Chapter 3 Regulatory Environment

3.1 Introduction

Reclamation must fulfill or comply with the federal environmental requirements described below, as they pertain to their action of modifying a CVP facility and approving the banking of CVP water outside the service area. Chapter 4, as appropriate, provides additional details on regulations specific to each environmental resource.

3.2 Federal Regulations

3.2.1 Clean Air Act

The federal Clean Air Act (CAA) was enacted to protect and enhance the nation’s air quality in order to promote public health and welfare and the productive capacity of the nation’s population (42 U.S. Code [USC] 85). The CAA requires an evaluation of any federal action to determine its potential impact on air quality in the project region.

Federal Conformity Requirements

The Clean Air Act Amendments of 1990 (CAAA) require that all federally funded projects are consistent with the plan or program that conforms to the appropriate State Implementation Plan (SIP). Federal actions are subject to either the transportation conformity rule (40 CFR 51[T]), which applies to federal highway or transit projects, or the general conformity rule.

The purpose of the general conformity rule is to ensure that federal projects conform to applicable SIPs so that they do not interfere with strategies employed to attain the National Ambient Air Quality Standards (NAAQS). The rule applies to federal projects in areas designated as nonattainment areas for any of the six criteria pollutants and in some areas designated as maintenance areas. The rule applies to all federal projects except:

- programs specifically included in a transportation plan or program that is found to conform under the federal transportation conformity rule,
- projects with associated emissions below specified *de minimis* threshold levels, and
- certain other projects that are exempt or presumed to conform.

A general conformity determination would be required if a Proposed Action's total direct and indirect emissions fail to meet the following two conditions:

- emissions for each affected pollutant for which the region is classified as a maintenance or nonattainment area for the national standards are below the *de minimis* levels indicated in Tables 3-1 and 3-2, and
- emissions for each affected pollutant for which the region is classified as a maintenance or nonattainment area for the national standards are regionally insignificant (total emissions are less than 10% of the area's total emissions inventory for that pollutant).

If the two conditions above are not met, a general conformity determination must be performed to demonstrate that total direct and indirect emissions for each affected pollutant for which the region is classified as a maintenance or nonattainment area for the national standards would conform to the applicable SIP.

However, if the above two conditions are met, the requirements for general conformity do not apply, as the Proposed Action is presumed to conform to the applicable SIP for each affected pollutant. As a result, no further analysis or determination would be required. As described in Section 4.4, Air Quality, each of the alternatives would conform to the applicable SIP.

Table 3-1. Federal *de Minimis* Threshold Levels for Criteria Pollutants in Nonattainment Areas

Pollutant	**Emission Rate (Tons per Year)**
Ozone (VOC or NO_X)	
Serious nonattainment areas	50
Severe nonattainment areas	25
Extreme nonattainment areas	10
Other ozone nonattainment areas outside an ozone transport region	**100**
Marginal and moderate nonattainment areas inside an ozone transport region	
VOC	50
NO_X	100
CO: All nonattainment areas	100
SO_2 or NO_2: All nonattainment areas	100
PM10	
Moderate nonattainment areas	100
Serious nonattainment areas	70
Pb: All nonattainment areas	25

Source: 40 CFR 51.853.

Note: *de minimis* threshold levels for conformity applicability analysis. Bolded text indicates pollutants for which the region is in nonattainment and a conformity determination must be made.

VOC = volatile organic carbon.
NO_X = oxides of nitrogen.
CO = carbon monoxide.
SO_2 = sulfur dioxide.
NO_2 = nitrogen dioxide.
PM10 = particulate matter 10 microns or less in diameter.
Pb = lead.

Table 3-2. Federal *de Minimis* Threshold Levels for Criteria Pollutants in Maintenance Areas

Pollutant	**Emission Rate (Tons per Year)**
Ozone (NO_X), SO_2 or NO_2	
All maintenance areas	100
Ozone (VOCs)	
Maintenance areas inside an ozone transport region	50
Maintenance areas outside an ozone transport region	100
CO: All maintenance areas	**100**
PM10: All maintenance areas	100
Pb: All maintenance areas	25

Source: 40 CFR 51.853.

Note: *de minimis* threshold levels for conformity applicability analysis. Bolded text indicates pollutants for which the region is a maintenance area and a conformity determination must be made.

VOC = volatile organic carbon.
NO_X = oxides of nitrogen.
CO = carbon monoxide.
SO_2 = sulfur dioxide.
NO_2 = nitrogen dioxide.
PM10 = particulate matter 10 microns or less in diameter.
Pb = lead.

3.2.2 Federal Endangered Species Act

Section 9 of the Federal Endangered Species Act

Section 9 of the federal Endangered Species Act (ESA) of 1973, as amended, prohibits the take of fish or wildlife species listed under ESA as endangered or threatened. *Take*, as defined by ESA, means “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.” *Harm* is defined by regulation as “any act that kills or injures the species, including significant habitat modification.” Typically, all or some forms of take of threatened species are prohibited by regulation at the time of listing; however, take of some listed species may occur. As such, Reclamation would seek take authorization under Section 7 of the ESA as described below.

Section 7 of the Federal Endangered Species Act

Section 7 of the ESA requires federal agencies, in consultation with the Secretary of the Interior and/or Commerce, to ensure that their actions do not jeopardize the continued existence of endangered or threatened species, or result in the destruction or adverse modification of the critical habitat of these species. Reclamation has submitted a Biological Assessment (BA) for formal consultation with the USFWS.

Protection of Plants under the Federal Endangered Species Act

Section 9 of ESA prohibits removing, digging up, cutting, and maliciously damaging or destroying federally listed plants on sites under federal jurisdiction or doing so on nonfederal land in violation of any state law or regulation. Moreover, under Section 7 of ESA, federal agencies are prohibited from jeopardizing the continued existence of any federally listed species as a result of taking an action. Thus, the Section 7 process protects federally listed plants from the adverse effects of federal actions. As described above, Reclamation has submitted a BA for formal consultation with the USFWS.

3.2.3 Migratory Bird Treaty Act

The Migratory Bird Treaty Act (MBTA) (16 USC 703 et seq.) implements various treaties and conventions among the United States, Canada, Japan, Mexico, and the former Soviet Union for the protection of migratory birds. Unless permitted by regulations, the MBTA makes it unlawful to pursue, hunt, take, capture, or kill; attempt to take, capture or kill; possess, offer to or sell, barter, purchase, deliver, or cause to be shipped, exported, imported, transported, carried or received any migratory bird, part, nest, egg or product, manufactured or not. Subject to limitations of the MBTA, the Secretary of the Interior may adopt regulations determining the extent to which these activities may be allowed, having regard for temperature zones, distribution, abundance, economic value, breeding habits, and migratory flight patterns. Potential effects on migratory birds are described in Section 4.5, Biological Resources.

3.2.4 Executive Order 13186—Responsibilities of Federal Agencies to Protect Migratory Birds

Executive Order 13186 directs federal agencies to take certain actions to further implement the MBTA. Each federal agency taking actions that have, or are likely to have, a measurable negative effect on migratory bird populations was directed to develop and implement, within 2 years of the order date (January 10, 2001), a Memorandum of Understanding (MOU) with the USFWS to promote the conservation of migratory bird populations. Reclamation has not signed an MOU with the USFWS regarding migratory birds. After a review of Executive Order 13186, it was determined that, at that time, no MOU was appropriate. Nevertheless, the order states that notwithstanding the requirement to finalize an MOU within 2 years, each federal agency is encouraged to immediately begin implementing the conservation measures set forth in the order, as appropriate and practical.

3.2.5 Bald Eagle Protection Act

The Bald Eagle Protection Act (BEPA) prohibits the taking or possession of and commerce in bald and golden eagles, with limited exceptions. BEPA makes it unlawful for any person to take, possess, sell, purchase, barter, offer to sell or purchase or barter, transport, export, or import at any time or in any manner a bald or golden eagle, alive or dead; or any part, nest, or egg of these eagles; or violate any permit or regulations issued under BEPA. "*Take*" includes pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb. *Transport* includes convey or carry by any means and also deliver or receive for conveyance.

3.2.6 Section 106 of the National Historic Preservation Act

Section 106 of the National Historic Preservation Act (15 USC 470 *et seq*.) requires that federal agencies evaluate the effects of federal undertakings on historical, archeological, and cultural resources and provide opportunities for the Advisory Council on Historic Preservation to comment on the proposed undertaking. The first step in the process is to identify cultural resources eligible for inclusion in the National Register of Historic Places that are located in or near the project area. The second step is to identify the possible effects of the proposed federal actions. The lead agency must examine whether there are feasible alternatives that would avoid such effects. If an effect cannot reasonably be avoided, measures must be taken to minimize or mitigate potential adverse effects. Reclamation has included an analysis of effects on cultural resources in this EIS (Section 4.7).

3.2.7 Clean Water Act

Federal water quality regulations are established primarily in the Clean Water Act (CWA) and administered by the EPA. These regulations are subsequently implemented primarily by the State Water Resources Control Board (State Water Board), U.S. Army Corps of Engineers (Corps) and other state agencies as deemed appropriate.

Several sections of the CWA pertain to regulating effects on waters of the United States. Section 101 specifies the objectives of CWA implemented largely through Title III (Standards and Enforcement) and Section 301 (Prohibitions). The discharge of dredged or fill material into waters of the United States is subject to permitting specified under Title IV (Permits and Licenses) of CWA and specifically under Section 404 of the act (Discharges of Dredge or Fill Material). Section 401 (Certification) specifies additional requirements for permit review, particularly at the state level.

Section 401

Under CWA Section 401, applicants for a federal license or permit to conduct activities that may result in the discharge of a pollutant into waters of the United States must obtain certification from the state in which the discharge would originate or, if appropriate, from the interstate water pollution control agency with jurisdiction over affected waters at the point where the discharge would originate. Therefore, all projects that have a federal component and may affect state water quality (including projects that require federal agency approval [such as issuance of a Section 404 permit]) must also comply with CWA Section 401. In California, the authority to grant water quality certification has been delegated to the State Water Board, and applications for water quality certification under CWA Section 401 are typically processed by the RWQCB with local jurisdiction. Water quality certification requires evaluation of potential impacts in light of water quality standards and CWA Section 404 criteria governing discharge of dredged and fill materials into waters of the United States. For purposes of this project, MID is coordinating with the Corps facilitated by Reclamation to determine if waters of the US would be affected. If they are, MID, as the project proponent, will obtain certification from the Central Valley RWQCB under Section 401 of the CWA.

Section 402—National Pollutant Discharge Elimination System Program

The 1972 amendments to the federal Water Pollution Control Act established the NPDES permit program to regulate discharges of pollutants from point sources (Section 402). The 1987 amendments to CWA created a new section of CWA devoted to stormwater permitting. The EPA has granted the state primacy in administering and enforcing the provisions of the CWA and the NPDES permit program. The NPDES permit program is the primary federal program that regulates point-source and nonpoint-source discharges to waters of the United States. The State Water Board issues both general and individual permits for certain activities.

Section 404

Section 404 of the CWA regulates the discharge of dredged or fill material into waters of the United States. Under Section 404, the Corps is responsible for issuing permits authorizing the placement of dredged or fill materials into jurisdictional water of the United States. MID, as the project proponent, is coordinating with the Corps to ensure that effects on waters are minimized. Reclamation is participating in this coordination.

Federal Flood Insurance Program

Congress passed the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. The intent of these acts was to reduce the need for large, publicly funded flood control structures and disaster relief by restricting development on floodplains.

The Federal Emergency Management Agency (FEMA) administers the National Flood Insurance Program (NFIP) to provide subsidized flood insurance to communities that comply with FEMA regulations limiting development in floodplains. FEMA issues flood insurance rate maps (FIRMs) for communities participating in the NFIP. These maps delineate flood hazard zones in the community. The WSEP does not include any development that would increase risk to people or property as a result of uncontrolled flows.

Executive Order 11988 (Floodplain Management)

Executive Order 11988 (May 24, 1977) requires federal agencies to prepare floodplain assessments for proposed actions located in or affecting floodplains. If an agency proposes to conduct an action in a floodplain, it must consider alternatives to avoid adverse effects and incompatible development in the floodplain. If the only practical alternative involves siting in a floodplain, the agency must minimize potential harm to or in the floodplain and explain why the action is proposed in the floodplain. The WSEP would be located within a floodplain, but would not affect the capacity of the floodplain or increase risk to people or property.

Executive Order 11990 (Protection of Wetlands)

Executive Order 11990 (May 24, 1977) requires federal agencies to prepare wetland assessments for proposed actions located in or affecting wetlands. Agencies must avoid undertaking new construction in wetlands unless no practical alternative is available and the Proposed Action includes all practical measures to minimize harm to wetlands. MID, as the project proponent, is coordinating with the Corps to ensure that effects on wetlands are minimized. Reclamation is participating in this coordination.

Executive Order 12898 (Environmental Justice)

Executive Order 12898 (February 11, 1994) requires federal agencies to identify and address adverse human health or environmental effects of federal programs, policies, and activities that could be disproportionately high on minority and low-income populations. Federal agencies must ensure that federal programs or activities do not directly or indirectly result in discrimination on the basis of race, color, or national origin. Federal agencies must provide opportunities for input into the NEPA process by affected communities and must evaluate the potentially significant and adverse environmental effects of proposed actions on minority and low-income communities during environmental document preparation. Even if a proposed federal project would not result in adverse effects on minority and low-income populations, the environmental document must describe how Executive Order 12898 was addressed during the NEPA process. There are no environmental justice issues, as fully disclosed in Section 4.16, Environmental Justice.

Executive Order 13007 (Indian Sacred Sites) and April 29, 1994, Executive Memorandum

Executive Order 13007 (May 24, 1996) requires federal agencies with land management responsibilities to accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners and avoid adversely affecting the physical integrity of such sacred sites. Where appropriate, agencies are to maintain the confidentiality of sacred sites. Among other things, federal agencies must provide reasonable notice of proposed actions or land management policies that may restrict future access to or ceremonial use of, or adversely affect the physical integrity of, sacred sites. The agencies must comply with the April 29, 1994, Executive Memorandum, *Government-to-Government Relations with Native American Tribal Governments*. No sacred sites are known to exist on or near facilities or other aspects of the project that would be affected by the WSEP.

3.2.8 Farmland Protection Policy Act and Memoranda on Farmland Preservation

Two policies require federal agencies to include assessments of the potential effects of a proposed project on prime and unique farmland. These policies are the Farmland Protection Policy Act (FPPA) and the Memoranda on Farmland Preservation, dated August 30, 1976, and August 11, 1980, respectively, from the CEQ. Under requirements set forth in these policies, federal agencies must determine these effects before taking any action that could result in converting designated prime or unique farmland for nonagricultural purposes. If implementing a project would adversely affect farmland preservation, the agencies must consider alternative actions to lessen those effects. Federal agencies also must ensure that their programs, to the extent practicable, are compatible with state, local, and private programs to protect farmland. The Natural Resources Conservation Service (NRCS) is the federal agency responsible for ensuring that these laws and policies are followed.

In this EIS, the effects to agricultural lands from implementation of the WSEP have been assessed using methods described in Section 4.3, Agriculture. Additionally, MID is consulting with the NRCS through the land evaluation and site assessment (LESA) process. The rating assigned by the NRCS for the loss of prime farmland will be included in the Final EIS, and this Draft EIS identifies this loss as adverse. Environmental commitments to establish conservation easements on agricultural land are included to reduce the intensity of this effect (see Chapter 2).

3.3 Public Outreach

Reclamation held scoping meetings on October 22 and October 29, 2007 at Madera Irrigation District's offices. Before the meetings, public notices were posted at MID's offices and published in the *Madera Tribune* and the *Fresno Bee* announcing the time, date, location and purpose of the meetings. Each scoping meeting included an overview of the meeting's purpose, the proposed project and alternatives, potentially significant environmental issues, and opportunities for future public involvement. Attendees were encouraged to provide written comments. Approximately a dozen members of the public asked questions at the meetings and 10 written comments were received. Comments and issues raised related to water supply, water quality, water rights, biological resources, and economic costs to farmers.

3.4 Coordination with Other Agencies

Reclamation has been coordinating with the Corps and USFWS (cooperating agencies under NEPA) to analyze potential environmental effects of the Proposed Action. The Corps is in the process of verifying the wetland delineation provided by MID and MID will seek permits for reshaping existing drainage ditches and adding structures in artificial canals. Reclamation submitted a BA to the USFWS for the WSEP in April 2008. The USFWS has provided two insufficiency memos requesting additional information on the project and Reclamation has responded to these memos. The USFWS's comments relate primarily to avoiding and minimizing effects on federally listed species that may use the swales and associated habitat on Madera Ranch.

Chapter 4 Affected Environment and Environmental Consequences

This chapter presents an assessment of the environmental effects associated with each alternative being considered, including the No Action Alternative. This chapter describes the existing physical environment at Madera Ranch and delineates the potential effects that may result from construction of the various improvements proposed under each alternative.

Also included are a discussion of mitigation measures and a description of potential cumulative effects associated with implementation of the MID WSEP and other projects.

4.0.1 Resources Considered

This section evaluates effects on:

- Water Supply
- Aesthetics
- Agriculture
- Air Quality
- Climate Change
- Biological Resources
- Cultural Resources
- Geology, Seismicity, and Soils
- Land Use
- Noise
- Public Health and Safety
- Public Services and Utilities
- Traffic and Circulation
- Water Quality
- Socioeconomics
- Environmental Justice
- Indian Trust Assets

4.0.2 Cumulative Effects Analysis

Cumulative effects are defined as the impact on the environment that results from the incremental effects of the action when added to other past, present, and reasonably foreseeable actions, regardless of what agency (federal or non-federal) or person undertakes such actions (40 CFR 1508.7). Cumulative effects can result from individually minor but collectively major actions taking place over a period of time.

The analysis of cumulative effects associated with reasonably foreseeable future actions should not be speculative, but based upon known long-range plans and other plans developed by agencies, organizations, and individuals. Cumulative effects are summarized at the end of each resource discussion. The study area for effects is dependent on the resource and the anticipated range of the effect. For most resource effects, the cumulative effects analysis focuses on effects in Madera County. In the case of resource effects on water supply, air quality, and biological resources, the broader area of the San Joaquin Valley was considered. As the proposed action has an indefinite lifespan, all reasonably foreseeable future actions are considered.

Cumulative effects on resources that relate to construction, occurring between 2009 and 2012, are considered only within the immediate vicinity (less than 1 mile) of the alternatives.

4.0.3 Planned and Current Projects in Madera County

Table 4.0-1 lists past, present, and probable future projects in the general vicinity of the study area that are included in the cumulative effects analysis.

Table 4.0-1. Projects Considered for the Water Supply Enhancement Project Cumulative Analysis

No.	Project Name	Description	Date of Completion
1.	San Joaquin River Settlement	Under the San Joaquin River Restoration Program, a comprehensive long-term effort to restore flows in the San Joaquin River from Friant Dam to the confluence of the Merced River, ensure irrigation supplies to Friant water users, and restore a self-sustaining fishery in the river.	Long-term effort
2.	Tri-Dairies Project	Three new dairy farms west of State Route 99 in Madera County.	2009
3.	Gateway Village	Conversion of a 2,062-acre site from existing agricultural uses to a master planned community.	2010
4.	Gunner Ranch West	Conversion of a 1,135-acre site from existing agricultural uses to a master planned community.	2010–2012
5.	Tesoro Viejo	Conversion of a 1,579-acre site from existing agricultural uses to a master planned community.	2010–2012
6.	North Fork Village	Conversion of a 2,238-acre site from existing agricultural uses to a master planned community.	2010–2012

San Joaquin River Settlement

In 1988, a coalition of environmental groups, led by the Natural Resources Defense Council (NRDC), filed a lawsuit challenging the renewal of long-term water service contracts between the United States and the CVP Friant Division contractors.

After more than 18 years of litigation, known as NRDC et al. v. Kirk Rodgers et al., a settlement (Settlement) was reached. On September 13, 2006, the Settling Parties, including NRDC, Friant Water Users Authority (FWUA), and the U.S. Departments of the Interior and Commerce, agreed on the terms and conditions of the Settlement. The U.S. Eastern District Court of California approved the settlement on October 23, 2006. The Settlement includes a Restoration Goal and Water Management Goal. The San Joaquin River Restoration Program (SJRRP) is a comprehensive long-term effort to restore flows in the San Joaquin River from Friant Dam to the confluence of the Merced River, restore the river channel and provide defined water flows to ultimately allow salmon to reestablish viable, naturally-reproducing populations, in 152 miles of the San Joaquin River between Friant Dam and the Merced River. The co-equal Water Management Goal is to mitigate water supply impacts resulting from water releases called for under the Settlement. The SJRRP is a direct result of and implements the Settlement.

Under the Settlement, the Settling Parties agreed to make releases to the San Joaquin River based on hydrographs in the Settlement that average 15–20% of the Friant Division's CVP water supply. The Settlement also contains provisions to reduce or avoid adverse water supply effects on the Friant Division contractors that may result from the releases specified in the Settlement. While the overall effects of the Settlement are considered cumulatively, water supply effects will be considered in this Draft EIS as an existing constraint on future water supply availability, as both actions are expected to start within a similar timeframe and the availability of water for banking could be a substantial constraint on the ability to implement the Proposed Action.

Tri-Dairies Project

The Tri-Dairies project is the construction and operation of three separate dairies (Costa Pride Farms, Borges Dairy, Soares Dairy), each of which will be located west of SR 99 and south of SR 152 in the western portion of Madera County. Both the Costa Pride Farms and Borges Dairy sites are within 1 mile of the proposed action.

Costa Pride Farms has applied to the County for a Conditional Use Permit (CUP) #2005-30 for the establishment and operation of a new 5,000 Holstein milk cow dairy to be located south of Avenue 17 and east of Road 12, approximately 11 miles west of the city of Madera. This milk cow herd will be supported by 1,000 dry cows, 2,700 heifers (12–24 months), 2,025 heifers (3–11 months), and 675 calves (<3 months). The dairy will have a total of 12,062 animals. The 1,783-acre project site includes the 196-acre dairy facilities site and 1,523 acres of net farmable land. The remaining 64 acres contain farm roads, irrigation facilities, and water well sites.

Borges Dairy has applied to the County for CUP Application #2005-31 for the establishment and operation of a new 3,180 Holstein milk cow dairy to be located on the south side of Avenue 14 between Road 9 and the Chowchilla Canal, approximately 13 miles west of the city of Madera. The milk cow herd will be supported by 636 dry and bred cows, 2,100 heifers (12–24 months), 1,458 heifers (3–11 months) and 117 calves (<3 months). The dairy will have a total of 8,055 animals. The 1,213-acre project site includes the 147-acre dairy facilities site, and 972 acres of net farmable land. The remaining 94 acres contain farm roads, irrigation facilities, and water well sites.

Soares Dairy has applied to the County for CUP Application #2005-37 for the construction and operation of a new 2,880 Holstein milk cow dairy to be located on Road 1 approximately 1.5 miles south of Avenue 21. This dairy project site is 15 miles southwest of Chowchilla. In addition to the milk cows there will be 664 dry cows, 1,280 heifers (12–24 months), 1,100 heifers (3–11 months) and 600 calves (<3 months). The dairy will have a total of 6,794 animals. The

956-acre project site includes the 109-acre dairy facilities site and 769 acres of net farmable land. The remaining 78 acres will contain farm roads, irrigation facilities, and water well sites.

Madera County New Growth

Gateway Village, Gunner Ranch West, Tesoro Viejo, and North Fork Village are all master planned communities proposed for development east of the city of Madera along the San Joaquin River. Many other potential future developments exist in this area but are too speculative to consider at this time. Given the distance of these sites from the proposed action (more than 20 miles), these developments are considered in the context of cumulative effects on regional resources such as agriculture, air quality, biological resources, land use, water supply, and growth-inducing effects. Effects on more localized resources such as traffic and water quality were not considered cumulatively.

4.1 Water Supply

4.1.1 Introduction

This section describes the environmental setting and effects of the proposed alternatives on water resources and supplies. Relevant regulations that apply to these resources also are described.

Methods and Terminology

The policies and regulations that govern Reclamation and the Corps must be taken into account in the analysis of the alternatives and in assessing potential effects on local or regional sources of surface water supply. MID's proposed operations would be subject to the conditions of MID's existing contracts with Reclamation and of MID's water rights.

The analysis of surface water resources and supply is based on a comparison of the range of historical diversions by MID to what is expected with the Proposed Action and alternatives. The analysis of groundwater resources and supply is based on an assessment of current groundwater basin conditions and expected conditions with the Proposed Action and alternatives.

4.1.2 Affected Environment

Surface Water Supplies

Sources of water for the Proposed Action and alternatives include MID's long-term water supply contracts with Reclamation (Friant Division supplies and Hidden Unit supplies), CVP non-storable uncontrolled flows delivered under temporary contract, and MID's pre-1914 water rights.

Friant Division Supplies

MID has a CVP water supply contract with Reclamation for delivery from the Friant Division of 85,000 af/year of Class 1 water and 186,000 af/year of Class 2 water, both for irrigation purposes (long-term renewal contract 175r-2891-LTR1; February 21, 2001). Class 1 water is "firm" supply, and Class 2 water is less reliable water that is dependent on seasonal runoff accumulating behind Friant Dam. Class 2 water may be available after all Class 1 obligations have been met. MID's yield from all the water supply contracts averaged 167,342 af/year during the period from 1985 to 2007. The long-term agricultural water supply contracts that supply water to the Madera area are summarized in Table 4.1-1.

Table 4.1-1. CVP Water Supply Contracts in Madera Area (acre-feet/year)

Contractor	CVP Source	Class 1 Supply	Class 2 Supply	Other CVP Supplies
MID	Friant Division	85,000	186,000	
	Hidden Unit (from Hensley Lake on the Fresno River)			40,357 (average 1985–2007)
GFWD	Friant Division	–	14,000	
CWD	Friant Division	55,000	160,000	
	Buchanan Unit (from Eastman Lake on the Chowchilla River)		–	24,000
Madera County	Friant Division	200	–	

Notes:
GFWD = Gravelly Ford Water District.
CWD = Chowchilla Water District.
CVP = Central Valley Project.
– = no contract.

Water available from behind Friant Dam is diverted into the Madera Canal (for MID and CWD), the San Joaquin River (for GFWD), and the Friant-Kern Canal (for the remaining Friant contractors) (Figure 2-1). MID receives water from the Madera Canal through diversions into the district at the Lateral 6.2, Hildreth Creek (sporadically), the Fresno River (Lateral 18.8 with downstream diversion into the Main Canal), Dry Creek–Lateral 24.2, Berenda Creek, and at Lateral 32.2. Water for GFWD and several other users is released down the San Joaquin River for diversion at various points above Gravelly Ford.

However, the SJRRP, as described in the Introduction to Chapter 4, will result in roughly a 25% decrease of water available from the Friant Division. The effects of this water supply reduction on MID water supply are described further under Historical and Proposed Diversions.

Hidden Unit Supplies

MID also has a contract with Reclamation that makes available for delivery to MID “the entire quantity of Project Water from Hidden Unit for irrigation purposes” (Long-Term Renewal Contract 14-06-200-4020A-LTR1; February 21, 2001). The Hidden Unit includes CVP water stored or flowing through Hensley Lake on the Fresno River. The yield from the Hidden Unit has averaged 52,952 af/year since 1992 (Dorrance pers. comm.). The Corps, which operates Hidden Dam/Hensley Lake, releases water down the Fresno River from Hensley Lake for diversion by MID into its Main Canal. The river typically is dry downstream of the MID diversion, although when flood control parameters have been exceeded, excess flows are released past the MID diversion. In some years, flows in excess of MID needs extend to the Eastside Bypass for short periods. MID also uses the Fresno River channel to convey Friant water from the Madera Canal to the Main Canal diversion.

Other Supplies

In addition, MID has pre-1914 water rights that average 7,938 af/year from Big Creek and 7,719 af/year from Soquel Creek (Dorrance pers. comm.). Water from Soquel Creek is regulated in Bass Lake and then flows into Millerton Lake and is diverted into the Madera Canal. Water from Big Creek is diverted through Hensley Lake.

Friant Section 215 water, which occasionally is available to MID, is CVP water that Reclamation determines is available at Friant Dam as the result of an unusually large water supply not otherwise storable for CVP purposes, or infrequent and otherwise-uncontrolled flows of short duration. MID must enter into a temporary contract with Reclamation, not to exceed 1 year, to obtain Friant Section 215 water.

Historical and Proposed Diversions

MID diverts an average of 167,342 af/year (1985–2007) of surface water from the sources discussed above. Of that amount, an average of 102,756 af/year (1985–2007) of surface water is delivered to district farmers. The remaining surface water, averaging 64,586 af/year (1985–2007), has been recharged (with a small amount lost to evapotranspiration) through MID conveyances at eight existing percolation facilities, or incidentally recharged as a result of spills (Table 4.1-2).

Table 4.1-2. Historical Availability of MID Water (acre-feet)

Calendar Year[1]	Year Type[2]	MID Diversions[3]	Surface Water Delivered To MID Customers (AF)[4]	Water Sent to Existing Recharge Basins (AF)[5]	Required Carriage Water (AF)[6]	Water that would have been available for the Proposed Action (AF)[7]	Water that would have been available for the Proposed Action with River Restoration(AF)[8]
1985	D	133,630	85,234	NA	41,213	7,183	0
1986	W	318,478	149,426	NA	66,742	55,000	55,000
1987	C	95,138	58,414	NA	17,034	19,146	19,146
1988	C	84,777	53,718	NA	15,199	15,112	0
1989	C	102,883	61,411	NA	18,686	21,679	0
1990	C	72,094	46,402	NA	16,528	8,583	0
1991	C	116,052	79,583	NA	22,939	13,387	0
1992	C	95,956	61,967	NA	19,123	14,385	0
1993	W	263,134	154,367	5,192	58,352	45,223	45,223
1994	C	114,705	77,910	0	23,429	12,964	12,964
1995	W	343,754	128,351	4,310	65,778	55,000	55,000
1996	W	241,850	134,546	3,879	52,448	50,976	49,927
1997	W	247,374	150,356	3,665	49,646	41,189	33,409
1998	W	189,990	105,428	4,248	55,052	25,262	25,262
1999	AN	170,854	123,951	2,120	40,587	4,169	0
2000	AN	181,495	124,365	5,882	43,281	7,877	7,877
2001	D	147,584	108,150	805	28,996	9,274	0
2002	D	133,633	101,566	369	28,105	3,380	0
2003	BN	152,003	111,635	867	33,800	5,454	0
2004	D	136,998	107,696	0	29,303	0	0
2005	W	188,505	124,680	0	40,556	23,269	23,269
2006	W	193,742	116,660	3,956	46,056	27,070	27,070
2007	C	124,248	97,570	218	23,385	2,858	0

Calendar Year[1]	Year Type[2]	MID Diversions[3]	Surface Water Delivered To MID Customers (AF)[4]	Water Sent to Existing Recharge Basins (AF)[5]	Required Carriage Water (AF)[6]	Water that would have been available for the Proposed Action (AF)[7]	Water that would have been available for the Proposed Action with River Restoration(AF)[8]
Annual Average		**167,342**	**102,756**	**2,367**	**36,358**	**20,367**	**15,398**
Total Volume Since 1985		**3,848,877**	**2,363,386**	**35,511**	**836,237**	**468,441**	**354,147**

NA = not applicable.

1 MID performs water accounting on a calendar year basis.

2 Year Type:
W = Wet year type. AN = Above normal year type. BN = Below normal year type. D = Dry year type. C = Critical year type

3 Diversions include transfers-in and MID Entitlements: Friant Class I, Friant Class II, Friant 215, Hidden Unit, Big Creek, North Fork Willow, and carryover of MID entitlements in Millerton Reservoir. It does not include: natural waters and other non-MID flows in creeks used in the MID distribution system; City of Madera run-off entering the MID distribution system; or Fresno River flows that were not diverted into the MID distribution system.

4 As measured by MID.

5 As measured by MID at Airport Pit, Burgess Pond, Allende Pond, Russell Pond, Dirt/Beeman Pit, Hospital Pond, and Pistoresi Pond. Deliveries to these locations were not formally measured by MID prior to 1993 but were generally minor for the period 1985-1992. MID also periodically sends water to Lake Madera, which is located adjacent to the Fresno River upstream of the MC&I intake. Consequently, these flows are not tracked in this spreadsheet and are excluded from Water that Would Have Been Available to the Project.

6 Required Carriage Water includes normal operational conveyance recharge, evaporation, evapotranspiration, and water that flows out of the MID's distribution system back into the Fresno River and San Joaquin River. Normal conveyance recharge, evaporation, and evapotranspiration were calculated using 2004 as a benchmark year in which uncontrolled recharge was minimal and by back-calculating the amount of recharge per day that MID ran water in its system. This factor was then applied to other years adjusting for the actual number of days that MID ran water during those years.

7 Water that Would Have Been Available to the Project represents MID entitlement water that was diverted, but not delivered to MID customers or to existing recharge basins or used as carriage water. Values in this column have been capped at 55,000 acre-feet because that is the annual recharge capacity of the Project. In years with transfers-in, the deductions for deliveries, recharge, and carriage water were adjusted downward using the ratio:
Diversions of MID Entitlements/(Diversions of MID Entitlements + Transfers-in).

8 San Joaquin River restoration impact on available water was estimated by using the Steiner (September 2005) estimated reduction in MID Class 1 and 2 allocations for 1985–2004 and the averages for the year types of 2005–2007 as detailed in the Kondolf hydrographs used in the Stipulation of Settlement (September 2006). First, the Steiner reduction was reduced by the amount of Class 1 and 2 allocations that were not called by MID in that year because other cheaper water was available (e.g., 215 and uncontrolled flows). Under a River Restoration scenario MID would have called this water. Second, the total MID diversions for that year were reduced by the adjusted Steiner reduction. Third, the diverted water was allocated in the following order to stay consistent with the philosophy that MID will not reduce other uses and recharge as a consequence of the Proposed Action:

- First: Water required for conveyance recharge and ET (carriage water),

Calendar Year[1]	Year Type[2]	MID Diversions[3]	Surface Water Delivered To MID Customers (AF)[4]	Water Sent to Existing Recharge Basins (AF)[5]	Required Carriage Water (AF)[6]	Water that would have been available for the Proposed Action (AF)[7]	Water that would have been available for the Proposed Action with River Restoration(AF)[8]

- Second: MID Farmer Deliveries
- Third: Water sent to existing recharge basins
- Fourth: Spill back to SJ and Fresno Rivers
- Fifth: Water Bank

Table 4.1-2 provides details regarding historical availability of water for the bank with and without the estimated impact of the SJRRP on water supply. The presented data are based on continuous, daily, weekly, and monthly flow measurements by MID and Reclamation at various points of diversion and readings from more than 800 farm turnouts. This table includes estimated diversions of MID entitlements toward the SJRRP. Detailed notes on assumptions and calculations follow the table.

The MID service area includes approximately 129,000 acres (more than 200 square miles) and approximately 417 miles of open-flow gravity conveyances, of which 192 miles are unlined and 225 miles are clay-lined (MID AB3030 Groundwater Management Plan prepared by Boyle Engineering 1999). The system does not include any telemetry or Supervisory Control and Data Acquisition (SCADA) systems to provide real-time adjustment of flows in response to changing conditions. Ditch tenders adjust flows in response to farmer demand by adding or removing boards from weir structures that are usually miles from locations where flow adjustment is required—resulting in significant lag times and inaccuracy. Historically, water that was not accounted for as delivered to farmers or sent to existing recharge basins or carriage water was attributable to:

- unauthorized diversions of MID's water for agricultural use;
- irregular, uncontrolled spills at a variety of locations that changed from month to month and year to year, depending on operational circumstances throughout the 200–square mile service area; and
- extended evaporative and seepage losses (above those indicated in the column titled Required Carriage Water) from conveyances that were filled to capacity and continued to hold water above immediate irrigation needs.
- The extensive conveyance system has been used as a form of temporary banking to accommodate uncontrolled flows and to allow greater flexibility in MID's deliveries.

In response to these conditions, MID's operations have become more efficient. Ditch tenders are required to be more responsive to farmers' demands and to curtail lag time and inaccuracies. In addition, MID has become more vigilant in preventing unauthorized diversions of its water supplies. Thus, MID is not proposing to increase the amount of water it diverts, reduce deliveries to farmers, or reduce deliveries to existing recharge basins, on average, and would be consistent with the SJRRP.

Table 4.1-2 details the historical availability of MID water that could have been banked, and conservatively excludes all water that returns to the Fresno and San Joaquin Rivers from diversions of MID's entitlements. This exclusion is conservative because non-MID water also is diverted by others into MID's conveyance system, such as uncontrolled flows and city of Madera runoff. Use of the conveyance system to control uncontrolled flows and runoff is likely to continue and is under the control of other agencies. MID has not included in Table 4.1-2 such flows as being available for the WSEP because it has no control over such operations. Further, it should be noted that MID uses an approximately 12-mile reach of the Fresno River to convey water from the Madera Canal and Hensley Lake to the main intake (MC&IC intake) of the MID distribution system. All losses and non-MID uses of water along this reach of the Fresno River have been excluded from the WSEP availability calculation.

Historically, there would have been water available for recharge in each of the last 22 years, with an average availability of 20,367 af/year. Over the last 22 years, available water exceeded the proposed banking capacity of the WSEP.

However, as described above and in the Chapter 4 Introduction, the implementation of the SJRRP will result in a decrease in the supplies available to MID from the Friant Division. As such, the water that will be available for use by the WSEP is less than what it would have been historically. The impact of the SJRRP on available water was estimated by using the Steiner (September 2005) estimated reduction in MID Class 1 and 2 allocations for 1985–2004 and the averages for the year types of 2005–2007 as detailed in the Kondolf hydrographs used in the Stipulation of Settlement (MID September 2006). Under the SJRRP, MID water would have been available for recharge in only 11 of the last 22 years (50% of the time), with an average availability of 15,398 af/year. The SJRRP would result in complete loss of available MID Friant Division water in most years with below average precipitation but would allow the full diversion of water that would have been available in most above average to wet years. Thus, the majority of water that historically would have been available to the project (more than 75% over the period 1985–2007) would still be available after implementation of the San Joaquin River restoration settlement agreement. Other than this decrease in MID's entitlement to Friant Division supply, the SJRRP has no effect on the WSEP. State and federal agencies currently are evaluating the effects of the SJRRP in a program-level EIS/EIR.

Groundwater Hydrology

The WSEP is located in the Madera subbasin of the San Joaquin Valley groundwater basin. The total surface area of the subbasin is 394,000 acres or 614 square miles (California Department of Water Resources 2004). Surface water in the northern portion of the San Joaquin Valley, including MID's service area, is drained toward the Delta by the San Joaquin River and its tributaries. Surface water in the southern portion of the valley is drained internally by the Kings, Kaweah, Tule, and Kern Rivers, which flow into the Tulare drainage basin. Under natural conditions, these surface water flow patterns historically were mimicked by groundwater flows. Those conditions no longer prevail because of more than 100 years of intense groundwater pumping. The Madera subbasin (DWR Number 22.06) is bounded on the north by the Chowchilla subbasin (DWR Number 22.05), on the south by the Kings subbasin

(DWR Number 22.08, separated by the San Joaquin River), on the west by the Delta-Mendota subbasin (DWR Number 22.07, separated by the San Joaquin River), and on the east by the crystalline bedrock of the Sierra Nevada foothills.

The Madera subbasin groundwater aquifer system consists of unconsolidated continental deposits, including older Tertiary and Quaternary age materials overlain by younger Quaternary deposits. Groundwater in the Madera subbasin is recharged by natural river and stream seepage, deep percolation of irrigation water, canal seepage, and intentional recharge. Groundwater flow is generally to the southwest in the eastern portion of the subbasin and to the northwest in the western portion. Locally, however, groundwater flow directions vary significantly because of the intense agricultural, municipal, and industrial groundwater pumping, which also has caused overdraft in a variety of locations, including the vicinity of Madera Ranch (Madera Irrigation District 1999; California Department of Water Resources 2004; Schmidt pers. comm.). The amount of groundwater pumping within the Madera subbasin varies from year to year, depending on the availability of MID surface water, precipitation, and temperature. In critically dry years, groundwater pumping can more than double over the amount of pumping during wet years.

As detailed in MID’s AB3030 Groundwater Management Plan (GMP) and in DWR’s Bulletin 118 (California Department of Water Resources 2004), the Madera subbasin has been subjected to severe long-term groundwater overdraft. A variety of overdraft estimates has been compiled for various portions of the basin. At the request of MID, Ken Schmidt and Associates compiled the results of these various efforts to estimate overdraft for the entire basin. Based on the compiled prior work and independent calculations, Schmidt estimated an average groundwater overdraft of 100,000 af/year as of 2000 (Schmidt pers. comm.). The recent draft Integrated Regional Water Management Plan substantiated these findings and indicated overdraft could be as much as 200,000 af/yr by 2030 (Madera County 2008).

As depicted in Figure 4.1-1, groundwater levels in the Madera subbasin have declined an average of 67 feet since 1945 and 30 feet since 1980 (California Department of Water Resources 2005). Although there have been some years of slight recovery, the overall trend is downward. Similar groundwater level declines have occurred in the vicinity of Madera Ranch. Since 1943, groundwater levels beneath Madera Ranch and the surrounding area have declined at least 90 feet, and the trend remains downward.

The available banking capacity in the dewatered aquifer beneath the Madera Ranch area (above the current water table) has been estimated to range from 286,720 to 573,440 af, with 400,000 af most commonly estimated (CALFED Bay-Delta Program 2000; Bureau of Reclamation 1998).

4.1.3 Regulatory Environment

Federal

Service Area under Madera Irrigation District's Contracts

MID needs Reclamation approval for banking of CVP water in lands outside MID's service area. MID is coordinating with Reclamation in preparing this EIS and would obtain Reclamation approval through the Record of Decision before implementing the Proposed Action.

Groundwater recharge programs are provided for under MID's contracts with Reclamation, as long as they are consistent with applicable state and federal law and are described in MID's Water Conservation Plan. MID has included the proposed WSEP in its 2005 update to its Water Conservation Plan. Under the Proposed Action, MID proposes to bank diversions that remain available following deliveries to farmers and deliveries to existing recharge basins (in a manner comparable to past operations) and after accounting for normal conveyance losses.

Exchanges of Central Valley Project Water under Madera Irrigation District's Contracts

MID's contracts with Reclamation require prior written approval from Reclamation before an exchange can be implemented. The water banking space provided by the Proposed Action could facilitate a range of water exchanges among MID, GFWD, CWD, and potentially other water users in Madera County. For exchanges to proceed, additional environmental analysis would be necessary to ensure the direct, indirect, and cumulative effects of the exchange are addressed. Several examples of potential exchanges follow. GFWD has a Class 2 entitlement that could be delivered to Madera Ranch for recharge and water banking. As much as 90% of the banked water (minus conveyance losses) then could be delivered directly back to GFWD through existing conveyance facilities (e.g., GF Canal and Cottonwood Creek) or through an exchange. Similarly, CWD, which has both Class 1 and Class 2 water entitlements, could exchange water with MID farmers in lieu of their normal deliveries from Millerton Lake, thereby making an equal volume of water available in Millerton Lake for delivery to CWD through the San Joaquin River in the same fashion as used currently.

MID or other exchange participants would coordinate with Reclamation regarding any exchanges and would obtain Reclamation approval prior to implementation.

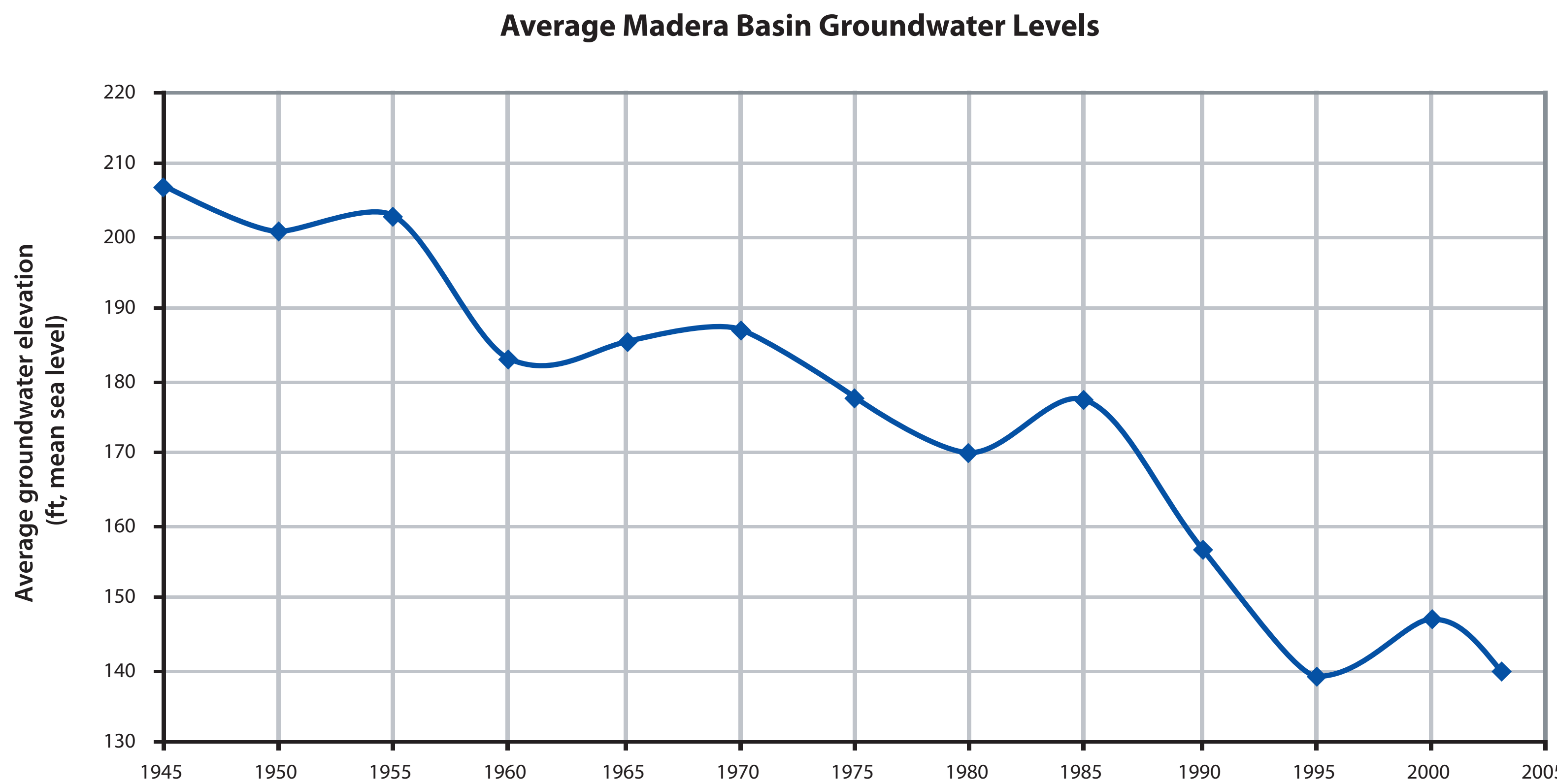

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Figure 4.1-1
Historical Trends in Average Groundwater Levels in the Madera Subbasin

State

State Water Resources Control Board

Under the California Water Code, the State Water Board is responsible for allocating surface water rights and permitting diversion and use of water throughout the state. The two most common types of surface water rights in California are riparian and appropriative. Through its Division of Water Rights, the State Water Board issues permits to divert water for new appropriations or to change existing appropriative water rights.

The Proposed Action would not involve water obtained through riparian rights and would not impair any existing or known riparian rights to water in the San Joaquin River, Fresno River, or other rivers and streams.

The Proposed Action would enable banking of water for MID, a holder of both CVP contract entitlements and appropriative water rights. No water right amendments or applications are necessitated by the Proposed Action. Persons or entities that participate in and make use of the Proposed Action would not affect other appropriative water rights.

Local

Madera County General Plan

The *Madera County General Plan Policy Document* (Madera County 1995b) contains agricultural water supply policies (General Plan 3.C.12) that state that the County would work with local irrigation districts to preserve local water rights. The County and MID oppose public and private sales of water rights to users outside Madera County. Specifically, the County's goal is to protect and enhance the natural qualities of streams, creeks, and groundwater (Goal 5.C). The general plan specifically states that the County shall protect and preserve areas with prime percolation capabilities (Goal 5.C.1).

Madera Irrigation District AB3030 Groundwater Management Plan

MID approved its AB3030 GMP in May 1999. Some of the primary goals of the plan include:

- ensuring long-term availability of high-quality groundwater,
- maintaining local control of groundwater resources within MID, and
- prohibiting the net export of groundwater from MID and use of groundwater to replace surface water removed from MID as a result of a transfer.

The Proposed Action conforms to the mission statement and meets the primary goals listed above. The Proposed Action would ensure the long-term availability of high-quality groundwater, would maintain local control, and would avoid the net export of groundwater or surface water.

Madera County Integrated Regional Water Management Plan

The *Integrated Regional Water Management Plan* (Madera County 2008) contains detailed recommendations for long-term water quality protection and water supply planning in Madera County.

4.1.4 Analysis of Environmental Effects

Methods

The institutional, regulatory, and policy conditions were presented earlier in this chapter in some detail because they govern the physical water supply conditions, related operations, and approach and assumptions used to assess the potential effects of the alternatives. This section specifically addresses surface water supplies and resources from local and regional perspectives.

The WSEP's design capacity is based on facilities to divert and convey as much as 200 cfs of water from either Friant Division or Hidden Unit operations to Madera Ranch for recharge. Recovered water would flow by gravity or be pumped to MID. Each of the alternatives, including the Proposed Action, specifies an annual recharge capacity of 55,000 af/year. These specifications have been established for design purposes. The operating conditions and the ability to bank water would be determined primarily by:

- availability of wheeling capacity in the Madera Canal and MID conveyances,
- percolation rate and total area available to recharge the water,
- ability of the groundwater basin to bank and transmit water,
- hydrologic conditions that would influence the volume and timing of diversions of water for banking from the Friant Division or Hidden Unit operations,
- farmer irrigation demand in the pump-back area, and
- San Joaquin River restoration.

The effects of the alternatives on water supply and management are related primarily to the amount of water that would be diverted to local users. MID is not proposing to increase the amount of water it diverts; rather, the alternatives include banking a portion of the water that historically has been diverted.

Environmental Effects

Alternative A—No Action

Under the No Action Alternative, Reclamation would not approve the banking of CVP water outside MID's service area, nor would Reclamation issue an MP-620 permit to approve modifications to its distribution system. Reclamation's No Action Alternative would have no adverse effects on water supply. However, the future conditions could change to support agricultural activities. The type and extent of water supply effects from agricultural activities would vary based on the type of activities conducted; in general increased agricultural operations would be expected to contribute to the groundwater overdraft situation in the County. These effects would be evaluated by MID or the County under CEQA depending on the discretionary permits needed.

Alternative B—Water Banking outside the MID Service Area Using Swales and Alteration of Reclamation-Owned Facilities

Effect WS-1: Changes in Groundwater Supplies or Overdraft Rates in Madera County

MID proposes to limit water recovery to 90% of the water that is recharged at Madera Ranch under the Proposed Action. This limitation would ensure that the Proposed Action does not deplete groundwater supplies in Madera County but rather contributes to the reduction of the rate of groundwater overdraft over time. Compared to the current overdraft conditions, the Proposed Action would have only a slight benefit. However, over the life of the project, the reduction in the rate of overdraft would be a beneficial effect.

Effect WS-2: Substantial Effects on Surrounding Groundwater Wells as a Result of Recovery Operations

Under Alternative B, approximately 40 new wells would be used to recover banked water. While the well field has been designed to draw from the mound of banked surface water, it is possible that this pumping could cause the water levels in surrounding wells to decline below levels that would occur absent Alternative B. As described in Chapter 2, the MROC will monitor water levels in perimeter wells and impose operational constraints to avoid or minimize effects. The MROC is responsible for implementation of the MOCP. The plan would include the following basic activities.

- Monitor recovery operations to ensure that 10% of the banked water is left behind to help alleviate overdraft.
- Monitor TDS in recovered water leaving Madera Ranch and in groundwater flowing away from Madera Ranch to ensure that water quality remains appropriate for irrigation purposes.

- Monitor drinking water wells within 1 mile of Alternative B for fecal coliform, TDS, and select components of TDS, as specified by the MROC.
- Monitor water levels in perimeter wells during recharge operations and shut down recharge operations in the event that off-site water levels rise to within 30 feet of the ground surface.
- Monitor water levels in off-site wells during recovery operations and adjust operations, provide compensation, or provide an alternate source of water in the event that water levels drop to unacceptable levels in off-site wells as a consequence of operations.
- Perform ongoing surveillance of MID conveyances to ensure that, if accidental spills of hazardous materials occur, these spills do not enter the recharge facilities.

Implementation of the MOCP would ensure that effects are avoided or minimized. This effect is not considered adverse.

Effect WS-3: Substantially Alter the Existing Drainage Pattern or Contribute to Existing Local or Regional Uncontrolled Flows

Madera Ranch and the surrounding landscape are fairly level. Standard measures for erosion control and management of the stormwater runoff would be included in the construction plans for Alternative B, and, therefore, this alternative would not substantially alter any existing drainage pattern.

One thousand acres of recharge basins would be constructed within an area as large as 1,300 acres, although individual basin cells would be on the order of 5–80 acres each. These basins would be excavated and some spoils would be used to form low berms to achieve an effective depth of approximately 5 feet to prevent wind-induced waves from overtopping the berms. Berm heights would vary, depending on topography, but would not exceed 5 feet.

The Department of Safety of Dams (DSOD) has developed criteria delineating its jurisdiction over impounded surface water bodies. Dams that meet jurisdictional coverage must meet specific safety and integrity requirements based on the risk associated with their potential failure. Water would be impounded in shallow excavations, and most of the berms would be lower than 5 feet and below the DSOD jurisdictional height limit of 6 feet. The nearest residence is approximately 0.75 mile away from the recharge basin window and outside the fenced ranch perimeter. Given the area between the recharge basins and residences, water escaping in the event of berm failure would pool on land between the Madera Ranch site and the residence. This effect is not considered adverse.

Effect WS-4: Adverse Effects on the Area of Origin of Water from Amendments to Existing Water Rights

MID is not proposing to amend its existing water rights and is not proposing to buy water as part of Alternative B. Water exchanges between MID and other potential users would require additional analysis, but generally would include only water that historically was diverted for agricultural use or that previously has been exchanged between parties in a similar manner.

MID does intend to sell banking space to local municipal and industrial (M&I) users. Banking capacity also could be reserved and used to help implement the SJRRP. MID would allocate 10,000 af each for M&I and environmental water users in Madera County. M&I users are broadly evaluated in Chapter 5, “Growth Inducing Effects.” All potential users would require separate environmental approvals and would rely on their own water entitlements in using the proposed groundwater banking and recovery facilities. These exchanges would not reduce the availability of water in the area of origin. There is no effect.

Effect WS-5: Reduced Surface Water Availability in Madera County or the Area of Origin

Alternative B does not involve diversion of water directly from the San Joaquin River or Fresno River to the water bank. Friant Division and Hidden Unit water would be diverted from the Millerton Lake and Hensley Lake, respectively, as MID has done historically, and then delivered to Madera Ranch. The quantities of water diverted would be within the range of historical diversions. There would be no direct influence on the San Joaquin River or Fresno River water availability or streamflows.

Nothing in Alternative B would allow MID or its participants to divert or transfer water out of the area of origin, and would not deprive those with legal rights or entitlements to the San Joaquin River or Fresno River from obtaining water supplies currently available. Alternative B does not include, nor seek changes to, water rights, in terms of type, place, or point of use, for water that originates in the San Joaquin River or Fresno River.

There are no known adverse water supply effects that would be associated with the proposed diversion of Class 1, Class 2, or Section 215 water because:

- this water is available as part of permitted operations of the Friant Division,
- reductions in diversions resulting from the SJRRP would not prohibit the bank from meeting MID or Reclamation’s purpose and need,
- operations are already conditioned under the existing biological opinion, and
- current facilities would be used.

Because these waters would be used within existing local service areas, Alternative B would not reduce local water supplies. In fact, it provides a net benefit in available water supplies to Madera County. Water reductions resulting from the SJRRP would reduce the average availability of water by roughly 25%. However, this reduction would not significantly inhibit MID's ability to meet the water needs of the project because the SJRRP would not result in a reduction of water available in wet years (Table 4.1-2).

Thus, there would be no substantial adverse reduction in surface water availability in Madera County or the San Joaquin area of origin.

Effect WS-6: Water Supply Reliability Improvement in Dry Years

Under Alternative B, up to 55,000 af of banked water would be available in dry years. The actual amount available would depend on the amount of water banked in previous years. This would be an improvement in water supply reliability during dry years because the banked water would be used to offset supply reductions in dry years, thereby making supply more dependable in all year types. This would be a beneficial effect.

Alternative C—Water Banking outside the MID Service Area without Swales and Alteration of Reclamation-Owned Facilities

Alternative C is similar in scope and design to Alternative B, with the primary exception that the natural swales that occur on the site would not be used for recharge. This would not result in any differences from what was described above for Alternative B relative to changes to existing water rights or the overall method of water banking and, with the implementation of the MOCP, would result in nearly identical effects (Effects WS-1, WS-2, WS-3, WS-4, WS-5, and WS-6). Thus, water supply effects are considered identical to those that would occur under Alternative B and not considered adverse. Similar to Alternative B, groundwater overdraft reduction would be beneficial.

Alternative D—Water Banking outside the MID Service Area with Banking and Recovery via Gravelly Ford Canal

Alternative D is similar in scope and design to Alternative B, with the exception that water would be conveyed to the site via Gravelly Ford Canal. This could result in substantial effects on existing water rights (Effect WS-7) or regional surface water availability (Effect WS-8) that does not occur under either Alternative B or Alternative C (Effects WS-4 and WS-5).

Alternative D still would result in beneficial effects on local groundwater supply (Effect WS-1) nearly identical to those that occur under Alternative B and would not adversely affect local groundwater wells and existing drainage patterns (Effects WS-2, WS-3, respectively).

Effect WS-7: Adverse Effects on the Area of Origin of Water from Amendments to Existing Water Rights

MID is not proposing to amend its existing water rights and is not proposing to buy water as part of Alternative D. However, significant water exchanges will need to occur in order to facilitate the use of GF Canal as the primary conveyance route for water coming into and out of the bank. As water would not be able to be pumped back into MID's service area, MID would release water into the San Joaquin River in exchange for other water releases from the Friant Dam. Reclamation is the only feasible partner for such exchanges that would allow MID to bank its existing water right at Madera Ranch and then exchange that water for releases of SJRRP water into MID's service area.

MID does intend to sell banking capacity to local M&I users. Additional banking capacity also could be reserved and used to help implement the SJRRP in addition to water exchanges that would facilitate the functionality of Alternative D. Under Alternative B, MID would allocate 10,000 af each for M&I and environmental water users in Madera County. M&I users are broadly evaluated in Chapter 5, "Growth Inducing Effects." All potential users would require separate environmental approvals and would rely on their own water entitlements in using the proposed groundwater banking and recovery facilities. None of the proposed exchanges would reduce the availability of water in the area of origin. There is no effect.

Effect WS-8: Reduced Surface Water Availability in Madera County or the Area of Origin

Alternative D would involve the diversion of water during wet years directly from the San Joaquin River to the water bank via GF Canal, and could therefore alter the flows in the river and by diverting water at the beginning of Reach 2. However, this diversion would be compliant with the flow requirements set forth under the Settlement, which has been developed to protect downstream beneficial uses. As shown in Table 4.1-2, MID would be able to bank available water during most wet years. During dry years, water would not be available to the bank, as it would be needed for restoration flows, and no diversions via GF Canal would occur.

Under Alternative D, MID could bank water during wet years without adversely affecting restoration flows. During dry years, MID would not bank and could make releases to the San Joaquin River for restoration flows in exchange for the delivery of restoration flows to MID users. The flow release schedule for the SJRRP calls for the release of 116,662 af during critical low years, representing the smallest release under the Settlement. During the eight critical dry years during 1984–2007, MID surface water deliveries averaged 67,122 af (with total diversions averaging 100,732 af) and a maximum surface water delivery of 97,570 af in 2007. Thus, settlement releases could be exchanged with MID deliveries, even in critical dry years. This trend holds true for deliveries under all water type conditions, and thus MID could exchange flows with the SJRRP releases without adverse effects on San Joaquin River flows. These exchanges would, in years that exchanges occur, allow Reclamation to achieve its flow objectives in Reach 2, but Reclamation still would be required to make releases to support 5-cfs flows in Reach 1 (from Friant Dam to GF Canal). This would not represent an adverse effect on flows in the San Joaquin River as it would have no effect on the benchmarks necessary to meet the goals of the San Joaquin River Settlement. No loss of surface water is expected.

Additionally, nothing in Alternative D would allow MID or its participants to divert or transfer water out of the area of origin, and Alternative B would not deprive those with legal rights or entitlements to the San Joaquin River or Fresno River from obtaining water supplies currently available. Alternative D does not include, nor seek changes to, water rights in terms of type, place, or point of use, for water that originates in the San Joaquin River or Fresno River.

No known adverse water supply effects would be associated with the proposed diversion of Class 1, Class 2, or Section 215 water because additional supplies are not being requested and SJRRP will not diminish the effectiveness of the WSEP because:

- both MID’s CVP supplies and the SJRRP water are available as part of permitted operations of the Friant Division,
- overall reductions in contract water and deliveries resulting from San Joaquin River restoration would not prohibit the bank from meeting MID or Reclamation’s purpose and need,
- operations are already conditioned under the existing biological opinion(s) governing CVP operations, and
- current facilities would be used, and in several areas resized, to allow more operational flexibility.

Because these waters would be used within existing local service areas, Alternative D would not reduce local water supplies. It is anticipated that Alternative D would result in a net benefit in available water supplies to Madera County. Water reductions resulting from the SJRRP would reduce the average availability of water by roughly 15%. However, this reduction would not significantly reduce the water available for banking in the WSEP to the extent that the project would lose feasibility.. San Joaquin River restoration would result in no reduction of water available in wet years (Table 4.1-2).

There would be no reduction in surface water availability in Madera County or the San Joaquin area of origin as a result of Alternative D. There is no effect.

Cumulative Effects

Adverse water supply effects related to operations could have cumulative impacts in Madera County (Effects WS-2, WS-3, and WS-8). Under all action alternatives, Effect WS-2 could cumulatively contribute to impacts on surrounding groundwater wells. However, implementation of the MOCP (Madera Irrigation District 2007) and the ongoing activities of the MROC should ensure that local groundwater supply effects are avoided and minimized. Additionally, the project does not contribute to the ongoing cumulative effect of groundwater overdraft but rather provides a benefit by limiting the amount of water recovered so that 10% of the water banked is left in the aquifer.

Under Alternatives B, C, and D, Effect WS-3 could cumulatively contribute to effects of local uncontrolled flows. However, no other future activities are proposed that would change surface water levels in the area around Madera Ranch.

Under Alternative D, proposed water exchanges would, in years that exchanges occur, result in Reclamation needing to provide water in Reach 1 of the San Joaquin River (the reach upstream of GF Canal to the base of Friant Dam) and exchanges benefiting lower reaches. However, no other future activities are proposed that would change surface water levels in the area around Madera Ranch. The only proposed future action is the SJRRP, which is analyzed as an existing condition because Alternative D is dependent on it to be workable.

Thus, no potential significant cumulative effects are anticipated for Alternatives B, C, and D.

4.2 Aesthetics

4.2.1 Introduction

This section describes the aesthetics—including the regional character and any visual resources in the vicinity of Madera Ranch—for the areas potentially affected by the proposed alternatives. It discusses the affected environment, relevant regulations and policies, methods of analysis, and possible effects.

4.2.2 Affected Environment

The aesthetic value of an area is a measure of its visual character and quality, combined with the viewer response to the area (Federal Highway Administration 1983). The scenic quality component can best be described as the overall impression that an individual viewer retains after driving through, walking through, or flying over an area (U.S. Bureau of Land Management 1980).

Regional Character

Madera Ranch is located in the largely agricultural western portion of Madera County, in the area known as the Valley Floor. It is bordered by Avenue 12 to the north, Avenue 7 to the south, Road 21 to the east, and agricultural lands to the west (Figure 4.2-1). The regional character of this area is typical of rural agricultural regions. Typical views of the region include:

- agricultural operations, such as tree, row, and field crop production;
- agricultural storage and maintenance areas;
- irrigation canals;
- rural residences;
- agricultural wells; and
- aboveground utility facilities

Vicinity Character

The vicinity of the WSEP is considered the Madera Ranch, which is typical of the region as described above but has a greater percentage of grasslands. Figure 4.2-1 shows the existing land uses at Madera Ranch and surrounding lands. The majority of the site is covered with grasslands that are used for grazing. Smaller portions of the site are used for agriculture, including vineyards and row crops. A farm headquarters and storage area is located near the center of the site, and two residences are on the east side of the site. Madera Ranch is generally level with little vertical relief. Views of the foreground consist of grasslands and some row crops. To the east, the Sierra Nevada may be visible in the distance, depending on weather conditions.

Sensitive Viewers

The primary viewer groups of Madera Ranch are residents and motorists. A few farmhouses are scattered throughout the vicinity, surrounded by agricultural land. Many of the residents of these farmhouses both live and work in the area; they generally make their living from the land and thus often hold their surroundings in high esteem. They typically are sensitive to visual change because of their familiarity with the view, their investment in the area (if they are homeowners or long-time residents), and their sense of ownership of the view. The view from their homes and yards represents a visual extension of their property, and changes in this view are quickly recognized and can cause the residents to have strong reactions, both positive and negative. This sensitivity is tempered somewhat by the fact that during most of the workday, residents generally are focused on work-related activities rather than on the landscape itself.

In addition to local residents, people traveling on Avenue 7, Avenue 12, and Road 21 are exposed to Madera Ranch. These individuals are considered to have moderately low sensitivity to changes because they are focused more on driving and are exposed to the site for only a short period of time. However, the roadways are very straight, giving roadway travelers some limited opportunities to take in the scenery around them.

4.2.3 Analysis of Environmental Effects

Methods

Baseline conditions in the Madera Ranch vicinity were determined by studying photographs, conducting drive-through reconnaissance, conducting research, and discussing the nature of the existing facilities with MID and Madera Ranch staff. The aesthetic effects of the alternatives were determined by assessing the visual resource changes that could result and predicting how viewers would respond to those changes.

Numerous federal agencies and organizations have developed visual assessment methodologies to standardize the quality and accuracy of visual analyses. The approach used for this visual assessment is adapted from the Federal Highway Administration’s visual effects assessment system (Federal Highway Administration 1983), which is widely accepted for general visual analysis.

The visual effects assessment process involves identifying:

- relevant policies and concerns for protection of visual resources;

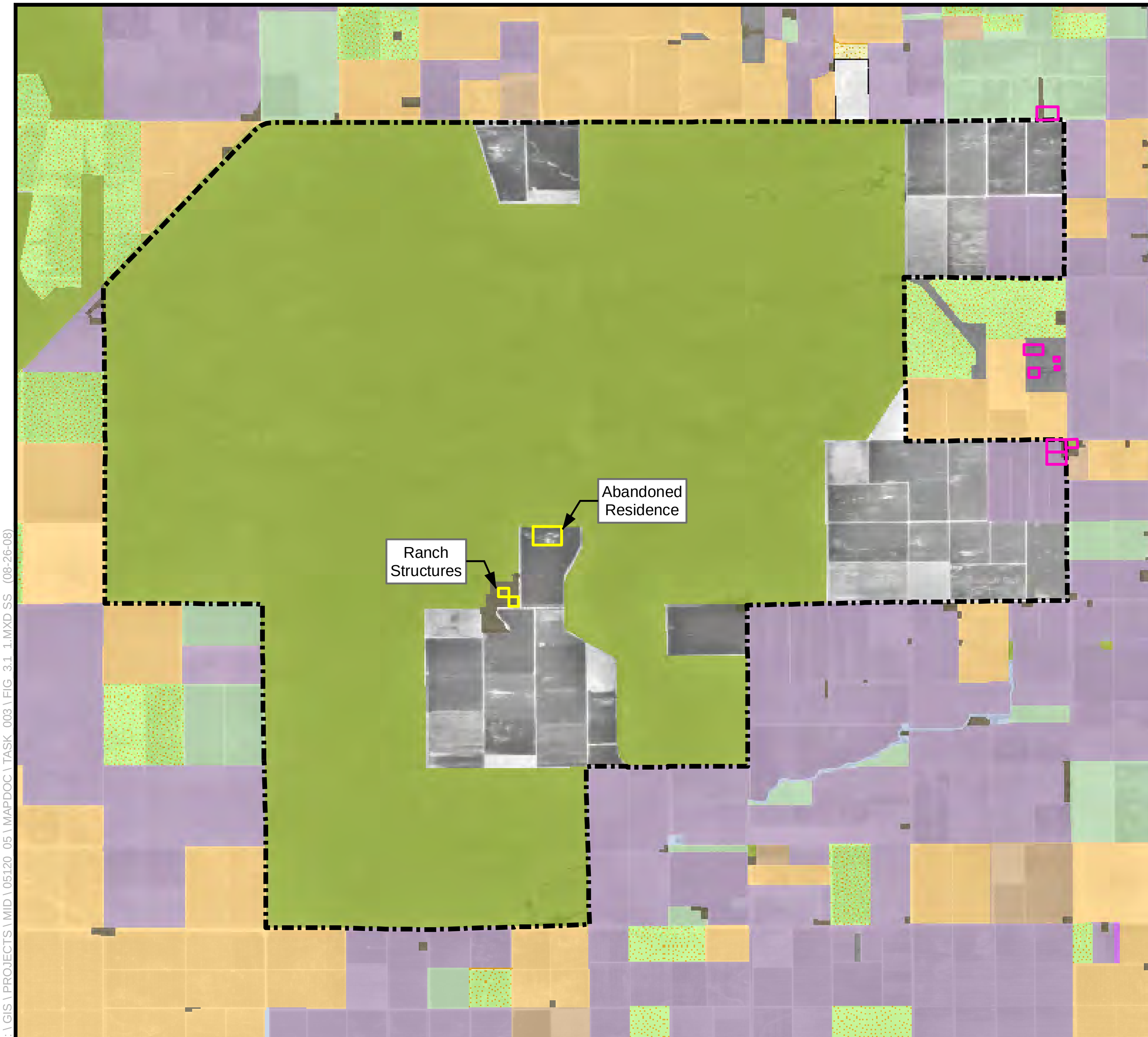

Figure 4.2-1

Land Uses in and Adjacent
to Madera Ranch

Legend

Madera Ranch Boundary

Residence
Structure

Field Crops
Truck, Nursery, and Berry Crops
Pasture
Grain and Hay Crops
Vineyards
Idle
Citrus and Subtropical
Deciduous Fruits and Nuts
Incidental to Agriculture
Grassland
Water Surface
Urban

0 0.5 1
Miles

Off-site Source: DWR 2001
Aerial Photo: USGS Digital
Orthophoto Quarter Quadrangle, 1993

N

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- visual resources (i.e., visual character and quality) of the region, the immediate vicinity of the project, and the project site;
- important viewing locations and the general visibility of the project site using descriptions and photographs;
- viewer groups and their sensitivity; and
- potential effects, mitigation of effects, and other recommendations.

The analysis of effects on aesthetics includes a qualitative assessment of the effects that construction and operation of the alternatives would have on the area's visual character and quality. A survey was conducted of the Madera Ranch site and surrounding roadways to characterize existing conditions and to identify areas sensitive to visual changes. In addition, the County's General Plan (Madera County 1995a, 1996b) was analyzed for policies or direction related to aesthetics and to determine whether there are any designated scenic roadways, vistas, or areas.

Roadways with substantial traffic in the area, specifically Avenue 7, Avenue 12, and Road 21, were considered visually sensitive, as the highest number of viewers would use these routes. Although the area contains scattered rural residential development, no residences were identified as being in direct proximity of any alternatives (i.e., immediately adjacent to the Madera Ranch site and unbuffered by distance or existing agricultural operations).

Environmental Consequences and Mitigation Strategies

Based on a review of the *Madera County General Plan Background Report* (Madera County 1995b) and Caltrans Scenic Highway Program (California Department of Transportation 2008), no designated scenic vistas or highways are visible from or within the vicinity of the alternatives. Thus, none of the alternatives would affect scenic vistas or resources. As no night lighting is proposed, no effects associated with glare could occur.

There are no federally or state-designated scenic roadways or vistas within Madera Ranch site boundaries or its vicinity. In addition, there are no County-designated scenic roadways or vistas, and those that are eligible for such designation are located far beyond the viewshed of Madera Ranch (California Department of Transportation 2008).

Alternative A—No Action

Under the No Action Alternative, Reclamation would not approve the banking of CVP water outside MID's service area, nor would Reclamation issue an MP-620 permit to approve of modifications to its distribution system. The future conditions could change to support agricultural activities. Because Madera Ranch would not be visible from population centers or major circulation routes, and because the expected features associated with the future no action conditions would appear very similar to those already present under existing conditions, the No Action Alternative would have no effect on aesthetics.

Alternative B—Water Banking outside the MID Service Area Using Swales and Alteration of Reclamation-Owned Facilities

Effect AES-1: Temporary Degradation of Visual Character or Quality from Construction-Related Activities

Construction of Alternative B action would require the use of heavy equipment and large trucks, which would cause the area to resemble a typical construction site. Construction activities involving grading, trenching, and the storage of construction equipment and materials on Madera Ranch would be visible from Avenue 7, Avenue 12, and Road 21 and adjoining properties. Construction-related activities along Cottonwood Creek, the 24.2 Canal, and Section 8 Canals also would be visible to motorists and rural residents. However, the operation of construction equipment is similar to agricultural activities that already occur in the area, including field-leveling, disking, and harvesting. In addition, construction activities would be only temporary in nature, lasting for 6 months for each of two construction seasons. As such, there would not be a considerable change in views, and construction-related activities would not result in a substantial adverse effect on visual character or quality.

Effect AES-2: Degradation of Visual Character or Quality from New Permanent Features

Alternative B would involve:

- modification and extension of canals and drainage ditches;
- use of natural swales and construction of engineered recharge basins to recharge water; and
- installation of recovery wells, pipelines, and lift stations.

Madera Ranch would not be visible from population centers or major circulation routes. However, it would be visible from nearby residences and Avenue 7, Avenue 12, and Road 21.

Canals and drainage ditches are common visual features in the agricultural areas of Madera County and are visible from Madera Ranch. The proposed new construction and/or modifications to existing canals and drainage ditches would be consistent with the agricultural nature of the area and would be similar to other visual features already occurring in the area.

The recharge basins that would be constructed as part of Alternative B would look similar to drainage ponds that already exist in the area, which blend in visually with the surrounding environment. Diversion of water to the swales would mimic natural processes, thus blending in with the natural environment. None of the drainages or swales to be used for recharge is visible from surrounding roads or properties. Under Alternative B, portions of Sections 28 and 29 periodically would be inundated, and portions of this water would be visible from Avenue 7. However, this condition would be identical to that which has existed at that location for more than 13 years. All of these recharge facilities would appear similar to flooded agricultural fields. Therefore, recharge basins and swales proposed under Alternative B would blend in with existing agricultural features in the area.

New wells, pipelines, lift stations, and utilities also would be constructed as part of Alternative B. The planned pipelines would be buried and follow alignments along existing roadways. The wells, lift stations, and utilities would be similar to features commonly found in western Madera County and the area surrounding Madera Ranch.

Because Madera Ranch would not be visible from population centers or major circulation routes, and because the planned new features would appear very similar to those present under existing conditions, Alternative B would not have an adverse aesthetic effect.

Alternative C—Water Banking Outside the MID Service Area without Swales and Alteration to Reclamation-Owned Facilities

Alternative C is similar in scope and design to Alternative B, with the primary exception that the natural swales that occur on the site would not be used for recharge. Thus, the visual character of the proposed engineered recharge basins would be very similar to the visual identity of the swales in Alternative B, and the effects would be nearly identical (Effects AES-1 and AES-2). As described above for these effects, the area is used for agricultural purposes, and the construction activities and resulting changes in facilities (such as canals and lift stations) would result in similar views from within the ranch and from nearby residences and Avenue 7, Avenue 12, and Road 21 compared to the existing activities and facilities on the Ranch. Pipelines would be buried and would result in no changes in aesthetics. The constructed basins proposed as part of Alternative C would be similar to flooded fields. Thus, there would be no considerable changes in aesthetics during or after construction that would result in any adverse visual effects.

Alternative D—Water Banking Outside the MID Service Area with Banking and Recovery via Gravelly Ford Canal

Alternative D is similar in scope and design to Alternative B, with the exception that water conveyance to the site occurs primarily through Gravelly Ford Canal (GF Canal) and not the Section 8 Canal and other local conveyances. Thus, the visual character of the alternative would be similar to Alternative B, and the effects on aesthetics would be nearly identical (Effects AES-1 and AES-2). As described above for these effects, the area is currently used for agricultural purposes, and the construction activities and resulting changes in facilities (such as canals and lift stations) would result in similar views from within the ranch and from nearby residences and Avenue 7, Avenue 12, and Road 21 compared to the existing activities and facilities on the Ranch. Pipelines would be buried and would result in no changes in aesthetics. The constructed basins proposed as part of Alternative D would be similar to flooded fields. More water than usual would be seen in GF Canal, but this would not represent a significant change in the visual character of the area and would not represent an adverse effect. Thus, there would be no considerable changes in aesthetics during or after construction that would result in any substantial adverse visual effects.

Cumulative Effects

Because the Proposed Action and alternatives will not result in adverse effects on visual resources, no cumulative effects are anticipated.

4.3 Agriculture

4.3.1 Introduction

This section describes the existing and historical agricultural land uses, including important farmland, in the areas potentially affected by the proposed alternatives. It discusses the affected environment, relevant regulations and policies, methods of analysis, and possible effects.

4.3.2 Affected Environment

Methodology and Terminology

Potential effects of an action on agricultural resources fall into two categories: indirect effects on the ability of farmland to support various levels of crop or livestock production, and the direct removal of land from agricultural use.

The ability of farmland to support various levels of crop or livestock production is referred to as *farmland quality*. The factors that affect farmland quality include the physical and chemical characteristics of a site's soils and the topography, climate, and quality and availability of irrigation water.

Under its Farmland Mapping and Monitoring Program (FMMP), the California Department of Conservation prepares maps of Important Farmlands, as described below (California Department of Conservation 2004, 2006a). Important Farmland maps are prepared periodically for most of the state's agricultural areas based on information from Natural Resources Conservation Services (NRCS) soil survey maps and land inventory and monitoring criteria developed by the NRCS. These criteria generally are expressed as definitions that characterize the land's suitability for agricultural production, physical and chemical characteristics of the soil, and actual land use. Important Farmland maps generally are updated every 2 years.

The Important Farmland mapping system uses eight mapping categories—five categories relating to agricultural lands and three categories associated with nonagricultural lands. The five agricultural mapping categories are summarized below.

- *Prime Farmland* includes lands with the combination of physical and chemical features best able to sustain long-term production of agricultural crops. The land must be supported by a developed irrigation water supply that is dependable and of adequate quality during the growing season. It also must have been used for the production of irrigated crops at some time during the 4 years before the mapping data were collected.

- *Farmland of Statewide Importance* refers to lands with agricultural characteristics, irrigation water supplies, and physical characteristics similar to prime farmland but with minor shortcomings, such as steeper slopes or less ability to hold and store moisture.
- *Unique Farmland* is lands with lesser quality soils used for the production of California's leading agricultural cash crops. These lands usually are irrigated but may be nonirrigated orchards or vineyards as found in some of the state's climatic zones.
- *Farmland of Local Importance* refers to lands of importance to the local agricultural economy, as determined by each county's board of supervisors and a local advisory committee. The county includes in its definition of farmland of local importance those lands that are presently under cultivation for small grain crops but that are not irrigated. The definition also includes lands that are currently in irrigated pasture but have the potential to be cultivated for row/field crop use.
- *Grazing Land* is land on which the existing vegetation is suited to the grazing of livestock.

Current Land Use

Figure 4.3-1 shows general existing land use conditions on and adjoining Madera Ranch. The majority of the land in the Madera Ranch vicinity is used for grazing with some areas in row crop production. A small portion is planted in vineyards. Table 4.3-1 summarizes these land uses and lists the corresponding acreages.

Table 4.3-1. Summary of Current Land Use on Madera Ranch

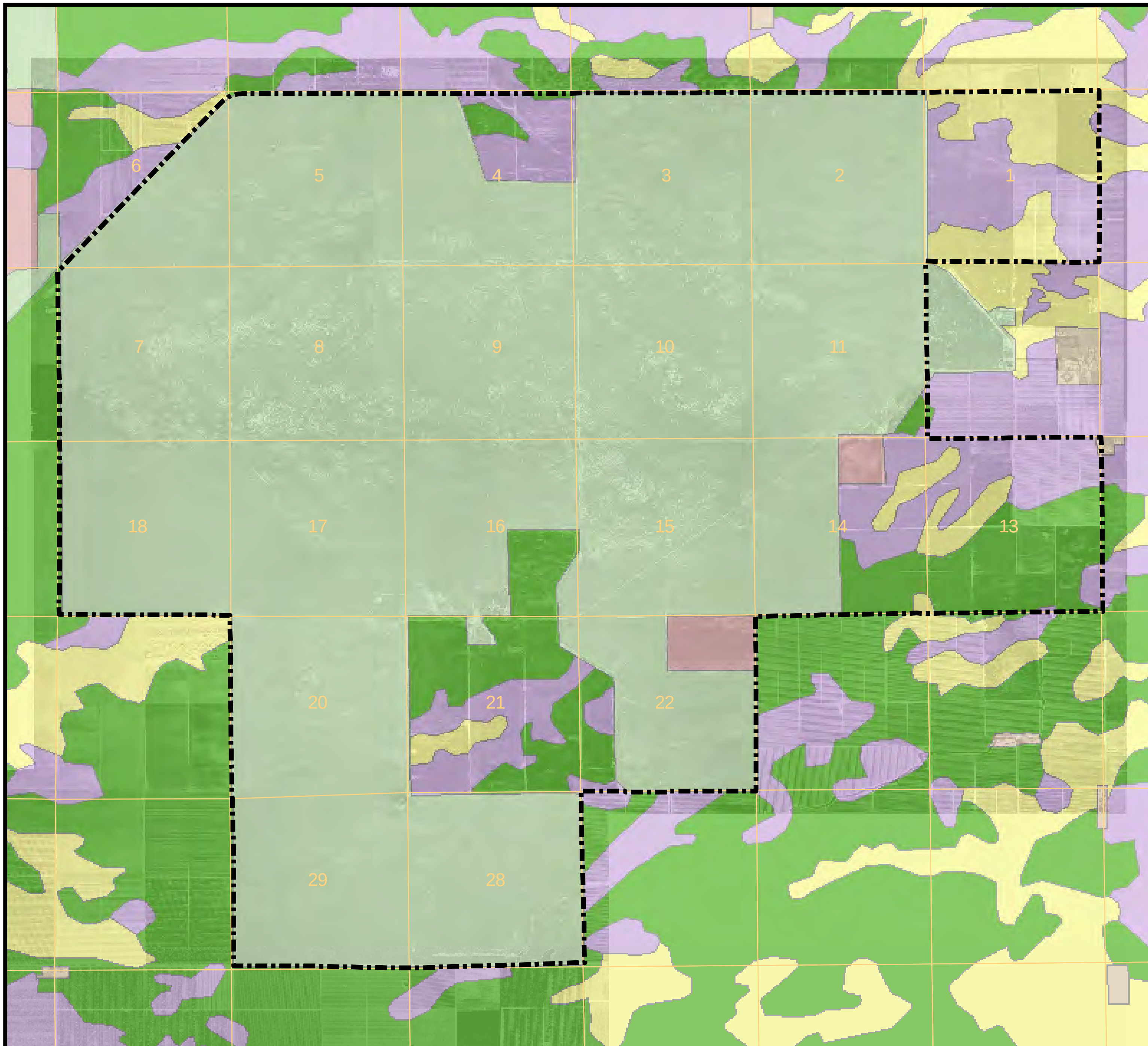
Land Use	Acres
Vineyards	320
Grain and hay crops	2,424
Annual grassland used for grazing	10,878
Semi-agricultural & incidental to agriculture*	24
Total	13,646

* Ranching facilities and Cottonwood Creek.

Agriculture throughout Madera County is also significant, with agricultural lands making up 47% (648,300 acres) of the total county area. In 2007, the top five crops were milk; almonds, nuts, and hulls; grapes; pistachios; and replacement heifers. Nuts, almonds, hulls, grapes, and pistachios (along with many other crop types in the county) represent permanent crops that cannot easily be abandoned or fallowed from year to year. Approximately 86% of the cultivated land in Madera County is in permanent crops.

Figure 4.3-1

Farmland Mapping and Monitoring Program Classifications and USGS Topographic Sections



Legend

Section Line

Madera Ranch Boundary

Farmland of Local Importance

Farmland of Statewide Importance

Grazing Land

Other Land

Prime Farmland

Unique Farmland

0 0.5 1

Miles

Aerial Photo Source: USGS Digital Orthophoto Quarter Quadrangle, 1993

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Agricultural Land Classifications

Figure 4.3-1 shows the FMMP categories present on Madera Ranch. Table 4.3-2 shows land classification acreages on Madera Ranch and in the entire county. Madera Ranch represents approximately 1.8% of the county's total Important Farmland (California Department of Conservation 2006b).

Table 4.3-2. Acreages of Important Farmland

Important Farmland Category	Madera Ranch	County
Prime Farmland	1,085	98,681
Farmland of Statewide Importance	491	85,362
Unique Farmland	1,017	163,977
Farmland of Local Importance	151	17,415
Grazing Land	10,978	399,724
Total	**13,722**	**765,159**

Note: Acreages reported by various agencies differ slightly from those reported by the Madera County Assessor's Office.

Source: California Department of Conservation 2006b (2004–2006 data).

Williamson Act Lands/Farmland Security Zone

Agricultural land can be protected under the Williamson Act (see discussion under Williamson Act below) within designated agricultural preserves.[1] A tract of land protected by Williamson Act contract can be protected further under the Farmland Security Zone Act (see discussion under Farmland Security Zone Act below) as a farmland security zone. The entire site at Madera Ranch is under Williamson Act contracts. These Williamson Act contracts will remain in effect indefinitely because no notice of nonrenewal or application for cancellation has been submitted (Upton pers. comm.). Portions of the properties outside of Madera Ranch along the Section 8 and 24.2 Canals are also part of the farmland security zone.

[1] An *agricultural preserve* is the "area within which a city or county will enter into Williamson Act contracts with landowners. The boundary [of the agricultural preserve] is designated by resolution of the board or city council having jurisdiction. Agricultural preserves must generally be at least 100 acres in size" (California Department of Conservation 2007).

4.3.3 Analysis of Environmental Effects

Methods

As described above, there could be two main types of effects on agricultural land as a result of the WSEP: direct effects and indirect effects. *Direct effects* are caused by the action and occur at the same time and place. *Indirect effects* are caused by the action and are later in time or farther removed in distance but are still reasonably foreseeable. The effects on agricultural resources are assessed based on direct disturbances related to construction and changes in land use resulting from new facilities, and indirect changes related to changes in water supplies for agricultural uses. Additionally, MID is consulting with NRCS to rate the proposed land conversion.

Environmental Consequences

Alternative A—No Action

Under the No Action Alternative, Reclamation would not approve the banking of CVP water outside MID's service area, nor would Reclamation issue an MP-620 permit for modifications to its distribution system. However, the future conditions would likely change. If MID sells the property to agricultural users, additional property on Madera Ranch would go into agricultural production. Potential conflicts with Williamson Act contracts, loss of agricultural land designated as important farmland, or conflict with local zoning designations would need to be evaluated by MID or the County under CEQA, depending on the discretionary permits needed. Until MID sells the property, it would continue in its current use of grazing.

Alternative B—Water Banking outside the MID Service Area Using Swales and Alteration of Reclamation-Owned Facilities

Effect AG-1: Alteration of Madera Ranch Agricultural Operations

Alternative B would not change the pattern of agricultural operations at the site. Furthermore, MID's water conveyance facilities allow delivery of surface water to the property without any physical changes. Proposed canal expansions would allow an increase in water delivery to the property that would be banked on site for later recovery and use in MID's current service area. It is not expected that the banked water would be recovered for use on Madera Ranch. Rather, the water would be transferred back into MID's service area for use. Thus, there would be no effect on agricultural areas associated with water banking operations at Madera Ranch.

Effect AG-2: Conflict with Williamson Act Contracts

According to the Williamson Act (Government Code sec. 51202[e]), a compatible use is any use determined by the county or city administering the agricultural preserve to be compatible with the agricultural, recreational, or open-space use of land within the preserve and subject to contract. The County Planning Department previously has determined that development of a groundwater bank on the Madera Ranch site would not conflict with the AE designation (Merchen pers. comm.). According to the County, the following activities are considered compatible uses: "the erection, construction, or maintenance of a water facility" (Madera County Rules and Procedures for Agricultural Preserves, California Government Code 51238). In addition, as discussed above, the changes resulting from Alternative B would be compatible with existing agricultural land use and zoning designations. Additionally, water banked and recovered at Madera Ranch would be used by MID, which provides water primarily for agricultural uses. One of the project purposes is to improve the reliability of the water supply. It is expected that will help ensure that any Williamson Act properties to which this water is applied can be maintained in their current land use. For these reasons, Alternative B would not conflict with any Williamson Act contracts and would have no effect on Williamson Act compatibility.

Effect AG-3: Loss of Agricultural Land Designated as Prime Farmland or Farmland of Statewide Importance

Implementation of the Alternative B would result in the direct loss of approximately 27 acres of prime farmland. Approximately 13 acres of farmland of statewide importance would be lost at Madera Ranch, and an additional 4.6 acres of farmland of statewide importance would be lost as a result of the 24.2 Canal extension (for a total of 17.3 acres). This represents a loss of approximately 2.8% of the prime farmland and farmland of statewide importance at Madera Ranch. However, the majority of the changes associated with Alternative B would occur on land classified by the FMMP as grazing land. Figure 4.3-2 shows the locations of the facilities that would result in the direct conversion of farmland, and Table 4.3-3 shows the acreages of farmland that would be converted. Alternative B would not result in conversion of farmland outside Madera Ranch; rather it is likely that the WSEP would support existing prime farmland and farmland of statewide importance because the increased water supply reliability would maintain favorable conditions for farmers to continue farming operations on those lands.

Although the loss of prime farmland and farmland of statewide importance at Madera Ranch is relatively small, and a primary objective of the WSEP is to help preserve agricultural land use through the provision of reliable and affordable water supplies, this effect is considered adverse because it would convert prime farmland or farmland of statewide importance to a nonagricultural land use. Conservation easements on agricultural land would be established (Environmental Commitment AG-1) that would reduce the intensity of this effect.

Table 4.3-3. Areas of Farmland Affected by the Proposed Alternatives

	Madera Ranch	Alternative B				Alternative C				Alternative D			
		Phase 1	Phase 2*	Total	Percent	Phase 1	Phase 2**	Total	Percent	Phase 1	Phase 2*	Total	Percent
Prime Farmland	1,085	23.6	2.9	26.5	2.4	26.5	n/a	26.5	2.4	23.6	2.9	26.5	2.4
Farmland of Statewide Importance	491	17.3	0.08	17.38	3.5	17.38	n/a	17.38	3.5	0	0.08	0.08	<0.1
Unique Farmland	1,017	11.1	4.6	15.7	1.5	15.7	n/a	15.7	1.5	11.1	4.6	15.7	1.5
Farmland of Local Importance	151	0	4.04	4.04	2.7	4.04	n/a	4.04	2.7	0	4.04	4.04	2.7
Grazing Land	10,978	18.0	1,020*	1038	9.5	1,038	n/a	1038	9.5	18.0	1,020*	1038	9.5
Total	**13,722**			**1,101.62**				**1,101.62**				**1,084.32**	

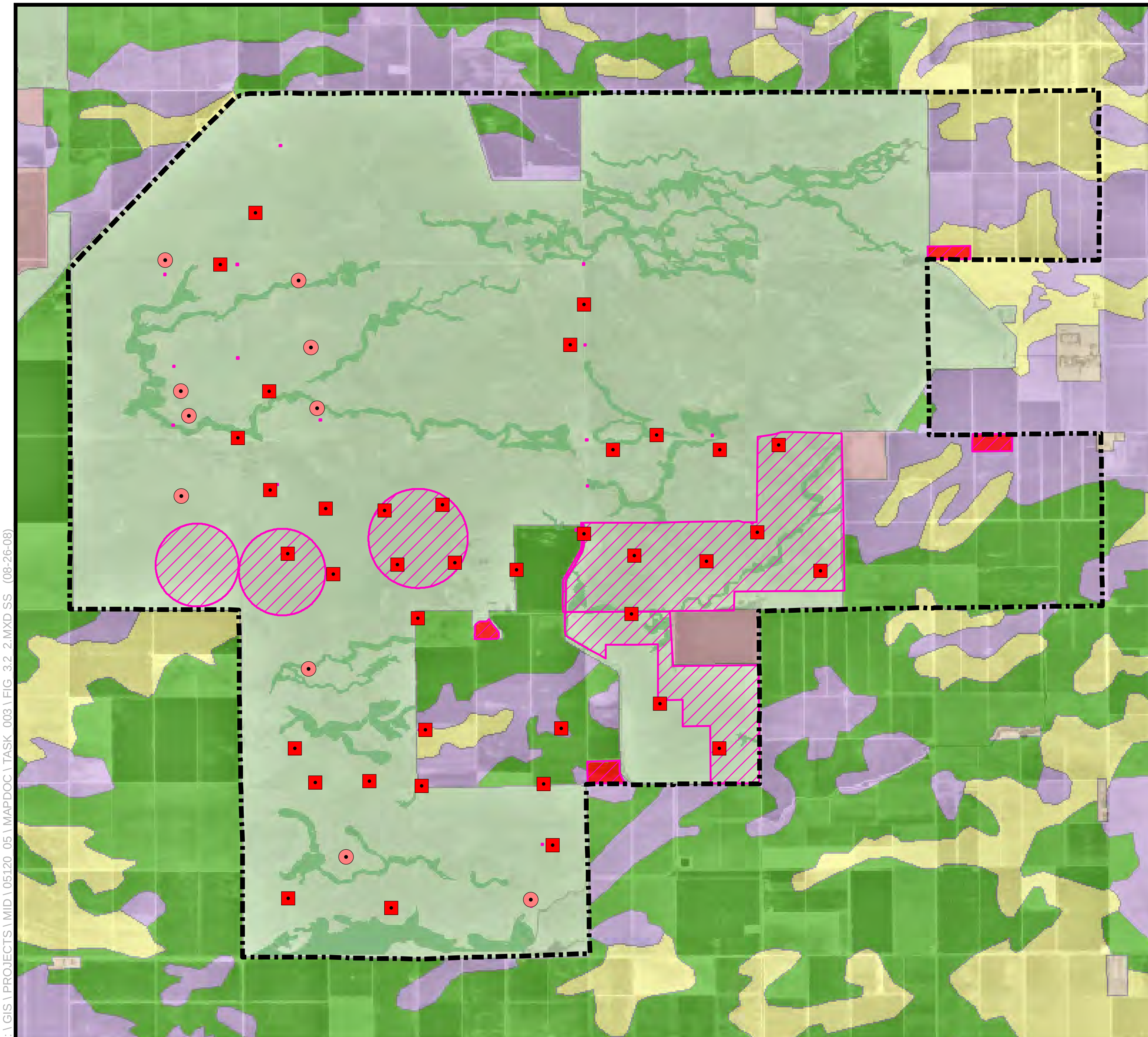
*The potential impacts of Alternative B and Alternative D, Phase 2 to grazing land represent a maximum value. These impacts, which would be associated with construction of engineered recharge basins, would not occur if the use of natural swales for recharge under Phase 1 meets the proposed objectives.

**Under Alternative B, all recharge facilities are constructed during Phase 1.

Source: California Department of Conservation 2006b (2004–2006 data).

Figure 4.3-2

Proposed Project Facilities and Farmland Mapping and Monitoring Program Classifications



Legend

Madera Ranch Boundary

Proposed Well - Optimistic Approach

Proposed Well - Conservative Approach

Phase 1 Recharge Swales

Phase 2 Recharge Basins

Recharge Basins

Farmland of Local Importance

Farmland of Statewide Importance

Grazing Land

Other Land

Prime Farmland

Unique Farmland

0 0.5 1

Miles

Aerial Photo Source: USGS Digital Orthophoto Quarter Quadrangle, 1993

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Effect AG-4: Conflict with Local Zoning Designations

Madera Ranch is located within the AE general plan land use designation and is zoned for agricultural use, meaning that the future land use must be compatible with agricultural uses. The County Planning Department previously has determined that development of groundwater storage on the Madera Ranch site would not conflict with the AE designation (Merchen pers. comm.).

In addition, only a small portion of the site, approximately 1,101 acres or 8% of the site, would be used for water banking facilities under Alternative B. Agriculture would continue on Madera Ranch except where recharge basins would be established and permanent, unburied facilities would be located. Land removed from agricultural production would continue to support agricultural practices and be consistent with the AE designation. Grazing would continue on the majority of the ranch along with row crop production. MID does not propose to establish grassland conservation easements on prime farmland, unique farmland, or farmland of statewide importance. However, other areas of the ranch may continue to be used for grazing per grassland conservation easements.

Modification and extension of existing ditches and canals would cause only temporary disruption and would result in changes that also would be consistent with continued agricultural production on the extensive agricultural areas of the site as well as on adjoining properties. Furthermore, implementation of Alternative B would enhance water reliability and flexibility and help to maintain water costs at levels that are affordable to farmers. Because Alternative B would not conflict with local zoning designations, there would be no effect.

Alternative C—Water Banking outside the MID Service Area without Swales and Alteration of Reclamation-Owned Facilities

Alternative C is similar in scope and design to Alternative B, with the primary exception that the natural swales that occur on the site would not be used for recharge. However, the expected footprint of recharge basins under Alternative C would be identical to Alternative B and would result in similar effects. Similar to what was described for Alternative B above for Effects AG-1, AG-2, AG-3, and AG-4, Alternative C would result in conversion of approximately 27 acres of prime farmland and 17 acres of farmland of statewide importance, but would not change agricultural operations on Madera Ranch or elsewhere and would not result in conflicts with Williamson Act contracts or County zoning regulations. Thus, effects on agricultural resources are considered equivalent to those that would occur under Alternative B and are considered adverse only because of conversion of prime farmland or farmland of statewide importance to a nonagricultural land use (as described in Effect AG-3). Conservation easements on agricultural land would be established (Environmental Commitment AG-1) that would reduce the intensity of this effect.

Alternative D—Water Banking outside the MID Service Area with Banking and Recovery via Gravelly Ford Canal

Alternative D is similar in scope and design to Alternative B, with the exception that water would be conveyed to the site via GF Canal. For this reason, one recharge basin would not be built under Alternative D that was proposed under Alternative B. The expected footprint of recharge basins under Alternative D would be similar to Alternative B and would result in equivalent effects relative to changes in agricultural land use, consistency with zoning and the general plan, and effects on lands included in Williamson Act contracts (Effects AG-1, AG-2, AG-3, and AG-4). However, under Alternative D, the loss of farmland of statewide importance would be less than that described for Alternative B. (Less than 1/10 of an acre under Alternative D compared to approximately 17 acres converted under Alternative B). Thus, effects on agricultural resources are considered similar in scope to those that would occur under Alternative B and are considered adverse only because of conversion of prime farmland or farmland of statewide importance to a nonagricultural land use (as described in Effect AG-3). Conservation easements on agricultural land would be established (Environmental Commitment AG-1) that would reduce the intensity of this effect.

Cumulative Effects

Other projects, combined with the WSEP, have the potential to result in a cumulative effect on agriculture in Madera County. Specifically, development projects could result in permanent conversion of agricultural land to urbanized areas, and reductions in county-wide agricultural production would continue as water becomes more expensive and limited. However, the WSEP's contribution is not considerable. Agriculture would continue on Madera Ranch except where permanent, unburied facilities are located. MID does not propose to establish grassland conservation easements on prime farmland, unique farmland, or farmland of statewide importance. However, other areas of the ranch may continue to be used for grazing per grassland conservation easements. MID is also proposing agricultural conservation easements at a 2:1 ratio to fully compensate for the loss of prime farmland, unique farmland, and farmland of statewide importance associated with all of the alternatives. Furthermore, the alternatives would help maintain the viability of agriculture in Madera County. Thus, it is not anticipated that the alternatives would contribute to cumulative impacts on agriculture.

4.4 Air Quality

4.4.1 Introduction

This section describes the existing air quality conditions in the areas potentially affected by the Proposed Action and alternatives. It discusses the affected environment, relevant regulations and policies, methods of analysis, possible effects, and mitigation efforts.

4.4.2 Affected Environment

Methods and Terminology

Several key sources were used to develop information concerning the affected environment:

- Guide for Assessing and Mitigating Air Quality Impacts (GAMAQI) prepared by the San Joaquin Valley Air Pollution Control District (SJVAPCD) (2002);
- air monitoring data for the San Joaquin Valley Air Basin (SJVAB), as compiled by the California Air Resources Board (ARB) and found on their web site (http://www.arb.ca.gov/adam/welcome.html); and
- a description of the air quality plans developed by the SJVAPCD as found on their web site (http://www.valleyair.org/).

Within the SJVAB, the pollutants of primary concern are ozone (O_3), particulate matter smaller than or equal to 10 microns in diameter (PM10), and particulate matter smaller than or equal to 2.5 microns in diameter (PM2.5). O_3 results from the reaction of two other pollutants, reactive organic gases (ROGs) and nitrogen oxides (NO_X), in the presence of sunlight. Both PM10 and PM2.5 can be emitted directly from combustion processes or as fugitive dust. They also can form in the atmosphere from the reaction of precursors. Both classes of particulates can be harmful to human health because they can be inhaled deeply into the lungs.

Ambient air quality is affected by the climate, topography, and the type and amount of pollutants emitted. The location of the WSEP, Madera Ranch, is subject to a combination of topographical and climatic factors that result in high potential for regional and local accumulation of pollutants. The following discussion describes climatic and topographic characteristics of the SJVAB, relevant air quality standards, and existing air quality conditions within the basin.

Climate and Topography

Madera Ranch is located in the SJVAB. The mountain ranges bordering the air basin near the site (the Coast Ranges to the west and Sierra Nevada to the east) influence wind directions and speeds and atmospheric inversion layers in the San Joaquin Valley. These mountain ranges channel winds through the valley, affecting both the climate and dispersion of air pollutants.

Because of the mountain ranges bordering the air basin, temperature inversions occur frequently in the valley. Inversions occur when the upper air is warmer than the air beneath it, thereby trapping pollutant emissions near the earth's surface and not allowing them to disperse upward. Inversions occur frequently throughout the year in the San Joaquin Valley, although they are more prevalent and of a greater magnitude in the late summer and fall months.

Ambient Air Quality Standards and Existing Air Quality Conditions

The federal Clean Air Act (CAA), enacted in 1963 and amended several times thereafter (including the 1990 amendments), establishes the framework for modern air pollution control. The EPA has established national ambient air quality standards (NAAQS) for criteria pollutants (Table 4.4-1). Criteria pollutants include carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), O_3, PM10, and PM2.5, and lead. Most standards have been set to protect public health. For some pollutants, standards have been based on other values (such as protection of crops, protection of materials, or avoidance of nuisance conditions).

Ozone, and its precursors, reactive organic compounds and NO_X; sulfates; visibility-reducing particles; NO_2; and PM10 and PM2.5 are considered to be regional pollutants because they or their precursors affect air quality on a regional scale—NO_2 reacts photochemically with ROGs to form O_3, while PM10 and PM2.5 can form from chemical reaction of atmospheric chemicals, including NO_X, sulfates, nitrates, and ammonia. These processes can occur at some distance downwind of the source of pollutants. Pollutants such as CO, SO_2, lead, and PM10 are considered to be local pollutants because they tend to disperse rapidly with distance from the source. Although PM10 and PM2.5 are considered to be regional pollutants, they also can be localized pollutants, as direct emissions of PM10 from automobile exhaust can accumulate in the air locally near the emission source. In the area where the Madera Ranch site is located, PM10, PM2.5, and O_3 are of particular concern.

Table 4.4-1. Applicable State and Federal Ambient Air Quality Standards

			Standard, as parts per million		Standard, as micrograms per cubic meter		Violation Criteria	
Pollutant	Symbol	Average Time	California	Federal	California	Federal	California	Federal
Ozone	O_3	1 hour	0.09	0.12	180	235	If exceeded	If exceeded on more than 3 days in 3 years
		8 hours	0.07	0.075	137	157	NA	If exceeded on more than 3 days in 3 years
Carbon monoxide	CO	8 hours	9.0	9	10,000	10,000	If exceeded	If exceeded on more than 1 day per year
		1 hour	20	35	23,000	40,000	If exceeded	If exceeded on more than 1 day per year
Nitrogen dioxide	NO_2	Annual average	NA	0.053	NA	100	NA	If exceeded
		1 hour	0.25	NA	470	NA	If exceeded	NA
Sulfur dioxide	SO_2	Annual average	NA	0.03	NA	80	NA	If exceeded
		24 hours	0.05	0.14	131	365	If exceeded	If exceeded on more than 1 day per year
		1 hour	0.25	NA	665	NA	NA	NA
Hydrogen sulfide	H_2S	1 hour	0.03	NA	42	NA	If equaled or exceeded	NA
Vinyl chloride	C_2H_3Cl	24 hours	0.010	NA	26	NA	If equaled or exceeded	NA
Inhalable particulate matter	PM10	Annual geometric mean	NA	NA	20	NA	If exceeded	NA
		Annual arithmetic mean	NA	NA	NA	50	NA	If exceeded
		24 hours	NA	NA	50	150	NA	If exceeded on more than 1 day per year
Fine particulate matter	PM2.5	Annual arithmetic mean	NA	NA	12	15	NA	If exceeded
		24 hours	NA	NA	NA	65	NA	If exceeded on more than 1 day per year
Sulfate particles	SO_4	24 hours	NA	NA	25	NA	If equaled or exceeded	NA
Lead particles	Pb	Calendar quarter	NA	NA	NA	1.5	NA	If exceeded no more than 1 day per year
		30 days	NA	NA	1.5	60	If equaled or exceeded	NA

Notes: All standards are based on measurements at 25 C and 1 atmosphere pressure. National standards shown are the primary (health effects) standards. NA = not applicable.
Source: U.S. Environmental Protection Agency and California Air Resources Board.

Attainment Status and Monitoring Data

Areas are classified as either *attainment* or *nonattainment* with respect to state ambient air quality standards (CAAQS) and NAAQS. Comparing actual monitored air pollutant concentrations to state and federal standards makes these classifications. If a pollutant concentration is lower than or meets the state or federal standard over a designated period of time, the area is classified as being in attainment of the standard for that pollutant. If a pollutant violates the standard, the area is considered a nonattainment area for that pollutant. If data are insufficient to determine whether a pollutant is violating the standard, the area is designated unclassified. This typically occurs in unurbanized areas where levels of the pollutant are not a concern.

The EPA has classified Madera County as an extreme nonattainment area with regard to the 1-hour O_3 standard and a serious nonattainment area with regard to the 8-hour O_3 standard. The EPA revoked the 1-hour O_3 standard on June 15, 2005. However, because of litigation regarding the implementation of the 8-hour O_3 standard, the San Joaquin Valley is still subject to the conformity requirements of the 1-hour standard until such time as the EPA finds adequate 8-hour budgets. At this time EPA has not made an adequacy finding on the 8-hour budgets. With regard to the CO standard, the EPA has classified Madera County as an unclassified/attainment area. The EPA has classified Madera County as a serious maintenance area with regard to the PM10 standard and a nonattainment area with regard to the PM2.5 standard.

Table 4.4-2 summarizes the local air quality monitoring data taken from the monitoring station that is closest to Madera Ranch. The closest monitoring site is located in Madera, and this site monitors only O_3 concentrations.

Description of Pollutants

Ozone

O_3 is not emitted directly into the air but is formed by a photochemical reaction in the atmosphere. O_3 precursors, which include ROGs and NO_X, react in the atmosphere in the presence of sunlight to form O_3. Because photochemical reaction rates depend on the intensity of ultraviolet light and air temperature, O_3 is primarily a summer air pollution problem. The O_3 precursors (ROGs and NO_X) are emitted by stationary combustion engines and mobile sources such as construction equipment.

O_3 is a respiratory irritant and an oxidant that increases susceptibility to respiratory infections and can cause substantial damage to vegetation and other materials. It is a severe eye, nose, and throat irritant. O_3 also attacks synthetic rubber, textiles, plants, and other materials and can cause extensive cell damage and leaf discoloration in plants.

In coordination with the ARB and other northern/central California air districts, preliminary work has begun on developing the 8-hour O_3 Attainment Demonstration Plan for the San Joaquin Valley. The SJVAPCD adopted the valley's 8-hour O_3 attainment demonstration plan for the EPA in April 2007. The 8-hour O_3 state implementation plan (SIP), approved on June 14, 2007, would include those control measures already included in the 1-hour Extreme O_3 Attainment Demonstration Plan plus additional measures identified during preparation of the 8-hour O_3 SIP. Those additional measures could include steps to further control or offset emissions generated by stationary sources.

Table 4.4-2. Madera County O_3 Air Quality Monitoring Results

	State/ Federal Standards	O_3 Concentration (ppm)						
		2002	2003	2004	2005	2006	2007	2008
Highest 1-hour average (ppm)	0.09/ NA	0.141	0.120	0.097	0.095	0.113	0.091	0.120
Highest 8-hour average (ppm)	0.07/ 0.075	0.110	0.102	0.085	0.081	0.095	0.084	0.107
Days > state 1-hour standard		21	15	3	1	4	0	9
Days > state 8-hour standard		66	67	25	19	35	12	46
Days > federal 1-hour standard*		2	0	0	N/A	N/A	N/A	N/A
Days > federal 8-hour standard		40	42	7	5	15	5	24

* Federal 1-hour standard revoked in 2005.

Source: The monitoring data are from the ARB web site: <http://www.arb.ca.gov/adam/welcome.html>.

PM10 and PM2.5

Health concerns associated with suspended particulate matter focus on those particles small enough to reach the lungs when inhaled. Particulates can damage human health and retard plant growth. Particulates also reduce visibility, soil buildings and other materials, and corrode materials. PM10 and PM2.5 emissions are generated by a wide variety of sources, including agricultural activities, industrial emissions, dust suspended by vehicle traffic and construction equipment, and secondary aerosols formed by reactions in the atmosphere.

Carbon Monoxide

CO is essentially inert to plants and materials but can have adverse effects on human health. CO is a public health concern because it combines readily with hemoglobin, reducing the amount of oxygen transported in the bloodstream. Effects on humans range from slight headaches to nausea to death.

Motor vehicles are the dominant source of CO emissions in most areas. High CO levels develop primarily during winter when periods of light winds combine with the formation of ground-level temperature inversions (typically from the evening through early morning). These conditions result in reduced dispersion of vehicle emissions. Motor vehicles also exhibit increased CO emission rates at low air temperatures.

Greenhouse Gases and Climate Change/Global Warming

Global climate change is a problem caused by combined worldwide greenhouse gas emissions (GHGs). GHGs in the atmosphere trap infrared radiation emitted from the earth's surface, causing a "greenhouse effect." Emissions in excess of naturally occurring GHGs are thought to be responsible for the enhancement of the greenhouse effect and to contribute to what is termed *global warming*, a trend of unnatural warming of Earth's natural climate.

CO_2 and N_2O are the two GHGs released in the greatest quantities from mobile sources burning gasoline and diesel fuel. Because of the relatively long life of primary GHGs in the atmosphere, which results in the accumulation over time and well-mixing of these gases in the atmosphere, their impact on the atmosphere is mostly independent of the point of emission. Climate change is a global problem, and GHGs are global pollutants, unlike criteria air pollutants (such as O_3 precursors) and toxic air contaminants (TACs), which are pollutants of regional and local concern. Worldwide, California is the 12th to 16th largest emitter of CO_2 (California Energy Commission 2006), and is responsible for approximately 2% of the world's CO_2 emissions (California Energy Commission 2006).

Changes in California's climate and ecosystems are occurring at a time when California's population is expected to increase from 34 million to 59 million by the year 2040 (California Energy Commission 2006). As such, the number of people potentially affected by climate change and the amount of anthropogenic GHG emissions expected under a "business as usual" scenario are expected to increase.

The SJVAPCD has not yet established significance thresholds or guidance for evaluating effects associated with GHGs and their contribution to climate change.

4.4.3 Regulatory Standards

Madera Ranch is located in the SJVAPCD. The SJVAPCD has jurisdiction for air quality issues throughout the eight-county SJVAB, which includes Madera County. The SJVAPCD administers air quality regulations developed at the federal, state, and local levels. Air quality regulations applicable to the WSEP are described below.

Federal Requirements

The CAA governs NAAQS. The CAA delegates primary responsibility for ensuring clean air to the EPA. The EPA develops rules and regulations to preserve and improve air quality and delegate specific responsibilities to state and local agencies.

The EPA has established NAAQS for criteria pollutants (Table 4.4-1). Criteria pollutants are CO, NO_2, SO_2, O_3, PM10, and lead.

If an area does not meet the federal NAAQS shown in Table 4.4-1, federal clean air planning requirements specify that the particular state must develop and adopt SIPs. SIPs are air quality plans that show how air quality standards will be attained. In California, the EPA has delegated the authority to prepare SIPs to the ARB, which, in turn, has delegated that authority to individual air districts.

Madera Ranch is located in a federal nonattainment area for O_3 and PM10. The SJVAPCD has adopted a SIP that addresses PM10, O_3, and the O_3 precursors (NO_X and ROGs). The SIP specifies that regional air quality standards for O_3 and PM10 concentrations can be met through additional source controls and through trip reduction strategies. The SIP also establishes emissions budgets for transportation and stationary sources. Those budgets, developed through air quality modeling, reveal how much air pollution can be in an area before there is a violation of the NAAQS.

Federal Conformity Requirements

The CAA and amendments require that all federally funded projects come from a plan or program that conforms to the appropriate SIP. Federal actions are subject to either the transportation conformity rule (40 CFR 51[T]), which applies to federal highway or transit projects, or the general conformity rule.

The purpose of the general conformity rule is to ensure that federal projects conform to applicable SIPs so that they do not interfere with strategies employed to attain the NAAQS. The rule applies to federal projects in areas designated as nonattainment areas for any of the six criteria pollutants and in some areas designated as maintenance areas. The rule applies to all federal projects except:

- programs specifically included in a transportation plan or program that is found to conform under the federal transportation conformity rule,
- projects with associated emissions below specified *de minimis* threshold levels, and
- certain other projects that are exempt or presumed to conform.

A general conformity determination would be required if a proposed action's total direct and indirect emissions fail to meet the following two conditions:

- emissions for each affected pollutant for which the region is classified as a maintenance or nonattainment area for the national standards are below the *de minimis* levels indicated in Tables 4.4-3 and 4.4-4, and
- emissions for each affected pollutant for which the region is classified as a maintenance or nonattainment area for the national standards are regionally insignificant (total emissions are less than 10% of the area's total emissions inventory for that pollutant). Emissions inventory data were obtained from the ARB's Emissions Inventory database (California Air Resources Board 2009).

If the two conditions above are not met, a general conformity determination must be performed to demonstrate that total direct and indirect emissions for each affected pollutant for which the region is classified as a maintenance or nonattainment area for the national standards would conform to the applicable SIP.

However, if the above two conditions are met, the requirements for general conformity do not apply, as the proposed action is presumed to conform to the applicable SIP for each affected pollutant. As a result, no further analysis or determination would be required.

Table 4.4-3. Federal *de Minimis* Threshold Levels for Criteria Pollutants in Nonattainment Areas

Pollutant	Emission Rate (Tons per Year)
Ozone (ROG/VOC or NO_X)	
Serious nonattainment areas	50
Severe nonattainment areas	25
Extreme nonattainment areas	**10**
Other ozone nonattainment areas outside an ozone transport region[1]	100
Other ozone nonattainment areas inside an ozone transport region[1]	
ROG/VOC	50
NO_X	100
CO: All nonattainment areas	100
SO_2 or NO_2: All nonattainment areas	100
PM10	
Moderate nonattainment areas	100
Serious nonattainment areas	70
PM2.5	
Direct emissions	**100**
SO_2	100
NO_X (unless determined not to be a significant precursor)	100
ROG/VOC or ammonia (if determined to be significant precursors)	100
Pb: All nonattainment areas	25

Source: 40 CFR 51.853.

Notes: *de minimis* threshold levels for conformity applicability analysis.

Bolded text indicates pollutants for which the region is in non-attainment, and a conformity determination must be made.

[1] Ozone Transport Region comprises the states of Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont and the Consolidated Metropolitan Statistical Area that includes the District of Columbia and northern Virginia (Section 184 of the Clean Air Act).

ROG = reactive organic gas.
VOC = volatile organic carbon.
NO_2 = nitrogen dioxide.
NO_X = oxides of nitrogen.
SO_2 = sulfur dioxide.
PM10 = particulate matter 10 microns in diameter or smaller.
PM2.5 = particulate matter 2.5 microns in diameter or smaller.
CO = carbon monoxide.

Table 4.4-4. Federal *de Minimis* Threshold Levels for Criteria Pollutants in Maintenance Areas

Pollutant	Emission Rate (Tons per Year)
Ozone (NO_X, SO_2 or NO_2)	
All maintenance areas	100
Ozone (ROG/VOC)	
Maintenance areas inside an ozone transport region[1]	50
Maintenance areas outside an ozone transport region[1]	100
CO: All maintenance areas	100
PM10: All maintenance areas	**100**
PM2.5	
Direct emissions	100
SO_2	100
NO_X (unless determined not to be a significant precursor)	100
ROG/VOC or ammonia (if determined to be significant precursors)	100
Pb: All maintenance areas	25

Source: 40 CFR 51.853.

Notes: *de minimis* threshold levels for conformity applicability analysis.

Bolded text indicates pollutants for which the region is in maintenance, and a conformity determination must be made.

[1] Ozone Transport Region comprises the states of Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont and the Consolidated Metropolitan Statistical Area that includes the District of Columbia and northern Virginia (Section 184 of the Clean Air Act).

ROG	=	reactive organic gas.
VOC	=	volatile organic carbon.
NO2	=	nitrogen dioxide.
NO_X	=	oxides of nitrogen.
SO2	=	sulfur dioxide.
PM10	=	particulate matter 10 microns in diameter or smaller.
PM2.5	=	particulate matter 2.5 microns in diameter or smaller.
CO	=	carbon monoxide.

Because the proposed action is not a federal highway or transit project, it is subject to the General Conformity Rule. As indicated above, the proposed action area is classified as an extreme nonattainment area with regard to the federal 1-hour O_3 standard and a nonattainment area with regard to the federal PM10 and PM2.5 standards. Consequently, to fulfill general conformity requirements, an analysis must be undertaken to identify whether the proposed action's total emissions of O_3, PM10, and PM2.5:

- are below the appropriate *de minimis* levels indicated in Tables 4.4-3 and 4.4-4, and
- are regionally insignificant (total emissions are less than 10% of the area's total emissions inventory for that pollutant).

State Requirements

The ARB, which is part of the California Environmental Protection Agency (CalEPA), develops air quality regulations at the state level. Similar to federal regulations, state regulations establish industry-specific pollution controls for criteria, toxic, and nuisance pollutants. California also requires basins to develop plans and strategies for attaining state ambient air quality standards as set forth in the California Clean Air Act of 1988 (Table 4.4-1).

The ARB is also responsible for developing motor vehicle emission standards for California vehicles. In August 1998, the ARB identified particulate emissions from diesel-fueled engines (diesel PM) as TACs. In September 2000, the ARB approved a comprehensive diesel risk-reduction plan to reduce emissions from both new and existing diesel-fueled engines and vehicles. The goal of the plan is to reduce diesel PM10 emissions and the associated health risk by 75% in 2010 and by 85% by 2020. The plan identifies 14 measures that the ARB will implement over the next several years. To the extent that the ARB measures are enacted before any phase of construction, the WSEP would be required to comply with applicable diesel control measures.

Local Requirements

At the local level, the SJVAPCD is responsible for establishing and enforcing local air quality rules and regulations that address the requirements of federal and state air quality laws. Air quality is also managed through land use and development planning practices. These practices are implemented through the general planning process.

4.4.4 Analysis of Environmental Effects

Methods

The proposed action would generate construction-related emissions and operational emissions. The approach used to evaluate construction and operational effects is described below.

Construction Effects Assessment Methods

Construction of the Proposed Action would generate pollutant emissions from a variety of emission sources and activities. All phases of project construction—project mobilization, site preparation, site clearing and grubbing, and construction—would generate air emissions.

The primary pollutant-generating activities associated with these phases include:

- exhaust emissions from off-road construction vehicles and equipment;
- exhaust emissions from vehicles used to deliver supplies to the project site or to haul materials from the site;
- exhaust emissions from worker commute trips;
- fugitive dust from grading; and
- fugitive dust from equipment operating on exposed earth and from the handling of sand, gravel, aggregate, and associated construction materials.

Construction of the Proposed Action would generate emissions of ROG, NO_X, CO, sulfur oxides (SO_X), and PM10. Construction-related emissions also would include fugitive PM10 dust from site grading and exhaust emissions resulting from worker commute trips and off-road construction equipment. Emissions from off-road construction equipment are estimated based on the ARB's off-road model (California Air Resources Board 2007). Fugitive dust emission factors are based on research done by the Midwest Research Institute for the South Coast Air Quality Management District (Midwest Research Institute 1996).

Construction equipment for the proposed action during Phase 1 most likely would include:

- 18 heavy diesel-powered scrapers (40- to 60-yard capacity);
- five 500-horsepower (hp) diesel-powered skip loaders;
- 30 heavy-duty, off-road-type, diesel-powered, bottom dump trucks (60-yard capacity);
- five large, diesel-powered, crawler-type tractors;
- five diesel-powered motor graders;
- three diesel-powered, large-capacity water tankers;
- three diesel-powered trackhoes;
- four well drill rigs (most likely diesel-powered) and support equipment in the form of semi-trailer trucks;
- five rubber-tired, diesel-powered backhoes; and
- support equipment, such as maintenance rigs.

In addition to the equipment listed above, construction would require up to 3,500 loads of concrete in diesel-powered transit mixers, 50 diesel semi-trailer loads of well casing, 15 diesel semi-trailer loads of pumping equipment, and 20 diesel semi-trailer loads of other equipment.

All but the off-road bottom dumps and drill rigs would be brought in on semi-trailer trucks. Some of the haul rigs would be up to 13-axle rigs to carry the weight of the scrapers. Except for some maintenance rigs, all would be stored on site during the construction period.

Several daily trips would be made to pick up supervising staff, surveyors, and inspectors. In addition, equipment operators would be traveling to and from the site daily. During construction, fuels and lubricants would be transported on a daily basis.

During Phase 2, a similar but lesser amount of heavy equipment would be mobilized and used on the Madera Ranch to construct the additional ponds in Sections 16, 17, and 18.

The grading phase of construction would use the largest amount of heavy-duty construction equipment and would be the primary source of emissions during construction. Under the Proposed Action, the construction site would be mass graded, with a first grading phase of about 540,000 cubic yards and a possible second phase grading of about 8 million cubic yards; grading activities would occur over several years. Based on the description of the Proposed Action, the grading activity is estimated to involve four bulldozers, eight rubber-tired scrapers, two graders, and as many as three water trucks used for controlling dust and conveying compaction water. The actual number of water-spreading pieces of equipment would depend on how much compaction water could be directly applied through hoses and pipes. In addition to the emissions associated with operation of construction equipment, worker commute trips would contribute a small amount of emissions.

The information shown in Table 4.4-5 was used to estimate construction-related emissions during peak construction days.

Table 4.4-5. Amount and Types of Heavy Equipment to Be Used for Mass Grading during Peak Construction Activities

Equipment Type	Alternatives B and C	Alternative D
Bulldozers	4	2
Rubber-tiered scrapers	8	6
Motor grader	2	1
Water trucks	3	2

Operational Effects Assessment Methods

Operation emissions for the Proposed Action would include both indirect mobile source emissions and direct stationary source emissions. Emissions from mobile sources associated with operation of the alternatives would be generated by workers commuting, but because the alternatives would employ only a few workers, the emissions associated with commute trips would be negligible.

If propane engines are used, direct emissions from stationary sources would result from the operation of propane-fueled engines to drive pumps installed at wells and lift stations. The primary operational emissions associated with the Proposed Action would include PM10 and O_3 precursors (ROG, NO_X) emitted as internal combustion (IC) engine exhaust. Operational emissions of O_3 precursors and PM10 were estimated using emission calculations based on emission factors from the EPA AP-42 Emissions Factors (U.S. Environmental Protection Agency 1995).

Information on the estimated size and number of engines for wells and lift station pumps was provided by MID. Pessimistic or worst-case engine hp requirements were used to estimate emissions for the purposes of this analysis. Comparing worst-case emissions to the effects threshold ensures that all potentially adverse effects are disclosed. However, actual or average emissions likely will be substantially lower than the worst-case emissions scenario.

Determination of Level of Effect

General Conformity

Because the proposed action would need approval by Reclamation, preparation of a General Conformity Analysis is required. As such, a quantitative evaluation of construction and operational emissions was conducted and evaluated against the federal *de minimis* thresholds (Tables 4.4-3 and 4.4-4).

Environmental Consequences

Alternative A—No Action

Under the No Action Alternative, Reclamation would not approve the banking of CVP water outside MID’s service area, nor would Reclamation approve of modifications to its distribution system. The No Action Alternative would have no adverse effects on air quality. However, the future conditions would change to support agricultural activities or water banking activities.

Under the No Action Alternative, the changes to air quality could vary. MID likely would sell the property to agricultural users and additional air quality effects could occur because additional lands would go into agricultural production; the amount and type of air quality effects would depend on the future agricultural practices. The SJVAB, which includes Madera County, would continue to be in severe nonattainment for O_3 and for PM10. The future conditions would be evaluated by MID or the County under CEQA depending on the discretionary permits needed. If MID sells the property to others interested in water banking, the effects would be similar to those described under the Proposed Action. The types of facilities and number of wells may vary depending on the quantity of water proposed to be banked.

Alternative B—Water Banking outside the MID Service Area Using Swales and Alteration of Reclamation-Owned Facilities

Effect AQ-1: Generation of Construction Emissions in Excess of Federal *de Minimis* Threshold Levels

Grading associated with Alternative B, including balanced cut and fill, would require the movement of approximately 8.8 million cubic yards of soil. Grading would be balanced on site in order to eliminate the need to haul additional fill material to the site or to haul excess material off site. These preliminary grading activities are expected to involve multiple pieces of heavy construction equipment, listed in Table 4.4-6.

Construction of Alternative B would generate short-term fugitive PM10 dust as a result of activities that disturb the soil, such as grading and excavation, and ROG, NO_X, CO, PM10, and PM2.5 from exhaust. Estimated annual air pollutant emissions during on-site grading are shown in Table 4.4-6. Estimates are based on a fugitive dust emission factor developed for construction activities in California. Actual fugitive dust emissions may differ slightly based on variations in soil type, wind, and soil moisture.

Table 4.4-6. Maximum Yearly Construction Emissions for the Proposed Action (tons per year)

Emission Source	ROG	NO_X	PM10	PM2.5
Alternative B (on-site heavy equipment including fugitive dust and worker trips)				
Phase 1	6.5	28.3	19.7	4.8
Phase 2	3.5	28.4	19.9	4.9
Worker Trips—Fresno	0.6	0.5	0.4	0.1
Worker Trips—Madera	0.1	0.1	0.0	0.0
Worker Trips—Chowchilla/Firebaugh	0.0	0.0	0.0	0.0
Haul Trucks	0.5	7.1	0.3	0.3
Total	**11.2**	**64.4**	**40.3**	**10.1**
Federal *de minimis* Threshold Levels	10	10	100	100
Regionally Significant Threshold (10% threshold)	13,870	23,881.95	10,902.55	10,902.55

Construction activities also would generate fugitive dust and exhaust PM10. Sources of fugitive dust and PM10 include:

- excavating soils and sediment,
- loading the excavated material onto trucks,
- tracking dirt onto paved surfaces,
- generating truck exhaust, and
- releasing dust to blow in the wind.

As shown in Table 4.4-6, Alternative B would result in a net increase in ROG, NO_X, PM10, and PM2.5 emissions. The increases ROG and NO_X emissions are in excess of the federal *de minimis* threshold levels. Environmental Commitments AQ 1: Implement San Joaquin Valley Air Pollution Control District Regulation VIII Control Measures, and AQ-2: Reduce Emissions Associated with Idling Equipment, would reduce these emissions, but not to below federal *de minimis* levels. Consequently, implementation of Alternative B is not found to be a conforming project, and there would be an adverse effect.

Effect AQ-2: Generation of Operational Emissions in Excess of Federal *de Minimis* Threshold Levels

Operation of Alternative B would require pumping at wells and lift stations to deliver water to users. For the purpose of this analysis, MID has conservatively assumed that all new pump locations could be propane-powered. Propane-fueled IC engines that exceed 50 hp would require a permit from the SJVAPCD. These new engines would be subject to SJVAPCD rules and regulations and would have to meet best available control technology (BACT) standards. Alternative B includes an engine specification requiring the purchase and use of IC engines with catalytic controls. In addition, all engines greater than 50 hp would need to meet the emission limitations published in the SJVAPCD BACT clearinghouse. Therefore, the emission estimates for operations that are compared to the threshold are the controlled engine emission estimates. Emissions above this level would not be expected to occur because they would not meet the engine specifications set by MID nor would they comply with the applicable BACT guideline. Because the electric pumps at existing wellhead locations are not expected to contribute any operational emissions, they are not addressed in this analysis, which focuses instead on the potential emissions associated with cycling and operation of the propane-fueled IC (catalytic-controlled) engines.

The engines could be used up to 24 hours per day and up to a total operating time of 2,880 hours per year. The emission estimate uses the worst-case scenario of 102 engines with a combined total of 7,385 hp. As shown in Table 4.4-7, normal operation of the propane-fueled engines with emission control devices is not expected to generate emissions in excess of the federal *de minimis* thresholds. Thus, given the commitment to use engines with catalytic control and the

SJVAPCD BACT requirement for engines over 50 hp, the controlled emissions are less than the threshold. Therefore, the potential effect is not considered adverse.

Table 4.4-7. Alternative B–Related Emissions from Operations (tons per year)

	VOCs*	NO_X	PM10
Controlled emissions from IC engines at wells and lifts/stations	3.51	3.51	14.05
Federal *de minimis* Threshold Levels	10	10	100
Regionally Significant Threshold (10% threshold)	13,870	23,881.95	10,902.55

Notes:

Estimate assumes a combined total of 7,385 hp.

Estimate assumes engine operating time of 2,880 hours per year.

Emission factors based on SJVAPCD BACT Guideline 3.3.12 (San Joaquin Valley Air Pollution Control District 2002).

* VOCs = volatile organic compounds.

This emission estimate is based on a worst-case scenario of all engines operating on propane fuel and pessimistic assumptions for the maximum number of engines required. In the event that a combination of propane- and electric-powered engines is used or fewer engines are required, the emissions would be reduced.

Alternative C—Water Banking outside the MID Service Area without Swales and Alteration of Reclamation-Owned Facilities

Alternative C is similar in scope and design to Alternative B, with the primary exception that the natural swales that occur on the site would not be used for recharge. However, the construction activities and operational needs under Alternative C would be similar to Alternative B and would result in equivalent effects on air quality (Effects AQ-1 and AQ-2). Thus, effects on air quality are considered equivalent to those which would occur under Alternative B and are considered adverse for construction activities. Implementation of Environmental Commitment AQ-1: Implement San Joaquin Valley Air Pollution Control District Regulation VIII Control Measures, and AQ-2: Reduce Emissions Associated with Idling Equipment, would reduce the severity of this effect.

Alternative D—Water Banking outside the MID Service Area with Banking and Recovery via Gravelly Ford Canal

Alternative D is nearly identical in scope and design to Alternative B, with the exception that water would be conveyed to the site via Gravelly Ford Canal. The off-ranch portions of the GF Canal will require the movement of 15,000 cubic yards of soil, and operation of the following equipment is anticipated, in addition to the equipment in Table 4.4-3:

- 18 heavy diesel-powered scrapers (40- to 60-yard capacity);
- five 500-hp diesel-powered skip loaders;
- 30 heavy-duty, off-road-type, diesel-powered, bottom dump trucks (60-yard capacity);
- five large, diesel-powered, crawler-type tractors;
- five diesel-powered motor graders;
- two diesel-powered, large-capacity water tankers;
- three diesel-powered trackhoes;
- four well drill rigs (most likely diesel-powered) and support equipment in the form of semi-trailer trucks;
- five rubber-tired, diesel-powered backhoes; and
- support equipment, such as maintenance rigs.

Construction activities associated with Alternative D are shown in Table 4.4-8.

Table 4.4-8. Maximum Yearly Construction Emissions for Alternative D (tons per year)

Emission Source	ROG	NO_X	PM10	PM2.5
Alternative B (on-site heavy equipment including fugitive dust and worker trips)				
Phase 1	8.4	36.6	20.2	5.2
Phase 2	3.5	28.4	19.9	4.9
Worker Trips—Fresno	0.6	0.5	0.4	0.1
Worker Trips—Madera	0.1	0.1	0.0	0.0
Worker Trips—Chowchilla/Firebaugh	0.0	0.0	0.0	0.0
Haul Trucks	0.5	7.1	0.3	0.3
Total	**13.1**	**72.7**	**40.8**	**10.5**
Federal *de minimis* Threshold Levels	10	10	100	100
Regionally Significant Threshold (10% threshold)	13,870	23,881.95	10,902.55	10,902.55

As shown in Table 4.4-7, Alternative D would result in a net increase in ROG, NO_X, PM10, and PM2.5 emissions. The increase in NO_X emissions is in excess of the federal *de minimis* threshold levels. Implementation of Environmental Commitments AQ 1: Implement San Joaquin Valley Air Pollution Control District Regulation VIII Control Measures, and AQ-2: Reduce Emissions Associated with Idling Equipment, would reduce the intensity of this effect, but not to below federal *de minimis* levels. Consequently, implementation of Alternative D is not found to be a conforming project, and there would be an adverse effect.

Operational needs that effect air quality under Alternative D would be similar to Alternatives C and B and would result in equivalent effects on air quality (Effect AQ-2). Therefore, the potential effect is not considered adverse.

Cumulative Effects

Effect AQ-3: Result in a Cumulative Net Increase of Any Criteria Pollutant for Which the Region Is in Nonattainment under an Applicable Federal or State Ambient Air Quality Standard (Including Releasing Emissions That Exceed Quantitative Thresholds for O_3 Precursors)

The Madera Ranch site is located in the SJVAB, where air quality conditions are regulated by SJVAPCD. Although the application of the GAMAQI control measures to this effect would minimize adverse effects, the SJVAPCD assumes air emissions to be cumulatively adverse if, with Environmental Commitments, there remains any increase in a pollutant for which the SJVAB is classified as a nonattainment area (69 FR 20550). The SJVAB is in nonattainment for O_3 and PM10.

The SJVAPCD has not established threshold criteria for construction emissions. However, because construction would result in emissions of O_3 precursors (ROG and NO_X) and PM10, and could result in the cumulative net increase in these pollutants, effects of construction emissions could be adverse. Because construction would not be long-term, construction of the alternatives would not contribute to the cumulative SJVAB's long-term air pollution problems.

As seen in Table 4.4-5, operation of the alternatives would not result in an increase in O_3 precursor (NO_X) emissions above the SJVAPCD thresholds of 10 tons per year. Although the GAMAQI states that these emissions would not be considered a cumulative net increase in O_3 precursors, as noted previously, the SJVAPCD assumes air emissions to be cumulatively adverse if, with Environmental Commitments, an alternative results in any increase in a pollutant for which the SJVAB is classified as a nonattainment area. Thus the effect is considered adverse.

Implementation of control measurements for construction emissions of PM10 required by SJVAPCD (Environmental Commitment AQ-1) would reduce emissions of PM10 associated with construction. Emissions of PM10, ROG, and NO_X associated with operations would be reduced by the emission-control devices described for the propane-fueled engine. In addition, MID will shut off the diesel engines when not in use (Environmental Commitment AQ-2) to reduce the severity of the effect.

4.5 Biological Resources

4.5.1 Introduction

This section describes the existing biological resources in the areas potentially affected by the proposed alternatives. It discusses the affected environment, relevant regulations and policies, methods of analysis, and possible effects.

4.5.2 Affected Environment

This section describes the environmental setting and existing conditions of biological resources, including plant communities, wildlife and habitats, and sensitive plant and wildlife species at Madera Ranch.

Methodology and Terminology

Jones & Stokes documented biological resources at Madera Ranch through a phased series of surveys, beginning with reconnaissance-level surveys and concluding with focused and intensive surveys. To prepare for this survey effort, Jones & Stokes biologists:

- identified applicable state, federal, and local regulations governing protection of biological resources at Madera Ranch, including off-site canals;
- conducted computer searches of the California Natural Diversity Database (CNDDB) (California Natural Diversity Database 2008) and the California Native Plant Society's (CNPS's) Electronic Inventory (California Native Plant Society 2007) to obtain information on the presence of threatened and endangered plant and wildlife species and sensitive communities at or in the vicinity of Madera Ranch and off-site canals;
- consulted the USFWS, DFG, and local experts to obtain additional information on the status of threatened and endangered species in the Madera Ranch vicinity, and off-site canals;
- obtained and reviewed applicable scientific literature and environmental reports germane to describing and evaluating the status of biological resources on Madera Ranch and off-site canals; and
- reviewed the USGS topographic map (Bonita Ranch 7.5-minute quadrangle) and soil survey map for Madera County (Stromberg 1951). Madera Ranch is in T12S, R16E, and includes Sections 1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 13, 14, 15, 16, 17, 18, 20, 21, 22, 28, and 29 and the southeast half of Section 6. Because much of the natural resource setting references these Public Land Survey System (PLSS) section numbers, Figure 4.5-1

provides a graphical illustration of the location of each section throughout the property.

Field Surveys

Field surveys were designed to lay the foundation for determining the presence and abundance of threatened and endangered species. The specific goals of these surveys were to:

- document the actual and potential occurrence and distribution of threatened and endangered plants and animals on Madera Ranch,
- evaluate Madera Ranch in terms of its overall habitat quality and potential to support threatened and endangered species, and
- provide a summary and conclusions for biological constraints to be considered in an alternatives analysis and for effect analysis.

During February–April 2000, Jones & Stokes conducted reconnaissance-level surveys at Madera Ranch (Jones & Stokes 2000). Additional detailed surveys were conducted during June–November 2000 and in April 2001. In May 2009 California State University, Stanislaus, Endangered Species Recovery Program (ESRP) initiated additional surveys for wildlife. ICF Jones & Stokes conducted detailed surveys of facility corridors for plants in April 2009. Wetland delineations also were conducted in 2000 and 2005 to map and characterize wetlands occurring in the project area, with an update in 2009. As discussed in more detail below, these surveys included:

- reconnaissance-level surveys to characterize habitats present in the project area,
- delineation of wetlands and identification of vernal swales that contribute to the wetlands and vernal pools,
- focused plant surveys to identify areas that likely contain threatened and endangered plants on portions of Madera Ranch where these plants have not yet been identified,
- detailed-transect wildlife surveys to identify and evaluate habitat conditions and document the actual and potential occurrence of sensitive species throughout Madera Ranch, and
- focused surveys for Fresno kangaroo rat (*Dipodomys nitritoides exilis*) and San Joaquin kit fox (*Vulpes macrotus nautica*).

Nearly 2,500 person-hours were spent evaluating biological resources on Madera Ranch. Of this total, 320 person-hours were spent evaluating botanical resources, and 2,160 person-hours were spent evaluating biological resources.

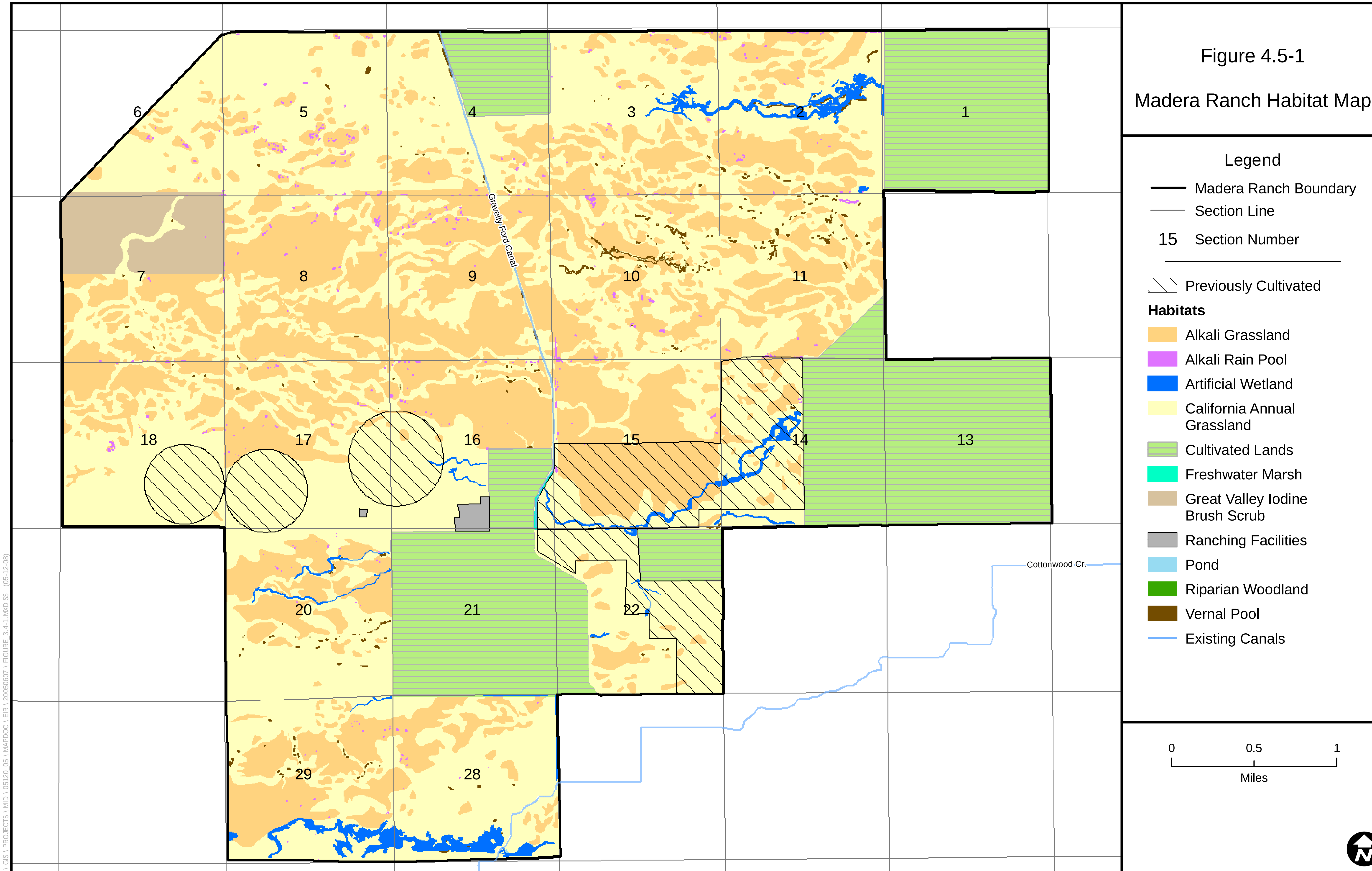


Figure 4.5-1

Madera Ranch Habitat Map

Results of the botanical and wildlife surveys are summarized in Existing Conditions below. Details of the survey results have been documented previously (Jones &Stokes 2000, 2008). The surveys this spring will be documented in summer 2009.

Botanical Surveys

Plant surveys included reconnaissance visits to the site, aerial photo interpretation, field surveys for threatened and endangered plants, and delineation of wetlands. The entire Madera Ranch property was assessed with reconnaissance-level surveys and photo interpretation.

Jones & Stokes botanists performed reconnaissance-level surveys of the entire Madera Ranch property—other than cultivated areas (Sections 1, 13, 21, the eastern half of Section 14, the northeastern quarter of Sections 4 and 22, the southeastern quarter of Section 16, and the western edge of Section 22)—in February and March 2000. The purpose of the surveys was to become familiar with Madera Ranch and plant communities and to determine the appropriate survey protocols for the sensitive species surveys. Sections 15, 16, 17, 20, 21, 22, 28, and 29 were surveyed following the guidelines for assessing effects of proposed developments on rare and endangered plants and plant communities (California Department of Fish and Game 2000a). Early-blooming-season floristic surveys were performed during the week of April 3–7, 2000. In addition to conducting the floristic inventory, the survey team characterized the plant communities present and mapped the wetlands. Surveys for summer-blooming species were conducted on June 5 and 6, 2000, focusing on habitat for the summer-blooming species identified during the April surveys. On June 27, 2000, the northern half of Section 7 was surveyed for palmate-bracted bird's-beak (*Cordylanthus palmatus*). Per Jones & Stokes, the northern half of Section 7 was the only potential habitat area identified for this endangered species. Reference locations were not visited.

Jones & Stokes completed additional fieldwork during 2005 focused on two issues: (1) additional wetland delineation surveys conducted in response to comments from the Corps and (2) reconnaissance-level habitat evaluations of proposed facilities locations outside of Madera Ranch. The wetland delineation work was intended to ground-truth the results of aerial interpretation work conducted previously and to provide additional data points for evaluating wetlands across the entire Madera Ranch site. Reconnaissance-level habitat evaluations were conducted for facilities that would be constructed along the Main No. 2 Canal, Cottonwood Creek, 24.2 Canal, and Section 8 Canal. These locations are beyond the boundaries of Madera Ranch and had not been surveyed previously.

ICF Jones & Stokes conducted detailed walking transect surveys on April 14 and 15, 2009, with two botanists walking 30 feet apart throughout the Phase 1 facility corridors. These spring surveys did not reveal any federally or state-listed plant species. Additional late season surveys will be conducted in July 2009.

Wildlife Surveys

Wildlife surveys included:

- six reconnaissance visits to the site;
- more than 320 miles of walking transect surveys looking for blunt-nosed leopard lizards (*Gambelia sila*), San Joaquin kit fox burrows, kangaroo rat (*Dipodomys* spp.) burrows, burrowing owl (*Athene cunicularia hypugea*) burrows, and other sensitive species;
- 10 nights of spotlighting for kit fox;
- 45 camera/bait stations and 442 camera nights of surveys for kit fox;
- 11,120 trap nights for kangaroo rats;
- fairy shrimp sampling; and
- surveys for wintering birds.

4.5.3 Setting

Madera Ranch is located in southwestern Madera County and encompasses 13,646 acres. The topography slopes gently downward from east to west, ranging in elevation from about 215 feet above mean sea level (feet msl) to about 175 feet msl. The site is gently undulating and traversed by numerous shallow swales that generally run from east to west.

Watersheds and Streams

Madera Ranch lies in the historical floodplain between the Fresno River and San Joaquin River, and the south side of the ranch lies in the active floodplain of Cottonwood Creek. With the exception of Sections 28 and 29, which are inundated with Cottonwood Creek water in wet years, uncontrolled flows are rare because the surrounding areas are protected by upstream reservoirs, levees, and water diversions, and upstream off-site portions of drainages have been filled in by farmer field-leveling. The average annual rainfall at Madera Ranch is approximately 11 inches, most of which falls between October and April (California Irrigation Management Information System Station #145).

The most significant water features on Madera Ranch are Cottonwood Creek and GF Canal. Cottonwood Creek is a channelized, seasonally flowing stream that crosses Madera Ranch at the southwest corner of Section 28. The Cottonwood Creek channel has been deepened and widened by excavation throughout its length on and off the ranch. Natural streamflow occurs only during the wet season, typically from January through March. During this wet season, uncontrolled flows from the creek frequently flow out onto the southern portions of Sections 28 and 29 through a berm system that was installed in the early 1990s. From April through October, MID uses Cottonwood Creek to convey and distribute San Joaquin River and Fresno River water to growers. The creek is typically dry in November and December. MID periodically removes sediment, debris, and vegetation from the creek channel and banks using a variety of heavy equipment that moves up and down the dry creek channel. The mean width of Cottonwood Creek within the ordinary high-water mark is 40 feet.

GF Canal is a 40- to 90-foot-wide, 9- to 16-foot-deep trapezoidal irrigation and uncontrolled flow conveyance canal that bisects Madera Ranch. GFWD uses GF Canal to convey agricultural water to Section 21 and part of Section 22. In the past, during above-normal water years, waters flowed through GF Canal to Avenue 12. There are several turnouts on GF Canal where water historically has been directed to flow into grassland areas in Sections 4, 9 and 16 of Madera Ranch.

Watersheds at Madera Ranch are highly localized, and most rainfall infiltrates rapidly into the ground. Historically, the swales at Madera Ranch likely received uncontrolled flows from Cottonwood Creek and other drainages south of the Fresno River. However, as surrounding lands were brought into agricultural use and leveled, these swales have been isolated from upstream sources of water, with the exception of uncontrolled flows from Cottonwood Creek onto swales in Section 28 and 29.

Plant Communities and Wildlife Habitats

Seven native and one nonnative plant communities were identified on Madera Ranch. The names of the plant communities used in this report are based on the conventions described by Sawyer and Keeler-Wolf (1995) and are used to describe the wildlife habitats. The descriptions of these communities and habitats include a listing of the representative plants and wildlife that typically occur in each area and the regional distribution of the community type in the vicinity of Madera Ranch. Table 4.5-1 shows the acreage of each of these communities, and Figure 4.5-1 shows the distribution of each community on Madera Ranch. Table 4.5-2 lists sensitive plants that occur or may occur at the project site.

Table 4.5-1. Plant Communities on Madera Ranch

Community	Approximate Size in Acres
California annual grassland	6,462
Alkali grassland	4,044
Vernal pool	22
Great Valley iodine brush scrub	292
Freshwater marsh	2
Alkali rain pool	16
Riparian woodland	2
Cultivated lands	2,745
Pond	2
Other Land-Cover Types:	
Cottonwood Creek (Canal)	4
Gravelly Ford Canal	33
Ranching facilities	22
Total	**13,618**

Table 4.5-2. Special-Status Plants Occurring or Potentially Occurring at Madera Ranch

Name	Status[a] Federal/State/ CNPS	Distribution	Habitat	Occurrence in Project Area
Palmate-bracted bird's-beak *Cordylanthus palmatus*	E/E/1B	Livermore Valley and scattered locations in the Central Valley from Colusa County to Fresno County	Alkaline grasslands, chenopod scrub; blooms May–October	Unlikely to occur
Succulent owl's-clover *Castilleja campestris* ssp. *succulenta*	T/E/1B	Eastern edge of San Joaquin Valley and adjacent foothills, from Stanislaus County to Fresno County	Vernal pools; blooms April–May	Unlikely to occur (out of range)
San Joaquin Orcutt grass *Orcuttia inaequalis*	T/E/1B	Scattered locations along east edge of the San Joaquin Valley and adjacent foothills, from Stanislaus County to Tulare County	Large, deep vernal pools; blooms May–September	Suitable habitat not present
Hairy Orcutt grass *Orcuttia pilosa*	E/E/1B	Scattered locations along east edge of the Central Valley and adjacent foothills, from Tehama County to Merced County	Large, deep vernal pools; blooms May–August	Suitable habitat not present
Greene's tuctoria *Tuctoria greenei*	E/R/1B	Eastern Central Valley and foothills	Large, deep vernal pools; blooms May–June	Suitable habitat not present

* Status explanations:

Federal

– = No status

E = Listed as "endangered" under the federal Endangered Species Act.

T = Listed as "threatened" under the federal Endangered Species Act.

State

– = No status

E = Listed as "endangered" under the California Endangered Species Act.

R = Listed as "rare" under the California Endangered Species Act.

California Native Plant Society

1B = List 1B species: rare, threatened, or endangered in California and elsewhere.

Madera Ranch lies in the San Joaquin Valley subregion of the California Floristic Province (Hickman 1993). The local flora include 198 taxa (species, subspecies, and varieties) in 39 plant families. Nonnative species represent 53 taxa (26.8%), which is on the low end of the range (20–71%) reported for the proportion of nonnatives in other California annual grasslands (Heady 1988).

Although the surrounding land has been converted to agriculture, most of Madera Ranch is open, grazed rangeland. Rangeland vegetation consists primarily of annual grassland. Two grassland plant communities (California annual grassland and alkali grassland) and two wetland plant communities (vernal pool and alkali rain pool) are present in the annual grassland. In addition, Great Valley iodine bush scrub occurs in the northern half of Section 7. Freshwater marsh is present in portions of the channel of the GF Canal. Riparian woodland is present on the margins of a small pond in Section 28. Vineyards, orchards, and cropland are present in cultivated portions of the ranch (Figure 4.5-1).

California Annual Grassland

Vegetation

California annual grassland is open grassland composed of annual grasses and forbs (Sawyer and Keeler-Wolf 1995). Although the dominant grasses are of Mediterranean or Eurasian origin, the annual and perennial herbs are mostly native to the California Floristic Province. At Madera Ranch, California annual grassland occupies sandy loam soils, primarily of the Pachappa soil series.

At Madera Ranch, characteristic species include the following:

- Soft chess (*Bromus hordeaceus*).
- Foxtail barley (*Hordeum murinum* ssp. *leporinum*).
- Rattail fescue (*Vulpia myuros*).
- Common fiddleneck (*Amsinckia menziesii*).
- Popcornflower (*Plagiobothrys canescens*).
- Johnny-tuck (*Triphysaria eriantha*).
- Blue dicks (*Dichelostemma capitata*).
- California goldfields (*Lasthenia californica*).
- Purple owl’s-clover (*Castilleja exerta*).
- Bird’s-eye gilia (*Gilia tricolor* ssp. *diffusa*).

California annual grassland is the most widespread plant community at Madera Ranch, occurring in most uncultivated areas on the ranch, in both uplands and swales.

Within the California annual grassland community, small areas of accumulated wind-blown sand derived from basin soils are characterized by showy annual wildflower species, including baby blue-eyes (*Nemophila menziesii*), California poppy (*Eschscholzia californica*), sun cup (*Camissonia campestris*), and tidy-tips (*Layia platyglossa*).

California annual grasslands have experienced historical agricultural disturbance in several areas of Madera Ranch, including Sections 14, 15, 16, 17, 18, and 22 (Figure 4.5-1). Grasslands in Sections 16, 17, and 18 were disturbed more than 10 years ago, and there is little discernable difference between this habitat and areas that have not experienced agricultural production. Grassland in Section 22 was disturbed more recently than 10 years ago, and annual grasses there are similar to undisturbed areas but have not completely recovered. Even though furrows are still present, grassland in Sections 14 and 15 is most similar to undisturbed areas. The similarities found between historically cultivated areas and undisturbed areas suggest that California annual grasslands can recover from relatively severe effects.

Wildlife

Many wildlife species use annual grassland for foraging, but these species usually require special habitat features such as burrows, rock outcrops, ponds, or habitats with shrubs or trees for breeding, resting, and escape cover. Mammals commonly found in grassland habitat include desert cottontail (*Sylvilagus audobonii*), black-tailed jackrabbit (*Lepus californicus*), Heermann's kangaroo rat (*Dipodomys heermanni*), San Joaquin pocket mouse (*Perognathus inornatus*), California ground squirrel (*Spermophilus beecheyi*), American badger (*Taxidea taxus*), and coyote (*Canis latrans*).

Common birds known to breed in annual grasslands include western meadowlark (*Sturnella neglecta*) and California horned lark (*Eremophila alpestris actia*).

Grasslands also provide important foraging habitat for a variety of raptors including:

- red-tailed hawk (*Buteo jamaicensis*),
- northern harrier (*Circus cyaneus*),
- white-tailed kite (*Elanus leucurus*),
- American kestrel (*Falco sparverius*),
- western burrowing owl (*Athene cunicularia hypugea*),
- short-eared owl (*Asio flammeus*),
- prairie falcon (*Falco mexicanus*), and
- turkey vulture (*Cathartes aura*).

Amphibian species that typically breed in ponds and vernal pools in grassland habitat include:

- western spadefoot toad (*Scaphiopus hammondii*),
- western toad (*Bufo boreas*), and
- Pacific treefrog (*Hyla regilla*).

Characteristic reptiles that breed in grasslands include:

- western fence lizard (*Sceloporus occidentalis*),
- side-blotched lizard (*Uta stansburiana*),
- common garter snake (*Thamnophis sirtalis*), and
- gopher snake (Pituophis melanoleucus).

Regional Distribution

California annual grassland is the typical grassland community of the California Central Valley and adjacent foothills. Although common in foothill areas, California annual grassland is regionally uncommon in the Central Valley as a result of conversion to cropland. Few areas of California annual grassland are left in Madera County west of SR 99. Therefore, California annual grassland at Madera Ranch is a sensitive plant community.

Alkali Grassland

Vegetation

The alkali grassland community present at Madera Ranch occurs on strongly saline-alkali soils, generally of the Fresno and El Peco soil series. This plant community is uncommon and has not been characterized in the ecological literature. In addition to the typical grassland species cited above, perennial and halophytic species (species that grow in salty soils) are common. Perennial species present in the alkali grasslands include interior goldenbush (*Isocoma acradenia* var. *bracteosa*), locoweed (*Astragalus* spp.), alkali sacaton (*Sporobolus airoides*), and saltgrass (*Distichlis spicata*). The presence of these perennial species suggests that the vegetation in areas of strongly saline-alkali soils historically was a shrub community dominated by saltbush (*Atriplex* spp.) or iodine bush (*Allenrolfea occidentalis*). Except for the absence of shrubby saltbush species, the floristic composition and cover of annual grasses and forbs in alkali grassland at Madera Ranch is very similar to that of valley saltbush scrub.

Slickspots, also called alkali scalds, are common in the alkali grassland. Slickspots are relatively shallow, sparsely vegetated depressions containing strongly saline-alkali soils (Reid et al. 1993). At Madera Ranch, they are interspersed on nearly level inter-swale landforms where soils are mapped as different stages and/or complexes of the Fresno, El Peco, and Dinuba series. These soil series are strongly to slightly saline-alkali and possess a carbonate-silica cemented hardpan at depths ranging from 20 to 40 inches. The slickspots have a fringe of annual halophytic species, including common spikeweed (*Centromadia pungens*), bush seepweed (*Suaeda moquinii*), alkali peppergrass (*Lepidium dictyotum*), large-flowered sand spurry (*Spergularia macrotheca* var. *leucantha*), and annual saltscale (*Atriplex* spp.) species.

As described above under California annual grassland, some areas of alkali grassland have experienced historical agricultural disturbance. Alkali grassland was not entirely disturbed, or has recovered from these activities, and during botanical surveys it was observed in historical agricultural areas in Sections 14, 15, and 22. Alkali grasslands were much less extensive in former agricultural land in Sections 16, 17, and 18 (Figure 4.5-1).

Wildlife

Many of the wildlife species characteristic of California annual grasslands described above are the same as those species associated with the alkali grasslands. Western burrowing owl, western meadowlark, and California horned lark are the more visible bird species of this area. Badger, coyote, and black-tailed jackrabbit also have been observed in this habitat.

Regional Distribution

Alkali grasslands are a sensitive plant community restricted to a few occurrences along the central trough of the Central Valley at the lower end of older alluvial fans. These alluvial fans historically received finer-textured, water-transported sediments and water-soluble salts derived from granitic rocks (San Joaquin Valley) or sedimentary and metamorphic rocks (Sacramento Valley). Areas with alkali grasslands have (or historically had) a high water table, and the capillary rise of water to the soil surface and subsequent evaporation deposits salts at or near the soil surface. Alkali grasslands are not well-documented, although areas with soils suitable for the support of alkali grasslands occur from Glenn County to Kern County. However, many of these areas of alkali soils have been converted to cropland, with scattered remnants present primarily in the National Wildlife Refuge System. In Madera County, alkali grasslands occur west of SR 99 in the area between the Fresno River and the San Joaquin River where natural vegetation is present.

Vernal Pools

Vegetation

Vernal pools are seasonal wetlands that form in depressions, generally in annual grassland habitat. Water collects in the pool basins during winter rainfall, and extended ponding is maintained by a subsurface layer that is very slowly permeable.

At Madera Ranch, vernal pools occur in swales, primarily on soils mapped under the Pachappa series. Although a claypan or hardpan is absent, wetland hydrology is maintained by the very slow permeability of the soil surface horizons caused by the high salinity. Holland (1978) reports that vernal pools are uncommon on the soil series group that includes the Pachappa series because of the absence of a restrictive layer. Because vernal pools are so uncommon on this soil type, neither Holland (1986) nor Sawyer and Keeler-Wolf (1995) include this type of vernal pool in their plant community descriptions. Vernal pool fairy shrimp (*Branchinecta lynchi*) are present in the vernal pools at Madera Ranch.

The vernal pools at Madera Ranch are floristically similar to northern claypan vernal pools (Holland 1986; Sawyer and Keeler-Wolf 1995). They are often dominated by Mediterranean barley (*Hordeum marinum* ssp. *gussoneanum*), which is often seen in vernal pools of relatively brief ponding. Typical vernal pool endemics present in the pools include coyote thistle (*Eryngium vaseyi* var. *vallicola*), Fremont’s goldfields (*Lasthenia fremontii*), California water-starwort (*Callitriche marginata*), bracted popcornflower (*Plagiobothrys bracteatus*), Pacific foxtail (*Alopecurus saccatus*), American pillwort (*Pilularia americana*), and vernal pool smallscale (*Atriplex persistens*).

Most of the vernal pools on Madera Ranch are connected by swales. The swales are shallow drainages that convey surface runoff during and immediately after storms. Swales may be an important route for dispersal of aquatic organisms between vernal pools. Because the swales at Madera Ranch lack a duripan and the vegetation does not differ substantially from the adjacent grasslands, the swales are not distinguished as separate features on Figure 4.5-1.

Wildlife

Vernal pools and swales provide important breeding habitat during the wet season for various wildlife species, including California tiger salamander (*Ambystoma californiense*), western spadefoot toad, and vernal pool fairy shrimp. During the wet season, dabbling ducks may use the pools, and Brewer’s blackbirds (*Euphagus cyanocephalus*), common snipe (*Gallinago gallinago*), long-billed dowitcher (*Limnodromus scolopaceus*), least sandpiper (*Calidris minutilla*), and American pipits (*Anthus reubescens*) may graze and glean from pool shorelines. American avocets (*Recurvirostra americana*), California horned larks, and western meadowlarks nest in the swales and adjacent grasslands. Mourning doves (*Zenaida macroura*) and lesser nighthawks (*Chordeiles acutipennis*) may nest in the dry vernal pool beds.

Regional Distribution

Northern claypan vernal pools are a sensitive plant community present at scattered locations throughout the Central Valley, generally occurring on the alluvial fan terraces along both margins of the valley but also occurring in the central trough. The distribution of northern claypan vernal pools is similar to that of alkali grasslands described above. The presence of vernal pools in Madera County west of SR 99 previously had not been documented (California Natural Diversity Database 2004), although additional vernal pools could occur on other lands where soils and vegetation are similar to those at Madera Ranch. Vernal pools have been documented in Madera County east of SR 99, but these are a different type of habitat classified as northern hardpan vernal pools.

Alkali Rain Pools

Vegetation

Alkali rain pools are a rare type of vernal pool that has not been described in the ecological literature and appears to have been little studied. Jones & Stokes previously identified this habitat in Tulare County (Jones & Stokes Associates 1998). Alkali rain pools form in slickspots that pond water for long duration. Alkali rain pools are unvegetated except for a fringe of annual halophytic species, including bush seepweed, alkali peppergrass, dwarf popcornflower (*Plagiobothrys humistratus*), California alkali grass (*Puccinellia simplex*), large-flowered sand spurry, and annual saltscale species.

Alkali rain pools differ from other vernal pools in their vegetation, soils, and hydrology. Alkali rain pool vegetation is sparse and concentrated on the pool margins and along soil cracks. In contrast, vegetation in other vernal pools typically covers the entire pool bottom. Moreover, alkali rain pools lack plant species characteristic of vernal pools. Instead, vegetation in alkali rain pools is composed of mostly annual, halophytic/alkali-tolerant species.

Wildlife

When wet, alkali rain pools on Madera Ranch provide habitat for crustaceans and other invertebrates, such as Lindahl's fairy shrimp (*Branchinecta lindahli*). Alkali fairy shrimp (*Branchinecta mackini*) and Lindahl's fairy shrimp are present in the alkali rain pools, indicating that the pH ranges from 6.9 to 9.6 (Jones & Stokes 2000). The longhorn fairy shrimp (*Branchinecta longiantenna*), a potential inhabitant of alkali rain pools, was not observed at Madera Ranch. San Joaquin tiger beetle (*Cicindela tranquebarica* ssp.) is present around the moist margins of the alkali rain pools and other slickspots. Brewer's blackbirds and a variety of shorebirds, including killdeer (*Charadrius vociferus)*, common snipe (*Gallinago gallinago*), long-billed dowitcher (*Limnodromus scolopaceus*), and least sandpiper (*Calidris minutilla*), forage for insects along the shores of the rain pools. In the dry season, this habitat is used by many of the same species associated with the alkali grasslands and dry vernal pool beds.

Regional Distribution

Alkali rain pools form a sensitive plant community that has been documented only at the Carrizo Plains, Madera Ranch, one site in Tulare County, and Semitropic Water Bank in Kern County. However, alkali rain pools are expected to occur at other locations where strongly saline/alkali soils are found. These soils occur primarily in the central trough of the Central Valley at the lower end of older alluvial fans, as described above for alkali grasslands. In Madera County, alkali rain pools are known only at Madera Ranch, although they could occur on other parcels in western Madera County where soils and vegetation are similar to those at Madera Ranch.

Great Valley Iodine Bush Scrub

Vegetation

Great Valley iodine bush scrub is an open or dense scrub community dominated by iodine bush. In typical Great Valley iodine bush scrub, cover of annual grasses and forbs is generally low, being inhibited by a high water table and soils that are highly saline or alkali (Holland 1986). At Madera Ranch, other perennial species associated with this community include interior goldenbush, locoweed, rusty molly (*Kochia californica*), alkali sacaton, and saltgrass. The herbaceous understory of Great Valley iodine bush scrub is similar to that of alkali grassland, with a high cover of grass and forb species except where slickspots are present. On Madera Ranch, cover of annual grasses and forbs is high, consistent with the fact that the water table is no longer close to the surface (see Section 4.1, Water Supply).

Wildlife

Wildlife species associated with this habitat include many of the same species found in the annual grassland habitat.

Regional Distribution

Great Valley iodine bush scrub is a sensitive plant community reported from about 30 scattered locations in the Central Valley, ranging from Contra Costa County to Kern County (California Natural Diversity Database 2008). Most of the occurrences are found in the basins along the trough of the Central Valley, where the water table historically was high. At Madera Ranch, this plant community is present in the northern half of Section 7 (Figure 4.5-1). Great Valley iodine bush scrub has also been reported along Avenue 12, on property adjacent to Madera Ranch.

Freshwater Marsh

Vegetation

Freshwater marsh is a wetland habitat dominated by emergent perennials, typically tules (*Schoenoplectus* spp.) or cattails (*Typha* spp.). Freshwater marsh occurs in the southeastern corner of Section 16 within the channel of the GF Canal (Figure 4.5-1). Dominant species include common bulrush (*Schoenoplectus acutus*), narrow-leaved cattail (*Typha angustifolia*), broad-leaved cattail (*T. latifolia*), and yellow cress (*Rorippa palustris*).

Wildlife

Representative wildlife species favoring this habitat include the Pacific treefrog, common garter snake (*Thamnophis sirtalis*), red-winged blackbird (*Agelaius phoeniceus*), mallard (*Anas platyrhynchos*), great egret (*Ardea alba*), and great blue heron (*Ardea herodias*).

Regional Distribution

Freshwater marsh is found throughout the Central Valley. Historically, freshwater marsh was extensive in the Delta and in the flood basins associated with the major river systems. Currently, the main occurrences are along sloughs associated with the larger river systems (Sacramento, San Joaquin, and others) or at wildlife refuges and duck clubs (California Natural Diversity Database 2008). Small pockets of freshwater marsh occur in many areas where standing water is present for all or much of the year, including both natural and human-made features such as irrigation and drainage canals and stock ponds. Freshwater marsh is a sensitive plant community because of state and federal policies and regulations mandating no net loss of wetlands.

Riparian Woodland

Vegetation

Riparian woodland is an open-canopied, tree-dominated habitat occurring along streams, adjacent to lakes and ponds, or on alluvial fans or floodplains where a high water table is present. The woody canopy is generally dominated by cottonwood (*Populus* spp.) or willow (*Salix* spp.) trees. The understory may be shrubby (willows, blackberry [*Rubus* spp.], wild rose [*Rosa* spp.], buttonwillow [*Cephalanthus occidentalis* var. *californicus*]) or composed primarily of herbaceous species, such as mugwort (*Artemisia douglasiana*).

At Madera Ranch, a stand of riparian woodland is present around the margins of the small pond in the southeastern corner of Section 28 (Figure 4.5-1). Cottonwood and willow trees also occur along the GF Canal on the western side of Section 22.

Wildlife

Riparian woodland habitat provides foraging and breeding habitat for many wildlife species. Swainson's hawk (*Buteo swainsoni)*, American kestrel (*Falco sparverius*), great horned owl (*Bubo virginianus*) and mourning dove use the larger cottonwoods in this habitat for roosting and perching between foraging trips. Downy woodpecker (*Picoides pubescens*) and house finches (*Carpodacus mexicanus*) also nest in the trees.

Regional Distribution

Riparian woodland occurs at scattered locations throughout the Central Valley, primarily along rivers and streams. Isolated patches of habitat occur around farm ponds or along drainage canals. In Madera County, riparian woodland occurs along the San Joaquin, Fresno, and Chowchilla Rivers. Riparian woodland is a sensitive plant community at Madera Ranch because it is locally and regionally uncommon.

Cultivated Lands

Madera Ranch includes approximately 2,700 acres of land currently in agricultural production and approximately 1,500 acres of land that previously have been cultivated (Figure 4.5-1). Lands currently in agricultural production are planted with cotton and vineyards and lack native vegetation. Lands that have not been cultivated recently have reverted to California annual grassland and support wildlife associated with undisturbed grassland.

Other Habitats

Two other habitat types found at Madera Ranch are described below. These habitats are a small pond and bird-nesting habitat. Bird-nesting habitat is located within previously described habitats and communities.

Pond

A 2-acre pond is located in the southeastern corner of Section 28 (Figure 4.5-1). The hydrology of this wetland is artificially maintained. The pond is connected to Cottonwood Creek via a culvert that was constructed in the 1990s. GFWD occasionally diverts water from Cottonwood Creek into the pond, and inflow is controlled by a gate valve. If the water level in the pond is high enough, a portion of the water stored in the pond can be returned to Cottonwood Creek when needed.

The pond is vegetated by vernal pool species and ruderal wetland species characteristic of disturbed seasonal wetlands such as stock ponds or detention basins. The species present include bracted popcornflower, purslane speedwell

(*Veronica peregrina*), dock (*Rumex* spp.), weedy cudweed (*Gnaphalium luteo-album*), hyssop loosestrife (*Lythrum hyssopifolium*), and yellow cress (*Rorippa* spp.). A stand of riparian woodland dominated by Fremont cottonwood (*Populus fremontii* ssp. *fremontii*) and black willow (*Salix gooddingii*) is present around the margins. Barn swallows (*Hirundo rustica*), several species of bats (*Myotis* spp.), and common nighthawks (*Chordeiles minor*) forage over the pond, and raccoons (*Procyon lotor*), striped skunks (*Mephitis mephitis*), and deer mice (*Peromyscus maniculatus*) likely find food and water along the edges of the basin.

Ponds are a common habitat in the Central Valley. No sensitive plants are present in the pond at Madera Ranch.

Bird Nesting Habitat

There are four distinct nesting habitats on Madera Ranch: grassland habitats, tree habitats, tule/shrub habitats, and agricultural land. Grassland nesting habitat is the most abundant on site. The diversity in soil types, frequency of burrows, and grassland cover provide several ecological niches for nesting. Key grassland nesting species on site include:

- killdeer,
- western burrowing owl,
- western meadowlark,
- California horned lark, and
- savannah sparrow (*Passerculus sandwichensis*).

Tree nesting habitat is more limited on Madera Ranch, but there are approximately 2 dozen trees that provide suitable nesting habitat. Most of these trees are near ranching facilities; several are along GF Canal; and another cluster of nesting trees is in the riparian woodland in Section 28.

Tule/shrub nesting habitats also are limited on Madera Ranch. Tule nesting habitat is located along GF Canal in the southeast corner of Section 16. Shrub nesting habitats are found along GF Canal and other agricultural drainage ditches (Figure 4.5-1). Tule/shrub nesting species on site include song sparrow (*Melospiza melodia*) and red-winged blackbird (*Agelaius phoeniceus*).

Agricultural land also can provide nesting habitat depending on the crop type and cropping patterns. Agricultural land in alfalfa production, including land in Sections 1, 4, 13, 14, 16, 21 and 22, could provide foraging habitat for tricolored blackbirds (*Agelaius tricolor*).

Threatened and Endangered Species

Threatened and Endangered Plants

Five plants listed by USFWS as threatened or endangered under the federal Endangered Species Act (ESA), or species that are candidates for possible future listing as threatened or endangered under ESA, are known to occur in the vicinity of Madera Ranch: palmate-bracted bird's-beak (*Cordylanthus palmatus*), succulent owl's-clover, San Joaquin Orcutt grass, hairy Orcutt grass, and Greene's tuctoria. None of these species was located on Madera Ranch during the botanical surveys.

Palmate-Bracted Bird's-Beak

Palmate-bracted bird's-beak is a federally and state-listed endangered species that was collected along Firebaugh-Madera Road in 1937 (California Natural Diversity Database 2008). Sections 6 and 7 are adjacent to the location of this occurrence. Palmate-bracted bird's-beak grows in chenopod scrub and alkali meadows in association with iodine bush, common glasswort (*Salicornia subterminalis*), bush seepweed, western borax-weed, saltgrass, alkali heath, common spikeweed, and low barley (California Natural Diversity Database 2008). This habitat occurs in the northern half of Section 7. Jones & Stokes surveyed the northern half of Section 7 and detected no palmate-bracted bird's-beak. However, there remains a possibility that palmate-bracted bird's beak is present in the seed bank and in other alkali grassland areas (Cypher pers. comm.).

Succulent Owl's-Clover

Succulent owl's-clover (*Castilleja campestris* ssp. *succulenta*) is federally listed as threatened and state-listed as endangered. It occurs in northern hardpan vernal pools in association with coyote thistle (*Eryngium castrense*), stipitate popcornflower (*Plagiobothrys stipitatus*), white-headed navarretia (*Navarretia leucocephala*), Fremont's goldfields, tricolor monkeyflower (*Mimulus tricolor*), woolly marbles, and downingia (*Downingia* spp.) (California Natural Diversity Database 2008). Madera Ranch is outside the known range for succulent owl's-clover, and northern hardpan vernal pools, which are habitat for the species, do not occur on Madera Ranch. Therefore, succulent owl's-clover is presumed to be absent from the site

Orcutt Grasses

Three Orcutt grasses (*Orcuttia* spp. and *Tuctoria greenei*; San Joaquin Orcutt grass [*Orcuttia inaequalis*], hairy Orcutt grass [*Orcuttia pilosa*], and Greene's tuctoria [*Tuctoria greenei*]) are present in the Madera Ranch vicinity. San Joaquin Orcutt grass is federally listed as threatened and state-listed as endangered. Hairy Orcutt grass is both federally and state-listed as endangered. Greene's tuctoria is federally listed as endangered and state-listed as rare. All three species occur in large, deep northern hardpan vernal pools (California Natural Diversity Database 2008). Madera Ranch is outside of the known range for these three species, and northern hardpan vernal pools, which are habitat for the species, do not occur on Madera Ranch. Therefore, most Orcutt grasses are presumed to be absent from the site. However, there remains a possibility that Greene's tuctoria is present (Cypher pers. comm.).

Threatened, Endangered, and Other Sensitive Wildlife

Table 4.5-3 lists the federally listed wildlife species that occur, or potentially could occur, at Madera Ranch. The listing status, distribution, habitat requirements, and estimated probability of occurrence at Madera Ranch are also presented. There is no designated critical habitat on Madera Ranch.

The two federally listed species documented as occurring on Madera Ranch during the biological surveys are vernal pool fairy shrimp and blunt-nosed leopard lizard.

San Joaquin kit foxes have been documented previously near Madera Ranch, but none were seen on the property during the surveys conducted for this study. The grassland habitats of Madera Ranch provide suitable habitat for Fresno kangaroo rats, and records from CNDDB and university museum collections show this area to be within the historical distributional range of this species. However, the field transect and trapping surveys conducted for this study did not document the presence of Fresno kangaroo rats at Madera Ranch.

Additionally, none of the following species was documented during surveys conducted to date, although limited suitable habitat is present for them at Madera Ranch:

- vernal pool tadpole shrimp (*Lepidurus packardi*),
- Conservancy fairy shrimp (*Branchinecta conservatio*),
- mid-valley fairy shrimp (*Branchinecta mesovallensis*),
- California tiger salamander, (*Ambystoma californiense [=A. tigrinum c.]*)
- California horned lizard (*Phrynosoma coronatum frontale*),
- silvery legless lizard (*Anniella pulchra pulchra*), and
- American peregrine falcon (*Falco peregrinus*)

Table 4.5-3. Special-Status Wildlife Species Occurring or Potentially Occurring at the Project Site

Species Name	Status[a] Fed/State	California Distribution	Habitat Requirements	Occurrence on Madera Ranch
Invertebrates				
Vernal pool fairy shrimp *Branchinecta lynchi*	T/–	Central Valley, interior North and South Coast Ranges; from Tehama County to Santa Barbara County; isolated populations also in Riverside County	Vernal pools; also found in sandstone rock outcrop pools	Documented in vernal pools on Madera Ranch
Vernal pool tadpole shrimp *Lepidurus packardi*	E/–	Shasta County to Merced County	Vernal pools and ephemeral stock ponds	Not recorded from Madera County. Not found during surveys
Conservancy fairy shrimp *Branchinecta conservatio*	E/–	Disjunct occurrences in Solano, Merced, Tehama, Butte, and Glenn Counties	Large, deep vernal pools in annual grasslands	Not recorded from Madera County. Not found during surveys
Longhorn fairy shrimp *Branchinecta longiantenna*	E/–	Eastern margin of South Coast Ranges from Contra Costa County to San Luis Obispo County and in Merced County	Small, clear to moderately turbid, clay- or grass-bottomed pools in sandstone rock outcrops	Not recorded from Madera County. Not found during surveys
Mid-valley fairy shrimp *Branchinecta mesovalliensis*	–/–	Sacramento, Solano, Contra Costa, San Joaquin, Madera, Merced, and Fresno Counties	Shallow vernal pools; vernal swales; and various artificial ephemeral wetland habitats, including roadside puddles, scrapes, and ditches	Not found during surveys
Insects				
San Joaquin tiger beetle *Cicindela tranquebarica* ssp.	–/–	San Joaquin Valley and Carrizo Plain	Alkali and clay flats, sand dunes, sand bars, beeches, and sandy soils	Documented on Madera Ranch
Amphibians				
Western spadefoot *Scaphiopus hammondii*	–/SSC	Sierra Nevada foothills, Central Valley, Coast Ranges, coastal counties in southern California	Shallow streams with riffles and seasonal wetlands, such as vernal pools in annual grasslands and oak woodlands	Widespread occurrence in Madera County. Documented on Madera Ranch during surveys

Species Name	Status[a] Fed/State	California Distribution	Habitat Requirements	Occurrence on Madera Ranch
California tiger salamander *Ambystoma californiense (=A. tigrinum c.)*	T/-	Central Valley, including Sierra Nevada foothills below approximately 1,000 feet, and coastal regions; from Butte County south to Santa Barbara County	Small ponds, lakes, or vernal pools in grasslands and oak woodlands for larvae; rodent burrows, rock crevices, or fallen logs for cover for adults and for summer dormancy	Widespread occurrence in Madera County. Not found during surveys but suitable habitat occurs on Madera Ranch
Reptiles				
Blunt-nosed leopard lizard *Gambelia (=Crotaphytus) sila*	E/E, FP	San Joaquin Valley from Stanislaus County through Kern County and along eastern edges of San Luis Obispo and San Benito Counties	Open habitats with scattered low bushes on alkali flats, and low foothills, canyon floors, plains, washes, and arroyos; substrates may range from sandy or gravelly soils to hardpan	Historically documented on-site in Sections 5 and 29; suitable habitats present in slickspots and other open habitats on Madera Ranch; transect surveys conducted in May 2009 confirmed that this species is present
Giant garter snake *Thamnophis gigas*	T/T	Central Valley from Fresno north to Gridley/Sutter Buttes area; has been extirpated from areas south of Fresno	Sloughs, canals, and other small waterways where there is a prey base of small fish and amphibians; requires grassy banks and emergent vegetation for basking and areas of high ground protected from flooding during winter	Documented at Mendota Pool; but not found during surveys on Madera Ranch. Unlikely to occur there because of limited and marginal habitat and lack of connectivity to populations outside Madera Ranch
California horned lizard *Phrynosoma coronatum frontale*	–/SSC	Sacramento Valley, including foothills, south to southern California; Coast Ranges south of Sonoma County; below 4,000 feet in northern California	Grasslands, brushlands, woodlands, and open coniferous forests with sandy or loose soil; requires abundant ant colonies for foraging	Widespread occurrence in Madera County. Suitable habitat on Madera Ranch, but none observed during wildlife surveys
Silvery legless lizard *Anniella pulchra pulchra*	–/SSC	Along Coast, Transverse, and Peninsular Ranges from Contra Costa County to San Diego County, with spotty occurrences in San Joaquin Valley	Habitats with loose soil for burrowing or thick duff or leaf litter (often forages in leaf litter at plant bases); may be found on beaches, sandy washes, and in woodland, chaparral, and riparian areas	Possible occurrence. Documented in San Joaquin Valley. Is a subterranean species. Suitable habitat exists on Madera Ranch

Species Name	Status[a] Fed/State	California Distribution	Habitat Requirements	Occurrence on Madera Ranch
Birds				
Swainson's hawk *Buteo swainsoni*	–/T	Lower Sacramento and San Joaquin Valleys, Klamath Basin, and Butte Valley; highest nesting densities occur near Davis and Woodland, Yolo County	Nests in oaks or cottonwoods or near riparian habitats; forages in grasslands, irrigated pastures, and grainfields	Nesting pairs documented in the center of the property; high potential to use Madera Ranch for foraging
Mountain plover *Charadrius montanus*	PT/SSC	Does not breed in California; in winter, found in Central Valley south of Yuba County, along the coast in parts of San Luis Obispo, Santa Barbara, Ventura, and San Diego Counties and in parts of Imperial, Riverside, Kern, and Los Angeles Counties	Open plains or rolling hills with short grasses or very sparse vegetation; nearby bodies of water are not needed; may occupy newly plowed or sprouting grainfields	Documented in nearby areas of San Joaquin Valley; may occur seasonally on Madera Ranch but not known to breed there
White-tailed kite *Elanus leucurus*	–/FP	Yearlong resident in coastal and valley lowlands, closely associated with agricultural areas	Inhabits herbaceous and open spaces of most habitats in cismontane California	Documented in and probably nests on Madera Ranch
Ferruginous hawk *Buteo regalis*	–/SSC	Does not nest in California; winter visitor along the coast from Sonoma County to San Diego County, eastward to Sierra Nevada foothills and southeastern deserts, Inyo-White Mountains, plains east of Cascade Range, and Siskiyou County	Open terrain on plains and in foothills where ground squirrels and other prey are available	Documented on Madera Ranch. Seasonal occurrence during migration only. Good foraging habitat on Madera Ranch, but does not breed there
Long-billed curlew *Numenius americanus*	–/SSC	Nests in northeastern California in Modoc, Siskiyou, and Lassen Counties; winters along the coast and in interior valleys west of Sierra Nevada	Nests in high-elevation grasslands adjacent to lakes or marshes; during migration and in winter, frequents coastal beaches, mudflats, interior grasslands, and agricultural fields	Documented on Madera Ranch; winter foraging flocks. Does not breed on Madera Ranch
Western burrowing owl *Athene cunicularia*	–/SSC	Lowlands throughout California, including Central Valley, northeastern plateau, southeastern deserts, and coastal areas; rare along South Coast	Level, open, dry, heavily-grazed or low-stature grassland or desert vegetation with available burrows	Nesting pairs documented throughout upland habitats on Madera Ranch. Extensive foraging habitat on Madera Ranch

Species Name	Status[a] Fed/State	California Distribution	Habitat Requirements	Occurrence on Madera Ranch
Loggerhead shrike *Lanius ludovicianus*	C/SSC	Resident and winter visitor in lowlands and foothills throughout California; rare on coastal slope north to Mendocino County, occurring only in winter	Open habitats with scattered shrubs, trees, posts, fences, utility lines, or other perches	Documented on and likely breeds on Madera Ranch
Tricolored blackbird *Aglaius tricolor*	–/SSC	Permanent resident in Central Valley from Butte County to Kern County; breeds at scattered coastal locations from Marin County south to San Diego County and at scattered locations in Lake, Sonoma, and Solano Counties; rare nester in Siskiyou, Modoc, and Lassen Counties	Nests in dense colonies in emergent marsh vegetation, such as tules and cattails, or upland sites with blackberries, nettles, thistles, and grainfields; habitat must be large enough to support 50 pairs; probably requires water at or near nesting colony	Documented on Madera Ranch; high-quality foraging habitat throughout uplands. Nomadic breeder, so occurrence on Madera Ranch is probably irregular
Golden eagle *Aquila chrysaetoss*	–/FP	Nests in Siskiyou, Modoc, Trinity, Shasta, Lassen, Plumas, Butte, Tehama, Lake, and Mendocino Counties and in Lake Tahoe Basin; reintroduced into central coast; winter range includes the rest of California, except southeastern deserts, very high altitudes in Sierra Nevada, and east of Sierra Nevada south of Mono County	In western North America, nests and roosts in coniferous forests within 1 mile of a lake, reservoir, stream, or the ocean	Documented in foraging on grasslands
Bald eagle *Haliaeetus leucocephalus*	D/E, FP	Nests in Siskiyou, Modoc, Trinity, Shasta, Lassen, Plumas, Butte, Tehama, Lake, and Mendocino Counties and in Lake Tahoe Basin; reintroduced into central coast; winter range includes the rest of California, except southeastern deserts, very high altitudes in Sierra Nevada, and east of Sierra Nevada south of Mono County	In western North America, nests and roosts in coniferous forests within 1 mile of a lake, reservoir, stream, or the ocean	Documented in Madera County; lack of habitat on Madera Ranch; could potentially forage for waterfowl using artificial pond and proposed recharge basins

Species Name	Status[a] Fed/State	California Distribution	Habitat Requirements	Occurrence on Madera Ranch
American peregrine falcon *Falco peregrinus anatum*	E/E, FP	Permanent resident along North and South Coast Ranges; may summer in Cascade and Klamath Ranges and through Sierra Nevada to Madera County; winters in Central Valley south through Transverse and Peninsular Ranges and plains east of Cascade Range	Nests and roosts on protected ledges of high cliffs, usually adjacent to lakes, rivers, or marshes that support large prey populations	Documented in Madera County. May occur incidentally on Madera Ranch while foraging
Mammals				
San Joaquin pocket mouse *Perognathus inornatus*	–/–	Eastern side of San Joaquin Valley	Grasslands and oak savannas with friable soils	Documented on Madera Ranch and in Madera County near project site
Fresno kangaroo rat *Dipodomys nitratoides exilis*	E/E	Fresno County only	Found in alkali-sink habitats at elevations from 200 to 300 feet	Historic records of occurrence adjacent to Madera Ranch. Potential burrows for this species present throughout upland habitats on Madera Ranch, although extensive surveys revealed no Fresno kangaroo rats. No extant populations of this species are known
San Joaquin kit fox *Vulpes macrotis mutica*	E/T	Principally occurs in San Joaquin Valley and adjacent open foothills to the west; recent records show this species present in 17 counties, extending from Kern County north to Contra Costa County	Saltbush scrub, grasslands, oak, savannas, and freshwater scrub	Documented in Madera County near Madera Ranch; suitable burrow sites were present in every section, but no positive evidence of occurrence obtained during wildlife surveys

Species Name	Status[a] Fed/State	California Distribution	Habitat Requirements	Occurrence on Madera Ranch
Nelson's antelope ground squirrel *Ammospermophilus nelsoni*	–/T	Western side of San Joaquin Valley from southern Merced County south to Kern and Tulare Counties; also found on Carrizo Plain in San Luis Obispo County and Cuyama Valley in San Luis Obispo and Santa Barbara Counties	Arid grasslands from 200 to 1,200 feet in elevation, with loamy soils and moderate shrub cover of *Atriplex* and other shrub species	Madera Ranch is within subspecies' historical range, but no documented occurrences. None observed during extensive wildlife surveys on Madera Ranch. Not likely to occur there

[a] Species status definitions

Federal

E = listed as endangered under the federal Endangered Species Act (ESA).
T = listed as threatened under ESA.
PT = proposed for federal listing as threatened under ESA.
PD = federally proposed for delisting.
– = no listing.

State

E = listed as endangered under the California Endangered Species Act (CESA).
T = listed as threatened under CESA.
FP = fully protected under the California Fish and Game Code.
SSC = species of special concern in California.
– = no listing.

Sources: California Natural Diversity Database 2004 and Jones and Stokes file data.

Invertebrates

Vernal Pool Fairy Shrimp. The vernal pool fairy shrimp is listed as threatened under ESA. Vernal pool fairy shrimp were documented in several pools on Madera Ranch during reconnaissance surveys. Vernal pool and alkali rain pool habitat on Madera Ranch is potentially suitable for this species. Wetland areas with greater disturbance, like those in GF Canal and near the property boundary in Section 28, are less likely to support this species because of agricultural contamination (Figure 4.5-1).

Vernal Pool Tadpole Shrimp. The vernal pool tadpole shrimp is listed as threatened under ESA. Vernal pool and alkali rain pools are the most suitable habitat for this species on Madera Ranch, but no tadpole shrimp have been documented.

Conservancy Fairy Shrimp. The Conservancy fairy shrimp is a federally listed endangered species. In contrast to the habitat requirements of vernal pool fairy shrimp and vernal pool tadpole shrimp, vernal pool and alkali rain pool habitat on Madera Ranch is least suitable for Conservancy fairy shrimp because the species normally inhabits large, turbid pools called playa pools (Eriksen and Belk 1999; Vollmar 2002), and there are few of these large, turbid pools on the Madera Ranch site. No Conservancy fairy shrimp have been documented in the Madera Ranch area. However, there remains a possibility that this species is present on the property (Owens pers. comm.).

Mid-Valley Fairy Shrimp. The mid-valley fairy shrimp is not listed under ESA. The USFWS recently reviewed a petition to list this species and determined that listing is not warranted at this time. Its habitat requirements are similar to those of vernal pool fairy shrimp and vernal pool tadpole shrimp, but the species has not been documented at Madera Ranch.

Insects

San Joaquin Tiger Beetle. The San Joaquin tiger beetle is not a federally or state-listed species but is considered sufficiently rare by the scientific community to qualify for such listing. Most habitats on Madera Ranch are suitable for this species, although alkali scalds and vernal pools are most suitable because these habitat types provide foraging opportunities (Figure 4.5-1). Several live individuals, one dead individual, and other signs of beetle activity were documented at Madera Ranch.

Amphibians

Western Spadefoot Toad. The western spadefoot toad is designated as a species of special concern by DFG. Western spadefoot toad tadpoles were observed in GF

Canal in 2000, in Sections 4 and 9. Vernal and alkali rain pools are potential breeding and estivation habitat for this species. Wetlands near the property boundary in Section 28 are less likely to support this species because of their connectivity to other sources of water that support mosquitofish (*Gambusia affinis*) and bullfrogs (*Rana catesbeiana*) (Figure 4.5-1).

California Tiger Salamander. The California tiger salamander is federally listed as threatened. Vernal and alkali rain pools are potential breeding habitat for this species, and upland areas within approximately 1 mile of a wetland are potential nonbreeding areas. Madera Ranch has suitable habitat for this species and is within its historical distribution range, but no evidence of California tiger salamanders was found during reconnaissance surveys conducted for amphibians while surveying for vernal pool crustaceans.

California Red-Legged Frog. The California red-legged frog is federally listed as threatened. The California red-legged frog was likely never common on the valley floor, and subsequent habitat destruction and modification, as well as many years of pesticide use, appear to have extirpated the species from this portion of its former range. No on-site habitat was considered suitable for this species.

Reptiles

Blunt-Nosed Leopard Lizard. The BNLL is listed as endangered under California Endangered Species Act (CESA) and ESA and as a fully protected species under the California Fish and Game Code. Historical records indicate the presence of BNLL in the vicinity of Madera Ranch and on Madera Ranch in 1987. The approximately 4,044 acres of alkali grassland habitat and high kangaroo rat burrow density make much of Madera Ranch suitable for BNLL (Table 4.5-1 and Figure 4.5-1). Transect surveys conducted in May 2009 confirmed that this species is present.

Giant Garter Snake. The giant garter snake (*Thamnophis gigas*) is listed as threatened under CESA and ESA. The giant garter snake has been documented at Mendota Pool (California Natural Diversity Database 2004), but no records of this species have been documented on Madera Ranch. Although limited marginal habitat for this species exists along the GF Canal in Section 16, it is not viably connected with any areas of documented occurrences in the vicinity (Figure 4.5-1). The giant garter snake was not located during surveys and is not likely to occur in this area. Similarly, because of significant regional population declines, no extant records within Madera County, the prolonged periods of dryness, seasonal fluctuation of water, and lack of consistent prey base, giant garter snake is unlikely to be within the canals of Mendota Wildlife Management Area (MWMA).

California Horned Lizard. The California horned lizard is a California species of special concern. The Madera Ranch area is in the historical range of the California horned lizard, and the property contains suitable habitat, although none was observed during extensive transect surveys.

Silvery Legless Lizard. The silvery legless lizard is listed as a California species of special concern. Madera Ranch is within the historical range of the silvery legless lizard and includes suitable habitat. Silvery legless lizards live primarily in the soil and would not have been readily detected during the field surveys conducted during summer 2000.

Birds

Swainson's Hawk. The Swainson's hawk is listed as threatened under CESA. Nesting sites and potential breeding Swainson's hawk pairs have been documented on Madera Ranch near ranch headquarters in Section 16. All habitats on Madera Ranch provide suitable foraging habitat from March through September when the species may be present. There is limited nesting habitat because of the relatively few trees on site (Figure 4.5-1).

White-Tailed Kite. The white-tailed kite is designated as a fully protected species under the Fish and Game Code. The white-tailed kite nests in all 14 ecological zones throughout its range in California. Madera Ranch is located in one of these zones, and pairs of kites have been sighted on the property and could be present year-round. It could breed in the Fremont cottonwoods in Section 28 or other mature trees around the ranch. Annual and alkali grasslands provide suitable foraging habitat for this species (Figure 4.5-1).

Ferruginous Hawk. The ferruginous hawk is designated as a state species of special concern by DFG. Ferruginous hawks were documented at Madera Ranch during the October, November, and December 2000 and January 2001 surveys. It is a migratory visitor to this area and does not breed there. Annual and alkali grasslands provide suitable foraging habitat for this species (Figure 4.5-1).

Long-Billed Curlew. The long-billed curlew is designated as a bird of conservation concern by USFWS and a species of special concern by DFG. A wintering population of approximately 200 long-billed curlews has been documented from October to March on Madera Ranch. Annual and alkali grasslands provide suitable habitat for foraging or rest during wintering migration (Figure 4.5-1), but the long-billed curlew is not expected to nest at Madera Ranch.

Western Burrowing Owl. The western burrowing owl is designated as a species of special concern by DFG and is covered under the Migratory Bird Treaty Act (MBTA). Numerous burrowing owls were observed and documented at Madera Ranch during transect surveys. Annual and alkali grasslands provide suitable foraging and nesting habitat for this species (Figure 4.5-1).

Loggerhead Shrike. The loggerhead shrike is a federal bird of conservation concern and a state species of special concern. Loggerhead shrikes have been documented throughout the Madera Ranch area. Annual and alkali grasslands provide suitable foraging habitat, and some nesting habitat exists along GF Canal and cultivated portions of the property (Figure 4.5-1).

Tricolored Blackbird. The tricolored blackbird is designated as a state species of special concern by DFG. It is also designated as a migratory nongame bird of management concern by USFWS. The Madera Ranch area is in the historical range of the tricolored blackbird, and the ranch contains suitable habitat. Several hundred tricolored blackbirds were documented foraging between the agricultural land and grassland in Section 16. There is very little wetland breeding habitat; however, there is ample foraging habitat in the alfalfa fields to support a large breeding colony of thousands of pairs (Figure 4.5-1). This species tends to be nomadic in its breeding, selecting different locations different years depending on suitability and availability of the habitat.

Golden Eagle. The golden eagle is a fully protected species by DFG and is federally protected under the Bald and Golden Eagle Protection Act (BGEPA). Golden eagles have been detected periodically foraging on Madera Ranch.

Bald Eagle. The bald eagle is federally protected under the BGEPA, is endangered under CESA, and is a fully protected species under the California Fish and Game Code. Bald eagles could periodically forage on Madera Ranch, but regionally have primarily been found foraging and nesting around Millerton Lake.

American Peregrine Falcon. The American peregrine falcon is listed as endangered under the ESA and CESA and is a fully protected species under the California Fish and Game Code. No American peregrine falcons were observed on Madera Ranch during the October, November, and December 2000 and January 2001 wintering bird surveys. All habitats on Madera Ranch, particularly the annual and alkali grasslands (Figure 4.5-1), provide suitable foraging habitat for this species. This species is not likely to breed on Madera Ranch.

Mammals

San Joaquin Pocket Mouse. The San Joaquin pocket mouse is not a federally or state-listed species but is considered sufficiently rare by the scientific community to qualify for such listing. Annual and alkali grasslands provide suitable habitat for this species, and San Joaquin pocket mice were captured throughout Madera Ranch during small mammal trapping (Figure 4.5-1).

Fresno Kangaroo Rat. The Fresno kangaroo rat was state-listed as endangered on October 20, 1980, and federally listed as endangered on January 30, 1985. Madera Ranch has suitable grassland habitat for Fresno kangaroo rats, but none have been identified on Madera Ranch, despite live trapping surveys (11,120 trap-nights) conducted in suitable habitat throughout Madera Ranch. Much of the habitat on Madera Ranch is homogeneous, likely a result of the long history of cattle grazing, making the property less suitable for the Fresno kangaroo rat. Currently, no extant populations or individuals are known to exist anywhere.

San Joaquin Kit Fox. The San Joaquin kit fox was listed as endangered by the USFWS in 1967 and by the state in 1971. San Joaquin kit foxes have been previously documented in Madera County near Madera Ranch (T12S R14E) (California Natural Diversity Database 2004), but none on Madera Ranch during transect, spotlighting, or camera/bait station surveys. Numerous burrow dens potentially suitable for kit fox were observed in every section of Madera Ranch during the surveys, but none of them contained direct evidence of kit fox occupancy (e.g., scat, fur, natal pups, etc.).

4.5.4 Analysis of Environmental Effects

Potential effects on biological resources and measures to avoid, minimize, or compensate for identified effects are described below.

Methods

Approach

The approach used to analyze effects of the Proposed Action on habitat, plants, and wildlife is to:

- conduct extensive biological surveys to document botanical and wildlife resources on Madera Ranch;
- draw conclusions regarding species populations on the Madera Ranch site from these surveys, based on the presence or absence of habitat, plant communities, and wildlife;
- identify effect mechanisms to analyze effects of the alternatives; and
- determine the extent and duration of effects.

Effect Mechanisms

The Proposed Action could affect up to approximately 2,100 acres of Madera Ranch. Of this amount, approximately 130 acres currently are cultivated. MID would deliver surface water to approximately 700 acres of swales on a seasonal basis and would construct canals, ditches, and pipelines to convey the water to and from its facilities on Madera Ranch. MID would drill wells, install pump heads, and construct lift stations on the 24.2 Canal and the Main No. 2 Canal to deliver recovered water back into MID’s system. As needed, MID would construct as much as approximately 1,000 acres of engineered recharge basins to supplement the recharge capacity of the swales (Table 4.5-4 and Figure 4.5-2).

Table 4.5-4. Effects of Project Action Alternatives on Madera Ranch Habitats

	Effect (acres[a])			
Habitat	Flooding Swales	Temporary Construction Effects	Permanent Construction Effects[b]	No Anticipated Effect
Alternative B				
California annual grassland	660	178	790	4,850
Alkali grassland	30	100	230	3,698
Vernal pool	5.5	0.04	0.1	15.8
Great Valley iodine brush scrub	10	0	0	280
Freshwater marsh	No effect	0.1	2.0	0
Alkali rain pool	0.4	1.0	1.1	13.1
Riparian woodland	No effect	No effect	2	2
Cultivated lands	No effect	70	60	2,615
Pond	No effect	No effect	No effect	2
Total	**705.9**	**349.14**	**1085.2**	**11,476**
Alternative C				
California annual grassland	No effect	178	790	4,850
Alkali grassland	No effect	100	230	3,698
Vernal pool	No effect	0.04	0.1	21.3
Great Valley iodine brush scrub	No effect	0	0	280
Freshwater marsh	No effect	0.1	2.0	0
Alkali rain pool	No effect	1.0	1.1	13.1
Riparian woodland	No effect	No effect	2	2
Cultivated lands	No effect	70	60	2,615
Pond	No effect	No effect	No effect	2
Total	**No effect**	**349.14**	**1,085.2**	**11,481.4**
Alternative D				
California annual grassland	660	178	790	4,850
Alkali grassland	30	100	230	3,698
Vernal pool	5.5	0.04	0.1	15.8
Great Valley iodine brush scrub	10	0	0	280
Freshwater marsh	No effect	0.1	2.0	0
Alkali rain pool	0.4	1.0	1.1	13.1
Riparian woodland	No effect	No effect	2	2

Habitat	Effect (acres[a]) Flooding Swales	Temporary Construction Effects	Permanent Construction Effects[b]	No Anticipated Effect
Cultivated lands	No effect	70	60	2,615
Pond	No effect	No effect	No effect	2
Total	**705.9**	**349.14**	**1085.2**	**11,476**

[a] Temporary effects include the effects associated with extraction facilities.

[b] Permanent effects include up to 40 acres of facilities in Phase 1. The total reflects conservative assumptions that all Phase 2 recharge bases would be constructed under the Alternative. Phase 2 recharge bases would only be constructed as required to augment Phase 1 recharge facilities. Acreages associated with construction of the Phase 2 recharge basins are apportioned across habitat types within a 1,300-acre area.

Project elements within water bodies and uplands are summarized in Table 4.5-5.

Table 4.5-5. Project Elements within Water Bodies and Uplands

Project Elements	U.S. Water Subject to CWA 404	Approximate Length/ Surface Area/Cut/Fill
Proposed Water Body Components		
Section 8 Canal, Cottonwood Creek, and Main No. 1 Canal Connection Upgrade (Section 8 Canal/Cottonwood Creek Connection)	Yes	250 lf cut
Gravelly Ford Canal Sedimentation Basin and Flow Regulation Area (Weir #1)	Yes	500 sf
Gravelly Ford Canal Flow Control Weir at Cottonwood Creek (Weir #2)	Yes	500 sf
Cottonwood Creek overflow improvements (rock slope protection)	Yes	350 lf
Reconditioning of existing canals and ditches (canal maintenance)	Yes	Excavation to previous shape
Reconditioning of existing canals and ditches (canal maintenance)	Yes	75 sf each
Planned Water Body Components		
Cottonwood Creek Lift Stations	Yes	500 sf each
Gravelly Ford Canal Section 21 Northern/Western Laterals	Yes	100 sf
Gravelly Ford Canal Section 22 Southern Lateral	Yes	100 sf
Upland Components		
24.2 Canal improvements	No	76,000 cy excavation
Section 8 Canal upgrades/extensions	No	57,000 cy excavation
Use of swales for recharge(1) (2)	No	No cut or fill. <6 acres vernal pool/alkali rain pool from use of swales

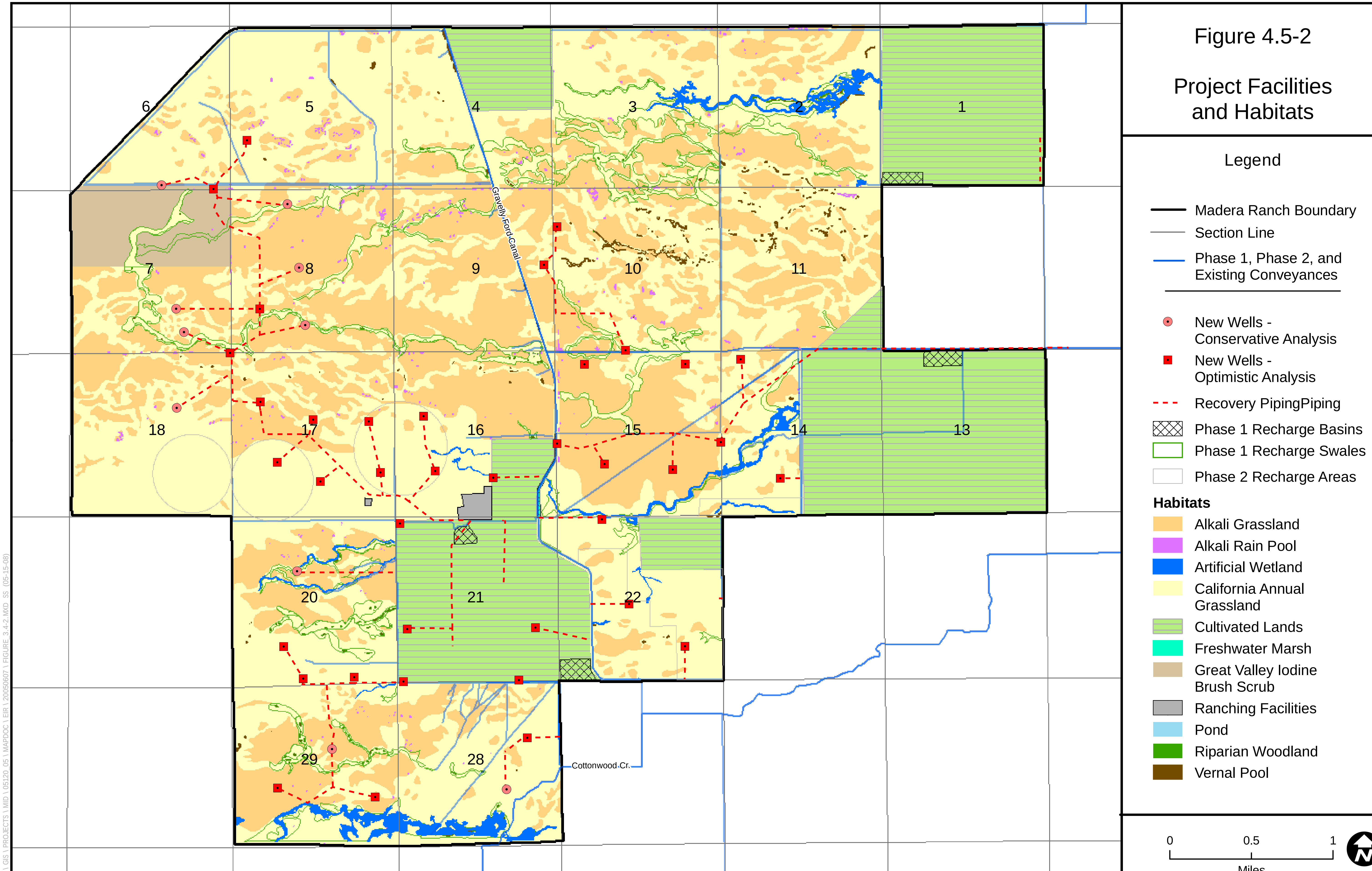


Figure 4.5-2

Project Facilities and Habitats

Project Elements	U.S. Water Subject to CWA 404	Approximate Length/ Surface Area/Cut/Fill
55 acres of recharge basins in agricultural lands	No	55 acres
1,000 acres of recharge basins in grasslands	No	444,000 cy excavation
Recovery wells	No	<0.1 acre/well
Recovery pipelines and electrical facilities (3)	No	<1.5 ac vernal pool/alkali rain pools from corridors

Notes:

[1] Vernal pools are located in swales and are subject to review under ESA Section 7.

[2] Swales not used for recharge under Alternative C. See Table 4.5-4 for vernal pool/alkali rain pool effects under Alternative C.

[3] Alternatives B, C, and D are the same for recovery facilities because the layout does not change.

CWA = Clean Water Act; lf = linear feet; sf = square feet; cy = cubic yards.

The Proposed Action could result in both direct and indirect effects. Activities that could result in direct effects on sensitive habitats and sensitive species include:

- flooding swales on a seasonal basis;
- excavating areas to construct recharge basins and distribution canals/ditches;
- disposing of soil from excavation activities;
- drilling recovery wells and building pump plants;
- trenching to install the distribution and collection pipelines;
- blading of existing access roads (annually) and pesticide use;
- during operation of recharge basins, applying algicide or other chemicals if necessary to keep vegetation in check and minimize algae growth;
- compacting soils by traffic on and adjacent to construction access corridors and staging areas and by vehicle use of maintenance roads;
- potentially spilling toxic substances from vehicles during construction and operations and maintenance;
- creating noise during construction and maintenance; and
- disturbing bird nests.

The Proposed Action also may cause indirect effects. Indirect effects occur later in time or are farther removed in distance but must be predictable and reasonably certain to occur in order to be assessed. Potential mechanisms of indirect effects on sensitive habitats and sensitive species include:

- changes in hydrology, such as altered patterns of runoff or changes to the surface water retention pattern and capacity and elevation of the perched water table;
- erosion and sedimentation that result from grading and other activities that remove vegetation;
- water quality effects from contaminants such as road runoff or pesticides; and
- introduction of invasive nonnative species, including mosquitofish and bullfrog.

The activities described above can result in both permanent and temporary effects. Effects were characterized as permanent if they would result in the conversion of habitat to nonhabitat for the life of the Proposed Action. The extent of permanent and temporary effects on habitats at Madera Ranch was estimated by overlaying the outline of proposed recharge basins, canals/ditches, extraction wells, pipelines, and maintenance roads (proposed footprint) on the map of habitats. The footprint for the buried pipelines, maintenance roads, and canals/ditches is estimated to be a linear corridor 10 feet wide. The proposed footprint for the extraction wells is estimated to be 0.1 acre each.

Regularly traveled maintenance roads could remain all or partially unvegetated for the life of the Proposed Action as a result of disturbance and soil compaction. During construction activities, individual plants could be uprooted, buried, or crushed.

Environmental Consequences

Alternative A—No Action

Under the No Action Alternative, Reclamation would not approve the banking of CVP water outside MID's service area, nor would Reclamation issue an MP-620 permit for modifications to its distribution system. Reclamation's action would have no adverse effects on biological resources. The future conditions would continue to support agricultural activities; the type and extent of the activities is uncertain at this time. Future owners would be subject to comply with CESA and ESA and the effects may be evaluated by the County under CEQA if discretionary permits are needed.

Alternative B—Water Banking outside the MID Service Area Using Swales and Alteration of Reclamation-Owned Facilities

Effect BIO-1: Temporary Disturbance of California Annual Grassland and Alkali Grassland during Construction

Construction activities (e.g., traffic, laydown, work areas) could remove approximately 178 acres of California annual grassland and 100 acres of alkali grassland (Table 4.5-4 and Figure 4.5-2). California annual grassland and alkali grassland are resilient plant communities, as demonstrated in Sections 14, 15, 16, 17, 18, and 22 at Madera Ranch, where they have recovered from previous cultivation (Figure 4.5-2). Effect BIO-1 is not expected to cause long-term degradation and therefore would not be considered adverse.

Effect BIO-2: Permanent Removal of California Annual Grassland and Alkali Grassland Habitats during Construction

Construction of the proposed recharge basins, canals/ditches, extraction wells, pipelines, and maintenance roads could permanently remove up to approximately 790 acres of California annual grassland and up to approximately 230 acres of alkali grassland habitats (Table 4.5-4 and Figure 4.5-2). Effect BIO-2 would be an adverse effect because it would substantially reduce the amount of this locally uncommon habitat. Environmental Commitment BIO-1: Establish a Grasslands Conservation Easement would compensate for this loss of habitat.

Effect BIO-3: Loss or Disturbance of Iodine Bush Scrub or Sensitive Plant Species Habitat as a Result of Construction

Iodine bush scrub habitat on Madera Ranch is limited to the northern half of Section 7 (Figure 4.5-2). Up to one well and a pipeline to deliver recovered groundwater back into MID's distribution system would be constructed in the northwest corner of the project area. Thus, activities associated with Effect BIO-3 could result in the loss or temporary disturbance of iodine bush scrub in Section 7. The effect would be considered adverse. Similarly, although previous botanical surveys indicated that state- and federally listed plants are not present, if there is a localized effect, it could be substantial to regional populations of iodine bush scrub. Therefore, Environmental Commitment BIO-3a: Avoid Effects on Iodine Brush Scrub and Environmental Commitment BIO-3b: Survey for Sensitive Plants are proposed.

Effect BIO-4: Potential for Construction-Related Mortality of Sensitive Vernal Pool Crustaceans

Excavating, grading, trenching, soil movement, soil compaction, and removal of vernal pools, alkali rain pools, or artificial wetlands could result in direct adverse effects on vernal pool crustaceans. (Impacts on wetlands are described in

Section 4-18, Wetlands.) Trenching and soil movement could result in indirect adverse effects by altering suitable habitat, such as changing the hydrology of or increasing sedimentation in the pools (Table 4.5-4).

Vernal pool fairy shrimp, listed as threatened under the ESA, was identified in several pools during surveys at Madera Ranch. No other vernal pool crustaceans were found during those surveys, although suitable habitat may be present. Construction activities would avoid most of the naturally occurring vernal pools. Vernal pools previously were mapped in GF Canal, but these have been inundated for the past several years and are unlikely to function as vernal pools.

Effect BIO-4 could have an adverse effect on vernal pool fairy shrimp and substantially reduce the local distribution of sensitive biological resources occurring at Madera Ranch. This effect is considered adverse and would be minimized and compensated for with the implementation of Environmental Commitment BIO-2a: Preconstruction Surveys/Avoid Effects on Vernal Pools and Alkali Rain Pools and Environmental Commitment BIO-2b: Create, Restore, or Preserve Vernal Pools.

Effect BIO-5: Potential for Operation- and Maintenance-Related Mortality of Sensitive Vernal Pool Crustaceans

Operation and maintenance of MID facilities could result in direct effects on vernal pool crustaceans. Flooding swales on a seasonal basis could result in degradation of vernal pool habitat for vernal pools within the swales and major adverse effects on vernal pool crustaceans in these areas. Temporary rapid expansion of the existing pools from uncontrolled flows could move extant crustaceans and their eggs to peripheral areas where they could be subject to increased mortality from desiccation and/or predation during subsequent rapid pool-size decrease as the waters percolate into the subsurface. Other operational effects are also possible.

As described in Section 4.11, Public Health and Safety, if the swales pond water and mosquitoes become an issue with the MCMAVCD, the abatement district may use mosquitofish to control mosquitoes. These fish also could prey on vernal pool species, should they survive prolonged inundation. However, the overall need for mosquitofish is expected to be low because water levels would fluctuate rapidly as water flows through the swales and generally would not persist after flows cease.

Furthermore, if swales are wet or moist year-round, they could become a dispersal corridor for bullfrogs. Bullfrogs could prey on vernal pool species. However, swales are not expected to be wet year-round and periodic drying of the swales would inhibit the establishment of bullfrogs in the interior of the property.

Maintenance of new permanent facilities will take place more than 250 feet from existing vernal pools, but adverse effects potentially could occur.

Effect BIO-5 is adverse because it could affect fairy shrimp occurring at Madera Ranch. This effect would be minimized and compensated for with the implementation of Environmental Commitment BIO-2a: Preconstruction Surveys/Avoid Effects on Vernal Pools and Alkali Rain Pools and Environmental Commitment BIO-2b: Create, Restore, or Preserve Vernal Pools.

Effect BIO-6: Potential for Construction-Related Mortality of San Joaquin Tiger Beetle

Construction activities and modification of annual grassland and alkali grassland, slickspots in particular, could have an adverse effect on the San Joaquin tiger beetle. The San Joaquin tiger beetle is not a federally or state-listed species but is sufficiently rare to be of concern. Most habitats on Madera Ranch are suitable for this species, although alkali scalds and vernal pools are most suitable because these habitat types provide foraging opportunities.

Some individual beetles could be killed from direct effects during construction activities and indirect effects caused by habitat modification. Excavating, grading, trenching, soil movement, soil compaction, and vehicle traffic in the Madera Ranch vicinity could result in direct effects on the species. Adults and larval beetles could be trapped inside their burrows during grading or trenching, crushed on the ground by construction-related vehicles, or disturbed to the point that they abandon their foraging areas. Construction activities near occupied habitats also could result in indirect effects. Trenching and soil movement could result in indirect effects such as altering the hydrology and soil microenvironment, making it unsuitable for egg deposition or larva habitation. Construction of the recharge basins could remove up to approximately 230 acres of alkali grassland containing slickspot habitat (Table 4.5-4).

Potential habitat for San Joaquin tiger beetle is widely distributed, and construction would disturb less than 10% of its potential habitat on Madera Ranch. Therefore, Effect BIO-6 is considered adverse, but it does not represent a substantial reduction in the local or regional distribution of San Joaquin tiger beetles.

Effect BIO-7: Potential for Operation- and Maintenance-Related Mortality of San Joaquin Tiger Beetle

The San Joaquin tiger beetle could be affected by operations and maintenance of MID facilities. Operating and maintaining the recharge basins and extraction facilities and maintaining the banks of the conveyance canals could have direct adverse effects on this species if they use these areas. Adults and larval beetles could die from contact with herbicides, be trapped inside their burrows during disking or filling of burrows, be crushed by vehicles, or be disturbed by these activities to the point that they abandon their foraging areas. Flooding swales on a seasonal basis also could cause mortality of tiger beetles and larvae.

Potential habitat for San Joaquin tiger beetle is widely distributed, and operations would disturb less than 10% of its potential habitat on Madera Ranch. Therefore, Effect BIO-7 is not considered adverse because it does not represent a substantial reduction in the local or regional distribution of San Joaquin tiger beetles.

Effect BIO-8: Potential for Construction-Related Mortality of California Tiger Salamander

Construction and modification, including direct and indirect effects on naturally occurring vernal pools, alkali rain pools, wetlands in GF Canal, annual grassland, and alkali grassland could have major adverse effects on California tiger salamander if this species is present on Madera Ranch. (Impacts on wetlands are described in Section 4-18, Wetlands.)

The California tiger salamander is federally listed as threatened and is a candidate for listing under CESA. Vernal and alkali rain pools are potential breeding habitat for this species, and upland areas within 1.25 miles of a wetland are potential nonbreeding habitat. Madera Ranch has suitable habitat for this species, and it is within the historical distribution range, but no evidence of California tiger salamanders was found during reconnaissance surveys conducted for amphibians while surveying for vernal pool crustaceans.

Excavating, grading, trenching, soil movement, soil compaction, and removing vernal pools and adjacent nonbreeding habitat could result in direct effects on this species. Tiger salamanders could be trapped inside their estivation or shelter burrows, crushed by construction vehicles, or displaced to adjacent areas where they could be subject to increased exposure, food shortages, and predation. Grading, trenching, and soil movement could alter the hydrology of the habitat and compact available animal burrows suitable for shelter and estivation, causing additional indirect adverse effects on the species.

If tiger salamanders are present, Effect BIO-8 would have an adverse effect on a species that is listed as threatened under the ESA and is a candidate for listing under CESA and could substantially reduce the local distribution of sensitive biological resources occurring at Madera Ranch. This effect would be minimized and compensated for with the implementation of Environmental Commitments BIO-1: Establish a Grasslands Conservation Easement; BIO-2a: Preconstruction Surveys/Avoid Effects on Vernal Pools and Alkali Rain Pools; BIO-2b: Create, Restore, or Preserve Vernal Pools; BIO-4a: Preconstruction Surveys for California Tiger Salamander; BIO-4b: Restrict Construction Activity in Suitable Aquatic and Upland Habitat for California Tiger Salamander to the Dry Season

(April 1–November 1); and BIO-4c: Fence the Construction Zone and Implement Erosion Control Measures in Areas Where Suitable Aquatic Habitat for California Tiger Salamander Is Present.

Effect BIO-9: Potential for Operation- and Maintenance-Related Mortality of California Tiger Salamander

Operation and maintenance of MID facilities could result in direct effects on California tiger salamander if this species is found to occur in vernal pools that would be near these activities. Flooding natural swales on a seasonal basis could result in beneficial or adverse effects on this species. Expanded pool size and duration could benefit breeding tiger salamanders by increasing the area and time available for breeding. However, rapid pulsing of water input and percolation loss following the initiation of breeding could result in the movement of adults, larvae, and eggs to areas beyond the traditional boundaries of the vernal pool and result in increased loss from desiccation and/or predation. Other operational effects are also possible. As described in Section 4.11, Public Health and Safety, if the swales pond water and mosquitoes become an issue with the MCMAVCD, the abatement district may use mosquitofish to control mosquitoes. These fish could also prey on California tiger salamander larvae. However, the overall need for mosquitofish is expected to be low because water levels would fluctuate rapidly as water flows through the swales and generally would not persist after flows cease. Furthermore, if swales are wet or moist year-round, they could become a dispersal corridor for bullfrogs. Bullfrogs could prey on California tiger salamander. However, swales are not expected to be wet year-round, and periodic drying of the swales would inhibit the establishment of bullfrogs in the interior of the property.

If California tiger salamanders are present, Effect BIO-9 could have an adverse effect on a species that is listed as threatened under the ESA and could substantially reduce the local distribution of sensitive biological resources occurring at Madera Ranch. This effect would be minimized and compensated for with the implementation of Environmental Commitment BIO-1: Establish a Grasslands Conservation Easement; Environmental Commitment BIO-2a: Preconstruction Surveys/Avoid Effects on Vernal Pools and Alkali Rain Pools; and Environmental Commitment BIO-2b: Create, Restore, or Preserve Vernal Pools.

Effect BIO-10: Potential for Construction- and/or Operation- and Maintenance-Related Mortality of Western Spadefoot Toad

Construction and operations/maintenance activities potentially could result in direct or indirect loss of western spadefoot toads currently known to occupy vernal pools on Madera Ranch. The western spadefoot toad is designated as a species of special concern by DFG.

Western spadefoot toad tadpoles were observed in GF Canal in 2000 (Figure 4.5-1). Vernal and alkali rain pools are potential breeding and estivation habitat for this species. Other operational effects as describe above related to mosquitofish and bullfrogs also possibly could occur.

Although western spadefoot toads are widely distributed throughout California, suitable habitat at Madera Ranch is limited to vernal pools and alkali rain pools. Therefore, Effect BIO-10 is potentially moderately adverse because it could substantially reduce the local distribution of western spadefoot toads. This effect would be minimized and compensated for with the implementation of Environmental Commitment BIO-2a: Preconstruction Surveys/Avoid Effects on Vernal Pools and Alkali Rain Pools and Environmental Commitment BIO-2b: Create, Restore, or Preserve Vernal Pools.

Effect BIO-11: Potential for Construction- and/or Operation- and Maintenance-Related Effects on Blunt-Nosed Leopard Lizard

Construction activities and modification of annual grassland and alkali grassland habitat could have an adverse effect on BNLL habitat. The BNLL is listed as endangered under CESA and ESA and as a fully protected species under the California Fish and Game Code. Historical records indicate the presence of BNLL in the vicinity of Madera Ranch and on Madera Ranch, and a few individuals were recently confirmed on site. The approximately 4,044 acres of alkali grassland habitat and high kangaroo rat burrow density make much of Madera Ranch suitable for BNLL (Figure 4.5-2).

Construction activities, including excavating, grading, trenching, soil movement, and noise and disturbance from vehicle traffic, could result in harm to and harassment of the species. Operational activities, including banking water in the swales, also could result in harm to and harassment of this species. Direct mortality is not authorized under California Fish and Game Code. Therefore, Effect BIO-11 is considered an adverse effect because direct mortality of this species must be avoided to comply with state law and because any effect could be a substantial adverse effect on the species or a substantial reduction in the local or regional distribution of BNLL.

In the event Phase 2 is constructed, up to 230 acres of alkali grassland habitat and 790 acres of annual grassland could be permanently affected. The extent of this effect on the species depends on the presence and abundance of the species in the construction area and the species' ability to persist in the area post-construction. If the species is present, the effects could be substantial. However, initial surveys indicate densities are likely to be low and these areas have previously been cultivated. To offset these potential habitat effects, MID will establish a conservation easement equivalent to the size of the disturbance area.

To minimize and mitigate the potential effect of Alternative B, MID will implement Environmental Commitments BIO-1: Establish a Grasslands Conservation Easement and BIO-5: Pre-Activity Surveys for Blunt-Nosed Leopard Lizard.

Effect BIO-12: Potential for Construction- and/or Operation- and Maintenance-Related Mortality of California Horned Lizard

Construction and modifying grassland and alkali grassland habitat could have an adverse effect on the California horned lizard, which is listed as a California species of special concern.

Constructing facilities could result in converting existing grassland habitat suitable for the species. Direct mortality could result from excavating, grading, trenching, and soil movement. Individuals could be trapped inside burrows during construction; crushed by construction vehicles; or displaced to adjacent areas where they could be subject to increased exposure, food shortages, and predation. Flooding swales on a seasonal basis also could result in loss of some individuals. The level of loss from all activities associated with Alternative B, however, is anticipated to be low, if loss occurs at all, because no California horned lizards were observed during transect surveys.

Potential habitat for California horned lizards is widely distributed in California, specifically in Madera County and on Madera Ranch. Therefore, Effect BIO-12 is not considered adverse because it does not represent a substantial reduction in the local or regional distribution of California horned lizards.

Effect BIO-13: Potential for Construction- and/or Operation- and Maintenance-Related Mortality of Silvery Legless Lizard

Construction and modifying grassland and alkali grassland habitat could have an adverse effect on the silvery legless lizard, which is considered sufficiently rare and/or vulnerable by the scientific community to be of concern. Constructing facilities could result in converting existing grassland habitat suitable for the species. Direct mortality could result from excavating, grading, trenching, and soil movement. Individuals could be trapped inside burrows during construction; crushed by construction vehicles; or displaced to adjacent areas where they could be subject to increased exposure, food shortages, and predation. Flooding swales on a seasonal basis also could result in the loss of some individuals. The level of loss from all activities associated with Alternative B, however, is anticipated to be low, if loss occurs at all.

Effect BIO-13 would not be considered adverse because it would not substantially reduce the local or regional distribution of this species.

Effect BIO-14: Potential for Operation- and Maintenance-Related Harm and Harassment of Giant Garter Snake

Alternative B would have no effect on this species on Madera Ranch because aquatic habitat does not pond for a sufficient duration to support a prey base for this species. Focused surveys for this species by Dr. Sean Barry confirmed that the habitat was unsuitable and the species was not present. Similarly, canals within the MWMA are also unsuitable for giant garter snake because of extended periods of dryness, seasonal fluctuation of water, and lack of consistent prey base. Long-term habitat conditions on Madera Ranch are not expected to improve for giant garter snake because of the seasonal nature of MID's operations. Therefore, project operations and maintenance would have no effect on this species.

Effect BIO-15: Potential for Construction-Related Disturbance of Nesting Swainson's Hawk and White-Tailed Kite

Construction of facilities has the potential to directly affect nesting Swainson's hawk and white-tailed kite. The Swainson's hawk is designated federal bird of conservation concern and the white-tailed kite is a fully protected species under the California Fish and Game Code. Both species have been documented on Madera Ranch. Suitable foraging habitat is present throughout the area, but nesting habitat is limited because few trees are present.

Noise associated with excavating, grading, trenching, and drilling at the Madera Ranch site could result in displacement of adult birds from active nests, resulting in the loss of eggs or nestlings. Conversion of cultivated lands to recharge basins also could result in loss of potential foraging habitat for these species—particularly Swainson's hawk—requiring individuals to fly farther to obtain food. The energy costs required to obtain food could affect annual productivity of nesting pairs in the area.

Alternative B is not expected to have direct effects on individuals of these species. The indirect effect of conversion of cultivated lands is minor because approximately 60 acres of farmland would be converted to nonagricultural use and the surrounding areas are dominated by agricultural lands. The potential indirect effect of construction-related noise on active nests (Effect BIO-15) would be adverse because it could substantially reduce the local distribution of sensitive biological resources. This effect would be minimized with the implementation of Environmental Commitment BIO-6: Preconstruction Surveys and Avoidance Activities for Raptors.

Effect BIO-16: Potential Loss of Foraging Area for Greater Sandhill Crane, Golden Eagle, Ferruginous Hawk, Prairie Falcon, Merlin, Mountain Plover, Long-Billed Curlew, and Short-Eared Owl

Construction and modification of annual grassland and alkali grassland could result in loss of potential foraging habitat for these species (Table 4.5-3). Greater sandhill crane is state listed as threatened. Golden eagle, ferruginous hawk, prairie falcon, merlin, mountain plover, long-billed curlew, and short-eared owl are species of concern for the USFWS or DFG. The golden eagle also is a fully protected species under the California Fish and Game Code. These species use Madera Ranch during the nonbreeding season for foraging and resting; none of these species is likely to use the area for breeding.

Construction of the facilities could result in the use and conversion of approximately 5–10% of the grassland habitat at Madera Ranch that could be used for resting and foraging (Table 4.5-3). However, these species are highly mobile and forage in a variety of sites throughout the Central Valley, and no direct mortality is anticipated from the indirect effect of losing available prey as a result of this habitat conversion, and no breeding habitat would be lost. Therefore, Effect BIO-16 is not considered adverse because it would not substantially reduce the local or regional distribution of these species.

Effect BIO-17: Potential for Construction-Related Mortality of Western Burrowing Owl

Western burrowing owl could be crushed during grading and soil movement activities proposed. The western burrowing owl is designated as a federal species of special concern by USFWS. The western burrowing owl has been documented on Madera Ranch. Western burrowing owls nest in burrows, with annual and alkali grasslands providing suitable foraging and nesting habitat.

Excavating, grading, trenching, soil movement, and soil compaction at the Madera Ranch site could result in direct effects on burrowing owls. Individuals could be trapped inside their burrows during grading or trenching, crushed on the ground by construction-related vehicles, or disturbed to the point that they abandon their burrows. Burrowing owls displaced to adjacent areas ultimately may die as a result of starvation, exposure, or predation. Construction activities near occupied habitats also could result in indirect effects. Construction of the recharge basins could remove vegetation and habitat for various prey species. A decline in forage species availability could be an indirect effect on the burrowing owls.

The potential effect of construction on this species could be adverse because it could have a substantial local adverse effect on a sensitive species and substantially reduce the local distribution of sensitive biological resources. This effect would be minimized with the implementation of Environmental Commitment BIO-1: Establish a Grasslands Conservation Easement and BIO-7: Preconstruction Surveys for Western Burrowing Owl.

Effect BIO-18: Potential for Operation-Related Mortality of Western Burrowing Owl

Western burrowing owls, their eggs, and their fledglings nest in burrows. Flooding swales on a seasonal basis would not be expected to adversely affect the active nests of these species because flooding typically would begin well before the start of the breeding season (mid-March) and end before the peak of the breeding season (mid-April). Western burrowing owls also prefer nest locations that are not at the low-point of swales to minimize predation and dry to increase nest success. The owls on site are also habituated to ranch vehicles and farm equipment traveling around the site, and most facilities would need to be accessed in the summer, post-breeding season. No effect is expected from project operation.

Effect BIO-19: Potential for Construction-Related Harm to Loggerhead Shrike

The loggerhead shrike is a federal bird of conservation concern. Loggerhead shrikes have been documented throughout the Madera Ranch area. Annual and alkali grasslands provide suitable foraging habitat, but nesting habitat is limited to portions of GF Canal and cultivated portions of the property (Figure 4.5-1).

Construction activities and modification of grassland and alkali grassland habitat could have an adverse effect on loggerhead shrikes, and Alternative B would result in the loss of approximately 5–10% of their foraging habitat (Table 4.5-4).

Noise associated with excavating, grading, trenching, and vehicle traffic at the Madera Ranch site could result in displacement of loggerhead shrikes from active nests, resulting in the loss of eggs or nestlings. Individual, nonbreeding birds also may respond to the disturbance of construction activities by leaving the area.

The potential loss of foraging habitat and indirect effect of construction-related noise on active nests would be adverse because it could substantially reduce the local distribution of sensitive biological resources. This effect would be minimized and compensated for with the implementation of Environmental Commitment BIO-1: Establish a Grasslands Conservation Easement.

Effect BIO-20: Potential for Construction-Related Foraging Habitat Loss for Tricolored Blackbird

Converting agricultural land could have an adverse effect on tricolored blackbirds. The tricolored blackbird is designated as a state species of special concern by DFG and as a species of federal special concern by USFWS. Madera Ranch area is in the historical range of the tricolored blackbird, and Madera Ranch contains suitable habitat. Tricolored blackbirds occur infrequently on Madera Ranch, foraging on the grasslands and agricultural lands.

No mortality is anticipated from direct or indirect effects of the construction activities associated with Alternative B. Crop production would continue on agricultural lands still under the ownership of MID. Effect BIO-20 would not be considered adverse because of the nomadic nature of breeding in this species and the availability of other crop breeding areas at or near Madera Ranch.

Effect BIO-21: Potential for Effects on San Joaquin Kit Fox

Vehicle traffic, excavating, grading, trenching, soil movement, and soil compaction could result in direct effects on this species, if present. San Joaquin kit foxes, if present, potentially could be trapped inside their den burrows, crushed by construction vehicles, or displaced to adjacent areas where they could be subject to increased exposure, food shortages, and predation. Additionally, noise and ground vibration from intermittent well operation may mask important natural sounds used by kit foxes to detect prey and avoid predators.

Operational effects, including vegetation changes resulting from seasonal inundation of swales, also have the potential to affect this species. These operational effects are unlikely to adversely affect the kit fox because of their mobility and home range size. Foraging is unlikely to be affected because prey populations are expected to be the same post-project. Other types of vehicle traffic, soil movement, and compaction effects associated with maintenance may occur intermittently, in small areas where repairs are needed. These effects may occur along the same corridor in which the facility was initially installed. Overall, because of the abundance of the grasslands and the species' habitat requirements, these effects are unlikely to adversely affect the potential for San Joaquin kit fox to persist on Madera Ranch, should they be present.

In the event Phase 2 is constructed, up to 230 acres of alkali grassland habitat and 790 acres of annual grassland could be permanently affected. The extent of this effect on the species depends on the presence and abundance of the species in the construction area and the species' ability to persist in the area post-construction. If the species is present, the localized direct effects could be substantial if the species is not avoided. However, initial surveys indicate densities are likely to be low and these areas have previously been cultivated.

This effect is considered potentially moderate and would be minimized with the implementation of Environmental Commitments BIO-1: Establish a Grasslands Conservation Easement and BIO-8: Preconstruction Surveys for San Joaquin Kit Fox.

Effect BIO-22: Potential for Effects on Fresno Kangaroo Rat

Excavating, grading, trenching, soil movement, soil compaction, and removing grassland habitat could adversely affect the Fresno kangaroo rat, if present. Habitat losses in Phase 1 include approximately 280 acres of temporary effects and 40 acres of permanent effects. Individuals could be trapped inside their burrows, crushed by construction vehicles, or displaced to adjacent areas where they could be subject to increased exposure, food shortages, and predation. Trenches left open during the night could trap Fresno kangaroo rats that might be active within the construction area.

Operational effects also have the potential to result in effects on this species. Use of the swales could result in a new mosaic of habitats, including new plant species. The overall implications of this change in habitat conditions and thereby the Fresno kangaroo rat are difficult to predict. The plant species composition is likely to change because the wetter conditions may favor the growth of wetland species or upland species that are less drought-tolerant. This process has been observed on Madera Ranch, as swales with irrigation runoff discharged into them have experienced an increase in nonnative weedy plants. In Section 7, Great Valley iodine bush scrub habitat (10 acres) could benefit from a rising water table. Approximately 710 acres of annual grasslands, some with friable soils, are in the swales. Foraging is unlikely to be affected because seed production is expected to be similar following implementation of Alternative B. Dispersal is unlikely to be affected because the swales historically have flooded, and because these areas still would be usable for most of the year for the species life history requirement (including movement, food storage, and sand-bathing). Overall, because of the abundance of the grasslands and the species habitat requirements, localized vegetation changes are unlikely to adversely affect the Fresno kangaroo rat populations on Madera Ranch, should they be present.

While the potential for Fresno kangaroo rat to be present is small based on previous surveys, acoustic degradation of habitat attributable to noise and ground vibration from well operation potentially could disturb them in the vicinity of the pumps. Pump noise also may mask sounds of approaching predators, thereby increasing the potential of predation for this species. However, very little is known about nature of these potential impacts, nor the adaptive capacity of kangaroo rats to accommodate to such noise. However, kangaroo rats are especially sensitive to low-frequency sounds. Work on the desert kangaroo rat and other dune vertebrates have shown that off-road vehicle sound levels have a serious impact on hearing acuity (Brattstrom and Bondello 1983 cited in Goldingay et al. 1997). The pumps would operate intermittently and only during periods of water extraction. To some degree, the operation of construction equipment could cause these same effects.

In the event Phase 2 is constructed, up to 230 acres of alkali grassland habitat and 790 acres of annual grassland could be permanently affected. The extent of this effect on the species depends on the presence and abundance of the species in the construction area and the species' ability to persist in the area post-construction. If the species is present, the localized direct effects could be substantial if the species is not avoided. Despite possible low densities, Effect BIO-22 is considered adverse because, if Fresno kangaroo rat is present, it could substantially reduce the local or regional distribution of this species. This effect would be minimized with the implementation of Environmental Commitment BIO-1: Establish a Grasslands Conservation Easement and Environmental Commitment BIO-9: Conduct Pre-Activity Surveys for Fresno Kangaroo Rat.

Effect BIO-23: Potential for Mortality of San Joaquin Pocket Mouse

Construction and modifying annual grassland and alkali grassland could have an adverse effect on San Joaquin pocket mouse. Annual and alkali grasslands provide suitable habitat for this species, and San Joaquin pocket mice were captured throughout Madera Ranch during small mammal trapping.

Excavating, grading, trenching, soil movement, soil compaction, and vehicle traffic at the Madera Ranch site could result in direct effects on pocket mice. Individuals could be trapped inside their burrows during grading or trenching, crushed on the ground by construction-related vehicles, or disturbed to the point that they abandon their burrows. Construction of recharge basins could modify and remove forage vegetation and habitat for burrows. Flooding swales on a seasonal basis also could displace individuals from their burrows, making them vulnerable to exposure and predation.

However, because there are successful breeding individuals on Madera Ranch and because suitable habitat will continue to be abundant on site, localized effects are not expected to inhibit future breeding success. Therefore, Effect BIO-23 is not adverse because it would not substantially reduce in the local or regional distribution of these species.

Alternative C—Water Banking outside the MID Service Area without Swales and Alteration of Reclamation-Owned Facilities

Alternative C is similar in scope and design to Alternative B, with the exception that recharge is achieved using engineered recharge basins in lieu of the natural swales that occur on the site. Thus, engineered basins would be built in Phase 1 instead of using the swales in Phase 1 under Alternative B. However, the expected footprint of recharge basins under Alternative B would be identical to the maximum build-out of Phase 2 of Alternative B and would result in nearly identical effects on biological resources (Effects BIO-1, BIO-2, BIO-4, BIO-6 through BIO-10, BIO-12 through BIO-21, and BIO-23).

Effect BIO-3: Loss or Disturbance of Iodine Brush Scrub or Sensitive Plant Species Habitat and Effect BIO-5: Potential for Operation- and Maintenance-Related Mortality of Sensitive Vernal Pool Crustaceans are lower under this alternative because the swales are not used for recharge and fewer vernal pools and alkali rain pools, including plant species habitat (habitat for Greene's tuctoria), would be inundated from banking activities.

In contrast, Effect BIO-11: Potential for Construction- and Operation- and Maintenance- Related Effects on Blunt-Nosed Leopard Lizard; Effect BIO-21: Potential Effects on San Joaquin Kit Fox; and Effect BIO-22: Potential for Effects on Fresno Kangaroo Rat would be higher, as grassland habitat would be guaranteed to be permanently affected by the creation of permanent recharge basins (under Alternative B the overall need and quantity of ponds likely will be lower than the maximum 1,000 acres possible). The Environmental Commitments identified for Alternative B associated with these effects would be appropriate and applicable under Alternative D.

Alternative D—Water Banking outside the MID Service Area with Banking and Recovery via Gravelly Ford Canal

Alternative D is similar in scope and design to Alternative B, with the exception that water would be conveyed to the site via GF Canal. For this reason, one recharge basin would not be built under Alternative D that was proposed under Alternative B. The majority of the swales proposed under Alternative C would also be used (less approximately 100 acres), and the expected footprint of recharge basins under Phase 2 of Alternative D would be nearly identical to Phase 2 of Alternative B. Alternative D would result in nearly identical effects on biological resources as Alternative B, including Effects BIO-1 through BIO-23. The Environmental Commitments associated with these effects are still appropriate and applicable. Off-site improvements on GF Canal would occur in agricultural lands along the existing GF Canal. However, two additional effects were identified for this alternative (Effects BIO-24 and BIO-25 described below).

Effect BIO 24: Potential Mortality of Sensitive Species during Construction

The off-ranch GF Canal alignment has not been surveyed for sensitive wildlife species. However, aerial photos and DWR land-cover review indicate that the majority of the alignment of the canal, more than 95%, is located in intensive agricultural lands and is unsuitable for many sensitive species. However, construction of the checkdams, culvert crossings, and other facilities has the potential to adversely affect local individual species should suitable habitat be present. The potential effect of construction on sensitive species could be adverse because it could have a substantial local effect on a sensitive species and substantially reduce the local distribution of sensitive biological resources should they be present. This effect would be minimized with the implementation of

Environmental Commitment BIO-10: Conduct Preconstruction Surveys for Sensitive Species along the Off-Ranch Portion of Gravelly Ford Canal.

BIO-25: Potential for Entrainment of Anadromous Fish If Restored to the San Joaquin River

When the SJRRP proceeds and anadromous fish are restored to the San Joaquin River, Alternative D potentially could result in the entrainment of salmon and steelhead trout into the GF Canal. While these species currently are not present because of downstream barriers and the lack of suitable habitat, future restoration efforts contemplate the reintroduction of these species to the San Joaquin River. The potential effect of operation on anadromous species could be adverse because it could interfere substantially with the movement of any migratory fish. This effect would be minimized with the implementation of Environmental Commitment BIO-11: Implement Protective Measures for Anadromous Fish.

Cumulative Effects

Effect BIO-26: Result in a Cumulative Loss of Grassland

Alternative B could potentially result in the loss or conversion of up to 700 acres of annual and alkali grassland habitat in recharge swales and up to 1,000 acres in recharge basins, which could contribute to the historical cumulative habitat loss. Substantial areas of Madera County have been converted to other uses, including agriculture and urban development, and this trend is expected to continue. Environmental Commitment BIO-1: Establish a Grasslands Conservation Easement would help reduce this effect; MID’s proposed grasslands conservation easement at Madera Ranch will preserve in perpetuity an area of habitat equivalent in size to the area subject to long-term degradation or permanent displacement (1:1 ratio of acres conserved to acres lost). To compensate for the potential incremental cumulative effect of Alternative B, the preservation ratio will be increased to 1.2:1. This compensation would contribute to reduction of the projected future cumulative loss of this habitat type in western Madera County.

Effect BIO-27: Result in a Cumulative Loss of Habitat for Endangered Species

Given the likely low density of most federally listed species on the property, the conservation measures proposed as part of Alternative B, the continued operation of the majority of the property in open space, and the mitigation lands that would be provided, vernal pool fairy shrimp, California tiger salamander, San Joaquin kit fox, blunt-nosed leopard lizard, and Fresno kangaroo rat are not anticipated to be irreparably harmed by the approval of Alternative B. However, there remains an adverse cumulative effect on these species because of the overall loss of their habitats throughout the Central Valley.

As both Alternatives C and D are similar in scope and effect to Alternative B, it is anticipated that Alternative C or D also would contribute to cumulative impacts on biological resources. Alternative B would contribute to cumulative impacts on grassland and biological resources dependent on grassland. The cumulative effects on grasslands are expected to be higher under Alternative C or D than under Alternative B because fewer ponds likely would be constructed, though the cumulative effects on vernal pools are expected to be lower because the swales would not be used for banking. The use of GF Canal under Alternative D is expected to result in a cumulative benefit to migratory fish because of increasing water supply reliability and storage and developing a water bank that facilitates instream flows.

4.6 Climate Change

4.6.1 Introduction

This section describes the existing environmental conditions, the consequences of implementing the WSEP alternatives, and how the Proposed Action and alternatives may respond to climate change in the future.

The Affected Environment discussion below describes the current setting of the action area. The purpose of this information is to establish the existing environmental context against which the reader can understand the environmental changes caused by the alternatives. The environmental setting information is intended to be directly or indirectly relevant to the subsequent discussion of impacts.

The environmental changes associated with the alternatives are discussed under Environmental Consequences. This section identifies effects and describes how they would occur.

4.6.2 Affected Environment

Global climate change is primarily a consequence of anthropogenic emissions of GHGs emanating from the combustion of fossil fuels, industrial activities, and other GHG–producing activities such as deforestation and land use change.

GHGs play a critical role in the earth's radiation budget by trapping infrared radiation emitted from the earth's surface that otherwise could have escaped to space. This phenomenon, known as the *greenhouse effect*, keeps the earth's atmosphere near the surface warmer than it otherwise would be and allows successful habitation by humans and other forms of life.

Prominent GHGs contributing to this process are water vapor, CO_2, nitrous oxide (N_2O), methane (CH_4), O_3, and certain hydro- and fluorocarbons. Assembly Bill 32 regulates six GHGs (CO_2, CH_4, N_2O, hydrofluorocarbons [HFCs], perfluorocarbons [PFCs], and sulfur hexafluoride [SF_6]) because they are released as a result of human activities and contribute significantly to global warming.

The combustion of fossil fuels releases carbon that has been stored underground into the active carbon cycle, thus increasing concentrations of GHGs in the atmosphere. Emissions of GHGs in excess of natural ambient concentrations are thought to be responsible for the enhancement of the greenhouse effect and to contribute to what is termed *global warming*, a trend of unnatural warming of the earth's natural climate. Higher concentrations of these gases lead to more absorption of radiation and warm the lower atmosphere further, thereby increasing evaporation rates and temperatures near the surface.

Climate change is a global problem, and GHGs are global pollutants, unlike criteria air pollutants (such as O_3 precursors) and TACs, which are pollutants of regional and local concern. Because GHG emissions have long atmospheric lifetimes, GHGs are effectively well-mixed globally and are expected to persist in the atmosphere for time periods several orders of magnitude longer than criteria pollutants such as O_3. Given their long atmospheric lifetimes, GHG emission reduction strategies can be effectively undertaken on a global scale whereby the mitigation of local GHG emissions can be offset by distant GHG reduction activities.

The discussion provided below first describes GHG emissions and their global warming potential, including anthropogenic contributions to GHG emissions. A discussion of recorded GHG inventories at the global, federal, and state levels and their respective contributions to climate change follows.

Greenhouse Gas Emissions

The characteristics, sources, and units used to quantify the six gases listed in AB-32 (CO_2, CH_4, N_2O, HFCs, PFCs, and SF_6) are documented in this section, in order of abundance in the atmosphere; water vapor, although the most abundant GHG, is not included because natural concentrations and fluctuations far outweigh anthropogenic (human-caused) influences.

To simplify reporting and analysis, methods have been set forth to describe emissions of GHGs in terms of a single gas. The most commonly accepted method to compare GHG emissions is the global warming potential (GWP) methodology defined in the Intergovernmental Panel on Climate Change (IPCC) reference documents (Intergovernmental Panel on Climate Change 2001). The IPCC defines the GWP of various GHG emissions on a normalized scale that recasts all GHG emissions in terms of CO_2 equivalent (CO_2e), which compares the gas in question to that of the same mass of CO_2 (CO_2 has a GWP of 1 by definition). For example, a high GWP represents high infrared absorption and long atmospheric lifetime compared to CO_2. The conversion of GHG emissions to equivalent CO_2 emissions must also include a time horizon to account for chemical reactivity and lifetime differences between various GHG species. The standard time horizon for climate change analysis is 100 years. GHGs generally have long atmospheric lifetimes, and a 100-year horizon provides an accurate and effective timeframe for analyzing their impacts. Generally, GHG emissions are quantified in terms of metric tons of CO_2e emitted per year. One metric ton equals about 1.1 American tons.

The atmospheric residence time of a gas is equal to the total atmospheric abundance of the gas divided by its rate of removal (Seinfeld 2006). The atmospheric residence time of a gas is in effect a "half life" measurement of how long a gas is expected to persist in the atmosphere when taking into account removal mechanisms such as chemical transformation and deposition.

Table 4.6-1 lists the GWP of each GHG, its lifetime, and abundance in the atmosphere in parts per trillion (ppt). Units commonly used to describe the concentration of GHGs in the atmosphere are parts per million (ppm), parts per billion (ppb), and ppt, referring to the number of molecules of the GHG in a sampling of 1 million, 1 billion, or 1 trillion molecules of air. Collectively, HFCs, PFCs, and SF_6 are referred to as high GWP gases (HGWPG). CO_2 is by far the largest component of worldwide CO_2e emissions, followed by CH_4, N_2O, and HGWPGs in order of decreasing contribution to CO_2e.

Table 4.6-1. Lifetimes, Global Warming Potentials, and Abundances of Several Significant Greenhouse Gases

Gas	Global Warming Potential (100 Years)	Lifetime (Years)	1998 Abundance (ppt)
CO_2	1	50–200[2]	365,000,000
CH_4	21	9–15	1,745
N_2O	310	120	314
HFC-23	11,700	264	14
HFC-134a	1,300	14.6	7.5
HFC-152a	140	1.5	0.5
CF_4	6,500	50,000	80
C_2F_6	9,200	10,000	3
SF_6	23,900	3,200	4.2

Source: Intergovernmental Panel on Climate Change 1995, 2001.

[1] The unit ppt represents parts per trillion in the atmosphere.

[2] No single lifetime can be defined for CO_2 because of the different rates of uptake by different removal processes.

Table 4.6-2 lists the anthropogenic contribution of GHG in terms of CO_2e.

Table 4.6-2. Global Anthropogenic Greenhouse Gas Emissions (CO_2e)

Gas	CO_2 Equivalent Percentage
CO_2 (deforestation, decay of biomass, etc.)	17.30
CO_2 (other)	2.80
CO_2 (fossil fuel use)	56.60
CH_4	14.30
N_2O	7.90
Fluorinated gases (includes HFCs, PFCs, SF_6)	1.10

Source: Olivier et al., 2005, 2006 in Intergovernmental Panel on Climate Change 2007.

Carbon Dioxide

CO_2 is the most important anthropogenic GHG and accounts for more than 75% of all anthropogenic GHG emissions. Its long atmospheric lifetime (on the order of decades to centuries) ensures that atmospheric concentrations of CO_2 will remain elevated for decades after GHG mitigation efforts to reduce GHG concentrations are promulgated (Intergovernmental Panel on Climate Change 2007a).

Increasing concentrations of CO_2 in the atmosphere are primarily a result of emissions from the burning of fossil fuels, gas flaring, cement production, and land use changes. Three-quarters of anthropogenic CO_2 emissions are the result of fossil fuel burning (and to a very small extent, cement production), and approximately one-quarter of emissions are the result of land-use change (Intergovernmental Panel on Climate Change 2007a).

Anthropogenic emissions of CO_2 have increased concentrations in the atmosphere most notably since the industrial revolution; the concentration of CO_2 has increased from about 280 ppm to 379 ppm over the last 250 years (Intergovernmental Panel on Climate Change 2001). IPCC estimates that the present atmospheric concentration of CO_2 has not been exceeded in the last 650,000 years and is likely to be the highest ambient concentration in the last 20 million years (Intergovernmental Panel on Climate Change 2007a, 2001).

Methane

CH_4, the main component of natural gas, is the second largest contributor to anthropogenic GHG emissions and has a GWP of 21 (Association of Environmental Professionals 2007; Intergovernmental Panel on Climate Change 1995). Anthropogenic emissions of CH_4 are the result of growing rice, raising cattle, burning natural gas, and mining coal (National Oceanic and Atmospheric Administration 2005). Atmospheric CH_4 has increased from a pre-industrial concentration of 715 ppb to 1,775 ppb in 2005 (Intergovernmental Panel on Climate Change 2001).

Nitrous Oxide

N_2O is a powerful GHG, with a GWP of 310 (Intergovernmental Panel on Climate Change 1995). Anthropogenic sources of N_2O include agricultural processes, nylon production, fuel-fired power plants, nitric acid production, and vehicle emissions. N_2O also is used in rocket engines, racecars, and as an aerosol spray propellant. Agricultural processes that result in anthropogenic N_2O emissions are fertilizer use and microbial processes in soil and water (Association of Environmental Professionals 2007).

N_2O concentrations in the atmosphere have increased from pre-industrial levels of 270 ppb to 319 ppb in 2005 (Intergovernmental Panel on Climate Change 2001).

Hydrofluorocarbons

HFCs are human-made chemicals used in commercial, industrial, and consumer products and have high GWPs (U.S. Environmental Protection Agency 2006). HFCs generally are used as substitutes for O_3-depleting substances (ODS) in automobile air conditioners and refrigerants. As seen in Table 4.6-3, the most abundant HFCs, in order from most abundant to least, are HFC-23 (14 ppt), HFC-134a (7.5 ppt), and HFC-152a (0.5 ppt).

Concentrations of HFCs have risen from zero to current levels. Because these chemicals are human-made, they do not exist naturally in ambient conditions.

Perfluorocarbons

The most abundant PFCs are CF_4 (PFC-14) and C_2F_6 (PFC-116). These human-made chemicals are emitted largely from aluminum production and semiconductor manufacturing processes. PFCs are extremely stable compounds that are destroyed only by very high–energy ultraviolet rays, resulting in the very long lifetimes of these chemicals as shown in Table 4.6-1 (U.S. Environmental Protection Agency 2006).

PFCs have large GWPs and have risen from zero to current concentration levels shown in Table 4.6-1.

Sulfur Hexafluoride

SF_6, another human-made chemical, is used as an electrical insulating fluid for power distribution equipment, in the magnesium industry, in semiconductor manufacturing, and as a trace chemical for study of oceanic and atmospheric processes (U.S. Environmental Protection Agency 2006). In 1998, atmospheric concentrations of SF_6 were 4.2 ppt and steadily increasing in the atmosphere.

SF_6 is the most powerful of all GHGs listed in IPCC studies with a GWP of 23,900 (Intergovernmental Panel on Climate Change 1995).

Climate Change

Worldwide, California is the 12th to 16th largest emitter of CO_2 and is responsible for approximately 2% of the world's CO_2 emissions (California Energy Commission 2006).

Transportation is responsible for 41% of the state's GHG emissions, followed by the industrial sector (23%), electricity generation (20%), agriculture and forestry (8%), and other sources (8%) (California Energy Commission 2006). Emissions of CO_2 and N_2O are byproducts of fossil fuel combustion, among other sources. CH_4, a highly potent GHG, usually results from off-gassing associated with agricultural practices and landfills. Sinks[1] of CO_2 include uptake by vegetation and dissolution into the ocean. California GHG emissions in 2002 totaled approximately 491 million metric tons (MMT) of CO_2e.

GHG Inventories

A GHG inventory is a quantification of all GHG emissions and sinks within a selected physical and/or economic boundary.[2] GHG inventories can be performed on a large scale (for global and national entities) or on a small scale (for a particular building or person).

GHG emission and sink specifications are complicated by the fact that the natural processes may dominate the carbon cycle. Although some emission sources and processes are easily characterized and well understood, components of GHG budgets are not known with accuracy. As such, GHG protocols are under development and ad-hoc tools must be developed to quantify emissions from certain sources and sinks.

[1] A CO_2 sink is a resource that absorbs CO_2 from the atmosphere. The classic example of a sink is a forest in which vegetation absorbs CO_2 and produces oxygen through photosynthesis.
[2] A sink is a pool (reservoir) that absorbs or takes up released GHG, such as carbon.

The following sections outline the global, national, and statewide GHG inventories to put into context the relative magnitude of the Proposed Action–related emissions.

Intergovernmental Panel on Climate Change Global Greenhouse Gas Inventory

The IPCC was established by the World Meteorological Organization and United Nations Environment Programme to assess scientific, technical, and socioeconomic information relevant to the understanding of climate change, its potential impacts, and options for adaptation and mitigation (Intergovernmental Panel on Climate Change 2007). In the 2007 IPCC Synthesis Report, global anthropogenic GHG emissions were estimated to be 49,000 MMT of CO_2e in 2004, which is 70% above 1970 emission levels. CO_2 contributed to 76.7% of total emissions; CH_4 accounted for 14.3%; N_2O contributed 7.9% of total emissions; and fluorinated gases (HFCs, PFCs, and SF_6) contributed to the remaining 1.1% of global emissions in 2004. Energy supply was the sector responsible for the greatest amount of GHG emissions (25.9%), followed by industry (19.4%), forestry (17.4%), agriculture (13.5%), and transport (13.1%) (Intergovernmental Panel on Climate Change 2007).

EPA National GHG Inventory

The EPA estimates that total U.S. GHG emissions for 2004 amounted to 7,078 MMT of CO_2e, which is 13.1% greater than 1990 levels (U.S. Environmental Protection Agency 2008). U.S. GHG emissions were responsible for 14.4% of global GHG emissions in 2004 (Intergovernmental Panel on Climate Change 2007; U.S. Environmental Protection Agency 2008). Table 4.6-3 summarizes the contribution of each GHG to total U.S. GHG emissions in 2005, based on CO_2e. The largest contributors to U.S. GHG emissions in 2004 by economic sector were the electric industry (33.4%), transportation (27.9%), and the industrial sector (19.6%) (U.S. Environmental Protection Agency 2008).

Table 4.6-3. U.S. Greenhouse Gas Inventory: 2004 Anthropogenic Greenhouse Gas Emissions (CO_2 equivalent) by Source Gas

Gas	CO_2 Equivalent Percentage
CO_2	85.3
CH_4	7.7
N_2O	5.0
HFCs, PFCs, and SF_6	2.0
Source: U.S. Environmental Protection Agency 2007.	

California Statewide Greenhouse Gas Inventory

The California Energy Commission's *Inventory of Greenhouse Gas Emissions and Sinks: 1990–2004* estimates that California is the second largest emitter of GHG emissions in the United States. The commission estimates that in 1990 California's gross GHG emissions amounted to between 425 and 452 MMT of CO_2e. The California Energy Commission estimated that in 2004 California's gross GHG emissions were 492 MMT of CO_2e. The transportation sector produced approximately 40.7% of California's GHG emissions in 2004. Electric power production accounted for approximately 22.2% of emissions, the industrial sector contributed 20.5% of the total, agriculture and forestry contributed 8.3%, and other sectors contributed 8.3% (California Energy Commission 2006).

The ARB recently released revised estimates of California's 1990 and 2004 emissions, now estimating that 1990 emissions amounted to 433 MMT of CO_2e, and 2004 emissions levels were 484 MMT of CO_2e (California Air Resources Board 2007).

4.6.3 Regulatory Standards

Climate change has only recently been widely recognized as an imminent threat to the global climate, economy, and population. As a result, the climate change regulatory setting—nationally, statewide, and locally—is complex and evolving.

There are currently no federal regulations pertaining to climate change, although 12 U.S. states and cities (including California), in conjunction with several environmental organizations, sued to force the EPA to regulate GHGs as a pollutant pursuant to the CAA (*Massachusetts vs. Environmental Protection Agency et al.* [U.S. Supreme Court No. 05-1120; argued November 29, 2006—decided April 2, 2007]). The Supreme Court ruled that the plaintiffs had standing to sue, that GHGs fit within the CAA's definition of a pollutant, and that the EPA's reasons for not regulating GHGs were insufficiently grounded in the CAA. Despite the Supreme Court ruling, there are no promulgated federal regulations to date limiting GHG emissions.

The most notable regulation related to GHG emissions in the Proposed Action area is the California Global Warming Solutions Act of 2006, widely known as Assembly Bill 32, which requires the ARB to develop and enforce regulations for the reporting and verification of statewide GHG emissions. The ARB is directed to set a GHG emission limit, based on 1990 levels, to be achieved by 2020. The bill sets a timeline for adopting a scoping plan for achieving GHG reductions in a technologically and economically feasible manner.

Additionally, the Proposed Action is located in the SJVAB, which is within the jurisdiction of the SJVAPCD. The SJVAPCD has not adopted programs addressing global climate change. However, at its August 21, 2008, meeting, the governing board of the SJVAPCD took action authorizing the Air Pollution Control Officer to begin development of a Climate Change Action Plan, which would include development of guidance for considering GHGs in the CEQA process; development of a carbon exchange bank for voluntary GHG reductions in the SJVAB; development of voluntary emission reduction agreements to mitigate GHG increases associated with new projects; and encouragement of the development of climate protection measures that reduce GHG emissions as well as toxic and criteria pollutants and opposition to measures that result in significant increases in toxic or criteria pollutant emissions in already affected areas.

4.6.4 Analysis of Environmental Effects

Methods

The Proposed Action's incremental increases in GHG emissions associated with off-road construction equipment would contribute to regional increases in GHG emissions and associated climate change effects. Operational effects resulting from pumping at wells and lift stations to deliver water to users also would produce GHG emissions through the combustion of propane if propane pumps are used. The assessment of climate change impacts considers each of these potential sources. Construction equipment and activity, and operational assumptions, are described in Section 4.4, Air Quality.

Construction Effects Assessment Methods

Construction emissions were calculated based on the type and magnitude of development that would occur during the construction period. Proposed Action–related factors used to evaluate construction climate change impacts include:

- **CO_2, CH_4, and N_2O Emissions from Construction Equipment:** Type, number of pieces, and usage for each type of construction equipment; estimated fuel usage and type of fuel (diesel, gasoline) for each type of equipment; and emission factors for each type of fuel.
- **CO_2, CH_4, and N_2O Emissions from Delivery and Haul Trucks:** Type, capacity, number of trips, haul distance, and Emfac2007 emission factors from URBEMIS 2007.
- **CO_2, CH_4, and N_2O Emissions from Grading, Excavation, and Hauling Equipment:** Type and number of pieces of equipment to be used, projected haul routes associated with soil movement, and fuel emission factors.
- **CO_2, CH_4, and N_2O Emissions from Other Mobile Sources:** Mobile source emissions associated with haul truck activities and worker commute trips were evaluated based on information provided by the project applicant.

The URBEMIS 2007 model (version 9.2.4) was used to calculate CO_2 emissions associated with construction. URBEMIS 2007 accounts for CO_2 emissions resulting from fuel use by construction equipment and worker commutes.

URBEMIS does not quantify CH_4 and N_2O emissions, although these two pollutants are emitted from construction equipment. CH_4 and N_2O emissions associated with construction emissions from off-road equipment were determined by scaling the construction CO_2 emissions predicted by URBEMIS by the ratio of CH_4/CO_2 and N_2O/CO_2 emissions expected per gallon of diesel fuel according to the California Climate Action Registry (CCAR) diesel fuel emission estimates (The Climate Registry 2008). The CCAR emission factor for CO_2 is 10.15 kilogram (kg) CO_2 per gallon of diesel fuel. Construction equipment using diesel fuel emits 0.58 gram CH_4 per gallon and 0.26 gram N_2O per gallon (The Climate Registry 2008). The ratios of CH_4 and N_2O to CO_2 per gallon of diesel fuel are 0.00006 and 0.00003, respectively. CO_2 emissions for each year were multiplied by these ratios to estimate CH_4 and N_2O emissions from construction equipment operation. These emissions were converted to CO_2e using the GWP of each gas.

Because GHGs have long atmospheric lifetimes, total GHG emissions were summed for the length of the construction period.

The SJVAPCD has determined that compliance with its Regulation VIII, including implementation of all feasible control measures specified in its GAMAQI (San Joaquin Valley Air Pollution Control District 2002), constitutes sufficient mitigation to minimize adverse air quality effects. Compliance with these regulations also would help reduce GHG emissions.

Operational Effects Assessment Methods

Operation emissions for the action alternatives would include both indirect mobile-source emissions and direct stationary source emissions. Emissions from mobile sources associated with operation of the alternatives would be generated by workers commuting, but because the alternatives would employ only a few workers, the emissions associated with commute trips would be negligible.

If propane engines are used, direct emissions from stationary sources would result from their operation to drive pumps installed at wells and lift stations. The primary operational emissions associated with the Proposed Action are expected to include CO_2, CH_4, and N_2O emitted as IC engine exhaust. Operational emissions of GHGs were estimated using calculations based on emission factors from The Climate Registry (The Climate Registry 2008).

MID provided information on the estimated size and number of engines for wells and lift station pumps. Worst-case engine hp requirements were used to estimate emissions for the purposes of this analysis to ensure that all potentially adverse effects are disclosed. However, actual or average emissions likely will be substantially lower than the worst-case emissions scenario.

Environmental Consequences

Alternative A—No Action

Under the No Action Alternative, Reclamation would not approve the banking of CVP water outside MID's service area, nor would Reclamation issue an MP-620 permit for modifications to its distribution system. There would be no changes in Reclamation's contributions to climate change. However, the future conditions would likely change to support agricultural activities or water banking activities. Thus, additional climate change effects could occur based on future land use; the amount and type of climate change effects would depend on future practices.

Alternative B—Water Banking outside the MID Service Area Using Swales and Alteration of Reclamation-Owned Facilities

Effect CC-1: Increased GHG Emissions during Construction

Increases in GHGs in the atmosphere may result in climate changes. California relies on snowpack for summer streamflows to provide energy, municipal water, watershed health, and irrigation. A potential rise in sea levels could threaten California's coastal communities. Reduced snowpack, changes in the timing of streamflows, extreme or unusual weather events, rising sea levels, increased occurrences of vector-borne diseases, and effects on crop health could significantly affect the environment in Madera County. Construction of the Proposed Action would result in the direct emissions of GHGs through the use of petroleum fuels and indirect emissions through the use of electrical power.

Chapter 2, "Alternatives," presents measures that would be implemented as part of the Proposed Action to reduce dust (Environmental Commitment AQ-1) and vehicle exhaust emissions (Environmental Commitment AQ-2), and some of these measures also would help reduce GHG emissions.

The Proposed Action's incremental increases in GHG emissions associated with off-road construction equipment would contribute to regional increases in GHG emissions and associated climate change effects. This analysis presents the quantity of GHGs that would be emitted with implementation of the Proposed Action in the context of the total GHG emissions in California. The GHG mass calculations were performed using The Climate Registry's emissions factors for diesel fuel for construction equipment and were converted into units of CO_2e using the IPCC's Second Assessment Report global warming potential values. Table 4.6-4 provides a summary of the estimated indirect and direct GHG emissions from construction.

Table 4.6-4. Maximum Construction Emissions for the Proposed Action (metric tons)

Emission Source	CO_2	CH_4	N_2O	CO_2e
On-site heavy equipment, including fugitive dust and worker trips				
Phase 1	4,884.6	0.3	0.1	4,929.3
Phase 2 (grading)	3,683.9	0.2	0.1	3,717.6
Worker Trips—Fresno	390.2	0.0	0.0	393.8
Worker Trips—Madera	38.0	0.0	0.0	38.3
Worker Trips—Chowchilla/Firebaugh	18.7	0.0	0.0	18.9
Haul Trucks	875.9	0.1	0.0	883.9
Total	**9,891.4**	**0.6**	**0.3**	**9,981.8**

The total estimated CO_2e emissions during construction would be approximately 9,982 metric tons. This is approximately 0.002% of the CO_2e emissions for California in 2004 (California Air Resources Board 2007). These emissions would not continue past the Proposed Action completion date. As such, this would not result in a substantial change in GHG emissions, and there would be no adverse effect.

Effect CC-2: Increase in GHG Emissions as a Result of Operation and Maintenance

Operation of the Proposed Action would require pumping at wells and lift stations to deliver water to users. For the purpose of this analysis, MID conservatively has assumed that all new pumps could be propane-powered. Use of electric pumps in place of propane pumps would reduce GHG emissions from operations. Propane-fueled IC engines that exceed 50 hp would require a permit from the SJVAPCD. Because the electric pumps at existing wellhead locations are not expected to contribute any operational emissions as a result of this action, they are not addressed in this analysis, which focuses instead on the worst-case scenario, the potential emissions associated with cycling and operation of the propane-fueled IC (catalytic-controlled) engines.

The engines could be used up to 24 hours per day and up to a total operating time of 2,880 hours per year. The emission estimate uses the worst-case scenario of 102 engines with a combined total of 7,385 hp. It was assumed that the pumps would consume 8,500 British thermal units (btus) per horsepower-hour (btu/hp-hr) (Israelson 1962). Table 4.6-5 provides a summary of the estimated direct GHG emissions from operation.

Table 4.6-5. Alternative B–Related Emissions from Operations (tons per year)

	CO_2	CH_4	N_2O	CO_2e
Controlled emissions from IC engines at wells and lifts/stations	11,402.1	0.02	0.07	11,425.4

Notes:

Estimate assumes a combined total of 7,385 hp.

Estimate assumes engine operating time of 2,880 hours per year.

Propane fuel consumption estimated at 8,500 btu/hp-hr (Israelson 1962). Emission factors for propane based on The Climate Registry General Reporting Protocol (The Climate Registry 2008).

This emission estimate is based on a worst-case scenario of all engines operating on propane fuel and pessimistic assumptions for the maximum number of engines required. In the event that a combination of propane- and electric-powered engines is used or fewer engines are required, the emissions would be reduced.

The annual estimated operational increase in CO_2e emissions under the Proposed Action would be approximately 11,425 metric tons. This is approximately 0.002% of the projected CO_2e emissions for California in 2004 (California Air Resources Board 2007).

The Proposed Action's contribution to global climate change is small compared to the total California emissions, but operation of propane-powered pumps over the life of the WSEP could result in an adverse effect. Implementation of Environmental Commitments AQ-3: Use Electric Pumps would reduce the severity of this effect.

Effect CC-3: Secondary Emissions at Power Plants

Electricity and natural gas usage by the pumps and any additional facilities to be constructed or improved as a result of the Proposed Action is expected to be minimal. Use of electricity instead of propane for the pumps is expected to decrease GHG emissions from pumping activities. Maintenance activities of existing facilities, including facility upkeep and operation, would not change as a result of the Proposed Action. Additionally, the maintenance associated with new facilities such as ponds would not result in noticeable changes in emissions. Table 4.6-6 summarizes electricity-related GHG emissions associated with project operations. These emissions would not be considered an adverse effect.

Table 4.6-6. Electricity-Related GHG Emissions Operations, Alternatives B–D (metric tons per year)

	Total Electricity Usage (kWh/year)	CO_2 Emissions (tons/year)	CH_4 Emissions (tons/year)	N_2O Emissions (tons/year)	CO_2e Emissions (tons/year)
kWh Off peak	1,738,613	385.76	0.0238	0.0064	388.2
kWh Partial peak	1,096,082	243.20	0.0150	0.0040	244.8
kWh On peak	944,898	209.65	0.0129	0.0035	211.0
kWh Off peak	180,986	40.16	0.0025	0.0007	40.4
kWh Partial peak	180,986	40.16	0.0025	0.0007	40.4
Total	**4,141,565**	**919**	**0**	**0**	**925**

Alternative C—Water Banking outside the MID Service Area without Swales and Alteration of Reclamation-Owned Facilities

Alternative C is similar in scope and design to Alternative B, with the primary exception that the natural swales that occur on the site would not be used for recharge, and ponds would be constructed instead. The construction activities and operational needs under Alternative C would be similar to Alternative B and would result in similar effects on climate change. Consequently, GHG emissions would be similar to those described under Alternative B because recharge ponds would be constructed under this alternative.

Effect CC-1: Increased GHG Emissions during Construction

Construction activities under Alternative C would be similar to those under Alternative B. The total estimated CO_2e emissions during construction are estimated to be approximately 9,982 metric tons. Consequently, the effect on climate change from construction activities is considered similar to the effect under Alternative B. These emissions would be considered an adverse effect. Implementation of Environmental Commitments AQ-1, AQ-2, and AQ-3 would reduce the intensity of this effect.

Effect CC-2: Increase in GHG Emissions as a Result of Operation and Maintenance

Operational activities under Alternative C would be similar to those under Alternative B. The annual estimated operational increase in CO_2e emissions under Alternative C would therefore be approximately 11,425 metric tons. Consequently, the effect on climate change from operational activities is considered equivalent to that under Alternative B. These emissions would be considered an adverse effect. Implementation of Environmental Commitment AQ3: Use Electric Pumps would reduce the intensity of this effect.

Effect CC-3: Secondary Emissions at Power Plants

Electricity and natural gas usage required by the pumps and any additional facilities to be constructed or improved as a result of Alternative C is expected to be minimal. Use of electricity instead of propane for the pumps is expected to decrease GHG emissions from pumping activities. Maintenance activities, including facility upkeep and operation, do not change as a result of this alternative. Table 4.6-6 summarizes electricity-related GHG emissions associated with project operations. These emissions would not be considered an adverse effect.

Alternative D—Water Banking outside the MID Service Area with Banking and Recovery via Gravelly Ford Canal

Alternative D will result in an increase in GHGs during construction due to additional grading and reshaping of the off-site portions of GF Canal. These effects would be larger than the reduction in air quality effects associated with fewer Section 8 canal improvements and elimination of the 24.2 lateral improvements.

Effect CC-1: Increased GHG Emissions during Construction

Construction activities under Alternative D are summarized in Table 4.6-7.

Table 4.6-7. Maximum Construction Emissions for the Proposed Action (metric tons)

Emission Source	CO_2	CH_4	N_2O	CO_2e
On-site heavy equipment, including fugitive dust and worker trips				
Phase 1	6,240.9	0.4	0.2	6,297.9
Phase 2 (grading)	3,683.9	0.2	0.1	3,717.6
Worker Trips—Fresno	390.2	0.0	0.0	393.8
Worker Trips—Madera	38.0	0.0	0.0	38.3
Worker Trips—Chowchilla/Firebaugh	18.7	0.0	0.0	18.9
Haul Trucks	875.9	0.1	0.0	883.9
Total	**11,247.6**	**0.6**	**0.3**	**11,350.4**

The total estimated CO_2e emissions during construction therefore are estimated to be approximately 11,350 metric tons. Consequently, the effect on climate change from construction activities is considered equivalent to that which would occur under Alternative B. These emissions would be considered an adverse effect. Implementation of Environmental Commitments AQ-1 and AQ-2 would reduce the intensity of this effect.

Effect CC-2: Increase in GHG Emissions as a Result of Operation and Maintenance

Operational activities under Alternative D would be similar to those under Alternative B. The annual estimated operational increase in CO_2e emissions under Alternative D therefore would be approximately 11,425 metric tons. Consequently, the effect on climate change from operational activities is considered equivalent to that under Alternative B. These emissions would be considered an adverse effect. Implementation of Environmental Commitments AQ-1, AQ-2, and AQ-3 would reduce the intensity of this effect.

Effect CC-3: Secondary Emissions at Power Plants

Electricity and natural gas usage required by the pumps and any additional facilities to be constructed or improved as a result of Alternative D is expected to be minimal. Use of electricity instead of propane for the pumps is expected to decrease GHG emissions from pumping activities. Maintenance activities, including facility upkeep and operation, do not change as a result of implementing this alternative. Table 4.6-6 summarizes electricity-related GHG emissions associated with project operations. These emissions would not be considered an adverse effect.

Cumulative Effects

Climate change is a global problem, and GHGs are global pollutants. As such, impacts of the Proposed Action and its alternatives on climate change (Effects CC-1 to CC-3) have been evaluated from a cumulative perspective. Although emissions resulting from the Proposed Action and its alternatives may not be significant on a project level, the combination of emissions from many sources results in substantial effects on climate change. Consequently, emissions generated from the Proposed Action and its alternatives are considered to have adverse effects on climate change as discussed above.

Table 4.6-8 provides a summary of the estimated GHG emissions from construction and operation of the Proposed Action. These emissions were calculated for construction and operational activities under Alternatives B and C, as Alternatives B and C are nearly identical in scope and design. Thus, the construction activities and operational needs under Alternatives B and C would be similar. In addition, Table 4.6-9 summarizes GHG emissions from construction and operation of the Proposed Action under Alternative D.

Table 4.6-8. Alternative B/C–Related Emissions from Construction and Operations (tons per year)

	CO_2	CH_4	N_2O	CO_2e
Construction	9,401.0	0.3	0.4	9,525.7
Operation	11,402.1	0.02	0.07	11,425.4
Total	**20,803.1**	**0.32**	**0.47**	**20,951.1**

Table 4.6-9. Alternative D–Related Emissions from Construction and Operations (tons per year)

	CO_2	CH_4	N_2O	CO_2e
Construction	8,395.3	0.5	0.2	8,472.1
Operation	11,402.1	0.02	0.07	11,425.4
Total	**19,797.4**	**0.5**	**0.3**	**19,897.5**

The total estimated CO_2e emissions during construction and operation of the Proposed Action would be approximately 19,898 metric tons. This is approximately 0.004% of the CO_2e emissions for California in 2004 (California Air Resources Board 2007). Construction emissions would not continue past the Proposed Action completion date of 2010, and Environmental Commitments AQ-1 and AQ-2 would reduce the intensity of these effects. Operational emissions are a result of using propane pumps. Environmental Commitment AQ-3 would reduce the intensity of this effect. As such, the Proposed Action would not make a considerable contribution to climate change effects.

Proposed Action Performance under Changing Conditions

The Proposed Action and alternatives would be responsive to the changing environment under increased global warming, and this is a major benefit of implementing the WSEP. Many of the regional effects of climate change would be expressed through changes in weather patterns, resulting in changes in the timing and amount of water coming through the system (Table 4.6-10).

Table 4.6-10. Climate Change Outcomes That May Directly or Indirectly Affect Environmental Resources

Potential Effect of Climate Change	Expected Consequences for the Sacramento–San Joaquin Watershed
Changes in timing, intensity, location, amount, and variability of precipitation	• Potential increases in storm intensity and flooding potential • Possible increased drought potential
Increase in rain relative to snow; reduction in average annual snowpack	• Loss of 5 million af or more of average annual water banking in snowpack • Increased challenges for reservoir management; increased challenges related to balance between flood protection and water supply needs
Long-term changes in watershed vegetation; increased incidence of wildfires	• Changes in timing and intensity of runoff • Possible increased incidence of flooding • Possible increases in sediment delivery to surface waters
Increase water temperature	• Increased demand for releases to control water temperature • Potential adverse changes in water quality, including reduction in dissolved oxygen levels • Possible adverse effects on threatened and endangered aquatic species • Potential for increased success of nonnative invasive species in aquatic ecosystems
Increased temperature and altered precipitation patterns	• Changes in agricultural cropping patterns; resulting alteration in agricultural water demand • Changes in urban water demand

Source: Modified from California Department of Water Resources 2006.

af = acre-feet.

The WSEP would be a valuable tool in addressing these changed conditions because it would allow banking of water when it is available for use at a later time when it is needed but may not be available. For example, during a wet winter and dry spring year type, MID would be able to use the water supply provided in the winter during the irrigation season without adverse effects on agriculture. Similarly, during a series of wet years, water could be banked (similar to a reservoir) for use in future dry years. Wet years also provide an opportunity for banking to temporarily offset groundwater overdraft. As such, MID would be able to respond to the shift in timing of flows attributable to climate change. The WSEP provides additional flexibility in the system in meeting demands and managing the timing of diversion and use.

4.7 Cultural Resources

4.7.1 Introduction

This section describes the existing environmental setting for the areas potentially affected by the proposed alternatives. It summarizes the cultural setting of the Madera Ranch site and describes cultural resources identified in the Madera Ranch vicinity and their significance; discusses relevant regulations and policies, methods of analysis, and possible effects.

4.7.2 Affected Environment

Methodology and Terminology

The following discussion of cultural resources is based on a review of existing information regarding the prehistoric, ethnographic, and historical context of the Madera Ranch vicinity. Additional information was requested from the Native American Heritage Commission (NAHC) and from Native American individuals with knowledge of local resources of concern to Native Americans. Jones & Stokes conducted a preliminary field visit, consulted historic maps, and conducted a mixed-strategy survey of the vicinity to identify cultural resources. Additionally, historical research was carried out at statewide repositories in Sacramento and local repositories in the Madera vicinity to evaluate cultural resources identified in the field.

Prefield Research

Records Search

A records search was conducted at the Southern San Joaquin Valley Information Center (SSJVIC) at California State University, Bakersfield, on April 7, 2000, and records search updates were requested on February 24 and March 7, 2005. Specific records reviewed at the SSJVIC included those from surveys previously conducted and sites previously recorded in and within a 0.5-mile radius of the Madera Ranch vicinity. The *National Register of Historic Places* (NRHP) (including updates through January 2000 and March 7, 2005), the *California Inventory of Historic Resources* (California Department of Parks and Recreation 1976), *California Historical Landmarks* (California Department of Parks and Recreation 1996), and the California Register of Historical Resources (CRHR) also were reviewed.

The records searches indicate that one cultural resource study had been conducted in the project area of potential effect (APE) (Jones & Stokes 2002), and seven cultural resource investigations have been conducted within a 0.5-mile radius of

Madera Ranch (Baloian and Flint 2002; Cannon 1986; Hudlow 2000; Nissley et al. 1975; Price 2001; Ptomey 1990; Riddell 1975). Jones & Stokes (2002) recorded a total of 13 historic-era cultural resources in and adjacent to the present APE, on Madera Ranch. In addition to these resources, one prehistoric archaeological site (CA-Mad-300) and historic Cottonwood Creek Bridge (P-20-2323) have been recorded within an 0.8-km radius of the APE (Feldman 2001; Hudlow 2000; Peak and Gerry 1975). CA-Mad-300 consists of three oval depressions and "several" round depressions thought to be prehistoric structural remnants. The site is located 2 km south of Madera Ranch above a filled-in slough (Peak and Gerry 1975).

Historical Research

Historical research was conducted at the following repositories in Sacramento:

- library at California State University, Sacramento;
- California History Room of the California State Library;
- library of the California Department of Conservation, California Geological Survey;
- California State Archives; and
- Bureau of Land Management (BLM) cadastral survey records.

Research also was conducted at the following repositories in the Madera vicinity:

- the County library, Madera;
- the County Recorder's and Assessor's offices, Madera;
- MID, Madera;
- Gravelly Ford Irrigation District, Madera; and
- Columbia Canal Company, Firebaugh.

The results of this research are presented in the *Historical Context* section of the cultural resources inventory and evaluation report (Jones & Stokes 2002) and were used to evaluate the cultural resources identified in the field.

Jones & Stokes contacted the Madera County Historical Society requesting information on known historic resources in the Madera Ranch vicinity. No information has resulted from this consultation.

Native American Consultation

On April 4, 2000, March 3 and 7, 2005, and again on February 12, 2009, Jones & Stokes requested that NAHC staff members in Sacramento conduct a search of the sacred lands file for cultural resources. NAHC personnel reported that no cultural resources listed in the sacred lands file are present in the Madera Ranch vicinity. They also provided Jones & Stokes with a list of interested Native American individuals and organizations that may have knowledge of cultural resources in the vicinity. ICF Jones & Stokes contacted each Native American contact by letter and telephone. To date, this consultation has not yielded information regarding cultural resources in the vicinity.

Field Visit and Map Research

On May 30, 2000, two Jones & Stokes archaeologists conducted a driving survey of the Madera Ranch vicinity to become familiar with current land use and access issues on the property and to identify areas sensitive for cultural resources. The information gathered during the field visit was used to design the cultural resources survey strategy and to identify potential effects on cultural resources.

During the field visit, the archaeologists mapped current land uses, topography, vegetation, and cultural resource locations on topographic maps of the area. The information obtained was cross-checked with aerial photographs of the vicinity. Historic maps were obtained from BLM survey records and the California Geological Survey Library, both in Sacramento. Potential cultural resource locations as indicated on historic maps were cross-checked with field notes and aerial photographs, resulting in the identification of eight cultural resources in the vicinity.

Field Survey

The APE was systematically surveyed to identify cultural resources. In 2000, Jones & Stokes conducted an intensive pedestrian survey of 650 acres of the Madera Ranch property. The area was surveyed by walking transects spaced 100 feet between surveyors. In March 2005, Jones & Stokes returned to the Madera Ranch vicinity to visit locations beyond the boundaries of Madera Ranch where construction would occur (i.e., along the Main No. 2, Section 8, and 24.2 Canals).

In March 2009, ICF Jones & Stokes conducted further surveys of approximately 1,319 acres of the Madera Ranch property and 10 locations beyond the boundaries of Madera Ranch where construction would occur (i.e., adjacent to Cottonwood Creek and 24.2 Canal). These surveys included intensive pedestrian surveys and subsurface trenching of six areas identified as sensitive for buried cultural resources. The pedestrian survey was conducted by walking transects spaced 100 feet between surveyors. The subsurface trenching consisted of six 15-foot trenches with an average depth of 7 feet at six areas on Madera Ranch where paleosols were identified as a result of past geotechnical studies.

Findings

As a result of prefield research, historical research, the 2000 survey, 2002 survey, 2005 survey, and the 2009 survey, 16 cultural resources were identified within the APE and evaluated for NRHP significance. These cultural resources are presented in Table 4.7-1. A detailed description and significance evaluation of these resources previously have been documented (Jones & Stokes 2002) and more recently have been documented (ICF Jones & Stokes 2009). None of these cultural resources appears to meet the significance criteria for NRHP listing. Reclamation, however, will make the determination of eligibility for identified cultural resources and seek concurrence from the California State Historic Preservation Officer (SHPO), pursuant to Section 106 of the NHPA (36 CFR 800).

Table 4.7-1. Cultural Resource Sites Identified at Madera Ranch

Primary Number or Trinomial	Temporary Site Number	Description
P-20-2402	JSA-Cultural-2	Gravelly Ford Canal
P-20-2385	JSA-Cultural-6	Road 17 segment
P-20-2386	JSA-Cultural-7	Historic road
P-20-2400	JSA-Cultural-8	Levee and associated ditches
P-20-2390	JSA-Cultural-21	Historic road
CA-Mad-2309-H	JSA-Cultural-22	Water pumping location and access road
P-20-2393	JSA-Cultural-A-1	Irrigation ditch
P-20-2394	JSA-Cultural-B-1	Levee and associated ditches
CA-Mad-2310-H	JSA-Cultural-B-2	Water pumping location
P-20-2398	JSA-Cultural-B-6	Concrete ditch
P-20-2399	JSA-Cultural-B-7	Dry pond
P-20-2389	JSA-Cultural-B-18	Concrete footings
Main No. 1 Canal		Irrigation canal
Main No. 2 Canal		Irrigation canal
Section 8 Canal		Irrigation canal
24.2 Canal		Irrigation canal

4.7.3 Setting

A concise summary of regional prehistoric, ethnographic, and historic backgrounds is presented below. A detailed discussion of the regional setting for cultural resources previously has been documented in Draft Cultural Resources Inventory and Evaluation Report for the Proposed Madera Water Bank, Madera

County, California (Jones & Stokes 2002) and in Cultural Resources Inventory and Evaluation for the Madera Irrigation District Water Supply Enhancement Project, Madera County, California (ICF Jones & Stokes 2009).

Prehistory

The Madera Ranch vicinity lies in the San Joaquin Valley cultural region (Moratto 1984). This region comprises the following four complexes, which describe specific cultural traits within a given time period:

- the Positas Complex,
- the Pacheco Complex,
- the Gonzaga Complex, and
- the Panoche Complex.

The Positas Complex (3300–2600 BC) is characterized by small, shaped mortars; short, cylindrical pestles; millingstones; perforated flat cobbles; and spire-lopped *Olivella* beads.

The Pacheco Complex (2600 BC–AD 300) comprises two phases: A and B. Phase B (2600–1600 BC) is characterized by foliated bifaces; rectangular *Haliotis* ornaments; and thick, rectangular *Olivella* beads. Phase A (1600 BC–AD 300) is represented by more varied types of shell beads. *Olivella* beads of spire-ground, modified saddle, saucer, and split-drilled types are present, as are *Haliotis* disc beads and ornaments. Other artifacts characteristic of this phase include perforated canine teeth; bone awls, whistles, and grass saws; large-stemmed and side-notched points; and an abundance of millingstones, mortars, and pestles (Moratto 1984; Olsen and Payen 1969).

The Gonzaga Complex (AD 300–1000) is characterized by burials in which the bodies of the deceased are either extended or flexed. This complex also is characterized by bowl mortars and shaped pestles; squared- and tapered-stem projectile points; few bone awls and grass saws; and a shell industry composed of distinctive *Haliotis* ornaments and rectangular, split-punched, and oval *Olivella* beads.

The Panoche Complex (AD 1500–European contact) is characterized by the presence of few millingstones and varied mortars and pestles; small side-notched arrow points; clamshell disc beads; *Haliotis* epidermis disc beads; *Olivella* lipped, side-ground, and rough disc beads; and bone awls, whistles, saws, and tubes. Flexed burials and primary and secondary cremations are found (Moratto 1984; Olsen and Payen 1969).

Ethnography

The Madera Ranch vicinity lies within the traditional homelands of the Northern Valley Yokuts (specifically the Huechi and Hoyima Yokuts), whose territory extended southward from just north of the Calaveras River to the bend of the San Joaquin River near Fresno. The foothills of the Diablo Range probably marked the western boundary of Northern Valley Yokuts territory, while the eastern boundary is at the lower foothills of the Sierra Nevada. The Northern Valley Yokuts made their livelihood through fishing and hunting and gathering various plant foods, especially acorns. Most principal settlements sat perched on top of low mounds, on or near the banks of large watercourses. The elevated positions helped to keep the inhabitants, their houses, and their possessions above the waters of the spring floods. A strong tendency toward residence in permanent villages, fostered by the abundant riverine resources, was evident; the same sites were occupied for generations (Kroeber 1925; Wallace 1978).

Historical Content

This historical context focuses on the development of irrigation in the Madera area because the three newly identified cultural resources (Main No. 2 Canal, 24.2 Canal, and Section 8 Canal) are associated with this theme. It should be noted that this section is derived from several sources. In some instances, these sources are not consistent with one another.

The development of large-scale irrigation literally changed the face of California by allowing the development of large-scale agriculture, residential and industrial power, and substantial new recreation areas. The Spanish and Mexicans had practiced irrigation on a limited scale by diverting water from streams to mission orchards, gardens, and pueblos via open ditches. The development of large farms in the post-gold rush era and a series of devastating droughts in the 1860s, however, provided the impetus for the construction of more extensive irrigation projects. (Hart 1978:205.)

In the late 1880s, the portion of present-day Madera County between the Chowchilla and San Joaquin Rivers and the lower Sierra foothills and Chowchilla Canal was one of the last large areas of the San Joaquin Valley with ready water sources at hand; yet it had relatively little land under irrigation. Following in the wake of the Wright Act, the Madera Irrigation District (not related to the present MID) was established in 1888, comprising 280,000 acres. Owners of large areas of land on the lower San Joaquin River, such as Miller & Lux, however, objected to the formation of the district and the proposed use of San Joaquin waters. Opposition to the newly formed district was bolstered by owners of large landholdings who were content with the methods of farming then in use in the region. The Madera Irrigation District found itself in a losing legal battle, with the prospect of extended litigation. The organizers of the district dissolved the entity in 1896. (Adams 1929:199; Barnes 1963:7; Harding 1960:100; Rodner 1948:6.)

The MC&IC was a contemporary of the first Madera Irrigation District. The MC&IC used the Fresno River as its sole water supply and sold water rights to the MC&IC, formed in 1888, to "acquire, hold and dispose of water and water rights" (Barnes 1963:2). Flow from the Fresno River was supplemented by up to 100 cfs from the North Fork of the San Joaquin River, Big Creek, and Chilcoot Ditch. The MC&IC had rights to only 200 cfs from the Fresno River, which did not allow for adequate service to the canal company's customers. In addition, the organization suffered from a lack of available funding and insufficient maintenance and operation of the system. (Adams 1929:200.)

The conditions outlined above led to an interest in a larger irrigation project. An irrigation bureau was formed, and the manager of the MC&IC, R. L. Hargrove, filed a preliminary engineering report proposing to divert 3,000 cfs from the San Joaquin River and store some several hundred thousand-acre feet of water at the site of present Friant Dam. Subsequent investigations were conducted, and a plan was drawn up for a 350,000-acre irrigation district. The current MID was formed in 1920 and was immediately subjected to litigation from Miller & Lux, who opposed diversion of water from the San Joaquin River by MID. As a result of legal conflicts, the San Joaquin River Water Storage District was organized to include both Miller & Lux and MID land and to institute a suitable compromise to the interests of the former two groups. Agreement was never reached, however, and the storage district was dissolved in 1929 (Adams 1929; Madera Irrigation District 1981:3–6; Miller 1993)

Meanwhile, the state had conceived the State Water Plan and planned to construct Friant Dam and Reservoir. Anticipating state assistance with the development of a water supply for the district, MID purchased the Friant site. The water project was turned over to Reclamation, however, and MID waited until 1939 before being granted a water supply from Friant Dam, which was built in 1944 (Madera Irrigation District 1981:6.) MID began supplying water to its customers in 1949, when the distribution system in the central part of the district was purchased from the MC&IC. The rest of MID distribution system was built in 1955 and 1959 by Reclamation. It is the last open-ditch irrigation system built by Reclamation in California (Madera Irrigation District 1981:6).

The building of the area's irrigation systems spurred development of the region's rich agricultural industry from the 1870s to the present. The growth of Madera County, in turn, is tied to the region's agricultural development. People began settling in Madera County to establish farming colonies. In time, several self-sufficient communities emerged, prompting the development of infrastructure and small industries. In present-day Madera County, logging, mainly of sugar pine, developed concurrently with other industries, such as copper and granite mining. Grapes, raisins, figs, cotton, alfalfa, fruit, cattle, and seed and field crops are historically important crops and remain significant today (Clough 1968; Madera County 2007).

4.7.4 Analysis of Environmental Effects

The Proposed Project is considered a federal undertaking because Reclamation will be involved in project permitting. As a federal undertaking, the endeavor is subject to the provisions of Section 106 of the National Historic Preservation Act (hereafter Section 106). Specific regulations (36 CFR 800) regarding compliance with Section 106 state that, although the tasks necessary to comply with Section 106 may be delegated to others, the federal agency is ultimately responsible for ensuring that the Section 106 process is completed according to statute. The Section 106 process is a consultation process that involves the SHPO throughout; the process also calls for including Native American Tribes and interested members of the public, as appropriate, throughout the process. Implementing regulations for Section 106 (36 CFR 800) detail the following five basic steps:

1. Initiate the Section 106 process.
2. Identify and evaluate cultural resources to determine whether they are historic properties (cultural resources that are determined eligible for inclusion in the NRHP).
3. Assess the effects of the undertaking on historic properties within the APE.
4. If historic properties may be subject to adverse effects, Reclamation, the SHPO, and any other consulting parties (including Native American Tribes) continue consultation to seek ways to avoid, minimize, or mitigate the adverse effect. A memorandum of agreement (MOA) is usually developed to document the measures agreed upon to resolve the adverse effects.
5. Proceed in accordance with the terms of the MOA.

Criteria for Determining Significance of a Resource

Section 106 requires federal agencies to consider the effects of their actions on properties that may be eligible for listing or are listed in the NRHP. To determine whether an undertaking could affect NRHP eligible properties, cultural resources (including archeological, historical, and architectural properties) must be inventoried and evaluated for the NRHP. To qualify for listing in the NRHP, a property must be at least 50 years old or, if fewer than 50 years old, be of exceptional historic significance. It must represent a significant theme or pattern in history, architecture, archaeology, engineering, or culture at the local, state, or national level. The criteria for evaluating the eligibility of cultural resources for listing in the NRHP are found in 36 CFR Part 60.4. A property must meet at least one of the following criteria:

1. Is associated with events that have made a significant contribution to the broad patterns of our history; or

2. is associated with the lives of persons significant in our past; or
3. embodies the distinctive characteristics of a type, period or method of construction, or represents the work of a master, or possesses high artistic value, or represents a significant and distinguishable entity whose components may lack individual distinction; or
4. has yielded, or may be likely to yield, information important in prehistory or history.

In addition to meeting the significance criteria, potentially historic properties must possess integrity to be considered eligible for listing in the NRHP. Integrity refers to a property's ability to convey its historic significance. Integrity is a quality that applies to historic resources in seven specific ways: location, design, setting, materials, workmanship, feeling, and association. A resource must possess two, and usually more, of these kinds of integrity, depending on the context and the reasons the property is significant.

Methods

Identified cultural resources were evaluated for NRHP eligibility according to the criteria outlined above. To evaluate identified cultural resources, Jones & Stokes developed historic contexts—frameworks within which to gauge the relationship of identified resources to themes, events, individuals, research agendas, and resource characteristics important at a local, state, or national level.

Historical research identified two broad contexts within which to evaluate cultural resources identified in the Madera Ranch vicinity: ranching/agricultural pursuits and irrigation. Cultural resources related to ranching/agricultural pursuits are evaluated within a historic framework of the development of ranching in Madera County and the resources' association with the Pope and Talbot families. Research on irrigation identified historic canals built by Miller & Lux to irrigate range and agricultural lands; these resources are evaluated within the framework of Miller & Lux's role in the irrigation of the San Joaquin Valley. Later irrigation efforts that culminated in the formation of MID are an important subset of the irrigation theme.

Evaluation of cultural resources identified as a result of the present investigation indicates that the alternatives considered in this analysis would not affect historic, archaeological, architectural, or traditional cultural properties that appear to be eligible for NRHP. However, the alternatives do have the potential to affect as-yet-unidentified cultural resources, such as buried archaeological sites. Effects could result from the physical disturbance of unidentified cultural resources during construction or construction-related activities.

Environmental Consequences

As documented previously, cultural resources CA-Mad-2309-H, P-20-2385, P-20-2386, P-20-2389, P-20-2390, P-20-2393, P-20-2394, P-20-2398, P-20-2400, P-20-2402, , CA-Mad-2310-H, P-20-2399, the Main No. 1 Canal, the Main No. 2 Canal, the 24.2 Canal, and the Section 8 Canal, were evaluated previously under the NRHP's significance criteria. None of these resources were found to be eligible under the NRHP's significance criteria (Jones & Stokes 2002; ICF Jones & Stokes 2009).

Alternative A—No Action

Under the No Action Alternative, Reclamation would not approve the banking of CVP water outside MID's service area, nor would Reclamation issue an MP-620 permit to approve of modifications to its distribution system. Reclamation's action would have no adverse effects on cultural resources. However, it is expected that under this alternative conditions would change to support agricultural activities.

Alternative B—Water Banking Outside the MID Service Area and Alteration of Reclamation-Owned Facilities

Effect CR-1: Damage to or Destruction of Nine Historic Features on Madera Ranch through Construction of Recharge Basins

Alternative B would result in damage to or destruction of nine historic features (CA-Mad-2309-H, P-20-2386, P-20-2389, P-20-2390, P-20-2393, P-20-2394, P-20-2398, and P-20-2400) on Madera Ranch as a result of the excavation of recharge basins. Brief resource descriptions are presented in Table 4.7-1. Jones & Stokes (2002:26–29; 2007:46, 48–50, 52; ICF Jones & Stokes 2009:53-68) evaluated these nine resources for eligibility for listing in the NRHP and recommended all as ineligible for NRHP listing. Under NEPA, modification of these resources would not be considered an adverse effect on cultural resources.

Effect CR-2: Physical Modifications to Gravelly Ford Canal (P-20-2402)

Alternative B would result in physical modifications to the GF Canal (P-20-2402) for use in the proposed water-collection system. Modifications would consist of grading the canal bottom and side slopes, as well as construction of three to five permanent canal crossings. Jones & Stokes (2002:26; 2007:44) evaluated P-20-2402 for eligibility for NRHP listing and recommended the canal as ineligible for NRHP listing. Under NEPA, modification of this resource would not be considered an adverse effect on cultural resources.

Effect CR-3: Physical Modifications to Historic Main No. 1, Main No. 2, and Section 8 Canal

Alternative B would result in physical modifications to the Main No. 1, Main No. 2, and Section 8 Canals. Modifications include the installation of lift gates and other ancillary features and canal widening.

The Main No. 1, Main No. 2, and Section 8 Canals are components in the MC&IC system, which MID purchased for distributing water in 1949 (Madera Irrigation District 1981:6). The addition of the MC&IC canal system gave MID access to Fresno River and San Joaquin River water, increasing its service capabilities (Barnes 1963:3). The MC&IC portion of MID irrigation system is associated with the early development of irrigation in the Madera region, which promoted the cultivation of new and diverse crops. The period of significance for the Main No. 2 and the Section 8 Canals is therefore 1870–1920, the former date marking the approximate construction of the MC&IC system and the latter marking the inception of MID.

Because of the system's association with early irrigation and agricultural development, the Main No. 1, Main No. 2, and Section 8 Canals appear to meet NRHP Criterion A at the local level of significance. Main No. 2 and Section 8 Canals do not, however, retain integrity of workmanship and design because MC&IC and MID have modified the canals through regular maintenance and redesign since 1920. These modifications resulted in water conveyance structures that do not resemble their historic antecedents but look like modern ditches and canals. As modern canals, the Main No. 1, Main No. 2, and Section 8 Canals do not physically convey their historical significance. Therefore, the Main No. 1, Main No. 2 and Section 8 Canals do not appear to be historic properties. Under NEPA modification of these canals would not be considered an adverse effect on cultural resources.

Effect CR-4: Physical Modification of 24.2 Canal

Reclamation, under contract with MID, built 24.2 Canal in 1955 as a component of MID's distribution system (Madera Irrigation District 1981). Although certainly important in MID's service operations, construction of the system is not a historically important event. The 24.2 Canal is not associated with historically consequential persons and is not associated with the work of a renowned engineer. For these reasons, the 24.2 Canal does not appear to meet the significance criteria of the NRHP and would not qualify as a historic property. Therefore, under NEPA, modification of the 24.2 Canal would not result in adverse effects on a cultural resource.

Effect CR-5: Physical Disturbance of Currently Undiscovered Cultural Resources

The present analysis is based on record searches and a review of prehistoric, ethnographic, and historic literature pertaining to the Madera Ranch vicinity; consultation with Native Americans; historical research; and a pedestrian survey of the vicinity (Jones & Stokes 2002, 2007). Despite the comprehensiveness of the cultural resources inventory, construction may unearth or reveal additional cultural resources that have not been recorded previously and may not have been visible during surveys conducted to date (Jones & Stokes 2007:39–42, 55). The physical disturbance of undiscovered cultural resources could result in an adverse effect under NEPA. Implementation of Environmental Commitment CR-1 to stop construction if cultural resources are discovered would reduce the intensity of the effect.

Alternative C—Water Banking Outside the MID Service Area without Swales and Alteration of Reclamation-Owned Facilities

Alternative C is similar in scope and design to Alternative B, with the primary exception that the natural swales that occur on the site would not be used for recharge. However, the expected footprint of recharge basins under Alternative C would be nearly identical to Phase 2 of Alternative B and would result in equivalent effects on cultural resources (Effects CR-1, CR-2, CR-3, CR-4, and CR-5). None of the resources identified would be recommended for eligibility. Thus, under NEPA, effects on cultural resources are not considered adverse unless cultural resources are discovered during construction (as described in Effect CR-5). Implementation of Environmental Commitment CR-1 to stop construction if cultural resources are discovered would reduce the intensity of this effect.

Alternative D—Water Banking Outside the MID Service Area with Banking and Recovery via Gravelly Ford Canal

Alternative D is similar in scope and design to Alternative B, with the exception that water would be conveyed to the site via GF Canal. For this reason, one recharge basin would not be built under Alternative D that was proposed under Alternative B. However, the expected footprint of recharge basins under Alternative D would be nearly identical to Alternative B and would result in equivalent effects on cultural resources (Effects CR-1, CR-2, CR-3, CR-4, and CR-5). None of the resources identified would be recommended for eligibility. Thus, under NEPA, effects on cultural resources are not considered adverse unless cultural resources are discovered during construction (as described in Effect CR-5). Implementation of Environmental Commitment CR-1 to stop construction if cultural resources are discovered would reduce the intensity of this effect.

Cumulative Effects

Alternative B could result in the physical disturbance of undiscovered cultural resources. MID would halt construction if artifacts are discovered and require evaluation by a professionally qualified archaeologist. This would minimize effects on cultural resources and therefore would not result in a significant regional cumulative effects on cultural resources in Madera County.

As both Alternatives C and D are equivalent to Alternative B in scope and effect, it is not anticipated that Alternative C or D would contribute to cumulative impacts on cultural resources.

4.8 Geology, Seismicity, and Soils

4.8.1 Introduction

This section describes the geologic (including paleontological), seismic, and soil conditions, hazards, and constraints in the areas potentially affected by the proposed alternatives. It discusses the affected environment, relevant regulations and policies, methods of analysis, and possible effects and provides information relating to the final selection of a Proposed Action.

4.8.2 Affected Environment

This section provides an overview of geologic, paleontological, seismic, and soil conditions at the Madera Ranch site. In some instances, the affected area is extended to include land located outside the site (in the Madera Ranch vicinity) that could be affected by potential changes in the groundwater table resulting from the Proposed Action or alternatives.

Methodology and Terminology

The affected area covers a large land area that encompasses a range of geologic materials and soil types. The information provided in this section is presented in a general manner to facilitate a discussion of existing soil and geologic conditions at a level that is appropriate for NEPA analysis. It is based largely on regional literature published by the NRCS, the California Division of Mines and Geology (CDMG) (now called the California Geological Survey), and the County. Information from these published sources is supplemented by site-specific data collected and analyzed during wetland resource inventories (ICF Jones & Stokes 2008).

Setting

Geology

The Madera Ranch site is located on the level and nearly level alluvial landforms that occupy the east-central flank of the San Joaquin Valley, a large northwest-trending structural trough filled with a thick layer of alluvial sediments (Bailey 1966). The regional geologic map compiled by Jennings and Strand (1958) indicates that the site is underlain by basin and alluvial fan deposits, which consist of gravels, sands, silts, and clays deposited by rivers and streams during the last 10,000 years (Figure 4.8-1). The basin and alluvial fan deposits are of similar age.

The basin deposits consist of instream, natural levee, and floodplain deposits that have been salinized in areas by groundwater. These salinized basin deposits serve as the primary parent material of the moderately and strongly saline-alkali soils that dominate the affected area (discussed below). The alluvial fan deposits compose portions of the east-west–trending San Joaquin River, Fresno River, and Cottonwood Creek alluvial fans, which coalesce in the Madera area.

Seismicity

Faults

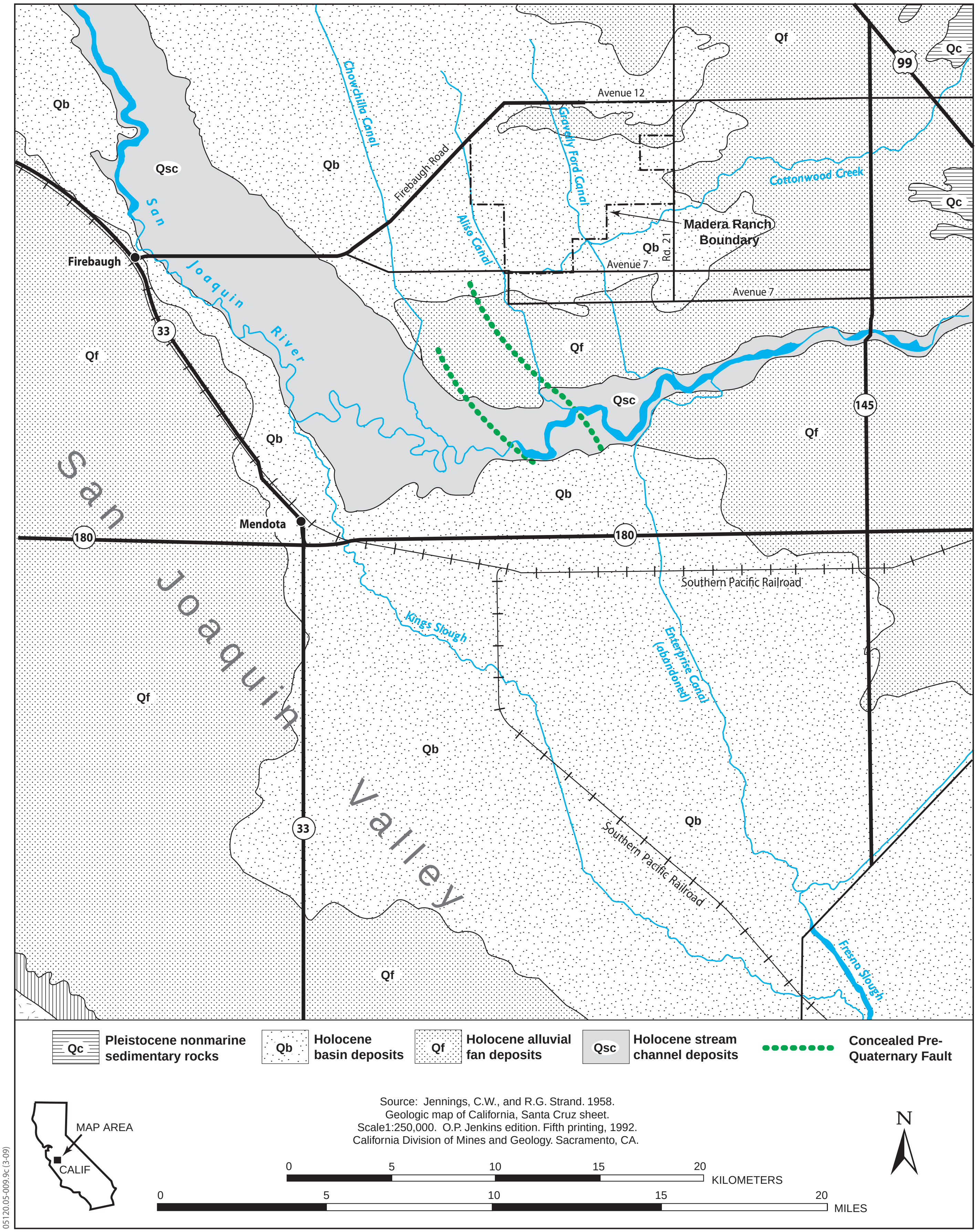
Well-defined, active earthquake faults are almost nonexistent on the alluvial plains of the San Joaquin Valley. Most known faults that exist in the San Joaquin Valley show no evidence of displacement during the last 1.6 million years (i.e., precede the Quaternary period and therefore are considered inactive) and are concealed by overlying sediments. Known faults in the immediate vicinity of Madera Ranch are of this type and include two unnamed fault traces located approximately 2 miles southwest of Madera Ranch (Figure 4.8-1) (Jennings 1994). These fault traces do not present a hazard of ground surface rupture for the WSEP.

No known active faults cross the Madera Ranch site (Hart and Bryant 1997). All known active faults in the San Joaquin Valley and surrounding mountain ranges are located more than 20 miles from the site. The closest of these faults show no evidence of displacement during the last 1.6 million years and are only located approximately. Known active faults include:

- the northwest-trending Kings Canyon lineament, located approximately 20 miles north of Madera Ranch;
- the northwest-trending Clovis fault, located approximately 30 miles east of Madera Ranch; and
- a group of unnamed faults, located approximately 30 miles south of Madera Ranch.

Faults that have experienced displacement during more recent times are located more than 30 miles away. These faults are listed below.

- ***The Ortigalita fault zone*** is a northwest-trending fault system located approximately 45 miles northwest of Madera Ranch, near San Luis Reservoir. This fault shows evidence of displacement during the last 10,000 years.
- ***The San Joaquin fault*** is a northwest-trending fault system located approximately 30 miles west of Madera Ranch near the city of Los Banos. This fault shows evidence of displacement during the last 10,000–700,000 years.



Source: Jennings, C.W., and R.G. Strand. 1958.
Geologic map of California, Santa Cruz sheet.
Scale1:250,000. O.P. Jenkins edition. Fifth printing, 1992.
California Division of Mines and Geology. Sacramento, CA.

Figure 4.8-1
Geologic Map of the Project Site and Surrounding Area

- ***The O'Neill fault system*** is a northwest-trending fault system located approximately 35 miles west of Madera Ranch, near Los Banos. Constituent faults show evidence of displacement during the last 10,000–700,000 years.
- ***The San Andreas fault system*** is a northwest-trending fault system located approximately 60 miles west of Madera Ranch. Segments of this fault have experienced displacement during historical times (i.e., the last 200 years).
- ***The Calaveras fault*** is a northwest-trending fault located approximately 70 miles northwest of Madera Ranch. This fault has experienced displacement during historical times (i.e., the last 200 years) (Jennings 1994).

Seismic Ground-Shaking Hazard

Seismic ground-shaking has been identified as the primary seismic hazard in Madera County (Madera County 1995a). In the western portion of the county, unconsolidated alluvial sediments, which amplify the destructive energy of seismic waves to a greater degree than hard bedrock, are the main geologic substrate and potential risk. Only low levels of ground shaking would be expected to occur in the eastern and central portions of the San Joaquin Valley during the maximum probable earthquake on the San Andreas fault (located approximately 60 miles west of the proposed site) (Madera County 1995a). While seismic ground-shaking is identified as the primary seismic hazard in Madera County, the hazard is relatively low compared to other regions of California that are located closer to active fault systems.

In 1996, the CDMG released a report to aid in the assessment of seismic ground-shaking hazards in the state (Peterson et al. 1996). The report contains a seismic hazard map that depicts the peak horizontal ground-acceleration values exceeded in a given region of California at a 10% probability in 50 years (i.e., a 0.2% probability in 1 year). The peak horizontal ground-acceleration values depicted on the map represent probabilities of the ground-shaking intensity likely to occur in a given area as a result of characteristic earthquake events on nearby faults.

These values can be used to assess the relative seismic ground-shaking hazard for a given region. The peak horizontal ground-acceleration value shown in the report and thus the seismic ground-shaking hazard for the eastern side of the San Joaquin Valley is relatively low, among the lowest in the state. The active San Andreas fault, located approximately 60 miles west of Madera Ranch, is responsible for most of the seismic ground-shaking hazard in the San Joaquin Valley.

The findings of the CDMG probabilistic seismic hazard assessment are generally consistent with those of the *Five County Seismic Safety Element* prepared by the Tulare County Council of Governments for the counties of Fresno, Kings, Tulare, Madera, and Mariposa in 1974 (Tulare County Council of Governments 1974). The five-county hazard assessment indicated that only relatively low levels of ground-shaking would be expected to occur in the eastern and central portions of the San Joaquin Valley during the maximum probable earthquake on the San Andreas fault (magnitude 8–8.5 on the Richter scale) (Madera County 1995a). Thus, although seismic ground-shaking is the most significant type of seismic hazard in the Madera area, both of the above seismic hazard assessments indicate that the hazard is relatively low compared to other regions of California that are located closer to active fault systems.

Liquefaction Hazard

Liquefaction is a natural process by which soils and sediments lose shear strength and fail during episodes of intense, prolonged seismic ground-shaking. The susceptibility of a given soil or sediment to liquefaction is primarily a function of inherent soil properties, such as texture and bulk density, and local groundwater elevations. Poorly consolidated, water-saturated fine sands and silts located within 50 feet of the surface typically are considered to be the most susceptible to liquefaction. The potential for liquefaction to occur, on the other hand, is a function of *both* the susceptibility of a given soil or sediment to liquefaction *and* the potential for strong seismic ground-shaking to occur.

Although there are soils and sediments that contain fine sands and silts beneath and in the vicinity of Madera Ranch, they generally are not susceptible to liquefaction because they are either too coarse-textured or contain too much clay (Madera County 1995a) and because they are not saturated with water within 50 feet of the ground surface. The potential for liquefaction at Madera Ranch is expected to be low because of the site's soil and sediment characteristics as described above and because the seismic ground-shaking hazard in the region is relatively low.

Soils

Soils in Madera County were surveyed by the NRCS during the 1950s (Stromberg et al. 1962). When the survey was conducted, much of the land in western Madera County was uncultivated; undisturbed, native soils were extensive in the vicinity of Madera Ranch. Since that time, many of the native soils in western Madera County have been physically and/or chemically altered from their natural condition by agricultural practices, such as subsoiling (ripping), saline-alkali soil reclamation (described below), leveling, ditch construction, and groundwater pumping (which can lower the water table).

Agricultural practices such as these have resulted in the alteration of native soils in certain southern and southeastern portions of Madera Ranch (discussed below and in Section 4.3, Agriculture). Consequently, the descriptions of soils in these areas provided by the NRCS are probably only partially accurate. Moreover, it is worth noting that the descriptions below of such soil characteristics as drainage class and permeability refer to the upper 5 feet of soil material. Soil/sediment characteristics of the materials that underlie the upper 5 feet of soil, such as texture and permeability, may be different.

A soil map of Madera Ranch is shown in Figure 4.8-2. Although all of the soils in these areas formed from alluvium derived primarily from granitic rock, the soil map units delineated by Stromberg et al. (1962) can be grouped into one of two general categories based on the relative age of the granitic rock alluvium from which they formed and the type of geomorphic surfaces on which they occur:

- soils formed from recent alluvial fan and floodplain deposits and
- soils formed from older alluvial fan and basin deposits.

The soils that make up each of the above groups typically exhibit a common range of characteristics. For example, soils formed from older alluvial fan and basin deposits are more developed, exhibit substantial textural variation with depth, and typically are excessively saline and alkaline. In contrast, soils formed from recent floodplain and alluvial fan deposits typically are less developed, exhibit relatively little textural variation with depth, and are less affected by excess salinity and alkalinity. In general, the swales proposed for recharge as part of Alternative B Phase 1 are underlain by the relatively recent alluvial fan and floodplain deposits, which have lower salt content. The swales are mapped mostly as Pachappa series soils (described below).

Soils Formed from Older Alluvial Fan and Basin Deposits

Soils on older alluvial fan and basin deposits include those of the Fresno, El Peco, Traver, Dinuba, Chino, Borden, and Calhi series. They occupy the greatest proportion of total land area in Madera Ranch (Figure 4.8-2) and support most of the alkali grasslands, slickspots, and alkali rain pools that exist on the uncultivated portions of the site. With the exception of the fine-textured and moderately fine-textured subsoil horizons (i.e., layers) that occur in some of these soils, they are typically coarse-textured and moderately coarse-textured throughout and are at least slightly saline-alkali.

Most of the older alluvial fan and basin soils on Madera Ranch also contain a lime-silica–cemented hardpan or a weakly cemented silty substratum at depths ranging from 5 to 36 inches below the ground surface. In their natural condition, these soils are slowly to moderately permeable, are moderately well- to somewhat poorly drained, and typically have relatively low organic matter content and low to moderate native fertility.

Soils of the Fresno and El Peco Series. The moderately coarse-textured soils of the Fresno and El Peco series occupy the greatest proportion of land at Madera Ranch (Figure 4.8-2). The soils of both series occur on level and nearly level surfaces that, in their natural condition, frequently exhibit low, hummocky (mound-intermound) microrelief. They typically consist of sandy loams, fine sandy loams, silt loams, and loams to depths of more than 60 inches and contain a discontinuous, 5- to 6-inch-thick lime-silica–cemented hardpan at depths ranging from 5 to 36 inches below the ground surface.

Most of the Fresno and El Peco soils at the site are moderately to strongly saline-alkali. Because of the high content of exchangeable sodium and the water-restrictive duripans, these soils are very slowly permeable and somewhat poorly drained. Most of the slickspots and alkali rain pools that exist on the uncultivated portions of the site occur on moderately to strongly saline-alkali soils of the Fresno and El Peco series. (Not all mapped areas of these series support slickspots or alkali rain pools.)

Soils of the Traver, Dinuba, Chino, and Borden Series. The coarse-textured soils of the Traver series and the moderately coarse-textured soils of the Dinuba series are found in association with soils of the El Peco series on the southern half of the Madera Ranch site.

Soils of the Traver and Dinuba series are similar to the soils of the Fresno and El Peco series in that they typically consist of slightly to strongly saline-alkali sandy loams and fine sandy loams that exist on level and nearly level surfaces that frequently exhibit a low, hummocky microtopography. However, they typically do not contain a lime-silica–cemented hardpan, although soils of the Dinuba series are sometimes underlain by a weakly cemented layer of stratified silts and fine sands at depths ranging from 26 to 36 inches below the ground surface. Soils of the Dinuba and Traver series are slowly to moderately permeable. Because they lack a true duripan, they have better internal drainage than the soils of the Fresno and El Peco series.

Soils of the Chino series occur in nearly level, swale-like positions throughout Madera Ranch. They are similar to soils of the Traver series but consist of slightly finer textures and have poorer internal drainage.

Soils of the Borden series occur on nearly level surfaces near the northeast part of Madera Ranch. They differ from the soils of the Traver, Dinuba, and Chino series mainly in that they typically have a moderately clay-enriched subsoil horizon and are not as strongly affected by excess salinity and alkalinity. Soils of the Borden series have moderately slow permeability and are well-drained.

Soils of the Calhi Series. Soils of the Calhi series occur in small areas throughout Madera Ranch. They formed from granitic alluvium that was reworked by wind, are slightly to moderately saline-alkali, and typically consist of loamy fine sands throughout. They generally occur on undulating ridges and small mounds within larger areas of Fresno, El Peco, and Dinuba soils. Because of their uniform, sandy texture and lack of subsurface restrictive layers, they have moderate permeability and good internal drainage.

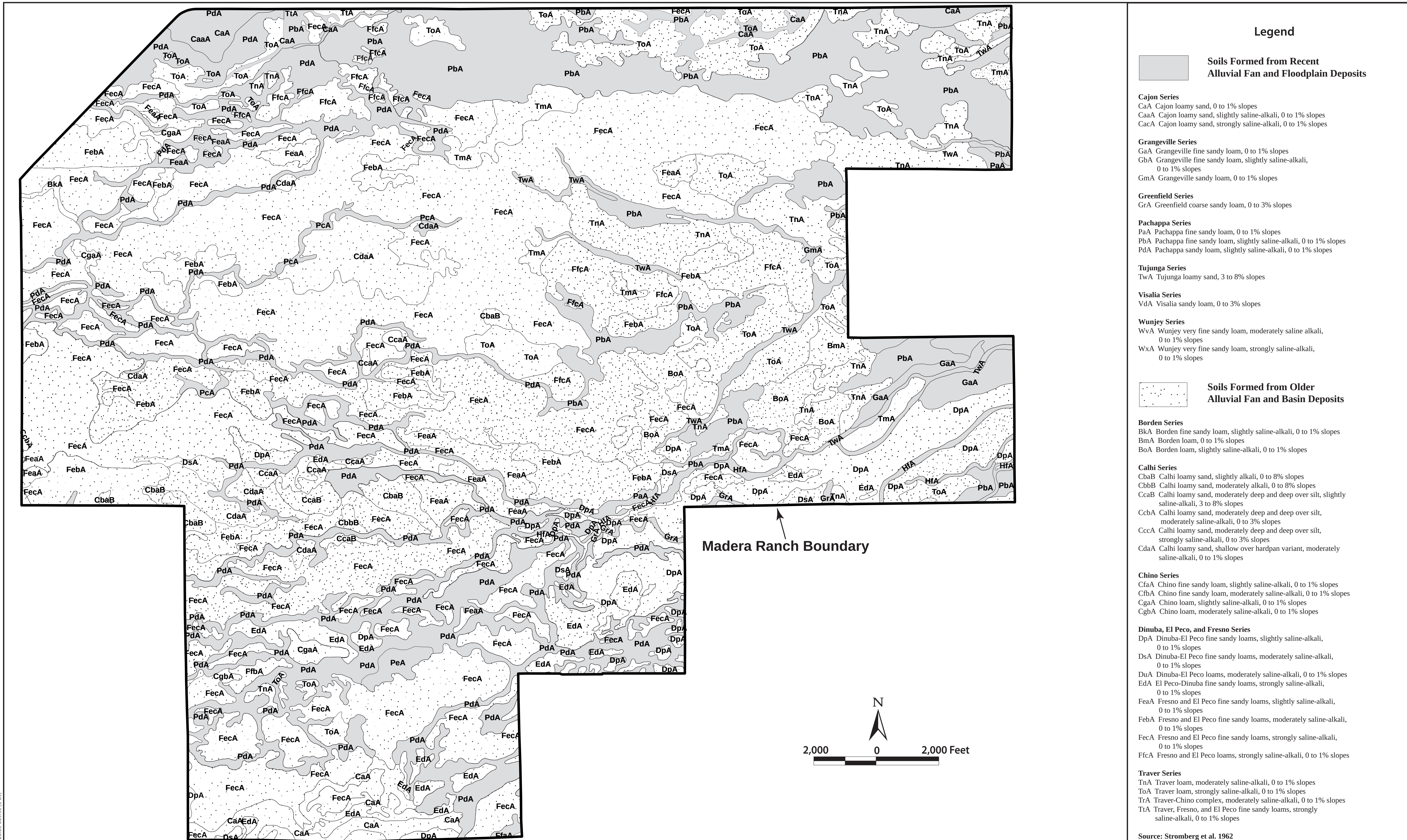


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Figure 4.8-2
Soil Map of the Project Site

Soils Formed from Recent Alluvial Fan and Floodplain Deposits

Soils on recent alluvial fan and floodplain deposits include those of the Pachappa, Greenfield, Cajon, Wunjey, Tujunga, and Visalia series. They are less developed, less extensive, and show less morphologic variation with depth than the older basin and alluvial fan soils described above. These soils typically occur on level and nearly level surfaces and in long, swale-like positions that are often subject to continued alluvial deposition. They lack the fine-textured subsoil horizons and duripans found in the basin soils; with few exceptions, they are coarsely textured throughout and consist of loamy sands, sandy loams, and fine sandy loams to depths of more than 60 inches.

Most of the recent alluvial fan and floodplain soils are not as severely affected by excess salinity and alkalinity as the soils formed from older alluvial fan and basin soils. They typically have moderate to rapid permeability, are moderately well to somewhat excessively drained, and are characterized by low organic matter content and low native fertility.

Soils of the Pachappa and Greenfield Series. The coarse- and moderately coarse-textured soils of the Pachappa and Greenfield series formed from the oldest of the recent alluvial fan and floodplain deposits that exist at Madera Ranch. Soils of the Pachappa series occupy relatively large areas throughout the site, while soils of the Greenfield series are much less extensive. The soils of both series typically are located on nearly level surfaces in narrow, swale-like positions that are not usually subject to continued alluvial deposition; they generally consist of fine sandy loams and sandy loams with the slightly finer-textured subsoil horizons.

Soils of the Pachappa and Greenfield series are, at most, slightly affected by excess salinity and alkalinity near the surface, but they become moderately to strongly saline-alkali with depth. The soils of both series typically are moderately rapidly permeable and well-drained, but they support many of the vernal pools that occur at the site.

Soils of the Cajon, Grangeville, Wunjey, Tujunga, and Visalia Series. The coarse-textured soils of the Cajon, Grangeville, Wunjey, Tujunga, and Visalia series formed from the youngest of the recent alluvial fan and floodplain deposits at Madera Ranch. The soils of these series typically are located on nearly level surfaces and in narrow, swale-like depressions that can be subject to continued alluvial deposition; they generally show little textural variation with depth and consist of sandy loams, loamy sands, and sands that are moderately rapidly permeable and moderately well- to somewhat excessively drained. The soils of the Cajon, Grangeville, Wunjey, and Visalia series are slightly to strongly saline-alkali; soils of the Tujunga series typically are nonsaline and nonalkali throughout.

Subsurface Soils

Extensive data have been collected on the subsurface geology of the property (Bookman-Edmonston 2003). These findings include:

- an average of 260 feet of sediments are deposited above the Corcoran clay beneath Madera Ranch;
- since the Pleistocene, the migration of rivers has produced a network of thick overlapping bands of sandy channel deposits trending from east-northeast to west-southwest;
- five major stratigraphic units were identified above the Corcoran clay;
- the Corcoran clay is discontinuous under the eastern and southeastern portion of the property and is continuous under the western portion of the property;
- approximately 13% of the aquifer material is clayey, 28% is silty, and 59% is sandy;
- the most extensive clayey zones occur at depths of about 70 to 100 feet; and
- there are no identified fault zones under the project site.

Subsidence

Land subsidence is the lowering of the land-surface elevation from changes that take place underground. Common causes of land subsidence from human activity are pumping water, oil, and gas from underground reservoirs; collapse of underground mines; drainage of organic soils; and initial wetting of dry soils.

Overdrafting of aquifers is the major cause of subsidence in the southwestern United States. In many aquifers, groundwater is pumped from pore spaces between grains of sand and gravel. If an aquifer has beds of clay or silt within or next to it, the lowered water pressure in the sand and gravel causes slow drainage of water from the clay and silt beds. The reduced water pressure is a loss of support for the clay and silt beds. Because these beds are compressible, they compact (become thinner), and the effects are seen as a lowering of the land surface. The lowering of land surface elevation from this process is permanent. For example, if lowered groundwater levels caused land subsidence, recharging the aquifer until groundwater returned to the original levels would not result in an appreciable recovery of the land-surface elevation.

In the San Joaquin Valley, most subsidence is correlated with reduced water pressure in confined aquifers. Subsidence from 1926 to 1973 occurred in significant amounts southwest of Madera County, with subsidence of 28 feet approximately 15 miles southwest of Madera Ranch and 8 miles southwest of Mendota. During this period no subsidence was experienced at Madera Ranch.

(Bookman-Edmonston 2003). The County has indicated there has been some recent subsidence in the western portion of the county above the Corcoran Clay resulting from groundwater overdraft, but the amount was not described (Madera County 2008).

Water and Wind Erosion Hazards

Water and wind erosion are processes by which individual soil particles are detached and transported from one location to another by rain and the shear forces of wind and overland water flows. The most direct and detrimental effects of water and wind erosion are the loss of nonrenewable topsoil resources, the degradation of soil quality, and the degradation of air and receiving-water quality.

It is generally accepted that the amount of soil lost as a result of water erosion is the direct result of several factors. The most notable of these factors are slope gradient, the type and density of soil cover, and soil *erodibility,* which is defined as the inherent susceptibility of a given soil to detachment and transport. Soil texture, which plays a large role in controlling the cohesiveness of a soil, also exerts a major influence on a given soil's erodibility.

The poorly structured, fine sandy loam surface soils that occupy most of Madera Ranch have high erodibility. However, the prevailing slope gradient on the site is extremely low (typically 0–1%). Therefore, the rate of runoff is slow and the hazard of water erosion, even under disturbed conditions, is slight to nonexistent (Stromberg et al. 1962).

As with water erosion, the susceptibility of a given soil to wind erosion depends largely on inherent soil properties, such as organic matter content, coarse-fragment (e.g., gravel) content, aggregate stability, calcium carbonate content, and, most importantly, soil texture. For the purpose of identifying and assessing wind-erosion hazards, the NRCS established wind erodibility groups (WEGs).

WEGs are groupings of soil textural types with similar properties that affect their resistance to wind erosion in cultivated areas (Soil Survey Division Staff 1993). The WEGs also should be applicable when assessing the susceptibility of soils at Madera Ranch to wind erosion when vegetation cover is removed and soils are disturbed during construction of the Proposed Action and alternatives.

There are eight WEGs, ranging from 1 to 8; the lower the number, the greater the susceptibility to wind erosion. All the soils on the site belong to WEGs 1–4, indicating that they range from highly susceptible to wind erosion to moderately susceptible to wind erosion.

Saline-Alkali (Salt-Affected) Soils

As discussed above, most of the soils at Madera Ranch, especially those formed from older alluvial fan and basin deposits, are classified as saline-alkali (Figure 4.8-2). The properties of and classification system for these soils are discussed in detail below.

Properties and Classification. The term *saline-alkali* is somewhat ill-defined, but, in general, it is applied to soils that contain sufficient salinity, alkalinity, and/or exchangeable sodium to interfere with the growth of most agricultural crops. Stromberg et al. (1962) assigned the saline-alkali soils in Madera County to three categories based on soluble salt content (salinity) and the effect of alkalinity on plant growth (Table 4.8-1).

Table 4.8-1. Categories of Saline-Alkali Soils in Madera County

Category	Soluble Salt Content[a]	Effect of Alkalinity on Plant Growth[b]
Normal	< 0.2	No significant
Slightly saline-alkali	0.2–0.5	Slight
Moderately saline-alkali	0.5–1.0	Moderate
Strongly saline-alkali	> 1.0	Strong

Source: Stromberg et al. 1962.
Notes:
[a] A measure of soil salinity; percentage on dry-weight basis.
[b] A qualitative measure of soil alkalinity.

According to this system, soils classified as strongly saline-alkali are more likely to have a substantial effect on plant growth than soils classified as moderately or slightly saline-alkali. Although Stromberg et al. (1962) did not state explicitly what part of the soil profile the above categories refer to, soil profile descriptions provided in the Madera area soil survey suggest that they refer to conditions in the topsoil layers, which are the layers in which most plant roots are found. This interpretation is consistent with the fact that many soils classified as slightly saline-alkali by Stromberg et al. (1962) have slightly alkaline topsoils but moderately to strongly alkaline subsoils.

The classification system presented in Table 4.8-1 is no longer used by the NRCS for the purpose of classifying salt-affected soils. It has been replaced by a new system that was developed by workers at the U.S. Salinity Laboratory (USSL) (Table 4.8-2). Most of the saline-alkali soils at Madera Ranch probably would be classified as saline-sodic or sodic under the new system, although it is difficult to determine for certain because of the paucity of available chemical data for soils in Madera County.

Table 4.8-2. Current Classification Scheme for Salt-Affected Soils

Category	Electrical Conductivity of Saturated Soil Extract[a] (deciSiemens per meter)	Soil pH[b]	Exchangeable Sodium[c]
Normal	< 4.0	< 8.5	< 15
Saline	> 4.0	< 8.5	< 15
Sodic	< 4.0	> 8.5	> 15
Saline-sodic	> 4.0	< 8.5	> 15

Notes:

[a] A measure of soil salinity.

[b] A function of soil alkalinity.

[c] Percentage on a dry-weight basis.

The terms *soil salinity, soil alkalinity,* and *exchangeable sodium* are defined below, as are the detrimental effects that each of these soil parameters can have on soil properties and plant growth when present in excessive quantities.

- ***Soil salinity*****:** The amount of soluble salts (e.g., sodium chloride [NaCl]) present in a soil. The conventional measure of soil salinity is the electrical conductivity (EC) of a saturated soil extract, which typically is expressed in units of deciSiemens per meter (dS/m). The main effects of high soil salinity are stunted plant growth and poor seed germination. The mechanisms responsible for these effects are primarily osmotic: soluble salts have a strong affinity for water, so when they are present in high concentrations, they make it difficult for plants to extract water from the soil. Specific salt ions, such as sodium (Na^+), can have toxic effects on some plant species and can induce nutrient imbalances if present in sufficient quantities.
- ***Soil alkalinity*****:** The degree or intensity of alkalinity in a soil. Alkalinity can be measured directly by summing the concentrations of bicarbonate (HCO_3^-) and carbonate (CO_3^{2-}) in a soil solution, or it can be calculated from soil pH. Soils with appreciable alkalinity typically have pH values greater than 7.0. The main effect of high soil alkalinity is to increase soil pH and reduce the availability of essential plant nutrients. Alkalinity induces precipitation reactions that remove nutrients, such as iron and calcium, from the soil solution, making them unavailable to plants.
- ***Exchangeable sodium*****:** The fraction of a soil's cation exchange capacity that is occupied by sodium ions. Exchangeable sodium is a direct function of a soil's soluble salt content and usually is determined by measuring the ionic concentration of sodium in a saturated soil extract. The main effect of high levels of exchangeable sodium is on the physical properties of the soil, which in turn affect plant growth. When soil salinity is low, exchangeable sodium disperses soil clays and destroys the soil structure, interfering with the ability of plant roots to obtain necessary air and water.

> Because exchangeable sodium reduces soil permeability and infiltration rates, it can increase runoff and erosion. High levels of exchangeable sodium also can induce nutrient deficiencies by displacing other essential plant nutrients from the soil's exchange complex. When soil salinity is high, the detrimental effects of exchangeable sodium are generally less evident because high concentrations of soluble salts help keep soil clays flocculated (i.e., clustered in aggregates or flocks).

Sources of Soluble Salts in Madera Ranch Soils

The chemical composition of soluble salts commonly found in soils can be traced to many sources. Some of the most common and significant sources include mineral weathering reactions, groundwater, and human-caused inputs such as fertilizer and irrigation water.

The excess quantities of soluble salts found in Madera Ranch soils are derived primarily from mineral weathering reactions, shallow groundwater, and surface floodwaters temporarily retained in the soil pore space by restrictive subsoil horizons, such as the lime-silica–cemented hardpans that occur in soils of the Fresno and El Peco series (Stromberg et al. 1962). Largely because of the San Joaquin Valley's semiarid climate, soluble salts from these sources have accumulated gradually over time, resulting in the saline soil conditions that exist in much of western Madera County. The fact that many of the saline soils at Madera Ranch are alkaline and contain excess exchangeable sodium (i.e., are saline-alkali) suggests that sodium bicarbonate ($NaHCO_3$) constitutes a significant proportion of the accumulated salts.

Saline-Alkali Soil Reclamation

To improve the suitability of saline-alkali soils for agricultural crop production, the soils typically must be treated with chemical amendments, such as gypsum and elemental sulfur, and large volumes of high-quality irrigation water. This practice is commonly referred to as soil reclamation. Gypsum is applied to displace exchangeable sodium from the soil, and the elemental sulfur is used to neutralize excess soil alkalinity. Gypsum- and sulfur-amended soils are subsequently flood irrigated to flush excess salts and displaced sodium ions from the root zone. The reclamation process typically is repeated until soil drainage and aeration improve and soil salinity and pH reach acceptable levels.

The proposed pond areas that would be affected by the alternatives were dry land farmed agriculture intermittently in the 1930s through 1970s. Crops that have been grown in these sections include row and forage crops, such as sugar beets, alfalfa, barley, and wheat, all of which have good to moderate salt tolerance. Agricultural lands were reclaimed (i.e., treated with gypsum and/or sulfur) in the past (Roughton pers. comm. [1]). The rest of Madera Ranch is grazed and probably has not been subject to reclamation efforts.

Slickspots and Alkali Rain Pools

Slickspots, also referred to as panspots, alkali scalds, and small playas, are commonly occurring features in the uncultivated and marginally disturbed portions of Madera Ranch. They are located primarily on nearly level surfaces underlain by the moderately to strongly saline-alkali soils of the Fresno, El Peco, Traver, and Dinuba series. Although they vary considerably in size and form, the slickspots on Madera Ranch typically consist of relatively shallow, oval, and irregularly shaped depressions that range in size from a few square feet to more than 0.5 acre. Several conceptual models have been proposed for slickspot genesis, most of which are reviewed in a fair amount of detail by Reid et al. (1993). Although the mechanisms described by each model differ somewhat, all of them reflect the relatively unique set of conditions that must occur for slickspots to form.

The slickspots that pond water for significant duration during the wet season are classified as alkali rain pools, a specific type of seasonal wetland (see Section 4.5, Biological Resources). The slickspots on Madera Ranch are largely devoid of vegetation but are rimmed with salt- and alkali-tolerant plant species.

The soil survey of the Madera area indicates that the pre-1962 distribution of slickspots in the county was fairly extensive (Stromberg et al. 1962). Like the slickspots on Madera Ranch, they were located primarily in uncultivated areas underlain by moderately and strongly saline-alkali soils of the Fresno, El Peco, Dinuba, and Traver series, primarily in the westernmost portions of Madera County. Many of these areas since have been cultivated for agriculture, resulting in a significant reduction in the number and distribution of slickspots in the county.

Although no exhaustive statewide surveys have been conducted, the consensus is that slickspots in California form primarily on sodic soil landscapes in the Sacramento and San Joaquin Valleys and in smaller, nearby valleys, such as the Carrizo Plain (Reid et al. 1993; Arroues pers. comm.). Because many, if not most, of these landscapes also have been cultivated for agriculture, it is reasonable to assume that the statewide distribution of slickspots also has been reduced significantly. A review of historical aerial photographs contained in soil surveys of counties in the San Joaquin and Sacramento Valleys generally supports this conclusion; it indicates that a significant proportion of the remaining uncultivated sodic soil landscapes that contain slickspots are located in wildlife refuges and natural areas that have been protected for their species diversity and habitat value.

Paleontological Resources

A number of geologic units in the project area have some potential to contain paleontological resources. These include the Modesto Formation, Riverbank Formation and Turlock Lake Formation. The Turlock Lake Formation is overlain by the Riverbank Formation which is overlain by the Modesto Formation. The following discussion provides additional information on these formations, which are considered particularly sensitive on a regional basis. Other units are also locally sensitive.

Quaternary alluvial and fluvial strata flooring the Central Valley record erosional dissection of the Sierran and Coast Ranges uplifts. Fossil remains of vertebrates are common in Pleistocene units throughout California, and Pleistocene alluvial units in particular can contain diverse vertebrate fauna representing various evolutionarily important taxa. Sloths, horses, camels, mammoths, and bison have been collected from middle to late Pleistocene sediments in many areas throughout central California (Jefferson 1991; Dundas et al. 1996; Hilton et al. 2000). Vertebrate mammalian fossils have proved helpful in determining the relative age of alluvial fan sedimentary deposits (Louderback 1951; Savage 1951; Albright 2000). Mammalian inhabitants of the Pleistocene alluvial fan and floodplain included mammoths, horses, mastodons, camels, ground sloths, and pronghorns. The Pleistocene epoch, known as the "great ice age," began approximately 1,800,000 years ago.

Diverse vertebrate fauna, dominated by large herbivorous mammals, were discovered in May 1993 at the Madera County Landfill in alluvial fan, fan channel, and marsh/lacustrine (sedimentary lake deposits) sediments representing the upper unit of the Turlock Lake Formation. A late Irvingtonian age is indicated for the fauna. The fossil-bearing stratum normally is magnetized and is inferred to have an upper bound on the age of the fauna at 780,000 years before present (BP). The site location in Fairmead, California, where these fauna were discovered is approximately 16 miles from the project site. Because the geologic units that exist at the fossil discovery site in Fairmead are also present at the subject project site, the potential for similar paleontological resources to be present is high. (Dundas et al. 1996.)

The Modesto Formation, which is Late Holocene/Early Pleistocene in age, is present in the immediate vicinity of the project area. The formation is composed of alluvium derived from the interior of the Sierra Nevada upper fans and terraces as well as fine-grained stratified alluvium of flood basins and lower fans. Also present is the Turlock Lake formation, which is late Pleistocene in age and is composed of undifferentiated alluvium. Turlock Lake is the older of these formations and the Modesto Formation is the younger.

The Modesto Formation can be divided into an upper and lower member (i.e., distinct upper and lower levels), both of which occur in the project area. The lower member of the Modesto is composed of consolidated, slightly weathered, well-sorted silt and fine sand, locally containing gravels. Age estimates for the lower member range from 42,000 to 73,000 years BP. The upper member of the Modesto Formation is composed of unconsolidated, unweathered gravel, sand, silt, and clay. These deposits form alluvial terraces that are topographically higher than those of the lower member. Age estimates for the upper member range from 12,000 to 26,000 years BP. (Dundas 1996.)

A unit that is not present locally and surficially at Madera Ranch, but is known to have been deposited between the Modesto and Turlock Lake Formations, is the Riverbank Formation, which consists of 3 to 4 meters of massive clayey sand. All three formations serve as ideal preservation environments for paleontological resources. The Modesto Formation and Upper Riverbank Formation are considered to be Rancholabrean, and the Lower Riverbank Formation and Turlock Lake Formation are considered to be Irvingtonian.

Surveys of Late Cenozoic land mammal fossils in northern California have been provided by Hay (1927), Stirton (1939), Savage (1951), Lundelius et al. (1983), and Jefferson (1991a, 1991b). On the basis of his survey of vertebrate fauna from the nonmarine Late Cenozoic deposits of the San Francisco Bay region, Savage (1951) concluded that two major divisions of Pleistocene-age fossils could be recognized: the Irvingtonian (older Pleistocene fauna) and the Rancholabrean (younger Pleistocene and Holocene fauna). These two divisions of Quaternary Cenozoic vertebrate fossils are widely recognized today in the field of paleontology. The age of the more recent Pleistocene, Rancholabrean fauna was based on the presence of bison and on the presence of many mammalian species that are inhabitants of the same area today. In addition to bison, large land mammals identified as part of the Rancholabrean fauna include mammoths, mastodons, camels, horses, and ground sloths. (Dundas 1996.)

Remains of land mammals have been found at a number of localities in alluvial deposits of the Modesto Formation or the Riverbank Formation. These units are Pleistocene in age, and remains discovered in these units would be considered fossils. Thus action-related activities may have an effect on paleontological resources if conducted on these units and resources are present. No paleontological resources have been discovered in the course of dozens of soil test-pits conducted for the project, but there remains a potential for them to be present.

4.8.3 Analysis of Environmental Effects

Methods

The assessment of effects that the alternatives would have on geologic, seismic, and soil conditions at Madera Ranch, and the effects that such conditions would have on facilities and human safety, were based on:

- analysis of existing literature on geologic, seismic, and soil conditions at Madera Ranch;
- discussions with NRCS soil scientists and University of California Extension farm advisors; and

- site-specific soil, geologic, and groundwater data collected by Jones & Stokes.

Environmental Consequences

Alternative A—No Action

Under the No Action Alternative, Reclamation would not approve the banking of CVP water outside MID's service area, nor would Reclamation issue an MP-620 permit to approve of modifications to its distribution system. Reclamation's action would have no adverse effects on geologic resources. However, the future conditions would change to support agricultural activities. Potential effects would be evaluated by the County under CEQA, depending on the discretionary permits needed.

Alternative B—Water Banking outside the MID Service Area Using Swales and Alteration of Reclamation-Owned Facilities

Effect GEO-1: Potential Exposure of People or Structures to Substantial Adverse Effects Resulting from Liquefaction

Based on existing conditions, the potential for liquefaction to occur in Madera County is low. Implementation of Alternative B would raise the groundwater table to depths as shallow as 30 feet below the ground surface in places under and near Madera Ranch; however, it would not increase the potential for liquefaction because soils and sediments on and in the vicinity of Madera Ranch generally are not susceptible to liquefaction. Additionally, there would be few structures constructed as part of this alternative, and it is not expected that the risk to people or structures would change. As such, there would be no effect.

Effect GEO-2: Potential Subsidence Caused by Groundwater Overdraft

The potential for subsidence on Madera Ranch is low to moderate depending on subsurface geological effects influenced by the location of application of banked water and the location and depth of recovery of banked water. Banking of water would be located in areas with the greatest percolation capacity, including the swales that have historically supported natural percolation. Recovery of banked water would be from a depth above the confined aquifer and would not directly affect the confined aquifer. However, operations would indirectly affect recharge to the confined aquifer and directly affect the seepage stress across the Corcoran clay underlying Madera Ranch. In the east of the site, the Corcoran clay is thin and the area tends to respond as a single unconfined aquifer, making subsidence in this area unlikely. On the western portion of the site, the Corcoran clay is thicker and project operations could have an effect on head differences above and below the Corcoran clay. (Bookman-Edmonston 2003.) No substantial increases in subsidence are expected to occur because pumping will be above the Corcoran clay, MID will leave 10% of the banked water in the aquifer, and the MROC will monitor the effects on ground surface elevations and will restrict project operations if subsidence is observed. As such, there would be no adverse effect.

Effect GEO-3: Potential Risks to Property Caused by Construction on an Expansive Soil

Most of the soils and sediments on which facilities would be constructed are coarse- and moderately coarse-textured and would not be classified as expansive according to Table 18-1-B of the Uniform Building Code (UBC). However, some portions of the area in which facilities would be constructed are in areas with expansive soils. All of the facilities would be engineered and designed according to the UBC. This would prevent any structural damage from soil expansion and contraction. There would be no effect.

Effect GEO-4: Potential Loss of a Substantial Amount of Topsoil from Land Grading Operations

Topsoil materials would be stripped from all areas to be graded, temporarily stockpiled, and reapplied as a top-dressing once final grade is attained. There would be no effect.

Effect GEO-5: Increase in Wind and Water Erosion Rates during and Shortly after Construction

The extensive land- and soil-stockpiling activities could cause a temporary increase in wind and water erosion rates. Such increased rates would occur during and shortly after construction. The potential for land-grading and soil-stockpiling activities to have such an effect on erosion rates would be greatest in a groundwater recharge basin, where the volume of soil disturbed and changes to existing slope gradients would be the most extensive.

An increase in wind erosion rates could result in the loss or redistribution of soil material and could have an adverse effect on air quality (see Section 4.4, Air Quality, for a discussion of air quality effects). However, the consequences of increased water erosion rates during and shortly after construction would vary considerably with the location.

To control water and wind erosion during construction, MID will prepare a SWPPP in compliance with the requirements of the NPDES General Construction Permit, and the Central Valley RWQCB would administer the SWPPP (Environmental Commitment WQ-1a). The SWPPP would prescribe temporary BMPs to control accelerated wind and water erosion during and shortly after construction and permanent BMPs to control erosion and sedimentation once construction is complete. The County would require that MID prepare an erosion-control plan and obtain a grading permit before initiating construction of facilities. This effect is not considered adverse.

Effect GEO-6: Increase in Long-Term Wind and Water Erosion Rates

Extensive land-grading activities that would be undertaken during construction temporarily would increase the hazard of erosion at the Madera Ranch site by increasing slope gradients and exposing highly erodible soils to erosion by wind and water. The potential for an action alternative to have such an effect would be greatest in the groundwater recharge window, where the volume of soil disturbed and changes to existing slope gradients would be the most significant.

Once construction is complete, all graded surfaces, including the soil disposal areas located between the groundwater recharge basins, would be revegetated by re-applying stockpiled topsoil using methods to be described in the SWPPP.

The SWPPP may specify that topsoil will be stripped from the footprint of the recharge basins during initial grading operations, temporarily stockpiled, and reapplied to the surfaces of the soil disposal piles once final grade is established. The strippings, which would contain the rhizomes and seeds of native and naturalized grasses and forbs, would serve as the main seedbank for revegetation. Topsoiling is intended to establish native and naturalized vegetation to control potential wind and water erosion. The vegetation should be sufficient to stabilize the soil disposal piles and maintain erosion rates at or near preconstruction levels once construction is complete. However, Figure 4.8-2 indicates that many of the topsoils that exist in the footprint of the Phase 2 groundwater recharge basins are at least slightly saline-alkali.

Although many of the soils in these areas have been partially reclaimed for agricultural purposes (Roughton pers. comm.[1]), most probably still contain excess salinity, alkalinity, and exchangeable sodium, which can limit soil infiltration capacity and permeability and interfere with normal plant growth and seed germination. Repeated handling of weakly structured topsoil materials during grading operations would degrade the soil structure, which would exacerbate the adverse effect of excess exchangeable sodium on soil infiltration capacity. Therefore, the chemical and physical properties of the topsoil materials that would be applied to the surfaces of the soil disposal piles for revegetation purposes could cause significant runoff and interfere with the establishment and survival of vegetation. As a result, wind and water erosion rates could increase above preconstruction levels.

The degree to which soil salinity, alkalinity, and exchangeable sodium will retard vegetation establishment in topsoiled areas is unknown because of the variability in depth of excavation, distribution of salts throughout the soil profile, and other factors. As an example, the vegetation at a pilot infiltration pond that was constructed in 2000 fully established in a reasonable amount of time, although the area was mapped as strongly saline-alkali, the applied soil was not segregated, and disturbed areas were not seeded.

However, if vegetation does not sufficiently establish (i.e., minimum of 70% vegetative cover 1 year after application) in topsoiled areas, substantial accelerated erosion could occur. This effect could be adverse, unless measures were implemented to promote vegetation growth. Implementing of Environmental Commitment GEO-1, Amend Soils as Required in Topsoiled Areas, in the event of insufficient vegetation establishment would reduce the intensity of this effect.

Effect GEO-7: Potential Destruction of a Unique Pedologic Feature

Research indicates that soil slickspots are a unique pedologic feature that occurs on sodic soil landscapes throughout the United States. In California, they once occurred primarily on alluvial landforms in the San Joaquin and Sacramento Valleys. However, because of the extensive agricultural development that has occurred in these areas, the abundance and distribution of slickspots in California have been reduced significantly. Consequently, slickspots have become somewhat rare.

Some of the groundwater recharge basins and other elements of Alternative B are proposed in areas supporting generally undisturbed soil slickspot terrain. Permanent effects on such terrain could extend over more than 300 acres. Grading and excavation to form the recharge basins and other elements could permanently destroy the slickspots. This effect is considered adverse because it could result in the loss of unique, nonrenewable pedologic features.

Implementing Environmental Commitment BIO-1, Establish a Grasslands Conservation Easement, would reduce the extent and intensity of this effect.

Effect GEO-8: Potential Soil Salinization from Elevated Groundwater Levels

Alternative B could raise existing groundwater elevations (and salinity) significantly. In certain areas on and near the Madera Ranch site, an elevated water table could result in the salinization of the root zones of economically important, deep-rooted fruit and nut crops that occur in the vicinity of the site and could thereby adversely affect their growth.

Simply defined, *salinization by groundwater* is a process by which excess soluble salts are concentrated in the soil (root zone) during the evapotranspiration (ET) of saline groundwater. The mechanisms involved in this process vary, depending on the location of the water table relative to the root zone.

When groundwater is shallow enough to occupy all or a portion of the root zone, ET occurs directly from the water table. Salts dissolved in the groundwater are left behind in the process and accumulate in the root zone, where they can have various adverse effects on soil properties and plant growth.

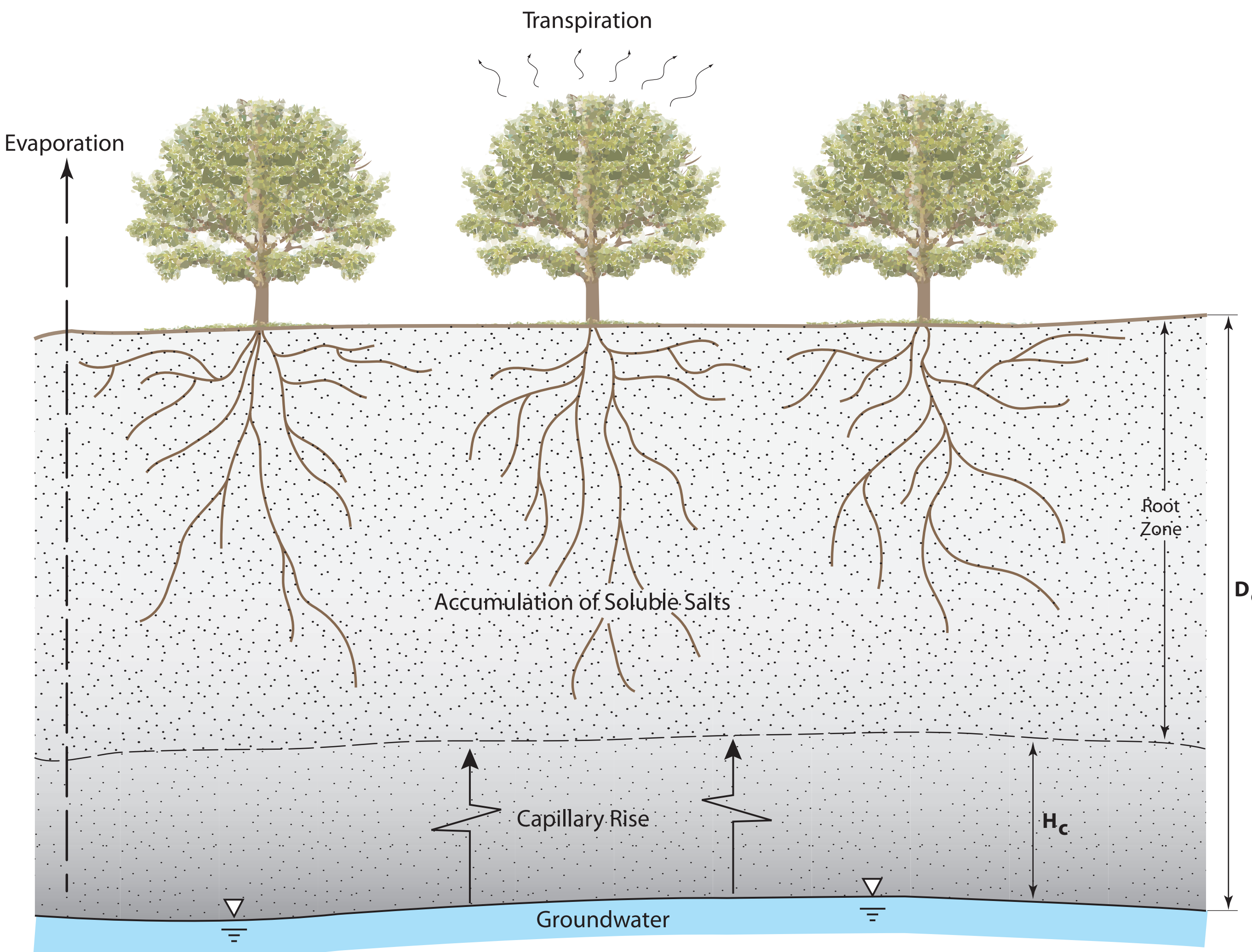
When the water table is beneath the lower boundary of the root zone, the process of salinization by groundwater is somewhat more complex. In such a situation, plant roots cannot access the groundwater directly, and evaporation of groundwater at the soil surface can be negligible. However, groundwater and dissolved salts can move upward into the root zone in response to the water potential gradient (i.e., the potential for water to move upward) that exists between the surface of the water table and overlying soil materials. Once in the root zone, the groundwater can evaporate at the soil surface and be transpired by vegetation. In this case, soluble salts in the groundwater are left behind and accumulate in the root zone, as described above. Because the capillary forces that arise as a result of the interaction between water and soil are a major driving force in this upward movement of groundwater, the process frequently is referred to as *capillary flow* or *capillary rise*, and soil salinization resulting from capillary flow frequently is referred to as *capillary salinization*.

The upward, capillary flow of groundwater can be extensive (several yards), but the rate of flow generally decreases with increasing height above the water table. Because the rate of salt movement is in proportion to the rate of water movement, it also decreases with increasing height above the water table. The distance at which the rate of capillary flow becomes too small for any significant upward movement of salt is defined as the *critical capillary height* (H_c) (Smedema and Rycroft 1983). The critical capillary height is primarily a function of soil texture, with fine-textured soils generally having greater values than coarse-textured soils. Because the upward movement of salt is the product of the capillary flow rate and the salt content, H_c also increases with the salt content of the groundwater. Characteristic values of H_c for some common soil textures are as follows:

- sand, 50–75 centimeters (cm);
- loamy sand and sandy loam, 100–150 cm;
- loam, clay loam, and clay, 100–150 cm; and
- fine sandy loam and silt loam, 150–200 cm.

If the water table falls below a certain elevation, known as the *critical water-table depth* (D_c) (Figure 4.8-3), the capillary zone (H_c) will not extend into the root zone, and capillary salinization will not occur. If the water table is located above the critical water-table depth, capillary salinization is possible (Figure 4.8-3). Regardless of the depth of the water table or the value of H_c, there will be little capillary salinization of the root zone if the salinity of the groundwater remains less than 1,000 milligrams per liter (mg/l) (i.e., EC less than 1.5 dS/m) (Smedema and Rycroft 1983).

A Jones & Stokes soil scientist determined the potential for water tables affected by Alternative B to salinize the soil (root zone) in Madera Ranch. To do so, the soil scientist calculated D_c based on a worst-case estimate for the value of H_c and a reasonable estimate of the maximum rooting depth for three common, deep-rooting fruit and nut crops grown at Madera Ranch: almonds, grapes, and pistachios.



Legend

H_c Critical capillary height

D_c Critical water-table depth

Source: Adapted from Smedema and Rycroft 1983.

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Figure 4.8-3
Capillary Salinization of the Root Zone by Groundwater

Almond-tree roots have been found as deep as 25 feet in Madera County (Holtz pers. comm.); however, University of California Extension farm advisors indicate that a reasonable estimate of the maximum rooting depth of almonds, grapes, and pistachios in a relatively uniform soil with no restrictive layers (i.e., slowly permeable soil horizons) is approximately 8–10 feet (Ferguson pers. comm.; Freeman pers. comm.). Assuming that the value of H_c at Madera Ranch is at most 6.5 feet, the value of D_c would be approximately 14–17 feet below the ground surface. Because Alternative B would be operated and constrained so that affected water tables would not reach elevations higher than 30 feet below the ground surface at the Madera Ranch site boundary (i.e., would not extend above D_c), groundwater would not cause salinization of the root zones of important, deep-rooting agricultural crops surrounding Madera Ranch. Therefore, there would be no effect.

Effect GEO-9: Potential Destruction of a Sensitive Paleontological Resource

Sensitive paleontological resources (e.g., fossils, trackways) have been reported in various sediments in the San Joaquin Valley, particularly in the relatively older (and usually deeper) geologic formations. Because the near-surface sediments underlying the site are geologically young and because the depth of excavation would be fairly shallow, there is a relatively low probability that excavation activities would disturb buried fossils. Nevertheless, because the possibility exists for a sensitive fossil to be discovered, the potential exists for Alternative B to destroy a sensitive paleontological resource, resulting in an adverse effect.

Implementing Environmental Commitment GEO-2, Stop Work in Event of Fossil Discovery, would minimize the intensity of the effect.

Alternative C—Water Banking outside the MID Service Area without Swales and Alteration of Reclamation-Owned Facilities

Alternative C is similar in scope and design to Alternative B, with the primary exception that the natural swales that occur on the site would not be used for recharge. Thus, engineered basins could change slightly the pattern of groundwater recharge at the site. The expected footprint of recharge basins under Alternative C would be similar to Phase 2 of Alternative B and would result in equivalent effects on geologic resources during construction and operation (Effects GEO-1, GEO-2, GEO-3, GEO-4, GEO-5, GEO-6, GEO-7, GEO-8, and GEO-9). Effects on geologic resources would be considered minor, except for the loss of soil slickspot terrain (Effect GEO-7) and the potential loss of paleontological resources discovered during construction (Effect GEO-9), which are considered adverse. Implementation of Environmental Commitments BIO-1 and GEO-2, respectively, would reduce the intensity and minimize the extent of these effects. The effect of implementing Alternative C on local groundwater conditions has been determined to be beneficial.

Alternative D—Water Banking outside the MID Service Area with Banking and Recovery via Gravelly Ford Canal

Alternative D is similar in scope and design to Alternative B, with the exception that water would be conveyed to the site via GF Canal. For this reason, one recharge basin would not be built under Alternative D that was proposed under Alternative B. However, the expected footprint of recharge basins under Alternative D would be nearly identical to that under Alternative B and would result in equivalent effects on geologic resources during construction and operation (Effects GEO-1, GEO-2, GEO-3, GEO-4, GEO-5, GEO-6, GEO-7, GEO-8, and GEO-9). Effects on geologic resources would not be considered adverse, excluding the loss of soil slickspot terrain (Effect GEO-7) and the potential loss of paleontological resources discovered during construction (Effect GEO-9), which are considered adverse. Implementation of Environmental Commitments BIO-1 and GEO-2, respectively, would reduce the intensity and minimize the extent of these effects. The effect of Alternative D on local groundwater conditions has been determined to be beneficial.

Cumulative Effects

None of the effects described above has the potential to result in an adverse contribution to the regional cumulative effects on geologic resources in Madera County, with one potential exception. The abundance and distribution of slickspots in California have been reduced significantly; thus, losses at Madera Ranch could result in an adverse cumulative effect on this pedologic resource. Environmental Commitment BIO-1 is anticipated to protect this resource at Madera Ranch and thus not contribute to regional cumulative effects.

As both Alternatives C and D are equivalent in scope and overall effect to Alternative B, it is anticipated that neither Alternative C nor D would contribute to cumulative effects on geologic resources.

4.9 Land Use

4.9.1 Introduction

This section describes the existing and planned land uses for the areas potentially affected by the proposed alternatives. It discusses the affected environment, relevant regulations and policies, methods of analysis, and possible effects.

4.9.2 Affected Environment

Methodology and Terminology

The land use setting was determined by analyzing various documents, examining aerial photographs of the site, and holding discussions with MID and County Planning Department staff. The sources of information used in this section include:

- *Madera County General Plan Background Report* (Madera County 1995a),
- *Madera County General Plan Policy Document* (Madera County 1995b), and
- *Madera County General Plan Land Use Diagram* (Madera County 1995c).

Setting

Madera Ranch is located in western Madera County, several miles from the city of Madera and the unincorporated community of Firebaugh. The site is situated in a rural agricultural area under the jurisdiction of the County. No other established communities are located in the vicinity of Madera Ranch.

As shown in Figure 4.9-1, most of Madera Ranch consists of grasslands, with smaller portions of the site in agricultural production. Agricultural land uses include a mix of field crops, hay and grain crops, and a small portion in vineyard production. In addition to agricultural land uses, Madera Ranch contains numerous on-site access roads, irrigation wells, various related utilities, canals, drainage ditches, and a shop/storage area. For a more detailed description of current and historical agricultural land use at Madera Ranch, see Section 4.3, Agriculture.

4.9.3 Analysis of Environmental Effects

Methods

Existing land use conditions were identified by examining the County General Plan and aerial maps of the Madera Ranch vicinity. Future planned uses for the vicinity were identified by examination of the County General Plan and County zoning maps. The determination of effects was made by comparing the existing and planned environmental setting for land use with how each resource would be affected by implementation of the alternatives.

Environmental Consequences

Alternative A—No Action

Under the No Action Alternative, Reclamation would not approve the banking of CVP water outside MID's service area, nor would Reclamation issue an MP-620 permit to approve of modifications to its distribution system. Reclamation's action would have no adverse effects on land use. However, the future conditions would change to support agricultural activities. Potential effects would be evaluated by the County under CEQA depending on the discretionary permits needed.

Alternative B—Water Banking outside the MID Service Area Using Swales and Alteration of Reclamation-Owned Facilities

Madera Ranch is located in western Madera County and is generally bounded by Avenue 7, Avenue 12, and Road 21. The site is located several miles from the city of Madera and the unincorporated community of Firebaugh. No other established communities are in the vicinity of Madera Ranch. Because the proposed water bank is located at a distance from both of these communities and would retain traffic flow along Avenue 7, Avenue 12, and Road 21, it would not physically divide an established community.

There is no habitat conservation plan that applies to the Madera Ranch site; therefore, there would be no effects associated with potential conflict with an applicable habitat conservation plan.

Effect LU-1: Conflict with Applicable Land Use Plans, Policies, or Regulations, Including Land Use Designations and Zoning Ordinances

Madera Ranch is designated by the General Plan land use diagram as AE (agricultural exclusive). The site also is zoned for agricultural rural exclusive (40-acre minimum). For the effect to be minor, future proposed land uses must be compatible with current agricultural land use designations. The County Planning Department previously determined that development of a groundwater bank on

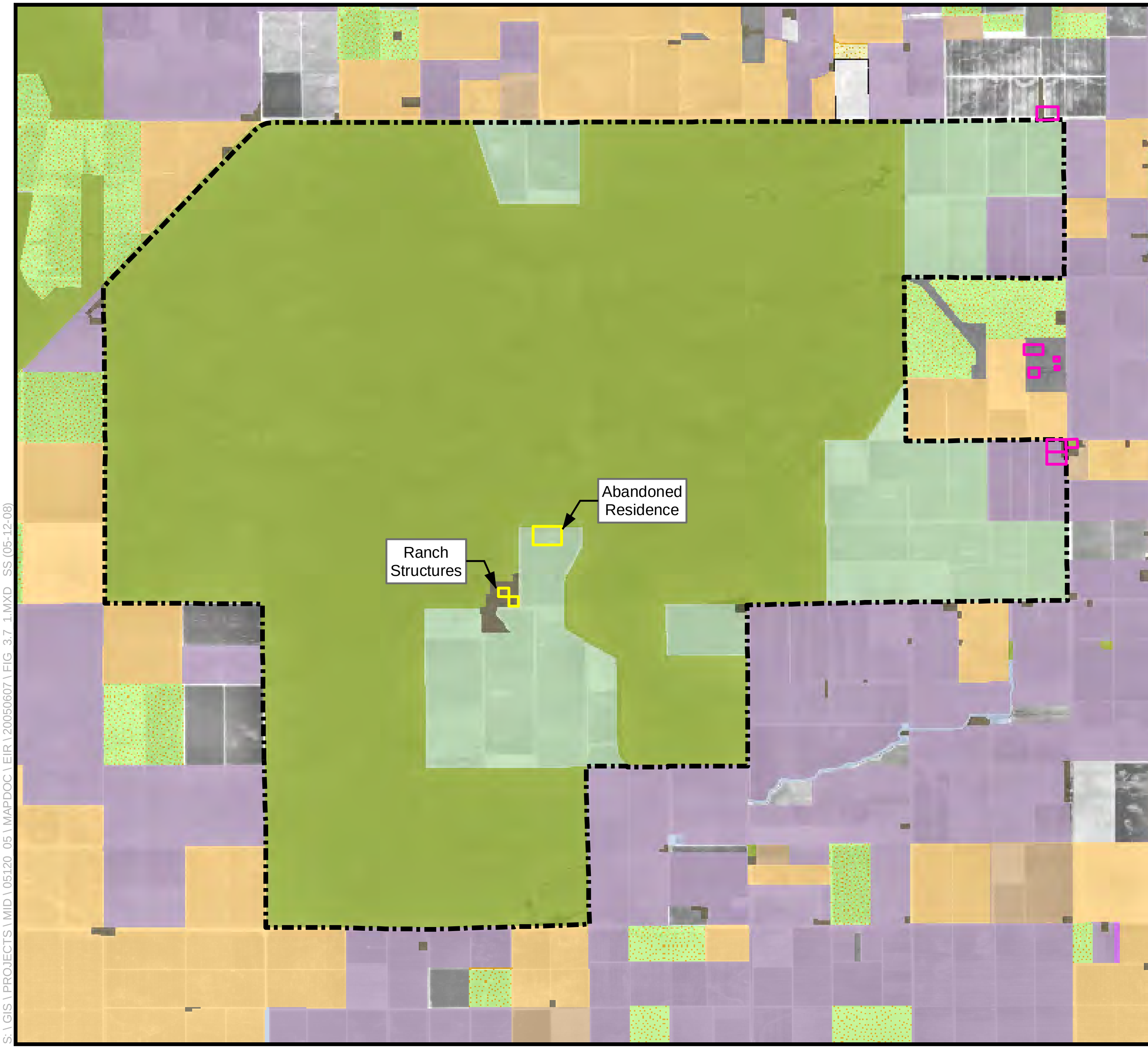

Figure 4.9-1

Land Uses in and Adjacent to Madera Ranch

Legend

Madera Ranch Boundary

Residence
Structure

Field Crops
Truck, Nursery, and Berry Crops
Pasture
Grain and Hay Crops
Vineyards
Idle
Citrus and Subtropical
Deciduous Fruits and Nuts
Incidental to Agriculture
Native Vegetation
Water Surface
Urban

0 0.5 1
Miles

Off-site Source: DWR 2001
Aerial Photo: USGS Digital Orthophoto Quarter Quadrangle, 1993

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the Madera Ranch site would not conflict with the AE designation (Merchen pers. comm.). In addition, grazing and agricultural land use would continue on most of the ranch, along with some row crop production. While some of the modifications would directly remove a small portion of farmland from production, these modifications would be consistent with continued agricultural production because they would enhance agricultural production by providing improved water storage and supply for agricultural irrigation. Because Alternative B would not conflict with applicable land use plans, policies, or regulations, Effect LU-1 would have no effect.

Effect LU-2: Land Use/Operational Conflicts between Existing and Proposed Land Uses

As discussed under Effect LU-1, modifications to the Madera Ranch site would be compatible with agricultural land uses at Madera Ranch. Construction activities might disrupt agricultural operations at Madera Ranch, but these disruptions would be only temporary and would not result in permanent conflict with agricultural land uses. In addition, the resulting changes would not fragment agricultural land or result in modifications that would indirectly preclude agricultural land uses. As mentioned above, the proposed facilities (recharge basins, canals, and ditches) would be similar to existing structures that do not conflict with agricultural uses, but rather facilitate agricultural production by providing improved water supply and storage for agricultural irrigation.
Effect LU-2 is not considered adverse because implementation of Alternative B would not conflict with existing or proposed land uses.

Effect LU-3: Conflict with Recreational Land Uses

No recreational areas are located in or near the Madera Ranch site nor would Alternative B affect recreational activities. The purpose of Alternative B is to enhance water supply services, and it will not affect recreation or increase the need for recreational services. Alternative B would not conflict with recreational land uses. Effect LU-3 would result in no effect.

Alternative C—Water Banking Outside the MID Service Area without Swales and Alteration of Reclamation-Owned Facilities

Alternative C is similar in scope and design to Alternative B, with the primary exception that the natural swales that occur on the site would not be used for recharge. Thus, there would be no differences in land use between Alternatives B and C. Alternative C would result in equivalent effects on land use (Effects LU-1, LU-2, and LU-3) and would not conflict with applicable land use plans, policies, or regulations; or recreation or other land uses. Identified effects on land use related to minor disruptions of agriculture are not considered adverse (Effect LU-2).

Alternative D—Water Banking Outside the MID Service Area with Banking and Recovery via Gravelly Ford Canal

Alternative D is similar in scope and design to Alternative B, with the exception that recharge is achieved using engineered recharge basins in lieu of the natural swales that occur on the site, and water would be delivered to and from the site using the GF Canal. Thus, there would be no differences in land use between Alternatives B and D. Alternative D would result in equivalent effects on land use (Effects LU-1, LU-2, and LU-3) and would not conflict with applicable land use plans, policies, or regulations; or recreation or other land uses. Identified effects on land use related to minor disruptions of agriculture during construction are not considered adverse (Effect LU-2).

Cumulative Effects

The alternatives would not result in conflicts with existing or proposed land uses in the Madera Ranch area. The incremental effect of Alternative B would not result in a considerable contribution to cumulative effects. As both Alternatives C and D are equivalent in scope and overall effect as Alternative B, it is anticipated that neither Alternative C nor D would result in cumulative effects on land use.

4.10 Noise

4.10.1 Introduction

This section describes the existing environmental setting for the areas potentially affected by the proposed alternatives. It discusses the affected environment, relevant regulations and policies, and possible effects and provides information relating to the final selection of an action alternative.

4.10.2 Affected Environment

Methods and Terminology

A brief discussion of common noise terminology and descriptors used in this report follows.

- *Sound*: A vibratory disturbance created by a vibrating object that, when transmitted by pressure waves through a medium such as air, can be detected by a receiving mechanism like human ears or a microphone.
- *Noise*: Sound that is loud, unpleasant, unexpected, or otherwise undesirable.
- *Decibel (dB)*: A measure of sound or vibration amplitude on a logarithmic scale that indicates the squared ratio of sound pressure or vibration velocity root-mean-squared amplitude to a reference sound pressure or vibration amplitude. For sound, the reference pressure is 20 micropascals.
- *A-weighted decibel (dBA)*: An overall frequency-weighted sound level in decibels that approximates the frequency response of the human ear.
- *Equivalent sound level* (L_{eq}): The equivalent steady-state sound or vibration level that would contain the same acoustical or vibration energy in a stated period of time.

In general, human sound perception is such that a change in sound level of 3 dB is just noticeable, a change of 5 dB is clearly noticeable, and a change of 10 dB is perceived as a doubling or halving of the sound level (Cowan 1994).

Sources of information for this section are field measurements conducted by ICF Jones & Stokes, regulatory information from the County of Madera, and sound level data provided by U.S. Electrical Motors.

Setting

The Madera Ranch site is composed of agricultural and grazing land, with scattered residences. Sources of noise in the area include distant traffic, wildlife, agricultural activities, groundwater pumps, and irrigation district lift stations. A field investigation was conducted to quantify existing background noise conditions and noise from groundwater pumping operations on Madera Ranch. The investigation was conducted on November 6, 2000, between 7:30 a.m. and noon. Sound level measurements were conducted with a Larson Davis Model 812 Type 1 sound-level meter. Calibration of the meter was checked before and after each measurement session using a Larson Davis Model CA250 calibrator. Temperature, wind speed, and humidity were sampled manually throughout the day with a Kestrel Model 3000 handheld weather station.

Class 3 cloud cover conditions (sunny, with the sun essentially unobscured 80% of the time) were present all day. In the morning, wind conditions were generally calm (speeds less than 2 miles per hour [mph]). As the day progressed, wind speeds increased to the range of 8 to 13 mph. Ambient sound levels of 35–51 dBA were measured throughout the day. The quietest ambient sound level (35 dBA) was measured in the early morning when wind speeds were lowest; this sound level was generated primarily by noise from distant traffic and natural sources (e.g., birds). As wind speeds increased, it became clear that the effects of the wind were governing the ambient sound level and increasing background sound levels.

Sound level measurements were taken in the vicinity of two groundwater pumps driven by diesel engines and in the vicinity of four groundwater pumps driven by electric motors. At a distance of 50 feet, the diesel engines produced sound levels of 81–86 dBA. At a distance of 25 feet, three of the electric pumps produced sound levels of 57–58 dBA, and the fourth electric pump produced a sound level of 68 dBA. The fourth pump was producing a high-frequency squeal, indicating that it may not have been operating properly.

Sensitive receptors in the area of the proposed recharge and recovery wells include residences that are approximately 1,320 feet from the location of the nearest proposed new well. There are also sensitive residential receptors along the two canals where new lift stations would be located. The closest sensitive receptor to a noise source is a residence located approximately 300 feet from a proposed lift station on Main No.2 Canal.

4.10.3 Analysis of Environmental Effects

Methods

Potential sources of noise associated with the WSEP re:

- activities associated with construction of the canals and the recharge basins,

- drilling of the recovery wells,
- operation of the well pumps, and
- operation of the engines at the lift stations.

Sound levels produced by these various sources are based on data from standard references, previous studies, and equipment manufacturers' data. Projected sound levels from these sources then are estimated using a point-source attenuation model. With this model, noise from the source is assumed to attenuate at a rate of 6 dB for each doubling of distance. Additional attenuation is assumed to result from molecular absorption and anomalous excess attenuation (Hoover and Keith 1996). For standard conditions (59ºF, 70% relative humidity), molecular absorption is taken to be 0.7 dBA per 1,000 feet, and anomalous excess attenuation is assumed to be 1.0 dBA per 1,000 feet. To determine potential noise effects, the distances needed for noise to attenuate to County noise-level standards of 45 dBA (nighttime) and 50 dBA (daytime) are assessed for each source.

Environmental Consequences and Mitigation Strategies

Alternative A—No Action

Under the No Action Alternative, Reclamation would not approve the banking of CVP water outside MID's service area, nor would Reclamation issue an MP-620 permit to approve of modifications to its distribution system. Reclamation's action would have no adverse effects on noise. However, the future conditions would change to support agricultural activities. Potential effects would be evaluated by the County under CEQA depending on the discretionary permits needed.

Alternative B—Water Banking outside the MID Service Area Using Swales and Alteration of Reclamation-Owned Facilities

Effect NOI-1: Exposure of Residences to Noise from Grading and Construction Activities

Construction of the canals and grading to develop the recharge basins under Alternative B would involve the use of heavy construction equipment. Table 4.10-1 summarizes typical noise levels produced by heavy equipment.

Table 4.10-1. Typical Noise Levels Produced by Heavy Equipment

Equipment	Typical Noise Level (dBA) 50 Feet from Source
Backhoe	80
Dozer	85
Grader	85
Scraper	89
Truck	88

Source: Federal Transit Administration 1995.

For this assessment, it is assumed that one backhoe and two graders could be operating in a local area concurrently and that they could operate at any time during the day or night. The combined sound from these sources is 89 dBA at 50 feet. The distances needed for a source of this sound level to attenuate to County noise-level standards are:

- 3,900 feet for 45 dBA (nighttime standard) and
- 2,600 feet for 50 dBA (daytime standard).

Residences near the southeastern end of Madera Ranch are located within 2,600 feet of the proposed recharge facilities. This effect is, therefore, considered adverse because noise levels would exceed County standards at these residences. . Implementation of Environmental Commitment NOI-1to Employ Noise-Reducing Construction Practices would minimize the intensity and timing of the effect.

Effect NOI-2: Exposure of Residences to Noise from Well-Drilling Operations

At each well site, well drilling would involve initial drilling 24 hours a day for several days, then intermittent drilling during daytime hours for several days. The specific types of drilling units to be used are not known. Experience from previous studies indicates that a source level of 85 dBA at 50 feet is a reasonably conservative assumption for well drilling operations. The distances needed for a source of this sound level to attenuate to County noise-level standards are:

- 2,900 feet for 45 dBA (nighttime standard) and
- 2,000 feet for 50 dBA (daytime standard).

Although all wells would be located at least 0.25 mile (1,320 feet) from the nearest residences, this analysis indicates that noise from drilling could exceed County noise standards at these residences. This effect therefore is considered adverse. Implementation of Environmental Commitment NOI-2to Employ Noise-Reducing Methods during Well-Drilling Operations would minimize the intensity and timing of the effect.

Effect NOI-3: Exposure of Residences to Noise from Operation of Engines at Wells

A single pump with an engine rating of up to 100 hp would be used at each wellhead. The pumps could be either electric or propane-fueled. Data provided by U.S. Electrical Motors for a 100-hp electric motor running under no load (Roughton pers. comm.) indicate that the motor would produce a sound level of 56 dBA at 50 feet. To approximate the sound level produced under load, 3 dB were added to the no-load condition for a resulting source level of 59 dBA at 50 feet. The distances needed for a source of this level to attenuate to County noise-level standards are:

- 250 feet for 45 dBA (nighttime standard) and
- 140 feet for 50 dBA (daytime standard).

The sound level of a similarly sized pump operated by a propane-fueled reciprocating engine was calculated using the equations for reciprocating engines from *Noise Control for Buildings, Manufacturing Plants, Equipment and Products* (Hoover and Keith 1996). Based on these calculations, a 100-hp propane-fueled engine would produce a sound level of 75 dBA at 50 feet. This sound level represents a reasonable worst-case scenario at the well locations.

The distances needed for a source of this level to attenuate to County noise-level standards are:

- 1,250 feet for 45 dBA (nighttime standard) and
- 800 feet for 50 dBA (daytime standard).

All wells would be located at least 0.25 mile (1,320 feet) apart and would be located at least 0.25 mile (1,320 feet) from the nearest property line. Accordingly, no meaningful cumulative effects of simultaneous pump operation noise are anticipated. As such, the analysis is based on the noise from a single pump. This analysis indicates that noise from propane-fueled well pumps with the maximum horsepower rating is not likely to exceed County nighttime noise standards at the nearest residences. Therefore no adverse effect from operation of engines at wells is anticipated.

Effect NOI-4: Exposure of Residences to Noise from Operation of Engines at Lift Stations

Two propane-fueled pumps totaling 200 hp could be used at each of the lift stations located along the Main No. 2 Canal under Alternative B. Noise from engines typically increases at a rate of 3 dB for each doubling of horsepower (Hoover and Keith 1996). Using the sound data for the 100-hp pump described above, the noise level from the two pumps is estimated to be 78 dBA (75 dBA + 3 dB) at 50 feet. The distances needed for a source of this sound level to attenuate to County noise-level standards are:

- 1,600 feet for 45 dBA (nighttime standard) and
- 1,000 feet for 50 dBA (daytime standard).

The lift stations along Main No. 2 Canal potentially would be located as close as 300 feet to the nearest residence (Dorrance pers. comm.). This analysis indicates that there is potential for noise from the lift stations under the maximum horsepower scenario to exceed County noise standards at residences. This effect therefore is considered adverse. Implementation of Environmental Commitment NOI-4 to Employ Noise-Reducing Methods during Lift Station Operations would result in avoidance of the effect or minimization to below County standards.

Alternative C—Water Banking Outside the MID Service Area without Swales and Alteration of Reclamation-Owned Facilities

Alternative C is similar in scope and design to Alternative B, with the primary exception that the natural swales that occur on the site would not be used for recharge. However, the expected footprint of facilities, including noise-producing pumps for recovery wells and lift stations, and associated construction, under Alternative C would be similar to Alternative B and would result in equivalent effects related to construction (grading and drilling) and operation (recovery and lift station pumps) noise near residences (Effects NOI-1, NOI-2, NOI-3, and NOI-4). Thus, noise effects are considered equivalent to those that would occur under Alternative B and are considered adverse. Implementation of Environmental Commitments NOI-1, NOI-2, NOI-3, and NOI-4 would reduce the intensity of these effects.

Alternative D—Water Banking Outside the MID Service Area with Banking and Recovery via Gravelly Ford Canal

Alternative D is similar in scope and design to Alternative B, with the exception that water would be conveyed to the site via GF Canal. For this reason, one recharge basin would not be built under Alternative D that was proposed under Alternative B and lift stations would be built in locations different from those proposed under Alternative B. Thus, Alternative D would result in unique potential adverse effects related to lift stations (Effect NOI-5, described below). All other anticipated construction and operation effects under Alternative D would be similar to Alternative B and would result in similar effects related to construction (grading and drilling) and operation (recovery pumps) noise near residences (Effects NOI-1, NOI-2, and NOI-3). Thus, noise effects are considered equivalent to those that would occur under Alternative B for Effects NOI-1, NOI-2, and NOI-3and are considered adverse. Implementation of Environmental Commitments NOI-1, NOI-2, and NOI-3, respectively, would reduce the intensity of these effects.

Effect NOI-5: Exposure of Residences to Noise from Operation of Engines at Lift Stations

One propane-fueled pump totaling 200 hp could be used on the proposed lift station located on the GF Canal. Noise from engines typically increases at a rate of 3 dB for each doubling of horsepower (Hoover and Keith 1996). Using the sound data for the 100-hp pump described above, the noise level from the pump is estimated to be 78 dBA (75 dBA + 3 dB) at 50 feet. The distances needed for a source of this sound level to attenuate to County noise-level standards are:

- 1,600 feet for 45 dBA (nighttime standard) and
- 1,000 feet for 50 dBA (daytime standard).

As the final location of this station is not known, the lift station potentially could be located within 1,000 feet of a residence. This analysis indicates that there is potential for noise from the lift stations under the maximum horsepower scenario to exceed County noise standards at residences. This effect therefore is considered adverse. Implementation of Environmental Commitment NOI-4 (as discussed above under Effect NOI-4) would result in avoidance of the effect or minimization to below County standards.

Cumulative Effects

None of the effects described for each alternative above have the potential to result in an adverse cumulative contribution to local noise. No other construction is proposed during the anticipated construction period that would contribute to cumulative noise increases during construction. Operational noise from pumps could contribute to a cumulative local increase in noise effects. However, proposed mitigation (Environmental Commitments NOI-3 and NOI-4) is anticipated to reduce this effect at Madera Ranch during operations and thus not contribute to local cumulative effects. No additional mitigation is proposed.

As Alternative C is equivalent in scope and overall effect to Alternative B, it is anticipated that Alternative C would not contribute to cumulative noise effects. Alternative D could result in additional effects related to the propane-fueled pump, but this effect would be reduced by implementing Environmental Commitment NOI-4. As such, none of the alternatives is expected to contribute to cumulative effects.

4.11 Public Health and Safety

4.11.1 Introduction

This section describes the existing environmental setting for analyzing hazards and public health issues potentially affected by the proposed alternatives. The issues include hazardous materials, mosquitoes, drowning, and wildland fire. This section discusses the affected environment and possible effects of the Proposed Action and alternatives.

4.11.2 Affected Environment

Methodology and Terminology

Reconnaissance of the site, review of regulatory databases, and interviews of property owners and regulatory agency personnel contained in the initial site assessment (TRC 1999, updated in 2002) form the basis for understanding potential hazardous materials effects. Mosquito breeding conditions were based on communication with MCMAVCD staff and mosquito ecology literature.

Setting

There are no residences within 1 mile of known soil contamination (described in the following paragraph) and no schools in the vicinity of Madera Ranch.

Historical and current agricultural, commercial, and industrial activities associated with the Madera Ranch site and adjoining area have been associated with hazardous materials usage, storage, and disposal. An environmental site assessment was conducted for the area, including Madera Ranch and a greater study area with a radius of 5 miles. In addition, a limited phase-2 site assessment was completed (TRC 1999, 2002). The following discussion summarizes these assessments and hazardous materials or waste expected or suspected in the vicinity of Madera Ranch.

Soil Contamination

A site assessment was conducted in September 1999 and again in July 2002. This assessment included reconnaissance of Madera Ranch, review of regulatory databases, interviews of property owners and regulatory agency personnel, and limited sampling of groundwater (TRC 1999, 2002). The initial environmental site assessment found no evidence of on-site contamination. However, some past and present on-site fuel storage may have resulted in soil contamination in the immediate area of the storage sites.

Records of three on-site underground storage tanks (USTs) were found. The records disclosed that the USTs had been removed under the oversight of County Environmental Health Department officials. For all three UST removals, closure letters were issued indicating that no further action was required. The only contamination found through observations during UST removal and limited soil sampling was trace amounts of toluene at one of the UST sites (TRC 1999).

Several of the irrigation wells in Sections 1 and 13 of the Madera Ranch property have been fitted with diesel motors and supporting aboveground storage tanks (ASTs). These 1,500-gallon diesel ASTs do not have secondary containment but recently have been equipped with drip collection pans. The soil in the region of the motor and AST pads was stained (TRC 1999). Although stained soil was observed at these AST locations, TRC concluded that significant contamination as a result of AST operation is not likely.

Mosquito-Borne Diseases

In addition to being a nuisance, mosquitoes can act as disease-carrying vectors. All species of mosquitoes require standing water to complete their growth cycle. Any standing body of water represents a potential mosquito breeding habitat. Although mosquitoes typically stay close to suitable breeding habitat and blood-meal hosts, they are known to travel up to 10 miles under breezy conditions (Dillahunti pers. comm.).

Mosquitoes reproduce year-round, but reproduction is substantially diminished during the cool winter season, roughly October through April, and mosquito suppression activities in Madera County typically begin in March (Dillahunti pers. comm.). Water quality also affects mosquito reproduction. Generally, poor-quality water (water with limited circulation, high temperature, and high organic content) produces greater numbers of mosquitoes than high-quality water (water with high circulation, low temperature, and low organic content) (Collins and Resh 1989). In addition, irrigation and flooding practices may influence the level of mosquito production associated with a water body. Typically, water bodies with water levels that slowly increase or recede produce greater numbers of mosquitoes than water bodies with water levels that are stable or that rapidly fluctuate (Collins and Resh 1989).

Mosquito Species of Concern

In Madera County, two species of mosquito are primary targets for suppression (Dillahunti pers. comm.). These two species, *Culex pipiens* and *C. tarsalis*, are potential vectors of encephalitis and West Nile virus. Other species of mosquitoes exist in Madera County that can cause a substantial nuisance in surrounding communities, but the *Culex* mosquito is the vector species of primary concern.

Although the West Nile virus can be transmitted by a number of mosquito species, *Culex* is the most common carrier. This disease is thought to be a seasonal epidemic that flares up in the summer and fall. West Nile virus is spread when mosquitoes that feed on infected birds bite humans and other animals (U.S. Department of Health and Human Services 2005).

The encephalitis mosquito (*C. tarsalis*) breeds in almost any freshwater pond. Birds appear to be the primary blood-meal hosts of this species, but the insect also will feed on domestic animals and humans (Bohart and Washino 1978). This species is the primary carrier in California of western equine encephalitis, St. Louis encephalitis, and California encephalitis and is considered a significant disease vector of concern in the state.

The house mosquito (*C. pipiens*) usually breeds in waters with a high organic material content (Bohart and Washino 1978). This species often is identified by its characteristic buzzing near its host's ear. Although the primary blood-meal host is birds, the house mosquito also can seek out humans. The house mosquito can be a vector of St. Louis encephalitis.

Mosquito Concerns at Madera Ranch

Potential mosquito habitat exists on the Madera Ranch site. Natural water features, including swales and vernal pools, are potential mosquito breeding sites. In addition, agricultural ditches and canals and irrigated cropland are potential mosquito breeding sites. Orchards and vineyards surrounding the Madera Ranch site have been identified as breeding areas (Dillahunti pers. comm.).

4.11.3 Analysis of Environmental Effects

Effect Assessment Methods

The hazardous materials effect assessment included a site assessment (TRC 1999, 2002) and a review of probable hazardous materials use and storage patterns related to operation of the WSEP. The hazards of and risks inherent in the materials and wastes present, or suspected present, in the Madera Ranch area were considered in this evaluation. In addition, the hazards of and risk inherent in the alternatives were considered.

The mosquito assessment included a review of mosquito ecology and WSEP features possibly conducive to mosquito breeding and propagation. Changes in requirements for mosquito abatement were predicted based on the acreage of open-water habitat developed as a product of the alternatives, conservatively assuming that all open-water habitat has the potential for mosquito production.

Analytical Approach and Effect Mechanisms

Hazardous Materials

Effects related to hazardous materials include the mixing of known contaminated soil or groundwater with imported water. Reconnaissance of the site, review of regulatory databases, and interviews of property owners and regulatory agency personnel contained in the initial site assessment (TRC 1999, 2002) form the basis for understanding potential hazardous materials effects. Limited confirmatory sampling, including sampling of agricultural groundwater wells and agricultural soils, was conducted to identify existing and potential groundwater concerns with regard to the mobilization and transport of agricultural nonpoint-source pesticides. California Department of Pesticide Regulation’s (DPR’s) existing database of groundwater management zones, which was developed using a statistical approach to determine areas of groundwater vulnerability, was reviewed to identify potential areas of pesticide mobilization concerns.

Safety Hazards

Potential physical safety hazards, including drowning and wildland fire, were reviewed based on various risk factors, such as proximity to human populations, ease of public access, and public rights-of way. Potential physical hazards from dam failure were evaluated quantitatively by comparing recharge basin design to DWR’s DSOD criteria.

Health Hazards

Mosquito-related effect mechanisms include habitat-type conversions and changes in open-water acreage and water management practices related to operation under the Proposed Action. The creation, removal, and/or management of habitat types, including irrigated agriculture, could increase or decrease the amount of potential breeding habitat for mosquitoes. Management and design of recharge facilities could substantially affect mosquitoes’ breeding success. Breeding conditions and abatement requirements were evaluated based on mosquito ecology and control literature, communication with MCMAVCD staff, and the design and operational management specifications of each alternative.

In determining the effects of the Proposed Action and alternatives on human health with respect to mosquito vectors and pests, the alternative was considered to have an adverse effect if it would necessitate increasing levels of mosquito abatement programs to maintain mosquito populations at pre-implementation levels.

Environmental Consequences and Mitigation Strategies

Alternative A—No Action

Under the No Action Alternative, Reclamation would not approve the banking of CVP water outside MID's service area, nor would Reclamation issue an MP-620 permit for modifications to its distribution system. Reclamation's action would have no adverse effects on public health and safety. However, the future conditions would change to support agricultural activities. Potential effects would be evaluated by the County under CEQA depending on the discretionary permits needed.

Alternative B—Water Banking outside the MID Service Area Using Swales and Alteration of Reclamation-Owned Facilities

Alternative B would involve the use of hazardous materials during construction and operations (e.g., fuels, lubricants, paints, coatings, pesticides.) Also, the water that would be banked in the swales and/or recharge basins could support mosquitoes. Mosquito breeding success could be substantially affected by management and design of the swales or recharge basins. Alternative B could increase or decrease the amount of potential breeding habitat for mosquitoes. Physical hazards such as drowning and berm failure associated with the canal and basins are assessed below.

Effect PHS-1: Potential Creation of a Public Hazard from Risk of Drowning

Several canals would be enlarged or extended as a result of Alternative B. Maintenance ramps would provide egress at several locations along the canals, most likely near points of Madera County road crossings. Reasonable measures to prevent trespass also have been included in the design of facilities. Safety precautions, such as fencing around the entire Madera Ranch property, warning signs, and setbacks, will be taken. MID will implement Environmental Commitment PHS-1a, Implement Necessary Emergency Preparedness Plan(s), to minimize the potential for this effect. Therefore, the potential hazard of drowning represented by Effect PHS-1 is not considered adverse.

Effect PHS-2: Potential Creation of a Public Hazard from Risk of Berm Failure

Recharge basins would be constructed on up to 1,000 acres under Alternative B, although individual basin cells would be on the order of 5–80 acres each. These basins would be excavated, and some spoils would be used to form low berms to achieve an effective depth of up to 5 feet to prevent wind-induced waves from overtopping the berms. Berm heights would vary, depending on topography, but would not exceed 5 feet.

DSOD has developed criteria delineating its jurisdiction over impounded surface water bodies. Dams that meet jurisdictional coverage must meet specific safety and integrity requirements based on the risk associated with their potential failure. Because the berms would not exceed a height of 5 feet, they would be below the DSOD jurisdictional height limit of 6 feet. In addition, because water would be impounded in shallow excavations, most of the berms would be lower than 5 feet. The nearest residence is approximately 0.75 mile away, uphill of the recharge basin locations and outside the fenced ranch perimeter. Given the topography of the area between the recharge basins and residences, water escaping in the event of berm failure would pool on land between Madera Ranch and the residence. Thus, there would be no effect.

Effect PHS-3: Potential Creation of a Public Hazard from Risk of Wildland Fire

Madera Ranch is covered primarily by annual grassland. During summer months, this dry grassland could pose a fire hazard. Although dense population centers, such as the city of Madera, are physically separated from Madera Ranch by surrounding agriculture, there are several residences near the Madera Ranch site. Existing roads on Madera Ranch would be bladed on a regular basis and could act as firebreaks. The potential fire hazard to the public as a result of accidental ignition of grassland is low, and once constructed Alternative B would not result in changes in this hazard. However, a minor increase in wildfire risks could occur during construction as a result of using construction equipment in the vicinity of dry grassland. Environmental Commitments PHS-1a and PHS-1b would reduce the intensity of this hazard.

Effect PHS-4: Potential Increase in Adult Mosquito Populations

Under Alternative B, water would be diverted into 700 acres of swales. Up to 1,000 acres of recharge basins also could be flooded to about 3–5 feet deep and would have berms with 1:1.5 to 1:2 vertical-to-horizontal slopes. Recharge basins and canals would be managed to control and eliminate emergent vegetation.

As discussed previously, open-water areas are potential breeding areas for mosquitoes. Breeding habitats would be influenced by the proposed operational strategy. During some years, only recharge would occur; during some years, only recovery would occur; and during some years, there would be no on-site activity, corresponding to the natural cycle of dry and wet years and resultant customer needs. MID would divert water to the basins and swales during the winter and spring, from approximately November through March, and possibly as late as May in wet years. Water would be extracted during an estimated 8-month summer and fall period that would correspond to user demand.

During the mosquito-breeding period of March–October, recharge basins and swales used to perform recharge generally would not contain standing water. During nonoperational periods, recharge basins and swales are expected to be fully drained approximately 8 months of any given year. The size of each recharge basin cell would be about 5 to 80 acres, which is enough area to generate wave action from winds, which would suppress development of mosquito larvae. Waves can disrupt the ability of mosquito larvae to penetrate the surface of water and take flight, thus effectively suppressing the population.

Water in the swale areas would range in depth from several inches to 4 feet, and water flowing through the swales also would discourage development of mosquito larvae. During pilot testing of recharge on the property, MID observed that water percolates quickly. Typically, no standing water remained more than 24 hours after flow to the swales and basins had ceased. Thus, MID expects that mosquito production would be inhibited because during application, water levels would fluctuate rapidly as water flows through the swales and generally would not persist after flows cease. Additionally, only during a few months in spring would the timing for application of the water and the breeding season overlap.

Emergent vegetation is a critical element of mosquito breeding habitat because the vegetation is used as a structure to hold eggs and/or cover larvae. Emergent vegetation would be eliminated from the recharge basins whenever possible to further reduce the likelihood of mosquito production. However, vegetation would not be removed from the swales.

New and enlarged MID conveyances under Alternative B would convey water through the irrigation season according to the currently used schedules but would contain water more frequently because of the conveyance of water to and from the water bank. However, MID anticipates that these conveyances still would be fully drained for maintenance during some portion of October and November in most years. Months of operation would vary, although the conveyances would carry water primarily during the summer and fall under extraction operations and during the winter under recharge operations. Although mats of algae or other vegetation could develop in the conveyances, providing suitable habitat for mosquito production, algae growth (and control measures) would be the same as under current conditions.

The design and proposed operational strategy of Alternative B would suggest limited mosquito production; however, varying mosquito ecology precludes a quantitative analysis of net mosquito production that would result from Alternative B. It is conceivable that a net increase in mosquito production, and resulting increased public health risks, could occur. Therefore, Effect PHS-4 is potentially adverse. The Environmental Commitment PHS-2 to Implement an Agreement with the MCMAVCD would reduce the intensity of adverse effects.

Effect PHS-5: Potential Exposure or Disturbance of Hazardous Materials or Wastes

An initial environmental site assessment at Madera Ranch, including site reconnaissance, database review, and interviews, was conducted in September

1999 and again in July 2002. The site assessment did not identify significant soil or groundwater contamination on or in the vicinity of Madera Ranch related to past or present storage, handling, or disposal of hazardous materials and wastes. The initial site assessment also did not identify any significant regional groundwater contamination plume or significant RCRA-permitted storage facilities within a 5-mile radius of the Madera Ranch site.

Although there are no substantial hazardous materials concerns in the Madera Ranch site and vicinity, surface soil contamination associated with ASTs in Sections 1 and 13 was identified during the site reconnaissance. This type of contamination is commonly found at similar diesel-powered pump engines, and as described above, it was determined that the contamination is limited to the immediate area of the ASTs. However, Sections 1 and 13 are currently used to grow grain and hay crops and would continue to be used for that purpose as part Alternative B. No recharge basins are proposed for construction in Section 1 or 13, and there are no swales in these sections that could be used for recharge. The only change proposed as part of Alternative B would be that MID would deliver surface water, when available, in lieu of pumping groundwater to irrigate the fields.

During construction and operation, the use of fuels and lubricants for construction equipment and propane pumps has the potential to accidentally release hazardous materials into the environment. To reduce this adverse effect, Environmental Commitment WQ-1b: Implement a Spill Prevention and Control Program would be implemented. Therefore, exposure or disturbance of hazardous materials or waste is not anticipated and there is no effect.

Alternative C—Water Banking Outside the MID Service Area without Swales and Alteration of Reclamation-Owned Facilities

Alternative C is similar in scope and design to Alternative B, with the primary exception that the natural swales that occur on the site would not be used for recharge. Thus, there would be no substantive differences in public health and safety effects between Alternatives B and C. Alternative C would result in equivalent effects related to an increase in drowning risks at new canals and ditches, berm failure, wildland fires during construction, mosquito production at the recharge basins, and release or disturbance of hazardous materials (Effects PHS-1, PHS-2, PHS-3, PHS-4, and PHS-5). Adverse effects resulting from fire risk (Effect PHS-3) would be mitigated as described under Alternative B (Environmental Commitment PHS-1a and 1b). Alternative C provides similar open-water habitats and would result in similar potential effects regarding mosquito breeding (Effect PHS-4) that would be minimized as described under Alternative B (Environmental Commitment PHS-2).

Alternative D—Water Banking Outside the MID Service Area with Banking and Recovery via Gravelly Ford Canal

Alternative D is similar in scope and design to Alternative B, with the exception that water would be conveyed to the site via GF Canal. For this reason, one recharge basin would not be built under Alternative D that was proposed under Alternative B and lift station would be built in different locations than proposed under Alternative B. Thus, there would be no substantive differences in public health and safety effects between Alternatives B and D. Alternative D would result in equivalent effects (Effects PHS-1, PHS-2, PHS-3, PHS-4, and PHS-5). Adverse effects resulting from fire risk still would be present (Effect PHS-3) and would be minimized as described under Alternative B (Environmental Commitment PHS-1a and 1b). Alternative D provides similar open-water habitats as described under Alternative B and would result in equivalent potential effects regarding mosquito breeding (Effect PHS-4) and would be mitigated as described under Alternative B (Environmental Commitment PHS-2).

Cumulative Effects

Effects related to fire and increased mosquito production could have cumulative impacts in Madera County. Development of emergency preparedness plans (Measure PHS-1a) and compliance with local fire district requirements (Measure PHS-1a) would negate any cumulative fire risk. Likewise, completion of an implementation agreement with the MCMAVCD (Measure PHS-2) would eliminate the risk of any potential contribution to regional increases in adult mosquitoes.

As Alternative C and D are identical to Alternative B in scope and effect, it is not anticipated that either alternative would contribute to cumulative effects on public health and safety.

4.12 Public Services and Utilities

4.12.1 Introduction

This section describes the existing public services and utilities in the areas potentially affected by the Proposed Action and alternatives. The analysis addresses effects of each alternative on fire protection, police protection, wastewater (sewage), water service, schools, solid waste, recreation, and electricity. This section discusses the affected environment, relevant regulations and policies, methods of analysis, possible effects, and mitigation efforts.

4.12.2 Affected Environment

Information in this section is primarily from the *Madera County General Plan Policy Document* (1995b).

Regional

The Madera Ranch site is in the service areas of the following utility providers:

- The Pacific Gas and Electric Company (PG&E) (electricity);
- AT&T (telephone);
- County Fire Department, contracted to the California Department of Forestry (firefighting); and
- Madera County Sheriff’s Department (law enforcement).

MID delivers water to Sections 1, 13 ½, and 14 of Madera Ranch, but Madera Ranch is not served by community drinking water, wastewater, or stormwater services, and there are no schools in the vicinity of Madera Ranch; therefore, these services and facilities are not discussed in this section.

Local

Local power and communication utility lines cross the Madera Ranch site. These lines serve development on the site, including the shop area and well facilities. An electrical substation is located immediately north of the site across Avenue 12. The County Fire Department and the California Department of Forestry provide fire protection to the site, and the County Sheriff’s Department provides law enforcement services to the site. MID and GFWD provide irrigation water to farmers in the area, generally between March and October. Only part of Madera Ranch is located in MID or GFWD boundaries.

4.12.3 Analysis of Environmental Effects

Methods

The analysis of effects on public services and utilities includes a qualitative assessment of the WSEP's effect on public and utility services, including electricity and emergency services. Effects were determined based on the changes that would occur in electricity use as a result of construction and operation of the project, and disruptions to emergency access and irrigation facilities during construction.

Schools are not discussed because Madera Ranch is not located in the vicinity of a school and the alternatives would not cause any increase in schoolchildren or result in effects on school facilities. Solid waste is not discussed because construction and operation of the alternatives would not increase development that would require the disposal of solid waste.

Environmental Effects

Alternative A—No Action

Under the No Action Alternative, Reclamation would not approve the banking of CVP water outside MID's service area, nor would Reclamation issue an MP-620 permit to approve of modifications to its distribution system. Reclamation's action would have no adverse effects on public services and utilities. However, future conditions would change to support agricultural activities. Potential effects would be evaluated by the County under CEQA, depending on the discretionary permits needed.

Alternative B—Water Banking outside the MID Service Area Using Swales and Alteration of Reclamation-Owned Facilities

Effect PSU-1: Increased Demand for Utilities

Alternative B would involve the installation of up to 49 new 75–100-hp groundwater wells and up to 20 lift station pumps, which would increase demand for electricity for the site. Electricity either would be provided by PG&E in accordance with PG&E and CPUC regulations or would be purchased directly from the power grid. A connection would be made to existing electric lines along either Avenue 7 or Avenue 9. To provide the necessary service, a new utility substation would be constructed on Madera Ranch. All costs associated with constructing and maintaining required facilities would be borne by MID. Because PG&E could provide service to the water banking facility along existing utility lines and MID would provide substation facilities, this action would not result in an adverse effect.

Effect PSU-2: Potential Disruption of Emergency-Response Routes

As described in Section 4.13, Traffic and Circulation, all the local roadways (State Route 99; Avenues 7, 10, and 12; and Roads 16 and 21) are currently operating at acceptable Levels of Service (B–D). The construction-related activities would not substantially increase the number of daily (0.3–7%) and peak-hour (1–28%) vehicles currently traveling along these roadways and would not contribute to exceedance of traffic thresholds recommended by the Institute of Transportation Engineers. However, the increase in slow-moving traffic during construction in the vicinity of Madera Ranch could reduce emergency response times on the affected roads. Because of this potential increase in emergency response times, Effect PSU-2 is considered adverse. Implementation of Environmental Commitments PSU-1a and PSU 1b would minimize adverse effects associated with Alternative B.

Effect PSU-3: Temporary Disruption of Irrigation Service as a Result of Construction

Several canals that currently provide irrigation water would be reconditioned or extended. These canals would need to be dry during construction and, therefore, would not be able to convey irrigation water during these times. To minimize the disruptions to irrigators using these canals, MID will ensure that construction on these facilities is limited to winter, when the canals are not required to deliver irrigation water. As such, Effect PSU-3 is not considered adverse.

Alternative C—Water Banking Outside the MID Service Area without Swales and Alteration of Reclamation-Owned Facilities

Alternative C is similar in scope and design to Alternative B, with the primary exception that the natural swales that occur on the site would not be used for recharge. Thus, there would be no substantive differences in potential effects on public services and utilities between Alternatives A and B. Alternative C would result in equivalent effects on electricity use, emergency services, and irrigation services (Effects PSU-1, PSU-2, and PSU-3). Adverse effects resulting from the potential disruption of emergency service routes during construction would be mitigated as described under Alternative B (Environmental Commitment PSU-1a and 1b).

Alternative D—Water Banking Outside the MID Service Area with Banking and Recovery via Gravelly Ford Canal

Alternative D is similar in scope and design to Alternative B, with the exception that water would be conveyed to the site via GF Canal. For this reason, one recharge basin would not be built under Alternative D that was proposed under Alternative B and lift stations would be built in locations different from those proposed under Alternative B. However, there would be no substantive differences in potential effects on electricity use, emergency services, or irrigation services between Alternatives B and D. Alternative D would result in equivalent effects (Effects PSU-1, PSU-2, and PSU-3). Adverse effects resulting from the potential disruption of emergency service routes during construction would be mitigated as described under Alternative B (Environmental Commitment PSU-1a and 1b).

Cumulative Effects

Effects related to the disruption of emergency response routes could have cumulative impacts in Madera County. Development of a traffic safety plan (Measure PSU-2b) and notifying emergency service providers of traffic route changes (Measure PSU-2a) would negate any potential for cumulative effects. As Alternatives C and D are identical in scope and effect to Alternative B, it is not anticipated that Alternatives C and D would contribute to cumulative effects on public services.

4.13 Traffic and Circulation

4.13.1 Introduction

This section describes the existing traffic and circulation conditions in the areas potentially affected by the proposed alternatives. It discusses the affected environment, relevant regulations and policies, methods of analysis, and possible effects.

4.13.2 Affected Environment

Methods and Terminology

Roadway Levels of Service

Level of service (LOS) measures the quality of service provided by a roadway. LOS criteria established by the Transportation Research Board are shown in Table 4.13-1. These criteria use a letter rating to describe the peak-period driving conditions for a particular facility. The roadway traffic conditions become progressively worse from A to F.

Table 4.13-1. Roadway Level of Service Definitions

Level of Service Rating	Definition
A	Free flow; insignificant delays
B	Stable operations; minimal delays
C	Stable operations; acceptable delays
D	Approaching unstable; queues develop rapidly but no excessive delays
E	Unstable flow; significant delays
F	Forced flow; low operating speeds

Source: Transportation Research Board 1994.

LOS criteria for highways are established by Caltrans and take into account numerous variables, including annual average daily traffic, roadway capacity, grade, and environment (urban versus rural). According to Caltrans policy and the County's criteria, LOS D is acceptable for planning purposes, and LOS E and F are unacceptable. As shown in Table 4.13-2, all the roadways potentially affected by the alternatives are currently operating at LOS D or better; therefore, all the roadways are operating at acceptable levels.

Table 4.13-2. Roadway Characteristics

Roadway	Responsibility	Functional Classification	Average (vehicles per day)	Peak Hour (vehicles per day)	LOS
SR 99[a]	Caltrans	4-lane freeway	62,000–63,000	5,600–6,200	D
Avenue 7[b]	Madera County	2-lane local road	3,256	326	C
Avenue 10[c]	Madera County	2-lane local road	2,440	244	B/C
Avenue 12[b]	Madera County	2-lane local road	2,419	242	A/B
Road 16[b]	Madera County	2-lane local road	371	37	A
Road 21[b]	Madera County	2-lane local road	Unavailable	Unavailable	A

Notes:

[a] Source: California Department of Transportation 2007.

[b] Source: Madera County Transportation Commission 2007. Traffic counts for Avenue 7 are from 2004, Avenue 12 from 2007, and Road 16 from 2005. Counts have never been conducted for Road 21.

[c] Source: Stone pers. comm. and Levine pers. comm. Based on the most recent available data from 1998.

Setting

Madera County is in a major transportation corridor between northern and southern California; State Route (SR) 99 is the primary route for north/south travel. The county’s economy is based on farming, agricultural processing, and manufacturing. Because most of the county’s products are shipped to outside locations, interstate and intrastate transportation are vital.

Roadways

As shown in Figure 4.13-1, Madera Ranch is regionally served by SR 99, which is generally a four-lane divided roadway (oriented north/south), and locally served by Avenues 7, 10, and 12 and Roads 16 and 21, which are all two-lane roadways maintained by the County. SR 99 is under the jurisdiction of Caltrans. Roadways and roadway segments potentially affected by the WSEP are:

- SR 99 from Madera to Fresno,
- Avenue 7 from Firebaugh to SR 99,
- Avenue 14 to Avenue 23 to Avenue 10,
- Avenue 10 from Road 23 to Road 21 (the Madera Ranch site),
- Avenue 12 from Road 16 to SR 99,
- Road 16 from Chowchilla to Avenue 12, and
- Road 21 from Avenue 12 to Avenue 7.

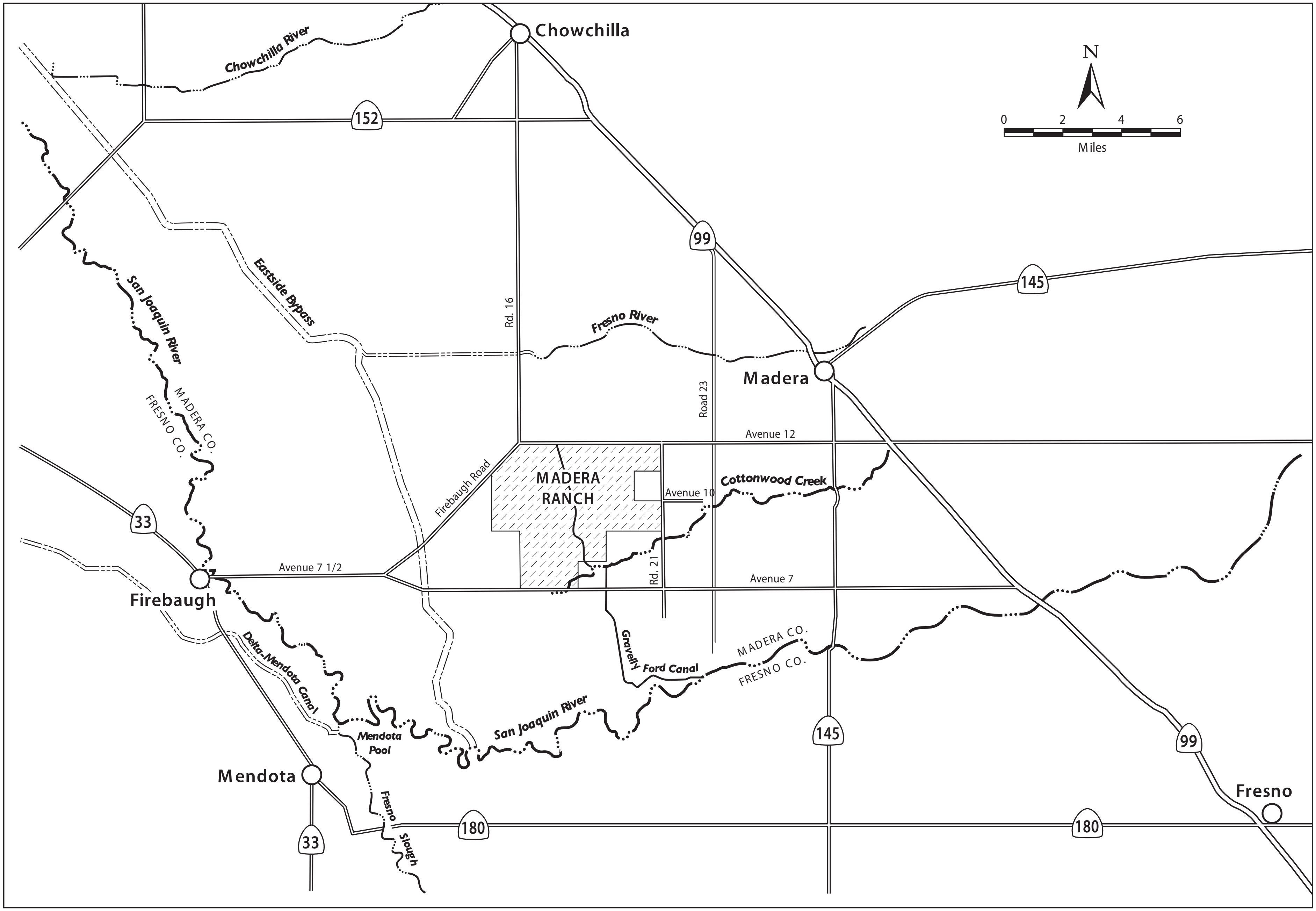


Figure 4.13-1
Regional and Local Roadway Network

Information about the most current traffic volumes, roadway classifications, and LOS is provided in Table 4.13-2. Avenues 7 and 12 are considered major truck routes (Stone pers. comm.). Although estimates of truck traffic on local roadways serving the Madera Ranch site are currently unavailable, it is estimated that the percentage of trucks or other slower moving vehicles (e.g., farm vehicles) is higher than average because of local agriculture.

4.13.3 Analysis of Environmental Effects

Methods

The following section describes the methods used to assess traffic and circulation effects associated with the alternatives. As described under Existing Conditions above, traffic counts from 1998 through 2007 are used to provide traffic data for roadways in the vicinity of Madera Ranch. Consequently, 1998–2007 traffic data are used to characterize the baseline traffic condition for this transportation and circulation analysis. Traffic and circulation effects would be limited to construction, and each of the alternatives involves a similar construction effort. As such, it is assumed that each of them generates the same vehicle trips.

Vehicle Access and Parking

Madera Ranch is located in the largely agricultural western portion of Madera County, approximately 5 miles southwest of the city of Madera and 10 miles northwest of Fresno. The Madera Ranch site would be accessed locally from Avenues 7 and 12. Avenue 10 would provide direct access to the site.

Trip Distribution

As shown in Table 4.13-3, the traffic analysis assumes that construction workers under the alternatives would come from the Fresno Metropolitan Statistical Area (MSA). The analysis assumes origination of the construction workforce would be:

- 70% from Fresno,
- 20% from Madera,
- 5% from Chowchilla, and
- 5% from Firebaugh.

The analysis assumes that 100% of the total number of heavy-truck trips would be generated from the greater Fresno metropolitan area.

Trip Generation

To assess the magnitude and directional variation of vehicle trips associated with construction of the alternatives, vehicle-trip generation was analyzed using an estimate of the required construction-related workforce. Assuming a worst-case scenario, construction of the alternatives could require up to 60 construction workers. Implementation of the Proposed Action could generate up to 3,600 heavy-truck (e.g., concrete, equipment) trips during construction of the recharge basins. Table 4.13-3 provides an estimate of the total number of construction-related vehicle trips that would be generated, including the peak and average daily vehicle trips.

The traffic and circulation analysis also assumes a worst-case scenario in which each of the 60 workers would drive a separate vehicle to Madera Ranch, making two trips per day, or one round-trip from home to the site and back. Under this scenario, construction of the alternatives would result in an average of approximately 176 vehicle trips per day and about 68 total vehicle trips per day during the peak morning and afternoon traffic periods (Table 4.13-3) during the period of construction (approximately 365 days).

In addition, it is estimated that construction-related activities would include the use of several types of equipment, including backhoes, scrapers, water trucks, pickup trucks, and front loaders. It is assumed that equipment would be stored on site while in use and would not result in a substantial increase in the overall daily trip generation.

Operations and maintenance–related activities would require only occasional inspection visits; therefore, operations and maintenance–related traffic would be negligible and is not expected to affect the operating conditions of existing roadways. Consequently, operations-related traffic is not addressed further in this analysis.

Table 4.13-3. Anticipated Construction Vehicle Trip Generation and Workforce Distribution

Vehicle Origin City	Percent Distribution of Local Workforce	Daily Workforce	Daily Vehicle Trips	Daily Peak-Hour Vehicle Trips
Fresno				
Construction Workers	70	42	84	42
Heavy Trucks	100	28	56	8
Total		**70**	**140**	**50**
Madera	20	12	24	12
Chowchilla	5	3	6	3
Firebaugh	5	3	6	3
Total	**100**	**88**	**176**	**68**

Environmental Consequences and Mitigation Strategies

Alternative A—No Action

Under the No Action Alternative, Reclamation would not approve the banking of CVP water outside MID's service area, nor would Reclamation issue an MP-620 permit to allow modifications to its distribution system. Reclamation's action would have no adverse effects on traffic. However, the future conditions would change to support agricultural activities. Some increase in traffic in the region could occur as a result of development. Potential effects would be evaluated by the County under CEQA, depending on the discretionary permits needed.

Alternative B—Water Banking outside the MID Service Area Using Swales and Alteration of Reclamation-Owned Facilities

Effect TRAF-1: Temporary Construction-Related Increase in Traffic Volumes on Local and Regional Roadways

Construction of Alternative B temporarily would increase the traffic volumes on SR 99; Avenues 7, 10, and 12; and Roads 16 and 21. It is assumed that the route preferred by construction workers and truck drivers traveling from the Fresno metropolitan area would be north along SR 99 to Avenue 7, west to Road 21, north to Avenue 10, and west to the Madera Ranch site. Workers originating from Madera most likely would travel south along SR 99 to Avenue 12, west to Road 21, south to Avenue 10, and west to the site.

From Chowchilla, workers most likely would travel south along Road 16 to Avenue 12, east to Road 21, south to Avenue 10, and west to the Madera Ranch site. Workers originating from Firebaugh most likely would travel east along Avenue 7 to Road 21, north to Avenue 10, and west to the site.

Using the above-mentioned travel pattern assumptions, Figure 4.13-2 identifies the preferred travel routes for both daily and peak-hour traffic volumes. Table 4.13-4 also provides estimates of the increase in traffic on local and regional roadways that would be anticipated to result from the construction workforce commuting to and from the construction site. As the anticipated construction activities are similar in scope, the anticipated construction workforce is assumed to be identical, regardless of alternative.

As described above, all the roadways are currently operating at an acceptable LOS. Because construction-related activities would not substantially increase the number of daily (0.3–7%) and peak-hour (1–28%) vehicles traveling along these roadways and would not contribute to exceedance of traffic thresholds recommended by the Institute of Transportation Engineers, Effect TRAF-1 is not considered adverse.

Table 4.13-4. Increase in Construction-Related Traffic on Regional and Local Roadways

Roadway Segment	Existing Average Daily Trips	Existing LOS	Daily Trips (Percent Increase)	Existing Peak-Hour Trips	Peak-Hour Trips (Percent Increase)
State Route 99	52,000	D	164 (0.3)	4,700	62 (1)
Avenue 7	3,300	B/C	146 (4)	330	53 (16)
Avenue 10	2,440	B/C	176 (7)	244	68 (28)
Avenue 12	2,270–8,520	B/C	30 (0.4–1)	227 - 852	15 (2–7)
Road 16	580	B/C	6 (1)	58	3 (5)
Road 21	NA	B/C	176 (NA)	NA	68 (NA)

NA = not available.

LOS = level of service.

Effect TRAF-2: Potential Increase in Construction-Related Traffic Volume Delay and Hazard on Local and Regional Roadways

Construction-related activities would involve the daily use of heavy trucks, which could increase safety hazards on local roadways. Although construction-related activities would take place for only a short time, these activities would result in greater-than-normal truck traffic along local roadways. As additional heavy trucks travel to and from the Madera Ranch site, there could be conflicts between drivers of slow-moving vehicles (including farm equipment) and drivers of other vehicles on local roadways; therefore, Effect TRAF-2 is considered adverse. Implementation of Environmental Commitment PSU-1b, Implement a Traffic Safety Plan, would minimize the intensity of this effect.

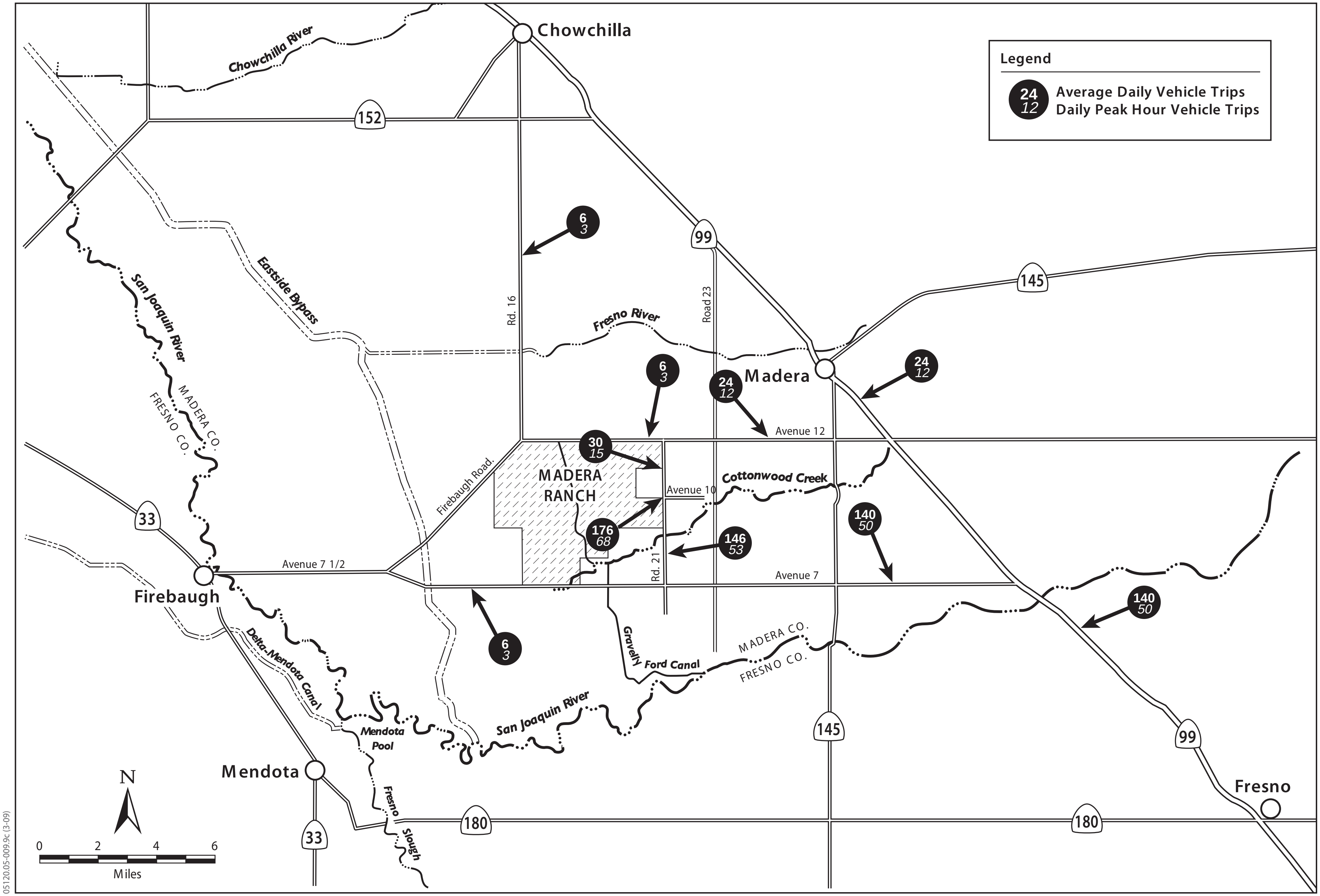


Figure 4.13-2
Project-Related Trip Distribution—Construction Period

Effect TRAF-3: Potential Damage to the Roadway Surface during Construction

The increased volume and frequency of vehicle traffic along local and regional roadways during the construction period would not result in a substantial deterioration of the roadway surface. However, heavy trucks and construction equipment accessing the site could affect the structure or maintenance needs of specific turnout or access points from local roadways. Currently, both the County and Caltrans implement programs that provide for the maintenance of safe and reliable roadways. Effect TRAF-3 is considered adverse. Implementation of Environmental Commitment TRAF-1, Implement a Road Improvement Plan, would minimize the timing and intensity of this effect.

Effect TRAF-4: Potential Increase in the Demand for Parking Space at the Construction Site(s)

Implementation of Alternative B would increase the demand for parking spaces for construction employees and would require the development of an equipment staging area at the Madera Ranch site. However, as described more fully in Chapter 2, "Alternatives," adequate parking and equipment staging areas would be included as part of Alternative B. Because construction-related parking and equipment storage needs would be addressed in the design of the alternative, Effect TRAF-4 is not considered adverse.

Alternative C—Water Banking outside the MID Service Area without Swales and Alteration of Reclamation-Owned Facilities

Alternative C is similar in scope and design to Alternative B, with the primary exception that the natural swales that occur on the site would not be used for recharge. Thus, engineered basins would be built earlier in the design cycle than under Alternative B. This would not result in changes to the overall construction and/or operational traffic patterns or levels anticipated under Alternative B and would result in equivalent effects (Effects TRAF-1, TRAF-2, TRAF-3, and TRAF-4). Thus, traffic effects are considered similar to those that would occur under Alternative B and are considered adverse. Implementation of Environmental Commitments PSU-1b and TRAF-1 would reduce the intensity of these effects.

Alternative D—Water Banking outside the MID Service Area with Banking and Recovery via Gravelly Ford Canal

Alternative D is nearly identical in scope and design to Alternative B, with the exception that water would be conveyed to the site via GF Canal. For this reason, one recharge basin would not be built under Alternative D that was proposed under Alternative B and lift stations would be built in locations different from those proposed under Alternative B. This would not result in changes to the overall construction and/or operational traffic patterns or levels anticipated under Alternative B and would result in equivalent effects (Effects TRAF-1, TRAF-2, TRAF-3, and TRAF-4). Thus, traffic effects are considered similar to those that would occur under Alternative B and are considered adverse. Implementation of Environmental Commitments PSU-1b and TRAF-1 would reduce the intensity of these effects.

Cumulative Effects

Temporary construction (Effect TRAF-1, TRAF-2 and TRAF-3) and parking effects (Effect TRAF-4) would not contribute to any cumulative effect as construction traffic is only temporary in duration and the project would provide sufficient parking for the activity under all of the alternatives.

As both Alternatives C and D are equivalent in scope and overall effect to Alternative B, it is anticipated that neither Alternative C nor D would contribute to cumulative traffic effects.

4.14 Water Quality

4.14.1 Introduction

This section examines the potential effects of the proposed alternatives on water quality, as influenced by surface water hydrology and flooding, groundwater hydrology, surface water quality, and groundwater quality.

4.14.2 Affected Environment

This section provides an overview of water quality conditions in surface water and groundwater resources of the affected environment. The affected environment consists of water resources that exist within or flow through the study area, an area that includes Madera Ranch; the immediate surrounding area; the underlying groundwater aquifer; and surface drainage features such as GF Canal, Cottonwood Creek, the Fresno River, and the San Joaquin River. This section also discusses potential environmental effects on water quality associated with the alternatives and their conformance with the applicable federal, state, and local regulations.

Methods and Terminology

MID and previous property owners collected a large amount of data for evaluating the existing physical and chemical conditions in surface water and groundwater resources in the area. These data include hydrologic and geophysical properties of soils, deeper geologic features, and groundwater aquifers. All of these data were evaluated for this analysis.

Setting

General Climate

The San Joaquin Valley is surrounded by the Coast Ranges to the west, by the San Emigdio and Tehachapi Mountains to the south, by the Sierra Nevada to the east, and by the Delta and Sacramento Valley to the north. The climate of the valley floor is arid to semi-arid with dry, hot summers and mild winters. Summer temperatures may be higher than 100 degrees Fahrenheit (°F) for extended periods; winter temperatures are only occasionally below freezing (32°F). The average annual rainfall at Madera Ranch is approximately 11 inches, most of which falls between October and March. The winter snowpack, which accumulates above 5,000 feet elevation, primarily in the Sierra Nevada, supplies the vast majority of water in the basin. The west-side streams contribute little to water totals in the valley because the Coast Ranges are too low to accumulate a snowpack, and their eastern slopes are subject to a rain shadow phenomenon, producing only seasonal runoff.

Surface Water

The San Joaquin River is the major surface water feature south and west of the area (Figure 2-1). The total San Joaquin River basin drains 7,395 square miles, of which 4,320 square miles are in the Sierra Nevada and 2,273 square miles are in the San Joaquin Valley (Kratzer et al. 2002). According to U.S. Geological Survey (USGS) flow records from 1951 to 1995, 66% of the average San Joaquin River flow comes from three major east-side river basins: the Merced River (15%), the Tuolumne River (30%), and the Stanislaus River (21%) (Kratzer et al. 2002). The remaining flow in the San Joaquin River comes from the Bear Creek Basin, which includes Mud and Salt Sloughs, and small ephemeral creeks that drain from the west, including Orestimba Creek, Del Puerto Creek, and various drainage canals.

The other two major rivers in the action area are the Fresno River and the Chowchilla River. The Fresno River drains a watershed of approximately 237 square miles above Hidden Dam and Hensley Lake. Historically, the Fresno River has had ephemeral flows consisting of large winter uncontrolled flows and no summer flows. The Chowchilla River forms the northern boundary of the Madera area and drains approximately 236 square miles above Buchanan Dam. The Chowchilla River, like the Fresno River, has ephemeral flows consisting of large winter uncontrolled flows and no summer flows. Minor drainages in the vicinity of Madera Ranch include Cottonwood Creek and its tributaries (Figures 2-1 and 2-2). These minor drainages convey water from the Madera Canal to local canals, and all of their flows are diverted for use. Madera Canal is 36 miles long and extends northwest from Friant Dam to Ash Slough and diverts water to MID. The canal crosses the Fresno River 3 miles downstream of Hidden Dam. West of the area is the Eastside Bypass, which conveys uncontrolled flows from the San Joaquin River and from miscellaneous drainages to northwestern Madera County.

Cottonwood Creek is an ephemeral stream in which MID and GFWD maintain flow recorders. The creek is fed by runoff within a rural basin that lies generally between the Sierra foothills and SR 99 and SR 49. Data from 1954 through 2003 indicate that natural flows occur only during the rainy season, typically beginning in mid-January and ending in late March, with the highest flows in February. In wet years, the creek frequently overflows its banks at the intersection of Road 23 and Avenue 10 (2 miles east of the ranch) and on the south side of the ranch. FEMA-designated floodplains at Madera Ranch include the southeast half of Sections 13, 22, and 28. All of these floodplains are associated with Cottonwood Creek, which crosses Madera Ranch in Section 28 only. During the irrigation season (typically beginning in late March and running through September) MID uses the creek as an extension of the Main No. 2 Canal. Creek flows during this time are Millerton Lake and Hidden Lake waters being delivered to farmers by MID. Without these deliveries, the creek would be dry during this time throughout Madera Ranch and its vicinity.

Surface Water Quality

Surface waters from the San Joaquin River, Fresno River, and Cottonwood Creek have been used to irrigate land around and on Madera Ranch for more than 100 years. In general, these waters are known for their high quality for agricultural use. The average specific conductance for the San Joaquin River is 45 microSiemens per centimeter (µS/cm) (approximately 28 milligrams per liter [mg/l] total dissolved solids [TDS]; Table 4.14-1), which indicates a much lower TDS than the groundwater beneath Madera Ranch, which averages 466 µmhos/cm (approximately 291 mg/l TDS). Friant and Hensley Lake water delivered to Madera ranch in 2005–2007 had a TDS ranging from 28 to 100 mg/l, whereas groundwater quality beneath the ranch during this same period ranged from 180 to 660 mg/l TDS (MID groundwater monitoring report summary October 29, 2007). The *2001 Annual Water Quality Report for Hensley Lake* (Chan 2002) states that nutrient alkalinity and chemical oxygen demand data show that excessive nutrients are not present. The average specific conductance for the Fresno River below Hensley Lake is 116 µmhos/cm (approximately 72.5 mg/l TDS; Table 4.14-2), also lower than the groundwater at Madera Ranch. Tables 4.14-1 and 4.14-2 present water quality data for the San Joaquin River and Fresno River, respectively, and are representative of the source water for the Proposed Action. The source water for the WSEP would dilute concentrations of minerals and other constituents in the native groundwater, and, as a consequence, recovered water would be of generally better quality than the native groundwater.

Table 4.14-1. Summary of Water Quality Data: San Joaquin River below Friant Dam, 1958–1988

	Count[a]	Maximum	Minimum	Average[b]	Criteria
Flow (cfs)	91	7,090	25	411	Not listed
pH (standard units)	123	8.2	6.5	7.1	<6.5 or >8.5[c]
Water temperature (ºF)	93	68	39	51	Not listed
Specific conductance (µmhos/cm at 25ºC)	122	120	25	45	150[c]
Dissolved oxygen (mg/l)	121	15.5	6.4	11.7	Not listed
Calcium (mg/l as Ca)	52	15	2	3.5	Not listed
Magnesium (mg/l as Mg)	49	6.2	0.1	1	Not listed
Sodium (mg/l as Na)	117	11	1.6	3.8	20[d]
Potassium (mg/l as K)	35	2.9	0.4	1	Not listed
Chloride (mg/l)	103	8.5	0.8	3.3	250[g]
Sulfate (mg/l as SO4)	29	8.2	0.3	3.2	250[g]
Fluoride (mg/l as F)	9	0.3	0.1	0.3	2.0[e]
Silica (mg/l as SiO_2)	15	14	9	12.5	Not listed
Boron (mg/l as B)	31	0.2	0.07	0.081	2.0[f]
Ammonia nitrogen (mg/l as N)	1	0.04	0.04	0.04	Temperature-dependent
Nitrate nitrogen (mg/l)	14	4.1	0.08	0.64	10[c,g]
Nitrogen, ammonia and organic, total (mg/l as N)	25	3.2	0.03	0.39	Not listed
Nitrate + nitrite (mg/l as N)	15	0.16	0.02	0.04	10[c,g]
Phosphorus dissolved (mg/l)	19	0.25	0.02	0.04	Not listed

Source: Data taken from Bookman-Edmonston 2003.

[a] Number of samples with detectable constituents.

[b] Flow-weighted average of all detectable constituents.

[c] California Regional Water Quality Control Board, Basin Plan Amendment Criteria (1998).

[d] Sodium criteria for people on a 500-mg/l sodium diet. U.S. Environmental Protection Agency National Drinking Water Standard (2004).

[e] Fluoride criteria are still under review by the DHS (2004).

[f] Data in µg/l converted to mg/l (µg/l x 1000). California Regional Water Quality Control Board, Basin Plan Amendment Criteria (1998)—2.0 (15 March–15 September) and 2.6 (16 September–14 March).

[g] U.S. Environmental Protection Agency National Drinking Water Standard (2004).

Table 4.14-2. Summary of Water Quality Data: Fresno River below Hidden Dam, 1958–1988

	Count[a]	Maximum	Minimum	Average[b]	Criteria
Flow (cfs)	59	1,100	0	83	Not listed
pH (standard units)	82	9.2	6.6	7.3	<6.5 or >8.5[c]
Water temperature (ºF)	72	95	32	59	Not listed
Specific conductance (µmhos/cm at 25ºC)	83	548	57	116	150[d]
Dissolved oxygen (mg/l)	82	14	3.1	9.9	Not listed
Calcium (mg/l as Ca)	40	48	4.3	9.2	Not listed
Magnesium (mg/l as Mg)	40	19	0.6	1.9	Not listed
Sodium (mg/l as Na)	81	61	5	9.7	20[e]
Potassium (mg/l as K)	33	23	0.9	1.4	Not listed
Chloride (mg/l)	80	120	3.2	9	250[f]
Sulfate (mg/l as SO_4)	31	43	0.2	2.6	250[f]
Fluoride (mg/l as F)	11	0.2	0.1	0.1	2[g]
Silica (mg/l as SiO_2)	20	35	14	22.9	Not listed
Boron (mg/l as B)	29	1.2	0.01	0.113	2.0[h]
Nitrate nitrogen (mg/l)	27	4	0.02	1.06	10[c,d]
Nitrogen, ammonia and organic, total (mg/l as N)	2	0.6	0.4	0.6	Temperature- and pH-dependent
Phosphorus dissolved (mg/l)	3	0.16	0.04	–	Not listed

Source: Data taken from Bookman-Edmonston 2003.

– = No data.

[a] Number of samples with detectable constituents.

[b] Flow-weighted average of all detectable constituents.

[c] California Regional Water Quality Control Board, Basin Plan Amendment Criteria (1998).

[d] Criteria for San Joaquin River. No criteria listed for the Fresno River in the California Regional Water Quality Control Board, Basin Plan Amendment Criteria (1998).

[e] Sodium criteria for people on a 500-mg/l sodium diet. U.S. Environmental Protection Agency National Drinking Water Standard (2004).

[f] U.S. Environmental Protection Agency National Drinking Water Standard (2004).

[g] Fluoride criteria are still under review by the DHS (2004).

[h] Data in µg/l converted to mg/l (µg/l x 1000). California Regional Water Quality Control Board, Basin Plan Amendment Criteria (1998)—2.0 (15 March–15 September) and 2.6 (16 September–14 March).

Section 303(d) of the CWA establishes the total maximum daily load (TMDL) process to assist in guiding the application of state water quality standards. Under this section, states must identify streams whose water quality is impaired (affected by the presence of pollutants or contaminants) and establish the TMDL or the maximum quantity of a particular constituent that a water body can assimilate without experiencing adverse effect (U.S. Environmental Protection Agency 2007). The Fresno River, Cottonwood Creek, and upper San Joaquin River are not included on the 303(d) list. The 303(d) list does include reaches of the San Joaquin River, but all of the listed river reaches are downstream of the Madera Canal diversion and are not pertinent to this action.

EPA's STORET database (Storage and Retrieval of U.S. Waterways and Parametric Data) was searched for surface water quality information for Cottonwood Creek, but no data were available (STORET 2007). Because of the operations summarized above, the quality of Cottonwood Creek water is likely similar to that of all other MID conveyances during the irrigation season. During the rainy season (and based on the surrounding rural land uses), water quality is suspected to be similar to typical small rural streams, which are primarily dependent on mineral composition of the soils and associated parent materials within a watershed, hydrologic characteristics, and sources of contaminants in the watershed.

Groundwater

Madera Ranch is located in the Madera subbasin of the San Joaquin Valley Groundwater Basin. The total surface area of the subbasin is 394,000 acres or 614 square miles (California Department of Water Resources 2004). The Madera subbasin aquifer system consists of unconsolidated continental deposits, including older Tertiary and Quaternary age deposits overlain by a younger Quaternary deposit (California Department of Water Resources 2004). Groundwater recharge in the Madera subbasin occurs from river and stream seepage, deep percolation of irrigation water, canal seepage, and intentional recharge (California Department of Water Resources 2004). Groundwater flow is generally southwestward in the eastern portion of the subbasin, and to the northwest in the western portion (California Department of Water Resources 2004). However, groundwater flow directions vary on a local basis as a result of intense agricultural, municipal, and industrial groundwater pumping that also has caused overdraft in a variety of locations, including Madera Ranch. See Section 4.1, Water Supply, for additional information about groundwater hydrology.

Groundwater Quality

Groundwater in the vicinity of Madera Ranch is used primarily for agricultural supply, although domestic wells serve rural residents. Section 4.8, Geology, describes the geologic and hydrogeologic characteristics of the local groundwater aquifer system, which is composed of an unconfined layer above the Corcoran Clay layer (E-clay) and a confined layer located beneath the Corcoran Clay layer.

Groundwater quality differences between the confined and unconfined aquifers are difficult to distinguish from production well samples because the majority of wells are perforated both above and below the Corcoran Clay, providing a mix of waters from both aquifers. In addition, the clay is thin to absent in some areas. Consequently, the majority of well sample data represent an average of water quality from within the confined and unconfined aquifers. However, it is known that the base of fresh water in the confined aquifer beneath the E-clay layer occurs about 1,000 feet below ground surface. The underlying saline groundwater originated from prehistoric periods when the Central Valley was a marine environment inundated by salt water (California Department of Water Resources 1975).

In general, groundwater quality in the eastern San Joaquin Valley is excellent with the dominant cation and anion being sodium and bicarbonate, respectively. The confined aquifer tends to have larger proportions of calcium. At the western edge of Madera County near the San Joaquin River, sodium and chloride are more prevalent. Nitrate is the most prevalent constituent that exceeds drinking water maximum contaminant levels (MCL) in the eastern San Joaquin groundwater basin (U.S. Geological Survey 2001). Agricultural practices are known to be the major cause of this nitrate contamination, with the MCL of 10 parts per million of nitrogen (ppm N) being exceeded in about 40% of shallow wells. Concentrations of trace metals and other toxic inorganic constituents such as selenium, arsenic, and boron are generally low. The USGS frequently has detected pesticides in groundwater samples from the eastern San Joaquin Valley. However, only five pesticides were found in more than 10% of the samples, including atrazine, desethylatrazine, simazine, 1,2-dibromo-3-chloropropane (DBCP), and diuron (U.S. Geological Survey 2001). Concentrations of pesticides were generally low (less than 0.1 parts per billion [ppb]) and less than drinking water MCLs. The widely used soil fumigant DBCP violated its MCL (0.2 ppb) in about 20% of domestic wells and 40% of agricultural wells located in vineyard production areas. Because this regional data showed elevated nitrate and DBCP, sampling of groundwater was conducted at Madera Ranch to determine whether this was an issue of concern.

Groundwater samples were collected from wells on the Madera Ranch site during 1999–2001 (TRC 1999, 2002) and 2005–2007 and were tested for organic and inorganic constituents. The locations of these wells are shown on Figure 4.14-1. Seven wells were tested for organic constituents. No organic constituents were detected, except for 1,2,3-Trichloropropane, which was detected in two wells located in Section 1 (RW-2 and RW-4) but was not detected in a third well located in Section 1 (RW-1) or in a downgradient well located in Section 4 (RW-21) (Table 4.14-3). There are no state and federal drinking water standards for this fumigant, but EPA Region IX has listed a health advisory—a drinking water equivalent level of approximately 0.02 micrograms per liter (µg/l). Contacts with the Madera County Agricultural Commission indicate that agricultural chemicals have been used on site, but based on a review of material safety data sheets, 1,2,3-Trichloropropane was not identified as an ingredient in the agricultural chemicals applied on site historically (TRC 2002). Based on the available data, the extent of effects on groundwater may be limited to the vicinity of these two wells.

Table 4.14-3. Summary of Groundwater Analysis Results for 1,2,3-Trichloropropane on Madera Ranch (µg/l)

Well	1999	2000	2001	2005	2006	2007
Section 1 (RW-1)	–	–	ND	–	–	–
Section 1 (RW-2)	0.07	0.24	0.02	0.5	0.41	0.22
Section 1 (RW-4)	–	–	0.05	0.17	0.19	ND
Section 4 (RW-21)	–	–	ND	–	–	–

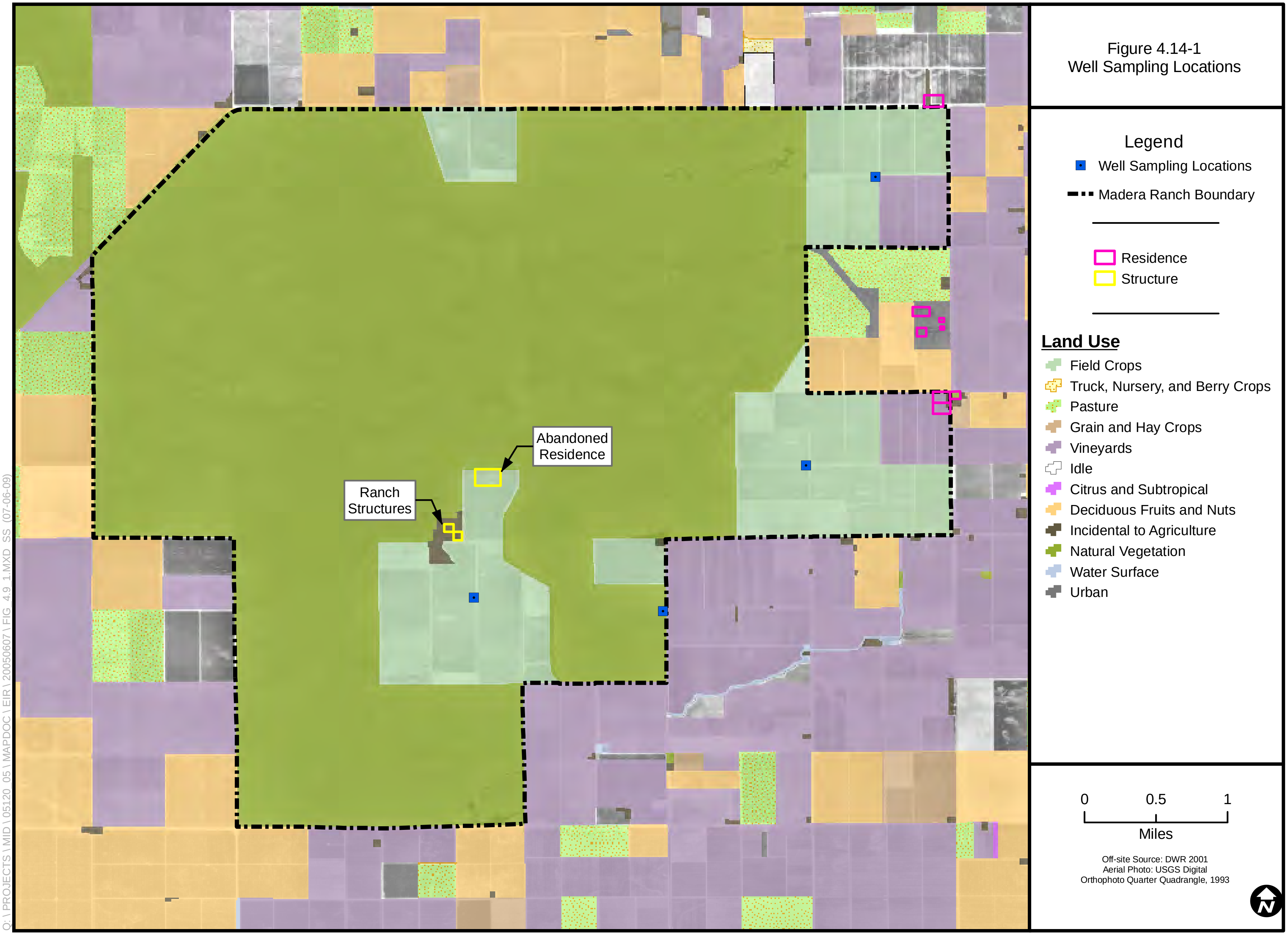
Source: TRC 1999, 2002, 2007.
– = not applicable or not analyzed.

Four wells were tested for inorganic constituents in September 1999 (TRC 1999). Inorganic data presented in Table 4.14-4 show the relative chemistry of the groundwater at Madera Ranch. As indicated, no state or federal criteria were exceeded.

Table 4.14-4. Groundwater Results for Inorganic Constituents on Madera Ranch (mg/l)[a]

	Well Identification				Drinking Water Action Level Criteria
	Section 1 (RW2) [b]	Section 13 (RW7) [b]	Section 21 (RW20) [b]	Section 22 (RW16) [b]	
pH (standard units)	7.8	7.5	7.7	7.8	6.5–8.5[c]
Chloride (mg/l)	51.6	23.9	34.6	18.7	250[f]
Fluoride (mg/l)	<0.1	<0.1	<0.1	<0.1	2.4[d]
Nitrate nitrogen (mg/l)	3.5	2.5	3.5	1.6	10[d]
Sulfate (mg/l as SO_4)	9.5	26.5	15.6	11.3	250[e]
Bicarbonate (HCO_3)	134	156	264	143	NS
Carbonate (CO_3)	<2	<2	<2	<2	NS
Hydroxide	<2	<2	<2	<2	NS
Total alkalinity ($CaCo_3$)	134	156	264	143	NS
Hardness ($CaCO_3$)	180	180	280	120	NS
Specific conductance (µmhos/cm at 25ºC)	466	438	607	354	900[f]
Total dissolved solids	309	313	411	265	500[f]
Aluminum	<0.05	<0.05	<0.05	<0.05	1[d]
Arsenic	<0.002	0.003	0.004	0.007	0.01[d]

Figure 4.14-1
Well Sampling Locations



Off-site Source: DWR 2001
Aerial Photo: USGS Digital
Orthophoto Quarter Quadrangle, 1993

Q: \ PROJECTS \ MID \ 05120_05 \ MAPDOC \ EIR \ 20050607 \ FIG_4.9_1.MXD SS (07-06-09)

	Well Identification				Drinking Water Action Level Criteria
	Section 1 (RW2) [b]	Section 13 (RW7) [b]	Section 21 (RW20) [b]	Section 22 (RW16) [b]	
Barium	0.14	0.14	0.18	0.078	1 [d]
Cadmium	<0.001	<0.001	<0.001	<0.001	0.005[d]
Calcium (as Ca)	37	37	58	24	NS
Chromium	<0.005	<0.005	<0.005	<0.006	0.05[c]
Copper	<0.005	<0.005	<0.005	<0.005	1[e]
Iron	<0.015	0.037	<0.015	0.024	0.3[e]
Lead	<0.005	<0.005	<0.005	<0.005	0.015[d]
Magnesium (as Mg)	12	12	15	6.7	NS
Mercury	<0.001	<0.001	<0.001	<0.001	0.002[d]
Selenium	<0.005	<0.005	<0.005	<0.005	0.05[d]
Silver	<0.005	<0.005	<0.005	<0.005	0.1[d]
Sodium (as Na)	30	29	46	37	NS
Zinc	<0.005	0.007	0.009	0.006	5[e]

Source: Bookman-Edmonston 2003.

NS = No existing primary or secondary MCL standard.

< = Value preceded by this sign indicates parameter was not detected above the method detection limit shown.

[a] Units are in milligrams per liter (mg/L) unless otherwise noted. Milligrams per liter are equivalent to parts per million.

[b] Ranch well: Monitoring wells (see Figure 4.14-1).

[c] California Regional Water Quality Control Board, Basin Plan Amendment Criteria (1998).

[d] Primary MCL from California Code of Regulations (CCR) Title 22 (2004).

[e] Secondary MCL from CCR, Title 22, or from the U.S. Environmental Protection Agency National Drinking Water Standards (2004).

[fe] Recommended secondary MCL from the U.S. Environmental Protection Agency National Drinking Water Standards (2004).

4.14.3 Analysis of Environmental Effects

Environmental Effects

Alternative A—No Action

Under the No Action Alternative, Reclamation would not approve the banking of CVP water outside MID's service area, nor would Reclamation issue an MP-620 permit to approve of modifications to its distribution system. Reclamation's action would have no adverse effects on water quality. However, the future conditions would change to support agricultural activities. The type and extent of water quality effects from agricultural activities would vary based on the type of activities conducted; these effects would be evaluated by the County under CEQA, depending on the discretionary permits needed.

Alternative B—Water Banking outside the MID Service Area Using Swales and Alteration of Reclamation-Owned Facilities

Effect WQ-1: Degradation of Water Quality Resulting from Construction Runoff

Construction of the recharge ponds, upgrades of canals, and installation of the recovery wells and recovery system would require grading and excavation along with disturbances of soils and vegetation under Alternative B. Although construction would be intermittent, stormwater runoff could cause soil erosion of disturbed sites and transport other construction-related contaminants (e.g., fuels, oil, concrete, paint) to nearby receiving waters and thereby impair water quality and aquatic organisms and their habitats. The extent of the effect depends on soil erosion potential, type of construction practice, extent of disturbed area, timing of precipitation events, and proximity to drainage channels.

This effect is considered adverse. Environmental Commitments WQ-1a and WQ-1b would minimize the extent and intensity of effects.

Effect WQ-2: Water Quality Effects from Construction-Related Dewatering

Discharge of water from construction-related dewatering during lift station construction and enlarging of the Section 8 Canal could result in the release of contaminants to surface water or groundwater. Primary construction-related contaminants that may reach groundwater would include sediment, oil and grease, and construction-related hazardous materials.

This effect would be considered adverse if the quality of water in the canal or underlying groundwater exceeded established standards as a result of construction activities. Implementation of Environmental Commitment WQ-2 would ensure that this potential effect does not occur.

Effect WQ-3: Potential Effects on Groundwater or Surface Water Quality from Recharge or Recovery Operations

Recharge operations may increase the potential for water quality degradation as a result of dispersion of contaminants from uncontrolled flows or a spill upstream of MID's diversion points. If contaminants were to enter the aquifer and concentrate to a degree that violates water quality standards, a major effect would result. As described below, MID will continue surveillance operations of MID conveyances to ensure that contaminants from uncontrolled flows or spills upstream do not enter the recharge facilities.

Alternative B temporarily may increase TDS in the groundwater beneath the ranch as a result of short-term leaching of salts during recharge. TDS in the native groundwater beneath the Madera Ranch ranges from about 180 to 660 mg/l (as shown in Table 4.14-4). Recharge water allocated from the San Joaquin River and Fresno River would contain approximately 28 to 100 mg/l TDS (Tables 4.14-1 and4.14-2). MID had three percolation studies performed and found that leaching of salts from the soil profile would be largely complete during the initial 3- to 4-month recharge season. They further concluded that the increase in TDS would be short-term, temporary, and localized. After the initial flushing of salts has occurred, TDS concentrations would begin to decline as the low TDS recharge water mixes with the higher TDS groundwater. Over the long term, it is expected that TDS concentrations in groundwater would drop below current levels. An additional factor reducing the potential effect of leaching salts is that the swale recharge areas were chosen specifically because they overlie the highest-permeability soils with the lowest salt concentrations in the Madera Ranch area. Taken together, over the long term, the recovered water is expected to be more reflective of the source water quality, which has lower TDS concentrations than the native groundwater. There would be no adverse effect on groundwater quality over the long term.

The MROC, as described Chapter 2, would be responsible for development and implementation of the MOCP, which includes:

- monitoring recovery operations to ensure that 10% of the banked water is left behind to help abate the overdraft;
- monitoring TDS in recovered water leaving Madera Ranch and in groundwater flowing away from Madera Ranch to ensure that water quality remains suitable for irrigation purposes;
- monitoring drinking water wells within 1 mile of Madera Ranch for fecal coliform, TDS, and select components of TDS as specified by the Oversight Committee;
- monitoring water levels in perimeter wells during recharge operations and shutting down recharge operations if off-site water levels rise to within 30 feet of the ground surface;
- monitoring water levels in off-site wells during recovery operations and adjusting operations, providing compensation, or providing an alternate source of water in the event that water levels drop to unacceptable levels in off-site wells as a consequence of operations; and
- ongoing surveillance of MID conveyances to ensure that if accidental spills of hazardous materials occur, they do not enter the recharge facilities.

Implementation of the MOCP would ensure that effects associated with spills or leached salts are avoided or minimized. This effect is not considered adverse.

Effect WQ-4: Potential Soil Salinization from Elevated Groundwater Levels (also in Section 4.8, Geology)

Because Alternative B will be operated and constrained so that water tables affected would not reach elevations higher than 30 feet below the ground surface at the Madera Ranch site boundary, groundwater would not cause salinization of the root zones of important, deep-rooted agricultural crops surrounding the site. Therefore, there would be no effect.

Effect WQ-5: Potential Erosion Attributable to Reversal of Flows in 24.2 Canal and Cottonwood Creek/Main No. 2 Canal

In Phase 2, MID is proposing to construct lift stations on 24.2 Canal and Cottonwood Creek/Main No. 2 Canal to provide as much as 100 cfs of pump-back delivery capacity. Recovered water would be pumped back up the 24.2 Canal between Avenue 10 and the Fresno River. Recovered water would be pumped back up Cottonwood Creek/Main No. 2 Canal between Road 23 and SR 99.

During existing MID operations, Cottonwood Creek commonly carries 300 cfs, and no adverse scouring or bank erosion has been noted (Howard pers. comm.). Because only as much as 100 cfs is expected with Alternative B and velocities would likely be 1 foot per second or less, no adverse scouring or bank erosion is expected. This effect is not considered adverse.

Alternative C—Water Banking outside the MID Service Area without Swales and Alteration of Reclamation-Owned Facilities

Alternative C is similar in scope and design to Alternative B, with the primary exception that the natural swales that occur on the site would not be used for recharge. Thus, engineered basins would be built earlier in the design cycle than under Alternative B. This would not result in changes to water sources or the overall patterns of water banking anticipated under Alternative B and, with the implementation of the MOCP, would result in similar effects (Effects WQ-1, WQ-2, WQ-3, WQ-4, and WQ-5) resulting from construction and operation of the WSEP. Thus, water quality effects are considered equivalent to those that would occur under Alternative B, and Effects WQ-1 and WQ-2 are considered adverse. Implementation of Environmental Commitments WQ-1a, WQ-1b, and WQ-2 would reduce the intensity of these effects.

Alternative D—Water Banking outside the MID Service Area with Banking and Recovery via Gravelly Ford Canal

Alternative D is similar in scope and design to Alternative B, with the exception that water would be conveyed to the site via GF Canal. For this reason, one recharge basin would not be built under Alternative D that was proposed under Alternative B. This would not result in changes to quality of the water sources or the overall patterns of water banking anticipated under Alternative B and, with the implementation of the MOCP, would result in similar effects (Effects WQ-1, WQ-2, WQ-3, and WQ-4). Use of GF Canal for conveyance does alter the pattern of dispersal of water into the bank but is not anticipated to alter the water quality characteristics of the bank. Effects resulting from reversal of flows (Effect WQ-5) still could occur but would occur on GF Canal (Effect WQ-6).

Thus, overall water quality effects are considered equivalent to those that would occur under Alternative B and are considered adverse. Implementation of Environmental Commitments WQ-1a, WQ-1b, and WQ-2 would reduce the intensity of these effects.

Effect WQ-6: Potential Erosion Attributable to Reversal of Flows in Gravelly Ford Canal

In Phase 2, MID is proposing to construct a lift station on GF Canal to provide as much as 200 cfs of pump-back delivery capacity. Recovered water would be pumped back up GF Canal to the San Joaquin River.

During existing GFWD operations, GF Canal always carries less than 200 cfs, and no adverse scouring or bank erosion has been noted (Dorrance pers. comm.). Under Alternative D, improvements to the GF Canal would be engineered to accommodate as much as 200 cfs with velocities of up to 1 foot per second, which is the highest flow that would occur under this alternative. Thus, no substantial scouring or bank erosion is expected. This effect is not considered adverse.

Cumulative Effects

Construction-related effects (WQ-1 and WQ-2) would have no regional water quality cumulative effect because environmental commitments included as part of Alternative B would be implemented to avoid impacts on water quality. Adverse water quality effects related to operations could have cumulative impacts within Madera County (Effects WQ-3, WQ-5, and WQ-6). Implementation of the MOCP (Madera Irrigation District 2007) and the ongoing activities of the MROC would ensure that local water quality effects are avoided and minimized. No additional activities are known to exist that would affect water quality in local canals and in the groundwater in and around Madera Ranch. Thus, no potential cumulative effects are anticipated for any of the alternatives (Alternatives B, C, and D).

4.15 Socioeconomics

4.15.1 Introduction

This section presents the environmental background necessary to analyze the socioeconomic effects of the proposed alternatives. Specific topics include current employment, income, and demographic information for Madera County. Existing levels of agricultural production and income also are described.

Implementation of the alternatives could affect the socioeconomic characteristics of the study area by:

- temporarily increasing construction-related employment opportunities in the area, and
- increasing or decreasing the amounts of agriculture-related employment and income in Madera County.

This analysis assumes that enough construction workers to staff the activities reside within a reasonable commute distance from the site and that these workers already have housing; therefore, the effect of the alternatives on the local housing supply is expected to be minimal. Consequently, no setting or background information related to housing supply and housing availability is provided in the following section.

4.15.2 Affected Environment

The alternatives are proposed for Madera Ranch, which is located in southwestern Madera County. The Madera Ranch site and Madera County as a whole are characterized as highly rural areas with low population levels. However, the site is within a reasonable commute distance from the cities that comprise the Fresno metropolitan statistical area (MSA) (e.g., Madera, the greater Fresno metropolitan area). This section includes background or regional employment and income information for the Fresno MSA, as defined by the California Employment Development Department. This MSA includes both Fresno and Madera Counties and occupies a geographic area described by the U.S. Bureau of Economic Analysis as possessing extensive economic interactions and linkages. Activities occurring at or near the site could trigger socioeconomic effects.

Methods and Terminology

Information for the socioeconomic analysis was obtained from the California Department of Finance, the U.S. Bureau of Economic Analysis, and the U.S. Census Bureau. In addition, Madera County's general plan documents (Madera County 1995a, 1995b), the County Economic Development

Commission, and the *California Water Plan Update* (California Department of Water Resources 2005) were consulted for information related to current and future land use, population statistics, and planned growth rates for Madera County and the state. In addition, both the GFWD and MID have developed groundwater management plans to evaluate the availability of groundwater resources to support current and future demands. Information on existing agricultural uses and agricultural productivity was obtained from the County Agricultural Commissioner's Office.

Employment and Income

Overall, the labor market of the Fresno MSA is dominated by agriculture and agriculture-related services and industries. In addition to employment resulting from the direct production of a variety of both field and orchard crops, agriculture contributes indirectly to other MSA jobs in manufacturing (e.g., grain, nut, and fruit processing) and wholesale trade (e.g., farm and food processing machinery, farm supplies).

An estimated 348,600 part-time and full-time jobs are held in the Fresno MSA (Table 4.15-1). The largest employment sectors are the professional services, government, trade, and farming (agricultural) sectors. Professional services employment accounts for 22% of total jobs in the MSA. Agricultural employment accounts for 8% of jobs, or 46,800 jobs, in the MSA and is closely tied to the manufacturing sector. Roughly 45% (12,200) of jobs in the manufacturing industry are related to food processing activities (California Employment Development Department 2007).

Residents of the Fresno MSA generate a relatively large demand for retail products and services. Combined employment in the retail trade and professional services industries accounts for 49% (169,600) of the total number of jobs in the MSA (Table 4.15-1).

Table 4.15-1. Selected Employment Characteristics for the Fresno Metropolitan Statistical Area (2006)

Industry	Number of Full-Time and Part-Time Jobs
Total Labor Force	348,600
Farm (including production and services)	46,800
Non-farm	301,800
Mining and Construction	23,300
Manufacturing	27,400
Transportation and Public Utilities	9,800
Trade (including wholesale and retail)	48,400
Finance, Insurance, and Real Estate	15,300
Professional Services	77,700
Leisure and Hospitality	28,200
Government	67,600
Other	4,100

Source: California Employment Development Department 2007.

For 2006, the average unemployment rate in the Fresno MSA was 8.0%, significantly higher than the statewide unemployment rate of 4.9%. The traditional reliance of Madera County and the overall MSA on agricultural production and food processing as main sources of employment has resulted in substantial seasonal fluctuations in the unemployment rate. This, combined with a small industrial base, perpetuates consistently high unemployment rates, which were as high as 19% in 1983 (California Employment Development Department 2001).

In 1996, earnings (i.e., wages, salaries, other labor income, and proprietor's income) in Madera County accounted for 61% of total personal income (U.S. Bureau of Economic Analysis 1998). The largest business sectors in Madera County, as measured by worker's earnings, were services (18%), government (17%), and retail trade (9%). The agricultural sector contributed 6% of Madera County's earned income in 1996.

Population and Demographics

The total population in Madera County in 2000 was 123,109; of this total, 68,775 residents (56%) lived in the unincorporated portions of the county (see Table 4.15-2). For 2000, Madera County's ethnic composition ranged from 62% white to 1% Asian/Pacific Islander. The County is considered ethnically diverse; minority populations account for an estimated 38% of Madera County's total population.

Table 4.15-2. Population and Percent Ethnicity Data* for Madera County

Area	Total 2000 Population	White	African American	Native American	Asian/Pacific Islander	Hispanic
Madera County	123,109	62%	4%	3%	1%	44%
City of Madera	43,207	48%	4%	3%	1%	68%
City of Chowchilla	11,127	64%	10%	3%	1%	28%
Unincorporated Area	68,775	NA	NA	NA	NA	NA

Notes:

NA=Not applicable

* All ethnicity data population data (e.g., city and county) are from 2000 sources: California Department of Finance 2000a.

Median household income for Madera County is $36,286. Persons in poverty were estimated at 21% of the county population for the 2000 census year (Table 4.15-3).

Table 4.15-3. Income Data for Madera County

Area	Median Household Income	Percent above Poverty Level	Percent below Poverty Level
Madera County	$36,286	79	21

Source: U.S. Census Bureau 2001.

Relationship between Water Costs and Crop Production

As described in Section 4.3, Agriculture, 86% of the cultivated lands in Madera County are permanent crops such as orchards or vineyards that are cultivated for many seasons without the need to replant each season. As such, these crops are established for long-term production and fallowing or abandonment from year to year is difficult. Permanent crop farmers tend to ensure these crops receive water in dry years so as not to compromise the ability of the crop to produce over the long term.

Water costs in Madera County currently are being affected by the drought and reduced surface water deliveries of up to 50%. For those crops that are not permanent, farmers may choose to fallow land and wait until conditions are better for planting or change crop types to better balance the water costs and market values of the crop. However, permanent crops are difficult to change or fallow, and therefore, changes in water costs generally do not have an effect on permanent crop production or type.

Although the overall permanent crop production may not change in years when water costs are higher, the regional economy could be affected by farmers cutting other costs, such as employment and investment in equipment.

4.15.3 Analysis of Environmental Effects

Methods

This socioeconomic analysis assesses the potential effects resulting from implementation of the alternatives, which would generate temporary employment related to construction and permanent employment related to operations. Effects on employment were evaluated for the Fresno MSA. Activities occurring at or near the site could trigger effects on employment and income if there is an insufficient local workforce. However, the site is within a reasonable commute distance from the cities that make up the Fresno MSA, which contains an adequate construction workforce.

The following assumptions were used to assess socioeconomic effects under each of the alternatives.

- Estimates of construction-related employment were provided by MID (Roughton pers. comm.). Implementation of the alternatives would generate about 101 temporary construction-related employment positions over the period of construction, and 1–2 permanent operations staff positions.
- Enough construction workers reside within a reasonable commute distance from the Madera Ranch site and presumably already have housing. Therefore, effects on population and housing are expected to be minimal and are not assessed further.
- Construction of the alternatives is not expected to take place within an existing residential area; therefore, implementation is not anticipated to result in the displacement of any existing residences or community facilities.

The direct socioeconomic effects associated with the alternatives would be focused on the effects on employment and income resulting from a small, temporary increase in regional employment during construction, and estimates about how farmers might respond to changes in water costs and reliability. The indirect socioeconomic effects resulting from the banking of water at Madera Ranch are addressed in Chapter 5, “Growth Inducing Effects.”

Environmental Consequences and Mitigation Strategies

Alternative A—No Action

Under the No Action Alternative, Reclamation would not approve the banking of CVP water outside MID's service area, nor would Reclamation issue an MP-630 permit to approve of modifications to its distribution system. Reclamation's action would have no adverse effects on socioeconomics. However, the future conditions at Madera Ranch would change to support agricultural activities. Potential effects would be evaluated by the County under CEQA, depending on the discretionary permits needed. Regardless of changes at Madera Ranch, the No Action Alternative would result in a decreased water supply reliability in the MID service area, which could adversely affect farming economies in the region by increasing water costs. With reduced supplies, farmers are likely to have to pay more for water and modify other operational costs, by measures such as reducing workforce. This would have an adverse effect on the regional economy.

Alternative B—Water Banking outside the MID Service Area Using Swales and Alteration of Reclamation-Owned Facilities

Effect SE-1: Increase in Temporary Construction-Related Employment and Income in the Fresno Metropolitan Statistical Area

Under Alternative B, approximately 100 seasonal workers would be employed annually for a period of 12 months. This work force would be required only for construction and not indefinitely. Generally, direct effects on employment would result from expenditures on the design, engineering, and construction of facilities. This spending also would result in direct effects on local businesses that provide goods and services to the engineering and construction firms. Construction positions most likely would be filled by residents of the local area, including residents of the greater Fresno MSA. Because implementing Alternative B would increase construction-related employment opportunities and income for local workers, Effect SE-1 is considered beneficial.

Effect SE-2: Increase in Permanent Employment and Income in the Local Area Attributable to Operation of the Water Supply Enhancement Project

An estimated one to two jobs would be created by Alternative B to handle operation and maintenance responsibilities when the facilities are completed. The new jobs would generate minor direct effects on local businesses that provide goods and services needed to support operation of the water bank. The employment and income effects of Effect SE-2 are considered beneficial.

Effect SE-3: Effects on the Agricultural Economy Attributable to an Increase in Water Costs

The costs associated with implementation of Alternative B would be paid by those who choose to use the bank by purchasing banking space. Water rates for non-participants would stay within the current range during all year types. In dry years, when farmers may want to recover banked water, additional water rates would apply to those who opt to participate in the bank by purchasing banking space to supplement their supplies. These water rates would be slightly less than projected costs of non-MID water, such as that obtained by transfers or spot market purchases of water.

Therefore, water costs would rise only in dry years and only related to the banked water. Because water costs are not expected to increase beyond the reasonable range of historical costs as a result of Alternative B, and because there would not be a change in crop production for the majority of crops as many of the crops in Madera County are permanent, there would be no adverse effect on agricultural economies related to increased water costs. Additionally, farmers could benefit in dry years by securing supplies at rates less than transfer costs or other options, such as spot market transfers.

Effect SE-4: Changes in Employment and Income in the Local Area because of Increased Water Supply Reliability

Alternative B has the potential to have two differing effects on employment and income, one beneficial and one negative. The actual effect would depend on farmers' responses to changes in water costs and water reliability from year to year and the effect that has on their long-term planning for farming operations. The beneficial effect is related to improving the reliability of the surface water supplies for MID contractors, which would result in greater certainty in regard to maintaining the current agricultural lands. This certainty has the potential to result in increased employment and associated incomes because farmers are more likely to hire and retain workers and invest in equipment for long-term use. This increase in employment and income is beneficial.

However, in response to increased costs, some farmers may choose to reduce their workforce or not invest in equipment. These choices depend on crop type, existing workforce, and existing cultivated land. This could have a negative impact on the regional economy if these types of choices are made by many farmers over several years. As described above under SE-3, water costs are not expected to rise beyond the normal range of costs. The increased reliability has the potential to offset some of these costs. As such, it is not expected that there would be a substantial change, and this effect is not considered adverse.

Alternative C—Water Banking outside the MID Service Area without Swales and Alteration of Reclamation-Owned Facilities

Alternative C is similar in scope and design to Alternative C, with the primary exception that the natural swales that occur on the site would not be used for recharge. Thus, there would be no substantive differences in potential effects on public services and utilities between Alternatives B and C. Increased water costs are not expected to have an effect on the environment (SE-3). Alternative C would result in equivalent effects (Effects SE-1 and SE-2) on temporary and permanent employment. Alternative C would result in beneficial socioeconomic effects (SE-4).

Alternative D—Water Banking outside the MID Service Area with Banking and Recovery via Gravelly Ford Canal

Alternative D is similar in scope and design to Alternative B, with the exception that recharge is achieved using engineered recharge basins in lieu of the natural swales that occur on the site and some differences in the types of conveyance facility improvements. Thus, there would be no substantive differences in potential effects on public services and utilities between Alternatives B and D. Alternative D would result in equivalent effects (Effects SE-1 and SE-2) on temporary and permanent employment. Increased water costs are not expected to have an effect on the environment (SE-3). Alternative D would result in beneficial socioeconomic effects (SE-4).

Cumulative Effects

As none of the alternatives would result in adverse effects on socioeconomics, there would be no cumulative effects.

4.16 Environmental Justice

4.16.1 Introduction

This section presents the environmental background necessary to analyze compliance with Executive Order 12898 and provides background information on the ethnic and income characteristics of the study area.

4.16.2 Executive Order 12898

On February 11, 1994, President Clinton issued Executive Order 12898, Federal Actions to Address Environmental Justice in Minority and Low-Income Populations. The purpose of the order is to avoid the disproportionate placement of any adverse environmental, economic, social, or health effects from federal actions and policies on minority and low-income populations. By memorandum on February 11, 1994, the President directed EPA to ensure that agencies analyze environmental effects on minority and low-income communities, including human health, social, and economic effects.

To comply with Executive Order 12898, the most current U.S. Census Bureau demographic data available (U.S. Census Bureau 2000) were analyzed at a geographic scale commensurate with the area of potential effect. The WSEP would be implemented west of the city of Madera in unincorporated Madera County. Consequently, the environmental justice assessment focused on an examination of the overall Madera County statistics and not the city of Madera (see Table 4.16-1). Income and ethnicity variables for Madera County were analyzed to determine whether the county has a relatively high population of low-income or minority residents.

Table 4.16-1. Population and Percent Ethnicity Data* for Madera County

Area	Total 2000 Population	White	African American	Native American	Asian/ Pacific Islander	Hispanic
Madera County	123,109	62%	4%	3%	1%	44%
City of Madera	43,207	48%	4%	3%	1%	68%
City of Chowchilla	11,127	64%	10%	3%	1%	28%
Unincorporated Area	68,775	NA	NA	NA	NA	NA

Notes:

NA=Not applicable.

* All ethnicity data population data (city and county) are for 2000 sources: California Department of Finance 2000a.

Population and Demographics

The total population of Madera County in 2000 was 123,109; of this total, 68,775 residents (56%) lived in the unincorporated portions of the county (see Table 4.16-1). For 2000, Madera County's ethnic composition ranged from 62% white to 1% Asian/Pacific Islander. Madera County is considered ethnically diverse; minority populations account for an estimated 38% of the county's total population.

Median household income for Madera County is $36,286. Persons in poverty were estimated at 21% of Madera County population for the 2000 census year (Table 4.16-2).

Table 4.16-2. Income Data for Madera County

Area	Median Household Income	Percent above Poverty Level	Percent below Poverty Level
Madera County	$36,286	79	21
Source: U.S. Census Bureau 2001.			

4.16.3 Environmental Justice Finding of No Disproportionate Effect

After the alternatives were selected, the environmental effects of the WSEP were reviewed and evaluated to determine whether they could result in disproportionate effects on minority or low-income populations. Implementation of the Proposed Action would be for a largely rural and undeveloped area of Madera County. According to a review of census data for 1990, both Madera County and the Madera Ranch area are considered similarly ethnically diverse. Minority populations account for an estimated 38% of Madera County's total population.

Although minority and/or low-income populations may be located in the vicinity of the Madera Ranch site, census data indicate that the overall percentage of minority and low-income populations located in the vicinity of Madera Ranch is fairly similar to that of the overall Madera County population. Consequently, the Madera Ranch area is not considered to be composed of a disproportionately high level of minority or low-income populations.

As described elsewhere in this chapter, environmental effects considered include traffic, land use, air quality, noise, public safety, and hazardous materials. None of the environmental effects identified for either the Proposed Action or any of the alternatives would affect a specific population group. Consequently, implementation of the Proposed Action would not disproportionately affect a specific ethnic or income group.

4.17 Indian Trust Assets

4.17.1 Introduction

This chapter describes the existing environmental setting for the areas potentially affected by the proposed alternatives. It discusses the affected environment, possible effects, and mitigation efforts.

4.17.2 Affected Environment

Indian Trust Assets (ITAs) are legal interests in property held in trust by the United States for federally recognized Indian tribes or individual Indians. An Indian trust has three components: (1) the trustee, (2) the beneficiary, and (3) the trust asset. ITAs can include land, minerals, federally reserved hunting and fishing rights, federally reserved water rights, and instream flows associated with trust land. Beneficiaries of the Indian trust relationship are federally recognized Indian tribes with trust land; the United States is the trustee. By definition, ITAs cannot be sold, leased, or otherwise encumbered without approval of the United States. The characterization and application of the United States trust relationship have been defined by case law that interprets Congressional acts, executive orders, and historical treaty provisions.

Consistent with President William J. Clinton's 1994 memorandum, *Government-to-Government Relations with Native American Tribal Governments*, Reclamation assesses the effect of its programs on tribal trust resources and federally recognized tribal governments. Reclamation is tasked to actively engage federally recognized tribal governments and consult with such tribes on a government-to-government level (59 FR 1994) when its actions affect ITAs.

The U.S. Department of the Interior (DOI) Departmental Manual Part 512.2 ascribes the responsibility for ensuring protection of ITAs to the heads of federal bureaus and offices (U.S. Department of the Interior 1995). Part 512, Chapter 2, of the Departmental Manual states that it is the policy of the DOI to recognize and fulfill its legal obligations to identify, protect, and conserve the trust resources of federally recognized Indian tribes and tribal members. All Federal bureaus are responsible for, among other things, identifying any effect of their plans, projects, programs or activities on ITAs; ensuring that potential effects are explicitly addressed in planning, decision, and operational documents; and consulting with recognized tribes who may be affected by the WSEP.

Consistent with this, Reclamation's Indian trust policy states that Reclamation will carry out its activities in a manner that protects ITAs and avoids adverse effects when possible, or provides appropriate mitigation or compensation when it is not. To carry out this policy, Reclamation incorporated procedures into its

NEPA compliance procedures to require evaluation of the potential effects of its proposed actions on trust assets (Bureau of Reclamation 1993). Reclamation is responsible for assessing whether the alternatives have the potential to affect ITAs. Reclamation will comply with procedures contained in Departmental Manual Part 512.2, guidelines, which protect ITAs.

There are no ITAs affected by this action. The nearest ITA to the WSEP is located approximately 28 miles east-northeast—the Table Mountain Rancheria.

4.17.3 Analysis of Environmental Effects

No tribes possess legal property interests held in trust by the United States in the area affected by any of the alternatives. Thus, none of the alternatives would affect ITAs.

4.18 Wetlands

4.18.1 Introduction

This section describes the existing wetland resources in the areas potentially affected by the proposed alternatives. It discusses the affected environment, relevant regulations and policies, methods of analysis, and possible effects.

4.18.2 Affected Environment

ICF Jones & Stokes delineated waters of the United States at Madera Ranch by a combination of field surveys and aerial photograph interpretation. The initial wetland delineation was started in early 2000, with updates in late 2000, 2004, 2005, and 2009.

Wetlands were identified using the routine onsite determination procedure from the Corps wetlands delineation manual (Environmental Laboratory 1987). The 1987 manual provides technical guidelines and methods for determining the boundaries of jurisdictional wetlands based on three parameters: hydrophytic vegetation, hydric soils, and wetland hydrology. The wetland indicator of plant species was taken from the national list of plant species that occur in wetlands (Reed 1988). Although the study area was larger than 5 acres, the routine determination procedure was used instead of the comprehensive determination procedure because the areas of potential wetlands were small and widely scattered across the site. Sampling along regular transects would not have been an effective or efficient means for determining wetland boundaries.

ICF Jones & Stokes' wetland delineators made hydrological observations on wetlands present at Madera Ranch during reconnaissance surveys on December 9, 1999; February 3, 2000; and March 10, 2000. Wetland hydrology was not observed directly for all wetlands at Madera Ranch. Instead, selected representative areas with evident wetland hydrology were noted, mapped, and marked as reference locations for later surveys. Photographs of wetland areas were taken during the March 10 site visit.

ICF Jones & Stokes' wetland delineators revisited the study area on March 20, 21, and 22, 2000. Sample points were established at 14 representative locations throughout the study area. At each sample point, the dominant plant species within 6 feet of the sample point were recorded. A shallow soil pit (less than 18 inches deep) was excavated by hand at each sample point to compare soil characteristics with the mapped unit and to determine whether soils exhibited redoximorphic features. Data from each sample point were recorded on standard data forms.

From April 3 through April 7, 2000, ICF Jones & Stokes biologists conducted vegetation surveys of the study area. Surveys were performed by walking line transects across each section at approximately 150-foot intervals and recording plant species and plant communities present. During this survey, the delineation study area was inspected, and all wetlands present were identified and mapped using the vegetation and hydrology indicators determined from the representative sample points.

Wetlands at Madera Ranch are seasonal and, as such, are a type of problem area (Environmental Laboratory 1987). At Madera Ranch, wetland hydrology is evident only during the rainy season (mid-October to mid-April). Because no rain fell between March 8 and April 13, wetland hydrology was not evident in most wetlands during the late March and April surveys. Corps guidelines for problem areas recommend that, when a wetland indicator is absent because of a normal seasonal variation in environmental conditions, a wetland delineator may determine the parameters of their survey based on personal ecological knowledge of the range of an area's normal environmental conditions. ICF Jones & Stokes delineators inferred the presence of wetland hydrology during their late March and early April surveys by comparing each area they surveyed with the reference areas observed to have wetland hydrology during the February 3 and March 10 surveys.

The potential extent of Corps jurisdiction along Cottonwood Creek was determined by visual estimation of the ordinary high water mark (OHWM), defined as "that line on the shore established by the fluctuations of water and indicated by physical characteristics such as a clear, natural line impressed on the bank, shelving, changes in the character of soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas" (33 CFR 328.3[e]).

Natural Resources Conservation Service/U.S. Army Corps of Engineers Site Verification Visit in 2000

On June 27, 2000, Don Nielson of the Madera Office of the NRCS and Kevin Roukey of the Sacramento District Corps visited the site with Jones & Stokes' lead wetland delineator to verify the wetland delineation and stream mapping. Mr. Nielson returned to the site on June 29 for additional site review. He determined that the delineation of Sections 15, 16, 17, 20, 21, 22, 28, and 29 was accurate and certified the delineation. For the purposes of the project that was contemplated at that time (a water bank), Mr. Roukey agreed that remaining areas of the ranch could be delineated by photo interpretation for the purposes of planning and the Section 404 permit process.

Photo Interpretation in 2000

Wetlands in Sections 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 13, 14, and 18 were delineated by aerial photography interpretation in 2000. Aerial photographs of the entire Madera Ranch were taken on March 15, 2000, by Aerial Photomapping Services of Clovis, California. Aerial photographs provided for the delineation were unrectified black and white prints (1 inch = 800 feet).

The photo signatures of potential wetlands in these sections were compared with the photo signatures of wetlands identified in the field survey study area. Standing water was visible in deeply ponding wetlands. Other wetlands produced characteristic photo signatures. Slickspots possess a high albedo and are readily apparent. Alkali rain pools were indicated by a darker signature corresponding to an area of saturated soil. Shallow vernal pools were indicated by sharply defined darker areas within the lighter grassland matrix, typically occurring within swales.

Site Verification Visit in 2004

On August 26, 2004, Don Nielson, Larry Norris, and other staff from the Madera Office of the NRCS visited the site with Jones & Stokes' lead wetland delineator to verify the photo-interpreted portions of the project site. NRCS determined that additional data collection was needed before the delineation could be certified (Nielson pers. comm.). The Corps concurred with this assessment and also requested that additional data be collected (Norton pers. comm.). In response, additional field studies were undertaken in 2005 to collect data from the portions of Madera Ranch not field surveyed in 2000.

Field Surveys in 2005

In 2005, the delineation study area was expanded to include the sections evaluated in 2000 by aerial photography. Areas with apparent wetland photo signatures were field verified to confirm that wetland indicators were present. Data were collected from all sections of Madera Ranch and offsite locations where other activities would occur.

Jones & Stokes' wetland delineators made hydrological observations on wetlands in the northern sections of Madera Ranch during reconnaissance surveys on March 3, 4, 9, 10, and 11, 2005. Areas with wetland hydrology were noted and mapped as reference locations for later surveys. Jones & Stokes' wetlands delineators revisited the study area on April 4, 5, 6, 14, and 15, 2005, to collect data from 85 additional sample points, primarily in the northern sections of Madera Ranch. Data collection methods were the same as in 2000.

Observations were also made at Cottonwood Creek, the West Lateral canal, the 24.2 Canal, the Section 8 Canal, and the Main #2 Canal on March 11, April 14, and July 12, 2005. Each canal was visually inspected to document the general characteristics and to evaluate it for potential Corps jurisdiction.

Photo Interpretation in 2008

During 2006, MID advanced a test project to determine the feasibility of using swales for groundwater recharge; this included letting agricultural tail-water spill into the swale in Section 14 and 15. This effort concluded use of the swales was feasible and preferable to pond construction because of cost. MID continued the effort in 2007. Also, between 2005 and 2008, several agricultural tenants changed as did the crop types being grown on the property. The new tenants also let agricultural water spill into swales in several locations on the property. Cottonwood Creek was allowed to spill into the bottom of Section 28 and 29 as it had historically, and the northern reach of GF Canal was also used during this period of time. Therefore, to update the delineation to reflect current site conditions, Jones & Stokes used one-half meter resolution imagery from Aerials Express (August 2006) and one meter resolution imagery from the National Agricultural Imagery Program (June 2005) to map artificial wetlands, Cottonwood Creek, GF Canal, and other interpretable canals. One-half meter imagery was used for most of the property and one-meter imagery was used for Sections 6, 7, 18, and the western 1/8th of Sections 5, 8, 17, 20, and 29. The features were digitized at a scales ranging from 1:2,000 (for half-meter photos) to 1:4,500 (for one-meter photos). The alkali rain pools and vernal pools appeared to be shifted with the new aerial photographs because they were previously digitized using un-rectified aerial photographs. Therefore, the pool locations were adjusted, using a GIS software rubber sheeting process, to overlay the registered 2005 and 2006 aerial photographs.

Site Verification Visit in 2009

On February 3, 2009, Mike Finan and Kathy Norton from the Sacramento District Corps office visited the site with ICF Jones & Stokes staff to further assess Cottonwood Creek, GF Canal, and swales. As a result of this site visit, Mr. Finan requested several additional revisions to the delineation.

Results and Discussion

The area of wetlands delineated at Madera Ranch include seasonal wetlands, GF Canal, Cottonwood Creek and many small, isolated vernal pools and alkali rain pools (including those previously delineated but affected by agricultural activities). Project elements within water bodies and uplands are summarized in Table 4.5-5 (located in Section 4.5, Biological Resources). A discussion of the delineation results and a description of the wetlands and other waters are presented below.

Field Verification of 2000 Aerial Photography Interpretation

Interpretation of aerial photography overestimated both the extent of alkali rain pools and the extent of vernal pools. The slightly darker photo signature apparent in some slick spots was found to be saturated soils, where the wet portions of the pools were in clear contrast with the lighter dry portions. However, a dark photo signature was also found to be present in some slick spots that do not pond, presumably because of a difference in soil chemistry from slickspots with light photo signatures.

Extensive areas with darker photo signatures in swales in Sections 10 and 11 were interpreted in 2000 as indicating the presence of large wetland areas. However, large areas of wetlands were not observed in these sections during the subsequent surveys. The darker signatures indicate both small vernal pools and wetter areas of annual grassland, areas that do not pond for a sufficiently long period to have wetland hydrology but that do have more vigorous plant growth than the adjacent, drier grassland.

General Hydrologic Observations

Precipitation data for the 1999–2000 rainfall year was obtained from the California Irrigation Management Information System (CIMIS) station in Madera (MADERA.A, CIMIS station #145). Precipitation during the 1999–2000 rainfall year (July 1 to June 30) was near average (263.6 mm [10.4 inches]) as of May 18, 2000. However, the rainfall season was compressed within a short timeframe. Rainfall was less than 15% of average until mid-January. Most of the season's precipitation fell between mid-January and the first week of March.

During Jones & Stokes' surveys on February 3, 2000, and March 10, 2000, ponding was observed in isolated wetlands. By February 3, rainfall was at 32.9% of normal. At that time, only the deeper wetlands were ponded. By March 10, rainfall was 85.1% of average and all areas subsequently delineated as wetlands were ponded.

Precipitation data for the 2004–2005 rainfall year is an average of the data from the MADERA.A and MADERA.T (Touchstone station #32) CIMIS stations. The amount and pattern of rainfall in 2004–2005 was substantially different than in 1999–2000. Precipitation during the 2004–2005 rainfall year was well above average, with 153% of normal rainfall as of May 31, 2005. By March 3, 2005, rainfall was 113% of normal. In addition, rainfall events were spread relatively evenly across the rainfall year, with weekly rainfall totals exceeding 20 mm in 10 weeks between late October and early May.

Precipitation was below average in 2005 at 216.41 mm (8.52 inches), above average in 2006 at 290.58 mm (11.4 inches), and below average in 2007 at 134.37 mm (5.29 inches).

Changing Site Conditions

Recent application of agricultural tail-water to several locations throughout the property and a wet year during 2006 has resulted in some changed conditions on the property. The overall number of vernal pools on the property appears to have been reduced by inundation, and some have been recategorized from earlier mapping efforts. In general, the inundated vernal pools appear to be at low spots within existing swales and conveyances. Mapping in 2001 indicated the presence of vernal pools in GF Canal and at the southern portion of the property in Sections 28 and 29, and these areas have been recategorized because of their human influence and artificial hydrology. A November 2007 site visit confirmed that the swales in Section 2, 3, 14, and 15 continued to be used for agricultural tail-water.

Wetlands

Vernal Pools

The area of vernal pools delineated in the field study area is 21.22 acres. Vernal pools occur in swales, primarily on soils mapped under the Pachappa series. A duripan is absent and wetland hydrology is maintained by the very slow permeability of the soil surface horizons. Holland (1978) reports that vernal pools are uncommon in the soil series group that includes the Pachappa series because there is no restrictive layer. Because vernal pools are so uncommon on this soil type, neither Holland (1986) nor Sawyer and Keeler-Wolf (1995) include this type of vernal pool in their plant community descriptions. Jones & Stokes' invertebrate biologists found vernal pool fairy shrimp, *Branchinecta lynchi*, in the vernal pools during surveys in 2000–2001, which indicates that the pH is between 6.8 and 7.6 (Jones & Stokes file information). Vernal pools at Madera Ranch meet all three wetland parameters: hydrophytic vegetation, hydric soils, and wetland hydrology.

Vegetation

The pools on Madera Ranch are often dominated by Mediterranean barley, which is usually seen in vernal pools that pond for a relatively short time. Typical vernal pool endemics present in the pools include coyote thistle, Fremont's goldfields, California water-starwort, bracted popcorn flower, mousetails, Pacific foxtail, and American pillwort. The dominant plant species are usually or almost always found in wetlands. Therefore, vernal pool vegetation meets the criterion for hydrophytic vegetation.

Vernal Pool Soils

Vernal pools in the study area exist primarily within shallow depressions located on nearly level to gently sloping swale-like landforms. Soils in these swale-like landforms are mapped primarily as various phases of the Pachappa series. Soils in vernal pools located within Pachappa soil map units typically had finer subsoil textures, yellower matrix hues, and lower matrix chromas than are characteristic for soils of the Pachappa series. Additionally, most of the vernal pool soils in these map units exhibited redoximorphic features that consisted of a few faint to moderately prominent iron concentrations and depletions in the surface A horizon and/or immediately above a fine-textured (i.e., sandy clay loam) subsoil horizon. Vernal pool soils located within Pachappa soil map units with low chroma matrix colors and/or redoximorphic iron concentrations and/or depletions within 14 inches of the soil surface meet the hydric soils criterion.

Vernal pool soils located within Cajon loamy sand with low chroma matrix colors within 10 inches of the soil surface meet the hydric soils criterion.

Hydrology

Vernal pools at Madera Ranch are inundated for several weeks during the growing season and, therefore, have wetland hydrology. Wetland hydrology of Madera Ranch vernal pools clearly differs from the hydrology of typical vernal pools. Vernal pools generally are found on soils that have a subsoil restrictive layer—either a duripan, claypan, or both (Holland 1978). The restrictive layer creates a perched water table near the soil surface that regulates water levels in the pools (Hanes et al. 1990). Water lost to evaporation and transpiration is replaced by subsurface flow from the adjacent uplands.

At Madera Ranch, the vernal pool soils do not have an identifiable restrictive layer above which a perched water table is present. Ponding appears to be attributable to very low permeability at the soil surface or in the upper soil horizons. The vernal pools with longer ponding duration appear to have the most clay present in the soil, with a clay Bt horizon. The duration of ponding depends primarily on the amount and timing of rainfall. Unlike typical vernal pools, the duration of ponding in vernal pools at Madera Ranch is not affected by the total amount of rainfall during the rainy season because there is no restrictive layer in the lower soil horizons to prevent the excess water from percolating deep into the ground. Observations of ponding depth and duration in vernal pools in 2005 were essentially the same as those in 2000, despite the greater amount of precipitation and more regular rainfall pattern in 2005.

Some of the vernal pools adjacent to the agricultural areas have had their hydrology altered by irrigation runoff.

Wetland Assessment

Vernal pools at Madera Ranch meet all three wetland parameters: hydrophytic vegetation, hydric soils, and wetland hydrology.

Alkali Rain Pools

The area of alkali rain pools delineated in the field study area is 16.33 acres. Alkali rain pools have not been described in the ecological literature and appear to have been little studied. Jones & Stokes previously identified this habitat in Tulare County (Jones & Stokes Associates 1998). Alkali rain pools form in slickspots that pond water for a long time. Jones & Stokes' invertebrate biologists found Lindahl's fairy shrimp in the alkali rain pools during surveys in 2000–2001, which indicates that the pH ranges from 6.9 to 8.6 (Jones & Stokes file information). Alkali rain pools at Madera Ranch meet all three wetland parameters: hydrophytic vegetation, hydric soils, and wetland hydrology.

Vegetation

Alkali rain pools have different vegetation, soils, and hydrology than vernal pools (soils and hydrology are discussed below). Alkali rain pool vegetation is sparse, concentrated on the pool margins and along soil cracks. In contrast, vegetation in vernal pools typically covers the entire pool bottom. Alkali rain pools lack plant species characteristic of vernal pools, such as those found in vernal pools at Madera Ranch. Instead, vegetation of alkali rain pools is composed of halophytic/alkali tolerant, mostly annual species. Dominant species include seepweed, alkali peppergrass, dwarf popcorn flower, California alkali grass, large-flowered sand spurry, and annual *Atriplex* species.

The dominant plant species are usually or almost always found in wetlands. Therefore, the alkali rain pool vegetation meets the hydrophytic vegetation criterion. Because of the low vegetation cover, an alkali rain pool might be classified not as a wetland, but as other water, similar to a mud flat or playa lake. However, alkali rain pools are small and a component of a grassland ecosystem. The overall landscape is terrestrial and vegetated, not aquatic and unvegetated, as in mud flats and playa lakes.

Soils

Alkali rain pools form in slickspots, which are relatively shallow, sparsely vegetated depressions containing strongly saline-alkali soils (Reid et al. 1993). In the study area, they are interspersed on nearly level interswale landforms where soils are mapped as different phases and/or complexes of the Fresno, El Peco, and Dinuba series, all of which are strongly to slightly saline alkali and possess a carbonate silica cemented hardpan at depths ranging from 20 to 40 inches.

Soils in alkali rain pools generally lacked hydric soil indicators such as low chroma matrix colors and other redoximorphic features but often showed evidence of inundation, such as sediment deposits and mudcurls. The lack of hydric soil indicators in slickspots inundated for significant periods of time (i.e., alkali rain pools) may be partially the result of their high soluble salt content, which results in low plant density and low microbiological activity within the pool boundaries. Despite the lack of hydric soil indicators, the slickspot soils are classified on the Madera County Hydric Soils List as hydric because they meet Criterion 3 (i.e., they are ponded for a long duration or a very long duration during the growing season) of the list.

Hydrology

Alkali rain pools at Madera Ranch are inundated for several weeks during the growing season and, therefore, have wetland hydrology. Wetland hydrology of alkali vernal pools also differs from that of typical vernal pools. Although the Fresno and El Peco species soils have a duripan, no perched water table was observed above it. Therefore, all ponding occurs at the soil surface, similar to vernal pools on Madera Ranch.

Several factors appear to be responsible for ponding. Slickspots that pond water have a compact surface crust with a platy structure, and the pores are largely vesicular; both of these factors reduce permeability (Reid et al. 1993). In addition, slickspots have been observed to possess higher clay content than the adjacent soil (Reid et al. 1993). High sodium levels may cause clay particles (that would otherwise be aggregated) in the upper part of the A horizon to deflocculate, causing soil pores to become “plugged”. This reduces permeability to the point that water ponds on the soil surface.

In contrast, nonponding slickspots at Madera Ranch lacked a compact surface crust. The reason for this difference is unclear; perhaps nonponding slickspots have lower levels of clay. Alkali rain pools were often found along fence lines or roads, suggesting that soil compaction by cattle or vehicles may have a role in creating the surface crust.

The presence of shrimp exoskeletons, although not a standard wetland hydrology indicator when the delineation field work was performed, was a useful indicator of wetland hydrology for differentiating between alkali rain pools and nonponding slickspots. Free-swimming crustaceans, including seed shrimp (*Ostracoda*) and fairy shrimp (*Branchinecta* sp.), were observed in all vernal pools and alkali rain pools during the February 3 and March 10, 2000, surveys, and during the March 2005 surveys. Free-swimming crustaceans need two or more weeks of ponding to complete their life cycles. The presence of crustacean exoskeletons in dried pool basins indicates that inundation was present for two weeks or longer, sufficient time for these shrimp to live and reproduce.

Wetland Assessment

Alkali rain pools at Madera Ranch meet all three wetland parameters: hydrophytic vegetation, hydric soils, and wetland hydrology.

Seasonal Wetlands

The delineation indicates there could be approximately 153 acres of seasonal wetlands on site. This number has varied over time and will continue to vary based on the amount and duration of application of additional water via agricultural tail-water or banking. Seasonal wetlands are observable from aerial photos in Sections 2, 3, 14, 15, 16, 20, 22, 28 and 29. These areas primarily have this classification because they have the hydrology component of wetlands. In many instances wetland soils are not present and there is limited wetland vegetation. Their primary function is grassland, except when they are wetted. Wetlands in the northern swales in Section 2 were classified as seasonal wetlands rather than vernal pools because they do not provide the functions and values of vernal pool habitat. Wetland hydrology of the northern swales is artificial and results from irrigation runoff or pumping of water into the swales for stock watering. During the wetlands reconnaissance of Madera Ranch and the botanical survey conducted in 2000, Jones & Stokes observed ponded areas at several locations along the northern swale and subsequently mapped these areas as vernal pools. In 2005, during the wetland delineation work to ground-truth areas delineated in 2000 by photointerpretation, only the easternmost portion of the northern swale exhibited ponding and that most of the swale did not appear to have been inundated recently. Vegetation in the swale consisted of upland grasses and forbs, and the soils did not exhibit hydric soil indicators. During subsequent site visits, Jones & Stokes again observed input of irrigation water and dominance by weedy wetland species, including smartweed (*Polygonum* sp.). Because the water source is not rainfall based and plant species normally associated with vernal pools were absent, these wetlands are best classified as seasonal wetlands.

Wetlands west of Cottonwood Creek at the south end of Section 28 were characterized as vernal pools during the original wetland delineation in 2000. Although the wetlands were not dominated by vernal pool endemics, they were in shallow depressions. One of the dominant wetland species was water chickweed (*Montia fontana*), a wetlands generalist; other vernal pool endemics were not found. Although Jones & Stokes observed drift lines in the swale adjacent to the pools, they were unaware that the swales received periodic inflows from Cottonwood Creek. In 2005, Jones & Stokes observed that the area of inundation was much greater and of longer duration than had been observed in 2000, and perennial wetland vegetation, including rushes (*Juncus* spp.) had become established. Aerial photographs from 2006 indicate a continuation of this trend. The source of the wetland hydrology was overflow from Cottonwood Creek, the bank of which had been breached to redirect flood flows into the swale at the south end of Sections 28 and 29. In a 2009 site visit the west berm of the creek had been reconstructed, though MID indicates this area will continue to flood during high flow events. Because the hydrology is not rainfall based and vernal pool endemics were absent, these wetlands are best classified as seasonal wetlands.

The small pond located in the southeastern corner of Section 28 was also classified as a seasonal wetland. The basin is vegetated by vernal pool species and ruderal wetland species characteristic of disturbed seasonal wetlands, such as stock ponds or detention basins. A stand of riparian woodland is present around the margins. The pond was inundated during the April 2000 surveys. Based on the presence of hydrophytic vegetation and wetland hydrology, a wetland is present in the basin. However, this is an artificially maintained wetland.

The pond is connected to Cottonwood Creek via a culvert, and inflow is controlled by a gate valve. Therefore, the wetland hydrology is artificially maintained. If the inflows were discontinued, there is no reason to expect that wetland hydrology would continue. Other deeply excavated areas on Madera Ranch (e.g., Sections 16, 18, and the northern section of GF Canal) do not pond and do not exhibit wetland hydrology.

A second small pond is present along the eastern edge of Section 2. This pond was unvegetated at the time of the surveys in 2000. The wetland hydrology is artificially maintained by pumping water into the pond.

Other Waters

Other waters were delineated only on the Madera Ranch property. However, other waters in the vicinity of Madera Ranch were evaluated for their jurisdictional status.

Cottonwood Creek

Cottonwood Creek is a natural stream that has been channelized along portions of its length. The channel has been deepened and widened by excavation. It is used to convey irrigation water from the Main No. 2 Canal and also conveys flood water during storm events. Cottonwood Creek becomes channelized approximately 2.75 miles east of Madera Ranch, near Road 22. Cottonwood Creek crosses Madera Ranch at the southwest corner of Section 28. The extent of Cottonwood Creek on Madera Ranch was delineated on the basis of its OHWM. The mean width of Cottonwood Creek within the OHWM on Madera Ranch is approximately 40 feet.

Cottonwood Creek continues west to just before the Eastside Bypass (approximately 7 miles west of Madera Ranch), where it turns north, paralleling the Bypass in a 15- to 20-foot-wide channel that is separated from the bypass by a levee. The channel showed evidence of having standing water, but no evidence of scour. Hydrophytes are present, at least in places, in the channel. It eventually flows into the Fresno River at Latitude 36.97695 degrees north, Longitude 120.366670 degree west.

Although historically it may have been a tributary of a water of the United States, Cottonwood Creek (an ephemeral flowing water body) does not currently appear to have a hydrological connection to the Fresno River under normal circumstances. As noted above, the creek has been channelized and realigned, conveying mainly irrigation water and, at times during the rainy season, runoff from surrounding areas and ditches. Such flooding and high flows, however, are rare in Cottonwood Creek, as indicated by the lack of channel scour, because of storage in local reservoirs such as Bass Lake, Millerton Lake, and Hensley Lake. Only in response to very extreme rainfall events does water flow the 15.5 miles from Madera Ranch to Cottonwood Creek's connection to the Fresno River. According to the Maintenance Supervisor for the Lower San Joaquin Levee District, Cottonwood Creek might connect to the Fresno River once every 10 years (Batey pers. comm.).

Canals

Gravelly Ford Canal

GF Canal is a flat-bottom earth-lined channel that conveys irrigation water from the San Joaquin River to Madera Ranch. GF Canal and Cottonwood Creek share a quarter-mile reach of channel in the northeast quarter of Section 27. Flow into the northern reach of GF Canal is via a flow control structure on Cottonwood Creek. Flow is one-way; water conveyed via GF Canal is directed onto crops. The portion of the channel north of the ranch road along the boundary between Sections 16 and 21 was thought to have been abandoned during earlier versions of the delineation, but has conveyed flows in recent years. Freshwater marsh is present in the portion of the channel immediately north of the ranch road. Other portions of the canal north of the ranch road are vegetated by annual grassland and seasonal wetlands.

24.2 Canal

The 24.2 Canal is an earth-lined channel that conveys irrigation water to areas east of Madera Ranch. Flow is one-way; water conveyed via the 24.2 Canal is directed onto crops or into the Main No. 1 Canal, which flows into the Main No. 8 Canal. The canal terminates in agricultural land.

Section 8 Canal

The Section 8 Canal is an earth-lined channel that conveys irrigation water from the Main No. 1 Canal and Main No. 2 Canal (via Cottonwood Creek) to the east side of Madera Ranch. Flow is one-way; water conveyed via the Section 8 Canal is directed onto crops, and any surplus runoff is directed into swales, where it percolates into the ground. The canal terminates in agricultural land.

24.2–19.5 West Lateral Canal

The 24.2–19.5 West Lateral Canal is an earth-lined channel that conveys irrigation water from the 24.2 Canal to the northeast corner of Madera Ranch. Flow is one-way; water conveyed via the 24.2–19.5 West Lateral Canal is directed onto crops, and any surplus runoff is directed into swales, where it percolates into the ground. The canal terminates in agricultural land.

Main No. 2 Canal

The Main No. 2 Canal originates at the Madera Main Canal. It connects and terminates with Cottonwood Creek east of Road 25.

Uplands

California Annual Grassland

Two grassland plant communities are present: California annual grassland and alkali grassland. Alkali grassland, which occurs on strongly saline-alkali soils, is discussed below. Slickspots are scattered within the grasslands. Few slickspots occur within California annual grassland; most occur within alkali grassland and are discussed in the “Alkali Grassland” section.

Vegetation

California annual grassland is the typical grassland community of the California Central Valley and adjacent foothills, composed of non-native annual grasses and forbs (Sawyer and Keeler-Wolf 1995).

California annual grassland is the most widespread plant community at Madera Ranch, occurring in most uncultivated areas on the ranch, in both uplands and swales.

The dominant species in California annual grassland usually are not found in wetlands. Therefore, California annual grassland does not meet the hydrophytic vegetation criterion.

Soils

California annual grassland occurs on Pachappa-Grangeville soils and on the slightly saline-alkali Fresno-El Peco soils. In the study area, soil samples in California annual grassland were generally restricted to the swales. The soils in the swales differed from soils of the Pachappa series in that they often possessed fine textured (i.e., sandy clay loam) subsoil horizons. The moderately sandy clay loam subsoil horizons were also found in vernal pools but at shallower depths than those in the grasslands. Soils in California annual grassland were not classified as hydric because they typically lacked the low chroma matrix colors and other redoximorphic features observed in the vernal pool soils.

Hydrology

On March 10, 2000, and in March 2005, when wetlands on Madera Ranch were observed to be inundated, no inundation or soil saturation was observed in California annual grassland. No other wetland hydrology indicators were observed.

Wetland Assessment

California annual grassland at Madera Ranch lacks all three wetland parameters: hydrophytic vegetation, hydric soils, and wetland hydrology.

Alkali Grassland

On Madera Ranch, alkali grassland is intermediate between typical California annual grassland and Valley sink scrub or Valley saltbush scrub (Holland 1986) communities. In Valley sink scrub, iodine bush (*Allenrolfea occidentalis*) is the dominant perennial shrub, and cover of annual grasses and forbs is generally low. At Madera Ranch, Valley saltbush scrub occurs only in the northern half of Section 7, outside the study area. In addition to the typical grassland species cited above, perennial and halophytic species are common. Perennial species present in the alkali grasslands include interior goldenbush, locoweed, alkali sacaton, and saltgrass. Slickspots are common and have a fringe of annual halophytic species, as described above for alkali rain pools.

In alkali grasslands that occur on clay soils, such as in the northern San Joaquin Valley, the vegetation is dominated by halophytic species that usually are found in wetlands (Jones & Stokes Associates 1990). At Madera Ranch, however, alkali grassland is dominated by species that are usually not found in wetlands. Hydrophytic or halophytic species are present but constitute a small percentage of the composition and cover. Therefore, alkali grassland on Madera Ranch does not meet the criterion for hydrophytic vegetation.

Soils

Soils in alkali grassland are mapped as Fresno, El Peco, or Dinuba series and are moderately to strongly saline-alkali. Characteristics of soil samples taken in alkali grassland match those reported for those soils in the soil survey report. These soils were not classified as hydric because they lacked hydric soil indicators and were not classified as hydric on the Madera County Hydric Soils List.

Soils examined at sample points located within slickspots typically had finer textures and shallower hardpans than are characteristic for soils of the Fresno, El Peco, or Dinuba series. Soils in slickspots generally lacked hydric soil indicators such as low chroma matrix colors and other redoximorphic features. Slickspot soils were not classified as hydric because they lacked hydric soil indicators and were not classified as hydric on the Madera County Hydric Soils List.

Hydrology

On March 10, 2000, and March 2005, when wetlands on Madera Ranch were observed to be inundated, no inundation or soil saturation was observed in alkali grassland or in slickspots. No other wetland hydrology indicators were observed.

Wetland Assessment

Alkali grassland at Madera Ranch lacks all three wetland parameters: hydrophytic vegetation, hydric soils, and wetland hydrology. The slickspots were fringed by hydrophytic vegetation but lacked hydric soils and wetland hydrology.

Cultivated Lands

Cultivated lands at Madera Ranch include: all of Sections 1, 13, and 21; the northeast quarter of Section 4; the east half of Section 14; the southeastern quarter of Section 16; the northeastern quarter of Section 22; and, the portion of Section 22 west of the GF Canal. These cultivated areas are planted in alfalfa or corn and lack native vegetation except along the margins of roadsides and fence lines. Soils in the cultivated areas have been modified by cultivation and mostly were not examined in detail. Historically, the soils in the cultivated areas were mapped primarily as Fresno, El Peco, and Pachappa series. The cultivated areas appear to have been leveled at some time prior to this survey. On March 10, 2000, and in March 2005, when wetlands on Madera Ranch were observed to be inundated, no inundation or soil saturation was observed on cultivated lands.

Any wetlands that were present in the cultivated areas were converted to cropland before the passage of the Farm Security Act in 1985. Section 21 has been cultivated longer than any other section on Madera Ranch; it has been farmed since the mid-1960s. Section 22 was tilled and dryland cropped intermittently from the late 1960s until the early 1980s. Sections 16 and 17 contained center pivots for irrigated pasture and crops in the mid-1970s (Loquaci pers. comm.). The south half of Section 15 and a portion of Section 17 were also cultivated for between 10 and 15 years, starting around 1970, but are no longer cultivated. Therefore, any wetlands formerly present in the cultivated areas would be prior converted wetlands. No farmed wetlands are present in the cultivated areas.

4.18.3 Analysis of Environmental Effects

Methods

Approach

The approach used to analyze effects of the Proposed Action on wetlands is to:

- conduct extensive surveys to document wetland resources on Madera Ranch;
- identify effect mechanisms to analyze effects of the alternatives; and
- determine the extent and duration of effects.

The wetland terminology used in this section is slightly different than the terminology used in Section 4.5, Biological Resources. For example, freshwater marsh and ponds are treated as habitat types in the biological resources section because they have different wildlife habitat functions than other vegetation types. Under this section freshwater marsh, ponds, and swales that have water applied to them regularly are seasonal wetlands. Vegetation in these areas will fluctuate back and forth between grassland and wetland depending on the amount of water and area applied.

Effect Mechanisms

The Proposed Action could affect up to approximately 2,100 acres of Madera Ranch. Of this amount, approximately 130 acres currently are cultivated. MID would deliver surface water to approximately 700 acres of swales on a seasonal basis and would construct canals, ditches, and pipelines to convey the water to and from its facilities on Madera Ranch. MID would drill wells, install pump heads, and construct lift stations on the 24.2 Canal and the Main No. 2 Canal to deliver recovered water back into MID's system. As needed, MID would construct as much as approximately 1,000 acres of engineered recharge basins to supplement the recharge capacity of the swales (Figure 4.5-2). Table 4.18-1 shows the wetland types and how they would be affected under each alternative.

Table 4.18-1. Effects of Project Action Alternatives on Madera Ranch Wetlands

	Effect (acres[a])			
Wetland	Flooding Swales	Temporary Construction Effects	Permanent Construction Effects[b]	No Anticipated Effect
Alternative B				
Vernal pool	5.5	0.04	0.1	15.8
Alkali rain pool	0.4	1.0	1.1	13.1
Seasonal wetland[c]	(549)	0.1	2.0	151
Total	**(543.1)**	**1.14**	**3.2**	**181.9**

	Effect (acres[a])			
Wetland	Flooding Swales	Temporary Construction Effects	Permanent Construction Effects[b]	No Anticipated Effect
Alternative C				
Vernal pool	No effect	0.04	0.1	21.3
Alkali rain pool	No effect	1.0	1.1	13.1
Seasonal wetland[c]	151	0.1	2.0	0
Total	**151**	**1.14**	**3.2**	**36.4**
Alternative D				
Vernal pool	5.5	0.04	0.1	15.8
Alkali rain pool	0.4	1.0	1.1	13.1
Seasonal wetland[c]	(500)	0.1	2.0	100
Total	**(494)**	**1.14**	**3.2**	**130.9**

[a] Temporary effects include the effects associated with extraction facilities.

[b] Permanent effects include up to 40 acres of facilities in Phase 1. The total reflects conservative assumptions that all Phase 2 recharge bases would be constructed under the Alternative. Phase 2 recharge bases would only be constructed as required to augment Phase 1 recharge facilities. Acreages associated with construction of the Phase 2 recharge basins are apportioned across habitat types within a 1,300-acre area.

[c] Site conditions change seasonally. The total amount of seasonal wetland is expected to vary based on water year, amount of water banked, and area water is banked. This represents the greatest potential change in seasonal wetlands. Numbers in parenthesis indicate increases in seasonal wetlands. The total wetted area is not expected to exceed approximately 700 acres.

Project elements within water bodies and uplands are summarized in Table 4.5-5.

The Proposed Action could result in both direct and indirect effects. Activities that could result in direct effects on wetlands include:

- temporary or permanent removal of wetlands;
- flooding swales on a seasonal basis;
- excavating areas to construct recharge basins and distribution canals/ditches;
- disposing of soil from excavation activities;
- during operation of recharge basins, applying algicide or other chemicals if necessary to keep vegetation in check and minimize algae growth;
- compacting soils by traffic on and adjacent to construction access corridors and staging areas and by vehicle use of maintenance roads; and
- potentially spilling toxic substances from vehicles during construction and operations and maintenance.

The Proposed Action also may cause indirect effects. Indirect effects occur later in time or are farther removed in distance but must be predictable and reasonably certain to occur in order to be assessed. Potential mechanisms of indirect effects on wetlands include:

- changes in hydrology, such as altered patterns of runoff or changes to the surface water retention pattern and capacity and elevation of the perched water table;
- erosion and sedimentation that result from grading and other activities that remove vegetation; and
- water quality effects from contaminants such as road runoff or pesticides.

The activities described above can result in both permanent and temporary effects. Effects were characterized as permanent if they would result in the conversion of wetlands for the life of the Proposed Action. The extent of permanent and temporary effects on wetlands at Madera Ranch was estimated by overlaying the outline of proposed recharge basins, canals/ditches, extraction wells, pipelines, and maintenance roads (proposed footprint) on the map of wetlands. The footprint for the buried pipelines, maintenance roads, and canals/ditches is estimated to be a linear corridor 10 feet wide. The proposed footprint for the extraction wells is estimated to be 0.1 acre each.

Environmental Consequences and Mitigation Strategies

Alternative A—No Action

Under the No Action Alternative, Reclamation would not approve the banking of CVP water outside MID's service area, nor would Reclamation issue an MP-620 permit for modifications to its distribution system. Reclamation's action would have no adverse effects on wetlands. However, the total extent of seasonal wetlands could decrease depending on how the water is managed on Madera Ranch and if MID continues to bank its pre-1914 water. The future conditions would continue to support agricultural activities; the type and extent of the activities is uncertain at this time. Future owners would be subject to comply with CESA and ESA and the effects may be evaluated by the County under CEQA if discretionary permits are needed.

Alternative B—Water Banking outside the MID Service Area Using Swales and Alteration of Reclamation-Owned Facilities

Effect WET-1: Permanent Removal of Vernal Pools and Alkali Rain Pools during Construction, Operation, and Maintenance

Construction of the proposed recharge basins, canals/ditches, extraction wells, pipelines, and maintenance roads would occur more than 250 feet from vernal pools and alkali rain pools. However, a possibility remains that these wetlands could experience both direct (construction of permanent facilities, compaction of soils) and indirect (changes to nearby hydrogeology or introduction of sediment) disturbances. In several instances, vernal pools are located within the swales proposed for operation. Flooding swales on a seasonal basis could result in degradation of vernal pool habitat for vernal pools within the swales. This effect is considered to be adverse. Implementation of Environmental Commitments BIO-2a: Preconstruction Surveys/Avoid Effects on Vernal and Alkali Rain Pools and BIO-2b: Create, Restore, or Preserve Vernal Pools would minimize the extent of and compensate for adverse effects associated with Alternative B.

Effect WET-2: Other Wetland Effects during Construction, Operation, and Maintenance

Implementation of the Proposed Action would result in minor amounts of fill of waters of the United States subject to Corps jurisdiction under the CWA during installation of the weirs along Cottonwood Creek and improvements to GF Canal. Additionally, excavation is expected to occur where the Section 8 Canal connects with Cottonwood Creek. No construction-related impacts on wetlands are expected in the swales or constructed basin. The total amount of fill is still being evaluated by the Corps based on the project description, preliminary engineering designs, and relationship of project elements to waters of the United States and is expected to be less than 5 acres. No substantial effects are expected to occur during construction along Cottonwood Creek because there are limited wetlands in this area. In GF Canal there are seasonal wetlands, including approximately 2 acres of freshwater marsh that would be affected. These effects would be offset by the development of freshwater marsh within GF Canal during operation and formation of seasonal wetlands within the swales during banking. (Direct or indirect effects could occur on vernal pools and alkali rain pools, as described above in Effect WET-1.)

Operational effects associated with the banking of water in the swales likely will increase the acreage of seasonal wetlands that occur on Madera Ranch. This acreage will fluctuate based on the water year type and length of time water is banked in the swales. This increase in seasonal wetlands is expected to result in greater wetland functions and values on site that could benefit waterfowl. No maintenance is proposed within the swales, and therefore no adverse operational effects are expected to occur in the swales. Maintenance of the canals periodically may result in the removal of wetland features that grow during operational periods. No substantial operational effects are expected to occur because no maintenance is proposed in the swales, limited wetland resources are expected to develop within the canals, and wetlands within in the canals would retain their previous functions after maintenance. As such, construction and operational effects on wetlands are not adverse.

Alternative C—Water Banking Outside the MID Service Area without Swales and Alteration to Reclamation-Owned Facilities

Alternative C is similar in scope and design to Alternative B, with the exception that recharge is achieved using engineered recharge basins in lieu of the natural swales that occur on the site. Thus, engineered basins would be built in Phase 1 instead of using the swales in Phase 1 under Alternative B. The total amount of seasonal wetlands would decrease under this alternative because water would no longer be applied to any swales. This is not considered an adverse effect because these areas primarily function as grassland. The expected footprint of recharge basins under Alternative B would be identical to the maximum build-out of Phase 2 of Alternative B and would result in nearly identical temporary and permanent construction effects on wetlands (Effects WET-1 and WET-2) and Environmental Commitments BIO-2a and BIO-2b would reduce the adverse Effect WET-1.

Alternative D—Water Banking Outside the MID Service Area with Banking and Recovery via Gravelly Ford Canal

Alternative D is similar in scope and design to Alternative B, with the exception that water would be conveyed to the site via GF Canal. For this reason, one recharge basin would not be built under Alternative D that was proposed under Alternative B. The majority of the swales proposed under Alternative C would also be used (less approximately 100 acres), and the expected footprint of recharge basins under Phase 2 of Alternative D would be nearly identical to Phase 2 of Alternative B. Alternative D would result in nearly identical temporary and permanent construction effects on wetlands as Alternative B (Effects WET-1 and WET-2). However, the extent of wetlands that could be affected could be greater under Alternative D because of the increased disturbance to GF Canal. However, as described under Effect WET-2, this effect is not adverse. The Environmental Commitments associated with Effect WET-1 are still appropriate and applicable.

Cumulative Effects

Effect WET-3: Cumulative Loss of Wetlands

The WSEP would result in a minor conversion of wetlands (no more than 5 acres for any of the alternatives). At the same time, the use of swales for alternatives B and D have the potential to increase wetlands on Madera Ranch depending on the specific operations. Other projects, such as development and projects proposed in the County, have the potential to also convert wetlands, while banking efforts could result in increased wetlands. Overall, wetland loss in the region and throughout California is substantial, but regulatory programs and other efforts generally ensure no net loss of wetlands. Each of the alternatives includes commitments to offset wetlands loss attributable to the project, and therefore, there would be no cumulative effect.