory movement to and from the wintering grounds. *Animal Behaviour* 35: 1685–1693.

Rees, E.C. 2006. *Bewick's Swan*. T. & A.D. Poyser, London, UK.

Rees, E.C. & Beekman, J.H. 2010. Northwest European Bewick's Swans: a population in decline. *British Birds* 103: 640–650.

Rees, E.C., Kirby, J.S. & Gilburn, A. 1997. Site selection by swans wintering in Britain and Ireland; the importance of habitat and geographic location. *Ibis* 139: 337–352.

Reinecke, K.J., Kaminski, R.M., Moorehead, D.J., Hodges, J.D. & Nassar, J.R. 1989. Mississippi Alluvial Valley. *In* L.M. Smith, R.L. Pederson & R.M. Kaminski (eds.), *Habitat Management for Migrating and Wintering Waterfowl in North America.,* pp. 203–247. Texas Tech University Press, Lubbock, Texas, USA.

Reinecke, K.J., Brown, M.W. & Nassar, J.R. 1992. Evaluation of aerial transects for counting wintering mallards. *Journal of Wildlife Management* 56: 515–525.

Rendón, M.A., Green, A.J., Aguilera, E. & Almaraz, P. 2008. Status, distribution and long-term changes in the waterbird community wintering in Doñana, south-west Spain. *Biological Conservation* 141: 1371–1388.

Richman, S.E. & Lovvorn, J.R. 2003. Effects of clam species dominance on nutrient and energy acquisition by spectacled eiders in the Bering Sea. *Marine Ecology Progress Series* 261: 283–297.

Richman, S.E. & Lovvorn, J.R. 2004. Relative foraging value to Lesser Scaup ducks of native and exotic clams from San Francisco Bay. *Ecological Applications* 14: 1217–1231.

Robertson, G.J. & Cooke, F. 1999. Winter philopatry in migratory waterfowl. *Auk* 116: 20–34.

Rodway, M.S. 2007. Timing of pairing in waterfowl II: Testing the hypotheses with Harlequin Ducks. *Waterbirds* 30: 506–520.

Rogers, P.M. & Hammer, D.A. 1998. Ancestral breeding and wintering ranges of the Trumpeter Swan (*Cygnus buccinator*) in the Eastern United States. *Bulletin of The Trumpeter Swan Society* 27: 13–29.

Roshier, D.A., Klomp, N.I. & Asmus, M. 2006. Movements of a nomadic waterfowl, Grey Teal *Anas gracilis*, across inland Australia – results from satellite telemetry spanning fifteen months. *Ardea* 94: 461–475.

Ross, P.G., Luckenbach, M.W., Wachapreague, V. & Bowman, T. 2009. *Distribution, Habitat Characteristics, Prey Abundance and Diet of Surf Scoters* (Melanitta perspicillata) *and Long-tailed Ducks* (Clangula hyemalis) *in Polyhaline Wintering Habitats in the Mid-Atlantic Region: a Comparison of Shallow Coastal Lagoons and Chesapeake Bay Environs*. U.S. Fish & Wildlife Service, Sea Duck Joint Venture, Anchorage, Alaska, USA.

Roy, C.L., Herwig, C.M. & Doherty, P.F. 2013. Mortality and refuge use by young ring necked ducks before and during hunting season in north central Minnesota. *Journal of Wildlife Management* 77: 947–956.

Salewski, V. & Bruderer, B. 2007. The evolution of bird migration – a synthesis. *Naturwissenschaften* 94: 268–279.

Schummer, M.L., Petrie, S.A. & Bailey, R.C. 2008. Interaction between macroinvertebrate abundance and habitat use by diving ducks during winter on northeastern Lake Ontario. *Journal of Great Lakes Research* 34: 54–71.

Schummer, M.L., Kaminski, R.M., Raedeke, A.H. & Graber, D.A. 2010. Weather related indices of autumn–winter dabbling duck abundance in middle North America. *Journal of Wildlife Management* 74: 94–101.

Schummer, M.L., Cohen, J., Kaminski, R.M., Brown, M.E. & Wax, C.L. 2014. Atmospheric teleconnections and Eurasian snow cover as predictors of a weather severity index in relation to Mallard *Anas platyrhynchos* autumn–winter migration. *Wildfowl* (Special Issue 4): 451–469.

Scott, D.A. & Rose, P. 1996. *Atlas of Anatidae Populations in Africa and Western Eurasia*. Wetland International Publication No. 41. Wetlands International, Waginingen, Netherlands.

Sea Duck Joint Venture. 2004. Sea duck information series. www.seaduckjv.org/infoseries/toc.html.

Sears, J. 1989. Feeding activity and body condition of Mute Swans *Cygnus olor* in rural and urban areas of a lowland river system. *Wildfowl* 40: 88–98.

Sedinger, J.S. & Alisauskas, R.T. 2014. Cross-seasonal effects and the dynamics of waterfowl populations. *Wildfowl* (Special Issue 4): 000–000.

Serie, J.R. & Bartonek, J.C. 1991. Population status and productivity of Tundra Swans, *Cygnus columbianus* in North America. *Wildfowl* (Special Supplement No. 1): 172–177.

Shaughnessy, F.J., Gilkerson, W., Black, J.M., Ward, D.H. & Petrie, M. 2012. Predicted eelgrass response to sea level rise and its availability to foraging Black Brant in Pacific coast estuaries. *Ecological Applications* 22: 1743–1761.

Silverman, E.D., Saalfeld, D.T., Leirness, J.B. & Koneff, M.D. 2013. Wintering sea duck distribution along the Atlantic Coast of the United States. *Journal of Fish and Wildlife Management* 4: 178–198.

Skalos, D.A. 2012. Evaluating body condition and predicting lipid mass of wintering Pacific greater white-fronted geese (*Anser albifrons frontalis*). M.Sc. thesis, University of California-Davis, Davis, California, USA.

Skov, H., Heinänen, S., Žydelis, R., Bellebaum, J., Bzoma, S., Dagys, M., Durinck, J., Garthe, S., Grishanov, G., Hario, M., Kieckbusch, J.J., Kube, J., Kuresoo, A., Larsson, K., Luigujoe, L., Meissner, W., Nehls, H.W., Nilsson, L., Petersen, I.K., Mikkola-Roos, M., Pihl, S., Sonntag, N. & Stipniece, A. 2011. *Waterbird Populations and Pressures in the Baltic Sea*. Nordic Council of Ministers, Copenhagen, Denmark.

Smeins, F.E., Diamond, D.D. & Hanselka, C.W. 1991. Coastal prairie. *In* R.T. Coupland (ed.), *Ecosystems of the World 8A. Natural Grasslands: Introduction and Western Hemisphere,* pp. 269–290. Elsevier Science, New York, USA.

Smith, L.M., Vangilder, L.D. & Kennamer, R.A. 1985. Foods of wintering brant in eastern

North America. *Journal of Field Ornithology* 56: 286–289.

Smith, L.M. & Sheeley, D.G. 1993. Factors affecting condition of northern pintails wintering in the Southern High Plains. *Journal of Wildlife Management* 57: 62–71.

Smith, L.M. 2003. *Playas of the Great Plains*. University of Texas Press, Austin, Texas, USA.

Söderquist, P., Gunnarsson, G. & Elmberg, J. 2013. Longevity and migration distance differ between wild and hand-reared Mallards *Anas platyrhynchos* in Northern Europe. *European Journal of Wildlife Research* 59: 159–166.

St. James, E.A., Schummer, M.L., Kaminski, R.M., Penny, E.J. & Burger, L.W. 2013. Effect of weekly hunting frequency on duck abundances in Mississippi wildlife management areas. *Journal of Fish and Wildlife Management* 4: 144–150.

Stafford, J.D., Kaminski, R.M., Reinecke, K.J. & Manley, S.W. 2006. Waste rice for waterfowl in the Mississippi Alluvial Valley. *Journal of Wildlife Management* 70: 61–69.

Stafford, J.D., Janke, A.K., Anteau, M.J., Pearse, A.T., Fox, A.D., Elmberg, J., Straub, J.N., Eichholz, M.W. & Arzel, C. 2014. Spring migration of waterfowl in the northern hemisphere: a conservation perspective. *Wilfowl* (Special Issue 4): 70–85.

Stenseth, N.C., Mysterud, A., Ottersen, G., Hurrell, J.W., Chan, K.-S. & Lima, M. 2002. Ecological effects of climate fluctuations. *Science* 297: 1292–1296.

Stott, R.S. & Olson, D.P. 1973. Food-habitat relationship of sea ducks on the New Hampshire coastline. *Ecology* 54: 996–1007.

Systad, G.H., Bustnes, J.O. & Erikstad, K.E. 2000. Behavioral responses to decreasing day length in wintering sea ducks. *Auk* 117: 33–40.

Takekawa, J., Miles, A., Tsao-Melcer, D., Schoellhamer, D., Fregien, S. & Athearn, N. 2009. Dietary flexibility in three representative waterbirds across salinity and depth gradients in salt ponds of San Francisco Bay. *Hydrobiologia* 626: 155–168.

Tamisier, A. & Grillas, P. 1994. A review of habitat changes in the Camargue: an assessment of the effects of the loss of biological diversity on the wintering waterfowl community. *Biological Conservation* 70: 39–47.

Tate J., Jr. & Tate, D.J. 1966. Additional records of Whistling Swans feeding in dry fields. *The Condor* 68: 398–399.

Thomas, G. 1976. Habitat usage of wintering ducks at the Ouse Washes, England. *Wildfowl* 27: 148–151.

Thompson, J.D. & Baldassarre, G.A. 1990. Carcass composition of nonbreeding Blue-winged Teal and Northern Pintails in Yucatan, Mexico. *The Condor* 92: 1057–1065.

Tombre, I.M., Høgda, K.A., Madsen, J., Griffin, L.R., Kuijken, E., Shimmings, P., Rees, E. & Verscheure, C. 2008. The onset of spring and timing of migration in two arctic nesting goose populations: the pink-footed goose *Anser brachyrhynchus* and the barnacle goose *Branta leucopsis*. *Journal of Avian Biology* 39: 691–703.

Toral, G.M. & Figuerola, J. 2010. Unraveling the importance of rice fields for waterbird populations in Europe. *Biodiversity and Conservation* 19: 3459–3469.

Tourenq, C., Bennetts, R.E., Kowalski, H., Vialet, E., Lucchesi, J.L., Kayser, Y. & Isenmann, P. 2001. Are ricefields a good alternative to natural marshes for waterbird communities in the Camargue, southern France? *Biological Conservation* 100: 335–343.

U.S. Department of Agriculture. 2010. *Catfish 2010. Part I: Reference of Catfish Health and Production Practices in the United States, 2009*. U.S. Department of Agriculture – Animal and Plant Health Inspection Service, Fort Collins, Colorado, USA.

Väänänen, V.-M. 2001. Hunting disturbance and the timing of autumn migration in *Anas* species. *Wildlife Biology* 7: 3–9.

Varner, D.M. 2008. Survival and foraging ecology of Interior Population trumpeter swans. M.Sc. thesis, Southern Illinois Universy, Carbondale, Illinois, USA.

van Eerden, M.R. (ed.). 1997. Patchwork: patch use, habitat exploitation and carrying capacity for water birds in Dutch freshwater wetlands. Ph.D. thesis, Rijksuniversiteit Groningen and Rijkswaterstaat Directie IJsselmeergebied, Lelystad, Netherlands.

Venne, L.S., Anderson, T.A., Zhang, B., Smith, L.M. & McMurry, S.T. 2008. Organochlorine pesticide concentrations in sediment and amphibian tissue in playa wetlands in the Southern High Plains, USA. *Bulletin of Environmental Contamination and Toxicology* 80: 497–501.

Vest, J.L., Kaminski, R.M., Afton, A.D. & Vilella, F.J. 2006. Body mass of lesser scaup during fall and winter in the Mississippi flyway. *Journal of Wildlife Management* 70: 1789–1795.

Vickery, J., Sutherland, W., Watkinson, A., Rowcliffe, J. & Lane, S. 1995. Habitat switching by dark-bellied Brent Geese *Branta b. bernicla* (L.) in relation to food depletion. *Oecologia* 103: 499–508.

Voslamber, B., Knecht, E. & Kleijn, D. 2010. Dutch Greylag Geese *Anser anser*: migrants or residents. *Ornis Svecica* 20: 207–214.

Waldeck, P. & Larsson, K. 2013. Effects of winter water temperature on mass loss in Baltic Blue Mussels: implications for foraging sea ducks. *Journal of Experimental Marine Biology and Ecology* 444: 24–30.

Ward, D.H., Reed, A., Sedinger, J.S., Black, J.M., Derksen, D.V. & Castelli, P.M. 2005. North American Brant: effects of changes in habitat and climate on population dynamics. *Global Change Biology* 11: 869–880.

Weaver, K.H. 2013. Tundra Swan (*Cygnus columbianus columbianus*) habitat selection during the nonbreeding period. M.Sc. thesis, The University of Western Ontario, London, Ontario, Canada.

Weller, M.W. 1964. Distribution and migration of the redhead. *Journal of Wildlife Management* 28: 64–103.

Wetlands International 2014. *Waterbird Population Estimates*. http://wpe.wetlands.org.

Wiens, J.A. 1973. Pattern and process in grassland bird communities. *Ecological Monographs* 43: 237–270.

Wiens, J.A. 1989. *The Ecology of Bird Communities. Volume 1. Foundations and Patterns*. Cambridge University Press, Cambridge, UK.

Williams III, S.O. & Chabreck, R.H. 1986. *Quantity and quality of waterfowl habitat in Louisiana*. Research Report No. 8. Louisiana State University, Baton Rouge, Louisiana, USA.

Wiseman, A.J., Kaminski, R.M., Riffell, S., Reinecke, K.J. & Larson, E.J. 2010. Ratoon grain sorghum and other seeds for waterfowl in sorghum croplands. *Proceedings of the Southeast Association of Fish Wildlife Agencies* 64: 106–111.

Wooten, D.E. & Werner, S.J. 2004. Food habits of Lesser Scaup *Aythya affinis* occupying baitfish aquaculture facilities in Arkansas. *Journal of the World Aquaculture Society* 35: 70–77.

Zammuto, R.M. 1986. Life histories of birds: clutch size, longevity, and body mass among North American game birds. *Canadian Journal of Zoology* 64: 2739–2749.

Zink, R.M. 2011. The evolution of avian migration. *Biological Journal of the Linnean Society* 104: 237–250.

Zipkin, E.F., Gardner, B., Gilbert, A.T., O'Connell, A.F., Jr., Royle, J.A. & Silverman, E.D. 2010. Distribution patterns of wintering sea ducks in relation to the North Atlantic Oscillation and local environmental characteristics. *Oecologia* 163: 893–902.

Žydelis, R.M. & Ruskete, D.R. 2005. Winter foraging of Long-tailed Ducks (*Clangula hyemalis*) exploiting different benthic communities in the Baltic Sea. *Wilson Bulletin* 117: 133–141.

Žydelis, R.M., Bellebaum, J., Österblom, H., Vetemaa, M., Schirmeister, B., Stipniece, A., Dagys, M., van Eerden, M. & Garthe, S. 2009. Bycatch in gillnet fisheries – an overlooked threat to waterbird populations. *Biological Conservation* 142: 1269–1281.

Photograph: A spring of Green-winged and Blue-winged Teal wintering in Louisiana, by Charlie Hohorst.

© Wildfowl & Wetlands Trust

Exhibit P

U.S. Fish & Wildlife Service

2016 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation

National Overview

Issued August 2017

Preliminary Findings

Director's Message

From the earliest days of our nation, the love of nature and a connection with the outdoors, have always been an integral part of our identity as Americans. Which is why it's not surprising that even as our society continues to change and diversify in the 21st Century, those values endure.

Our passion for wildlife and wild places, and the lengths to which we go to pursue that passion, are reflected in the preliminary findings of the 2016 National Survey of Fishing, Hunting and Wildlife-Associated Recreation.

As it has since it was first conducted in 1955 – and every five years since – this detailed and rigorous survey is based on interviews with thousands of Americans from all walks of life.

The preliminary 2016 findings should hearten everyone who cares about the health of our wildlife, natural landscapes and people.

In 2016, more than 101 million Americans – a staggering 40 percent of the U.S. population – participated in some form of fishing, hunting or other wildlife-associated recreation such as birdwatching or outdoor photography. And in doing so, we spent an estimated $156.3 billion on equipment, travel, licenses and fees. These expenditures represent 1 percent of the nation's Gross Domestic Product – creating and supporting thousands of jobs and communities across the nation.

More than 35.8 million Americans went fishing in 2016, while 11.5 million hunted and 86 million watched wildlife. This means that 14 percent of Americans 16 years of age or older fished, 5 percent hunted and 35 percent participated in wildlife watching.

These findings are not just good news for the nation's economy. Revenues from the sale of licenses and tags, as well as excise taxes paid by hunters, anglers and shooters continue to support vital wildlife and habitat conservation efforts in every state and U.S. territory. And on a personal level, a growing body of scientific research suggests that we're all healthier, happier and better off in myriad ways when we spend time in nature.

We will continue to analyze and refine the data gathered in 2016, releasing final numbers and a series of detailed special reports to help the conservation community use this information to connect even more Americans with their natural heritage.

You can do your part too when you drop a line in the water or take friends and family on their first hunt. You'll find a deeper connection with both nature and people, and at the same time help support vital conservation work across the nation.

That's something we can all get behind.

Greg Sheehan
Principal Deputy Director, U.S. Fish and Wildlife Service

Exhibit Q

2017-2018 CALIFORNIA WATERFOWL & UPLAND GAME HUNTING REGULATIONS

Exhibit R

Public Use of Department Lands

Effective July 1, 2017 – June 30, 2018

For info, scan with your smartphone's barcode scanner app!

Hunt with California Waterfowl!

~ We serve 1,500 hunters per year ~

general hunts • veterans • women • youth • families

Learn more, apply or donate hunts at www.calwaterfowl.org/hunt-program

2017-2018 CALIFORNIA

WATERFOWL & UPLAND GAME

HUNTING REGULATIONS

Contents

NONDISCRIMINATION Any person excluded from participation in, denied the benefits of, or otherwise subjected to discrimination under any program of the California Department of Fish and Wildlife (CDFW), on the grounds of age, race, national origin, disability, religious or political affiliation, color, sex, ancestry, marital status or sexual orientation should contact the nearest regional office of the Department or its headquarters in Sacramento, California, telephone (916) 322 8911. In addition, you may contact the U.S. Equal Employment Opportunity Commission, Washington, D.C. or a local EEOC office listed in your phone directory under U.S. Government.

Alternate communication format is available upon request. If reasonable accommodation is needed contact CDFW at (916) 322 8911 or the California Relay (Telephone) Service for the deaf or hearing impaired from TDD phones at (800) 735 2929.

The CDFW neither endorses products or services listed nor accepts any liability arising from the use of products or services listed.

Contact

wildlife.ca.gov

Headquarters
1416 Ninth Street, Sacramento 95814
(916) 653-7664
wildlife.ca.gov/explore/contact-us

License and Revenue Branch
1740 North Market Blvd.,
Sacramento, CA 95834

State of California
Governor Edmund G. Brown Jr.

Natural Resources Agency
Secretary John Laird

Department of Fish and Wildlife
Director Charlton H. Bonham

California Fish and Game Commission

Eric Sklar President – St. Helena	**Russell Burns** Member - Napa
Jacque Hostler-Carmesin Vice President – McKinleyville	**Peter Silva** Member - Chula Vista
Anthony Williams Member – Huntington Beach	**Valerie Termini** Executive Director - Sacramento

CDFW Contributors
Special thanks to staff at Regulations Unit, License & Revenue Branch, Office of Communications, Education & Outreach, Wildlife Branch, and Law Enforcement Division.

Cover Photo: 2017 Duck Stamp Winner John Nelson Harris of Groveland, Fla

Hunting licenses are sold at most of the following CDFW offices and at authorized license agents statewide. License sales are also available online at ***www.ca.wildlifelicense.com/InternetSales*** and by telephone at (800) 565-1458. To purchase hunting items via online or telephone sales, you must already have hunter education on file in the ALDS.

NORTHERN REGION

Serving Del Norte, Humboldt, Lassen, Mendocino, Modoc, Shasta, Siskiyou, Tehama and Trinity counties.
601 Locust Street, Redding, CA 96001
(530) 225-2300
8:00 AM–4:30 PM, Monday–Friday
askregion1@wildlife.ca.gov

Eureka Field Office

619 Second Street Eureka, CA 95501
(707) 445-6493
8:00 AM–4:30 PM, Monday–Friday

NORTH CENTRAL REGION

Serving Alpine, Amador, Butte, Calaveras, Colusa, El Dorado, Glenn, Lake, Nevada, Placer, Plumas, Sacramento, San Joaquin, Sierra, Sutter, Yolo and Yuba counties.
1701 Nimbus Road, Rancho Cordova, CA 95670
(916) 358-2900
8:00 AM–4:30 PM, Monday–Friday
r2info@wildlife.ca.gov

CENTRAL REGION

Serving Fresno, Kern, Kings, Madera, Mariposa, Merced, Monterey, San Benito, San Luis Obispo, Stanislaus, Tulare and Tuolumne counties.
1234 E. Shaw Avenue, Fresno, CA 93710
(559) 243-4005
8:00 AM–4:30 PM, Monday–Friday
reg4sec@wildlife.ca.gov

BAY DELTA REGION

Serving Alameda, Contra Costa, Marin, Napa, Sacramento, San Mateo, Santa Clara, Santa Cruz, San Francisco, San Joaquin, Solano, Sonoma, and Yolo counties
7329 Silverado Trail, Napa, CA 94558
(707) 944-5500
8:00 AM–4:30 PM, Monday–Friday
Askbdr@wildlife.ca.gov

Stockton Field Office

2109 Arch Airport Road, Suite 100
Stockton, CA 95206
(209) 234-3420
8:00 AM–4:30 PM, Monday–Friday

SOUTH COAST REGION

Serving Los Angeles, Orange, San Diego, Santa Barbara and Ventura counties.
3883 Ruffin Road, San Diego, CA 92123
(858) 467-4201
8:00 AM–4:30 PM, Monday–Friday
askr5@wildlife.ca.gov

Los Alamitos Field Office

4665 Lampson Avenue, Suite C
Los Alamitos, CA 90720
(562) 342-7100
8:00 AM–4:30 PM, Monday–Friday

INLAND DESERTS REGION

Licenses not sold at this location.
Serving Imperial, Inyo, Mono, Riverside and San Bernardino counties.
3602 Inland Empire Blvd., Ste. C-220
Ontario, CA 91764
(909) 484-0167
8:00 AM–4:30 PM, Monday–Friday
AskRegion6@wildlife.ca.gov

MARINE REGION

Serving the entire California coast, from border to border and three nautical miles out to sea.
20 Lower Ragsdale Drive, Ste. 100
Monterey, CA 93940
(831) 649-2870
8:00 AM–4:30 PM, Monday–Friday
AskMarine@wildlife.ca.gov

LICENSE AND REVENUE BRANCH

1740 N. Market Boulevard, Sacramento, CA 95834
(916) 928-5805
8:00 AM - 5:00 PM, Monday - Friday
LRB@wildlife.ca.gov

YOUR STATE DUCK STAMP DOLLARS AT WORK

State Duck Stamp funds are used for waterfowl conservation in California as well as preserving habitat for breeding pintail in Canada.

EST. 2004
J.F. GRIFFIN PUBLISHING
Williamstown, MA | Birmingham, AL

About This Guide

This high-quality guide is offered to you by the California Department of Fish & Wildlife through its unique partnership with J.F. Griffin Publishing, LLC.

The revenue generated through ad sales significantly lowers production costs and generates savings. These savings translate into additional funds for other important agency programs.

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THE LARGEST SELECTION OF SITKA WATERFOWL GEAR
IN THE WESTERN UNITED STATES.
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Outdoor & Sport Co.
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WHAT'S NEW FOR 2017?

EXPANSION OF THE LANDS PASS PROGRAM

Currently, Lands Passes are required at six California Department of Fish and Wildlife (CDFW) properties. With the passage of recent legislation and regulations, this requirement expands to a total of 42 wildlife areas and ecological reserves by no later than January 1, 2018. Participating properties are listed on pages 46 and 52. (Subsections 551(w) and 630(c) Title 14, California Code of Regulations). There will also be signs about the Lands Pass Program posted on the properties that are included. Where required, a Lands Pass must be obtained and carried by each visitor, 16 years of age or older, unless they are carrying a valid hunting or fishing license in their own name. School groups and organized youth groups are exempt from the requirement, and are encouraged to contact the Department to arrange group visits. Instructions on how to purchase Lands Passes appear on page 24.

Management of California Department of Fish and Wildlife (CDFW) lands is funded primarily by hunters and anglers. The Lands Pass Program began in 1988, and is expanding to provide an opportunity for all visitors to contribute to the management of the properties they enjoy and appreciate.

NEW DRAWING PROCESS FOR SPECIAL UPLAND GAME WILD BIRD HUNTS

Drawing application for the specially managed wild upland game bird hunts is now conducted through the Automated License Data System (ALDS). Hunters must be successfully drawn through this random drawing application to participate in pheasant, chukar, quail, wild turkey and dove special hunts. To apply hunters must have a valid California hunting license. Adult hunters must also purchase an Upland Game Bird Stamp to hunt upland game birds.

Applications may be purchased online, at retail agents or by calling (800) 565-1458. A non-refundable $2.42 application fee will be charged for each hunt applicant. Hunters may select their top three choices, and may only apply once for each available hunt date for each area. For additional information and hunting opportunities go to ***http://wildlife.ca.gov/Hunting/Upland-Game-Birds/Hunts***

The Apprentice Pheasant Hunts for beginning hunters will continue to be applied to at ***https://nrm.dfg.ca.gov/ApprenticeHunts/Default.aspx***

PINTAIL BAG LIMITS

The pintail bag limit has decreased to 1 per day for the 2017-2018 season. The 2016 breeding population estimate was 2.62 million, a decline of 14% from 2015 and a 41% total decline since 2011. The last time the limit was 1 per day was 2008. The waterfowl hunting regulations are established based on the previous year's breeding population estimates.

CONTACT US

- Mobile: ***www.dfg.ca.gov/mobile***
- Facebook: ***www.facebook.com/CaliforniaDFW***
- Twitter: Text follow CaliforniaDFW to 40404 in the US
- Blogs: ***cdfgnews.wordpress.com***
- Flickr: ***www.flickr.com/photos/CaliforniaDFG***
- YouTube: ***www.youtube.com/user/CaliforniaDFG***

STAY CONNECTED TO CDFW

Having your e mail address and mobile number will enable the CDFW to send you information you can use, such as license sales dates, harvest report card deadlines and other hunting information as it becomes available. When purchasing a license from a license agent or online, you may update your profile by providing your e mail address and mobile number. Fish and Game Code, Section 1050.6, and California Government Code, Section 11015.5, prohibit the CDFW from selling or sharing your personal information with any third party.

REPORT UPLAND GAME BIRD DISEASE

Band tailed pigeons are susceptible to Avian Trichomonosis, a disease caused by a protozoal parasite. Sick birds often resist flying and may appear to be panting or gulping. CDFW makes an effort to document the occurrence of this and other avian diseases.

While this specific disease is not transmissible to humans, CDFW recommends hunters thoroughly cook all wild game.

If you observe more than 5 sick or dead birds in the same location you can report your findings to the CDFW Wildlife Investigations Lab at (916) 358 2790 or online: ***https://www.wildlife.ca.gov/Conservation/Laboratories/WildlifeInvestigations/Monitoring/MortalityReport.aspx***

SHOOTERS & HUNTERS: HELP PREVENT WILDFIRES.

The target shooting and hunting community prides itself on being safe and responsible with firearms in all situations—from using them outdoors to storing them safely at home. Sometimes, however, unusual conditions such as extremely dry environments require an extra level of awareness and safety on the part of shooters.

Wildfires have many possible causes. The National Shooting Sports Foundation, the trade association for the firearms and ammunition industry, reminds all shooters that during dry and hot weather conditions their use of certain ammunition and targets could accidentally ignite a wildfire. NSSF reminds all target shooters and hunters, as well as other outdoor enthusiasts, to consider the potential consequences of their activities in fire-prone environments.

- **Make it a point to know the regulations and rules related to shooting in areas experiencing dry and hot conditions, whether on public or private land or at shooting ranges. Many national forests, for example, do not allow recreational shooting when fire restrictions are in effect.**
- **Consider the type of ammunition and targets you are using. Minimize the risk of fires by not using steel-jacketed ammunition, ammunition with steel-core components, tracer rounds or exploding targets in fire-prone areas.**
- **Remember that equipment, such as cars and ATVs, can have extremely hot exhaust systems that could ignite dry vegetation, so park only in designated areas.**
- **Extinguish and dispose of smoking materials safely.**
- **Follow guidelines to extinguish campfires.**
- **Warn others of potential dangers and behaviors for starting wildfires.**
- **Report any wildfire you see to authorities.**
- **Spread this message to other target shooters, hunters and outdoor enthusiasts.**

NSSF.ORG

National SHOOTING SPORTS Foundation
PROMOTE • PROTECT • PRESERVE

LICENSE INFORMATION

Effective: July 1, 2017-June 30, 2018

Includes 5% license agent handling fee and 3% ALDS nonrefundable application fee.
Your license, validation, reservation, and permit/pass purchases support conservation and management of California's wildlife.

Recovering Service Member	$7.30
Duplicate (annual licenses only)	$10.54

2017 LIFETIME HUNTING LICENSE	FEE
Ages 0-9	$518.25
Ages 10-39	$846.75
Ages 40-61	$763.00
Ages 62+	$518.25
Lifetime Bird Hunting Privilege Package (includes Lifetime California Duck Validation and Lifetime Upland Game Bird Validation)	$301.50

Learn more about Lifetime Hunting and Fishing Licenses at ***www.wildlife.ca.gov/licensing***

HUNTER EDUCATION	FEE
Hunter Education Equivalency Exam	$52.25
Duplicate Hunter Education Certificate (available for those issued after 1989)	$6.22

VALIDATIONS	FEE
California Duck**	$20.52
Federal Duck***	$25.00
Upland Game Bird**	$9.46
Harvest Information Program	FREE

RESERVATION APPLICATIONS	FEE
Per Choice	$1.34

HUNTING PASS	FEE
Type-A Season Pass	$159.33
Type-B Season Pass	$53.18
Type-A One-Day Pass	$21.09
Type-A Two-Day Pass	$34.05

ANNUAL AND DAILY LANDS PASS FEES FOR 2017	FEE
Annual CDFW Lands Pass****	$24.33
Daily CDFW Lands Pass (One-Day)****	$4.32

SPECIAL USE PERMITS	FEE
Type-1	$122.50
Type-2	$462.50
Type-3	$536.00

See page 29 for reservaton, permit and pass information.

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* Available only at CDFW License Sales offices.
** Not required for junior license holders.
*** Required for hunters 16 and older. Available from the US Postal Service and some license agents.
**** A Lands Pass required for visitors without a fishing or hunting license at Gray Lodge WA, Grizzly Island WA, Los Banos WA, San Jacinto WA, Imperial WA, and Elkhorn Slough ER. This expands to 42 properties, starting no later than January 1, 2018. See page 24 for details.

LICENSE PROVISIONS

A valid California hunting license is required for taking any bird or mammal. Hunters must carry licenses and be prepared to show them on request (§700, T14, CCR). Guns and other equipment used in hunting must be shown on request. A trapping license is required to sell furs of furbearing mammals and nongame mammals, regardless of the method of take. Fur buyers and fur agents: See §696, T14, CCR; contact your nearest CDFW License Sales Office.

Residency: A resident is defined as any person who has resided continuously in California for six months immediately before the date of purchase of a license, tag or permit; persons on active duty with the armed forces of the United States or an auxiliary branch; or Job Corps enrollees. (Section 70, FGC)

IDENTIFICATION REQUIRED FOR LICENSE PURCHASE §700.4, T14, CCR

Any person applying for any license, tag, permit, reservation or other entitlement issued via the ALDS shall provide valid identification. Acceptable forms of identification include:

- Any license document or identification number previously issued via ALDS
- Valid driver's license or identification card issued by the Department of Motor Vehicles or the entity issuing driver's licenses from the licensee's state of domicile
- US Birth Certificate/US Certificate or Report of Birth Abroad
- INS American Indian Card
- Birth certificate or passport issued from a US territory
- US Passport
- US Military Identification Cards (Active or reserve duty, dependent, retired member, discharged from service, medical/religious personnel)
- Certificate of Naturalization (Green Card) or Citizenship.
- Foreign Government Identification Card

Applicants less than 18 years of age may provide any form of identification described above, or a parent or legal guardian's identification as described above.

VALIDATION OF LICENSES

To be valid, every California hunting or sport fishing license shall be signed by the licensee. In addition, the license must contain the following information about the licensee: true name, residence address, date of birth, height, color of eyes, color of hair, weight, and sex.

HUNTER EDUCATION REQUIREMENT

Licenses shall be issued to hunters only upon presentation of one of the following: An annual California hunting license issued in any prior year; a two-day nonresident California hunting

PURCHASE HUNTING LICENSES AND APPLY FOR DRAWINGS ONLINE!

For more information, visit: ***www.wildlife.ca.gov/Licensing/Online Sales***

DUCKS UNLIMITED

There are over 4,000 DU events held across the country each year. By attending a local event, you can have a great time while helping us fill the skies with waterfowl. To find one near you, visit *ducks.org/events*.

license issued after the 1999/2000 license year; a California certificate of hunter education completion or equivalency; a certificate of successful completion of a California-approved hunter education course from any state or province; or hunting license issued in either of the two previous years from any state, province, European country, or South Africa.

For more information, on hunter education requirements or hunter education classes, contact any CDFW license sales office or visit the CDFW web site at ***www.wildlife.ca.gov/hunter-education***.

PROOF OF HUNTER EDUCATION MUST BE PROVIDED TO CDFW BEFORE HUNTING ITEMS MAY BE PURCHASED ONLINE

Hunters who are purchasing a license for the first time must provide their proof of hunter education to a CDFW license sales office or any license agent before they can purchase a hunting license or any hunting items online or by telephone. Hunters may contact CDFW via fax at (916) 419-7587 or email LRB@wildlife.ca.gov and provide their personal identification and proof of hunter education. Department staff will update your customer record. Once you receive notification that your customer record has been updated, you will be able to purchase a hunting license anywhere licenses are sold, including online.

DISABLED VETERAN HUNTING LICENSES

A reduced-fee hunting license is available for qualified disabled veterans.

To prequalify for a disabled veteran hunting license, submit a letter from the Veteran's Administration documenting that you were honorably discharged from the US military and have a service–connected disability rating of 50% or greater. Send a photocopy of your identification, GO ID and documentation of eligibility by email to LRB@wildlife.ca.gov or by fax to (916) 419-7587. After you receive notification from the Department that your customer record has been updated, you will be able to purchase a low cost disabled veteran hunting license anywhere licenses are sold. You may also apply by mail or in person at any Department of Fish and Wildlife license sales office. For more information on the disabled veterans hunting license, visit ***www.wildlife.ca.gov/Licensing/Hunting***.

RECOVERING SERVICE MEMBER REDUCED-FEE HUNTING LICENSE

Reduced-fee hunting licenses are available for recovering service members. Fish and Game Code, Section 7150, defines a recovering service member as a member of the Armed Forces, including a member of the National Guard or a Reserve, who is undergoing medical treatment, recuperation, or therapy and is in an outpatient status while recovering from a serious injury or illness related to the member's military service.

To prequalify for a recovering service member license, submit a letter from your commanding officer or from a military medical doctor verifying your eligibility as a recovering service member. Please have your commanding officer or military medical doctor include the expected recovery date in your verification letter. Send a photocopy of your identification, GO ID and documentation of eligibility by email to LRB@wildlife.ca.gov or by fax to (916) 419-7587. Once you receive notification from the Department that your customer record has been updated, you will be able to purchase a low cost recovering service member hunting license anywhere licenses are sold. You may also apply by mail or in person at any Department of

NONLEAD AMMUNITION IMPLEMENTATION

Phase 1
July 1, 2015

Nonlead ammo required on all CDFW wildlife areas, ecological reserves and bighorn sheep hunts

Phase 2
July 1, 2016

Nonlead shot required when using a shot gun to take resident small game mammals, furbearing mammals, nongame mammals, nongame birds, any wildlife for depredation purposes, and upland game birds except for dove, quail, snipe, and any game birds taken on licensed game bird clubs

Phase 3
July 1, 2019

Nonlead ammo required when taking any wildlife with a firearm in California

Fish and Wildlife license sales office. For more information on disabled veteran hunting licenses, visit ***www.wildlife.ca.gov/Licensing/Hunting***.

VALIDATIONS TO HUNT WATERFOWL AND UPLAND GAME BIRDS

Any person, except a person hunting under the authority of a junior hunting license, who takes ducks, geese, or brant must have a California Duck Validation (FGC 3700.1) in possession. Any hunter who is age 16 or older must possess a Federal Duck Stamp to take ducks, geese or brant. The Federal Duck Stamp must be signed across the face to be valid and may be affixed anywhere on the back of your hunting license or carried separately from your California hunting license. Any person, except a person hunting under the authority of a junior hunting license, who takes upland game birds must have a California Upland Game Bird Validation (FGC 3682.1) in possession. Any person who purchases a California Duck Validation is eligible to claim a free collectible California Duck Stamp. Any person who purchases an Upland game Bird Validation is eligible to claim a free collectible Upland Game Bird Stamp. Visit ***wildlife.ca.gov/Licensing/Collector-Stamps*** to claim your collectible stamps.

HIP VALIDATION REQUIRED

If you plan to hunt migratory game birds (ducks, geese, coots, dove, band-tailed pigeon, snipe, gallinules or black brant), you must complete a Harvest Information Program (HIP) survey and possess a free HIP validation. HIP surveys and validations are available at license agents. Hunters may be cited for hunting migratory game birds without a HIP validation in possession.

HUNTING AREA PERMITS/PASSES

Except for persons hunting on most Type C wildlife areas or hunting under the authority of a junior hunting license, all hunters using State-controlled hunting areas during the waterfowl season are required to obtain an entry permit from the hunter checking station. To obtain a permit, hunters must pre-purchase one of the following passes from any CDFW license agent, license sales office or online and present it at the check station:

- **Type A One-Day Pass** – valid for one hunter entry on one Type A area
- **Type A Two-Day Pass** - may be used by one hunter for two entries or two hunters for one entry each;
- **Type A Season Pass** - this nontransferable pass may be used for any available hunt day on any Type A or Type B area; or
- **Type B Season Pass** - this nontransferable pass may be used for any available hunt day on Type B areas only.

No hunting pass required for Type C wildlife areas.

RESERVATION APPLICATION PROCESS

Hunters can apply for waterfowl hunting reservations using an electronic season-long application or a multiple choice application online, at a CDFW license sales office, or at any license agent. Hunters can apply for waterfowl hunting reservations review their hunt choices, and check drawing results online at ***wwildlife.ca.gov/Licensing/Online-Sales***.

NO SALES AT CHECK STATIONS

Check stations do not sell any items. Hunters must purchase any needed passes and validations in advance from CDFW license sales offices, license agents, or online. To find a license agent near you or purchase items online visit the CDFW website at: ***wildlife.ca.gov/Licensing/Online-Sales***.

DUCKS UNLIMITED

There are over 4,000 DU events held across the country each year. By attending a local event, you can have a great time while helping us fill the skies with waterfowl. To find one near you, visit *ducks.org/events*.

TELEPHONE SALES

Most hunting and sport fishing license items, including validations, drawing applications, and tags, may be purchased via telephone from Active Network's telephone license sales line at (800) 565-1458. To purchase items via telephone, you must have hunter education on file in the ALDS. Items purchased by telephone sales will be delivered by mail within 15 days of purchase.

GET OUTDOORS IDENTIFICATION (GO ID)

All licenses are imprinted with your permanent GO ID number. Your GO ID can be used to retrieve your customer information in the future.

PROTECT YOUR LICENSE FROM HEAT

License documents subjected to extreme or prolonged heat may darken and become difficult to read. To protect your license, keep it away from heat sources.

DUPLICATE HUNTING LICENSES

Under ALDS, your customer record will contain a history of all your license purchases. If you lose your license or additional validations, you can go to any CDFW license sales office or license agent and purchase a duplicate license and validations for a reduced fee.

REFUNDS

California resident and nonresident hunting licenses are nonrefundable.

IT IS UNLAWFUL TO:

- Trespass while hunting. (FGC 2016)
- Litter in or within 150 feet of state waters or place the litter where it can pass into state waters. This includes empty shotgun shells going into state waters and not retrieved. (FGC 5652)
- Hunt or discharge a firearm within 150 yards of a dwelling (safety zone) without permission of the owner or the person in control of the property. (FGC 3004)

- Take waterfowl or resident small game with a shotgun capable of holding more than 3 shells. (CCR T14-311(a), 507)
- Transport game birds without fully feathered head or wing attached. (CCR T14-251.7)
- Waste the carcass of any game bird or mammal. (FGC 4304)
- Hunt over bait. (CCR T14-257.5, 509)
- Shoot unauthorized nongame birds. (FGC 3800)
- Hunt on a state or federal wildlife area without the proper permit when required. (CCR T14-550, 551)
- Use an electronic calling device when taking waterfowl. (CCR T14-507)
- Use live decoys when hunting waterfowl. (CCR T14-507)
- Use any mammal (except a dog) or an imitation of a mammal as a blind in approaching or taking game birds. (FGC 3502)
- Transfer any license, tag, stamp, permit, application or reservation to another person. (FGC 1052)
- Use or possess any license, tag, stamp, permit, application or reservation that was not lawfully issued to the user; or alter, mutilate deface, duplicate or counterfeit any license, tag, stamp, permit, application or reservation. (FGC 1052)
- Fail to exhibit upon demand to any peace officer, all licenses, tags, and wildlife and devices capable of being used to take wildlife. (FGC 2012)
- Prohibit a Warden from inspecting any boat, market, or receptacle where fish or wildlife may be found. (FGC 1006)
- Hunt without your hunting license in possession. (CCR T14-700)
- Use a fishing or hunting license that is not completely filled out.
- Possess fish or wildlife taken unlawfully. (FGC 2002)
- Take fish or wildlife in violation of any section of law. (FGC 2000)

INTERSTATE WILDLIFE VIOLATOR COMPACT

The Interstate Wildlife Violator Compact (IWVC) is an agreement between 44 states, which allows for the reciprocal recognition of hunting, fishing and trapping license suspensions. If your license privileges have been suspended by another state, the suspension may be recognized here in California. For example, if your sport fishing, hunting or trapping privileges have been suspended in Colorado for five years, your privileges may also be suspended for five years in California or any of the states participating in the IWVC. The purchase of licenses or tags during the term of the suspension is a violation of the law and may result in prosecution.

NORTHERN CALIFORNIA 2017-2018 SHOOTING HOURS

DATE	EUREKA		TULE LAKE-KLAMATH BASIN		COLUSA		SAN FRANCISCO BAY AREA		SACRAMENTO		LOS BANOS	
	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
September 1	6:14	7:48	6:02	7:39	6:07	7:38	6:10	7:38	6:05	7:35	6:04	7:31
September 2	6:15	7:47	6:03	7:37	6:08	7:37	6:11	7:37	6:06	7:34	6:05	7:30
September 9	6:22	7:35	6:10	7:25	6:14	7:25	6:17	7:26	6:12	7:23	6:11	7:19
September 16	6:29	7:23	6:17	7:13	6:21	7:14	6:23	7:15	6:19	7:12	6:17	7:09
September 23	6:35	7:11	6:25	7:01	6:27	7:03	6:29	7:05	6:25	7:01	6:22	6:58
September 30	6:43	7:00	6:32	6:49	6:33	6:52	6:35	6:54	6:31	6:50	6:28	6:48
October 7	6:50	6:48	6:40	6:37	6:40	6:41	6:41	6:43	6:38	6:39	6:34	6:37
October 14	6:57	6:37	6:48	6:25	6:47	6:30	6:48	6:33	6:44	6:29	6:41	6:27
October 21	7:05	6:27	6:56	6:15	6:54	6:20	6:54	6:24	6:51	6:19	6:47	6:18
October 28	7:13	6:17	7:04	6:05	7:02	6:11	7:01	6:15	6:59	6:10	6:54	6:10
November 4	7:21	6:09	7:13	5:56	7:10	6:03	7:09	6:08	7:06	6:02	7:01	6:02
November 5*	6:22	5:08	6:14	4:55	6:11	5:02	6:10	5:07	6:07	5:01	6:02	5:02
November 11	6:29	5:02	6:21	4:48	6:17	4:56	6:16	5:01	6:14	4:56	6:08	4:56
November 18	6:38	4:56	6:30	4:42	6:25	4:51	6:24	4:56	6:21	4:50	6:16	4:51
November 25	6:45	4:52	6:38	4:38	6:33	4:47	6:31	4:53	6:29	4:47	6:23	4:48
December 2	6:53	4:49	6:46	4:35	6:40	4:45	6:38	4:51	6:36	4:45	6:29	4:46
December 9	6:59	4:49	6:52	4:35	6:46	4:45	6:44	4:51	6:42	4:45	6:35	4:46
December 16	7:05	4:50	6:58	4:36	6:51	4:47	6:49	4:52	6:47	4:46	6:40	4:48
December 23	7:09	4:53	7:02	4:39	6:55	4:50	6:53	4:56	6:51	4:49	6:44	4:51
December 30	7:11	4:58	7:04	4:44	6:57	4:54	6:55	5:00	6:53	4:54	6:47	4:56
January 6	7:11	5:04	7:04	4:50	6:58	5:00	6:55	5:06	6:54	5:00	6:47	5:02
January 13	7:09	5:12	7:02	4:58	6:57	5:07	6:54	5:13	6:53	5:07	6:46	5:08
January 20	7:06	5:20	6:58	5:06	6:54	5:15	6:52	5:20	6:50	5:14	6:44	5:16
January 27	7:01	5:28	6:53	5:15	6:49	5:23	6:48	5:28	6:45	5:22	6:40	5:23

* Daylight saving time changes to standard time. Hours indicated on and after this date are in standard time.

SOUTHERN CALIFORNIA 2017-2018 SHOOTING HOURS

DATE	ATASCADERO		KERN COUNTY-BAKERSFIELD		BISHOP-OWENS VALLEY		LOS ANGELES		SAN DIEGO		CALIPATRIA	
	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
September 1	6:05	7:29	5:59	7:22	5:54	7:22	5:57	7:19	5:54	7:13	5:47	7:07
September 2	6:06	7:28	5:59	7:21	5:55	7:20	5:58	7:17	5:54	7:11	5:47	7:05
September 9	6:11	7:18	6:05	7:11	6:01	7:10	6:03	7:08	5:59	7:02	5:52	6:56
September 16	6:16	7:08	6:10	7:01	6:07	6:59	6:08	6:58	6:03	6:53	5:56	6:46
September 23	6:22	6:57	6:15	6:51	6:13	6:48	6:13	6:48	6:08	6:43	6:01	6:37
September 30	6:27	6:47	6:20	6:41	6:19	6:38	6:18	6:39	6:12	6:34	6:06	6:27
October 7	6:33	6:37	6:26	6:31	6:25	6:27	6:23	6:29	6:17	6:25	6:11	6:18
October 14	6:38	6:28	6:32	6:22	6:31	6:17	6:28	6:20	6:22	6:16	6:16	6:09
October 21	6:45	6:19	6:38	6:13	6:38	6:08	6:34	6:12	6:28	6:08	6:21	6:01
October 28	6:51	6:11	6:44	6:05	6:45	6:00	6:40	6:04	6:33	6:01	6:27	5:54
November 4	6:58	6:04	6:51	5:58	6:52	5:52	6:46	5:58	6:39	5:55	6:33	5:48
November 5*	5:59	5:03	5:52	4:57	5:53	4:51	5:47	4:57	5:40	4:54	5:34	4:47
November 11	6:05	4:59	5:58	4:52	5:59	4:46	5:53	4:52	5:45	4:50	5:40	4:42
November 18	6:11	4:54	6:05	4:48	6:06	4:41	5:59	4:48	5:52	4:46	5:46	4:38
November 25	6:18	4:51	6:11	4:45	6:14	4:38	6:06	4:45	5:58	4:43	5:52	4:36
December 2	6:25	4:50	6:18	4:43	6:20	4:36	6:12	4:44	6:04	4:42	5:58	4:35
December 9	6:30	4:50	6:24	4:44	6:26	4:36	6:18	4:44	6:10	4:43	6:04	4:35
December 16	6:35	4:52	6:28	4:45	6:31	4:37	6:23	4:46	6:14	4:45	6:09	4:37
December 23	6:39	4:55	6:32	4:49	6:35	4:41	6:26	4:49	6:18	4:48	6:12	4:40
December 30	6:42	4:59	6:35	4:53	6:38	4:45	6:29	4:54	6:21	4:52	6:15	4:45
January 6	6:42	5:05	6:35	4:59	6:38	4:51	6:30	4:59	6:22	4:58	6:16	4:50
January 13	6:42	5:11	6:35	5:05	6:37	4:58	6:29	5:06	6:21	5:04	6:16	4:56
January 20	6:39	5:18	6:33	5:12	6:35	5:05	6:27	5:12	6:20	5:10	6:14	5:03
January 27	6:36	5:26	6:29	5:19	6:30	5:13	6:24	5:19	6:16	5:17	6:11	5:09

* Daylight saving time changes to standard time. Hours indicated on and after this date are in standard time.

WATERFOWL HUNTING REGULATIONS

SUMMARY OF WATERFOWL REGULATION CHANGES FOR 2017-2018

- **Pintail bag limit decreased to 1 per day**
- **White goose bag limit increased in the Colorado River Zone to 20 per day**

STATEWIDE AND ZONE WATERFOWL REGULATIONS

502. Waterfowl, Migratory; American Coot and Common Moorhen (Common Gallinule).

(a) Definitions.

- (1) Dark geese. Dark geese include Canada geese, cackling geese, Aleutian geese and white-fronted geese ("specklebelly").
- (2) Large Canada geese. Large Canada geese include western Canada geese ("honker") and lesser Canada geese ("lessers").
- (3) Small Canada geese. Small (about the size of a mallard) Canada geese include cackling geese and Aleutian geese. Both are white-cheeked geese nearly identical in appearance to Large Canada geese. Aleutian geese have a thin white neck ring and Cackling geese have dark breasts. Both species have a high-pitched cackle as opposed to the deeper "honking".
- (4) White geese. White geese include Ross' geese, snow geese and blue phase of both species.

(b) Waterfowl Hunting Zones.

- (1) Northeastern California Zone: In that portion of California lying east and north of a line beginning at the intersection of Interstate 5 with the California-Oregon state line; south along Interstate 5 to its junction with Walters Lane south of the town of Yreka; west along Walters Lane to its junction with Easy Street; south along Easy Street to the junction with Old Highway 99; south along Old Highway 99 to the point of intersection with Interstate 5 north of the town of Weed; south along Interstate 5 to its junction with Highway 89; east and south along Highway 89 to Main Street in Greenville; north and east to its junction with North Valley Road; south to its junction of Diamond Mountain Road; north and east to its junction with North Arm Road; south and west to the junction of North Valley Road; south to the junction with Arlington Road (A22); west to the junction of Highway 89; south and west to the junction of Highway 70; east on Highway 70 to Highway 395; south and east on Highway 395 to the point of intersection with the California-Nevada state line; north along the California-Nevada state line to the junction of the California-Nevada-Oregon state lines west along the California-Oregon state line to the point of origin.
- (2) Southern San Joaquin Valley Zone: All of Kings and Tulare counties and that portion of Kern County north of the Southern California Zone.
- (3) Southern California Zone: In that portion of southern California (but excluding the Colorado River zone) lying south and east of a line beginning at the mouth of the Santa Maria River at the Pacific Ocean; east along the Santa Maria River to where it crosses Highway 101-166 near the City of Santa Maria; continue north on 101-166; east on Highway 166 to the junction with Highway 99; south on Highway 99 to the junction of Interstate 5; south on Interstate 5 to the crest of the Tehachapi Mountains at Tejon Pass; east and north along the crest of the Tehachapi Mountains to where it intersects Highway 178 at Walker Pass; east on Highway 178 to the junction of Highway 395 at the town of Inyokern; south on Highway 395 to the junction of Highway 58; east on Highway 58 to the junction of Interstate 15; east on Interstate 15 to the junction with Highway 127; north on Highway 127 to the point of intersection with the California-Nevada state line.
- (4) Colorado River Zone: In those portions of San Bernardino, Riverside, and Imperial counties lying east of the following lines: Beginning at the intersection of Nevada State Highway 95 with the California-Nevada state line; south along Highway 95 through the junction with Highway 40; continue south on Highway 95 to Vidal Junction; south through the town of Rice to the San Bernardino-Riverside county line on a road known as "Aqueduct Road" also known as Highway 62 in San Bernardino County; southwest on Highway 62 to Desert Center Rice Road; south on Desert Center Rice Road/Highway 177 to the town of Desert Center; continue east 31 miles on Interstate 10 to its intersection with the Wiley Well Road; south on this road to Wiley Well; southeast along the Milpitas Wash Road to the Blythe, Brawley, Davis Lake intersections; south

WATERFOWL CONSUMPTION HEALTH WARNINGS

The California Environmental Protection Agency s Office of Environmental Health Hazard Assessment (OEHHA) determines whether a public health hazard may exist from consumption of waterfowl taken from certain locations in California based on laboratory testing data. The following advisories have been issued. The guidelines are based on risk estimates that assume long term consumption; thus, occasional intake of duck meat slightly above the recommended quantitative limits is not expected to produce a health hazard.

Grasslands area (Western Merced County)
Because of elevated selenium levels, no one should eat more than 4 oz. of duck meat from the Grasslands area in any two week period. No one should eat livers of duck from the area.

Suisun Bay (Contra Costa and Solano Counties)
Because of elevated selenium levels, no one should eat more than 4 oz. per week of (greater and lesser) scaup meat, or more than 4 oz. of scoter meat in any two week period. No one should eat livers of duck from the area.

San Pablo Bay (Contra Costa, Marin, Solano, Sonoma Counties)
Because of elevated selenium levels, no one should eat more than 4 oz. per week of greater scaup meat, or more than 4 oz. of scoter meat in any two week period from the bay. No one should eat livers of duck from the area.

San Francisco Bay (Alameda, Contra Costa, Marin, San Francisco, San Mateo, Santa Clara Counties)
Because of elevated selenium levels, no one should eat more than 4 oz. per week of greater scaup meat from the central bay, or more than 4 oz. of greater scaup meat from the south bay in any two week period. No one should eat livers of duck from the area.

on the Blythe Ogilby Road also known as County Highway 34 to its intersection with Ogilby Road; south on this road to Highway 8; east seven miles on Highway 8 to its intersection with the Andrade-Algodones Road/Highway 186; south on this paved road to the intersection of the Mexican boundary line at Los Algodones, Mexico.

(5) Balance of State Zone: That portion of the state not included in Northeastern California, Southern California, Colorado River or the Southern San Joaquin Valley zones.

(6) Special Management Areas

(A) North Coast. All of Del Norte and Humboldt counties.

(B) Humboldt Bay South Spit (West Side). Beginning at the intersection of the north boundary of Table Bluff County Park and the South Jetty Road; north along the South Jetty Road to the South Jetty; west along the South Jetty to the mean low water line of the Pacific Ocean; south along the mean low water line to its intersection with the north boundary of the Table Bluff County Park; east along the north boundary of the Table Bluff County Park to the point of origin.

(C) Sacramento Valley. Beginning at the town of Willows; south on Interstate 5 to the junction with Hahn Road; east on Hahn Road and the Grimes-Arbuckle Road to the town of Grimes; north on Highway 45 to its junction with Highway 162; north on Highway 45-162 to the town of Glenn; west on Highway 162 to the point of beginning.

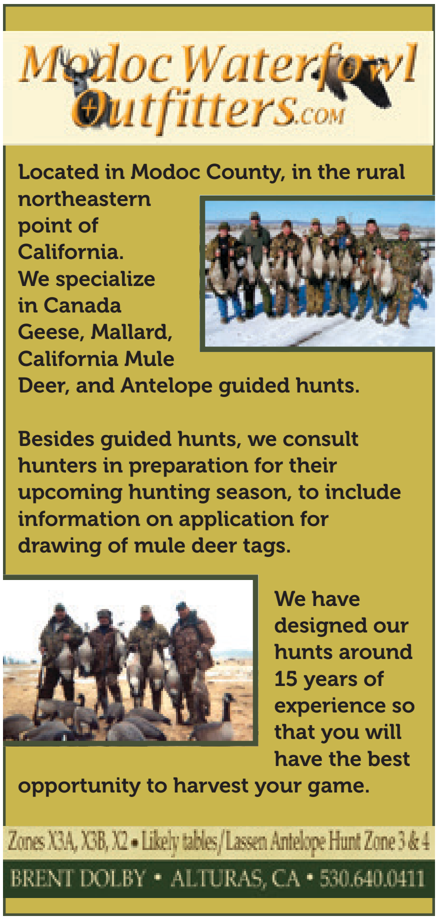
(D) Morro Bay. Beginning at a point where the high tide line intersects the State Park boundary west of Cuesta by the Sea; northeasterly to a point 200 yards offshore of the high tide line at the end of Mitchell Drive in Baywood Park; northeasterly to a point 200 yards offshore of the high tide line west of the Morro Bay State Park Boundary, adjacent to Baywood Park; north to a point 300 yards south of the high tide line at the end of White Point; north along a line 400 yards offshore of the south boundary of the Morro Bay City limit to a point adjacent to Fairbanks Point; northwesterly to the high tide line on the sand spit; southerly along the high tide line of the sand spit to the south end of Morro Bay; easterly along the Park boundary at the high tide line to the beginning point.

(E) Martis Creek Lake. The waters and shoreline of Martis Creek Lake, Placer and Nevada counties.

(F) Northern Brant. Del Norte, Humboldt and Mendocino counties.

(G) Balance of State Brant. That portion of the state not included in the Northern Brant Special Management Area.

(H) Imperial County. Beginning at Highway 86 and the Navy Test Base Road; south on Highway 86 to the town of Westmoreland; continue through the town of Westmoreland to Route S26; east on Route S26 to Highway 115; north on Highway 115 to Weist Rd.; north on Weist Rd. to Flowing Wells Rd.; northeast on Flowing Wells Rd. to the Coachella Canal; northwest on the Coachella Canal to Drop 18; a straight line from Drop 18 to Frink Rd.; south on Frink Rd. to Highway 111; north on Highway 111 to Niland Marina Rd.; southwest on Niland Marina Rd. to the old Imperial County boat ramp and the water line of the Salton Sea; from the water line of the Salton Sea, a straight line across the Salton Sea to the Salinity Control Research Facility and the Navy Test Base Road; southwest on the Navy Test Base Road to the point of beginning.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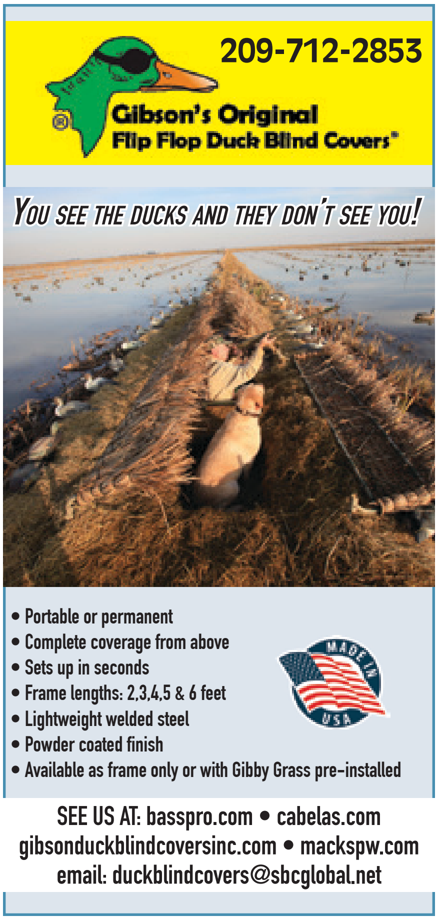
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(c) Seasons and Bag and Possession Limits for American Coots, and Common Moorhens.

(1) Statewide Provisions

		Daily bag limit: 25, either all of one species or a mixture of these species. Possession limit: triple the daily bag limit

(d) Seasons and Bag and Possession Limits for Ducks and Geese by Zone.

(1) Northeastern California Zone (NOTE: SEE SUBSECTION 502(d)(6) BELOW FOR SPECIAL SEASONS AND CLOSURES.)

	From the first Saturday in October extending for 105 days. **(Oct 7 – Jan 19)** Scaup: from the first Saturday in October extending for a period of 58 days **(Oct 7 – Dec 3)** and from the fourth Saturday in December extending for a period of 28 days. **(Dec 23 – Jan 19)**	Daily bag limit: 7 Daily bag limit may include: • 7 mallards, but not more than 2 females. • 1 pintail (either sex). • 2 canvasback (either sex). • 2 redheads (either sex). • 3 scaup (either sex). Possession limit: triple the daily bag limit.
	Regular Season: Dark geese from the first Saturday in October extending for 100 days. **(Oct 7 – Jan 14)** White geese from the first Saturday in October extending for a period of 58 days **(Oct 7 – Dec 3)** and from the first Saturday in January extending for a period of 14 days. **(Jan 6 – Jan 19)** Late Season: White-fronted geese from March 3 extending for 5 days. **(Mar 3 – Mar 7)** White geese from the first Tuesday in February extending for 33 days. **(Feb 6 – Mar 10)** During the Late Season, hunting is only permitted on Type C wildlife areas listed in Section 550-552, navigable waters, and private lands with the permission of the land owner under provisions of Section 2016, Fish and Game Code. Hunting is prohibited on Type A and Type B wildlife areas, the Klamath Basin National Wildlife Refuge Complex, the Modoc National Wildlife Refuge, and any waters which are on, encompassed by, bounded over, flow over, flow through, or are adjacent to any Type A and Type B wildlife areas, the Klamath Basin National Wildlife Refuge Complex, or the Modoc National Wildlife Refuge.	Daily bag limit: 30 Daily bag limit may include: • 20 white geese. • 10 dark geese but not more than 2 Large Canada geese (see definitions: 502(a)). Possession limit: triple the daily bag limit.

(2) Southern San Joaquin Valley Zone (NOTE: SEE SUBSECTION 502(d)(6) BELOW FOR SPECIAL SEASONS AND CLOSURES.)

(A) SPECIES	(B) SEASON	(C) DAILY BAG AND POSSESSION LIMITS
Ducks (including Mergansers)	From the third Saturday in October extending for 100 days. **(Oct 21 – Jan 28)** Scaup: from the first Saturday in November extending for 86 days. **(Nov 4 – Jan 28)**	Daily bag limit: 7 Daily bag limit may include: • 7 mallards, but not more than 2 females. • 1 pintail (either sex). • 2 canvasback (either sex). • 2 redheads (either sex). • 3 scaup (either sex). Possession limit: triple the daily bag limit.
Geese	From the third Saturday in October extending for 100 days. **(Oct 21 – Jan 28)**	Daily bag limit: 30 Daily bag limit may include: • 20 white geese. • 10 dark geese (see definitions: 502(a)). Possession limit: triple the daily bag limit.

(3) Southern California Zone (NOTE: SEE SUBSECTION 502(d)(6) BELOW FOR SPECIAL SEASONS AND CLOSURES.)

(A) SPECIES	(B) SEASON	(C) DAILY BAG AND POSSESSION LIMITS
Ducks (including Mergansers)	From the third Saturday in October extending for 100 days. **(Oct 21 – Jan 28)** Scaup: from the first Saturday in November extending for 86 days. **(Nov 4 – Jan 28)**	Daily bag limit: 7 Daily bag limit may include: • 7 mallards, but not more than 2 females. • 1 pintail (either sex). • 2 canvasback (either sex). • 2 redheads (either sex). • 3 scaup (either sex). Possession limit: triple the daily bag limit.
		Daily bag limit: 23 Daily bag limit may include: • 20 white geese. • 3 dark geese (see definitions 502(a)). Possession limit: triple the daily bag limit.

(4) Colorado River Zone (NOTE: SEE SUBSECTION 502(d)(6) BELOW FOR SPECIAL SEASONS AND CLOSURES.)

(A) SPECIES	(B) SEASON	(C) DAILY BAG AND POSSESSION LIMITS
Ducks (including Mergansers)	From the third Friday in October extending for 101 days. **(Oct 20 – Jan 28)** Scaup: from the first Saturday in November extending for 86 days. **(Nov 4 – Jan 28)**	Daily bag limit: 7 Daily bag limit may include: • 7 mallards, but not more than 2 females or Mexican-like ducks. • 1 pintail (either sex). • 2 canvasback (either sex). • 2 redheads (either sex). • 3 scaup (either sex). Possession limit: triple the daily bag limit
Geese	From the third Friday in October extending for 101 days. **(Oct 20 – Jan 28)**	Daily bag limit: 24 Daily bag limit may include: • 20 white geese. • 4 dark geese (see definitions: 502(a)). Possession limit: triple the daily bag limit.

(5) Balance of State Zone (NOTE: SEE SUBSECTION 502(d)(6) BELOW FOR SPECIAL SEASONS AND CLOSURES.)

(A) SPECIES	(B) SEASON	(C) DAILY BAG AND POSSESSION LIMITS
Ducks (including Mergansers)	From the third Saturday in October extending for 100 days. **(Oct 21 – Jan 28)** Scaup: from the first Saturday in November extending for 86 days. **(Nov 4 – Jan 28)**	Daily bag limit: 7 Daily bag limit may include: • 7 mallards, but not more than 2 females. • 1 pintail (either sex). • 2 canvasback (either sex). • 2 redheads (either sex). • 3 scaup (either sex). Possession limit: triple the daily bag limit.
Geese	Early Season: Large Canada geese only from the Saturday closest to October 1 for a period of 5 days **(Sept 30 – Oct 4)** EXCEPT in the North Coast Special Management Area where Large Canada geese are closed during the early season. Regular Season: Dark and white geese from the third Saturday in October extending for 100 days **(Oct 21 – Jan 28)** EXCEPT in the Sacramento Valley Special Management Area where the white-fronted goose season will close after December 21. **(Oct 21 – Dec 21)** Late Season: White-fronted geese and white geese from the second Saturday in February extending for a period of 5 days **(Feb 10 – Feb 14)** EXCEPT in the Sacramento Valley Special Management Area where the white-fronted goose season is closed. During the Late Season, hunting is not permitted on wildlife areas listed in Sections 550-552 EXCEPT on Type C wildlife areas in the North Central and Central regions.	Daily bag limit: 30 Daily bag limit may include: • 20 white geese. • 10 dark geese EXCEPT in the Sacramento Valley Special Management Area where only 3 may be white-fronted geese (see definitions: 502(a)). Possession limit: triple the daily bag limit.

(6) Special Management Areas (see descriptions in 502(b)(6))

	(A) SPECIES	(B) SEASON	(C) DAILY BAG AND POSSESSION LIMITS
1. North Coast	All Canada Geese	From November 7 extending for a period of 83 days **(Nov 7 – Jan 28)** (Regular Season) and from February 17 extending for a period of 22 days **(Feb 17 – Mar 10)** (Late Season). During the Late Season, hunting is only permitted on private lands with the permission of the land owner under provisions Section 2016, Fish and Game Code.	Daily bag limit: 10 Canada Geese of which only 1 may be a Large Canada goose (see definitions: 502(a)), EXCEPT during the Late Season the bag limit on Large Canada geese is zero. Possession limit: triple the daily bag limit
2. Humboldt Bay South Spit (West Side)	All Species	Closed during brant season.	
3. Sacramento Valley	White-Fronted Geese	Open concurrently with the goose season through December 21, and during Youth Waterfowl Hunting Days. **(Oct 21 – Dec 21)**	Daily bag limit: 3 white-fronted geese. Possession limit: triple the daily bag limit.
4. Morro Bay	All species	Open in designated area only from the opening day of brant season through the remainder of waterfowl season.	
5. Martis Creek Lake	All species	Closed until November 16.	
6. Northern Brant	Black Brant	From November 8 extending for 37 days. **(Nov 8 – Dec 14)**	Daily bag limit: 2 Possession limit: triple the daily bag limit.
7. Balance of State Brant	Black Brant	From November 9 extending for 37 days. **(Nov 9 – Dec 15)**	Daily bag limit: 2 Possession limit: triple the daily bag limit.
8. Imperial County	White Geese	From the first Saturday in November extending for a period of 86 days **(Nov 4 – Jan 28)**(Regular Season) and from the first Saturday in February extending for a period of 16 days **(Feb 3 – Feb 18)**(Late Season). During the Late Season, hunting is only permitted on private lands with the permission of the land owner under provisions of Section 2016, Fish and Game Code.	Daily bag limit: 20 Possession limit: triple the daily bag limit.

(e) Youth Waterfowl Hunting Days Regulations (NOTE: To participate in these Youth Waterfowl Hunts, federal regulations require that hunters must be 17 years of age or younger and must be accompanied by a non-hunting adult 18 years of age or older.)

(1) Statewide Provisions.

(A) SPECIES	(B) SEASON	(C) DAILY BAG AND POSSESSION LIMITS
Ducks (including Mergansers), American Coot, Common Moorhen, Black Brant, Geese	1. Northeastern California Zone: The Saturday fourteen days before the opening of waterfowl season extending for 2 days. **(Sept 23 – 24)** 2. Southern San Joaquin Valley Zone: The Saturday following the closing of waterfowl season extending for 2 days. **(Feb 3 – Feb 4)** 3. Southern California Zone: The Saturday following the closing of waterfowl season extending for 2 days. **(Feb 3 – Feb 4)** 4. Colorado River Zone: The Saturday following the closing of waterfowl season extending for 2 days. **(Feb 3 – Feb 4)** 5. Balance of State Zone: The Saturday following the closing of waterfowl season extending for 2 days. **(Feb 3 – Feb 4)**	Same as regular season.

REPORT WATERFOWL MORTALITY

Certain habitat conditions may increase the possibility of disease outbreaks in waterfowl and other waterbirds. Two of the most common diseases of waterfowl include avian botulism and avian cholera. These outbreaks can result in the death of many birds.

CDFW tries to document disease outbreaks in waterfowl in California. If you observe greater than 5 sick, dead, or dying waterfowl in the same location you can report your findings to the CDFW Wildlife Investigations Lab at (916) 358 2790 or online: ***https://www.wildlife.ca.gov/Conservation/Laboratories/WildlifeInvestigations/Monitoring/MortalityReport.aspx***

(f) Falconry Take of Ducks (including Mergansers), Geese, American Coots, and Common Moorhens.

(1) Statewide Provisions

(A) SPECIES	(B) SEASON	(C) DAILY BAG AND POSSESSION LIMITS
Ducks (including Mergansers), Geese, American Coot and Common Moorhen	1. Northeastern California Zone. Open concurrently with duck season through January 14, 2018. **(Oct 7 – Jan 14)** 2. Balance of State Zone. Open concurrently with duck season and February 3-4, 2018 EXCEPT in the North Coast Special Management Area where the falconry season for geese runs concurrently with the season for Small Canada geese (see 502(d)(6)). **(Oct 21 – Jan 28 & Feb 3 – Feb 4)** 3. Southern San Joaquin Valley Zone. Open concurrently with duck season and January 29-31, 2018. Goose hunting in this zone by means of falconry is not permitted. **(Oct 21 – Jan 31)** 4. Southern California Zone. Open concurrently with duck season and January 29-February 2, 2018. EXCEPT in the Imperial County Special Management Area where the falconry season for geese runs concurrently with the season for white geese. **(Oct 21 – Jan 31 & Feb 1 – Feb 2)** 5. Colorado River Zone. Open concurrently with duck season and January 29 through February 1, 2018. Goose hunting in this zone by means of falconry is not permitted. Federal regulations require that California's hunting regulations conform to those of Arizona, where goose hunting by means of falconry is not permitted. **(Oct 20 – Jan 31 & Feb 1)**	Daily bag limit: 3 Daily bag limit makeup: • Either all of 1 species or a mixture of species allowed for take. Possession limit: 9

YOUTH AND JUNIOR WATERFOWL HUNTS FOR THE 2017-18 SEASON

HUNT	DATES	DETAILS	HOW TO APPLY
Northeastern Zone Federal Youth Waterfowl Hunt Days	9/23/2017 9/24/2017	Open to waterfowl hunters age 17 or under. Federal refuges and State wildlife areas (except Butte Valley, Shasta Valley, and Willow Creek) are open for youth hunters.	Contact the wildlife area you wish to hunt for details.
Sacramento NWR Special Junior Hunt	12/2/2017	All blinds are reserved for junior hunters. Hunters must have a valid junior hunting license to apply.	Use a post card to apply directly to the USFWS. For information visit: fws.gov/refuge/Sacramento/visit/hunting.html
Delevan NWR Special Junior Hunt	12/9/2017	All blinds are reserved for junior hunters. Hunters must have a valid junior hunting license to apply.	Use a post card to apply directly to the USFWS. For information visit: fws.gov/refuge/Sacramento/visit/hunting.html
Southern San Joaquin Valley, Southern California and Balance of State zones Federal Youth Waterfowl Hunt Days	2/3/2018 2/4/2018	Open to waterfowl hunters age 17 or under. Most federal refuges and state wildlife areas are open for youth hunters.	Submit a season-long application or a multiple-choice reservation application for these dates online, at a license agent or a CDFW license sales office.

CALIFORNIANS TURN IN POACHERS & POLLUTERS

If you see someone poaching or polluting, immediately call CalTIP at our toll free number, 24 hours a day, seven days a week. You don t have to give us your name. Help Fish and Wildlife stop the senseless waste of our fish & wildlife resource.

Together we can make a difference!

1 (888) 334-CALTIP (2258)

§505. DECOYS.

The use of live birds as decoys is prohibited.

§506. SHOOTING HOURS.

Shooting hours for migratory game birds, including mourning doves, white-winged doves, band-tailed pigeons, American coots, common moorhens, common snipe (jacksnipe), and waterfowl for all of California shall be from one- half hour before sunrise to sunset.

Exception: In areas open to hunting on, over or adjacent to the waters of Morro Bay, San Luis Obispo County, the shooting time shall be from 7:00 a.m. to sunset.

§507. PROVISIONS RELATED TO THE TAKING OF MIGRATORY GAME BIRDS

(as defined in Section 502 but also includes mourning doves, white-winged doves, band-tailed pigeons, and snipe.

(a) Authorized Methods

Only the following methods may be used to take migratory game birds:

(1) Falconry.

(2) Bow and Arrows or Crossbows. Only arrows or crossbow bolts with flu-flu fletching may be used except that conventionally fletched arrows may be used to take waterfowl sitting on the water from scullboats or similar watercraft.

(3) Muzzle-loading Shotguns.

(4) Shotguns 10 Gauge or Smaller. Shotguns 10 gauge or smaller using shot shells only and incapable of holding more than three shells in the magazine and chamber combined may be used, except no shotgun larger than 12 gauge shall be used in areas open to hunting on, over or adjacent to the waters of Morro Bay, San Luis Obispo County. If a plug is used to reduce the capacity of a magazine to fulfill the requirements of this section, the plug must be of one piece construction incapable of removal without disassembling the gun. Shotgun shells may not be used or possessed that contain shot size larger than No. BB in lead or T shot in steel or other nontoxic shot approved by the U.S. Fish and Wildlife Service. All shot shall be loose in the shell.

(b) Use of Dogs.

Dogs may be used to take and retrieve migratory game birds.

(c) Prohibition on Electronically operated Devices.

Electronic or mechanically-operated calling or sound-reproducing devices are prohibited when attempting to take migratory game birds. It is unlawful to use devices that are either electronically-powered, or activated by anything other than natural wind, to directly or indirectly cause rotation of decoy wings or blades that simulate wings, when attempting to take waterfowl between the start of the season and November 30th.

(d) Live Decoy Prohibition.

The use of live decoys is prohibited when attempting to take migratory game birds.

§507.1 NONTOXIC SHOT REQUIREMENT FOR WATERFOWL, AMERICAN COOT AND COMMON MOORHEN HUNTING.

Only bismuth-tin, steel, copper-plated steel, nickel-plated steel, tin-plated steel, zinc-plated steel, zinc chloride-plated steel, zinc chromate plated steel, iron-tungsten, iron-tungsten-nickel, tungsten-bronze, tungsten-iron-copper-nickel, tungsten-matrix, tungsten-polymer, tungsten-tin-iron, tungsten-tin-bismuth, tungsten-tin-iron-nickel, and tungsten-iron-polymer or other nontoxic shot approved by the U.S. Fish and Wildlife Service may be used or possessed for waterfowl, American coot and common moorhen hunting statewide.

NOTE: *The U.S. Fish and Wildlife Service reviews and may approve applications for other types of non-toxic shot throughout the year. Other non-toxic shot types that may have been approved after the publication of this booklet may be found at:* ***https://www.fws.gov/birds/bird-enthusiasts/hunting/nontoxic.php***

§507.5. SCULL BOATS.

Migratory game birds may not be taken by a scull boat or similar watercraft while under motorized power. The motor shall be removed from its mountings before any take or approach is attempted.

This section shall not prohibit shooting migratory game birds from scull boats or similar watercraft with motor attached if beached or anchored; nor shall it prohibit the use of a motor for the sole purpose of picking up dead or injured birds.

§509. CONCURRENCE WITH FEDERAL REGULATIONS.

(a) The regulations adopted by the United States through its Secretary of Interior under the Migratory Bird Treaty Act, as amended annually in Part 10, subparts A and B, and Part 20, Title 50, Code of Federal Regulations, are hereby adopted and made a part of this Title 14 except where said federal regulations are less restrictive than the provisions of Chapter 7 of this Title 14 (sections 500-509), the provisions of Chapter 7 prevail.

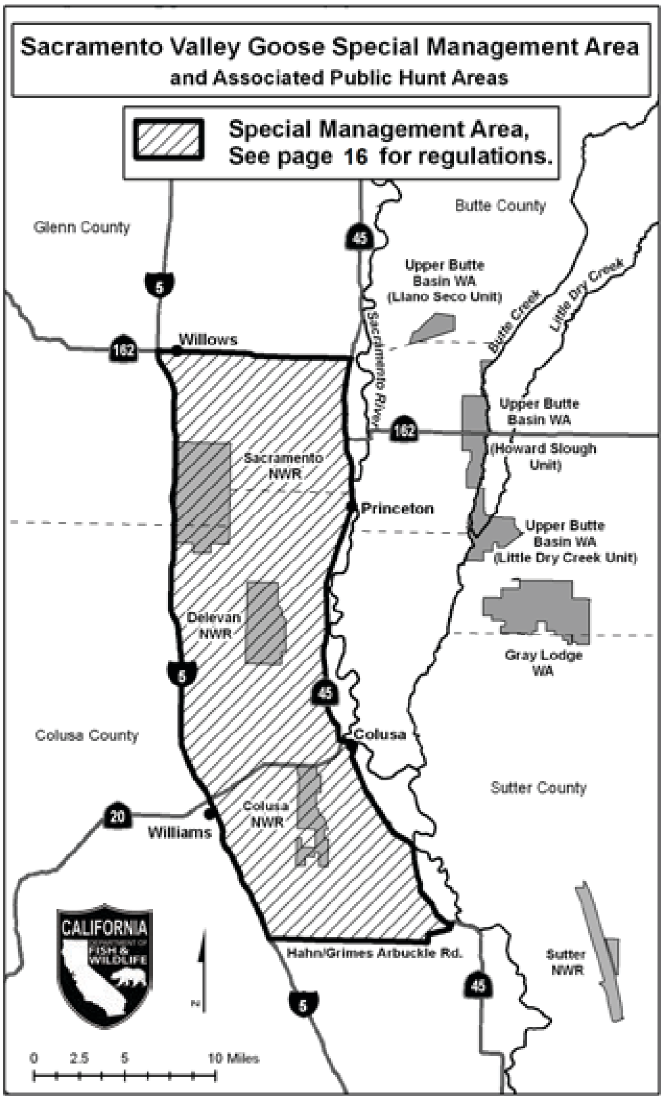
(b) Any violations of the regulations adopted pursuant to subsection (a) are violations of this section.

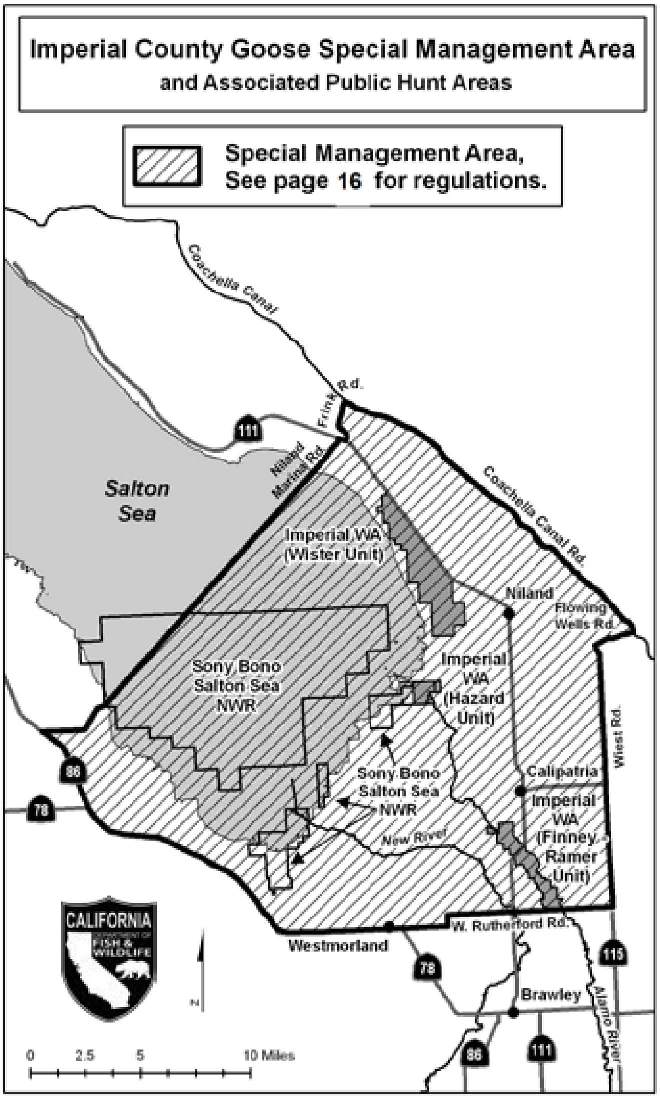
(c) It shall be unlawful for any person aged sixteen years or older to take any migratory waterfowl unless at the time of such taking the person carries in his or her immediate possession an unexpired Federal migratory-bird hunting and conservation stamp validated by his or her signature written by him or herself in ink across the face of the stamp prior to any taking of such birds.

REPORT BIRD BANDS

Go to *www.ReportBand.gov*

You will need to provide the band number and how, when and where it was recovered. You will receive a certificate of appreciation via email, about the bird. The band is yours to keep.



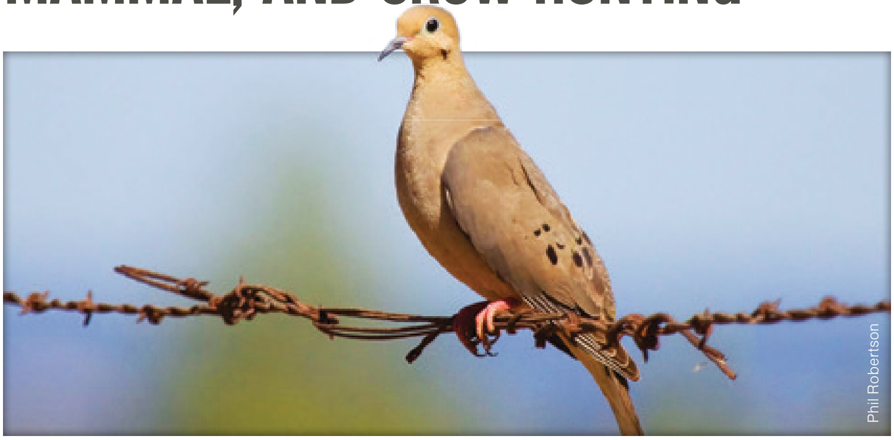


THE CASE FOR NON-TOXIC SHOT...

- Lead is toxic and there are effective and affordable alternatives to lead shot.
- Many hunters who regularly access state and federal land already use non toxic shot.
- Science has proven beyond doubt that exposure to lead is harmful, resulting in restrictions on the use of lead in gasoline and paints as well as restricting imports of products containing lead.
- Because of its toxicity, lead shot has been illegal to use for waterfowl hunting nationwide since 1991.
- There is a growing body of evidence that lead shot from shotgun shells is a direct, contributing factor to wildlife mortality and leads to secondary poisoning. More than 100 species of upland birds, waterfowl and raptors are known to have ingested lead shot.
- At least 15 international studies, eight of them in Canada, have linked lead shot in game animals to higher levels of lead in people who eat those game animals.
- Effective non toxic loads are now increasingly available and cost about as much as a box of premium lead.
- Studies have demonstrated that steel shot, the most commonly available alternative and the least expensive, is effective when hunting waterfowl. Steel is also an effective pheasant load.
- Hunters are encouraged to consider using non toxic shot for all of their upland game hunting. Using non toxic shot also eliminates the potential risk of ingesting lead in game consumed by hunters and their families.

(Revised and reprinted with permission from: Minnesota Department of Natural Resources)

UPLAND GAME BIRD, SMALL GAME MAMMAL, AND CROW HUNTING



Phil Robertson

Mourning dove

UPLAND GAME REGULATION CHANGES: 2017-2018

- **Greater sage-grouse hunting is closed for the 2017-2018 season. At the Fish and Game Commission's June 22 meeting, the Commission adopted zero quotas for all 4 sage-grouse hunting zones. The closures were recommended by the California Department of Fish and Wildlife due to declining population estimates, which are based on annual lek counts.**

§257. RESIDENT SMALL GAME DEFINED.

"Resident small game" means the following resident game birds: Chinese spotted doves, Eurasian collared-doves, ringed turtle-doves of the family Columbidae, California quail and varieties thereof, Gambel's or desert quail, mountain quail and varieties thereof, sooty (blue) grouse, ruffed grouse, sage grouse , white-tailed ptarmigan, Hungarian partridges, red-legged partridges, including the chukar and other varieties, ring-necked pheasants and varieties, and wild turkeys of the order Galliformes; and the following game mammals: jackrabbits and varying hares (genus *Lepus*), cottontail rabbits, brush rabbits, pigmy rabbits (genus *Sylvilagus*), and tree squirrels (genus *Sciurus* and *Tamiasciurus*).

§310.5. SHOOTING HOURS FOR UPLAND GAME BIRDS.

The shooting hours for all upland game birds, except for pheasants and the spring wild turkey season, shall be from one-half hour before sunrise to sunset. The shooting hours for pheasants shall be from 8:00 a.m. to sunset. The shooting hours for the spring wild turkey season shall be from one-half hour before sunrise to 5:00 p.m.

§311. METHODS AUTHORIZED FOR TAKING RESIDENT SMALL GAME.

(Refer to Section 507, page 22, for authorized methods of take for migratory game birds, i.e. MOURNING DOVES, WHITE-WINGED DOVES, BAND-TAILED PIGEON, AND SNIPE.)

The take or attempted take of any resident small game with a firearm shall be in accordance with the use of nonlead projectiles and ammunition persuant to Section 250.1.

Only the following may be used to take resident small game:

(a) Shotguns 10 gauge or smaller using shot shells only and incapable of holding more than three shells in the magazine and chamber combined. If a plug is used to reduce the capacity of a magazine to fulfill the requirements of this section, the plug must be of one piece construction incapable of removal without disassembling the gun;

(b) Shotgun shells may not be used or possessed that contain shot size larger than No. BB, except that shot size larger than No. 2 may not be used or possessed when taking wild turkey. All shot shall be loose in the shell.

(c) Muzzle-loading shotguns;

(d) Falconry;

(e) Bow and arrow (see Section 354 for archery equipment regulations);

(e) (1) It shall be unlawful to take wild turkey by use of hunting arrows and crossbow bolts unless fitted with a broad head type blade which will not pass through a hole seven-eighths inch in diameter. Mechanical/retractable broad heads shall be measured in the open position.

(f) Air rifles powered by compressed air or gas and used with any caliber of pellet, except that wild turkey may only be taken with a pellet that is at least 0.177 caliber;

(g) In addition to the methods listed in (a), (b), (c), (d), (e), and (f) above, firearm rifles and pistols may be used for taking rabbits and squirrels only; except in Los Angeles County where rifles and pistols may not be used;

(h) In San Diego and Orange counties only, rabbits may be taken at any time during the open season by means of box traps. Such traps shall not exceed 24 inches in any dimension, shall be tended at least once every 24 hours, and shall show the name and address of the trap owner. All rabbits taken under this section shall be immediately killed and become a part of the daily bag limit;

(i) Electronic or mechanically-operated calling or sound-reproducing devices are prohibited when attempting to take resident game birds;

(j) Coursing dogs may be used to take rabbits;

(k) Archers hunting during any archery season may not use or possess a firearm while in the field engaged in archery hunting during an archery season except as provided in subsection (1).

  (1) Nothing in this section shall prohibit the lawful possession of a concealed firearm by an active peace officer listed in Chapter 4.5 (commencing with Section 830) of Title 3 of Part 2 of the Penal Code or a retired peace officer in lawful possession of an identification certificate issued pursuant to Penal Code Section 25455 authorizing the retired officer to carry a concealed firearm. Nor shall this section prohibit the lawful possession of a concealed firearm pursuant to a concealed carry permit issued pursuant to Penal Code Section 26150 or 26155.

(l) The use of live decoys is prohibited when attempting to take resident game birds;

(m) Pistols and revolvers may be used to take sooty and ruffed grouse in those counties only and for the season described in Section 300(a)(1)(E).

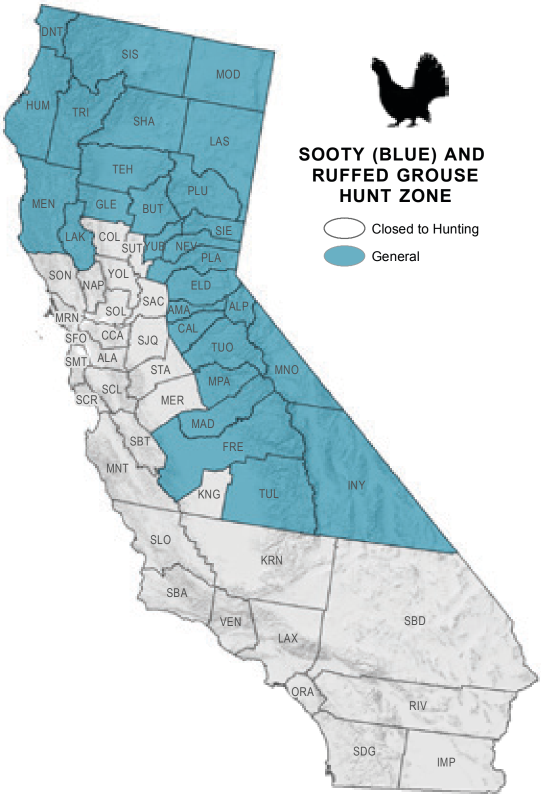
(n) Crossbows, except for provisions of Section 354(d) and (g).

(o) Dogs may be used to take and retrieve resident small game.

JULY 2017 - JUNE 2018 UPLAND GAME BIRD, SMALL GAME MAMMAL AND CROW SEASONS

SPECIES	SEASON DATES	DAILY BAG LIMIT	POSSESSION LIMIT
Pheasant	Nov 11 - Dec 24	2 males per day for first two days of the season; 3 males per day after the first two days of the season.	Triple the daily bag
Archery only	Oct 14 - Nov 5 Dec 25 - Jan 21	2 pheasants per day for first two days of the season; 3 pheasants per day after the first two days of the season. The daily archery bag may contain not more than 1 female pheasant.	
Falconry	Aug 19 - Feb 28	2 pheasants per day for first two days of the season; 3 pheasants per day after the first two days of the season. The daily falconry bag may contain birds of either sex. Hawking hours are Sunrise to Sunset.	
Quail: Zone Q1 (Mountain Quail Only)	Sep 9 - Oct 20	10	Triple the daily bag
Zone Q1 (All Quail)	Oct 21 - Jan 28		
Zone Q2	Sep 30 - Jan 28		
Zone Q3	Oct 21 - Jan 28		
Early Season for Hunters with Junior Hunting Licenses in Mojave National Preserve	Oct 7 - 8	10	Triple the daily bag
Archery Only	Aug 19 - Sep 8		
Falconry	Aug 19 - Feb 28		
Chukar	Oct 21 - Jan 28	6	Triple the daily bag
Archery Only	Aug 19 - Sep 8		
Falconry	Aug 19 - Feb 28		
Sage Grouse	Sep 9 - 10	2017-2018 Season Closed (see Summary of Upland Game Regulation Changes for 2017-2018, p. 20).	
Falconry Only	Nov 4 - Jan 2		
Sooty (Blue)/Ruffed Grouse	Sep 9 - Oct 9	2; All of one species or mixed	Triple the daily bag
Archery Only	Aug 19 - Sep 8		
Falconry	Aug 19 - Feb 28		
Ptarmigan	Sep 9 - 17	2 per day or season	
Falconry	Aug 19 - Feb 28		
Wild Turkey (Spring)	Mar 31 - May 6	1 bearded	3 per season, combined
Archery Only	May 7 - May 20		
Additional Junior	Mar 24 - 25 & May 7 - May 20		
Wild Turkey (Fall)	Nov 11 - Dec 10	1 either sex	2 per season
Mourning Dove and White-winged Dove	Sep 1 - 15 & Nov 11 - Dec 25	15 doves per day in aggregate of which no more than 10 may be white-winged doves	Triple the daily bag
Spotted Dove and Ringed Turtle Dove		No limit	No limit
Eurasian Collared Dove	All Year	No Limit	No Limit
Band-tailed Pigeon	Sep 16 - 24 (North) Dec 16 - 24 (South)	2	Triple the daily bag
American Crow	Dec 2 - Apr 5	24	48
Snipe	Oct 21 - Feb 4	8	Triple the daily bag
Tree Squirrel	Sep 9 - Jan 28	4	4
Archery/Falconry Only	Aug 5 - Sep 8		
Rabbits & Varying Hare	July 1 - Jan 28	5	10
Falconry Only	Jan 29 - Mar 18		
Jackrabbit	Open all year	No limit	No limit

QUAIL HUNT ZONE



SOOTY (BLUE) AND RUFFED GROUSE HUNT ZONE

BAND-TAILED PIGEON HUNT ZONE

AMERICAN CROW HUNT ZONE

TREE SQUIRREL HUNT ZONE

Season

🟦 General

○ Closed to Hunting

TREE SQUIRREL ARCHERY ONLY & FALCONRY ONLY AREA

Season

🟦 Archery/Falconry Only Area

○ Closed to Hunting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PUBLIC USES ON STATE AND FEDERAL LANDS

Regulations and notes in RED TEXT are new this year.

EXPANSION OF THE LANDS PASS PROGRAM

- **Since the 1990's, a Lands Pass has been required for each visitor, 16 years or older, who is not carrying a hunting or fishing license, at: Gray Lodge Wildlife Area (WA), Grizzly Island WA, Los Banos WA , San Jacinto WA, Imperial WA, and Elkhorn Slough Ecological Reserve.**
- **No later than January 1, 2018, the Lands Pass requirement will expand to 42 wildlife areas and ecological reserves. These properties are listed on pages 46 and 52 (Subsections 551(w) and 630(c) of these regulations). There will also be signs about this requirement posted on the properties that are included.**
- **Lands Passes can be obtained on-line at *www.ca.wildlifelicense.com/InternetSales/* and printed at home, by phone at (800) 565-1458, or in-person (sales agent and CDFW sales office locations at *www.wildlife.ca.gov/Licensing*).**
- **Purchase Lands Passes in advance of your visit. Cell/Wi- Fi may be unavailable on-site. With the exception of the Elkhorn Slough ER, Lands Passes are not sold in-person at the areas/reserves.**

MOBILITY IMPAIRED HUNTER REQUIREMENTS AND INFORMATION

A number of State Wildlife Areas and National Wildlife Refuges have hunting blinds designated for use by mobility impaired hunters. A "mobility impaired hunter" is defined as any person who has been issued a Department of Motor Vehicles "Disabled License Plate"; "Permanent Parking Placard Identification Card"; "Disabled Veteran License Plate"; or valid "Mobility Impaired Disabled Persons Motor Vehicle Hunting License" (FG form 1460). The blue plastic "Disabled Parking Placard" may not be substituted for the required "Identification Card" which bears the name of the mobility impaired person. Disabled hunters must provide the registration certificate for DMV issued disabled license plates.

PLAN AHEAD BEFORE VISITING A WILDLIFE AREA!

IMPORTANT: Check stations do not sell any license items, permits or passes. Be sure to purchase any needed licenses, passes and validations from a CDFW license sales office, a license agent or online at ***www.wildlife.ca.gov/Licensing/Online Sales***.

DISABLED ACCESSIBLE BLIND SITES EXIST AT THE FOLLOWING AREAS:

National Wildlife Refuges: Sacramento (3), Delevan (3), Merced (1), Kern (2), Kesterson (1). State Wildlife Areas: Gray Lodge (4), Grizzly Island (2), Imperial/Sonny Bono Salton Sea (4), Mendota (6), Los Banos (2), San Jacinto (2), Shasta Valley (1), North Grasslands Wildlife Area (2), Upper Butte Basin (5), Yolo Bypass (1). Additional areas with disabled access to assigned ponds: Colusa; and Sutter. Details regarding facilities at each location can be obtained by phoning the wildlife area you wish to visit. Disabled accessible blind sites not filled through the reservation draw conducted by the Department's License and Revenue Branch, will be filled through an on-site lottery draw or by a disabled only first-come, first-served waiting list or line. Disabled hunters, who enter the first-come, first-served waiting list or line, may not enter any other first-come, first-served list or line, on the wildlife area or refuge for that hunt day.

RESERVATION SYSTEM

Reservations to hunt on specified State-controlled hunting areas during the waterfowl and pheasant seasons are issued by drawing. Resident, junior and nonresident hunters with annual hunting licenses may apply. Hunters may apply as many times per season as desired but no more than once for each area for each shoot day. Season-long and multiple choice reservation applications may be submitted through the Automated License Data System online, at CDFW license sales offices and license agents. Each reservation assures entry to the area selected for the date issued. Reservations may not be transferred to another person. Refunds will not be issued for emergency area closures due to unforeseen weather or other conditions. Reservations for areas that are closed due to flooding will not be accepted at other areas. Numbered reservations will be honored in numerical order, at the time the check station starts issuing permits for the hunt day, except for Grizzly Island and Mendota Wildlife Areas, where reservations are processed in order of vehicle position. Reservation holders must be present at the time their reservation number is called.

HOW TO APPLY

Reservation applicants may purchase season-long and multiple choice applications through the Automated License Data System at Department license sales offices, license agents, or on the internet for any or every available Saturday, Sunday and/or Wednesday. To be included in the drawing, completed applications must be submitted at least 17 days before the hunt date requested.

Disabled hunters may apply for a drawing to hunt at disabled accessible hunting sites by entering the hunt code for the desired disabled accessible hunting site on their reservation application. To apply, hunters must meet the requirements to hunt at a disabled accessible hunting site (see page 24). Hunters who apply for a disabled accessible hunting site at a given area may not apply for any other reservation draw for that area on that date.

NATIONAL WILDLIFE REFUGE REGULATIONS

Check the appropriate webpage for each refuge and the signage on each refuge to ensure you have the most up-to-date information on refuge regulations. The website for the National Wildlife Refuges is ***http://fws.gov/refuges***.

INFORMATIONAL NOTE: LOWER SHERMAN ISLAND WILDLIFE AREA

Any decoys left in the field and all blinds on the Lower Sherman Wildlife Area are available for use onsite by any hunter on a first come, first served basis on all shoot days.

§550. GENERAL REGULATIONS FOR PUBLIC USE ON ALL DEPARTMENT OF FISH AND WILDLIFE LANDS.

(a) All department land, except for fishing access and public access lands, is closed to visitor access and use until and unless the land is opened for a use or uses through regulations adopted by the commission in sections 550, 550.5, 551, 552, 630, and 702 of these regulations. The commission determines whether proposed designations and uses are consistent with the authorizing and reference statutes listed at the end of this section and the purposes for which the lands were acquired. Each proposed designation or use is subject to review pursuant to state and federal regulatory requirements prior to being authorized.

(b) Definitions.

- (1) "Department land" is defined as:
  - (A) any state-owned real property over which the department has jurisdiction and management authority;
  - (B) real property over which the department has management authority through a current lease, memorandum of understanding, management agreement, or similar document;
  - (C) real property designated by the commission as a wildlife area (Section 551 of these regulations);
  - (D) real property designated by the commission as an ecological reserve (Section 630 of these regulations);
  - (E) real property held or administered by the department as a fishing access;
  - (F) real property held or administered by the department as a public access;
  - (G) real property designated by the commission as a public shooting area.
- (2) "Compatible uses" is defined as visitor uses that are consistent with the purposes and management of a particular department land. Predominant compatible uses on department lands are hunting, fishing, wildlife viewing, wildlife photography, environmental education and/or environmental research.
- (3) "Environmental education" is defined as:
  - (A) department administered or sponsored interpretive programs offered to the public; or
  - (B) activities to increase the understanding and appreciation of wildlife and the natural environment conducted by organized youth or school groups.
- (4) "Environmental research" is defined as the field study of biological, physical, or cultural processes or values with the primary purpose of improving the understanding of the natural environment.
- (5) "Visitor" is defined as any person, other than a department employee or designee performing official duties, who enters department land.
- (6) "Entry permit" is defined as a permit which allows entry to specified department land for department-authorized activities where general access is restricted per subsection 550(c)(2)(D). Entry permits may require payment of a fee to the department.
- (7) "Hunting Pass" is defined as a proof of payment of a fee that must be presented by a visitor in order to obtain an entry permit to hunt on specified Department lands.
- (8) "Lands Pass" is defined as a proof of payment of a fee for entry for authorized uses other than hunting that is required of visitors who are not carrying a valid hunting, fishing or trapping license on Department lands listed in subsections 551(w) and 630(c).
- (9) "Special use" is defined as an activity, use, event or gathering on department land that is not authorized in sections 550, 551 or 630 of these regulations but which may be allowed with written authorization from the department; typically in the form of a Special Use Permit. When allowed, special uses occur on a limited basis as defined in the Special Use Permit or other authorizing document. An authorized special use on department land shall not conflict with the normal uses, purposes or management of the department land.
- (10) "Reservation" is defined as a randomly drawn application that assures entry onto a wildlife area, when presented with the appropriate entry pass as specified in Section 550.5(c), if applicable.
- (11) "Fishing" for the purposes of department land is defined as angling as defined in Section 1.05 of these regulations, or as taking fish on department wildlife areas using bow and arrow fishing tackle as defined in Section 1.23 of these regulations.
- (12) "Hunting" for the purposes of department land is defined as the legal take (as take is defined in Fish and Game Code Section 86) of wildlife species pursuant to sections 550, 550.5, 551, 552, and 630 of these regulations, in addition to the general hunting regulations for seasons and method of take. The provisions of sections 550, 550.5, 551, 552, and 630 shall have precedence over general hunting regulations on department land where there may be differences between them.
- (13) "Camping" for the purposes of department land is defined as an overnight or after-hours visitor stay which may include a vehicle, trailer, motor home, boat, tent, or any other type of vehicle or shelter.
- (14) "Wildlife viewing" for the purposes of department land is defined as pedestrian use of roads or designated trails when and where authorized by the department.
- (15) "Dog training" for the purposes of department land is defined as the non-commercial act of training a hunting dog to improve the dog's performance in hunting migratory or upland game birds and retrieval of downed game, and to enhance the hunting experience.
- (16) "Dog trial" for the purposes of department land is defined as an organized competitive or scored event for testing hunting dog performance.
- (17) "Upland game birds" for the purpose of department land is defined as the upland game bird species listed in Fish and Game Code Section 3683.

(c) Visitor Entry and Responsibilities.

- (1) Visitors are responsible for knowing and complying with all regulations pertaining to fishing, hunting, and use of department land. These regulations are incorporated by reference into and become a condition of all visitor entry, passes, entry permits, and special use permits. Failure to comply with any such regulations is a violation of this section.
- (2) Visitor entry onto department land is at the discretion of the department, which may limit entry as it deems appropriate, to manage and protect fish, wildlife, native plants, habitats and other natural resources. Entry may require payment of a fee, a pass and/or an entry permit as provided in subsection 550.5(c).
  - (A) Visitor entry, where authorized or designated, is for activities authorized according to sections 550, 550.5, 551, 552, or 630 of these regulations. It shall be unlawful to enter or use department land without complying with the applicable sections of these regulations.
  - (B) All visitors shall present and show valid entry permits, season or annual passes, licenses, and all fish and game taken on department land at the checking station or upon the request of any department employee. Visitors shall return all entry permits to the checking station or point of entry upon leaving department land.
  - (C) Visitor entry is authorized only from sunrise to sunset except during department-authorized hunting or fishing opportunities when access to hunting and fishing sites at other times may be permitted.
  - (D) The department may close all or portions of department land to visitors entirely, seasonally, or to specific activities or uses, and may limit the number of visitors entering an area for safety reasons, to reduce crowd-

ing, to avoid or reduce environmental disturbance, to limit the take of species, or to protect natural or cultural resources. Designated closures and use restrictions for specific properties are provided in sections 551(for wildlife areas) and 630 (for ecological reserves) of these regulations.

1. The department may close any department land, or portion thereof, to any or all visitor use or access, without notice, by posting closed signs.
2. No visitor(s), other than those possessing written authorization from the department, shall enter or access any department land or portion thereof which is closed to visitors, including areas posted with closed signs and seasonally closed areas. This restriction does not apply to department employees or designees in the performance of official duties.

(E) On department land where entry and exit sites are designated by the department, no visitor shall enter or leave the land except at those designated sites.

(F) It shall be unlawful for a visitor to enter any department land or portion thereof where the department has restricted visitor entry without a valid entry permit or pass. Subsection 550.5(c) specifies how to obtain an entry permit or pass.

1. Where a fee is required for entry, a pass must be purchased in advance through the department's Automated License Data System. Passes are sold by license agents, department license sales offices, or online at www.wildlife.ca.gov.
2. Where an entry permit is required for hunting, a hunting pass must be presented with photo identification at the time of entry for issuance of an entry permit. Entry permits are available and issued by the department only at the area checking station, point of entry, or by mail for successful special drawing applicants.
3. Rules regarding entry and reservation fees required for hunting on certain wildlife areas are in subsection550.5(c) and Section 702 of these regulations.
4. Where a fee is required for entry for authorized uses other than hunting, a Lands Pass must be purchased in advance. Additional rules for Lands Passes are in subsection 550.5(c) of these regulations.

(3) Daily Entry Permit Revocations, Refusals, and Ejections. Employees of the department are authorized to refuse entry or issuance of entry permits, revoke permits and/or eject any visitor from department land for violation of any regulations, drug or alcohol intoxication, disorderly conduct, or for any reason when it appears that the general safety or welfare of the property or persons thereon is threatened. The decision and duration of revocation, in such respect, of any department employee assigned management or enforcement responsibilities for the area shall be final.

(A) Visitors found to violate any such refusal, revocation or ejection may be cited and fined.

(B) Visitors affected by this subsection may appeal such actions to the commission.

(4) Penalties.

(A) A visitor's failure to comply with sections 550, 551, 552 or 630 of these regulations may result in any or all of the following:

1. denial of permission to enter department lands;
2. revocation of any pass and/or permit already issued;
3. ejection from department lands for up to one calendar year from the date of discovery; and
4. citation or arrest under applicable provisions of the Fish and Game Code or these regulations.

(B) proceeding under any of the above provisions shall not preclude the exercise of any other remedy.

(d) Special Use Permits. Any person, group, organization, agency or company wishing to request approval of a special use, as defined in subsection 550(b)(9), on any department land shall submit a Permit Application for Special Use of Department Lands and the permit fee as specified in Section 702 of these regulations to the department. Additional regulations that apply to Special Use Permits are located in Section 550.5 of these regulations. Department review and issuance is dependent upon staffing availability. If the department determines that the requested special use can be conducted in a manner that is not in conflict with current uses, management, or purposes of the department land on which the special use is proposed, the department may issue a special use permit.

(1) The department will charge fees to recover the department's reasonable costs to review and issue Special Use Permits.

(2) Conditions of issuance of the Special Use Permit may include a requirement to reimburse the department for any staff time or other costs related to the special use.

(3) All permittees shall observe and comply with all local, state and federal laws, regulations, requirements, terms, and conditions applicable to the special use.

(4) The Special Use Permit must be approved in writing by the department and in possession of the permittee prior to entering, and during the use of, department land.

(e) Environmental Education. Environmental education activities on department land shall be conducted only under written authorization from the regional manager or designee and coordinated with the area manager.

(1) If a purpose of the environmental education activity is to generate revenue for a person, entity or organization, the written authorization shall be in the form of a Special Use Permit.

(f) Research. Environmental research on department land shall be conducted only under written authorization from the regional manager or designee. Authorization may be given if the department determines that the environmental research and associated activities are compatible with current uses, management and purposes of the property. Conditions of approval may include, but are not limited to:

(1) proof of all necessary collecting permits;

(2) submission of written progress reports to the department;

(3) a schedule of activities and deliverables;

(4) provision of electronic copies of geospatial and all other field data and reports in a digital format specified by the department; and

(5) submission of copies of Natural Diversity Database field data forms for species tracked by the department.

(g) Protection of Resources. Except for the take of fish and/or wildlife in compliance with general and site-specific hunting and fishing regulations, or under written authorization from the department to conduct environmental research or environmental education, no visitor shall:

(1) mine or disturb geological formations, archeological, cultural or anthropological artifacts, structures, or resources;

(2) take or disturb any bird nest, or eggs thereof;

(3) cut, saw, trim, remove, or disturb any plant, mammal, fish, mollusk, crustacean, amphibian, reptile, soil, sand, gravel, rock, mineral, or any other form of plant or animal life on department land, except that non-woody vegetation may be cut and used for temporary hunting blinds; or

(4) construct or build any type of structure, including those made of vegetation (except as provided in subsection 550(g)(3)) or any other type of material, on department land except as may be specifically authorized by a Special Use Permit.

(h) Fishing. Fishing (as defined in subsection 550(b)(11)) on department land shall be allowed except as otherwise stated in subsections 551(o), 551(y) or 630(e) of these regulations, or when the area is closed according to these regulations or posted by the department with signs that prohibit entry or fishing.

(1) Fishing shall be conducted in accordance with general fishing regulations, except that it shall be limited to fishing from the shore unless boating facilities and/or areas for boats or other floating devices are designated or as allowed in subsections 551(o), 551(y) or 630(e) of these regulations.

(2) No visitor shall take fish (as defined in Fish and Game Code Section 45) from department land for commercial purposes.

(i) Regional Manager's Authority.

(1) The regional manager or his designee shall have the authority to place temporary restrictions on visitor use of department land for the purposes of protecting public health and safety or natural resources when circumstances warrant additional restrictions, and where such restrictions are not provided in sections 550, 550.5, 551, 552, and 630 of these regulations.

(2) On state wildlife areas, the regional manager may authorize junior pheasant hunts during or outside the general pheasant season and may authorize junior turkey hunts during the regular season.

(3) For Lower Sherman Island Wildlife Area only, the Regional Manager may determine whether decoys may be left in the field. ***Note:*** *Any decoys left in the field and all blinds on Lower Sherman Island Wildlife Area are available for use onsite by any hunter on a first come, first-served basis on all shoot days.*

(j) Wildlife viewing, hiking, and photography are allowed on department land except when the property or portion of the property is specifically closed.

(1) Photography, videography, or filming of any type for commercial (profit or sale) purposes on or of department land requires a Special Use Permit from the department and a permit from the California Film Commission, pursuant to Government Code section 14998.8, et seq. The department shall not authorize or issue a Special Use Permit for any commercial photography, videography, or filming of any type without a valid permit from the California Film Commission.

(k) Introduction of Species. Visitors are prohibited from releasing, introducing, or transplanting animal or plant species, including domestic or domesticated species, onto or within department land or waters without a valid permit issued by the department except as authorized for dog training in a designated area.

(l) Feeding of Wildlife. Visitors are prohibited from feeding fish or wildlife except as part of an otherwise legal activity, such as fishing in compliance with general fishing regulations, and Section 550(h).

(m) Pets. Visitors are prohibited from bringing pets, including but not limited to dogs and cats, onto department land except on a leash of less than ten feet or inside a motor vehicle, unless otherwise prohibited or restricted in subsections 551(o) or 630(h) of these regulations, or by prohibitions posted on the department land. Visitors may use dogs for hunting during an open season for an authorized species pursuant to subsection (n) of this section, unless otherwise prohibited.

(n) Use of Dogs for Hunting, Training and Dog Trials. The department may prohibit or restrict dog training, dog trials, or the use of dogs for any purpose on any department land. While in parking lots or checking stations, dogs must be leashed. While engaged in authorized hunting, training or dog trials, dogs may be off leash. On wildlife areas, while in transit between parking lots or checking stations and the areas where authorized hunting, training or dog trials take place, dogs may be off leash but must be kept within ten feet of their owner or handler. On ecological reserves, when not engaged in authorized hunting, training or dog trials, dogs must be controlled per subsection (m) of this section.

(1) Dog training is allowed only on department lands with designated dog training areas as identified in subsections 551(i) and 630(i) of these regulations and, pursuant to those subsections, may require written authorization.

(2) Dog trials are authorized on department land identified in subsection 551(i) of these regulations and require a Special Use Permit pursuant to subsection 550.5(d) of these regulations.

(3) The use of dogs for hunting mammals or training or trialing to prepare for or simulate hunting mammals on department land is subject to the provisions of Section 265 of these regulations.

(4) Additional site-specific regulations pertaining to dogs apply as specified in subsection 551(o) of these regulations.

(o) Horses, Pack Stock, and Horseback Riding. Recreational use of horses is allowed on department lands designated as wildlife areas except when the area is specifically closed or as specified in subsection 551(l) of these regulations. The recreational use of horses is prohibited on all other department lands except lands with department-designated horse trails or areas identified in subsection 630(g) of these regulations.

(p) Camping, Motorhomes, and Camp Trailers.

(1) No visitor shall camp, including on a boat, on any department land except on those wildlife areas where the department has designated campsites or camping areas, as provided in subsection 551(m) and Section 552 of these regulations. Within these wildlife areas, camping shall occur only in the department-designated campsites or areas. Camping, where authorized, may be conducted for up to seven consecutive nights and for a total of no more than fourteen nights per calendar year.

(2) The department may provide written authorization to camp outside of designated camping areas for authorized research, monitoring or management purposes. Such written authorization shall be in the immediate possession of the authorized person(s) at all times while on department land.

(3) Campers, camp trailers and motorhomes are prohibited on department lands except on those lands with department-designated camp trailer or motorhome accessible camping or parking areas.

(A) Visitors who wish to camp must register their camper, camp trailer or motorhome at the checking station or appropriate office and are limited to one camper, camp trailer or motorhome per registrant in the parking area. Utility trailers and cargo trailers are prohibited in designated camper, camp trailer and motorhome accessible camping and parking areas unless specifically authorized under a Special Use Permit.

(B) Parking areas are for visitor use only. The visitor responsible for the registered camper, camp trailer or motorhome shall show proof of use of the area within the previous seven days upon request. Failure to do so may result in citation and removal of the truck and camper, camp trailer or motorhome at the owner's expense.

(C) Campers, camp trailers and motorhomes over 30 feet in length are prohibited on all department lands.

(D) Tow vehicles for camp trailers must be stowed in designated vehicle parking lots.

(4) Camping is prohibited on all department lands designated as ecological reserves.

(q) Fires.

(1) Except as further restricted in subsection 551(n) of these regulations, fires are restricted to portable gas stoves, charcoal briquette barbeques, or fireplaces or pits developed by the department for visitor use, within department-designated campsites or camping areas on those lands designated as wildlife areas.

(2) Visitors are prohibited from using any form of fire on other department lands, including but not limited to wildlife areas that do not include designated campsites or camping areas and those lands designated as ecological reserves.

(3) No fire shall be left unattended and all fires shall be completely extinguished by the visitor before leaving the site.

(r) Hazardous Substances. No visitor shall apply, leave, dump, bury, release or dispose of any pesticide, herbicide, or hazardous substance, material or waste in, on, or from department land.

(s) Farming or Grazing. Unauthorized farming or grazing (including but not limited to cattle, horses, sheep, goats, and hogs) and associated activities on department land are prohibited.

(t) Vandalism. No visitor shall tamper with, deface, damage, destroy or remove any property not their own when such property is located within any department land.

(u) Signs and Markers. No visitor shall tamper with, deface, damage, destroy or remove any barrier, sign, signpost, trail marker, or signboard on any department land. No visitor shall place any sign, flagging, or marking of any kind on any department land without prior written authorization from the department.

(v) Litter. It shall be unlawful to leave, deposit, drop, dump, bury, or scatter any bottles, cans, glass (including broken glass), feathers, hides, carcasses, targets, shells, casings, vegetation, earth, rock, waste, sewage, cigarettes, cigars, or other debris or trash ("refuse") on any department land except in a receptacle or area designated for that purpose. Where no designated receptacles are provided, visitors must remove all refuse from the area.

(1) Visitors shall remove all of their personal equipment and belongings from department land daily. Failure to do so may result in unremoved items being deemed litter and disposed of.

(w) Fireworks/Explosives. No visitor shall import, possess or use fireworks, explosives or incendiary devices of any type on any department land unless authorized under permit by the department for management purposes.

(x) Possession and Use of Alcohol, Marijuana, and Controlled Substances.

(1) No visitor shall possess, use, or be under the influence of alcohol while in the field hunting. For the purpose of this section, "in the field" is defined as all areas of department land except designated parking and camping areas. Visitors under the influence of alcohol to a level determined to be unsafe may be cited and ejected per section 550(c)(3).

(2) No visitor shall possess, use, or be under the influence of marijuana on any department land. Visitors in possession of medical marijuana cards and/or other legal authorization to possess marijuana for medical purposes (per Health and Safety Code sections 11362.7 through 11362.83) may only possess marijuana in that visitor's transport vehicle. Visitors with authorization to possess marijuana may not use it or be under its influence on department land. Visitors using or determined to be under the influence of marijuana on department land, or in possession of marijuana in violation of this section, may be cited and ejected per section 550(c)(3).

(3) No visitor shall possess, use, or be under the influence of any illicit controlled substance on any department land. Visitors possessing, using or under the influence of any illicit controlled substance on any department land may be cited and ejected per section 550(c)(3). Illicit controlled substances for purposes of this regulation are those substances where no medical authorization exists and no legal authorization allows possession for legitimate use of the substance.

(y) Motor Vehicles.

(1) Visitors are prohibited from driving or operating any motor vehicle or trailer on department lands except on designated roads.

(2) Visitors are prohibited from stopping any motor vehicle between designated parking areas to drop off passengers or hunting equipment.

(3) On department lands where auto tour routes are provided, visitors shall use any pullouts or wide spots along the route to stop and view wildlife rather than block the road for other visitors.

(4) Designated parking areas are for visitor use only. Parking motor vehicles and trailers outside of designated parking areas is prohibited except for special use or research permittees who may be authorized otherwise. Utility, flatbed, cargo, or similar trailers are prohibited on department lands except as authorized under a Special Use Permit.

(5) No visitor shall operate a motor vehicle carelessly in willful disregard of the rights or safety of others, or without due caution, or at a speed or in a manner likely to endanger any person, property, natural resources, or wildlife on department lands.

(6) Operators of motor vehicles shall not exceed 15 mph, unless otherwise posted, and shall comply with traffic and other signs posted on department lands.

(7) The use of off highway vehicles (OHV's), all-terrain vehicles (ATV's), motorcycles, and snowmobiles is prohibited on all department land, except where authorized and designated in subsection 551(k) of these regulations.

(z) Boats and Swimming.

(1) The department may restrict the use and operation of boats, boat motors, and floating devices ("boating") on department lands to protect natural resources or provide for the orderly operation of compatible uses on these areas. Boating restrictions may include but are not limited to, prohibitions on use and operation or, if boating is allowed, limiting boat speeds and/or motor size and type. During the times waterfowl are present, the provisions of Section 251 of these regulations, which prohibits pursuit or shooting of birds or mammals from a motor driven vehicle (including but not limited to motorboats, airboats, or sailboats) also apply.

(2) Boats and floating devices are generally allowed on wildlife areas, except as restricted or prohibited in subsection 551(l) and Section 552 of these regulations. Boats are generally prohibited on ecological reserves except as provided in subsection 630(f) of these regulations. Where boats and/or floating devices are allowed on department land, they shall be used subject to the following regulations:

(A) no visitor shall operate a vessel carelessly in willful disregard of the rights or safety of others, or without due caution, or at a speed or in a manner likely to endanger any person, property, or wildlife;

(B) where launch sites are designated by the department, all boats must be launched and removed from those sites;

(C) any boat trailer shall remain attached to the tow vehicle and be stowed in a designated parking area;

(D) all visitors shall remove their boats or floating devices from the water or beach when instructed to do so by an employee of the department. Any peace officer may remove the boat or floating device of any visitor who has been instructed to remove it from the water or beach and fails to comply with that instruction;

(E) the use of boats or other floating devices may be restricted to certain zones designated by the department;

(F) boat speed shall not exceed five miles per hour unless otherwise posted; and

(G) any peace officer may remove any boat or floating device that is left unattended on department land or in the water in excess of 72 hours.

(3) Swimming is prohibited on department lands except where designated and authorized in subsection 630(f) of these regulations.

(aa) Aircraft. No visitor shall operate any aircraft, hovercraft, or hot air balloon within department lands except as authorized by a Special Use Permit issued by the department.

(bb) Bicycles and bike riding are prohibited on department lands except where authorized and designated in subsection 551(j), Section 552, and subsection 630(g) of these regulations.

(1) On department lands where trails or roads have been designated for bicycles, no visitor shall ride, operate, leave, or park a bicycle except on those designated areas.

(cc) Firearms, Archery, and Other Propulsive Equipment.

(1) Nothing in this section shall prohibit the lawful possession of a concealed firearm by an active peace officer listed in Chapter 4.5 (commencing with Section 830) of Title 3 of Part 2 of the Penal Code or a retired peace officer in lawful

possession of an identification certificate issued pursuant to Penal Code Section 25455 authorizing the retired officer to carry a concealed firearm. Nor shall this section prohibit the lawful possession of a concealed firearm pursuant to a concealed carry permit issued pursuant to Penal Code Section 26150 or 26155.

(2) Possession, discharge, and use of firearms or archery equipment is prohibited on department lands except within department-designated hunting areas or shooting sites, or with a permit issued by the department, or as authorized for dog training in a designated area, or when fishing with bow and arrow tackle as defined in subsection 550(b)(11) and allowed in subsection 550(h), or when dispatching a trapped animal per subsections 465.5(g)(1) and 550(ee) of these regulations. This prohibition includes air or gas operated devices or guns and all other propulsive devices.

(3) General (Non Hunting) Uses

(A) The use of glass or porcelain targets is prohibited on all department lands. Clay targets shall be used only at designated shooting sites where their use is allowed.

(B) Designated shooting sites are open daily from sunrise to sunset unless otherwise listed in subsections 551(v) or 630(j) of these regulations.

(C) Except as otherwise provided, an adult supervised youth may possess and discharge a BB gun on any wildlife area. A BB gun is not an authorized method of take and may not be used to take wildlife on any wildlife area. A BB gun is defined as an air and/or spring-actuated rifle similar to Daisy BB gun models 96 (Timberwolf), 105 (Buck), or 1938 (Red Ryder), firing a spherical BB no larger than 0.177 inches in diameter (4.5 mm) at a muzzle velocity no greater than 350 feet per second. For the purpose of this section a youth is defined as a visitor under the age of 16.

(4) Hunting Method of Take. Where hunting is allowed, it shall be conducted in accordance with general hunting regulations and subject to sections 550, 550.5, 551, 552, and 630 of these regulations.

(A) Possession or discharge of shotguns larger than twelve gauge is prohibited on all department lands designated as Type A or Type B wildlife areas.

(B) Except for bow and arrow tackle as defined subsection 550(b)(11) and allowed in subsection 550(h), or as otherwise provided, no rifles, pellet or BB guns, combination rifle-shotguns, pistols, archery equipment, or revolvers shall be possessed in the field or discharged on any Type A or Type B wildlife areas. All legal firearms and archery equipment may be used on Type C wildlife areas unless prohibited in subsection 551(r) of these regulations. Firearms and archery equipment may be used on ecological reserves where hunting is authorized in subsection 630(d) of these regulations, subject to any restrictions therein.

(C) The use or possession of shot size larger than T in steel or BB in non-toxic (other than steel) shot is prohibited on all department lands and national wildlife refuges. On those department lands where big game species may be hunted, shotguns with slugs may be used.

(D) A hunter shall not possess more than 25 shot shells while in the field on Type A wildlife areas during the waterfowl season unless otherwise provided for in subsection 551(o) of these regulations. Subsection 551(o) also specifies additional wildlife areas where a hunter shall not possess more than 25 shot shells in the field during the waterfowl season. Only those visitors possessing a valid hunting permit for that day may possess ammunition in the field.

(E) It shall be unlawful to take wildlife except in compliance with the non-toxic shot and certified nonlead projectile requirements of Section 250.1 of these regulations.

(F) Except for bow and arrow tackle defined in subsection 550(b)(11) and allowed in subsection 550(h), archery equipment shall not be used during the waterfowl and pheasant seasons on Type A or Type B wildlife areas, unless provided in subsection 551(u) of these regulations.

(G) Loaded firearms, as defined in Fish and Game Code Section 2006 or Section 25850 of the Penal Code, are prohibited in parking lots, visitor areas, checking stations, and any other facility on department lands.

(dd) Falconry.

(1) On ecological reserves, falconry is prohibited.

(2) On Type C wildlife areas, raptors may be used to take legal game in accordance with general hunting and falconry regulations.

(3) On Type A and Type B wildlife areas, raptors may be used to take legal game only from the first Saturday following the end of the waterfowl season through the end of the falconry pheasant season. Raptors may be used only on Saturdays, Sundays, and Wednesdays.

(ee) Trapping: Trapping is allowed on Type C wildlife areas, subject to furbearer and trapping provisions in sections 460 through 467 and property-specific closures or restrictions in subsections 551(o) and 551(r) of these regulations.

§550.5 RESERVATIONS, ENTRY PERMITS, FEES, PASSES, AND SPECIAL USE PERMITS.

(a) Reservations for Hunting Activities.

(1) Reservations for waterfowl and pheasant hunting are available for Type A wildlife areas for all authorized shoot days of the season. On Type B wildlife areas, reservations are required for the opening weekend of waterfowl season and may be required for the opening of pheasant season.

(A) Reservations shall be issued by random drawing. Applications are available through the Automated License Data System at license agents, department license offices and online. To find the locations of department license agents, department license offices or to apply for a reservation online, go to the department's website at ***www.wildlife.ca.gov***. Applicants must possess an annual or lifetime hunting license valid for the hunting season for which they are applying. Two-day nonresident hunting licenses shall not be used to apply for reservation drawings. To be included in a reservation drawing, applications must be received by the department through the Automated License Data System or at the address specified on the application at least 17 days prior to the hunt date. Late, incomplete, or incorrect applications will not be included in the drawing. The fee to apply for a reservation is specified in Section 702 of these regulations. The application fee is non-refundable.

(B) Unless otherwise provided in Section 551 of these regulations, the reservation system only serves to assure entry onto a wildlife area and does not necessarily constitute a method for prioritization over other users.

(C) Multiple Applications.

1. An applicant is limited to one application for each wildlife area for each authorized shoot day. Shoot days are specified under subsections 551(e), 551(o), 551(p), 551(q), 551(s), and 552(a) of these regulations.
2. The department may eliminate applications that are not in compliance with these regulations from any reservation drawing. Persons who submit more than

one application for the same shoot day for the same wildlife area may be barred from hunting on department-operated areas for a period of one year following the date the department discovers the violation. Any reservation issued as a result of such improper submission, or to any person currently barred from the department-operated areas, shall be void (not valid).

(D) Unless otherwise stated on the hunting reservation or on information mailed with the reservation, each successful reservation applicant shall be granted a one-day entry permit during the waterfowl or pheasant season. The entry permit shall be issued to the successful applicant for the date and wildlife area stated on the hunting reservation upon the applicant presenting a one-day, two-day, or season pass. Verification of the successful applicant/reservation holder shall require identification per subsection 700.4(c) of these regulations. Unless otherwise provided, the reservation will expire one and one-half hours before shoot time for the date stated on the reservation. For some wildlife areas, the department will number reservations in the order in which they are drawn. These reservations will be accepted at checking stations in numerical order. The reservation holder must be present at the time the number is called in order to have priority over other, lower-priority reservations.

(E) Except as provided in subsection 550.5(a)(1)(F) or subsection 551(x) of these regulations, a reservation shall be valid for entry for up to six visitors who must hunt as a party. No more than two visitors in a hunting party may be adult hunters (18 years of age or older as of July 1 of the licensing year). Each adult may be accompanied by up to two hunters holding junior hunting licenses or two non-shooters irrespective of age, or one of each. All hunters must be in possession of a valid hunting license. Non-shooters are defined as visitors who accompany a reservation holder in the field or remain at a designated parking area. Non-shooters shall not discharge or possess ammunition or a firearm on the wildlife area.

(F) When hunting a designated hunting zone, assigned pond, or blind area, a reservation will assure entry only for the number of visitors (adult hunters, junior hunters, and/or non-shooters) that does not exceed the capacity of the designated zone, assigned pond or blind area.

(b) Reservations for Wildlife Viewing. Reservations for wildlife viewing may be available for certain department lands during peak viewing periods or when guided tours are offered. The department may limit the number of reservations available for each of these opportunities.

(c) Entry Permits, Fees, and Passes.

(1) Where the department has determined that entry permits are required per subsection 550(c)(2) of these regulations and/or that fees are necessary to offset the department's costs of providing public recreational opportunities, an appropriate pass must first be purchased for a fee through the department's Automated License Data System at a license agent, department license office or on the department's website at ***www.wildlife.ca.gov***. An entry permit will be issued only when an appropriate hunting pass is presented at the checking station or point of entry.

(2) Passes for hunting during the waterfowl season are sold as one day, two day, or Type A or Type B season hunting passes. Applicable fees are listed in subsection 702(b) of these regulations.

(3) Entry permits and hunting passes are required for waterfowl hunting on all Type A wildlife areas.

(4) Entry permits and proof of either a Type A or Type B season hunting pass are required for waterfowl hunting on all Type B wildlife areas. One or two day passes are not accepted at Type B wildlife areas.

(5) Entry permits and/or passes or special drawings may be required for hunting on Type C wildlife areas where the department has determined that restricted access is necessary per subsection 550(c) of these regulations (see subsection 551(q) of these regulations).

(6) Each visitor must have a valid entry permit in their immediate possession while on department lands that require an entry permit.

(7) Visitors with a valid junior hunting license are exempt from purchasing a daily or annual hunting pass but will only be issued an entry permit when accompanied by an adult and upon presenting a valid junior hunting license issued in that visitor's own name. An adult is defined as a person 18 years old or older. An adult hunter or non-shooter may accompany up to two junior hunters on department lands.

(8) Any visitor 16 or 17 years of age presenting a valid junior hunting license issued in his or her own name will be issued an entry permit and may hunt independently. Hunters 16 or 17 years of age who hunt without an adult shall not be accompanied by any visitor 15 years of age or younger.

(9) Any required entry permits will be issued on a first-come, first served basis and/or by a reservation drawing to be held at a designated department office. The department shall inform the commission in writing and the public via the news media when limits imposed under this section differ substantially for a specific area from the prior year. Such notification shall include: the land affected; the time period; the reason for the limitation or closure; the number of entry permits to be issued; and the method of issuance.

(10) Entry permits are non-transferable. Forgery, duplication, alteration or fraudulent use of entry permits, passes, or processes for obtaining them, is prohibited. Any person who violates these regulations may be barred from department lands for one calendar year from the date the department discovers the violation.

(11) A Daily or Annual Lands Pass for Authorized Uses Other than Hunting (Lands Pass) is required for visitor entry on department lands listed in subsections 551(w) and 630(c) of these regulations. A Lands Pass must be purchased in advance and carried by each visitor, on their person, while on the subject property. Information about how to purchase a Lands Pass is explained in 550.5(c)(1) of these regulations. Exceptions to the Lands Pass requirements are as follows:

(A) Visitors carrying a valid California sportfishing, hunting, or trapping license issued in the visitor's own name are not required to purchase a Lands Pass.

(B) Participants in school or organized youth group field trips, or visitors who are under 16 years of age are not required to obtain a Lands Pass.

(12) In addition to the sources listed for purchasing passes in subsection 550.5(c)(1), Lands Passes may be purchased at the Elkhorn Slough Ecological Reserve Visitor Center at the time of entry during business hours.

(d) Special Use Permits. Special uses, as defined in subsection 550(b)(9) of these regulations, on department lands require written authorization from the department. Such authorization will typically be in the form of a Special Use Permit (per subsections 550(d) and 550(n)(2) of these regulations). The department shall not issue Special Use Permits for activities or uses that conflict with the current uses, management or purposes of a department land, would have a significant environmental effect, or would constitute an unlawful use of state resources under Government Code Section 8314.

(1) Types of Special Use.

(A) Type 1 Special Use. A Type 1 special use is an activity that meets all of the following criteria:

1. involves 30 or fewer visitors on site;
2. involves ten or fewer (0-10) animals (such as dogs or horses) or bicycles (or other pedaled vehicles) in total;
3. does not require the use of animals, bicycles, vehicles, or large equipment outside of designated parking areas, roads, trails, or other areas authorized for visitor use; and
4. does not require use of the site for more than one calendar day during normal operating hours of the department land.

(B) Type 2 Special Use. A Type 2 special use is a hunting dog trial or testing event or activity.

(C) Type 3 Special Use. A Type 3 special use is an activity that meets any one of the following criteria:

1. involves more than 30 visitors on site;
2. involves more than ten animals or bicycles in total;
3. requires the use of animals, bicycles, vehicles, or large equipment outside of designated parking areas, roads, trails, or other areas authorized for visitor use; or
4. requires use of the site for more than one calendar day or outside of normal operating hours of the department land.

(2) Application Process for Special Use Permits.

(A) Application for a Special Use Permit shall be made on the “Permit Application for Special Use of Department Lands”, as specified in Section 702 of these regulations. Failure to disclose fund-raising or commercial activities or other information per the instructions on the application may result in a citation and fine.

(B) Applications and Special Use Permit fees shall be submitted at least 45 calendar days prior to the date of the requested activity or event to the appropriate regional office. The permit fees for Type 1, Type 2, and Type 3 Special Uses are specified in Section 702 of these regulations.

1. If a special use event or activity is entirely canceled, Type 1 and Type 2 permit fees are refundable. Type 3 permit fees are refundable until 10 calendar days prior to the scheduled start of the special use, after which the permit fee will be forfeited if the permittee cancels the special use. Cancelations prior to 10 calendar days before the start of a Type 3 special use must be provided to the area manager in writing.
2. All Special Use Permit fees are refundable if the department does not approve a special use permit application or does not have adequate staff available to review an application.

(3) Special Use Permit Application Review Process

(A) Evaluation Criteria. Criteria used to evaluate Special Use Permit applications shall include, but not be limited to, the following:

1. Will the proposed special use create a greater potential hazard or liability to the State, resources, or the public than typical operations within the department land on which the special use is proposed?;
2. Is the special use a compatible use as defined in subsection 550(b)(2)?;
3. Can the use be conducted so as not to conflict with the current uses, management or purposes of the property?;
4. Will the special use require the exclusive use of part or all of a property?;
5. Will the special use interfere with other visitors’ use of the property?;
6. Will additional department staffing or staff time be required to prepare for, monitor or assist with, or return department land to its previous condition following the special use?;
7. Will the permittee charge any fees and, if so, will the proposed fees exceed those the department charges for licenses, day use fees, or passes?;
8. Will any items, products, or services be sold?; and,
9. Has the applicant complied with the terms and conditions of any prior Special Use Permit issued by the department?.

(B) Notification of Approval of Special Use Permit. If the department intends to issue a Special Use Permit, it will provide written notification to the applicant. The notification will provide an itemized explanation of any fees, charges or deposits that need to be paid, as well as terms and conditions that need to be accepted by the applicant/permittee, in order for a Special Use Permit to be finalized and valid. Payment instructions will be included with the notification.

(C) Notification of Denial of Special Use Permit. If the department intends to deny issuance of a Special Use Permit, it shall provide written notification to the applicant that the application for a Special Use Permit is denied and include the reason(s) for the denial in the notification.

(4) Possible Costs In Addition to the Special Use Permit Fee.

(A) For department lands that normally require a fee for a Lands Pass or entry permit, the Lands Pass or entry fee will be required in addition to the Special Use Permit fee. Whether the daily use or entry fee for each special use participant will be paid directly to the department by the participants or by the permittee will be determined as part of the development of the Special Use Permit.

(B) Additional Anticipated Costs. If the regional manager or his designee determines in advance that department staff will need to conduct work outside of normal duties or hours to prepare for the special use, monitor or assist with the special use, or return department land to its previous condition following the special use, payment of the additional anticipated cost to the department will be added to the Special Use Permit fee specified in Section 702 of these regulations and required to be paid as a condition of the department issuing a Special Use Permit. The additional cost shall be based on the estimated number of hours, the job classification of state personnel required to conduct the work, and the department’s costs for employee benefits, overhead, mileage, and use of department equipment and supplies.

(C) Cleaning or Damage Deposit. Depending on the anticipated need for cleaning or repair to department property, including land, infrastructure and/or equipment, the department may charge the applicant a cleaning or damage deposit in an amount determined by the regional manager or his designee. Costs to return department property to its previous condition following the special use shall be deducted from this deposit. The regional manager or his designee shall determine whether all, a portion or none of the deposit is refunded based on department costs to clean up or repair damage.

(D) For-Profit or Fund Raising Activities. Any person, entity, or organization is prohibited from holding, sponsoring, leading, or otherwise conducting a recreational, educational, or other activity occurring wholly or partially within or on any department land for the purpose of generating revenue or fund raising without adequate compensation for the use of State resources. Unless an event is sponsored or co-sponsored by the department, payment to the department of a guaranteed minimum fee or percentage of the gross revenue of the event shall be a condition of any Special Use Permit that authorizes activities on department land that are intended to generate revenue or raise funds. The rate or amount of compensation shall be specified in the draft Special Use Permit. The criteria used to determine the rate or amount of compensation shall include, without limitation:

1. the extent of the department land to be used;
2. the duration, size and scope of the event;
3. the anticipated impact on department resources and facilities;
4. prevailing fees for comparable facilities in the locality;
5. amount and type of permittee's equipment and materials to be used on the department land;
6. the number of people, vehicles, bicycles, and/or domestic animals on the department land because of the special use;
7. the amount of gross revenue the permittee expects to generate from the event;
8. the cost of services or time required of or by the department;
9. whether the applicant is a non-profit organization with tax-exempt status under section 501(c), Subtitle A of the U.S. Internal Revenue Code; and
10. any other considerations as appropriate.

(5) Terms and Conditions of Special Use Permits.

(A) To protect human health and safety, natural or cultural resources, or department facilities, the regional manager or his designee may impose special conditions in addition to the standard terms and conditions included in the Permit Application for Special Use of Department Lands as specified in Section 702. The department must provide notice of any special conditions as part of the notification of approval referenced in subsection 550.5(d)(3)(B) of these regulations.

(6) Acceptance of the Terms and Conditions of Special Use Permits and Payment of Fees.

(A) Type 1 or Type 2 Special Use Permit. The notification of approval for a Type 1 or Type 2 Special Use Permit will include a Special Use Permit signed by the wildlife area or ecological reserve manager and the regional manager or his designee. The Special Use Permit will include an attachment titled: Attachment B: Applicant Acceptance of Terms, Conditions and Costs as specified in Section 702. The Special Use Permit is not valid unless the permittee accepts the terms and conditions of the Special Use Permit by signing and submitting the signed original of Attachment B and the full payment of the permit fee and all other costs indicated on the permit to the appropriate regional office at least five calendar days before the beginning of the event or activity. The permittee should make and keep a copy of the signed Attachment B with the Special Use Permit. Conducting a special use event or activity without a valid permit is a violation of subsections 550(c)(2)(A) and 550.5(d)(8) of these regulations.

(B) Type 3 Special Use Permit. The notification of approval for a Type 3 Special Use Permit will include a draft permit (not valid). The draft Special Use Permit will include an attachment titled: Attachment B: Applicant Acceptance of Terms, Conditions and Costs as specified in Section 702. In order to receive a final, valid Special Use Permit, the applicant must accept the terms and conditions of the Special Use Permit by signing Attachment B, and send the signed original draft permit and the full payment of the permit fee and all other costs indicated on the permit to the appropriate regional office at least ten calendar days before the beginning of the event or activity. After the Special Use Permit is signed by the wildlife area or ecological reserve manager and the regional manager or his designee, it will be mailed back to the permittee as the valid permit. Conducting a special use event or activity without a valid permit is a violation of subsections 550(c)(2)(A) and 550.5(d)(8) of these regulations.

(7) Valid Special Use Permit. A valid Special Use Permit includes the completed application, including the permit section of the form signed by the wildlife area or ecological reserve manager and the regional manager or his designee, and any and all attachments referenced in the Special Use Permit. In order for a Special Use Permit to be valid, all costs that are required to be paid in advance, as indicated on the permit, must be paid-in-full by the permittee.

(8) Possession of Special Use Permit. The permittee or their representative shall have the valid Special Use Permit in his immediate possession and on-site during the special use and shall present it to any department employee upon request.

(9) Authorized Activities. Only the activities or uses specifically authorized in the Special Use Permit are permitted. Issuance of a Special Use Permit does not grant visitors any right to conduct activities not covered by the Special Use Permit. Conducting activities or uses not covered by the Special Use Permit shall result in revocation of the Special Use Permit, and may result in a citation and fine.

(10) Termination of Special Use Permit. The regional manager or his designee may terminate any Special Use Permit when the department deems termination necessary for human health and safety, protection of natural or cultural resources or department facilities. In addition, any Special Use Permit may be cancelled without notice in the event of a disaster or unforeseen emergency.

(11) Revocation of Special Use Permit. The regional manager or his designee may revoke a Special Use Permit and deny future Special Use Permit applications for violation of any rules or regulations of the department or conditions of a Special Use Permit.

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§551. ADDITIONAL VISITOR USE REGULATIONS ON DEPARTMENT LANDS DESIGNATED AS WILDLIFE AREAS.

(a) The areas listed in Section 551 have been designated by the commission as wildlife areas. All wildlife areas are maintained for the primary purposes of developing a statewide program of ecological conservation, restoration, preservation, development and management of wildlife and wildlife habitat and hunting. A legal description of the boundaries of each wildlife area is on file at the department's headquarters, 1416 9th Street, Sacramento. Visitor use is subject to the regulations below and in sections 550 and 550.5, as well as any other sections of Title 14, CCR, and the Fish and Game Code that may apply. These regulations are incorporated by reference into and become a condition of entry and/or permits. Visitors are responsible for knowing and understanding these regulations prior to entry.

(b) Wildlife areas owned and operated by the department (Types A, B and C as defined in Section 551(e)) are as follows:

(1) Antelope Valley Wildlife Area (Sierra County) (Type C);
(2) Ash Creek Wildlife Area (Lassen and Modoc counties) (Type B);
(3) Bass Hill Wildlife Area (Lassen County), including the Egan Management Unit (Type C);
(4) Battle Creek Wildlife Area (Shasta and Tehama counties) (Type C);
(5) Big Lagoon Wildlife Area (Humboldt County) (Type C);
(6) Big Sandy Wildlife Area (Monterey and San Luis Obispo counties) (Type C);
(7) Biscar Wildlife Area (Lassen County) (Type C);
(8) Burcham and Wheeler Flats Wildlife Area (Mono County) (Type C);
(9) Buttermilk Country Wildlife Area (Inyo County) (Type C);
(10) Butte Valley Wildlife Area (Siskiyou County) (Type B);
(11) Cache Creek Wildlife Area (Lake County), including the North Fork Cache Creek and Harley Gulch management units (Type C);
(12) Camp Cady Wildlife Area (San Bernardino County) (Type C);
(13) Cantara/Ney Springs Wildlife Area (Siskiyou County) (Type C);
(14) Cartago Wildlife Area (Inyo County) (Type C);
(15) Cedar Roughs Wildlife Area (Napa County) (Type C);
(16) Cinder Flats Wildlife Area (Shasta County) (Type C);
(17) Clear Lake Wildlife Area (Lake County), including the Rodman Slough Unit (Type C);
(18) Collins Eddy Wildlife Area (Sutter and Yolo counties) (Type C);
(19) Colusa Bypass Wildlife Area (Colusa County) (Type C);
(20) Coon Hollow Wildlife Area (Butte County) (Type C);
(21) Cottonwood Creek Wildlife Area (Merced County), including the Upper Cottonwood and Lower Cottonwood management units (Type C);
(22) Crescent City Marsh Wildlife Area (Del Norte County) (Type C);
(23) Crocker Meadow Wildlife Area (Plumas County) (Type C);
(24) Daugherty Hill Wildlife Area (Yuba County) (Type C);
(25) Decker Island Wildlife Area (Solano County) (Type C);
(26) Doyle Wildlife Area (Lassen County) (Type C);
(27) Dutch Flat Wildlife Area (Modoc County) (Type C);
(28) East Walker River Wildlife Area (Mono County) (Type C);
(29) Eel River Wildlife Area (Humboldt County) (Type C);
(30) Elk Creek Wetlands Wildlife Area (Del Norte County) (Type C);
(31) Elk River Wildlife Area (Humboldt County) (Type C);
(32) Fay Canyon Wildlife Area (Alpine County) (Type C);
(33) Fay Slough Wildlife Area (Humboldt County) (Type C);
(34) Feather River Wildlife Area (Sutter and Yuba counties), including the Abbott Lake, Lake of the Woods, Marysville, Morse Road, Nelson Slough, O'Connor Lakes, Shanghai Bend, and Star Bend management units (Type C);
(35) Fitzhugh Creek Wildlife Area (Modoc County) (Type C);
(36) Fremont Weir Wildlife Area (Yolo County) (Type C);
(37) French Valley Wildlife Area (Riverside County) (Type C);
(38) Grass Lake Wildlife Area (Siskiyou County) (Type C);
(39) Gray Lodge Wildlife Area (Butte and Sutter counties) (Type A);
(40) Green Creek Wildlife Area (Mono County) (Type C);
(41) Grizzly Island Wildlife Area (Solano County), including the Crescent (Type A), Gold Hills (Type B), Goodyear Slough (Type B), Grey Goose (Type C), Grizzly Island (Type A), Island Slough (Type B), Joice Island (Type A), West Family (Type B) and Garibaldi, Cordelia and Montezuma Slough management units;
(42) Hallelujah Junction Wildlife Area (Lassen and Sierra counties) (Type C);
(43) Heenan Lake Wildlife Area (Alpine County) (Type C);
(44) Hill Slough Wildlife Area (Solano County) (Type C);
(45) Hollenbeck Canyon Wildlife Area (San Diego County) (Type C);
(46) Honey Lake Wildlife Area (Lassen County) (Type B);
(47) Hope Valley Wildlife Area (Alpine County) (Type C);
(48) Horseshoe Ranch Wildlife Area (Siskiyou County) (Type C);
(49) Imperial Wildlife Area (Imperial County), including the Wister Management Unit (Type A) and Finney Ramer Management Units (Type C);
(50) Indian Valley Wildlife Area (Lake County) (Type C);
(51) Kelso Peak and Old Dad Mountains Wildlife Area (San Bernardino County) (Type C);
(52) Kinsman Flat Wildlife Area (Madera County) (Type C);
(53) Knoxville Wildlife Area (Napa and Yolo counties) (Type C);
(54) Laguna Wildlife Area (Sonoma County) (Type C);
(55) Lake Berryessa Wildlife Area (Napa County) (Type C);
(56) Lake Earl Wildlife Area (Del Norte County) (Type C);
(57) Lake Sonoma Wildlife Area (Sonoma County) (Type C);
(58) Little Panoche Reservoir Wildlife Area (Fresno County) (Type C);
(59) Los Banos Wildlife Area (Merced County) (Type A);
(60) Lower Sherman Island Wildlife Area (Sacramento County) (Type C);
(61) Mad River Slough Wildlife Area (Humboldt County) (Type C);
(62) Marble Mountains Wildlife Area (San Bernardino County) (Type C);
(63) Mendota Wildlife Area (Fresno County) (Type A);
(64) Merrill's Landing Wildlife Area (Tehama County) (Type C);
(65) Miner Slough Wildlife Area (Solano County) (Type C);
(66) Monache Meadows Wildlife Area (Tulare County) (Type C);
(67) Morro Bay Wildlife Area (San Luis Obispo County) (Type C);
(68) Moss Landing Wildlife Area (Monterey County) (Type C);
(69) Mouth of Cottonwood Creek Wildlife Area (Shasta and Tehama counties) (Type C);
(70) Mud Lake Wildlife Area (Siskiyou County) (Type C);
(71) Napa-Sonoma Marshes Wildlife Area (Solano, Napa, and Sonoma counties), including the American Canyon, Coon Island, Dutchman Slough, Huichica

Creek, Napa River, Ringstrom Bay, Sonoma Creek, Tolay Creek, and Wingo management units (Type C); and Green Island, Southern Crossing, and White Slough management units;

(72) North Grasslands Wildlife Area (Merced and Stanislaus counties), including the China Island, Gadwall, and Salt Slough management units (Type A);

(73) O'Neill Forebay Wildlife Area (Merced County) (Type C);

(74) Oroville Wildlife Area (Butte County), including the Thermalito Afterbay Management Unit (Type C);

(75) Petaluma Marsh Wildlife Area (Marin and Sonoma counties), including the Black John Slough, Burdell, and Petaluma River management units (Type C); and Bahia, Day Island, Green Point, Novato Creek, Point Sonoma, and Rush Creek management units;

(76) Pickel Meadow Wildlife Area (Mono County) (Type C);

(77) Pine Creek Wildlife Area (Modoc County) (Type C);

(78) Point Edith Wildlife Area (Contra Costa County) (Type C);

(79) Putah Creek Wildlife Area (Solano County) (Type C);

(80) Rector Reservoir Wildlife Area (Napa County) (Type C);

(81) Red Lake Wildlife Area (Alpine County) (Type C);

(82) Rhode Island Wildlife Area (Contra Costa County) (Type C);

(83) Sacramento Bypass Wildlife Area (Yolo County) (Type C);

(84) Sacramento River Wildlife Area (Butte, Colusa, and Glenn counties) (Type C);

(85) San Felipe Valley Wildlife Area (San Diego County) (Type C);

(86) San Jacinto Wildlife Area (Riverside County), including the Davis Road Unit and the Potrero Unit (Type A);

(87) San Luis Obispo Wildlife Area (San Luis Obispo County) (Type C);

(88) San Luis Reservoir Wildlife Area (Merced County) (Type C);

(89) San Pablo Bay Wildlife Area (Marin and Sonoma counties) (Type C);

(90) Santa Rosa Wildlife Area (Riverside County) (Type C);

(91) Shasta Valley Wildlife Area (Siskiyou County) (Type B);

(92) Sheepy Ridge Wildlife Area (Siskiyou County) (Type C);

(93) Silver Creek Wildlife Area (Lassen County) (Type C);

(94) Slinkard-Little Antelope Wildlife Area (Mono County) (Type C);

(95) Smithneck Creek Wildlife Area (Sierra County) (Type C);

(96) South Fork Wildlife Area (Kern County) (Type C);

(97) South Spit Wildlife Area (Humboldt County) (Type C);

(98) Spenceville Wildlife Area (Yuba and Nevada counties) (Type C);

(99) Surprise Valley Wildlife Area (Modoc County) (Type C);

(100) Sutter Bypass Wildlife Area (Sutter County) (Type C);

(101) Tehama Wildlife Area (Tehama County) (Type C);

(102) Truckee River Wildlife Area (Placer and Nevada counties), including the Boca, Polaris, Union Ice, and West River management units (Type C);

(103) Upper Butte Basin Wildlife Area (Butte and Glenn counties), including the Howard Slough, Little Dry Creek, and Llano Seco management units (Type A);

(104) Volta Wildlife Area (Merced County) (Type A);

(105) Waukell Creek Wildlife Area (Del Norte County) (Type C);

(106) Warner Valley Wildlife Area (Plumas County) (Type C);

(107) West Hilmar Wildlife Area (Merced and Stanislaus counties) (Type C);

(108) West Walker River Wildlife Area (Mono County) (Type C);

(109) White Slough Wildlife Area (San Joaquin County) (Type C);

(110) Willow Creek Wildlife Area (Lassen County) (Type B); and

(111) Yolo Bypass Wildlife Area (Yolo County) (Type A).

(c) Areas owned and operated by federal agencies where public hunting opportunities are administered by the department are listed in this subsection. Additional regulations for the areas listed in this subsection are in Section 552 of these regulations.

(1) Baldwin Lake (San Bernardino County) (Type C);

(2) Colusa National Wildlife Refuge (Colusa County) (Type A);

(3) Delevan National Wildlife Refuge (Colusa County) (Type A);

(4) Kern National Wildlife Refuge (Kern County) (Type A);

(5) Lake Berryessa Wildlife Area (Napa County) (Type C);

(6) Lake Sonoma Wildlife Area (Sonoma County) (Type C);

(7) Merced National Wildlife Refuge (Merced County) (Type A);

(8) Sacramento National Wildlife Refuge (Glenn and Colusa counties) (Type A);

(9) San Luis National Wildlife Refuge (Merced County) (Type A), including the San Luis, Kesterson, West Bear Creek, Freitas, and Blue Goose Units;

(10) Sonny Bono Salton Sea National Wildlife Refuge (Imperial County) (Type A) (operated with the Imperial Wildlife Area); and

(11) Sutter National Wildlife Refuge (Sutter County) (Type A).

(d) Areas operated by the department in cooperation with other state or federal agencies are:

(1) Clifton Court Forebay (Contra Costa County) (Type C);

(2) Little Panoche Reservoir Wildlife Area (Fresno County) (Type C);

(3) O'Neill Forebay Wildlife Area (Merced County) (Type C);

(4) Perris Reservoir State Recreation Area, area day use fee (Riverside County);

(5) Rector Reservoir Wildlife Area (Napa County) (Type C);

(6) Sacramento River National Wildlife Refuge, including the La Barranca Unit, Blackberry Island Unit, Mooney Unit, Ohm Unit, Flynn Unit, Heron Island Unit, and Rio Vista Unit (Tehama County); Pine Creek Unit, Dead Man's Reach Unit, North Llano Seco Island 1 & 2 Units, and Llano Seco Riparian Sanctuary Unit (Butte County); and McIntosh Landing North and South Units, Capay Unit, Phelan Island Unit, Jacinto Unit, Ord Unit, Ord Bend Unit, South Ord Unit, Hartley Island Unit, Sul Norte Unit, Codora Unit, Packer Unit, Afton Unit, North Drumheller Slough Unit, and Drumheller Slough Unit (Glenn County) (Type C).

  (A) Additional regulations for the Sacramento River National Wildlife Refuge are in Section 552 of these regulations.

(7) San Luis Reservoir Wildlife Area (Merced and Santa Clara counties) (Type C); and

(8) Volta Wildlife Area (Merced County) (Type A), US Bureau of Reclamation

(e) Types of Wildlife Areas:

(1) "Type A" wildlife areas are defined as wildlife areas which have restricted hunter access during waterfowl season, and require a hunting pass to be purchased in advance and exchanged for an entry permit at the wildlife area, per subsections 550.5(c) and 702(b) of these regulations. Reservations are available per subsection 550.5(a) of these regulations during waterfowl season. Species open for hunting are waterfowl, coots, moorhens, snipe, pheasant, and dove, unless otherwise specified in subsection 551(s). Except as provided in subsection 551(p) and Section 552 of these regulations, shoot days are Saturdays, Sundays, and Wednesdays during waterfowl season, youth waterfowl hunt days authorized in Section 502 of these regulations, and daily during the September dove season only. All Type A wildlife areas are closed to hunting on Christmas Day.

(2) "Type B" wildlife areas are defined as wildlife areas which have restricted hunter access during waterfowl season and require a Type A or Type B season hunting pass to be purchased in advance and presented for an entry permit at the wildlife area, per subsection 550.5(c) and Section 702 of these regulations. Reservations are required for opening

weekend per subsection 550.5(a) of these regulations. Species open for hunting include waterfowl, coots, moorhens, snipe, pheasant, and dove, unless otherwise specified in subsection 551(s). Except as provided in subsection 551(p), shoot days are Saturdays, Sundays, and Wednesdays during waterfowl season and daily during the September dove season only. All Type B wildlife areas are closed to hunting on Christmas Day, except as provided in subsection 551(o).

(3) "Type C" wildlife areas are defined as wildlife areas that, except as provided in subsections 551(q) and 551(t), are open daily for hunting all legal species and do not require the purchase of a hunting pass for entry.

(4) For Perris Reservoir State Recreation Area, the fee to obtain an entry permit for hunting shall be the day-use fee determined by the California Department of Parks and Recreation (***www.parks.ca.gov***).

(f) Shooting Hours:

(1) Waterfowl: Except as provided in subsections 551(p) and 551(q), waterfowl shooting hours on all wildlife areas shall be from one half-hour before sunrise to sunset (pursuant to Section 506 of these regulations).

(2) Other Species: Except as provided in subsections 551(p), 551(q), and 551(s), species other than waterfowl may be taken where authorized only during the legal shooting hours for the taking of each species as specified in sections 250.5, 310, 310.5, 352, and 474 of these regulations.

(g) Deferred Openings: When the department considers such deferral desirable to protect agricultural crops from waterfowl, it may defer opening a wildlife area to visitor access until, in the opinion of the department, the danger of crop damage in the immediate region is abated.

(h) Assigned Hunting Zones: In order to assure proper hunter dispersal and promote safety, the department may subdivide the open hunting portion of any wildlife area into zones, assign hunters to zones and/or designate where hunters shall park.

NOTE: *The remainder of Section 551, Title 14, CCR includes regulations that apply only to individual wildlife areas. These regulations are organized primarily by type of public use in the following pages of this booklet. To see the same property-specific regulations organized under the name of each wildlife area, go to:* ***www.wildlife.ca.gov/Lands/Regulations***

(i) Wildlife Areas Authorized for Dog Training and/or Dog Trials: Dog training and/or dog trials are authorized as specified below. Dog trials require a Special Use Permit. Site-specific dog training and/or trial prohibitions are identified in subsection 551(o). General rules regarding the use of dogs for hunting, training or trials are located in subsection 550(n) of these regulations.

551(i)	AREA	DOG TRAINING	DOG TRIALS
(1)	Gray Lodge Wildlife Area	Allowed with written authorization from the area manager.	Allowed.
(2)	Grizzly Island Wildlife Area	Allowed on the area but prohibited from March 1 through June 30, August 1 through the end of the tule elk season in September, and October 1 through the end of waterfowl season.	Allowed on the area but prohibited from March 1 through June 30, August 1 through the end of the tule elk season in September, and October 1 through the end of waterfowl season.
(3)	Hollenbeck Canyon Wildlife Area	Allowed only in the designated portion of the area from September 1 through February. Only male ring-necked pheasants, male bobwhite quail, either sex feral pigeons, and male mallard ducks may be used for dog training purposes. Release or possession of female ring-necked pheasant, female bobwhite quail, female mallard, or any other bird species is prohibited. It is unlawful to release or possess a male mallard duck without at least one wing clipped.	Not authorized.
(4)	Imperial Wildlife Area	Allowed with written authorization from the area manager.	Allowed only in designated areas on the Finney-Ramer Unit.
(5)	Little Panoche Reservoir Wildlife Area	Prohibited.	Allowed.
(6)	Los Banos Wildlife Area	Allowed only in the designated portion of the area from the end of waterfowl season to March 31 and July 1 through September 15.	Allowed only in the designated portion of the area from the end of waterfowl season to March 31 and July 1 through September 15.
(7)	Mendota Wildlife Area	Allowed only in the designated portion of the area from the end of waterfowl season to March 31.	Allowed.
(8)	North Grasslands Wildlife Area	Allowed only in the designated portion of the area from the end of waterfowl season to March 31 and July 1 through September 15.	Allowed on the area but prohibited from April 1 through June 30 and September 15 through the end of waterfowl season.
(9)	O'Neill Forebay Wildlife Area	Allowed.	Allowed.
(10)	Oroville Wildlife Area	Allowed only in the designated portion of the area from July 1 through March 15.	Allowed only in the designated portion of the area from July 1 through March 15.
(11)	San Felipe Valley Wildlife Area	Allowed only in the designated portion of the area from September 1 through the end of February.	Not authorized.
(12)	San Jacinto Wildlife Area	Allowed only on the Davis Road Unit and requires written authorization from the area manager.	Allowed only on the Davis Road Unit.
(13)	Spenceville Wildlife Area	Allowed only in the designated portion of the area from July 1 through March 15.	Allowed only in the designated portion of the area from July 1 through March 15.
(14)	Yolo Bypass Wildlife Area	Allowed with written authorization from the area manager.	Not authorized.

(j) Bicycles: Except for their use on roads or levees for transportation between parking lots and hunting areas during the waterfowl season on Type A or B wildlife areas, or as provided in this subsection, the use of bicycles by visitors is prohibited on wildlife areas (also see subsection 550(bb) of these regulations).

551(j) AREA	BICYCLES
(1) Cache Creek Wildlife Area	Allowed only on the Harley Gulch Unit from the third Saturday in April through the third Saturday in November.
(2) Daugherty Hill Wildlife Area	Allowed only on the Daugherty Hill Unit from May 10 through September 15. Prohibited on other units.
(3) Hollenbeck Canyon Wildlife Area	Allowed only on designated trails or routes.
(4) Oroville Wildlife Area	Allowed only on roads open to vehicles.
(5) San Felipe Valley Wildlife Area	Allowed only on designated trails or routes.
(6) San Jacinto Wildlife Area (Potrero Unit)	Allowed only on designated trails.
(7) Spenceville Wildlife Area	Allowed only on designated trails and roads.
(8) Upper Butte Basin Wildlife Area	Allowed only from one week after the end of waterfowl season until two weeks prior to opening of waterfowl season.
(9) Yolo Bypass Wildlife Area	Allowed only in designated areas.

(k) Off-Highway Vehicles: Except as provided in this subsection, off-highway vehicles are prohibited on wildlife areas.
  (1) Eel River Wildlife Area. Off-highway vehicles are allowed only for commercially licensed anglers who are utilizing the wave-slope for fishing access.
  (2) South Spit Wildlife Area. Off-highway vehicles are allowed only on the west side of South Jetty on designated access corridors and wave-slope.
  (3) Tehama Wildlife Area. Off-highway vehicles are allowed only on roads open to vehicles.

(l) Wildlife Areas with Boat and/or Horse and Pack Stock Restrictions: Per subsections 550(z) and 550(o), the use of boats or horses is allowed on wildlife areas except as restricted in this subsection. See subsection 550(z) of these regulations for additional regulations about the use of boats.

551(l) AREA	BOATS	HORSES & PACK STOCK
(1) Battle Creek Wildlife Area		Prohibited
(2) Big Lagoon Wildlife Area	Speed restricted to 5 mph for motorized vessels.	
(3) Butte Valley Wildlife Area	Prohibited from March 1 through September 1. Motors are prohibited.	
(4) Cache Creek Wildlife Area		Allowed only on the Harley Gulch Unit from the third Saturday in April through the third Saturday in November.
(5) Cottonwood Creek Wildlife Area		Prohibited.
(6) Daugherty Hill Wildlife Area		Allowed only on the Daugherty Hill unit from May 10 through September 15.
(7) Gray Lodge Wildlife Area		Allowed only on the east side from July 1 through August 31.
(8)Grizzly Island Wildlife Area	The use of boats is prohibited on all management units, except the Grey Goose Unit and the portion of the Goodyear Slough Unit to the south of Lake Herman Road and east of the eastern-most railroad tracks. Access to those two areas is by boat only. There is no foot access. Launching of boats at the Montezuma Slough unit for access to Montezuma Slough is allowed. Boats less than eight feet in length may be used to transport decoys and/or blind materials.	Allowed only during department-authorized dog trials.
(9) Hallelujah Junction Wildlife Area		Prohibited.
(10) Heenan Lake Wildlife Area	Prohibited except during controlled entry fishing events (see subsection 551(y)).	
(11) Hollenbeck Canyon Wildlife Area		Allowed only on designated trails or routes. Horse trailers are permitted within the designated parking area if space is available.
(12) Imperial Wildlife Area (Finney-Ramer Unit)	Required for waterfowl hunting. Only non-motor driven boats or boats with electric motors may be used.	
(13) Imperial Wildlife Area (Wister Unit)	Only hand-portable boats that are non-motorized or use an electric motor are allowed.	
(14) Laguna Wildlife Area		Prohibited.

551(l) AREA	BOATS	HORSES & PACK STOCK
(15) Lake Earl Wildlife Area	Motors prohibited during waterfowl season.	
(16) Little Panoche Reservoir Wildlife Area	Only non-motorized boats or boats with electric motors may be used.	Allowed only during department-authorized dog trials.
(17) Mendota Wildlife Area		Allowed only during department-authorized dog trials.
(18) Mouth of Cottonwood Creek Wildlife Area		Prohibited.
(19) North Grasslands Wildlife Area		Horseback riding is allowed only during department-authorized dog trials.
(20) O'Neill Forebay Wildlife Area		Allowed only during department-authorized dog trials.
(21) Oroville Wildlife Area	Motorized boats are subject to 5 mph speed limit except on the southern portion of the Thermalito Afterbay Unit (those portions of the water surface south of Highway 162), where motorized boat speeds may exceed 5 mph.	Allowed only on roads open to vehicles or within 25 feet of the exterior boundary fences. Horse drawn carriages are only allowed on roads open to vehicles.
(22) Perris Reservoir State Recreation Area	Only motorized boats may be used.	
(23) Sacramento River Wildlife Area	Boat-in Only Access Units: Colusa South, Colusa North, Moulton South, Moulton North, Stegeman, Princeton South, Beehive Bend, Oxbow, Jacinto, Ord Bend, Shannon Slough, Pine Creek North, Wilson Landing, Dicus Slough, and Merrills Landing. Walk-In or Boat-In Access Units: Princeton Southeast, Princeton East, Princeton North, Site 21, Pine Creek West, Pine Creek East.	Prohibited.
(24) San Felipe Valley Wildlife Area		Allowed only on designated trails or routes.
(25) San Luis Reservoir Wildlife Area		Prohibited.
(26) Shasta Valley Wildlife Area	Only non-motorized boats or boats with electric motors may be used.	
(27) South Spit Wildlife Area		Allowed only on west side of South Jetty Road.
(28) Spenceville Wildlife Area		Allowed only on designated trails and roads.
(29) Upper Butte Basin Wildlife Area		Prohibited.
(30) Volta Wildlife Area (US Bureau of Reclamation Lands)	Boat trailers allowed beyond the checking station only to launch boats. Vehicles may be driven past Parking Lot 1 to launch boats.	
(31) Yolo Bypass Wildlife Area	No boats or flotation devices allowed.	Prohibited.

(m) Wildlife Areas with Camping, Camp Trailers and Motorhomes as a Designated Use: Unless permitted in this subsection, camping and the use of camp trailers and motorhomes are prohibited on wildlife areas. For additional rules about camping on department lands, see subsection 550(p) of these regulations.

551(m) AREA	CAMPING
(1) Antelope Valley Wildlife Area	No motorhomes or camp trailers permitted. Camping allowed only from May 1 through October 31.
(2) Ash Creek Wildlife Area	Allowed.
(3) Butte Valley Wildlife Area	Allowed.
(4) Cache Creek Wildlife Area	No motorhomes or camp trailers permitted. No camping within 1/4 mile of designated parking areas.
(5) Cottonwood Creek Wildlife Area	Allowed only in the Upper Cottonwood Creek Unit parking lot.
(6) Daugherty Hill Wildlife Area	No tent camping. Overnight parking with camp trailers allowed only in designated parking lots.
(7) Gray Lodge Wildlife Area	Allowed only during waterfowl season. Camp trailers or motorhomes may be placed in the designated camp trailer area no sooner than one week before the opening of waterfowl season and must be removed from the wildlife area no later than one week after the end of the regular waterfowl season. All campers, defined as a shell or shelter made to be mounted on a pickup truck must remain attached to a registered vehicle when on the area. All camp trailers and motorhomes must be registered at the checking station within one week of placement.
(8) Grizzly Island Wildlife Area	Not allowed except with prior written authorization from the area manager during the tule elk season.
(9) Honey Lake Wildlife Area (Fleming and Dakin Units)	Allowed.
(10) Hope Valley Wildlife Area	Backpack camping allowed east of Highway 89 only.
(11) Horseshoe Ranch Wildlife Area	Allowed.

551(m) AREA	CAMPING
(12) Imperial Wildlife Area (Finney-Ramer Unit)	Allowed only in designated area at Finney Lake.
(13) Imperial Wildlife Area (Wister Unit)	Allowed only in designated area. Campers must obtain an entry permit pursuant to subsection 551(w)(3). No unattached trailers or tents allowed in the checking station parking lot.
(14) Indian Valley Wildlife Area	Camping allowed, but camp trailers and motorhomes are prohibited.
(15) Knoxville Wildlife Area	Primitive camping is allowed beyond 1/4 mile from Berryessa-Knoxville Road.
(16) Lake Sonoma Wildlife Area	Allowed only in Army Corps of Engineers-designated campgrounds.
(17) Little Panoche Reservoir Wildlife Area	Allowed only in parking lot, except during authorized dog trials when participants must adhere to conditions of Special Use Permit issued per subsection 550(n)(2) of these regulations.
(18) Los Banos Wildlife Area	Allowed only in the main office parking area, and only during waterfowl season.
(19) Mendota Wildlife Area	Allowed only in checking station parking lot, and only during waterfowl season.
(20) North Grasslands Wildlife Area	Allowed only in checking station parking lot, and only during waterfowl season.
(21) O'Neill Forebay Wildlife Area	Allowed only in parking lot, except during authorized dog trials when participants must adhere to conditions of Special Use Permit issued per subsection 550(n)(2) of these regulations.
(22) Oroville Wildlife Area	Allowed only in designated camping sites by permit issued from the Oroville CHP office at (530) 538-2700.
(23) San Luis Obispo Wildlife Area	Allowed only in the parking lot and no more than 30 vehicles are allowed without a Special Use Permit (see subsection 550(d) of these regulations).
(24) San Luis Reservoir Wildlife Area	Allowed only in parking lot.
(25) Shasta Valley Wildlife Area	Allowed.
(26) Spenceville Wildlife Area	Allowed in designated campsites from September 1 through the end of spring turkey season.
(27) Surprise Valley Wildlife Area	Allowed only in south parking area, except from April 1 through August 15 when camping is prohibited.
(28) Tehama Wildlife Area	Allowed.
(29) Upper Butte Basin Wildlife Area	Allowed only in the checking station parking lots on the night before a shoot day during the waterfowl season.
(30) Volta Wildlife Area (U.S. Bureau of Reclamation Lands)	Allowed only in checking station parking lot.

(n) Additional Fire Restrictions on Wildlife Areas: The fire restrictions included below are in addition to the regulations regarding fire on department lands included in subsection 550(q) of these regulations.
(1) Grizzly Island Wildlife Area
(A) Fires are prohibited except for the use of portable gas stoves in designated parking areas and sites.
(2) Hope Valley Wildlife Area
(A) Fires are prohibited except for the use of portable gas stoves.
(3) Knoxville Wildlife Area
(A) Fires are prohibited except for the use of portable gas stoves.
(4) Oroville Wildlife Area
(A) Fires are prohibited except for the use of portable gas stoves within designated campsites.
(5) Spenceville Wildlife Area
(A) Fires are prohibited except for portable gas stoves within designated campsites.

(o) Designated Closures and Restrictions on Wildlife Areas:
Nothing in this subsection shall prohibit the lawful possession of a concealed firearm as provided in subsection 550(cc)(1) of these regulations.

551(o) AREA	DESCRIPTION OF CLOSURE OR RESTRICTION
(1) Antelope Valley Wildlife Area	Closed to hunting from February 1 through June 30.
(2) Ash Creek Wildlife Area	Portions of the area may be closed to all visitor entry from March 1 through August 15.
(3) Baldwin Lake Wildlife Area	A hunter shall not possess more than 25 shot shells while in the field.
(4) Battle Creek Wildlife Area	No hunting or possession of firearms or archery equipment. Dog training and trials are prohibited.
(5) Butte Valley Wildlife Area	Closed to boating and water-related activity from March 1 through September 1.
(6) Cache Creek Wildlife Area	The use of dogs for wild pig hunting is prohibited.
(7) Cottonwood Creek Wildlife Area	Closed to hunting after the last Sunday in January to the opening of Zone A archery deer season. Dog training and trials are prohibited. The use of dogs for wild pig hunting is prohibited.
(8) Crescent City Marsh Wildlife Area	No hunting or possession of firearms or archery equipment.
(9) Daugherty Hill Wildlife Area	Closed to hunting February 1 through June 30 except for the spring turkey season when only turkeys may be hunted. Closed to all visitor entry during the first nine days of the spring turkey season except for special turkey permit holders.
(10) Eel River Wildlife Area	Portions of the area are closed to vehicle entry from March 1 through September 15. Cannibal Island Unit is closed to all visitor use from the Monday following the end of youth hunting day (subsection 502(e)(1)(B)(5) of these regulations) through April 1.

551(o) AREA	DESCRIPTION OF CLOSURE OR RESTRICTION
(11) Elk Creek Wetlands Wildlife Area	No hunting or possession of firearms or archery equipment.
(12) Elk River Wildlife Area	Closed to all visitor use from the Monday following the end of youth hunting day (subsection 502(e)(1)(B)(5) of these regulations) through April 1.
(13) Fay Slough Wildlife Area	Closed to all visitor use from the Monday following the end of youth hunting day (subsection 502(e)(1)(B)(5) of these regulations) through April 1.
(14) Feather River Wildlife Area	Closed to hunting February 1 through June 30 except for the spring turkey season when only turkeys may be hunted. The Shanghai Bend Unit is closed to hunting. No person shall enter that portion of the O'Connor Lakes Management Unit marked as closed to entry from March 1 through June 30.
(15) Fremont Weir Wildlife Area	Closed to hunting February 1 through June 30 except for the spring turkey season when only turkeys may be hunted.
(16) Gray Lodge Wildlife Area	Closed to all non-hunting uses from two weeks prior to opening of waterfowl season through one week after end of waterfowl season except those areas designated for wildlife viewing purposes. The west side of the area is closed to falconry. Dove hunting allowed only in designated areas.
(17) Grizzly Island Wildlife Area (Garibaldi Unit)	Closed to the public.
(18) Grizzly Island Wildlife Area (Gold Hills, Goodyear Slough, Island Slough, West Family and Grey Goose Units)	A hunter shall not possess more than 25 shot shells while in the field during waterfowl season. Closed to all public use from the end of waterfowl season to September 30. Access to the Grey Goose Unit and the Goodyear Slough Unit to the south of Lake Herman Road and east of the eastern most railroad tracks is by boat only. Gold Hills and Island Slough units are open to hunting on Christmas Day when Christmas falls on a Saturday, Sunday or Wednesday.
(19) Grizzly Island Wildlife Area (Joice Island Unit)	Closed to public use except when permits are issued for waterfowl hunting, special wild pig hunts, and during the special season open to fishing from mid-May to mid-August (contact area headquarters for details).
(20) Grizzly Island Wildlife Area (Cordelia and Montezuma Slough units)	No hunting or possession of firearms or archery equipment.
(21) Grizzly Island Wildlife Area (Grizzly Island Unit)	Dogs are prohibited from March 1 to June 30, all of August, and during the tule elk hunting season in September. Dogs may be used to assist in the take of game which is in season, authorized by area regulations and in portions of the area open to such take. Dogs are otherwise prohibited during October and through the end of waterfowl season. Closed to uses other than hunting from the last Monday in July to the end of the Grizzly Island tule elk season and from October 1 through the end of waterfowl season.
(22) Hallelujah Junction Wildlife Area	Closed to all visitor use from February 1 through June 30. Dogs are prohibited except for hunting.
(23) Hill Slough Wildlife Area	No hunting or possession of firearms or archery equipment.
(24) Hollenbeck Canyon Wildlife Area	Hunting is allowed in designated areas only. Closed to hunting February 1 through August 31.
(25) Honey Lake Wildlife Area (Fleming and Dakin Units)	Portions of the area may be closed to all visitor use from March 1 through August 15.
(26) Hope Valley Wildlife Area	Closed to hunting from February 1 until the opening of archery deer season.
(27) Imperial Wildlife Area (Finney Ramer Unit)	A hunter shall not possess more than 25 shot shells while in the field during waterfowl season. Waterfowl hunting allowed only from boats and islands. Closed to hunting from February 1 through June 30.
(28) Imperial Wildlife Area (Wister Unit)	Closed to all non-hunting public uses from one week before the opening of waterfowl season through the end of waterfowl season, except for designated wildlife viewing sites and designated fishing areas.
(29) Laguna Wildlife Area	The Timber Hill, Blucher Creek, and Cooper Road units are closed to hunting. Only the wetland portions of the Occidental Road Unit associated with the Laguna de Santa Rosa are open to hunting, and hunting is allowed only when the Laguna de Santa Rosa is navigable and the wetlands are accessible by boat. Foot or terrestrial access to the Occidental Road Unit is prohibited because there is no visitor right-of-way. Dogs are prohibited from March 2 through June 30.
(30) Lake Berryessa Wildlife Area	Dogs are prohibited from February 15 through July 15.
(31) Lake Earl Wildlife Area	Bush Creek public access is closed to all visitor use from the Monday following the end of youth waterfowl hunting days (subsection 502(e)(1)(B)(5) of these regulations) through April 1. Dogs are prohibited except for hunting.
(32) Lake Sonoma Wildlife Area	Closed to hunting except through special drawings. The portion of the area posted as "Critical Habitat" is closed to all visitor use and entry from February 1 through August 1. Dogs are prohibited.
(33) Little Panoche Reservoir Wildlife Area	The use of dogs for wild pig hunting is prohibited.
(34) Los Banos Wildlife Area	Closed to all visitor use from September 15 until the opening of waterfowl season. Closed to non-hunting uses during the waterfowl season on Saturdays, Sundays, and Wednesdays. A hunter shall not possess more than 25 shot shells while in the field during waterfowl season, except on days when only upland game may be taken, and on special "youth only" waterfowl hunt days when there shall be no restrictions on the number of shot shells taken into the field. Dogs are prohibited in the interpretive viewing area.
(35) Mad River Slough Wildlife Area	Closed to all visitor use from the Monday following the end of youth hunting days (subsection 502(e)(1)(B)(5) of these regulations) through April 1. Dogs are prohibited except for hunting.

551(o) AREA	DESCRIPTION OF CLOSURE OR RESTRICTION
(36) Mendota Wildlife Area	Closed to all visitor use from September 16 until the opening of waterfowl season except for the designated tour route and fishing site. Closed to non-hunting uses during the waterfowl season.
(37) Morro Bay Wildlife Area	Closed to hunting from the day after the end of waterfowl season until the opening day of brant season. A hunter shall not possess more than 25 shot shells while in the field.
(38) Moss Landing Wildlife Area	Closed to hunting on New Year's Day. The Salt Ponds are closed to hunting.
(39) Napa-Sonoma Marshes Wildlife Area	The following units are closed to all hunting, firearms and archery use: the White Slough Unit, the Green Island Unit and the portion of the American Canyon Unit south of the PG&E lines. The Southern Crossing unit is closed to all visitor uses during restoration. Dogs are prohibited from March 2 through June 30.
(40) North Grasslands Wildlife Area	A hunter shall not possess more than 25 shot shells while in the field during waterfowl season, except on days when only upland game may be taken and on special “youth only” waterfowl hunt days when there shall be no restrictions on the number of shot shells taken into the field.
(41) O'Neill Forebay Wildlife Area	Closed to all visitor use the day of and day after designated special apprentice pheasant hunts except for special apprentice pheasant hunt permit holders.
(42) Oroville Wildlife Area	Closed to hunting February 1 through August 31 except during the spring turkey season when only turkeys may be hunted through a special drawing. Dogs are prohibited from March 2 through June 30.
(43) Perris Reservoir State Recreation Area	Shore hunting for waterfowl, coots, and moorhens is prohibited. Upland game may be taken only in designated areas. Fishing is permitted in the designated waterfowl hunting area only on non-shoot days.
(44) Petaluma Marsh Wildlife Area	The Bahia, Day Island, Green Point, Novato Creek, Point Sonoma, and Rush Creek units are closed to hunting, firearms, and archery use. Dogs are prohibited on all units from March 2 through June 30.
(45) Putah Creek Wildlife Area	Closed to hunting February 1 until the opening weekend of Zone A deer archery season which is defined in Section 360 of these regulations.
(46) Rector Reservoir Wildlife Area	Closed to hunting from the day after spring turkey season closes to the opening of archery deer season.
(47) Red Lake Wildlife Area	Closed to hunting February 1 through August 31 except during archery deer season.
(48) Sacramento Bypass Wildlife Area	Closed to hunting February 1 through August 31.
(49) Sacramento River Wildlife Area	Closed to hunting February 1 through August 31 except during the spring turkey season when only turkeys may be hunted. Boat-in Only Access Units: Colusa South, Colusa North, Moulton South, Moulton North, Stegeman, Princeton South, Beehive Bend, Oxbow, Jacinto, Ord Bend, Shannon Slough, Pine Creek North, Wilson Landing, Dicus Slough, Merrills Landing.
(50) San Felipe Valley Wildlife Area	Closed to hunting February 1 through August 31 except during the spring turkey season when only turkeys may be hunted. D-16 general deer zone tags may not be used west of Highway S-2.
(51) San Jacinto Wildlife Area (Davis Road Unit)	Upland game (doves, pheasants, quail, snipe, and rabbits) may be taken only in designated areas. A self-issued permit, acquired on-site, is required to enter the upland game hunting area.
(52) San Jacinto Wildlife Area (Potrero Unit)	Only upland game birds and resident small game within designated areas may be taken, unless otherwise restricted or limited within the unit.
(53) San Luis Obispo Wildlife Area	Closed to all visitor uses except for the shooting area/range.
(54) San Luis Reservoir Wildlife Area	The use of dogs for wild pig hunting is prohibited. Motor vehicles are allowed in the parking lot only.
(55) Santa Rosa Wildlife Area	Closed to hunting on the portion of the area that lies within Fish and Game Refuge 4D (see Fish and Game Code Section 10837).
(56) Shasta Valley Wildlife Area	Only individuals possessing a "Type A" or Type "B" season pass and their guests (nonhunting guests or junior hunters) may enter the wildlife area on Wednesdays, Saturdays, and Sundays during the waterfowl season.
(57) Spenceville Wildlife Area	Closed to hunting February 1 through August 31 except during the spring turkey season when only turkeys may be hunted. Closed to all visitor entry during the first nine days of the spring turkey season except for special turkey permit holders. The posted area around the Spenceville Mine is closed to visitor entry.
(58) Sutter Bypass Wildlife Area	Those portions of the east and west levees of the area adjacent to the Sutter National Wildlife Refuge (SNWR) are closed to hunting. The west levee of the area is closed to hunting from the northern boundary of the SNWR south to Oswald/Hughes Road. The east levee of the area is closed to hunting from the northern boundary of the SNWR south to the SNWR checking station parking lot. The remaining portion of the east levee from the SNWR parking lot south to the southern boundary of the SNWR is closed to hunting pursuant to Section 625 of these regulations.
(59) Tehama Wildlife Area	The portion of the area south of Antelope Creek is closed to all visitor use and entry from the first Monday in December through the last Friday in March. The use of dogs for wild pig hunting is prohibited.
(60) Upper Butte Basin Wildlife Area	Closed to all non-hunting uses from two weeks prior to opening of waterfowl season through one week after the end of waterfowl season. Dogs are prohibited except for hunting.

551(o) AREA	DESCRIPTION OF CLOSURE OR RESTRICTION
(61) Volta Wildlife Area (U.S. Bureau of Reclamation Lands)	Closed to all visitor uses from August 15 until the opening of waterfowl season except that fishing in the Volta Wasteway Channel is allowed. Fishing is restricted to the Volta Wasteway Channel for a distance of one mile downstream from the Ingomar Grade from September 15 until the end of waterfowl season. Closed to non-hunting uses during the waterfowl season. A hunter shall not possess more than 25 shot shells while in the field during waterfowl season, except on days when only upland game may be taken and on special "youth only" waterfowl hunt days when there shall be no restrictions on the number of shot shells taken into the field.
(62) White Slough Wildlife Area	Closed to hunting February 1 through August 31.
(63) Yolo Bypass Wildlife Area	Closed to all non-hunting uses from two weeks prior to opening of waterfowl season through one week after the end of waterfowl season except those areas designated for wildlife viewing purposes. Pheasant hunting is prohibited in assigned blind areas.

(p) Type A or Type B Wildlife Areas with Shoot Day or Shooting Hours Restrictions During the Waterfowl Season:

551(p) AREA	DESCRIPTION OF RESTRICTION
(1) Butte Valley Wildlife Area	Pheasant hunting is allowed only on Sundays during pheasant season. Dove may be taken daily during the September dove season, and only on waterfowl hunt days during the late dove season.
(2) Grizzly Island Wildlife Area (Joice Island Unit)	After the department determines fall flight forecast and/or numbers in the Suisun Marsh warrant opening this unit to hunting, it will be open only on Sundays.
(3) Imperial Wildlife Area (Wister Unit)	Pheasant, quail and rabbit hunting is allowed only on Mondays and Thursdays. Dove may be taken daily during the September dove season. After the September dove season, dove may be taken only on pheasant hunt days. Snipe may be taken only on waterfowl and pheasant hunt days.
(4) Kern National Wildlife Refuge	Hunting of waterfowl, coots, moorhens and pheasants is allowed only on Saturdays and Wednesdays. Pheasant hunting is only allowed during the pheasant season. Snipe hunting is prohibited.
(5) Merced National Wildlife Refuge	Hunting for waterfowl, coots, and moorhens is allowed only on Saturdays and Wednesdays.
(6) San Jacinto Wildlife Area (Davis Road Unit)	Hunting for waterfowl, coots and moorhens is allowed only on Saturdays and Wednesdays. Pheasant hunting is allowed only on Mondays during pheasant season. All other upland game hunting is allowed only in designated areas from July 1 through January 31. A self-issued permit, acquired on-site, is required to enter the upland game hunting area.
(7) San Jacinto Wildlife Area (Potrero Unit)	Unless otherwise restricted by the department, hunting is allowed daily only for upland game birds and resident small game in designated areas. A self-issued permit, acquired on-site, is required to enter the designated hunting area.
(8) San Luis National Wildlife Refuge (Bear Creek Unit)	Entry permits must be returned to the checking station by 3:00 p.m. Hunting on the West Bear Creek portion is prohibited until the third Saturday in November.
(9) Shasta Valley Wildlife Area	Pheasant hunting is allowed only on Sundays during the pheasant season. Quail and snipe may be taken only on waterfowl hunt days. Dove may be taken daily during the September dove season, and only on waterfowl hunt days during the late dove season.

(q) Type C Wildlife Areas with Shoot Day Restrictions and/or Special Drawing Requirements: Unless identified with specific shoot days, seasonal closures or special drawing requirements below, or with closures identified in subsection 551(o), Type C wildlife areas are open daily. Information about special drawings is available at www.wildlife.ca.gov.

551(q) AREA	DESCRIPTION OF RESTRICTION OR REQUIREMENT
(1) Baldwin Lake	Hunting is allowed only during waterfowl season and only on Saturdays and Wednesdays. Hunting is allowed only from a boat. Special draw entry permits are required for the first seven hunt days of waterfowl season.
(2) Clifton Court Forebay	Hunting is allowed only on Saturdays, Sundays, and Wednesdays and only during waterfowl season. Self-registration is required.
(3) Cottonwood Creek Wildlife Area	Special draw entry permits are required for all visitor entry during the opening weekend of the Zone A general deer season. Self-registration required all other times of year.
(4) Daugherty Hill Wildlife Area	Special draw entry permits are required for the first nine days of the spring turkey season.
(5) Fay Slough Wildlife Area	Hunting is allowed only on Saturdays, Sundays, and Wednesdays and only during waterfowl season.
(6) Grizzly Island Wildlife Area (Gray Goose Unit)	Hunting is allowed only on Saturdays, Sundays, and Wednesdays and only during waterfowl season.
(7) Imperial Wildlife Area (Finney Ramer Unit)	A daily entry permit and self-registration are required. Entry permits are available at self-registration booths at Finney and Ramer lakes on a first-come, first-served basis.
(8) Laguna Wildlife Area (Occidental Road Unit)	Hunting is allowed only on Saturdays, Sundays, and Wednesdays and only during waterfowl season.
(9) Lake Berryessa Wildlife Area	Special draw entry permits are required.
(10) Lake Sonoma Wildlife Area	Hunting is only allowed during department-authorized special hunts for deer, turkey and wild pigs. Deer hunting is only allowed with a J-1 or A-25 deer tag available through the big game drawing.

551(q) AREA	DESCRIPTION OF RESTRICTION OR REQUIREMENT
(11) Little Panoche Reservoir Wildlife Area	Self-registration is required on site.
(12) Morro Bay Wildlife Area	Shooting hours are from 7:00 a.m. until sunset.
(13) Moss Landing Wildlife Area	Hunting is allowed only on Saturdays, Sundays, and Wednesdays and only during waterfowl season. Closed to hunting on New Year's Day.
(14) Napa-Sonoma Marshes Wildlife Area	Hunting is allowed only on Saturdays, Sundays, and Wednesdays during open season for authorized species except that dove and rabbits may be hunted daily during the September dove season.
(15) O'Neill Forebay Wildlife Area	Self-registration is required at the parking lot except for junior pheasant hunts and the day following junior hunts when entry is controlled through special drawings.
(16) Oroville Wildlife Area	Special draw entry permits are required for the spring turkey season.
(17) Perris Reservoir	Hunting for waterfowl is allowed until noon on Saturdays and Wednesdays. Hunting is allowed daily for upland game from the first Saturday after Labor Day through January 31.
(18) San Luis Reservoir Wildlife Area	Special draw entry permits are required for all visitor entry during the opening weekend of the Zone A deer season. Self-registration is required at the parking lot on Dinosaur Point Road at all other times of year.
(19) San Pablo Bay Wildlife Area	Blinds shall be available on a first come-first served basis.
(20) Spenceville Wildlife Area	Special draw entry permits are required for the first nine days of the spring turkey season.

(r) Firearm Restrictions on Type C Wildlife Areas: The regulations in this subsection are in addition to the regulations regarding firearms in subsection 550(cc) of these regulations. The restrictions in this subsection do not prohibit the lawful possession of a concealed firearm as provided in subsection 550(cc)(1) of these regulations.

551(r) AREA	DESCRIPTION OF RESTRICTION
(1) Baldwin Lake	Rifles and pistols are prohibited.
(2) Bass Hill Wildlife Area	Only shotguns, archery equipment, or muzzle loaders may be used on the Egan Management Unit.
(3) Battle Creek Wildlife Area	All firearms and archery equipment are prohibited.
(4) Big Sandy Wildlife Area	Rifles and pistols are prohibited.
(5) Clifton Court Forebay	Rifles and pistols are prohibited.
(6) Collins Eddy Wildlife Area	Rifles, pistols, and archery equipment are prohibited.
(7) Colusa Bypass Wildlife Area	Rifles and pistols are prohibited.
(8) Cottonwood Creek Wildlife Area (Lower Cottonwood Creek Unit)	Only shotguns and archery equipment may be used. Only archery equipment may be used from the start of the Zone A archery deer season until the start of Zone A general deer season.
(9) Cottonwood Creek Wildlife Area (Upper Cottonwood Creek Unit)	Firearms may be used or possessed only from the opening of the Zone A general deer season through the last Sunday in January. Only archery equipment may be used from the start of the Zone A archery deer season until the start of the Zone A general deer season.
(10) Crescent City Marsh Wildlife Area	All firearms and archery equipment are prohibited.
(11) Daugherty Hill Wildlife Area	During spring turkey season, only shotguns, archery equipment, and air rifles firing pellets of a minimum 0.177 caliber and powered by compressed air or gas may be used.
(12) Decker Island Wildlife Area	Rifles and pistols are prohibited.
(13) Eel River Wildlife Area	Rifles and pistols are prohibited.
(14) Elk Creek Wetlands Wildlife Area	All firearms and archery equipment are prohibited.
(15) Elk River Wildlife Area	Rifles and pistols are prohibited.
(16) Fay Slough Wildlife Area	Rifles and pistols are prohibited.
(17) Feather River Wildlife Area	Rifles and pistols are prohibited.
(18) Fremont Weir Wildlife Area	Rifles and pistols are prohibited.
(19) Grizzly Island Wildlife Area (Grey Goose Unit)	Rifles and pistols are prohibited.
(20) Grizzly Island Wildlife Area (Cordelia and Montezuma Slough Units)	All firearms and archery equipment are prohibited.
(21) Hill Slough Wildlife Area	All firearms and archery equipment are prohibited.
(22) Hollenbeck Canyon Wildlife Area	Rifles and pistols are prohibited.
(23) Horseshoe Ranch Wildlife Area	During spring turkey season only shotguns and archery equipment may be used.
(24) Imperial Wildlife Area (Finney-Ramer Unit)	Rifles and pistols are prohibited.
(25) Kinsman Flat Wildlife Area	During spring turkey season only shotguns and archery equipment may be used.

551(r) AREA	DESCRIPTION OF RESTRICTION
(26) Laguna Wildlife Area	Rifles and pistols are prohibited.
(27) Lake Berryessa Wildlife Area	Firearms are allowed only for special hunts.
(28) Lake Earl Wildlife Area	Rifles and pistols are prohibited. Possession of firearms or archery equipment for waterfowl hunting is permitted only during waterfowl season and only within the first 100 feet inland from the shoreline and on the water surface of Lake Earl and Lake Tolowa.
(29) Lake Sonoma Wildlife Area	Firearms are allowed only for special hunts.
(30) Little Panoche Reservoir Wildlife Area	Rifles and pistols are prohibited.
(31) Lower Sherman Island Wildlife Area	Rifles and pistols are prohibited.
(32) Mad River Slough Wildlife Area	Rifles and pistols are prohibited.
(33) Miner Slough Wildlife Area	Rifles and pistols are prohibited.
(34) Morro Bay Wildlife Area	Rifles and pistols are prohibited.
(35) Moss Landing Wildlife Area	Rifles and pistols are prohibited.
(36) Mouth of Cottonwood Creek Wildlife Area	Rifles and pistols are prohibited.
(37) Napa-Sonoma Marshes Wildlife Area	Rifles and pistols are prohibited. All firearms and archery equipment are prohibited on the White Slough Unit, the Green Island Unit and the portion of the American Canyon Unit that is south of the PG&E lines.
(38) O'Neill Forebay Wildlife Area	Rifles, pistols, and shotgun slugs are prohibited.
(39) Oroville Wildlife Area	Rifles and pistols are prohibited except at the portion of the area designated as a shooting range.
(40) Perris Reservoir	Rifles and pistols are prohibited.
(41) Petaluma Marsh Wildlife Area	Rifles and pistols are prohibited. All firearms and archery equipment are prohibited on the Bahia, Day Island, Green Point, Novato Creek, Point Sonoma, and Rush Creek units.
(42) Point Edith Wildlife Area	Rifles and pistols are prohibited.
(43) Rhode Island Wildlife Area	Rifles and pistols are prohibited.
(44) Sacramento Bypass Wildlife Area	Rifles, pistols, and archery equipment are prohibited. Buckshot and slugs are prohibited.
(45) Sacramento River Wildlife Area	Rifles and pistols are prohibited.
(46) San Felipe Valley Wildlife Area	Rifles and pistols are prohibited in designated areas.
(47) San Luis Reservoir Wildlife Area	Rifles and pistols are prohibited.
(48) San Pablo Bay Wildlife Area	Rifles and pistols are prohibited.
(49) Santa Rosa Wildlife Area	All firearms, archery equipment, air and gas guns, spear guns, and other propulsive devices are prohibited on the portion of the area that lies within Fish and Game Refuge 4D (see Fish and Game Code Section 10837).
(50) South Spit Wildlife Area	Rifles, pistols, and archery equipment are prohibited.
(51) Sutter Bypass Wildlife Area	Rifles and pistols are prohibited.
(52) Truckee River Wildlife Area	Rifles and pistols are prohibited.
(53) West Hilmar Wildlife Area	Rifles and pistols are prohibited.
(54) White Slough Wildlife Area	Rifles and pistols are prohibited. All firearms and archery equipment are prohibited in the portion of the area designated as Pond 9.

(s) Additional Hunter Opportunities on Type A and Type B Wildlife Areas: Information about the special drawings and big game drawings referred to in this subsection is available at www.wildlife.ca.gov.

551(s) AREA	SPECIES	HUNT REQUIREMENTS
(1) Ash Creek Wildlife Area	Pronghorn antelope	Allowed only with an Apprentice Zone 5 - Big Valley tag available through the big game drawing.
(2) Butte Valley Wildlife Area	Pronghorn antelope	Allowed only with an apprentice tag available through the big game drawing.
(3) Gray Lodge Wildlife Area	Deer	Allowed only with a G-12 deer tag available through the big game drawing.
(4) Gray Lodge Wildlife Area	Pheasant	Pheasant hunting open daily for the first nine days of the pheasant season and on waterfowl hunt days for the remainder of the pheasant season.
(5) Gray Lodge Wildlife Area	Quail and Rabbit	Allowed only on pheasant hunt days.
(6) Gray Lodge Wildlife Area	Turkey	Allowed only through a special drawing during the spring season.
(7) Grizzly Island Wildlife Area	Pheasant	Pheasant hunting open daily for the first twelve days of the pheasant season and on waterfowl hunt days for the remainder of the pheasant season.

551(s)	AREA	SPECIES	HUNT REQUIREMENTS
(8)	Grizzly Island Wildlife Area	Tule elk	Allowed only with an elk tag available through the big game drawing. Methods of take for big game are authorized per Section 353 of these regulations.
(9)	Grizzly Island Wildlife Area (Crescent and Grizzly Island units)	Rabbits	Allowed daily in July and on pheasant hunt days.
(10)	Grizzly Island Wildlife Area	Wild Pigs	Allowed only with a tag obtained through a special drawing. Only shotguns with slugs and archery equipment are authorized. Rifles and pistols are prohibited.
(11)	Honey Lake Wildlife Area	Quail and rabbit	Allowed only on waterfowl shoot days that occur during the pheasant season.
(12)	Imperial Wildlife Area	Quail	Allowed only on pheasant hunt days.
(13)	Imperial Wildlife Area (Wister Unit)	Rabbits	Allowed daily during the rabbit season except during the waterfowl season, when rabbits may be taken only on pheasant hunt days.
(14)	Imperial Wildlife Area (Wister Unit)	Raccoons	Allowed daily from August 1 through one week before opening of waterfowl season.
(15)	Los Banos Wildlife Area	Pheasant	Pheasant hunting is open daily for the first nine days of the pheasant season, on waterfowl hunt days for the remainder of the pheasant season and on the day after Thanksgiving.
(16)	Los Banos Wildlife Area	Raccoons and rabbits	Self-registration is required. Raccoons may not be taken during waterfowl season.
(17)	Mendota Wildlife Area	Pheasant	Pheasant hunting is open daily for the first nine days of the pheasant season, on waterfowl hunt days for the remainder of the pheasant season and on the day after Thanksgiving.
(18)	Mendota Wildlife Area	Raccoons, rabbits, and crows	Self-registration is required. Raccoons may not be taken during waterfowl season.
(19)	North Grasslands Wildlife Area	Pheasant	Pheasant hunting is open daily for the first nine days of the pheasant season, on waterfowl hunt days for the remainder of the pheasant season and on the day after Thanksgiving.
(20)	North Grasslands Wildlife Area	Raccoons and rabbits	Self-registration required. Raccoons may not be taken during waterfowl season. Rabbits may be hunted daily from July 1 through September 15 and from the day after the end of waterfowl season until the end of the rabbit season. During the waterfowl season, rabbit hunting is allowed only on waterfowl and pheasant hunt days.
(21)	Shasta Valley Wildlife Area	Quail	Self-register at area. Quail shoot days are limited to waterfowl shoot days only.
(22)	Tehama Wildlife Area	Deer	During the G-1 deer season, only persons with department issued entry permits may enter.
(23)	Tehama Wildlife Area	Deer	Allowed only with a J-3 apprentice tag available through the big game drawing.
(24)	Tehama Wildlife Area	Wild Pigs	Allowed only with a tag obtained through a special drawing. No dogs permitted.
(25)	Upper Butte Basin Wildlife Area	Rabbits	Allowed only during the September dove season, and on waterfowl or pheasant hunt days during the late dove season.
(26)	Upper Butte Basin Wildlife Area (Little Dry Creek Unit)	Deer	Allowed only with a J-9 apprentice tag available through the big game drawing.
(27)	Upper Butte Basin Wildlife Area	Pheasant	Pheasant hunting is open daily for the first five days of the pheasant season and on waterfowl hunt days for the remainder of the pheasant season.
(28)	Volta Wildlife Area	Rabbits	Allowed except during waterfowl season. Self-registration required.
(29)	Yolo Bypass Wildlife Area	Pheasant	Pheasant hunting is open daily for the first nine days of the pheasant season and on waterfowl hunt days for the remainder of the pheasant season.

(t) Species Restrictions for Hunting on Type C Wildlife Areas: Only the species listed for each of the wildlife areas in the table below may be hunted on those areas.

551(t)	AREA	SPECIES
(1)	Baldwin Lake Wildlife Area	Waterfowl, coots, and moorhens only.
(2)	Clifton Court Forebay	Waterfowl, coots, and moorhens only.
(3)	Collins Eddy Wildlife Area	Waterfowl, coots, moorhens, and upland game only.
(4)	Eel River Wildlife Area	Waterfowl, coots, snipe, and pheasant only.
(5)	Elk River Wildlife Area	Waterfowl, coots, and snipe only.
(6)	Fay Slough Wildlife Area	Waterfowl, coots, and snipe only.
(7)	Grizzly Island Wildlife Area (Grey Goose Unit)	Waterfowl, snipe, coots, moorhens, and pheasants only on Saturdays, Sundays and Wednesdays and only during open seasons.
(8)	Hollenbeck Canyon Wildlife Area	Crow, coyote, upland game birds, and resident small game only.
(9)	Laguna Wildlife Area	Waterfowl, coots, and moorhens only.
(10)	Lake Earl Wildlife Area	Waterfowl, coots, snipe, and moorhens only.
(11)	Lake Sonoma Wildlife Area	Deer, wild pigs, and turkeys only. May require a permit from the U.S. Army Corps of Engineers.

551(t) AREA	SPECIES
(12) Lower Sherman Island Wildlife Area	Waterfowl, coots, moorhens, pheasant, dove, and rabbits only.
(13) Mad River Slough Wildlife Area	Waterfowl, coots, and snipe only.
(14) Miner Slough Wildlife Area	Waterfowl only.
(15) Moss Landing Wildlife Area	Waterfowl, coots, and moorhens only.
(16) Napa-Sonoma Marshes Wildlife Area	Waterfowl, coots, moorhens, snipe, rabbits, quail, pheasants, and dove only.
(17) O'Neill Forebay Wildlife Area	Waterfowl, pheasants, quail, dove, rabbits, and crows only.
(18) Perris Reservoir	Waterfowl, coots, moorhens, dove, pheasants, quail, and rabbits only.
(19) Petaluma Marsh Wildlife Area	Waterfowl, coots, moorhens, and rabbits only.
(20) Point Edith Wildlife Area	Waterfowl, coots, and moorhens only.
(21) Rhode Island Wildlife Area	Waterfowl, coots, and moorhens only.
(22) Sacramento Bypass Wildlife Area	All legal species except big game.
(23) San Pablo Bay Wildlife Area	Waterfowl, coots, and moorhens only.
(24) Santa Rosa Wildlife Area	Deer, rabbits, and quail only.
(25) South Spit Wildlife Area	Waterfowl, coots, and snipe only.
(26) West Hilmar Wildlife Area	Waterfowl, quail, doves, pheasants, and rabbits only.
(27) White Slough Wildlife Area	Waterfowl, pheasants, quail, and dove only.

(u) Type A Wildlife Areas Which Allow Archery Equipment During Waterfowl and Pheasant Season per subsection 550(cc)(4):
  (1) Los Banos Wildlife Area
(v) Shooting Areas. This subsection identifies wildlife areas, pursuant to subsection 550(cc) of these regulations, with designated shooting areas (i.e., ranges) and additional regulations for each designated shooting area:
  (1) Nothing in this subsection shall prohibit the lawful possession of a concealed firearm as provided in subsection 550(cc)(1) of these regulations.
  (2) Oroville Wildlife Area
    (A) All legal firearms and archery equipment may be possessed and discharged at the target practice area, which is open year-round. Only paper and clay targets may be used and must be removed by the user when leaving the area.
  (3) San Luis Obispo Wildlife Area
    (A) No person shall enter the San Luis Obispo Wildlife Area except that portion of the area designated as a public shooting facility under supervision of the authorized rangemaster or with written authorization from the department.
    (B) No firearms or other propulsive devices of any kind may be possessed or discharged except at the designated public shooting facility under the direction and control of the authorized rangemaster.
    (C) The public shooting facility is open Wednesday through Monday, from one-half hour before sunrise to one-half hour before sunset, except for the lighted ranges which are open from one-half hour before sunrise until 10:00 p.m.
    (D) Daily range fees are required and to be paid at the facility.
    (E) Alcoholic beverages may not be possessed or consumed on any part of the San Luis Obispo Wildlife Area by any authorized rangemaster, or by any person who discharges or attempts to discharge a firearm or propulsive device, or shoot an arrow.
    (F) Full metal jacket bullets are not allowed.
  (4) Spenceville Wildlife Area
    (A) All legal firearms and archery equipment may be possessed and discharged at the target practice area, which is open year-round. Only paper and clay targets may be used and must be removed by the user when leaving the area.

***Note:** Currently, five of the wildlife areas listed in subsection 551(w) require the Lands Passes as described below: Gray Lodge, Grizzly Island, Los Banos, San Jacinto and Imperial. By January 2018, all areas listed in subsection 551(w), except as noted below, will implement this requirement.*

(w) Wildlife Areas That Require a Daily or Annual Lands Pass for Authorized Uses Other than Hunting (Lands Pass): Pursuant to subsection 550(c) and 550.5(c) of these regulations, it shall be unlawful for a visitor to enter any wildlife area, or portion thereof listed in this section, without carrying a valid Lands Pass or a valid hunting, fishing or trapping license on their person. A Lands Pass must be purchased in advance. Information on how to purchase a Lands Pass and exceptions to this requirement are provided in subsection 550.5(c).

(1) Ash Creek Wildlife Area
(2) Bass Hill Wildlife Area
(3) Battle Creek Wildlife Area
(4) Butte Valley Wildlife Area
(5) Cache Creek Wildlife Area (***Note:** Lands Pass implementation delayed for this location.*)
(6) Crescent City Marsh Wildlife Area
(7) Eel River Wildlife Area
(8) Elk Creek Wetlands Wildlife Area
(9) Elk River Wildlife Area
(10) Fay Slough Wildlife Area
(11) Gray Lodge Wildlife Area
(12) Grizzly Island Wildlife Area
(13) Hollenbeck Canyon Wildlife Area
(14) Honey Lake Wildlife Area
(15) Hope Valley Wildlife Area
(16) Horseshoe Ranch Wildlife Area
(17) Imperial Wildlife Area (Wister and Finney-Ramer units)
(18) Lake Earl Wildlife Area
(19) Los Banos Wildlife Area
(20) Mad River Slough Wildlife Area
(21) Mendota Wildlife Area
(22) Mouth of Cottonwood Creek Wildlife Area
(23) Napa-Sonoma Marshes Wildlife Area (Green Island Unit)
(24) North Grasslands Wildlife Area
(25) San Felipe Valley Wildlife Area
(26) San Jacinto Wildlife Area
(27) Shasta Valley Wildlife Area
(28) South Spit Wildlife Area
(29) Tehama Wildlife Area
(30) Upper Butte Basin Wildlife Area
(31) Volta Wildlife Area
(32) Willow Creek Wildlife Area
(33) Yolo Bypass Wildlife Area

(x) Additional Waterfowl Reservation Regulations:

551(x) AREA	NUMBER OF HUNTERS PER RESERVATION	RESERVATION EXPIRES
(1) Colusa National Wildlife Refuge	Four persons, but not more than two junior hunters or non-shooters.	One hour before shoot time.
(2) Delevan National Wildlife Refuge	Four persons, but not more than two junior hunters or non-shooters.	One hour before shoot time.
(3) Gray Lodge Wildlife Area	Two adults; each adult hunter may bring up to two junior hunters or two non-shooters or one of each.	One and one-half hours before shoot time.
(4) Grizzly Island Wildlife Area	Two adults; each adult hunter may bring up to two junior hunters or two non-shooters or one of each. Reservation numbers are not used at Grizzly Island to determine the order in which entry permits are issued.	One hour before shoot time.
(5) Grizzly Island Wildlife Area (Joice Island Unit)	Two adults; each adult hunter may bring up to two junior hunters or two non-shooters or one of each.	One hour before shoot time.
(6) Imperial Wildlife Area (Wister Unit)	Six people, but no more than four adults. Blinds at the Union Tract and Hazard Unit are limited to four individuals. Waterfowl hunters must hunt from within 100 yards of assigned blind sites.	One and one-half hours before shoot time.
(7) Kern National Wildlife Refuge	Two adults; each adult hunter may bring up to two junior hunters or two non-shooters or one of each but may not exceed capacity of spaced blinds.	One and one-half hours before shoot time.
(8) Los Banos Wildlife Area	Blinds – Two persons. Free roam – Two adults; each adult hunter may bring up to two junior hunters or two non-shooters or one of each.	One hour before shoot time.
(9) Mendota Wildlife Area	Two adults; each adult hunter may bring up to two junior hunters or two non-shooters or one of each.	One hour before shoot time.
(10) Merced National Wildlife Refuge	Two persons in the two-person blinds, three persons in the three-person blinds (from 1 to 3 three-person blinds available).	One and one-half hours before shoot time.
(11) North Grasslands Wildlife Area (China Island Unit)	Two adults; each adult hunter may bring up to two junior hunters or two non-shooters or one of each. Check in at the Kesterson Unit.	One and one-half hours before shoot time.
(12) North Grasslands Wildlife Area (Gadwall Unit)	Two adults; each adult hunter may bring up to two junior hunters or two non-shooters or one of each. Check in at the Salt Slough Unit.	One and one-half hours before shoot time.
(13) North Grasslands Wildlife Area (Salt Slough Unit)	Free roam - two adults; each adult may bring up to two junior hunters or two non-shooters or one of each. Zone 13 - Four blinds; up to four persons per blind. Field 50 - One disabled access blind; up to three persons. One general blind - up to three persons.	One hour before shoot time.
(14) Sacramento National Wildlife Refuge	Four persons, but not more than two junior hunters or non-shooters.	One and one-half hours before shoot time.
(15) San Jacinto Wildlife Area	Two adults and two junior hunters.	3:00 a.m. or until last reservation is called.
(16) San Luis National Wildlife Refuge (Bear Creek Unit)	Two adults; each adult hunter may bring up to two junior hunters or two non-shooters or one of each. For East Bear Creek, three persons per reservation. Check in at the Salt Slough Unit.	One and one-half hours before shoot time.
(17) San Luis National Wildlife Refuge (Blue Goose Unit)	Three persons in the three-person blinds. Two persons in the two-person blinds.	One and one-half hours before shoot time.
(18) San Luis National Wildlife Refuge (Freitas North Unit)	One boat with up to four people. Check in at Kesterson Unit.	3:00 a.m.
(19) San Luis National Wildlife Refuge (Freitas South Unit)	One boat with up to four people. Check in at Salt Slough Unit.	3:00 a.m.

551(x) AREA	NUMBER OF HUNTERS PER RESERVATION	RESERVATION EXPIRES
(20) San Luis National Wildlife Refuge (Kesterson Unit)	Three persons in the three-person blinds (16 blinds). Two persons in the two-person blinds (15 blinds).	One and one-half hours before shoot time.
(21) San Luis National Wildlife Refuge (San Luis Unit)	Blinds - Two persons in the two person blinds, three persons in the three person blinds. Free roam - two adults; each adult hunter may bring up two junior hunters or two non-shooters or one of each.	One hour before shoot time.
(22) Sutter National Wildlife Refuge	Four persons, but not more than two junior hunters or non-shooters.	One hour before shoot time.
(23) Upper Butte Basin Wildlife Area (Howard Slough Unit)	Up to three hunters.	One hour before shoot time.
(24) Upper Butte Basin Wildlife Area (Little Dry Creek Unit)	Up to three persons.	One hour before shoot time.
(25) Upper Butte Basin Wildlife Area (Llano Seco Unit)	Up to three persons.	One and one-half hours before shoot time.
(26) Volta Wildlife Area	Two adults; each adult hunter may bring up to two junior hunters or two non-shooters or one of each.	One hour before shoot time.
(27) Yolo Bypass Wildlife Area	Blinds - up to four hunters. Free roam - two adults; each adult hunter may bring up to two junior hunters or two non-shooters or one of each.	One and one-half hours before shoot time.

(y) Fishing Regulations on Wildlife Areas pursuant to subsections 550(c)(2)(C) and 550(h) of these regulations: The property-specific fishing regulations in this subsection are in addition to the general regulations regarding fishing and the hours of operation of department lands located in Section 550 of these regulations.

- (1) Grizzly Island Wildlife Area (Montezuma Slough Unit)
  - (A) Fishing access along Montezuma Slough is open all year, no hour restrictions.
- (2) Heenan Lake Wildlife Area
  - (A) Only boats propelled by oars or electric motors may be used.

(z) Woodcutting. Woodcutting is prohibited on all department lands except as provided in this subsection. Where permitted, woodcutting requires written authorization from the regional manager or his designee and may occur only between September 16 and February 28 on the following areas:

- (1) Eel River Wildlife Area
- (2) South Spit Wildlife Area

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eRegs

§552. PUBLIC USE REGULATIONS FOR NATIONAL WILDLIFE REFUGES THAT ARE ALSO DESIGNATED AS WILDLIFE AREAS BY THE COMMISSION.

Note: *Please check the webpage for each refuge and the signage on each refuge to be sure you have the most up-to-date information on refuge regulations. The website for the National Wildlife Refuges is* ***http://www.fws.gov/refuges/***

(a) The power to control entry on the National Wildlife Refuges that are also designated as wildlife areas in subsections 551(c) and (d) is at the discretion of the Director of the U.S. Fish and Wildlife Service. The hunting programs for the "Type A" areas listed below are administered by the department. Requirements in this section for steel or other non-toxic shot approved by the U.S. Fish and Wildlife Service are in accordance with Title 50 of the Code of Federal Regulations (CFR), Section 32.2(k), October 1, 2012 edition.

(1) Colusa National Wildlife Refuge, Type A.

(A) Area Firearms Restrictions: Only shotguns and steel or other nontoxic shot approved by the U.S. Fish and Wildlife Service are permitted. A hunter shall not possess more than 25 shot shells while in the field. It shall be unlawful to possess a loaded firearm, defined as a firearm with an unexpended shell in the firing chamber until hunters are in designated free roam or assigned pond areas.

(B) Hunt Days: Waterfowl, coots, moorhens, and snipe: Saturdays, Sundays, and Wednesdays during open seasons. Pheasant: Waterfowl hunt days during the pheasant season.

(C) Authorized Species: Waterfowl, coots, moorhens, snipe, and pheasants.

(D) It shall be unlawful to retain an entry permit or remain on the wildlife refuge later than one and one half hours after sunset, unless participating in overnight stay in accordance with subsection (a)(1)(E).

(E) Camping is prohibited, except on the night before each waterfowl shoot day, when camping in a vehicle, motorhome or trailer within the check station parking area is allowed. Tents are prohibited. No person may build or maintain fires, except in portable gas stoves.

(F) Bicycles: Prohibited.

(G) Hunters may enter or exit only at designated locations. Stopping vehicles between designated parking areas to drop off passengers or hunting equipment is prohibited.

(H) Special Restrictions: When hunting from assigned hunting sites, it shall be unlawful to hunt outside the assigned pond boundary or to hunt from levee roads. Pheasant and snipe hunting are not permitted in the assigned pond area with the exception of pheasant hunting on the first Monday of pheasant season.

(I) Reservations: Each reservation assures entry of up to four individuals with no more than two junior hunters or non-shooters per one adult hunter.

(2) Delevan National Wildlife Refuge, Type A.

Note: *On the second Saturday in December, all hunting sites are reserved for junior hunters. Adult hunters may use the freeroam areas (contact U.S. Fish and Wildlife Service at (530) 934-2801 for information).*

(A) Area Firearms Restrictions: Only shotguns and steel or other nontoxic shot approved by the U.S. Fish and Wildlife Service are permitted. A hunter shall not possess more than 25 shot shells while in the field. It shall be unlawful to possess a loaded firearm, defined as a firearm with an unexpended shell in the firing chamber, until hunters are in designated free roam or assigned pond/spaced blind areas.

(B) Hunt Days: Waterfowl, coots, moorhens, and snipe: Saturdays, Sundays, and Wednesdays during open seasons. Pheasant: First Monday of pheasant season and on waterfowl hunt days during the pheasant season.

(C) Authorized Species: Waterfowl, coots, moorhens, snipe, and pheasants.

(D) It shall be unlawful to retain an entry permit or remain on the wildlife refuge later than one and one half hours after sunset, unless participating in overnight stay in accordance with subsection (a)(2)(E).

(E) Camping is prohibited, except on the night before each waterfowl shoot day, when camping in a vehicle, motorhome or trailer within the check station parking area is allowed. Tents are prohibited. No person may build or maintain fires, except in portable gas stoves.

(F) Bicycles: Prohibited.

(G) Reservations: Each reservation assures entry of up to four individuals with no more than two junior hunters or non-shooters per one adult hunter.

(H) Special Restrictions: When assigned hunting sites, hunters shall hunt only within 100 feet of their assigned sites, except to retrieve downed birds. Pheasant and snipe hunting are not permitted in the assigned blind area except on the first Monday of pheasant season.

(I) Hunters may enter or exit only at designated locations. Stopping vehicles between designated parking areas to drop off passengers or hunting equipment is prohibited.

(3) Kern National Wildlife Refuge, Type A.

(A) Area Firearms Restrictions: Only shotguns and steel or other nontoxic shot approved by the U.S. Fish and Wildlife Service are permitted. A hunter shall not possess more than 25 shot shells while in the field.

(B) Hunt Days: Waterfowl, coots, and moorhens: Saturdays and Wednesdays during open seasons. Pheasant: Waterfowl hunt days during the regular pheasant season.

(C) Authorized Species: Waterfowl, coots, moorhens, and pheasants. Hunting of common snipe is prohibited.

(D) Camping and Trailers: Prohibited.

(4) Merced National Wildlife Refuge, Type A.

(A) Area Firearms Restrictions: Only shotguns and steel or other nontoxic shot approved by the U.S. Fish and Wildlife Service are permitted. A hunter shall not possess more than 25 shot shells per day.

(B) Hunt Days: Saturdays and Wednesdays during waterfowl season.

(C) Shooting Hours: Waterfowl shooting hours will be from one-half hour before sunrise until 12:00 noon.

(D) Authorized Species: Waterfowl, coots, and moorhens. Hunting of common snipe is prohibited.

(E) Camping and Trailers: Prohibited.

(F) Bicycles: Allowed.

(G) Reservations: Each reservation assures entry of no more than three persons if three-person blinds are available, or no more than two persons, if two-person blinds are available. All persons entering on the same reservation will receive the same hunt assignment.

(H) Special Restrictions: Hunters must hunt from assigned blinds, except to retrieve downed birds.

(5) Sacramento National Wildlife Refuge, Type A.

Note: *On the first Saturday in December, all hunting sites are reserved for ju-*

nior hunters. Adult hunters may use the freeroam areas (contact U.S. Fish and Wildlife Service at (530) 934-2801 for information).

(A) Area Firearms Restrictions: Only shotguns and steel or other nontoxic shot approved by the U.S. Fish and Wildlife Service are permitted. A hunter shall not possess more than 25 shot shells while in the field. It shall be unlawful to possess a loaded firearm, defined as a firearm with an unexpended shell in the firing chamber, until hunters are in designated free roam or assigned pond/spaced blind areas.

(B) Hunt Days: Waterfowl, coots, moorhens, and snipe: Saturdays, Sundays, and Wednesdays during open seasons. Pheasants: The first Monday of pheasant season and on waterfowl hunt days during the pheasant season.

(C) Authorized Species: Waterfowl, coots, moorhens, snipe, and pheasants.

(D) It shall be unlawful to retain an entry permit or remain on the wildlife refuge later than one and one half hours after sunset, unless participating in overnight stay in accordance with subsection (a)(5)(E).

(E) Camping is prohibited, except on the night before each waterfowl shoot day, when camping in a vehicle, motorhome or trailer within the check station parking area is allowed. Tents are prohibited. No person may build or maintain fires, except in portable gas stoves.

(F) Bicycles: Prohibited.

(G) Reservations: Each reservation assures entry of up to four individuals with no more than two junior hunters or non-shooters per one adult hunter.

(H) Special Restrictions: When assigned hunting sites, hunters shall hunt only within 100 feet of their assigned sites, except to retrieve downed birds. Pheasant and snipe hunting are not permitted in the assigned blind area except on the first Monday of pheasant season.

(I) Hunters may enter or exit only at designated locations. Stopping vehicles between designated parking areas to drop off passengers or hunting equipment is prohibited.

(6) Sacramento River National Wildlife Refuge, Type C.

***Note:** Check the refuge webpage at **http://www.fws.gov/refuge/sacramento_river/** and signs posted at the refuge for the most up-to-date information about refuge regulations.*

(A) Units: The refuge includes the La Barranca Unit, Blackberry Island Unit, Todd Island Unit, Mooney Unit, Ohm Unit, Flynn Unit, Heron Island Unit, Rio Vista Unit, Foster Island Unit (Tehama Co.); Pine Creek Unit, Dead Man's Reach Unit, Llano Seco Island 1 & 2 Units, and Llano Seco Riparian Sanctuary Unit, (Butte Co.); and McIntosh Landing North and South Units, Capay Unit, Phelan Island Unit, Jacinto Unit, North Ord Unit, Ord Bend Unit, South Ord Unit, Hartley Island Unit, Sul Norte Unit, Codora Unit, Packer Unit, Afton Unit, Drumheller North Unit, Drumheller Slough Unit (Glenn Co.), and Bogg's Bend Unit (Colusa Co.).

(B) Area Firearm Restrictions:

1. Only shotguns and archery equipment are allowed. No rifles, crossbows, air guns, paintball guns or pistols may be used or possessed.
2. Target shooting is prohibited.
3. No firearms or archery equipment are allowed in areas closed to hunting.
4. Ammunition is restricted to only federally-approved nontoxic shot while in the field except for hunting deer or wild pigs. For hunting deer or wild pigs, hunters may possess nonlead shotgun slugs in accordance with Section 250.1 of these regulations.
5. Firearms must be unloaded before transporting them between parking areas and hunting areas. "Unloaded" means that no unexpended cartridge or shell is in the chamber of the firearm. This is in addition to the requirement in subsection 550(cc) of these regulations that requires firearms to be unloaded in parking lots, check-in stations and other facilities.

(C) Public Access:

1. The following units are closed to public access: Ohm, McIntosh Landing North and South, North Ord, Llano Seco Riparian Sanctuary, and Hartley Island.
2. Access is allowed by boat only on the following units: La Barranca, Blackberry Island, Todd Island, Mooney, Flynn, Heron Island, Foster Island, Phelan Island, Jacinto, Dead Man's Reach, South Ord, Lano Seco Island 1 & 2, and Afton.
3. Access is allowed on foot or by boat only on the following units: Rio Vista, Pine Creek, Capay, Ord Bend, Sul Norte, Codora, Packer, Drumheller North, Drumheller Slough and Bogg's Bend.
   a. On Packer and Drumheller North, only boats up to 14 feet in length are allowed.
4. All units that are open to public hunting may only be accessed by boat, except for Sul Norte, Codora, Drumheller North, Drumheller Slough, Capay and Bogg's Bend, which may be accessed only on foot or by boat.

(D) Day Use Hours: Day use hours are from 2 hours before sunrise to one and one half hours after sunset.

(E) Bicycles: Bicycles are allowed May 15 through August 15. Other conveyances are prohibited. Mobility-impaired hunters should contact the refuge manager for allowed conveyances.

(F) Dogs and Pets In General:

1. Pets shall be controlled in accordance with subsection 550(m) of these regulations, and hunting dogs shall be controlled in accordance with subsection 550(n) of these regulations.
2. Dogs are prohibited for the take and pursuit of wild pigs.

(G) Camping: Camping is allowed only on gravel bars up to 7 days during a 30 day period.

(H) Sport Fishing: Sport fishing is allowed on designated areas of the refuge in accordance with State regulations.

(I) Falconry is prohibited.

(J) Areas Open for Hunting In Accordance with State and Federal Regulations:

1. Units open to hunting of authorized species are: La Barranca, Todd Island, Mooney, Heron Island, Flynn, Rio Vista, Foster Island, Pine Creek, Capay, Phelan Island, Jacinto, Dead Man's Reach, South Ord, Llano Seco Island 1 & 2, Sul Norte, Codora, Afton, Drumheller North, Drumheller Slough, and Bogg's Bend.
2. The Mooney Unit is open to hunting for authorized species except that waterfowl hunting is prohibited.
3. The Codora Unit is open for hunting only for hunters holding a junior hunting license who are accompanied by a non-hunting adult and only on Saturdays and Sundays.
   a. Waterfowl hunting is prohibited on the Codora Unit
4. All other units are closed to hunting.
5. Hunting is prohibited within 50 feet of any landward boundary adjacent to private property.

(K) Authorized Species (unless otherwise stated in subsection (J) or restricted in this subsection): goose, duck, coot, moorhen, dove, snipe, turkey, pheasant, quail, deer, and wild pig. Hunting of all other species is prohibited.

1. Wild Pigs may be hunted only from September 1 through March 15.

(L) Commercial Guiding: Commercial guiding is prohibited.

(M) Personal Property: Permanent blinds, ladders and screw-in foot pegs are prohibited. All personal property, including tree stands, decoys and boats must be removed by one and one-half hours after sunset.

(7) San Luis National Wildlife Refuge, Type A.

(A) Area Firearms Restrictions: Only shotguns and steel or other nontoxic shot approved by the U.S. Fish and Wildlife Service are permitted. A hunter shall not possess more than 25 shot shells while in the field.

(B) Hunt Days: Saturdays, Sundays, and Wednesdays during waterfowl season. Waterfowl hunting is prohibited on the West Bear Creek Unit prior to the third Saturday in November.

(C) Authorized Species: Waterfowl, coots, and moorhens. Hunting for pheasants will be allowed with an entry permit and only in a special zone on the Kesterson Unit on the first Saturday and Sunday of pheasant season and in the San Luis Unit free roam area on waterfowl shoot days for the duration of pheasant season. Pheasant hunting may also be allowed on the first Monday of pheasant season, but only within the spaced blind area of the Kesterson Unit. Snipe hunting is allowed only within the San Luis Unit free roam area, and only on waterfowl shoot days when the area is open to hunting by adult license holders.

(D) Camping and Trailers: Prohibited on the San Luis, Blue Goose, and the West Bear Creek Units.

(E) Bicycles: Allowed.

(F) Reservations: For the Kesterson and Blue Goose units, each reservation assures entry of no more than three persons if three-person blinds are available, or no more than two persons if two-person blinds are available. For the Freitas units (north and south), each reservation assures entry of one boat with up to four persons. All persons entering on the same reservation will receive the same hunt assignment.

(G) Special Restrictions: Hunters in the Kesterson and Blue Goose units must hunt from assigned blinds, except to retrieve downed birds. Hunters in free roam areas are not restricted to blinds. Access to the Freitas units is by boat only. Maximum boat speed may not exceed 5 mph. Inboard water thrust and air-thrust boats are prohibited. Construction of permanent blinds is prohibited. Cutting or breaking of woody vegetation is prohibited. All blinds and equipment must be removed following each day's hunt.

(H) Hunters may enter or exit only at designated locations. Stopping vehicles between designated parking areas to drop off passengers or hunting equipment is prohibited.

(8) Sonny Bono Salton Sea National Wildlife Refuge, Type A.

(A) Area Firearms Restrictions: Only shotguns and steel or other nontoxic shot approved by the U.S. Fish and Wildlife Service are permitted. A hunter shall not possess more than 25 shot shells while in the field. Firearms must be unloaded when being transported between parking areas and blind sites.

(B) Hunt days: Saturdays, Sundays, and Wednesdays during open seasons.

(C) Authorized Species: Waterfowl, coots, and moorhens.

(D) Camping and Trailers: Prohibited.

(E) Special Restrictions: Hunters in the Hazard Unit shall hunt only from within 100 feet of their assigned blind sites or stakes, except to retrieve downed birds. Hunters in the Union Tract shall hunt only from within their blinds, except to retrieve downed birds.

(F) Blind Limitation: Not more than four individuals may occupy a blind site.

(9) Sutter National Wildlife Refuge, Type A.

(A) Area Firearms Restrictions: Only shotguns and steel or other nontoxic shot approved by the U.S. Fish and Wildlife Service are permitted. A hunter shall not possess more than 25 shot shells while in the field. It shall be unlawful to possess a loaded firearm, defined as a firearm with an unexpended shell in the firing chamber, until hunters are in designated free roam or assigned pond areas.

(B) Hunt Days: Waterfowl, coots, moorhens, and snipe: Saturdays, Sundays, and Wednesdays during open seasons. Pheasant: Waterfowl hunt days during the pheasant season.

(C) Authorized Species: Waterfowl, coots, moorhens, snipe, and pheasants.

(D) It shall be unlawful to retain an entry permit or remain on the wildlife refuge later than one and one half hours after sunset, unless participating in overnight stay in accordance with subsection (a)(9)(E).

(E) Camping is prohibited, except on the night before each waterfowl shoot day, when camping in a vehicle, motorhome or trailer within the check station parking area is allowed. Tents are prohibited. No person may build or maintain fires, except in portable gas stoves.

(F) Bicycles: Prohibited.

(G) Hunters may enter or exit only at designated locations. Stopping vehicles between designated parking areas to drop off passengers or hunting equipment is prohibited.

(H) Special Restrictions: When hunting from assigned hunting sites, it shall be unlawful to hunt outside the assigned pond boundary or to hunt from levee roads. Pheasant and snipe hunting are not permitted in the assigned pond area.

(I) Reservations: Each reservation assures entry of up to four individuals with no more than two junior hunters or non-shooters per one adult hunter.

§630. ADDITIONAL VISITOR USE REGULATIONS ON DEPARTMENT LANDS DESIGNATED AS ECOLOGICAL RESERVES.

(a) The areas listed in this section have been designated by the commission as ecological reserves. A legal description of the boundaries of each ecological reserve is on file at the department's headquarters, 1416 Ninth Street, Sacramento. All ecological reserves are maintained for the primary purpose of developing a statewide program for protection of rare, threatened, or endangered native plants, wildlife, aquatic organisms, and specialized terrestrial or aquatic habitat types. Visitor uses are dependent upon the provisions of applicable laws and upon a determination by the commission that opening an area to such visitor use is compatible with the purposes of the property. Visitor use is subject to the regulations below, in sections 550 and 550.5 of these regulations, as well as any other commission regulations that may apply. These regulations are incorporated by reference into and become a condition of entry, passes, and/or permits. It is the responsibility of all visitors to know and understand these regulations prior to entry. Ecological reserves that are marked with an asterisk (*)

in subsection 630(b) are adjacent to or share sensitive marine environments with Marine Protected Areas (MPAs), Marine Managed Areas (MMAs), and/or Special Closures that are defined in Section 632 of these regulations. The general regulations for MPAs, MMAs, and Special Closures are in subsection 632(a) of these regulations, and site-specific regulations for each area are in subsection 632(b) of these regulations. The designated names of the MPAs in subsection 632(b) of these regulations generally correspond with the names of adjacent or overlapping ecological reserves. For example, Fagan Marsh Ecological Reserve shares marine waters with the Fagan Marsh State Marine Park and Moro Cojo Ecological Reserve is adjacent to the Moro Cojo State Marine Reserve.

(b) Ecological Reserves owned and operated by the department:

(1) Agua Hedionda Lagoon Ecological Reserve, San Diego County*;
(2) Albany Mudflats Ecological Reserve, Alameda County*;
(3) Alkali Sink Ecological Reserve, Fresno County;
(4) Allensworth Ecological Reserve, Tulare County;
(5) Apricum Hill Ecological Reserve, Amador County;
(6) Atascadero Creek Marsh Ecological Reserve, Sonoma County;
(7) Bair Island Ecological Reserve, San Mateo County*;
(8) Bakersfield Cactus Ecological Reserve, Kern County;
(9) Baldwin Lake Ecological Reserve, San Bernardino County;
(10) Ballona Wetlands Ecological Reserve, Los Angeles County;
(11) Batiquitos Lagoon Ecological Reserve, San Diego County*;
(12) Big Table Mountain Ecological Reserve, Fresno County;
(13) Blue Ridge Ecological Reserve, Tulare County;
(14) Blue Sky Ecological Reserve, San Diego County;
(15) Bobelaine Ecological Reserve, Sutter County;
(16) Boden Canyon Ecological Reserve, San Diego County;
(17) Boggs Lake Ecological Reserve, Lake County;
(18) Bolsa Chica Ecological Reserve, Orange County*;
(19) Bonny Doon Ecological Reserve, Santa Cruz County;
(20) Boulder Creek/Rutherford Ranch Ecological Reserve, San Diego County;
(21) Buena Vista Creek Ecological Reserve, San Diego County;
(22) Buena Vista Lagoon Ecological Reserve, San Diego County*;
(23) Burton Mesa Ecological Reserve, Santa Barbara County;
(24) Butler Slough Ecological Reserve, Tehama County;
(25) Butte Creek Canyon Ecological Reserve, Butte County;
(26) Butte Creek House Ecological Reserve, Butte County;
(27) Buttonwillow Ecological Reserve, Kern County;
(28) By-Day Creek Ecological Reserve, Mono County;
(29) Calhoun Cut Ecological Reserve, Solano County;
(30) Cambria Pines Ecological Reserve, San Luis Obispo County;
(31) Cañada de los Osos Ecological Reserve, Santa Clara County;
(32) Canebrake Ecological Reserve, Kern County;
(33) Carlsbad Highlands Ecological Reserve, San Diego County;
(34) Carrizo Canyon Ecological Reserve, Riverside County;
(35) Carrizo Plains Ecological Reserve, San Luis Obispo County, including the American, Panorama, Elkhorn Plain, North Chimineas, and South Chimineas Units;
(36) China Point Ecological Reserve, Siskiyou County;
(37) Chorro Creek Ecological Reserve, San Luis Obispo County;
(38) Clover Creek Ecological Reserve, Shasta County;
(39) Coachella Valley Ecological Reserve, Riverside County;
(40) Coal Canyon Ecological Reserve, Orange County;
(41) Coldwater Canyon Ecological Reserve, Ventura County;
(42) Corral Hollow Ecological Reserve, San Joaquin County;
(43) Corte Madera Marsh Ecological Reserve, Marin County*;
(44) Cosumnes River Ecological Reserve, Sacramento County;
(45) Crestridge Ecological Reserve, San Diego County;
(46) Dales Lake Ecological Reserve, Tehama County;
(47) Del Mar Mesa/Lopez Ridge Ecological Reserve, San Diego County;
(48) Del Monte Dunes Ecological Reserve, Monterey County;
(49) Eden Landing Ecological Reserve, Alameda County;
(50) Elkhorn Slough Ecological Reserve (National Estuarine Research Reserve), Monterey County*;
(51) Estelle Mountain Ecological Reserve, Riverside County;
(52) Fagan Marsh Ecological Reserve, Napa County*;
(53) Fall River Mills Ecological Reserve, Shasta County;
(54) Fish Slough Ecological Reserve, Inyo and Mono counties;
(55) Fremont Valley Ecological Reserve, Kern County;
(56) Goleta Slough Ecological Reserve, Santa Barbara County*;
(57) Harrison Grade Ecological Reserve, Sonoma County;
(58) Headwaters Forest Ecological Reserve, Humboldt County;
(59) Hidden Palms Ecological Reserve, Riverside County;
(60) Indian Joe Springs Ecological Reserve, Inyo County;
(61) Joshua Creek Canyon Ecological Reserve, Monterey County;
(62) Kaweah Ecological Reserve, Tulare County;
(63) Kerman Ecological Reserve, Fresno County;
(64) King Clone Ecological Reserve, San Bernardino County;
(65) Laguna Laurel Ecological Reserve, Orange County;
(66) Lake Hodges Ecological Reserve, San Diego County;
(67) Lake Mathews Ecological Reserve, Riverside County;
(68) Leek Springs Ecological Reserve, El Dorado County;
(69) Liberty Island Ecological Reserve, Solano County;
(70) Limestone Salamander Ecological Reserve, Mariposa County;
(71) Little Butte Ecological Reserve, Mendocino County;
(72) Little Red Mountain Ecological Reserve, Mendocino County;
(73) Loch Lomond Vernal Pool Ecological Reserve, Lake County;
(74) Lokern Ecological Reserve, Kern County;
(75) Macklin Creek Ecological Reserve, Nevada County;
(76) Magnesia Spring Ecological Reserve, Riverside County;
(77) Marin Islands Ecological Reserve, Marin County*;
(78) Mattole River Ecological Reserve, Mendocino County;
(79) McGinty Mountain Ecological Reserve, San Diego County;
(80) Meadowbrook Ecological Reserve, San Diego County;
(81) Moro Cojo Ecological Reserve, Monterey County*;
(82) Morro Dunes Ecological Reserve, including the Bayview Unit, San Luis Obispo County;
(83) Morro Rock Ecological Reserve, San Luis Obispo County;
(84) Napa River Ecological Reserve, Napa County;
(85) North Table Mountain Ecological Reserve, Butte County;
(86) Oasis Springs Ecological Reserve, Riverside County;
(87) Offshore Rocks and Pinnacles, coastal counties;

(88) Otay Mountain Ecological Reserve, San Diego County;
(89) Owl Creek Ecological Reserve, Humboldt County;
(90) Palo Verde Ecological Reserve, Riverside County;
(91) Panoche Hills Ecological Reserve, Fresno County;
(92) Peninsular Ranges Ecological Reserve, Riverside County;
(93) Peytonia Slough Ecological Reserve, Solano County;
(94) Phoenix Field Ecological Reserve, Sacramento County;
(95) Pilgrim Creek Ecological Reserve, San Diego County;
(96) Pine Hill Ecological Reserve, including the Salmon Falls Unit, El Dorado County;
(97) Piute Creek Ecological Reserve, San Bernardino County;
(98) Plaisted Creek Ecological Reserve, San Diego County;
(99) Pleasant Valley Ecological Reserve, Fresno County;
(100) Quail Hollow Ecological Reserve, Santa Cruz County;
(101) Quail Ridge Ecological Reserve, Napa County;
(102) Rancho Jamul Ecological Reserve, including the Headquarters Unit, San Diego County;
(103) Redwood Shores Ecological Reserve, San Mateo County;
(104) River Springs Lakes Ecological Reserve, Mono County;
(105) Saline Valley Ecological Reserve, Inyo County;
(106) San Antonio Valley Ecological Reserve, Santa Clara County;
(107) San Bruno Mountain Ecological Reserve, San Mateo County;
(108) San Diego River Ecological Reserve, San Diego County;
(109) San Dieguito Lagoon Ecological Reserve, San Diego County*;
(110) San Elijo Lagoon Ecological Reserve, San Diego County*;
(111) San Felipe Creek Ecological Reserve, Imperial County;
(112) San Joaquin River Ecological Reserve, Fresno and Madera counties;
(113) San Luis Rey River Ecological Reserve, San Diego County;
(114) Sands Meadow Ecological Reserve, Tuolumne County;
(115) Santa Cruz Long-toed Salamander Ecological Reserve, Santa Cruz County;
(116) Santa Rosa Plain Vernal Pool Ecological Reserve, including the Hall Road, Todd Road, Wikiup and Yuba Drive units, Sonoma County;
(117) Santa Rosa Plateau Ecological Reserve, Riverside County;
(118) Semitropic Ecological Reserve, Kern County;
(119) Sky Valley Ecological Reserve, Riverside County;
(120) Springville Ecological Reserve, Tulare County;
(121) Stone Corral Ecological Reserve, Tulare County;
(122) Stone Ridge Ecological Reserve, Butte County;
(123) Sycamore Canyon Ecological Reserve, Riverside County;
(124) Sycuan Peak Ecological Reserve, San Diego County;
(125) Table Bluff Ecological Reserve, Humboldt County;
(126) Theiller Sebastopol Meadowfoam Ecological Reserve, Sonoma County;
(127) Thomes Creek Ecological Reserve, Tehama County;
(128) Tomales Bay Ecological Reserve, Marin County;
(129) Upper Newport Bay Ecological Reserve, Orange County*;
(130) Vernalis Ecological Reserve, San Joaquin County;
(131) Walker Canyon Ecological Reserve, San Diego County;
(132) Watsonville Slough Ecological Reserve, Santa Cruz County;
(133) West Mojave Desert Ecological Reserve, San Bernardino County;
(134) Woodbridge Ecological Reserve, San Joaquin County;
(135) Yaudanchi Ecological Reserve, Tulare County; and
(136) Yorkville Ecological Reserve, Mendocino County.

Note: *The remainder of Section 630, Title 14, CCR includes regulations that apply only to individual ecological reserves. These regulations are organized primarily by type of public use in the following pages of this booklet. To see the same property-specific regulations organized under the name of each ecological reserve, go to:* ***www.wildlife.ca.gov/Lands/Regulations***

Note: *Currently only the Elkhorn Slough Ecological Reserve has implemented the Lands Pass requirement described below. By January 2018, all ecological reserves listed in subsection 630(c) will implement this requirement.*

(c) Ecological Reserves That Require a Daily or Annual Lands Pass for Authorized Uses other than Hunting: Pursuant to subsection 550(c) and 550.5(c) of these regulations, it shall be unlawful for a visitor to enter any ecological reserve or portion thereof listed in this section without carrying a valid Lands Pass or a valid hunting, fishing, or trapping license on their person. A Lands Pass must be purchased in advance. Information on how to purchase a Lands Pass and exceptions to this requirement are provided in subsection 550.5(c).
  (1) Batiquitos Lagoon Ecological Reserve
  (2) Boden Canyon Ecological Reserve
  (3) Bolsa Chica Ecological Reserve
  (4) Buena Vista Lagoon Ecological Reserve
  (5) Canebrake Ecological Reserve
  (6) Elkhorn Slough Ecological Reserve
    (A) Lands Passes may be purchased at the visitor center during business hours.
  (7) North Table Mountain Ecological Reserve
  (8) San Elijo Lagoon Ecological Reserve
  (9) Upper Newport Bay Ecological Reserve
  (10) Woodbridge Ecological Reserve

(d) Ecological Reserves with Hunting as a Designated Public Use: Unless listed and specified as allowed in the table below, hunting is prohibited on ecological reserves. Where hunting is allowed, it shall be subject to all applicable general hunting regulations and the area-specific regulations set forth in this subsection.

AREA	HUNTING DESCRIPTIONS
(1) Allensworth Ecological Reserve	Allowed only at such times and in the specific areas designated by the department.
(2) Bair Island Ecological Reserve	Waterfowl hunting only.
(3) Baldwin Lake Ecological Reserve	Waterfowl and upland game only. Waterfowl hunting shall be from boats only.

AREA	HUNTING DESCRIPTIONS
(4) Blue Ridge Ecological Reserve	Allowed only as part of department special hunting opportunities at such times and in the specific areas designated by the department.
(5) Boden Canyon Ecological Reserve	Upland game allowed but only at such times and in the specific areas designated by the department.
(6) Buttonwillow Ecological Reserve	Allowed only at such times and in the specific areas designated by the department.
(7) By-Day Creek Ecological Reserve	Allowed.
(8) Calhoun Cut Ecological Reserve	Waterfowl allowed only from a boat on the waters within the reserve that are accessible only from Lindsey Slough. There are no launch sites on the reserve.
(9) Cañada de los Osos Ecological Reserve	Allowed but only as part of department special opportunities at such times and in the specific areas designated by the department.
(10) Canebrake Ecological Reserve	Allowed only at such times and in the specific areas designated by the department.
(11) Carrizo Plains Ecological Reserve	Allowed only at such times and in the specific areas designated by the department. Hunting of coyotes and ground squirrels is prohibited on the North and South Chimineas units.
(12) China Point Ecological Reserve	Allowed from August 1 through February 14.
(13) Coal Canyon Ecological Reserve	Allowed only at such times and in the specific areas designated by the department. Shotguns and archery equipment only.
(14) Cosumnes River Ecological Reserve	Allowed only at such times and in the specific areas designated by the department.
(15) Dales Lake Ecological Reserve	Waterfowl only.
(16) Eden Landing Ecological Reserve	Waterfowl allowed, but only at such times and in the specific areas designated by the department.
(17) Elkhorn Slough Ecological Reserve	Allowed only at such times and in the specific areas designated by the department.
(18) Estelle Mountain Ecological Reserve	Upland game only.
(19) Fish Slough Ecological Reserve	Allowed.
(20) Indian Joe Springs Ecological Reserve	Upland game only.
(21) Kaweah Ecological Reserve	Allowed only at such times and in the specific areas designated by the department.
(22) Kerman Ecological Reserve	Allowed from July 1 through January 31. Only licensed hunters are allowed to possess firearms. Shotguns only.
(23) Liberty Island Ecological Reserve	Allowed only at such times and in the specific areas designated by the department.
(24) Lokern Ecological Reserve	Allowed only at such times and in the specific areas designated by the department.
(25) North Table Mountain Ecological Reserve	Deer and upland game allowed from the day after spring turkey season through November 15.
(26) Oasis Springs Ecological Reserve	Allowed.
(27) Otay Mountain Ecological Reserve	Allowed in accordance with the Bureau of Land Management's Wilderness Area regulations (43 CFR 6300, Oct. 1, 2012).
(28) Palo Verde Ecological Reserve	Deer, rabbits, dove, quail, and waterfowl only and allowed only at such times and in the specific areas designated by the department. Deer hunting is by archery only. Rabbit, dove, quail, and waterfowl hunting is by shotgun only.
(29) Panoche Hills Ecological Reserve	Allowed from July 1 through January 31.
(30) Peninsular Ranges Ecological Reserve	Upland game only.
(31) Piute Creek Ecological Reserve	Allowed.
(32) Pleasant Valley Ecological Reserve	Allowed only at such times and in the specific areas designated by the department.
(33) Quail Ridge Ecological Reserve	Allowed but only as part of department special opportunities at such times and in the specific areas designated by the department.
(34) Rancho Jamul Ecological Reserve	Allowed only at the times and in the specific areas designated by the department.
(35) River Springs Lakes Ecological Reserve	Allowed.
(36) Saline Valley Ecological Reserve	Allowed.
(37) San Antonio Valley Ecological Reserve	Allowed, but only as part of department special opportunities at such times and in the specific areas designated by the department.
(38) San Felipe Creek Ecological Reserve	Allowed.
(39) Sky Valley Ecological Reserve	Upland game only.
(40) Stone Corral Ecological Reserve	Allowed only at such times and in the specific areas designated by the department.
(41) Tomales Bay Ecological Reserve	Waterfowl only.
(42) Vernalis Ecological Reserve	Upland game only and only on the Vernalis Unit at such times and in the specific areas designated by the department.
(43) Walker Canyon Ecological Reserve	Allowed.
(44) West Mojave Desert Ecological Reserve	Allowed from July 1 through January 31.

(e) Fishing Restrictions and Additional Regulations on Ecological Reserves Pursuant to Subsection 550(h) of These Regulations: Except as otherwise provided in the table below, fishing for non-commercial purposes is allowed in ecological reserves but is limited to angling from shore. Fishing for commercial purposes is prohibited on ecological reserves.
The terms "Prohibited" and "Allowed" in this table refer to whether fishing is prohibited or allowed on the subject ecological reserve.

AREA	FISHING DESCRIPTIONS
(1) Agua Hedionda Lagoon Ecological Reserve	Prohibited.
(2) Baldwin Lake Ecological Reserve	Prohibited.
(3) Ballona Wetlands Ecological Reserve	Prohibited except from designated areas on the shore of the Ballona Creek flood control channel or from a boat within the channel. Barbless hooks only.
(4) Bolsa Chica Ecological Reserve	Prohibited except at a designated area at the north end of outer Bolsa Bay, and as provided in subsection 632(b) of these regulations for the marine waters shared with the Bolsa Bay and Bolsa Chica Basin State Marine Conservation Areas.
(5) Buena Vista Lagoon Ecological Reserve	Prohibited except at designated fishing areas.
(6) Butte Creek Canyon Ecological Reserve	Prohibited except by hand-carried boats or flotation devices in the main channel of Butte Creek from February 1 through April 30.
(7) By-Day Creek Ecological Reserve	Prohibited.
(8) Calhoun Cut Ecological Reserve	Prohibited except from a boat within the main channel of Calhoun Cut accessible only from Lindsey Slough. There are no launching sites on the reserve.
(9) Cañada de los Osos Ecological Reserve	Prohibited except for special opportunities offered in specific areas at times designated by the department.
(10) Canebrake Ecological Reserve	Allowed only in specific areas designated by the department.
(11) China Point Ecological Reserve	Allowed from boats and the shore.
(12) Cosumnes River Ecological Reserve	Allowed only from a boat in the main channel of the Cosumnes River and sloughs accessible from the Mokelumne River.
(13) Eden Landing Ecological Reserve	Allowed from boats and the shore, but only at such times and in the specific areas designated by the department.
(14) Elkhorn Slough Ecological Reserve	Allowed only from specific areas designated by the department and as provided in subsection 632(b) of these regulations for the marine waters shared with the Elkhorn Slough State Marine Reserve. Fishing is prohibited in the Elkhorn Slough Marine Conservation Area (subsection 632(b) of these regulations).
(15) Fagan Marsh Ecological Reserve	Allowed from boats and the shore.
(16) Fish Slough Ecological Reserve	Prohibited within the 20-acre fenced and posted plot of land encompassing two spring areas and an artificial impoundment of 5.6 acres located in the northwest corner of the area known as "Fish Slough," northern Inyo and southern Mono counties.
(17) Goleta Slough Ecological Reserve	Prohibited.
(18) Leek Springs Ecological Reserve	Prohibited.
(19) Liberty Island Ecological Reserve	Allowed from boats and from shore.
(20) Morro Rock Ecological Reserve	Allowed but visitors may only enter upon that portion of Morro Rock between the low tide mark and a point ten (10) feet in elevation above the mean high tide mark.
(21) Oasis Springs Ecological Reserve	Prohibited.
(22) Palo Verde Ecological Reserve	Allowed at night.
(23) Peytonia Slough Ecological Reserve	Allowed from boats and the shore.
(24) Redwood Shores Ecological Reserve	Allowed from boats and the shore. Only lightweight, hand-carried boats may be launched and operated.
(25) San Joaquin River Ecological Reserve	Allowed from boats and the shore at times and in places designated by the department. Only lightweight, hand carried, non-gasoline powered boats or other floating devices are permitted, and they may only be launched from designated launching sites.
(26) Tomales Bay Ecological Reserve	Allowed from boats and the shore. Only lightweight, hand-carried boats may be launched and operated.
(27) Upper Newport Bay Ecological Reserve	Allowed from boats and in designated shore areas and as provided in subsection 632(b) of these regulations for marine waters shared with the Upper Newport Bay State Marine Conservation Area. Clamming and wading are prohibited.
(28) Vernalis Ecological Reserve	Allowed from boats and from shore.

(f) Swimming and/or Boating: Unless listed and specified in the columns below, swimming and boating are prohibited on ecological reserves, per subsections 550(z)(2) and 550(z)(3) of these regulations.

		Prohibited except as part of special fishing opportunities in specific areas at times designated by the department. Only lightweight hand-carried boats or floating devices allowed. Gasoline-powered boats are prohibited.
		Allowed but only lightweight, hand carried, non-gasoline powered boats or other floating devices are permitted, and they may only be launched from designated launching sites.

(g) Bicycles, Horses, Pack Stock, and/or Horseback Riding: Except as listed and specified in the columns below, bicycles and other pedaled vehicles, horses, pack stock and horseback riding are prohibited on ecological reserves, per subsections 550(bb) and 550(o) of these regulations.

AREA	BICYCLE DESCRIPTION	HORSE/PACK-STOCK DESCRIPTION
(1) Ballona Wetlands Ecological Reserve	Allowed only on the designated path on the north side of the Ballona Creek flood control channel.	Prohibited.
(2) Canebrake Ecological Reserve	Prohibited.	Allowed only on established trails in designated areas.
(3) Coal Canyon Ecological Reserve	Allowed on designated trails only, excluding dates within 72 hours after any weather event that produces 1/4 inch of precipitation in any 24 hour period, or any such event that produces 1/2 inch of precipitation in any 72 hour period.	Allowed only on designated trails, excluding dates within 72 hours after any weather event that produces 1/4 inch of precipitation in any 24 hour period, or any such event that produces 1/2 inch of precipitation in any 72 hour period.
(4) Crestridge Ecological Reserve	May be allowed on designated roads during designated seasons as determined by the department. Closures may be implemented at the discretion of the department.	Allowed only on designated trails.
(5) Eden Landing Ecological Reserve	Allowed only on designated trails.	Allowed only on designated trails.
(6) Headwaters Forest Ecological Reserve	Allowed only on the northern 3.5 mile designated corridor.	Prohibited.

AREA	BICYCLE DESCRIPTION	HORSE/PACK-STOCK DESCRIPTION
(7) Magnesia Spring Ecological Reserve	Year round access is allowed only on that portion of the Mike Schuler Trail in the northeast corner of Section 24, and the Lower Mirage Trail where it enters Section 24 in the north and continues south until the trail becomes the Herb Jeffries Trail which continues south and then east and exits the Ecological Reserve at the eastern border of Section 24. Access is also allowed year round on the Hopalong Cassidy Trail in the eastern portion of Section 35. Those portions of the Art Smith Trail in Sections 35 and 27 are open from October 1 through June 30 and closed from July 1 through September 30.	Year round access is allowed only on that portion of the Mike Schuler Trail in the northeast corner of Section 24, and the Lower Mirage Trail where it enters Section 24 in the north and continues south until the trail becomes the Herb Jeffries Trail which continues south and then east and exits the Ecological Reserve at the eastern border of Section 24. Access is also allowed year round on the Hopalong Cassidy Trail in the eastern portion of Section 35. Those portions of the Art Smith Trail in Sections 35 and 27 are open from October 1 through June 30 and closed from July 1 through September 30.
(8) Redwood Shores Ecological Reserve	Allowed only along the levee-top road system.	Prohibited.
(9) Upper Newport Bay Ecological Reserve	Allowed only on paved Back Bay Drive.	Allowed only on established trails in designated areas.

(h) Designated Closures and Restrictions on Ecological Reserves:

AREA	DESCRIPTION OF CLOSURE OR RESTRICTION
(1) Apricum Hill Ecological Reserve	Closed to all visitor use/access.
(2) Bair Island Ecological Reserve	Closed to all visitor use/access from February 15 through May 20.
(3) Ballona Wetlands Ecological Reserve	Pets, including dogs and cats, are prohibited. Unless the department determines that restoration or other uses in the following areas is more appropriate, existing recreational uses may be allowed under license agreement with Playa Vista Little League in that portion of Area C identified in the license agreement and existing parking areas may be allowed under leases to the County of Los Angeles.
(4) Bobelaine Ecological Reserve	Closed to all visitor use/access.
(5) Bolsa Chica Ecological Reserve	Pets are prohibited, except when they remain inside a motor vehicle. Visitors must stay on established trails, paths or other designated areas. The reserve is closed to visitor access and use from 8:00 p.m. to 6:00 a.m.
(6) Burton Mesa Ecological Reserve	Motor vehicle use by visitors is prohibited.
(7) Butte Creek Canyon Ecological Reserve	Motor vehicle use by visitors is prohibited.
(8) Butte Creek House Ecological Reserve	Motor vehicle use by visitors is prohibited.
(9) Calhoun Cut Ecological Reserve	The land portions of the reserve are closed to all visitor use/access. The navigable portions of Calhoun Cut and associated sloughs are accessible only by boat from Lindsey Slough.
(10) Cañada de los Osos Ecological Reserve	Closed to all visitor use/access except for special opportunities as provided in subsections 630(d)(9) and 630(e)(9) of these regulations.
(11) Canebrake Ecological Reserve	Pets are prohibited except for hunting dogs at such times and in the specific areas designated by the department.
(12) Carrizo Canyon Ecological Reserve	Closed to all visitor use/access from January 1 through September 30. Pets are prohibited, except when they remain inside a motor vehicle.
(13) Carrizo Plains Ecological Reserve	Access to the South Chimineas Unit requires an entry permit issued by the department. Permits must be filled out and returned to the department upon leaving the area.
(14) Coldwater Canyon Ecological Reserve	Closed to all visitor use/access except for pedestrian use of the existing travel corridor through the reserve.
(15) Corral Hollow Ecological Reserve	Closed to all visitor use/access.
(16) Cosumnes River Ecological Reserve	Pets are prohibited, except when they remain inside a motor vehicle.
(17) Goleta Slough Ecological Reserve	Visitors must stay on established trails, paths or other designated areas.
(18) Headwaters Forest Ecological Reserve	Pets are prohibited except for dogs on a leash on the northern 3.5 mile designated corridor.
(19) Hidden Palms Ecological Reserve	Closed to all visitor use/access.
(20) Lake Mathews Ecological Reserve	Closed to all visitor use/access.
(21) Leek Springs Ecological Reserve	Closed to all visitor use/access.
(22) Limestone Salamander Ecological Reserve	Closed to all visitor use/access.
(23) Macklin Creek Ecological Reserve	Closed to all visitor use/access.

AREA	DESCRIPTION OF CLOSURE OR RESTRICTION
(24) Magnesia Spring Ecological Reserve	Year round access is allowed only on that portion of the Mike Schuler Trail in the northeast corner of Section 24, and the Lower Mirage Trail where it enters Section 24 in the north and continues south until the trail becomes the Herb Jeffries Trail which continues south and then east and exits the Ecological Reserve at the eastern border of Section 24. Access is also allowed year round on the Hopalong Cassidy Trail in the eastern portion of Section 35. The Mirage Trail, located above the gate and west of the intersection with the Herb Jefferies trail, is open only for pedestrian use from May 1 through January 31, and is closed to all visitor use from February 1 through April 30. Those portions of the Art Smith Trail in Sections 35 and 27 are open from October 1 through June 30 and closed from July 1 through September 30. Pets are prohibited except when they remain inside a motor vehicle.
(25) Morro Rock Ecological Reserve	Visitor access/use allowed only for that portion of Morro Rock between the low tide mark and a point ten (10) feet in elevation above the mean high tide mark.
(26) Phoenix Field Ecological Reserve	Closed to all visitor use/access.
(27) Pine Hill Ecological Reserve	Closed to all visitor use/access.
(28) Quail Ridge Ecological Reserve	Closed to all visitor use/access except for special opportunities as provided in subsection 630(d)(33) of these regulations
(29) San Dieguito Lagoon Ecological Reserve	The California least tern nesting island is closed to all visitor use/access.
(30) San Joaquin River Ecological Reserve	Closed to all visitor use/access except for special opportunities as provided in subsection 630(e)(25) of these regulations.
(31) Santa Cruz Long-toed Salamander Ecological Reserve	Closed to all visitor use/access.
(32) Santa Rosa Plain Vernal Pool Ecological Reserve	Closed to all visitor use/access.
(33) Santa Rosa Plateau Ecological Reserve	Pets are prohibited. Smoking is prohibited, except inside a motor vehicle.
(34) Stone Ridge Ecological Reserve	Closed to all visitor use/access except for department authorized interpretive, educational, or research programs.
(35) Table Bluff Ecological Reserve	The fenced western lily area is closed to all visitor use/access.
(36) Tomales Bay Ecological Reserve	The land area of the reserve is closed to all visitor use/access from March 1 through June 30.
(37) Woodbridge Ecological Reserve	Closed to all visitor use/access except for the viewing area.

(i) Ecological Reserves Authorized for Dog Training:
  (1) Rancho Jamul Ecological Reserve.
    (A) Retriever training allowed in the designated area only, and only with written authorization from the area manager.

(j) Shooting Areas: Ecological Reserve, pursuant to subsection 550(cc) of these regulations, with designated shooting area (i.e., range) and additional regulations:
  (1) Carrizo Plains Ecological Reserve.
    (A) Target shooting is allowed in designated areas only.

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OTHER PUBLIC HUNTING AREAS

The U.S. Fish and Wildlife Service offers public hunting on other national wildlife refuges including:

- **Lower Klamath and Tule Lake National Wildlife Refuges**
  In Siskiyou and Modoc counties; contact Tule Lake Refuge headquarters, located seven miles west of the town of Tulelake, Route 1, Box 74, Tulelake, CA 96134, (530) 667 2231.

- **Humboldt Bay National Wildlife Refuge**
  Contact P.O. Box 576, Loleta, CA 95551, (707) 733 5406

- **Modoc National Wildlife Refuge**
  Located two miles southeast of Alturas; contact refuge headquarters, P.O. Box 1610, Alturas, CA 96101, (530) 233 3572

- **San Francisco Bay National Wildlife Refuge Complex**
  Contact 1 Marshlands Road, Fremont, CA 94555

- **Stone Lakes National Wildlife Refuge**
  1624 Hood Franklin Road, Elk Grove, CA 95757, (916) 775 4421

- **Havasu National Wildlife Refuge**
  317 Mesquite Avenue, Needles CA 92363 2649

- **Cibola National Wildlife Refuge**
  Contact P.O. Box AP, Blythe, CA 92225

- **Imperial National Wildlife Refuge**
  Contact P.O. Box 2217, Martinez Lake, AZ 85364

For additional information about National Wildlife Refuges, please go to:
http://www.fws.gov/refuges/

The CA Department of Parks and Recreation (DPR) allows hunting at the following sites:

- **San Luis Project Reservoirs** in Merced County located about 13 miles west of Los Banos. Contact DPR, P.O. Box 991, Los Banos, CA 93635.

- **Picacho State Recreation Area** located along the Colorado River in Imperial County about 20 miles north of Winterhaven; contact P.O. Box 1207, Winterhaven, CA 92283.

OTHER LAWS RELATED TO HUNTING

DEFINITION OF TAKE.

"Take" means hunt, pursue, catch, capture, or kill or attempt to hunt, pursue, catch, capture, or kill. (Fish and Game Code Section 86.)

ACCESS AND TRESPASS

Access to some lands and waters may be controlled by owners or administering agencies of private lands, Indian lands or reservations, waters impounded by dams, and other lands and waters. Also county ordinances may control the use of lands and waters administered by the county. In all cases it is advisable to check with the landowner or the administering agency for current regulations and to determine whether entry permits are required to be obtained for hunting or fishing on such lands. Hunters must obtain written permission from landowners before entering private property. TRESPASS: If the land you hunt on is not your own, it belongs to someone else. Make sure you have a legal right to be there. Contact the owner or person who administers the property, and secure written permission to hunt. A hunting license does not entitle you to enter private property. "It is unlawful to enter any lands under cultivation or enclosed by a fence, belonging to, or occupied by, another, or to enter any uncultivated or unenclosed lands, including lands temporarily inundated by waters flowing outside the established banks of a river, stream, slough, or other waterway, where signs forbidding trespass are displayed at intervals not less than three to the mile along all exterior boundaries and at all roads and trails entering such lands, for the purpose of discharging any firearm or taking or destroying any mammal or bird, including any waterfowl, on such lands without having first obtained written permission from the owner of such lands, or his agent, or the person in lawful possession thereof. Such signs may be of any size and wording, other than the wording required for signs under Section 2017,which will fairly advise persons about to enter the land that the use of such land is so restricted." Section 2016, Fish and Game Code.

DISCHARGING FIREARMS OR OTHER DEADLY WEAPONS

It is unlawful for any person, other than the owner, person in possession of the premises, or a person having the express permission of the owner or person in possession of the premises, to hunt or to discharge while hunting, any firearm or other deadly weapon within 150 yards of any occupied dwelling house, residence, or other building or any barn or other outbuilding used in connection therewith. The 150-yard area is a "safety zone." (See Section 3004, Fish and Game Code.)

PUBLIC ROAD OR OTHER WAY OPEN DEFINED

"Public road or other way open", particularly, with respect to safety regulations, includes any roads, dirt or otherwise, trails, open fields, parking lots, etc., open to public access.

PROHIBITION ON LOADED RIFLE OR SHOTGUN IN VEHICLE

It is always unlawful to: Place on, or carry or possess a loaded rifle or shotgun in any vehicle or conveyance or its attachments which is standing on or along or is being driven on or along any public highway or other way open to the public. A rifle or shotgun shall be deemed to be loaded for the purposes of this section when there is an unexpended cartridge or shell in the firing chamber but not when the only cartridges or shells are in the magazine.* The provisions of this section shall not apply to peace officers or members of the armed forces of this state or the United States, while on duty or going to or returning from duty. Fish and Game Code Section 2006.

***NOTE:** Hunters should be aware that subdivision (a) of Section 25850 of the Penal Code provides that:

(a) A person is guilty of carrying a loaded firearm when the person carries a loaded firearm on the person or in a vehicle while in any public place or on any public street in an incorporated city or in any public place or on any public street in a prohibited area of unincorporated territory

Penal Code 16840(b)(1) A firearm shall be deemed to be "loaded" when there is an unexpended cartridge or shell, consisting of a case that holds a charge of powder and a bullet or shot, in, or attached in any manner to, the firearm, including, but not limited to, in the firing chamber, magazine, or clip thereof attached to the firearm.

LITTER

It is unlawful to deposit, permit to pass into, or place where it can pass into the waters of the state, or to abandon, dispose of, or throw away, within 150 feet of the high water mark of the waters of the state, any cans, bottles, garbage, rubbish, or the viscera or carcass of any dead mammal, or the carcass of any dead bird. (Section 5652, Fish and Game Code.)

SAFETY

It is always unlawful to: Place on, or carry or possess a loaded rifle or shotgun in a vehicle or conveyance or its attachments on any public road or other way open to the public; Hunt while intoxicated; Shoot at any game bird from a powerboat, sailboat, motor vehicle, or aircraft while under power or still moving from use of sail or motor (See Section 251); Shoot any firearm from or upon a public road or highway.

FIREARMS

It is always unlawful to: Fail to send a complete written report to the Department within 48 hours after killing or wounding while hunting, any human being, or domestic animal belonging to another, or after witnessing such killing or wounding; Use a shotgun larger than 10 gauge; Use, for the taking of any game bird, a shotgun capable of holding more than three shells in the magazine and chamber combined; Use or possess shotshells containing shot size larger than No. BB in lead or No. T in steel when hunting migratory game birds; Use shot that is not loose in the shell for taking resident small game and migratory game birds; Possess a machine gun, silencer, shotgun with barrel less than 18 inches in length, or rifle with barrel less than 16 inches in length.

PARKS AND REFUGES

It is unlawful to hunt in any National Park or Monument, in State of California Beaches and Parks or Monument areas, or in any State Game Refuge, or to shoot into such an area any weapon capable of taking any bird.

Possess in any State Game Refuge any bird or mammal or part thereof, or any weapon capable of taking any bird. However, possession of firearms or bows and arrows by persons traveling through game refuges on a public highway or other public thoroughfare or right of way is permitted when the firearms are taken apart or encased and unloaded, and the bows are unstrung. National Parks and Monuments have special regulations regarding the possession of weapons, game and the running of hunting dogs. Check with federal officials before entering these areas.

TAGS AND LICENSES

It is always unlawful to: Hunt any game bird or mammal without having the required licenses, tags and/or stamps in possession; Change, mutilate, or transfer any license, tag, or stamp; Have in possession while hunting any license belonging to another person.

GAME RESTRICTIONS

It is always unlawful to: Use any light to assist in taking any game bird or game mammal; Sell or barter game taken under authority of a hunting license.

RESPECT FOR PROPERTY

It is always unlawful to damage other's property while hunting.

CHAPTER 1. GENERAL PROVISIONS AND DEFINITIONS

§250.5. Shooting Time.

In these orders whenever a specific clock time is mentioned, such time is meant to be legal California time for the date specified: i.e., during the days when California is on Pacific Daylight Saving Time, Pacific Daylight Saving Time is intended; when California is legally on Pacific Standard Time, Pacific Standard Time is intended. When reference is made to sunrise or sunset time, such reference is to the sunrise or sunset time at the location of the hunter.

§251. Pursuing or Shooting Birds and Mammals from Motor-Driven Air or Land Vehicles, Motorboats,Airboats, Sailboats or Snowmobiles.

(a) General Prohibition: No person shall pursue, drive, herd, or take any bird or mammal from any type of motor-driven air or land vehicles, motorboat, airboat, sailboat, or snowmobile, except:
  (1) When the motor of such motorboat, airboat, or sailboat has been shut off and/or the sails furled and its progress therefrom has ceased, and it is drifting, beached, moored, resting at anchor, or is being propelled by paddle, oar or pole.
  (2) When used by the landowner or tenant of private property to drive or herd game mammals for the purpose of preventing damage to private property.
  (3) Pursuant to a license from the department issued under such regulations as the commission may prescribe (see subsection 251(b) below).
(b) Mobility Disabled Persons Motor Vehicle License (*see Title 14, Section 251(b) at the following web site: www.fgc.ca.gov/regulations/current/regs.asp*)

§251.1. Harassment of Animals.

Except as otherwise authorized in these regulations or in the Fish and Game Code, no person shall harass, herd or drive any game or nongame bird or mammal or furbearing mammal. For the purposes of this section, harass is defined as an intentional act which disrupts an animal's normal behavior patterns, which includes, but is not limited to, breeding, feeding or sheltering. This section does not apply to a landowner or tenant who drives or herds birds or mammals for the purpose of preventing damage to private or public property, including aquaculture and agriculture crops.

§251.5. Game Birds, Game Mammals, Furbearers and Nongame Animals, Possession Of.

(a) Migratory game birds may not be held beyond the period provided by the federal regulations and in accordance with the daily bag and possession limits prescribed by these regulations. (See section 500.)
(b) Live mountain lions may be possessed only under terms of a permit issued by the Department pursuant to section 2150 of the Fish and Game Code or if the owner can demonstrate that the mountain lion was in his/ her possession on or before June 6, 1990 under a permit issued pursuant to section 3200 of said code.
(c) Every game bird, game mammal, furbearer or nongame animal taken under the authority of a hunting or trapping license and reduced to possession by the hunter or trapper shall be immediately killed and become a part of the daily bag limit.

§251.7. Possession, Transportation and Importation of Game Birds.

(a) No person may possess any birds taken in this state in excess of the daily bag and possession limits. The exception to this is for the purpose of transportation, cleaning, storage (including temporary storage), shipment, or taxidermy services, where an individual may possess game birds taken by another hunter provided that they are tagged by the hunter who has lawfully taken them. The tag must contain the hunter's name, address, hunting license number, kinds and numbers of game birds taken, date and location of kill, and signature.
(b) All birds, including migratory game birds, possessed or transported within California must have a fully feathered wing or head attached until placed into a personal abode or commercial preservation facility or being prepared for immediate consumption. Doves must have a fully feathered wing attached.
(c) Migratory game birds imported into California shall be accompanied by a declaration of entry as prescribed in Section 2353 of the Fish and Game Code.
(d) Only one possession limit of migratory game birds may be possessed per individual after the close of the season for that species.

§252. Bag and Possession Limit Defined.

"Bag and possession limit" means the daily bag limit of each kind of resident and migratory game birds, game mammals and furbearing mammals which may be taken and possessed by any one person unless otherwise authorized.

§258. Season Defined.

"Season" means that period of time during which resident and migratory game birds, game mammals and fur-bearing mammals may be taken. All dates are inclusive.

§260. Prohibition Against Taking Other Than Migratory Game Birds and Quail in Picacho State Recreation Area.

Notwithstanding any other provisions of these regulations, in Picacho State Recreation Area only migratory game birds and quail may be taken or possessed as prescribed in Sections 301, 500, 501 and 502 of these regulations.

§260.1. Prohibition Against Hunting Other Than During September-January on Providence Mountains State Recreation Area.

Notwithstanding any other provisions of these regulations, in Providence Mountains State Recreation Area hunting is permitted only during the period September 1 to January 31.

§260.2. Hunting Restrictions on Lake Oroville State Recreation Area.

Game species may be taken on the Lake Oroville State Recreation Area only as follows:
(a) No hunting of any type is permitted between February 1 and September 14 except for wild turkeys only, during the spring turkey hunting season as provided in Section 306 of these regulations.
(b) No waterfowl or deer hunting is permitted at any time.

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(c) Game species may be taken only during their respective open seasons or portions thereof falling within the period September 15 through January 31; and as provided in (a) above; and as otherwise provided by state Parks and Recreation area regulations (see area regulations).

§260.3. Prohibition Against Taking Other Than Migratory Game Birds on San Luis Reservoir State Recreation Area.

Notwithstanding any other provision of these regulations, in San Luis Reservoir State Recreation Area, only migratory waterfowl may be taken or possessed as prescribed in Section 502 of these regulations.

§260.4. Prohibition Against Taking Other Than Waterfowl and Resident Small Game on Perris Reservoir State Recreation Area.

Notwithstanding any other provision of these regulations, in Perris Reservoir State Recreation Area only waterfowl and resident small game may be taken or possessed as prescribed in Section 551 of these regulations.

§260.5. Prohibition Against Taking Other Than Waterfowl, American Coots, Common Moorhens and Common Snipe Within Harry A. Merlo State Recreation Area.

Notwithstanding any other provision of these regulations, in Harry A. Merlo State Recreation Area, only waterfowl, American coots, common moorhens and common snipe may be taken or possessed as prescribed in Section 502 of these regulations.

SPECIAL CLOSURES

§262. Prohibition Against Hunting on Portions of Frank's Tract State Recreation Area.

That portion of Frank's Tract State Recreation Area lying southwest of the following line is closed to hunting: Beginning at a point on Little Frank's Tract 2,000 feet north of the Piper Slough; southeast 2,000 feet east of the Piper Slough levee to the junction of the Holland Island levee.

§FGC 3681. Humboldt Bay

This section applies the Humboldt Bay area on Mondays, Tuesdays, Thursdays, and Fridays. See game warden before shooting on these days:

"In Districts 8 and 9, it is unlawful to take ducks or geese in any manner below the incoming or outgoing tidewater's edge or from any blind, boat, floating device, island, islet, or exposed tidal flat except on Saturdays, Sundays, Wednesdays, holidays and the opening and closing days during the prescribed open season except that the use of boats is permitted to retrieve crippled or dead birds."

In addition, hunters should be aware that there is a special waterfowl closure for south Humboldt Bay.

§11016. Fish and Game District 8.

The following constitutes Fish and Game District 8: The waters and tidelands to high-water mark of Humboldt Bay lying north of a straight line running east from the center of apron at the approach of the south jetty at the entrance of Humboldt Bay to the east shore line of the bay including the entrance of Humboldt Bay not included in District 7, and excluding all rivers, streams and sloughs emptying into the bay.

§11017. Fish and Game District 9.

The following constitutes Fish and Game District 9: The waters and tidelands to high-water mark of Humboldt Bay lying south of a straight line running east from the center of apron at the approach to the south jetty at the entrance of Humboldt Bay to the east shore line of the bay, excluding all rivers, streams and sloughs emptying into the bay.


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FEDERAL REGULATIONS RELATED TO HUNTING MIGRATORY GAME BIRDS

The following is a synopsis of Federal Regulations that pertain to the hunting of migratory game birds. Persons requiring more information should go to ***http://www.fws.gov/hunting/whatres.html***, where they will find a complete version of 50 CFR Part 20. When State law is different from the following Federal law the hunter must comply with the most restrictive law.

WHAT TERMS DO I NEED TO UNDERSTAND?

Migratory Birds are birds protected by federal law as a result of treaties signed with other countries. Protected migratory birds are listed in Title 50 Code of Federal Regulations, Section. 10.13. This list includes almost all birds found in the United States with the exception of the house sparrow, rock dove (commonly called domestic pigeon), European starling, and upland game birds (which are managed by state laws).

All migratory birds are protected under the Migratory Bird Treaty Act. However, a subset of migratory birds classified as migratory game birds and may be hunted in accordance with State and Federal regulations. The list of migratory game birds includes species of ducks, geese (including brant), doves and pigeons, rails, coots, gallinules and moorhens, and snipe, if there is an open season.

Daily bag limit means the maximum number of migratory game birds of a single species or combination (aggregate) of species permitted to be taken by one person in any one day during the open season in any one specified geographic area for which a daily bag limit is prescribed.

Aggregate daily bag limit means the maximum number of migratory game birds permitted to be taken by one person in any one day during the open season when such person hunts in more than one specified geographic area and/or for more than one species for which a combined daily bag limit is prescribed. The aggregate daily bag limit is equal to, but shall not exceed, the largest daily bag limit prescribed for any one species or for any one specified geographic area in which taking occurs.

Possession limit means the maximum number of migratory game birds of a single species or a combination of species permitted to be possessed by any one person when lawfully taken in the United States in any one specified geographic area for which a possession limit is prescribed.

Aggregate possession limit means the maximum number of migratory game birds of a single species or combination of species taken in the United States permitted to be possessed by any one person when taking and possession occurs in more than one specified geographic area for which a possession limit is prescribed. The aggregate possession limit is equal to, but shall not exceed, the largest possession limit prescribed for any one of the species or specified geographic areas in which taking and possession occurs.

Personal abode means one's principal or ordinary home or dwelling place, as distinguished from one's temporary or transient place of abode or dwelling such as a hunting club, or any club house, cabin, tent or trailer house used as a hunting club, or any hotel, motel or rooming house used during a hunting, pleasure or business trip.

Migratory bird preservation facility means:

1. Any person who, at their residence or place of business and for hire or other consideration; or
2. Any taxidermist, cold-storage facility or locker plant which, for hire or other consideration; or
3. Any hunting club which, in the normal course of operations; receives, possesses, or has in custody any migratory game birds belonging to another person for purposes of picking, cleaning, freezing, processing, storage or shipment.

Normal agricultural planting, harvesting, or post-harvest manipulation means a planting or harvesting undertaken for the purpose of producing and gathering a crop, or manipulation after such harvest and removal of grain, that is conducted in accordance with official recommendations of State Extension Specialists of the Cooperative Extension Service of the U.S. Department of Agriculture.

Normal agricultural operation means a normal agricultural planting, harvesting, post-harvest manipulation, or agricultural practice that is conducted in accordance with official recommendations of State Extension Specialists of the Cooperative Extension Service of the U.S. Department of Agriculture.

Normal soil stabilization practice means a planting for agricultural soil erosion control or post-mining land reclamation conducted in accordance with official recommendations of State Extension Specialists of the Cooperative Extension Service of the U.S. Department of Agriculture for agricultural soil erosion control.

Baited area means any area on which salt, grain, or other feed has been placed, exposed, deposited, distributed, or scattered, if that salt, grain, or other feed could serve as a lure or attraction for migratory game birds to, on, or over areas where hunters are attempting to take them. Any such area will remain a baited area for ten days following the complete removal of all such salt, grain, or other feed.

Baiting means the direct or indirect placing, exposing, depositing, distributing, or scattering of salt, grain, or other feed that could serve as a lure or attraction for migratory game birds to, on, or over any areas where hunters are attempting to take them.

Manipulation means the alteration of natural vegetation or agricultural crops by activities that include but are not limited to mowing, shredding, discing, rolling, chopping, trampling, flattening, burning, or herbicide treatments. The term manipulation does not include the distributing or scattering of grain, seed, or other feed after removal from or storage on the field where grown.

Natural vegetation means any non-agricultural, native, or naturalized plant species that grows at a site in response to planting or from existing seeds or other propagules. The term natural vegetation does not include planted millet. However, planted millet that grows on its own in subsequent years after the year of planting is considered natural vegetation.

WHAT HUNTING METHODS ARE ILLEGAL?

No persons shall take migratory game birds:

- With a trap, snare, net, rifle, pistol, swivel gun, shotgun larger than 10 gauge, punt gun, battery gun, machinegun, fish hook, poison, drug, explosive, or stupefying substance;
- With a shotgun of any description capable of holding more than three shells, unless it is plugged with a one-piece filler, incapable of removal without disassembling the gun, so its total capacity does not exceed three shells.
- From or by means, aid, or use of a sinkbox or any other type of low floating device, having a depression affording the hunter a means of concealment beneath the surface of the water;
- From or by means, aid, or use of any motor vehicle, motor-driven land conveyance, or aircraft of any kind, except that paraplegics and persons missing one or both legs may take from any stationary motor vehicle or stationary motor-driven land conveyance;
- From or by means of any motorboat or other craft having a motor attached, or any sailboat,

unless the motor has been completely shut off and/or the sails furled, and its progress therefrom has ceased;

- By the use or aid of live birds as decoys; although not limited to, it shall be a violation of this paragraph for any person to take migratory waterfowl on an area where tame or captive live ducks or geese are present unless such birds are and have been for a period of 10 consecutive days prior to such taking, confined within an enclosure which substantially reduces the audibility of their calls and totally conceals such birds from the sight of wild migratory waterfowl;
- By the use or aid of recorded or electrically amplified bird calls or sounds, or recorded or electrically amplified imitations of bird calls or sounds.
- By means or aid of any motor driven land, water, or air conveyance, or any sailboat used for the purpose of or resulting in the concentrating, driving, rallying, or stirring up of any migratory bird; By the aid of baiting, or on or over any baited area, where a person knows or reasonably should know that the area is or has been baited.

WHAT HUNTING METHODS ARE LEGAL?

It is legal to take migratory game birds including waterfowl and coots, on or over the following lands or areas that are not otherwise baited areas:

- Standing crops or flooded standing crops (including aquatics);
- Standing, flooded, or manipulated natural vegetation; flooded harvested croplands; or lands or areas where seeds or grains have been scattered solely as the result of a normal agricultural planting, harvesting, post-harvest manipulation or normal soil stabilization practice;
- From a blind or other place of concealment camouflaged with natural vegetation;
- From a blind or other place of concealment camouflaged with vegetation from agricultural crops, as long as such camouflaging does not result in the exposing, depositing, distributing or scattering of grain or other feed; or
- Standing or flooded standing agricultural crops where grain is inadvertently scattered solely as a result of a hunter entering or exiting a hunting area, placing decoys, or retrieving downed birds.
- It is legal to take migratory game birds, except waterfowl and coots, on or over lands or over areas that are not otherwise baited areas, and where grain or other feed has been distributed or scattered solely as the result of manipulation of an agricultural crop or other feed on the land where grown, or solely as the result of a normal agricultural operation.
- Wanton waste of migratory game birds. No person shall kill or cripple any migratory game bird without making a reasonable effort to retrieve the bird, and retain it in his actual custody, at the place where taken or between that place and either (a) his automobile or principal means of land transportation; or (b) his personal abode or temporary or transient place of lodging; or (c) a migratory bird preservation facility; or (d) a post office; or (e) a common carrier facility.

Non-toxic Shot No person may take ducks, geese (including brant), or coots while possessing shot (either in shotshells or as loose shot for muzzleloading) other than approved non-toxic shot. For a list of approved non-toxic shot, see (***http://www.fws.gov/migratorybirds/CurrentBirdIssues/nontoxic.htm***)

Opening Day of a Season No person on the opening day of the season shall possess any freshly killed migratory game birds in excess of the daily bag limit, or aggregate daily bag limit, whichever applies.

Field Possession Limit No person shall possess, have in custody, or transport more than the daily bag limit or aggregate daily bag limit, whichever applies, of migratory game birds, tagged or not tagged, at or between the place where taken and either (a) his automobile or principal means of land transportation; or (b) his personal abode or temporary or transient place of lodging; or (c) a migratory bird preservation facility; or (d) a post office; or (e) a common carrier facility.

Tagging requirement No person shall put or leave any migratory game birds at any place (other than at his personal abode), or in the custody of another person for picking, cleaning, processing, shipping, transportation, or storage (including temporary storage), or for the purpose of having taxidermy services performed, unless such birds have a tag attached, signed by the hunter, stating his address, the total number and species of birds, and the date such birds were killed. Migratory game birds being transported in any vehicle as the personal baggage of the possessor shall not be considered as being in storage or temporary storage.

Custody of birds of another No person shall receive or have in custody any migratory game birds belonging to another person unless such birds are properly tagged.

Termination of possession Subject to all other requirements of this part, the possession of birds taken by any hunter shall be deemed to have ceased when such birds have been delivered by him to another person as a gift; or have been delivered by him to a post office, a common carrier, or a migratory bird preservation facility and consigned for transport by the Postal Service or a common carrier to some person other than the hunter.

Gift of migratory game birds No person may receive, possess, or give to another, any freshly killed migratory game birds as a gift, except at the personal abodes of the donor or donee, unless such birds have a tag attached, signed by the hunter who took the birds, stating such hunter's address, the total number and species of birds and the date such birds were taken.

Transportation of birds of another No person shall transport migratory game birds belonging to another person unless such birds are properly tagged.

Species identification requirement No person shall transport within the United States any migratory game birds, except doves and band-tailed pigeons, unless the head or one fully feathered wing remains attached to each such bird at all times while being transported from the place where taken until they have arrived at the personal abode of the possessor or a migratory bird preservation facility.

Marking package or container No person shall transport by the Postal Service or a common carrier migratory game birds unless the package or container in which such birds are transported has the name and address of the shipper and the consignee and an accurate statement of the numbers of each species of birds therein contained clearly and conspicuously marked on the outside thereof.

Migratory Bird Hunting and Conservation Stamp The law requires that each waterfowl hunter 16 years of age and older must carry on his person a Migratory Bird Hunting and Conservation Stamp (Federal Duck Stamp) that is validated by the hunter signing the stamp in ink across the face of the stamp.

More restrictive regulations may apply to National Wildlife Refuges opened to public hunting. For additional information on refuge specific regulations see http://www.fws.gov/refuges/

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- **First Aid**
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- **Waterfowl Upland Game**
- **Bow Hunting**
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- **Hunt Planning**
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Exhibit S

Waterfowl Impacts of the Yolo Bypass Salmonid Habitat Restoration and Fish Passage Project – An effects analysis tool

October 20, 2017

Prepared for:
California Department of Water Resources

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1 Executive Summary

The Yolo Bypass Salmonid Habitat Restoration and Fish Passage Project proposes to increase fish habitat functions and values within the Yolo Bypass through the activation of floodplain processes by increasing the frequency, duration, and amount of flooding over the Fremont Weir between November and April. To evaluate various management alternatives under which the Project might operate and understand how the effects of those alternatives on waterfowl may either be minimized or off-set, this analysis designed a tool to model the effects on waterfowl and their habitat resulting from a change in Yolo Bypass flood management. Waterfowl habitat for the purposes of this analysis is defined as managed seasonal wetlands and winter flooded rice fields.

Potential flood flows through the future operation of gated notch variations in the Weir were analyzed. We evaluated the effects of five management alternatives (Existing Conditions and operational Alternatives 1, 4, 5 & 6) in three water years representing an exceedingly wet year (1999), a dry year (2002) and a wetter than normal year (2005). California Department of Water Resources provided the hydrologic modeling data via TUFLOW©. The hydrologic modeling data for the three years was used in combination with the landcover data to produce the amount of accessible and non-accessible acres of habitat available for waterfowl forage. These results were utilized to run the TRUEMET model to determine the potential impact to waterfowl from these Alternatives.

Comparisons were made to the Central Valley Joint Venture's (CVJV) current assumptions about food energy resources in the Yolo Basin planning area and between the Existing Conditions alternative and the four operational alternatives. The findings indicate that in the exceedingly wet year (1999) there were impacts to food forage availability in late November to December. However, there was very little change to the point when supply of food falls below food demand. This trend is repeated fairly consistently for each of the water years modeled and each of the alternatives. In each case, Alternatives 1 and 6 have the most impact on food supply mid-winter but none of the alternatives significantly alter the point at which demand exceeds supply in late-winter/early spring (less than 2-3 days).

The potential future changes as a result of the alternatives may be a reduction in hunter opportunity. Hunting opportunity and the long-term incentive to invest in the management of seasonal wetlands significantly drive the supply availability. Reductions in supply as a result of lost hunter opportunity would result in less food available and might ultimately cause demand to exceed supply earlier than under current and existing conditions.

2 Background

The Yolo Bypass Salmonid Habitat Restoration and Fish Passage Project (Project) has been developed to improve fish passage and increase floodplain fisheries rearing habitat in Yolo Bypass and the lower Sacramento River basin. The United States Department of the Interior, Bureau of Reclamation (Reclamation), as the Federal lead agency under the National Environmental Policy Act (NEPA), and the California Department of Water Resources (DWR), as the State of California (State) lead agency under the California Environmental Quality Act (CEQA), have prepared a joint Draft Environmental Impact Statement/Environmental Impact Report (EIS/EIR) to assess impacts of the Project.

The Project actions would implement Reasonable and Prudent Alternative (RPA) action I.6.1 and, in part, RPA action I.7, as described in the 2009 National Oceanic and Atmospheric Administration National Marine Fisheries Service (NMFS) *Biological Opinion and Conference Opinion on the Long-Term Operations of the Central Valley Project and State Water Project* (NMFS BO) and the 2012 Yolo Bypass Salmonid Habitat Restoration and Fish Passage Implementation Plan (Reclamation and DWR 2012).

The 2012 Yolo Bypass Salmonid Habitat Restoration and Fish Passage Implementation Plan (Implementation Plan) was prepared jointly by the California Department of Water Resources (DWR) and the U.S. Bureau of Reclamation (Reclamation) to address two specific RPA Actions set forth in the NMFS Operation BO:

RPA Action I.6.1: Restoration of Floodplain Rearing Habitat, through the increase of seasonal inundation within the lower Sacramento River basin; and

RPA Action I.7: Reduce Migratory Delays and Loss of Salmon, Steelhead, and Sturgeon, through the modification of Fremont Weir and other structures of the Yolo Bypass.

The Implementation Plan considers alternatives to increase juvenile fish rearing in the Yolo Bypass when the floodplain is inundated and improve adult fish passage at the Fremont Weir. While these actions are expected to improve fish habitat functions, there are concerns that there is the potential for the actions to have negative impacts on existing waterfowl habitat in the Yolo Bypass because existing managed wetlands and rice fields could be flooded at depths too great to allow for waterfowl foraging. Dabbling waterfowl prefer to forage in very shallowly flooded seasonal wetlands, but can feed in relatively deeper areas by upending as shown in Figure 1. Due to their physiology, they are limited to foraging in water depths of less than 18 inches (Nelson, 2012; Fredrickson, 1982) with preferred foraging depths less than 10 inches.

Figure 1. Upending dabbling ducks have a limit to the depth of water that allows foraging (Garg, 2007)

Five alternatives were evaluated under three historic water year conditions that represent a wet water year (1999) a dry water year (2002), and an above normal (wetter than normal) water year (2005). The three water years were chosen to represent years where there were flooding events that occurred in December, January, and February (the period of heaviest waterfowl usage in the Bypass) and where there were noticeable differences in the extent of flooding exhibited by the various alternatives in comparison to existing conditions in that year.

For each water year five alternatives were evaluated and included: No Action (Existing conditions), Alternative 1, Alternative 4, Alternative 5 and Alternative 6.

Alternative 1: East Side Gated Notch

Alternative 1, East Side Gated Notch, would allow increased flow from the Sacramento River to enter the Yolo Bypass through a gated notch on the east side of Fremont Weir. The invert of the new notch would be at an elevation of 14 feet, which is approximately 18 feet below the existing Fremont Weir crest. Water would be able to flow through the notch during periods when the river levels are not high enough to go over the crest of Fremont Weir (at an elevation of 32 feet).

Alternative 4: West Side Gated Notch – Managed Flow

Alternative 4, West Side Gated Notch – Managed Flow, would have a smaller amount of flow entering the Yolo Bypass through the gated notch in Fremont Weir than the other alternatives, but it would incorporate water control structures to maintain inundation in defined areas for longer periods of time within the northern Yolo Bypass. Alternative 4 would include the same gated notch and associated facilities as described for Alternative 3 (see Draft EIS/EIR document for Alternative 3 description). However, it would be operated to limit the maximum inflow from exceeding 3,000 cfs.

Alternative 5: Central Multiple Gated Notches

Through the strategy of using multiple gates and intake channels, Alternative 5, Central Multiple Gated Notches, has the goal of increasing the number of outmigrating juvenile fish that enter the Yolo Bypass. Trapezoidal channels create some limitations for fish passage because they have smaller flows at lower river elevations (because the channel is smaller at this elevation) when winter-run Chinook salmon are outmigrating. Alternative 5 includes multiple gates so that the deeper gate could allow more flow to enter the bypass when the river is at lower elevations. But flows would move to other gates when the river is higher to control inflows while maintaining fish passage conditions.

Alternative 6: West Side Large Gated Notch

Alternative 6, Large Gated Notch, is a large notch in the western location that would allow flows up to 12,000 cfs to enter the Yolo Bypass. It was designed with the goal of entraining more fish with the strategy of allowing more flow into the bypass when the Sacramento River is at lower elevations. Typically, winter-run Chinook salmon move downstream during the first high flow event of the season. This flow event is sometimes not high enough to result in what would be substantial flows into the bypass under Alternatives 1 through 5. The gated notch could allow more flow to enter during winter-run Chinook salmon outmigration, potentially maximizing fish entrainment.

Four main drivers or effects on waterfowl from increased flooding in the Yolo Bypass include: 1) changes to recreational use; 2) loss of farming and hunting income; 3) reductions in waterfowl foraging habitat; and 4) the loss of wetland seed production due to later spring drawdown of the inundated floodplain. The work conducted under this Task Order provides a method to evaluate the effect on waterfowl foraging habitat and therefore the capacity of the Yolo Bypass to support its proportion of waterfowl population goals as defined in the Central Valley Joint Venture's Implementation Plan (as derived from the North American Waterfowl Management Plan).

3 Overview of the Waterfowl Effects Analysis

The Yolo Bypass lies within the boundaries of the Central Valley Joint Venture's (CVJV) Yolo Basin planning area (Figure 2). The CVJV's dabbling duck population objectives are developed for each of the major 'basins' within the Central Valley, including the Yolo Basin. To analyze the effects of altered flooding regimes on dabbling ducks, a series of linked models were used (Figure 3). Land cover information was combined with flood-depth model results (Figure 4) and input into the Bypass Depth (BDepth) GIS model. This GIS model separated the depth of each land cover class into dry (0"), managed/shallow (≤18"), or deep (>18") water categories and performed that action for each date between October 1 and May 31 (Figure 5). Summations of the acre calculations from these outputs, in combination with the Yolo Basin's waterfowl population objectives, were then used in the TRUEMET Avian Bioenergetics Model for the Yolo Basin. Final output of this progression was food energy supply and food energy demand curves (Figure 6) that show how changes in flooding in the Yolo Bypass might affect the capacity for waterfowl habitats in the Bypass to provide adequate food resources for the waterfowl population in the Yolo Basin.

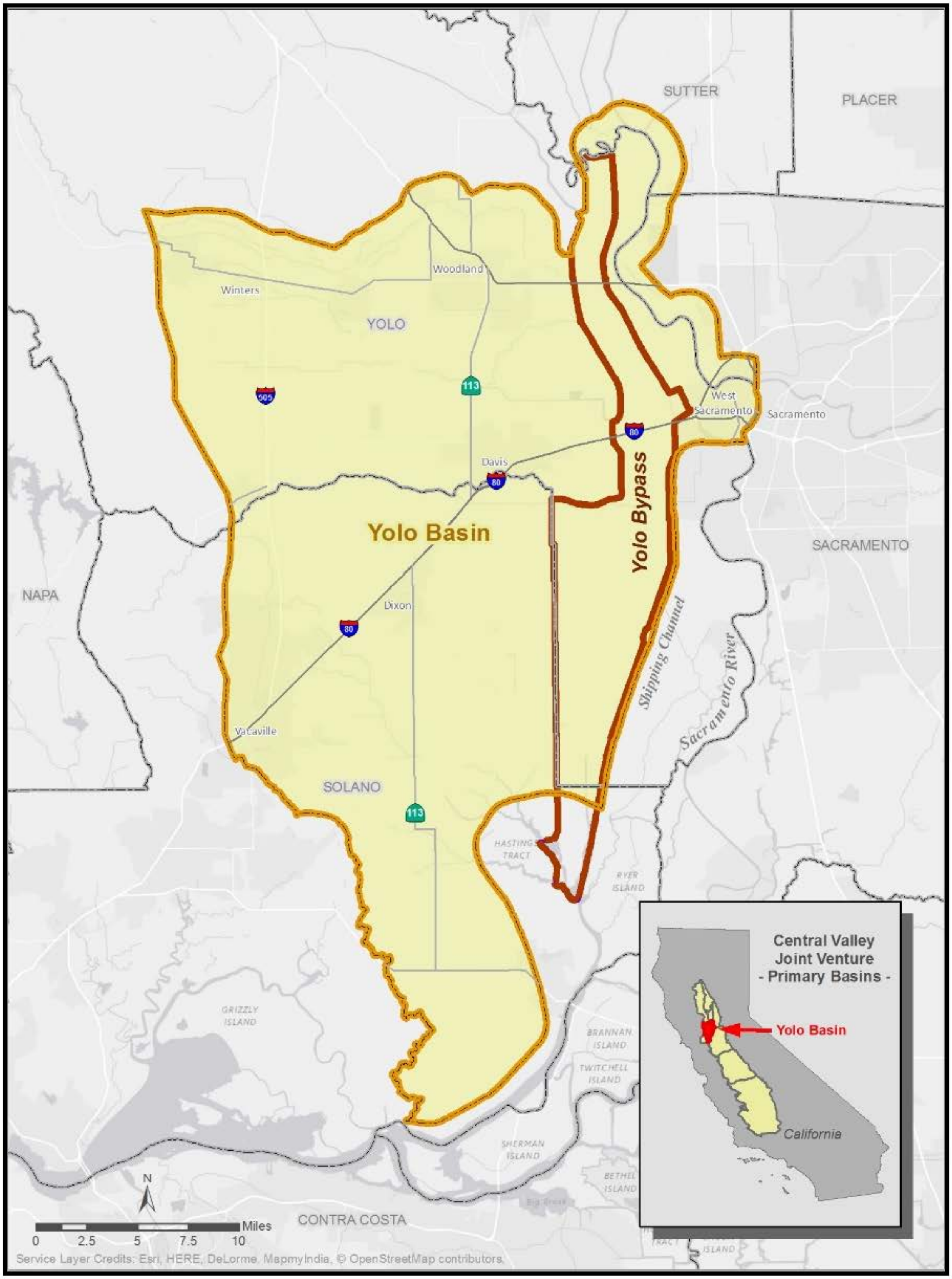


Figure 2. Location of the Yolo Bypass.

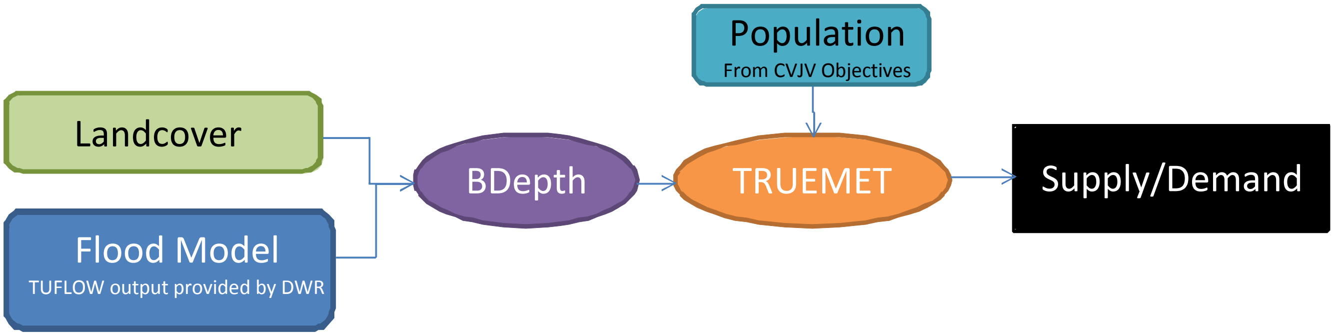


Figure 3. Data inputs and models used in the modeling of the loss of winter foraging habitat

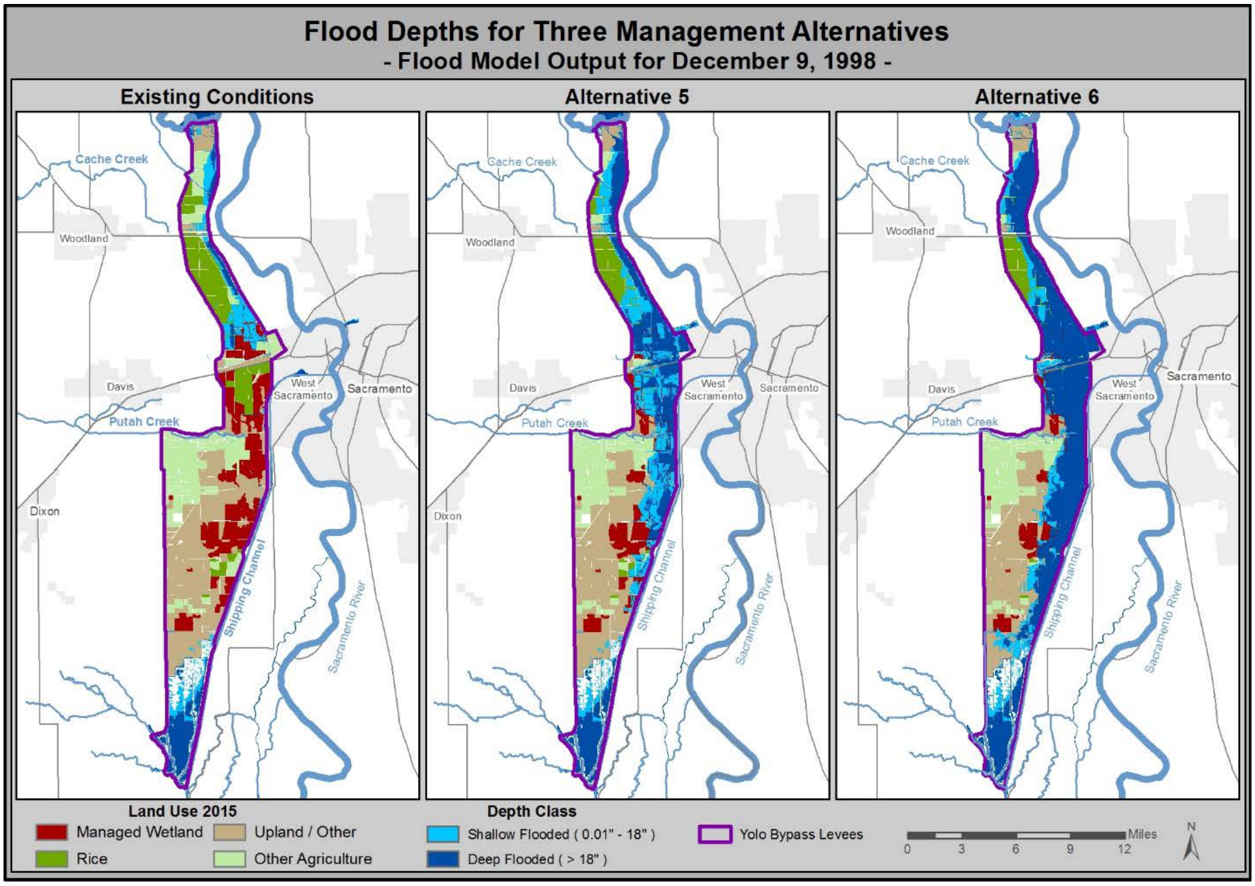


Figure 4. Example of a single day of flood depth model ouputs overlaid on land cover data. Although the Alternative 6 flooding pattern depicted here does not show the maximum flooding level (entire bypass flooded) experienced in the Bypass, it does represent the flooding pattern on the date where the maximum difference was observed in wetland acres between Existing Conditions and any Alternative in any of the three years evalutated.

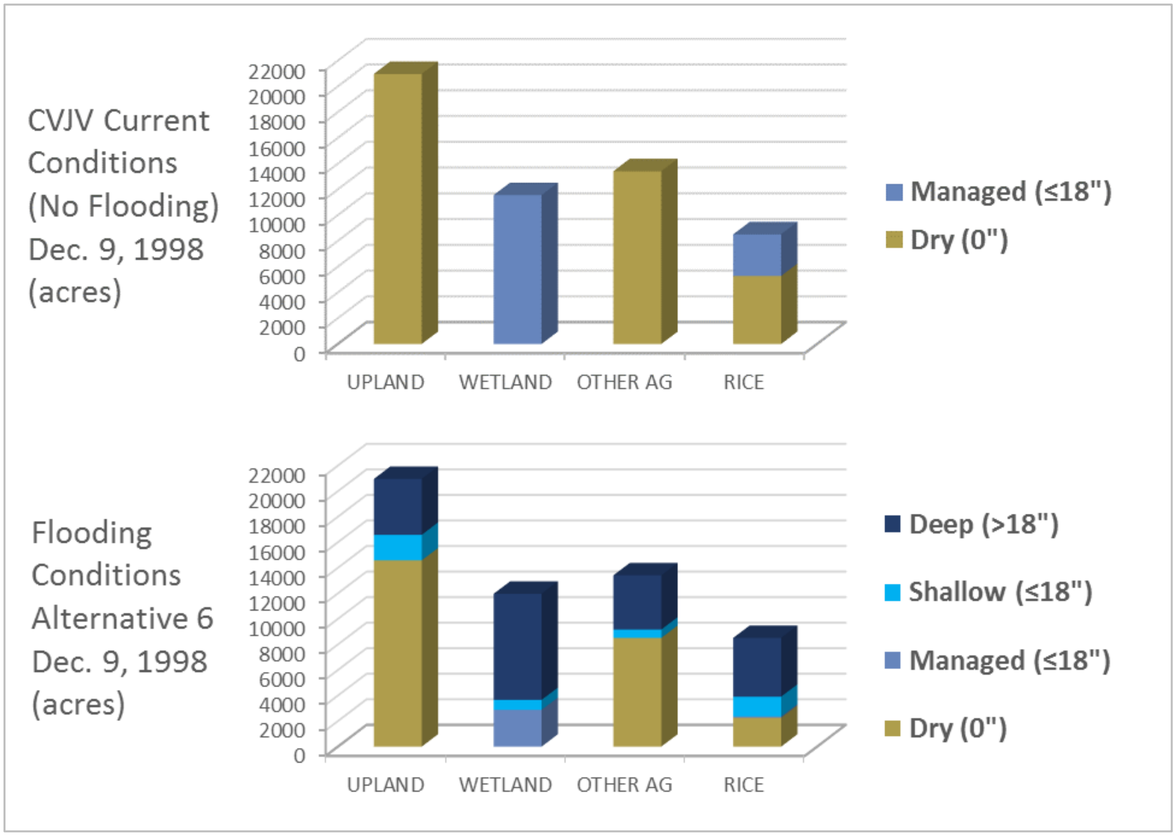


Figure 5. Graphic example of the acre calculation output from the BDepth model. This graphic compares data from a single day in water year 1999 to a year when no flooding occurs in the bypass.

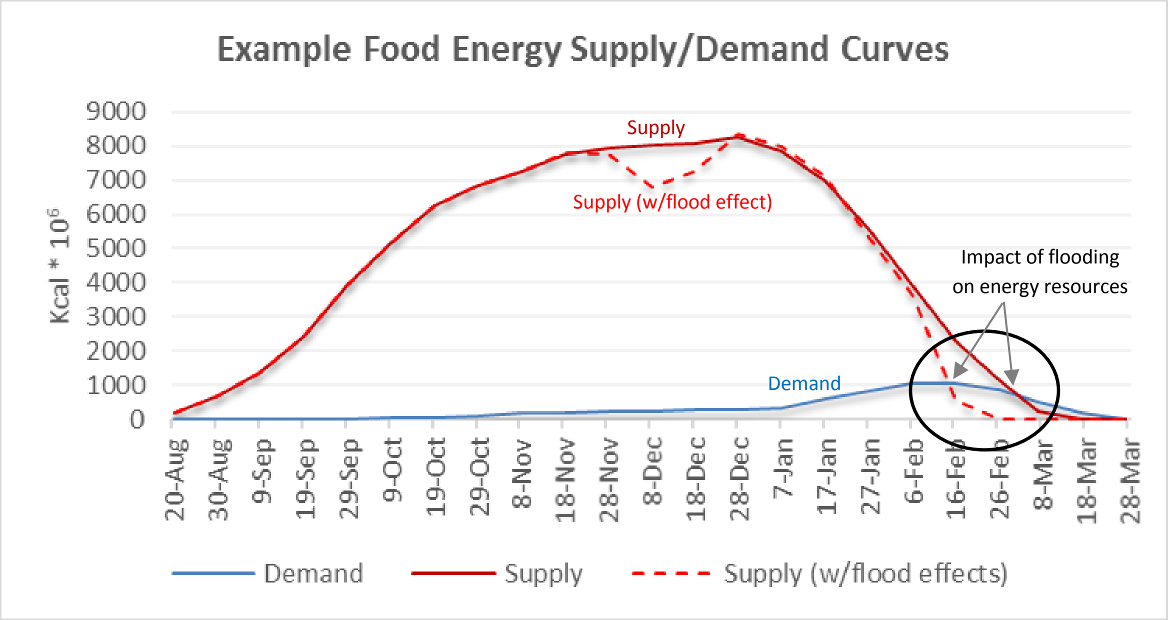


Figure 6. Example of food energy supply/demand curves output from TRUEMET model.

4 Methods

4.1 BDepth GIS Model

4.1.1 Land Cover Data

Land cover data for the analysis was provided by DWR. The data layer included crop information on a field level for all areas in the Yolo Bypass for a five year period from 2005 - 2009. Non-agriculture areas were labeled as either wetland or pastureland (upland). This was the same landcover layer used for other analyses conducted for the DWR's EIS/EIR report. Two changes were made to the dataset for this analysis. First, rice and corn are the only two crop types that are considered by the CVJV to have significant foraging value for wintering waterfowl in the Yolo Basin so the data layer was recoded to represent four cover types: Wetland, Upland (Pasture/Grassland), Rice, and Other Agriculture. There was no class for Corn because only a single agricultural field was labeled as corn in only one of the five years. Since that field was planted to other crops in all other years it was grouped with the Other Agriculture class. Additionally, because agricultural crops grown in an individual field can vary from year to year based on market prices and other factors, only fields that were planted to rice in at least 3 out of the 5 years were labeled as Rice in the layer used for the final analysis. The second change in the land cover layer was made in the Wetland class. The intent of this analysis is to address impacts to the current conditions of waterfowl habitat in the Yolo Bypass. Several wetland restorations and enhancement projects have occurred within the Bypass between 2009 (the most recent year represented in the original land cover layer) and 2016, so these restored/enhanced wetland areas were relabeled to Wetland in the final landcover layer (Figure 7).

4.1.1 TUFLOW Model Flood Depth Data

DWR provided modeling results from the TUFLOW© Flood and Coastal Simulation Software (TUFLOW), (BMT Group Ltd., United Kingdom) for a 16-year period of analysis (1997 – 2012) for each of the five alternatives analyzed. The TUFLOW output provided the patterns of inundation and depth throughout the Bypass on a daily basis between October 1 and May 31. The data was provided in NetCDF data format and imported into ESRI ArcGIS software using the Make NetCDF Raster tool.

4.1.2 BDepth Model

The BDepth model is a custom Python script tool written specifically for this project that runs within ESRI ArcGIS software. The tool automated the iterative process of:

1) importing a single date of flood inundation data from a NetCDF file into ArcGIS raster format;
2) recoding the depth layer into a 3-class layer representing dry, shallow-flooded, and deep-flooded areas;
3) clipping the 3-class depth layer to the extent of the land cover layer;
4) overlaying the flood and landcover layers using the "Union" command;
5) calculating the acres of each land cover type and flood depth combination;
6) outputting the acreage data to a text file; and
7) looping through this process for all 242 days (Oct 1 – May 31) in a given water year.

This tool was run 15 times, once for each alternative in each of the three evaluated water years. The output produced a text file containing the number of acres of each land cover class in each of the three depth classes for each day of that water year. These acre calculations were then used as input to the TRUEMET energetics model.

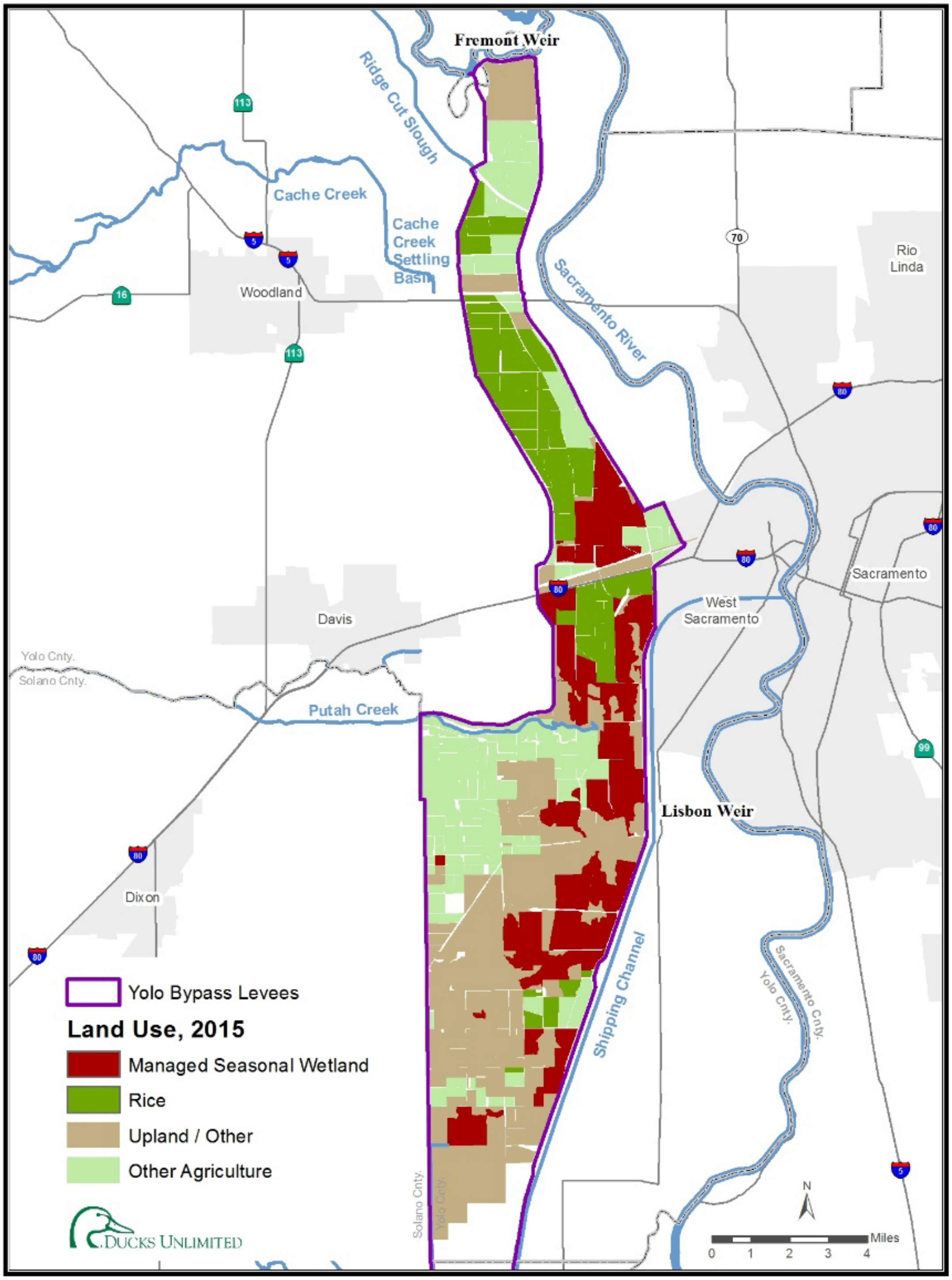


Figure 6. Land cover layer used for this analysis.

4.2 TRUEMET Energetics Model

Conservation planning for waterfowl in the Central Valley is the responsibility of the Central Valley Joint Venture (CVJV). The CVJV has divided the Central Valley into nine drainage basins that serve as planning units, including the Yolo Basin. Conservation and habitat objectives are established at the drainage basin scale, and the biological assumptions and data used to develop these objectives are fully described in the CVJV's implementation plan (CVJV 2006). Although this effects analysis is focused on management alternatives that are specific to the Yolo Bypass, our analysis was conducted at the larger scale of the Yolo Basin itself. We believe that the CVJV's planning approach provides the best context for evaluating these management alternatives; however, this requires us to report model results at the drainage basin scale. Moreover, the CVJV has established waterfowl population objectives at the drainage basin scale and these objectives cannot be distilled to smaller scales like the Yolo Bypass.

Conservation planning for migrating and wintering waterfowl in the Central Valley, and by extension the Yolo Bypass, is largely driven by the food limitation hypothesis which states that food availability during the non-breeding period influences survival and reproductive success through its effects on body condition (Williams et al. 2014). The fundamental assumption is that by providing adequate food and reducing energetic costs during fall and winter, birds will maintain good body condition, overwinter survival will be high and birds returning to the breeding grounds will be in good condition and may be more successful in reproduction.

Waterfowl in the Central Valley experience considerable variation in habitat availability from fall through spring. As a result, the CVJV used the daily ration model TRUEMET to evaluate landscape conditions and establish conservation objectives for non-breeding waterfowl (Petrie et al. 2016). TRUEMET allows the user to define when foraging habitats become available within the time period being modeled. As a result, the relationship between population energy demand and energy supply can be examined for any point in time for multiple foraging guilds, and exploitive competition for food resources among foraging guilds can be accounted for (e.g., the effects of goose consumption on dabbling duck food resources is accounted for in all period-specific estimates of dabbling duck energy supply). There are eight explicit inputs required for each TRUEMET model run: 1) number of days or time periods being modeled within the overall season of interest, 2) population objectives or estimates for each waterfowl foraging guild within each time period, 3) daily energy expenditure of a single bird in each foraging guild within each time period, 4) habitat types used by each waterfowl foraging guild to satisfy daily energy requirements, 5) area and availability of habitat types during each time period, 6) biomass of food in each habitat type at the start of the overall season of interest, 7) nutritional quality (i.e., true metabolizable energy content) and 8) decomposition rate of each food type. Implementation of any alternative proposed by the Yolo Bypass Salmonid Habitat Restoration and Fish Passage Project would specifically affect input #5 (above), the area and availability of habitat types during each time period. The Project could potentially affect input #6, the biomass of food in each habitat type, if the various flooding regimes alter plant species composition and/or the quality and quantity of seed production within managed wetland habitats in subsequent years. The analysis conducted under this task order only addresses the impacts to model input #5.

Within TRUEMET, the Total Energy Demand (TED; in kcal) of a foraging guild in a time period is calculated as:

$$TED_{jk} = POP_{jk} \times D_k \times DEE_{jk}$$

where TED_{jk} = total energy demand of foraging guild j in time period k, POP_{jk} = population size of foraging guild j in time period k, D_k = number of days in time period k, and DEE_{jk} = daily energy expenditure (kcal) of an average bird in foraging guild j in time period k. The Total Energy Supply (TES; in kcal) available to a foraging guild in a time period is calculated as:

$$TES_{jk} = \sum_{i=1}^{n} NEFH_{ijk}$$

where TES_{jk} = total energy supply available to foraging guild j in time period k, and $NEFH_{ijk}$ = net energy available in foraging habitat i to foraging guild j at the beginning of time period k. This equation assumes that foraging guild j has been given access to foraging habitat i within the model.

The TRUEMET model requires the user to identify the maximum area of foraging habitat (FH_i) possible within the time frame being modelled. This habitat is placed in a "reservoir" where it can be made available incrementally over time by the user, including releasing all of it in a single time period. For example, managed wetlands can be released from the reservoir at a rate that reflects their flooding schedule. Conversely, foraging habitats can be retrieved by the model and placed back in the reservoir where they are no longer available to the birds (e.g., where managed wetlands become deeply flooded and the food resources in these habitats cannot be accessed). The rate at which a foraging habitat is released from the reservoir or retrieved is dependent on user inputs that define the availability of this foraging habitat over the time (i.e., the user builds "availability curves" within the model). Thus, $NEFH_{ijk}$ is a function of the cumulative sum of food energy released from the reservoir prior to and including time period k, the cumulative sum of waterfowl food consumption and food decomposition that occur in time periods prior to k, and the cumulative energy of foraging habitat i returned to the reservoir in time periods prior to k (e.g. due to drying conditions). The model calculates $NEFH_{ijk}$ as follows:

$$NEFH_{ijk} = \left\{ \sum_{k=1}^{k-1} \left[EFH_{ijk} - CFH_{ik} - DFH_{ik} - R_{ik} \right] \right\} + EFH_{ijk}$$

where EFH_{ijk} is the energy of foraging habitat i released from the reservoir at the beginning of time period k to which foraging guild j has access, CFH_{ik} = total consumption of food energy in foraging habitat i during time period k, DFH_{ik} = decomposition of food energy in foraging habitat i during period k, and R_{ik} = energy of foraging habitat i returned to the reservoir at the end of time period k (e.g., due to drying conditions). The model calculates EFH_{ijk} as follows:

$$EFH_{ijk} = FBFH_i \times MEFH_i \times HFH_{ijk}$$

where $FBFH_i$ = the food biomass per unit area of FH_i that resides in the reservoir (i.e. starting condition), $MEFH_i$ = the true metabolizable energy (e.g., kcal/g) of foods provided by FH_i, and HFH_{ijk} = area of FH_i released from the reservoir at the beginning of period k to which guild j has access. TRUEMET calculates CFH_{ik} as follows:

$$CFH_{ik} = \sum_{j=1}^{n} \frac{NEFH_{ijk}}{TES_{jk}} \times \min(TED_{jk}, TES_{jk})$$

where CFH_{ik}= consumption of food energy in foraging habitat i in period k by all guilds having access to habitat i. Finally, TRUEMET calculates DFH_{ik} as follows:

$$DFH_{ik} = \mathrm{T}EFH_{ik} \times DRFH_{ik}$$

where DFH_{ik} = decomposition of food energy (kcal) in foraging habitat i in period k, $TEFH_{ik}$ is the total energy of foraging habitat i that exists outside the reservoir in period k, and $DRFH_{ik}$ is the decomposition rate applied to the food in foraging habitat i in period k expressed as a fraction.

The equation for CFH_{ik} illustrates an important assumption of the model. For each time period, birds in a foraging guild are assumed to consume a food in proportion to its availability where availability is defined in energetic terms. For example, assume that birds in a duck guild are given access to managed wetlands and that this foraging habitat provides forty percent of all the food energy available to ducks in time period k. Within time period k, ducks would meet forty percent of their food energy needs from managed wetlands (if $TED_{jk} \geq TES_{jk}$) then the food resources provided by managed wetlands would be completely exhausted within time period k, though this foraging habitat could provide food energy in future time periods if additional managed wetlands were made available in these future periods).

The assumption that foods are consumed in proportion to their contribution to total food energy may be violated in some model scenarios. Birds may show some selection in the foods they eat, and thus deplete some foods at a faster or slower rate than what would be predicted by relative energy abundance alone. Most applications of the model are more concerned with the total energy available to a guild in each time period, as opposed to accurately predicting how quickly a given foraging habitat is depleted. The biological assumption is that birds will switch to less favored foods as more desired foods are depleted. However our ability to accurately model food energy for each foraging guild using TRUEMET is strongly dependent on our understanding and assumptions about how foraging guilds overlap in their use of habitats and the exploitive competition for food resources that result from this overlap. Thus, careful consideration must be given about the habitats that are assumed to be used by each foraging guild.

TIME PERIODS.

Migrating and wintering waterfowl are present in the Central Valley from mid-August through the end of March. As a result, we modeled waterfowl population energy demand and food energy supply for the Yolo Basin at ten-day intervals between August 16 and March 31.

Waterfowl guild population objectives and estimates. The CVJV now recognizes two foraging guilds, ducks and geese, and these same foraging guilds were used for here. Approximately 92% of all ducks are dabbling ducks, whereas the remainders are diving ducks. Diving ducks were pooled with dabbling ducks in the TRUEMET model to account for their potential competition for food resources with dabbling ducks, especially wetland plant seeds in managed seasonal wetlands. The goose guild includes white-fronted geese, lesser snow geese, Ross's geese, western Canada geese, Aleutian cackling geese, and Tundra swans. The majority of geese using the Yolo Basin are white-fronted geese, lesser snow geese, and Ross's geese.

Duck population objectives for each 10-day interval represent the number of birds that are expected to winter in the Yolo Basin when continental breeding duck populations are at NAWMP goals. Population objectives for the Central Valley as a whole were first "stepped down" from the NAWMP and then divided among the CVJV's nine drainage basins based on an understanding of bird distribution in the Central Valley. Five percent of the Central Valley duck population objective was assigned to the Yolo Basin (CVJV 2006). This equates to approximately 30.4 million duck-use-days or DUD's, where one DUD equates to a single duck residing in the Yolo Basin for one day. However, transforming these DUD's into 10-day population objectives requires an understanding of duck migration chronology within the Yolo Basin. We used information on duck migration chronology specific to the Yolo Basin (Fleskes et al. 2005) to establish these 10-day population objectives using the same approach adopted in the 2006 CVJV Implementation Plan (CVJV 2006). This resulted in population objectives that were highest in late winter-early spring, and reflected the Fleskes et al. (2005) study that reported high bird numbers in the Yolo Basin during these latter time periods (Table 1). Duck numbers in the Central Valley as a whole peak in late December-early January after which they decline (CVJV 2006). As a result, we also established 10-day population objectives for the Yolo Basin based on duck migration chronology for the Central Valley as a whole (Table 1). This set of alternative population objectives was used in some model scenarios to examine how robust our results were to different assumptions about migration chronology, which undoubtedly varies from year to year. These alternative population objectives still equated to 30.4 million DUDS's, but represent a different temporal pattern of bird use of the Yolo Basin from mid-August through March.

Many North American goose populations have exceeded their population objectives and Joint Ventures have been advised to use recent goose counts when developing implementation plans (Koneff 2003). As a result, we used recent counts of geese in the Central Valley (Olson 2015) and information on migration chronology (Fleskes et al. 2005) to estimate the number of geese in the Yolo Basin for each 10-day period between mid-August and late March. Although our effects analysis is focused on ducks, not geese, it is important to account for the effects of goose consumption on duck food resources in the Yolo Basin.

Ten Day Period	Population Objective[a]	Population Objective[b]
Aug 20	1,346	18,045
Aug 30	2,788	35,406
Sept 9	3,558	43,021
Sept 19	4,386	51,117
Sept 29	7,000	70,812
Oct 9	13,755	94,325
Oct 19	29,166	115,508
Oct 29	50,544	131,345
Nov 8	73,584	145,903
Nov 18	94,755	162,928
Nov 28	108,821	188,348
Dec 8	118,636	212,690
Dec 18	124,838	224,832
Dec 28	126,628	223,856
Jan 7	143,521	214,779
Jan 17	231,951	198,394
Jan 27	316,169	182,740
Feb 6	397,999	167,511
Feb 16	467,338	152,225
Feb 26	384,707	135,630
Mar 7	235,821	188,259
Mar 17	78,667	98,678
Mar 27	5,015	15,607

[a] Ten-day duck population objectives for the Yolo Basin based on the CVJV's current assumptions about duck migration chronology for the Yolo Basin.

[b] Ten-day duck population objectives for the Yolo Basin based where duck migration for the Yolo Basin is assumed to be the same as for the Central Valley as a whole.

Table 1. Ten-day duck population objectives represented under two different migration chronologies.

DAILY ENERGY EXPENDITURE

The daily energy expenditure (DEE) of geese and swans was estimated by multiplying the resting metabolic rate (RMR) of an "average" bird by a factor of three to account for the energy costs of free living (Williams et al. 2014). We used the following equation from Miller and Eadie (2006) to calculate the RMR for geese and swans:

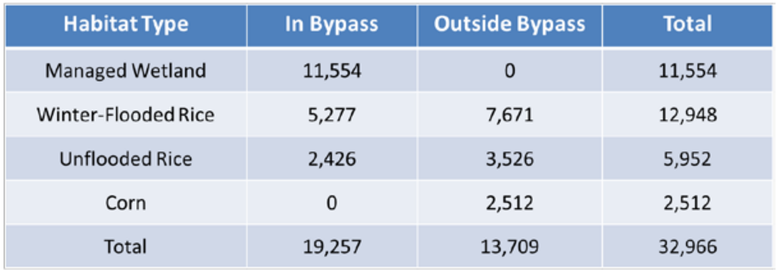
$$\text{Geese and Swans RMR } (kJ\ /\ \text{day}) = 419 * (\text{body mass in kg})^{\ 0.719}$$

Body mass estimates were for geese and swans were obtained from Bellrose (1980), and adult weights were used to avoid underestimating DEE. The relative abundance of species included in the goose foraging guild varied by time period. As a result, we calculated a weighted body mass for all time periods. Finally, we converted kJ to kcal by dividing the latter by 4.18 .

The CVJV did not use an estimate of RMR to estimate DEE for ducks. Instead, they relied on Miller and Newton's (1999) period specific estimates of DEE for pintails between August and March that were derived from pintail body mass and carcass composition. We adopted those values here. Weighted body mass for ducks in the Central Valley is 0.84 kg. This is similar to pintails (0.92 kg), which make up **46%** of the CVJV duck population objective (CVJV 2006).

FORAGING HABITAT AREA AND AVAILABILITY

The CVJV assumes that ducks in the Central Valley rely on three major foraging habitats, including managed seasonal wetlands, harvested rice fields that are winter-flooded, and harvested grain corn fields that are flooded and unflooded (CVJV 2006). We adopted the same assumptions for ducks that utilize the Yolo Basin. Geese were assumed to forage in harvested rice fields and harvested grain corn fields regardless if they are flooded, and believed to use wetlands mostly for roosting purposes. The area of each of these habitat types in the Yolo Bypass and Yolo Basin as a whole is presented in Table 2.



Habitat Type	In Bypass	Outside Bypass	Total
Managed Wetland	11,554	0	11,554
Winter-Flooded Rice	5,277	7,671	12,948
Unflooded Rice	2,426	3,526	5,952
Corn	0	2,512	2,512
Total	19,257	13,709	32,966

Table 2. Acres of foraging habitat in the Yolo Basin.

Temporal variation in habitat availability can strongly influence the food supplies available to ducks and geese. As a result, we incorporated the CVJV's current assumptions about the temporal availability of important waterfowl habitats in the Yolo Basin. In general, flooding of managed seasonal wetlands begins in late August with all wetlands flooded by late November. These wetland habitats remain flooded through March, after which they are drawn-down (de-watered) to promote the growth of moist-soil plant species during late spring and summer. Harvest of rice and grain corn generally begins in early September and is complete by late October to early November. For harvested rice fields that are winter-flooded, flooding begins in late September and peaks by mid-winter after which the amount of winter-flooded rice declines steadily through March (CVJV 2006, Petrie et al. 2016).

BIOMASS, NUTRITIONAL QUALITY, AND DECOMPOSITION RATES OF WATERFOWL FOOD TYPES

We used waterfowl food biomass estimates for managed seasonal wetlands and harvested grain corn fields presented in the CVJV Plan (2006), but updated those estimates for rice habitats on the basis of more recent information (Fleskes 2012). We also slightly adjusted food biomass estimates for managed seasonal wetlands after reviewing the study on which these estimates were based (Naylor 2002). The nutritional quality, or true metabolizable energy, of waterfowl foods was also taken from the CVJV Plan. We also used estimated decomposition rates for seeds in managed wetlands and rice and corn fields from the CVJV Plan, which are based on earlier work by Nelms and Twendt (1996) and Naylor et al. (2002).

Although seed production from moist soil plants accounts for most of the food energy available to ducks in managed seasonal wetlands, invertebrates can make up 25% of the diet from January through March (Euliss and Harris 1987). To recognize the potential importance of invertebrates during late winter, the CVJV assumes that managed seasonal wetlands provide 31 kg/ha beginning January 1 (CVJV 2006). This estimate is based on late winter estimates of invertebrate biomass for seasonal wetlands in the Mississippi Alluvial Valley (Manley 1999;).

MODEL SCENARIOS

To evaluate the effects of the Project on duck food supplies in the Yolo Basin we first modeled the relationship between duck population energy demand and food energy supply in a manner that reflected the CVJV's current assumptions about habitat availability in the Yolo Basin (Current Conditions). Those conditions assume that managed seasonal wetlands, winter-flooded rice, and harvested grain corn fields are all managed at water depths < 18, which allows ducks to fully exploit the food resources provided by these habitats (harvested grain corn fields that are not flooded are also assumed to be available to ducks as described above). Current conditions were modelled using the CVJV's existing assumptions about duck migration chronology in the Yolo Basin (Current Conditions MC 1) and where duck migration chronology was assumed to reflect that of the Central Valley as a whole (Current Conditions MC 2).

Under existing conditions of the Fremont Weir, the Yolo Bypass experiences varying levels and durations of flooding events in any given year, ranging from nearly no flooding in exceedingly dry years to complete flooding of the bypass for extended periods in exceedingly wet years. Assuming that impacts to waterfowl foraging availability may vary as a result of this natural variation in flooding events, we evaluated three historic water year conditions that represent a wet water year (1999) a dry water year (2002), and an above normal (wetter than normal) water year (2005).

In addition to modelling the relations between duck energy demand and food energy supply for each scenario, we also plotted how the acreage of managed seasonal wetlands $\leq$ 18 inches in depth (optimal foraging conditions for ducks) varied among scenarios between late August and late March (Figures 7 - 9). Managed seasonal wetlands contain the bulk of food resources available to ducks in the Yolo Basin (and the Yolo Bypass itself; see Results), and these differences in the availability of managed wetlands among scenarios offer a simple but direct view on how a given alternative impacts the principle food supply of ducks in the Yolo Basin. These same wetland habitats also provide for most of the hunting opportunity in the Yolo Basin, and can provide some insight into how duck hunting opportunities on public and privately managed wetlands may also be impacted by these alternatives.

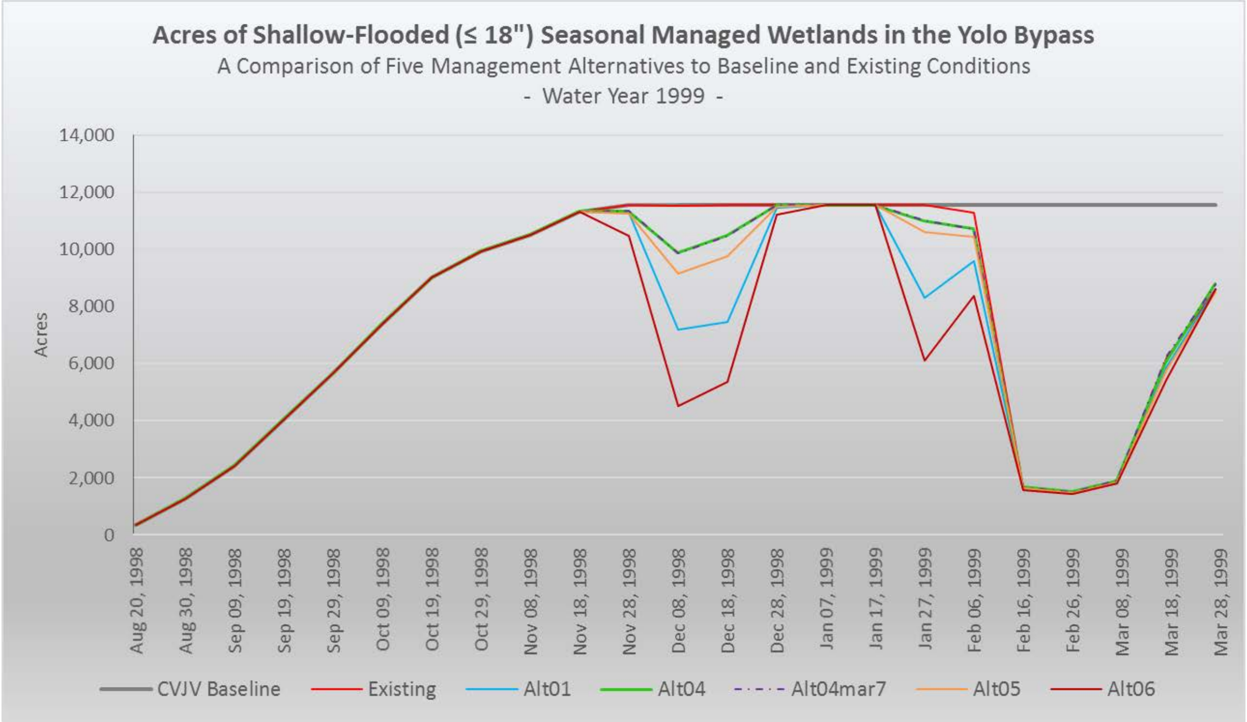


Figure 7. Average of number of acres of shallow-flooded (≤18") managed seasonal wetlands on a 10-day period, used as inputs to calculate the TRUEMET supply curves for 5 alternatives, baseline, and existing conditions in water year 1999.

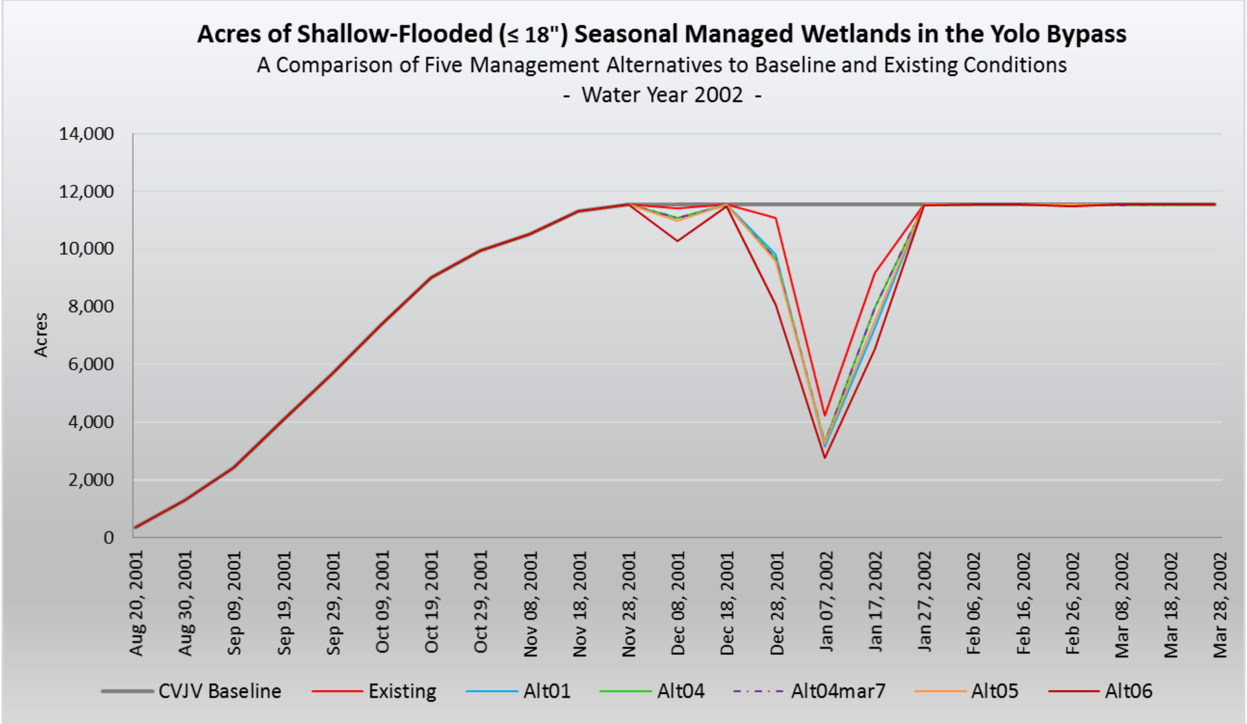


Figure 8. Average of number of acres of shallow-flooded (≤18") managed seasonal wetlands on a 10-day period, used as inputs to calculate the TRUEMET supply curves for 5 alternatives, baseline, and existing conditions in water year 2002.

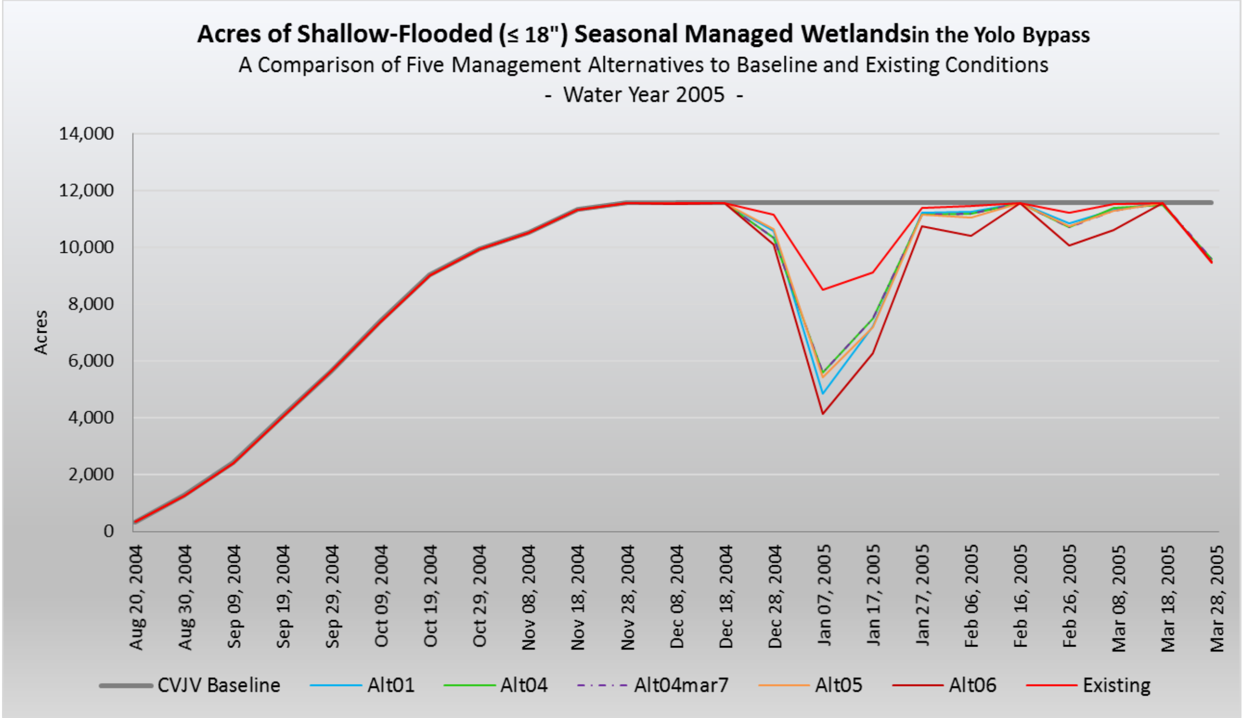


Figure 9. Average of number of acres of shallow-flooded (≤18") managed seasonal wetlands on a 10-day period, used as inputs to calculate the TRUEMET supply curves for 5 alternatives, baseline, and existing conditions in water year 2005.

5 Results

GIS BDepth Output

Appendix A, Tables 1-3 present a summary of the Bdepth GIS model output for each water year, showing the number of additional Acre-days and the average number of acres-per-day flooded in each land cover class under five management alternatives in comparison to existing conditions. Appendix A, Figures 1 and 2 present graphical representations of the acres of wetland and rice in each flooding depth class between October 1 and May 31. Note that the GIS analysis was run on the full 242 day (Oct 1 – May 31) TUFLOW dataset provided by DWR and these tables and figures represent that full dataset, whereas the TRUEMET analysis uses only the data between Oct. 1 through March 31 which represents the period of wintering waterfowl use in the Central Valley. Also note that the GIS analysis was run on existing conditions and five management alternatives. Alternative 4 with a March 7 operational cut-off was summarized by the GIS analysis, but was not examined under the TRUEMET analysis for waterfowl energetics. This alternative is identical to Alternative 4 except for the one-week period between March 7 -15, and was not expected to result in a significant difference in conclusions drawn from the TRUEMET analysis.

TRUEMET Analysis

The Yolo Basin provides approximately 27,000 acres of duck habitat in the form of managed seasonal wetlands, winter-flooded rice, and harvest grain corn fields (Table 1). Although nearly 40% of these acres occur outside of the Bypass, approximately 70% of the total food energy available to ducks in the Yolo Basin occurs within the boundaries of the Yolo Bypass. This is largely due to all managed seasonal wetlands being located in the Bypass (Table 1), and the high food density associated with these habitats. Within the Bypass itself, managed seasonal wetlands account for nearly 80% of all duck food resources.

CURRENT CONDITIONS MC 1 & MC 2

Duck food energy supplies in the Yolo Basin were insufficient to meet the duck population objectives established by the CVJV given the Joint Venture's current assumptions about migration chronology (MC 1) and habitat availability, as food supplies appear exhausted by early March (Figure 10). However, duck food supplies are predicted to be sufficient where migration chronology for the Yolo Basin is assumed to be similar to that of the Central Valley as a whole (MC 2; Figure 11).

1999 EXISTING CONDITIONS AND ALTERNATIVES

For Existing Conditions, duck food energy supplies were insufficient to meet population energy demands by mid-February regardless of what migration chronology we assumed (Figures 12 and 13). This exhaustion of duck food resources occurred approximately two weeks earlier than that predicted for the Current Conditions MC 1 scenario (Figure 10). In general, Alternatives 1, 4, 5, and 6 all predicted that duck food supplies would be exhausted by mid-to late February regardless of migration chronology (Figures 14-21); however, these alternatives did differ in terms of their impacts of duck food resources during the December periods. For example, Alternatives 1 and 6 produced steep declines in food energy supply during December compared to Existing Conditions (Figures 14 and 20 vs. 12), while Alternatives 4 and 5 (Figures 16 and 18) produced only modest declines during this month. In general, our choice of migration chronology had little effect on the overall relationship between Supply and Demand for any 1999 scenario.

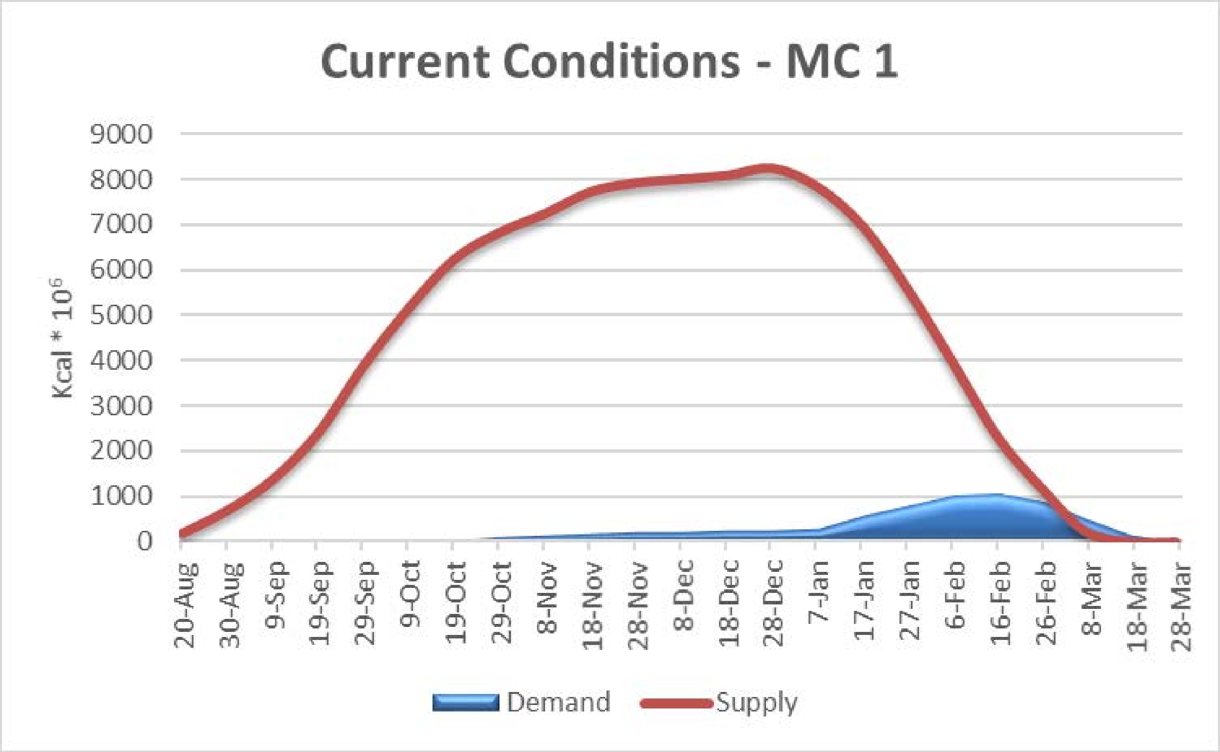


Figure 10. Duck food energy supply and demand curves for migration chronology 1 (Late-winter Peak).

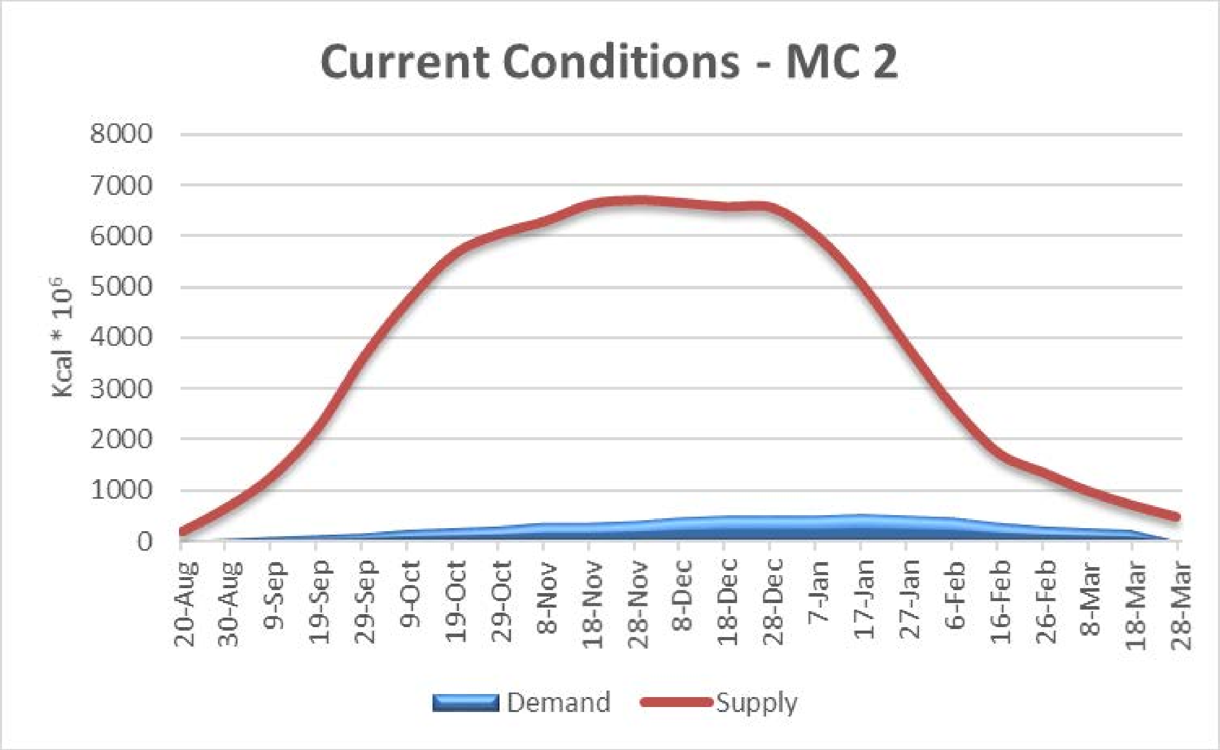


Figure 11. Duck food energy supply and demand curves for migration chronology 2 (Mid-winter Peak).

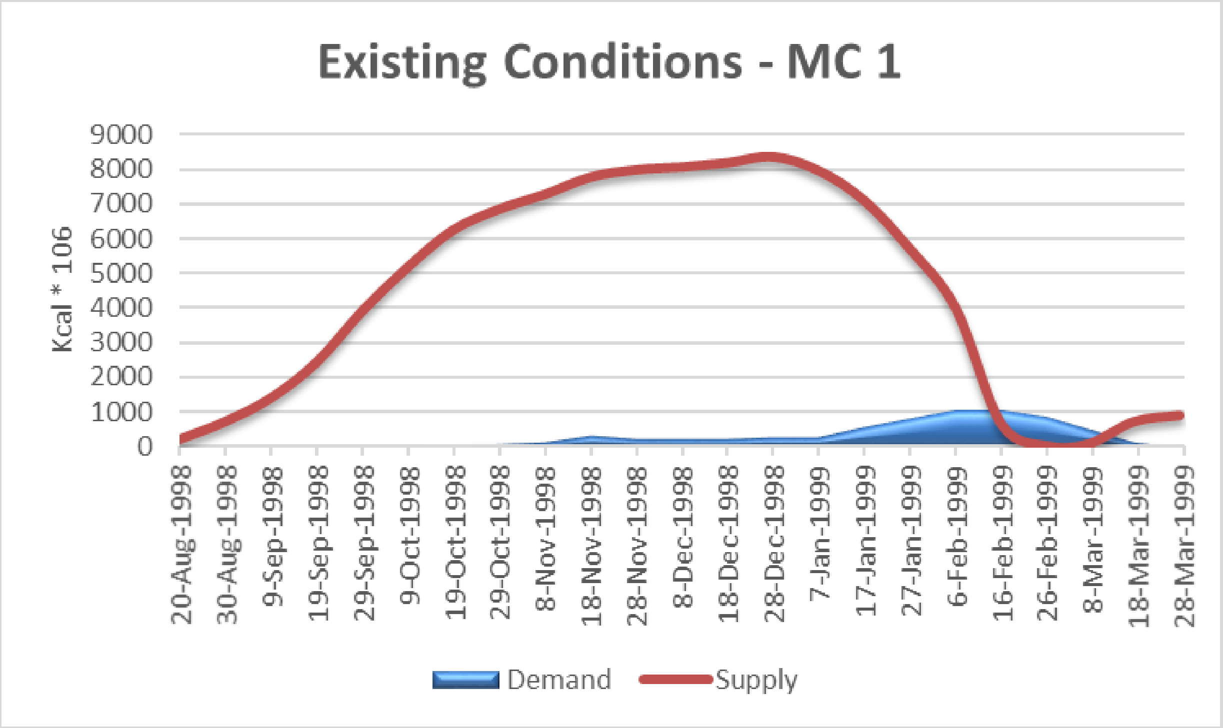


Figure 12. Duck food energy supply and demand curves: 1999, Existing MC 1 (Late-winter Peak).

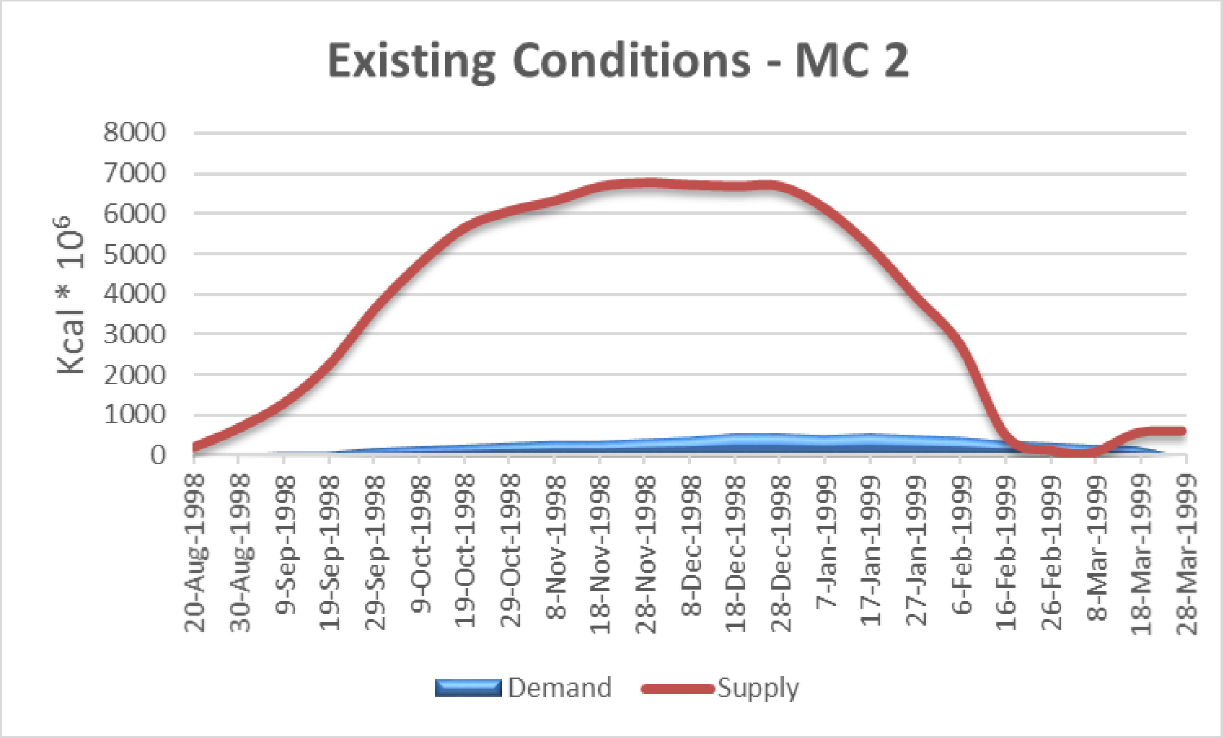


Figure 13. Duck food energy supply and demand curves: 1999, Existing MC 2 (Mid-winter Peak).

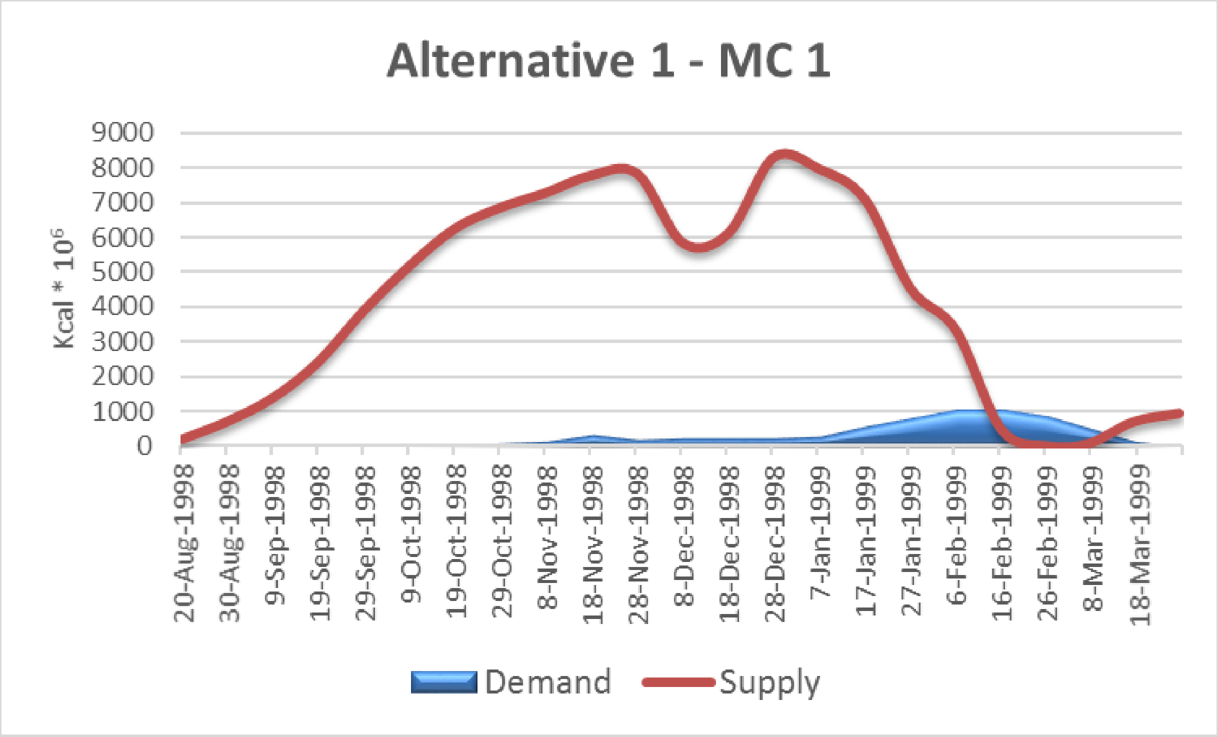


Figure 14. Duck food energy supply and demand curves: 1999 Alternative 1, MC 1 (Late-winter Peak).

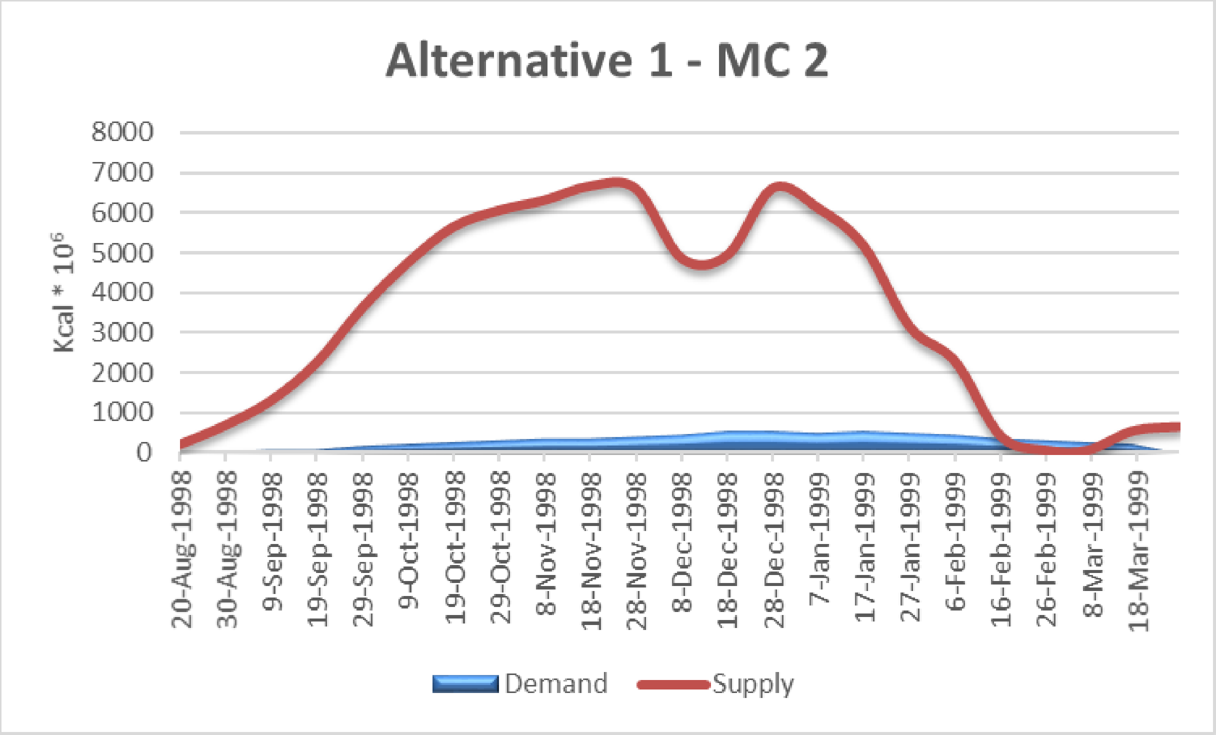


Figure 15. Duck food energy supply and demand curves: 1999 Alternative 1, MC 2 (Mid-winter Peak).

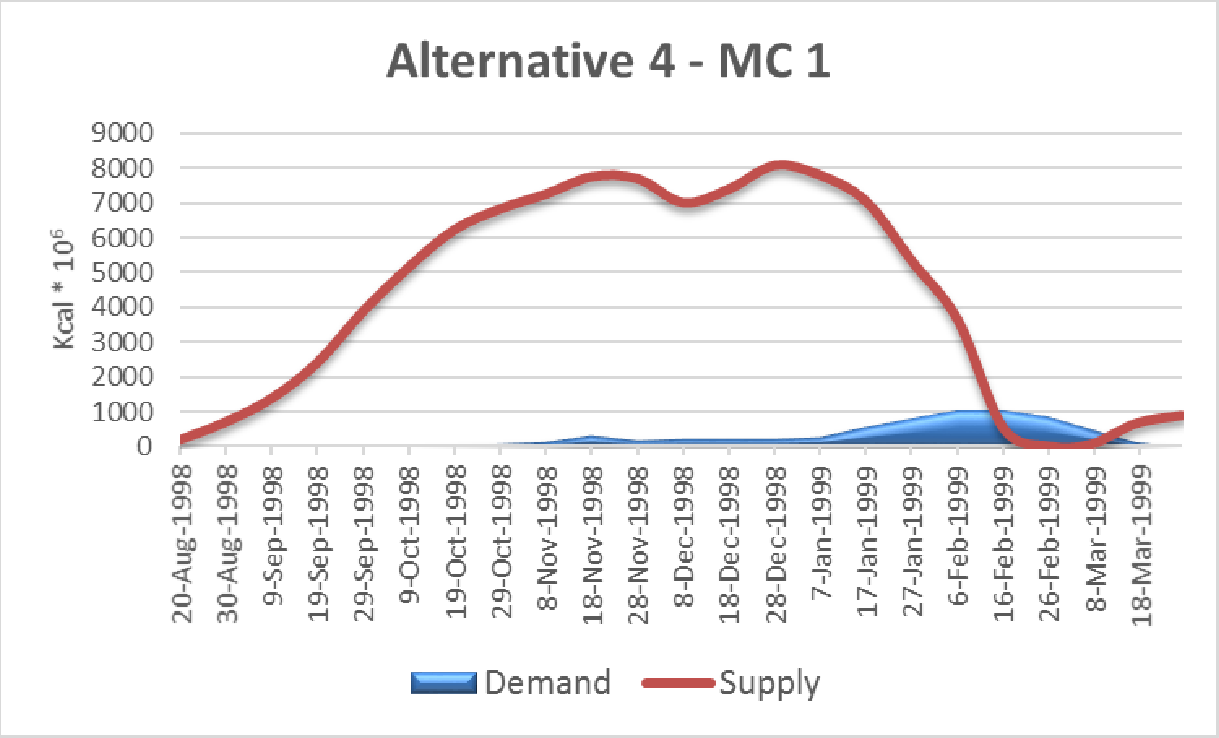


Figure 16. Duck food energy supply and demand curves: 1999 Alternative 4, MC 1 (Late-winter Peak).

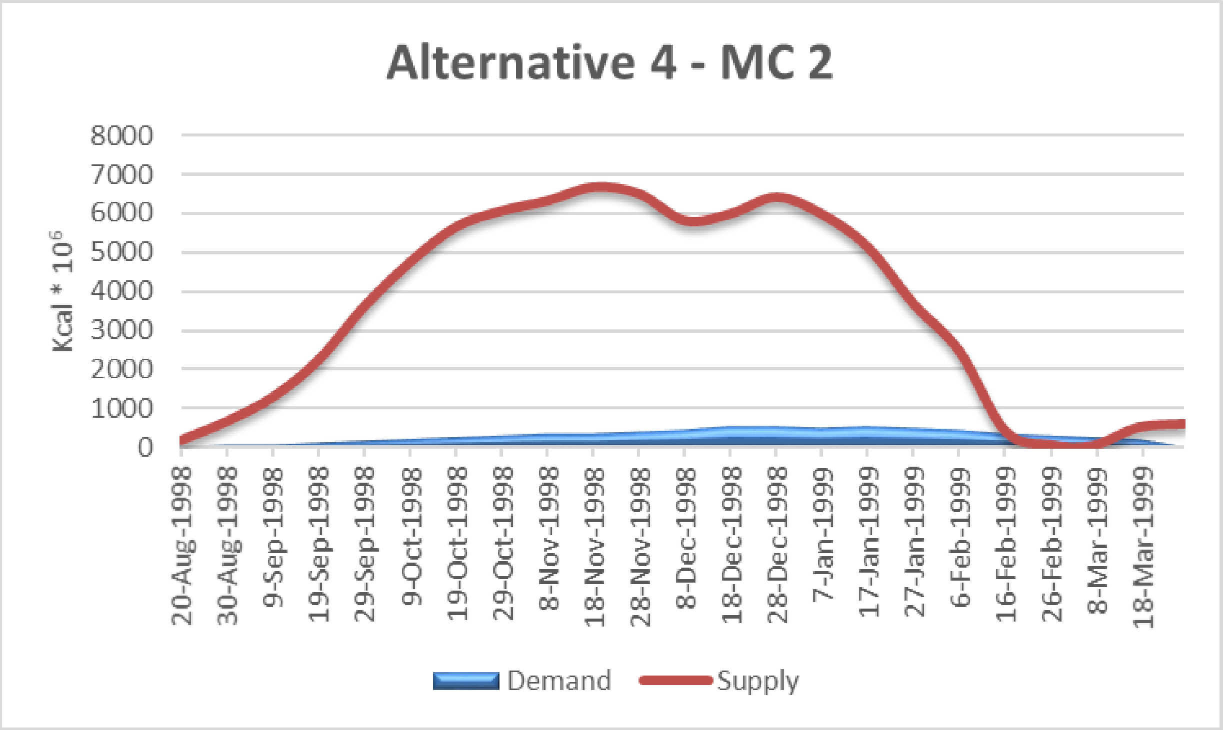


Figure 17. Duck food energy supply and demand curves: 1999 Alternative 4, MC 2 (Mid-winter Peak).

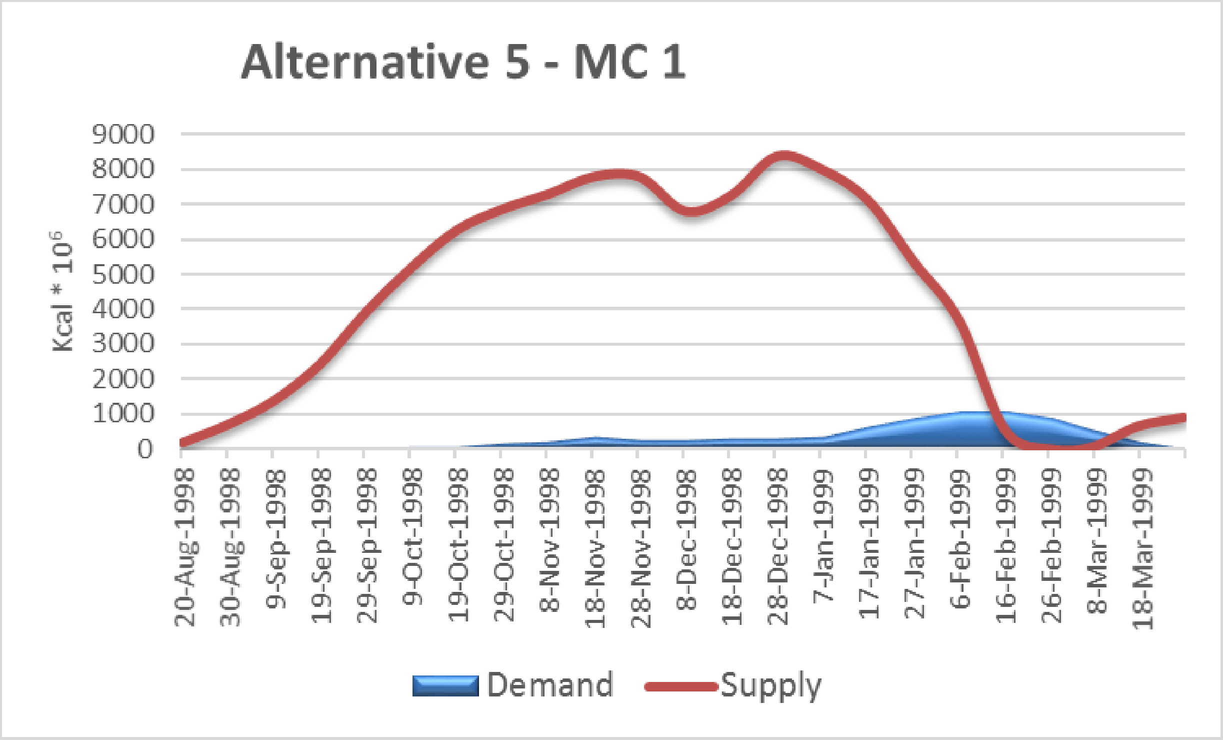


Figure 18. Duck food energy supply and demand curves: 1999 Alternative 5, MC 1 (Late-winter Peak).

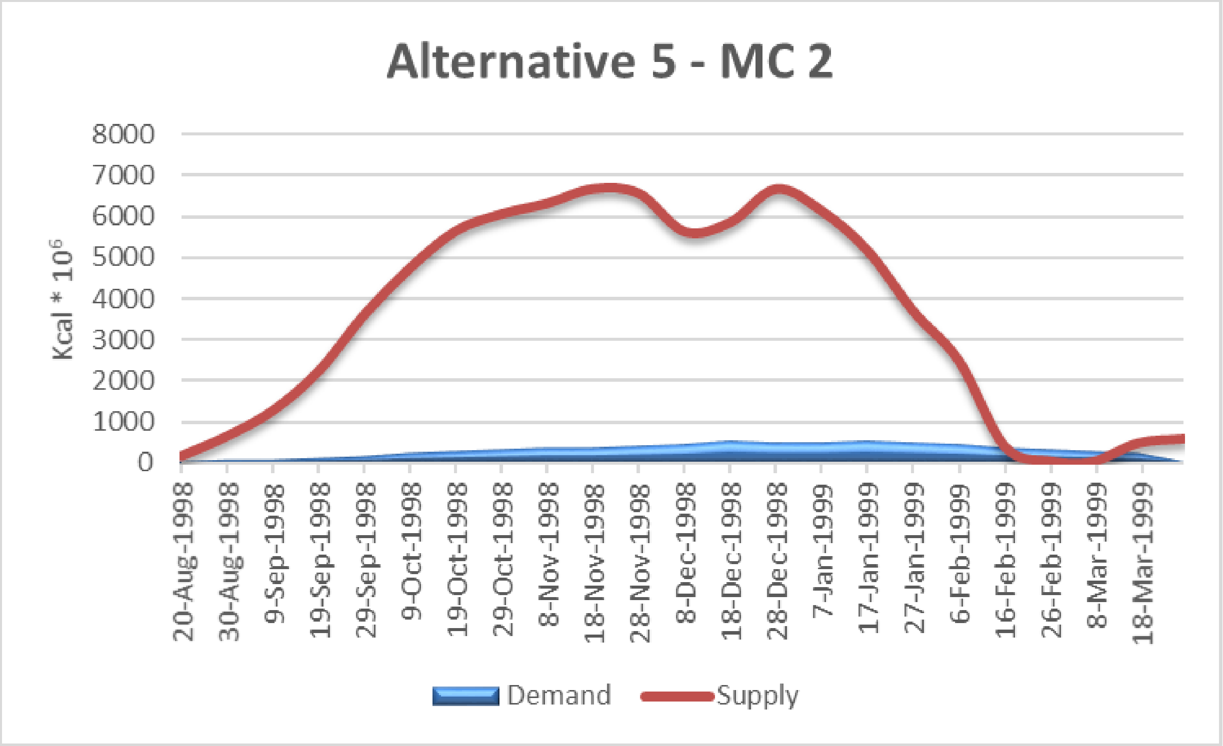


Figure 19. Duck food energy supply and demand curves: 1999 Alternative 5, MC 2 (Mid-winter Peak).

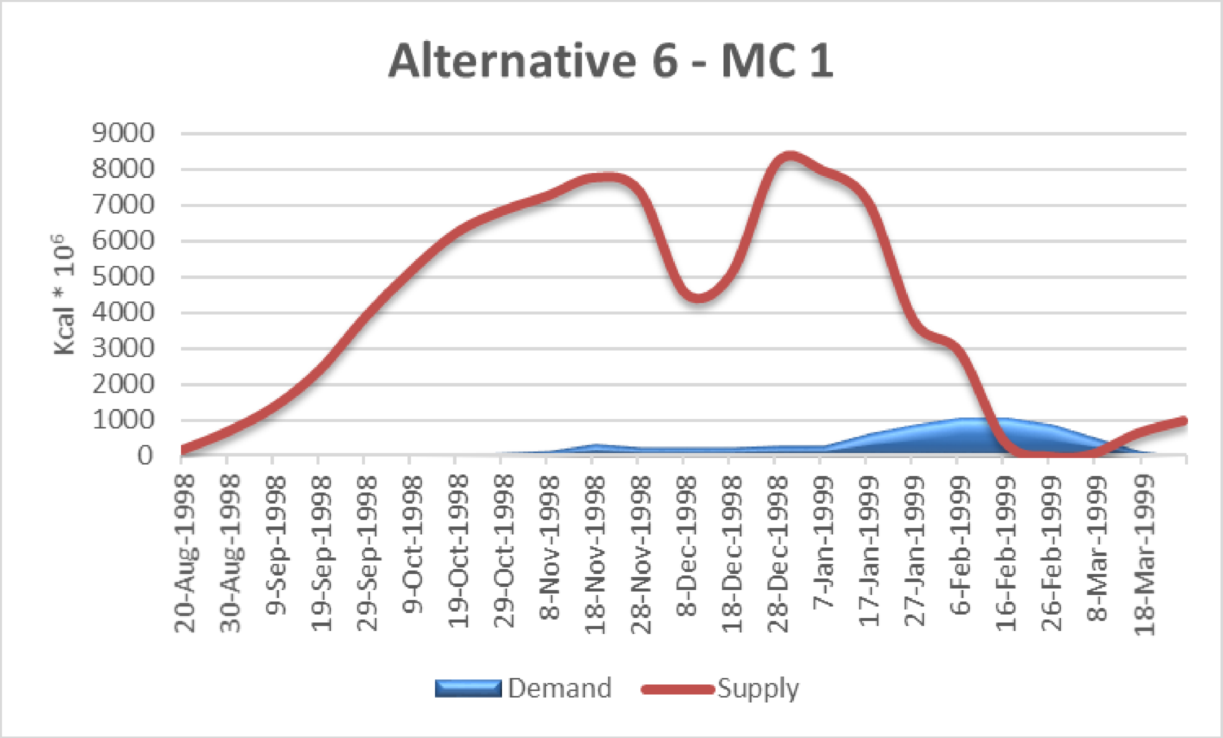


Figure 20. Duck food energy supply and demand curves: 1999 Alternative 6, MC 1 (Late-winter Peak).

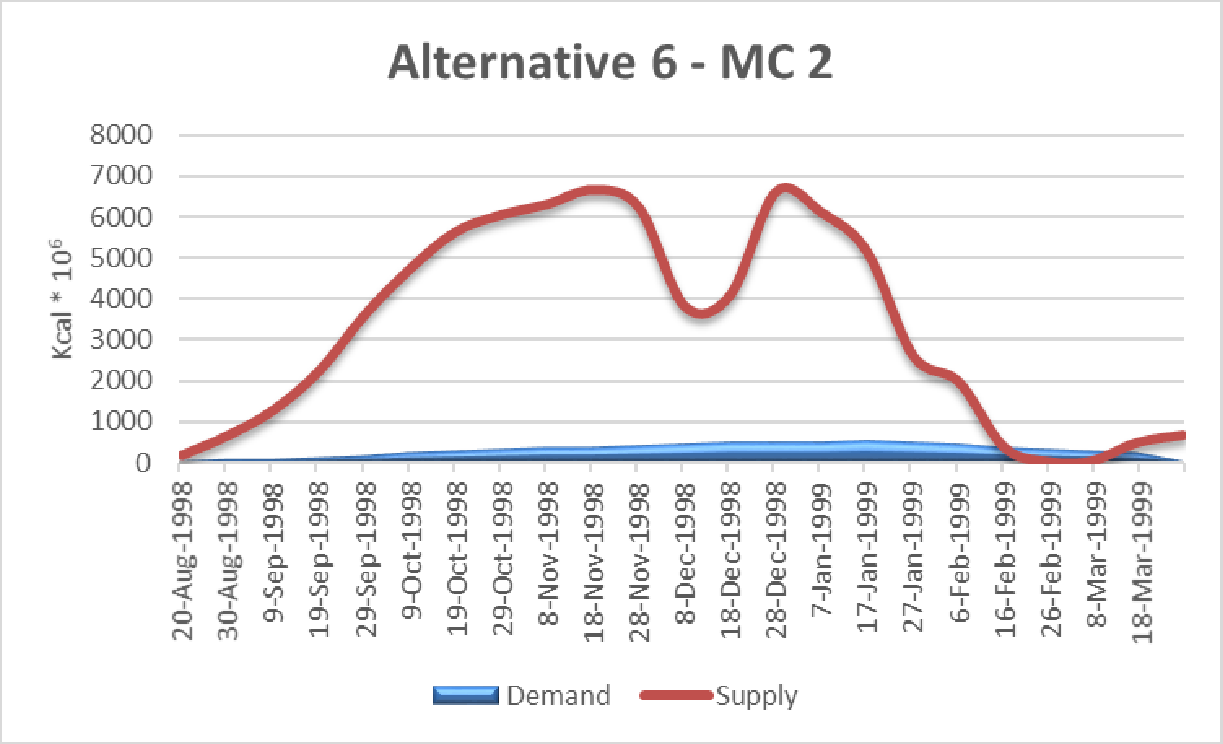


Figure 21. Duck food energy supply and demand curves: 1999 Alternative 6, MC 2 (Mid-winter Peak).

2002 EXISTING CONDITIONS AND ALTERNATIVES

For Existing Conditions, duck food energy supplies were insufficient to meet population energy demands by early March (Figure 22), similar to the food deficit documented for the Current Conditions scenario (Figure 10). In general, there was little difference in the supply-demand relationship between Existing Conditions and any of the four alternatives. Each scenario produced a similarly sharp decline in the supply curve from late December through mid-January before increasing in late January, though supply continued to remain above demand even during this period of decline (Figures22 - 26).

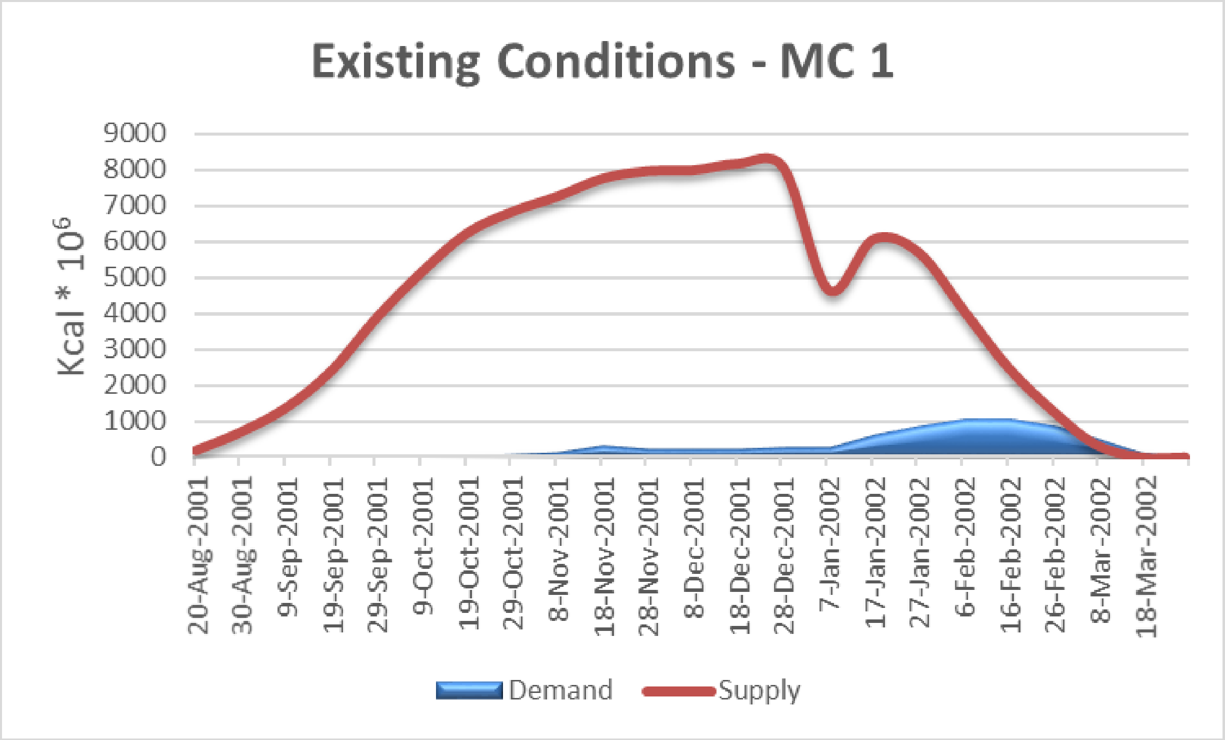


Figure 22. Duck food energy supply and demand curves: 2002 Existing Conditions, MC 1 (Late-winter Peak).

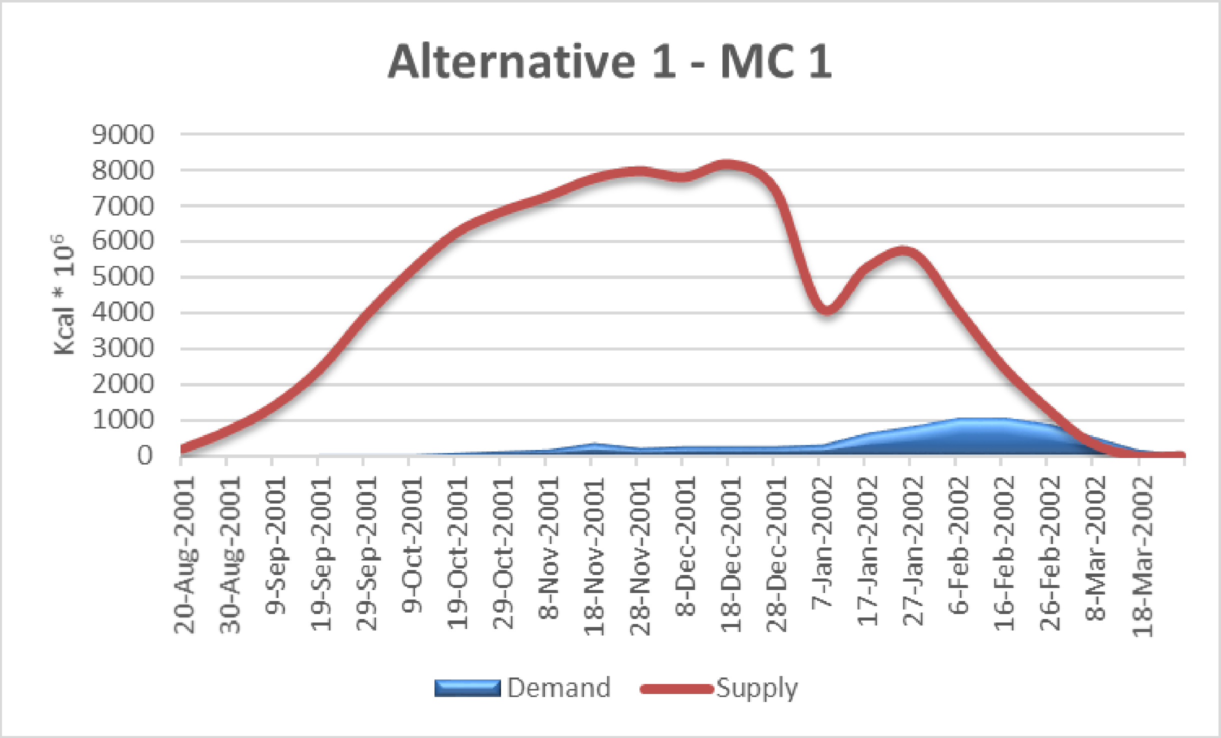


Figure 23. Duck food energy supply and demand curves: 2002 Alternative 1, MC 1 (Late-winter Peak).

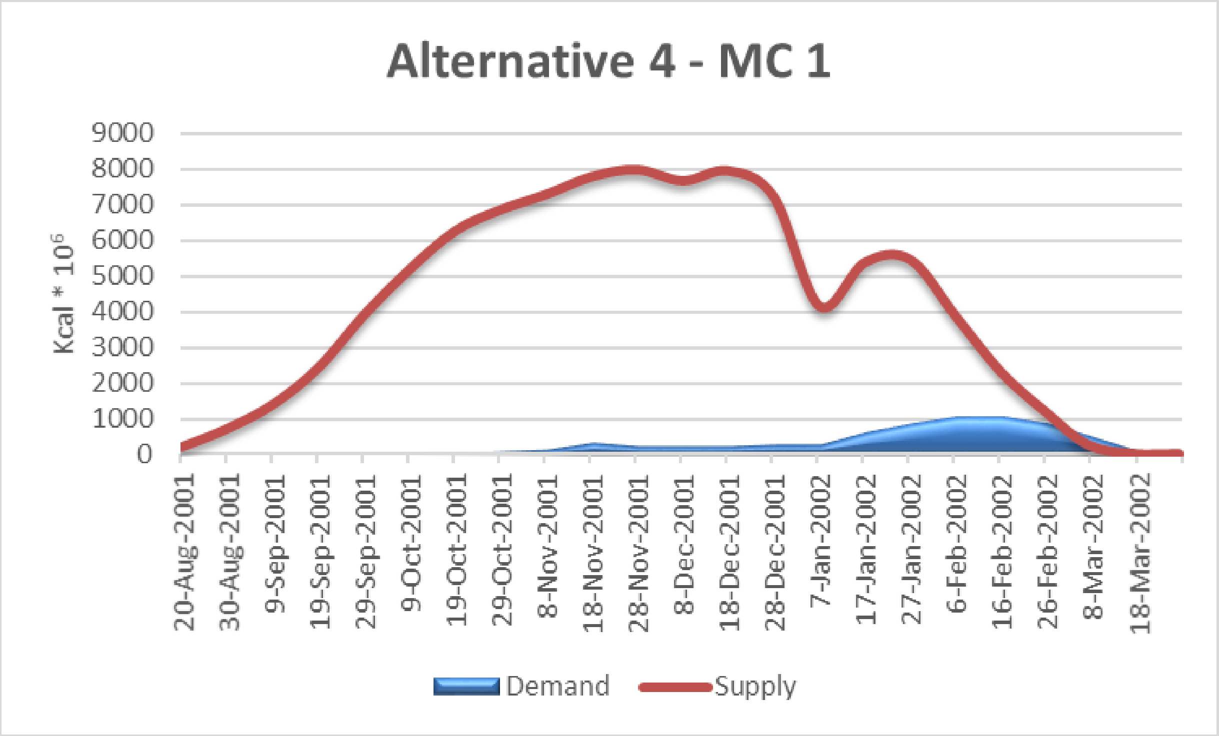


Figure 24. Duck food energy supply and demand curves: 2002 Alternative 4, MC 1 (Late-winter Peak).

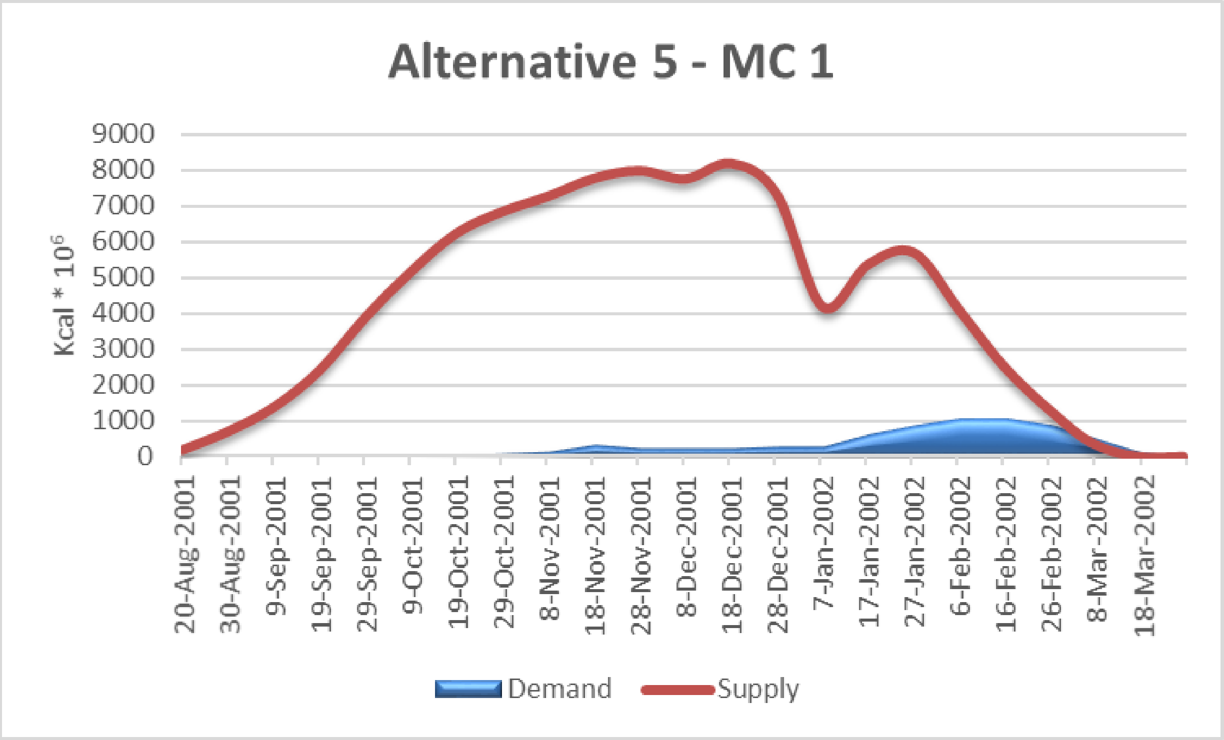


Figure 25. Duck food energy supply and demand curves: 2002 Alternative 5, MC 2 (Late-winter Peak).

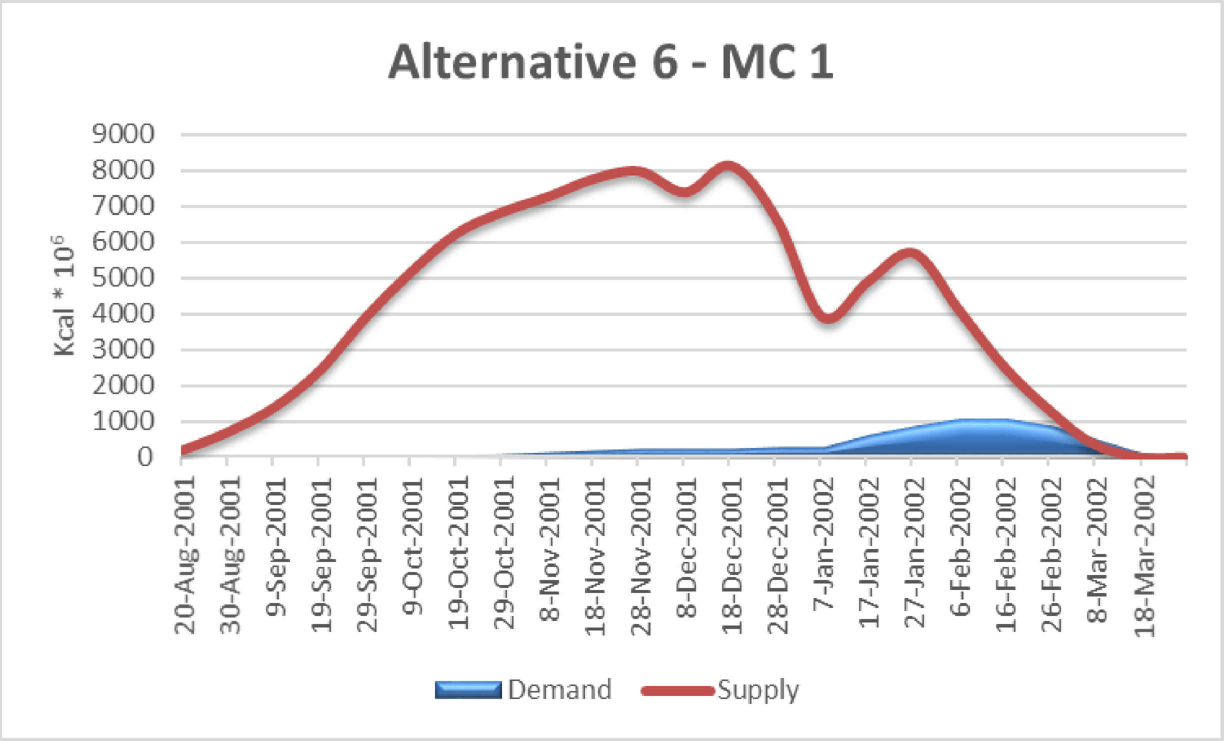


Figure 26. Duck food energy supply and demand curves: 2002 Alternative 6, MC 1 (Late-winter Peak).

2005 EXISTING CONDITIONS AND ALTERNATIVES

For Existing Conditions, duck food energy supplies were insufficient to meet population energy demands by early March (Figure 27), similar to the food deficit documented for the Current Conditions scenario (Figure 10). In general, the relationship between supply and demand was similar between Existing Conditions and each of the four alternatives, though the decline in from late December through mid-January was modestly higher for the alternatives (Figures 27 – 31).

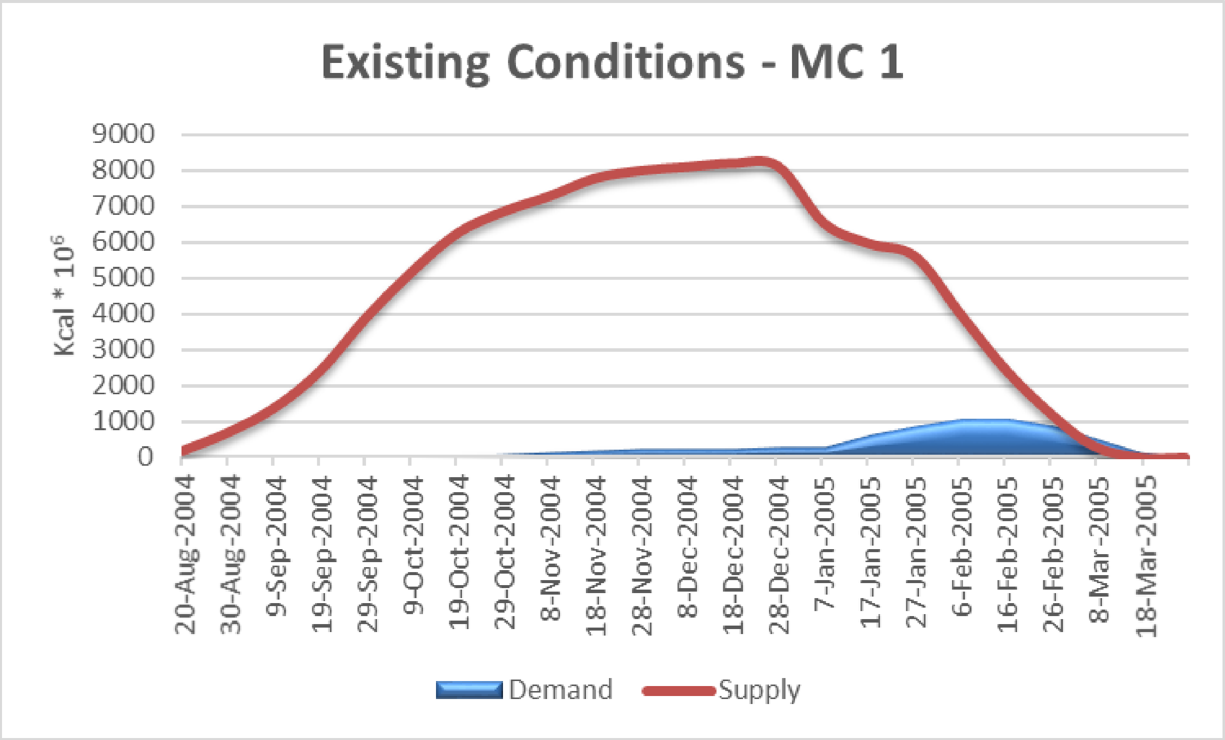


Figure 27. Duck food energy supply and demand curves: 2005 Existing Conditions, MC 1 (Late-winter Peak).

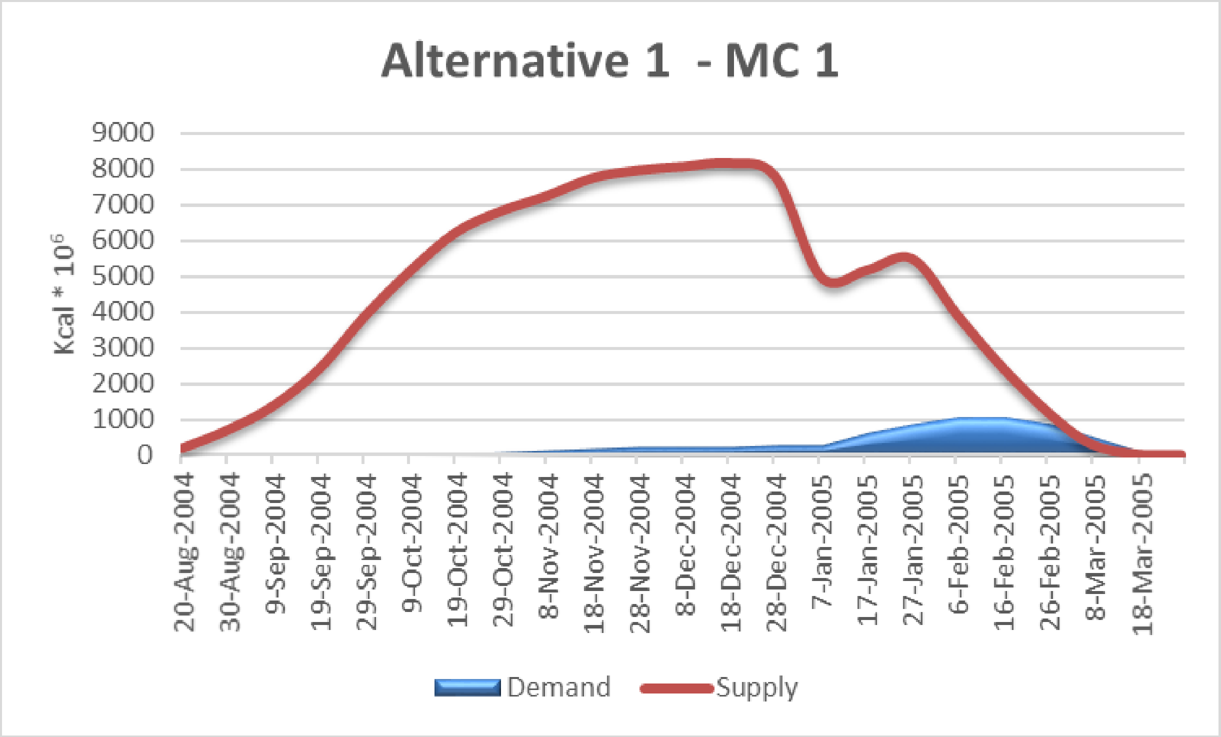


Figure 28. Duck food energy supply and demand curves: 2005 Alternative 1, MC 1 (Late-winter Peak).

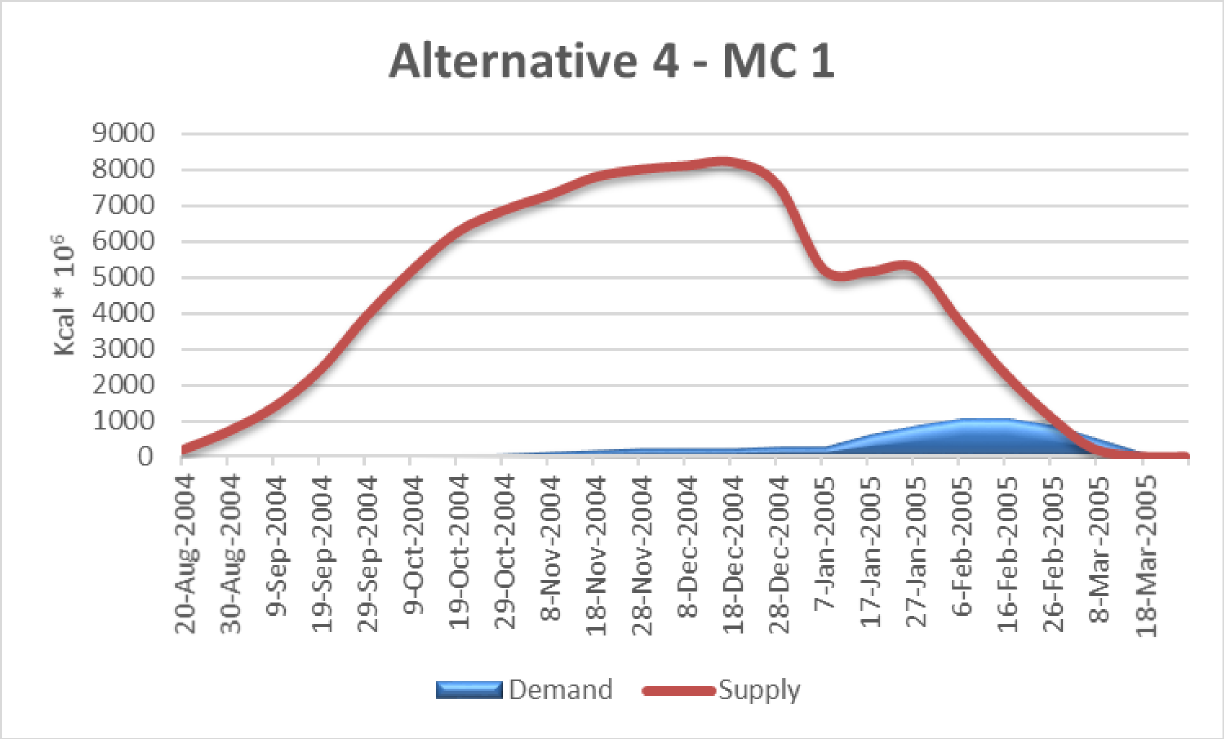


Figure 29. Duck food energy supply and demand curves: 2005 Alternative 4, MC 1 (Late-winter Peak).

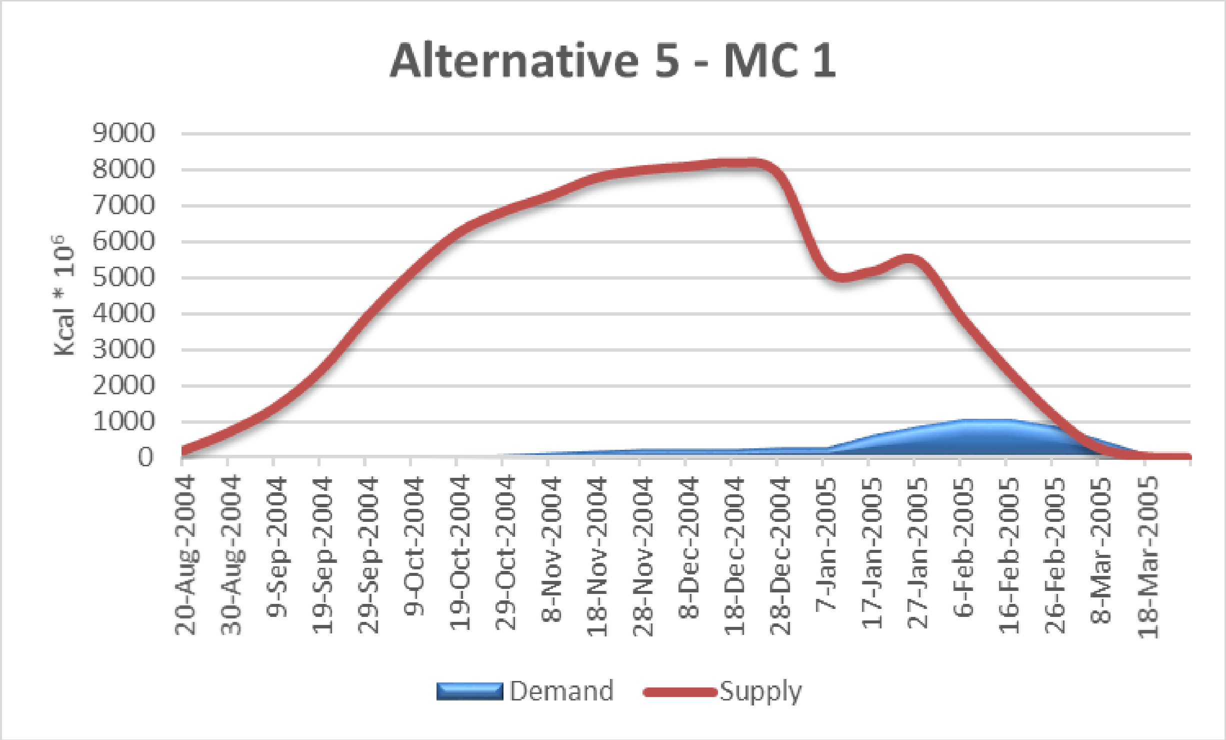


Figure 30. Duck food energy supply and demand curves: 2005 Alternative 5, MC 2 (Late-winter Peak).

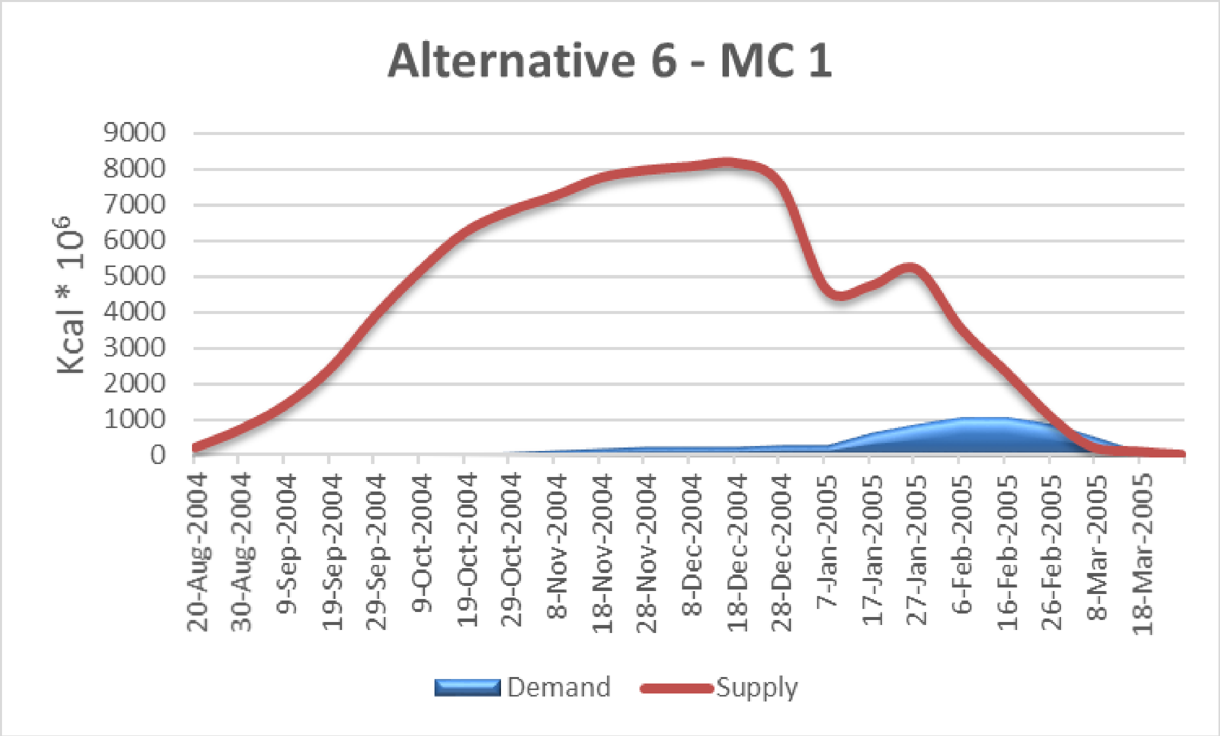


Figure 31. Duck food energy supply and demand curves: 2005 Alternative 6, MC 1 (Late-winter Peak).

AVAILABILITY OF MANAGED SEASONAL WETLANDS 1999

The acreage of available managed seasonal wetlands (i.e. flooded to a depth of ≤ 18 inches) under Existing Conditions was similar to that of Current Conditions through late December, where Current conditions reflect the CVJV's existing assumptions about wetland availability in the Yolo Basin. However, beginning in mid- January the availability of managed wetlands under Existing Conditions substantially declined relative to Current Conditions (Figure 7). **The availability of managed wetlands under Alternatives 6 and 1 was substantially less than for Existing Conditions during late November and early December (up to 7,000 and 4,500 acres respectively), while the availability of managed wetlands under Alternatives 4 and 5 also declined during this period relative to Existing Conditions (up to 2,500 and 1,500 respectively)**. Wetland availability for each Alternative was also less than for Existing Conditions for much of January; however, wetland availability was nearly identical for Existing Conditions and each Alternative after this period (Figure 7).

AVAILABILITY OF MANAGED SEASONAL WETLANDS 2002

The acreage of available managed seasonal wetlands under Existing Conditions was similar to that for Current Conditions through mid-November. Although wetland availability declined substantially from early December through early January, there was little difference among Existing Conditions and each Alternative during this period of decline. After mid-January the availability of managed seasonal wetlands under Existing Conditions and each Alternative equaled that of Current Conditions (Figure 8).

AVAILABILITY OF MANAGED SEASONAL WETLANDS 2005

The acreage of available managed seasonal wetlands under Existing Conditions was similar to that for Current Conditions through mid-December. Wetland availability under Existing Conditions declined relative to Current Conditions between mid-December and mid-January, but was similar to Current Conditions after mid-January. **The decline in wetland availability during the mid-December to mid-January period was significantly larger for most Alternatives compared to Existing Conditions by up to 5,000 acres.**

6 Discussion

It is important to distinguish between our use of "Current Conditions" and "Existing Conditions" as a baseline condition for evaluating the Fremont Weir management alternatives and the resulting impact on waterfowl habitat conditions in the Yolo Bypass and ultimately the Yolo Basin. Current Conditions reflect the CVJV's existing assumptions about habitat availability in the Yolo Basin, which do not account for the "natural" periodic flooding of the Yolo Bypass that makes some of these habitats unavailable because they are flooded to depths ≥ 18 inches. In contrast, Existing Conditions do account for these periodic flood events that "naturally" make some of these waterfowl foraging habitats unavailable because they are too deeply inundated. As a result Current Conditions provide a baseline from which to evaluate how flooding, regardless of its depth and duration, is likely to alter habitat availability from its ideal state as envisioned by the CVJV (i.e. where habitats are flooded over traditional time periods and water depths do not exceed 18 inches at any time for key habitat types). In contrast Existing Conditions reflect the fact that periodic "natural" flooding events do occur, and that these flood events make some habitats unavailable to waterfowl in a way independent of any decision on how the Fremont Weir is currently operated. As a result, alternative scenarios that do reflect how the Fremont Weir may be actively managed in the future should be judged against these Existing Conditions in terms of their waterfowl impacts.

The CVJV's current assumptions (i.e. Current Conditions) about waterfowl habitat in the Yolo Basin suggest that duck energy demand exceeds supply by early March when duck migration chronology corresponds to MC 1. In contrast, food energy supply remains above demand under current conditions when duck migration chronology for the Yolo Basin is similar to that of the Central Valley as a whole, as represented in MC 2. These differences are largely explained by the effects of food decomposition. Under MC 1, most population energy demand occurs in late winter – early spring after waterfowl food resources have been subject to considerable decomposition as a result of being flooded for several months. These partially decomposed food resources are less able to meet population energy demand compared to MC 2 where there has been less time for these food sources to deteriorate.

Although we explored the possible effects of using different migration chronologies in our 1999 simulations, there was little evidence that the choice of migration chronology impacted our overall conclusions. Thus our discussion of the 1999 results focuses on those model simulations that used MC 1, which is the migration chronology now assumed by the CVJV. Although Existing Conditions in 1999 drove supply below demand approximately two weeks earlier than Current Conditions during the late winter - early spring period, there was little difference in 1999 between Existing Conditions and each of the alternatives in terms of when duck food sources were completely depleted in the late winter – early spring period. In contrast some of the alternatives in 1999 differed substantially from existing conditions in terms of duck food energy supplies during late November through late December, though in no case did demand exceed supply.

Although none of the 1999 alternatives drove food energy supply below demand in the late November-late December period, the substantial decline in the supply curve for some alternatives during this period (e.g. Alternatives 1and 6) warrants further consideration. In theory, duck use of the Yolo Basin / Bypass should be unaltered during this decline in food energy supply as food supplies remain above population energy needs. However, the possible effects of these alternatives on duck use of the Yolo Basin needs to be considered in the larger context of the Central Valley landscape. The food supplies available to ducks in the Central Valley generally increase in an almost linear fashion from late August through mid-December as foraging habitats like managed seasonal wetlands and harvested rice fields are intentionally flooded (CVJV 2006). Reversing the supply curve for ducks in the Yolo Basin during a period of time when habitat conditions are improving in surrounding landscapes (i.e. in other drainage basins) may discourage bird use of the Yolo Basin regardless of the predicted relationship between supply and demand.

Any alternative effects on the supply curve, even when supply is not driven below demand, needs to be also considered relative to hunting opportunities and the long-term incentive to invest in the management of seasonal wetlands, especially on private lands. The late November-late December drop in the supply curve for the 1999 alternatives compared to Existing Conditions is mirrored by a similar decline in the availability of managed seasonal wetlands that are ≤ 18 inches in depth. This is to be expected as managed wetlands account for nearly 70% of all duck food resources in the Yolo Basin. A similar relationship between declines in the supply curve and the availability of managed wetlands is also apparent for the 2002 and 2005 results.

Most of the hunting opportunity in the Yolo Basin is likely provided by managed seasonal wetlands. Moreover, approximately two thirds of these wetlands are privately owned and managed as duck clubs. Alternatives that increase deep flooding of these managed wetlands compared to Existing Conditions will further reduce hunting opportunities on these wetlands regardless of any relationship between duck population energy demand and food energy supply. Moreover, alternatives that reverse the supply curve as described earlier may further reduce hunting opportunities by discouraging bird use in the Yolo Basin. Perhaps most importantly, alternatives that discourage private duck clubs from continuing to invest in wetland management because of declining hunting opportunities may, in the long term, seriously erode the waterfowl carrying capacity of the Yolo Basin.

7 References

Central Valley Joint Venture, 2006. Central Valley Joint Venture Implementation Plan – Conserving Bird Habitat. U.S. Fish and Wildlife Service, Sacramento, CA.

Fleskes, J.P., Yee, J.L., Casazza, M.L., Miller, M.R., Takekawa, J.Y., Orthmeyer, D.L., 2005. Waterfowl distribution movements and habitat use relative to recent changes in the Central Valley of California. Final report U.S. Geological Survey Western Ecological Research Center, Dixon Field Station, Dixon, California.

Fredrickson, L., Taylor, S.T., 1982. Management of Seasonally Flooded Impoundments for Wildlife. U.S. Department of the Interior, Fish and Wildlife Service Resource Publication 148.

Garg, J.M., 2007. Northern Pintails – Upending, Wikimedia Commons GNU Free Documentation License. http://en.wikipedia.org/wiki/File:Northern_Pintails_%28Male_%26_Female%29-_Up-ending_I_342.jpg (accessed February, 25, 2002)

Miller, M.R., Newton, W.E., 1999. Population energetics of northern pintails in the Sacramento Valley. Journal of Wildlife Management 63:1222-1238.

Miller, M.R., Eadie, J.M., 2006. The allometric relationship between resting metabolic rate and body mass in wild waterfowl (Anatidae) and an application to estimation of winter habitat requirements. Condor 108:166–177.

Naylor, L.W., 1999, Evaluating moist-soil production and management in Central Valley wetlands to determine habitat needs for waterfowl. MS thesis, University of California, Davis, CA.

Nelson, F., 2012. Shallow Water Management for Dabbling Waterfowl: Fish and Wildlife Habitat Management Guidesheet. Natural Resource Conservation Service MN, U.S. Department of Agriculture with content provided by the Missouri Department of Conservation.

Williams, C.K., Dugger, B.D., Brasher, M.G., Coluccy, J.M., Cramer, D.M., Eadie, J.M., Gray, M.J., Hagy, H.M., Livolsi, M., McWilliams, S.R., Petrie, M., Soulliere, G.J., Tirpak, J.M., Webb, E.B., 2014. Estimating habitat carrying capacity for migrating and wintering waterfowl: considerations, pitfalls and improvements. Wildfowl special issue 4: 407-435.

Appendix A. GIS BDepth Model Output Summary Tables and Graphs

Water Year 1999 (Wet Year)													
		Additional Acre-Days of Flooding for Five Alternatives Compared with Existing Conditions											
		Managed Seasonal Wetlands			Rice Fields			Upland / Other			Other Agriculture		
	Alternative	Managed (0")	Shallow Flooded (<18")	Deep Flooded (>18")	Managed (0")	Shallow Flooded (<18")	Deep Flooded (>18")	Not Flooded (0")	Shallow Flooded (<18")	Deep Flooded (>18")	Not Flooded (0")	Shallow Flooded (<18")	Deep Flooded (>18")
Total Additional Acre-Days	Alternative 1	-	93,473	145,148	-	73,844	95,905	-	31,754	61,650	-	46,474	95,953
	Alternative 4	-	84,150	41,388	-	90,183	132,935	-	23,222	34,681	-	65,159	118,274
	Alternative 4 March 7	-	84,541	40,166	-	90,436	131,935	-	22,672	31,847	-	65,636	117,260
	Alternative 5	-	98,162	71,926	-	86,614	59,898	-	33,110	52,681	-	52,050	69,149
	Alternative 6	-	89,934	247,590	-	81,671	144,752	-	70,110	120,723	-	42,545	141,367
Average # Acres / Day	Alternative 1	-	386	600	-	305	396	-	131	255	-	192	397
	Alternative 4	-	348	171	-	373	549	-	96	143	-	269	489
	Alternative 4 March 7	-	349	166	-	374	545	-	94	132	-	271	485
	Alternative 5	-	406	297	-	358	248	-	137	218	-	215	286
	Alternative 6	-	372	1,023	-	337	598	-	290	499	-	176	584

* Average # Acres/Day is calculated as: "Total Additional Acre-Days"/242. Water year data ranged from October 2, 1998 - May 31, 1999 (242 days).

Appendix A – Table 1. Number of additional “acre-days” of flooding for five management alternatives when compared to existing conditions, for water year 1999.

Water Year 2002 (Dry year)

		Additional Acre-Days of Flooding for Five Alternatives Compared with Existing Conditions											
		Managed Seasonal Wetlands			Rice Fields			Upland / Other			Other Agriculture		
	Alternative	Managed (0")	Shallow Flooded (<18")	Deep Flooded (>18")	Managed (0")	Shallow Flooded (<18")	Deep Flooded (>18")	Not Flooded (0")	Shallow Flooded (<18")	Deep Flooded (>18")	Not Flooded (0")	Shallow Flooded (<18")	Deep Flooded (>18")
Total Additional Acre-Days	Alternative 1	-	16,439	47,252	-	24,971	28,206	-	10,715	27,969	-	6,739	31,173
	Alternative 4	-	20,129	40,803	-	81,733	152,534	-	12,759	36,184	-	55,659	143,202
	Alternative 4 March 7	-	20,094	40,727	-	73,560	140,725	-	12,231	33,433	-	49,683	131,641
	Alternative 5	-	22,832	47,477	-	30,794	28,665	-	14,426	35,373	-	10,228	32,360
	Alternative 6	-	45,458	87,258	-	45,512	57,425	-	20,427	55,832	-	20,505	57,814
Average # Acres / Day*	Alternative 1	-	68	195	-	103	117	-	44	116	-	28	129
	Alternative 4	-	83	169	-	338	630	-	53	150	-	230	592
	Alternative 4 March 7	-	83	168	-	304	582	-	51	138	-	205	544
	Alternative 5	-	94	196	-	127	118	-	60	146	-	42	134
	Alternative 6	-	188	361	-	188	237	-	84	231	-	85	239

* Average # Acres/Day is calculated as: "Total Additional Acre-Days"/242. Water year data ranged from October 2, 1998 - May 31, 1999 (242 days).

Appendix A - Table 2. Number of additional "acre-days" of flooding for five management alternatives when compared to existing conditions, for water year 2002.

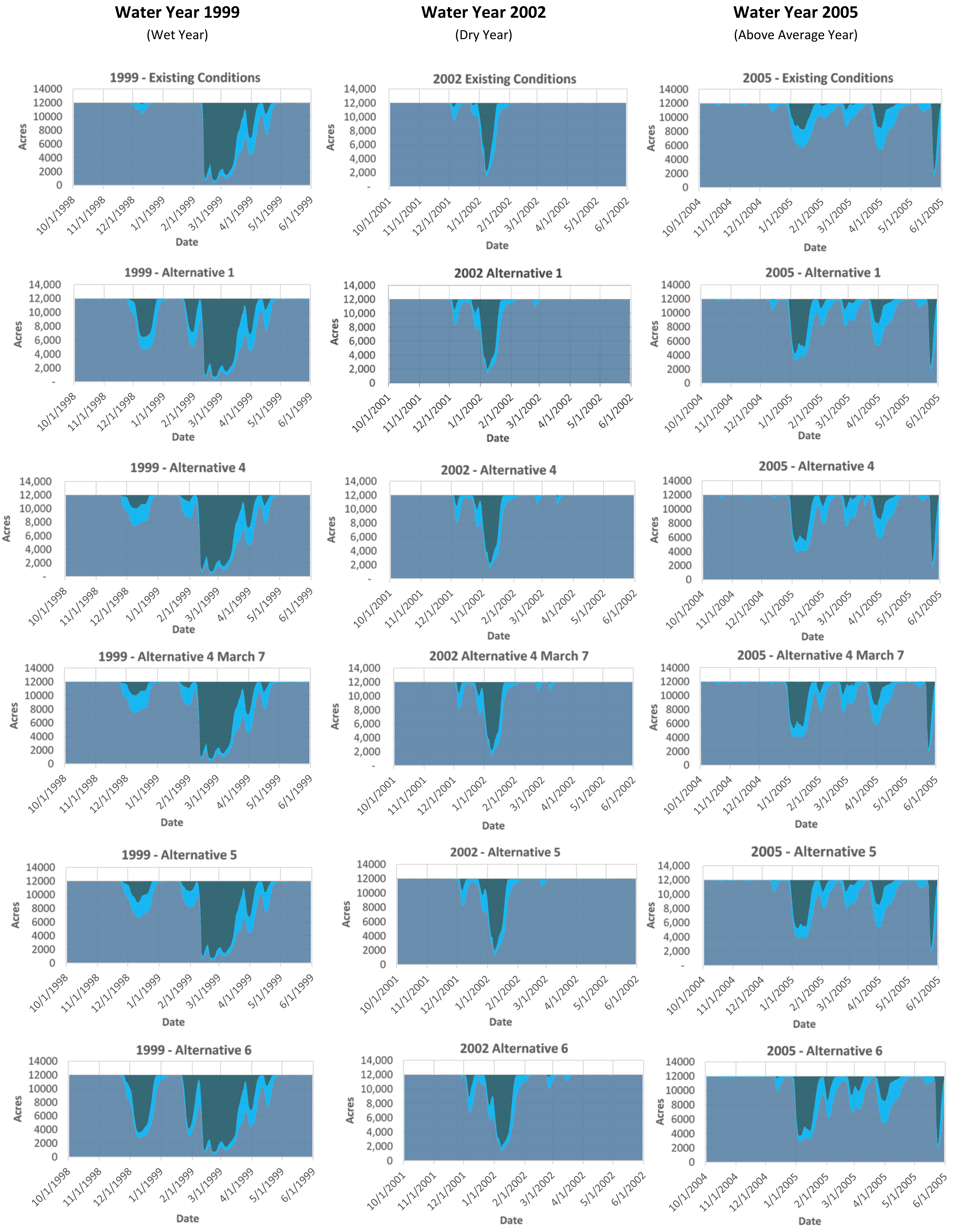
		Water Year 2005 (Above Normal Year)											
		Additional Acre-Days of Flooding for Five Alternatives Compared with Existing Conditions											
		Managed Seasonal Wetlands			**Rice Fields**			**Upland / Other**			**Other Agriculture**		
	Alternative	**Managed (0")**	**Shallow Flooded (<18")**	**Deep Flooded (>18")**	**Managed (0")**	**Shallow Flooded (<18")**	**Deep Flooded (>18")**	**Not Flooded (0")**	**Shallow Flooded (<18")**	**Deep Flooded (>18")**	**Not Flooded (0")**	**Shallow Flooded (<18")**	**Deep Flooded (>18")**
Total Additional Acre-Days	Alternative 1	-	(2,468)	72,929	-	(2,234)	32,600	-	13,702	29,568	-	(5,204)	33,653
	Alternative 4	-	(23,335)	66,060	-	19,409	156,930	-	11,675	36,272	-	15,397	132,168
	Alternative 4 March 7	-	(22,909)	66,319	-	15,846	145,906	-	11,686	34,172	-	11,432	121,597
	Alternative 5	-	5,667	70,258	-	4,567	34,579	-	23,235	41,237	-	(1,803)	35,424
	Alternative 6	-	18,549	124,442	-	16,685	63,310	-	24,691	59,309	-	(884)	63,579
Average # Acres / Day*	Alternative 1	-	(10)	301	-	(9)	135	-	57	122	-	(22)	139
	Alternative 4	-	(96)	273	-	80	648	-	48	150	-	64	546
	Alternative 4 March 7	-	(95)	274	-	65	603	-	48	141	-	47	502
	Alternative 5	-	23	290	-	19	143	-	96	170	-	(7)	146
	Alternative 6	-	77	514	-	69	262	-	102	245	-	(4)	263

* Average # Acres/Day is calculated as: "Total Additional Acre-Days"/242. Water year data ranged from October 2, 1998 - May 31, 1999 (242 days).

Appendix A - Table 3. Number of additional "acre-days" of flooding for five management alternatives when compared to existing conditions, for water year 2005.

Acres of Seasonal Wetlands Flooded in the Yolo Bypass, by Depth Class, for 3 Water Years and 5 Management Alternatives

Depth Class: ▨ Dry (0”) ▨ Shallow Flooded (≤18”) ▨ Deep Flooded (> 18”)

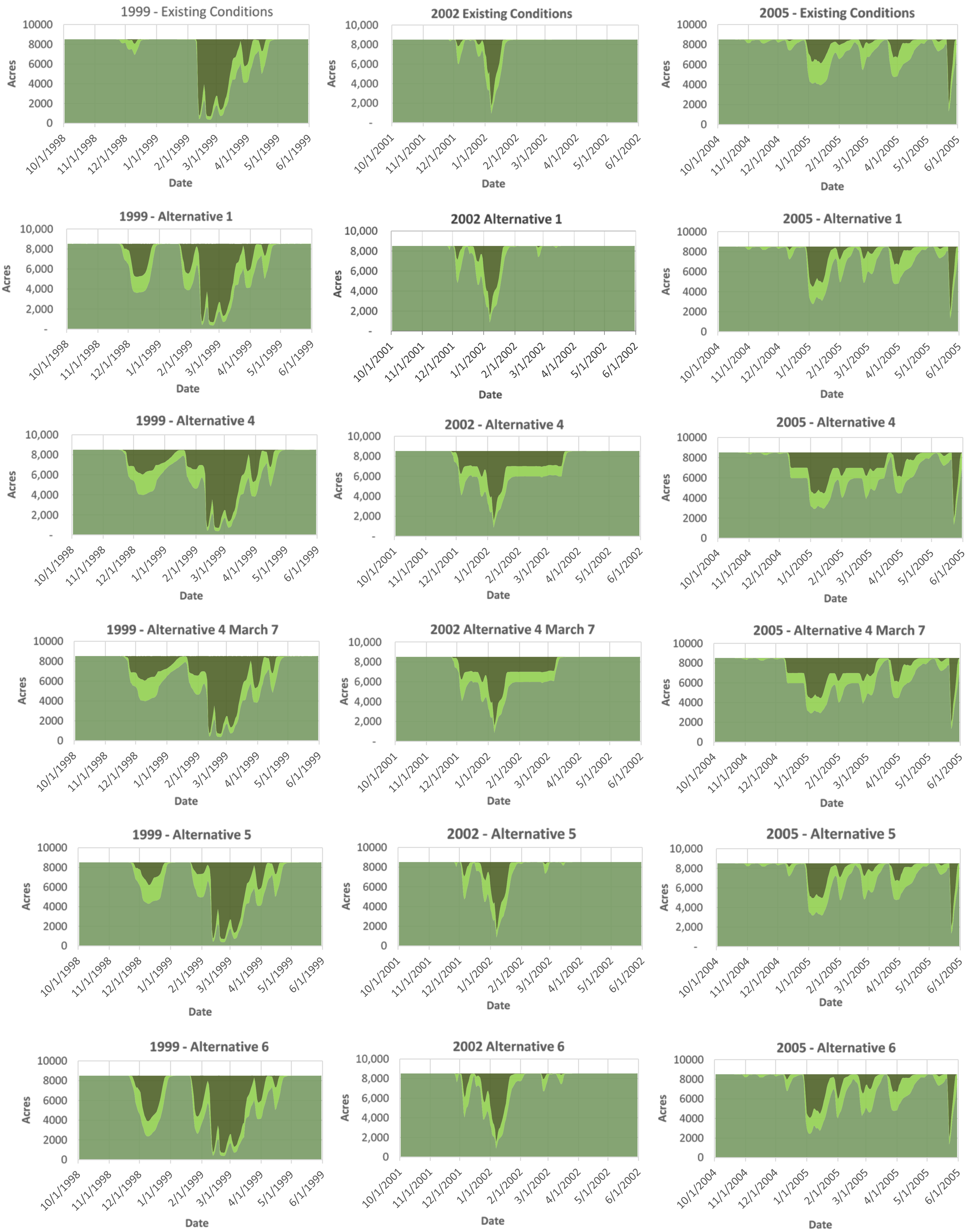


Appendix A – Figure 1. Acres of seasonal wetlands flooded in the Yolo Bypass, by Depth Class, for three water years and 5 management alternatives.

Acres of Rice Fields Flooded in the Yolo Bypass, by Depth Class, for 3 Water Years and 5 Management Alternatives

Depth Class: 🟩 **Managed (0")** 🟩 **Shallow Flooded (≤18")** 🟩 **Deep Flooded (> 18")**

Water Year 1999	**Water Year 2002**	**Water Year 2005**
(Wet Year)	(Dry Year)	(Above Average Year)



Appendix A – Figure 2. Acres of rice agriculture flooded in the Yolo Bypass, by Depth Class, for three water years and 5 management alternatives.

IN01

Buckman, Carolyn

From: Enstrom, Karen@DWR <Karen.Enstrom@water.ca.gov>
Sent: Monday, January 29, 2018 9:16 AM
To: Nelson, Ben@usbr.gov; Buckman, Carolyn
Subject: FW: Yolo Bypass Salmonid Habitat Restoration and Fish Passage Project comment

Happy Monday!
Just forwarding you a public comment re our project's potential effect on the Putah Creek salmon population.

Karen Enstrom
Program Manager
Yolo Bypass Habitat Restoration Branch
Division of Environmental Services
California Department of Water Resources

Karen.Enstrom@water.ca.gov
916-376-9778 office
916-812-9600 cell

From: Patrick Huber [mailto:prhuber@ucdavis.edu]
Sent: Wednesday, January 24, 2018 8:40 AM
To: Enstrom, Karen@DWR <Karen.Enstrom@water.ca.gov>
Cc: Rich Marovich <RMarovich@scwa2.com>; John McNerney <JMcNerney@cityofdavis.org>; Tracie Reynolds <TReynolds@cityofdavis.org>; Lucas Frerichs <lucasf@cityofdavis.org>
Subject: Yolo Bypass Salmonid Habitat Restoration and Fish Passage Project comment

Dear DWR, this email is a public comment on the DEIR for this project.

I attended one of the public meetings last year as a representative of the City of Davis. During that meeting I advised the consultant team that the current population of spawning salmon on Putah Creek needed to be addressed. This population has rapidly increased over the past several years and is an important natural feature for the citizens of Davis and surrounding communities. These salmon necessarily need to traverse Yolo Bypass en route to spawning habitat in the vicinity of the cities of Davis and Winters. The proposed project is likely to have some kind of impact on this population. While my hypothesis is that it will prove beneficial to these salmon, an assessment is warranted in the EIR. 1

The consultant team agreed that this should be analyzed. However, unless I am just simply missing it in the voluminous DEIR, this assessment seems to be missing. Please add this assessment prior to finalizing the EIR.

Thank you.

Patrick Huber

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Patrick Huber, Ph.D.
Project Scientist

Agricultural Sustainability Institute
Information Center for the Environment
Landscape Analysis and Systems Research Lab
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530-754-6621

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IN02

February, 2018

Yolo Bypass Salmonid Restoration EIS/EIR Public Comments

Karen Enstrom and Ben Nelson:

As Property and Farm Manager for David teVelde and his operation in Yolo County, Bypass Farms, I feel it very important to provide our feedback regarding these EIS/EIR documents. The following are the points I feel are important to note as this project moves forward.

1

1. In my ten years on this property it has often been overlooked by various agencies and projects that much of what has been proposed will be implemented on lands owned by Mr. teVelde. Specific to this document portions of each alternative will be implemented on parcels on both the east and west of the Yolo Bypass east levee owned by Mr. teVelde. Much of what is referred to as "Tule Pond", the entire "Ag Crossing 1", and lands inside the Yolo Bypass running along the west side of the east levee almost north to the Fremont Weir are part of Mr. teVelde's holdings. Like the west Yolo Bypass Levee, the CA DWR has a maintenance and access easements for the levees that fall inside of this alignment. However, agreements for the public access to the wildlife area and many parts of the proposed project areas are assumed public access but are in fact private property.

2

2. As the project proceeds, there needs to be some environmental indemnification to land owners and their operations. As the habitat enhancement succeeds, and as more threatened and endangered species are encouraged to use this passage, the risk for incidental take also increases. There are always some risks of incidental take and they exists because of the ag operation and environmental interface. Attention needs to be paid to how these enhancement projects will increase the duration of the timing when both ag and environmental interests are engaged in their various activities. Take into consideration, Bypass Farm's routine operations such as pruning, control of vegetation along riparian areas, reestablishing locations where irrigation pumps are seasonally installed, and the creation of irrigation drainage ditches and drains (which are all normal operations at the beginning and end of each season) will be occurring along the areas where projects will potentially be implemented.

3

While the information included in these documents is very detailed, it is also understandably very specific to the project area. Being so specific it fails to include any improvements to the Ag operation areas where fish can currently strand as water recedes. Hopefully, these project improvements will deter fish from entering ag areas or assist their exiting as waters recede. It is only logical that more attention will be paid to the project area with all the publicity and public monies being invested. The landowner and ag operation need to be protected if preexisting problem areas for fish are not resolved by the large project. Problem areas need to be identified and mitigated with the DWR or NGO so there is no liability on the part of the landowner if an issue is identified after projects are completed.

4

There is also little mention of additional / or arrival of other species besides the critical fish species that will benefit from easier access back into the river. It seems that there would be more plant and animal species that would benefit from all the alternatives, increased flows and flood durations. The idea of added species and a wider wildlife biodiversity is great. However, as new species are identified or move in it will also increase the potential for additional farming restrictions and impacts on ag land. For an operation that surrounds the project areas this is a cause for concern.

3. Chapter 2.3.1- Ag Crossing 1.

5 Ag Crossing 1 is an integral component to connecting the Tule Canal to the River. Bypass Farms has the infrastructure to move irrigation water from the Ridge cut Slough through the Yolo Bypass East Levee and into the upper Elkhorn basin. Despite discussion with the DWR engineers and biologists regarding alternatives to a siphon type system, this method has been included in this document. The concern with the siphons is that they will fill rapidly with sediment and become useless or quickly become a very challenging maintenance item. Siphons work very well where large amounts of water are being moved preventing sediment gathering at the bottom. In this location we are the very bottom of the irrigation system and flows can be intermittent. The slow flows are of Ridge cut water with high turbidity and sediment. Ag Crossing 1 is inside the Bypass and will be subject to whatever sediment gathers after flood events.

6 The sediment from the water does not account for the beaver and wildlife activity coming from the adjacent wildlife area. Beavers can be very problematic for water delivery and dealing with them and their industrious habits can be very costly. Pipeline could quickly be plugged and siphons going below grade will be very challenging to maintain.

7 In my opinion, it would be best to install seasonally removable flash boards, a weir or other control structures to allow water to be held at a higher elevation in the irrigation channel during the summer and when removed could allow water to flow unimpeded from the Tule pond into the Tule canal during the fish passage season.

8 If the siphons are the selected method of moving the water the following requests would be made:

- construct the structure so that the headwall of siphons can be accessed easily with a Backhoe or excavator for routine clearing and maintenance
- Install screens on the headwall to prevent wildlife from entering the pipes
- Include a water control / over flow structure that can be used to divert water to the south. Water control would be located just west of the weir or siphons to allow ag irrigation water to be diverted into the Tule canal during the irrigation season and for flooding of the adjacent private wetland area/ fields for shorebird and waterfowl programs and recreation.
- Upon completion of the project ensure the following: *a.)* re-installment of a gate on the road and *b.)* install fencing or berms if new access points have been created to prevent trespass on private lands. Gates and possible fencing will also provide a defined means for public access into the wildlife area.
- an agreement/ easement with the operators of the wildlife area, the operators of the project and the land owner to allow farm personal and equipment access to both sides of the Ag

Crossing 1 structure and general area. This will ensure that any maintenance work, cleaning, permitted wildlife control is permissible and allowed.

- Delineation of property boundary at Ag Crossing 1. The DWR and DFW needs to clearly define the complete access and property lines on any maps or publications regarding to the Fremont Weir wildlife area. As well as a clear definition of maintenance, access of structure and existing irrigation infrastructure.

- reestablish the northern side of the irrigation canal west of the project to prevent irrigation water runoff, surface water diversion into the Fremont Weir wildlife area and safe public access. The wildlife area has been inaccessible to the farming operation for some time. This project will greatly benefit Bypass Farms by potentially helping to shore up the north side of the irrigation channel which in turn will allow us to irrigate and convey water without water losses into the Tule pond area.

4. Spoils

9 Regardless of the alternative that is selected and goes forward with construction, Bypass Farms looks forward to working with the DWR and the contractors in providing suitable lands for depositing spoils. The teVelde properties adjacent to the project site will hopefully make for less hauling and help control costs to project implementation. In addition, dirt deposited by previous projects to clean out the weir and Bypass that elevated the lands adjacent to the Bypass levee, have helped control and mitigate seepage. The ability to increase the elevation of additional lands will coincide nicely with the potential for more seepage from longer duration of flood/ water against the east Yolo Bypass Levee.

5. Selected alternative-

Alternative 5 is the provided alternative that Bypass Farms would prefer to see put into place. The biggest benefits we see from this alternative –

- Multiple gates – in discussion with biologists the multiple gate idea should provide greater benefit to critical species 10
- The project and channel are in middle of the wildlife area- any additional/ non-flood flows will not be against the east yolo bypass levee
- The project ties into the south end of Tule pond which is an area that the creation of a channel and tying into Ag Crossing 1 will have a benefit to the agricultural operations

6. General comments and Concerns

- Facility maintenance
    - Will there be planned and funded routine maintenance of the created channel and ag crossing structures? 11
    - Would the DWR be willing to partner/ agree to a maintenance contract with Bypass Farms to provide channel maintenance as needed if costs are covered in return for any dirt that is generated on a routine basis?

- Access
  - There are studies included for all types of impacts related to access and construction management / BMPS. However, I didn't note anything regarding maintenance or assistance to maintain the County Roads 16 and 117 during and after construction. Will any maintenance to these roads be implemented? Or perhaps maintenance will be limited to a pre-construction state? 12
  - I found no study or mention of increased public access due to publicity and improvements in the wildlife area and mitigation for additional / more people and traffic. Will any mitigation be taken to control public traffic? For example, there are currently no public facilities in the wildlife area and even though it is technically closed most of the year there has been a definite increase in use and traffic which continues year-round. This level has steadily increased over the past couple years. 13

Dominic Bruno

Farm Manager

Bypass Farms / teVelde Family Trust

IN03

California Water Research

Deirdre Des Jardins
145 Beel Dr
Santa Cruz, CA 95060
(831) 423-6857
ddj@cah2oresearch.com

February 15, 2017 VIA electronic mail

Re: Comments on the Draft Environmental Impact Statement/Environmental Impact Report for the Yolo Bypass Salmonid Habitat Restoration and Fish Passage Project

California Water Research requests that Reclamation and the Department of Water Resources analyze alternatives with gate closure dates of March 30 and April 30 for the inundation flows, to help meet the obligations of the Central Valley Project and State Water Project to offset project impacts on Chinook salmon and to sustain natural production of Chinook salmon in the Sacramento River basin. Doing so would also be important for mitigation of impacts of any new intakes in the North Delta. 1

The Appendix A Plan Formulation Report by the Department of Water Resources states,

> Agricultural production in the Yolo Bypass would be affected if fields are inundated in the spring when growers need to start field preparation and planting. For these types of impacts, the key driver in the potential for impacts is the closure date for the gated notch. All alternatives incorporate the same closure dates (either March 30 or April 30); thus, the key performance indicator is the size of the facility that allows water into the Yolo or Sutter bypasses. (p. 3-20.)

It then states,

> The gated notch structures were originally planned to stay open through April to allow juveniles to enter the Yolo Bypass, but discussions with stakeholders indicated that an earlier inundation end date (originally suggested as March 15) would reduce impacts to agricultural users and wetlands. The Lead Agencies analyzed whether this change would result in a substantive decrease in benefits to the focus fish species and found little change in benefits, so the end date was changed for all alternatives to March 15.
> (p. 4-8-4-9.)

The Department of Fish and Wildlife developed a conceptual model of Chinook salmon and steelhead life histories in 2008 as part of the Delta Regional Ecosystem Restoration Implementation Plan (DRERIP). The Chinook salmon and steelhead DRERIP conceptual life history model was compiled by John G. Williams, and was peer reviewed in 2010.[1] Figure 30 from page 46 of the DRERIP model shows juvenile salvage in the Delta over a six-year period from 1995-2001. Clearly fry and parr migrants emigrate through April and would benefit from access to floodplain habitat for rearing. 2

Analyzing inundation dates of March 30 and April 30 is also consistent with the recommendations of the 2010 Delta Flow Criteria report produced by the State Water Resources Control Board pursuant Water Code section 85086 (b)(1).)[2] The report states,

> The timing of floodplain inundation for the protection of Central Valley Chinook salmon should generally occur from winter to mid-spring to coincide with the peak juvenile Chinook salmon outmigration period (which itself generally coincides with peak flows) and to avoid non-native access to the floodplain (which would generally occur in late-spring). (AR/NHI 1, p. 25.) The benefits of floodplain inundation generally increase with increasing duration, with even relatively short periods of two-weeks providing potential benefits to salmon. (Jeffres *et al.*, 2008 as cited in AR/NHI 1, p. 25.) (p. 62.) 3

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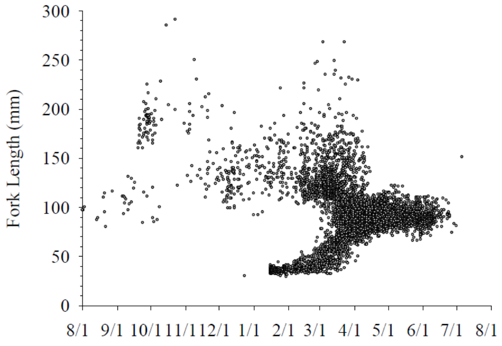
[1] Williams, G. J. 2010. Life History Conceptual Model for Chinook salmon and Steelhead. DRERIP Delta Conceptual Model. Sacramento (CA): Delta Regional Ecosystem Restoration Implementation Plan. Available at https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=28422. Incorporated by reference.

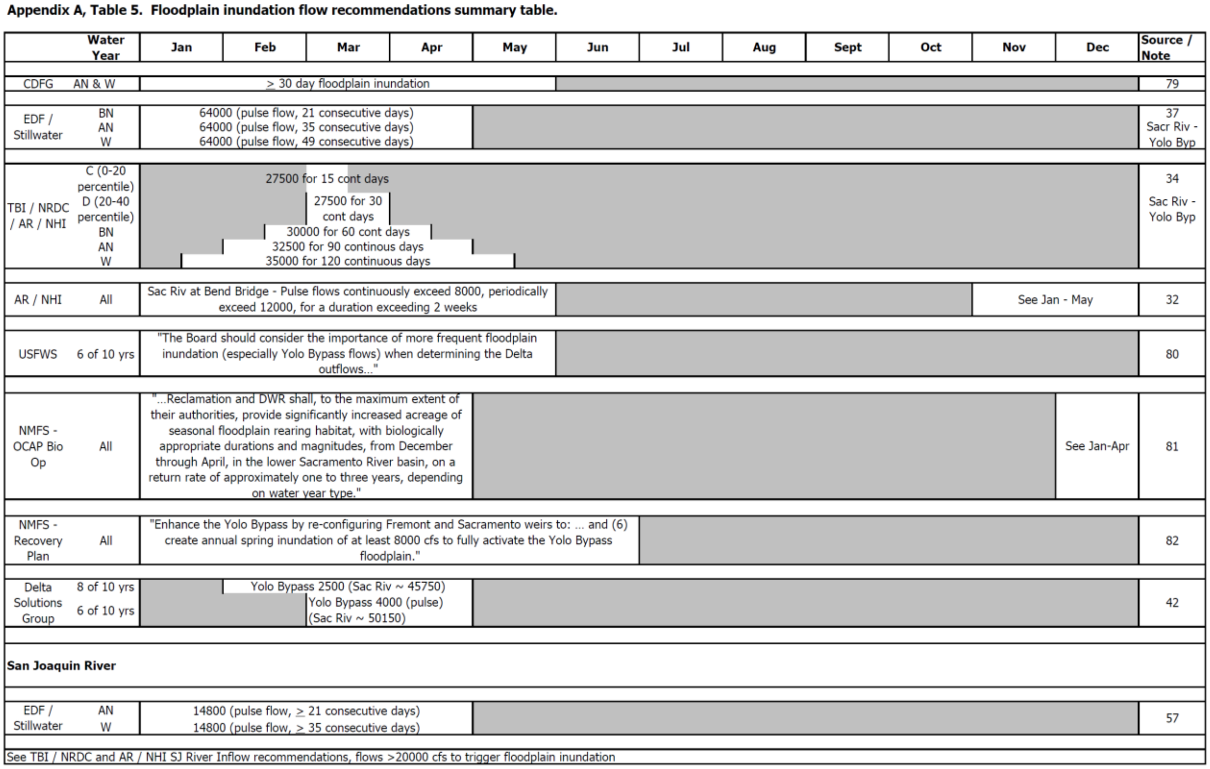
[2] State Water Resources Control Board. 2010 Development of Flow Criteria for the Sacramento-San

y_delta/deltaflow/docs/final_rpt08

Figure 30. Juvenile Chinook at the Delta diversions; size at date of 6,752 juvenile Chinook sampled at the CVP and SWP diversion facilities in the Delta from August 1995 through July 2001. Data from Hedgecock (2002).



The 2010 Delta flow criteria report also had the following table of recommendations for inundation of the bypass (p. 163.) DWR and Reclamation should analyze alternatives consistent with the recommendations in the 2010 Delta flow criteria report. 4



Appendix A, Table 5. Floodplain inundation flow recommendations summary table.

	Water Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Source / Note
CDFG	AN & W	> 30 day floodplain inundation												79
EDF / Stillwater	BN	64000 (pulse flow, 21 consecutive days)												37 Sacr Riv - Yolo Byp
	AN	64000 (pulse flow, 35 consecutive days)												
	W	64000 (pulse flow, 49 consecutive days)												
TBI / NRDC / AR / NHI	C (0-20 percentile)			27500 for 15 cont days										34 Sac Riv - Yolo Byp
	D (20-40 percentile)			27500 for 30 cont days										
	BN		30000 for 60 cont days											
	AN		32500 for 90 continous days											
	W	35000 for 120 continuous days												
AR / NHI	All	Sac Riv at Bend Bridge - Pulse flows continuously exceed 8000, periodically exceed 12000, for a duration exceeding 2 weeks										See Jan - May		32
USFWS	6 of 10 yrs	"The Board should consider the importance of more frequent floodplain inundation (especially Yolo Bypass flows) when determining the Delta outflows..."												80
NMFS - OCAP Bio Op	All	"...Reclamation and DWR shall, to the maximum extent of their authorities, provide significantly increased acreage of seasonal floodplain rearing habitat, with biologically appropriate durations and magnitudes, from December through April, in the lower Sacramento River basin, on a return rate of approximately one to three years, depending on water year type."											See Jan-Apr	81
NMFS - Recovery Plan	All	"Enhance the Yolo Bypass by re-configuring Fremont and Sacramento weirs to: ... and (6) create annual spring inundation of at least 8000 cfs to fully activate the Yolo Bypass floodplain."												82
Delta Solutions Group	8 of 10 yrs		Yolo Bypass 2500 (Sac Riv ~ 45750)											42
	6 of 10 yrs			Yolo Bypass 4000 (pulse) (Sac Riv ~ 50150)										
San Joaquin River														
EDF / Stillwater	AN	14800 (pulse flow, > 21 consecutive days)												57
	W	14800 (pulse flow, > 35 consecutive days)												
See TBI / NRDC and AR / NHI SJ River Inflow recommendations, flows >20000 cfs to trigger floodplain inundation														

Sincerely,

Deirdre Des Jardins

Principal, California Water Research

IN04

Cal Marsh & Farm Ventures, LLC

1059 Court St., Suite 120 • Woodland, CA 95695
P: (530) 458-8063 • F: (530) 458-5369

February 15, 2018

Karen Enstrom
California Department of Water Resources
3500 Industrial Blvd., West
Sacramento, CA 95691

RE: Yolo Bypass Salmonid Habitat Restoration and Fish Passage Project

Dear Ms. Enstrom,

We would like to offer the following comments on the EIR/EIS.

The goal of the Project is to provide, more and better, floodplain habitat for winter-run Chinook salmon juveniles coming out of the upper Sacramento River in late fall and early winter. Studies have shown that juvenile salmon use such habitats selectively on their migration to the ocean, resulting in enhanced growth, increased survival, and population abundance. Floodplain habitats are found in the lower Sacramento River, above the Delta, as well as in the river channels of the tidal Delta.

Scientific knowledge of floodplain performance and its productive capability is far better today than when the Biological Opinion was written. Today it is now clearly understood that it is not just a matter of flooded acreage during flood events, but greater benefits can be obtained when the waters are retained with lower flow rates allowing floodwaters to warm up and produce more food for fish.

The Yolo Bypass, with both the river and tidal elements, is an area with significant habitat potential if water and fish were allowed increased access; this can be achieved through structural modifications to the Fremont Weir to increase the frequency and magnitude of flows from the Sacramento River into the Bypass. With modifications flows could start earlier, last longer, be higher in volume, and flow rate than at present.

The main difference between the alternatives presented is location of the notch in Fremont Weir and the amount of flow that will be discharged into the Bypass. The information presented in the EIR shows that a "managed" 3,000 cfs flow could inundate similar acreage as the 6,000 cfs alternative, minimal internal infrastructure.

1

Alternative 4, with half the flow, creates the same floodplain foot-print, maintains the same number of wetted-acre days and provides higher quality habitat. The proposed infrastructure would allow volitional movement into and out of the floodplain areas by both juvenile and adult fish. In addition, the lower flow alternative is more agreeable to landowners within the Bypass who would be affected; only the willing landowners would participate.

In summary, we are advocates for "managed" floodplain habitat in the Yolo Bypass and believe it is essential to the survival of the salmon populations in the Sacramento River watershed.

Sincerely,

John Brennan

David Katz

David Katz

IN05

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Ronald A Arendt
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Arbitrations / Mediations
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rarendt@arendtadr.com
(916) 925-1151

February 6, 2018

Karen Enstrom DWR
3500 Industrial Blvd.
West Sacramento, CA 95691

Channel Ranch Partnership
Yolo County Parcel # 33-440-02
RE: Lowering of Wiers

To All Those Concerned;

My clients, Channel Ranch and its members, through my office are expressing their concerns and
opposition to the proposed State and Federal Yolo Bypass Salmoniod Habitat Restoration and Fish
Passage Project. The Channel Ranch Partnership has been in existence for over 45 years with two
primary purposes and goals. These are conservation of wetlands and wildlife and also providing an 1
outdoor experience of hunting and fishing for family members and guests. The project as proposed
substantially impairs management of their property to achieve both of those goals as it would affect
enjoyment of their valued property during substantial periods of time presently utilized for those
purposes.

It appears that the thought processes utilized in the project proposal are quite flawed. Other projects
presently in place contraindicate success should this project be undertaken. The California
Department of Fish and Wildlife has identified Striped Bass is a major predator for Salmoniod
young. That same department has programs in place which relocate Striped Bass downriver of the 2
access point of this proposed project area which would be utilized as a means of ingress and egress
of the Salmoniod young to the ocean. What seems to be overlooked is the proposition of increased
mammal and avian predation of those young fish in the floodplain created by the lowering of the
weirs. It is recognized in studies by the DWR and Bureau of Reclamation that floodplain rearing
reduces the probability that many of these juvenile fish would reach the ocean. Given that there is an
overriding concern about climate change causing increased temperatures, utilization of the floodplain 3
could have a disastrous effect on any of the young fish which might be generated or introduced by
the flooding of the project area. What is also seemingly overlooked is the fact that we have been in
many years of drought. The dollars used to fund this project would be better spent in creating a water
retention system at higher elevations to serve the general human populace and its increasing water 4
demands both locally as well as to the South. Increased Striped Bass limits would be far more 5
efficacious and with associated increased revenues.

Also very important to the members of Channel Ranch is the financial and fiscal effect on the
partnership should this project go through. A substantial decrease in the value of the property will
result should this project go forward. For over 45 years this partnership property has been cultivated 6
and maintained for the purpose of an investment as well as outdoor recreational enjoyment. Levees
have been constructed. Duck blinds have been placed. Indigenous crops have been promoted. Water
pumping equipment has been maintained. Access roads have been created and maintained both by
owners of the property as well as government entities. Utilization of the property in the manner
which is recommended by the project effectively constitutes a taking which by the very least should 7

be compensable to the owners of said property. There appears to be no provision in the project for such compensation.

8 Rather than spend substantial time and money and effort in creating a speculative project, we encourage those who support this project to revisit better usage of those dollars for the overall general good rather than to a project which has many aspects of failure which seemingly have not been thoroughly and conscientiously thought out with the common good in mind.

Sincerely,

Ronald A Arendt

Ronald A Arendt

Cc: Channel Ranch members

IN06

SOMACH SIMMONS & DUNN
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW

500 CAPITOL MALL, SUITE 1000, SACRAMENTO, CA 95814
OFFICE: 916-446-7979 FAX: 916-446-8199
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February 14, 2018

Via Electronic Mail
Karen Enstrom
California Department of Water Resources
3500 Industrial Blvd.
West Sacramento, CA 95691
Karen.Enstrom@water.ca.gov

Via Electronic Mail
Ben Nelson
Bureau of Reclamation, Bay-Delta Office
801 I St., Suite 140
Sacramento, CA 95814
bnelson@usbr.gov

Re: Comments on Yolo Bypass Salmonid Habitat Restoration and Fish Passage Draft Environmental Impact Report/Environmental Impact Statement

Dear Ms. Enstrom and Mr. Nelson:

The following comments on the draft environmental impact report/environmental impact statement (DEIR/EIS) for the proposed Yolo Bypass Salmonid Habitat Restoration and Fish Passage Project (Project) are submitted on behalf of the Conaway Preservation Group (Conaway).

Conaway owns Conaway Ranch, which comprises over 17,000 contiguous acres of active farmland, open space, and wildlife habitat along the Sacramento River in Yolo County. Approximately 40 percent of the Conaway Ranch property is located within the Yolo Bypass, making it a strategic location for a wide variety of projects and programs to improve flood protection, improve water quality, preserve open space, and provide fish and wildlife habitat. The Ranch's productive farmlands also play an important role in the local economy as a steady source of revenue and labor. 1

Conaway supports the joint effort of the U.S. Bureau of Reclamation (USBR) and California Department of Water Resources (DWR) (collectively, the "Lead Agencies") in pursuing the proposed Project. Conaway has continually pressed for such restoration actions within the Yolo Bypass because it believes that such efforts can achieve the co-equal goals of aiding endangered and threatened fish species and supporting agricultural and recreational opportunities on surrounding private property. Furthermore, because of its 85 percent ownership of the land within Reclamation District 2035 (RD 2035), Conaway is uniquely positioned to assist in the acquisition of necessary project components, such as flood and habitat conservation easements.

The Lead Agencies have an exceptional opportunity to advance state-wide objectives in environmental restoration with the cooperation of willing sellers, such as Conaway. DWR has recognized at public meetings, in response to questions about the possible use of eminent domain, that the Project will not be implemented without willing sellers. It is within this context that Conaway offers comments on the DEIR/EIS. Although the following comments focus on Alternative 1, the preferred EIR alternative, they apply equally to Alternatives 2 through 6.

I. The Lead Agencies Must Obtain Conaway's Consent to Increase Inundation of Conaway Ranch Lands Within the Yolo Bypass

Alternative 1 would allow increased flows—up to 6,000 cubic feet per second (cfs)—from the Sacramento River to enter the Yolo Bypass through a gated notch on the east side of the Fremont Weir. Compared to the No Action Alternative presented in the DEIR/EIS, Alternative 1 would inundate portions of Conaway for purposes other than flood control and would result in the inundation of up to 5,000 acres in non-flood years.

The DEIR/EIS states that "[l]and currently subject to agricultural activities, including those under conservation easements would continue to be farmed and remain subject to existing easements and restrictions." (DEIR/EIS, pp. 11-17.) The Sacramento and San Joaquin Drainage District (SSJDD) currently holds an easement on Conaway Ranch for flood control purposes. ("Flood control easement" attached as Exhibit A.) Specifically, the flood control easement provides ". . . a perpetual right and easement . . . for the passage of all flood waters of the Yolo By-Pass, which from time to time inundate, or which have heretofore inundated, the lands of the grantor herein . . . ." (Exhibit A at pp. 363-364.) 2

Although the DEIR/EIS acknowledges the continued effect of existing easements attached to the land affected by the proposed Project, the Project proposes to inundate portions of Conaway Ranch for a use that is not authorized under the existing flood control easement. Civil Code section 806 states, "The extent of a servitude is determined by the terms of the grant, or the nature of the enjoyment by which it was acquired." By its express terms, the existing flood easement grants SSJDD a non-possessory interest in the underlying land for flood control purposes only and does not include any other uses. However, the proposed Project is intended to enhance fisheries rearing habitat. (DEIR/EIS, p. ES-2.) The proposed use clearly exceeds the scope of the existing flood control easement.

Changing the nature of an easement, which results in an increased burden on the underlying land, is not permissible without the landowner's consent. (*Krieger v. Pacific Gas and Electric Co.* (1981) 119 Cal.App.3d 137, 145-146.) Enhancing fisheries rearing habitat by extending the geographic extent and duration of inundation would significantly increase the burden on Conaway as the underlying landowner. For example, although not discussed in the DEIR/EIS, increased flooding would damage the Cross Canal—used for conveyance of irrigation water—thereby preventing water from being delivered to Conaway Ranch lands outside of the Yolo Bypass. Current flows in the Yolo Bypass are sufficient to erode the berms of the Cross Canal, which require an estimated $50,000 to $100,000 in annual maintenance in order to maintain the carrying capacity. In fact, RD 2035 spent $60,000 to restore the Cross Canal in 2017 after high water in the Yolo Bypass. However, it is clear that more frequent flooding of the Cross Canal would require more frequent repairs. Piping of a one-third section of the Cross Canal to permanently prevent damage would cost an estimated $10 million. The DEIR/EIS does not address the Project's potential to damage the Cross Canal; however, as a likely consequence of the proposed Project, these damages necessitate a discussion of mitigation options to ensure annual or permanent repairs.

When the Cross Canal is out of commission due to damage from the Yolo Bypass flows, Conaway and RD 2035 must pump groundwater to meet irrigation demands. However, at a cost of $50 per acre foot, groundwater is significantly more expensive than the $6 per acre foot cost of Sacramento River water that Conaway diverts pursuant to its state-held water rights. Furthermore, because the DEIR/EIS incorrectly concludes that the Project as proposed would not lead to additional groundwater pumping, it also incorrectly concludes that impacts to land subsidence would be less than significant. (DEIR/EIS, pp. 7-28, 7-45.) The analysis disregards the costs and regulatory restrictions on private landowners who actively monitor and manage subsidence, and potential impacts to critical infrastructure, including the Yolo Bypass levees. 3

Drainage culvert capacity would also need to be increased at an estimated cost of $250,000 to $500,000, and general ditch maintenance, including sediment deposition removal, would need to occur more frequently, at a cost of $50,000 each year. Impacts to other drainage and irrigation structures, such as levees, water control structure, and roads, would also result in increased maintenance activities and associated costs to Conaway. Additionally, by adding 6,000 cfs of additional flows in the Yolo Bypass, the freeboard would be further reduced and the level of flood protection provided by the west levee of the Yolo Bypass would be diminished. Furthermore, because of the broader area of inundation, a larger portion of Conaway Ranch lands would need to be leveled approximately every to two to three years at a cost of $200 to $300 per acre — an additional cost to Conaway of up to $1.5 million. Such costs directly affect potential profitability of rice and other crops grown on Conaway Ranch. Finally, as discussed further below, the Project will increase the burden on Conaway through increased regulatory risk of liability under the federal and state Endangered Species Acts (ESA). 4

The use proposed by the Project is not authorized by the existing flood control
easement and significantly expands the burdens imposed on the landowner. This would result
in a taking of private property without payment of just compensation as guaranteed by the 5
Constitution of the United States and the California Constitution. This discussion is notably
absent from the DEIR/EIS, but is pertinent to the feasibility of the proposed Project and
alternatives discussion. The DEIR/EIS should be revised to reflect the Project's significant
impacts to the Cross Canal, and associated impacts to groundwater resources, as well as 6
increased subsidence and impacts to agricultural resources and crop yields, and mitigation
measures should be included to address these impacts. For the proposed Project to move
forward, it also is necessary for the Lead Agencies to consult with Conaway and reach 7
agreement regarding necessary amendments to the existing flood easement.

II. The Proposed Project Would Have Quantifiable Impacts on Conaway Agricultural Income and the Local Economy Due to Reduced Agricultural Yields

8 The increased inundation would impact agricultural production on Conaway lands within the Yolo Bypass. The DEIR/EIS acknowledges the potential impacts from delayed planting, noting that changes in the seasonal timing of inundation of the Yolo Bypass could affect the cultivation of crops, particularly rice. This, in turn, could have adverse economic effects not only for Conaway, but also for the local economy. However, the DEIR/EIS includes no further analysis of these potential impacts. The DEIR/EIS, therefore, does not adequately address how increased inundation conflicts with existing, permitted agricultural uses and may be so economically damaging as to effectively convert portions of existing farmland to a non-agricultural use.

9 Reductions in crop yields are a driving factor in agricultural revenue losses due to flooding in the Yolo Bypass. Inundation during the months when the land is being prepared for planting and during the growing season can result in significant losses to crop yield. The months of March, April, and May are critically important in the rice farming season, as this is the time in which preparation and planting of the field begins. The period of inundation proposed under Alternative 1 would end on March 15 each year. It takes at least 45 days to drain the land from the last day of inundation. An additional 30 days are needed to allow for groundwork. If inundation ends on March 15, planting would begin around June 1. However, ideal planting time is May 5 through May 15, and the last possible date for planting is approximately June 10. Based on Conaway's experience farming rice, the delay in planting under Alternative 1 could lower crop yields by 10 to 20 percent, which, at today's price of approximately $19 per sack, would result in a gross reduction of income for Conaway of $150 to $300 per acre, along with reduced revenue to Yolo County and the local economy.

A 2013 report written jointly by representatives of the University of California, Davis, Yolo County, and Douglas Environmental, quantified agricultural impacts of flooding in the

Yolo Bypass under a variety of possible flooding scenarios in order to evaluate future projects connected to the Bay Delta Conservation Plan. (*Howitt* et al., Agricultural and Economic Impacts of Yolo Bypass Fish Habitat Proposals (Apr. 2013) p. 1, attached as Exhibit B.) The study was based on a comprehensive economic, agronomic, and geo-referenced dataset of agricultural production in the Yolo Bypass between 2005 and 2009, and found that flooding with a flow of 6,000 cfs through March 24 would result in total annual losses to the Yolo County economy — excluding other substantial costs associated with infrastructure maintenance and repairs — of over $1.7 million. (*Id.* at iii, 22.) By comparing earlier and later flooding end dates, the study illustrated that flooding of the Yolo Bypass later into the planting season has a real and quantifiable impact on the local agricultural economy.

The study expressly excluded a quantification or discussion of management difficulties and other challenges which would likely accompany changes to inundation periods and frequencies. (*Id.* at p. 40.) The DEIS/DEIR addresses potential increases to bank loan rates, but downplays the likely inability of agricultural tenants to acquire production loans altogether due to increases in production risks resulting from changes in flooding frequency and duration. Furthermore, the DEIR/EIS should recognize that farmers within Conaway Ranch are likely to experience greater difficulty in obtaining crop insurance as flooding on the land increases and they may be subject to higher insurance premiums. All of these reasonably foreseeable economic impacts threaten the sustainability of agriculture on Conaway Ranch.

The potential reduction in agricultural yields in addition to increased costs should be analyzed in the DEIR/EIS in greater detail. Conaway is available and willing to discuss such impacts, and potential Project modifications and mitigation, further with the Lead Agencies to ensure the proposed Project does not result in unintended significant adverse impacts to agricultural resources, or a significant negative economic impact to Conaway or Yolo County.

III. Introduction of New Species and Impacts to Existing Species' Habitat from Changes in Inundation Patterns Would Place Additional Burdens on Conaway

As stated in the DEIR/EIS, changes in the inundation pattern of the Yolo Bypass could reduce habitat for waterfowl and other terrestrial species, as well as disturb fish species and their habitat. However, the DEIR/EIS omits a discussion of impacts to landowners within the project area resulting from changes in species and habitat management. 10

The introduction of additional aquatic and terrestrial endangered species from increased inundation on Conaway Ranch within the Yolo Bypass would require additional coordination by Conaway and RD 2035 personnel with resource management agencies, even for routine operations and maintenance activities. Changes in inundation periods and frequencies create a risk of "take" violations under the federal and ESAs due to the introduction of protected species on the property or the creation of new risks to protected species. Conaway could be required to obtain permits to complete maintenance activities associated with increased flooding because of potential impacts to species. The introduction of winter-run Chinook salmon, Central Valley spring-run Chinook salmon, Central Valley steelhead, North American green sturgeon, and split-tail and fall-run Chinook salmon could also restrict the times when the operations and maintenance activities could take place. Additionally, changes to inundation and resulting challenges in delivering water to fields, or to drain water from fields, could impact existing conservation easements on privately owned land for a variety of terrestrial species, including the giant garter snake, Swainson's hawk, and tricolored blackbird. (DEIR/EIS, p. 9-8.) So, while the Project aids conservation efforts for some species, it may hinder conservation efforts for others. Conaway must not be forced to bear increased regulatory or cost burdens associated with the Project. In order for the Project to move forward Conaway will need to receive adequate regulatory assurances under both the federal ESA and CESA, which could include formal consultation and issuance of a biological opinion under ESA Section 7, a Safe Harbor Agreement, and Enhancement of Survival Permit and state consistency determination, or other appropriate assurances.

Additionally, while the DEIR/EIS concludes that there will be no significant increase in the use of recreational facilities, it disregards the significant environmental and economic impact of the inverse: a substantial decrease in suitable duck hunting opportunities. As stated in the DEIS/DEIR, all proposed Project alternatives would impact waterfowl hunting opportunities due the reductions in availability of shallow-flooded wetlands during the hunting season. This would impact private hunting clubs economically and may disincentivize such clubs from managing shallow-flooded wetlands. Changes in water levels can also alter the habitat suitability for migratory waterfowl that utilize Conaway Ranch, as different species of waterfowl prefer different water levels and water depth influences which species will utilize a particular area. The DEIS/DEIR does not analyze the potential significance of such impacts, but merely notes the uncertainty of the magnitude of these effects on individual private parcels. The conclusion that such impacts are may vary within the Project area does not excuse the Lead Agencies from analyzing and mitigating known impacts likely to result from the proposed Project. Private property owners supporting waterfowl hunting opportunities in the Yolo Bypass, and the associated habitat, should not be left to invest their own resources in researching and addressing such widespread impacts independent from the ongoing Project review process. 11

IV. Conclusion

Conaway appreciates USBR and DWR's recognition of the unique opportunities available in the Yolo Bypass and on Conaway Ranch to restore and improve aquatic habitats with the cooperation of private property owners. As discussed above, the DEIR/EIS must recognize and fully mitigate the Project's potentially significant impacts to Conaway Ranch's agricultural and other resources. Conaway has already invested significant resources in reviewing and understanding the proposed Project, and the Lead Agencies must consider the 12 heavy financial burden and regulatory risks that the proposed Project imposes on Conaway Ranch lands within the Project area if it is approved. Conaway invites further discussion of the comments provided in this letter and will gladly offer additional data, information, or insight regarding this effort. Conaway will continue to be engaged in the Project review process and requests to receive notice of all Project-related matters moving forward. On behalf of Conaway, thank you for taking time to accept and review our comments, and please do not hesitate to contact me to discuss this letter further. 13

Sincerely,
Kelley M Taber
Kelley M. Taber
Attorney

Enclosures

KMT:MEC:mb

cc: Paul Navazio, City Manager (*Via U.S. Mail*)
City of Woodland

Michael Webb, City Manager (*Via U.S. Mail*)
City of Davis

John Young, Agricultural Commissioner (*Via U.S. Mail*)
Yolo County

EXHIBIT A

All of Exhibit A
14

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362

Yolo Bypass

STATE OF CALIFORNIA) SS
COUNTY OF YOLO)

I, H. R. SAUNDERS, County Clerk of the County of Yolo, State of California, and ex-officio Clerk of the Superior Court thereof, do hereby certify that I have compared the foregoing copy with the original Order Confirming Sale in the Matter of the Estate of Annie Schluer, Deceased No. 4462 filed in my office on the 25th day of March, 1940, and the same is a full, true and correct copy of the original and the whole thereof, as the same remains on record and on file in my office.

Witness my hand and the seal of the Superior Court, this 25th day of March, 1940.

(COURT SEAL) H. R. SAUNDERS, Clerk
By Opal Davis, Deputy

Recorded at Request of HUSTON HUSTON & HUSTON Mar. 25 A. D. 1940 at 50 min. past 10 o'clock A. M.

Document Number 891 LE R. PIERCE, Recorder.

COMPARED

Item # 27

THIS INDENTURE, made this 24th day of January, 1940, by and between BIRCH RANCH & OIL COMPANY, a corporation, organized and existing under and by virtue of the laws of the State of Nevada, the party of the first part, and SACRAMENTO AND SAN JOAQUIN DRAINAGE DISTRICT, a body corporate and politic existing under and by virtue of the laws of the State of California, the party of the second part,

WITNESSETH:

That the said party of the first part for and in consideration of the sum of $160,184.00 lawful money of the United States of America to it in hand paid by the said party of the second part, the receipt whereof is hereby acknowledged, does by these presents grant, bargain and sell to Sacramento and San Joaquin Drainage District, the said party of the second part, its successors and assigns, a prepetual right and easement, without recourse to compensation for damage therefrom, past, present or future, for the passage of all flood waters of the Yolo By-Pass, which may from time to time inundate, or which have heretofore inundated, the lands of the grantor herein, the said party of the first part, over, upon and across all of that certain real property situate in the County of Yolo, State of California, and more particularly described as follows:

PARCEL 1:

The Easterly 54 acres, more or less of the NE¼, the Westerly 45 acres, more or less, of the NE¼, the Westerly 65 acres, more or less, of the SE¼ and all of the SW¼ of Section 13, Township 10 North, Range 2 East, M. D. B. & M., 196.8 acres, more or less, of the S½ of Sec. 14 and 202.4 acres, more or less, of the E½ of Sec. 23, T. 10 N., R. 2 E., lying below the Yolo By-pass flood plane, the SE¼ of Sec. 23, all of Sec. 24, except 30 acres, more or less, in the Northeast corner thereof, all of Sec. 25, T. 10 N., R. 2 E., the Southerly 356 acres, more or less, of Sec. 19 except 5.00 acres in the Southeast corner thereof and all of Sec. 30, T. 10 N., R. 3 E., and containing 3,117.20 acres, more or less, lying within the Cache Creek Settling Basin. EXCEPTING from said Section 25, Township 10 North, Range 2 East and said Section 30, Township 10 North, Range 3 East so much of the South Halves thereof, as was heretofore conveyed to Sacramento & Woodland Railroad, by deed dated February 5th, 1912 and recorded February 5th, 1913, in the office of the County Recorder of Yolo County in Block 81 of Deeds at page 123, and containing approximately 60.46 acres more or less.

PARCEL 2:

All of that portion of Section 32 and Section 33, Township 10 North, Range 3 East, M. D. B. & M., and Sections 3, 4, 5, 8, 9, 10, 11, Section 14 except S½ of SE¼ thereof, Sections 15, 16, 21, 22, W½ of Section 23, N. 120 acres of W½ of Section 26, W½ of Section 27, W½ and NE¼ of Section 34, Township 9 North, Range 3 East, lying within the Yolo By-pass and containing 6,529.6 acres, more or less.

TO HAVE AND TO HOLD the said right and easement unto the said party of the second part and to its successors and assigns forever.

IN WITNESS WHEREOF, the said party of the second part, by its president and secretary thereunto duly authorized by resolution of its board of directors, has caused its corporate name to be hereunto subscribed and its corporate seal to be hereunto affixed, the day and year first above written.

(CORPORATE SEAL)

BIRCH RANCH & OIL COMPANY
By

A. OTIS BIRCH
President
ROBERT R. LANDRUM
Secretary

STATE OF CALIFORNIA
SS
COUNTY OF LOS ANGELES

On this 29 day of January, 1940, before me, F. B. OLDS, a Notary Public in and for the County of Los Angeles, State of California, personally appeared A. OTIS BIRCH and ROBERT R. LANDRUM known to me to be the president and secretary respectively of Birch Ranch & Oil Company the corporation described in and that executed the foregoing instrument, also known to me to be the person who executed it for and on behalf of said corporation and they duly acknowledged to me that such corporation executed the same.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my official seal the day and year in this certificate first above written.

(SEAL)

F. B. OLDS Notary Public in and for the County of Los Angeles, State of California. My Commission Expires June 22, 1943.

THIS IS TO CERTIFY:

That I am the duly elected, qualified and acting Secretary of the Birch Ranch & Oil Co., a Nevada corporation; that as such Secretary I have in my possession the original Minute Book of said corporation; that at a Special Meeting of the Board of Directors of said corporation held on Saturday, the 27th day of January, 1940, the following preambles and resolutions were unanimously adopted:

"The Chairman stated that on January 14, 1935, this corporation had entered into an option and agreement with the SACRAMENTO AND SAN JOAQUIN DRAINAGE DISTRICT, a body corporate and politic existing under and by virtue of the laws of the State of California, by which this corporation was to be paid $160,184.00 as the purchase price of a perpetual right and easement, without recourse to compensation for damage therefrom, past, present or future, for the passage of all flood waters of the Yolo By-Pass of the Conaway Ranch real property; and that the said SACRAMENTO AND SAN JOAQUIN DRAINAGE DISTRICT have previously paid on the purchase price the total sum of $130,347.25, and are now ready to pay the balance of $29,836.75, and will be immediately paid upon receipt of deed and title policy to the lands over which the easement rights are given, a copy of which deed was presented and read at the meeting.

Upon motion, duly adopted, it was unanimously

RESOLVED, that the President and Secretary of this corporation be, and they are hereby instructed and authorized to execute said deed on behalf of this corporation, and that the President, A. Otis Birch, may do everything else necessary to consummate the matter on behalf of this corporation, and to obtain the money from the District for this corporation.

That said preambles and resolutions were adopted by a unanimous vote of all of the directors of the corporation; that they have not been rescinded and are now in full force and effect.

DATED: Los Angles, California, January 27, 1940.

(CORPORATE SEAL)

ROBERT R. LANDRUM Secretary
BIRCH RANCH & OIL COMPANY

RESOLUTION

PASSED AND ADOPTED BY THE RECLAMATION BOARD

AT MEETING HELD JULY 15, 1936

IT IS RESOLVED AND ORDERED by the Reclamation Board of the State of California that S. A. HONAKER, as Assistant Secretary of said Board, is hereby authorized to consent to deeds or grants conveying, to the Sacramento and San Joaquin Drainage District or the Reclamation Board of the State of California, real estate, or any interest therein, or easements thereon, for public purposes, and to evidence said consent by his written acceptance attached to such deeds or grants together with a certified copy of this resolution in accordance with section 1158 of the Civil Code of the State of California.

STATE OF CALIFORNIA
COUNTY OF SACRAMENTO SS
OFFICE OF THE RECLAMATION BOARD

I, S. A. Honaker, Assistant Secretary of The Reclamation Board, do hereby certify that the above and foregoing is a true and exact copy of a resolution duly passed and adopted by said Board at its regular monthly meeting held July 15, 1936.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed the official seal of The Reclamation Board, this 21 day of March, 1940.

(SEAL)

S. A. HONAKER
S. A. Honaker
Assistant Secretary
THE RECLAMATION BOARD

STATE OF CALIFORNIA
SS
COUNTY OF SACRAMENTO

This is to certify that I, the undersigned, duly appointed, qualified and acting Assistant Secretary of The Reclamation Board, do consent to and accept the attached deed or grant by virtue of the authority vested in me by the resolution of said board, a certified copy of which is above set forth.

DATED: 21 March, 1940.
(SEAL)

S. A. HONAKER

Recorded at Request of WOODLAND ABSTRACT & TITLE CO. Mar 25 A. D. 1940 at 55 min. past 10 o'clock A. M.

Document Number 892 LE R. PIERCE, Recorder.

IN THE SUPERIOR COURT OF THE STATE OF CALIFORNIA,
IN AND FOR THE COUNTY OF CONTRA COSTA.

COPY

In the Matter of the Estate
of
HENRY A. JOHNSTON, also known
as H. A. JOHNSTON,
Deceased.

No. 9492
Dept. 2

DECREE OF FINAL DISTRIBUTION

GEORGE E. JOHNSTON, executor of the last will and testament of the above named HENRY A. JOHNSTON, also known as H. A. JOHNSTON, deceased, having on the 8th day of September, 1938, rendered and filed herein a full account and report of his administration of said estate, which said account was his first and final account, and having with said account filed a petition for the final distribution of the estate of said deceased, and said account and petition this day coming on regularly to be heard, proof having been made to the satisfaction of the Court, the Court finds:

That the clerk has given notice of the settlement of said account and the hearing of said petition in the manner and for the time required by law.

That said account is in all respects true and correct and is supported by proper vouchers.

That due and legal notice to the creditors of said deceased has been given in the manner and for the time prescribed by law, and within thirty days after the completion of the publication of said notice to creditors said executor duly filed with the clerk of this court an affidavit in due form containing a copy of the notice and stating the date of its first publication, and that more than six months have elapsed since the first publication of said notice, and that the time for filing and presenting claims against said estate has expired.

That all claims against said estate which have been presented and allowed have been paid; that all expenses of administration thus far incurred, and all taxes (except any additional Federal Estate Tax as hereinafter mentioned), that have attached to or accrued against said estate, including all inheritance taxes due the State of California, have yeen paid and discharged.

That Fred S. Nesson, a duly appointed, qualified and acting inheritance tax appraiser for said county and duly appointed as such herein, has duly returned and filed his appraisement and that the amount of the inheritance tax due the State of California has been fixed and determined in the manner required by law and that said inheritance tax has been paid in full, receipt for which is on file herein.

That all taxes which have become due from said estate under the provisions of the Personal Income Tax Act of 1935 of this State have been paid, as shown by the certificate of the Franchise Tax Commissioner of said State on file herein.

That said executor has caused to be made and filed in the manner and form required by law, Return for Federal Estate Tax on said estate and the property thereof, and that as shown by said Return there has been paid as such Federal

EXHIBIT B

All of Exhibit B
15

FINAL REPORT

Agricultural and Economic Impacts of Yolo Bypass Fish Habitat Proposals

PREPARED FOR: Yolo County

PREPARED BY: Richard Howitt[1], Duncan MacEwan[1], Cloe Garnache[1], Josue Medellin Azuara[1], Petrea Marchand[2], Doug Brown[3], Johan Six[1], and Juhwan Lee[1]

DATE: April 2013

Great egret in a harvested rice field. Photo courtesy of Dave Feliz

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[1] University of California, Davis
[2] County of Yolo
[3] Douglas Environmental

Executive Summary

The California Natural Resources Agency and the U.S. Department of the Interior propose to increase the frequency and duration of flooding in the Yolo Bypass for seasonal fish rearing habitat, both as a major component of the Bay Delta Conservation Plan (BDCP) and also as a Reasonable and Prudent Alternative (RPA) in the federal National Marine Fisheries Service's Biological Opinion on the Coordinated Long Term Water Operations of the Central Valley Plan and State Water Plan for winter run salmon, spring run salmon, and Central Valley steelhead. While the state and federal government have not yet fully defined proposals to flood the Bypass for juvenile salmon, the project will have broader support and cost less if state and federal agencies minimize effects on existing land uses such as flood protection, migratory waterfowl and other terrestrial species habitat, and agriculture.

This report provides a quantitative framework for assessment of agricultural impacts of flooding in the Yolo Bypass consistent with initial proposals in the Biological Opinion RPA and BDCP Conservation Measure 2 (CM2). Since the RPA and CM2 are not fully developed, this report evaluates 12 possible scenarios and describes a range of possible impacts on agriculture and the Yolo County economy. Of the 12 scenarios evaluated, 10 scenarios assume annual inundation through a specified date (RPA scenarios) and 2 scenarios assume opportunistic inundation associated with natural overtopping of the Fremont Weir (CM2 scenarios). The modeling framework developed for this report can be used to evaluate any future proposal, and therefore is a useful tool for ongoing discussions regarding project design.

Background

The 57,000-acre Yolo Bypass is first and foremost one of the primary means of providing flood protection to the Sacramento region. Yolo Bypass agriculture also provides significant benefits to the local economy, migratory waterfowl, and the flood protection system. The Bypass can carry on average four times the flow of the Sacramento River or approximately 420,000 cfs. Yolo Bypass agriculture helps to maintain this flood capacity by controlling vegetation, thereby reducing the state's responsibility for vegetation removal. Yolo Bypass rice fields also provide habitat and food for migratory waterfowl when flooded for straw decomposition during the winter months.

"Natural" flooding in the Yolo Bypass can occur at any time from the Sacramento River overtopping the Fremont Weir and/or from tributary flows entering the Bypass from the west during storm events. Farmers have adapted to these conditions and landowners have lowered their lease rates to some extent to reflect the risk. Natural flooding delays planting times and reduces crop yields in the Bypass – or even prevents planting. Late season flood events may reduce crop yields through short-duration flooding, even if farmers prepare fields early in the season. As such, increased frequency and duration of inundation within the Bypass for fish habitat may translate into financial losses for farmers and the regional economy.

Scenarios

CM2, as described in the February 2012 BDCP draft, would lower a portion of the Fremont Weir to an elevation of 17.5 feet, from its current elevation of 32.8 feet, and construct an operable gate to allow Sacramento River water to flow into the Yolo Bypass (BDCP 2012). CM2 also includes a number of other actions within the Yolo Bypass including construction of fish passage improvements at the Fremont Weir. CM2 actions are designed to reduce migratory delays and loss of adult salmon, steelhead, and sturgeon, enhance rearing habitat for juvenile Sacramento River Basin salmonids, enhance spawning and rearing habitat for Sacramento splittail, and improve food sources for delta smelt downstream of the Bypass. Since CM2 is not fully developed, the authors created a “low-impact” scenario that is consistent with the 2012 draft. This scenario suggests supplemental flooding of up to 6,000 cubic feet per second (cfs) for 30 to 45 days in years when flooding occurs naturally in the Yolo Bypass.[4] This scenario provides a low estimate of CM2 impacts to demonstrate the potential to develop a project that minimizes impacts on agriculture. This scenario should not be used as a proxy for actual CM2 agricultural impacts since CM2 is not fully developed. If the BDCP proposes flooding in years the Fremont Weir does not overtop, agricultural impacts will increase significantly relative to this scenario.

The RPA, in Actions I.6 and I.7, requires the U.S. Bureau of Reclamation and the California Department of Water Resources to evaluate modification of operations at the Fremont Weir to increase rearing habitat for juvenile salmon. Similar to BDCP, the Bureau of Reclamation plans to evaluate lowering a portion of the Fremont Weir and constructing an operable gate to allow Sacramento River water to flow into the Yolo Bypass. The RPA requires additional rearing habitat for juvenile winter run, spring run, and Central Valley steelhead from “December through April” in the “lower Sacramento River basin.” The RPA further identifies “an initial performance measure” of 17,000 to 20,000 acres with “appropriate frequency and duration.” Since Reclamation has not fully developed actions to implement the RPA, the authors created scenarios that are consistent with the existing language in Actions I.6 and I.7. These scenarios cover proposed annual flooding between 3,000 cfs and 6,000 cfs and end dates varying from February 15th to May 15th. These scenarios provide a range of possible RPA impacts, but should not be used as a proxy for actual RPA impacts since the RPA is not fully developed.

Flooding at the proposed volumes of 3,000 and 6,000 cfs would inundate[5] between 12,200 and 25,000 total[6] acres, assuming no flooding from creeks on the west side of the Yolo Bypass. An increase in flooding could result in economic losses to farmers and the local economy, dependent on timing, frequency, volume, and duration. In addition, flooding may increase the costs of late season rains which could affect land values, lending, and farming in the Yolo Bypass.

This study estimates the expected losses of total agricultural revenue, total Yolo County revenue (value added), tax revenue, and jobs for the twelve policy scenarios listed in Table 1.

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[4] See Table 3.4-3 of the February 2012 BDCP Draft Report.

[5] This study is an agricultural impact analysis and, as such, areas of inundation include the literal flooding “footprint” plus fields that are partially inundated, discussed in Section 2.2.

[6] 12,200 total acres includes 4,500 acres of wetlands and Liberty Island, and 25,000 total acres includes 9,200 acres of wetlands and Liberty Island. Thus, flooding will affect between 7,700 and 15,800 acres of land used for agricultural production.This footprint does not include any land in Solano County.

Table 1. Inundation Scenarios

3,000 cfs	6,000 cfs
Feb 15 (Annual)	Feb 15 (Annual)
Mar 24 (Annual)	Mar 24 (Annual)
Apr 10 (Annual)	Apr 10 (Annual)
Apr 30 (Annual)	Apr 30 (Annual)
May 15 (Annual)	May 15 (Annual)
Low-impact CM2 Scenario	Low-impact CM2 Scenario

Results

Table 2 identifies the expected total annual losses to the Yolo County economy (also known as value added losses) associated with the inundation scenarios evaluated in the study. The fundamental driving factors in the analysis are total acres inundated, reduced crop yields, and increased land fallowing. As the last day of flooding through the proposed gate in the Fremont Weir increases, farmers would delay field preparation and planting, resulting in reduced crop yields and increased land fallowing. Agricultural revenues would fall, translating into losses in the Yolo County economy and employment in the region.

Under the RPA scenarios, the effect of increased flooding early in the season would be small, less than $0.25 million with 6,000 cfs flow. Flooding through May 15 significantly increases effects, with total losses to Yolo County economy of $3.8 million and $8.9 million under 3,000 cfs and 6,000 cfs, respectively. Under the low-impact CM2 scenario, in which flooding only occurs as an extension to natural flooding, expected annual losses would range from $0.63 to $1.5 million under 3,000 and 6,000 cfs, respectively.

Table 2. Expected Total Annual Loss to Yolo County Economy (Value Added) (Thousands of 2008 dollars)

Inundation Scenario	3,000 cfs	6,000 cfs
February 15	148	241
March 24	931	1,744
April 10	2,337	5,015
April 30	3,371	7,735
May 15	3,886	8,889
Low-impact CM2 Scenario	625	1,468

Assumptions

This analysis relies on assumptions that may increase or decrease the estimates of impacts if changed. The analysis does not explicitly consider, for example, changes in late season rains and management and associated operation difficulties that may affect drainage and field preparation times. Consideration of these impacts would increase the estimates of actual expected annual losses to the economy from the scenarios modeled in this analysis. In addition, the areas of assumed inundation under different flooding scenarios might change if different hydrologic models are used to estimate the footprint and the models are further developed to allow evaluation of tributary flows. Depending on the size of the footprint, impacts could increase or decrease. Impacts could also change if the expected crop price changes. This study uses an expected crop price that is representative of an average over recent years and neither relies on recent boom price levels nor on earlier depressed agricultural conditions. Finally, river levels may not be high enough in all years to allow flooding in the Yolo Bypass through an operable gate. If the Yolo Bypass gate cannot be used every year, the estimates of flooding for each inundation end date (with the exception of the low-impact CM2 scenario) would also decrease.

Recommended Additional Research

In addition to evaluating additional inundation scenarios as more information becomes available, the authors also recommend the following actions:

- Create inundation scenarios that include the west side tributaries to the Bypass once existing models are adequately reviewed.
- Create inundation scenarios that reflect potential constrained project footprints of 7,000 to 10,000 acres, since the current analysis only models unconstrained flooding and therefore includes acres that do not directly benefit fish.
- Analyze the effect of crop insurance on farmer responses to likely inundation proposals.
- Analyze the response of agricultural lending institutions to likely inundation proposals.
- Evaluate proposed inundation scenarios under a range of expected future crop prices.
- Compare the predicted area of inundation under the MIKE21 and HEC-RAS models.
- Analyze potential economic benefits to Yolo County from increased recreation opportunities (e.g. short-term construction benefits or additional recreational opportunities).
- Analyze potential benefits to farmers of increased groundwater recharge resulting from more frequent flooding of the Bypass.

Acknowledgements

The authors thank Yolo County, the State and Federal Contractors Water Agency (SFCWA), and the Conaway Preservation Group for the funding and support necessary to prepare this study.

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Table of Contents

Figures

Tables

1 Introduction

The California Natural Resources Agency and the U.S. Department of the Interior propose to increase the frequency and duration of flooding in the Yolo Bypass for fish habitat, both as a major component of the Bay Delta Conservation Plan (BDCP) and also as a Reasonable and Prudent Alternative (RPA) in the federal National Marine Fisheries Service's Biological Opinion on the Coordinated Long Term Water Operations of the Central Valley Plan and the State Water Plan for winter run salmon, spring run salmon, and Central Valley steelhead. Under both alternatives, the project will have broader support and cost less if impacts on existing land uses – such as flood protection, migratory waterfowl and other terrestrial species, and agriculture – are minimized. Since the RPA and BDCP's Conservation Measure #2 (CM2) are not fully developed, this report evaluates 12 possible scenarios and describes a range of possible impacts on agriculture and the Yolo County economy with the goal of informing future decisions about project design. The modeling framework developed for this report also can be used to evaluate future proposals.

CM2, as described in the February 2012 BDCP draft, would lower a portion of the Fremont Weir to an elevation of 17.5 feet, from its current elevation of 32.8 feet, and construct an operable gate to allow Sacramento River water to flow into the Yolo Bypass (BDCP 2012). CM2 also includes a number of other actions within the Yolo Bypass including construction of fish passage improvements at the Fremont Weir. CM2 actions are designed to reduce migratory delays and loss of adult salmon, steelhead, and sturgeon, enhance rearing habitat for Sacramento River Basin salmonids, enhance spawning and rearing habitat for Sacramento splittail, and improve food sources for delta smelt downstream of the Bypass. Since CM2 is not fully developed, the authors created a "low-impact" scenario that is consistent with the 2012 draft. This scenario suggests supplemental flooding of up to 6,000 cubic feet per second (cfs) for 30 to 45 days in years when flooding occurs naturally in the Yolo Bypass.[7] This scenario provides a low estimate of CM2 impacts to demonstrate the potential to develop a project that minimizes impacts on agriculture.

The RPA, as described in Actions I.6 and I.7, requires the Bureau of Reclamation and the California Department of Water Resources to evaluate modification of operations at the Fremont Weir to increase rearing habitat for juvenile salmon. Similar to BDCP, the Bureau of Reclamation plans to evaluate lowering a portion of the Fremont Weir and constructing an operable gate to allow Sacramento River water to flow into the Yolo Bypass. The RPA requires additional rearing habitat for juvenile winter run, spring run, and Central Valley steelhead from "December through April" in the "lower Sacramento River basin." The RPA further identifies "an initial performance measure" of 17,000 to 20,000 acres with "appropriate frequency and duration." Since Reclamation has not fully developed actions to implement the RPA, the authors developed scenarios to evaluate possible options for annual flooding between 3,000 cfs and 6,000 cfs and end dates varying from February 15th to May 15th. These scenarios are modeled to provide a range of possible RPA impacts.

This study estimates the extent of inundation, crop yield loss, and effects on the agricultural economy from increasing the frequency and duration of flooding in the Yolo Bypass, either as a

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[7] See Table 3.4-3 of the February 2012 BDCP Draft Report.

result of CM2 or the RPA. Of the 12 scenarios evaluated, 10 scenarios assume annual inundation through a specified date (RPA scenarios) and 2 scenarios assume opportunistic inundation associated with natural overtopping of the Fremont Weir (CM2 scenarios). All estimates include the direct economic effects associated with reduced agricultural production, as well as multiplier (direct and induced) effects associated with upstream and downstream changes to the regional economy. The authors used the HEC-RAS hydrologic model and the DAYCENT agronomic model to estimate the extent of inundation and change in crop yield, respectively, for each of the 12 scenarios. The authors estimated the effect on agricultural production using the Bypass Production Model (BPM), developed specifically for the Yolo Bypass. The BPM estimates the change in crop mix, agricultural revenues, and other factors due to crop yield loss (DAYCENT model) and the number of acres affected (HEC-RAS and MIKE-21 models) in the Yolo Bypass. Results from the BPM are linked to the IMPLAN regional input-output model to estimate total output, value-added, and employment losses within the Yolo Bypass and the Yolo County economy.

1.1 Scope of Analysis and Caveats

This report presents model results of the impacts of increased flooding on Yolo Bypass agriculture and the Yolo County economy. Thus, the geographic scope of the analysis is Yolo County and, in particular, the Yolo Bypass. The study does not consider crop production shifts out of the region. This would require, in part, an analysis of the rice mills in West Sacramento and Woodland to determine the proportion of business from Bypass production in addition to other regional economic effects. Additionally, whether rice production would shift out of the Bypass is an agronomic question since specific soil and climate data is required. The modeling approach also is sensitive to several parameters that are clearly described in the report. In addition, the authors conducted sensitivity analysis of key parameters. This report provides information about these important parameters in this section and reviews them throughout the text. Section 5 provides sensitivity analysis.

Subbing: Increased flooding in the Bypass may raise the groundwater table in regions out of the Bypass. This may restrict farming and/or reduce yields in affected areas, thereby increasing economic losses. We do not account for subbing in this analysis.

Late Rains: We provide expected annual loss estimates by using a time series of hydrologic conditions in the Bypass. However, late season rains may have additional costs that we have not captured. For example, if farmers begin field preparation late due to flooding for fish habitat and late rains occur, this may delay planting further and increase economic losses.

Prices: Expected future crop prices are uncertain. We use 2009-2010 average prices which do not reflect recent booms or historic depressed levels. We analyze the sensitivity of impact estimates to price changes in Section 5.

Lending and Insurance: We do not evaluate the effect of increased flooding on lending and insurance for farmers in the Bypass. This is related to late season rains and other management difficulties Bypass farmers may face with extended flooding.

Drought or Less Frequent Inundation: For the RPA scenarios, we have implicitly assumed water will be available for increases in the duration and frequency of Bypass flooding for fish habitat in every year. We recognize that RPA Action 1.6.1 only requires an increase in the acreage of seasonal floodplain rearing habitat and allows that water may not be available for flooding in every year. In addition, extended drought may lower the river level below the range of the operable gate at Fremont Weir, which may decrease expected losses since flooding will not occur in these years.

1.2 Inundation Scenarios

We consider five inundation dates and two different flow rates associated with possible RPA implementation. Additionally, we consider one low-impact CM2 scenario under the same flow rates, for a total of twelve policy scenarios (see Table 1). The inundation dates correspond to the last day of Sacramento River water releases through operable gates in the Fremont Weir: February 15th, March 24th, April 10th, April 30th, and May 15th. The two flow rates are 3,000 cfs and 6,000 cfs, which correspond to the flows recommended for fish in *Technical Study #2: Evaluation of North Delta Migration Corridors: Yolo Bypass* prepared for the BDCP Integration Team in April 2009. As discussed in the Executive Summary and the Introduction, the authors created these inundation scenarios because the RPA and BDCP alternatives are not yet fully developed. This framework used to evaluate these scenarios can be used for evaluate other scenarios as the RPA and BDCP alternatives evolve.

We identified the five end dates to represent a range of outcomes from RPA alternatives to flooding for fish habitat in the Yolo Bypass. The RPA only includes flooding through April, but we include a May 15th date to inform discussions related to potential flooding for splittail. The 2010 BDCP draft proposes flooding for splittail every 7 years if flooding does not occur naturally, although the acres of splittail flooding are not specified. Once acreage targets are more fully refined, the model framework can be used to develop loss estimates specific to proposed flooding scenarios.

The low-impact CM2 scenario, as described in the introduction, corresponds to supplemental flooding in years with natural overtopping at Fremont Weir. As such, the end date in this scenario is variable and depends on the specific water year. In Section 3.3 we describe the time series of hydrologic conditions used to generate annual expected losses in the low-impact CM2 scenario.

Fields in the Bypass must drain before farmers can begin preparation for planting. Agricultural fields located along the east side of the Bypass adjacent to the Tule Canal/Toe Drain tend to drain more slowly than higher elevation fields to the west. According to author interviews with land managers and farmers, slower drainage on the east side delays planting and tends to lower crop yields. On average, it takes two weeks for fields to drain on the west side of the Bypass and four weeks on the east side of the Bypass. Field preparation takes an additional four weeks. Thus, the authors assumed a delay of six to eight weeks between the last day water is released through a Fremont Weir gate and planting, depending on the location of the field.

February 15th. February 15th represents an end date to Fremont Weir flooding when agriculture is largely unaffected. Farmers have an adequate buffer for unforeseen circumstances, such as rain or cool conditions that lengthen the time needed for field drainage. Farmers state they prefer to start ground preparation by March 15th to allow adequate time for field work and planting. It takes approximately 4 weeks from the date a farmer can start field work to the date of planting, so an end date of February 15th would typically result in early April planting on the west side of the Bypass and mid-April planting on the east side.

March 24th. The March 24th end date translates into planting by late May on the east side of the Bypass and mid-May on the west side of the Bypass. This inundation end date represents a scenario in which growers are expected to experience yield losses (see Section 3), but are still able to plant their crops. We anticipate some land fallowing and shift in crop mix but in general crop yields are high enough to cover variable costs.

April 10th. The April 10th end date translates into planting by early June on the east side of the Bypass and late May on the west side of the Bypass. According to farmers interviewed, in an average year, June 10th is the last possible date to plant. As such, significant yield losses and land fallowing are expected in this scenario. If any unforeseen circumstances occur in this scenario, there is a high risk that planting will not occur.

April 30th. The April 30th end date translates into planting in late June on the east side of the Bypass and mid-June for the west side of the Bypass. It corresponds to the latest flood date under the RPA. According to farmers interviewed, in an average year, June 10th is the last possible date to plant. As such, significant yield losses and land fallowing are expected in this scenario. In this scenario, planting may not occur at all on the east side of the Bypass and there is a high risk that planting will not occur on the west side.

May 15th. The May 15th end date for water releases represents a date when farmers state they will not plant crops, as it corresponds with a plant date of mid-July on the east side of the Bypass and early July on the west side of the Bypass. This date is frequently referred to in public forums as important for splittail habitat. Yield response functions from the DAYCENT model confirm that crop yields are not high enough to cover variable operation costs if the flooding through the operable gate in the Fremont Weir continues through May 15th. Consequently, significant land fallowing would occur. Contracts and other fixed costs may induce farmers to plant late in the season, however.

Low-impact CM2 scenario. The low-impact CM2 scenario is consistent with the description of CM2 in the BDCP February 2012 draft, but represents a scenario in which the impacts would be significantly lower than other potential scenarios. The actual proposal may differ significantly from this scenario, depending on future policy decisions. In this scenario, flooding is extended by 30 days in years with natural flooding in the Bypass to augment habitat and there is no flooding in dry years. We use a 26-year hydrologic time series, described in Section 3.3, to simulate this proposal. For example, with natural flooding until February 1 the CM2 proposal extends flooding by 30 days, through March 1. If CM2 proposed flooding during years in which natural flooding does not occur, impacts will increase significantly.

2 Data Overview

We collected extensive data for the Yolo Bypass to facilitate an empirical analysis of the proposed inundation scenarios. These include the following: (i) field-level geo-referenced crop data and agricultural region definitions, (ii) crop yields and yield change based on planting date, (iii) crop prices, (iv) costs of production, and (v) area inundated under proposed flow volumes. We review these data in the following section.

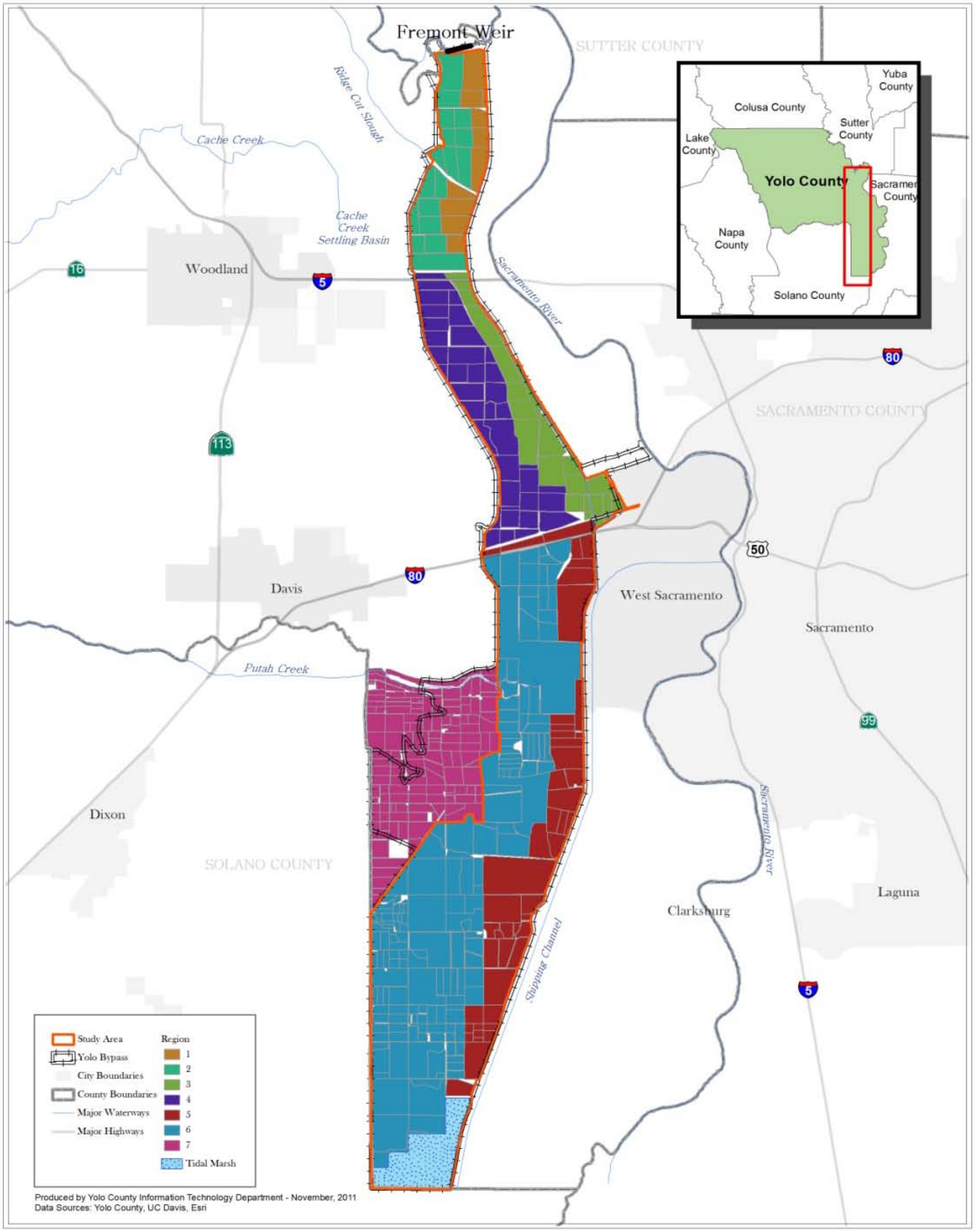
2.1 Agricultural Sub-regions

The Yolo Bypass slopes gradually downward from west to east and north to south. Temperatures are generally lower in the southern end of the Bypass. Consequently, there are heterogeneous production conditions across the region and natural differences in both yield and drainage times. We identified 7 homogenous agricultural sub-regions in the Yolo Bypass which represent these production conditions and, as such, form the basis of the BPM. We used soil and climate data, in addition to interviews with Bypass farmers, to develop homogenous agricultural sub-regions. The regions are illustrated in Figure 1.

Note that the BPM, as with the majority of agricultural production models, is a regional economic model, defined over the 7 regions illustrated in Figure 1. Field-level yield and production data are available for a subset of fields in the Bypass (discussed below), and these data are used in the DAYCENT agronomic model. We discuss this point again in Section 2.3 and again in Section 3, but want to raise the point here so the reader is not confused about the use of field-level data versus agricultural sub-regions in the model.

As shown in Figure 1, Regions 1 and 2 are located north of Interstate 5, Regions 3 and 4 are located between Interstate 5 and Interstate 80, and Regions 5, 6 and 7 are located south of Interstate 80. The area south of Interstate 80 is divided into three regions due to its relatively large width and the row crop region located in the western portion, which distinguishes it from the managed wetlands and grazing lands located to the east. CM2 and the RPA will most likely not affect Region 7, as this region is located outside of the flood inundation footprint. This region is therefore not discussed in further detail in this report or considered in the analysis.

Figure 1. Yolo Bypass Sub-regions



Produced by Yolo County Information Technology Department - November, 2011
Data Sources: Yolo County, UC Davis, Esri

2.2 Field Level Crop Data and Flood Footprint

We compiled detailed land use data for 2005-2009 from Pesticide Use Reports, the Yolo Natural Heritage Program, the Sacramento-Yolo Mosquito and Vector Control District, the Yolo Basin Foundation, and individual farmers. As a result of the extent of data collected, and verification with key stakeholders, the database for this study is the most comprehensive and detailed information on Yolo Bypass land use available.[8]

Table 3 identifies major land uses in the area of the Bypass affected by each of the respective flow volumes (identified by the HEC-RAS hydrologic model, discussed in Section 2.6) over the five years of data collected for the study. Agricultural land constitutes the majority of the area within the Bypass, followed by wetland and fallow land. The main crops in the affected area of the Yolo Bypass are rice, irrigated pasture, processing tomato, vine seed, safflower, wild rice, corn, and sunflowers.

We model 3,000 cfs and 6,000 cfs scenarios in this report which correspond to different total affected acres, as estimated by the HEC-RAS model. An important consideration for the agricultural impacts analysis is that in any flooding scenario, a sub set of fields will be partially innundated. In other words, the HEC-RAS model estimates a “literal” footprint of affected acres dependent on the flow volume, but this does not account for partial flooding of existing agricultural fields. Cultivation of proportions of these partially-flooded fields is costly and, in many cases, impossible. Partial innundation makes it difficult or impossible to use machinery to begin field preparation and, as such, the field is effectively entirely inundated. It is essential to account for the difference between the literal footprint from hydrologic modeling and the effective footprint, the latter is relevant for agricultural impact analysis.

To incorporate the effective flood footprint, we conducted a series of interviews with Bypass farmers and extension specialists to determine the proportion of a field flooded at which farmers cannot begin preparation. Farmers interviewed report the decision to prepare a partially inundated field is different between rice and other field crops and depends on a number of factors including relative prices, weather, and costs. We determined when 20 percent of a rice field is flooded farmers will not begin preparation. For all other crops, 30 percent is the relevant proportion. Fields partially inundated according to the above proportions are modeled as completely flooded and consequently included in the estimates of affected acres.

Note that preparation of a partially inundated field includes installation of checks to control existing flooding and other potentially costly management alternatives. We do not include these production costs in the analysis, thus our estimates are lower than they would be if we included these costs in the analysis.

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[8] DWR developed 2008 crop data for Yolo County, including the Yolo Bypass, that slightly differs from the 2008 data used for this dataset. The differences are small and do not affect the outcome of the study. Specifically, the BPM calibrates to a 5 year average (2005-2009), thus small changes to acreage in one year do not have a significant effect on model results.

Table 3. Major land uses in areas affected by increased inundation in the Yolo Bypass (acres)

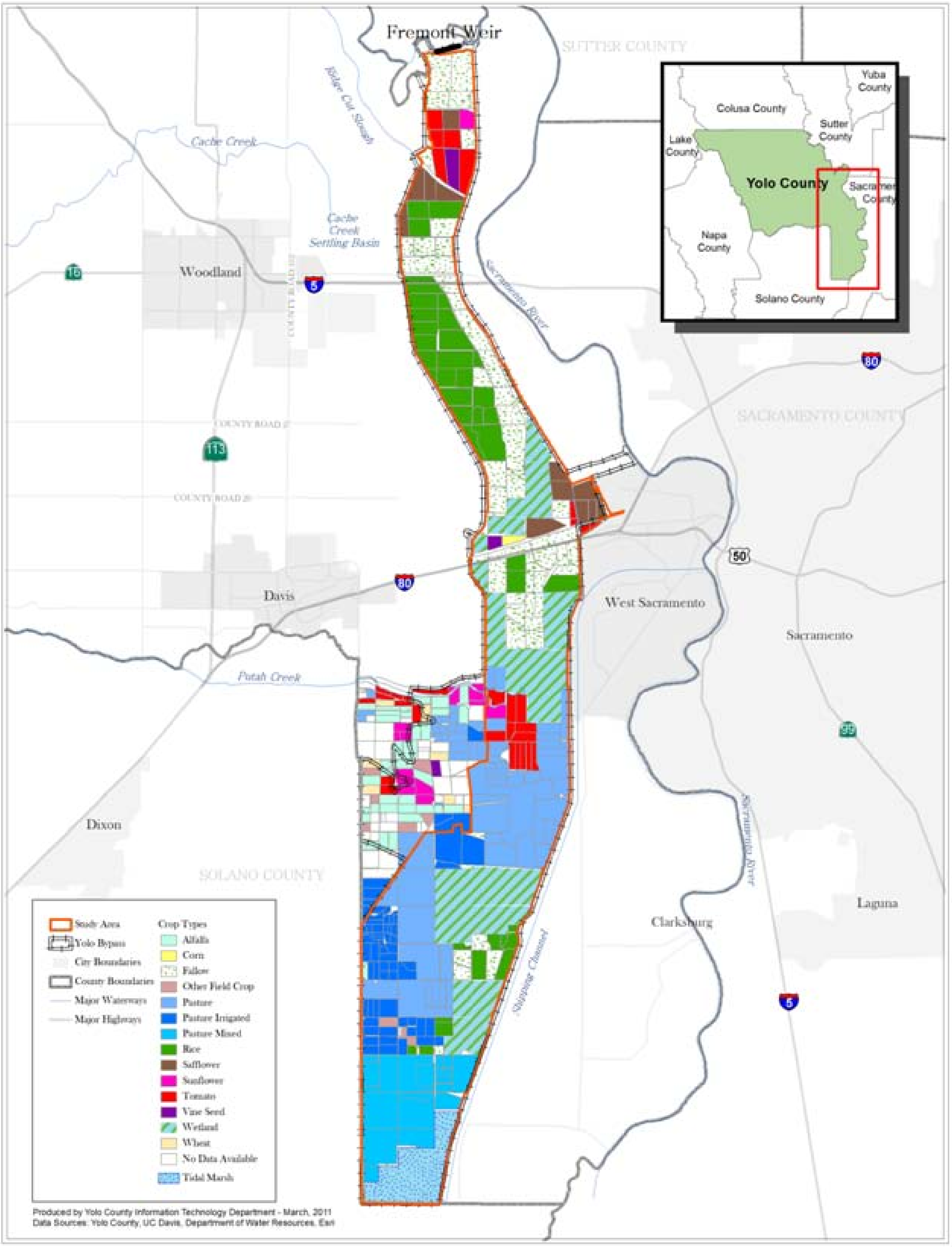
Crop and Flow Volume	2005	2006	2007	2008	2009
Fallow					
3,000 cfs	3,220	3,606	1,702	1,514	984
6,000 cfs	6,640	6,860	2,858	3,526	2,297
Liberty Island					
3,000 cfs	2,071	2,071	2,071	2,071	2,071
6,000 cfs	2,071	2,071	2,071	2,071	2,071
Vine					
3,000 cfs	245	0	0	0	72
6,000 cfs	245	104	0	0	238
Pasture					
3,000 cfs	2,026	2,026	2,026	2,026	2,284
6,000 cfs	3,890	3,890	3,987	3,890	5,166
Rice					
3,000 cfs	765	173	931	968	1,531
6,000 cfs	2,358	1,254	2,920	2,409	4,263
Safflower					
3,000 cfs	606	657	519	770	499
6,000 cfs	1,450	1,545	1,616	1,840	1,273
Sunflower					
3,000 cfs	138	0	0	0	0
6,000 cfs	138	0	0	0	0
Processing Tomatoes					
3,000 cfs	662	867	721	930	1,047
6,000 cfs	1,285	1,285	1,370	1,829	1,779
Wetland					
3,000 cfs	2,501	2,502	2,503	2,504	2,505
6,000 cfs	7,076	7,076	7,076	7,076	7,076
Wild Rice					
3,000 cfs	0	195	427	494	494
6,000 cfs	0	928	2,292	2,303	2,393
Corn					
3,000 cfs	0	138	584	208	0
6,000 cfs	0	138	925	208	0

We identified 9 major crop groups in areas affected by flooding in the Bypass, which we use for the subsequent analysis. The 9 crops include corn, irrigated pasture, non-irrigated pasture, rice, wild rice, safflower, sunflower, processing tomatoes, vines (melons). Fallow land is an implicit tenth group. Approximately 100 acres of crops did not fit into these categories directly, including dry beans and organic rice. We determined the number of acres was not sufficient to require an additional crop group and these acres were included in the crop group with the most similar cost, return, and production characteristics. Specifically, organic rice acres were added to the rice crop group and dry bean acres were added to the corn crop group.

Figures 2-6 illustrate the distribution of land use across the entire Yolo Bypass, by field, for the years 2005 through 2009. These data show typical crop rotations across the sub-regions. In the southern end of the Bypass, the crops are predominately pasture and in the northern sub-regions the crops are predominately rice. The eastern sub-regions include a mix of pasture, rice, corn, and processing tomatoes.

Crop acreage increased during the dry years of 2007 through 2009 and fallow land decreased. In 2008 and 2009, high agricultural commodity prices potentially resulted in planting of larger acreages than average, in particular for corn and wheat. Rice prices spiked in 2008, which partially explains the increase in rice acreage in the Yolo Bypass. Water year type also affects production. The California Department of Water Resources classified 2005 as an above normal hydrologic year type, 2006 as wet, and 2007 through 2009 as dry years. The Fremont Weir overtopped through May 3rd in 2006, overtopped for three days in May of 2005 (resulting in a couple of weeks of inundation), and did not overtop in 2007 through 2009.

Figure 2. Agricultural Land Use, Yolo Bypass 2005



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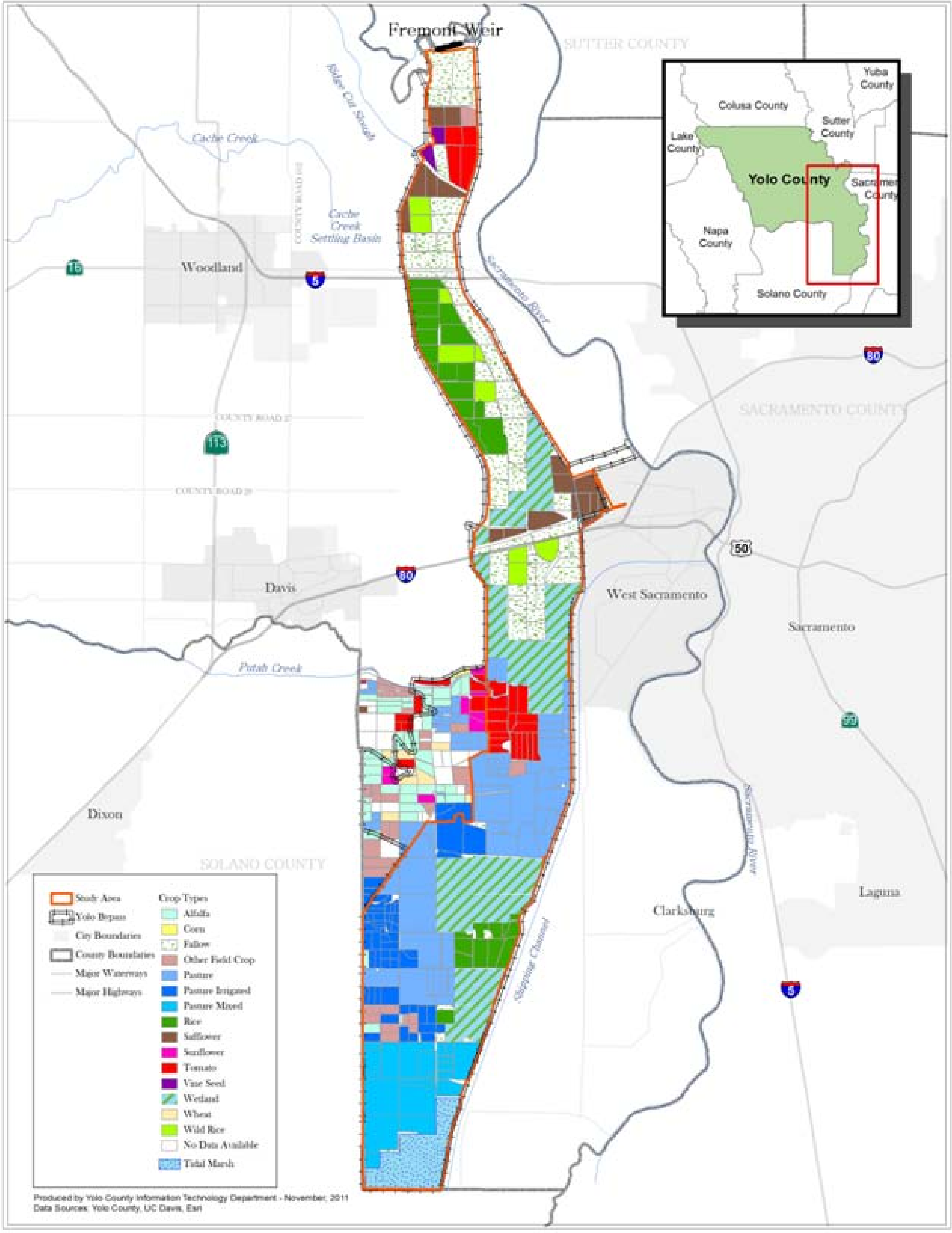
Data Sources: Yolo County, UC Davis, Department of Water Resources, Esri

Figure 3. Agricultural Land Use, Yolo Bypass 2006



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Data Sources: Yolo County, UC Davis, Esri

Figure 4. Agricultural Land Use, Yolo Bypass 2007

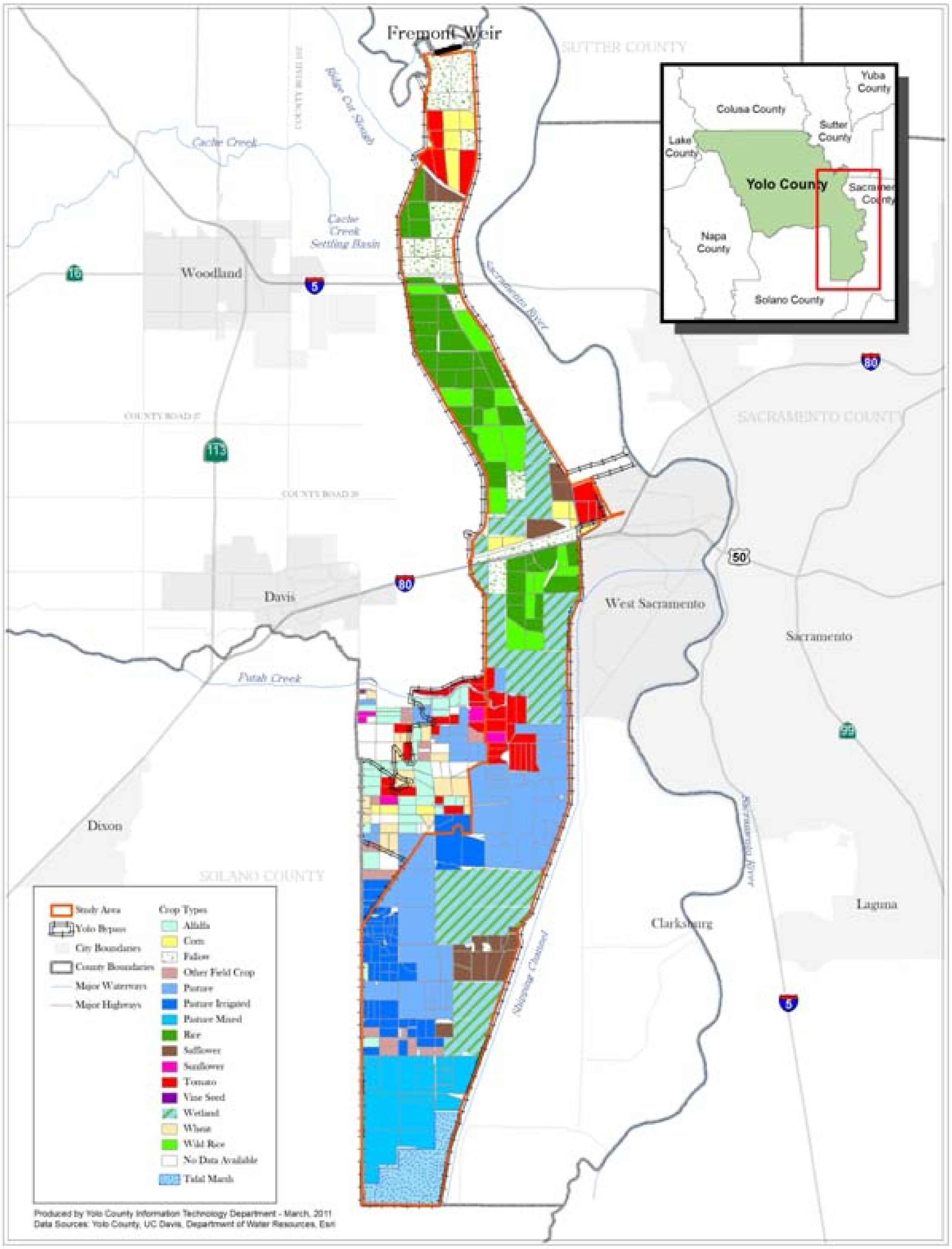

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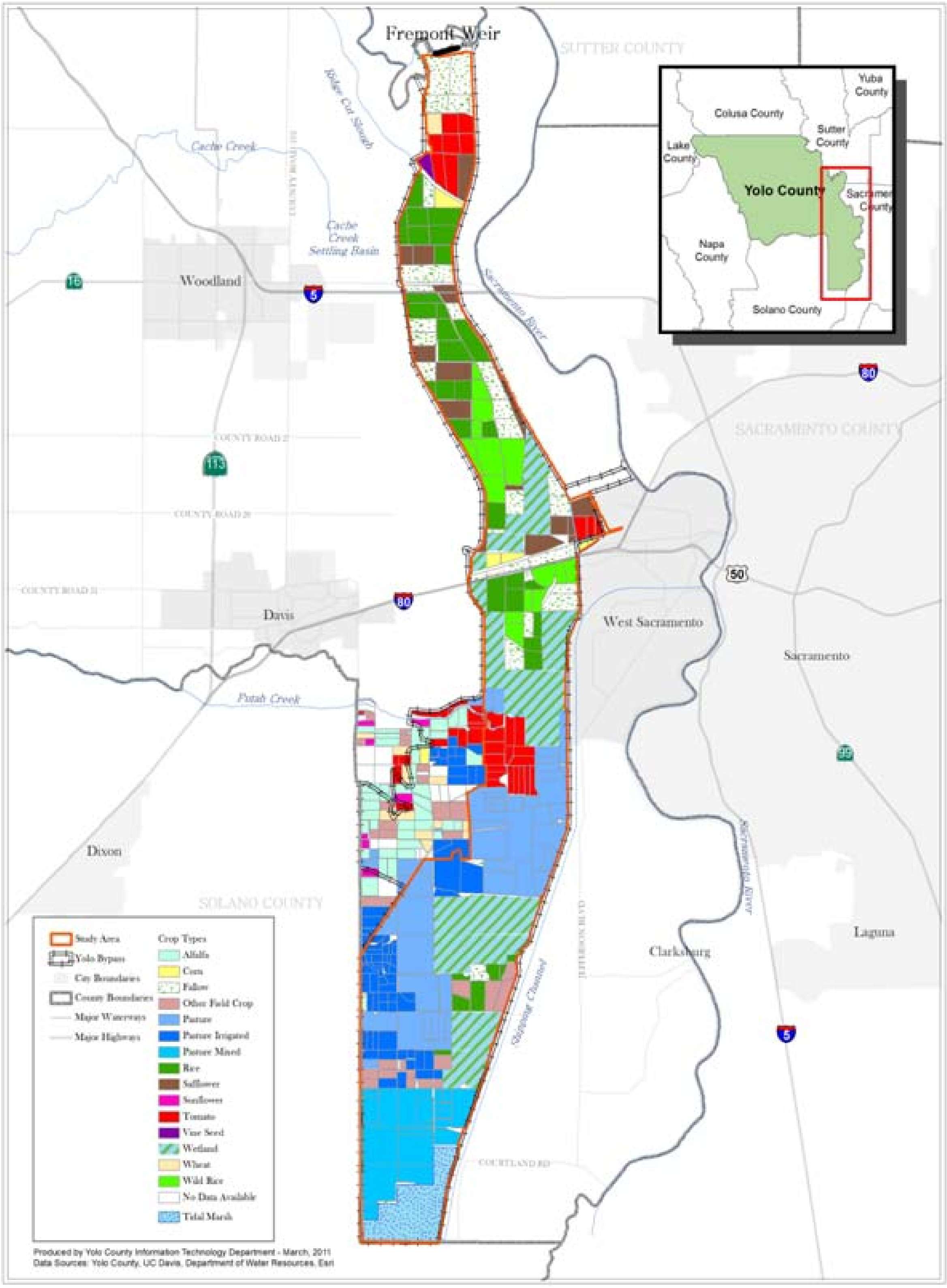
Figure 5. Agricultural Land Use, Yolo Bypass 2008



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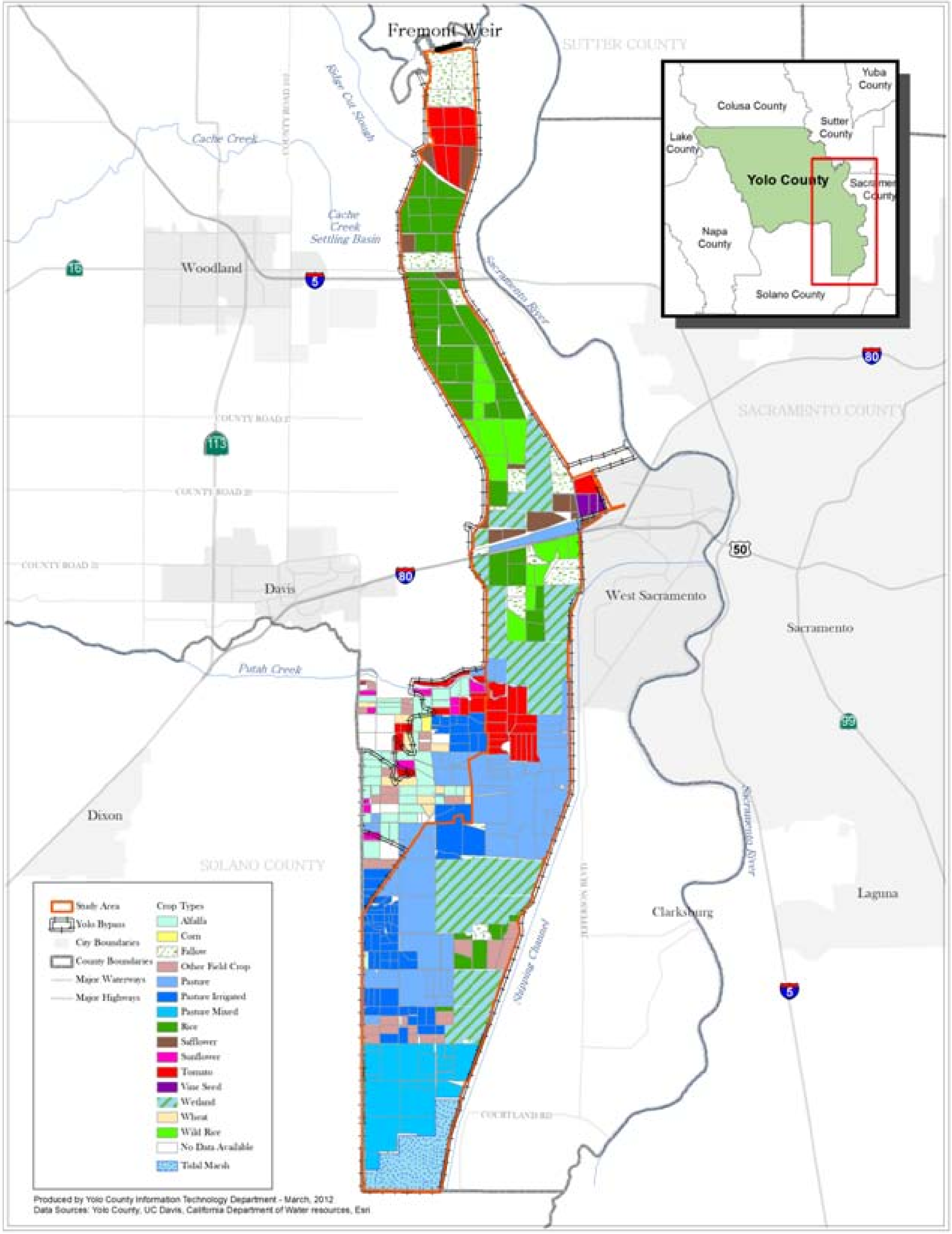
Data Sources: Yolo County, UC Davis, Department of Water Resources, Esri

Figure 6. Agricultural Land Use, Yolo Bypass 2009



Produced by Yolo County Information Technology Department - March, 2012
Data Sources: Yolo County, UC Davis, California Department of Water resources, Esri

2.3 Crop Yields

Holding total area inundated constant, crop yields are the fundamental driving factor for agricultural revenue losses due to flooding in the Yolo Bypass. We use two sources of information on crop yields in this analysis. This procedure is outlined here, explained again in Section 3, and all the technical details and equations are contained in Appendix A.

We observe field-level yield data and other micro-production characteristics (soil, climate, etc.) for a subset of fields in the Bypass. These fields are used to calibrate the DAYCENT agronomic model. The DAYCENT model estimates the yield on any given field taking into account all production conditions, including climate and date the crop was planted. We then use the calibrated DAYCENT model to estimate crop yields on a subset of fields in each of the 6 regions of the BPM. We control for all other factors and allow the planting date to vary, thus the DAYCENT model generates a series of data points, for each crop and region, which tells us the expected yield conditional on the crop planting date.

We use the data points from the DAYCENT results to estimate a single yield function, for each crop and region. We fit this function using non-linear regression analysis (discussed in Section 3 and Appendix A). The result is a single function, for each crop and region in the Bypass, which relates crop yield to the planting date. These functions are included in the BPM, discussed in Section 3.

In summary, we use field-level production observations to calibrate a field-level agronomic model. We use the model to simulate the yield on a subset of fields for each crop and region as a function of planting date. Finally, we fit a non-linear function to these data for each crop and region. Thus, we are able to determine crop yields for each region as a function of the planting date.

Note that consistent data on the yields, prices and costs of growing melons for vine seed were unavailable. Instead, we use economic information for melons grown for fruit, accordingly crop yields and budgets are expressed in terms of melons grown for fruit. This is not a critical assumption since melon acreage in the affected area averages less than 200 acres per year (between 2005 and 2009).

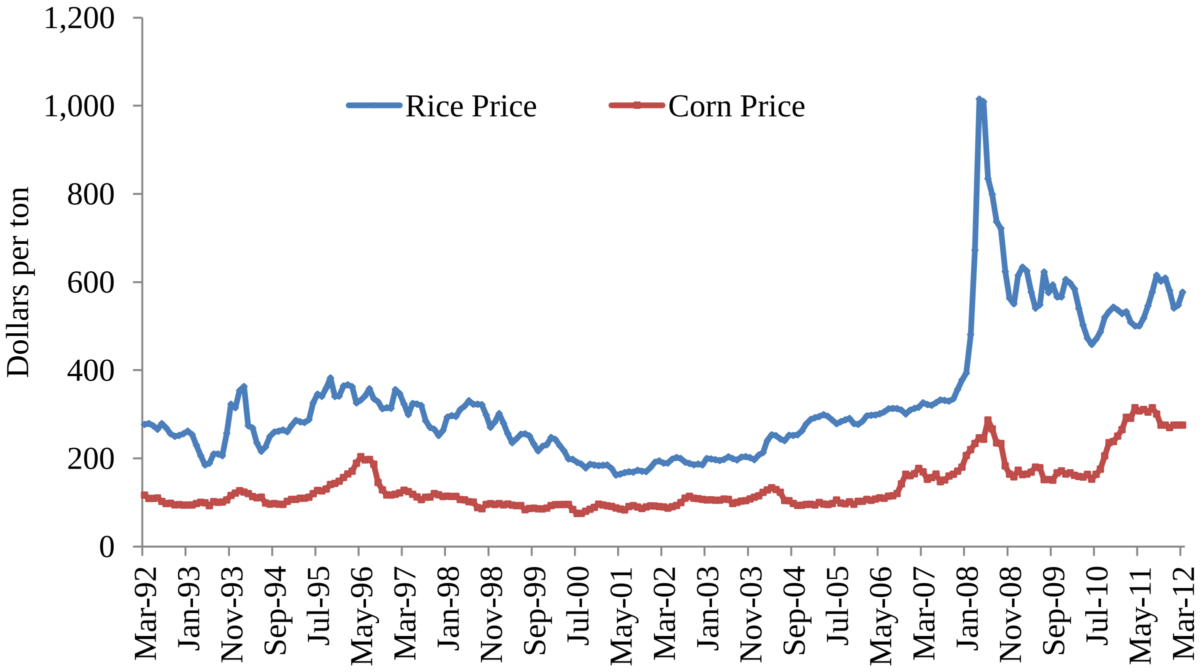
2.4 Crop Prices

We obtained crop prices for the 9 crops considered in the analysis from the Yolo County Agricultural Commissioner reports (Agricultural Commissioners Reports, 2012). No price data per animal unit month (AUM) or hay production was available for pasture, thus we used the price estimate per AUM per acre provided in the Cost and Returns study for flood irrigated pasture grown in the Sacramento Valley (UC Cooperative Extension, 2003). Additionally, sunflower prices are only available for 2007 and 2008 in the Agricultural Commissioner’s data. Therefore, we used data reported by the National Agricultural Statistics Service (NASS). We also use NASS data for wild rice because no price data are available prior to 2006.

One of the key components of this analysis is expected crop prices. Higher crop prices translate into larger losses per acre and induce farmers to plant later in the season, thereby reducing fallow land. The results of this study are sensitive to the choice of expected future crop prices.

Unfortunately, there is no general consensus for future expected crop prices. The commodity price spike of 2007/2008 was unprecedented and followed decades of declining real commodity prices. Prices have since declined but remain higher than pre-spike levels and appear to have stabilized on a higher trend. Figure 7 illustrates the 20 year trend in corn and rice prices and highlights the difficulty of selecting representative prices to use in this analysis.

Figure 7. Commodity Price Trends, Monthly Prices from 1992 - 2012[9] in Constant 2010 dollars



The impact analysis in this report uses a two-year average (2009-2010) of crop prices for each of the crop groups. There are two main reasons for this: (i) these years are representative of historical average prices in Yolo County and, (ii) 2009 and 2010 crop prices exclude the price spikes in 2008 and again in 2011.

Table 4 summarizes the average crop price[10] (dollars per ton) for each of the crop groups included in the analysis. Column two shows the prices used (2009-2010 average) and column three shows the 10 year average crop price. Related to point (i) above, Table 4 shows that 2009-2010 average crop prices are representative of the recent history (2000 - 2009 average). Namely, rice and corn prices are slightly higher than the 10 year average but other crops are generally lower. Column four reports 2008 prices for each of the crops. With the exception of corn and safflower, all crop prices were significantly inflated in 2008. In summary, 2009 and 2010 average prices are representative of recent prices in Yolo County and, more importantly, omit the recent price spikes which would upward bias our economic impact estimates.

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[9] Data compiled from http://www.indexmundi.com/

[10] Rice prices do not include direct payments, counter-cyclical program payments, or marketing loan payments. Where applicable, these are included in the data used for the analysis.

Table 4. Crop Prices, 2009-2010 average and 2000-2009 average (2008 dollars per ton)

Crop Group	2009-2010 Average	2000-2009 Average	2008
Corn	172.69	124.31	152.20
Irrigated Pasture	49.20 (based on $35 per AUM)	49.20 (based on $35 per AUM)	49.20 (based on $35 per AUM)
Non-Irrigated Pasture	49.20 (based on $35 per AUM)	49.20 (based on $35 per AUM)	49.20 (based on $35 per AUM)
Rice	397.89	251.36	513.10
Wild Rice	961.85	1,275.30	1,684.20
Safflower	351.18	319.79	432.62
Sunflower	1,196.15	1,781.47	1,092.32
Processing Tomatoes	78.81	59.15	68.81
Vine Seed (Melon Proxy)	303.00	292.9	296.10

2.5 Costs of Production

In this report, we use Cost and Return studies developed by the UC Cooperative Extension (UCCE) to determine crop costs of production. These studies provide production costs for representative farmers in the Sacramento Valley and, as such, are representative of Bypass farming. Crop budgets are prepared for various years, thus we use the NASS prices paid indices for specific item categories to express each item cost in constant 2008 dollars.

Given the variety of lease arrangements and ownership structures among Bypass farm operators, we did not include an annual land cost in the net return calculation maximized by the BPM model. Thus the model optimizes the net returns to land and management. This is common in PMP models. The technical discussion of this issue is in Appendix A. Note that PMP captures implicit land costs through the calibration routine, thus these costs are not “omitted” from the model. Table 5 summarizes the variable costs of production for each crop.

Table 5. Variable Production Costs per acre (in 2008 dollars)

Crop Group	Cost
Corn	$607
Melons	$4,110
Pasture irrigated	$269
Pasture dry	$118
Rice	$898
Safflower	$239
Sunflower	$553
Tomato, processing	$1,838
Wild rice	$502

2.6 Areas of Inundation

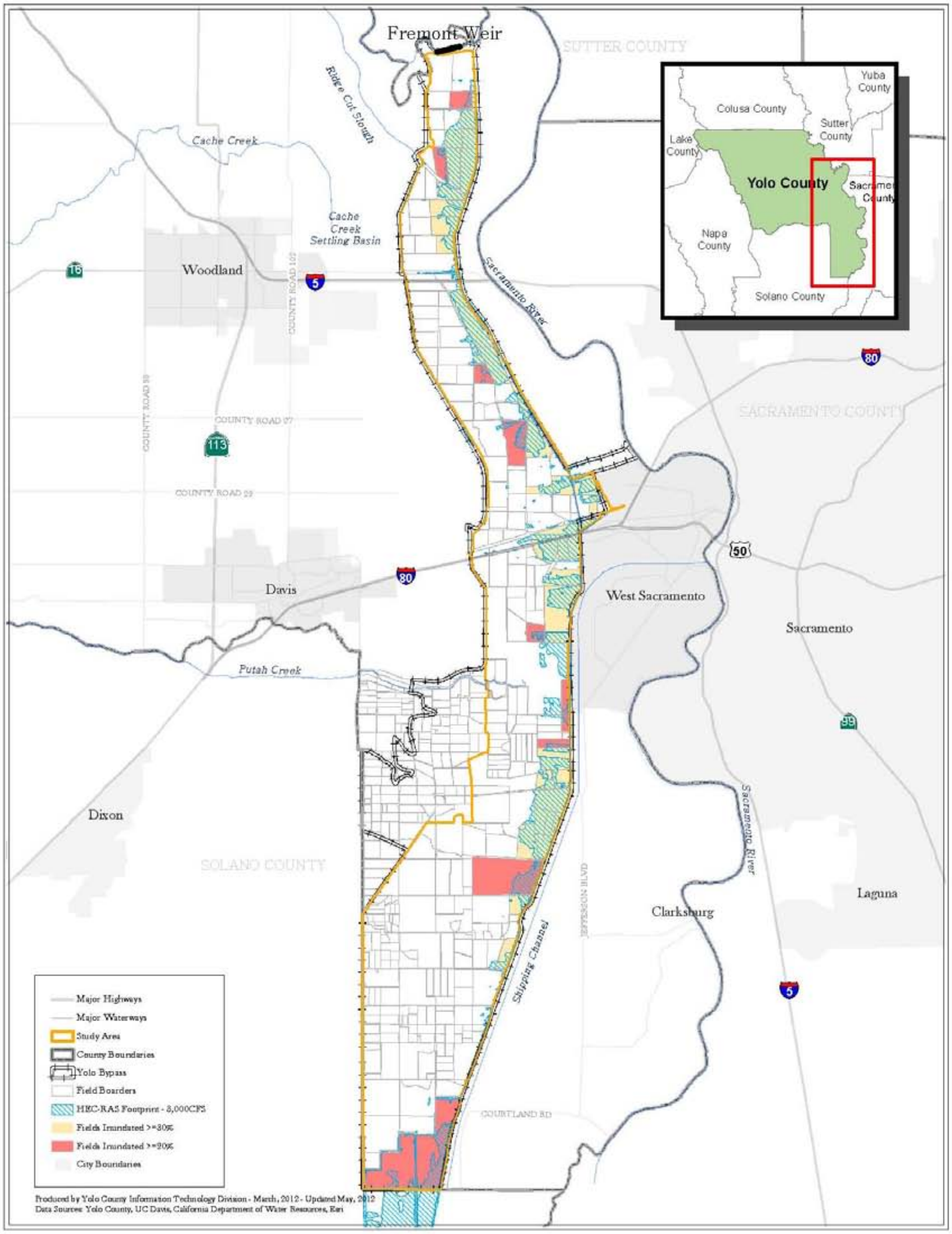
The second key driving factor in this analysis is the total number of affected acres under proposed flow volumes from Fremont Weir water releases through an operable gate. We consider two flow volumes (3,000 and 6,000 cfs) in this report.

We estimate the number of affected acres using the one-dimensional HEC-RAS hydrologic hydraulic simulation model. We use the HEC-RAS model for two reasons including, (i) the National Marine Fisheries Service used the HEC-RAS model to estimate innundated acreage for the Biological Opinion, and (ii) Yolo County recently completed an independent review of the MIKE-21 model that indicates additional data and improvements to the model are needed before it can used for policy decisions related to Yolo Bypass flooding. An initial comparison of the MIKE-21 and HEC-RAS footprints for 3,000 cfs and 6,000 cfs indicate the difference is relatively small.

Given the potential interest in this issue, some additional information is necessary to justify the decision to rely on HEC-RAS. Both one-dimensional (1-D) and two-dimensional (2-D) models are useful tools in hydraulic engineering and water resource planning studies. The accuracy of both 1-D and 2-D models is strongly dependent upon the quality of information specified by the user as input into the model and on the boundary conditions (flow, initial water level and channel roughness) the user must also specify. It can therefore be difficult to compare results without understanding how each model was developed, including how bed roughness, inflow and stage boundary conditions were specified, and other how other assumptions and constraints were entered as user-specified inputs to each model. Once the MIKE-21 or other model is improved as specified in the 2012 model review, MIKE-21 or another model can be used for making policy decisions related to Bypass flooding.

Figures 8 and 9 identify the fields inundated under the 3,000 and 6,000 cfs flow rates. We consider a field, in terms of restricting farm operations, to be effectively inundated if 30 percent or more of the field was inundated for field crops and 20 percent or more for rice crops. As discussed in Section 2.2, this reflects input received from Bypass farmers indicating that they would not typically initiate field preparation efforts if a portion of their field is still partially inundated. The blue areas in these figures identify the predicted flood inundation area. The red and yellow areas identify the contiguous fields that would be affected at 20% and 30%, respectively. Note that as the flow rate increases, the number of affected acres increases. Consequently, planting dates are delayed on more fields and farm revenue losses are expected to increase.

Figure 8. Agricultural Land Flooded under 3,000 cfs flow rates.



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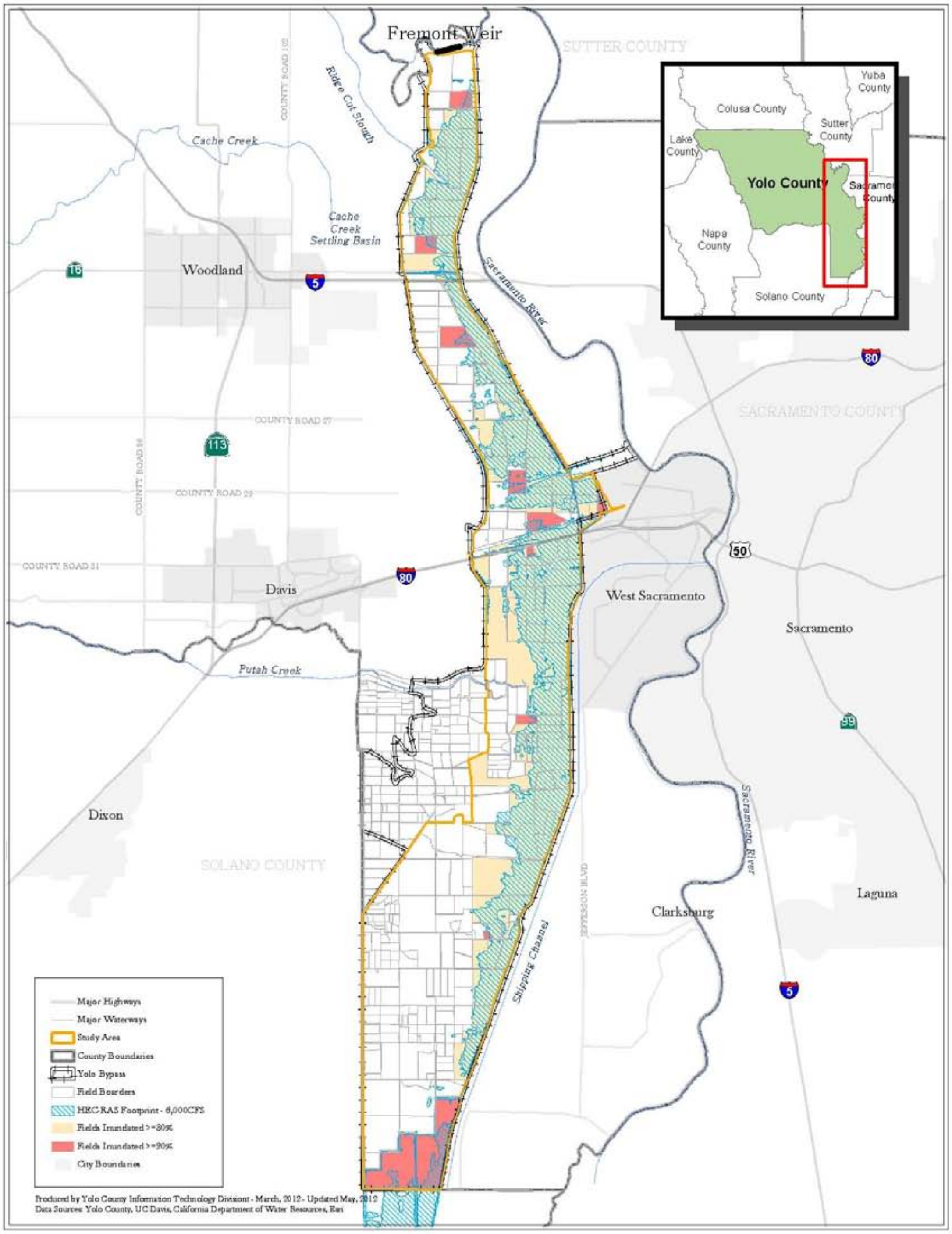
Data Sources: Yolo County, UC Davis, California Department of Water Resources, Esri

Figure 9. Agricultural Land Flooded under 6,000 cfs flow rates.



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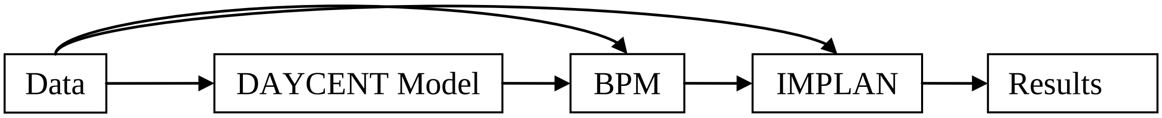
Data Sources: Yolo County, UC Davis, California Department of Water Resources, Esri

3 Overview of the Modeling Approach

We estimate the effect of the twelve proposed scenarios on Bypass agriculture based on the data summarized in Section 2 and a series of empirical models, summarized in this section. This section briefly reviews the modeling approach and policy scenarios evaluated. A detailed technical overview of the modeling approach is included in Appendix A.

Figure 10 provides an overview of the key steps in our analysis. Starting with input data described in the previous section, we use a series of linked models to estimate the effects on agriculture. The DAYCENT model is an agronomic model used to estimate field-level yields, as a function of planting date, for subsets of fields in each region of the Bypass. Regression analysis on the DAYCENT model output and additional input data are used to calibrate the BPM. Output from the BPM and other input data are used as inputs to the IMPLAN model. The fundamental results include direct, indirect, and induced (the sum of which is total) expected effects on total agricultural output (revenues), value added, agricultural employment, and statewide taxes.

Figure 10. Illustration of the Fundamental Modeling Approach



We briefly preview the five steps outlined in Figure 10, and provide more details in the subsequent sections.

Data: Input data were described in Section 2. In summary, we compiled a comprehensive economic, agronomic, and geo-referenced dataset of agricultural production in the Yolo Bypass between 2005 and 2009.

DAYCENT Model: Field-level data were used to calibrate the agronomic DAYCENT model (DeGryze et al 2009). We use the DAYCENT model to estimate crop yields as a function of various agronomic conditions, including planting date. We use non-linear regression analysis to fit a series of crop yield functions for each crop and region in the Bypass. Technical details are provided in Appendix A.

BPM: We use the crop yield functions estimated from the DAYCENT model, plus additional economic data, to calibrate the BPM. The BPM is the fundamental model of this analysis. The BPM relates changes in crop yield and total affected acres to changes in agricultural production and, fundamentally, changes in agricultural revenues. The BPM is a Positive Mathematical Programming (PMP after Howitt, 1995) model of agriculture in the 6 regions of the Yolo Bypass. PMP models calibrate exactly to an observed base year of production conditions and grower decisions and have been used extensively for water and agriculture policy analysis in

California and around the world. Appendix A reviews the technical details of the BPM and PMP calibration procedure.

IMPLAN: The IMPLAN model estimates regional economic losses. Expected revenue losses from the BPM analysis represent direct economic effects. Upstream and downstream industries will be affected, however, and some agricultural workers will lose their jobs when production in the Bypass decreases. We use the IMPLAN regional Input-Output (IO) model to estimate the direct, indirect, and induced effects of the 12 scenarios. The sum of these components represents the total impact of the scenarios.

The key result from this overview is that all of the analysis in this report is driven by observed data and observed grower decisions in the Bypass. We use a sequence of linked models to estimate the total (direct, indirect, and induced) effects of flood date and flow volume on agriculture in the Yolo Bypass. These effects are defined and described in detail in Section 4 and Appendix A.

3.1 Estimating Crop Yields (DAYCENT Model)

Crop yields are the fundamental driving factor for agricultural revenue losses due to flooding in the Yolo Bypass. As farmers delay planting, crop yields decline which in turn leads to lower revenues and land fallowing. We estimate crop yield, and variation based on planting date, using the DAYCENT agronomic model and non-linear regression analysis on output data.

We can summarize the procedure as two steps, (i) estimate field-specific yields using the DAYCENT model and, (ii) use the DAYCENT model output to perform regression analysis and estimate crop and region-specific yield functions. These functions relate crop yield to the planting date and are directly incorporated into the BPM. More information about this process is available in Appendix A.

Table 6 presents the results (after both steps are completed) from the yield data analysis by sub-region. Yields vary across regions and by planting date. Recall that after the last day of water releases through the Fremont Weir gate, there is a 6-8 week delay before planting occurs. This assumption is implicitly built into the yield data summarized in Table 6.

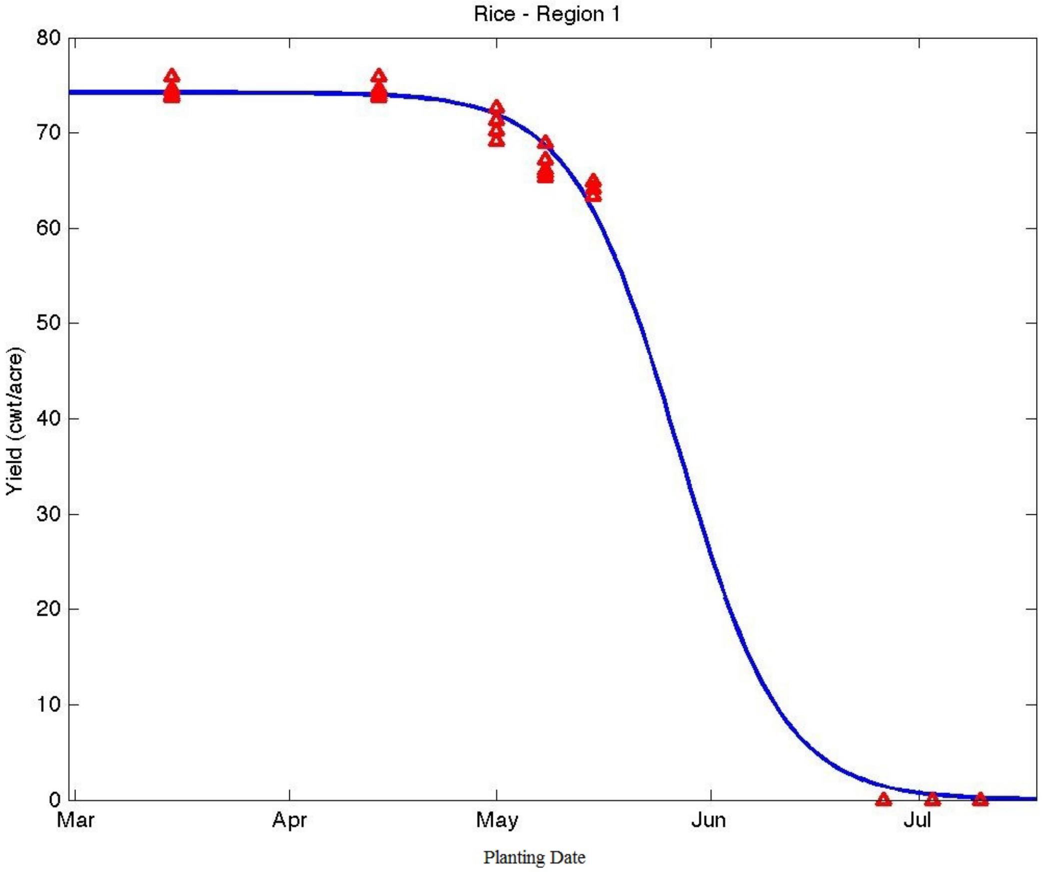
There are crop and region specific functions underlying all of the data summarized in Table 6. Figure 11 summarizes this function for an example crop of rice in Region 1. Yield functions for all the crops can be found in Appendix A. The vertical axis identifies the expected yield, the horizontal axis identifies the date, red triangles are output data from the DAYCENT field-level model, and the blue line represents the results of the fitted non-linear yield function.

There are several things to note from the example in Figure 11. First, one of these functions (the blue line) exists for every crop in every region. This governs the relationship between crop yield and planting date and, in part, drives the results of the economic (BPM) model. Second, note that the relationship is non-linear, as expected. Over some range early in the season, farmers will realize only a slight yield decline from a small delay in planting date. Substantial delays cause yields to decline rapidly.

Table 6. Estimated yield by planting date (last day of water releases) (tons/ac)

Yield (ton/acre)	**Region**	**Last day of water releases at Fremont Weir**			
		Feb 15th	**March 24th**	**April 10th**	**May 15th**
Corn	1	5.84	4.72	0.51	0.00
Corn	2	5.90	5.84	4.05	0.01
Corn	3	5.88	4.76	0.59	0.00
Corn	4	5.73	5.48	3.09	0.02
Pasture - dry (AUM/acre)	5	0.45	0.29	0.25	0.21
Pasture - dry (AUM/acre)	6	0.55	0.33	0.28	0.22
Pasture - irrigated (AUM/acre)	5	2.23	1.44	1.26	1.05
Pasture - irrigated (AUM/acre)	6	2.77	1.64	1.38	1.10
Rice	1	4.14	3.19	1.08	0.01
Rice	2	4.15	3.98	2.88	0.09
Rice	3	4.15	3.20	1.09	0.01
Rice	4	4.12	3.92	2.76	0.09
Rice	5	3.66	2.50	1.14	0.07
Rice	6	3.74	3.42	2.41	0.21
Safflower	1	1.07	0.51	0.29	0.07
Safflower	2	1.19	1.01	0.76	0.21
Safflower	3	1.09	0.51	0.29	0.08
Safflower	4	1.09	0.74	0.48	0.14
Safflower	5	0.98	0.41	0.21	0.04
Safflower	6	1.10	0.70	0.43	0.12
Sunflower	1	0.64	0.56	0.52	0.45
Sunflower	6	0.63	0.60	0.56	0.46
Processing Tomato	1	38.57	34.60	28.79	10.35
Processing Tomato	2	38.76	37.25	33.98	17.59
Processing Tomato	3	38.99	35.06	29.18	10.29
Processing Tomato	6	38.36	36.23	32.48	17.74
Melons	2	7.52	7.52	6.55	3.55
Melons	3	6.80	6.20	4.84	2.10
Melons	4	6.65	6.65	5.77	2.97
Wild rice	1	0.92	0.71	0.24	0.00
Wild rice	2	0.92	0.88	0.64	0.02
Wild rice	3	0.92	0.71	0.24	0.00
Wild rice	4	0.92	0.87	0.61	0.02
Wild rice	5	0.81	0.56	0.25	0.02
Wild rice	6	0.83	0.76	0.54	0.05

Figure 11. Example Expected Average Yield Function, Rice in Region 1



3.2 Bypass Production Model

The Bypass Production Model (BPM) combines the HEC-RAS data, DAYCENT yield functions, and other economic data into a Positive Mathematical Programming (PMP) agricultural production model of the Yolo Bypass. The model calibrates exactly to an observed base year of input and output data which, in our analysis, is 2005 - 2009 average land use. In other words, the model exactly replicates observed farmer behavior, in terms of input use and outputs, over this period. Once the model calibrates, and a series of economic and numerical checks are satisfied (see Howitt et al. 2012), we use the BPM to simulate changes in agricultural production under the twelve proposed policy scenarios. We review the basics of the BPM in this section. The interested reader can find technical details in Appendix A.

The BPM estimates the change in crop mix, agricultural revenues, and other factors due to crop yield loss (DAYCENT model) and the number of acres affected (HEC-RAS model) in the Yolo Bypass. The BPM calibrates to an average of 2005-2009 land use input data (summarized in Section 2). All dollars are expressed in 2008 real terms. Crop prices for calibration are an average of 2005-2007 prices in Yolo County. The 2005-2007 average prices were determined to be representative of conditions farmers in the Yolo Bypass faced, on average, when making planting decisions between 2005 and 2009. Input costs are expressed in 2008 dollars, from the UCCE budgets. Policy simulations use 2009-2010 average crop prices, as discussed previously.

Technical details of the PMP calibration procedure and functional forms in the model are left to Appendix A. We briefly review the estimation procedure in this section. The BPM estimation procedure can be summarized as a series of five steps:

Step 1: Calibrate the BPM to base data (2005 - 2009, as discussed previously). Perform a series of checks to ensure economic and numerical conditions are satisfied.

Step 2: Run the BPM for a season with *known* overtopping dates at Fremont Weir, and flooding in the Yolo Bypass. This represents the base condition (e.g. natural flooding) for agriculture in the Bypass in the absence of the proposed policy flooding scenarios (for that year). Repeat Step 2 for a series of known years. There are 26 known overtopping dates in the analysis which are discussed in more detail in the following section.

Step 3: Over the same series of years as step two, run the BPM and impose (sequentially - one at a time) the twelve proposed policy flooding scenarios. This represents what *would have* happened to Bypass agriculture *if* the flooding policy was implemented in that year. Repeat Step 3 for all of the same years as Step 2.

Step 4: For each year simulated in Steps 2 and 3, calculate the difference in agricultural revenues (and other outputs). Record the result for negative changes in revenue. Intuitively, for policy evaluation we are interested in negative changes in revenue because a positive change in revenue implies that the policy was “better” than nature. For example, if natural flooding occurred in the Bypass until April 30th, imposing a policy which stops water releases from a Fremont Weir gate on April 10th would not be possible (i.e. it would increase revenues).

Step 5: Calculate the average loss of revenue (and other changes) across all of the years simulated in Steps 2 - 4. This represents the expected effects due to the proposed flooding scenarios, and is the fundamental output of the BPM.

The fundamental procedure of the BPM is to generate an *expected* effect on agriculture by using the calibrated model to estimate what would have happened under natural flooding, and then asking what would have happened if a specific policy (last day of water releases) was in place. This procedure allows us to generate an expected effect because we control for the expected natural flood events in the Bypass. The following section illustrates this point.

3.3 Adjustments for Natural Flooding

In many years flooding occurs naturally in the Yolo Bypass and, in some years, flooding may occur late in the season. Estimates of agricultural losses need to account for the fact that natural conditions may result in flooding beyond the proposed policy date. We use a 26 year (1984-2009) time-series of hydrologic conditions in the Bypass to estimate expected future revenue losses in the Bypass. The implicit assumption is that the previous 26 years are representative of expectations for natural flooding in the near future. The implications of this assumption and details on the procedure used in the BPM are described in more detail in Appendix A.

Given the 26 year time-series, estimates represent expected annual losses due to flooding for fish habitat in the Bypass. There are two reasons these 26 years of data were identified as reasonable, including (i) detailed flow information over the Fremont Weir was available for these years, and (ii) it is representative of current hydrologic conditions in the Sacramento Valley watershed. Older hydrologic information less accurately represents current conditions because it does not account for changes in urban development and reservoir operations that have altered flows in the Sacramento River over time.

Table 7 summarizes the observed last day of overtopping and provides some notes about the nature of flooding in key years. During the 26 years, there are five years (1989, 1996, 1998, 2003 and 2005) in which flooding events in the Yolo Bypass did not occur consecutively. In these years, except for 2003, an early dry period enabled farmers to proceed with their land preparation, but planting was delayed or significantly affected by late floods. To account for this in the analysis, 28 days (the amount of time needed for field preparation) was credited to the planting date in these years. This assumes that farmers had to wait for the fields to drain in these years, but required minimal field preparation effort since this was completed earlier in the season.

Table 7. Fremont Weir Overtopping End Dates

Year	End Date	Important Notes and Adjustments
1984	11-Jan	
1985	-	
1986	25-Mar	
1987	-	
1988	-	
1989	14-Mar	Early dry year, followed by late flooding, farmers able to prepare fields early reducing the effect of late flooding
1990	-	
1991	-	
1992	-	
1993	6-Apr	
1994	-	
1995	13-May	
1996	24-May	Early dry year, followed by late flooding, farmers able to prepare fields early reducing the effect of late flooding
1997	13-Feb	
1998	8-Jun	Early dry year, followed by late flooding, farmers able to prepare fields early reducing the effect of late flooding
1999	14-Mar	
2000	17-Mar	
2001	-	
2002	10-Jan	
2003	7-May	Flooding confined to the Toe Drain; minimal effect on agriculture
2004	10-Mar	
2005	24-May	Early dry year, followed by late flooding, farmers able to prepare fields early reducing the effect of late flooding
2006	5-May	
2007	-	
2008	-	
2009	-	

3.4 IMPLAN

We use the Impact Analysis for Planning model (IMPLAN) Professional Version 3 and a 2009 database for Yolo County. We link the IMPLAN model to results from the BPM, in order to estimate changes in total output value, value added, employment, and tax revenues as a result of the proposed flood policies. IMPLAN is an input-output model which accounts for relationships between sectors of the economy in order to estimate the effects of a change (e.g. reduced agricultural output) in another sector of the economy. IMPLAN is widely used by State and Federal agencies including the California Department of Water Resources, the California Regional Water Quality Control Boards, the U.S. Army Corps of Engineers, the U.S. Bureau of Reclamation, the U.S. Bureau of Economic Analysis, and the U.S. Bureau of Land Management.

We summarize four key outputs for this analysis: changes in total output value, changes in "value added", changes in employment, and changes in statewide tax receipts. For each output we report direct, indirect, and induced effects, the sum of which is the total effect. We define these components below, further technical details can be found in Appendix A.

Total Output Value (e.g. Gross Revenues): The gross value of agricultural production in the Yolo Bypass to the "global" economy. For example, this is price multiplied by yield/acre multiplied by the total number of acres.

Total Value Added: The net value of agricultural production in the Yolo Bypass to the Yolo County economy. This measure recognizes that many inputs/outputs are produced or consumed outside of Yolo County and, as such, are not relevant effects for the flood policy analysis. For example, food production is exported out of the county, state, or country for many crops. Similarly, tractors are produced outside of the county, fertilizers are produced in another state, etc. The measure of value added controls for these effects. Total value added includes compensation for employees, income to business and landowners, and other business, specific to Yolo County.

Total Employment: The change in agricultural employment in Yolo County due to changes in agricultural production in the Yolo Bypass. Specifically, this includes NAICS classification system sector 111 - agricultural employment.

Total Statewide Tax Revenue: The change in tax receipts due to reduced output in the Yolo Bypass.

Each of these components has a direct, indirect, and induced effect on the Yolo County economy. The sum of the three is the total effect and sometimes the indirect and induced effects are jointly referred to as "multiplier" effects. We define these terms below.

Direct: Immediate effects on the relevant agricultural economy. For example, gross farm revenue losses due to reduced yields in the Bypass.

Indirect: Changes in related sectors as a result of direct changes to production in the Bypass. For example, reduced production in the Bypass will cause farmers to purchase fewer inputs, this is an indirect effect.

Induced: Changes in all other sectors of the economy as a result of the direct changes to production in the Bypass. For example, reduced production in the Bypass will lead to reduced hours for farm workers who will, in turn, purchase fewer goods and services from other industries in the region.

Total: Direct + Indirect + Induced

4 Results

We summarize the results of the analysis in this section. Results correspond to each of the 12 policy scenarios (water release end date and flow volume) for the four measures detailed in Section 3.4. First, we summarize changes in acreage across the Bypass.

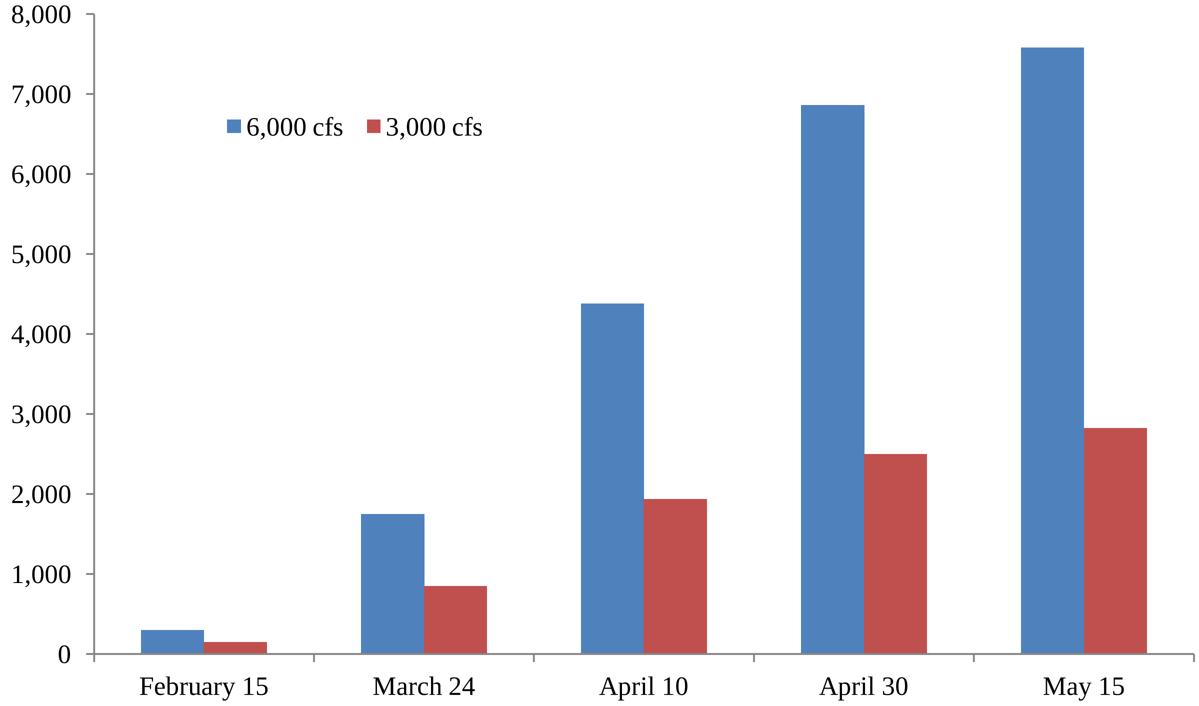
Results are annual expected losses, reported in constant 2008 dollars.

4.1 Acreage Change Summary

Farmers may fallow land or shift small amounts of land to alternative crops in response to delayed planting due to flooding. Figure 12 illustrates the expected annual acreage loss due to Bypass inundation policies. Specifically, this figure represents the average annual loss of acres across all crops, where the average is taken over the 26 year hydrologic time series. Flooding later in the season delays field preparation; this decreases crop yields and increases land fallowing. All else constant, the 3,000 cfs scenario affects fewer acres and results in less fallowing than the 6,000 cfs scenario.

There is a base level of average fallow acres in any given year within each of the affected 3,000 and 6,000 cfs flood areas. Specifically, in the 3,000 cfs flood region, the 2005 through 2009 base (calibration) data shows that an average of 2,200 acres are fallow in any given year. Similarly, in the 6,000 cfs flood region, 4,400 acres are fallow in any given year. These additional fallow acres are typically for rotation purposes and are not included in Figure 12.

Figure 12. Expected Annual Loss of Acres (26 year average), by Overtopping End Date.



We also evaluated a low-impact CM2 scenario where water flows through an operable gate at Fremont Weir are only imposed for an additional 30 days in years when there is natural flooding. As expected, the losses under this proposal are minimal. An average of 460 acres are expected to be fallowed under the 3,000 cfs low-impact CM2 scenario. This increases to 1,200 acres under the 6,000 cfs low-impact CM2 scenario.

4.2 Revenue Losses Summary

We summarize the expected agricultural revenue losses for each flow rate and last day of water releases from the Fremont Weir gate in Table 8. As shown, total output value (gross farm revenue) expected losses range from $0.28 to $17.3 million per year in the RPA scenarios, depending on the last day of water releases from the Fremont Weir gate and the flow rate. As expected, a later water release date delays planting and, consequently, reduces crop yields and increases farm revenue losses. Similarly, higher flow rates affect more fields and increase farm revenue losses.

Losses for the RPA scenarios should be interpreted as annual expected losses from continuous flooding up to the identified end date.

Table 8. Expected Annual Total Revenue Loss (2008 dollars), RPA Scenarios

Expected Total Revenue Loss (Output Value) ($2008)		
	3,000 cfs	6,000 cfs
February 15		
Direct	172,278	280,530
Indirect+Induced	116,463	189,826
Total	**288,741**	**470,356**
March 24		
Direct	1,081,960	2,026,110
Indirect+Induced	731,777	1,370,310
Total	**1,813,737**	**3,396,420**
April 10		
Direct	2,713,780	5,823,400
Indirect+Induced	1,835,472	3,938,499
Total	**4,549,252**	**9,761,899**
April 30		
Direct	3,915,080	8,981,760
Indirect+Induced	2,647,896	6,074,741
Total	**6,562,976**	**15,056,501**
May 15		
Direct	4,512,650	10,333,200
Indirect+Induced	3,052,140	6,988,682
Total	**7,564,790**	**17,321,882**

Expected losses for the low-impact CM2 scenario range between $1.2 to $2.8 million per year. The low-impact CM2 scenario corresponds to supplemental releases only in years where natural flooding occurs. As such, loss estimates are much lower, between $1.2 and $2.8 million per year. Note that in some years losses are zero (when there is no natural flooding) and in other years losses are substantial (when there is late natural flooding). These loss estimates correspond to expected annual losses, summarized in Table 9.

Table 9. Expected Annual Total Revenue Loss (2008 dollars), Low-impact CM2 Scenario

Expected Total Revenue Loss (Output Value) ($2008)		
	3,000 cfs	6,000 cfs
Low-impact CM2 Scenario		
Direct	725,930	1,704,640
Indirect+Induced	490,987	1,152,982
Total	**1,216,917**	**2,857,622**

A proportion of Yolo Bypass production and crop consumption occurs within Yolo County. As such, losses to Yolo County are expected to be less than total revenue losses. The proper measure of the effect on the Yolo County economy is change in “value added” (defined in section 3.4). Table 10 summarizes the change in value added under the proposed flooding policies. In the RPA scenarios expected losses in value added range from $0.14 to $8.9 million per year.

Table 10. Expected Annual Value Added Loss (2008 dollars), RPA scenarios

Expected Total Yolo County Revenue Loss (Value Added) ($2008)		
	3,000 cfs	6,000 cfs
February 15		
Direct	74,648	121,954
Indirect+Induced	73,568	119,914
Total	**148,216**	**241,868**
March 24		
Direct	469,589	879,285
Indirect+Induced	462,261	865,620
Total	**931,850**	**1,744,905**
April 10		
Direct	1,177,877	2,527,185
Indirect+Induced	1,159,463	2,487,936
Total	**2,337,340**	**5,015,121**
April 30		
Direct	1,699,112	3,898,193
Indirect+Induced	1,672,667	3,837,395
Total	**3,371,779**	**7,735,587**
May 15		
Direct	1,958,644	4,484,527
Indirect+Induced	1,928,028	4,414,727
Total	**3,886,672**	**8,899,254**

Comparable to the output value losses, value added losses in the low-impact CM2 scenario are lower than many of the RPA scenarios. Table 11 summarizes the CM2 results. Expected annual losses to value added range from $0.63 to $1.5 million per year.

Table 11. Expected Annual Value Added Loss (2008 dollars), Low-impact CM2 scenario

Expected Total Yolo County Revenue Loss (Value Added) ($2008)		
	3,000 cfs	6,000 cfs
Low-impact CM2 Scenario		
Direct	315,084	739,971
Indirect+Induced	310,155	728,336
Total	**625,239**	**1,468,307**

4.3 Employment Losses Summary

Table 12 summarizes the corresponding expected annual agricultural job losses under the proposed flooding policies. Employment effects are generally small, ranging from no effect to 130 jobs lost.

Table 12. Expected Annual Agricultural Jobs Loss, RPA scenarios

Expected Total Employment Loss		
	3,000 cfs	6,000 cfs
February 15		
Direct	1	2
Indirect+Induced	1	2
Total	**2**	**4**
March 24		
Direct	7	13
Indirect+Induced	7	12
Total	**13**	**25**
April 10		
Direct	17	37
Indirect+Induced	16	35
Total	**34**	**73**
April 30		
Direct	25	58
Indirect+Induced	24	55
Total	**49**	**112**
May 15		
Direct	29	66
Indirect+Induced	27	63
Total	**56**	**129**

Table 13 summarizes the low-impact CM2 scenario employment losses. Direct expected gross revenue losses are less than $1.5 million per year and the corresponding job losses are small.

Table 13. Expected Annual Agricultural Jobs Loss, CM2 Scenario

Expected Total Employment Loss		
	3,000 cfs	6,000 cfs
Low-impact CM2 Scenario		
Direct	5	11
Indirect+Induced	4	10
Total	**9**	**21**

4.4 Tax Losses Summary

Table 14 summarizes the total expected annual losses in tax revenues to the state under the proposed flooding scenarios in the RPA. Annual tax revenue losses can be as high as $0.82 million under the 6,000 cfs flow scenario that extends flooding as late as May 15. For the 3,000 cfs flow regime scenario, annual tax revenue losses are less than $0.36 million.

Table 14. Expected Annual Total Statewide Tax Revenue Losses (2008 dollars), RPA Scenarios

Expected State and Local Tax Revenue Loss ($2008)		
	3,000 cfs	6,000 cfs
February 15	13,604	22,193
March 24	85,515	160,130
April 10	214,496	460,241
April 30	309,428	709,892
May 15	356,677	816,686

Table 15 summarizes the expected annual tax revenue losses to the state for the low-impact CM2 scenario.

Table 15. Expected Annual Total Statewide Tax Revenue Losses (2008 dollars), Low-impact CM2 Scenario

Expected State and Local Tax Revenue Loss ($2008)		
	3,000 cfs	6,000 cfs
Low-impact CM2 scenario	57,377	134,744

5 Sensitivity Analysis

Results of the analysis are sensitive to parameters and assumptions listed in Section 1.1. Some overstate and others understate expected losses. We believe our estimates are generally conservative. Nonetheless, some sensitivity analysis is warranted.

Expected loss estimates are most sensitive to changes in area inundated, yield loss, and crop prices. Area inundated is driven by HEC-RAS model results that are based on RPA and low-impact CM2 scenarios. As such, we don't have a basis to vary the number of affected acres. Similarly, yield loss is a function of planting date that is driven by agronomic data and non-linear regression analysis. As such, we do not have a justifiable basis to vary this relationship. Prices, as discussed in Section 2.2, are uncertain and we perform sensitivity analysis on these parameters.

We select 2005-2006 average prices to represent a "low" price scenario and 2008 prices to represent a "high" price scenario. Note that some crop prices are actually higher (lower) than the base scenario for the lower (higher) sensitivity analysis scenarios. This is expected since some crop prices are correlated and we typically don't expect to observe all prices trending in the same direction. In other words, a sensitivity analysis where all crop prices are 10 percent higher is not relevant sensitivity analysis. Table 16 summarizes the low and high prices used for sensitivity analysis, in addition to the base (2009-2010) prices used in the analysis. Note that the largest uncertainty occurs with the price of rice, which experienced a large spike in 2008 following years of lower prices.

Table 16. Price Sensitivity Analysis Range (2008 dollars), All Scenarios

Crop Group	2005-2006 Average (LOW)	2009-2010 Average (BASE)	2008 (HIGH)
Corn	141.00	172.69	152.20
Irrigated Pasture	49.20 (based on $35 per AUM)	49.20 (based on $35 per AUM)	49.20 (based on $35 per AUM)
Non-Irrigated Pasture	49.20 (based on $35 per AUM)	49.20 (based on $35 per AUM)	49.20 (based on $35 per AUM)
Rice	274.80	397.89	513.10
Wild Rice	1,469.30	961.85	1,684.20
Safflower	314.80	351.18	432.62
Sunflower	1,056.10	1,196.15	1,092.32
Processing Tomatoes	67.75	78.81	68.81
Vine Seed (Melon Proxy)	349.80	303.00	296.10

Figure 13 summarizes the results of the price sensitivity analysis for the 3,000 cfs scenarios. Sensitivity analysis corresponds to the output of the BPM model, gross agricultural revenues (gross output value), or the direct effects listed in Table 8. The base estimate has been normalized to 1, thus the bars show the percentage deviation due to prices. For example, in the April 10 RPA scenario low prices reduce losses by 24 percent (0.76) and high prices increase losses by 23 percent (1.23).

Figure 13. Price Sensitivity Analysis for Gross Output Value under 3,000 cfs, All Scenarios.

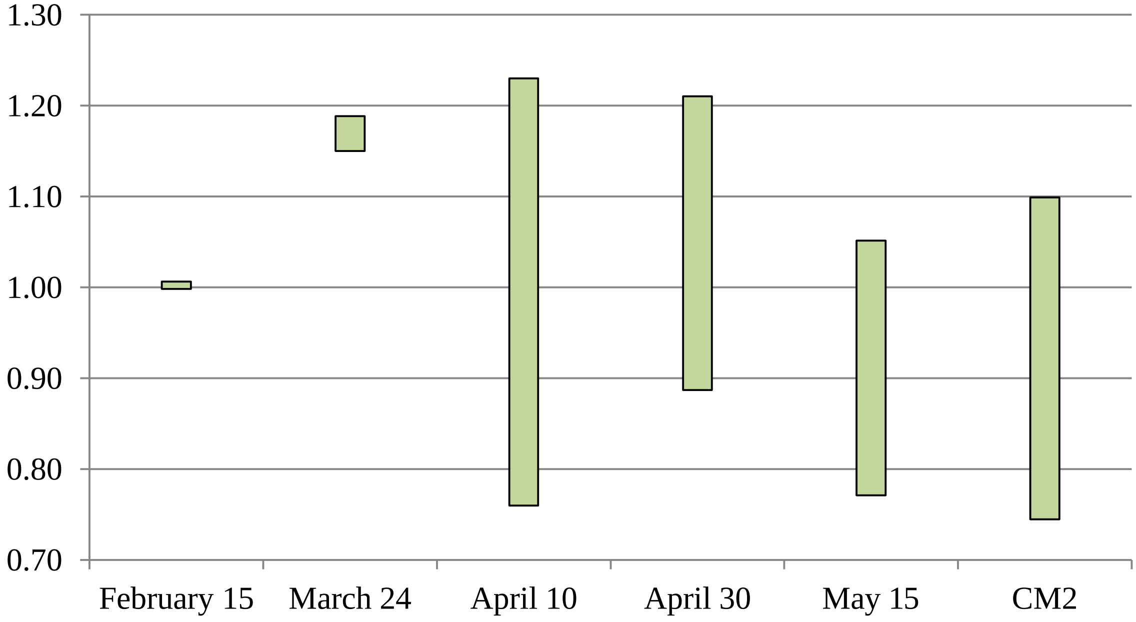
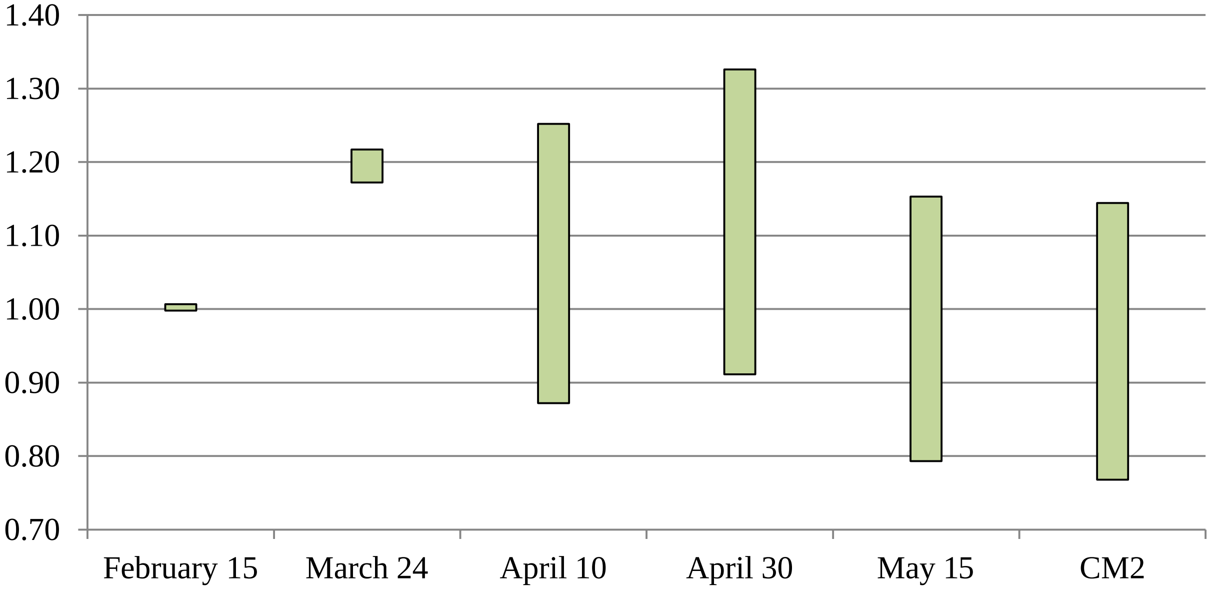


Figure 14 summarizes the results of the price sensitivity analysis for the 6,000 cfs scenarios. Again, sensitivity analysis corresponds to the output of the BPM model, gross agricultural revenues (gross output value), or the direct effects listed in Table 8. The base estimate has been normalized to 1, thus the bars show the percentage deviation due to prices. For example, in the April 10 RPA scenario low prices reduce losses by 13 percent (0.87) and high prices increase losses by 25 percent (1.25). Figures 13 and 14 indicate that results are slightly sensitive to crop prices, as expected. Our estimates based on 2009-2010 average prices are generally conservative since the deviation from the base is generally above 1.

Figure 14. Price Sensitivity Analysis for Gross output Value under 6,000 cfs, All Scenarios.



Other areas where we are unable to perform sensitivity analysis include weather shocks and changes in the cost of production. The latter raises an important point, namely we have implicitly assumed that the costs of production in the Bypass remain constant even with late flooding. However, if production costs go up, for example due to overtime labor or increased preparation costs, loss estimates will increase.

6 Conclusion

This study has assembled extensive data on cropping, water use, and the economics of the agricultural industry in the Yolo Bypass. We then use these data to calibrate and link four models. Namely, an engineering model of field flood inundation (HEC-RAS), an agronomic model of yield loss due to shorter growing seasons (DAYCENT), an economic production model of farm crop decisions in the Yolo bypass (BPM), and finally a regional economic model of the Yolo County economy (IMPLAN). The net economic results from these four models are measured as a set of output values for twelve alternative flood scenarios that cover two different volumes of flooding and five different ending dates for the RPA, plus an evaluation of the CM2 proposal. The five overtopping dates analyzed were selected to span the full range from no effect on cropping, to the cost of flooding that prevents any cropping, and intermediate values.

For each of the twelve scenarios the net dollar effect on the Yolo County economy is measured in terms of value-added. The loss in employment is measured in terms of full-time equivalent jobs, and the effect on the State tax receipts. The expected economic value added losses range widely from $0.15 to $8.9 million per year. The effect on job losses and tax receipts also varies widely, depending on the scenario.

Despite our efforts to assemble the very best data set, we would like to stress that the model results are sensitive to several assumptions. In particular, we would like to note that the areas of inundation under different flooding scenarios may well change with different engineering models and better data. In addition, we have attempted to use a weighted price for future crops that is representative of an average over recent years and neither relies on recent boom price levels or earlier depressed agricultural conditions.

We would also like to emphasize that this study is only able to measure the expected cost to the Yolo County economy, and is not able to account for changes in risk, management difficulties, and other factors facing the county and the agricultural industry in the Bypass.

7 References

Bay-Delta Conservation Plan (BDCP). (2012) February 2012 Draft Report. Available at : http://www.baydeltaconservationplan.com. Last Accessed May 5, 2012.

DeGryze, S, R. Catala, R. E. Howitt, J. Six. (2009)*Assessment of Greenhouse Gas Mitigation in California Agricultural Soils* California Energy Commission (2009) Issue: January, Publisher: UC Davis for Public Interest Energy Research (PIER) Program, California Energy Commission, Pages: 160

Buysse, J., Huylenbroeck, G., and Lauwers, L. 2007. Normative, Positive and Econometric Mathematical Programming as Tools for Incorporation of Multifunctionality in Agricultural Policy Modelling. *Agriculture, Ecosystems, and Environment.* 120:70-81.

Heckelei, T. & W. Britz. 2005. Models Based on Positive Mathematical Programming: State of the Art and Further Extensions. 21. Bonn, Germany: University of Bonn, Institute for Agricultural Policy, Market Research and Economic Sociology.

Heckelei, T. & H. Wolff (2003) Estimation of Constrained Optimisation Models for Agricultural Supply Analysis based on Generalised Maximum Entropy. *European Review of Agricultural Economics*, 30**,** 27-50.

Howitt, R.E. 1995. Positive Mathematical-Programming, American Journal of Agricultural Economics, 77(2), 329-342.

Howitt, R.E., J. Medellin-Azuara, D. MacEwan, and J.R. Lund. 20112. “Calibrating Disaggregate Models of Irrigated Production and Water Use: The California Statewide Agricultural Production Model.” Working Paper. University of California, Davis.

IMPLAN website: http:www.implan.com

Leontief, W., 1941. The structure of American economy, 1919-1929; an empirical application of equilibrium analysis. Harvard University Press, Cambridge, Mass.

Merel, P. and Bucaram, S. (2010) Exact Calibration of Programming Models of Agricultural Supply Against Exogenous Supply Elasticities. *European Review of Agricultural Economics,* 37**,** 395-418.

Merel, P., Simon, L., Yi, F. (2011) A Fully Calibrated Generalized CES Programming Model of Agricultural Supply. *American Journal of Agricultural Economics,* (forthcoming).

University of California Cooperative Extension (UCCE). Cost of Production Studies. Various Crops and Dates. Department of Agricultural and Resource Economics. Davis, California. URL = http://coststudies.ucdavis.edu.

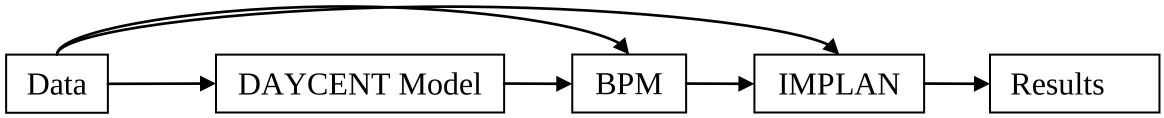
County Agricultural Commissioners (AgCom). Annual Crop Reports. Various years, various counties. Available at http://www.nass.usda.gov/Statistics_by_State/California/Publications/AgComm/Detail/index.asp.

0 Technical Appendix: Overview of the Modeling Approach

Evaluation of agricultural policies requires a modeling framework which can be used to simulate losses and estimate costs. In this report, we adopt a modeling framework driven entirely by a rich, empirical dataset, highlighted by Figure A1. We estimate the effect of 12 proposed policies of flood level and date for fish habitat on Bypass agriculture. The scenarios include flow rates of 3,000 and 6,000 cfs from the Sacramento River passing through an operable gate in the Fremont Weir. The last day of overtopping at Fremont Weir occurs on February 15, March 24, April 10, April 30 or May 15. Additionally, we evaluate the CM2 proposal which does not correspond to a specific end date.

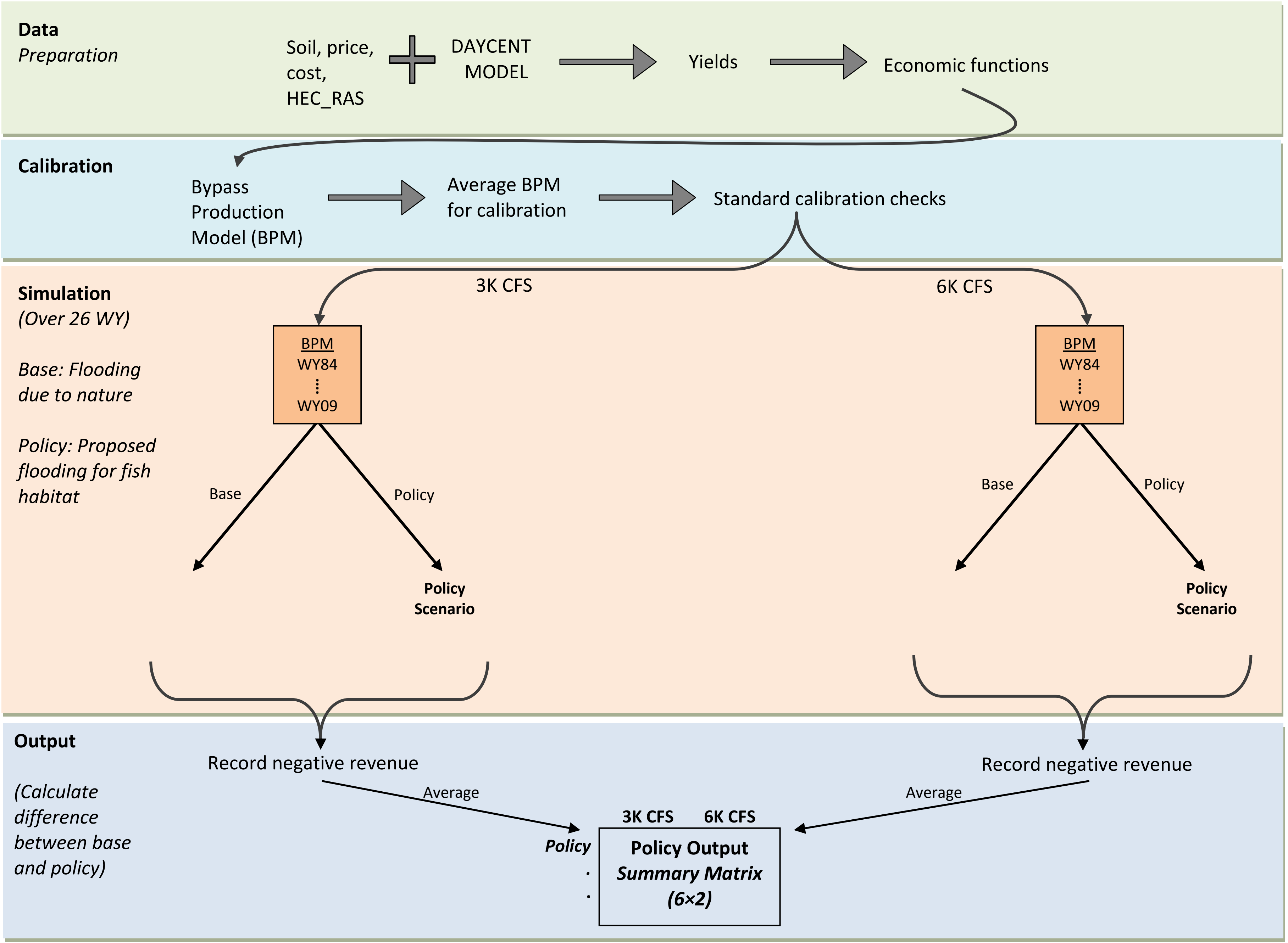
Figure A1 provides a simple illustration of the key steps in the analysis. Starting with input data (including the HEC-RAS model), we use a series of linked models to estimate the impacts to agriculture. The DAYCENT model is an agronomic model used to estimate field-level yields, as a function of planting date, for subsets of fields in each region of the Bypass. Regression analysis on the DAYCENT model output and additional input data are used to calibrate the BPM. Output from the BPM and other input data are used as inputs to the IMPLAN model.

Figure A1. Illustration of the Fundamental Modeling Approach



Production and geo-referenced land use data, HEC-RAS output, DAYCENT simulations, and regression analysis are used as inputs to the Bypass Production Model (BPM). The BPM is the fundamental economic model in the analysis. The technical details of the analysis can be summarized in four phases including, (i) data preparation, (ii) calibration, (iii) estimation, and (iv) output. The flow chart in Figure A2 illustrates this process, which we review in detail in this technical appendix.

Data preparation involves the compilation and synthesis of model data, including geo-referenced land use data, production data, and HEC-RAS model output. This stage additionally includes field-level simulations with the DAYCENT model and regression analysis. Model calibration includes development of the Bypass Production Model (BPM) and exact calibration, through Positive Mathematical Programming, in inputs and outputs to a known base year. Estimation involves simulation of the calibrated BPM over a series of known water years (nature) and sequentially imposing the 12 proposed policies on the model. The difference between the base and policy simulations is recorded for all years with revenue losses. The output phase estimates losses from the BPM and generates expected annual gross revenue losses. Output from the BPM are input to the IMPLAN model to estimate Yolo County direct, indirect, and induced economic effects.


Data
Preparation
Soil, price, cost, HEC_RAS
DAYCENT MODEL
Yields
Economic functions
Calibration
Bypass Production Model (BPM)
Average BPM for calibration
Standard calibration checks
Simulation
(Over 26 WY)
Base: Flooding due to nature
Policy: Proposed flooding for fish habitat
3K CFS
6K CFS
BPM
WY84
⋮
WY09
BPM
WY84
⋮
WY09
Base
Policy
Base
Policy
Policy Scenario
Policy Scenario
Output
(Calculate difference between base and policy)
Record negative revenue
Record negative revenue
Average
Average
3K CFS
6K CFS
Policy
Policy Output
Summary Matrix
(6×2)

1 Data Preparation

We collected extensive data for the Yolo Bypass in order to conduct an empirical analysis of the proposed inundation scenarios. These include the following: (i)field-level geo-referenced crop data and region definitions, (ii) crop yields and yield change based on planting date, (iii) crop prices, (iv) costs of production, and (v) area inundated under 3,000 and 6,000 cfs flow volumes. We review these data in the following section.

1.1 Land Use and Production Data

Production and land use data are summarized in the main text of this report, we provide a brief summary in this section. Land use data are from a series of years, 2005-2009, of land use for major crops, fallow land, and wetland in the Yolo Bypass. We identified 6 agricultural sub-regions in the Yolo Bypass which represent homogeneous production conditions and form the basis of the BPM. We used soil and climate data, in addition to interviews with Bypass farmers, to develop homogenous agricultural sub-regions.

1.2 The DAYCENT Model

The DAYCENT model (DeGryze et al. 2009) is an agronomic model of field-level yields for specific agricultural production regions. Johan Six and Juhwan Lee in the Plant Sciences Department at UC Davis were responsible for model analysis and simulations.

The DAYCENT model calibrates to observed production conditions on a sub-set of fields in the Yolo Bypass. The sub-set of fields is selected to represent heterogeneous production conditions in the Bypass. The model is calibrated against data for corn, rice, safflower, sunflower, processing tomato, alfalfa and mixed melons. The model does not explicitly simulate pasture so we use alfalfa grown on a yearly rotation to proxy for irrigated pasture. Based on interviews with farmers we determined that the yearly yield of dry pasture in AUM/acre is a fifth that of irrigated pasture. The model does not simulate vine seed so we use the yield for mixed melons (honeydew and watermelon) as a proxy for vine seed.

The DAYCENT model estimates the yield on any given field taking into account all production conditions, including climate and date the crop was planted. We use the calibrated DAYCENT model to estimate crop yields on a subset of fields in each of the 6 regions of the BPM. We control for all other factors and allow the planting date to vary, thus the DAYCENT model generates a series of data points, for each crop and region, of the expected yield given the crop planting date.

1.3 Yield Functions Regression Analysis

We use the data points from the DAYCENT model results to estimate a single yield function, for each crop and region. We fit this function using non-linear regression analysis which results in a single function, for each crop and region in the Bypass, which relates crop yield to the planting date. The yield response functions are included in the BPM.

We control for all other factors and specify yield as a function of the planting date. We estimate the yield function by pooling all field observations, from the DAYCENT model, in each region for the years 2005-2009. This is because we want to estimate the average yield response to the planting date over a range of years rather than capturing yearly weather effects. The objective of this study is to estimate the expected effects on agriculture due to increased flooding for fish habitat and, as such, we do not want to capture weather or other effects in the yield response functions.

For each crop i and region g, define $y_{i,g}$ as crop yield and $d_{i,g}$ as the planting date. Note that the planting date is the last day of over-topping plus region-specific drainage and preparation times. Model parameters include $\alpha_{i,g}$, $\beta_{i,g}^{0}$, and $\beta_{i,g}^{1}$. The estimated model for all crops except pasture is defined as

$$y_{i,g} = \frac{\alpha_{i,g}}{1+e^{\beta_{0i,g}+\beta_{1i,g}d_{i,g}}}. \tag{1.1}$$

Pasture exhibits a different response than the other crops due to its resistance to delayed planting date. We define the yield response function for pasture as

$$y_{i,g} = \frac{\alpha_{i,g}}{1+e^{\beta_{1i,g}d_{i,g}}}. \tag{1.2}$$

We experimented with a series of functional forms for the yield response functions and determined that the exponential provided the best fit of the data. Specifically, the AIC (and, AIC-corrected for small sample sizes) indicated that the models in Equations 1.1 and 1.2 were the best fit for the data.

We perform nonlinear regression analysis in Stata to generate parameter estimates. Not all crops are gown in all regions, thus yield functions only apply to regions where crops are grown. Dry and irrigated pasture have the same yield functions. Rice and wild rice have the same yield functions. These simplifications are made because there is limited data availability for these crops. The following tables summarize the parameter estimates and standard errors.

Table A1. Pasture Yield Function Parameter Estimates (standard errors in parentheses)

Pasture in Region	**Alpha**	**Beta-0**	**Beta-1**	**Observations**
5	0.900	2.784	-0.024	35
	(0.350)	(0.597)	(0.009)	
6	0.886	2.803	-0.025	35
	(0.350)	(0.602)	(0.009)	

Table A2. Corn Yield Function Parameter Estimates (standard errors in parentheses)

Corn in Region	Alpha	Beta-0	Beta-1	Observations
1	5.837	-32.354	0.222	43
	(0.037)	(12.347)	(0.092)	
2	5.905	-31.547	0.217	45
	(0.031)	(9.015)	(0.067)	
3	5.885	-31.247	0.214	45
	(0.038)	(10.278)	(0.076)	
4	5.731	-24.544	0.172	46
	(0.081)	(9.789)	(0.073)	

Table A3. Vine Seed (Melons) Yield Function Parameter Estimates (standard errors in parentheses)

Vine Seed in Region	Alpha	Beta-0	Beta-1	Observations
2	10.907	-5.012	0.032	37
	(1.786)	(1.197)	(0.006)	
3	8.871	-6.218	0.039	37
	(1.811)	(2.107)	(0.010)	
4	9.327	-5.544	0.036	37
	(1.801)	(1.576)	(0.008)	

Table A4. Rice Yield Function Parameter Estimates (standard errors in parentheses)

Rice in Region	Alpha	Beta-0	Beta-1	Observations
1	4.157	-19.492	0.132	54
	(0.014)	(1.065)	(0.007)	
2	4.160	-19.616	0.132	53
	(0.015)	(1.125)	(0.008)	
3	4.162	-19.571	0.132	53
	(0.015)	(1.111)	(0.008)	
4	4.140	-18.971	0.129	54
	(0.016)	(1.139)	(0.008)	
5	3.768	-22.392	0.154	47
	(0.009)	(1.614)	(0.012)	
6	3.821	-21.303	0.145	49
	(0.008)	(1.053)	(0.007)	

Table A5. Safflower Yield Function Parameter Estimates (standard errors in parentheses)

Safflower in Region	Alpha	Beta-0	Beta-1	Observations
1	1.472	-5.498	0.044	51
	(0.244)	(1.364)	(0.008)	
2	1.256	-8.812	0.059	51
	(0.073)	(1.501)	(0.009)	
3	1.531	-5.350	0.044	51
	(0.272)	(1.369)	(0.008)	
4	1.391	-5.830	0.046	51
	(0.200)	(1.360)	(0.008)	
5	1.278	-6.526	0.052	51
	(0.311)	(2.606)	(0.016)	
6	1.521	-5.429	0.045	51
	(0.294)	(1.487)	(0.008)	

Table A6. Sunflower Yield Function Parameter Estimates (standard errors in parentheses)

Sunflower in Region	Alpha	Beta-0	Beta-1	Observations
1	1.816	0.000	0.006	55
	(0.077)	(0)	(0.000)	
6	0.676	-5.104	0.025	55
	(0.054)	(1.968)	(0.010)	

Table A7. Processing Tomatoes Yield Function Parameter Estimates (standard errors in parentheses)

Processing Tomatoes in Region	Alpha	Beta-0	Beta-1	Observations
1	39.29	-10.09	0.06	55
	(0.536)	(0.720)	(0.004)	
2	39.49	-10.09	0.06	55
	(0.568)	(0.756)	(0.004)	
3	39.68	-10.25	0.06	55
	(0.557)	(0.762)	(0.004)	
6	39.76	-8.44	0.05	55
	(0.638)	(0.592)	(0.003)	

Equations (1.1) and (1.2), and the parameter estimates in Tables A1-A7, show that the best fit of the DAYCENT yield data is with a logistic-type functional form. Over a small range of planting delay there is a small effect on yields. Yields decline at an increasing rate over some intermediate range and, at some point, asymptote towards zero. Figures A3-A9 illustrate the yield functions for each crop in an example region. Data points are in red, fitted functions in blue.

Figure A3. Fitted Yield Function for Corn in Region 1

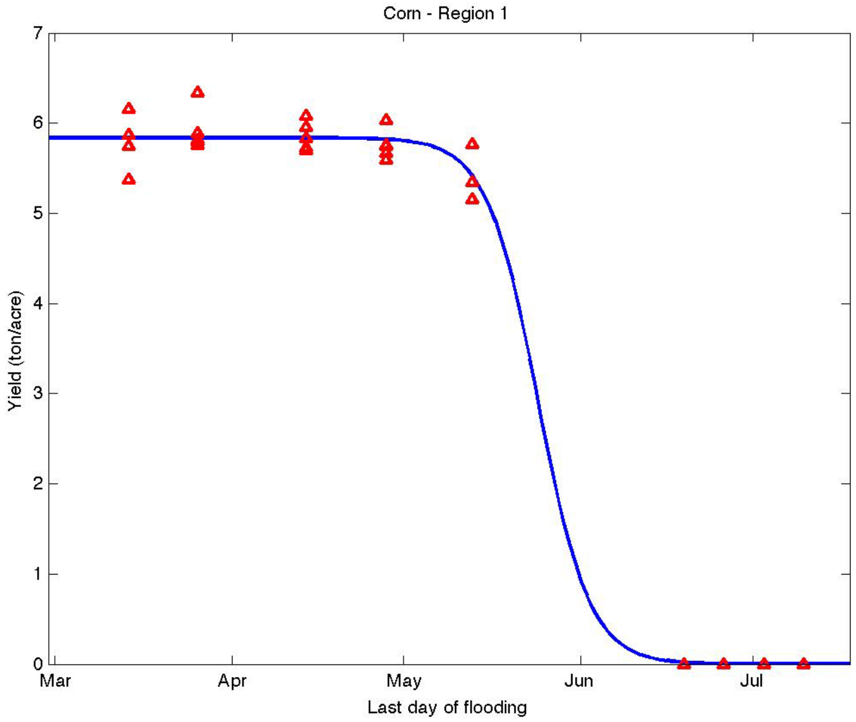


Figure A4. Fitted Yield Function for Pasture in Region 6

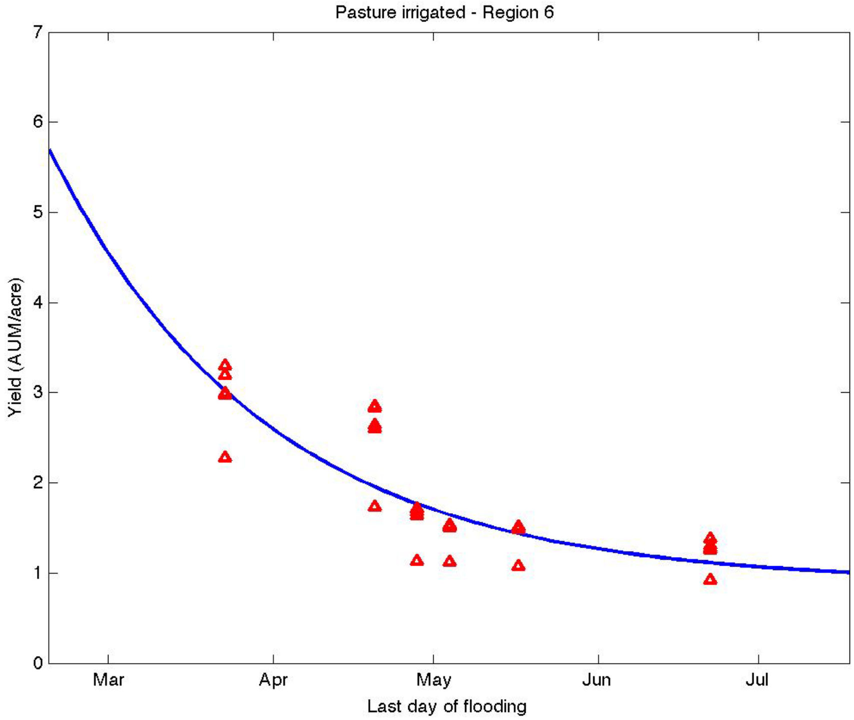


Figure A5. Fitted Yield Function for Rice in Region 2

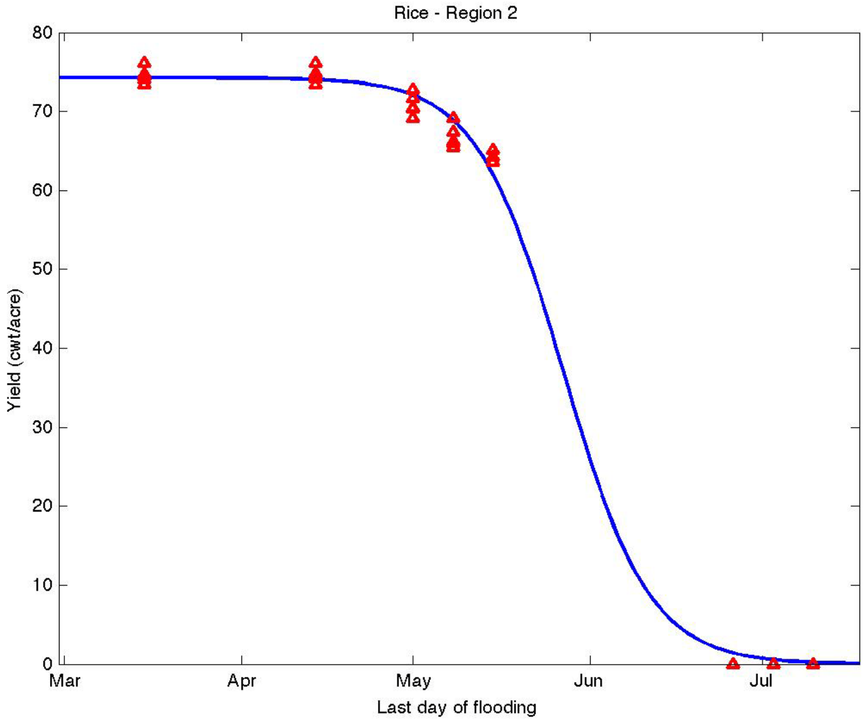


Figure A6. Fitted Yield Function for Safflower in Region 1

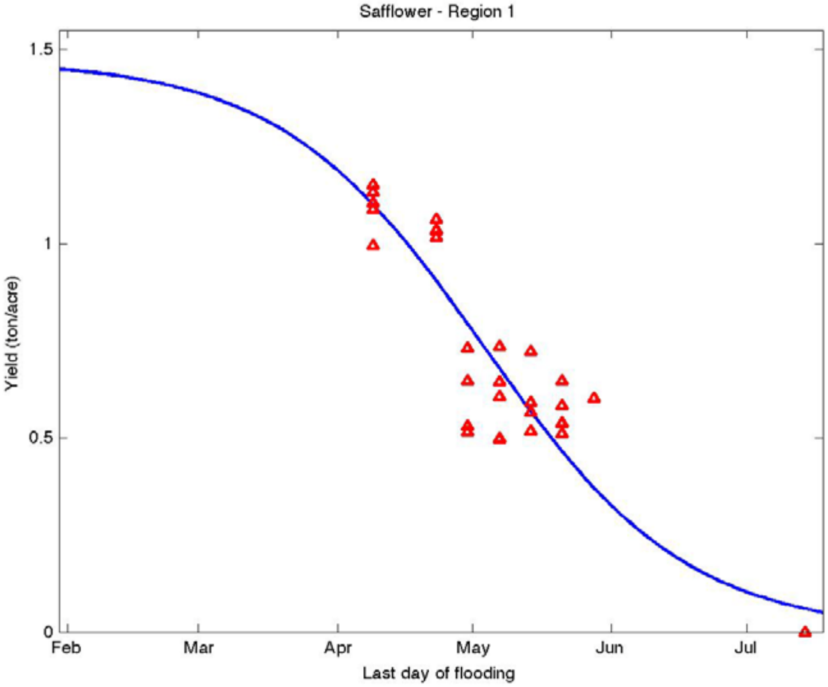


Figure A7. Fitted Yield Function for Sunflower in Region 1

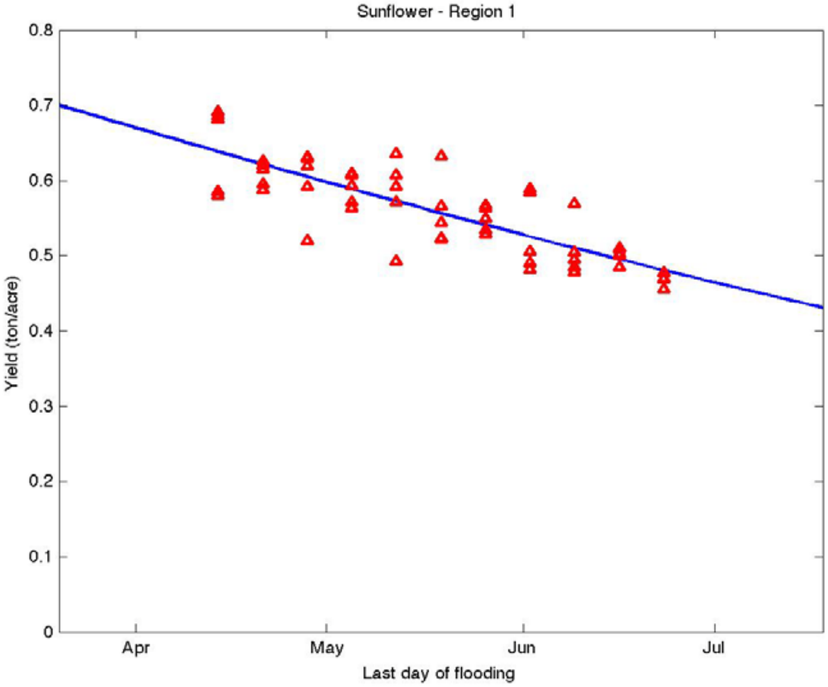


Figure A8. Fitted Yield Function for Processing Tomatoes in Region 3

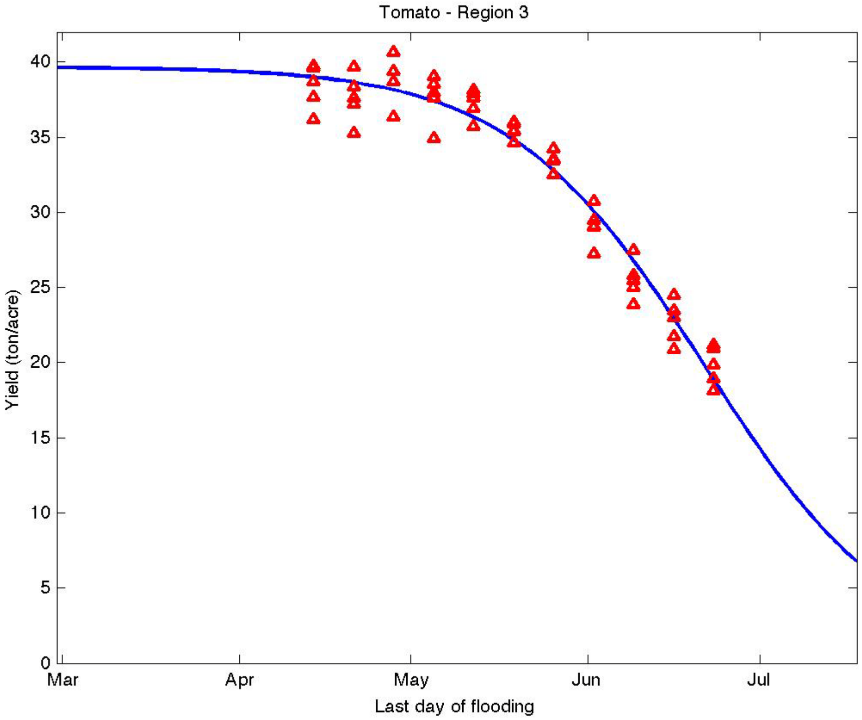
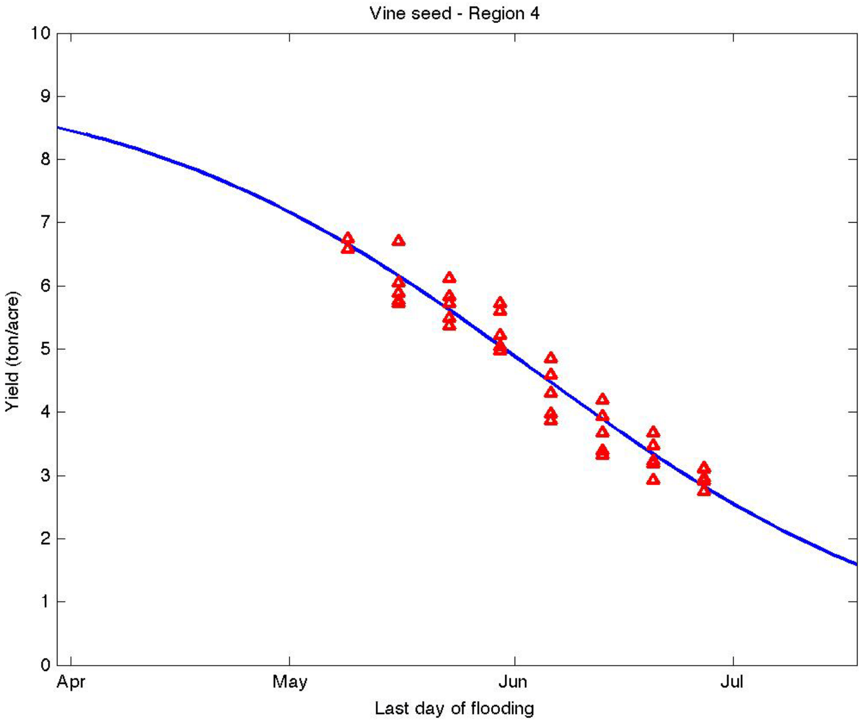


Figure A9. Fitted Yield Function for Melons (Vine Seed) in Region 4



2 The Bypass Production Model (BPM) Calibration

We use the crop yield functions estimated from the DAYCENT model, plus additional economic data, to calibrate the BPM. The BPM is the fundamental model of the analysis. The BPM relates changes in crop yield and total affected acres to changes in agricultural production and, fundamentally, changes in agricultural revenues. The BPM is a Positive Mathematical Programming (PMP after Howitt, 1995) model of agriculture in the 6 regions of the Yolo Bypass.

Note that a model is, by definition, a simplified representation of a real system. In the process of abstracting and simplifying a real system a model loses some information; thus even with theoretically consistent structure it is highly unlikely that a model will calibrate closely to observed (base year) data. The problem is well documented in the agricultural production modelling literature (Hazell and Norton 1986, Kasnakoglu 1990). One solution is to use observed farmer behavior, in the form of observed land use patterns, and additional exogenous information in order to calibrate the parameters of the structural model that exactly reproduce observed base-year conditions. The method of Positive Mathematical Programming is a common calibration method for structural agricultural production models (Howitt 1995), which we use in the BPM.

2.1 Positive mathematical programming (PMP)

The BPM self-calibrates using a three-step procedure based on Positive Mathematical Programming (PMP) (Howitt 1995) and the assumption that farmers behave as profit-maximizing agents. A traditional optimization model would have a tendency for overspecialization in production activities relative to what is observed empirically. PMP incorporates information on the marginal production conditions that farmers face, allowing the model to exactly replicate a base year of observed input use and output. Marginal conditions may include inter-temporal effects of crop rotation, proximity to processing facilities, management skills, farm-level effects such as risk and input smoothing, and heterogeneity in soil and other physical capital. In the BPM, PMP is used to translate these unobservable marginal conditions, in addition to observed average conditions, into region and crop-specific exponential cost functions.

Calibrating production models using PMP has been reviewed extensively in the recent literature. Buyssee et al. (2007) and Heckelei and Wolff (2003) argue that shadow values from calibration and/or resource constraints are an arbitrary source of information for model calibration. Subsequent research suggests using exogenous information such as land rents instead of shadow values (Heckelei and Britz 2005, Kanellopoulos et al. 2010). When multiple years of observations are available Heckelei and Britz (2005) propose a generalized maximum entropy formulation to estimate resource and calibration constraint shadow values. Merel and Bucaram (2010) and Merel et al. (2011) propose calibration against exogenous supply elasticity estimates. The BPM model is calibrated using traditional PMP with exogenous supply (acreage response) elasticity information.

2.2 Model Calibration

PMP is fundamentally a three-step procedure for model calibration that assumes farmers optimize input use for maximization of profits. In the first step a linear profit-maximization program is solved. In addition to basic resource availability and non-negativity constraints, a set of calibration constraints is added to restrict land use to observed values. In the second step, the dual (shadow) values from the calibration and resource constraints are used to derive the parameters for an exponential "PMP" cost function. In the third step, the calibrated model is combined into a full profit maximization program. The exponential PMP cost function captures the marginal decisions of farmers through the increasing cost of bringing additional land into production (e.g. through decreasing quality).

The BPM framework requires that additional land brought into production faces an increasing marginal cost of production. The most fertile land is cultivated first, additional land brought into production is of lower “quality” because of poorer soil quality, drainage or other water quality issues, or other factors that cause it to be more costly to farm. This is captured through an exponential land cost function (PMP cost function) for each crop and region. The exponential function is advantageous because it is always positive and strictly increasing, consistent with the hypothesis of increasing land costs. The PMP cost function is both region and crop specific, reflecting differences in production across crops and heterogeneity across regions. Functions are calibrated using information from acreage response elasticities and shadow values of calibration and resource constraints. The information is incorporated in such a way that the average cost data (known data) are unaffected.

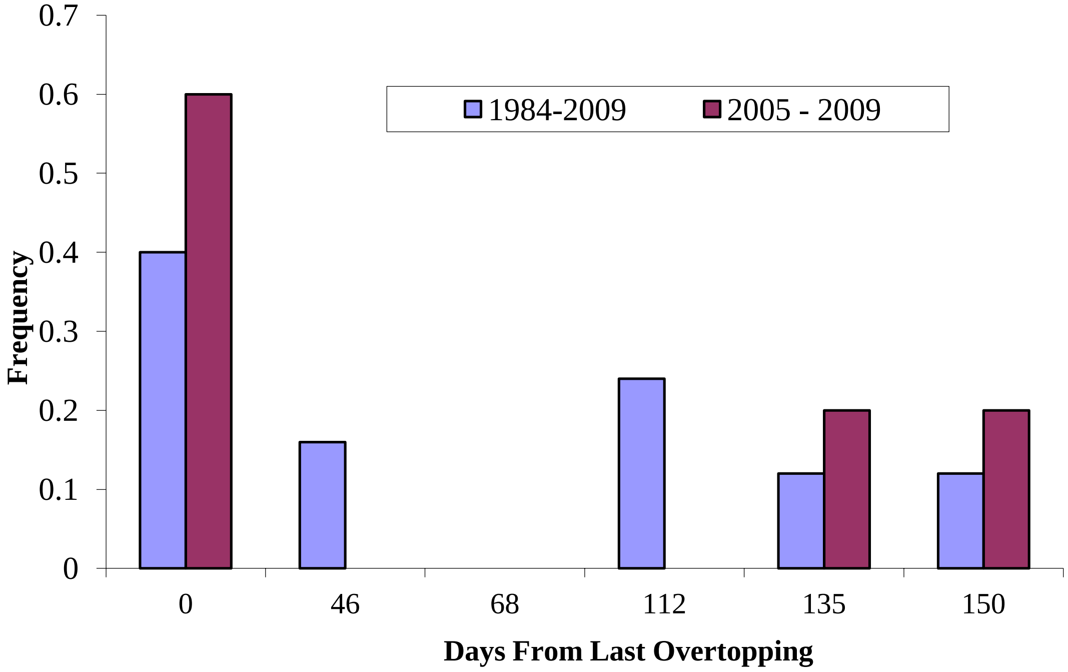
Formally, the exponential PMP cost functions are, for each crop i and region g, defined as

$$C_{gi}(x_{gi}) = \phi_{gi} e^{\gamma_{gi} x_{gi}}, \tag{1.3}$$

where ϕ_{gi} and γ_{gi} are parameters estimated by the PMP calibration routine described above and x_{gi} are total acres observed in production during the calibration base years.

The BPM calibrates to average observed land use between 2005 and 2009. We determined that 2005-2009 are representative of the full dataset (1984-2009) in terms of flood occurrence in the Yolo Bypass and, as such, are representative of land use in 3,000 and 6,000 cfs affected areas of the Bypass. Furthermore, detailed geo-referenced land use data were only available for 2005-2009 in the Yolo Bypass. The histogram in Figure A10 shows that the sub-set of years which we use for calibration (2005-2009) is representative of all years in the data (1984-2009) and, as such, represents a reasonable set of years to use for model calibration. While the data do omit some years of intermediate flood dates, Figure A10 shows that we capture the lower and upper bounds of inundation reasonably well. As such, we feel that calibration to average 2005-2009 land use accurately reflects base conditions in the Bypass.

Figure A10. Histogram of Overtopping Date Frequencies (84-09 and 05-09)



Standard calibration checks follow model calibration (see Howitt et al. 2012). These checks verify that the base year of observed data is reproduced by the calibrated model and that economic optimization requirements are satisfied.

We use a three year average of prices in the BPM, 2005-2007. These prices were determined to be representative of the average production conditions between 2005 and 2009 and, as such, are representative of the calibration data used in the model.

2.3 Profit Maximization Program Definition

The BPM solves for the cropping pattern that maximizes the agricultural profit across all regions subject to regional land constraints and yield functions estimated from the DAYCENT data. Data are as described previously. We assume the flood agency announces the policy it chooses for that year (or series of years) before farmers make their planting decisions. Therefore, farmers know the last day of overtopping for that year (with the exception of years where nature results in overtopping past the policy date) and the yields associated with that planting date. The objective function for the profit maximization program in the BPM is

$$\max_{x_{ig}} \sum_{g} \sum_{i} p_i \cdot y_{ig} \cdot x_{ig} - \sum_{g} \sum_{i} \phi_{ig} e^{\gamma_{ig} x_{ig}} - \sum_{g} \sum_{i} vc_{ig} x_{ig}, \tag{1.4}$$

where subscripts and variables are as previously defined, p_i are individual crop prices, and vc_{ig} are region and crop-specific variable costs of production per acre. Yields (y_{ig}) vary by planting date, as defined above, according to the yield functions estimated with DAYCENT model output as,

$$y_{i,g} = \frac{\alpha_{i,g}}{1+e^{\beta_{0i,g}+\beta_{1i,g}d_{i,g}}}, \quad \forall \text{i} \neq \text{pasture}, \tag{1.5}$$

and

$$y_{ig} = \alpha_{ig} + e^{\beta_{0ig}+\beta_{1ig}d_{ig}}, \text{ for } \text{i} = \text{pasture}, \tag{1.6}$$

where subscripts, variables, and parameters are as previously defined. Finally, land constraints in each region are defined as

$$\sum_i x_{ig} \leq b_g, \ \forall g, \tag{1.7}$$

where b_g is the total number of acres (crop acres plus fallow) observed in each region.

In summary the procedure in the calibrated BPM model is to maximize Equation (1.4) subject to Equations (1.5) - (1.7) by selecting the optimal crop mix, x_{ig}. Simulating the model over the base calibration data reproduces the observed base allocation.

3 BPM Simulation

BPM model simulations proceed for two flow volumes separately: 3k CFS and 6k CFS, given the calibrated model defined in Equations (1.4) - (1.7). we defined the simulation procedure in the main text of the report, and repeat here for completeness.

Step 1: Run the BPM for a season with *known* overtopping dates at Fremont Weir, and flooding in the Yolo Bypass. This represents the base condition (e.g. natural flooding) for agriculture in the Bypass in the absence of the proposed policy flooding scenarios (for that year). Repeat Step 1 for a series of known years, there are 26 total.

Step 2: Over the same series of years as step two, run the BPM and impose (sequentially - one at a time) the 12 proposed policy flooding scenarios. This represents what *would have* happened to Bypass agriculture *if* the flooding policy was implemented in that year. Repeat Step 2 for the all of the same years as Step 1.

Step 3: For each year simulated in Steps 1 and 2, calculate the difference in agricultural revenues (and other outputs). Record the result for negative changes in revenue. Intuitively, we only want negative changes in revenue because a positive change in revenue implies that the policy was “better” than nature. For example, if natural flooding occurred in the Bypass until April 30th then imposing a policy which stops overtopping at Fremont Weir on April 10th would not be possible (i.e. it would increase revenues).

Step 4: Calculate the average loss of revenue (and other changes) across all of the years simulated in Steps 1 - 3. This represents the expected impacts to agriculture due to the proposed flooding scenarios, and is the fundamental output of the BPM.

The fundamental procedure of the BPM is to generate *expected* losses to agriculture by using the calibrated model to estimate what would have happened under natural flooding, and then asking what would have happened if a specific policy (last day of overtopping) was in place. This procedure allows us to generate expected losses because we control for the expected natural flood events in the Bypass. The following section illustrates this point.

4 BPM Output and Expected Losses

The final phase in the analysis is to use the BPM simulations to estimate the change in agricultural gross revenues and acreage as a result of each of the policies (last overtopping date for RPA, or low-impact CM2 scenario) under both flow volumes (3k and 6k CFS). We estimate regional economic effects (jobs and income) using the IMPLAN model.

Economic losses are interpreted as expected annual losses in our analysis. The key assumption is that the previous 26 year hydrology in the Yolo Bypass is representative of expected future conditions. Specifically, natural overtopping at Fremont Weir will occur with the same expected frequency, duration, and volume. There are two reasons these 26 years of data were identified as reasonable, including (i) detailed flow information over the Fremont Weir was available for these years, and (ii) it is representative of current hydrologic conditions in the Sacramento Valley watershed. Older hydrologic information less accurately represents current conditions because it does not account for changes in urban development and reservoir operations that have altered flows in the Sacramento River over time. If better data become available we can revisit this assumption.

The policy analysis output in the report is the average, over 26 years, of annual losses as estimated by the individual policy scenarios in the BPM.

4.1 IMPLAN

The IMPLAN model estimates regional economic changes in production, value added, employment, and tax receipts. Expected revenue losses from the BPM analysis represent direct economic effects. However, upstream and downstream industries will be affected and some agricultural workers will lose their jobs when production in the Bypass decreases. We use the IMPLAN regional Input-Output model to estimate the direct, indirect, and induced effects of the 12 policy scenarios. The sum of these components represents the total effect of the policies.

IMPLAN is a multiplier model, which accounts for interrelationships among sectors and institutions in the regional economy. The input-output representation of the economy was first proposed by Leontief (1941). Production in this setting is assumed to occur by using fixed proportions of factors, such that the same amount of a production input.

Coverage if the IMPLAN area for this study is exclusive to Yolo County. We used the NAICS classification system and groped agricultural production into a single sector, NAICS 111. We employed IMPLAN Professional Version 3 and a 2009 database for Yolo County.

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IN07

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January 31, 2018

Karen Enstrom
California Department of Water Resources
3500 Industrial Boulevard
West Sacramento, California 95691

RE: EIR Yolo Bypass Salmonoid Habitat Project Comments

Dear Karen:

Following are some comments on the EIR named above.

The information in Chapter 13 greatly underestimates the project impact on private hunting clubs. The inundation estimates do not consider the amount of time needed to drain ponds down to shooting levels after levees emerge after each inundation.

Shooting levels include getting pond depths down to levels that can be safely waded and duck blinds can be bailed. Most leveed ponds are drained through a 30 inch diameter pipe controlled with a flash board riser or screw gate. Draining to shooting level requires 1 to 2 weeks after each inundation due to the time needed to drain water out of the drainage ditches and drain excess water in ponds through their water control structures. 1

The EIR (pages 13-27) states that the preferred alternative, Alternative 1, would result in an increase in inundation of up to 2 weeks on average for approximately half of the private hunting clubs. Due to the additional time needed to drain ponds to shooting depth, it appears that, on average, the impact could be closer to a month due to flooding solely from project operations. In years of multiple inundations, the impact would be even greater. 2

The EIR should analyze the annual range in additional flooding that affected clubs would experience.

It appears to us, that in many years we would lose the bulk of the best part of the waterfowl season due to inundation caused by the project adding to normal flood flows. This concern is bolstered by examination of river heights at Fremont Weir (information from CDEC) during 2014 to 2018. Based on operation criteria in the draft EIR, open gates on the weir notch and flood flow over the weir would cause the Sacramento River water to flow into the Yolo Bypass for 61 days during November-January in 2014-2015, 50 days in 2015-2016, 82 days in 2016-2017, and 81 days in 2017-2018...in all years, a substantial portion of the waterfowl season. 3

The EIR should also consider the months in which the impacts would occur. The EIR seems to treat all months equally (p13-27 " a 4.1% reduction in hunting days would not be a substantial reduction...perhaps not substantial," but still significant). 4

Generally, the December-January period provides the best hunting; so lost days during that period are more important than lost days earlier in the season.

Additionally, effective marsh management would be inhibited by flooding in March. Ponds should be drained in March and April to promote growth and seed production of important waterfowl food plants like smartweed, water grass, and swamp timothy. 5

The draft EIR doesn't explain how private duck clubs will be protected from project impacts.

Project staff has indicated at public meetings (BDCP public meeting in West Sacramento, October 6, 2010, several Yolo Bypass Work Group meetings, and the EIR public comment meeting on January 18, 2018) that eminent domain will not be used, and that impacts will be restricted to willing sellers. 6

The Glide In Ranch is not a willing seller.

The measures that will protect Glide In Ranch and other "unwilling" landowners from being flooded by project operations need to be described and evaluated in the EIR. No where in the EIR does it explain how you are going to flow water over willing participants without affecting unwilling participants such as Glide In Ranch. How do you plan to mitigate the affect of flows over Glide In Ranch property? How do you plan to flow water over willing participants ground without inundating Glide In Ranch at the same time? The mitigating factors need to be disclosed and included in the EIR.

Respectfully submitted,

Glide In Ranch Inc.

by Greg Kassis
Secretary

CC: Ben Nelson
Bureau of Reclamation, Bay Delta Office
801 I Street. Suite 140
Sacramento, 95814

Belan Wagner
Wagner-Kirkman
10640 Mather Boulevard Floor 2
Mather, California. 95655

Glide In Ranch:
Chris Fulster Jr., President
Don Stevens
Richard Goodell

IN08

Buckman, Carolyn

From: Nelson, Benjamin <bcnelson@usbr.gov>
Sent: Friday, February 16, 2018 11:23 AM
To: Buckman, Carolyn
Subject: Fwd: Yolo Bypass Salmonid Habitat Restoration and Fish Passage Project Draft EIS/EIR Comments

---------- Forwarded message ----------
From: **Doug Brown** <browndoug@att.net>
Date: Thu, Feb 15, 2018 at 3:40 PM
Subject: Yolo Bypass Salmonid Habitat Restoration and Fish Passage Project Draft EIS/EIR Comments
To: "Enstrom, Karen@DWR" <Karen.Enstrom@water.ca.gov>, bcnelson@usbr.gov
Cc: Bryan Busch <rd2068@cal.net>, "Chapman, Tom (Sacramento)" <Tom.Chapman@hdrinc.com>, Cindy Tuttle <CINDYT@cityofwestsacramento.org>, Elisa Sabatini <Elisa.Sabatini@yolocounty.org>, Eric Nagy <eric@larsenwurzel.com>, Gary Bardini <bardinig@saccounty.net>, "Goulart, Roberta" <rlgoulart@solanocounty.com>, gregf <gregf@cityofwestsacramento.org>, Jafar Faghih <Jafar.Faghih@hdrinc.com>, "Jason D. Campbell" <campbellja@saccounty.net>, "Michel, Traci" <TRACIM@cityofwestsacramento.org>, Mike Hardesty <Mhardesty@cal.net>, Ric Reinhardt <Reinhardt@mbkengineers.com>, Roland Sanford <rsanford@scwa2.com>, "Thomas L. Pate" <tpate@scwa2.com>, "Tibbitts. Dan" <tibbittsd@saccounty.net>, Tim Washburn <washburnt@saccounty.net>, "Wolk, Daniel M." <DMWolk@solanocounty.com>, "Zollo, Mark" <markz@cityofwestsacramento.org>, Philip Pogledich <Philip.Pogledich@yolocounty.org>, Petrea Marchand <petrea@conserosolutions.com>, Jennifer Metes <jennifer@conserosolutions.com>, Tara Morin <Tara@conserosolutions.com>

Karen and Ben, on behalf of the six local agency partners (Partners) that make up the Lower Sacramento/Delta North Region, I am hearby transmitting the Partners' joint comments on the Yolo Bypass Salmonid Habitat Restoration and Fish Passage Project Draft EIS/EIR. Please see the comments below and feel free to contact me directly with any questions.

Regards,

Doug Brown

Principal

Douglas Environmental

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Karen Enstrom

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RE: Comments on the Draft Environmental Impact Statement (EIS)/Environmental Impact Report (EIR) for the Yolo Bypass Salmonid Habitat Restoration and Fish Passage Project

Dear Mr. Nelson and Ms. Enstrom:

The Lower Sacramento/Delta North Region appreciates the opportunity to present comments on the Draft Environmental Impact Statement (EIS)/Environmental Impact Report (EIR) for the Yolo Bypass Salmonid Habitat Restoration and Fish Passage Project (Proposed Project).

1

We appreciate the California Department of Water Resources (DWR) ongoing support for our Regional Flood Management Planning efforts. Through these efforts, the six local agency partners, which include Solano County, Yolo County, Solano County Water Agency, West Sacramento Area Flood Control Agency, Sacramento Area Flood Control Agency, and Reclamation District 2068, are able to identify potential issues of concern early in habitat restoration project planning and to work with DWR and the U.S. Bureau of Reclamation (Bureau) to identify locally-supportable solutions.

This letter was prepared by representatives of the six local agency partners (Partners) to express our joint comments on the Draft EIS/EIR. By their nature, these comments represent the broad interests of the Partners. However, the project has specific localized impacts that are of concern to individual Partners. For this reason, several individual local agencies may be submitting their own comment letters. The Partners fully support the need and desire for individual local agencies to submit separate comment letters. 3

The following are the Partners' comments on the Draft EIS/EIR and the Proposed Project:

Regional Programmatic Integration and Governance – The Proposed Project is just one of the many habitat restoration and flood risk management projects being proposed in the Yolo Bypass/Cache Slough Complex. Many of these projects are being proposed as components of EcoRestore, the 2008 and 2009 Biological Opinions, the Central Valley Flood Protection Plan Conservation Strategy, and the Delta Conservation Framework. The Partners believe strongly that these projects cannot be viewed in isolation due to the adverse cumulative effects that can occur. The Partners developed a Corridor Management Framework in February 2015 to specifically address the integration of multiple projects and are in the process of adopting a Memorandum of Agreement to further these integration efforts. Any restoration projects within the Upper Yolo Bypass directly affect users in the Lower Yolo Bypass/Cache Slough Complex. Therefore, it is imperative that the Proposed Project's improvements in the Upper Yolo Bypass be implemented in the context of a larger program that meets the needs of all affected parties. This includes addressing the governance, flood control, agricultural sustainability, water quality and supply assurances, infrastructure, land use, and recreational components important to the Partners. The Partners strongly encourages DWR and the Bureau to initiate conversations with the regional representatives regarding the development of governance structures for these projects that meaningfully integrate local agencies as partners in the decision-making and adaptive management processes.

Loss of Agricultural Productivity –The Draft EIS/EIR demonstrates that the viability of agricultural lands within the Project's inundation footprint will be increasingly uncertain following implementation. That uncertainty arises from potential field preparation and planting delays which, in turn, can cause or contribute to reduced yields and (possibly) changes in crop selection. Other potential consequences of increased Yolo Bypass inundation include the loss of preventative planting insurance and reduced availability of farm loans, either of which would jeopardize the continuation of agriculture on affected lands. Although the Partners appreciate the inclusion of conservation easement purchases for the conversion of prime farmland, unique farmland, and farmland of statewide importance included in Mitigation Measure MM-AGR-1 for Alternative 4, we are concerned that the significant and unavoidable impact conclusion following mitigation implementation is indicative of the inadequacy of this mitigation approach. We strongly encourage DWR and the Bureau to consider a broader agricultural mitigation approach that fully offsets the loss of agricultural productivity anticipated with project implementation including the direct impacts on landowner and/or grower agricultural revenue; indirect impacts on farm employees, farm-related businesses, and their employees; induced impacts on the broader economy (value-added losses); and reductions in local tax and assessment revenues. Developing such an approach would provide the basis for addressing agricultural productivity impacts programmatically in a way that would facilitate implementation of the cumulative restoration and flood improvement projects being planned in the region. 2

Recreational Impacts Within State Wildlife Areas – The Proposed Project's construction and long-term sediment removal activities will substantially disrupt ongoing recreational uses within the Fremont Weir Wildlife Area (FWWA). The increased inundation in the Yolo Bypass associated with project implementation would also disrupt recreational uses in the FWWA as well as in the Sacramento Bypass Wildlife Area and the Yolo Bypass Wildlife Area (YBWA). Within 3 the YBWA, the increased inundation would reduce the ability of the Yolo Basin Foundation to provide their invaluable wildlife education program to youth in the region. We request that the Bureau and DWR work with local land owners, the Yolo Basin Foundation and Yolo County to identify recreational access and educational enhancements that can be implemented to offset the unavoidable impacts in the Yolo Bypass associated with project implementation. This recommendation is consistent with the 2017 Update to the Central Valley Flood Protection Plan, which encourages the inclusion of "Enriching Experiences" and multi-objective opportunities as an intended outcome of flood system improvements.

Barker Slough Pumping Plant Water Quality Impacts – Increasing the volume of water within the lower Yolo Bypass
prior to and after storm events will reduce the ability of urban and agriculture storm runoff from the local watershed
within the Cache Slough Complex to discharge into the western Delta. As a result, the poor quality water that discharges 4
into these sloughs will become further degraded for longer periods of time. Because the Barker Slough Pumping Plant is
located within this Complex, the degraded water quality will require increased treatment to meet the water quality
requirements for the municipal and industrial users supplied by the Solano County Water Agency. The Final EIS/EIR
needs to specifically evaluate the project's water quality impacts in the Cache Slough Complex and identify how water
quality impacts at the Barker Slough Pumping Plant will be minimized. In addition to the Proposed Project, the Yolo
Bypass is the focus area for multiple other ecosystem restoration initiatives. The Partners are very concerned about the
cumulative effect these habitat restoration projects can have on the operation and maintenance of existing agricultural 5
and municipal water diversions in the Lower Yolo Bypass/Cache Slough Complex due to increased attraction and
presence of listed species and the potential for increased exposure to water intakes that could lead to new restriction on
beneficial water supply uses. In addition, storm water drainage within this watershed may be adversely affected and
subject to increased regulation. The Draft EIS/EIR should further evaluate these cumulative impacts in the appropriate 6
sections of the document.

Impacts on Water Rights Holders – The Partners are concerned that the introduction of new listed fish species and/or
increase in the presence of listed species in the Tule Canal/Toe Drain, and ultimately in the Cache Slough Complex, will
adversely affect the ability of water rights holders to withdraw the water necessary to manage wetlands and agricultural
operations consistent with historic practices. The Final EIS/EIR should address what assurances can be put into place to 7
ensure that existing water rights holders are not harmed by project implementation. The Partners encourage DWR and
the Bureau to work directly with land owners and Reclamation Districts to ensure all potential water supply system
impacts are appropriately mitigated.

Haul Truck Traffic Impacts – The Partners are concerned about the lack of analysis of the impacts caused by the
substantial truck trips needed to haul excavated sediments from the project site during construction and subsequently
for long-term site operations and maintenance. These truck trips have the potential to generate significant noise and air 8
quality impacts for rural residents along the haul routes. The level of heavy truck traffic anticipated on rural county
roads that are clearly not designed to accommodate such use could be so destructive as to make them unusable by local
residents and by emergency vehicles. More detailed information regarding these truck trips and their direct effects on
local residents needs to be included in the document.

Impacts on Cultural Resources – The Partners are concerned that a cultural resources inventory has not been conducted
within major portions of the disturbance areas for the project alternatives particularly considering the area's cultural 9
sensitivity. It is unclear why the entire area of potential effect has not been surveyed, considering the initial cultural
resource investigations for this project commenced in 2014. It is also unclear why these surveys are being deferred to

after completion of the environmental review process. If the unevaluated areas are assumed to contain prehistoric sites that are large and rich in material remains, including human burials and associated ornaments and beads, as acknowledged under Impact CULT-2, then it is inappropriate to defer the evaluation of these resources until after completion of the environmental review process. Complete surveys of the sensitive cultural resources located within the area of potential effect should be conducted and a full assessment of the project's effects on these resources should be prepared and circulated for public comment prior to finalizing the environmental document. The Partners encourage the lead agencies to coordinate closely with affected Native American Tribes regarding the project's effects on Tribal cultural resources, consistent with the requirements of the National Historic Preservation Act and AB 52.

While the Partners understand the need to provide habitat for endangered fish species, we believe that DWR and the Bureau can reach this conservation goal with solutions that do not undermine invaluable existing environmental and agricultural resources, as well as educational and recreational opportunities, in the Yolo Bypass. The Partners are committed to working with DWR and the Bureau to address the issues identified above and we appreciate the opportunity to provide these comments on the Draft EIS/EIR. 10

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Ben Nelson

Natural Resources Specialist

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IN09

Buckman, Carolyn

From: Nelson, Benjamin <bcnelson@usbr.gov>
Sent: Wednesday, February 14, 2018 5:56 PM
To: Buckman, Carolyn
Subject: Fwd: Yolo Bypass Salmonid Habitat Restoration and Fish Passage Project (Project) -- Comments

---------- Forwarded message ----------
From: **Selby Mohr** <smohrfam@surewest.net>
Date: Wed, Feb 14, 2018 at 3:23 PM
Subject: Yolo Bypass Salmonid Habitat Restoration and Fish Passage Project (Project) -- Comments
To: bcnelson@usbr.gov, Karen.Engstrom@water.ca.gov
Cc: Tom Birmingham <tbirmingham@westlandswater.org>, Gary Sawyers <GWS@bolenfransen.com>, Jose Gutierrez <jgutierrez@westlandswater.org>, Russ Freeman <rfreeman@westlandswater.org>, Bobbie Ormonde <bormonde@westlandswater.org>, Selby Mohr <smohrfam@surewest.net>, Greg Mohr <gregmohr@comcast.net>, John Mohr <flashjm@pacbell.net>, BJ Susich <bjsusich@murphyaustin.com>

Mr. Nelson/Ms. Enstrom;

I am providing these comments as President of the Board of Directors of Mound Farms, and Secretary of the Board of Directors of Sweetwater Company (a Mutual Water Company). Both of these entities are located, operate, and maintain facilities in the lower Yolo Bypass of Yolo County. As mentioned in the January presentation which I attended, this is the start of the planning and meetings related to the development of this Project. My comments are very general and intended to be considered as the planning process evolves and moves forward, and I won't be attempting to be extremely detailed at this time. Therefore I am providing "bullet-point" type comments for your consideration.

1

I also understand that most, if not all, of the landowners in the Yolo Bypass have a flood easement over their properties. I understand that flood waters in the lower Yolo Bypass may be fed into the bypass from several sources including Cache Creek, Putah Creek, the Sacramento River through the Fremont and Sacramento Weirs, among other potential direct and indirect sources. Properties in the lower Yolo Bypass can be expected to flood in situations where the flood managers determine that implementation of weir operations is necessary to protect areas east of the Sacramento River or other areas that are threatened by potential flooding. The proposed Project is in addition to and completely separate from the flooding of the Yolo Bypass to protect property and lives. With all that in mind, please consider the following:

1. What are the projected impacts to the points of diversion along the new and more frequently flooded areas (which may be under water for longer periods) in the toe drain or other ditches from which we divert water for our operations? Will the operators of the project be establishing a reimbursement account for the purpose of

reimbursing the water rights owners/operators and water diverters for the increase in maintenance costs due to siltation or erosion to their facilities? 2

2. What is the projected lost income due to the increase in flooding by the operation of the weir for increased water/fish passage? 3 Is there an account being established to reimburse the owners/operators for lost income or a lost potential for renting out property? This needs to be considered from the aspect of agricultural operations, hunting operations, access and maintenance operations for habitat/restoration activities, and all the other associated activities which currently (or are planned to) take place in the Yolo Bypass. 4

3. What are the plans to replace the lost income or recreational enjoyment to wildlife/waterfowl hunting club owners/operators if their operations must be discontinued or are limited in any way because of the frequent flooding impacts do to the operation of the weir for fish passage?

I believe that these are good questions to address and start the serious and detailed dialogue between the project proponents, persons interested in the Yolo Bypass and the landowners in the Yolo Bypass. I look forward to continued participation in the process.

These questions and any tone of the letter, should not be construed to constitute and opinion about the project. Rather these comments and questions are being provided to assist in the development of the project and the evaluation of all the options and alternatives. 5

Thank you for accepting these email comments and I am looking forward to the next series of meetings.

Sincerely,

Selby Mohr

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Sacramento, CA 95818

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Ben Nelson

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IN10

Buckman, Carolyn

From: Nelson, Benjamin <bcnelson@usbr.gov>
Sent: Thursday, February 15, 2018 10:15 AM
To: Buckman, Carolyn
Subject: Fwd: DFW Study on Salmonids
Attachments: ATT00001.txt; IMG_0357.JPG; IMG_0358.JPG; IMG_0359.JPG; ATT00002.txt; ATT00003.txt

---------- Forwarded message ----------
From: <gmargari@comcast.net>
Date: Wed, Feb 14, 2018 at 10:20 AM
Subject: DFW Study on Salmonids
To: bcnelson@usbr.gov

Ben...just an FYI concerning a study that is being conducted by the California DFW as it relates to increasing the numbers of salmonids in the Sacramento River system. This article was recently posted in the Western Outdoor News issue dated 2/9/18. Thought you might be interested. 1

Gus Margarite
Rising Wings Duck Club

--
Ben Nelson

Natural Resources Specialist

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