RECLAMATION
Managing Water in the West

Madera Irrigation District Water Supply Enhancement Project

Final Environmental Impact Statement

EIS-06-127

U.S. Department of the Interior
Bureau of Reclamation
Mid Pacific Region
South Central California Area Office
Fresno, California

June 2011

Mission Statements

The mission of the Department of the Interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to Indian Tribes and our commitments to island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

Madera Irrigation District Water Supply Enhancement Project
Final Environmental Impact Statement
Madera County, California

Lead Agency
Bureau of Reclamation
United States Department of the Interior
Bureau of Reclamation
Mid-Pacific Region
South-Central California Office

Cooperating Agencies
U.S. Fish and Wildlife Service and U.S. Army Corps of Engineers

The United States Department of the Interior, Bureau of Reclamation (Reclamation), prepared this Final Environmental Impact Statement (EIS) for the Madera Irrigation District Water Supply Enhancement Project (MID WSEP). The MID WSEP Proposed Action is to construct a groundwater bank on the property known as Madera Ranch, west of the City of Madera, Madera County, California. The Federal actions include approval from Reclamation for MID to bank a portion of their CVP Friant Division contract water supply outside of its service area in the newly constructed groundwater bank at Madera Ranch and approval to extend the Reclamation-owned 24.2 Canal.

This Final EIS analyzes the potential direct, indirect and cumulative impacts of implementing the MID WSEP Reduced Alternative B (Proposed Action) which would involve banking CVP water outside the MID Service Area using select swales, recharge basins and the alteration of Reclamation-owned facilities.

This Final EIS also analyzes the potential direct, indirect and cumulative impacts of implementing the following alternatives:

- Alternative A - No Action Alternative;
- Alternative B - Banking CVP Water outside of the MID Service Area Using Swales and Alteration of Reclamation-owned Facilities;
- Alternative C - Banking CVP Water outside the MID Service Area without Swales and Alteration of Reclamation-owned Facilities;
- Alternative D - Banking CVP Water outside the MID Service Area with Banking and Recovery via Gravelly Ford Canal (no alteration of Reclamation-owned Facilities).

For further information regarding this Draft Environmental Impact statement, contact:

Chuck Siek, Supervisory Natural Resource Specialist
1243 ―N” Street Fresno, CA. 93721
Phone number (559) 487-5138
Fax number (559) 487-5397
E-mail, if available csiek@usbr.gov

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List of Acronyms and Abbreviations

°F	Degree Fahrenheit
AF	Acre-feet
AF/year	Acre-feet per year
APE	Area of Potential Effect
ARPA	Archaeological Resources Protection Act
AST	Aboveground Storage Tank
BACT	Best available control technique
BGEPA	Bald and Golden Eagle Protection Act
BLM	Bureau of Land Management
BMPs	Best Management Practices
btu/hp-hr	British thermal units per horsepower per hour
CAA	Clean Air Act
CARB	California Air Resources Board
CDFG	California Department of Fish and Game
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CFR	Code of Federal Regulations
cfs	Cubic feet per second
CH_4	Methane
CIMIS	California Irrigation Management Information System
CMP	Congestion Management Plan
CNDDB	California Natural Diversity Data Base
CNEL	Community Noise Equivalent Level
CNPS	California Native Plant Society
CO	Carbon monoxide
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
Corps	U.S. Army Corps of Engineers
CRHR	California Register of Historic Places
CVP	Central Valley Project
CWA	Clean Water Act
cy	Cubic yard
dB	Decibel
dBA	A-weighted decibel (decibel logarithmic scale)
DBCP	1,2-dibromo-3-chloropropane
D_c	Critical water table depth
DSOD	Division of Safety of Dams
DWR	California Department of Water Resources
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EO	Executive Order
EPA	Environmental Protection Agency

ESA	Endangered Species Act
ET	Evapotransipiration
Feet MSL	Feet below mean sea level
FEMA	Federal Emergency Management Agency
FMMP	Farmland Mapping and Monitoring Program
Fresno MSA	Fresno metropolitan statistical area
FWCA	Fish & Wildlife Coordination Act
GAMAQI	Guide for Assessing and Mitigating Air Quality Impacts
GHG	greenhouse gases
GF Canal	Gravelly Ford Canal
GFWD	Gravelly Ford Water District
GPS	Global Positioning System
H_c	Critical capillary height
hp	Horsepower
IBC	International Building Code
ITA	Indian Trust Asset
L_{DN}	Day-night average sound levels
L_{EQ}	Equivalent sound level
LOS	Level of Service
M&I	Municipal and Industrial
MBTA	Migratory Bird Treaty Act
MCL	Maximum contaminant levels
MCMAVCD	Madera County Mosquito and Vector Control District
MGD	Million gallons per day
mg/L	Milligram per liter
mg/m^3	Milligram per cubic meter
MID	Madera Irrigation District
MOCP	Monitoring and Operational Constraints Program
MOU	Memorandum of Understanding
MROC	Madera Ranch Oversight Committee
MWMA	Mendota Wildlife Management Area
N_2O	Nitrogen dioxide
NA^+	Sodium ion
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NAHC	Native American Heritage Commission
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NO_2	Nitrogen dioxide
NO_x	Nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Services
NRHP	National Register of Historic Places
O_3	Ozone
O&M	Operations and maintenance
OHWM	Ordinary high water mark

PG&E	Pacific Gas and Electric
PM_{10}	Particulate matter between 2.5 and 10 microns in diameter
$PM_{2.5}$	Particulate matter less than 2.5 microns in diameter
PPB	Parts per billion
PPM	Parts per million
PVC	Polyvinyl chloride
RCP	Reinforced concrete pipe
Reclamation	Bureau of Reclamation
ROD	Record of Decision
ROG	Reactive organic gases
ROW	Rights of way
RWQCB	Regional Water Quality Control Board
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SJRRP	San Joaquin River Restoration Program
SJVAB	San Joaquin Valley Air Basin
SJVAPCD	San Joaquin Valley Air Pollution Control District
SO_2	Sulfur dioxide
SO_x	Sulfur oxides
SR	State Route
SSJVIC	Southern San Joaquin Valley Information Center
SWP	State Water Project
SWPPP	Storm Water Pollution Prevention Program
SWRCB	State Water Resources Control Board
TDML	Total Daily Maximum Loads
TDS	Total Dissolved Solids
µg/L	Micrograms per liter
$\mu g/m^3$	Micrograms per cubic meter
µS/cm	MicroSiemens per centimeter
U.S.C.	United States Code
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UST	Underground storage tank
V/C	Volume-to-capacity
VOC	Volatile organic compounds
WSEP	Water Supply Enhancement Project

Executive Summary

Please note that text that has been revised since the Draft Environmental Impact Statement (EIS) is marked with a vertical line in the right margin. Text found to be redundant or unnecessary in the Draft EIS has been removed.

ES-1 Introduction

Madera Irrigation District (MID) approved a Water Supply Enhancement Project (WSEP) located on the property known as Madera Ranch, west of the city of Madera, in Madera County, California in September 2005. This approval was based on their Final Environmental Impact Report (EIR) completed for compliance with the California Environmental Quality Act (CEQA). At that time, there was no federal action that would require compliance with the National Environmental Policy Act (NEPA).

The U.S. Department of the Interior, Bureau of Reclamation (Reclamation) commented on the Draft EIR, stating that once MID proposed a federal action, Reclamation would need to complete and satisfy all NEPA requirements as well as all other legal requirements before approving any federal action. A Draft EIS was initiated in response to MID's request that Reclamation approve the banking of MID Central Valley Project (CVP) water outside MID's service area in the proposed WSEP, and the modification of the 24.2 Canal, a federal facility.

Pursuant to the requirements of NEPA, Reclamation published a Notice of Intent to prepare a Draft EIS and Notice of Public Scoping Meetings in the *Federal Register* on September 28, 2007. Reclamation and MID held Draft EIS scoping meetings at MID's offices in Madera on October 22 and 29, 2007. 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.

Reclamation filed a Notice of Availability in the *Federal Register* on July 28, 2009 for the Draft EIS. The Draft EIS underwent public review for 60 days, during which time Reclamation held a public meeting. After comments had been received, Reclamation prepared responses to comments and has included them in this Final EIS. Reclamation upon filing the Notice of Availability for this Final EIS in the *Federal Register* will circulate this Final EIS for at least 30 days before issuing a Record of Decision (ROD).

This Final EIS has been completed for compliance with NEPA by Reclamation as the Federal lead agency. Reclamation has been coordinating with the U.S. Army Corps of Engineers (Corps) and U.S. Fish and Wildlife Service (USFWS) to analyze the potential direct, indirect and cumulative environmental impacts of the Proposed Action.

ES-2 Purpose and Need

Currently, farmers in MID's service area use a combination of groundwater and surface water. During dry years, there is not adequate surface water to meet the water demand and groundwater pumping increases substantially. The amount of groundwater that has been pumped from the aquifer in the vicinity of Madera Ranch has exceeded the amount of water that has recharged the aquifer, resulting in groundwater overdraft. Even in wet years, the groundwater basin is in severe overdraft because groundwater pumping is steadily increasing for agricultural use as well as municipal and industrial (M&I) use. This overdraft has caused the water table to decline and groundwater quality to degrade and has resulted in excess space in the aquifer that could be used to bank surface water.

In the vicinity of Madera Ranch, the water table has declined more than 90 feet over the last 60 years. These conditions have made it increasingly expensive for farmers to pump groundwater. Additionally, in many years, MID has been unable to deliver sufficient surface water to farmers because water is available primarily during the early months of the year when irrigation demand is low, and often water is available only for short periods of time during the growing season.

The purpose of the proposed federal action is to:

- enhance water supply reliability and flexibility by using the excess aquifer space for surface water storage (water banking);
- reduce existing and future aquifer overdraft;
- reduce groundwater pumping costs;
- increase groundwater quality;
- encourage conjunctive use in the region as a means toward regional self-sufficiency.

ES-3 Description of the Project Alternatives

To meet these project purposes, MID proposes to implement the WSEP, by which MID would bank a portion of their CVP water from the San Joaquin and Fresno Rivers and other non-CVP water in the aquifer underlying Madera Ranch. Water would be banked in the aquifer, and 10% of the water would be left behind to reduce overdraft.

This Final EIS analyzes the potential direct, indirect and cumulative impacts of implementing the MID WSEP Reduced Alternative B (Proposed Action) which would involve banking CVP water outside the MID Service Area using select swales, recharge basins and the alteration of Reclamation-owned facilities.

This Final EIS also analyzes the potential direct, indirect and cumulative impacts of implementing the following alternatives:

- Alternative A - No Action Alternative;
- Alternative B - Banking CVP Water outside of the MID Service Area Using Swales and Alteration of Reclamation-owned Facilities;
- Alternative C - Banking CVP Water outside the MID Service Area without Swales and Alteration of Reclamation-owned Facilities;
- Alternative D - Banking CVP Water outside the MID Service Area with Banking and Recovery via Gravelly Ford Canal (no alteration of Reclamation-owned Facilities).

ES-3.1 Alternative A

Under the No Action Alternative, MID would not bank MID CVP water (MID Long-Term Water Service Contract supplies from both the Friant Division and Hidden Unit) on Madera Ranch (Figure 2-1) and Reclamation's delivery canals would not be enlarged. MID may bank non-CVP water on the property, and other limited on-site water banking and recovery facilities may be constructed if MID is able to find participants and funding to support these efforts. MID estimates that under the No Action Alternative, MID only could apply less than 5,000 acre-feet (AF) per year (AF/year) of their own non-CVP water, and recovery operations likewise would be limited if Reclamation-owned facilities were not altered. The number of other participants and amount of water they could bring to the project are uncertain. If the proposed project does not proceed, MID likely would sell the property to other agricultural interests. MID has had numerous offers from prospective buyers, including dairy, orchard, and row crop farmers. The No Action conditions would allow for agricultural activities.

ES-3.2 Alternative B

Alternative B would be completed in two phases. Phase 1 would involve only recharge-related facilities. Phase 2 would involve supplemental recharge facilities and facilities for recovery of banked water. Reclamation would approve a total banking capacity of 250,000 AF of MID CVP water outside the MID service area and issuance of an MP-620 permit (a Reclamation Mid-Pacific Region-specific permit issued for additions or alterations to Reclamation-owned conveyance and distribution facilities) for Lateral 24.2. After alteration of the Reclamation-owned facilities (Lateral 24.2) and certain MID facilities, MID would be able to recharge and recover a maximum of 55,000 AF annually.

Phase 1 activities would involve:

- reconditioning and extending canals to provide at least 200 cubic feet per second (cfs) of conveyance capacity into Madera Ranch;
- constructing approximately 55 acres of recharge basins on current agricultural land to regulate flow, remove sediment, and provide some recharge;
- applying recharge flows to approximately 700 acres of swales; and
- integrating approximately 2,600 acres of Madera Ranch row crops and vineyards into an in-lieu recharge program in which surface water periodically would be served in lieu of groundwater pumping subject to approval by the Madera Ranch Oversight Committee (MROC).

Phase 2 activities for recharge and recovery facilities would involve:

- additional upgrades to existing canals,
- construction of up to 1,000 acres of new on-site recharge basins and canals as required to supplement Phase 1 facilities and achieve 200 cfs of recharge capacity (if required),
- use of up to 15 existing wells for recovery,
- installation of up to 49 new wells and recovery pipelines (in phases over several years) to provide 200 cfs of recovery capacity, and
- installation of up to 12 lift stations on MID canals and one lift station on Gravelly Ford Canal (GF Canal) (in phases over several years) to provide 200 cfs of pump-back capacity into the MID service area.

ES-3.3 Reduced Alternative B

Reduced Alternative B represents a scaled-back version of Alternative B that uses fewer swales in order to minimize effects to vernal pools and limits the number of recharge basins to the number needed for the project to be practicable. It is included in the Final EIS as a revision to Alternative B to allow the public to see how the project has been modified, demonstrate how effects have been reduced, and facilitate the Corps use of this document in their permitting of the project. As with Alternative B, Reduced Alternative B would complete the water bank in two phases. Phase 1 would involve constructing necessary delivery infrastructure improvements (except for the Section 8 canal southwest extension), using select natural swales for recharge (550 acres versus 700 acres as proposed under Alternative B), and installing approximately five soil berms to direct recharge flows. Phase 2 would involve constructing a limited number of recharge basins (323 acres versus up to 1,000 acres under Alternative B) and facilities for recovery of banked water. Reclamation would approve banking of CVP water outside the MID service area and alteration of Reclamation-owned facilities.

ES-3.4 Alternative C

Alternative C is a variation of the Proposed Action that would complete the water bank in two phases and replace natural swale recharge solely with recharge basins. Phase 1 would involve recharge-related facilities only. Phase 2 would involve facilities for recovery of banked water. Reclamation would approve banking of CVP water outside the MID service area and alteration of Reclamation-owned facilities.

Phase 1 activities would involve:

- reconditioning and extending existing canals to provide at least 200 cfs of conveyance capacity into Madera Ranch,
- constructing up to 1,000 acres of new on-site recharge basins and canals as required to achieve 200 cfs of recharge capacity, and
- integrating approximately 2,600 acres of Madera Ranch row crops and vineyards into an in-lieu recharge program in which surface water periodically would be served in lieu of groundwater pumping subject to approval by the MROC.
- Phase 2 recharge and recovery facilities would involve:
- up to 15 existing wells for recovery;

- up to 49 new wells and recovery pipelines (in phases over several years) to provide 200 cfs of recovery capacity; and
- up to 12 lift stations on MID canals and one lift station on GF Canal (in phases over several years, total of 13 lift stations) to provide 200 cfs of pump-back capacity into the MID service area.

ES-3.5 Alternative D

Under Alternative D, MID would enter into an agreement with Gravelly Ford Water District (GFWD) to improve the GF Canal to allow water to be conveyed from the San Joaquin River through the GF Canal to Madera Ranch for banking of water and recovery of water from the ranch back through the canal to the river. The existing GFWD pumping plant would be enlarged; the existing, associated pipeline replaced with a larger-diameter line; the GF Canal re-graded to a flat-bottom (zero slope) configuration to allow two-way flow; a new connection to the river constructed to allow recovery water to reach the river without flowing through the pumps; and appropriate gate structures constructed. On-site improvements allowing water banking and extraction, including a pumping plant and pipeline to allow distribution of water uphill from the GF Canal, would be constructed.

MID would complete Alternative D in two phases. Phase 1 would involve recharge-related facilities only. Phase 2 would involve supplemental recharge facilities and facilities for recovery of banked water. Reclamation would approve the banking of CVP water outside the MID service area as described under Alternative B. No alteration of Reclamation-owned facilities would occur under Alternative D.

Phase 1 activities would involve:

- reconditioning of existing canals to provide at least 200 cfs of conveyance capacity into Madera Ranch;
- construction of approximately 26 acres of recharge basins on current agricultural land to regulate flow, remove sediment, and provide some recharge;
- application by MID of recharge flows to approximately 700 acres of swales; and
- integration of approximately 2,600 acres of Madera Ranch row crops and vineyards into an in-lieu recharge program in which surface water would be periodically served in lieu of groundwater pumping subject to approval by the MROC.
- Phase 2 recharge and recovery facilities would use or include:
- up to 15 existing wells for recovery,
- up to 49 new wells and recovery pipelines (in phases over several years) to provide 200 cfs of recovery capacity, and
- one lift station on GF Canal to provide 200 cfs of pump-back capacity to the San Joaquin River.

ES-4 Overview of Environmental Impacts

The EIS evaluates the direct, indirect, and cumulative environmental changes and/or impacts on the following resources:

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

A comparison of the Alternative impacts is displayed in the following Executive Summary table.

Table ES-1 Executive Summary Impacts and Mitigation Table

Potential Impact	Alternative	Potential Impact Determination	Avoidance/Mitigation Measures
Aesthetics			
AES-1: Temporary Degradation of Visual Character or Quality from Construction-Related Activities	B, Reduced B, C, D	Yes	
AES-2: Degradation of Visual Character or Quality from New Permanent Features	B, C, D	No	
Agriculture			
AG-1: Alteration of Madera Ranch Agricultural Operations	B, Reduced B, C, D	No	
AG-2: Conflict with Williamson Act Contracts	B, Reduced B, C, D	No	
AG-3: Loss of Agricultural Land Designated as Prime Farmland or Farmland of Statewide Importance	B, C, D	Yes	AG-1
AG-4: Conflict with Local Zoning Designations	B, Reduced B, C, D	No	

Air Quality			
AQ-1: Generation of Construction Emissions in Excess of Federal *de minimis* Threshold Levels	B, Reduced B, C, D	Yes	AQ-1, AQ-2
AQ-2: Generation of Operational Emissions in Excess of Federal *de minimis* Threshold Levels	B, Reduced B, C, D	No	
AQ-3: Result in a Cumulatively Considerable 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 Ozone Precursors)	B, Reduced B, C, D	Yes-cumulative	AQ-1, AQ-2
Biological Resources			
BIO-1: Temporary Disturbance of California Annual Grassland and Alkali Grassland during Construction	B, Reduced B, C, D	No	
BIO-2: Permanent Removal of California Annual Grassland and Alkali Grassland Habitats during Construction	B, Reduced B, C, D	Yes	BIO-1
BIO-3: Loss or Disturbance of Iodine Bush Scrub or Sensitive Plant Species Habitat as a Result of Construction	B, Reduced B, C, D	Yes	BIO-2a, BIO-2b
BIO-4: Potential for Construction-Related Mortality of Sensitive Vernal Pool Crustaceans	B, Reduced B, C, D	Yes	BIO-2a, BIO-2b
BIO-5: Potential for Operation- and Maintenance-Related Mortality of Sensitive Vernal Pool Crustaceans	B, Reduced B, C, D	Yes	BIO-2a, BIO-2b
BIO-6: Potential for Construction-Related Mortality of San Joaquin Tiger Beetle	B, Reduced B, C, D	No	
BIO-7: Potential for Operation- and Maintenance-Related Mortality of San Joaquin Tiger Beetle	B, Reduced B, C, D	No	
BIO-8: Potential for Construction-Related Mortality of California Tiger Salamander	B, Reduced B, C, D	Yes	BIO-1, BIO-2a, BIO-2b, BIO-4a, BIO-4b, BIO-4c
BIO-9: Potential for Operation- and Maintenance-Related Mortality of California Tiger Salamander	B, Reduced B, C, D	Yes	BIO-1, BIO-2a, BIO-2b
BIO-10: Potential for Construction- and/or Operation- and Maintenance-Related Mortality of Western Spadefoot Toad	B, Reduced B, C, D	Yes	BIO-2a, BIO-2b
BIO-11: Potential for Construction- and/or Operation- and Maintenance-Related Effects on Blunt-Nosed Leopard Lizard	B, Reduced B, C, D	Yes	BIO-1, BIO-5, BIO-5a, BIO-5b, BIO-5c
BIO-12: Potential for Construction- and/or Operation- and Maintenance-Related Mortality of California Horned Lizard	B, Reduced B, C, D	No	

BIO-13: Potential for Construction- and/or Operation- and Maintenance-Related Mortality of Silvery Legless Lizard	B, Reduced B, C, D	No	
BIO-14: Potential for Operation- and Maintenance-Related Harm and Harassment of Giant Garter Snake	B, Reduced B, C, D	No	
BIO-15: Potential for Construction-Related Disturbance of Nesting Swainson's Hawk and White-Tailed Kite	B, Reduced B, C, D	Yes	BIO-6
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	B, Reduced B, C, D	No	
BIO-17: Potential for Construction-Related Mortality of Western Burrowing Owl	B, Reduced B, C, D	Yes	BIO-1, BIO-7
BIO-18: Potential for Operation-Related Mortality of Western Burrowing Owl	B, Reduced B, C, D	No	
BIO-19: Potential for Construction-Related Harm to Loggerhead Shrike	B, Reduced B, C, D	Yes	BIO-1
BIO-20: Potential for Construction-Related Foraging Habitat Loss for Tricolored Blackbird	B, Reduced B, C, D	No	
BIO-21: Potential for Effects on San Joaquin Kit Fox	B, Reduced B, C, D	Yes	BIO-1, BIO-8
BIO-22: Potential for Effects on Fresno Kangaroo Rat	B, Reduced B, C, D	Yes	BIO-9
BIO-23: Potential for Mortality of San Joaquin Pocket Mouse	B, Reduced B, C, D	No	
BIO 24: Potential Mortality of Sensitive Species during Construction	C, D	Yes	BIO-10
BIO-25: Potential for Entrainment of Anadromous Fish If Restored to the San Joaquin River	D	Yes	BIO-11
BIO-26: Result in a Cumulatively Considerable Loss of Grassland	Cumulative	Yes	BIO-11
BIO-27: Result in a Cumulatively Considerable Loss of Habitat for Endangered Species	Cumulative	Yes	BIO-1
Cultural Resources			
CR-1: Damage to or Destruction of Nine Historic Features on Madera Ranch through Construction of Recharge Basins	B, Reduced B, C, D	No	
CR-2: Physical Modifications of Gravelly Ford Canal (P-20-2402)	B, Reduced B, C, D	No	
CR-3: Physical Modifications of Historic Main No. 1, Main No. 2 and Section 8 Canal	B, Reduced B, C, D	No	
CR-4: Physical Modification of 24.2 Canal	B, Reduced B, C, D	No	
CR-5: Physical Disturbance of Currently Undiscovered Cultural Resources	B, Reduced B, C, D	Yes	CR-1

Environmental Justice			
EJ-1: Disproportionate effects on minority or low-income populations	B, Reduced B, C, D	No disproportionate effects on minority or low-income populations	
Geology, Soils, Seismicity, and Erosion			
GEO-1: Potential Exposure of People or Structures to Substantial Adverse Effects Resulting from Liquefaction	B, Reduced B, C, D	No	
GEO-2: Potential Subsidence Caused by Groundwater Overdraft	B, Reduced B, C, D	No	MROC
GEO-3: Potential Risks to Property Caused by Construction on an Expansive Soil	B, Reduced B, C, D	No	
GEO-4: Potential Loss of a Substantial Amount of Topsoil from Land Grading Operations	B, Reduced B, C, D	No	
GEO-5: Increase in Wind and Water Erosion Rates during and Shortly after Construction	B, Reduced B, C, D	No	
GEO-6: Increase in Long-Term Wind and Water Erosion Rates	B, Reduced B, C, D	Yes	GEO-1
GEO-7: Potential Destruction of a Unique Pedologic Feature	B, Reduced B, C, D	Yes	BIO-1
GEO-8: Potential Soil Salinization from Elevated Groundwater Levels	B, Reduced B, C, D	No	
GEO-9: Potential Destruction of a Sensitive Paleontological Resource	B, Reduced B, C, D	Yes	GEO-2
Global Climate			
CC-1: Increased GHG Emissions during Construction	B, Reduced B	No	AQ-1, AQ-2
CC-1: Increased GHG Emissions during Construction	C, D, Cumulative	Yes	AQ-1, AQ-2
CC-2: Increase in GHG Emissions as a Result of Operation and Maintenance	B, Reduced B, C, D	Yes	AQ-3
CC-3: Secondary Emissions at Power Plants	B, Reduced B, C, D, Cumulative	No	
Growth-Inducing Effects			
GI-1: Inducement of Growth Attributable to Municipal and Industrial Participation in Water Bank	B, Reduced B, C, D	No	

Hazards, Public Health and Safety			
PHS-1: Potential Creation of a Public Hazard from Risk of Drowning	B, Reduced B, C, D, Cumulative	Yes	PHS-1a
PHS-2: Potential Creation of a Public Hazard from Risk of Berm Failure	B, Reduced B, C, D, Cumulative	No	
PHS-3: Potential Creation of a Public Hazard from Risk of Wildland Fire	B, Reduced B, C, D	Yes	PHS-1b, PHS-1b
PHS-4: Potential for Increase in Adult Mosquito Populations	B, Reduced B,C, D	Yes	PHS-2
PHS-5: Potential Exposure or Disturbance of Hazardous Materials or Wastes	B, Reduced B, C, D	No	WQ-1b
Indian Trust Assets			
ITA-1: Indian Trust Assets (ITA) are legal interests in property held in trust by the U.S. for federally-recognized Indian tribes or individual Indians.	B, Reduced B, C, D	No	
Land Use			
LU-1: Conflict with Applicable Land Use Plans, Policies, or Regulations, Including Land Use Designations and Zoning Ordinances	B, Reduced B, C, D	No	
LU-2: Land Use/Operational Conflicts between Existing and Proposed Land Uses	B, Reduced B, C, D	No	
LU-3: Conflict with Recreational Land Uses	B, Reduced B, C, D	No	
Noise			
NOI-1: Exposure of Residences to Noise from Grading and Construction Activities	B, Reduced B, C, D	Yes	NOI-1
NOI-2: Exposure of Residences to Noise from Well Drilling Operations	B, Reduced B, C, D	Yes	NOI-2
NOI-3: Exposure of Residences to Noise from Operation of Engines at Wells	B, Reduced B, C, D	No	
NOI-4: Exposure of Residences to Noise from Operation of Engines at Lift Stations	B, Reduced B, C, D	Yes	NOI-4
Effect NOI-5: Exposure of Residences to Noise from Operation of Engines at Lift Stations	B, Reduced B, C, D	Yes	NOI-4
Public Services and Utilities			
PSU-1: Increased Demand for Utilities	B, Reduced B, C, D	No	
PSU-2: Potential Disruption of Emergency-Response Routes (Moderate)	B, Reduced B, C, D	Yes	PSU-1a, PSU-1b
PSU-3: Temporary Disruption of Irrigation Service as a Result of Construction	B, Reduced B, C, D	No	
Effects related to the disruption of emergency response routes within Madera County	Cumulative	Yes	PSU-2a, PSU-2b
Socioeconomics			
SE-1: Increase in Temporary Construction-Related Employment and Income in the Fresno Metropolitan Statistical Area	B, Reduced B, C, D	Beneficial	

SE-2: Increase in Permanent Employment and Income in the Local Area	B, Reduced B, C, D	Beneficial	
SE-3: Increase in Water Costs Influencing Agricultural Production	B, Reduced B, C, D	No	
SE-4: Reliability of Water Supply on Changes in Employment and Income in the Local Area because of Increased Water Supply Reliability	B, Reduced B, C, D	Beneficial	
Traffic			
TRAF-1: Temporary Construction-Related Increase in Traffic Volumes on Local and Regional Roadways	B, Reduced B, C, D	No	
TRAF-2: Potential Increase in Construction-Related Traffic Volume Delay and Hazard on Local and Regional Roadways	B, Reduced B, C, D	Yes	PSU-1b
TRAF-3: Potential Damage to the Roadway Surface during Construction	B, Reduced B, C, D	Yes	TRAF-1
TRAF-4: Potential Increase in the Demand for Parking Space at the Construction Site(s)	B, Reduced B, C, D	No	
Water Resources			
WQ-1: Degradation of Water Quality Resulting from Construction Runoff	B, Reduced B, C, D	Yes	WQ-1a, WQ-1b
WQ-2: Water Quality Effects from Construction-Related Dewatering	B, Reduced B, C, D	Yes	WQ-2
WQ-3: Potential Effects on Groundwater or Surface Water Quality from Recharge or Recovery Operations	B, Reduced B, C, D, Cumulative	No	MOCP, MROC
WQ-4: Potential Soil Salinization from Elevated Groundwater Levels (also in Section 3.6, *Geology*)	B, Reduced B, C, D	No	
WQ-5: Potential Erosion Attributable to Reversal of Flows in 24.2 Canal and Cottonwood Creek/Main No. 2 Canal	B, Reduced B, C, Cumulative	Yes	MOCP, MROC, WQ-1a, WQ-1b, WQ-2
WQ-6: Potential Erosion Attributable to Reversal of Flows in Gravelly Ford Canal	D, Cumulative	No	MOCP, MROC
Water Supply			
WS-1: Changes in Groundwater Supplies or Overdraft Rates in Madera County	B, Reduced B, C, D	Beneficial	
WS-2: Substantial Effects on Surrounding Groundwater Wells as a Result of Recovery Operations	B, Reduced B, C, D, Cumulative	No	MOCP, MROC
WS-3: Substantially Alter the Existing Drainage Pattern or Contribute to Existing Local or Regional Uncontrolled Flows	B, Reduced B, C, D, Cumulative	No	MOCP, MROC
WS-4: Adverse Effects on the Area of Origin of Water from Amendments to Existing Water Rights	B, Reduced B, C, D	No	
WS-5: Reduced Surface Water Availability in Madera County or the Area of Origin	B, Reduced B, C	No	
WS-6: Water Supply Reliability Improvement in Dry Years	B, Reduced B, C, D	Beneficial	

WS-7: Adverse Effects on the Area of Origin of Water from Amendments to Existing Water Rights	D	No	
WS-8: Reduced Surface Water Availability in Madera County or the Area of Origin	D, Cumulative	No	
Wetlands			
WET-1: Permanent Removal of Vernal Pools and Alkali Rain Pools during Construction, Operation, and Maintenance	B, Reduced B, C, D	Yes	BIO-2a, BIO-2b
WET-2: Other Wetland Effects during Construction, Operation, and Maintenance	B, Reduced B, C, D	No	
WET-3: Cumulative Loss of Wetlands	Cumulative		

MOCP = Monitoring and Operational Constraint Plan (Appendix D)
MROC = Madera Ranch Oversight Committee

Section 1 Introduction

For any proposed major Federal action, Federal agencies must comply with the National Environmental Policy Act (NEPA), including full disclosure of potential direct, indirect and cumulative impacts as well as avoidance, minimization and mitigation measures in response to those impacts. This Final Environmental Impact Statement (EIS) satisfies the requirements for compliance with NEPA. NEPA requires the federal government to use all practical means and measures, consistent with other essential considerations of national policy, to promote a healthy human environment. It establishes policy, sets goals, and provides means for carrying out the policy. NEPA encourages the wise use of natural resources by requiring that environmental factors be considered in federal agency decision-making. NEPA also enables the public, private organizations, state and local agencies, and Native American tribal governments to be involved in and informed about the decision-making process.

This Final EIS has been completed for compliance with NEPA by the Department of Interior, Bureau of Reclamation (Reclamation) as the Federal lead agency for the Madera Irrigation District (MID) Water Supply Enhancement Project (WSEP) in Madera County, California. This Final EIS is an informational document that must be used by Reclamation when considering a decision on the MID WSEP Proposed Action or an alternative. Reclamation's NEPA process involves circulation of the Final EIS for 30 days prior to issuing a Record of Decision (ROD) and taking action. The ROD will describe the decision, the alternatives considered, the environmentally preferable alternative, relevant factors considered in the decision, and mitigation and monitoring requirements.

Reclamation's action relevant to the WSEP is to approve the banking of MID Central Valley Project (CVP) water outside MID's service area in the proposed Madera Ranch WSEP, and the alteration of the 24.2 Canal, a Reclamation-owned facility, as proposed by MID and described in Section 2 of this document. Reclamation owns and operates the CVP, a system of 20 reservoirs and more than 500 miles of major canals and aqueducts. The CVP includes Millerton Lake, contained by the Friant Dam on the San Joaquin River, which provides a portion of MID's water supply.

The Draft EIS for the MID WSEP was distributed for public review and comment on July 24, 2009. This Final EIS includes response to comments received on the Draft EIS in accordance with 40 Code of Federal Regulations (CFR) 1503.4. This Final EIS also discusses an alternative not discussed in the Draft EIS known as the Reduced Alternative B which has been selected as the preferred alternative, also referred to as the Proposed Action. Reduced Alternative B represents a scaled-back version of Alternative B that uses fewer swales in order to minimize effects to vernal pools and limits the number of recharge basins to the number needed for the project to be practicable. It is included in the FEIS as a revision to Alternative B to allow the public to see how the project has been modified, demonstrate how effects have been reduced, and facilitate the Corps use of this document in their permitting of the project.

In accordance with 40 CFR 1501.6, the lead Federal agency shall request that any other Federal agency which has jurisdiction by law be a cooperating agency. In addition, the lead Federal agency will collaborate to the fullest extent possible, with all cooperating agencies concerning issues relating to their jurisdiction and special expertise. To meet this requirement, Reclamation invited and received assistance from the U.S. Fish and Wildlife Service (USFWS) and the U.S. Army Corps of Engineers (Corps) as cooperating agencies. Reclamation provided the Draft EIS to the cooperating agencies for their review and assistance. These agencies will also be provided the Final EIS before its circulation.

1.1 Background

MID encompasses an area of 128,292 acres and delivers water to its service area as part of the Hidden Unit (Fresno River) and Friant Division (San Joaquin River) Long-Term Water Supply contracts with Reclamation. MID operates and maintains a gravity irrigation distribution system of approximately 300 miles of open flow canal systems and 150 miles of pipelines. In addition to the services rendered to the lands within MID, the District conveys agricultural water to the Gravelly Ford Water District (GFWD). MID is also a member of the Madera-Chowchilla Water and Power Authority, which operates and maintains the Madera Canal under an agreement with Reclamation.

The vicinity of Madera Ranch west of the city of Madera, in Madera County, California has long been considered a viable area to operate a water bank because of the aquifer space availability, fast percolation rate, and other characteristics. Other entities have previously explored opportunities to develop a water bank in the area, but for reasons not relevant to this analysis, these proposals were not implemented. These previous efforts, however, presented opportunities from which to learn and were a basis for development of more viable options that ultimately have resulted in MID's current WSEP proposal. MID as the state lead agency approved the WSEP in accordance with the California Environmental Quality Act (CEQA) in September 2005, based on their Final Environmental Impact Report (EIR) (State Clearinghouse #2005031068).

At the time, there was no proposed Federal action. Reclamation commented on the Draft EIR, stating that once MID proposed a Federal action, Reclamation would need to complete and satisfy all NEPA and all other Federal requirements before approving any Federal action.

In November, 2010, MID also adopted its Supplemental EIR to address new information and changed circumstances since the WSEP was approved in 2005. The Supplemental EIR provided updated information on MID's water supply relevant to the San Joaquin River Restoration settlement; updated information and analysis of impacts regarding bank participants, including 10,000 acre-feet (AF) of municipal and industrial (M&I) water users and 10,000 AF of water allocated to environmental users; and updated information and analysis of impacts on biological resources and new mitigation measures to protect biological resources, including special-status species and sensitive natural communities.

The Draft EIS was initiated in response to MID's request that Reclamation approve the banking of MID CVP water outside MID's service area in the proposed WSEP, and the modification of the 24.2 Canal, a federal facility.

The Draft EIS evaluated the potential environmental impacts of the No Action Alternative; Banking CVP Water Outside of the MID Service Area Using Swales and Alteration of Reclamation-owned Facilities; Banking CVP Water Outside the MID Service Area without Swales and Alteration of Reclamation-owned Facilities; and Banking CVP Water Outside the MID Service Area with Banking and Recovery via Gravelly Ford Canal (no alteration of Reclamation-owned Facilities).

MID has been working toward securing federal funds to assist in the cost of purchasing Madera Ranch and construction of the WSEP. In March 2009, Omnibus Public Land Management Act of 2009 (Public Law 11-111; H.R. 146-308) became law. Section 9102 of the law includes the WSEP and thus, has been authorized by the U.S. Congress and is eligible for federal funding. MID is pursuing funding through the appropriations process. MID will continue to pursue additional federal grants.

1.2 Proposed Action

On completion of the Proposed Action MID would bank a portion of their CVP water from the San Joaquin and Fresno Rivers and other non-CVP water in the aquifer underlying Madera Ranch. Water would be banked in the aquifer, and 10% of the water would be left behind to reduce overdraft. The Proposed Action (Reduced Alternative B) would involve two phases. Phase 1 would involve constructing necessary delivery infrastructure improvements (except for the Section 8 canal southwest extension), using select natural swales for recharge (550 acres versus 700 acres as proposed under Alternative B), and installing approximately five soil berms to direct recharge flows. Phase 2 would involve constructing a limited number of recharge basins (323 acres versus up to 1,000 acres under Alternative B) and facilities for recovery of banked water.

Reclamation would approve banking of CVP water outside the MID service area and alteration of Reclamation-owned facilities. Similar to Alternative B, Reduced Alternative B may include funding by Reclamation, under the Omnibus Public Land Management Act of 2009, the Policy and Program Services, Challenge Grant Program: Recovery Act of 2009 Water Marketing and Efficiency Grants, or any other funding source. Regardless of whether this funding is acquired, the project components and associated effects would be the same. A complete description of the Reduced Alternative B can be found in Section 2.

1.3 Purpose and Need

Currently, farmers in MID's service area use a combination of groundwater and surface water. During dry years there is not adequate surface water to meet the water demand and groundwater pumping increases substantially. The amount of groundwater that has been pumped from the aquifer in the vicinity of Madera Ranch has exceeded the amount of water that has recharged the aquifer, resulting in groundwater overdraft. Even in wet years, the groundwater basin is in severe overdraft because groundwater pumping is steadily increasing for agricultural use as well as M&I use. This overdraft has caused the water table to decline and groundwater quality to degrade and has resulted in excess space in the aquifer that could be used to bank surface water.

In the vicinity of Madera Ranch, the water table has declined more than 90 feet over the last 60 years. These conditions have made it increasingly expensive for farmers to pump groundwater. Additionally, in many years, MID has been unable to deliver sufficient surface water to farmers because water is available primarily during the early months of the year when irrigation demand is low, and often water is available only for short periods of time during the growing season.

The purpose of the proposed Federal action is to:

- enhance water supply reliability and flexibility by using the excess aquifer space for surface water storage (water banking);
- reduce existing and future aquifer overdraft;
- reduce groundwater pumping costs;
- increase groundwater quality;
- encourage conjunctive use in the region as a means toward regional self-sufficiency.

1.4 Applicable Regulatory Requirements and Required Coordination

This EIS is intended to fulfill the requirements of NEPA (42 United States Code [U.S.C.] §§ 4321-4370d) and the following statutes:

- Bald and Golden Eagle Protection Act (BGEPA), 16 U.S.C. §§ 668-668d, June 8, 1940, as amended 1959, 1962, 1972, and 1978.
- Clean Air Act (CAA), as amended, 42 U.S.C. §§ 7401-7671p, including 1990 General Conformity Rule;
- Clean Water Act (CWA), 33 U.S.C. §§ 1251-1387;
- Endangered Species Act (ESA), 16 U.S.C. §§ 1531-1544;
- Executive Order (EO) 11988 – Floodplain Management
- EO 11990 – Protection of Wetlands;
- EO 13007 – Indian Sacred Sites
- EO 13112 – Invasive Species; and
- EO 13186 – Migratory Birds
- EO 12898 – Environmental Justice;
- Farmland Protection Policy Act
- Federal Flood Insurance Program
- Memoranda on Farmland Preservation
- Migratory Bird Treaty Act (MBTA), 16 U.S.C. § 703 et seq.;
- National Historic Preservation Act (NHPA), 16 U.S.C.§§ 470-470x-6;

1.5 Public Involvement

- Reclamation published a Notice of Intent to prepare an EIS for the MID WSEP Proposed Action in the *Federal Register* on September 28, 2007.
- Reclamation held scoping meetings on October 22 and October 29, 2007 at MIDs 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.
- Pursuant to NEPA, the Draft EIS was made available for a 60-day public review period from July 24, 2009 to September 25, 2009. A notice of availability of the Draft EIS was published in the *Federal Register* July 27, 2009.
- To provide the public with opportunities to submit verbal and written comments on the Draft EIS, a public meeting was held during the Draft EIS circulation period at the MID Office, 12152 Road 28¼, Madera, California on August 27, 2009. The public comment period on the Draft EIS closed September 25, 2009. Written comments were received from two federal agencies, three state agencies, and four other entities.
- NEPA requires agencies to respond to comments on the Draft EIS that are received during the public comment period (President's Council on Environmental Quality (CEQ) Regulations for Implementing NEPA Section 1503.4). This document has been prepared pursuant to these requirements. Reclamation has considered all the comments received on the Draft EIS and has incorporated changes to Proposed Action based on comments received. Changes are denoted by a line on the right side of the document.

Details for the public outreach process are described in Section 4.

1.6 Regulatory Requirements

Permits and approvals would be required for the Proposed Action from a number of agencies as summarized in Table 1-1.

Table 1-1 Permits/Approvals Required

Agency	Permit/Approval
U.S. Army Corps of Engineers	Section 404 of the CWA permit
U.S. Fish and Wildlife Service	Section 7 of the ESA consultation
Bureau of Reclamation	MP620 permit (a Reclamation Mid-Pacific Region-specific permit issued for additions or alterations to Reclamation-owned conveyance and distribution facilities)
State Historic Preservation Office	Section 106 of the NHPA review
Regional Water Quality Control Board	Section 401 of the CWA certification; General Permit for Storm Water Discharges Associated with Construction Activity (CWA Section 402)
California Department of Fish and Game	Streambed Alteration Permit

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Section 2 Alternatives

2.1 Introduction

A Reduced Alternative B is included in this section. It is now the Proposed Action and is the result of a coordinated effort with the Corps, U.S. Environmental Protection Agency (EPA), USFWS, California Department of Fish and Game (DFG), MID and Reclamation to reduce overall environmental impacts. This alternative would use fewer swales and fewer basins than Alternative B.

This section provides a summary of the alternative screening process; a description of the Proposed Action, the three action alternatives, and the No Action Alternative. This chapter also provides a comparative evaluation of the potential environmental effects of the alternatives; and identifies the preferable alternative. The five alternatives analyzed in detail in this EIS are:

- Alternative A—No Action;
- Alternative B Banking water Outside the MID Service Area Using Swales and Alteration of Reclamation-Owned Facilities;
- Reduced Alternative B (Proposed Action)—Banking CVP water Outside the MID Service Area Using Select Swales and Alteration of Reclamation-Owned Facilities;
- Alternative C—Banking CVP water Outside the MID Service Area Without Swales and Alteration of Reclamation-Owned Facilities; and
- Alternative D—Banking CVP water outside the MID Service Area with Banking and Recovery via Gravelly Ford Canal (no alteration of Reclamation-Owned Facilities).

Table 2-1 Facility Components Associated with Project Alternatives

Component	Alternative B—Swales and Basins	Reduced Alternative B—Reduced Swales and Basins (Proposed Action)	Alternative C—Without Swales	Alternative D—Use of Gravelly Ford Canal
24.2 Canal Improvements	X	X	X	
Section 8 Canal, Cottonwood Creek, and Main No. 1 Canal Connection Upgrade	X	X	X	
Section 8 Canal Upgrades/Extensions	X	X	X (Excluding northern lateral)	X (Excluding new 1.55 mile segment in Section 13 and 14)
Gravelly Ford Canal Upgrade				X
Gravelly Ford Canal Sedimentation Basin and Flow Regulation Area	X	X	X	X
Cottonwood Creek Overflow Improvements	X	X	X	X
Reconditioning of existing ditches	X	X	X	X
Swales	X	X		X
Recharge Basins	X	X	X	
Section 8 Canal Southwestern Lateral Upgrade	X	X	X	X
Gravelly Ford Canal Section 21 Northern Lateral	X	X	X	X
Recharge Basins in Uplands	X	X	X	X
Recovery Wells	X	X	X	X
Recovery Pipelines and Electrical Facilities	X	X	X	X
Recovery Lift Stations	X	X	X	X

2.2 Alternative A – No Action

Under the No Action Alternative, MID would not bank MID CVP water (MID Long-Term Water Service Contract supplies from both the Friant Division and Hidden Unit on Madera Ranch) and Reclamation's delivery canals would not be enlarged (Figure 2-1). The No Action Alternative also excludes any funding by Reclamation, that would be available to the action alternatives, under the Omnibus Public Land Management Act of 2009, the Policy and Program Services, Challenge Grant Program: Recovery Act of 2009 Water Marketing and Efficiency Grants, or any other funding source.

MID may bank non-CVP water via a Warren Act contract with Reclamation on the property, and other limited on-site water banking and recovery facilities may be constructed if MID is able to find participants and funding to support these efforts. MID estimates that under the No Action Alternative, MID could only apply up to 5,000 AF per year (AF/year) of their own non-CVP water, and recovery operations likewise would be limited if Reclamation-owned facilities were not altered. The number of other participants and amount of water they could bring to the project is uncertain. Many participants, even if they bring their own supplies, also would have to obtain Reclamation's approval because banking of CVP water outside CVP contractor's service areas, transfers or exchanges of CVP water would be needed to deliver the water to the property and to recover it. Therefore, without the ability to bank MID CVP water outside MID's service area, the project likely would be infeasible for MID. MID's customers would be subject to continued water supply uncertainty and higher water costs because of a reduced supply and ongoing groundwater overdraft conditions.

If the Proposed Action does not proceed, MID likely would sell the property to other agricultural interests. MID has had numerous offers from prospective buyers, including dairy, orchard, and row crop farmers. The No Action conditions would continue to support agricultural activities. However, the type and extent of the activities are uncertain at this time. Future owners would be subject to compliance with all applicable Federal, State and local laws and regulations and any associated permits and/or approvals.

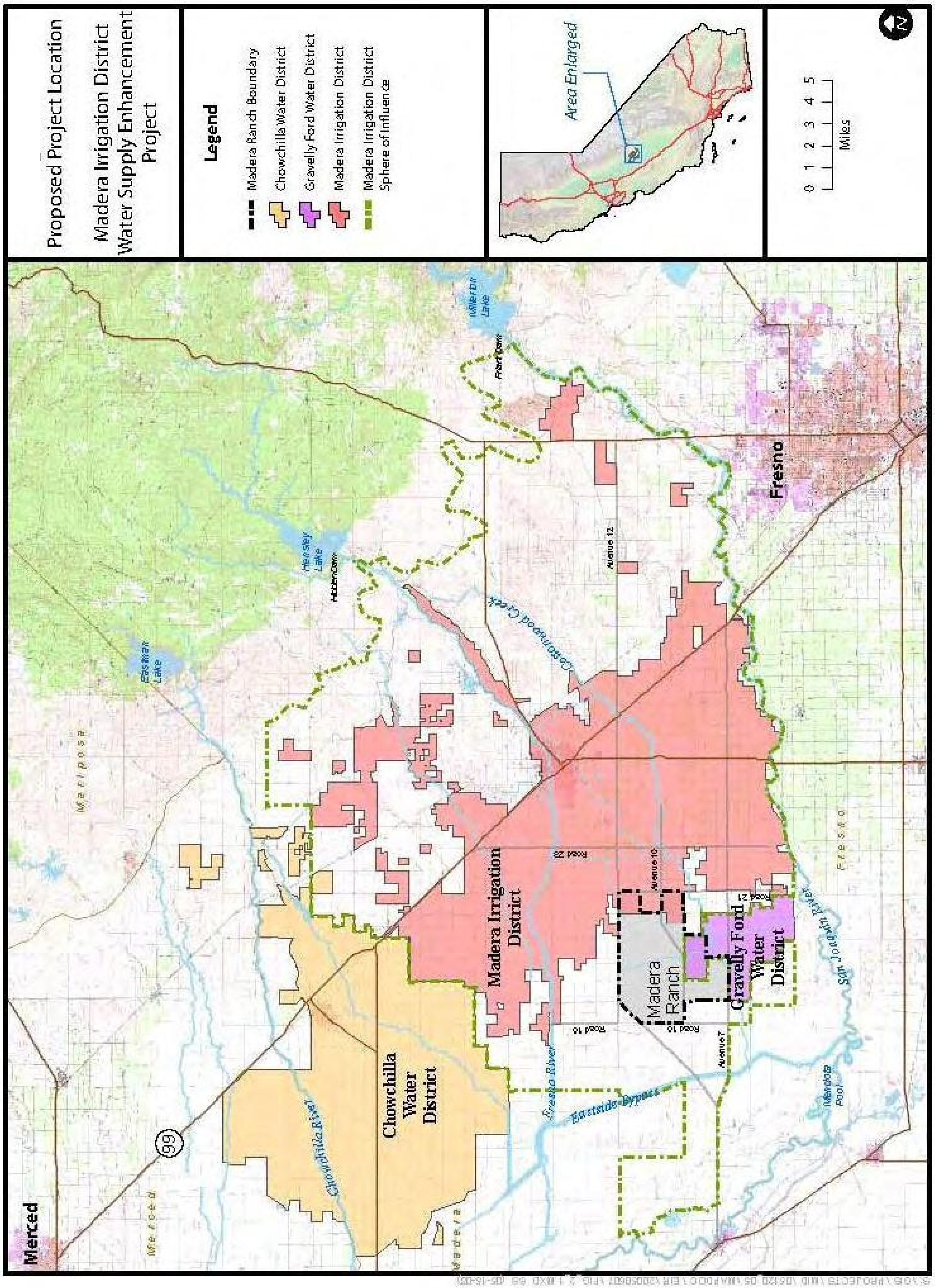

Figure 2-1 Proposed Project Location

2.3 Alternative B – Water Banking Outside MID Service Area Using Swales and Alteration of Reclamation-owned Facilities

Alternative B would be completed in two phases. Phase 1 would involve only recharge-related facilities. Phase 2 would involve supplemental recharge facilities and facilities for recovery of banked water. Reclamation would approve a total banking capacity of up to 250,000 AF of MID CVP water outside the MID service area and issuance of an MP-620 permit (a Reclamation Mid-Pacific Region-specific permit issued for additions or alterations to Reclamation-owned conveyance and distribution facilities) for alterations to Lateral 24.2. After alteration of the Reclamation-owned facilities (Lateral 24.2) and certain MID facilities, MID would be able to recharge and recover a maximum of 55,000 AF annually.

Alternative B also includes funding by Reclamation. MID has been working toward securing federal funds to assist in the cost of purchasing Madera Ranch and construction cost. In January 2009, the U.S. Congress passed the ―Omnibus Public Land Management Act of 2009" (Public Law 11-111; H.R. 146-308). Section 9102 of the Omnibus bill includes the ―Madera Water Supply Enhancement Project, California." Thus, the WSEP has been authorized by the U.S. Congress and is eligible for federal funding in the next budget cycle, in 2011. MID is currently pursuing federal funding through the appropriations process. In addition, MID pursued a grant award through Reclamation's Policy and Program Services, Challenge Grant Program: Recovery Act of 2009 Water Marketing and Efficiency Grants. The grant was not funded. Alternative B components and associated effects would be the same under various funding scenarios.

2.3.1 Phase 1

MID would implement Phase 1 to increase the capacity of existing MID conveyance facilities to deliver water to Madera Ranch facilities. Phase 1 would use primarily natural swales as recharge areas. Phase 1 activities would involve:

- reconditioning and extension of canals to provide at least 200 cubic feet per second (cfs) of conveyance capacity into Madera Ranch;
- construction of approximately 55 acres of recharge basins on current agricultural land to regulate flow, remove sediment, and provide some recharge;
- application of recharge flows to approximately 700 acres of swales; and
- integration of approximately 2,600 acres of Madera Ranch row crops and vineyards into an in-lieu recharge program in which surface water periodically would be served in lieu of groundwater pumping subject to approval by the Madera Ranch Oversight Committee (MROC).

Diversion and Conveyance Facilities

Figure 2-2 depicts the locations of existing canals in the vicinity of Madera Ranch.

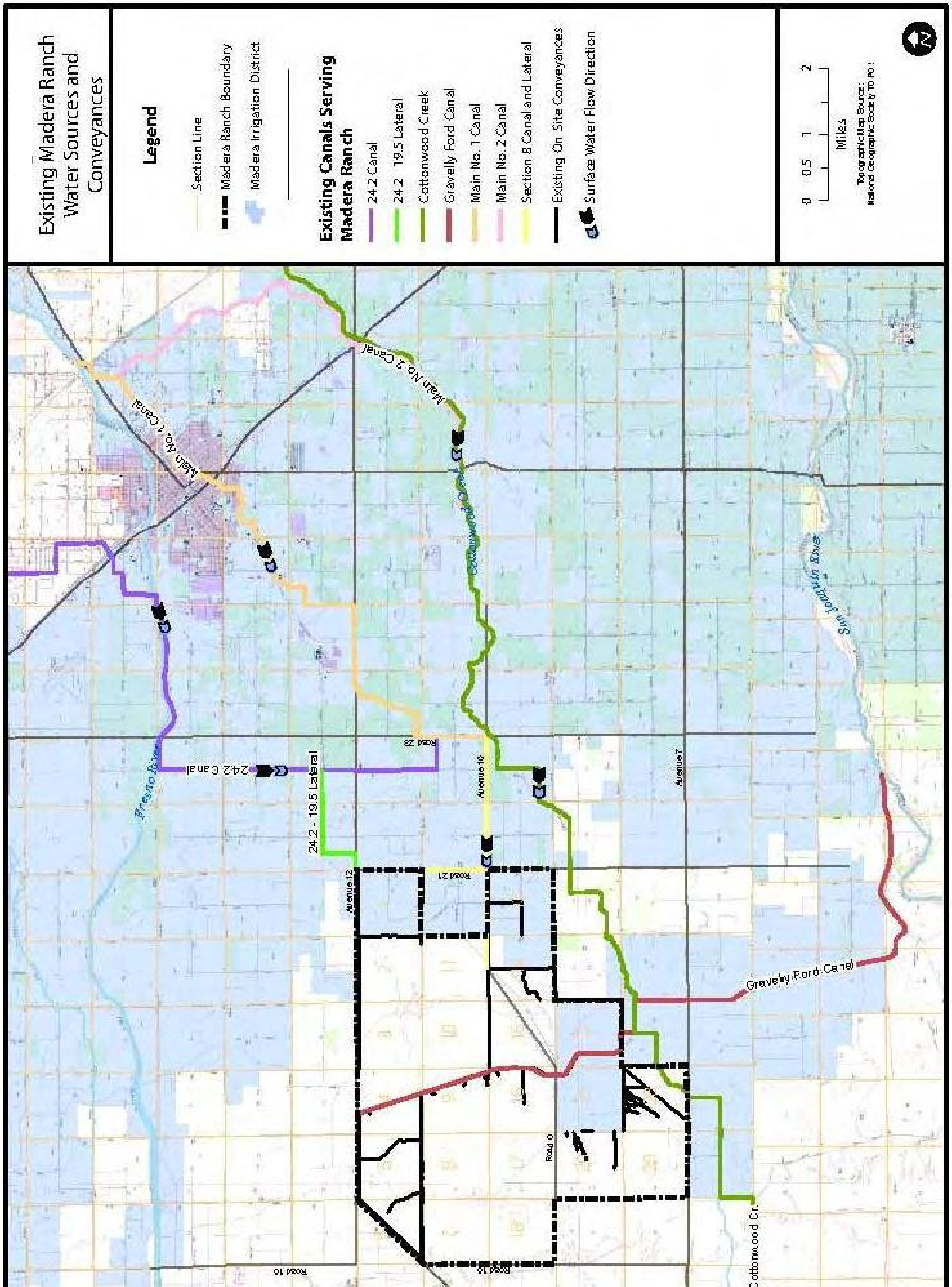

Figure 2-2 Existing Madera Ranch Water Sources and Conveyances

Upgrades to Existing Canals

During Phase 1, MID would upgrade canals to enable gravity delivery of at least 200 cfs into Madera Ranch. Upstream portions of Cottonwood Creek, the 24.2 Canal and the Main No. 1 Canal collectively provide more than 200 cfs of gravity feed conveyance capacity above MID's normal service needs during nonpeak irrigation months, and lesser amounts of capacity during peak irrigation months. However, the portions of these conveyances and the Section 8 Canal within two miles of the ranch are undersized, causing a bottleneck such that the capacity to deliver water to the ranch is less than 100 cfs. Specifically, the confluence of Cottonwood Creek, the Main No. 1 Canal, and the Section 8 Canal, approximately two miles east of the ranch, has a capacity of less than 100 cfs. In addition, the Section 8 Canal running from this confluence into the ranch has a capacity of less than 50 cfs, and the 24.2 Canal, 1.5 miles from the ranch, also has a capacity of less than 50 cfs and does not tie into the Section 8 Canal.

The following sections summarize how these and other conveyances would be upgraded to provide up to 200 cfs delivery capacity to and from Madera Ranch.

Reclamation Conveyance Facilities

MID would extend the Reclamation-owned earthen 24.2 Canal approximately 0.75 mile south to connect with the Section 8 Canal (Figure 2-3). The connector would be a buried pipeline, not an open canal. In addition, approximately 1.75 miles of the southern portion of the existing 24.2 Canal would be widened and deepened to accommodate 100 cfs of flow. In total, the extension pipeline and canal enlargement would involve moving approximately 36,000 cubic yards (cy) of soil. MID would acquire additional easements and fee title for canal expansion.

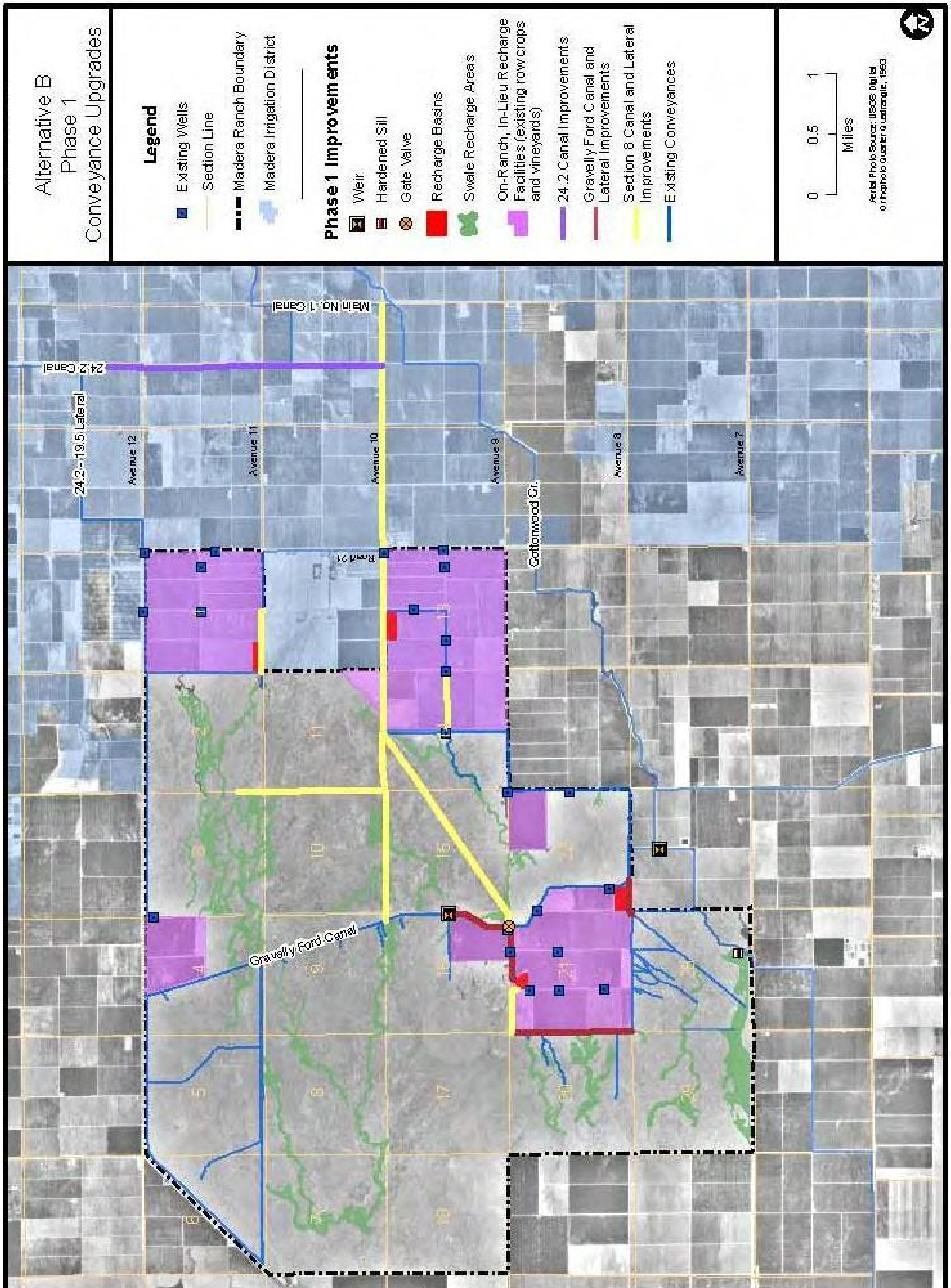

Figure 2-3 Alternative B Phase 1 Conveyance Upgrades

MID Conveyance Facilities

Section 8 Canal, Cottonwood Creek, and Main No. 1 Canal Connection Upgrade The existing connection between the Section 8 Canal (an earthen ditch built in the late 19th century), Cottonwood Creek, and Main No. 1 Canal would be widened and deepened to accommodate 100 cfs of flow. Only the connection would be widened; Cottonwood Creek would not be widened as its capacity is sufficient to meet the needs of the alternative. Work would be performed in an approximately 500-foot-long and 100-foot-wide area, requiring a temporary construction easement of 1.2 acres from neighboring landowners. No new permanent easements would be required.

Section 8 Canal Upgrade An approximately 1.75-mile segment of the earthen Section 8 Canal (from Road 23 to within approximately 0.25 mile of the Madera Ranch boundary at Road 21) would be reconstructed to expand from one-way, 50-cfs capacity to two-way (flat bottomed), 200-cfs capacity (Figure 2-3). The 1.75-mile segment of the canal from 0.25 mile east of the ranch, along the north side of Section 13 and to the western edge of ranch row crop land on the north side of Section 14, would be replaced with an approximately 1.75-mile-long, 84-inch reinforced concrete pipe (RCP), 200-cfs (two-way) pipeline placed within the channel of the existing canal.

During construction, Avenue 10 would be closed temporarily (local traffic only) to allow work on the canal. To expand the canal, an additional 40-foot corridor would be required, for a total of 8.9 acres of easement or fee simple ownership. The last 0.25 mile of the west end of the canal off-ranch would be carried in concrete pipe buried in the existing canal such that additional right-of-way would not be needed. A 40-foot-wide temporary construction easement may be required for this last 0.25 mile off-ranch (resulting in an easement of 1.2 acres). In total, this reconstruction involves moving approximately 76,000 cy of soil.

Section 8 Canal Western Extension A new, approximately 1.55-mile-long, 50 to 60-cfs earthen ditch would be constructed within a paved road in Sections 14 and 15 from the new Section 8 Canal pipeline to the Gravelly Ford Canal (GF Canal). The ditch would be constructed within the existing leveled shoulder (Figure 2-3). In total, this construction involves moving approximately 18,000 cy of soil.

Section 8 Canal Southwestern Extension Sections 14 and 15 are bisected diagonally by a 30- to 40-foot-wide, dirt farm road that was previously a ditch. A new approximately 1.8-mile-long, 20-cfs earthen ditch would be constructed from the new Section 8 Canal pipeline, along the shoulder of this road and to the GF Canal (Figure 2-3).

Section 8 Canal Northern Extension Sections 10 and 11 are divided by a 20- to 40-foot-wide dirt farm road bordered by the remnants of a ditch. A new approximately 1.2-mile-long, 20- to 50-cfs earthen ditch would be constructed along the alignment of the old ditch (Figure 2-3). In total, this construction involves moving approximately 14,000 cy of soil.

Section 8 Canal Section 14 Lateral Extension An existing Section 8 Canal lateral (20 cfs) that flows across Section 13 would be extended approximately 0.5 mile across Section 14 (Figure 2-

3). All work would be performed along the edge of row crop land. In total, this construction involves moving approximately 2,800 cy of soil.

Section 8 Canal Section 1 Lateral Extension An existing Section 8 Canal lateral (20 cfs) that flows east-west along the southern side of Section 1 would be extended approximately 0.5 mile to the southwestern corner of Section 1 (Figure 2-3). All work would be performed along the edge of row crop land.

Gravelly Ford Canal Sedimentation Basin and Flow Regulation Area With GFWD's permission, an approximately 3,000-foot-long segment of the GF Canal on the southeastern side of Section 16 would be equipped with a weir/control structure on the north side to allow use of the channel as a combined recharge area, sedimentation basin, and flow regulation area.

Gravelly Ford Canal Flow Control Weir at Cottonwood Creek With GFWD's permission, a new weir would be installed on the GF Canal approximately 1,000 feet south of Section 22 where the canal intersects and shares a channel with Cottonwood Creek. All work would be performed in the existing artificial channel and on adjacent farm roads.

Gravelly Ford Canal Section 21 Northern Lateral A new approximately 0.45-mile-long, 20- to 50-cfs earthen ditch would be constructed along the northern side of Section 21 from the GF Canal to a Phase 1 recharge basin located on farmland (Figure 2-3).

Gravelly Ford Canal Section 21 Western Lateral A new approximately 1-mile-long north/south canal would be constructed along the western side of Section 21 off of an existing 20- to 50-cfs earthen ditch bordering the southern side of the section. The new canal would be constructed on the shoulder of a dirt farm road bordering row crop land in Section 21 (Figure 2-3).

Gravelly Ford Canal Section 22 Southern Lateral A new approximately 0.28-mile-long, 20- to 50-cfs earthen ditch would be constructed along the southern side of Section 22 from the GF Canal to an existing ditch (Figure 2-3).

Cottonwood Creek Overflow Improvements A hardened sill (compacted or armored material with low potential for erosion) would be constructed on the existing Cottonwood Creek berm to protect the berm and to accommodate flow measurements. Sections 28 and 29 are inundated by Cottonwood Creek uncontrolled flows regularly during wet springs. These uncontrolled flows generally are prevented from flowing onto Avenue 7 by an earthen berm that runs along the southern boundary of Section 28 and north along the western boundary of Section 29.

Reconditioning of Existing Canals and Ditches Reconditioning would involve reconditioning GF Canal (described below), replacement of turnout gates (described below), brush removal, repair of berms that have been worn down over time, reconstruction of segments that have been filled by recent farm operations, and installation of farm road crossings as required.

Gravelly Ford Canal GF Canal is an earth-lined flat-bottom channel that conveys irrigation water from the San Joaquin River to Madera Ranch. Project elements affecting GF Canal include:

- Construction of a new weir structure and lift station (GF Canal sedimentation basin and flow regulation area as described above);
- Grading approximately 2.6 miles of the canal back to original design contour and capacity;
- Installing approximately three to five new turnouts;
- Replacing approximately two to three old turnouts; and
- Installing one flow monitoring station.

Gravelly Ford Canal Reconditioning GF Canal would be reconditioned north of the new weir and lift station to Avenue 12 (2.6 miles). Material that has eroded from the banks and settled in the bottom of the canal would be used to reform the banks of the canal. A grader and scraper would be used in the canal bottom to recontour the canal. Approximately 16,000 cy of dirt would be moved to reshape the existing berms of the canal.

Gravelly Ford Turnouts Approximately two new east berm turnouts would be installed to deliver water into the recharge areas. Three west berm turnouts would be replaced and three new west berm turnouts would be constructed (one to a recharge basin in agricultural lands, one gate structure to a new lateral canal system constructed in uplands, and one to an upland recharge areas). A flow monitoring station would also be installed. Each turnout is approximately 3-feet wide by 6-feet long by 6-feet tall and is/would be buried in the existing banks of the canal. The turnouts are constructed off-site at MID headquarters. Construction of the turnouts would require excavating approximately 32 cy of soil and the addition of 3 cy of fill material to install a gate and compact the soil adjacent to it.

Recharge Facilities

Recharge Basins Phase 1 would involve construction of approximately 55 acres of basins, approximately two basins that are 1,100 feet square, as shown in Figure 2-3 on agricultural land in order to:

- help regulate flows,
- allow settling of sediments before application of water to swales, and
- provide some recharge capacity.

The preliminary locations of four Phase 1 recharge basins are entirely on current agricultural land in Sections 1, 13, 21, and 22. The basins would be designed with 1.5:1 to 2:1 interior side slopes and average depths of four to five feet and surrounded by low earthen dikes created from the dirt excavated from the basin. Construction of the Phase 1 recharge basins could involve the movement of approximately 444,000 cy of soil.

Swale Recharge Areas Alternative B would entail diversion of water into approximately 700 acres of swales. The water would be conveyed to Madera Ranch through the existing and upgraded MID conveyances and to the swales through the existing, rehabilitated, and new ditches described above. At the head of each swale, a manually operated farm turnout (equipped with a gate valve and totalizing flow meter) would be installed to regulate and measure the flow into each swale. Several turnouts currently exist on GF Canal and these would be replaced and several new ones would be added. Flows at each turnout, based on pilot studies, would be no greater than 20 cfs and would average five cfs at the turnout. Maximum overall flows would be around one cfs per acre of application. Locations of the swales anticipated to be used during Phase 1 are depicted on Figure 2-3.

In-Lieu Recharge Facilities Madera Ranch includes 2,666 acres of row crops and vineyards that are irrigated entirely by a system of 23 wells. MID would recondition existing turnouts and install new turnouts under the Alternative B canals, pipelines, and ditches to enable delivery of surface water to these fields in lieu of groundwater pumping (Madera Irrigation District 2008).

These agricultural fields were purchased from MID in July 2008 by Grimmway Enterprises, Inc. Grimmway will continue to manage the property for agricultural uses. However, MID has retained rights to existing and future easements that would allow this Alternative to be implemented.

2.3.2 Phase 2

Phase 2 would expand the areas used to recharge, develop wells and piping to recover the banked water, and install pumps to deliver the recovered water as shown in Figures 2-4 and 2-5.

Phase 2 activities for recharge and recovery facilities would involve:

- additional upgrades to existing canals,
- construction of up to 1,000 acres of new on-site recharge basins and canals as required to supplement Phase 1 facilities and achieve 200 cfs of recharge capacity (if required),
- use of up to 15 existing wells for recovery,
- installation of up to 49 new wells and recovery pipelines (in phases over several years) to provide 200 cfs of recovery capacity, and
- installation of up to 12 lift stations on MID canals and one lift station on GF Canal (in phases over several years) to provide 200 cfs of pump-back capacity into the MID service area.

Upgrades to Existing Canals

Section 8 Canal Southwestern Lateral Upgrade The 20- to 50-cfs, Phase 1 earthen canal running diagonally across Sections 14 and 15 would be partially replaced with an approximately 1.75-mile-long, 72-inch to 84-inch RCP, 135- to 200-cfs (two-way) buried pipeline. The pipeline would extend from the Phase 1 Section 8 Canal upgrade (200-cfs pipeline) to the GF Canal beneath an existing 30- to 40-foot-wide dirt farm road (Figure 2-4).

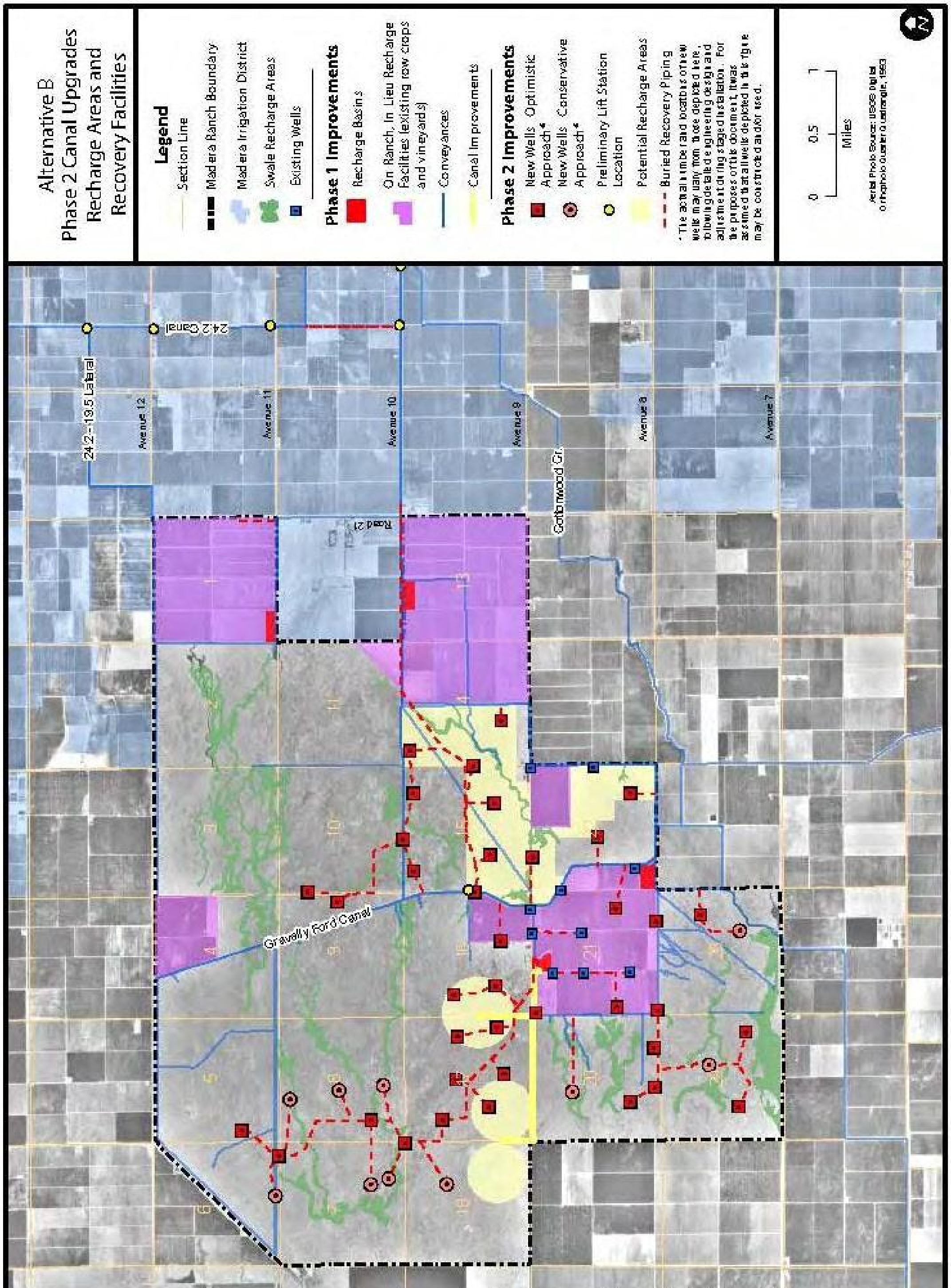

Figure 2-4 Alternative B Phase 2 Canal Upgrades, Recharge Areas, and Recovery Facilities

Gravelly Ford Canal Section 21 Northern Lateral The 0.45-mile-long Phase 1 ditch along the northern side of Section 21 would be replaced with an approximately 2.1-mile-long, 135-cfs, east-west earthen lateral canal along the north side of Sections 21 and 20 with two north-south sub-lateral canals running northward along the east and the west sides of Section 17.

Depending on the recharge basin acreage and construction methods up to 3.2 miles of 20- to 100-cfs earthen ditches would be constructed within the Phase 2 recharge basin area to distribute water into recharge areas.

Recharge Facilities

Depending on the performance of Phase 1 recharge facilities, up to approximately 1,000 acres of recharge basins may be constructed within a 1,300-acre area. Following pre-construction surveys as outlined in the Environmental Commitments, MID would begin construction of the basins. The following steps to construct recharge basins may occur, but would be dependent on final agency permits.

- *Stage 1:* Berming of recharge area boundaries along topographic contours using farm roads wherever possible and farm grading techniques, but no excavation (similar to unleveled rice fields).
- *Stage 2:* Deep ripping of corridors within the bermed areas, interspersed with corridors of undisturbed land.
- *Stage 3:* Excavation of basins varying from four to five feet deep.

The final number of recharge basins constructed and techniques summarized above is uncertain, and the highest estimated acreage is highly unlikely to be required. This EIS evaluates the potential effects associated with up to 1,000 acres of excavated basins. Recharge basins would be clustered in sets of three or four varying in size from 5 to 80 acres, with the first basin constructed in each set serving as both a settling and a recharge basin.

Construction of the recharge basins and internal routing ditches could involve the moving of up to approximately 7.7 million cy of soil. Basins would be designed with 1.5:1 to 2:1 interior side slopes and average depths of four to five feet. Low earthen dikes would be constructed around the recharge basins using excavated materials. Topsoil would be segregated during excavation and respread over the berm and construction disturbance areas to promote reestablishment of vegetation.

Recovery Facilities

Recovery Wells Banked water would be recovered using up to 15 existing wells and approximately 49 new wells, as shown in Figure 2-4. Wells would be placed, whenever possible, at locations that could be accessed by existing farm roads and at least 0.25 mile within the interior of the Madera Ranch boundary. The wells would be connected via a manifold to a buried pipeline, and a canal and lift station system would deliver the water back to MID.

Recovery Pipelines and Electrical Facilities Up to 11.6 miles of 8-inch- to 60-inch-diameter polyvinyl chloride (PVC) to RCP buried recovery pipelines, as shown in Figure 2-4, would run from recovery wells to the GF Canal and the Section 8 Canal for delivery back to farmers. The recovery pipelines would be buried 2–3 feet beneath the ground surface. Electrical lines servicing the electrical well pumps would be placed in the same trenches as the recovery pipelines to minimize disturbance and to ensure that all electrical lines are placed below grade. The recovery pipelines would be constructed during the same stage of project development as the well construction.

Recovery Lift Stations The MID delivery system is currently all gravity feed from east to west. In order to deliver up to 200 cfs from the recovery wells to MID's customers, up to 13 lift stations would be required on the same conveyances used to deliver water into the water bank, as depicted in Figure 2-5.

- *Stage 1:* One lift station would be constructed along the GF Canal to pump water recovered from wells on the west side of Madera Ranch. Four lift stations with capacity stepping downward from approximately 100 cfs to 80 cfs would be constructed on the 24.2 Canal.
- *Stage 2:* Six lift stations with capacity stepping downward from approximately 100 cfs to 80 cfs would be constructed on Cottonwood Creek and Main No. 2 Canal.
- *Stage 3:* After several years of operation, up to two additional lift stations may be added to the upper reaches of the Main No. 2 Canal as dictated by the required additional level of delivery.

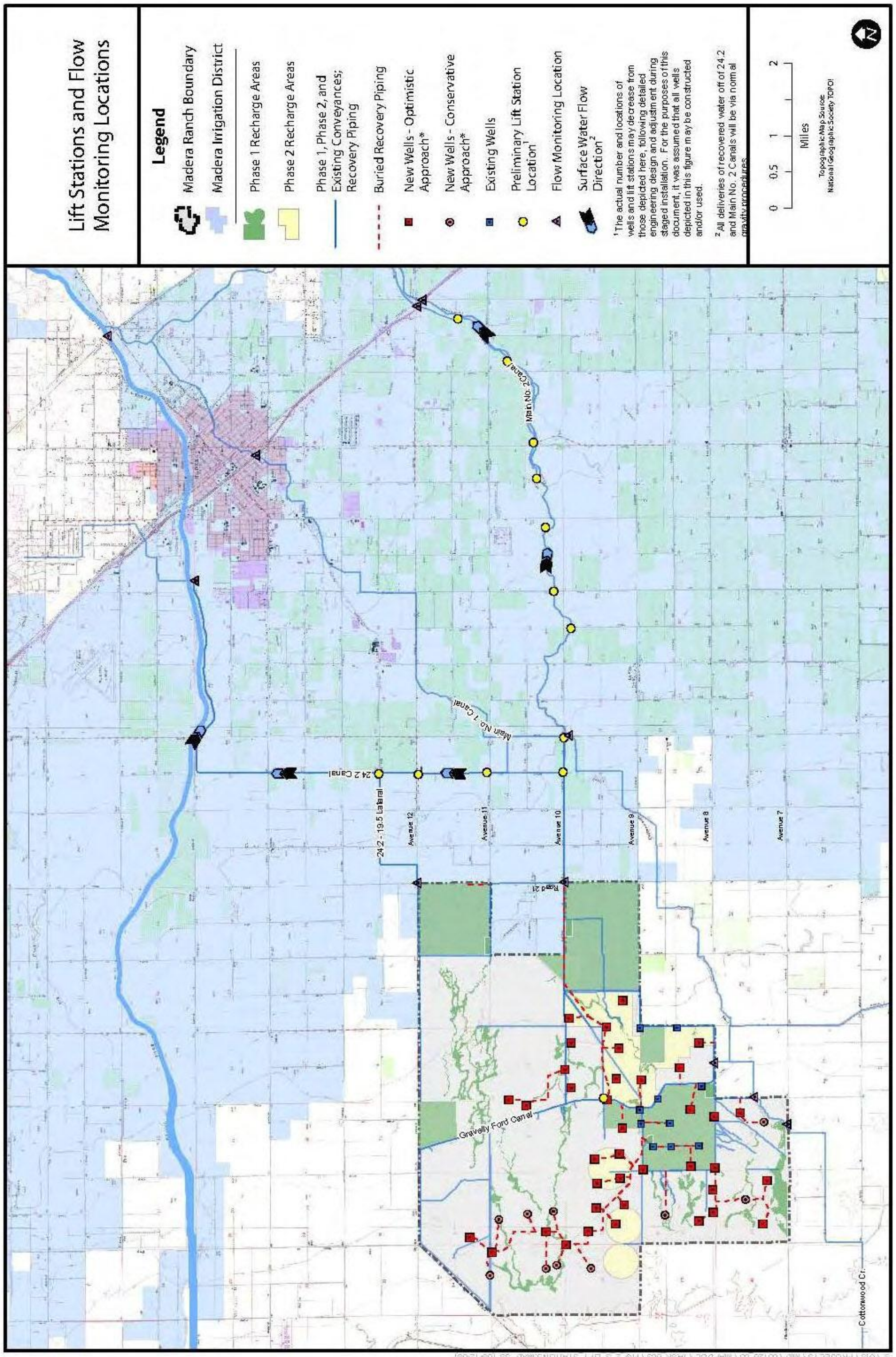

Figure 2-5 Lift Stations and Flow Monitoring Locations

2.3.3 Construction

The following construction activities would be similar for all action alternatives unless specified under a particular alternative.

Conveyance Facilities

Upgrade of Section 8 Canal, Cottonwood Creek, and Main No. 1 Canal Connection   The connection between the Section 8 Canal, Cottonwood Creek, and Main No. 1 Canal would be widened and deepened to accommodate 100 cfs of flow. Upgrading the connection would involve the following steps:

1. Draining the canals.
2. Excavating mud or silt from the bottom of the canals, and storing the wet material on site or transporting it to a storage site.
3. Excavating the canals to a sufficient width and depth to provide adequate capacity.
4. Transporting the excavated material to Madera Ranch for use as fill required by other proposed construction.
5. Installing piping for road crossings.

Water to control fugitive dust emissions would be supplied by a water truck. An excavator and dump truck would be required. Approximately 12 people would be employed during the upgrade of the connection.

Section 8 Canal Upgrade   Phase 1 construction would involve installation of approximately 1.5 miles of 84-inch diameter RCP on Madera Ranch and an additional 0.25 mile of 84-inch RCP immediately east of Madera Ranch, all in the channel of the existing Section 8 Canal. Installation of the pipeline would involve the following steps.

1. Draining the canal.
2. Excavating mud or silt from the bottom of the canal, and storing the wet material on site, or transporting it to a storage site. The material would be used to backfill the excavation, if suitable. The stored mud or silt would not be placed on wetlands.
3. Excavating the canal to a sufficient depth to provide adequate cover over the RCP, and preparing the pipe bed.
4. Transporting the pipe to the site on low-bed trucks. Unloading and stringing the pipe together using a large crane or large forklift.
5. Setting the pipe into the trench with the crane.
6. Placing backfill around the pipe using front loaders and a bulldozer.
7. Compacting the material around the pipe with an excavator-mounted compacting wheel. Compacting material above the pipe with a vibrating sheepsfoot roller.
8. Finishing the grade over the pipe with a motor grader.
9. Crossing in an area with steep banks. Both crossings would also require Section 404 permits from the Corps.

Water to control fugitive dust emissions would be supplied by a water truck. A gang truck and two or more pickup trucks would be required during pipe laying. Approximately 12 people would be employed during the installation of the pipeline. Installation of the 84-inch RCP temporarily would affect an area of approximately 32 acres adjacent to farmland.

Off-Ranch Canal Expansion and Extension Several reaches of the Section 8 Canal (1.75 miles), the 24.2 Canal (1.75 miles), and the Main No. 1 Canal (500 feet) would need to be expanded to increase their capacities to 200 cfs, 100 cfs, and 100 cfs, respectively.

Canal expansion would employ methods, equipment, and labor similar to the conveyance upgrades discussed above (see Upgrade of Section 8 Canal, Cottonwood Creek, and Main No. 1 Canal Connection). Temporary construction activities would affect about 53 acres. Additionally, MID would extend the 24.2 Canal approximately 0.75 mile to the south through a new pipeline to connect with the Section 8 Canal. Canal extension would employ methods, equipment, and labor similar to canal construction and pipeline installation. Temporary construction effects associated with extension of the 24.2 Canal would affect about nine acres.

On-Ranch Canal Extensions Existing on-ranch canals would be extended to deliver water to the recharge areas. Approximately 7.5 miles of canals would be extended on Madera Ranch. Extending the canals would involve the following steps.

1. Excavating the canal using an excavator or a Briscoe ditching machine pulled by a tractor.
2. Placing fill material for the canal embankments. Every effort would be made to balance cut and fill so that no import of material is necessary. Spoil material can be placed in the embankments.
3. Compacting the embankments using a vibrating sheepsfoot roller.
4. Finishing canal and embankment shaping with a diesel-powered, rubber-tired Gradall and motor grader.

Moisture for compaction of embankments would be applied from a water truck. The water truck also would provide dust control. A gang truck and two or more pickup trucks would be required to support canal construction. Approximately 10 people would be employed during canal construction. The area temporarily affected by canal extension would be approximately 81 acres on Madera Ranch.

On-Ranch Canal Reconditioning A diesel-powered, rubber-tired Gradall excavator; a Briscoe ditching machine pulled by tractor; and a diesel-powered, rubber-tired backhoe/front end loader would be used for reconditioning ditches and cutting farm road crossings within Madera Ranch.

Weir Installation Two weirs would be installed on GF Canal. Construction of the weirs would involve the following steps.

1. Clearing and grubbing the site with a motor grader and backhoe.
2. Excavating for the structure with an excavator.
3. Constructing wooden forms for the structure. Installing reinforcing steel bars within the forms.

4. Placing concrete from ready-mix trucks. A concrete pump may be used if necessary. Finishing the concrete surfaces and applying curing compound. Allowing the concrete to cure. Removing the forms and repairing the surface as necessary.
5. Placing backfill around the structure with a front end loader. Compacting the backfill with hand whackers.
6. Finishing the grade with a motor grader.

A pickup truck and a flatbed truck would be required to haul materials during construction. Approximately five people would be employed during construction. The areas temporarily affected by construction would be about 1 acre.

Recharge Facilities

Recharge Swales (Phase 1) Phase 1 recharge swales would remain unaltered and would not be subject to any construction activities.

Construction of Recharge Basins (Phase 2) The following staging may occur, but would be dependent on final agency permits.

- *Stage 1:* Berming of recharge area boundaries along topographic contours and using farm roads wherever possible. These recharge areas would be constructed using graders that follow prestaked topographic contours to raise 1- to 3-foot-high berms around the downslope portions of areas ranging from five acres to 80 acres. Berm material would be obtained from an approximate 50-foot-wide corridor parallel to the interior toe of the berm. Topsoil would be segregated during excavation and respread over the berm and construction disturbance areas to promote reestablishment of vegetation.
- *Stage 2:* Deep ripping of corridors within the bermed areas, interspersed with corridors of undisturbed land. This would be done to ensure deeper percolation is maximized during project operation.
- *Stage 3:* Excavation of basins varying from four to five feet deep. Because of the demonstrated permeability of soils at Madera Ranch, Stage 3 recharge basins are unlikely to be required. However, in the event these basins were used, they would be clustered in sets of three or four varying in size from five acres to 80 acres, with the first basin in each set serving as both a settling and a recharge basin. Basins would be designed with 1.5:1 to 2:1 interior side slopes and average depths of four to five feet. After excavation, each basin would be shallow-ripped or disked by construction equipment in order to break up compaction of the bottom soils in the recharge basin. Low earthen dikes would be constructed around the recharge basins using excavated materials. Topsoil would be segregated during excavation and respread over the berm and construction disturbance areas to promote reestablishment of vegetation. Excess soil removed during excavation would be managed to ensure that top layers are stockpiled, excavated soils would be mounded between basins, and stockpiled topsoil would be placed on top of the soil pile.

It is estimated that Stage 3 recharge basins would be constructed using:

- three to 20 heavy diesel-powered scrapers (40- to 60-yard capacity);
- three to five 500-horsepower (hp) diesel-powered skip loaders;

- 15 to 30 heavy-duty, off-road-type trucks (60-yard capacity);
- three to five large, diesel-powered, crawler-type tractors; and
- three to five diesel-powered motor graders.

The final combination of the acreages and techniques summarized above is uncertain. However, as previously discussed, this EIS evaluates the potential effects associated with 1,000 acres of Stage 3 excavated basins.

Recovery Facilities

Recovery facilities include recovery wells, pipelines, and lift stations.

Construction of Recovery Wells The recovery wells would be constructed by drilling to a depth of approximately 300–320 feet below ground surface. The wells would be gravel-packed between the casings and bore holes to maximize efficiency. Construction techniques would involve drilling, flushing, development, and testing to maximize well efficiency and longevity. The screen opening size, screen length, and screen depth of each well would be determined in the field by a registered geologist.

Drill rigs would use portable steel mud pits rather than excavated pits to reduce effects on surrounding habitat. Drilling water would be trucked in to most drill sites and stored in portable tanks. Two small berms would be used to control accidental spills during drilling operations, as required by Occupational Safety and Health Administration. A small berm would be constructed with a small front loader around the perimeter of the 100-foot-by-100-foot temporary construction area. Another berm would be constructed around all drilling equipment, and the area inside the berms would be lined with tarps to contain accidental spills of fuels, lubricants, and drilling effluent. These berms would be constructed of local materials. After drilling is completed, all equipment and fluids would be disposed of in a lawful manner; the berms would be leveled, and the sites would be restored to near preconstruction condition.

Each new well would be equipped with a line-shaft-driven, deep-well turbine pump typical of agricultural pumps. Each wellhead would be fitted with an electric motor, controls, valves, and individual water meters and would be mounted on a concrete slab, approximately five feet by five feet, to stabilize and seal the well and provide a stable foundation for the motor, controls, and piping. The new pumps could be driven by 25- to 200-hp electric motors. Electricity would be supplied to the wells through underground electrical cable adjacent to the collection pipeline. A transformer, switchgear, and control cabinet would be constructed adjacent to each well on a concrete slab, approximately six feet by 14 feet. Each well would be fenced within an enclosure of approximately 600 square feet to allow most areas of Madera Ranch to continue to be grazed by cattle. Well maintenance is described in the Maintenance section.

Five of the existing wells to be used for recovery are currently powered by diesel engines, and nine of these wells are powered by electric motors. These operations could be changed so that all recovery wells could be powered by electric motors, but the assumption is that existing propane powered pumps could remain and that new pumps could be propane gas–powered. Installation of each well would temporarily affect an area of approximately one acre, and each facility would permanently affect about 0.1 acre.

Installation of Recovery Pipelines The recovery pipelines would be constructed by trenching rectangular ditches wide enough to lay the pipe. Trenching would be performed by backhoes, track hoes, or trenching machines. Soil would be temporarily sidecast within the construction corridor and pushed back into the trench once the pipeline is in place. Backfill would be compacted using a vibrating sheepsfoot roller. Piping would be of manufactured materials, such as PVC or polyethylene, with the exception of steel pipe at the wellheads and RCP for larger diameters approaching 60 inches. Pipeline installation would temporarily disturb about 140 acres.

Construction of Recovery Lift Stations Lift stations would consist of reinforced concrete check structures with pumping equipment to reverse flow. The gates would allow control of flows of surface water to Madera Ranch and would be closed to accommodate reverse flows when recovered water is being pumped back to MID's customers.

Construction of the structures would require excavation of the site, erection of forms, installation of steel reinforcement and embeds, placement of concrete, stripping of forms, concrete patching, placement of backfill around the structure, and compaction of the backfill. Material from the structural excavation would be used for backfill after being conditioned to attain the proper moisture content.

Discharge piping would be installed for connection to the pumps. The pump connection would be aboveground, and the discharge to the canal would be underground for discharge below the water level. A trench would be excavated for the buried portion of the piping. The pumps would require installation of structural steel beams and grating, mounting of the pumps and drivers, and installation of electrical wiring and controls.

Required equipment would include an excavator, a backhoe, a water truck, a pickup truck, vibrating plate compactors, concrete ready-mix trucks, a compressor, a generator, a boom truck or crane, and an electrician's truck. Labor would require, at various times, a superintendent, carpenters, steel workers, laborers, operators, and electricians. The maximum crew probably would not exceed 12 persons.

Lift stations would be constructed in three phases, requiring about 90 to 120 days for each phase. Each lift station would require a work area of about 0.25 acre that would be disturbed during construction. The final area occupied by the structure would be about 2,500 square feet. The total area permanently affected by the lift stations would be less than 1.2 acres.

Staging Areas

MID would use its existing off-ranch facilities for the long-term storage and maintenance of materials and equipment. However, Madera Ranch has a central headquarters area with equipment laydown areas and storage buildings. MID would use these facilities as needed to store equipment and materials that would be used to construct, maintain, and operate this Alternative.

Construction Traffic

The primary transportation corridors to Madera Ranch would be State Route (SR) 99, Avenue 7, and Avenue 12 (Figure 2-1). The majority of the vehicle trips generated by Alternative B most likely would originate in Madera and Fresno, proceeding up SR 99 to either the Avenue 7 or the Avenue 12 exit, then to Road 23, Road 21, and Avenue 10, where traffic would enter Madera Ranch.

2.3.4 Maintenance

Maintenance Corridors

The maintenance corridors would include new roads in the recharge basin area and areas with heavy disturbance, and unimproved routes in grassland areas. The maintenance corridors would be configured to take advantage of existing farm roads, fence lines, farmed areas, and recharge basin areas. Maintenance corridors through undisturbed grassland areas would not be graded or gravel-packed.

Diversion and Conveyance Facilities

Maintenance of the Section 8 Canal, Cottonwood Creek, the 24.2 Canal and Main No. 1 Canal would be consistent with maintenance of most water infrastructure in the San Joaquin Valley. Channels would require cleaning every several years. Each channel would be cleaned using mechanized dredging. The dredged material would be disposed of in a lawful manner. Cleaning would be scheduled during periods when the canal is not in operation. Banks of channels would be kept clear of brush and trees, and small mammal burrows would be filled to minimize erosion of the channel banks.

Maintenance of the on-ranch conveyance ditches and canals also would be consistent with that of most water infrastructure in the San Joaquin Valley. Pumps, gates, and appurtenances would be serviced when they are not operating to keep the system in top condition. The exterior canal slopes would be kept clear of large brush and trees, but grass and small shrubs would be acceptable as long as the root systems do not compromise the interior canal lining. Noxious weeds and brush would be removed to prevent them from becoming established on nearby cropland. Canals and ditches on MID property would be unlined but would be kept clear of vegetation. Mechanical removal and permitted herbicides would be used to control unwanted vegetation. Any evidence of small mammal burrows would be monitored and burrows filled in to reduce the possibility of damage, leakage, and potential collapse of canal banks. Maintenance roads parallel to the canals and ditches would have all-weather surfaces; vegetation would be controlled.

Access to canal bottoms would be by intermittent ramps that would allow mechanical equipment access into the canals for cleaning. Deeper sections of canals would be cleaned using small mechanical equipment such as rubber-tired front-end loaders or ―bobcats." Materials removed from the canal bottoms would be disposed of by legal means, including spreading on farmland as allowed or on the maintenance areas of the groundwater bank property. Shallow sections of canals or ditches may be cleaned out using Gradall excavators that would work from access roads. The frequency of cleaning operations would be determined by what is necessary to maintain reasonable flow regimes in the canals.

Recharge Facilities

Recharge swales and basins would stand idle during dry years, when water is not available for banking. No maintenance would be performed in swales during these times, but recharge basins may be scarified as described below. During operation of recharge basins, it may be necessary to apply algaecide or other chemicals to keep vegetation in check and to minimize algae growth. Algaecides would not be used within natural swales used for recharge. Basin operation would require infrequent delivery of miscellaneous repair equipment, usually in smaller trucks such as non-semi, three-axle rigs. On average, after five years of actual use, basin bottoms would be scarified to remove the thin layer of low impermeable material that would develop over time. Other maintenance activities would be conducted as necessary.

Recovery Facilities

Recovery Wells Wells, meters, pumps, and appurtenances would be maintained during periods when recovery is not in progress to allow ready startup when a bank participant requests water. The wells are expected to run for up to five operating years before needing maintenance or repair. The well pumps are expected to operate for at least 10 years before requiring maintenance or repair. When a pump needs to be removed, a ―pump rig,” consisting of a truck-mounted boom designed to easily remove deep well pumps, would be brought in and backed up to the wellhead. The well discharge head and pump column, normally in 20-foot lengths, would be removed and ―laid by” the well on wood planking to keep them reasonably clean. The pump would be replaced with a new or refurbished pump by reversing the removal operation. The pump then would be taken to the shop for repair or overhaul. During operation, some fuels and lubricants may be transported to the site. Wells would be reworked on an average 20-year cycle.

Recovery Pipelines Nominal maintenance of recovery pipelines would be required. The anticipated life of recovery pipelines is approximately 50 years; however, in the event of a break in a pipeline or excessive leakage, segments of a pipeline would need to be replaced. Depending on the size and length of the segment to be replaced, the pipeline would be either mechanically or hand-excavated.

Maintenance Roads and Corridors Nominal maintenance on the maintenance roads and corridors would be required. The maintenance roads may require maintenance during wet winters if portions of the roads wash out or become impassable. To minimize effects on grassland habitat, no maintenance of the corridors in grassland areas is proposed.

2.3.5 Operations

Madera Ranch operations, including banking, water recovery, and maintenance to support banking and recovery, are described below, including measures to monitor potential effects on neighboring farmers and districts (adjacent stakeholders).

Water Banking

MID would bank a portion of its long-term water supply made available by contracts with Reclamation (Friant Division and Hidden Unit supplies), CVP uncontrolled flows provided under temporary contract and MID's pre-1914 non-CVP water rights supply. It is expected that average annual water available for banking would be approximately 20,000 AF (15,000 AF with river restoration) with wet years providing up to 55,000 AF (see the Water Supply Section for additional information). Water typically would be banked from mid-October through mid-April, depending on water-year type and availability.

Figure 2-6 illustrates the typical recharge season and historic deliveries. The upper part of the figure shows maximum Hidden Unit releases in relation to average Friant Division deliveries to MID, and indicates that off-season deliveries could occur and be used for recharge when water is available. Large amounts of water are unlikely to be banked during the summer because MID's system is being used to convey water to farmers. The lower part of the figure shows that based on historic deliveries, more than 45,000 AF was available less than 5% of the time; in May, for example, approximately 45,000 AF was available 5% of the time, 25,000 AF was available 70% of the time, and 18,000 AF was available 100% of the time. Water supply estimates based on the record from 1985 through 2007 indicate great variability in banking opportunities, ranging from less than 20,000 AF in 61% of years to more than 20,000 AF in 39% of years.

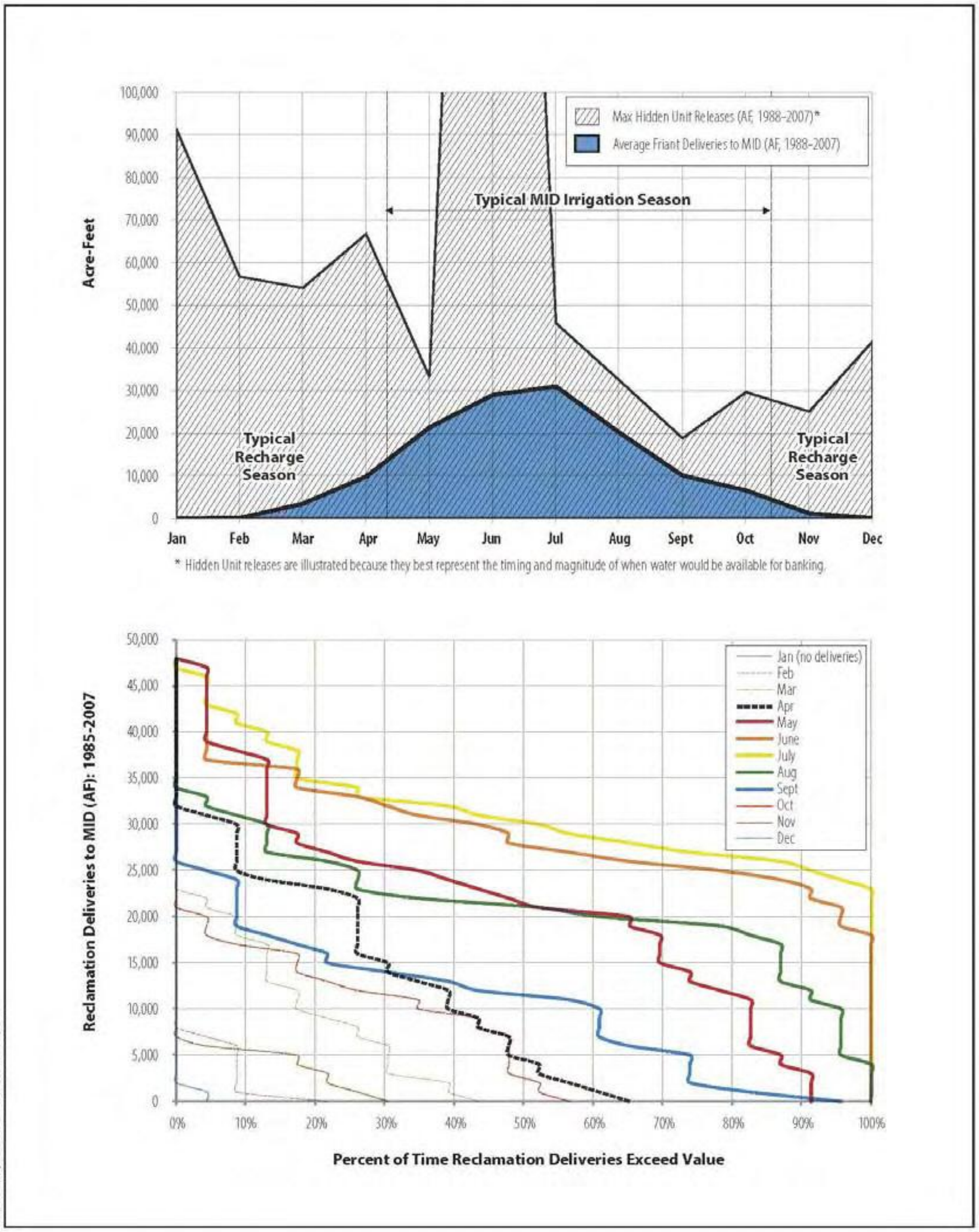

Figure 2-6 Typical Recharge Season and Historic Deliveries

Water would be delivered into distribution ditches, swales, and recharge basins through the enlarged Section 8 Canal (converting to a pipeline within Madera Ranch), the 24.2-19.5 lateral, the GF Canal, and Cottonwood Creek. Parshall flumes and weirs would be installed in these conveyances to regulate and measure flows.

Upstream recharge basins would be used for sedimentation. Flows through ditches, swales, and basins would be regulated in accordance with monitoring and operating criteria designed to prevent overflows and unacceptably high water table elevations beneath adjoining properties. MID would control upstream, off-site flows to avoid spillage in the same manner that current water operations are conducted. Ditch riders would monitor the flow in each canal, ditch, swale, and recharge basin to ensure proper control of flows and to ensure that programmed water levels in the recharge areas are maintained. Spillage would be minimized through diligent observation of conditions in accordance with MID's standard operating schedule.

Flows in the swales would be constrained by acreage (approximately 550 acres) and the canal's capacity to deliver water to the swales. Water depths could range from several inches to several feet depending on the topography of the swales, percolation rates, and the amount of water being applied. Flows in the canals would be constrained by capacity, and recharge for banking in the canals, including GF Canal, would depend on the percolation rates. During water years with limited water available for banking, MID would use canals and selected swales to bank available supplies. The swales would be selected based on readily available canal delivery locations and other management needs. Flows to the recharge basins, should they be needed, would be similarly constrained by seasonal water availability and delivery capacity.

Reclamation worked with MID to determine the maximum area that would be inundated and discussed this approach with the USFWS, Corps, and DFG in February 2010. In general, when doing initial operations, MID would step up the flow into a swale in discrete increments (typically around 2-5 cfs per increment) and once the inundation for that flow has stabilized (typically within one day), MID would mark the wetted extent with global positioning system (GPS). MID would then step up to the next higher flow increment and repeat the process. MID followed this process in a pilot project until they reached the maximum wetted extent. These flow-versus-inundated acreage data pairs allowed MID to build a ―rating curve" for a swale. This curve allowed MID to predict very accurately the wetted area given a certain flow. MID would then repeat the construction of the rating curves approximately two to three more times during a recharge season so that MID can observe how the swales perform over time. Because MID is stepping up from low to high flows, MID would be able to observe how each incremental segment of a swale contributes to or detracts from performance.

Monitoring and Operational Constraints Plan

Alternative B would recover no more than 90% of banked water, ensuring that there is a net gain by the aquifer. Recovered water would be delivered to farmers within MID, and potentially for M&I and environmental uses, ensuring that any deep percolation is recharged into the local aquifer system.

Madera Ranch Oversight Committee Adjacent property owners have expressed concern that water levels could rise and flood root zones during recharge events and that pumping costs might increase as the water table declines during recovery events. MID determined that modeled predictions would not provide sufficient security for adjacent stakeholders. Therefore, on April 17, 2006, the MID Board approved formation of the 10-member MROC composed of:

- the five MID board members;
- one elected board member from GFWD, as selected by the GFWD board;

- three independent members, representing the interests of surrounding landowners not within the service areas of MID or GFWD; and
- one County Supervisor.

The MROC would:

- ensure implementation of the Monitoring and Operational Constraints Program (MOCP) for Alternative B;
- protect adjacent landowners from unacceptable impacts by reviewing monitoring results and making recommendations for adjustments to operations if data suggest unacceptable impacts may occur;
- make recommendations for adjustment to the monitoring program as appropriate,
- prepare annual monitoring reports; and
- make available complete raw monitoring data to the Conservation Easement holder, the USFWS, the Corps, the DFG, and Reclamation within two weeks of obtaining the data from the MID. Provide the annual monitoring reports to these same five agencies as well as inform them within two weeks of any votes taken by the MROC, and the outcomes.

The MROC would meet monthly during recharge/recovery periods (usually winter/spring and summer, respectively) and quarterly during other periods when the facility is not in operation.

The MROC would implement the MOCP (Madera Irrigation District 2007) to ensure there are no unacceptable impacts on groundwater levels or quality. The draft MOCP includes the following components:

Water Level Monitoring MID would monitor water levels in on-site and off-site wells and adjust recharge operations to prevent off-site water levels from rising to within 30 feet of the ground surface. In the event that off-site water levels rise to within 30 feet of the ground surface, recharge operations would be halted and not be restarted until approved by the MROC. During recovery operations, MID would monitor water levels with operational adjustment, compensation, or provision of alternate sources of water in the event that water levels drop to unacceptable levels in off-site wells as a consequence of operations.

Water levels would be monitored in a network of wells that would include:

- recovery wells,
- wells near the Madera Ranch boundary, and
- select irrigation wells located at varying distances from Alternative B facilities.

The MROC would determine the numbers and locations of wells to be monitored. All wells installed only for monitoring purposes would be constructed within existing roads or lands already disturbed by other components of this Alternative (e.g., recharge basins).

The MROC would establish protocols to adjust operations and to avoid, minimize, or recommend compensation for adverse effects. Monitoring data collected during recharge and recovery would be interpreted using methods preapproved by the MROC to provide two levels of protection. First, data would be used in real time to adjust operations. Second, if, after adjusting operations, data indicate that off-site water levels would decline or rise (or have declined or risen) an unacceptable amount as a consequence of operations, the MROC would be immediately notified.

MROC would provide monthly raw data to the Corps and USFWS on request.

Water Quality Monitoring This Alternative primarily would convey and recharge water originating from Millerton Lake (Friant Division water) with lesser potential contributions of Fresno River water originating from Hensley Lake. These waters have been conveyed through the MID system and used for irrigation throughout the district for over 50 years. Friant water is recognized as high quality and generally of higher quality than the underlying groundwater.

MID's daily, ongoing operations currently include surveillance of conveyance facilities to ensure that accidental spills of hazardous materials that may occur near its facilities are discovered and addressed to prevent contamination of MID's water. This surveillance would continue and extend to the facilities constructed as part of this Alternative.

In addition to these precautions, MID believes it is important to monitor water quality. Water banked at Madera Ranch must not impair any designated beneficial uses of water or violate the water quality standards and objectives as defined in the Water Quality Control Plan for the Sacramento and San Joaquin River (Central Valley Regional Water Quality Control Board 2007). Therefore, in addition to its ongoing surveillance program, the MOCP water quality monitoring includes:

- sampling and analysis of recovered water leaving Madera Ranch and groundwater flowing away from Madera Ranch for total dissolved solids (TDS) to ensure that levels remain appropriate for irrigation purposes; and
- sampling and analysis of samples from drinking water wells within one mile of the Alternative for fecal coliform, TDS, and select components of TDS as specified by the MROC.

Water Accounting MID already extensively monitors flow throughout its system and those data would be used by this Alternative. Flows would be monitored where water enters Madera Ranch and where water leaves Madera Ranch. In addition, MID would monitor flows to specific recharge areas and from individual recovery wells for operational purposes. Recharge areas include swales, recharge basins, and in-lieu recharge areas.

Precipitation, wind, evaporation, and temperature would be monitored to calculate net precipitation and evaporation effects. Taken together, the data and estimates from all of these systems would be used to estimate evapotranspiration losses (from vegetation, crops, and recharge areas), recharge during conveyance, recharge into the facility, and recovery.

Recoverable Recharge Recharge that occurs during conveyance through the off-ranch MID system is part of normal MID operations and thus would not be considered banked because it is an existing condition that would not be changed by the Alternative. Flow into Madera Ranch and recharge areas would be monitored. Flow into recharge areas, minus estimated evaporation and evapotranspiration, would be considered banked. However, only 90% of the banked water would be considered recoverable, because 10% of the water applied would be retained in the bank to reduce overdraft rates.

Recovery Flow from recovery wells, minus recharge during conveyance to the perimeter of Madera Ranch, would be considered recovered water. Recharge of recovered water during conveyance would be considered returned to the water bank.

Almost all aquifer banking projects experience migration of recharged water away from recovery systems over time. In addition, a portion of early-season recharge water typically becomes inaccessible to recovery systems either through perching above silts/clays or through banking in sediments that drain too slowly to be of practical use to recovery systems. MID has concluded that actual aquifer losses cannot be reasonably predicted in a way that would adequately protect surrounding landowners from ―over-extraction.” Therefore MID has committed to operational constraints to leave 10% of the recharged water behind to ensure that the Alternative results in a net reduction in the rate of overdraft and to prevent ―over-recovery.”

Subsidence Monitoring Historically, subsidence has occurred to the west of Madera Ranch. However, ground elevation monitoring conducted by the U.S. Geological Survey (USGS) has indicated that no more than one foot of subsidence has occurred on Madera Ranch even though the area of Madera Ranch has been subjected to more than 100 years of intense groundwater pumping from above and below the Corcoran Clay. Therefore, it is unlikely that subsidence would be a factor in operations. Nonetheless, MID envisions that operations would include high accuracy GPS monitoring of multiple locations on Madera Ranch before and during operation of this Alternative. The elevations of on-site markers would be measured annually by MID and compared to distant USGS benchmarks to allow detection of any change in ground elevations. The MROC would monitor subsidence and has the authority to impose operational constraints or mitigation on the WSEP, depending on the level of impact, if any.

Water Recovery Operations

Water would be recovered using existing wells and new wells installed in the vicinity and downgradient of the recharge areas. As noted above, the MOCP would constrain recovery operations to prevent unacceptable impact on surrounding landowners. Recovered water would be pumped into collection piping, through the main pipeline, and into the enlarged Section 8 Canal.

Water would be conveyed via the Section 8 Canal into the MID distribution system through a series of lift stations. All of these deliveries would be made in lieu of normal surface water deliveries from Millerton Lake or Hensley Lake. Therefore, an equal volume of water would be made available in these respective reservoirs for delivery to other parts of the MID service areas, increasing the net supply of available water.

The recovery operations described above depend on farmer irrigation demand. As a consequence, recovery would be constrained to the irrigation season, typically running from mid-

March through mid-October. Peak irrigation demand, when 200 cfs of recovery capacity would be needed, typically occurs from May through August.

Use of the Water Bank Facilities by Other Entities

Under Alternative B, MID could use the entire annual recovery capacity (55,000 AF) of the facilities for its agricultural customers in some years. Based on MID's business plan, MID's capacity would be allocated as follows:

- 20,000 AF/year for MID overall in-district agricultural use;
- 5,000 AF/year for individual MID agricultural users;
- 10,000 AF/year for other Madera County agricultural users;
- 10,000 AF/year for all other Madera County users including industrial, commercial, and residential development; and
- 10,000 AF/year for environmental water obligations.

MID's Friant Division Long-Term contract with Reclamation does not provide for delivery of Millerton water to M&I users. However, there is a need for water storage by other Madera County water users. Other potential users would require separate environmental analysis and approvals, and would rely on their own water entitlements in using the proposed groundwater banking and recovery facilities.

If capacity is available after Madera County needs have been met, MID's banking facilities could be used by regional customers. Potential participants would be required to provide their own water for banking and would take delivery of banked water through exchange. Participant water would be gravity delivered through MID conveyances for recharge through the proposed facilities.

Potential non-MID participation could result in a wide array of agreements, water rights amendments, transfers, or changes to the operation of existing non-MID facilities. However, the specific tenants, potential agreements, and other related actions are not reasonably foreseeable. Therefore, analysis of these potential elements would be remote and speculative. As a result, the environmental analysis presented in this document has been conducted without regard to the specific entities or organizations that may desire to bank water in the proposed facility. Specifically, this environmental document does not evaluate:

- potential amendments to existing water rights, contracts, permits, or licenses that would allow prospective participants to use the facility;
- changes to operations of existing non-MID local, state, or federal facilities that could result from prospective participants seeking to use the facility; or
- individual water transfers or exchanges that could occur as a result of prospective participant use of the facility.

The types of actions would be subject to environmental analyses as separate projects. If any water rights amendments, water transfers, or changes in operation to federal, state, or non-MID local facilities would be required for use of the facility, the potential participant(s) would be the party(ies) responsible for complying with applicable environmental analyses requirements.

Mitigation

MID has developed a Madera Ranch Mitigation, Grazing, and Management Plan that describes future management issues associated with Madera Ranch related to grazing, water, species, vernal pools, and monitoring. A total of approximately 4,500 acres would need to be set-aside for mitigation with this alternative. Figure 2-7 MID's conceptual mitigation areas are from the Madera Ranch Mitigation, Monitoring and Reporting Plan which is provided in Appendix C of the Final EIS.

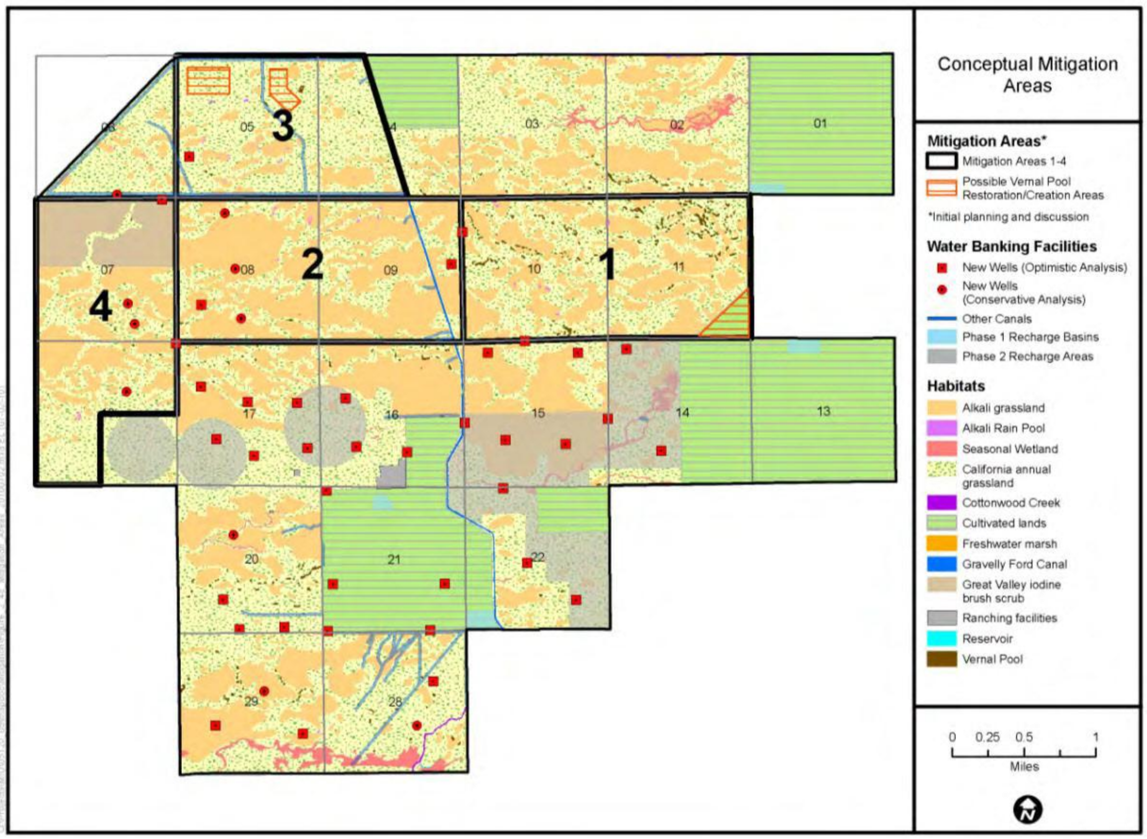

Figure 2-7 Conceptual Mitigation Areas

2.4 Reduced Alternative B – Water Banking Outside the MID Service Area Using Select Swales and Alteration of Reclamation-owned Facilities (Proposed Action)

As described in the introduction, Reduced Alternative B is now the Proposed Action and was developed with additional agency input. Reduced Alternative B represents a scaled-back version of Alternative B that uses fewer swales to minimize effects to vernal pools and limits the number of recharge basins to the minimum for the project to be practicable. Reduced Alternative B also directs recharge activities in the swales on a priority basis to help avoid effects to vernal pools. As with Alternative B it would complete the water bank in two phases. Phase 1 would involve constructing necessary delivery infrastructure improvements (except for the Section 8 canal southwest extension), using select natural swales for recharge (550 acres versus 700 acres as proposed under Alternative B), and installing approximately five soil berms to direct recharge flows. Phase 2 would involve constructing a limited number of recharge basins (323 acres versus up to 1,000 acres under Alternative B) and facilities for recovery of banked water. Reclamation would approve banking of CVP water outside the MID service area and alteration of Reclamation-owned facilities. Similar to Alternative B, Reduced Alternative B may include funding by Reclamation, under the Omnibus Public Land Management Act of 2009, the Policy and Program Services, Challenge Grant Program: Recovery Act of 2009 Water Marketing and Efficiency Grants, or any other funding source. Regardless of whether this funding is acquired, the project components and associated effects would be the same. A description of the Reduced Alternative B, the Proposed Action, follows.

2.4.1 Phase 1 Facilities

MID would implement Phase 1 to increase the capacity of existing MID conveyance facilities to deliver water to Madera Ranch facilities. Phase 1 would use primarily natural swales as recharge areas.

Phase 1 activities would involve:

- reconditioning and extension of canals to provide at least 200 cfs of conveyance capacity into Madera Ranch;
- construction of approximately 55 acres of recharge basins on current agricultural land to regulate flow, remove sediment, and provide some recharge;
- application of recharge flows to approximately 550 acres of swales; and
- integration of approximately 2,600 acres of Madera Ranch row crops and vineyards into an in-lieu recharge program in which surface water periodically would be served in lieu of groundwater pumping subject to approval by the MROC.

Diversion and Conveyance Facilities

Upgrades to Existing Canals Figure 2-2 depicts the locations of existing canals in the vicinity of Madera Ranch. During Phase 1, MID would upgrade canals to enable gravity delivery of at least 200 cfs into Madera Ranch. Upstream portions of Cottonwood Creek, the 24.2 Canal and the Main No. 1 Canal collectively provide more than 200 cfs of gravity feed conveyance capacity above MID's normal service needs during nonpeak irrigation months, and lesser amounts of capacity during peak irrigation months. However, the portions of these conveyances and the Section 8 Canal within two miles of the ranch are undersized, causing a bottleneck such that the capacity to deliver water to the ranch is less than 100 cfs. Specifically, the confluence of Cottonwood Creek, the Main No. 1 Canal, and the Section 8 Canal, approximately two miles east of the ranch, has a capacity of less than 100 cfs. In addition, the Section 8 Canal running from this confluence into the ranch has a capacity of less than 50 cfs, and the 24.2 Canal, 1.5 miles from the ranch, also has a capacity of less than 50 cfs and does not tie into the Section 8 Canal. The following sections summarize how these and other conveyances would be upgraded to provide up to 200 cfs delivery capacity to and from Madera Ranch.

Reclamation Conveyance Facilities

24.2 Canal Improvements MID would extend the earthen 24.2 Canal approximately 0.75 mile south to connect with the Section 8 Canal (Figure 2-8). The connector would be a buried pipeline, not an open canal. In addition, approximately 1.75 miles of the southern portion of the existing 24.2 Canal would be widened and deepened to accommodate 100 cfs of flow. In total, the extension pipeline and canal enlargement would involve moving approximately 36,000 cy of soil.

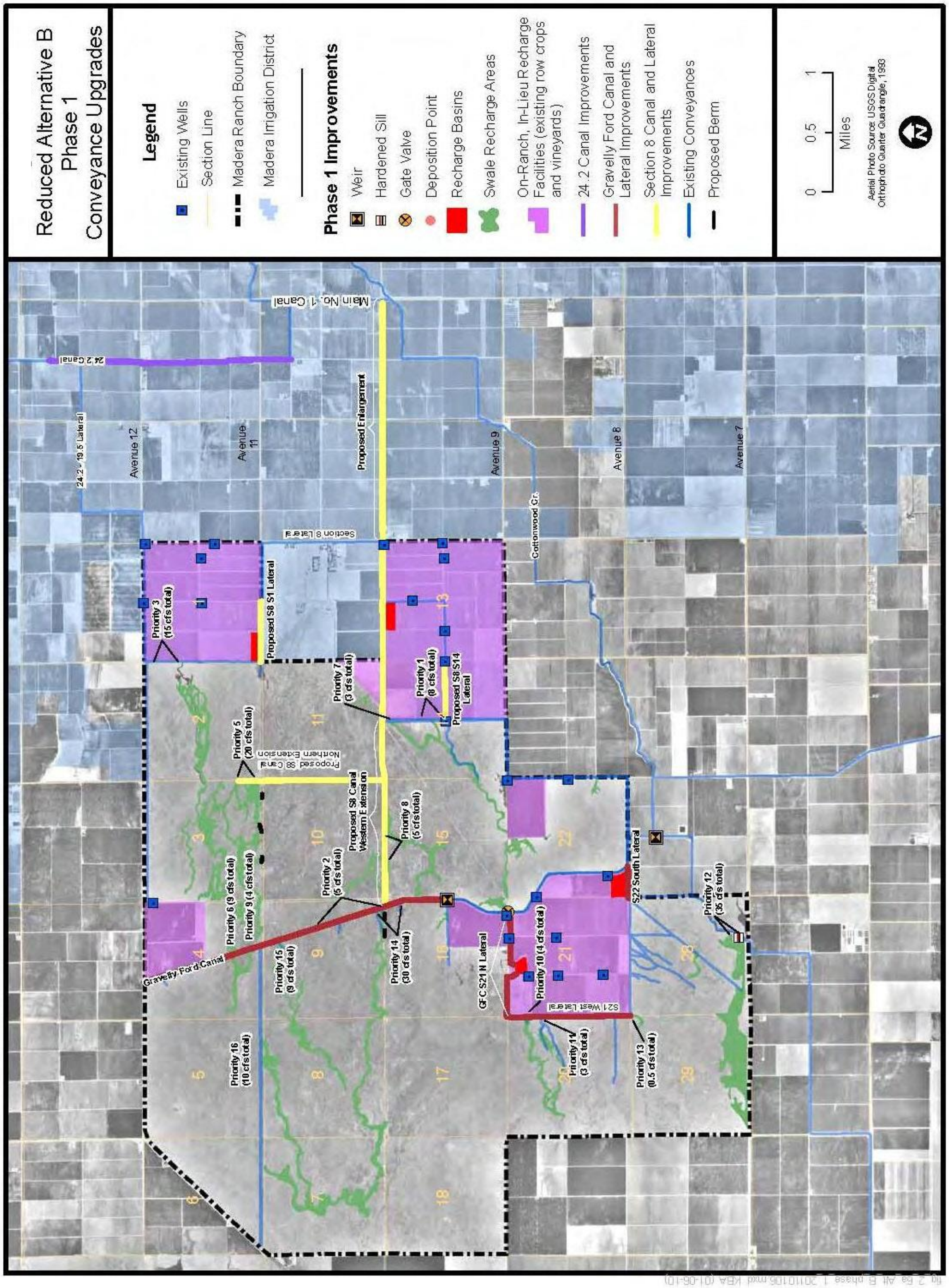

Figure 2-8 Reduced Alternative B Phase 1 Conveyance Upgrades

MID Conveyance Facilities

Section 8 Canal, Cottonwood Creek, and Main No. 1 Canal Connection Upgrade   The existing connection between the Section 8 Canal (an earthen ditch built in the late 19th century), Cottonwood Creek, and Main No. 1 Canal would be widened and deepened to accommodate 100 cfs of flow (Figure 2-2 and Figure 2-8). Only the connection would be widened; Cottonwood Creek would not be widened as its capacity is sufficient to meet the needs of the alternative. Work would be performed in an approximately 500-foot-long and 100-foot-wide area, requiring a temporary construction easement of 1.2 acres from neighboring landowners. No new permanent easements would be required.

Section 8 Canal Upgrade   An approximately 1.75-mile segment of the earthen Section 8 Canal (from Road 23 to within approximately 0.25 mile of the Madera Ranch boundary at Road 21) would be reconstructed to expand from one-way, 50-cfs capacity to two-way (flat bottomed), 200-cfs capacity (Figure 2-8). The 1.75-mile segment of the canal from 0.25 mile east of the ranch, along the north side of Section 13 and to the western edge of ranch row crop land on the north side of Section 14, would be replaced with an approximately 1.75-mile-long, 84-inch RCP, 200-cfs (two-way) pipeline placed within the channel of the existing canal.

During construction, Avenue 10 would be temporarily closed (local traffic only) to allow work on the canal. To expand the canal, an additional 40-foot corridor would be required, for a total of 8.9 acres of easement or fee simple ownership. The last 0.25 mile of the west end of the canal off-ranch would be carried in concrete pipe buried in the existing canal such that additional right-of-way would not be needed. A 40-foot-wide temporary construction easement may be required for this last 0.25 mile off-ranch (resulting in an easement of 1.2 acres). In total, this reconstruction involves moving approximately 76,000 cy of soil.

Section 8 Canal Western Extension   A new, approximately 1.55-mile-long, 50- to 60-cfs earthen ditch would be constructed within a paved road in Sections 14 and 15 from the new Section 8 Canal pipeline to the GF Canal. The ditch would be constructed within the existing leveled shoulder (Figure 2-8). In total, this construction involves moving approximately 18,000 cy of soil.

Section 8 Canal Northern Extension   Sections 10 and 11 are divided by a 20- to 40-foot-wide dirt farm road bordered by the remnants of a ditch. A new approximately 1.2-mile-long, 20- to 50-cfs earthen ditch would be constructed along the alignment of the old ditch (Figure 2-8). In total, this construction involves moving approximately 14,000 cy of soil.

Section 8 Canal Section 14 Lateral Extension   An existing Section 8 Canal lateral (20 cfs) that flows across Section 13 would be extended approximately 0.5 mile across Section 14 (Figure 2-8). All work would be performed along the edge of row crop land. In total, this construction involves moving approximately 2,800 cy of soil.

Section 8 Canal Section 1 Lateral Extension   An existing Section 8 Canal lateral (20 cfs) that flows east-west along the southern side of Section 1 would be extended approximately 0.5 mile to the southwestern corner of Section 1 (Figure 2-8). All work would be performed along the edge of row crop land.

Gravelly Ford Canal Sedimentation Basin and Flow Regulation Area With GFWD's permission, an approximately 3,000-foot-long segment of the GF Canal on the southeastern side of Section 16 would be equipped with a weir/control structure on the north side to allow use of the channel as a combined recharge area, sedimentation basin, and flow regulation area.

Gravelly Ford Canal Flow Control Weir at Cottonwood Creek With GFWD's permission, a new weir would be installed on the GF Canal approximately 1,000 feet south of Section 22 where the canal intersects and shares a channel with Cottonwood Creek. All work would be performed in the existing artificial channel and on adjacent farm roads.

Gravelly Ford Canal Section 21 Northern Lateral A new approximately 0.45-mile-long, 20- to 50-cfs earthen ditch would be constructed along the northern side of Section 21 from the GF Canal to a Phase 1 recharge basin located on farmland (Figure 2-8).

Gravelly Ford Canal Section 21 Western Lateral A new approximately 1-mile-long north/south canal would be constructed along the western side of Section 21 off of an existing 20- to 50-cfs earthen ditch bordering the southern side of the section. The new canal would be constructed on the shoulder of a dirt farm road bordering row crop land in Section 21 (Figure 2-8).

Gravelly Ford Canal Section 22 Southern Lateral A new approximately 0.28-mile-long, 20- to 50-cfs earthen ditch would be constructed along the southern side of Section 22 from the GF Canal to an existing ditch (Figure 2-8).

Cottonwood Creek Overflow Improvements A hardened sill (compacted or armored material with low potential for erosion) would be constructed on the existing Cottonwood Creek berm to protect the berm and to accommodate flow measurements. Sections 28 and 29 are inundated by Cottonwood Creek uncontrolled flows regularly during wet springs. These uncontrolled flows generally are prevented from flowing onto Avenue 7 by an earthen berm that runs along the southern boundary of Section 28 and north along the western boundary of Section 29 (Figure 2-8).

Reconditioning of Existing Canals and Ditches Reconditioning would involve reconditioning GF Canal (described below), replacement of turnout gates (described below), brush removal, repair of berms that have been worn down over time, reconstruction of segments that have been filled by recent farm operations, and installation of farm road crossings as required.

Gravelly Ford Canal Gravelly Ford Canal is an earth-lined flat-bottom channel that conveys irrigation water from the San Joaquin River to Madera Ranch. Project elements affecting Gravelly Ford Canal include:

- Construction of a new weir structure and lift station (GF Canal sedimentation basin and flow regulation area as described above);
- Grading approximately 2.6 miles of the canal back to original design contour and capacity;

- Installing approximately three to five new turnouts;
- Replacing approximately two to three old turnouts; and
- Installing one flow monitoring station.

Gravelly Ford Canal Reconditioning GF Canal would be reconditioned north of the new weir and lift station to Avenue 12 (2.6 miles). Material that has eroded from the banks and settled in the bottom of the canal would be used to reform the banks of the canal. A grader and scraper would be used in the canal bottom to recontour the canal. Approximately 16,000 cy of dirt would be moved to reshape the existing berms of the canal.

Gravelly Ford Turnouts Approximately two new east berm turnouts would be installed to deliver water into the recharge areas. Three west berm turnouts would be replaced and three new west berm turnouts would be constructed (one to a recharge basin in agricultural lands, one gate structure to a new lateral canal system constructed in uplands, and one to upland recharge areas). A flow monitoring station would also be installed. Each turnout is approximately 3-feet wide by 6-feet long by 6-feet tall and is/will be buried in the existing banks of the canal. The turnouts are constructed off-site at MID headquarters. Construction of the turnouts would require excavating approximately 32 cy of soil and the addition of three cy of fill material to install a gate and compact the soil adjacent to it.

Recharge Facilities

Recharge Basins Phase 1 would involve construction of approximately 55 acres of basins, approximately four basins that are 1,100 feet square, as shown in Figure 2-3 on agricultural land in order to:

- help regulate flows,
- allow settling of sediments before application of water to swales, and
- provide some recharge capacity.

The preliminary locations of four Phase 1 recharge basins are entirely on current agricultural land in Sections 1, 13, 21, and 22. The basins would be designed with 1.5:1 to 2:1 interior side slopes and average depths of four to five feet and surrounded by low earthen dikes created from the dirt excavated from the basin. Construction of the Phase 1 recharge basins could involve the movement of approximately 444,000 cy of soil.

Swale Recharge Areas The Proposed Action would entail diversion of water into approximately 550 acres of swales. The water would be conveyed to Madera Ranch through the existing and upgraded MID conveyances and to the swales through the existing, rehabilitated, and new ditches described above. At the head of each swale, a manually operated farm turnout (equipped with a gate valve and totalizing flow meter) would be installed to regulate and measure the flow into each swale. Several turnouts currently exist on GF Canal and these would be replaced and several new ones will be added. Flows at each turnout, based on pilot studies, would be no greater than 20 cfs and would average five cfs at the turnout. Maximum overall flows would be around one cfs per acre of application. Locations of the swales anticipated to be used during Phase 1 are depicted on Figure 2-3.

In-Lieu Recharge Facilities Madera Ranch includes 2,666 acres of row crops and vineyards that are irrigated entirely by a system of 23 wells. MID would recondition existing turnouts and install new turnouts from the Proposed Action canals, pipelines, and ditches to enable delivery of surface water to these fields in lieu of groundwater pumping (Madera Irrigation District 2008).

These agricultural fields were purchased from MID in July 2008 by Grimmway Enterprises, Inc. Grimmway will continue to manage the property for agricultural uses. However, MID has retained rights to existing and future easements that would allow the Proposed Action to be implemented.

2.4.2 Phase 2 Facilities

Phase 2 would expand the areas used to recharge, develop wells and piping to recover the banked water, and install pumps to deliver the recovered water (Figures 2-9 to 2-11).

Phase 2 activities for recharge and recovery facilities would involve:

- additional upgrades to existing canals,
- construction of up to 323 acres of new on-site recharge basins and canals as required to supplement Phase 1 facilities and achieve 200 cfs of recharge capacity (if required),
- use of up to 15 existing wells for recovery,
- installation of up to 49 new wells and recovery pipelines (in phases over several years) to provide 200 cfs of recovery capacity, and
- installation of up to 12 lift stations on MID canals and one lift station on GF Canal (in phases over several years) to provide 200 cfs of pump-back capacity into the MID service area.

Diversion and Conveyance Facilities

Recovery Pipeline An approximately 1.75-mile-long, 72-inch to 84-inch RCP, 135- to 200-cfs (two-way) buried pipeline would be installed under the road that runs diagonally across Sections 14 and 15. The pipeline would extend from the Phase 1 Section 8 Canal upgrade (200-cfs pipeline) to the GF Canal beneath an existing 30- to 40-foot-wide dirt farm road (Figure 2-4).

Gravelly Ford Canal Section 21 Northern Lateral The 0.45-mile-long Phase 1 ditch along the northern side of Section 21 would be replaced with an approximately 2.1-mile-long, 135-cfs, east-west earthen lateral canal along the north side of Sections 21 and 20 with two north-south sub-lateral canals running northward along the east and the west sides of Section 17.

Depending on the recharge basin acreage and construction methods, up to 3.2 miles of 20- to 100-cfs earthen ditches would be constructed within the Phase 2 recharge basin area to distribute water into recharge areas.

Recharge Facilities

Recharge Basins Depending on the performance of Phase 1 recharge facilities, up to 323 acres of recharge basins may be constructed within a 1,300-acre area (Figures 2-10 and 2-11).

Following surveys as outlined in the Environmental Commitments section, MID would begin construction of the basins. The following steps to construct recharge basins may occur.

- *Stage 1:* Berming of recharge area boundaries along topographic contours using farm roads wherever possible and farm grading techniques, but no excavation (similar to unleveled rice fields).
- *Stage 2:* Deep ripping of corridors within the bermed areas, interspersed with corridors of undisturbed land.
- *Stage 3:* Excavation of basins varying from four to five feet deep.

The final number of recharge basins constructed and techniques summarized above is uncertain, and the highest estimated acreage is highly unlikely to be required. This EIS evaluates the potential effects associated with up to 323 acres of excavated basins. Recharge basins would be arranged to minimize species and habitat effects, and a site visit in July 2010 with the resource agencies indicated MID should proceed with basin construction first on the west side of GF Canal (Figure 2-10); MID would maximize the use of this area before constructing basins on the eastern side of the property.

Construction of the recharge basins and internal routing ditches could involve the moving of up to 2.5 million cy of soil. Basins would be designed with 3:1 interior side slopes and average depths of four to five feet. Low earthen dikes would be constructed around the recharge basins using excavated materials. Topsoil would be segregated during excavation and respread over the berm and construction disturbance areas to promote reestablishment of vegetation.

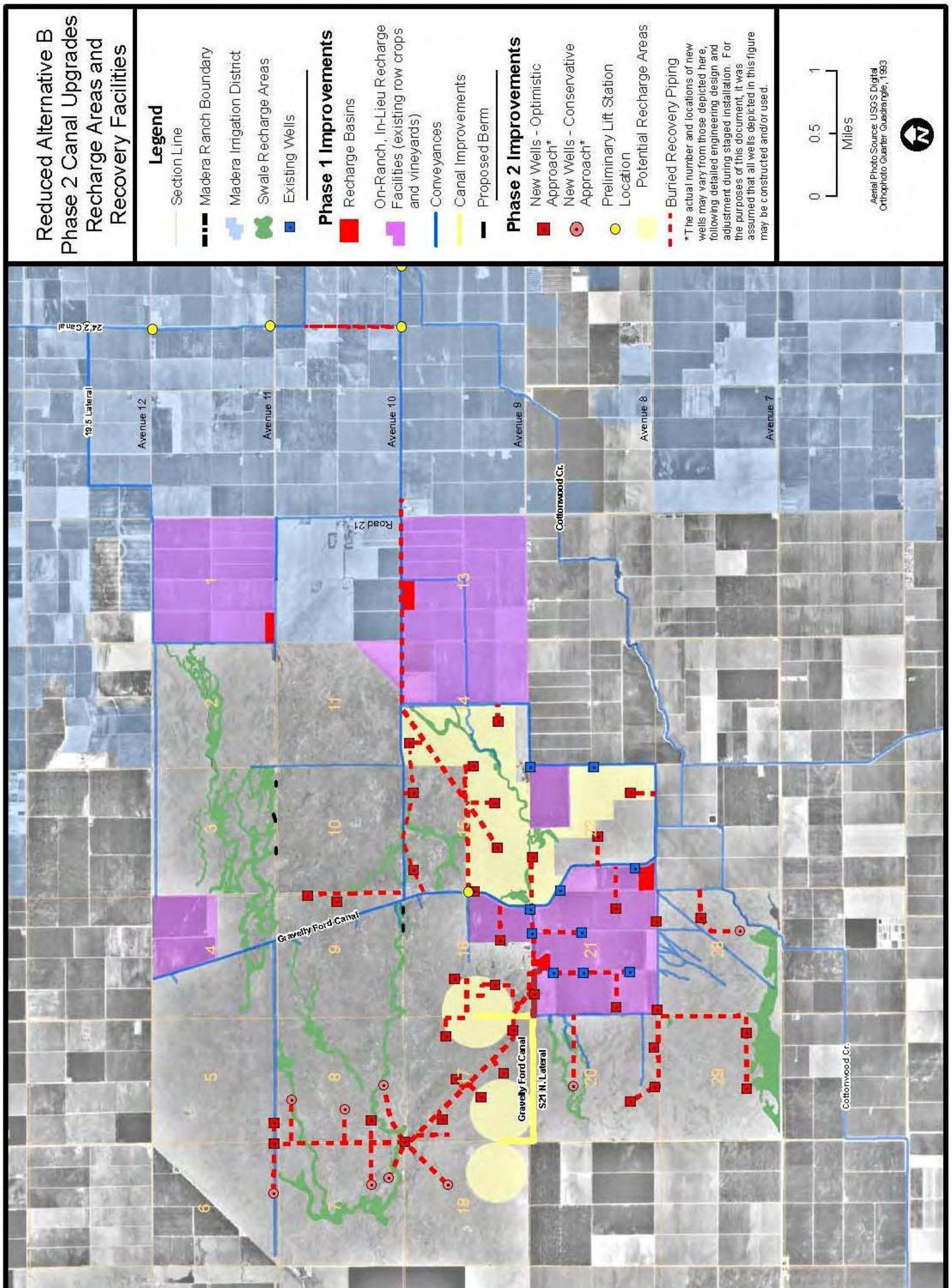

Figure 2-9 Reduced Alternative B Phase 2 Canal Upgrades, Recharge Areas, and Recovery Facilities

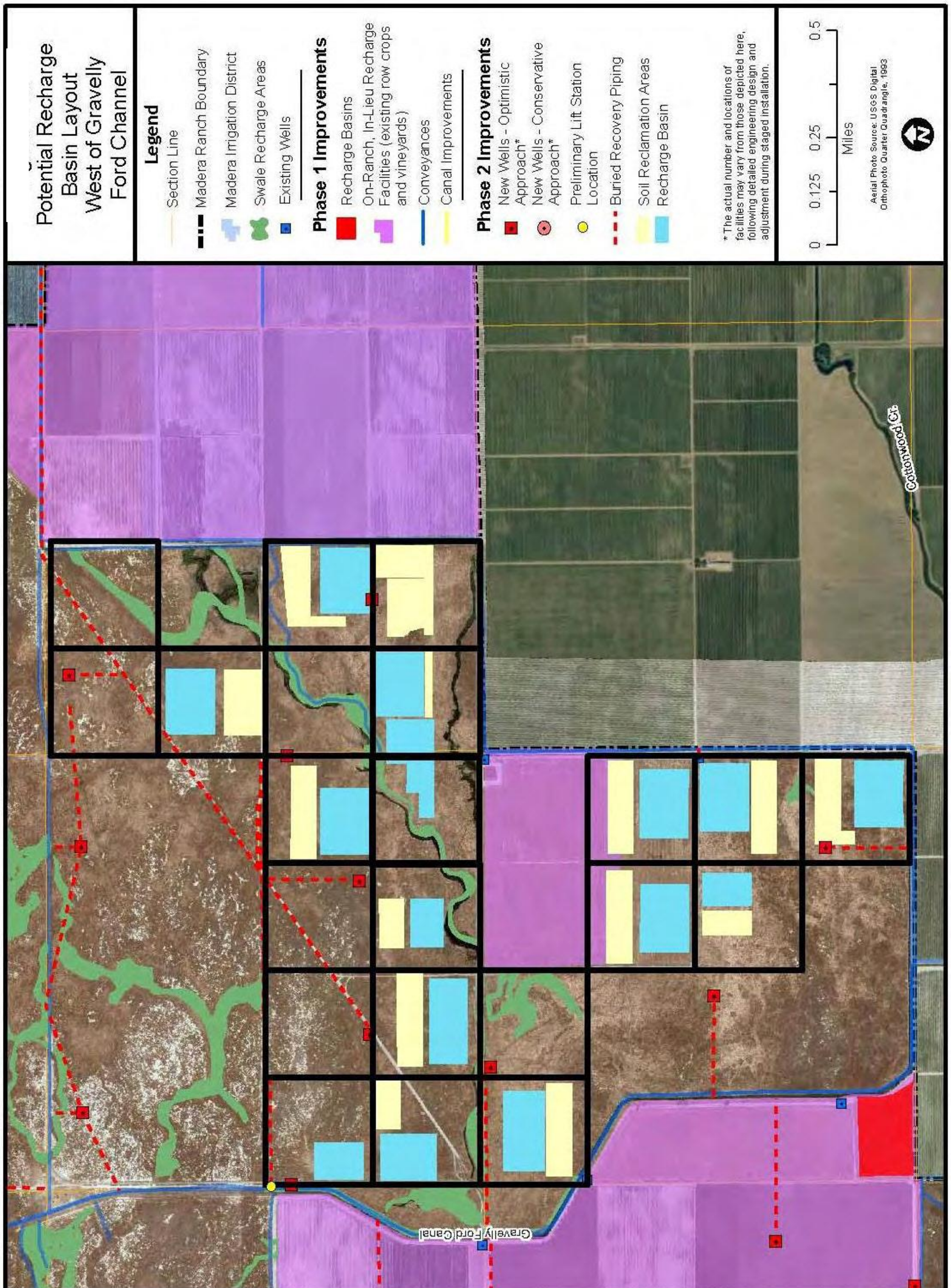

Figure 2-10 Potential Recharge Basin Layout West of Gravelly Ford Canal

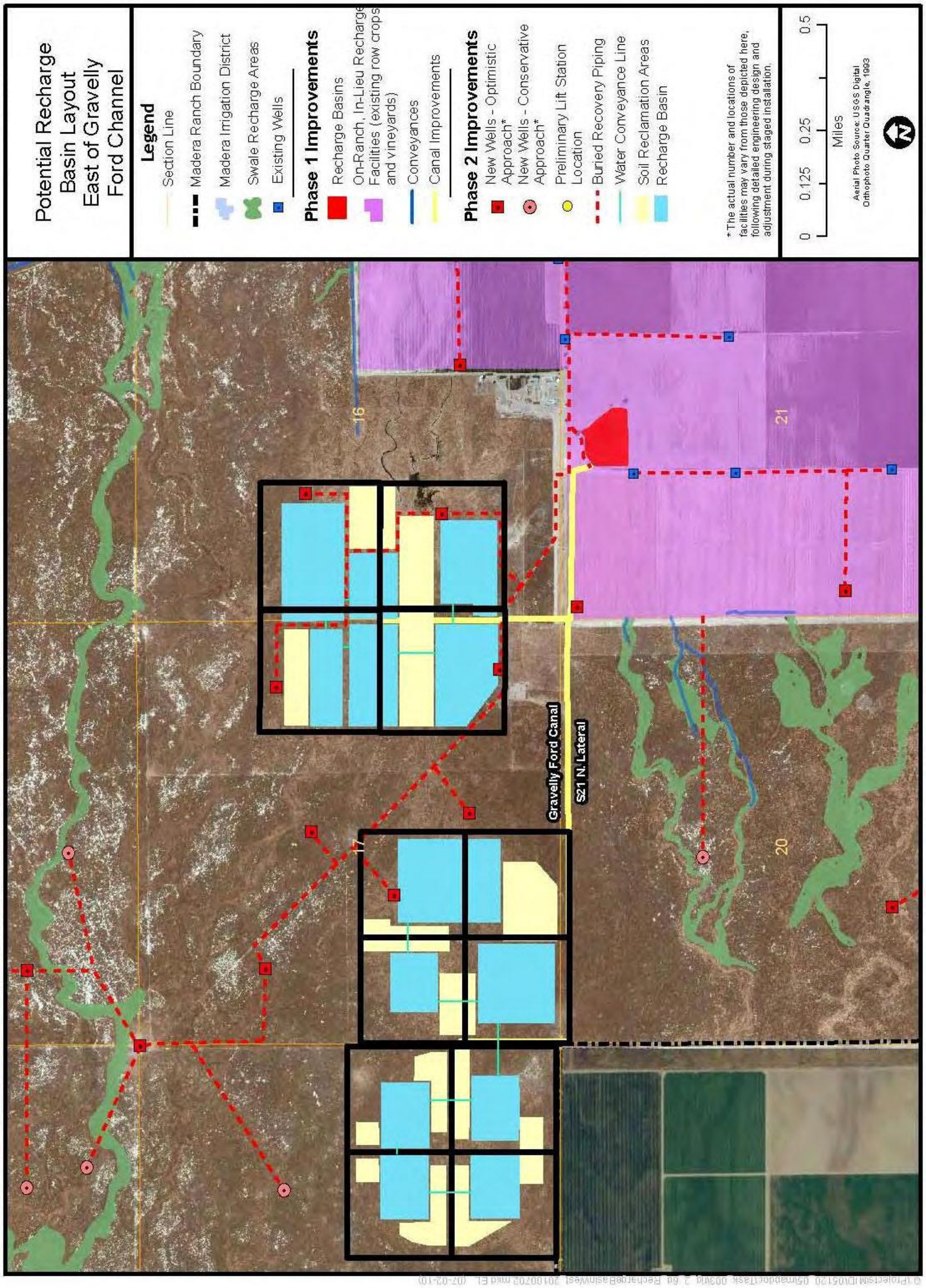

Figure 2-11 Potential Recharge Basin Layout East of Gravelly Ford Canal

Recovery Facilities
These elements are the same as described under Alternative B.

2.4.3 Construction

Conveyance Facilities
These elements are the same as described under Alternative B.

Recharge Facilities
Phase 1 recharge swales would largely remain unaltered and would not be subject to any construction activities. However, to ensure water is directed to desired swale areas up to five micro-berms could be installed. The location of these are illustrated in Figure 2-9. They could be approximately 100 feet long and a maximum of three feet high at the center to provide sufficient freeboard and long-term stability. MID and farmers on Madera Ranch routinely perform this type of earthwork. This project element would be completed in one day using district-owned equipment as follows:

- MID would perform a topographic survey along the fence line to confirm required dimensions;
- MID would temporarily remove fencing as necessary;
- MID would use a front-end loader to haul in the dirt from on-site canal excavation areas, place it, and compact it in approximately 6-inch lifts by driving over the fill material with the rubber tires of the loader; and
- following emplacement and compaction, MID would re-install the fence.

Construction of Recharge Basins (Phase 2) The staging of recharge basin construction proposed would proceed as follows.

- *Stage 1:* Berming of recharge area boundaries along topographic contours and using farm roads wherever possible. These recharge areas would be constructed using graders that follow prestaked topographic contours to raise 1- to 3-foot-high berms around the downslope portions of areas ranging from five acres to 80 acres. Berm material would be obtained from an approximate 50-foot-wide corridor parallel to the interior toe of the berm. Topsoil would be segregated during excavation and respread over the berm and construction disturbance areas to promote reestablishment of vegetation.
- *Stage 2:* Deep ripping of corridors within the bermed areas, interspersed with corridors of undisturbed land. This will be done to ensure deeper percolation is maximized during project operation.
- *Stage 3:* Excavation of basins varying from four to five feet deep. Because of the demonstrated permeability of soils at Madera Ranch, Stage 3 recharge basins are unlikely to be required. However, in the event these basins were used, they would be constructed to minimize species and habitat effects, and possibly clustered in sets of two to four varying in size from five acres to 80 acres, with the first basin in each set serving as both a settling and a recharge basin. Basins would be designed with 1.5:1 to 2:1 interior side slopes and average depths of four to five feet. After excavation, each basin would be shallow-ripped or disked by construction equipment in order to break up compaction of the bottom soils in the recharge basin. Low earthen dikes would be constructed around

the recharge basins using excavated materials. Topsoil would be segregated during excavation and respread over the berm and construction disturbance areas to promote reestablishment of vegetation. Excess soil removed during excavation would be managed to ensure that top layers are stockpiled, excavated soils would be mounded between basins, and stockpiled topsoil would be placed on top of the soil pile.

It is estimated that Stage 3 recharge basins would be constructed using:

- three to 20 heavy diesel-powered scrapers (40- to 60-yard capacity);
- three to five 500- hp diesel-powered skip loaders;
- 15 to 30 heavy-duty, off-road-type trucks (60-yard capacity);
- three to five large, diesel-powered, crawler-type tractors; and
- three to five diesel-powered motor graders.

The final combination of the acreages and techniques summarized above is uncertain. However, as previously discussed, this EIS evaluates the potential effects associated with up to 323 acres of excavated basins.

Recovery Facilities
These elements are the same as described under Alternative B.

Staging Areas
These elements are the same as described under Alternative B.

2.4.4 Maintenance
These elements are the same as described under Alternative B.

2.4.5 Operations
These elements are the same as described under Alternative B.

Mitigation
MID has developed a Madera Ranch Mitigation, Grazing, and Management Plan that describes future management issues associated with Madera Ranch related to grazing, water, species, vernal pools, and monitoring of conservation lands.

MID has proposed mitigation for the potential effects to protected species and their habitats that could result from implementation of the Proposed Action. Three mitigation areas are proposed, the first two areas would include 2,357 acres of land managed to provide affected species habitat. The third mitigation area includes 3,456 acres, approximately 375 acres of which are planned as recharge swales.

These lands would be managed for both recharge and species protection purposes, and would provide relatively natural lands between the swales that can provide habitat for the effected species and connects the compensation areas (Figure 2-12).

Vernal pools created or restored would be inoculated with cysts and seeds from other high quality vernal pools on site in accordance with USFWS-approved methods.

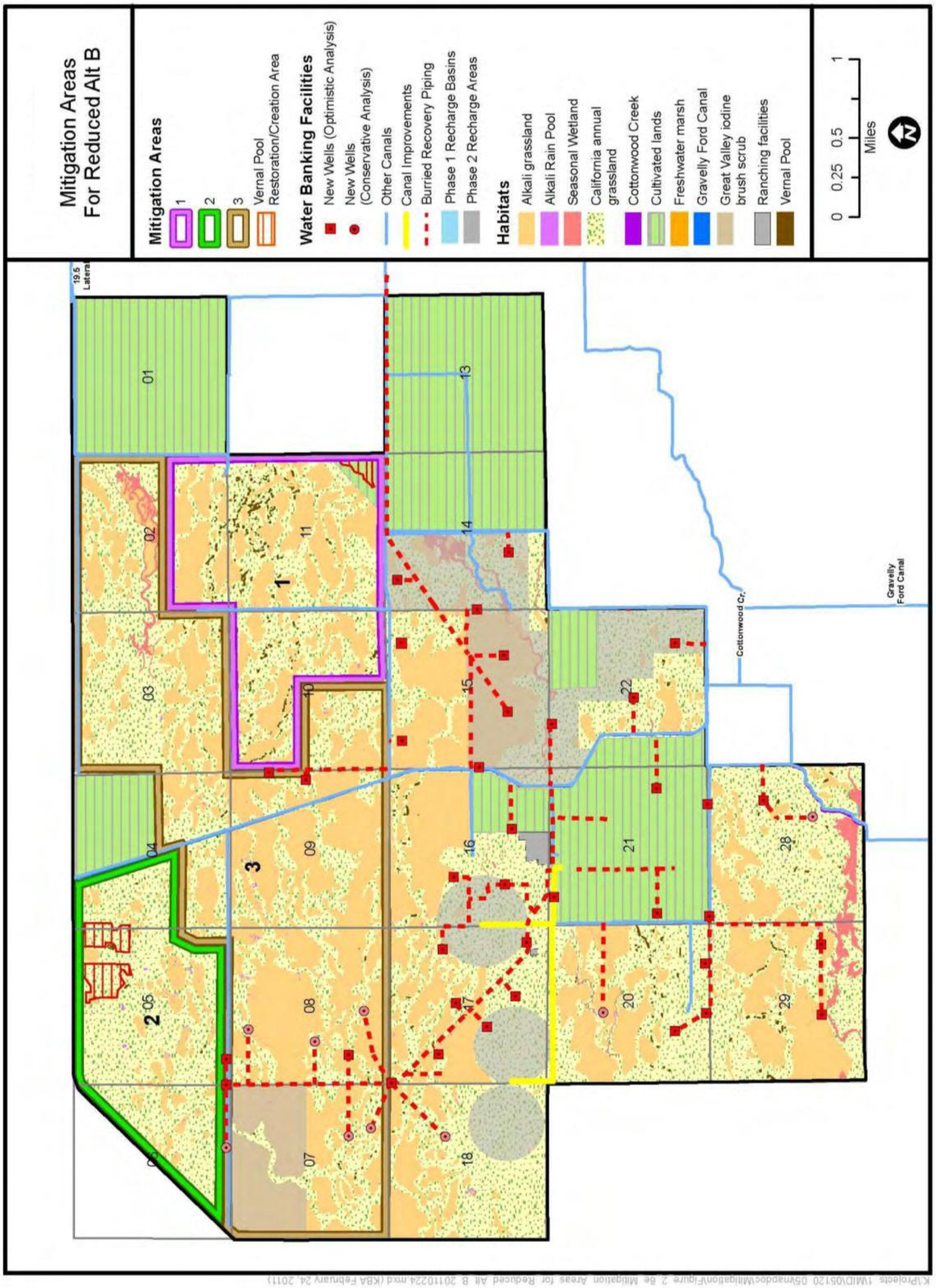

Figure 2-12 Mitigation Areas for Reduced Alternative B

2.5 Alternative C – Water Banking Outside the MID Service Area without Swales, and Alteration of Reclamation-owned Facilities

Alternative C is a variation of Alternative B that would complete the water bank in two phases and replace natural swale recharge solely with recharge basins. Phase 1 would involve recharge-related facilities only. Phase 2 would involve facilities for recovery of banked water. Reclamation would approve banking of CVP water outside the MID service area and alteration of Reclamation-owned facilities. Similar to Alternative B, Alternative C includes funding by Reclamation, under the Omnibus Public Land Management Act of 2009, the Policy and Program Services, Challenge Grant Program: Recovery Act of 2009 Water Marketing and Efficiency Grants, or any other funding source. Regardless of whether this funding is acquired, the project components and associated effects would be the same. A description of Alternative C follows.

2.5.1 Phase 1 Facilities

MID would implement Phase 1 to increase the capacity of existing MID conveyances to deliver water to Madera Ranch facilities. Phase 1 would use engineered basins as recharge areas (Figure 2-13).

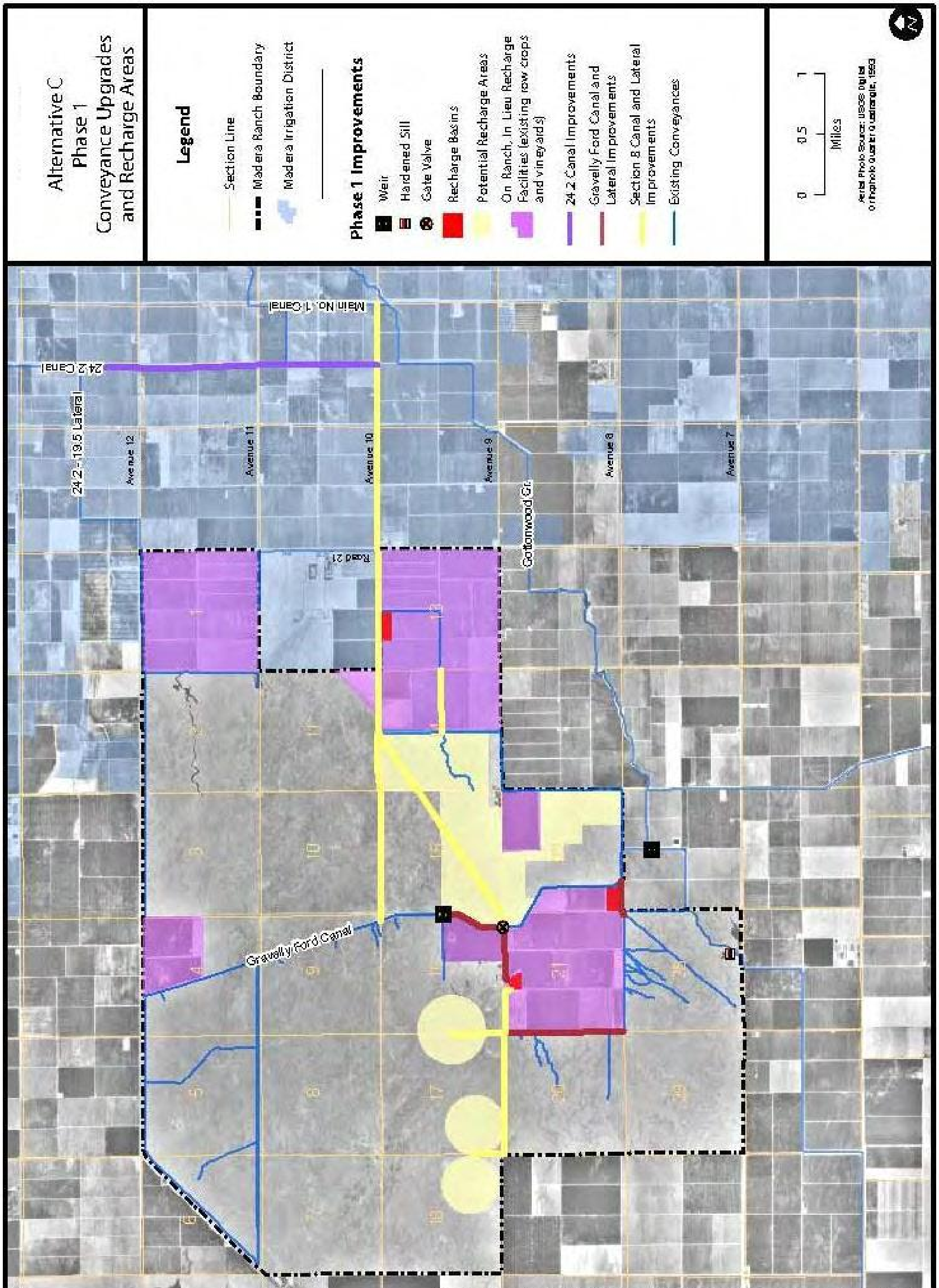

Figure 2-13 Alternative C Phase 1 Conveyance Upgrades and Recharge Areas

Phase 1 activities would involve:

- reconditioning and extension of existing canals to provide at least 200 cfs of conveyance capacity into Madera Ranch;
- construction of up to 1,000 acres of new on-site recharge basins and canals as required to achieve 200 cfs of recharge capacity; and
- integration of approximately 2,600 acres of Madera Ranch row crops and vineyards into an in-lieu recharge program in which surface water periodically would be served in lieu of groundwater pumping subject to approval by the MROC.

Diversion and Conveyance Facilities
Under Alternative C, conveyance facilities would be identical to those proposed under Alternative B, with the exception that neither the Section 8 Canal Northern Extension nor the Section 8 Canal Section 1 Lateral Extension would be required and Phase 2 conveyance upgrades under Alternative B would be constructed during Phase 1 of Alternative C to convey water to the engineered recharge basins.

Recharge Facilities
Recharge Basins Approximately 1,000 acres of recharge basins would be constructed within a 1,300-acre area. Recharge basins would be clustered in sets of three or four, varying in size from five to 80 acres, with the first basin constructed in each set serving as both a settling and a recharge basin.

Construction of the recharge basins and internal routing ditches could involve the movement of up to approximately 7.7 million cy of soil. Basins would be designed with 1.5:1 to 2:1 interior side slopes and average depths of four to five feet. Low earthen dikes would be constructed around the recharge basins using excavated materials. Topsoil would be segregated during excavation and respread over the berm and construction disturbance areas to promote reestablishment of vegetation.

In-Lieu Recharge Facilities As under Alternative B, MID would recondition existing turnouts and install new turnouts as in the Alternative B canals, pipelines, and ditches to enable delivery of surface water to these fields in lieu of groundwater pumping.

2.5.2 Phase 2 Facilities
Phase 2 would develop wells and piping to recover the banked water, and install pumps to deliver the recovered water as shown in Figure 2-14.

Phase 2 recharge and recovery facilities would involve:

- up to 15 existing wells for recovery;
- up to 49 new wells and recovery pipelines (in phases over several years) to provide 200 cfs of recovery capacity; and

- up to 12 lift stations on MID canals and one lift station on GF Canal (in phases over several years, total of 13 lift stations) to provide 200 cfs of pump-back capacity into the MID service area.

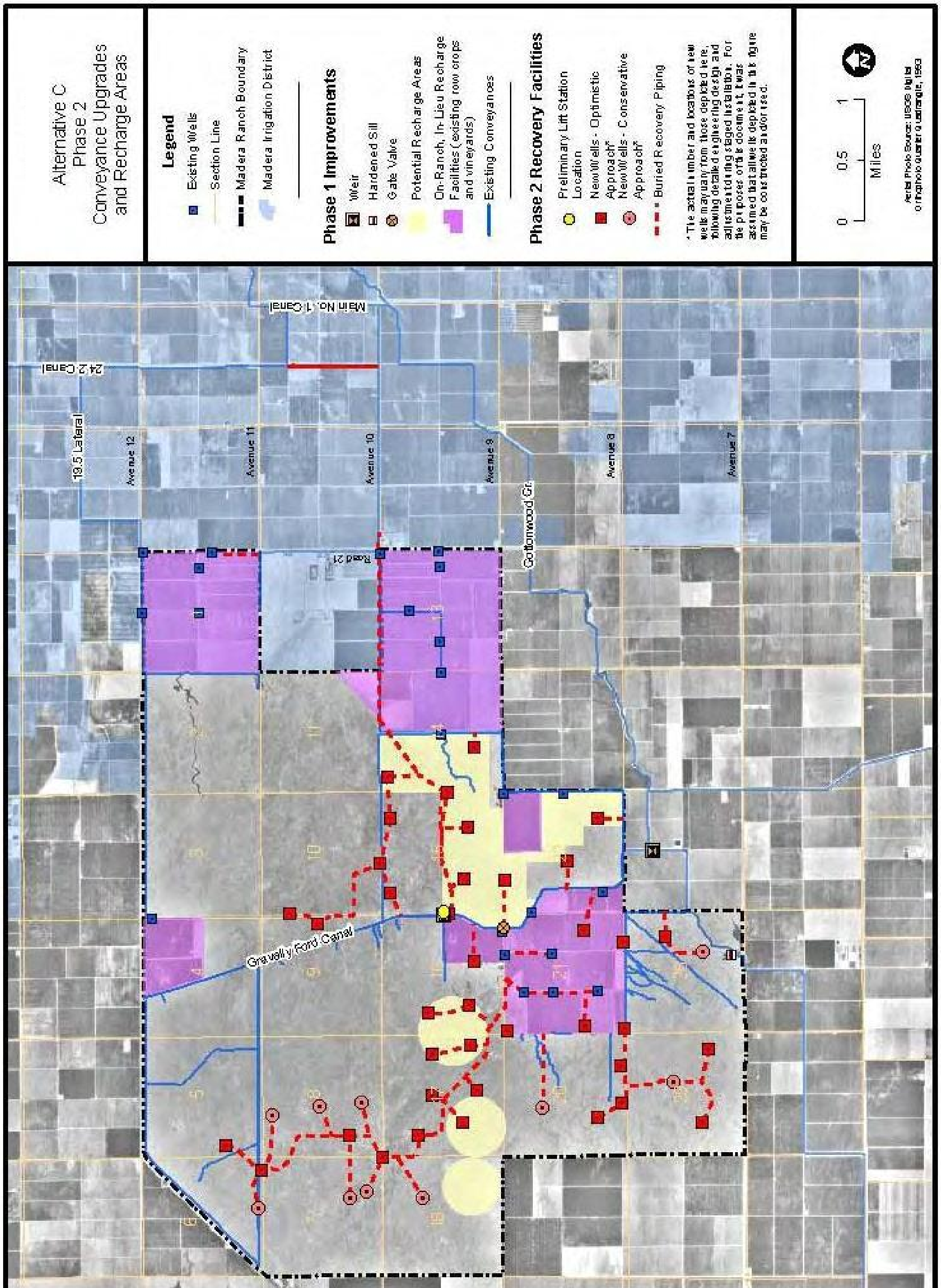

Figure 2-14 Alternative C Phase 2 Conveyance Upgrades and Recharge Areas

Recovery Facilities

Recovery Wells As under Alternative B, banked water would be recovered using up to 15 existing wells and approximately 49 new wells (Figure 2-14).

Recovery Pipelines and Electrical Facilities As under Alternative B, up to 11.6 miles of 8-inch- to 60-inch-diameter PVC to RCP buried recovery pipelines would run from recovery wells to the GF Canal and the Section 8 Canal for delivery back to farmers (Figure 2-14).

2.5.3 Construction

All construction methodologies necessary to construct Alternative C are described in detail under Alternative B – Water Banking outside the MID Service Area Using Swales and Alteration of Reclamation-Owned Facilities.

Recovery Lift Stations

As under Alternative B, up to 13 lift stations would be required on the same conveyances used to deliver water into the water bank (Figure 2-14).

2.5.4 Maintenance

All maintenance methodologies necessary to operate Alternative C are described in detail under Alternative B – Water Banking outside the MID Service Area Using Swales and Alteration of Reclamation-Owned Facilities.

Maintenance Corridors

As under Alternative B, the maintenance corridors would include new roads in the recharge basin area and areas with heavy disturbance, and unimproved routes in grassland areas.

2.5.5 Operations

Please refer to the Operations subsection of Alternative B – Water Banking outside the MID Service Area Using Swales and Alteration of Reclamation-Owned Facilities. Discussion related to swales would not apply to Alternative C, but all other aspects of recharge operations would be identical.

Mitigation

Mitigation anticipated for Alternative C could be approximately 3,500 acres based on effects from facility and recharge basin construction.

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

Under Alternative D, MID would enter into an agreement with GFWD to improve the GF Canal to allow water to be conveyed from the San Joaquin River through the GF Canal to Madera Ranch for banking of water and recovery of water from the ranch back through the canal to the river. The existing GFWD river pumping plant would be upsized; the existing, associated pipeline replaced with a larger-diameter line; the GF Canal regraded to a flat-bottom (zero slope) configuration to allow two-way flow; a new connection to the river constructed to allow recovery water to reach the river without flowing through the pumps; and appropriate gate structures constructed. On-site improvements allowing water banking and extraction, including a pumping plant and pipeline to allow distribution of water uphill from the GF Canal, would be constructed.

MID would complete Alternative D in two phases. Phase 1 would involve recharge-related facilities only. Phase 2 would involve supplemental recharge facilities and facilities for recovery of banked water. Reclamation would approve the banking of CVP water outside the MID service area as described under Alternative B. No alteration of Reclamation-owned facilities would occur under Alternative D. However, similar to Alternative B, Alternative D includes funding by Reclamation, under the Omnibus Public Land Management Act of 2009, the Policy and Program Services, Challenge Grant Program: Recovery Act of 2009 Water Marketing and Efficiency Grants, or any other funding source. Regardless of whether this funding is acquired, the project components and associated effects would be the same.

2.6.1 Phase 1 Facilities

MID would implement Phase 1 to increase the capacity of existing conveyances to deliver water to Madera Ranch.

Phase 1 would use primarily natural swales as recharge areas. Phase 1 activities would involve:

- reconditioning of existing canals to provide at least 200 cfs of conveyance capacity into Madera Ranch;
- construction of approximately 26 acres of recharge basins on current agricultural land to regulate flow, remove sediment, and provide some recharge;
- application by MID of recharge flows to approximately 700 acres of swales; and
- integration of approximately 2,600 acres of Madera Ranch row crops and vineyards into an in-lieu recharge program in which surface water would be periodically served in lieu of groundwater pumping subject to approval by the MROC.

Diversion and Conveyance Facilities

Upgrades to Existing Canals Figure 2-2 depicts the locations of existing canals in the vicinity of Madera Ranch. During Phase 1, MID would upgrade existing canals to enable delivery of at least 200 cfs into Madera Ranch. The following sections summarize how these and other conveyances would be upgraded to provide 200 cfs of delivery capacity to and from Madera Ranch.

Gravelly Ford Canal The configuration of the GF Canal, as shown on record drawings from 1966, indicates that the canal cannot convey 200 cfs, in part because of its highly irregular bottom. To allow a two-way flow of up to 200 cfs, the canal would have to be regraded, and the intake pipeline on the San Joaquin River connecting the pump plant to the open canal segments enlarged to a 72-inch-diameter concrete pipe. A flow meter would be installed in the pipeline. In addition to the canal improvements, an upsized pumping plant and pipeline improvements would be completed. Additional improvements would involve:

- installation of three checkdams,
- reconstruction of culvert crossings and farm road bridges, and

- installation of a Parshall flume at the edge of Madera Ranch to measure recovery volumes.

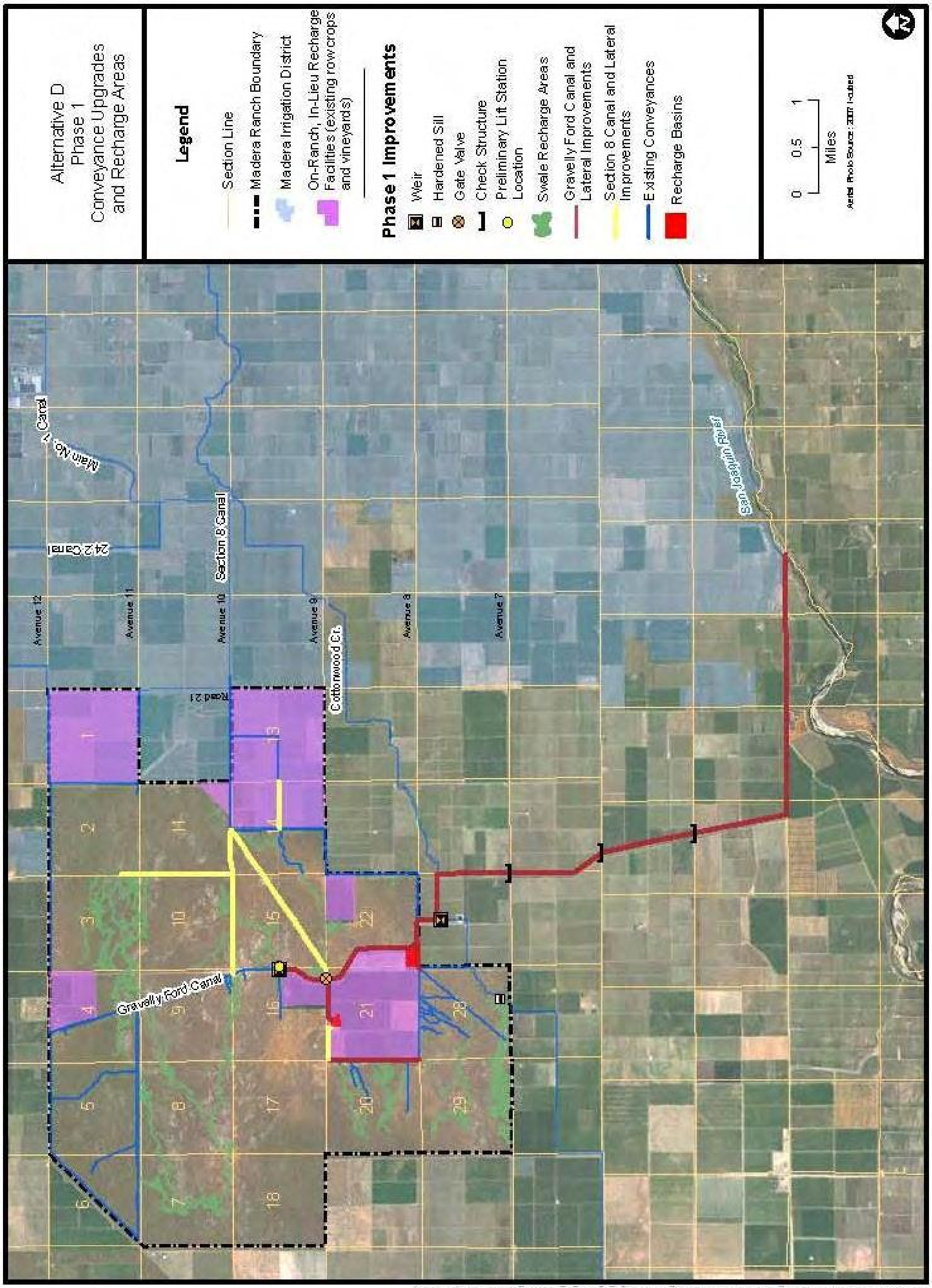

Figure 2-15 Alternative D Phase 1 Conveyance Upgrades and Recharge Areas

Additionally, a 400-hp pumping plant, consisting of two 200-hp pumps, would be required on-ranch to move water from the GF Canal uphill to the east as far as Section 13 so that water could be delivered to swales for recharge and in-lieu fields east of the canal.

Gravelly Ford Canal Sedimentation Basin and Flow Regulation Area With GFWD's permission, an approximately 0.6 mile segment of the GF Canal on the southeastern side of Section 16 would be equipped with a weir/control structure on the north side to allow use of the channel as a combined recharge area, sedimentation basin, and flow regulation area.

Gravelly Ford Canal Flow Control Weir at Cottonwood Creek As under Alternative B, with GFWD's permission, a new weir would be installed on the GF Canal approximately 1,000 feet south of Section 22 where the canal intersects and shares a channel with Cottonwood Creek (Figure 2-15).

Section 8 Canal/Gravelly Ford Canal Connection As under Alternative B, a new, approximately 1.55-mile-long, 20- to 50-cfs, earthen ditch would be constructed adjacent to a paved road in Sections 13, 14 and 15 to the GF Canal from the existing terminus of the Section 8 Canal (Figure 2-15).

Gravelly Ford Canal Section 21 Northern Lateral As under Alternative B, a new approximately 0.45-mile-long, 20- to 50-cfs earthen ditch would be constructed along the northern side of Section 21 from the GF Canal to a Phase 1 recharge basin located on farmland (Figure 2-15).

Gravelly Ford Canal Section 21 Western Lateral As under Alternative B, a new approximately one-mile-long north/south canal would be constructed along the western side of Section 21 off of an existing 20- to 50-cfs earthen ditch bordering the southern side of the section (Figure 2-15).

Gravelly Ford Canal Section 22 Southern Lateral As under Alternative B, a approximately 0.28-mile-long, 20-to 50-cfs earthen ditch would be constructed along the southern side of Section 22 from the GF Canal to an existing ditch (Figure 2-15).

Section 8 Canal Southwestern Extension Sections 14 and 15 are bisected diagonally by a 30- to 40-foot-wide, dirt farm road that was previously a ditch. As under Alternative B, a new approximately 1.8-mile-long, 20-cfs earthen ditch would be constructed from the Section 8 Canal along the shoulder of this road and to the GF Canal. This canal would require at least one pumping plant to deliver water from the GF Canal to the east (Figure 2-15).

Section 8 Canal Northern Extension As under Alternative B, Sections 10 and 11 are divided by a 20- to 40-foot-wide dirt farm road bordered by the remnants of a ditch. A new approximately 1.2-mile-long, 20- to 50-cfs earthen ditch would be constructed along the alignment of the old ditch (Figure 2-15).

Section 8 Canal Section 14 Lateral Extension An existing Section 8 Canal Lateral (20 cfs) that flows across Section 13 would be extended 0.5 mile across Section 14. All work would be performed along the edge of row crop land. This canal would require one pumping plant to deliver water to the east (Figure 2-15).

Reconditioning of Existing Ditches   As under Alternative B, reconditioning would involve replacement of turnout gates, brush removal, repair of berms that have been worn down over time, reconstruction of segments that have been filled by recent farm operations, and installation of farm road crossings as required.

Recharge Facilities

Recharge Basins   Phase 1 would involve construction of approximately 26 acres of basins, as shown in Figure 2-15, on agricultural land in order to:

- help regulate flows,
- allow settling of sediments prior to application of water to swales, and
- provide some recharge capacity.

The preliminary locations of two Phase 1 recharge basins are entirely on current agricultural land in Sections 21 and 22. The basins would be designed with 1.5:1 to 2:1 interior side slopes and average depths of four to five feet surrounded by low earthen dikes. Construction of the Phase 1 recharge basins could involve the movement of approximately 210,000 cy of soil. Topsoil would be segregated during excavation and respread over the berm and construction disturbance areas to promote reestablishment of vegetation.

Swale Recharge Areas   As under Alternative B, water would be diverted into approximately 700 acres of swales. The water would be conveyed to Madera Ranch through the existing and upgraded MID conveyances and GF Canal and to the swales through the existing, rehabilitated, and new ditches described above. Locations of the swales anticipated to be used during Phase 1 are depicted on Figure 2-15.

In-Lieu Recharge Facilities   As under Alternative B, MID would recondition existing turnouts and install new turnouts from canals, pipelines, and ditches to enable delivery of surface water to these fields in lieu of groundwater pumping.

2.6.2 Phase 2 Facilities

Phase 2 would require the construction of wells and piping to recover the banked water, and installation of pumps to deliver the recovered water as shown in Figure 2-16.

Phase 2 recharge and recovery facilities would use or include:

- up to 15 existing wells for recovery,
- up to 49 new wells and recovery pipelines (in phases over several years) to provide 200 cfs of recovery capacity, and
- one lift station on GF Canal to provide 200 cfs of pump-back capacity to the San Joaquin River.

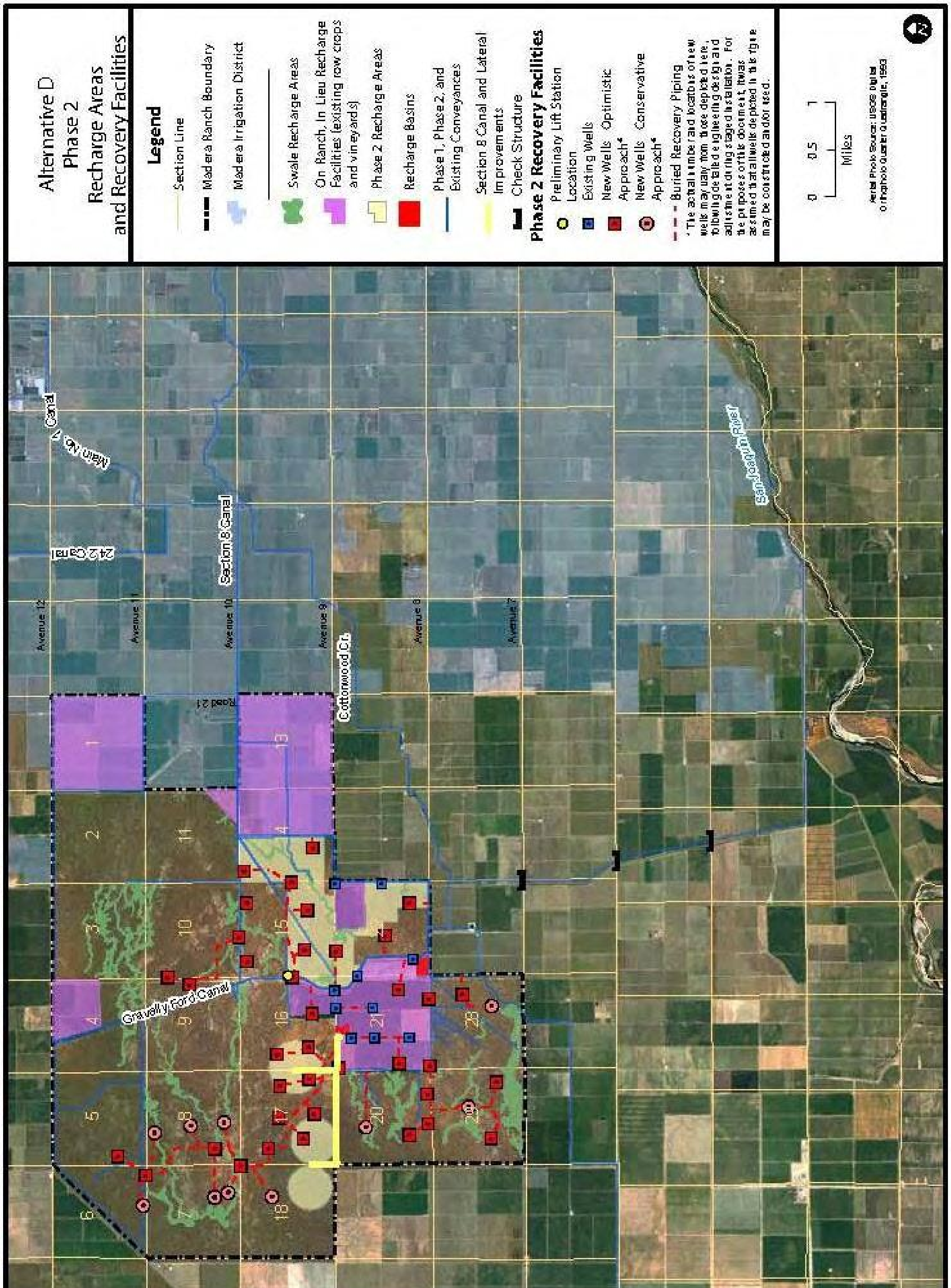

Figure 2-16 Alternative D Phase 2 Recharge Areas and Recovery Facilities

Diversion and Conveyance Facilities

Upgrades to Existing Canals As under Alternative B, up to 3.2 miles of 20- to 100-cfs earthen ditches would be constructed within the Phase 2 basin window to distribute water into recharge areas.

Gravelly Ford Canal Section 21 Northern Lateral As under Alternative B, the 0.45-mile-long Phase 1 ditch along the northern side of Section 21 would be replaced with an approximately 2.1-mile-long, 135-cfs east-west earthen lateral canal along the north side of Sections 21 and 20 with two north-south sub-lateral canals running northward along the east and the west sides of Section 17.

Recharge Facilities

Recharge Basins As under Alternative B, depending on the performance of Phase 1 recharge facilities, up to approximately 1,000 acres of recharge basins may be constructed in a 1,300-acre area.

Recovery Facilities

Recovery Wells As under Alternative B, banked water would be recovered using up to 15 existing wells and approximately 49 new wells (see Figure 2-16).

Recovery Pipelines and Electrical Facilities As under Alternative B, up to 11.6 miles of 8-inch- to 60-inch-diameter PVC to RCP buried recovery pipelines would run from recovery wells to the GF Canal (Figure 2-16).

Recovery Lift Station One lift station would be constructed along the GF Canal to pump water recovered from wells back to the San Joaquin River through the canal

2.6.3 Construction

All construction methodologies necessary to construct MID facilities under Alternative D are described in detail under Alternative B – Water Banking outside the MID Service Area Using Swales and Alteration of Reclamation-Owned Facilities. Construction of facilities on GFWD land and in GF Canal is described below.

Gravelly Ford Canal Improvements

Construction methods necessary for the upgrade of GF Canal are discussed in Alternative B under the subsections Upgrade of Section 8 Canal, Cottonwood Creek, and Main No. 1 Canal Connection, Weir Installation, and Construction of Recovery Lift Stations. The regrading of the off-ranch portions of GF Canal will require the movement of an additional 15,000 cy of soil.

2.6.4 Maintenance

All maintenance activities necessary to operate Alternative D are described in detail under Alternative B – Water Banking outside the MID Service Area Using Swales and Alteration of Reclamation-Owned Facilities.

Maintenance Corridors

As under Alternative B, the maintenance corridors would include new roads in the recharge basin area and areas with heavy disturbance, and unimproved routes in grassland areas.

2.6.5 Operations

Madera Ranch operations, including banking, water recovery, and maintenance to support banking and recovery, are described below, including measures to monitor potential effects on neighboring farmers and districts (adjacent stakeholders).

Water Banking

Please refer to the Banking subsection of Alternative B – Water Banking outside MID Service Area Using Swales and Alteration of Reclamation-Owned Facilities. Fewer swales, including those in Section 2, would be used under this alternative.

Monitoring and Operational Constraints Plan

Please refer to the Monitoring and Operational Constraints Plan subsection of Alternative B- Water Banking outside the MID Service Area Using Swales and Alteration of Reclamation-Owned Facilities. The MROC would revise the plan to accommodate additional monitoring in GF Canal if this alternative is selected.

Delivery Protocol

As no Reclamation or MID conveyances to Madera Ranch would be upgraded under this Alternative, MID would not be able to recover banked water for conveyance to MID's users or other bank participants.

In order to implement this Alternative, MID would need to enter into a wheeling agreement with Reclamation using San Joaquin River Restoration water. Under this scenario, in years when water is available for banking, it would be wheeled through the San Joaquin River and then the GF Canal and banked at Madera Ranch. In years when the water is needed by MID, it would be recovered from wells and allowed to flow back through the GF Canal to the San Joaquin River. MID's releases of recovered water to the San Joaquin River would be used as San Joaquin River Restoration flows in exchange for deliveries of San Joaquin River Restoration water from Millerton Lake to Madera Ranch water bank participants.

These deliveries would be made in lieu of normal surface water deliveries from Millerton Lake or Hensley Lake. Therefore, an equal volume of water would be made available to MID from these reservoirs for delivery to other parts of the MID service areas, increasing the net supply of available water.

Water Recovery Operations

Water would be recovered using existing wells and new wells installed in the vicinity and downgradient of the recharge areas. As noted above, recovery operations would be constrained by the MOCP to prevent unacceptable impact on surrounding landowners. Recovered water would be pumped into collection piping and into the GF Canal for delivery to the San Joaquin River. Recovered water would be delivered through exchange agreements as discussed above in the Delivery Protocol subsection of Alternative D.

The recovery operations described above do not depend on farmer irrigation demand but would depend on the schedule of required flows for San Joaquin River restoration, which may not match banking participant needs.

Use of the Water Bank Facilities by Other Entities

Please refer to the Use of the Water Bank Facilities by Other Entities subsection of Alternative B.

Mitigation

MID would revise its mitigation commitments under this alternative. Mitigation anticipated for Alternative D could be less than approximately 4,500 acres depending on the number of acres of recharge basins constructed. MID's conceptual mitigation areas would include a portion of the areas illustrated in Figure 2-12.

2.7 Environmental Commitments

The following environmental commitments would be implemented where applicable, in association with construction activities for the alternatives The environmental commitments section was developed by Reclamation and MID in coordination with the Corps and USFWS. Each commitment would be implemented in accordance with each agency's policies, guidance, and authorities. Additional detail on the environmental commitments is in the Affected Environment and Environmental Consequences section.

Table 2-2 Environmental Commitments

Identifier	Environmental Commitment	Commitment Specifications
Agriculture		
AG-1	Permanently Preserve Farmland by Establishing a Conservation Easement on Agricultural Land	MID will establish conservation easements on agricultural land at an effect-to-mitigation ratio of 2:1 to prevent permanent conversion of the land to urban uses and to increase farm viability. This mitigation will be in kind and used to mitigate the loss of farmland classified as prime farmland or farmland of statewide importance.
Air Quality		
AQ-1	Implement San Joaquin Valley Air Pollution Control District Regulation VIII Control Measures for construction emissions of PM10.	• All disturbed areas, including storage piles, that are not being actively used for construction purposes will be effectively stabilized against dust emissions using water, chemical stabilizer/suppressant, or vegetative ground cover. Chemical stabilizer/suppressants will not be used near waters of the United States. • All on-site unpaved roads and off-site unpaved access roads used during construction will be effectively stabilized against dust emissions using water or chemical stabilizer/suppressant. • All land-clearing, grubbing, scraping, excavating, land-leveling, grading, cut-and-fill, and demolition activities will be effectively controlled against fugitive dust emissions by applying water or presoaking. • All operations will limit or expeditiously remove the accumulation of mud or dirt from adjacent public streets at least once every 24 hours during operations (The use of dry rotary brushes is expressly prohibited except where preceded or accompanied by sufficient wetting to limit visible dust emissions. The use of blower devices is expressly forbidden.). After materials are added to or removed from the surface of outdoor storage piles, the piles will be effectively stabilized against fugitive dust emissions using sufficient water or chemical stabilizer/suppressant.
AQ-2	Reduce Emissions Associated with Idling Equipment	Per California Air Resources Board regulations (Title 13 of the California Code of Regulations, Sections 2480 and 2485), which limit idling of diesel-fueled commercial motor vehicles, MID will require that all diesel engines be shut off when not in use to reduce emissions from idling.
AQ-3	Use Electric Pumps	MID will use as many electric pumps as possible for recovery operations to reduce emissions associated with propane. If propane pumps are needed, MID will use engines with catalytic controls and that meet SJVAPCD best available control technology (BACT) requirement for engines over 50 hp.
Biological Resources		
BIO-1	Establish a Grasslands Conservation Easement	Mitigation for the loss of California annual grassland, alkali grassland, or Great Valley iodine brush scrub would consist of establishing a grasslands conservation easement at Madera Ranch over an area of habitat larger than the area subject to long-term degradation (2 acres conserved: 1 acre affected for swales) or permanent loss (3 acre conserved: 1 acre lost). MID also would implement a Madera Ranch Mitigation, Grazing, and Management Plan to improve existing on-site habitat through grazing management and species monitoring. This measure would compensate completely for the loss of these habitats.
BIO-2a	Preconstruction Surveys/Avoid Effects on Vernal Pools and Alkali Rain Pools	MID will minimize effects on species in this habitat by avoiding these wetlands to the extent practical. A buffer area will be established around suitable habitat for listed crustaceans in the action area, i.e., vernal pools. Buffer areas will be demarcated by installing fencing 250 feet from each occupied pool. A qualified biologist will flag the pools to be fenced, and temporary fences will be installed as the first order of work. Construction barrier fencing will be placed at the edge of the buffer areas. Temporary fences will be furnished, constructed, maintained, and later removed as shown on the construction plans, as specified in the special provisions, and as directed by the project engineer. Temporary fencing will be four feet high, orange, commercial-quality woven polypropylene. No construction activities will be permitted within the buffer zone (including staging or sidecasting of material) other than those activities necessary to erect the fencing. Erosion control measures will be employed adjacent to occupied listed crustacean habitat to prevent soil from eroding or falling into these areas. Natural/ biodegradable erosion control measures (e.g., straw wattles, hay bales) will be used. Plastic monofilament netting (erosion control matting) will not be allowed.
BIO-2b	Create, Restore, and/or Preserve Vernal Pools	MID will create, restore and/or preserve vernal pool habitat at Madera Ranch in an area protected under a conservation easement. Five acres of vernal habitat would be restored and/or preserved for each acre of vernal pool or alkali rain pool habitat lost as a result of activities associated with the Proposed Action (5 acre created: 1 acre lost). MID anticipates that the approximate split of these acreages will be 3:1 preservation and 2:1 creation/restoration. This ultimately will be determined based on wetland locations, soil conditions, and consultation with the Corps; soils, hydrology, vegetation, and species will be monitored. The performance standard for created vernal pools is to ensure the new vernal pools emulate the natural pools at Madera Ranch. Created vernal pools would have similar plant species composition and vegetation cover and invertebrate fauna as the vernal pools that are being removed by activities associated with the Proposed Action. Success of the vernal pool creation would be assessed by comparing the pools with undisturbed natural vernal pools at Madera Ranch. Restored vernal pools will have similar success criteria. This mitigation would compensate for the loss of vernal pool habitat. Restoration is more likely to be successful in areas with degraded habitat and where preservation is the most assured. In addition, MID will comply with Reclamation's wetlands mitigation and enhancement policy, which focuses on protecting, restoring, and enhancing wetlands and ensuring no overall net loss of wetlands. Wetland mitigation creation and restoration sites will be monitored until it is proven successful to the Corps, USFWS, and DFG. Mitigation sites must function for at least three years without human intervention.
BIO-3a	Avoid Effects on Iodine Bush Scrub	MID will locate the well and pipeline to avoid direct effects on iodine bush scrub habitat in the northern portion of Section 7 associated with construction activities. If wells and pipelines need to be constructed in this habitat, MID will conduct botanical surveys and mark plants to be avoided during construction.
BIO-3b	Survey for Sensitive Plants	During Phase 1, two botanists conducted visual surveys for palmate-bracted bird's beak (*Cordylanthus palmatus*) and other sensitive plant species along a 60-foot corridor (30 feet per side) along the proposed pipeline and canal alignments and in the swales east of Gravelly Ford Canal. The surveys were conducted in April and July and reference populations were visited. No listed species were found and sensitive *Atriplex* species were mapped to minimize future effects. The results of the botanical surveys will be used to determine which avoidance, minimization, and environmental commitments will be employed. During Phase 2, additional botanical surveys will be conducted in the area proposed for recharge basin creation. Complete visual surveys will be conducted in a similar manner in all areas proposed for permanent ground disturbance. If palmate-bracted bird's beak is found, the population will be delineated with highly visible flagging tape or plastic fencing and avoided. If other sensitive species are found, MID, DFG and USFWS will coordinate to determine the feasibility of avoiding the population.
BIO-4a	Preconstruction Surveys for California Tiger Salamander	A USFWS-approved biologist will conduct preconstruction surveys for California tiger salamander (*Ambystoma californiense [=A. tigrinum c.]*) in suitable aquatic and upland habitat. Before the start of ground-disturbing activities or vegetation removal, the approved biologist or biological monitor will survey the area to be affected that day for California tiger salamanders. The biologist also will examine any open trenches, which will have ramps or be closed when unattended, for the presence of salamanders. If a salamander is found in the construction area, the approved biologist will remove the animal from the area and release it into a suitable burrow at least 300 feet outside the construction area. The biologist will document the results of surveys on preconstruction survey log sheets, which will be kept on file at MID.
BIO-4b	Restrict Construction Activity in Suitable Aquatic and Upland Habitat for California Tiger Salamander to the Dry Season (April 1–November 1)	To avoid and minimize potential mortality and injury of breeding and dispersing California tiger salamanders, construction will take place only during the dry season (between April 1 and November 1 or before the onset of the rainy season, whichever occurs first) in suitable aquatic and upland habitat for the species. Upland habitat is defined as all habitat within one mile of occupied or suitable aquatic habitat. Specifically, this measure applies to all pipeline construction on Madera Ranch and during work at all delivery canals. This measure does not apply to construction activities in gravel shoulders and heavily disturbed non-habitat areas where construction is confined entirely to areas devoid of upland grassland habitat.
BIO-4c	Fence the Construction Zone and Implement Erosion Control Measures	The construction zone will be fenced in areas where suitable aquatic habitat for California tiger salamander is adjacent to the construction area. The purpose of the fence is to restrict construction equipment to the designated area only. Erosion control measures also will be implemented in these areas to prevent any soil or other materials from entering aquatic habitat. Locations of temporary

Identifier	Environmental Commitment	Commitment Specifications
	in Areas Where Suitable Aquatic Habitat for California Tiger Salamander Is Present	fences and erosion control measures will be shown on the construction plans and will be reviewed by a qualified biologist. Construction barrier fencing will be installed along the edge of the work area as the first order of work. Temporary fences will be furnished, constructed, maintained, and later removed as shown on the plans, as specified in the special provisions, and as directed by the project engineer. No construction activities will be permitted outside the designated construction zone other than those activities necessary to erect the fencing. Erosion control measures will be installed adjacent to suitable aquatic habitat to prevent soil from eroding or falling into these areas. Natural/biodegradable erosion control measures (e.g., straw wattles, hay bales) will be used. Plastic monofilament netting (erosion control matting) will not be allowed because salamanders can be caught in this type of material.
BIO-5	Pre-Activity Surveys for Blunt-Nosed Leopard Lizard	The objective of the blunt-nosed leopard lizard (*Gambelia [=Crotaphytus] sila*) (blunt-nosed leopard lizard) surveys is to avoid take of blunt-nosed leopard lizard during use of the swales for water banking and construction of water delivery canals and other facilities. Specific measures for linear facilities and swales are described below.
Bio-5a	Install exclusion fencing and conduct clearance surveys and construction monitoring for blunt-nosed leopard lizards	*Linear Facilities* Prior to construction of linear facilities in grassland and/or saltbush scrub/Valley sink scrub habitat and adjacent dirt roadways MID, in consultation and coordination with qualified wildlife biologists, shall create exclusion corridors based on habitat suitability and the need to create exclusion zones for burrows, scalds, and wetlands. Construction of linear facilities is restricted to May 1st through August 1st and may commence in areas only after Blunt-Nosed Leopard Lizard (―BNLL") pre-construction surveys are completed. Pre-activity BNLL surveys were coordinated with the USFWS and CDFG since California's Fish and Game Code does not allow take of this species. Pre-activity surveys shall consist of the following minimum parameters: 1. Surveys for adult BNLL shall be conducted between April 28th and July 1st and shall occur when the air temperature (as measured at 1-2 cm above the ground over a surface most representative of the area being surveyed) is between 25 ^{o}C - 35 ^{o}C (77 ^{o}F – 95 ^{o}F). Once the air temperature falls within the optimal range, surveys may begin after sunrise (once sun is high enough to shine directly on the ground surface being surveyed) and must end by 1400 hours or when the maximum air temperature is reached, whichever occurs first. 2. Time of day and air temperature shall be recorded at the start and end of each survey. 3. Surveys will not be conducted on overcast (cloud cover > 90%) or rainy days or when sustained wind velocity exceeds 10 mph (>3 on Beaufort wind scale). 4. Surveys shall be conducted on foot and transects shall be no larger than 10 meters wide, consist of a slow pace, and be conducted on a north-south orientation when possible. 5. Surveys shall be conducted for 12 days over the course of a 30 day period. Surveys shall be conducted for 4 consecutive days, weather permitting with at least one survey session consisting of a 4 consecutive day period. 6. The starting/ending locations of surveys should be modified/alternated to the extent practicable, but resulting in the same area surveyed. This is so that different portions of the site are surveyed at different time/temp periods. 7. Surveyors must be approved by the DFG and USFWS to conduct the BNLL reconnaissance surveys. The survey crew conducting focused BNLL surveys shall consist of no more than 3 Level I surveyors for every Level II surveyor. The names of every surveyor must be recorded for each survey day. 8. All herpetofauna observations shall be recorded/tallied. All BNLL observations shall be recorded with GPS, time of observation, name of observer, sex (if evident), and lifestage (adult, juvenile, hatchling). If BNLL is observed in association with or observed entering a particular burrow, burrow location (via GPS) should be recorded as well. 9. If a BNLL is observed within such areas, consultation with CDFG must immediately occur. However, if BNLL observations are made, BNLL surveys should not be halted; the entire survey should be completed for the entirety of the construction footprint; continuing the surveys is important to maximize detections and to best help inform where the lizards occur and may not occur. Partial surveys cannot be used to inform whether or not avoidance can or will occur. (hereafter 1- 9 collectively referred to as, ―BNLLPre-Construction Survey Parameters".) A. <u>Installation of Barrier</u> - Within 3 days after BNLL pre-construction surveys are completed, biologists shall oversee the creation an exclusion area by installing a non-gaping non-climbable barrier using a material approved by DFG and the USFWS along 3 sides of the planned linear facility construction perimeter. The barrier installation shall be overseen by biologists who have BNLL experience and who have been approved in advance by USFWS and DFG (hereafter, qualified BNLL biologists). The barrier fencing shall be installed perpendicular to the ground (vertical) and shall be sealed to ensure there are no gaps between segments or under the fencing. An example of possible suitable material can be found at http://www.ertecsystems.com/. Small mammal burrows and burrow complexes shall be excluded from the liner facility construction areas to the maximum extent practicable and a no disturbance buffer zone shall be established and clearly delineated from any burrows / burrow complexes. The day following the installation of the fencing, the qualified BNLL biologists shall walk approximately 10 meter transects along the partially fenced linear facility construction area during the time of day when air temperatures fall within the optimum range for species detection, during the peak BNLL activity season, and as outlined above. If no BNLL are detected, the fourth side of fencing may be installed and MID may begin work within the fenced area. At least two DFG and USFWS approved biologists will be present within the construction area when construction and other activities within the exclusion area are in progress. B. <u>Walking Surveys Throughout Construction</u> - Throughout construction, the biologists shall conduct walking surveys of the construction area, looking for BNLL. All open holes and trenches within habitat will be inspected at the beginning of the day, middle of the day, and end of day for trapped animals. If BNLL are detected at any time and within any area of the basin construction site, biologists will halt all work, open a section of the exclusion fencing, and allow the lizard to leave the area on its own (no chasing, following, etc. can occur). C. <u>Inadvertent Entrapment Prevention</u>-- To prevent inadvertent entrapment of BNLL or any other wildlife during the construction phase of the linear facilities, all excavated, steep-walled holes or trenches more than 2 feet deep shall be covered at the close of each working day by plywood or similar materials or provided with one or more escape ramps (with no greater than a 3:1 slope) constructed of earth fill or wooden planks. Before such holes or trenches are filled, they shall be thoroughly inspected for trapped animals by a qualified biologist. If BNLL are trapped, then it shall be allowed to escape on its own. In addition, all construction pipe, culverts, or similar structures with a diameter of 7.6 centimeters (3 inches) or greater that are stored at the construction site for one or more overnight periods will be thoroughly inspected for BNLL before the pipe is subsequently moved, buried, or capped. If during inspection one of these animals is discovered inside a pipe that section of pipe shall not be moved until the animal has escaped on its own. D. <u>Construction Time</u> - The permitted construction time is from one hour after sunrise to one hour before sunset, and two biological monitors shall also be active at all times when construction or other activities are in progress. The biological monitors shall survey the construction area during construction, scanning the ground for BNLL and routinely checking excavated soils to ensure that BNLL are not present. The biological monitors shall stop work if a lizard is found within the construction area until the lizard has been excluded from the work area. E. <u>Multiple Construction Areas</u> More than one linear facility construction area may be established and under construction at the same time provided the minimum number of biologists and biological monitors are present at each of the sites at all times during construction or other related activities.

Identifier	Environmental Commitment	Commitment Specifications
		F. Notification of Dead or Injured BNLL - If any dead or injured BNLL are observed on or adjacent to the construction site, or along haul roads/travel routes for worker and/or equipment, regardless of assumed cause, DFG and USFWS shall be notified. The initial notification to DFG and USFWS shall include information regarding the location, species, and the number of animals injured or killed. Following initial notification, MID shall send DFG and USFWS a written report within 2 calendar days. The report shall include the date and time of the finding or incident, location of the carcass, and if possible provide a photograph, explanation as to cause of death, and any other pertinent information. G. Fully Protected Species - These measures shall not be required if the species' fully protected status is rescinded and MID obtains incidental take authorization from DFG for this species for this project. *Recharge Basins* MID, in consultation and coordination with qualified wildlife biologists, shall create appropriately sized recharge basin construction areas before construction of recharge basins in grassland and/or saltbush scrub/Valley sink scrub habitat and adjacent dirt roadways within the former center pivot areas of Section 16, 17, and 18 on Madera Ranch. Construction areas shall be prioritized initially by reconnaissance surveys no more than 60 days prior to any basin construction activities or ground disturbance to identify areas with the fewest burrows and least suitable habitat for BNLL. Construction of basins will be restricted to May 1st through August 1st and may commence in areas identified through the above referenced reconnaissance surveys only after BNLL pre-construction surveys are completed by way of the BNLL Pre-Construction Survey Parameters (See paragraph I.A. above). The information gathered from these surveys will be used by DFG to determine which habitat is most likely occupied and to identify appropriate exclusion areas. (Basins shall initially be planned to be sited in the former center pivot areas of Section 16, 17, and 18.) If no BNLL is observed within 3 days after the completion of the BNLL pre-construction survey, biologists shall create an exclusion area by installing non-gaping non-climbable barrier. The installation for such barrier shall comply with the installation guidelines listed above under linear facilities, and must be supervised by a qualified BNLL biologist. (See paragraph I.B above.) Construction of the recharge basins is permitted from one hour after sunrise to one hour before sunset. (See I.E above.) More than one percolation basin construction area may be establish and under construction at the same time provided the minimum number of biologists and biological monitors are present at each of the sites at all times during construction or other related activities. Throughout construction, Biologists shall conduct walking surveys of the construction area to determine whether there is any detection of the BNLL. The survey procedures shall comply with paragraph I.C. listed above. Also during construction, all excavated, steep-walled holes or trenches more than 2 feet deep shall be covered as described under I.D above, to prevent inadvertent entrapment of BNLL or any other wildlife. Finally, if any dead or injured BNLL are observed on or adjacent to the construction site, then MID must notified DFG and USFWS in accordance with the outline procedures listed above under I.G. If the BNLL fully protected status is rescinded and an incidental take permit is granted, then these measures will not be required. *On-Ranch Ground Disturbing Facility Maintenance* MID will have an agency approved biologist review future ground disturbing facility maintenance work locations and sizes to evaluate the potential for effects to BNLL. If the activity is in suitable habitat and could affect burrows, MID will conduct the work during the appropriate seasonal window and implement site-specific exclusion measures such as fencing and additional surveys as prescribed above for linear facilities.
Bio-5b	Conduct blunt-nosed leopard lizard and burrow surveys of swales proposed for inundation	MID will conduct BNLL and burrow surveys of swales prior to inundation in swales. Those portions of swales that have been inundated annually for extended periods prior to Project approval will not be surveyed because potential burrows likely have been inundated and eroded, and BNLL are unlikely to aestivate in these areas. Pre-wetting BNLL surveys will be consistent with the *BNLL Pre-Construction Survey Parameters* listed above under I.A.. The information from these surveys will be used to determine which habitat is most likely occupied and to identify appropriate swale use areas. If no BNLL are found during the surveys, water may be applied throughout that following year. If a BNLL is sighted within the low point of a swale (i.e., the expected inundation area) it will be difficult to determine whether the burrows in the area are being used for nesting or refugia. Therefore, MID will delay using the swale for banking until the active season (April 28 to July 1); then MID will apply water to the swale slowly (i.e., approximately 12 inches per minute) to ensure lizards can escape burrows. These measures shall not be required if the species' fully protected status is rescinded and MID obtains incidental take authorization from DFG for this species for this project.
Bio-5c	Implement other protective measures for blunt-nosed leopard lizard	MID will implement other protective measures for blunt-nosed leopard lizard. MID would create at least three canal crossings along Gravelly Ford Canal and 6 canal crossings along the Section 8 Canal Northern Extension; the width of the crossings will vary from approximately 16 feet along Gravelly Ford Canal to approximately eight feet along the Section 8 Canal Northern Extension. While making Gravelly Ford Canal improvements and installing the Section 8 Canal Northern Extension, MID would excavate slightly below the bottom grade of the canal to install a culvert and provide for a crossing to connect the habitat units. The area would be backfilled, covering the crossing with soil from the canal improvement. A similar concept would be employed for the Section 8 Canal Northern Extension, though the length of the pipe segment would be four to eight feet and because of the flat hydraulic grade one larger pipe may be used. Additionally, on-ranch canal side slopes will be designed to allow BNLL to avoid entrapment.
BIO-6	Preconstruction Surveys and Avoidance Activities for Raptors	Preconstruction surveys would determine whether any sensitive raptors are nesting at Madera Ranch. If a tree is occupied at the time of construction, construction activities will be restricted to areas outside 0.5 mile of the tree. Setbacks will be marked with brightly colored temporary fencing.
BIO-7	Preconstruction Surveys for Western Burrowing Owl	The initial daytime burrow survey will help inform the Western burrowing owl (*Athene cunicularia*) survey. A qualified wildlife biologist will conduct a burrowing owl survey in accordance with DFG guidelines. The survey area will include the construction corridor and a 500-foot buffer. An initial survey will determine whether burrowing owls are present. Three additional surveys will be conducted to determine presence or absence of burrowing owls. In accordance with DFG survey guidelines, these surveys must be conducted on four separate days—two in the early morning and two in the late afternoon/early evening. Non-nesting owls may be passively relocated, also using DFG's guidelines.
BIO-8	Preconstruction Surveys for San Joaquin Kit Fox	Because of historical records and suitable San Joaquin kit fox (*Vulpes macrotis mutica*) habitat on or in the vicinity of Madera Ranch, it is assumed that kit foxes could be present at Madera Ranch. To avoid potential mortality of kit fox, agency approved (by USFWS and DFG) experienced biologists will survey to locate any natal dens, non-natal active dens, and/or potential dens in the Proposed Action area. Visual surveys will be conducted during meandering transects of the 1,000 foot corridor. If an active natal den is found, USFWS and DFG will be notified and MID will delay construction within 1,000 feet of the den until the pups have been weaned or moved to an off-site den, and/or reroute the construction corridor to avoid impacts on the kit foxes. Standard Kit fox provisions will be followed in accordance with USFWS guidelines.

Identifier	Environmental Commitment	Commitment Specifications
		Surveying will include meandering transect surveys for active dens (non-natal) out to 250 feet from the proposed facilities, which will involve simultaneous surveys for potential den sites out to 100 feet. If an active den is found, it will be avoided until the foxes have vacated the den. All potential dens will be flagged. Any potential den immediately in the construction corridor may need additional monitoring. Because construction is expected to proceed quickly—approximately 1,000 feet per day with trenches being open one to two nights—potential dens will not be collapsed. All surveys will be conducted within 30 days of site-specific construction by a qualified biologist. In addition, during construction, USFWS standard kit fox conservation measures such as speed limits, exit ramps, controlling toxic (oil or gas) spills from construction equipment, and covering pipes will be implemented to prevent harm or disturbance to kit foxes using the area. Any open pipes, newly dug pipeline trenches, and canals will be surveyed daily prior to construction to ensure kit foxes are not present.
BIO 9	Conduct Pre-Activity Surveys for Fresno Kangaroo Rat	The objective of the Fresno kangaroo rat (*Dipodomys nitratoides exilis*) surveys is to determine whether the Fresno kangaroo rat is present on the portion of Madera Ranch that could be affected by use of the swales for water banking and construction of water delivery canals. Initial trapping focused on the swales and canals east of GF Canal and determined the species was not present. Subsequent trapping will occur 1-year before use of swales or construction of facilities west of GF Canal. Surveys in swales will be conducted 1 to 2 years before the first wetting of the swale and will be valid for 5 years after the wetting of the swale. If the swale is re-wetted within the 5-year period, it will not need to be surveyed for another 5-year period. No additional survey efforts will be conducted of any swale areas that have been surveyed twice with neither survey resulting in a single trapping of the Fresno kangaroo rat. Kangaroo rat trapping efforts will be conducted by a surveyor holding a recovery permit for the Fresno kangaroo rat (10[a][1][A] permit). Meandering visual transect surveys for kangaroo rat burrow complexes and sign (e.g., tail drags, sand baths, seed caches) will be conducted by two to four biologists over all habitat within and out to 250 feet from the edge of the WSEP footprint, including swales, and within 100 feet of the top of GF Canal. All burrow complexes found will be recorded on a GPS unit, and data on the number of burrows, level of activity, and general suitability for kangaroo rats will be recorded in field notes (burrows suitable for kit fox also will be noted on GPS as part of this effort); information on vegetation type and percent cover also will be recorded. Following completion of the survey, potential trapping-sites will be prioritized based on a combination of the level of kangaroo rat activity (as evidenced by burrow density and/or the presence of other sign, though some areas without obvious sign may also be trapped) and project area coverage. Live trap stations and trap lines then will be established (staked and recorded with a GPS unit) by permitted biologists at the highest priority sites. Traps (Sherman live traps [Model XLKR: 13 inches x 3.5 inches x 3 inches]) will be set near active burrows, dust baths, or tracks, particularly along evident runways. Ten or more traps (or a number determined by the surveyor) will be set in relatively tight clusters (5-foot trap spacing) at high activity areas. Traps also will be set at 10 to 15 meter intervals (two traps per station) along evident movement corridors. Traps will be baited with a mixture of millet seed, crimped oats, wild birdseed, or other suitable seed. Bedding (crumpled unbleached paper towel) will be placed at the inside end of each trap and will not be allowed to contact the tripping mechanism. Paper towels will be replaced each time an animal is captured in the trap. Traps will be opened and baited at sunset and checked 1-2 times/evening as deemed appropriate by the lead biologist. All traps will be closed after they have been checked at dawn. Trapping will be conducted at each trap site for five consecutive nights. Trapping will not be conducted during the week of a full moon, unless the sky is overcast and moonlight is substantially reduced. Trapping will not be conducted in December or January or in periods of cold or inclement weather detrimental to kangaroo rats and as stipulated in the surveyor's recovery permit. Although Fresno kangaroo rats are active year round, their populations generally are lowest at this time. All non-Fresno kangaroo rats captured will be marked with a nontoxic semi-permanent ink marker on the belly to identify the re-trapping of the same animal(s). Trapping will cease with the capture of a Fresno kangaroo rat and MID, the USFWS, and DFG will be notified as soon as possible, if not the same day, then the next workday, or no later than the Monday following the capture should it occur on a Friday or Saturday night. Any measurements obtained to provide evidence that the animal captured is a Fresno kangaroo rat will be achieved with minimal and delicate handling fur and tissue samples will be taken only by a qualified, permitted biologist in accordance with their permit terms. A photo of the animal's hind legs (showing toes and including a ruler) will be taken and the animal will be immediately released; the animal's eyes will be shielded from the flash. The lead biologist will notify MID of the proposed trapping schedule and will inform MID weekly which trapping areas have been completed. Any capture of Fresno kangaroo rat will be reported immediately to MID, the USFWS, DFG, and Reclamation.
BIO-10	Conduct Preconstruction Surveys for Sensitive Species along the Off-Ranch Portion of Gravelly Ford Canal	Proposed off-ranch work areas associated with GF Canal improvements will be evaluated by a USFWS-approved biologist to determine whether habitat suitable to support sensitive species is present. If suitable habitat is discovered, MID will evaluate work locations to determine which species could be present and whether additional surveys may be needed. Depending on the results of this survey, MID also may implement Environmental Commitment BIO-1: Establish a Grasslands Conservation Easement, Environmental Commitment BIO-5: Pre-Activity Surveys for Blunt-Nosed Leopard Lizard, Environmental Commitment BIO-6: Preconstruction Surveys and Avoidance Activities for Raptors, and Environmental Commitment BIO-7: Preconstruction Surveys for Western Burrowing Owl.
BIO-11	Implement Protective Measures for Anadromous Fish	MID would work with Reclamation and the National Marine Fisheries Service (NMFS) to determine appropriate protective measures for migratory fish once they are restored to the San Joaquin River, including seasonal restrictions on diversions or intake screening in the event water is moved to and from Madera Ranch via GF Canal (Alternative D). Inter-agency discussions would occur at least two years in advance of the reintroduction of these species to the San Joaquin River.
Cultural Resources		
CR-1	Stop Construction If Cultural Resources Are Discovered	In the event of any inadvertent cultural resources discovery, human or otherwise, uncovered during construction or other ground-disturbing activities, the construction contractor will immediately stop work in the immediate vicinity and a minimum 100-foot buffer area from the find. The contractor will notify MID immediately and MID will notify Reclamation of the inadvertent discovery. A professionally qualified archaeologist will be sent to evaluate the inadvertent discovery for National Register of Historic Places (NRHP) eligibility. If human remains are discovered during ground-disturbing activities, the party responsible for CEQA will comply with state laws[1] relating to the disposition of human remains pursuant to Public Resources Code (PRC) section 5097. Reclamation may have additional responsibilities under Section 106 of the NHPA and will follow the procedures in 36 CFR Part 800.13.
Geology, Soils, Seismicity and Erosion		
GEO-1	Amend Soils as Required in Topsoiled Areas	Topsoiled areas with insufficient vegetation cover will be amended with gypsum and/or elemental sulfur in combination with high-quality irrigation water to reduce soil salinity, alkalinity, and exchangeable sodium to acceptable levels, such that acceptable vegetation cover is established in such areas within one year after topsoil is applied. All soil sampling and amendment recommendations will be conducted by, or under the supervision of, a certified professional soil scientist.
GEO-2	Stop Work in Event of Fossil Discovery	In the event that a fossil or material that could be a fossil is unexpectedly discovered during excavation operations, work will cease in the immediate vicinity of the find. A qualified paleontologist will be called to the site to evaluate the find and determine the sensitivity of the fossil. If the fossil is determined to be sensitive, the paleontologist will recover it from the site and submit it to an appropriate

[1] Madera Ranch does not include federal land, so only state human-remains laws apply.

Identifier	Environmental Commitment	Commitment Specifications
		museum or other repository for curation.
Hazards, Public Health and Safety		
PHS-1a	Implement Necessary Emergency Preparedness Plan(s)	MID will work with the Madera County Department of Public Health and the local fire districts to coordinate the preparation of emergency preparedness plan(s) that may be required by federal, state, and County statutes and regulations.
PHS-1b	Comply with Local Fire District Requirements	MID will consult the local fire districts to ensure that all regulations are complied with during construction.
PHS-2	Implement an Agreement with the Madera County Mosquito and Vector Control District	MID will enter into an agreement with the Madera County Mosquito Abatement & Vector Control District (MCMAVCD) regarding a specific mosquito abatement program. The agreement will allow the MCMAVCD to access Madera Ranch and also will include quantitative abatement thresholds and financial compensation requirements for MCMAVCD activities, if necessary. The MCMAVCD will monitor mosquito larvae production in the recharge basins, drainages, and distribution canals at no cost to MID, given that the amount of monitoring required is not excessive. Larvae populations will be tracked using methods and thresholds approved by the MCMAVCD, and suppression measures will be employed when thresholds are exceeded. Suppression measures may include environmental and biological methods, such as stocking mosquitofish, controlling emergent vegetation, and applying insecticides. Insecticide controls will be used only as a last resort, and use of insecticides over open water will be minimized to the extent feasible, given the mosquito abatement mandate of the MCMAVCD. The insecticides that may be used are only those that are approved for such uses by the U.S. Environmental Protection Agency (EPA). Mosquitofish, if used, will need to be stocked annually by the MCMAVCD. If operations result in an increase in mosquito production such that an extensive monitoring program is needed, MID will hire a professional pest control service and will bear the cost of that service.
Noise		
NOI-1	The construction contractor will employ noise-reducing construction practices so that noise from construction does not exceed County noise-level standards at adjacent residences.	Measures to be implemented would include the following. • Restrict construction to beyond 3,900 feet from residences during nighttime hours (10 p.m. to 7 a.m.). • Provide construction equipment with sound-control devices no less effective than those provided on the original equipment. No equipment will have an unmuffled exhaust. • Implement appropriate additional noise environmental commitments, including (but not limited to) changing the location of stationary construction equipment, shutting off idling equipment, rescheduling construction activity, notifying adjacent residents in advance of construction work, and installing acoustic barriers around stationary construction noise sources.
NOI-2	The construction contractor will employ noise-reducing methods during well drilling operations	The drilling contractor will employ noise-reducing construction practices so that noise from drilling does not exceed County noise-level standards at adjacent residences. Measures to be implemented may include those following. • Restrict well drilling to beyond 2,900 feet from residences during nighttime hours (10 p.m. to 7 a.m.), where feasible. • Use sound attenuation enclosures around noise-generating elements of the drilling operation.
NOI-3	The construction contractor will employ noise-reducing practices so that noise from well operations does not exceed County noise-level standards at adjacent residences.	Measures to be implemented may include: • restricting well installations to beyond 1,250 feet from residences, where feasible; • using electric pumps where well installations are within 1,250 feet of residences; and • using sound attenuation enclosures designed to achieve noise reductions sufficient to comply with County standards for noise-generating elements of the well operation when no other feasible control method is available.
NOI-4	The construction contractor will employ noise-reducing practices so that noise from lift station operations does not exceed County noise-level standards at adjacent residences	Measures to be implemented may include: • restricting lift station installations to beyond 1,600 feet from residences, where feasible; • using electric pumps where lift station installations are within 1,600 feet of residences; or • using sound attenuation enclosures designed to achieve noise reductions sufficient to comply with County standards for noise-generating elements of the lift station operation when no other feasible control method is available.
Public Services		
PSU-1a	Notify Emergency-Response Agencies of Proposed Traffic-Route Changes	Before beginning construction activities, MID or the construction contractor will contact local emergency-response agencies (law enforcement and fire protection) to provide information on the timing and location of any traffic control measures required during construction activities. Emergency-response agencies will be notified of any change to traffic control measures as the construction phases proceed so that emergency-response providers can modify their response routes to ensure that response time would not be affected.
PSU-1b	MID will require the construction contractor to prepare and implement a traffic safety plan (TSP) before the onset of construction activities.	The TSP will address: • appropriate vehicle size and speed, • travel routes, • detour or lane-closure plans, • flag person requirements, • locations of turnouts to be constructed, • coordination with law enforcement and fire control agencies, • coordination with California Department of Transportation (Caltrans) personnel (for work affecting state road rights-of way), • emergency access to ensure public safety, and • traffic and speed-limit signs.
Traffic		

Identifier	Environmental Commitment	Commitment Specifications
TRAF-1	MID will require the construction contractor to prepare and implement a road improvement plan (RIP) before the onset of the construction phase.	The RIP will identify road segments, bridges, and culverts that need to be improved and turnout locations that need to be constructed (as applicable) to accommodate construction activities. The plan also will identify damage that is caused by construction vehicles and that needs to be repaired.
Water Resources		
WQ-1a	Comply with National Pollutant Discharge Elimination System General Construction Permit	To reduce or eliminate construction-related water quality effects, before onset of any construction activities, MID or its contractor will obtain coverage under the National Pollutant Discharge Elimination System (NPDES) General Construction Permit. MID will be responsible to ensure that construction activities comply with the conditions in this permit, which will require development of a stormwater pollution prevention plan (SWPPP), implementation of best management practices (BMPs) identified in the SWPPP, and monitoring to ensure that effects on water quality are minimized. As part of this process, MID will implement multiple erosion and sediment control BMPs in areas with potential to drain to surface water (see Section 3.6, Geology, for a discussion of erosion and sediment control BMPs). These BMPs will be selected to achieve maximum sediment removal and represent the Best Available Technology (BAT) that is economically achievable. BMPs to be implemented as part of this environmental commitment may include, but are not limited to, the following measures. • Temporary erosion control measures (such as silt fences, staked straw bales/wattles, silt/sediment basins and traps, check dams, geofabric, sandbag dikes, and temporary revegetation or other ground cover) would be employed to control erosion from disturbed areas. • Drainage facilities in downstream off-site areas would be protected from sediment using BMPs acceptable to the Regional Water Quality Control Board (RWQCB). MID or its agent will perform routine inspections of the construction area to verify that the BMPs specified in the SWPPP are properly implemented and maintained. MID will notify its contractors immediately if there is a noncompliance issue and will require compliance.
WQ-1b	Implement a Spill Prevention and Control Program	MID or its contractor will develop and implement a spill prevention control and countermeasures program (SPCCP) to minimize the potential for, and effects from, spills of hazardous, toxic, or petroleum substances during construction activities for all contractors. The program will be completed before any construction activities begin. Implementation of this measure will comply with state and federal water quality regulations and minimize the effects of the Proposed Action. MID will review and approve the SPCCP before the onset of construction activities. MID will routinely inspect the construction area to verify that the measures specified in the SPCCP are properly implemented and maintained. MID will notify its contractors immediately if there is a noncompliance issue and will require compliance. The federal reportable spill quantity for petroleum products, as defined in the EPA's CFR (40 CFR 110), is any oil spill that (1) violates applicable water quality standards, (2) causes a film or sheen upon or discoloration of the water surface or adjoining shoreline, or (3) causes a sludge or emulsion to be deposited beneath the surface of the water or on adjoining shorelines. If a spill is reportable, the contractor's superintendent will notify MID, and MID will need to contact the appropriate safety and clean-up crews to ensure the SPCCP is followed. A written description of reportable releases must be submitted to the RWQCB. This submittal must include a description of the release, including the type of material and an estimate of the amount spilled, the date of the release, an explanation of why the spill occurred, and a description of the steps taken to prevent and control future releases. The releases will be documented on a spill report form. If a spill has occurred, MID will coordinate with responsible regulatory agencies to implement measures to control and abate contamination.
WQ-2	Implement Provisions for Dewatering	Before discharging any water from dewatering operations to surface water, MID or its contractors will obtain an NPDES permit and Waste Discharge Requirements (WDRs) from the RWQCB. Depending on the volume and characteristics of the discharge, coverage under the RWQCB's General Construction Permit or General Dewatering Permit is possible. As part of the permit, the permittee would design and implement measures as necessary so that the discharge limits identified in the relevant permit are met. As a performance standard, these measures will be selected to achieve maximum sediment removal and represent the BAT that is economically achievable. Implemented measures may include retention of water from dewatering operations until particulate matter has settled before it is discharged, use of infiltration areas, and other BMPs. Final selection of water quality control measures will be subject to approval by the RWQCB. MID will verify that coverage under the appropriate NPDES permit has been obtained before allowing dewatering activities to begin. MID or its agent will perform routine inspections of the construction area to verify that the water quality control measures are properly implemented and maintained. MID will notify its contractors immediately if there is a noncompliance issue and will require compliance.
Wetlands		
WET-1	Preservation of vernal pools and alkali rain pools.	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.
WET-2	Reduction of impacts to Waters of the United States from the discharge of fill	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.

Biological Opinion Commitments

On April 26, 2011, the USFWS issued a Biological Opinion to Reclamation (File Number 81420-2008-F-0279-1 (Appendix B) to address the impacts of Reduced Alternative B on Federally listed species. The following additional commitments (terms and conditions) are also imposed on Reduced Alternative B from the incidental take statement that was provided with the Biological Opinion.

1. Reclamation shall ensure through conditions in its approval letter or any funding for the proposed project that MID fully implements and adheres to the Environmental Commitments presented in the Biological Assessment and restated here in this Biological Opinion. These Environmental Commitments must be adhered to, regardless of species status under the California ESA.

2. Reclamation shall ensure through conditions in its approval letter for the proposed project the following Terms and Conditions:

    a) Reclamation shall ensure that MID grants and records an appropriate, USFWS-approved Conservation Easement with a USFWS-approved Conservation Easement holder for the mitigation lands described in the Biological Assessment, prior to project implementation.
    b) Reclamation shall ensure that MID incorporates by reference its Mitigation and Management Plan, developed for these mitigation lands, into said Conservation Easement.
    c) Reclamation shall ensure that MID includes language in the Conservation Easement stating that the Mitigation and Management Plan created for this project is a living document, to be viewed and used as an adaptive management plan under the direction and approval of the USFWS, DFG & Corps, with the goal of ensuring optimum habitat conditions for the species of concern.
    d) Reclamation shall ensure that MID has in place prior to project implementation an adequate, USFWS-approved funding mechanism, such as a non-wasting endowment held by a USFWS-approved endowment holder to fund the long-term management activities on their mitigation lands.

3. Reclamation shall ensure through conditions in its approval letter or any funding instrument for the proposed project that MID develops and implements an appropriate USFWS-approved hydrological study or studies, designed to monitor and report on conditions related to changing ecosystem characteristics in and adjacent to the swales used for water banking purposes. Such studies, and the information obtained from them, shall be used to inform Reclamation and MID of the degree and nature of habitat modification from current conditions, and whether take resulting from vegetative changes beyond the perimeter of water applications (i.e., greater than 20 percent) is exceeded. The information gathered from these studies shall be provided to the USFWS and DFG on thirty-day cycles or within thirty days of conclusion of a study cycle.

4. Reclamation shall ensure through conditions in its approval letter or any funding for the proposed project that MID develop a USFWS-approved monitoring and reporting

approach for the inundated swales and adjacent habitat sufficient to determine whether Fresno kangaroo rats and blunt-nosed leopard lizards re-colonize these areas during dry periods.

2.8 Environmentally Preferred Alternative

As described above, Reduced Alternative B, the Proposed Action is the preferred alternative. The No Action Alternative would not satisfy the purpose and need. In addition, groundwater overdraft would continue in Madera County. While Alternatives B, Reduced Alternative B, C, and D would facilitate growth that would not likely occur under the No Action Alternative, the No Action Alternative results in greater adverse effects on both water quality and water supply in Madera Ranch and the surrounding area. Alternative B, if fully built out would result in substantial effects to upland species and wetlands. Alternative C has reduced effects on wetland biological resources, a substantial effect on upland biological resources, and short-term increased effects on air quality. It is considered financially infeasible for MID as the cost outlay for 1,000 acres of recharge basins in Phase 1 of Alternative C does not give time for the bank to be operational prior to construction of basins (which under Alternative B and Reduced Alternative B banking within the swales would provide the financial ability to implement Phase 2). Alternative D reduces impacts on farmland of statewide importance relative to Alternative B, Reduced Alternative B, and C, and results in similar effects on biological resources relative to Alternative B. However, Alternative D includes the complication of having to operate the bank solely through water exchanges with the San Joaquin Settlement Water and could result in increased air quality effects during construction because of extensive additional canal construction along the off-site portions of GF Canal. While feasible, basing the bank on exchanges makes MID dependent on other agencies to receive water. Reliance on other agencies for water is not desirable, and the benefits of the alternative are not enough to compensate for this deficiency. In addition, it should be noted that Alternative D would rely on San Joaquin River restoration operations that have not yet been finalized and that may not come online within the time frame of desired Proposed Action implementation.

Given the elimination of the Section 8 canal southwest extension, reduction in the total number of swales used to minimize effects to wetlands, and identification of fewer basins to be constructed, Reclamation considers Reduced Alternative B to be the environmentally preferable alternative as well as the best overall alternative.

2.9 Alternatives Screening Process

The Draft EIS must present the environmental effects of the Proposed Action and alternatives in comparative form, sharply defining the issues and providing a clear basis for choice by decision-makers and the public (40 CFR 1502.14; Forty Questions No. 1).

The draft EIS must rigorously explore and objectively evaluate a reasonable range of alternatives along with the Proposed Action. Reasonable alternatives are those that feasibly may be carried out based on technical, economic, and environmental factors. Reclamation is not required to evaluate alternatives beyond the reasonable range of alternatives discussed in the environmental document. If alternatives have been eliminated from detailed study, the EIS must briefly discuss the reasons for their elimination (40 CFR 1502.14[a]; Forty Questions No. 1[a]).

The screening of alternatives starts with the statement of purpose and need, as identified in Chapter 1. In addition to the statement of purpose and need, Reclamation developed screening factors, based on cost, logistics, technology, social, environmental, and legal factors, that were considered in alternatives screening.

Typically, the development, evaluation, and selection of alternatives is a process in which Reclamation first lists a broad range of choices and then progressively narrows down the list to meet the purpose and need for action and feasibility factors. However, since the early 1990s the property has been conceived of for use as a groundwater bank, and an array of regional and site-specific alternatives has been considered. This information and past screening of viable approaches to water banking provide important context in the evaluation of alternatives and the reasoning that has led to the currently proposed alternatives. The screening process is described below following Background.

2.9.1 Background

Early project screening was conducted by former property owner Heber Perrett, Reclamation, California Department of Water Resources (DWR), former property owner Azurix Corporation, and MID. These groups explored a variety of alternatives, structural and nonstructural, throughout California. However, almost all of the proposed alternatives did not meet the objectives of a regional conjunctive-use groundwater bank in Madera County with an objective of increasing water supply reliability to MID farmers. Consequentially, these alternatives were not advanced as feasible alternatives because they failed screening as discussed below. Past alternatives considered and eliminated by these groups, including MID, included the following:

Water Conservation

Water conservation–related alternatives have limited potential to increase water supply reliability and reduce groundwater degradation in Madera County given the amount of water demand and size of the current and future overdraft anticipated. Water conservation is a component of all water management plans, but it is only one small component of voluntary and regulatory programs that are needed in Madera County (Madera County 2008).

Surface Water Storage

Surface water storage likely will be needed over the long term to address ongoing water supply and reliability issues throughout California and possibly in Madera County. However, there are few surface water storage options in Madera County that provide MID with necessary capacity to provide increased operational flexibility and groundwater overdraft protection. Furthermore, the surface water storage options are in the foothills, are likely to cost hundreds of millions of dollars, and are many years from obtaining water right entitlements and construction. The primary storage facility under consideration is Temperance Flat. This regional facility is still in the early planning phase and the cost required by MID and MID farmers would be substantially higher for a surface storage facility. Valley floor facilities are not feasible because of the limiting nature of geologic, topographic, and land use conditions in Madera County that eliminate the possibility of surface water storage.

Groundwater Banking in Other Areas

A variety of groundwater banking options in other areas was considered, including groundwater banking north of the Delta; groundwater banking in San Joaquin, Kern, or Fresno County; groundwater banking in other areas outside Madera County; and other groundwater banking sites in Madera County.

These alternatives were eliminated because of lack of existing water rights; lack of storage space in other areas; a substantial increase in water costs because of incurring storage and conveyance costs (see Water Transfers below); lack of contribution to groundwater overdraft protection in Madera County because there would be no recharge to the local aquifer; and significantly higher costs to construct a project on high-value land.

Water Transfers

Water transfers from imported water supplies likely would have to come from other CVP contractors. The CVP as a whole, like the Friant Division, is experiencing water supply reliability problems attributable to drought, water quality, and biological issues. Therefore, basing the project on water transfers would, in essence, be predicating achieving the purpose and need on long-term transfer agreements for another unreliable water supply. Water delivery through the Delta is constrained significantly per the 2008 BO on the Continued Operations of the CVP on CVP and State Water Project (SWP) operations.

In-Lieu Recharge

In-lieu recharge is a component of an overall water management program. Encouraging farmers to use surface supplies in-lieu of pumping groundwater would depend on the water year type and availability of the water supply, including a component of the water supply being available via banking or transfers. As described above, groundwater banking in other areas and water transfers are costly and do not meet the purpose and need. In-lieu recharge has limited potential to increase water supply reliability in Madera County and would increase the cost of conveyance to MID users if using out-of-area water.

MID's Alternatives

Previous screening as described above narrowed the range of alternatives to the use of the Madera Ranch property and potentially other locations in Madera County. However, as detailed below, other potential locations in Madera County were not found to be large enough, or underlain by sufficient banking space, to meet WSEP needs. Therefore, alternatives screening ultimately focused on alternative configurations and layouts for the project-specific facilities to minimize effects on biological resources while still meeting the objectives of the Proposed Action and the engineering design requirements.

The primary objective –is to meet the need for additional storage and reliable and affordable water supplies for MID customers." Accordingly, MID's 2005 EIR alternatives analysis, which is incorporated by reference, was limited to Madera County. As such, a wide variety of potential water delivery and banking locations was evaluated in or adjacent to MID's existing service area.

MID, through the 2005 EIR process, determined that only Madera Ranch offered sufficient areas of land with adequate groundwater recharge qualities, proximity to existing water conveyances, and available groundwater banking space to meet its identified objectives. Areas considered to be fatally flawed or impractical were screened out because of effects related to land use conversion, neighboring groundwater users, habitat, geohydrologic resources, and cost (Madera Irrigation District 2005).

MID developed alternatives based on the sources of water to be recharged, the capacities of the groundwater banking facilities, and the configuration of proposed facilities within the boundaries of Madera Ranch. Based on MID's screening during the 2005 EIR process, two alternatives were carried forward for analysis in the EIR.

Alternative 1 in the 2005 EIR (previously proposed by Azurix) is an ―engineered" alternative that focused on the construction of percolation ponds and a large 12-mile delivery canal. It would require an approximately 3,000-acre area and use of both grassland and agricultural land. It would include a diversion site approximately one mile upstream of Mendota Dam on a portion of the San Joaquin River that receives water from the Bay-Delta. An intake channel and 12-mile-long canal would need to be constructed to convey the diverted water via three lift stations to Madera Ranch. The canal would be lined with concrete between the first pumping plant and Madera Ranch. MID did not select this alternative because of the environmental effects including those associated with using lower-quality water and removing agricultural land from production, and the higher cost associated with constructing the canal.

Alternative 2 in the 2005 EIR (MID's Proposed Action, or Alternative B) would upgrade existing MID conveyances and add additional recharge areas and new recovery wells on the Madera Ranch property. These facilities would be used to bank San Joaquin River and Fresno River surface water and to recover the banked water when needed. The recovery of water would be limited to 90% of the amount recharged, thereby reducing the rate of overdraft of the underlying aquifer. MID would construct Alternative B in two phases.

A No Action Alternative (Alternative A), consisting of the sale and use of the property for other agricultural uses (e.g., dairies), also was analyzed.

2.9.2 Alternatives Screening

Alternatives that do not meet the purpose and need or cannot be technically implemented can be eliminated from detailed study, but the EIS must contain a description of the screening process used to exclude alternatives from the reasonable range. While Reclamation's scope is fairly narrowly defined to include improvements to Reclamation's facilities and banking outside MID's service area, Reclamation is compelled under NEPA to review all potential alternatives to ensure that no feasible alternatives are capriciously excluded from consideration and analyze a reasonable range of alternatives. Viable alternatives brought forward for consideration in the NEPA process were evaluated using the following criteria.

- The alternative can meet the purpose and need;
- The alternative can be reasonably and technically implemented;
- The cost or environmental impacts would not be prohibitive.

Screening criteria against which all alternatives should be measured should include such items as cost limits, geographical boundaries, and meeting the purpose and need.

The study area for Reclamation was limited to the regional area of Madera County, primarily MID's service area, in order to meet the purpose and need. The range of alternatives for this alternatives analysis was not limited to the Madera Ranch property, as alternatives outside of Madera Ranch still have the potential to meet the purpose and need. The following alternatives were considered.

- Nonstructural alternatives, including water transfers and conservation.
- New recharge basins on Madera Ranch within MID service area.
- New recharge basins on other properties (i.e., not on Madera Ranch) within MID service area.
- A Mendota Pool–supplied project (the Azurix project).
- Injection well recharge.
- Expansion of MID's delivery facilities.
- The Proposed Action with swale recharge only.
- Other users of the bank for storage.
- Reduced recharge basin options.

Each of these alternatives is described below.

Alternatives Considered but Eliminated from Further Consideration

Nonstructural Alternatives, Including Water Transfers and Conservation The groundwater overdraft situation in Madera County is so dire that many techniques and projects will need to be implemented to meet future agricultural and urban water demand (Madera County 2008). Water transfers and conservation are being explored and implemented by various water districts as part of a comprehensive county-wide water management approach. However, the yield from these projects is small compared to MID's needs, these approaches do not result in additional dry-year banking capacity to support a reliable water supply, and these projects contribute only a small amount to reducing groundwater overdraft (Madera County 2008). MID, Madera County, and other local irrigation and water districts will continue to implement transfer and conservation efforts, but this alternative would not meet MID's objectives or Reclamation's purpose and need and would not be reasonable to implement.

New Recharge Basins on Madera Ranch within MID Service Area This alternative would involve the creation of recharge basins on portions of Madera Ranch within MID's service area (Figure 2-1). This alternative was rejected for two key reasons.

1. Soils on Madera Ranch within MID's service area are not appropriate to allow for sufficient recharge and would require an additional 1,000 acres of recharge area on properties along the eastern edge of Madera Ranch (Bookman-Edmonston 2003).
2. Construction of ponds on Madera Ranch in MID's service area would require conversion of 1,600 acres of prime agricultural lands on Madera Ranch and another 1,000 acres of

prime agricultural lands on adjacent properties in MID's service area; this would results in effects that are contrary to MID's mission of providing water to farmers by removing existing agricultural lands from production and would require substantial additional capital expenditures. It does not meet MID's objectives or Reclamation's purpose and need, and cannot be reasonably implemented.

New Basins on Other Properties within MID Service Area This alternative would involve the expansion of MID's existing recharge ponds and/or construction of new recharge ponds on other properties within MID's service area. MID's existing recharge ponds are not large enough to meet the required recharge needs and could not meet the recharge needs even if expanded. The key reason the use of other properties was rejected is that other sites with permeable soils cannot achieve the 55,000 AF/year volume anticipated at Madera Ranch. Madera Ranch is relatively large and is in a key location near the end of MID's service area and conveyance facilities. The Madera Ranch property also has a smaller number of adjacent groundwater users compared to the majority of MID's service area, which reduces the risk of infiltrated water being withdrawn by adjacent users. Use of other sites for recharge also would require conversion of prime agricultural lands, thus resulting in increased agricultural effects. Acquisition necessary to implement this alternative would require substantial additional capital expenditures and be cost-prohibitive for MID under current market conditions.

Mendota Pool Supplied Project The Mendota Pool Supplied Project (the Azurix project) was one of the alternatives analyzed by MID in its 2005 EIR. This alternative would consist of a combination of distribution system improvements and groundwater recharge conducted using engineered recharge basins constructed on the portions of the Madera Ranch property where active cultivation currently exists. The water supply for the alternative would be Bay-Delta CVP water from Mendota Pool. The diversion site would be approximately one mile upstream from Mendota Dam. An intake channel and 12-mile-long canal would need to be constructed to convey the diverted water via three lift stations to the Proposed Action area. The canal would be concrete-lined between the first pumping plant and Madera Ranch. In order to finance the acquisition of land for the new canal and finance construction of the engineered recharge basins, the project would require double the capacity of the Proposed Action and would require non-local participation to facilitate the water transfers necessary to acquire water from Mendota Pool. MID does not hold water rights to water in Mendota Pool and therefore would be required to enter into long-term transfer and exchange agreements with third parties such as the San Joaquin River Exchange Contractors to make water available for banking. In addition, the project would not include conveyances for direct delivery of recovered water into MID. Rather, it would rely on the following chains of exchanges and transfers to enable delivery of banked water back to MID.

- Banked water would be recovered from Madera Ranch and pumped back to Mendota Pool for use by others such as the San Joaquin River Exchange Contractors in lieu of their normal Delta-Mendota Canal deliveries.
- The equivalent volume of water now made available in the Bay-Delta would be conveyed through the California Aqueduct to the southern part of the Central Valley and delivered to a southern Friant Division contractor in lieu of its normal Friant deliveries, making an

equivalent volume of water available in Millerton Reservoir available for delivery to MID farmers.

- As analyzed in MID’s 2005 EIR, water quality in Mendota Pool is of substantially lower quality compared to MID’s Friant Division and Hidden Unit contract supplies and compared to the existing groundwater quality beneath Madera Ranch. For this reason, the MROC, the committee responsible for monitoring the operations of the WSEP, requires prior approval before any use of Mendota Pool water by a vote of nine consenting, with no dissenters among the 10-person committee. This requirement, as well as concerns regarding water quality and cost of constructing a new 12-mile canal, resulted in MID determining that this alternative does not meet the purpose and need. In addition, for MID to physically receive water from this configuration for its farmers, MID would be required to perform a complex set of exchanges and transfers with SWP and Southern Friant Contractors, resulting in reduced reliability due to uncertainties associated with long-term availability of pumping capacity in the Delta, as well as delivery capacity in other conveyances not controlled by MID and long-term willingness of several third parties to perform exchanges and transfers. This alternative would not meet the screening criteria for Reclamation as the alternative is prohibitively greater in cost and in environmental impacts than the other alternatives, and the alternative cannot be reasonably implemented.

Injection Well Recharge This alternative would achieve recharge directly using injection wells rather than swales and basins as proposed by MID. This alternative does not satisfy MID’s purpose and need because of costs and technical and logistical issues. Similarly, Reclamation eliminated this alternative from further analysis because of its technical infeasibility and high costs compared to the cost of other feasible alternatives. Recharge using injection wells would pose the following significant challenges (Schmidt 2009).

- Injection wells typically accept water at lower rates than they can pump. Assuming that the Proposed Action (Alternative B) planned project wells are configured for both injection and recovery, Schmidt (2009) estimated that an additional 60 injection wells would be required to attain a recharge rate of 200 cfs. Injection wells require a higher quality of construction, instrumentation, and control than pumping wells. Taken together, Schmidt (2009) estimated that use of injection wells would increase well field capital costs by at least 50%. This increase in costs does not include the significant additional piping and a regulation reservoir that also would be required.
- Water would require treatment before injection to remove air, suspended particulates, bacteriological constituents, nutrients, organic constituents, and algae that would clog the wells, clog the geologic formation the water is injected into, and degrade groundwater quality. In addition, treatment may create trihalomethanes. Schmidt (2009) estimates that a 130-million gallon per day (MGD) treatment plant would be required, with capital costs ~~in~~ the hundreds of millions of dollars.” MID does not have the staffing or equipment to operate a treatment plant and would be required to invest millions of dollars to obtain this functionality. It also should be noted that operation of the treatment system would generate solid wastes requiring disposal.

- A high degree of expertise and operational infrastructure that MID lacks would be required to successfully operate and maintain injection wells over the long term, significantly increasing project operations and maintenance (O&M) costs. Schmidt (2009) estimated that injection wells would increase O&M costs by approximately $2.4 million dollars per year. This O&M estimate does not include O&M costs associated with the treatment plant.
- Surface-based recharge systems can last indefinitely with appropriate maintenance. However, even with treatment systems and the facilities summarized above, the useful life of injection wells would be no more than 30 years, resulting in a need for MID to incur periodic replacement costs.

Taken together, use of injection wells would increase WSEP capital costs by hundreds of millions of dollars, increase O&M costs by millions of dollars per year, provide uncertain performance, and require a complete reinvention of MID's O&M staffing and equipment resources. Schmidt (2009) reviewed numerous water banking and recharge projects throughout the Central Valley and found that injection wells were not selected for any of the projects for the variety of reasons summarized above.

Expansion of MID's Delivery Facilities This alternative would involve the expansion of delivery facilities, including widening, deepening, and constructing new canals within MID's service area to attain storage, recharge, and conveyance goals. This would allow MID to move their water allocation to users more effectively without requiring additional banking. MID could further enlarge the Section 8 Canal and also use Cottonwood Creek, which would contribute a small amount to groundwater recharge. However, the groundwater overdraft situation in Madera County is so dire that canal expansion and extensions would not reduce this problem; many techniques and projects, including conveyance projects, would need to be implemented to meet future agricultural and urban water demand (Madera County 2008). More importantly, this alternative would not meet MID's needs, as it would not provide sufficient banking to enable provision of water to users in dry years because the recharge amounts would be small. This alternative was not advanced for technical reasons and because it does not meet the overall purpose and need.

The Proposed Action with Swale Recharge Only This alternative would be similar to the Proposed Action, but would rely solely on the swales to put water into the bank. This alternative assumes that engineered recharge basins would not be needed. This alternative could meet the purpose and need. MID has proposed retaining the recharge ponds to ensure the alternative remains technically feasible and acceptable from a regulatory perspective. Extensive pilot testing indicates that the identified swales could provide the required recharge capacity, but the long-term performance is uncertain. Additionally, controversy remains regarding the use of the swales relative to biological impacts because of the uncertainty of these effects on endangered species. Therefore, in order to provide certainty that the project can meet objectives, MID is obligated to contemplate Phase 2 recharge basins as a back-up in the event that the swales cannot provide the required long-term performance. A swale-only alternative provides a reduction in biological effects associated with grassland conversion and a reduction in air quality effects from construction of the ponds. However, as described above, other biological resources could be adversely and unacceptably affected by use of the swales. Because there is still some question regarding its feasibility and because of existing concerns by the USFWS and DFG, it was eliminated according to Reclamation's screening criteria.

Other Users of the Bank for Storage MID's Proposed Action identifies agricultural users with 64% of the bank's annual operational capacity; industrial, commercial, and residential users with 18% of the capacity; and environmental users with 18% of the capacity. Under an Other Users alternative, the percentage of capacity used for urban or environmental purposes could be increased. This would increase the water supply reliability for urban or environmental users provided they could obtain the needed water rights to bank the water. The direct, indirect, and cumulative effects of this alternative would vary depending on which user received the majority allocation. However, this alternative would not achieve MID's objectives of providing its customers with a significant increase of dry year water supply. This alternative would not meet Reclamation's purpose and need for this project.

Reduced Recharge Basin Options After discussions with the Corps, U.S. EPA, USFWS and DFG, MID and Reclamation developed Reduced Alternative B (Proposed Action) that reduced the number of acres of swales used and the number of acres of basins created. In these various options, the number of swales could be reduced and basins could be constructed to make up for the reduction in the number of acres of swales that would be used for exchange. Options ranging from basins only (Alternative C) to use of 700 acres of swales and 200 acres of basins were evaluated. Options with a heavy emphasis on basins (i.e., more than 350 acres of basins) were eliminated by Reclamation and the Corps because of environmental, logistic and cost considerations.

Section 3 Affected Environment and Environmental Consequences

This section describes the existing proposed action area environment and the potential direct, indirect and cumulative impacts to the following resources resulting from the alternatives under consideration.

- Aesthetics
- Agriculture
- Air Quality
- Biological Resources
- Cultural Resources
- Environmental Justice
- Geology, Soils, Seismicity, and Erosion
- Global Climate
- Growth Inducement
- Hazards, Public Health, and Safety
- Indian Trust Assets (ITA)
- Land Use
- Noise
- Public Services and Utilities
- Socioeconomics
- Traffic and Circulation
- Water Resources
- Water Supply
- Wetlands

3.1 Aesthetics

This section describes the potential direct, indirect and cumulative impacts to visual resources in the vicinity of Madera Ranch.

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;
- 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).

3.1.1 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 3-1). 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 3-1 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.

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.

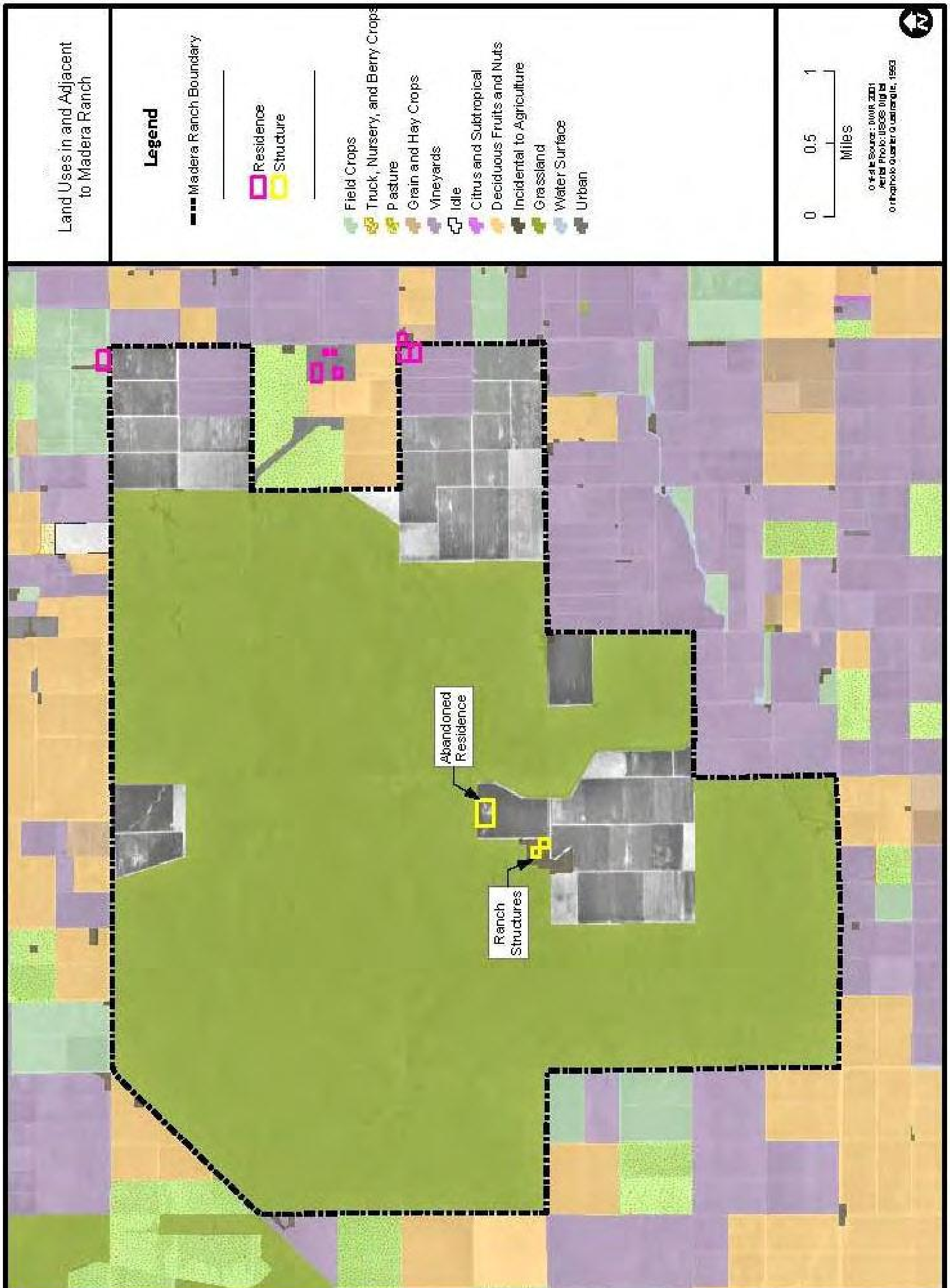

Figure 3-1 Land Uses In and Adjacent to Madera Ranch

3.1.2 Environmental Consequences

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 (a Mid-Pacific Region specific permit for modification or alteration of Reclamation-owned facilities) to approve 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 six 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. Environmental oriented viewer groups may find the new facilities constructed in grassland offensive because of the change in visual character due to a change in land use, however, the recharge basins would be located several miles from Avenue 12, are not expected to be visible from this road, and this group composes a minority of those using Avenue 12. 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. If increased numbers of migratory birds using the site were visible to motorists passing by, some of them might consider the increased migratory bird use to be a beneficial change. 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.

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

Reduced Alternative B is similar in scope and design to Alternative B, with the primary exception that a reduced number of natural swales will be used and a reduced number of ponds will be constructed. This would not result in any differences from what was described above for Alternative B relative to temporary degradation of visual character or quality from construction-related activities changes, or degradation of visual character or quality from construction of new permanent features. The effects of Reduced Alternative B would result in nearly identical effects to those that would occur under Alternative B (Effects AES-1 and AES-2), and thus, not considered 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 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 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.

3.2 Agriculture

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

3.2.1 Affected Environment

Agricultural lands make up 47% (648,300 acres) of the total Madera County land area. In 2007, the top five crops were grapes, almonds, nuts, and hulls, milk, pistachios; cattle and calves. 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.

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 3-1 summarizes these land uses and lists the corresponding acreages.

Table 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.

Table 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 3-2 Acreages of Important Farmland

Important Farmland Category	Madera Ranch	County
Prime Farmland	1,085	97,489
Farmland of Statewide Importance	491	85,135
Unique Farmland	1,017	163,973
Farmland of Local Importance	151	17,415
Grazing Land	10,978	399,499
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).

Agricultural land can be protected under the Williamson Act within designated agricultural preserves[1]. 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).

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. 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.

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.

Figure 3-2 shows the FMMP categories present on Madera Ranch.

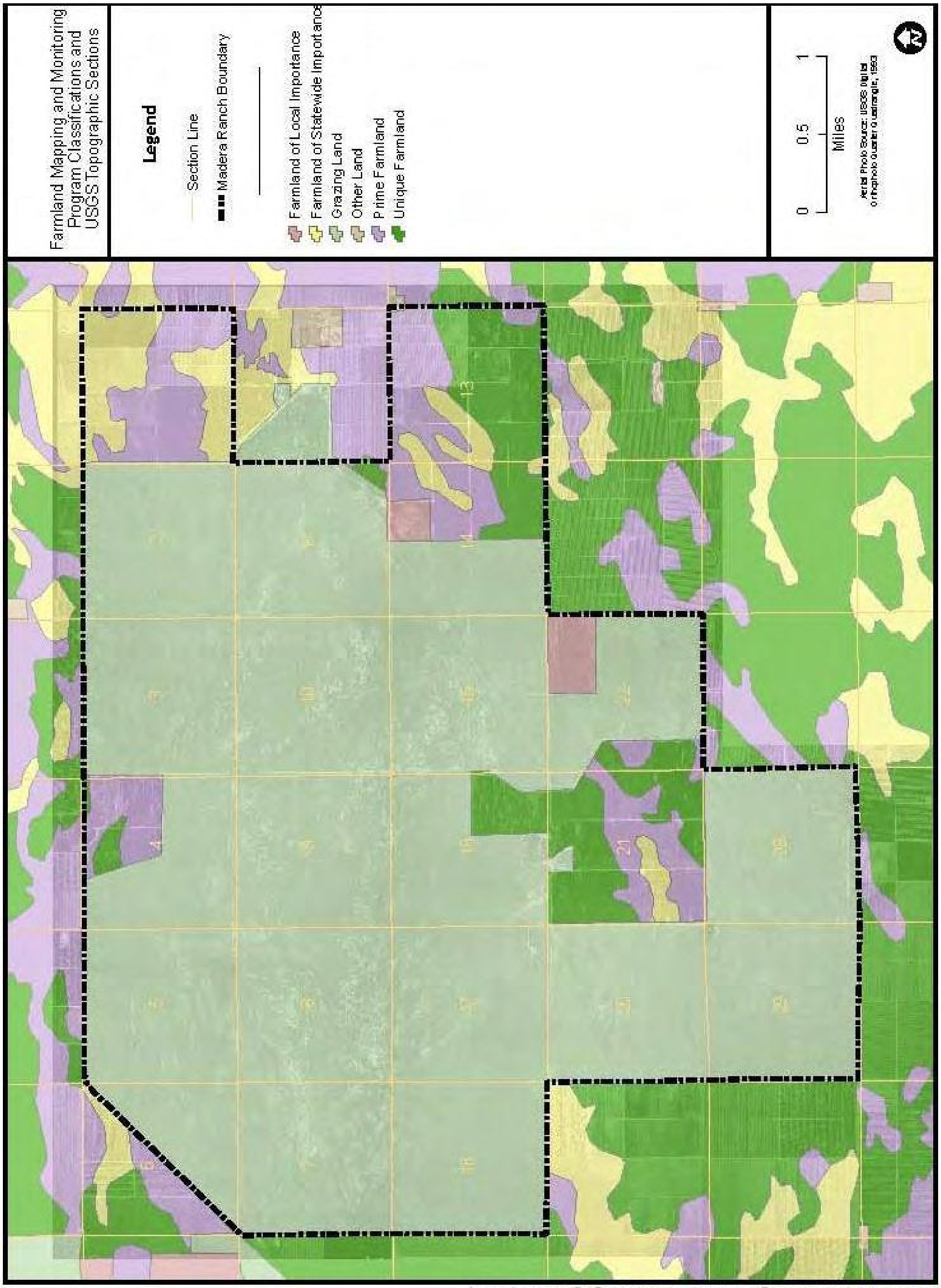

Figure 3-2 Farmland Mapping and Monitoring Classifications and USGS Topographic Classifications

3.2.2 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, a Mid-Pacific Region specific 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 3-3 shows the locations of the facilities that would result in the direct conversion of farmland, and Table 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.

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 Agricultural Exclusive (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.

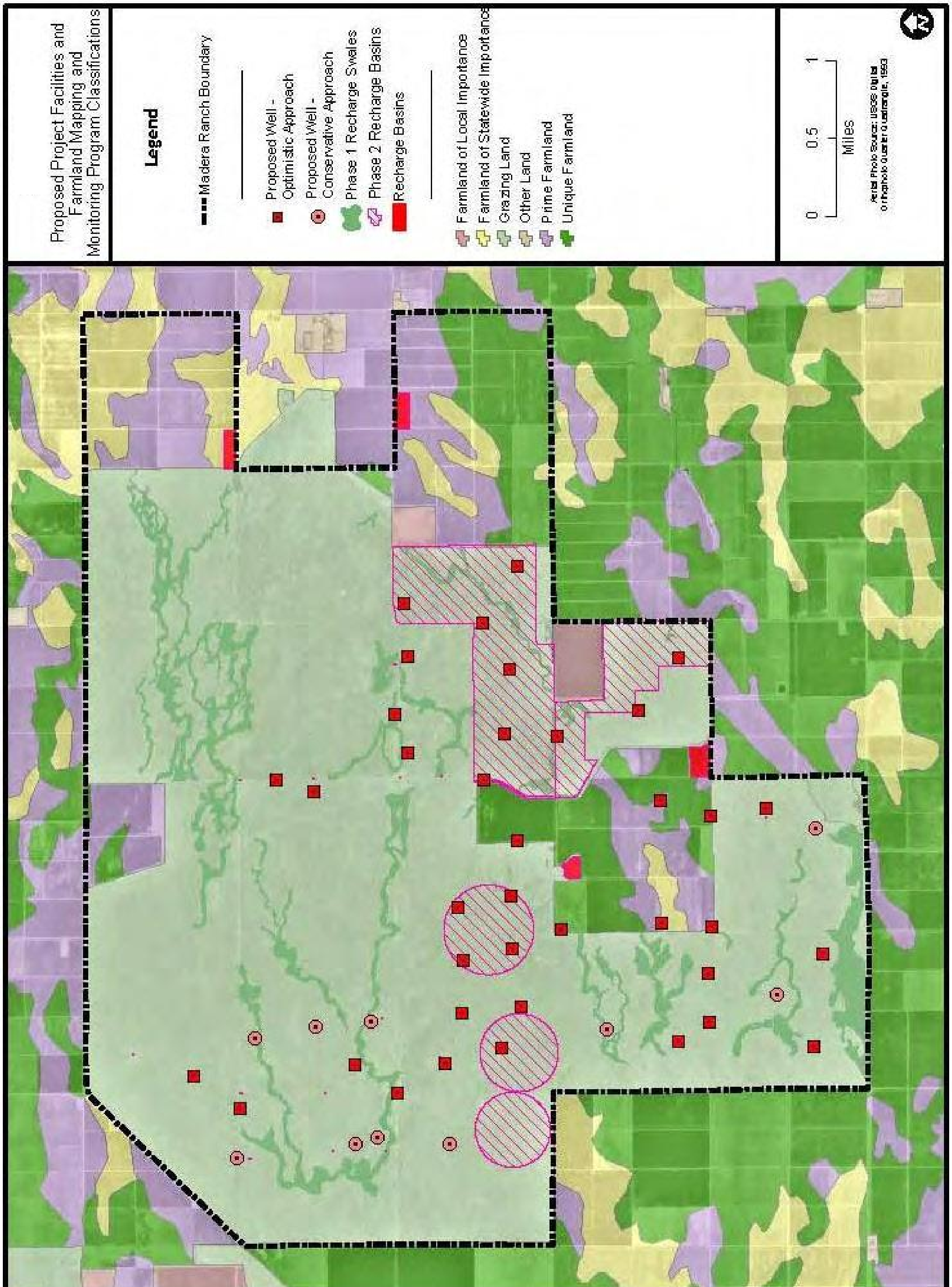

Figure 3-3 Proposed Project Facilities and Farmland and Monitoring Program Classifications

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

Madera Ranch		Alternative B				Reduced Alternative B				Alternative C				Alternative D			
		Phase 1	Phase 2*	Total	Percent	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	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	17.3	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	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	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	0	501	501	9.6	1,038	n/a	1038	9.5	18.0	1,020*	1038	9.5
Total	**13,722**			**1,101.62**				**564.62**			**1,101.62**				**1,084.32**		

*The potential impacts of Alternative B, Reduced 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).

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

Reduced Alternative B is similar in scope and design to Alternative B, with the primary exception that a reduced number of natural swales will be used and a reduced number of ponds will be constructed. Reduced Alternative B would also exclude construction of the Section 8 canal southwest extension. Similar to what was described for Alternative B above for Effects AG-1, AG-2, AG-3, and AG-4, Reduced Alternative B 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 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 mitigating 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.

3.3 Air Quality

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.

3.3.1 Affected Environment

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.

Climate and Topography

Madera Ranch is located in the San Joaquin Valley Air Basin (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 Proposed Action area lies within the SJVAB under the jurisdiction of the San Joaquin Valley Air Pollution Control District (SJVAPCD). The pollutants of greatest concern in the San

Joaquin Valley are carbon monoxide (CO), ozone (O_3), O_3 precursors such as volatile organic compounds (VOC), inhalable particulate matter between 2.5 and 10 microns in diameter (PM_{10}) and particulate matter less than 2.5 microns in diameter ($PM_{2.5}$).

The SJVAB has reached Federal and State attainment status for CO, nitrogen dioxide (NO_2), and sulfur dioxide (SO_2). Federal attainment status has been reached for PM_{10} but is in non-attainment for O_3, $PM_{2.5}$, and VOC. There are no established standards for oxides of nitrogen (NO_x); however, NO_x does contribute to NO_2 standards (San Joaquin Valley Air Pollution Control District 2011).

The Federal CAA, enacted in 1963 and amended several times thereafter establishes the framework for modern air pollution control. The EPA has established National Ambient Air Quality Standards (NAAQS) (Table 3-4) for criteria pollutants. Criteria pollutants include CO, NO_2, SO_2, O_3, PM_{10}, and $PM_{2.5}$, 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).

Table 3-4 Applicable State and Federal Ambient Air Quality Standards

Pollutant	Averaging Time	California Standards		National Standards	
		Concentration	Attainment Status	Concentration	Attainment Status
O_3	8 Hour	0.070 ppm (137 μg/m^3)	**Nonattainment**	0.075 ppm (147 μg/m^3)	**Nonattainment**
	1 Hour	0.09 ppm (180 μg/m^3)	**Nonattainment**	--	--
CO	8 Hour	9 ppm (10 mg/m^3)	Attainment	9.0 ppm (10 mg/m^3)	Attainment
	1 Hour	20 ppm (23 mg/m^3)	Unclassified	35 ppm (40 mg/m^3)	Unclassified
NO_2	Annual arithmetic mean	0.030 ppm (56 μg/m^3)	Attainment	0.053 ppm (100 μg/m^3)	Attainment
	1 Hour	0.18 ppm (338 μg/m^3)	Attainment	--	--
SO_2	Annual average	--	--	0.03 ppm (80 μg/m^3)	Attainment
	24 Hour	0.04 ppm (105 μg/m^3)	Attainment	0.14 ppm (365 μg/m^3)	Attainment
	1 Hour	0.25 ppm (655 μg/m^3)	Attainment	--	--
PM_{10}	Annual arithmetic mean	20 μg/m^3	**Nonattainment**	--	--
	24 Hour	50 μg/m^3	**Nonattainment**	150 μg/m^3	Attainment
$PM_{2.5}$	Annual Arithmetic mean	12 μg/m^3	**Nonattainment**	15 μg/m^3	**Nonattainment**
	24 Hour	--	--	35 μg/m^3	Attainment
Lead	30 day average	1.5 μg/m^3	Attainment	--	--
	Rolling-3 month average	--	--	0.15 μg/m^3	Unclassified

Source: California Air Resources Board 2011; San Joaquin Valley Air Pollution Control District 2011; 40 CFR 93.153
ppm = parts per million
mg/m^3 = milligram per cubic meter
μg/m^3 = microgram per cubic meter
-- = No standard established

Federal Conformity Requirements
The CAA and amendments require that all federally funded projects come from a 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. Because the Proposed Action is not a federal highway or transit project, it is subject to 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.

Madera Ranch is located in a federal extreme nonattainment area for O_3 and nonattainment area for $PM_{2.5}$. Consequently, to fulfill general conformity requirements, an analysis must be undertaken to identify whether the Proposed Action's total emissions of O_3, and $PM_{2.5}$:

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

3.3.2 Environmental Consequences
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 Reactive Organic Gases (ROG), NO_x, CO, sulfur oxides (SO_x), and PM_{10}. Construction-related emissions also would include fugitive PM_{10} 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 California Air Resources Boards'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 would most likely include:

- 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;
- 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 cy and a possible second phase grading of about eight million cy; 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 3-5 was used to estimate construction-related emissions during peak construction days.

Table 3-5 Amount and Types of Heavy Equipment to Be Used for Mass Grading during Peak Construction Activities

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

The estimated size and number of engines for wells and lift station pumps used worst-case engine hp requirements to ensure that all potentially adverse effects are disclosed. However, actual or average emissions may be substantially lower.

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; however, 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 $PM_{2.5}$. 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 cy 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 3-6.

Construction of Alternative B would generate short-term fugitive PM_{10} dust as a result of activities that disturb the soil, such as grading and excavation, and ROG, NO_x, CO, PM_{10}, and $PM_{2.5}$ from exhaust. Estimated annual air pollutant emissions during on-site grading are shown in Table 3-6. 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 3-6 Maximum Yearly Construction Emissions for Alternative B (tons per year)

Emission Source	ROG	NO_x	PM_{10}	$PM_{2.5}$
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 PM_{10}. Sources of fugitive dust and PM_{10} 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 3-6, Alternative B would result in a net increase in ROG, NO_x, PM_{10}, and $PM_{2.5}$ emissions. The increases ROG and NO_x emissions are in excess of the federal *de minimis* threshold levels. Environmental Commitments AQ 1: Implement SJVAPCD 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 3-7, 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 3-7 Alternative B–Related Emissions from Operations (tons per year)

	VOC	NO_x	PM_{10}
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).

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.

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

Reduced Alternative B is similar in scope and design to Alternative B, with the primary exception that a reduced number of natural swales will be used and a reduced number of basins will be constructed. Reduced Alternative B would also exclude construction of the Section 8 canal southwest extension. However, the construction activities and operational needs under Reduced Alternative B 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 SJVAPCD Regulation VIII Control Measures, and AQ-2: Reduce Emissions Associated with Idling Equipment, would reduce the severity of this 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 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 SJVAPCD 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 GF Canal. The off-ranch portions of the GF Canal would require the movement of 15,000 cy of soil, and operation of the following equipment is anticipated, in addition to the equipment in Table 3-3:

- 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 3-8.

Table 3-8 Maximum Yearly Construction Emissions for Alternative D (tons per year)

Emission Source	ROG	NO_x	PM_{10}	$PM_{2.5}$
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 3-8, Alternative D would result in a net increase in ROG, NO_x, PM_{10}, and $PM_{2.5}$ emissions. The increase in NO_x emissions is in excess of the federal *de minimis* threshold levels. Implementation of Environmental Commitments AQ 1: Implement SJVAPCD 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 Guide for Assessing and Mitigating Air Quality Impacts (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 PM_{10}.

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 PM_{10}, 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 3-5, 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 PM_{10} required by SJVAPCD (Environmental Commitment AQ-1) would reduce emissions of PM_{10} associated with construction. Emissions of PM_{10}, ROG, and NO_x associated with operations would be reduced by the emission-control devices described for the propane-fueled engine. In addition, MID would shut off the diesel engines when not in use (Environmental Commitment AQ-2) to reduce the severity of the effect.

3.4 Biological Resources

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.

3.4.1 Affected Environment

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 3-9 shows the acreage of each of these communities, and Figure 3-4 shows the distribution of each community on Madera Ranch. Table 3-10 lists sensitive plants that occur or may occur at the project site.

Table 3-9 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 3-10 Special-Status Plants Occurring or Potentially Occurring at Madera Ranch

Name	Status* 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
Heartscale *Atriplex cordulata*	–/–/1B	Alameda, Butte, Colusa, Fresno, Glenn, Kern, Madera, Merced, San Joaquin, San Luis Obispo, Solano, Stanislaus, Tulare, and Yolo Counties	Chenopod scrub, meadows and seeps, valley foothill grassland. Blooms April-October.	Could be present and would be impacted.
Lesser saltscale *A. miniscula*	–/–/1B	Butte, Fresno, Kern, Madera, Merced, Stanislaus, and Tulare Counties	Chenopod scrub, Playas, Valley and foothill grassland/alkaline, sandy. Blooms May-October.	Could be present and would be impacted.
Vernal pool smallscale *A. persistens*	–/–/1B	Glen, Madera, Merced, Solano, Stanislaus, and Tulare Counties.	Alkaline vernal pools. Elevation 10-115 meters. Blooms June-October.	Could be present and would be impacted.
Subtle orache *A. subtillis*	–/–/1B	Butte, Fresno, Kings, Kern, Madera, Merced, and Tulare Counties	Valley and foothill grassland. Blooms June-August (October but not common).	Could be present and would be impacted.
Lost Hills crownscale *A. vallicota*	–/–/1B	Fresno, Kings, Kern, Merced, and San Luis Obispo Counties	Chenopod scrub, Valley and foothill grassland, Vernal pools/alkaline. Blooms April-August.	Unlikely to occur (out of range)
Hoover's cryptantha *Cryptantha hooverii*	E/R/1B	Contra Costa , Kern, Madera, and Stanislaus Counties	Inland dunes, Valley and foothill grassland. Blooms April-May.	Could be present and would be impacted.
Recurved larkspur *Delphinium recurvatum*	–/–/1B	Alameda, Butte, Contra Costa, Colusa, Fresno, Glenn, Kings, Kern, Madera, Merced, Monterey, San Joaquin, San Luis Obispo, Solano, and Tulare Counties	Chenopod scrub, cismontane woodland, valley and foothill grassland, alkaline substrates. Blooms March-June.	Could be present and would be impacted.
Sanford's arrowhead *Sagittaria sanfordii*	–/–1B	Butte, Del Norte, El Dorado, Fresno, Merced, Mariposa, Orange, Placer, Sacramento, Shasta, San Joaquin, Tehama, and Ventura Counties	Marshes and swamps (assorted shallow freshwater). Blooms May-October.	Suitable habitat not present

Name	Status* Federal/State /CNPS	Distribution	Habitat	Occurrence in Project Area

* 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

California Native Plant Society (CNPS). 2010. Inventory of Rare and Endangered Plants (online edition, v7-10c). California Native Plant Society. Sacramento, CA. Accessed on Fri, Aug. 27, 2010 from http://www.cnps.org/inventory.
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 3-4).

California Annual Grassland 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 3-4). 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.

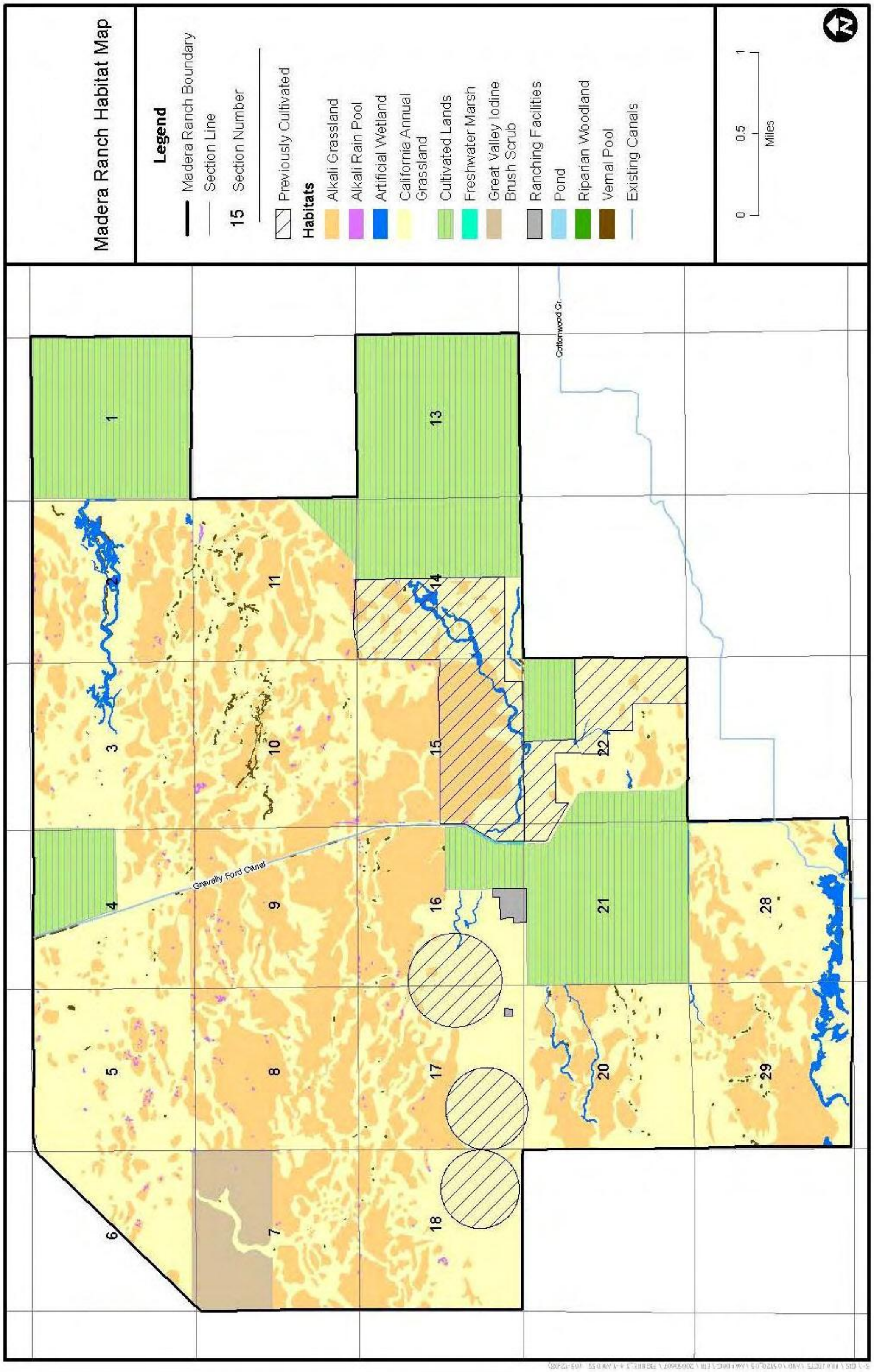

Figure 3-4 Madera Ranch Habitat Map

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. However, there are some actions such as deep ripping of certain soil types that cannot recover.

Overall vegetative differences including density and composition may persist for many years in areas with new roads or pipelines. This is supported by the one published study based on a Central Valley site (Holmstead and Anderson 1998). In this study, some aspects of regenerating vegetation were documented for sites restored after excavations at oil fields in the southern San Joaquin Valley. On sites restored by replacing stockpiled topsoil and planting seed, vegetation was sparser (i.e., had a lower density and cover of plants) than on undisturbed sites. Sites where stockpiled topsoil was replaced but no seeds were planted had a cover and density of plants lower than the seeded sites and much lower than adjacent undisturbed areas. The species composition of the sites and their long-term recovery were not documented in this study.
On Madera Ranch, portions of the property appear to have recovered from previous disturbance within five years, such as the access roads to the test pond work areas. Also, larger tracts of land have become re-established with annual grasslands, specifically, the western ½ of Section 14, the southern ½ of Section 15, and portions of Section 16, 17, 18 and 22 were cultivated approximately 30 years ago.

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 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 3-4).

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 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 3-4.

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 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. undescribed) 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 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 (Water Resources Section).

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 3-4). Great Valley iodine bush scrub has also been reported along Avenue 12, on property adjacent to Madera Ranch.

Freshwater Marsh 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 3-4). 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 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 3-4). 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 3-4). 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 two-acre pond is located in the southeastern corner of Section 28 (Figure 3-4). 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 two 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 3-4). 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 Plants

Five plants listed by USFWS as threatened or endangered under the Federal 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 [CNDDB] 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. Consultant biologists 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 (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 3-11 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.

Table 3-11 Special-Status Wildlife Species Occurring or Potentially Occurring at the Project Site

Species Name	Status* 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
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

Species Name	Status* Fed/State	California Distribution	Habitat Requirements	Occurrence on Madera Ranch
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
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

Species Name	Status* Fed/State	California Distribution	Habitat Requirements	Occurrence on Madera Ranch
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
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 American, inhabits mountain forests and open grasslands. Breeds from Alaska east across northern Canada south to Mexico, Canadian prairie provinces, and Labrador.	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* Fed/State	California Distribution	Habitat Requirements	Occurrence on Madera Ranch
American peregrine falcon *Falco peregrinus anatum*	-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 and Madera Counties y 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
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

Species Name	Status* Fed/State	California Distribution	Habitat Requirements	Occurrence on Madera Ranch

*Species status definitions

Federal

E	=	listed as endangered under the federal 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.

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. Surveys in 2009 resulted in blunt-nosed leopard lizard sightings in sections 3, 10, 14, and 15.

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. It should be noted that a property-wide trapping survey was conducted for the Fresno kangaroo rat in 2000, but a more intensive trapping survey was conducted in 2009 only for that portion of Madera Ranch lying east of the GF Canal.

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*)

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 3-4).

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.). Recently, small pools at the Sandy Mush Conservation Bank in Merced

County have been found to have Conservancy fairy shrimp, therefore the species is assumed to potentially be present in any of the vernal and alkali rain pools on Madera Ranch.

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.

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 3-4). 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 3-4).

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 habitat in the potentially affected area was considered suitable for this species.

Reptiles

Blunt-Nosed Leopard Lizard The blunt-nosed leopard lizard 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 blunt-nosed leopard lizard 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 blunt-nosed leopard lizard (Table 3-9 and Figure 3-4). Transect surveys conducted in May 2009 confirmed that this species is present.

Giant Garter Snake The giant garter snake 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 3-4). 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 3-4), but the site has definitely been used by a limited number of Swainson's hawks.

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 3-4).

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 3-4).

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 3-4), 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 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 3-4).

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 3-4).

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, although other habitat (such as blackberry thickets) may be used for breeding; however, there is ample foraging habitat in the alfalfa fields to support a large breeding colony of thousands of pairs (Figure 3-4). 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 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 has been removed from the ESA Threatened and Endangered list however it is designated as a fully protected species, pursuant to the Fish and Game code [FGC §3511 (b)(1)] under CESA. 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 3-4), 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 3-4).

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 two live trapping surveys conducted in suitable habitat on Madera Ranch. The first survey was a property-wide survey conducted in 2000, and the other was conducted only east of GF Canal in 2009. 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. The most recent surveys show that the species is not currently present east of GF Canal. 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.).

Documentation of Biological Resources at Madera Ranch

Biologists 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, 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 CNDDB (California Natural Diversity Database 2008) and the California Native Plant Society'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 section numbers, Figure 3-4 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, Consultant biologists 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 biological consultants initiated additional surveys for wildlife. Consultant biologists 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 and San Joaquin kit fox.

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 spring 2009 surveys were 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.

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. The northern half of Section 7 was the only potential habitat area identified for this endangered species. Reference locations were not visited.

Biologists 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.

Biologists 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 were conducted in July 2009 and those surveys also didn't result in any observations of listed plants.

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.

Figure 3-5 includes an overview of the phased project facilities in relation to habitat types within the Proposed Action area.

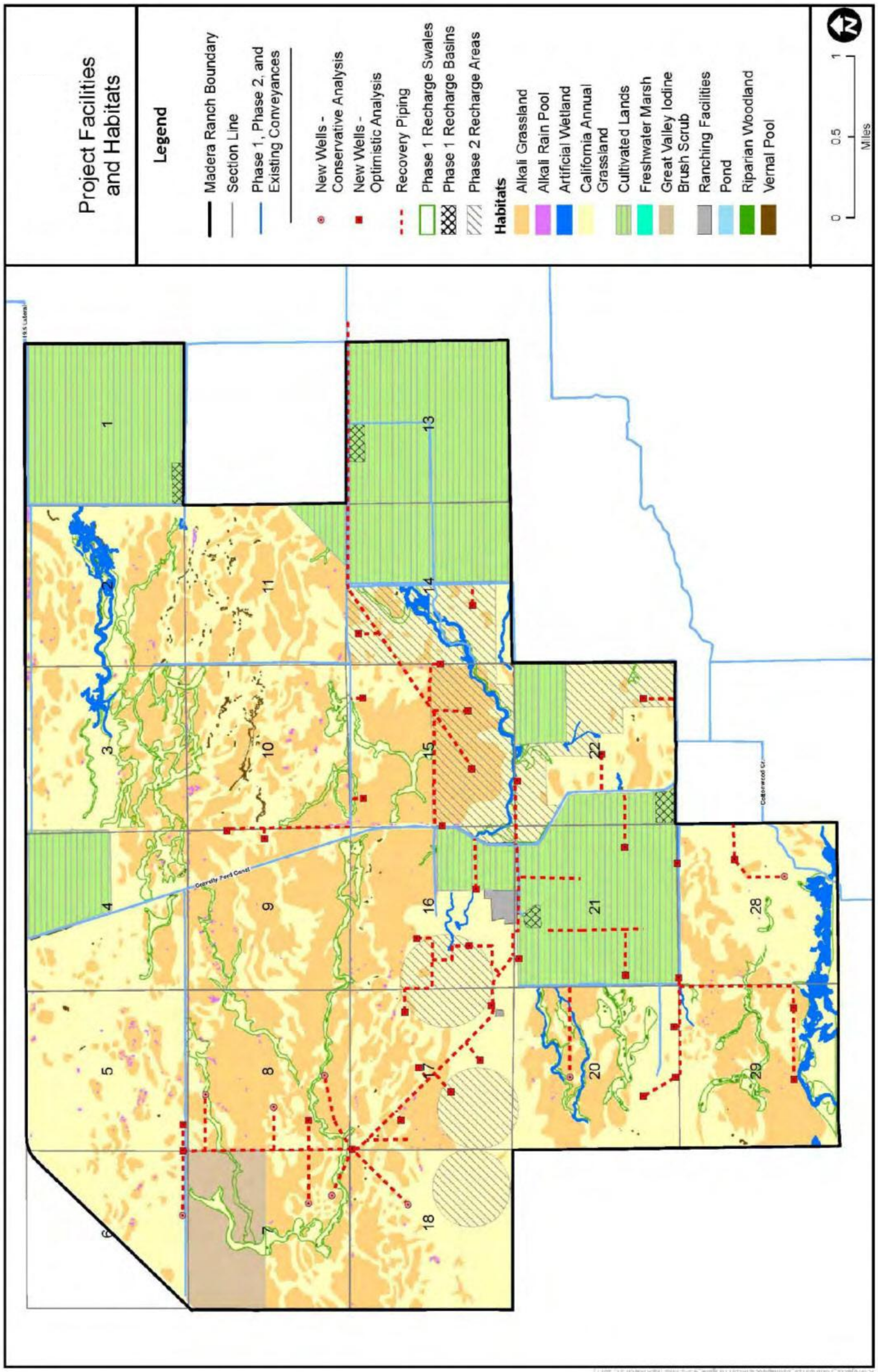

Figure 3-5 Project Facilities and Habitat within Proposed Action Area

A summary of Proposed Action habitat effects within Madera Ranch by project alternatives is included in Table 3-12.

Table 3-12 Effects of Proposed Action Alternatives on Madera Ranch Habitat

Habitat	Effect (acres[a])			
	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**
Reduced Alternative B				
California annual grassland	508	192	396	6,462
Alkali grassland	30	80	42	4,044
Vernal pool	1.3	0.2	0	22
Great Valley iodine brush scrub	10	0	0	292
Freshwater marsh	No effect	0.1	2	2
Alkali rain pool	0.4	0.6	1.8	16
Riparian woodland	No effect	0	0	2
Cultivated lands	No effect	70	60	2,745
Pond	No effect	0	0	2
Total	**549.7**	**343.9**	**501**	**13,587**
Alternative C				
California annual grassland	No effect	178	790	5,510
Alkali grassland	No effect	100	230	3,728
Vernal pool	No effect	0.04	0.1	26.8
Great Valley iodine brush scrub	No effect	0	0	290
Freshwater marsh	No effect	0.1	2.0	0
Alkali rain pool	No effect	1.0	1.1	13.5
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**	**12,187.3**
Alternative D				
California annual grassland	600	178	790	4,910
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	**645.9**	**349.14**	**1085.2**	**11,536**

[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.

A summary of Proposed Action project elements located within water bodies and upland habitats are included in Table 3-13.

Table 3-13 Project Elements within and near 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
Other Components within and near Water Bodies		
24.2 Canal improvements	Yes	36,000 cy excavation; (1.75 mile expanded and 0.75 mile new)
Section 8 Canal upgrades/extensions	Yes	76,000 cy excavation; (1.75 mile expanded, 1.75 mile existing to pipe, and multiple new extensions)
Use of swales for recharge(1) (2)	No	No cut or fill. <6 acres vernal pool/alkali rain pool from use of swales (Alternative B) and <2 acres for Reduced Alternative B
55 acres of recharge basins in agricultural lands	No	55 acres
Recharge basins in grasslands	No	Varies
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 and CWA Section 404.
2 Swales not used for recharge under Alternative C. See Table 3-12 for vernal pool/alkali rain pool effects under each Alternative.
3 Alternatives B, Reduced Alternative 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.

3.4.2 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, a Mid-Pacific Region-specific 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 3-12 and Figure 3-5). 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 3-5). 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 3-12 and Figure 3-5). 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 3-5). 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 the Wetlands section). 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 3-12).

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 the Public Health and Safety Section, if the swales pond water and mosquitoes become an issue with the Madera County Mosquito and Vector Control District (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 3-12).

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 a separate section on 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 the Public Health and Safety Section, 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, an adverse effect could occur 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 3-4). 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 blunt-nosed leopard lizard habitat. The blunt-nosed leopard lizard 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 blunt-nosed leopard lizard 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 blunt-nosed leopard lizard (Figure 3-5).

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 blunt-nosed leopard lizard.

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 would establish a conservation easement equivalent to the size of the disturbance area.

To minimize and mitigate the potential effect of Alternative B, MID would 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. If DFG uses the bank to store water for management activities at MWMA, the activities would only be those that are in the current management plan, which is in compliance with Federal ESA and CESA. 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 3-11). 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 and the BGEPA. 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 3-11). 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. Some loss of burrowing owl habitat would occur. However, lost burrows would be replaced.

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 3-4).

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 3-12).

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. The San Joaquin pocket mouse is known to enter torpor (a dormancy period) during colder weather. If flooding occurred during these colder time periods (such as early spring), individuals could be at risk of drowning in their burrows.

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.

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

Reduced Alternative B is similar in scope and design to Alternative B, with the primary exception that a reduced number of natural swales will be used in order to minimize effects to vernal pools, and a reduced number of ponds will be constructed. As with Alternative B it would complete the water bank in two phases. Phase 1 would involve constructing necessary delivery infrastructure improvements (except for the Section 8 canal southwest extension), using select natural swales for recharge (550 acres versus 700 acres as proposed under Alternative B), and installing approximately five soil berms to direct recharge flows. Phase 2 would involve constructing a limited number of recharge basins (323 acres versus up to 1,000 acres under Alternative B) and facilities for recovery of banked water.

Reduced Alternative B would result in nearly identical effects on biological resources as those identified under Alternative B, with the exception of the following effects:

- Effect BIO-4: Potential for Construction-Related Mortality of Sensitive Vernal Pool Crustaceans
- Effect BIO-5: Potential for Operation- and Maintenance-Related Mortality of Sensitive Vernal Pool Crustaceans
- Effect BIO-6: Potential for Construction-Related Mortality of San Joaquin Tiger Beetle
- Effect BIO-9: Potential for Operation- and Maintenance-Related Mortality of California Tiger Salamander
- Effect BIO-10: Potential for Construction- and/or Operation- and Maintenance-Related Mortality of Western Spadefoot Toad

The reduced footprint of recharge basins and number of swales proposed under Reduced Alternative B would reduce the potential for Effects BIO-4, BIO-5, BIO-6, BIO-9 and BIO-10.

The Environmental Commitments identified for Alternative B associated with effects on biological resources would be appropriate and applicable under Reduced Alternative B.

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 C.

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.

Effect BIO-25: Potential for Entrainment of Anadromous Fish If Restored to the San Joaquin River When the San Joaquin River Restoration Program (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 D 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 would 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. Reduced Alternative B would have less cumulative impacts than Alternative B. 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.

3.5 Cultural Resources

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 NHPA. The Section 106 process is a consultation process that involves the State Historic Preservation Office (SHPO) throughout; the process also calls for including Native American Tribes and interested members of the public, as appropriate, throughout the process.

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 National Register of Historic Places (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.

3.5.1 Affected Environment

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 Area of Potential Effect (APE) and evaluated for NRHP significance. These cultural resources are presented in Table 3-14. 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 requested SHPO concurrence on a finding of no historic properties affected. SHPO agreed with Reclamation's findings on August 31, 2009, and concurrence was received August 31, 2009 (Appendix E). However, since that time, a number of additional activities have been proposed which require expanding the APE. These activities include the proposed widening of the Section 8 Canal by 5 feet to accommodate additional water capacity; the addition of the southwest corner of Section 11 and the northern portion of Section 4 and 5 as a vernal pool areas; the proposed construction site of the Cottonwood Creek weir in Section 28; and the proposed construction site of the Gravelly Ford and Cottonwood Creek weir near Avenue 7 in Section 27. These areas and activities were not included in the original SHPO consultation package. Additional site surveys of this area were conducted on March 7-8, 2011 and no previously unknown cultural resources were identified. An updated memorandum (Appendix F) was prepared by consulting archaeologists.

Table 3-14 Cultural Resource Sites Identified at Madera Ranch

Primary Number or Trinomial	Temporary Site Number	Description
P-20-2402	JSA-Cultural-2	GF 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-20-2389	N/A	Concrete Footings
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

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 Madera Canal and Irrigation Company (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).

Historical Research

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 inclusion NRHP because there are no such properties within the project area. 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.

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. Archaeologists 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

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 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). Consulting archaeologists (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 a 0.49 mile 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 1.24 miles 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;
- GFWD, 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.

Native American Consultation

On April 4, 2000, March 3 and 7, 2005, and again on February 12, 2009, consultants 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 the consultants with a list of interested Native American individuals and organizations that may have knowledge of cultural resources in the vicinity. The consultants 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 consulting 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, consulting archaeologists 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, the consulting archaeologists 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, consulting archaeologists 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.

3.5.2 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) and SHPO concurred with these determinations on August 31, 2009 (Appendix E).

Alternative A—No Action

Under the No Action Alternative there would be no impacts to 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 3-14. Consulting archaeologists (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. 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. Consulting archaeologists (2002:26; 2007:44) evaluated P-20-2402 for eligibility for inclusion in the NRHP and recommended the canal as ineligible. Modification of this resource would be considered no impact to 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. 1, 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. Modification of these canals would not be considered an impact 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. Modification of the 24.2 Canal would be considered no impact 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, 2011). 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 impact. Implementation of Environmental Commitment CR-1 to stop construction if cultural resources are discovered would reduce the intensity of the effect.

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

Reduced Alternative B is similar in scope and design to Alternative B, with the primary exception that a reduced number of natural swales will be used and a reduced number of ponds will be constructed. Reduced Alternative B would also exclude construction of the Section 8 canal southwest extension. This would not result in any differences from what was described above for Alternative B relative to effects to cultural resources. The effects of Reduced Alternative B would result in nearly identical effects to those that would occur under Alternative B (Effects CR-1, CR-2, CR-3, CR-4 and CR-5), and thus, would be considered no impact to cultural resources.

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 cultural resources identified are eligible for inclusion in the NRHP. Thus, under NEPA, there is no impact to cultural resources. If cultural resources are discovered during construction (as described in Effect CR-5), it could result in an impact to cultural resources under NEPA. 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 cultural resources identified would be recommended for eligibility. Thus, there would be no impact to cultural resources 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 Reduced Alternative B and Alternatives C and D are equivalent to Alternative B in scope and effect, it is not anticipated these alternatives would contribute to cumulative impacts on cultural resources.

3.6 Environmental Justice

This section presents the environmental background necessary to analyze compliance with EO 12898 and provides background information on the ethnic and income characteristics of the study area.

On February 11, 1994, President Clinton issued EO 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.

3.6.1 Affected Environment

To comply with Executive Order 12898, the most current U.S. Census Bureau demographic data available (http://quickfacts.census.gov/qfd/states/06/0645022.html) 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 (Table 3-15). 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 3-15 Population and Percent Ethnicity Data for Madera County

Area	Total 2009 Population	White	African American	Native American	Asian	Hispanic
Madera County	148,632	87.6%	4.6%	3.3%	2.1%	51.7%
City of Madera	54,959	48.1%	3.9%	2.8%	1.4%	67.8%

Notes: All ethnicity data population data (city and county) are for 2009 U.S. Census State and County QuickFacts.

Population and Demographics

The total population of Madera County in 2000 was 148,632, a 20.7% increase between April 1, 2000 and July 1, 2009. 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 3-16).

Table 3-16 Income Data for Madera County

Area	Median 2008 Household Income	Percent above Poverty Level	Percent below Poverty Level
Madera County	$46,000	79	21

Notes: Income data are from 2009 U.S. Census State and County QuickFacts.

3.6.2 Environmental Consequences

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 2009, both Madera County and the Madera Ranch area are considered similarly ethnically diverse. Minority populations account for an estimated 61.7% 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.

3.7 Geology, Soils, Seismicity, and Erosion

This section describes the geologic, seismic and soil conditions in the proposed action area. This section also includes the paleontological conditions in the Proposed Action area.

3.7.1 Affected Environment

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.

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. 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. 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.

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 eight 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).

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 and undisturbed so 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, leveling, ditch construction, and groundwater pumping (which can lower the water table). Consequently, the descriptions of soils in these areas provided by the NRCS only describe the overall soil composition as there may be localized alterations.

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 these 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 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 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 five 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. 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, five-to six-inch-thick lime-silica–cemented hardpan at depths ranging from five 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.

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.

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. 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 3-17).

Table 3-17 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 3-17 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 (Table 3-18). 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 3-18 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) present in a soil. 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 and carbonate 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 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.

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 Biological Resources Section). 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.

Seismicity

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 two miles southwest of Madera Ranch (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.

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.

The findings of the California Division of Mines and Geology 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.

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.

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.

The NRCS established wind erodibility groups. All the soils on proposed action site belong moderately susceptible to highly susceptible wind erodibility groups.

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 BC. 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 approximately 10 to 13 feet 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.

3.7.2 Environmental Consequences

Alternative A—No Action

Under the No Action Alternative, there would be 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 would be above the Corcoran clay, MID would leave 10% of the banked water in the aquifer, and the MROC would monitor the effects on ground surface elevations and would 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. 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 Uniform Building Code in order to 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. 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 Storm Water Pollution Prevention Plan (SWPPP) in compliance with the requirements of the National Pollutant Discharge Elimination System (NPDES) General Construction Permit, and the Central Valley Regional Water Quality Control Board (RWQCB) would administer the SWPPP (Environmental Commitment WQ-1a). The SWPPP would prescribe temporary Best Management Practices (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, 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 Na^+ would 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 one 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 because the easement at Madera Ranch would incorporate an area larger than the area subject to long-term degradation: (2 acres conserved: 1 acre affected for swales) or permanent loss (3 acre conserved: 1 acre lost).

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, 19.6-29.5 inches;
- loamy sand and sandy loam, 39.3-59.0 inches;
- loam, clay loam, and clay, 39.3-59.0 inches; and
- fine sandy loam and silt loam, 39.3- 78.7.

If the water table falls below a certain elevation, known as the *critical water-table depth* (D_c) (Figure 3-6), 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 3-6). Regardless of the depth of the water table or the value of Hc, 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., Electrical Conductivity less than 1.5 deciSiemens/meter) (Smedema and Rycroft 1983).

A 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.

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 eight–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.

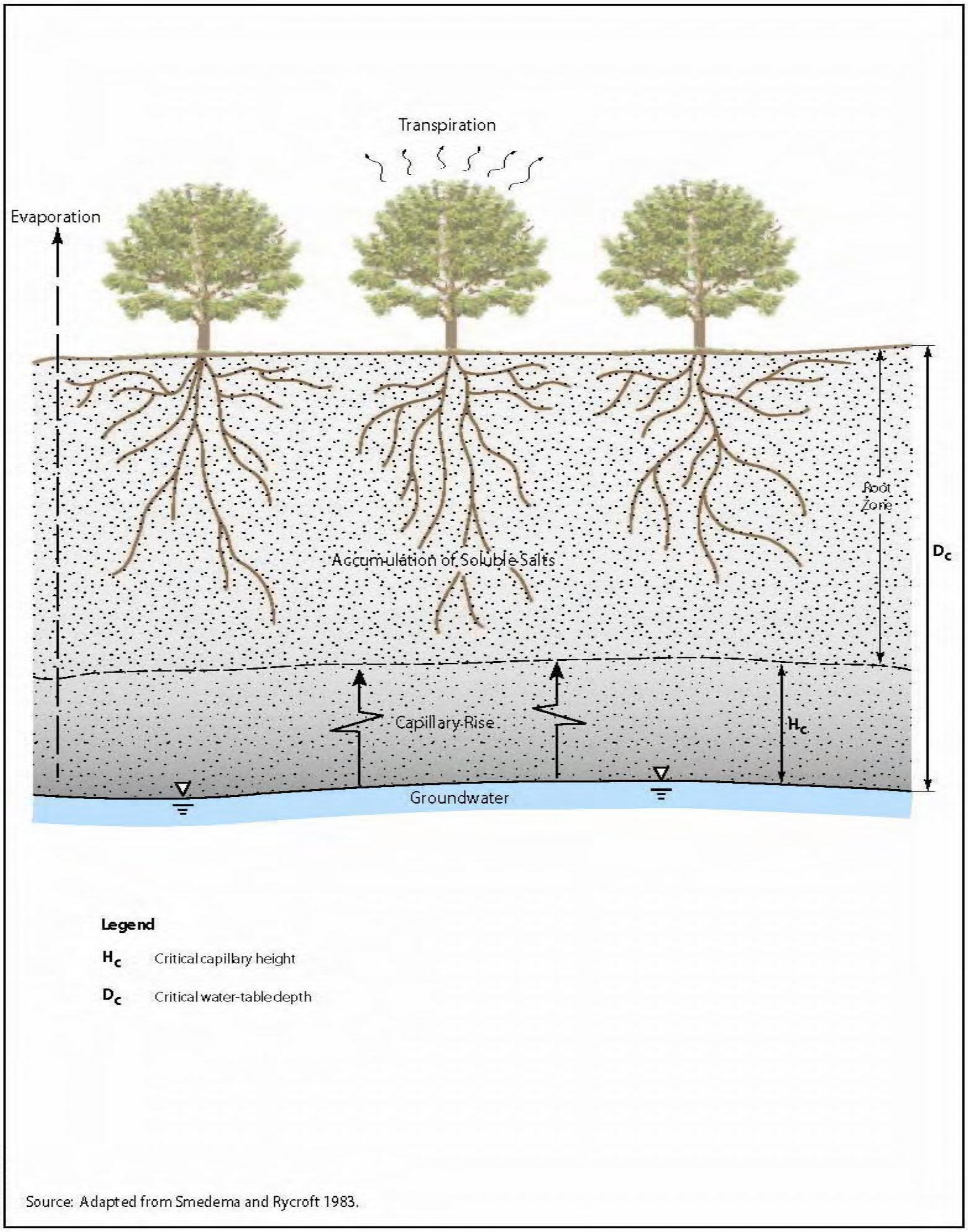

Figure 3-6 Capillary Salinization of the Root Zone by Groundwater

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

Reduced Alternative B is similar in scope and design to Alternative B, with the primary exception that a reduced number of natural swales will be used (550 acres versus 700 acres as proposed under Alternative B) and a reduced number of basins will be constructed (323 acres versus up to 1,000 acres under Alternative B). Reduced Alternative B would also exclude construction of the Section 8 canal southwest extension. Because Reduced Alternative B would use fewer swales and limit the number of recharge basins, the potential for erosion by wind and water due to extensive land-grading activities and potential for destruction of a sensitive paleontological resource or unique Pedologic Feature (Effects GEO-6, GEO-7, and GEO-9) would be reduced. Under Reduced Alternative B, effects on geologic resources (Effects GEO-1, GEO-2, GEO-3, GEO-4, GEO-5, GEO-6, GEO-7, GEO-8, and GEO-9) 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 Reduced Alternative B on local groundwater conditions has been determined to be beneficial.

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 Reduced Alternative B and Alternatives C and D are equivalent in scope and overall effect to Alternative B, it is anticipated that these alternatives would not contribute to cumulative effects on geologic resources.

3.8 Global Climate

Climate change refers to significant change in measures of climate (e.g., temperature, precipitation, or wind) lasting for decades or longer. Many environmental changes can contribute to climate change [changes in sun's intensity, changes in ocean circulation, deforestation, urbanization, burning fossil fuels, etc.] (Environmental Protection Agency 2010a)

Gases that trap heat in the atmosphere are often called greenhouse gases (GHG). Some GHG, such as carbon dioxide (CO_2), occur naturally and are emitted to the atmosphere through natural processes and human activities. Other GHG (e.g., fluorinated gases) are created and emitted solely through human activities. The principal GHG that enter the atmosphere because of human activities are: CO_2, methane (CH_4), nitrous oxide (N_2O), and fluorinated gasses (Environmental Protection Agency 2010a).

During the past century humans have substantially added to the amount of GHG in the atmosphere by burning fossil fuels such as coal, natural gas, oil and gasoline to power our cars, factories, utilities and appliances. The added gases, primarily CO_2 and CH_4, are enhancing the natural greenhouse effect, and likely contributing to an increase in global average temperature and related climate changes. At present, there are uncertainties associated with the science of climate change (Environmental Protection Agency 2010b).

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 California Air Resources Control Board (CARB) to develop and enforce regulations for the reporting and verification of statewide GHG emissions. The CARB 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.

3.8.1 Affected Environment

More than 20 million Californians rely on the SWP and CVP. Increases in air temperature may lead to changes in precipitation patterns, runoff timing and volume, sea level rise, and changes in the amount of irrigation water needed due to modified evapotranspiration rates. These changes may lead to impacts to California's water resources and project operations.

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 GHG 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.

3.8.2 Environmental Consequences

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 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 diesel fuel emission estimates (The Climate Registry 2008).

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

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 GHG 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.

Alternative A—No Action

Under the No Action Alternative, changes in the GHG emissions. 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 GHG 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 GHG through the use of petroleum fuels and indirect emissions through the use of electrical power.

Section 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 carbon dioxide equivalents (CO_2e) using the IPCC's Second Assessment Report global warming potential values. Table 3-19 provides a summary of the estimated indirect and direct GHG emissions from construction.

Table 3-19 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 per horsepower-hour (btu/hp-hr) (Israelson 1962). Table 3-20 provides a summary of the estimated direct GHG emissions from operation.

Table 3-20 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 3-21 summarizes electricity-related GHG emissions associated with project operations. These emissions would not be considered an adverse effect.

Table 3-21 Electricity-Related GHG Emissions Operations, Alternatives B–D (metric tons per year)

	Total Electricity Usage (kWh/year)	CO_2 Emissions	CH_4 Emissions	N_2O Emissions	CO_2e Emissions
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**

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

Reduced Alternative B is similar in scope and design to Alternative B, with the primary exception that a reduced number of natural swales would be used and a reduced number of basins would be constructed. Reduced Alternative B would also exclude construction of the Section 8 canal southwest extension. The construction activities and operational needs under Reduced Alternative B 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.

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 (Table 3-19). 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 CO2e emissions under Alternative C would therefore be approximately 11,425 metric tons (Table 3-20). 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 3-21 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 would result in an increase in GHG 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 3-22.

Table 3-22 Alternative D–Related Emissions from Construction (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 3-21 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 GHG 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 3-23 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.

Table 3-23 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**

Reduced Alternative B would result in less construction activity and less emissions than Alternative B. In addition, Table 3-24 summarizes GHG emissions from construction and operation of the Proposed Action under Alternative D.

Table 3-24 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.

3.9 Growth-inducing Effects

Under authority of NEPA, CEQ Regulations require EISs to consider the potential indirect impacts of a proposed action. The indirect effects of an action are those that occur later in time or farther away in distance, but are still reasonably foreseeable, and –may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate" (40 CFR 1508.8[b]). Specifically, this evaluation of potential growth-inducing impacts addresses whether the project would directly or indirectly: foster economic, population, or housing growth; remove obstacles to growth; increase population growth that would tax community service facilities; or encourage or facilitate other activities that cause significant environmental effects.

Madera County's General Plan and California Department of Finance data sets were consulted for information related to current and future land use, population statistics, and planned growth rates for Madera County. 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. The City of Madera has finalized its urban water management plan prepared pursuant to state law that documents how the available water supply would accommodate planned growth. Additionally, both the County and the City of Madera were consulted to determine whether projects approved and in process would be facilitated through the availability of M&I banking capacity at Madera Ranch.

The *California Water Plan* (California Department of Water Resources 2005), the *Critical Water Shortage Contingency Plan* (California Department of Water Resources 2000a), *Preparing for California's Next Drought*, *DWR Drought Report* (California Department of Water Resources 2000b), and *Integrated Regional Water Management Plan* (Madera County 2008) were consulted for data on statewide and local water needs, growth, and current and anticipated water shortages.

MID's budget for allocating banking capacity to local M&I users under the Proposed Action and alternatives is up to 10,000 AF/year, while MID could recover up to 45,000 AF/year for its agricultural users. It is important to note that the WSEP is intended to help offset dry or below normal water years, and water recovery for M&I uses is not expected to happen in wet or above normal years. It is reasonable to assume that there would be a net banking in wet years and a net recovery in dry years. As water year types vary, it is not expected that the WSEP would provide firm, or consistent, water supplies to those using the bank. Rather, the WSEP would provide greater water supply reliability in dry or below normal water year types. It would not increase the total amount of water supply available to any users.

Water supply by itself does not drive growth. Development at the local level is guided by many considerations, among them the availability of the water supply. Cities and counties regulate land uses by adopting general plans, zoning, and measures for the control of local growth. However, economic forces largely govern the rate and location of growth.

At the same time, economic and population growth depend on adequate water supplies. A wide range of wholesale and retail institutions plan for and manage water supply to meet current and future demands. It is conceivable that water banked at Madera Ranch could be used to improve water supply reliability or expand water supplies to users in the San Joaquin Valley and Southern California. However, MID's business plan only allows for the use of 10,000 AF/year in support of M&I projects and only within Madera County.

3.9.1 Affected Environment

California is a rapidly growing state with a 2009 population of 37 million people (U.S. Census Bureau-Last Revised: Thursday, 04-Nov-2010). The population is expected to rise to nearly 50 million by 2025 (California Department of Finance 2007).

Locally, the population of Madera County is estimated to have increased from 123,109 in 1991 to 148,632 in 2009 (U.S. Census Bureau-Last Revised: Thursday, 04-Nov-2010). The population of Madera County is estimated to increase to 212,874 by 2020 (California Department of Finance 2007).

Water use in Madera County in 2006 was 1.2 million AF, with approximately 97% (1.17 million AF) applied for agricultural purposes. Within the valley floor area of Madera County, groundwater accounted for approximately 75% of the total agricultural water use. Additionally, all urban and rural water is supplied by groundwater sources. The total county water demand is expected to be about 1.3 million AF/year by 2030, an increase of about 100,000 AF of water, most of which is attributed to growing urban and rural demand. Current overdraft is approximately 100,000 AF and is expected to rise to 155,000 AF if no action is taken in the county (Madera County 2008).

Development has proceeded in Madera County despite the existing overdraft condition. To date, the presence or absence of available groundwater has not been an obstacle to growth. With the preparation of the *Integrated Regional Water Management Plan* the County may revisit its development approval conditions and is looking seriously at a variety of options to resolve the overdraft problem. One option that may be considered is the use of Madera Ranch.

Current and Planned Development

Several residential and commercial developments are currently approved or in a discretionary permit process with the County. These projects have existing water supply rights that could utilize the water bank M&I allocation (Table 3-25). Within Madera County, there is already 7,455 AF/year of existing water supply for planned development that could potentially be banked under the M&I allocation of the alternatives. An additional 12,000 AF/year of existing water supply that could potentially utilize the bank for future development projects has also been identified. Thus, 19,455 AF/year of existing, known water supply identified for use in future land use development have been identified within Madera County. This represents almost double the amount of M&I shares (with one share equaling one AF of water) available at Madera Ranch under the proposed action and alternatives.

Additionally, many potential development projects are also identified in the *Integrated Regional Water Management Plan*; these are more speculative and water supplies for these potential projects have not yet been identified. The source of water for these projects would likely need to be groundwater or out-of-county sources. All of these projects would proceed only after County approvals and after obtaining a firm water supply, which is in no way dependent on the WSEP.

Table 3-25 Known Proposed Future Development in Madera County, Water Supply, and Potential Participants

Development	Total Project Acreage	Residential Units	Commercial/ Industrial Acreage	Status	Total af/ year (if known)	Water Supply Secured Elsewhere	Water Supply Source	Back up Dry Year Storage Needed	Potential Water Bank Participant	Potential Banked at Madera Ranch (af)
Gateway Village	2,392	6,455	185.6	Approved	6,374	Yes	Surface Water Groundwater	Yes	Yes	2,170
North Fork Village—North	2,238	2,522	82.3	Final EIR Pending	1,355	Yes	Unknown	Possibly	Unknown	1,355
Gunner Ranch West	1,135	3,014	209	Plan Pending	–	?	Unknown	Unknown	Unknown	
North Fork Village—Central Green	793	1,646	n/a	Supplemental EIR Pending	–	?	Unknown	Unknown	Unlikely	
Tesoro Viejo	1,574	4,600	n/a	Draft EIR Pending	4,810	Yes	Surface Water & Reclaimed	Possibly	Yes	3,930
Jim Cobb	350	350	60	Application Pending	–	?	Unknown	Unknown	Unlikely	
Dunmore Homes	368	2,064	n/a	Application Pending	–	?	Unknown	Unknown	Unknown	
City of Madera—Existing Homes	n/a	n/a	n/a	Existing Homes	–	?	Groundwater	Unknown	Yes	2,000
City of Madera—New Growth	500–1,000	300–400	50	Various Applications	–		Unknown	Unknown	Yes	1,000
Developer A	1,000–1,500	600	Unknown	Various Applications	1,000–1,200	Yes	Transfers	Yes	Yes	1,000
Developer B	500–1,000	500–1,000	Unknown	Application Pending	500–1,000	Yes	Transfers	Yes	Yes	1,000
Developer C	3,000	7,000	Unknown	Application Pending	7,000	Yes	Transfers	Yes	Yes	7,000
Total										**19,455**

Notes: Developers A–C are not named because final agreements have not been signed.

3.9.2 Environmental Consequences

The effect of MID water banking at Madera Ranch would be to increase the reliability and certainty of water supplies for current users with existing water rights or entitlements. The Proposed Action and alternatives do not include an application to appropriate water, would not involve water transfers, and would not create new water supplies that could be dedicated to urban development. The Proposed Action and alternatives are not anticipated to result in additional employment or demand for residential development within Madera County and therefore would not induce growth through increased economic activity.

Effect GI-1: Inducement of Growth due to Municipal and Industrial Participation in Water Bank

Between the currently identified planned projects and the current overdraft situation, the full 10,000 AF/year of non-MID M&I banking capacity is very likely, if not certain, to be fully utilized. Only participants with an existing water supply would be allowed to participate in the Bank. The banking of this water would not change the overall amount of water available to these M&I users, but does improve the reliability of the supply since the banking capacity provided by the WSEP helps M&I users manage their supplies. This firm supply would be applied to the planned growth regardless of implementation of the WSEP. The WSEP would therefore not cause growth, but removes an obstacle to growth because the increased reliability could make development easier or more attractive.

This growth could result in the conversion of agricultural and other open land to urban. It would be extremely speculative to identify specific areas where growth could occur or the indirect effects on specific community service facilities. The impacts of this growth, if any, would be (and in some cases have been) analyzed either in general plan EIRs for the local jurisdictions or in project-level CEQA compliance documents.

3.10 Hazards, Public Health, and Safety

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.

3.10.1 Affected Environment

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 five miles. In addition, a limited phase-2 site assessment was completed (TRC 1999, 2002).

Soil Contamination

There are no residences within one mile of known soil contamination and no schools in the vicinity of Madera Ranch. 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 (UST) were found. The records disclosed that the UST 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 (AST). These 1,500-gallon diesel AST 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, 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. 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.).

3.10.2 Environmental Consequences

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 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.

Health Hazards

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.

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 the DWR's Division of Safety of Dams (DSOD) criteria.

Alternative A—No Action

Under the No Action Alternative, there would be 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.

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 five–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 five feet to prevent wind-induced waves from overtopping the berms. Berm heights would vary, depending on topography, but would not exceed five feet.

The DWR's DSOD has developed criteria delineating its jurisdiction over impounded surface water bodies. Because the berms would not exceed a height of five feet, they would be below the DSOD jurisdictional height limit of six 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 three to five 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.

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 eight months of any given year. The size of each recharge basin cell would be about five 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 four 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. 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.

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 substantial 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 Resource Conservation and Recovery Act-permitted storage facilities within a five-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 AST 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 AST. 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.

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

Reduced Alternative B is similar in scope and design to Alternative B, with the primary exception that a reduced number of natural swales would be used (550 acres versus 700 acres as proposed under Alternative B) and a reduced number of basins would be constructed (323 acres versus up to 1,000 acres under Alternative B). Reduced Alternative B would also exclude construction of the Section 8 canal southwest extension. Thus, there would be no substantive differences in public health and safety effects between Alternative B and Reduced Alternative B. Reduced Alternative B 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). Although Reduced Alternative B would use fewer swales and limits the number of recharge basins, it still 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 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 Reduced Alternative B and Alternatives C and D are identical to Alternative B in scope and effect, it is not anticipated that these alternatives would not contribute to cumulative effects on public health and safety as well.

3.11 Indian Trust Assets

ITA 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. ITA 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, ITA 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 ITA.

The U.S. Department of the Interior Departmental Manual Part 512.2 ascribes the responsibility for ensuring protection of ITA 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 ITA; 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 ITA 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 ITA. Reclamation will comply with procedures contained in Departmental Manual Part 512.2, guidelines, which protect ITA.

3.11.1 Affected Environment

The nearest ITA to the WSEP is the Table Mountain Rancheria which is located approximately 28 miles east-northeast of the Proposed Action area.

3.11.2 Environmental Consequences

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 ITA.

3.12 Land Use

This section describes the existing and planned land uses for the areas potentially affected by the proposed alternatives.

The affected environment was determined by analyzing various documents, examining aerial photographs of the site, and holding discussions with MID and County Planning Department staff. 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.

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).

3.12.1 Affected Environment

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 3-7, 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.

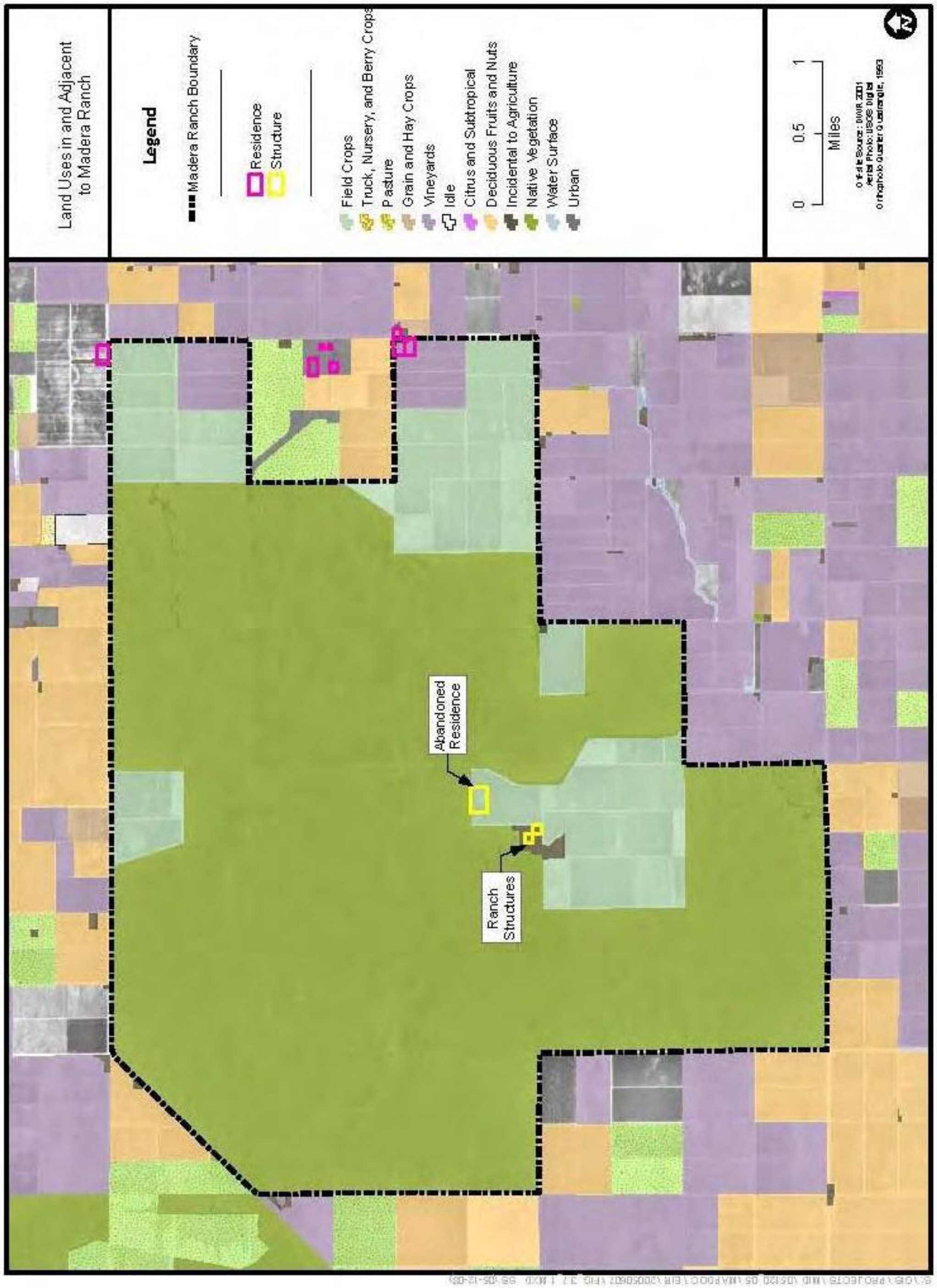

Figure 3-7 Land Uses in and Adjacent to Madera Ranch

3.12.2 Environmental Consequences

Alternative A—No Action

Under the No Action Alternative there would be no adverse effects on land use. However, the future conditions could 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 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 would 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.

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

Reduced Alternative B is similar in scope and design to Alternative B, with the primary exception that a reduced number of natural swales would be used and a reduced number of ponds would be constructed. This would not result in any differences from what was described above for Alternative B relative to land use effects. Reduced Alternative B would not conflict with applicable land use plans, policies, or regulations; recreational land uses; or existing or proposed land uses (Effects LU-1, LU-2 and LU-3). Similar to Alternative B, under Reduced Alternative B, Effects LU-1 and LU-3 would result in no effect, and Effect LU-2 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 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. As such, Alternative B would not result in a considerable contribution to cumulative effects. As Reduced Alternative B and Alternatives C and D are equivalent in scope and overall effect as Alternative B, these alternatives would not result in cumulative effects on land use.

3.13 Noise

This section describes potential temporary and permanent increases to noise levels resulting from the construction and operation of the WSEP.

Potential sources of noise associated with the WSEP are:

- 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 decibels for each doubling of distance. 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.

A brief discussion of common noise terminology and descriptors used in this section 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.

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 Project Consultants, regulatory information from the County of Madera, and sound level data provided by U.S. Electrical Motors.

3.13.1 Affected Environment

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 using a sound-level meter that was checked for proper calibration before and after each measurement session. Temperature, wind speed, and humidity were sampled manually throughout the day. There were minimal clouds and 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. Diesel engines are probably louder than electric engines (Breault et al. 2009), which explains why they had a higher sound level at a further distance than the electric engines.

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.

3.13.2 Environmental Consequences

Alternative A—No Action

Under the No Action Alternative there would be no adverse effects on noise. However, the future conditions could 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 3-26 summarizes typical noise levels produced by heavy equipment.

Table 3-26 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.

Reduced Alternative B—Water Banking Outside the MID Service Area Using Select Swales and Alteration of Reclamation-Owned Facilities
Reduced Alternative B is similar in scope and design to Alternative B, with the primary exception that a reduced number of natural swales would be used and a reduced number of ponds would be constructed. Reduced Alternative B would also exclude construction of the Section 8 canal southwest extension. However, the expected footprint of facilities, including noise-producing pumps for recovery wells and lift stations, and associated construction, under Reduced Alternative B 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 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.

3.14 Public Services and Utilities

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, and electricity.

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.

3.14.1 Affected Environment

Information in this section is primarily from the Madera County General Plan Policy Document (1995b).

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.

3.14.2 Environmental Consequences

Alternative A—No Action

Under the No Action Alternative there would be 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 the California Public Utility Commission 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 the Traffic and Circulation Section, all the local roadways are currently operating at acceptable Levels of Service. The construction-related activities would not substantially increase the number of daily and peak-hour 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 would 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.

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

Reduced Alternative B is similar in scope and design to Alternative B, with the primary exception that a reduced number of natural swales would be used and a reduced number of ponds would be constructed. Reduced Alternative B would also exclude construction of the Section 8 canal southwest extension. Thus, there would be no substantive differences in potential effects on public services and utilities between Alternative B and Reduced Alternative B. Reduced Alternative B 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 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.

3.15 Socioeconomics

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.

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 metropolitan statistical area (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 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.

3.15.1 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 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, and farm supplies).

The California Employment Development Department reports that 432,000 were in the labor force within the Fresno Metropolitan Service in March 2011. Of that amount, 353,100 were employed and 79,600 were unemployed for an unemployment rate of 18.4-percent.

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 3-27).

Table 3-27 Selected Employment Characteristics for the Fresno Metropolitan Statistical Area

Industry	Number of Full-Time and Part-Time Jobs
Total Labor Force	315,500
Farm (including production and services)	36,300
Non-farm	279,200
Mining and Construction	11,000
Manufacturing	25,000
Transportation, Public Utilities and Trade (including wholesale and retail)	54,200
Professional Services	26,400
Leisure and Hospitality	26,600
Government	68,600
Other	9,900

Source: California Employment Development Department 2011.

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.

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 (Table 3-28). 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 3-28 Population and Percent Ethnicity Data* for Madera County

Area	Total 2000 Population	White	African American	Native American	Asian/Pacific Islander	Hispanic
Madera County	148,632	87.6%	4.6%	3.3%	2.4%	51.7%
City of Madera	61,416	48%	2.7%	0.5%	0.1%	76.7%
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 3-29).

Table 3-29 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

About 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.

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.

3.15.2 Environmental Consequences

Alternative A—No Action

Under the No Action Alternative there would be 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.

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

Reduced Alternative B is similar in scope and design to Alternative B, with the primary exception that a reduced number of natural swales would be used and a reduced number of ponds would be constructed. Reduced Alternative B would also exclude construction of the Section 8 canal southwest extension. Thus, there would be no substantive differences in potential effects on public services and utilities between Alternative B and Reduced Alternative B. Increased water costs are not expected to have an effect on the environment (SE-3). Reduced Alternative B would result in equivalent effects (Effects SE-1 and SE-2) on temporary and permanent employment. Similar to Alternative B, Reduced Alternative B has the potential to result in beneficial socioeconomic effects (SE-4).

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.

3.16 Traffic and Circulation

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.

3.16.1 Affected Environment

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 3-30. 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 3-30 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 3-31, 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 3-31 Roadway Characteristics near Madera Ranch

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

Roadway	Responsibility	Functional Classification	Average (vehicles per day)	Peak Hour (vehicles per day)	LOS

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.

Madera County is in a major transportation corridor between northern and southern California; 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 3-8, 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.

Information about the most current traffic volumes, roadway classifications, and LOS is provided in Table 3-31. 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.

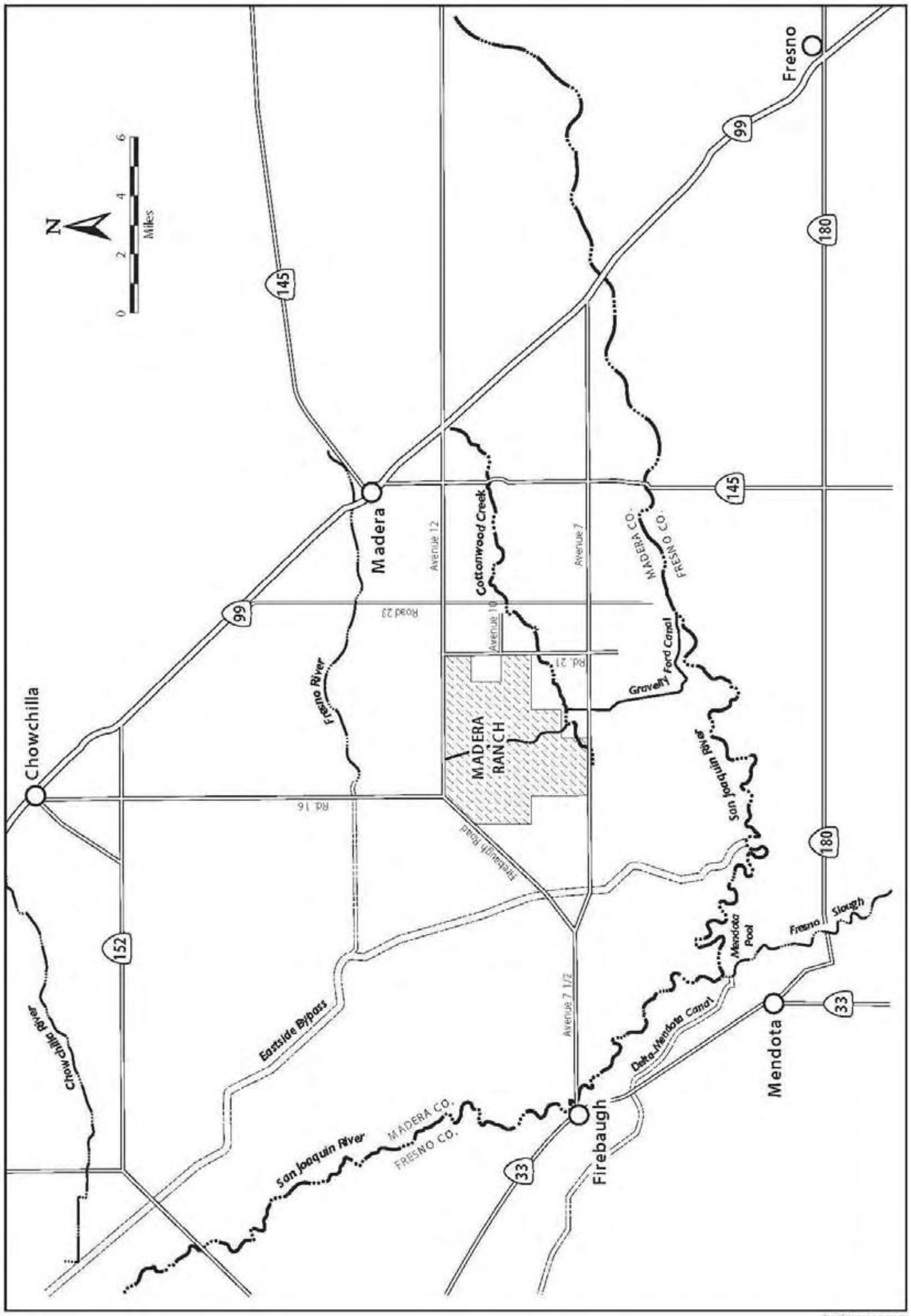

Figure 3-8 Regional and Local Roadway Network near Madera Ranch

3.16.2 Environmental Consequences

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 five 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 3-34, the traffic analysis assumes that construction workers under the alternatives would come from the Fresno 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 3-32 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 3-32) 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.

O&M–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 3-32 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**

Alternative A—No Action

Under the No Action Alternative there would be 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 3-9 identifies the preferred travel routes for both daily and peak-hour traffic volumes. Table 3-33 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.

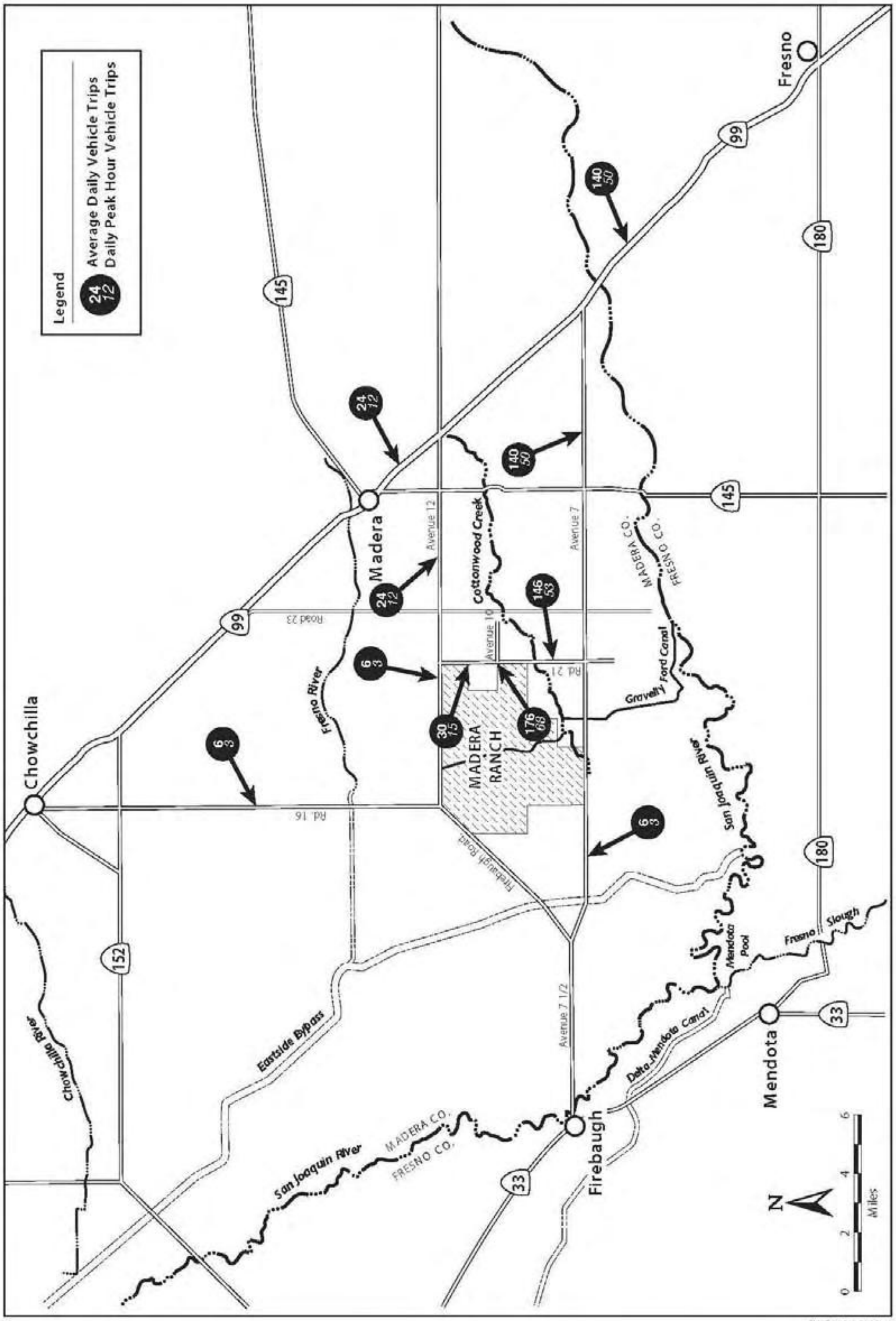

Figure 3-9 Project-related Trip Distribution – Construction Period

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 and peak-hour 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 3-33 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.

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 the Alternatives Section, 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.

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

Reduced Alternative B is similar in scope and design to Alternative B, with the primary exception that a reduced number of natural swales would be used and a reduced number of ponds would be constructed. Reduced Alternative B would also exclude construction of the Section 8 canal southwest extension. 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 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.

3.17 Water Resources

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.

3.17.1 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.

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.

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 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 (two miles east of the ranch) and on the south side of the ranch. Federal Emergency Management Agency (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) which refers to the electrical conductivity of water (approximately 28 mg/L TDS; Table 3-34), which indicates a much lower TDS than the groundwater beneath Madera Ranch, which averages 466 µS/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 µS/cm (approximately 72.5 mg/L TDS; Table 3-35), also lower than the groundwater at Madera Ranch. Tables 3-34 and 3-35 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 3-34 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 (µS/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 SO_4)	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]RWQCB, Basin Plan Amendment Criteria (1998).
[d]Sodium criteria for people on a 500- mg/L sodium diet. U.S. EPA 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). RWQCB, Basin Plan Amendment Criteria (1998)—2.0 (15 March–15 September) and 2.6 (16 September–14 March).
[g]U.S. EPA National Drinking Water Standard (2004).

Table 3-35 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 (µS/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	2g
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

	Count[a]	Maximum	Minimum	Average[b]	Criteria

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]RWQCB, Basin Plan Amendment Criteria (1998).
[d]Criteria for San Joaquin River. No criteria listed for the Fresno River in the RWQCB, Basin Plan Amendment Criteria (1998).
[e]Sodium criteria for people on a 500- mg/L sodium diet. U.S. EPA National Drinking Water Standard (2004).
[f]U.S. EPA 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). RWQCB, 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 the section on 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. The section on 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 PPM of nitrogen 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 MCL. 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 3-10. 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 3-36). 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 3-36 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.

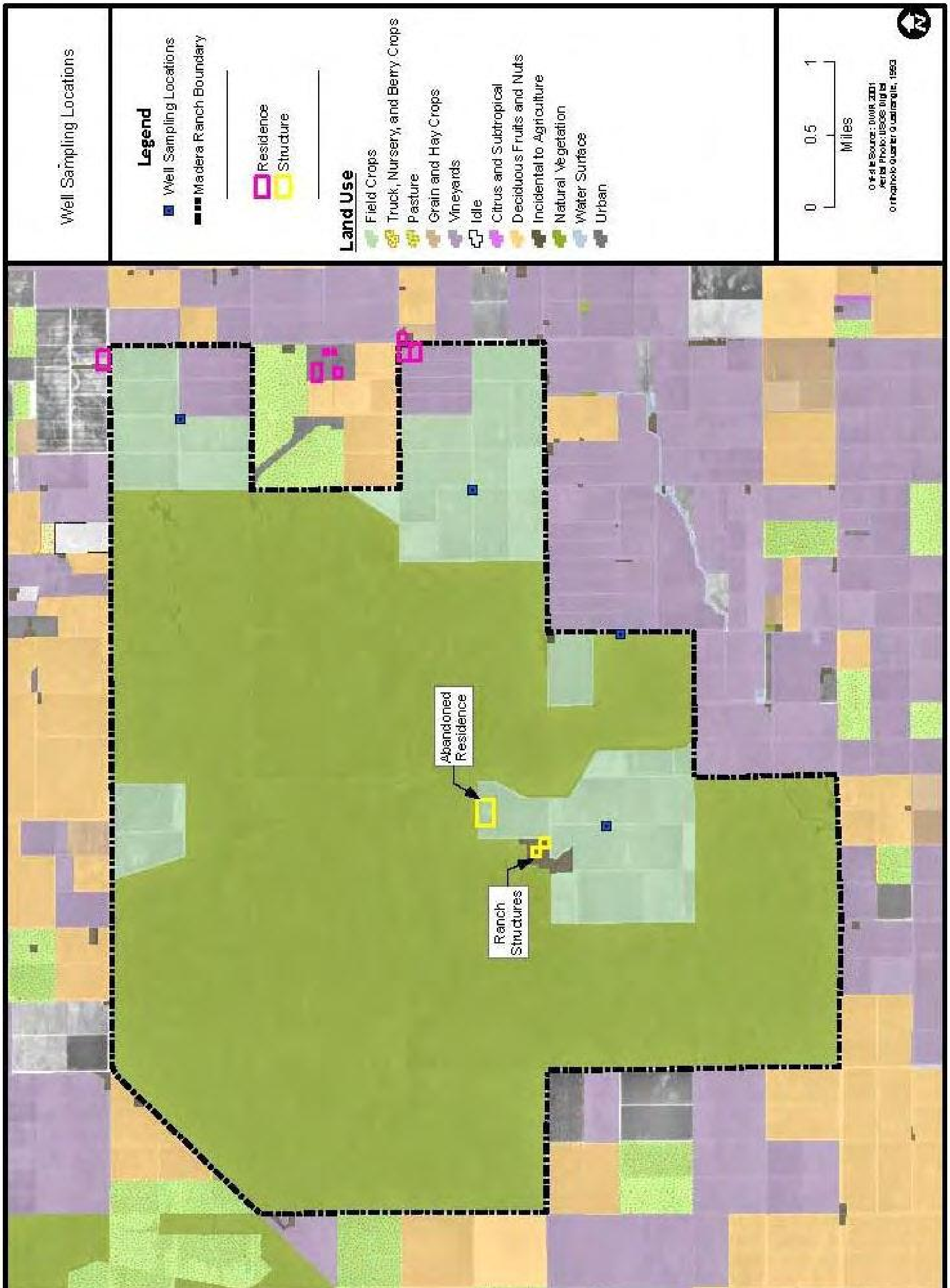

Figure 3-10 Well Sampling Locations

Four wells were tested for inorganic constituents in September 1999 (TRC 1999). Inorganic data presented in Table 3-37 show the relative chemistry of the groundwater at Madera Ranch. As indicated, no state or federal criteria were exceeded.

Table 3-37 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 (µS/cm at 25ºC)	466	438	607	354	900[f]
TDS	309	313	411	265	500f
Aluminum	<0.05	<0.05	<0.05	<0.05	1[d]
Arsenic	<0.002	0.003	0.004	0.007	0.01[d]
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 mg/L unless otherwise noted (mg/L are equivalent to PPM).
[b]Ranch well: Monitoring wells (Figure 3-11).
[c]RWQCB, 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. EPA National Drinking Water Standards (2004).
[f]Recommended secondary MCL from the U.S. EPA National Drinking Water Standards (2004).

3.17.2 Environmental Consequences

Alternative A—No Action

Under the No Action Alternative there would be no adverse effects to 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 would 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 3-37). Recharge water allocated from the San Joaquin River and Fresno River would contain approximately 28 to 100 mg/L TDS (Tables 3-34 and 3-35). MID had three percolation studies performed and found that leaching of salts from the soil profile would be largely complete during the initial three- to four-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 Section 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 one 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 Geology section) 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 one foot per second or less, no adverse scouring or bank erosion is expected. This effect is not considered adverse.

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

Reduced Alternative B is similar in scope and design to Alternative B, with the primary exception that a reduced number of natural swales would be used (550 acres versus 700 acres as proposed under Alternative B) and a reduced number of recharge basins would be constructed (323 acres versus up to 1,000 acres under Alternative B). Reduced Alternative B would also exclude construction of the Section 8 canal southwest extension. Although Reduced Alternative B would use fewer swales and limits the number of recharge basins, thereby reducing effects associated with degradation of water quality resulting from construction runoff and from recharge or recovery operations (Effects WQ-1 and WQ-3), it would not result in changes to the quality of water sources or the overall patterns of water banking anticipated under Alternative B. With the implementation of the MOCP, Reduced Alternative B would result in similar effects (Effects WQ-1, WQ-2, WQ-3, WQ-4, and WQ-5), from construction and operation of the WSEP. Thus, water quality effects would be similar 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 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 one 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).

3.18 Water Supply

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.

3.18.1 Affected Environment
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-D; December 29, 2010). 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 3-38.

Table 3-38 CVP Water Supply Contracts in Madera Area (AF/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 previously, would 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-E; December 29, 2010). 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

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 3-39 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.

Table 3-39 Historical Availability of MID Water (AF)

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

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

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

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 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 3-39 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 3-39 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, the implementation of the SJRRP would result in a decrease in the supplies available to MID from the Friant Division. As such, the water that would 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. 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 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/year by 2030 (Madera County 2008).

As depicted in Figure 3-11, 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.

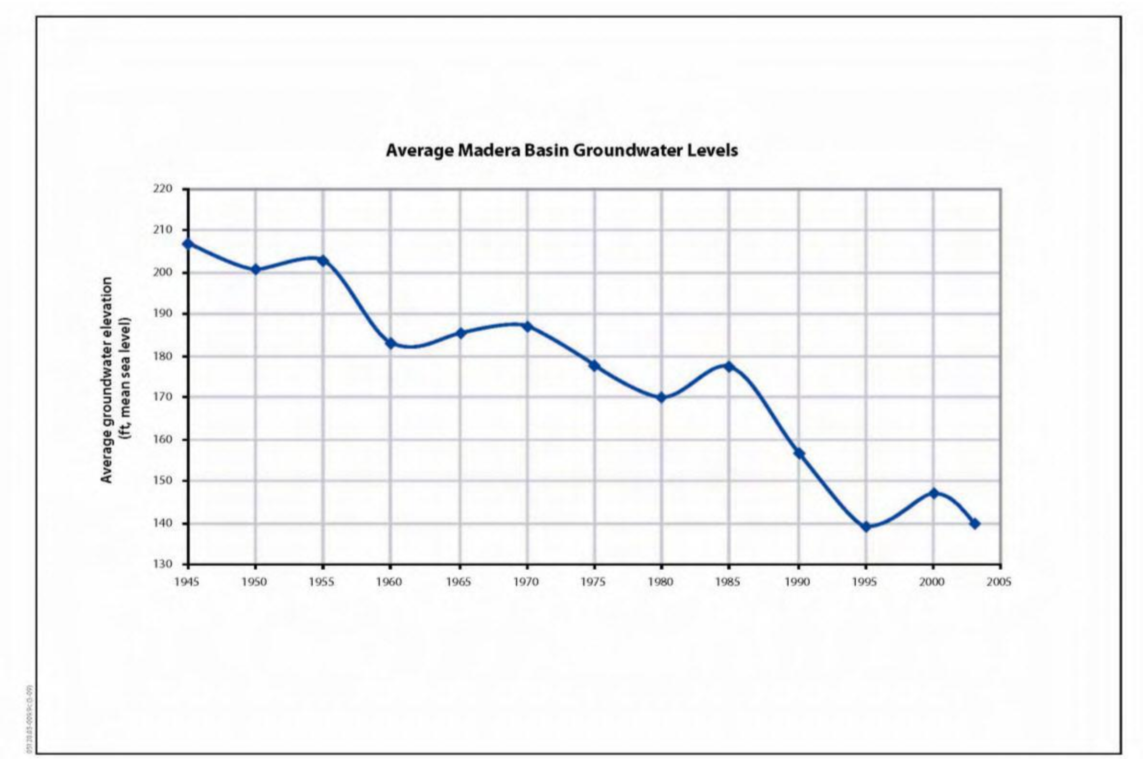

Figure 3-11 Historical Trends in Average Groundwater Levels in the Madera Subbasin

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).

3.18.2 Environmental Consequences

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.

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, a Mid-Pacific Region-specific 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 one 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 five–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 five feet to prevent wind-induced waves from overtopping the berms. Berm heights would vary, depending on topography, but would not exceed five feet.

DWR's 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 five feet and below the DSOD jurisdictional height limit of six 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 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 the section on 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 3-39).

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.

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

Reduced Alternative B is similar in scope and design to Alternative B, with the primary exception that a reduced number of natural swales would be used and a reduced number of ponds would be constructed. 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 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 GF 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 would 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 the Section on 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 3-39, 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 five-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 would 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 3-39).

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.

3.19 Wetlands

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.

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 the Biological Resources section. 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.

3.19.1 Affected Environment

MID consultants 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 five 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.

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.

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 six 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, 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. Wetland 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 ―the 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, the NRCS and Corps visited the site with the lead wetland delineator to verify the wetland delineation and stream mapping. It was 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), it was agreed upon that the 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, NRCS visited the site with the 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.

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. Wetland 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, Consultants 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, The Corps visited the site with Consultant staff to further assess Cottonwood Creek, GF Canal, and swales. As a result of this site visit, the Corps 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 3-13 (located in the Biological Resources section). 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 (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 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 0.7 inches in 10 weeks between late October and early May.

Precipitation was below average in 2005 at 8.52 inches, above average in 2006 at 11.4 inches, and below average in 2007 at 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. 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. Consultants previously identified this habitat in Tulare County (Jones & Stokes Associates 1998). Alkali rain pools form in slickspots that pond water for a long time. 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, Consultants 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, Project consultants 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 Project consultants observed drift lines in the swale adjacent to the pools, they were unaware that the swales received periodic inflows from Cottonwood Creek. In 2005, Project consultants 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

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.

California Annual Grassland 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 Vegetation 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.

3.19.2 Environmental Consequences

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 3-5). Effects on seasonal wetlands of the Alternative B, Reduced Alternative B, and Alternative C are similar as approximately 150 acres of swales mapped as seasonal wetland would continue to be inundated. Alternative D includes the inundation of approximately 45 acres of seasonal wetlands because fewer swales would be used to bank water. Inundation of an additional 400 acres (Reduced Alternative B) and 550 acres (Alternative B and Alternative C) of swale areas would result in the greatest effect to vernal pools and alkali rain pools under Alternative B (5.9 acres) and Alternative D (5.9 acres), followed by Reduced Alternative B (1.7 acres), and Alternative C (0 acres). For all alternatives, temporary construction would affect approximately one acre of alkali rain pools and less than 0.5 acre of vernal pools, and permanent construction would affect up to approximately two acres of alkali rain pools and no vernal pools.

Project elements within water bodies and uplands are summarized in Table 3-40.

Table 3-40 Project Elements within and near Water Bodies

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
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
Canal turnouts (seven new turnouts, two turnout replacements)	Yes	75 sf (0.04 ac) each
Wildlife crossings for Gravelly Ford Canal (three crossings)	Yes	1,018 sf (88 cy) each
Other Components within and near Water Bodies		
24.2 Canal improvements	No	36,000 cy excavation; (1.75 mile expanded and 0.75 mile new)
Section 8 Canal upgrades/extensions	No	76,000 cy excavation; (1.75 mile expanded, 1.75 mile existing to pipe, and multiple new extensions)
Use of swales for recharge(1) (2)	No	No cut or fill. <6 acres vernal pool/alkali rain pool from use of swales (Alternative B) and <2 acres for Reduced Alternative B
55 acres of recharge basins in agricultural lands	No	55 acres
Recharge basins in grasslands	No	Varies
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: CWA = Clean Water Act; lf = linear feet; sf = square feet; cy = cubic yards.
(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 3-12 for vernal pool/alkali rain pool effects under each Alternative.
(3)Alternatives B, Reduced Alternative B, C, and D are the same for recovery facilities because the layout does not change.

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.

Alternative A—No Action

Under the No Action Alternative there would be 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 five 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 two 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 would 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.

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

Reduced Alternative B is similar in scope and design to Alternative B, with the primary exception that a reduced number of natural swales would be used in order to minimize effects to vernal pools, and a reduced number of ponds would be constructed. Reduced Alternative B also directs recharge activities in the swales on a priority basis to help avoid effects to vernal pools. As with Alternative B it would complete the water bank in two phases. Phase 1 would involve constructing necessary delivery infrastructure improvements (except for the Section 8 canal southwest extension), using select natural swales for recharge (550 acres versus 700 acres as proposed under Alternative B), and installing approximately five soil berms to direct recharge flows (the berms would be placed to avoid fill of wetlands). Phase 2 would involve constructing a limited number of recharge basins (323 acres versus up to 1,000 acres under Alternative B) and facilities for recovery of banked water. The reduced footprint of recharge basins and number of swales proposed under Reduced Alternative B would reduce the temporary and permanent construction effects on wetlands discussed under Alternative B (Effects WET-1 and WET-2). Environmental Commitments BIO-2a and BIO-2b would reduce the adverse Effect WET-1.

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 five 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.

Section 4 Consultation and Coordination

4.1 Coordination with other Agencies

Both the Corps and USFWS are cooperating agencies and provided comments to Reclamation at various stages in the EIS process. The Corps verified the preliminary wetland delineation provided by MID on November 13, 2009, and MID sought permits for reshaping existing drainage ditches and adding structures in artificial canals. Reclamation submitted a biological assessment to the USFWS for the WESP in April 2008, which analyzed Alternative B. The USFWS has provided two insufficiency memos requesting additional information on the project and Reclamation has responded to these memos. The USFWS's comments related primarily to avoiding and minimizing effects on federally listed species that may use the swales and associated habitat on Madera Ranch. On May 13, 2009, Reclamation responded to USFWS's request. From May 2009 to July 2010, Reclamation, MID representatives, USFWS, Corps, DFG and EPA met to modify the project description in order to meet the Least Environmentally Damaging Practicable Alternative, pursuant to section 404 of the CWA. In January of 2011, Reclamation provided a revised biological assessment to the USFWS, which analyzed Reduced Alternative B.

4.2 Public Outreach Process

This section describes the scoping and public outreach process that was followed for the MID WSEP Draft EIS. The public outreach efforts were conducted in accordance with NEPA to determine the focus and content of this EIS, and to solicit and consider the views of federal, state, and local agencies, and the general public regarding the scope and content of the environmental analyses contained in the MID WSEP Draft EIS. These efforts are described here.

4.2.1 Notice of Intent

Pursuant to the requirements of NEPA, Reclamation published a Notice of Intent to prepare a Draft EIS and Notice of Public Scoping Meetings in the *Federal Register* on September 28, 2007. The Notice of Intent was circulated to the public, local, state, and federal agencies, and other interested parties to solicit comments on the MID WSEP Proposed Action.

4.2.2 Scoping Process

NEPA requires a formal scoping process for the preparation of an EIS (40 CFR 1501.7). The main objective of the scoping process is to provide the public and potentially affected resource agencies with information on the alternatives and to solicit public input regarding the issues and concerns that should be evaluated in the environmental documentation. The scoping process is generally intended to provide Reclamation with information regarding the range of actions, alternatives, resource issues, and mitigation measures that are to be analyzed in depth in the EIS and to eliminate from detailed study those issues found not to be significant.

The scoping process for the MID WSEP Proposed Action was conducted to elicit comments from public agencies, other interested organizations and the public on the scope of the potential environmental effects and issues to be addressed in the Draft EIS. Reclamation and MID held EIS scoping meetings at MID's offices in Madera on October 22 and 29, 2007. 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 Action and alternatives, potentially significant environmental issues, and opportunities for future public involvement. Attendees were given the opportunity to provide both oral and written comments. Only one verbal comment was made and a summary of that comment is included in Appendix A.

4.3 Draft EIS Availability

Pursuant to NEPA, the Draft EIS was made available for a 60-day public review period from July 24, 2009 to September 25, 2009. A notice of availability of the Draft EIS was published in the *Federal Register* July 27, 2009. The purpose of the notice was to inform interested parties of the availability of the Draft EIS for public review and comment. Reclamation also issued a press release on its website to notify persons about the public meeting and sent written notice to all agencies and individuals on the MID WSEP Draft EIS mailing list.

Copies of the Draft EIS were made available for public review at Reclamation, Denver Office Library; Natural Resources Library, U.S. Department of the Interior; Reclamation, Mid-Pacific Regional Office Library; the South-Central California Area Office of Reclamation, Fresno, California; Madera Library, Madera, California; Chowchilla Library, Chowchilla, California; Madera Ranchos Library, Madera, California; Fresno County Public Library, Fresno, California; and Clovis Regional Library, Clovis, California.

In addition, an electronic copy was made available on the Reclamation web site at: http://www.usbr.gov/mp/nepa/nepa_projdetails.cfm?Project_ID=3128

The public comment period on the Draft EIS closed September 25, 2009. Written comments were received from two federal agencies, three state agencies, and four other entities and are included in Appendix A. Comments (verbal and written) pertained to the following topics (Appendix A):

- potential impacts on water quality,
- potential impacts on water supply,
- potential water rights issues,
- potential impacts on biological resources, and
- socioeconomic concerns related to economic impacts on farmers.

NEPA requires agencies to respond to comments on the Draft EIS that are received during the public comment period (President's CEQ Regulations for Implementing NEPA Section 1503.4). This document has been prepared pursuant to these requirements. Reclamation has considered all the verbal and written comments received on the Draft EIS and has determined the Draft EIS requires some changes to the Proposed Action. Responses to comments are also included in Appendix A.

The public agencies that provided comments on the Draft EIS include:

- United States EPA
- RWQCB, Central Valley Region
- DFG
- Corps
- California Farm Bureau Federation

Reclamation will provide copies of the Final EIS to these agencies.

4.4 Regulatory Environment

The Proposed Action must comply with the following Federal Regulations:

4.4.1 Clean Air Act

The federal 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.C. 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 CAA Amendments of 1990 require that all federally funded projects are consistent with the 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. As described in the Air Quality section, each of the alternatives would conform to the applicable SIP. Table 2.2 describes the environmental commitments to implement the SJVAPCD Regulation VIII Control Measures for construction emissions of PM_{10}, to reduce emissions associated with idling equipment and for the use of electric pumps.

4.4.2 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. In addition, 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 previously, Reclamation submitted a revised biological assessment as part of the formal consultation process with the USFWS. The USFWS issued a Final Biological Opinion on April 26, 2011 (Appendix B). Table 2.2 and Section 2 describe the environmental commitments required for compliance to the Biological Opinion.

4.4.3 Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act (FWCA) requires that public and private entities consult with fish and wildlife agencies (federal and state) on specific water development projects that could affect fish and wildlife resources. The amendments enacted in 1946 require consultation with the USFWS and State fish and wildlife agencies "whenever the waters of any stream or other body of water are proposed or authorized to be impounded, diverted, the channel deepened, or the stream or other body of water otherwise controlled or modified for any purpose whatever, including navigation and drainage, by any department or agency of the United States, or by any public or private agency under Federal permit or license". Consultation is to be undertaken for the purpose of "preventing the loss of and damage to wildlife resources". CEQ regulations, §1502.25 (a) requires that "…. agencies shall prepare draft environmental impact statements concurrently with and integrated with environmental impact analyses and related surveys and studies required by the Fish and Wildlife Coordination Act (16 U.S.C. 661 et seq.), the National Historic Preservation Act of 1966 (16 U.S.C. 470 et seq.), the Endangered Species Act of 1973 (16 U.S.C. 1531 et seq.), and other environmental review laws and executive orders."

As required by both FWCA and NEPA, Reclamation initiated early involvement with both USFWS and CDFG to obtain their recommendations on fish and wildlife resources, giving those recommendations equal consideration with respect to the project purpose and need. The Final EIS describes action-related effects to wildlife resources and identifies alternative means and measures necessary to enhance or mitigate impacts to wildlife resources. Because FWS was a cooperating agency, Reclamation consulted with CDFG, and all recommendations for wildlife enhancement were fully considered by Reclamation, this EIS provides Reclamations compliance with the FWCA.

4.4.4 Migratory Bird Treaty Act

The MBTA (16 U.S.C. 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. Preconstruction surveys and avoidance measures for western burrowing owls and other raptors would ensure compliance with the MBTA (Table 2-2).

Executive Order 13186—MTBA Responsibilities of Federal Agencies

EO 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 two 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 EO 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 two years, each federal agency is encouraged to immediately begin implementing the conservation measures set forth in the order, as appropriate and practical. The preservation of grassland under conservation easement would aid in conserving potentially affected western burrowing owls and raptors (Table 2-2).

4.4.5 Bald and Golden Eagle Protection Act

The BGEPA prohibits the taking or possession of and commerce in bald and golden eagles, with limited exceptions. BGEPA 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 BGEPA. —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. The golden eagle is known to forage on Madera Ranch but does not nest there. As a result, there is no risk of take of golden eagles as defined under the BGEPA. Bald eagles are unlikely to use Madera Ranch, but if they do, they would only forage on the site and would therefore not be impacted (Table 2-2).

4.4.6 National Historic Preservation Act

Section 106 of the NHPA (15 U.S.C. 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 NRHP 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. The physical disturbance of undiscovered cultural resources could occur during construction; however, implementation of Environmental Commitment CR-1 (Table 2.2) to stop construction if cultural resources are discovered would reduce the intensity of the effect. As described in the Cultural Resource section, there would be no impacts to cultural resources.

Reclamation requested SHPO concurrence on a finding of no historic properties affected. SHPO agreed with Reclamation's findings on August 31, 2009, and concurrence was received August 31, 2009 (Appendix E). However, since that time, a number of additional activities have been proposed which require expanding the APE as described in the Cultural Resources section.

These areas and activities were not included in the original SHPO consultation package. Additional site surveys of this area were conducted on March 7-8, 2011 and no previously unknown cultural resources were identified. An updated memorandum (Appendix F) was prepared by consulting archaeologists.

4.4.7 Clean Water Act

Federal water quality regulations are established primarily in the CWA and administered by the EPA. These regulations are subsequently implemented primarily by the State Water Resources Control Board, 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 Resources Control 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. MID coordinated with the Corps facilitated by Reclamation to determine if waters of the United States would be affected. A permit for compliance to Section 401 of the CWA certification; General Permit for Storm Water Discharges Associated with Construction Activity (CWA Section 402) is required.

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 Resources Control Board issues both general and individual permits for certain activities. A NPDES General Permit for storm water discharges associated with construction activity is required under Section 402.

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 coordinated with the Corps to ensure that effects on waters are minimized. A Section 404 Permit for discharges associated with construction activity is required.

4.4.8 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.

FEMA administers the National Flood Insurance Program to provide subsidized flood insurance to communities that comply with FEMA regulations limiting development in floodplains. FEMA issues flood insurance rate maps for communities participating in the National Flood Insurance Program. 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.

4.4.9 Executive Order 11988 – Floodplain Management

EO 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.

4.4.10 Executive Order 11990 – Protection of Wetlands

EO 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 coordinated with the Corps to ensure that effects on wetlands are minimized. Table 2.2 describes the environmental commitments required for compliance to EO 11990.

4.4.11 Executive Order 12898 – Environmental Justice

EO 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 EO 12898 was addressed during the NEPA process. As described in the Environmental Justice section, there would be no disproportionately high adverse impacts on minority and low-income populations.

4.4.12 Executive Order 13007 – Indian Sacred Sites and April 29, 1994, Executive Memorandum

EO 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.

4.4.13 Farmland Protection Policy Act and Memorandum 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 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 NRCS is the federal agency responsible for ensuring that these laws and policies are followed.

MID has consulted with the NRCS and has evaluated potential impacts to agricultural land using the land evaluation and site assessment process. The rating assigned by the NRCS for the loss of prime farmland identifies this loss as adverse. Environmental commitments to establish conservation easements on agricultural land are included to reduce the intensity of this effect (Table 2.2).

4.4.14 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 ROD 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. For the Proposed Action, there would not need to be any water right amendments or applications. MID could only bank the water that they are already able to divert and use

Exchanges of CVP 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, Chowchilla Water District, 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, Chowchilla Water District, 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 Chowchilla Water District 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.

4.4.15 State Water Resources Control Board
Under the California Water Code, the State Water Resources Control 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 Resources Control 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.

4.4.16 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).

4.4.17 Madera Irrigation District AB3030f Groundwater Management Plan

MID approved its AB3030 Groundwater Management Plan 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.

4.4.18 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.

Section 5 Preparers and Reviewers

5.1 Bureau of Reclamation

South-Central California Area Office
1243 N Street
Fresno, CA 93721

Name	Expertise	Role
Patti Clinton	Natural Resources Specialist	Reviewer
Chuck Siek	Supervisory Natural Resources Specialist	Project Manager, Reviewer
Shauna McDonald	Wildlife Biologist	Reviewer
Brandee Bruce	Archeologist	Reviewer
Patricia Rivera	Native American Affairs	Reviewer

5.2 Project Consultants

Stoel Rives LLP
500 Capitol Mall, Suite 1600
Sacramento, CA 95814

Name	Expertise	Role
Barbara Brenner	Legal Review	Attorney

ICF Jones & Stokes
630 K Street, Suite 400
Sacramento, CA 95814

Name	Expertise	Role
Project Management Team		
Brad Norton	NEPA Compliance, Biologist	Project Director, Biological Resources
Jennifer Pierre	NEPA Compliance	Project Manager, Introduction, Alternatives
Technical Team		
Kim Marcotte	NEPA Compliance	Aesthetics, Agricultural Resources, Land Use
Shannon Hatcher	Air and Noise Specialist	Air Quality, Noise, Climate Change
Dave Buehler	Noise Specialist	Noise
Ed West	Wildlife Biologist	Biological Resources
Rob Preston	Botanist	Biological Resources
Gabriel Roark	Prehistoric Archaeologist	Cultural Resources
Christiaan Havelaar	Archaeologist	Cultural Resources
Joel Butterworth	Soil Scientist	Geology, Seismicity, and Soils
Stephanie Bradley	Environmental Specialist	Public Health and Safety, Public Services and Utilities, Traffic and Circulation

Name	Expertise	Role
Nate Martin	Hydrologist	Water Quality, Water Resources and Supply
Sacha Selim	GIS Specialist, graphic design	Geographic Information Systems
Becky Crosswhite	GIS Specialist	Geographic Information Systems
Darle Tilly	Technical Editor and Writer	Lead Technical Editor
Carol-Anne Hicks	Word Processor	Publications Specialist

Section 6 References

6.1 Printed References

Adams, F. 1929. Irrigation districts in California. *Reports of the Division of Engineering and Irrigation Bulletin 21.* Sacramento, CA: California State Printing Office.

Albright, L. B., III. 2000. Biostratigraphy and Vertebrate Paleontology of the San Timoteo Badlands, Southern California. University of California Publications, *Geological Sciences*, Vol. 144. University of California Press. Berkeley, CA.

Amdur, M. O., J. Doull, and C. D. Klaassen (eds). 1991. *Casarett and Doull's toxicology, the basic science of poisons*. 4th edition. New York: McGraw-Hill, Inc.

Association of Environmental Professionals. 2007. Alternative Approaches to Analyzing Greenhouse Gas Emissions and Global Climate Change in CEQA Documents. Available: http://www.califaep.org/userdocuments/File/AEP_Global_Climate_Change_June_29_Final.pdf. Accessed: June 1, 2008.

Bailey, E. H. 1966. Geology of Northern California. *Bulletin 190*. Sacramento: California Division of Mines and Geology.

Baloian, Mary C., and Sandra S. Flint 2002 Finding of Effect for Replacement of the Cottonwood Creek Bridge (41C-0006) on County Road 28, Madera County, California. 06-Mad-0-CR, BRLO-5941 (004). October. Applied EarthWorks, Fresno, California. Prepared for Madera County Road Department, Madera, California. Submitted to California Department of Transportation, District 6, Fresno. On file, Southern San Joaquin Valley Information Center, California Historical Resources Information System, Bakersfield (Study MA 978).

Barnes, H. 1963. History of use of Fresno River water for irrigation. *The Madera County Historian* 3(1):1–7.

Bohart, R. M., and R. K. Washino. 1978. *Mosquitoes of California*. 3rd edition. Berkeley: University of California, Division of Agricultural Sciences.

Bookman-Edmonston. 2003. Madera Ranch water bank: Hydrogeologic feasibility report. Prepared for Western Development and Storage, LLC.

Bookman-Edmonston. 2004. Addendum to Madera Ranch Water Bank Engineering Feasibility Study: Madera Irrigation District Water Supply Enhancement Project: Engine Driver Study. Rancho Cordova, CA.

Bookman-Edmonston. 2005. Water Supply Enhancement Project Feasibility Study of the Preferred Alternative. June 6, 2005. Rancho Cordova, CA.

Boyle Engineering Corporation. 1999. AB3030 Groundwater Management Plan. Madera Irrigation District. May.

Bureau of Reclamation. 1993. Indian Trust Asset Policy.

Bureau of Reclamation. 1998. Madera Ranch groundwater bank, phase 1 report. Fresno, CA.

CALFED Bay-Delta Program. 2000. Conjunctive use site assessment, integrated storage investigation. Sacramento, CA. February 2000.

California Air Resources Board. 2007. Draft California Greenhouse Gas Inventory (millions of metric tons of CO_2 equivalent) — By IPCC Category. Available: http://www.arb.ca.gov/cc/inventory/data/tables/rpt_Inventory_IPCC_Sum_2007-11-19.pdf. Accessed: June 1, 2008.

California Air Resources Board. 2007. Off-road Emissions Model. Available: http://www.arb.ca.gov/msei/offroad/offroad.htm.

California Air Resources Board. 2007. Proposed Early Actions to Mitigate Climate Change in California. Available: www.climatechange.ca.gov/.../2007-0420_ARB_early_action_report.pdf. Accessed: July 10, 2009.

California Air Resources Board. 2008. San Joaquin Valley Air Basin Air Monitoring Data. Available: http://www.arb.ca.gov/adam/welcome.html.

California Air Resources Board. 2009. San Joaquin Valley Air Basin Air Monitoring Data. Available: http://www.arb.ca.gov/adam/welcome.html.

California Department of Conservation. 2004. A Guide to the Farmland Mapping and Monitoring Program. Sacramento, CA.

California Department of Conservation. 2006a. Important Farmland Map of Madera County. Sacramento, CA.

California Department of Conservation. 2006b. Madera County 2004-2006 Land Use Conversion Data. Available: http://redirect.conservation.ca.gov/DLRP/fmmp/county_info_results.asp. Accessed: May 20, 2008.

California Department of Conservation. 2007. Williamson Act Program—Farmland Security Zones. Division of Land Resource Protection. Available: http://www.conservation.ca.gov/dlrp/lca/farmland_security_zones/Pages/Index.aspx. Accessed: November 26, 2007.

California Department of Finance. 2000a. E-4 Report, historical city/county population estimates, 1991–2000, with 1990 census counts. Demographic Research Unit. Sacramento, CA. Available: http://www.dof.ca.gov/research/demographic/reports/.
California Department of Finance. 2000b. Interim county population projections. Sacramento, CA.

California Department of Finance. 2007. Population Projections for California and Its Counties 2000–2005. July. Sacramento, CA.

California Department of Fish and Game. 2000a. Guidelines for assessing effects of proposed developments on rare and endangered plants and plant communities. December 9, 1983, revised April 2000. Sacramento, CA.

California Department of Forestry and Fire Protection. 1994. California hardwood rangeland vegetation. California Department of Forestry and Fire Protection, Sacramento, CA. Available: http://frap.cdf.ca.gov/data/frapgisdata/select.asp.

California Department of Parks and Recreation. 1976. California inventory of historic resources. California Office of Historic Preservation. Sacramento, CA: California Department of Parks and Recreation.

California Department of Parks and Recreation. 1996. California historical landmarks. Sacramento, CA: California Department of Parks and Recreation.

California Department of Transportation. 2001. 1999 traffic volumes on California state highways. Sacramento, CA.

California Department of Transportation. 2008. Caltrans–California Scenic Highway Program. Available: http://www.dot.ca.gov/hq/LandArch/scenic/schwy.htm . Accessed: May, 20, 2008.

California Department of Water Resources. 1975. California's Ground Water. *Bulletin 118*. Sacramento, CA.

California Department of Water Resources. 1981. Water Well Standards, State of California. Bulletin 74-81. Sacramento, CA.

California Department of Water Resources. 1998. California Water Plan Update *Bulletin 160–98*. Sacramento, CA.

California Department of Water Resources. 2000a. Critical Water Shortage Contingency Plan. Governor's Advisory Drought Planning Panel. December 29. Available: http://www.water.ca.gov/drought/docs/Contingency_Plan-text.pdf.

California Department of Water Resources. 2000b. Preparing for California's Next Drought, Changes Since 1987-92. July. Available: http://www.water.ca.gov/drought/nextdrought.cfm.

California Department of Water Resources. 2001. California Department of Water Resources, Division of Planning and Local Assistance, land use data. Last revised: December 27, 2001. Available: http://www.waterplan.water.ca.gov/landwateruse/landuse/l udataindex.htm. Accessed: November 20, 2002.

California Department of Water Resources. 2004. California's Ground Water. *Bulletin 118*. Individual Basin Descriptions.

California Department of Water Resources. 2005. Groundwater elevations in the Madera Subbasin. Available: http://www.sjd.water.ca.gov/groundwater/leveldata/index.cfm.

California Department of Water Resources. 2006. Progress on Incorporating Climate Change into Management of California's Water Resources—Technical Memorandum Report. Available at: http://baydeltaoffice.water.ca.gov/climatechange/DWRClimateChangeJuly06.pdf. Accessed: March 2007.

California Employment Development Department. 2001. Labor Market Info. Available: http://www.calmis.ca.gov/htmlfile/county/fresno.htm.

California Employment Development Department. 2007. Labor Market Info. Available: http://www.calmis.ca.gov/htmlfile/county/fresno.htm.

California Energy Commission. 2006. *Inventory of California Greenhouse Gas Emissions and Sinks 1990 to 2004.* (CEC-600-2006-013-SF). December. Available: http://www.energy.ca.gov/2006publicastions/CEC-600-2006-013/CEC-600-2006-013-SF.PDF.

California Native Plant Society. 1999. Electronic inventory of rare and endangered vascular plants of California, Version 1.5.1. Sacramento, CA.

California Native Plant Society. 2001. *Inventory of Rare and Endangered Plants of California* (sixth edition). Rare Plant Scientific Advisory Committee, David P. Tibor, Convening Editor. Sacramento, CA: California Native Plant Society.

California Native Plant Society. 2007. *Inventory of Rare and Endangered Plants* (online edition, v7-07a). Available: http://www.cnps.org/inventory. California Native Plant Society. Sacramento, CA.

California Natural Diversity Database. 2004. RareFind, Version 3.0.3 (November 2, 2004 update). Sacramento, CA: California Department of Fish and Game.

California Natural Diversity Database. 2008. RareFind, Version 3.1.0 (August, 2008 update). Sacramento, CA: California Department of Fish and Game.

Cannon, Bruce E. 1986. Letter Regarding Thematic Request for Determination of Eligibility for 118 California Highway Bridges. September 18. Region Nine, Federal Highway Administration, U.S. Department of Transportation, Sacramento, California. Submitted to State

Historic Preservation Officer, Sacramento, California. On file, Southern San Joaquin Valley Information Center, California Historical Resources Information System, Bakersfield (Study MA 90).

Central Valley Regional Water Quality Control Board. 1998. Basin Plan Amendment Criteria. Available: http://www.swrcb.ca.gov/rwqcb5/water_issues/basin_plans/.

Central Valley Regional Water Quality Control Board. 2007. *Water Quality Control Plan* (Basin Plan), Central Valley Region, Sacramento River and San Joaquin River Basins. Fourth Edition. Sacramento, CA.

Chan, C. M. 2002. Annual Water Quality Report Hensley Lake Water Year 2001. U.S. Army Corps of Engineers, Sacramento District, Sacramento, CA.

Clough, C. W. 1968. *Madera.* Fresno, CA: Panorama West Books.

Collins, J. N., and V. H. Resh. 1989. *Guidelines of the ecological control of mosquitoes in non-tidal wetlands of the San Francisco Bay area*. Berkeley: California Mosquito and Vector Control Associations, Inc., and the University of California Mosquito Research Program.

Cowan, J. P. 1994. Handbook of environmental acoustics. New York: Van Nostrand Reinhold.

Culbertson, A. E. 1934. Rediscovery of Dipodomys nitratoides exilis. *Journal of Mammalogy* 15:161–162.

Davis, F. W., D. M. Stoms, A. D. Hollander, K. A. Thomas, P. A. Stine, D. Odion, M. I. Borchert, J. H. Thorne, M. V. Gray, R. E. Walker, K. Warner, and J. Graae. 1998. *The California gap analysis project--final report.* University of California, Santa Barbara, CA. Available: http://www.biogeog.ucsb.edu/projects/gap/gap_home.html.

Ducks Unlimited. 1997. *California Wetland and Riparian Geographic Information System Project: final report.* January 17. Ducks Unlimited, Sacramento, CA. Available: http://maphost.dfg.ca.gov/wetlands/metadata/ wet_ph1.pdf.

Dundas, R. G., R. B. Smith, and K. L. Verosub. 1996. The Fairmead Landfill Locality (Pleistocene, Irvingtonian), Madera County, California: preliminary report and significance. *PaleoBios*, Volume 17, Numbers 2-4, Pages 50-58, September 13, 1996. Available: http://www.maderacountylibrary.org/Dundas.pdf.

Environmental Laboratory. 1987. *USACE of Engineers Wetlands Delineation Manual.* Wetlands Research Program Technical Report Y-87-1. U.S. Army Engineer Waterways Experiment Station. January. Vicksburg, MS. NTIS No. AD A176 912. Available: http://el.erdc.usace.army.mil/wetlands/pdfs/wlman87.pdf.

Eriksen, C.H., and D. Belk. 1999. *Fairy shrimps of California's puddles, pools and plays.* Mad River Press, Eureka, California.

Federal Highway Administration. 1983. Visual Impact Assessment for Highway Projects. (Contract DOT-FH-11-9694.) Washington, DC.

Federal Transit Administration. 1995. FTA Transit Noise and Vibration Impact Assessment Guidance Manual. April. DOT-95-16.

Feldman, J. 2001. Site Record Form for P-20-2323. October 29. Myra L. Frank & Associates, Los Angeles. On file, Southern San Joaquin Valley Information Center, California Historical Resources Information System, Bakersfield.

Gifford, E. W., and W. E. Schenck. 1926. Archaeology of the southern San Joaquin Valley, California. *University of California Publications in American Archaeology and Ethnology* 23(1):1–122.

Goldingay, R. L., P. A. Kelly, and D. F. Williams. 1997. The kangaroo rats of California: endemism and conservation of keystone species. *Pacific Conservation Biology* 3: 47-59.

Hanes, W. T., B. Hecht, and L. P. Stromberg. 1990. Water relationships of vernal pools in the Sacramento region, California. Pp.49-60. In D.H. Ikeda and R.A. Schlising (Eds.) *Vernal Pool Plants Their Habitat and Biology*. Studies from the Herbarium, CA State University, Chico, No. 8. Chico, CA

Harding, S. T. 1960. *Water in California.* Palo Alto, CA: N-P publications.

Hart, E. W., and W. A. Bryant. 1997. *Fault rupture hazard zones in California.* Special Publication 042. Sacramento: California Division of Mines and Geology.

Hart, J. D. 1978. *A Companion to California.* New York: Oxford Press.

Hay, O. P. 1927. *The Pleistocene of the Western Region of North America and its Vertebrated Animals*. Carnegie Institute Washington, Publication 322B.

Heady, H. F. 1988. Valley grassland. Pages 491–514 in M. G. Barbour and J. Major (eds.), *Terrestrial vegetation of California.* California Native Plant Society Special Publication Number 9. Sacramento, CA.

Hickman, J. C. (ed.). 1993. *The Jepson manual: higher plants of California*. Berkeley, CA: University of California Press.

Hilton, R. P., D. C. Dailey, and H. G. McDonald. 2000. A Late Pleistocene Biota from the Arco Arena Site, Sacramento, California. *PaleoBios Abstracts* 20(1), April 15, 2000. University of California Museum of Paleontology. Berkeley, CA.

Hodgson, E., and P. Levi. 1987. *Modern toxicology.* Norwalk, CT: Appleton & Lang.

Holland, R. F. 1978. *The geographic and edaphic distribution of vernal pools in the Great Central Valley, California.* California Native Plant Society Special Publication No. 4. Berkeley, CA.

Holland, R. F. 1986. *Preliminary descriptions of the terrestrial natural communities of California.* Sacramento, CA: California Department of Fish and Game.

Holland, R. F. 1998. Great Valley vernal pool distribution, photorevised 1996. Pages 71–75 in: C. W. Witham, E. T. Bauder, D. Belk, W. R. Ferren Jr. and R. Ornduff (eds). *Ecology, conservation, and management of vernal pool ecosystems—Proceedings from a 1996 Conference*. California Native Plant Society, Sacramento, California.

Holmstead, G. L. and D. C. Anderson. 1998. Reestablishment of Eriastrum hooveri (Polemoniaceae) following oil field disturbance activities. Madroño 45: 295-300.

Hoover, R. M., and R. H. Keith. 1996. *Noise control for buildings, manufacturing plants, equipment and products.* Houston, TX: Hoover & Keith, Inc.

Hudlow, Scott M. 2000. A Historic Architectural Survey Report for the Cottonwood Creek Bridge (41C-6), Madera County, California. August. Hudlow Cultural Resource Associates, Bakersfield, California. Submitted to Madera County Road Department, Madera, California. On file, Southern San Joaquin Valley Information Center, California Historical Resources Information System, Bakersfield (Study MA 737).

ICF Jones & Stokes. 2009. Cultural Resources Inventory and Evaluation for the Proposed Madera Groundwater Bank, Madera County, California. April. Sacramento, CA. (ICF J&S 5120.05). Prepared for Bureau of Reclamation, Fresno, CA.

ICF Jones & Stokes. 2009a. 2009 Botanical Survey Report for Madera Irrigation District's Water Supply Enhancement Project. October. Sacramento, CA. (ICF J&S 5120.05). Prepared for Madera Irrigation District, Madera, CA.

Institute of Transportation Engineers. 1989. *Traffic access and impact studies for site development.* Washington, DC: Transportation Planners Council.

Intergovernmental Panel on Climate Change. 1995. IPCC Second Assessment Report: Climate Change 1995 (SAR). Available: http://www.ipcc.ch/publications_and_data/publications_and_data_reports.htm#1.

Intergovernmental Panel on Climate Change. 2001: Climate Change 2001: Synthesis Report. A Contribution of Working Groups I, II, and III to the Third Assessment Report of the Intergovernmental Panel on Climate Change [Watson, R.T. and the Core Writing Team (eds.)]. Cambridge University Press, Cambridge, United Kingdom, and New York, NY, USA, 398 pp. Available: http://www.ipcc.ch/publications_and_data/publications_and_data_reports.htm#1.

Intergovernmental Panel on Climate Change. 2007: Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, Pachauri, R.K and Reisinger, A. (eds.)]. IPCC, Geneva, Switzerland, 104 pp. Available: http://www.ipcc.ch/publications_and_data/publications_and_data_reports.htm#1.

International Conference of Building Officials. 1997. Uniform building code. Whittier, CA: International Conference of Building Officials.

Israelsen, Orson W. 1962. *Irrigation Principles and Practices.* 3rd Edition.

Jefferson, G. T. 1991a. *A Catalogue of Late Quaternary Vertebrates from California: Part One, Nonmarine Lower Vertebrate and Avian Taxa*. Natural History Museum of Los Angeles County, Technical Report no. 5.

Jefferson, G. T. 1991b. *A Catalogue of Late Quaternary Vertebrates from California: Part Two: Mammals.* Natural History Museum of Los Angeles County, Technical Report no. 7.

Jennings, C. W. 1994. Fault activity map of California and adjacent areas. Scale 1:750,000. Geologic Data Map No. 6. Sacramento: California Division of Mines and Geology.

Jennings, C. W., and R. G. Strand. 1958. Geologic map of California, Santa Cruz sheet. Scale 1:250,000. O. P. Jenkins edition. Fifth printing, 1992. Sacramento: California Division of Mines and Geology.

Jones & Stokes Associates. 1998. Delineation of waters of the United States including wetlands at the Woodville solid waste site, Tulare County, California. December. (JSA 97-323). Sacramento, CA. Prepared for Public Works Department, County of Tulare, Visalia, CA.

Jones & Stokes. 2000. Summary of detailed surveys for biological resources at Madera Ranch and fishery resources at Mendota Pool, Madera County, California. (J&S 99331). December 12. Sacramento, CA. Prepared for Azurix, Los Angeles, CA, and Azurix Madera Corporation, Madera, CA.

Jones & Stokes. 2002. Cultural Resources Inventory and Evaluation for the Proposed Madera Groundwater Bank, Madera County, California. January. Sacramento, CA. (J&S 99331). Prepared for Azurix Madera Corporation, Madera, CA. On file at Southern San Joaquin Valley Information Center, California State University, Bakersfield.

Jones & Stokes. 2007. Cultural Resources Inventory and Evaluation for the Madera Irrigation District Water Supply Enhancement Project, Madera County, California. June. (J&S 05120.05). Sacramento, CA. Prepared for Madera Irrigation District, Madera CA.

Jones & Stokes. 2008. Delineation of waters of the United States at Madera Ranch, Madera County, California. June. Sacramento, CA. Initially prepared in 2002, with updates in 2004 and 2008. Prepared for Madera Irrigation District.

Kelly, Patrick, S. Phillips, C. Wilkinson, F. Vang. 2009. Surveys for Fresno Kangaroo Rats (*Dipodomys nitratoides exilis*) and Blunt-Nosed Leopard Lizards (*Gambelia sila*) at the Madera Ranch, Madera County, California. November 6. California State University Stanislaus. Fresno, CA. Prepared for ICF Jones & Stokes.

Kenneth D. Schmidt and Associated. 2009. Primary Evaluation of the Feasibility of Injection Wells for MID Water Supply Enhancement Project. February 19. Fresno, CA. Prepared for: Madera Irrigation District, Madera, CA.

Kenneth D. Schmidt and Associates. 2008. Proposed Groundwater Monitoring Program for Madera County. January. Fresno, CA. Prepared for: Resources Management Agency, County of Madera, Madera, CA.

Kratzer, C.R., C. Zamora, and D. L. Knifong. 2002. Diazinon and Chlorpyrifos Loads in the San Joaquin River Basin, California, January and February 2000. U.S. Geological Survey, Sacramento, CA.

Kroeber, A. L. 1925. *Handbook of the Indians of California.* Reprint, New York: Dover Publications, 1976. Originally published as Bulletin 78, Bureau of American Ethnology, Washington, D.C.

Louderback, G. D. 1951. Geologic History of San Francisco Bay. California Division of Mines and Geology Bulletin 154.

Lundelius, E. L. Jr., R. W. Graham, E. Anderson, J. Guilday, J. A. Holman, D. W. Steadman, and S. D. Webb. 1983. Terrestrial Vertebrate Faunas. Pages 311–353 in H. E. Wright Jr. and S. C. Porter (eds.), *Late- Quaternary Environments of the United States*, *Volume 1, The Late Pleistocene.* University of Minnesota Press. Minneapolis, MN.

Madera County Planning Department. 1994. Rio Mesa area plan draft environmental impact report. March. Prepared by The Keith Companies. Madera, CA.

Madera County Planning Department. 2001. Village of Gateway draft environmental impact report. February. Prepared by Environmental Science Associates. Madera, CA.

Madera County Planning Department. 2003. River Ranch Estates draft environmental impact report. April 9. Prepared by Valley Planning Consultants, Inc. Madera, CA.

Madera County Transportation Commission. 2007. Madera County Traffic Monitoring Program 2007 Traffic Volumes Report. September. Prepared by: TPG Consulting, Inc. Available: http://www.maderactc.org/public.html.

Madera County. 1974. Madera County Code. Adopted by Ordinance 398 § 9. Available: http://www.madera-county.com/countycode/maintoc.htm. Accessed May 17, 2005.

Madera County. 1995a. Madera County general plan background report. October 24. Madera, CA.

Madera County. 1995b. Madera County general plan policy document. October 24. Madera, CA.

Madera County. 1995c. Madera County general plan land use diagram. October 24. Madera, CA.

Madera County. 1995d. Madera County general plan: Final environmental impact report. Volume 1. October. Madera, CA.

Madera County. 2007. Madera County Department of Agriculture 2007 Agricultural Crop Report. Madera, CA. Available at: http://www.madera-county.com/agcommissioner/cropreports/pdfs/crops2007.pdf. Accessed: May 22, 2009.

Madera County. 2008. Integrated regional water management plan. April. Prepared by Boyle Engineering Corporation and Kenneth D. Schmidt and Associates. Fresno, CA.

Madera Irrigation District. 1981. Madera Irrigation District sixth annual report. Madera, CA.

Madera Irrigation District. 1999. AB3030 Groundwater Management Plan. Prepared by Boyle Engineering, Fresno, CA.

Madera Irrigation District. 2005a. Environmental impact report for the Madera Irrigation District water supply enhancement project. Draft. June. Prepared by Jones & Stokes, Sacramento, CA.

Madera Irrigation District. 2005b. Final environmental impact report for the Madera Irrigation District water supply enhancement project. September. Prepared by Jones & Stokes, Sacramento, CA.

Madera Irrigation District. 2005c. Water supply enhancement project findings, facts in support of findings, and statement of overriding considerations August. Prepared by Jones & Stokes, Sacramento, CA.

Madera Irrigation District. 2005d. Water supply enhancement project mitigation monitoring and reporting plan. August. Prepared by Jones & Stokes, Sacramento, CA.

Madera Irrigation District. 2007. Monitoring and operational support plan Madera Irrigation District water supply enhancement project. Draft. October. Madera, CA.

Madera Irrigation District. 2008. Water supply agreement. Contract document detailing agreements between MID and Grimmway regarding water supply arrangements. August. Madera Irrigation District, Madera, CA.

McGuire, K. R. 1995. Test excavations at CA-Fre-61, Fresno County, California, including Choinimne ethnography and ethnohistory. Occasional Papers in Anthropology 5. Bakersfield, CA: Museum of Anthropology, California State University, Bakersfield.

Midwest Research Institute. 1996. Improvement of Specific Emission Factors. (BACM Project No. 1). Final Report. Prepared under South Coast AQMD Contract No. 95040. March 29. Kansas City, MO.

Miller, M. C. 1993. *Flooding the Courtrooms: Law and Water in the Far West*. Lincoln, NE: University of Nebraska Press.

Moratto, M. J. 1984. *California Archaeology.* San Diego, CA: Academic Press.

National Oceanic and Atmospheric Administration. 2005. Greenhouse gases: frequently asked questions. Last revised: October 2008. Available: http://lwf.ncdc.noaa.gov/oa/climate/gases.html. Accessed: August 1, 2008.

National Research Council. 2001. *Climate Change Science—An Analysis of Some Key Questions*. Washington, DC: National Academy Press.

Nissley, Claudia A., Gerrit L. Fenenga, and Philip J. Wilke. 1975. Final Report of Archeological Reconnaissance on the Fresno River, Ash Slough, and Berenda Slough, San Joaquin Valley, California. Prepared for U.S. Army Corps of Engineers, Sacramento District, Sacramento, California. On file, Southern San Joaquin Valley Information Center, California Historical Resources Information System, Bakersfield (Study MA 260).

Olivier, J.G.J., J.A. Van Aardenne, F. Dentener, V. Pagliari, L.N. Ganzeveld, and J.A.H.W. Peters. 2005. Recent trends in global greenhouse gas emissions: regional trends 1970-2000 and spatial distribution of key sources in 2000. *Environmental Science* 2(2-3), pp. 81-99. DOI: 10.1080/15693430500400345. Available: http://www.mnp.nl/edgar/global_overview/. Accessed December 5, 2006.

Olsen, W. H., and L. A. Payen. 1969. Archaeology of the Grayson Site, Merced County, California. California Department of Parks and Recreation *Archaeological Reports 12*. Sacramento, CA.

Peak, A., and R. Gerry. 1975. Archaeological Site Survey Record for CA-Mad-300. February 1. On file, Southern San Joaquin Valley Information Center, California Historical Resources Information System, Bakersfield.

Peterson, M. D., W. A. Bryant, C. H. Cramer, T. A. Cao, M. Reichle, A. D. Frankel, J. J. Lienkaemper, P. A. McCrory, and D. P. Schwartz. 1996. *Probabilistic hazard assessment for the state of California*. Sacramento: California Division of Mines and Geology in cooperation with the U.S. Geological Survey.

Price, Barry A. 2001. Architectural Assessment of the Cottonwood Creek Bridge (41C-006), Madera County, California. Applied EarthWorks, Fresno, California. Submitted to Madera County Road Department, Madera, California.

Ptomey, Kathy. 1990. An Archaeological Assessment of the Madera Irrigation District Storm Drain Project, Madera County, California. October. Cultural Resource Facility, California State University, Bakersfield (CRF-90-117). Prepared for City of Madera, California. On file, Southern San Joaquin Valley Information Center, California Historical Resources Information System, Bakersfield (Study MA 344).

Reed, Jr., Porter B. 1988. National List of Plant Species That Occur in Wetlands: National Summary. U.S. Fish & Wildlife Service. *Biol. Rep*. 88 (24). 244 pp.

Reid, D. A., R. C. Graham, R. J. Southard, and C. Amrhein. 1993. Slickspot soil genesis in the Carrizo Plain, California. *Soil Science Society of America Journal* 57:162-168.

Riddell, F. 1975. An Archaeological Assessment of Cultural Resources for the Mid-Valley Canal Project in Fresno, Tulare, Merced, Madera, and Kings Counties, California. Prepared by Cultural Resources Section, State Department of Parks and Recreation, Sacramento, CA. Prepared for State Department of Water Resources, Sacramento, CA. On file at Southern San Joaquin Valley Information Center, Bakersfield (Report #MA-116).

Rodner, J. W. 1948. Economic payment capacity study, Madera Irrigation District. United States Department of the Interior, Bureau of Reclamation, Region II: Central Valley Project, Lower San Joaquin District, Merced, California. On file at Government Publications Room, California State Library, Sacramento.

San Joaquin Valley Unified Air Pollution Control District. 2002. Guide for Assessing and Mitigating Air Quality Impacts. Mobile Source/CEQA Section of the Planning Division of the San Joaquin Valley Unified Air Pollution Control District. January 10. Fresno, CA

San Joaquin Valley Air Pollution Control District. 2007. Air Quality Plans. Available: http://www.valleyair.org/.

Savage, D. E. 1951. Late Cenozoic Vertebrates of the San Francisco Bay Region. University of California Publications, Bulletin of the Department of Geological Sciences 28(10):215–314.

Sawyer, J. O., and T. Keeler-Wolf. 1995. A manual of California vegetation. Sacramento, CA: California Native Plant Society.

Schmidt, K.D. 2009. Preliminary Evaluation of the Feasibility of Injection Wells for MID Water Supply Enhancement Project. Technical Report. February 19. Kenneth D. Schmidt and Associates. Fresno, CA. Prepared for Madera Irrigation District, Madera, CA.

Schmidt, K.D. 2009. Addendum to Technical Memo USFWS Comments (3/09) (Preliminary Evaluation of the Feasibility of Injection Wells for MID Water Supply Enhancement Project

Technical Report). April 3. Kenneth D. Schmidt and Associates. Fresno, CA. Prepared for Madera Irrigation District, Madera, CA.

Seinfeld, John H., and N. Spyros Pandis. 2006. *Atmospheric Chemistry and Physics - From Air Pollution to Climate Change* (2nd Ed.). John Wiley and Sons, Inc.

Smedema, L. K., and D. W. Rycroft. 1983. *Land drainage: planning and design of agricultural drainage systems*. Ithaca, NY: Cornell University Press.

Soil Conservation Service. 1951. Soil Survey of Madera Area, California. Washington, DC: U.S. Department of Agriculture, Soil Conservation Service.

Soil Conservation Service. 1973. Land Capability Classification. *Agricultural Handbook No. 210*. Washington, DC: U.S. Department of Agriculture, Soil Conservation Service.

Soil Survey Division Staff. 1993. *National soils handbook.* Title 430-VI. U.S. Department of Agriculture. Washington, D.C.: U.S. Government Printing Office.

Stirton, R. A. 1939. Cenozoic Mammal Remains from the San Francisco Bay Region. *University of California Department of Geological Sciences Bulletin* 24(13).

Storage and Retrieval of U.S. Waterways and Parametric Data (STORET). 2007. U.S. Environmental Protection Agency. Last updated on Friday, December 14, 2007. Available at http://www.epa.gov/storet/index.html. Data accessed on May 13, 2008.

Storie, R. E. 1973. Storie Index Rating. *Special Publication 3203*. Division of Agricultural Sciences, University of California.

Stromberg L.K., G.L. Huntington, E.L. Begg and G.K. Smith. 1951. Soil map of the Madera area, California. Scale 20,000. 1944 & 1950 aerial photography. In Soil survey of Madera area, California, 1962. A57.38:951/11.

Stromberg, L. K., G. L. Huntington, E. L. Begg, G. K. Smith, and R. Ulrich. 1962. Soil survey of Madera area, California. U.S. Department of Agriculture in cooperation with the University of California Agricultural Experiment Station. Washington, DC: U.S. Government Printing Office.

Stutz, H. C. and G. L. Chu. 1993. *Atriplex persistens* (Chenopodiaceae): a new species from California. *Madroño* 40:209–213.

Stutz, H. C. and G. L. Chu. 1997. *Atriplex subtilis* (Chenopodiaceae): a new species from south-central California. *Madroño* 44:184–188.

The Climate Registry. 2008. General Reporting Protocol. Version 1.1. May. Available: http://www.theclimateregistry.org/downloads/GRP.pdf. Accessed: August 12, 2008.

Transportation Research Board. 1994. *Highway capacity manual.* Washington, DC: National Research Council.

TRC. 1999. Draft limited phase I and II property transfer evaluation: Ranch property near Fresno, California. September. Prepared by TRC, Irvine, CA (Project No. 99-252). Prepared for Azurix, Houston, TX.

TRC. 2002. Phase I environmental site assessment: Madera Ranch Property, Madera County, California. July. Prepared by TRC, Irvine, CA (Project No. 35158). Prepared for Layne Water Development and Storage, Los Angeles, CA.

Tulare County Council of Governments. 1974. Five County Seismic Safety Element. Visalia, CA.

U.S. Bureau of Economic Analysis. 1998. Regional Economic Accounts. Available: http://www.bea.gov/regional/index.htm.

U.S. Bureau of Land Management. 1980. Visual Resource Management Program. (Stock No. 024-001-00116-6). Washington, DC: U.S. Government Printing Office.

U.S. Census Bureau. 2000. Demographic data. Available: http://www.census.gov/.

U.S. Census Bureau. 2001. Income Data for Madera County. Available: http://www.census.gov/hhes/www/income/income.html.

U.S. Census Bureau. 2008. State and County QuickFacts. (Data derived from Population Estimates, Census of Population and Housing, Small Area Income and Poverty Estimates, State and County Housing Unit Estimates, County Business Patterns, Nonemployer Statistics, Economic Census, Survey of Business Owners, Building Permits, Consolidated Federal Funds Report). Available: http://quickfacts.census.gov/qfd/index.html. Accessed: October 2008.

U.S. Department of Health and Human Resources. 2005. West Nile Virus. Centers for Disease Control. Last revised: January 11, 2005. Available: http://www.cdc.gov/ncidod/dvbid/westnile/index.htm. Accessed: March 3, 2005.

U.S. Department of the Interior. 1995. Intergovernmental Relations, Part 512: American Indian and Alaska Native Programs, Chapter 2: Departmental Responsibilities for Indian Trust Resources, Originating Office: Office of American Indian Trust. December 1. Available: http://elips.doi.gov/app_dm/act_getfiles.cfm?relnum=3049.

U.S. Environmental Protection Agency. 1995. Compilation of Air Pollutant Emission Factors - Volume 1: Stationary Point and Area Sources. January 1995. Office of Air Quality and Planning Standards. Research Triangle Park, NC.

U.S. Environmental Protection Agency. 2004. National Drinking Water Standard. Available: http://www.epa.gov/OGWDW/standards.html.

U.S. Environmental Protection Agency. 2006. High Global Warming Potential (GWP) Gases. Available: http://www.epa.gov/highgwp/index.html. Accessed: January 4, 2008.

U.S. Environmental Protection Agency. 2007. 2006 California Section 303(d) List and TMDL Priority Schedule.

U.S. Environmental Protection Agency. 2008. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2006. April. Available: http://www.epa.gov/climatechange/emissions/downloads/08_CR.pdf. Accessed: May 6, 2008.

U.S. Fish and Wildlife Service. 1991. Biological Opinion on the Friant water contract renewal (Friant, U.S. Fish and Wildlife Service file #1-1-91-F-22). October 15. Sacramento, CA.

U.S. Fish and Wildlife Service. 1998. Recovery plan for upland species of the San Joaquin Valley, California. September. U.S. Fish and Wildlife Service, Region 1. Portland, OR.

U.S. Fish and Wildlife Service. 2005. Reinitiation of formal and early Section 7 endangered species consultation on the coordinated operations of the Central Valley Project and State Water Project and the operational criteria and plan to address potential critical habitat issues (U.S. Fish and Wildlife Service file #1-1-05-F-0055). February 16. Sacramento, CA.

U.S. Geological Survey. 2001. Water quality in the San Joaquin - Tulare Basins, California, 1992–1995. U.S. Geological Survey Circular 1159. Available: http://www.water.usgs.gov/pubs/circ/circ1159/conditionsGW.html. Accessed: March 4, 2001.

Vollmar, J.E. 2002. Chapter 2: Landscape Setting. *Wildlife and Rare Plant Ecology of Eastern Merced County's Vernal Pool Grasslands.* Volmar Consulting, Berkeley, California.

Wallace, W. J. 1978. Northern Valley Yokuts. Pages 462–470 in R. F. Heizer (ed.), *Handbook of North American Indians*, Volume 8, California. Washington, D.C.: Smithsonian Institution.

Western Development and Storage. 2005. 2005 Madera Ranch Pilot Recharge: Interim Technical Memorandum. Draft technical memorandum prepared by Dave Dorrance, May 22, 2005. Los Angeles, CA.

Western Development and Storage. 2010. Addendum and Clarification to ―2005 Madera Ranch Pilot Recharge: Interim Technical Memorandum" dated May 22, 2005. Technical memorandum prepared by Dave Dorrance, May 22, 2005. Los Angeles, CA.

Williams, D. F. 1990. Assessment of potential habitat for the blunt-nosed leopard lizard and San Joaquin kit fox in western Madera County, California. U.S. Fish and Wildlife Service, Endangered Species Office, Sacramento, CA, 31 pp.

6.2 Personal Communications

Arroues, Kerry. Soil scientist. Natural Resources Conservation Service, Hanford, CA. November 2000—telephone conversation with Scott Frazier, Jones & Stokes.
Beach, Rayburn. Planning director. Madera County Planning Department. March 11, 2005—letter to Kim Marcotte, Jones & Stokes.

Cypher, Ellen. Plant Ecologist. Endangered Species Recovery Program, California State University Stanislaus, Fresno, CA. Discussion with Shauna McDonald, Bureau of Reclamation. April, 2008—telephone conversation.

Dillahunti, Steve. Madera County Mosquito and Vector Control District, Madera, CA. December 7, 2000–telephone conversation.

Dorrance, David. (1). Western Development and Storage, L.L.C. March 17, 2005—email to Jim James, Jones & Stokes.

Dorrance, David. (2). Western Development and Storage, L.L.C. March 18, 2005—email to Lynn Wall, Jones & Stokes.

Dorrance, David. (3). Western Development and Storage, L.L.C. May 27, 2008—email to Matthew Jones, ICF Jones & Stokes.

Ferguson, Louise. Pomologist. University of California Extension, Kearny Agricultural Center, Parlier, CA. January 10, 2001—telephone conversation with Scott Frazier, Jones & Stokes.

Freeman, Mark. University of California Extension farm advisor, Fresno County, Fresno, CA. January 5, 2001—telephone conversation with Scott Frazier, Jones & Stokes.

Holtz, Brent. University of California Extension farm advisor, Madera County, Madera, CA. January 5, 2001—telephone conversation with Scott Frazier, Jones & Stokes.

Howard, Larry. (1). Assistant general manager. Madera Irrigation District, Madera, CA. March 8, 2005—telephone conversation with Gabriel Roark, Jones & Stokes.

Howard, Larry. (2). Assistant manager/chief engineer. Madera Irrigation District, Madera, CA. April 6, 2005—telephone conversation with Jim James, Jones & Stokes.

Levine, Liz. Transportation analyst. Madera County Transportation Commission, Madera, CA. December 14, 2000—fax regarding the 1994–1999 traffic monitoring program.

Merchen, David. Assistant planning director. Madera County Planning Department. December 22, 2000—telephone conversation.

Owens, Maryanne. Wildlife Biologist. U.S. Fish and Wildlife Service, Sacramento, CA. Discussion with Shauna McDonald, Bureau of Reclamation. May, 2008—telephone conversation.

Roberts, Don. Employee. Madera Irrigation District, Madera, CA. November 13, 2000—meeting with Gabriel Roark, Jones & Stokes.

Roughton, Robert E. (1). Director and principal engineer. Navigant Consulting, Inc., Rancho Cordova, CA. November 9, 2000—meeting with Scott Frazier, Jones & Stokes.

Roughton, Robert E. (2). Director and principal engineer. Navigant Consulting, Inc., Rancho Cordova, CA. October 31, 2000—fax transmission to Brad Norton, Jones & Stokes.

Schmidt, Ken. Hydrogeologist. Ken Schmidt & Associates, Fresno, CA. March 23, 2005—memorandum to Ron Pistoresi, Madera Irrigation District.

Stone, Bob. Transportation planner. Madera County Transportation Commission, Madera, CA. January 10, 2001—telephone conversation.

Upton, Daniel. Madera County Planning Department, Madera, CA. December 19, 2000—telephone conversation.

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