RECLAMATION

Managing Water in the West

Final Environmental Assessment and Finding of No Significant Impact

Volta Wildlife Area Level 2 Diversification / Incremental Level 4 Development Pilot Project

U.S. Department of the Interior
Bureau of Reclamation
Mid-Pacific Region

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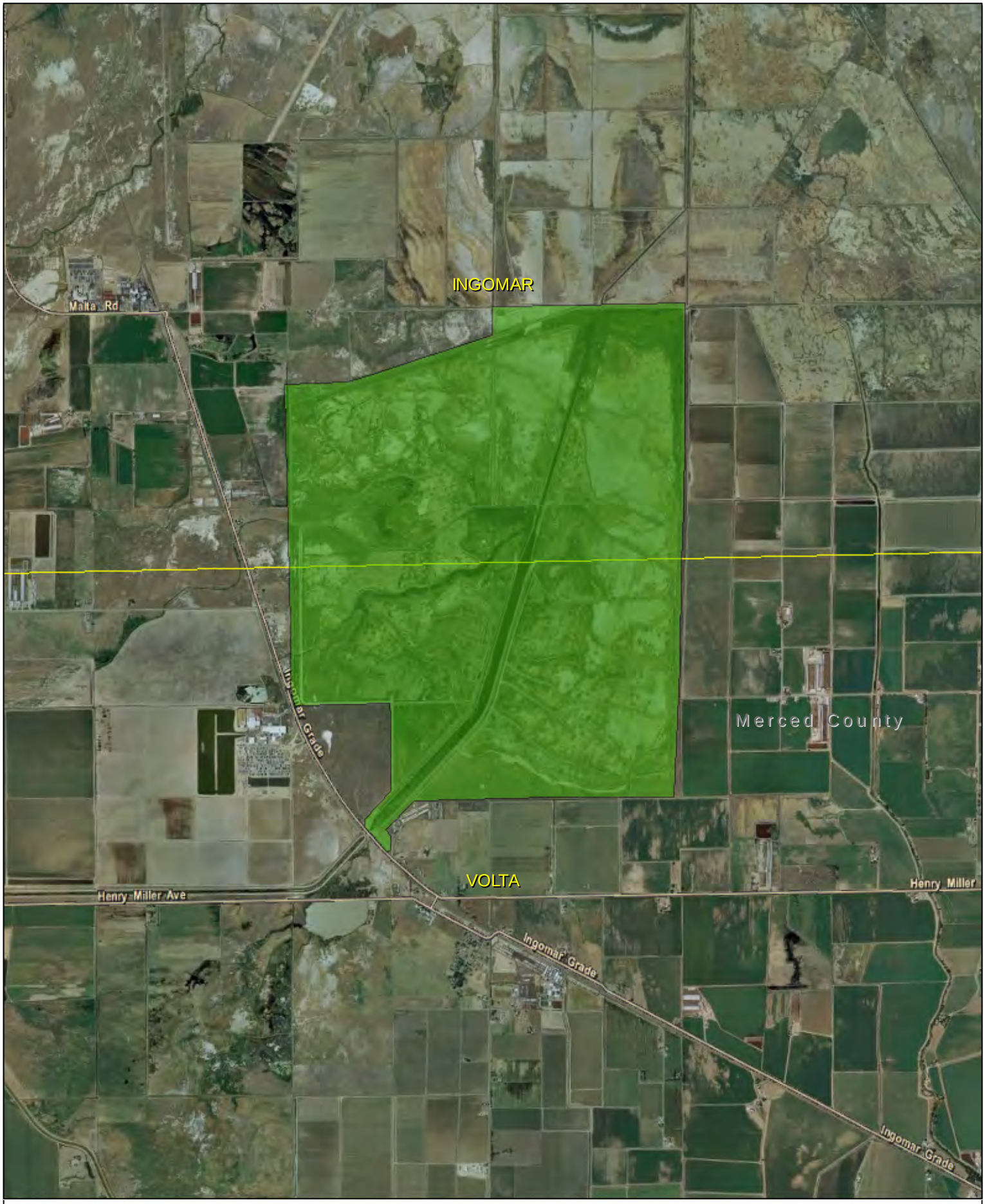
Section 1 Purpose and Need for Action

1.1 Introduction

Pursuant to the Central Valley Project Improvement Act of 1992 (CVPIA), Section 3406(d), the Secretary of the Interior, through the Bureau of Reclamation (Reclamation), is obligated to provide firm water supplies of suitable quality to 19 specific wetlands and wildlife habitat areas (refuges) in the California Central Valley.

Annual refuge water allocations were established in the *Report on Refuge Water Supply Investigations (3/1989)* and the *San Joaquin Basin Action Plan/Kesterson Mitigation Plan (12/1989)*, both reports incorporated into CVPIA by reference. Allocations are distinguished for two water types, Level 2 and Level 4. Level 2 Refuge Water Supplies refer to the historical annual average amount of water the refuges received between 1977 and 1984. Level 4 Refuge Water Supply is the annual amount of water needed for full development of the refuges based upon management goals developed in the 1980s. Incremental Level 4 is the difference between historic annual average water deliveries (Level 2) to refuges, and the refuge water supplies required to achieve optimum wetlands and wildlife habitat management (Level 4).

Section 3406(d)(2) requires that Reclamation provide full Level 4 supplies to all refuges starting in 2002. However, due to constraining issues including availability of water for Incremental Level 4 acquisition, funding and inadequate external conveyance capacity, Reclamation has not yet been able to meet that goal.



7.5 Minute Quad Index

Volta Wildlife Area

0 0.5 1 2 Miles

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Figure 1 2

1.2 Purpose and Need

Water demands in the San Joaquin and Sacramento Valley continue to grow while developed supplies have not increased appreciably over the past several decades. Population growth and economic development in the region are resulting in both larger and firmer water demands. Changes in irrigated agricultural practices are increasing the demand for water. Additionally, there are important environmental water uses that need to be protected or expanded to sustain the Valley's rich and diverse natural habitats.

Reclamation is responsible for providing Level 2 and Incremental Level 4 water to 19 designated federal, state, and privately owned/managed wetlands and wildlife areas (refuges), including Volta Wildlife Area (VWA) and Grassland Resource Conservation District (GRCD). Level 2 water supplies are primarily provided from Central Valley Project (CVP) supplies. However, a small percentage of Level 2 supplies is met through other diverse sources including state water rights water and groundwater. Reclamation must acquire Incremental Level 4 water supplies through various means, including spot market purchases and groundwater development. Incremental Level 4 supplies are not provided from CVP yield. CVPIA Section 3406(d)(1) includes language to support diversification of Level 2 supplies and reads in part, "In implementing this paragraph, the Secretary shall endeavor to diversify sources of supply in order to minimize possible adverse effects upon Central Valley Project contractors."

Reclamation also provides CVP water supplies to agricultural and municipal contractors. Each year beginning in February the Reclamation Central Valley Operation Office (CVO) issues an allocation announcement for the available water quantities to all CVP contractors for the contract year, or water year, that begins in March. The CVO water allocation announcement is revised monthly through approximately May reflecting changing hydrologic conditions. The last three years (2007-2009) have been drought years resulting in reduced CVP surface storage supplies and availability to CVP contractors. Water years 2007 and 2008 were critically dry years and reservoir levels have been low in 2009. Reclamation anticipates that these dry hydrologic conditions will continue to cycle in the future, and would like to be prepared for such circumstances.

Essentially no new surface water supplies have been developed in the San Joaquin Valley for several decades. Since groundwater can be readily developed at most locations within the San Joaquin Valley, demands are being met primarily through development and use of groundwater by private landowners, irrigation and water districts, towns and cities, industries, and others.

Reclamation, San Luis Delta Mendota Water Authority (SLDMWA) and other CVP water service contractors, as well as refuge water supply contractors south of the Delta desire that Reclamation's Refuge Water Supply Program diversify sources of Level 2 water supplies, including the groundwater option. Amounts of Level 2 water provided from diverse sources results in increased CVP supplies available to other CVP water service contractors.

The purpose of the Proposed Action is to diversify a portion of existing Level 2 water supplies delivered to the VWA and GRCD which would free up CVP surface water made available for

CVP agricultural contractors through the San Luis Delta-Mendota Water Authority (SLDMWA), while specific refuge water supply needs/obligations are satisfied. The Proposed Action will also provide for development of additional Incremental Level 4 water supplies which will augment the limited pool of Incremental Level 4 water available to those refuges south of the Delta.

The ultimate goal of the proposed action is to develop a groundwater supply along the Volta Wasteway Channel (Wasteway) that can be used to diversify Level 2 refuge water supply sources and provide an additional source for Incremental Level 4 water supply, improve water supply reliability for CVP contractors, VWA and GRCD, and to confirm that the water quality is acceptable for refuge use. Reclamation's immediate objective is to produce up to 5,000 acre-feet of groundwater per year from this project. The analysis of water quality would occur through the implementation of a groundwater and surface water monitoring plan.

Section 2 Alternatives Including the Proposed Action

2.1 No Action

Under the no action alternative, Reclamation would not fund the installation of groundwater wells at the VWA. Furthermore, Reclamation would not pump groundwater at VWA in order to free up CVP surface water supply for SLDMWA. Groundwater would not be delivered via the Wasteway to GRCD to diversify Level 2 and supplement Incremental Level 4 refuge water needs. Opportunities to diversify water supplies through conjunctive management of groundwater and surface water would continue to be explored.

2.2 Proposed Action

Reclamation proposes to provide American Recovery and Reinvestment Act (ARRA) funding for the installation of two groundwater production wells and two monitoring well clusters. Reclamation proposes to diversify CVP Level 2 and supplement Incremental Level 4 refuge water supplies by pumping groundwater with the new wells. The diversification effort is being proposed as a three-year pilot project. This pilot project would plan for, design, and construct the needed facilities (June 2010 start), and then operate the wells and monitor well production, water quality, and water levels beginning September 2010 through February 2013. The pilot project would implement monitoring at the two locations to confirm that water quality is suitable for refuge use. Based on the data acquired a determination would be made to continue or cease the diversification operations at any time during the pilot project.

Initially, new production wells at VWA would pump groundwater 24 hours a day (anticipated production is up to 2,000 acre-feet) for approximately five months/year, beginning in September/October through January/February, of acceptable quality that can be conveyed and used within VWA and GRCD. In order to provide flexibility, Reclamation may decide to pump an additional volume of groundwater annually based on well efficiency, well productivity, and monitoring program data collected the first year of the pilot project. An increase would only occur if, after the first year of production (September 2010 through February 2011), the monitoring data demonstrates suitable water quality and water levels which would sustain additional pumping and would not result in significant impacts to any resources identified in this environmental assessment. In addition, a sufficient surface water flow must be available in the Wasteway for dilution, if dilution is necessary. If the above mentioned conditions exist, the duration and volume of groundwater pumped annually under the proposed action may increase to year round pumping of up to 5,000 acre-feet during the second and third year of the pilot project.

The total amount of groundwater pumped annually would be split 50/50 between Level 2 and Incremental Level 4 water supply in order to address CVPIA Section 3406(d)(1) diversification goal. The groundwater would be substituted in lieu of south of Delta Refuges receiving a portion their CVP Level 2 surface water supply. The accepted ratio for the in-lieu substitution is two acre-feet groundwater pumped would result in one acre-foot CVP surface water delivered to SLDMWA. .

The use of groundwater could ultimately free up to 2,500 acre-feet of CVP Level 2 surface water supply annually. The Level 2 CVP surface water freed up by groundwater substitution would be delivered to the SLDMWA. SLDMWA contractors would utilize the CVP surface water supply within their service areas for reasonable and beneficial use. The proposed action would diversify refuge water supply, improve water supply reliability, and minimize adverse impacts to CVP agricultural and municipal contractors.

Well-related construction activities which would occur as part of the proposed action include:

- Drill pilot borings to obtain information for the final design of the production and monitoring wells,
- Final design of the two production wells and five associated monitoring wells,
- Drill production wells and monitoring wells,
- Well testing to estimate the sustainable yield of the production wells, and
- Design and installation of the pump based on well testing results,
- Construction of the surface facilities, and
- Implementation of a three-year monitoring program

Well Design Approach

Well design would be in accordance with the American Water Works Association standards and the California Department of Water Resources for Well Standards, Bulletin 74-90 dated June 1991. A total target range of up to 2,000 acre-feet/year is the anticipated production rate for pumping occurring between September/October through January/February. The actual yield may be more or less, but would not exceed 5,000 acre-feet/year, and is dependent on aquifer conditions and changes to pumping durations.

Test-Production Well Construction

Reclamation plans to construct two- production wells. The construction window for the production wells is between May 1, 2010 and October 1, 2010. The entire construction window would not be necessary for well completion. If construction begins in May 1, 2010, it is anticipated that the production wells would be completed prior to June 2010. The production wells would produce groundwater from geologic units at depths ranging from approximately 500 to 900 feet below ground surface (bgs).

Well Locations

The two selected production well sites are located along the federal right-of-way abutting the Wasteway at a distance of approximately 2,000 feet apart. Well Site #1 is located just north of and adjacent to the Wasteway and Well Site #2 is located on the south side adjacent to the Wasteway as shown on the aerial map in Figure 2. Figure 3 is a closer aerial view of the VWA and the well locations. The approximate GPS coordinates of the two wells, +/- 25 feet, are:

- Well Site #1: 37° 06’ 22.147” latitude and 120° 56’ 10.001” longitude, and
- Well Site #2: 37° 06’ 26.986” latitude and 120° 55’ 52.897” longitude.

Access to the well sites would be by existing roads with short access road needed for Well Site #1. This short access road would be surfaced with gravel. A 30- to 40-foot gravel pad around

each production well site would be necessary for routine operation and maintenance activities. A 150-foot x 150-foot work area would be needed for actual drilling. Staging, drilling and installation are estimated to require three weeks on site (15 days @10 hours/day) for each production well.

The production wells would be drilled using a large truck-mounted reverse circulation mud rotary drilling rig equipped with a mud pump, pipe rack, and drilling fluid holding tank/shaker system. Steel casing would be used for the two production wells. Concrete pads would be constructed and the production wellheads would be configured to accommodate electrical service to the wellhead as well as the discharge piping.

The pumps may range from 8 to 12 inches in diameter. The pump may be a submersible or a vertical turbine. The pump size and type would be determined after well testing has occurred and aquifer conditions are known

Construction discharge piping is necessary for the conveyance of groundwater from the wellhead to the Wasteway. Well #1 requires 100 feet of 12 inch PVC pipe and a trench 3 feet deep to the edge of the Wasteway. Well #2 requires 300 feet of 12 inch PVC pipe laid in a trench 3 feet deep at the minimum and 12 feet deep at the maximum. The areas would be trenched using a backhoe, restored after pipe is laid and recovered with trenched material. Groundwater would be discharged in a manner to prevent bank disturbance. In order to dissipate the energy of the discharged water to a point that would not cause erosion, either a concrete discharge structure or a stainless steel structure would be utilized in conjunction with bank protection. The specifics for each well are:

- Well #1 and Well #2: The discharge pipeline would run perpendicular to the Wasteway from the wellhead. An underground pipe would convey the pumped groundwater to a concrete structure constructed on the Wasteway bank. The concrete or stainless steel structure would dissipate the energy to prevent erosion of the bank.

The width of the concrete or stainless steel structures outlet would depend on the well's yield. Once this is known, calculations would be made so that the discharge rate has a maximum velocity less than 3 feet per second.

The pilot boring would be drilled with a direct circulation mud rotary drill rig. In addition to the drill rig, the standard support equipment includes a drill stem trailer, compressor, and shaker unit to control the drill cuttings. A backhoe would likely be used to transport the drill cuttings from the production well site to a location to be determined in consultation with Reclamation and CDFG. During well construction, a larger reverse circulation drill rig would be used. In addition to the support equipment noted above, a transfer truck would be used to haul the gravel pack material to the well sites. The backhoe would also be used to dig a mud pit at each well site. The five monitoring wells would be installed with the direct circulation mud rotary drill rig to minimize land disturbance and costs.

The surface completions for each test-production well would consist of an 8-foot by 10-foot concrete pad and 20-inch discharge pipe. The wells would be located adjacent to the Wasteway.

The discharge pipes of the wells would be routed from the well sites to the Wasteway and discharge would be at the edge of the Wasteway. Drilling of test holes for monitoring wells and construction of production wells is scheduled to begin in May 2010 and be completed by June 2010.

Monitoring Wells

A well cluster with a pair of monitoring wells would be drilled near each production well site to monitor water levels during the aquifer tests as well as throughout the three-year pilot project. The monitoring well clusters would include a well screened above the Corcoran Clay and one screened below the Corcoran Clay. A third monitoring well would be installed in association with Well #1 to monitor water levels within 100-feet of the surface. The purpose of the deep monitoring wells would initially be to assist in estimating aquifer hydraulic parameters during the aquifer tests, and later to assist in evaluating the sustainable pumping rates of the production wells and to assess the degree of well interference. The purpose of the shallow wells is to document the degree of communication, if any, between the deep production wells and the shallow aquifer during pumping. PVC casing would be used for the monitoring wells. Concrete pads and locking steel monuments would be installed around the monitoring wells.

The approximate GPS coordinates of the monitoring well clusters are:

- Well #1: 37° 06’ 20.221” Latitude, 120° 26’10.8333” Longitude
- Well #2: 37 06’ 28.521” Latitude, 120 55’ 52.855” Longitude

Additional support vehicles including a water tender, front-end loader, pipe truck, and pickup trucks would be parked on-site. The drilling rig and associated equipment would occupy an area of approximately 150 feet by 150 feet. Access for these vehicles would be directly off the adjacent existing road for the Well #1 monitoring wells. No improvements for site access would be required for Well #1 monitoring wells. A 300 foot long access road would be constructed to allow access to the Well #2 Monitoring Wells. This access road would be of similar construction as other existing roads in the VWA. No off-site discharge of drill cuttings or fluids would occur. Drill cuttings and inert bentonite clay, produced during drilling operations, would be contained in an on-site settling pond and spread on site in an approved location upon well completion.

During the development phase, the water would initially be very turbid. The production wells would be sampled for the presence of selected constituents (e.g., Boron, Arsenic, Selenium, Mercury, Uranium) following well development and prior to performing the aquifer tests. The water quality results may factor into the management decision for the large volume of water to be discharged during the aquifer tests.

Following the completion of the aquifer tests and the estimation of the aquifer hydraulic parameters, well efficiency, and assessment of potential well interference, a recommendation would be made for the initial pumping rates. Based on water level measurements recorded during implementation of the groundwater monitoring plan, Reclamation would re-evaluate the originally selected pumping rates and revise original recommendations, if necessary, based on the monitored performance of the well.

More detailed information on the construction, testing and operation of the two production wells is located in the final specifications and drawings section 02520 C, D and F (Appendix A).

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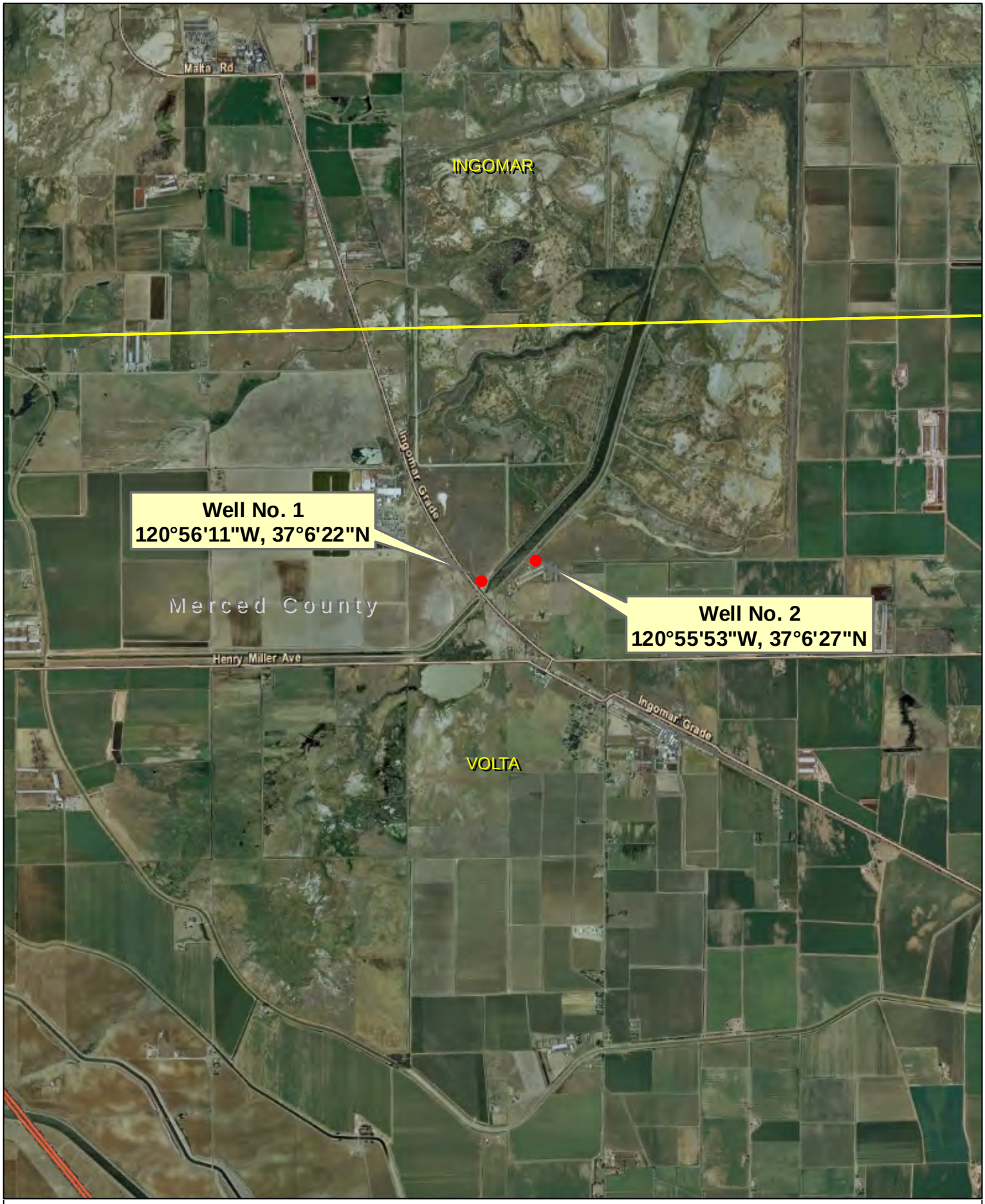

7.5 Minute Quad Index

Volta Quads with Wells

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Figure 2

USBR Owned Lands

Volta Wildlife Area

Volta Wildlife Area

0 100 200 400 600 800 1,000 Feet

N W E S

U.S. DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

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Section 3 Affected Environment and Environmental Consequences

This section discusses the affected environment and environmental consequences of the Proposed Action. The overall study area includes specific analysis for each resource that may be directly or indirectly affected by water diversification methods.

Volta Wildlife Management Area

The 3,000-acre VWA area is located in western Merced County, approximately six miles east of the Santa Nella Water District and approximately seven miles northwest of the town of Los Banos. The area is situated on the north side of Ingomar grade and abuts the northwest portion of the Grassland Water District (GWD). The refuge lies within the GRCD, along its southwest boundary. The Wasteway is the primary supply canal for the Northern Division of the GRCD. Water is pumped from the Wasteway through a variety of control structures for distribution throughout the wildlife refuges in the area. (Figure 1)

The refuge maintains more than 1,800 acres of wetlands, including 1,400 acres of moist soil plants; 720 acres of alkali sink habitat are preserved on the refuge as a rare ecological community (USBR 1997a). The VWA provides habitat for a variety of bird species, including ducks, geese, shorebirds, coots, and wading birds. Black-necked stilts, sandpipers, dunlins, and dowitchers are the dominant shorebird species.

VWA has primarily been managed as a seasonally flooded wetland to provide the habitat needs of migratory waterfowl associated species. Approximately 1,970 acres of the area are managed as seasonally and semi-permanently flooded wetlands.

The VWA is owned by Reclamation and managed by the CDFG through lease agreement pursuant to the act of Congress approved June 17, 1902 (32 Stat. 388) and acts amendatory thereof or supplementary thereto, and the act of August 27, 1954 (68 Stat. 879), all collectively referred to as Federal Reclamation law. The lease agreement was initiated in 1952 and has been renegotiated several times since. The lease agreement obligates the CDFG to manage the 2,887 acre Wasteway and reservoir containing seasonal and semi-permanent wetlands as waterfowl habitat, and to provide public recreation.

San Luis Delta Mendota Water Authority

The San Luis & Delta-Mendota Water Authority was established in January of 1992 and consists of 32 Member Agencies representing approximately 2,100,000 acres of federal and exchange water service contractors within the western San Joaquin Valley from the City of Tracy in the north to Kettleman City in the south, as well as portions of Monterey, San Benito, Santa Cruz, and Santa Clara counties.

There are four unit/divisions within the SLDMWA. The San Luis Unit includes Westlands Water District (WD), San Luis WD, Panoche WD, and the Pacheco WD. The San Felipe Division includes San Benito County WD, Santa Clara Valley WD, and the Pajaro Valley Water Management Agency. Southern DMC Delta Division includes Fresno Slough Water District,

James Irrigation District (ID), Reclamation District 1606, Tranquillity ID, Widren WD, Oro Loma WD, Mercy Springs WD, Eagle Field WD, Laguna WD, Broadview WD, and the Coelho Family Trust. The Northern DMC-Delta Division includes Banta Carbona ID, Centinella WD, Del Puerto WD, Patterson ID, Byron Bethany ID, Westside ID, and West Stanislaus ID.

The Water Authority is responsible for delivery of approximately 3,000,000 acre-feet of water to the Member Agencies. The Delta-Mendota Canal (DMC) is the primary conveyance canal which delivers the water within the Authority service area. Of this amount, 2,500,000 acre-feet are delivered to highly productive agricultural lands, 150,000 to 200,000 acre-feet for municipal and industrial uses, and between 250,000 to 300,000 acre-feet are delivered to wildlife refuges for habitat enhancement and restoration.

The Westside region receives water pumped from the Delta by the Tracy Pumping Plant and conveyed via the DMC, by gravity, up to 116 miles to the Mendota Pool in the San Joaquin River. The Tracy Pumping Plant and the canal immediately downstream were designed to carry 4,600 cubic feet per second (cfs), but physical and institutional factors now limit that capacity. Water is further delivered to users at numerous turnouts. The O'Neill Pumping Plant, located at mile 70, can pump up to 4,200 cfs to storage in San Luis Reservoir. San Luis Reservoir withdrawals are conveyed south in the San Luis Canal, or west to Santa Clara and San Benito Counties (the San Felipe Division) via the Pacheco Tunnel and to CVP contractors on the lower DMC and Mendota Pool.

3.1 Surface Water Resources

3.1.1 Affected Environment

Volta Wildlife Area and Grassland Resource Conservation District

CVPIA Level 2 and Level 4 water is provided by Reclamation contract 01-WC-20-1756 signed January 19, 2001 to provide firm water supplies to State Wildlife Area's south of the Delta. The total amount of CVPIA Level 4 water allocated to VWA is 16,000 acre-feet per year (13,000 Level 2, and 3,000 Incremental Level 4). The contract also identifies 3,000 acre-feet/year of Level 4 "replacement" water which was provided to VWA prior to the CVPIA. The total amount of Level 4 water allocated to GRCD is 180,000 acre-feet (125,000 Level 2, and 55,000 Incremental Level 4). CVP Water is delivered to VWA from the San Luis Reservoir and O'Neill Forebay via the DMC and the Wasteway. The Wasteway enters VWA at the southwest corner and passes through the center. Surface water is lifted into two ditches by low lift pumps near Ingomar Grade Road. The ditches convey water to the eastern and western sections of the VWA. Water flows from the boundary ditches to the internal ditches by gravity. The ditch along the southern boundary contains runoff from an adjacent dairy. Water is also diverted from the Wasteway via outtake pipes located near a check dam in the center of the VWA. The refuge also often obtains water through special contracts to supplement the firm CVP supply. CVP refuge supply also flows through the Wasteway into Pond 10 at the northern end of VWA, from there it is delivered into GRCD for refuge purposes. This is one of the many delivery locations for the GRCD.

The CVP supply is adequate to meet Level 2 water supplies for VWA. In addition, in the 1999/2000 water service year, VWA was eligible to receive 70 percent of the incremental Level 4 which amounts to 4,200 acre-feet. VWA's agreement for 13,000 acre-feet fulfilled both the Refuge's Level 2 water supply (10,000 acre-feet) and much of the Level 4 increment. The full Level 4 water supply for VWA is 16,000 acre-feet.

San Luis Delta Mendota Water Authority

Water use in the CVP Westside region is dependent upon land use, which is characterized as agricultural, M&I, or habitat management. Agricultural water use occurs on approximately 850,000 irrigated acres on the Westside. The current M&I water supply provides a portion of the water supply needs for approximately two million people in Santa Clara and San Benito Counties as well as the San Joaquin Valley. Water use for habitat management occurs on approximately 120,000 acres of refuge lands.

The Westside region receives water pumped from the Delta by the Tracy Pumping Plant and conveyed via the Delta Mendota Canal (DMC), by gravity, up to 116 miles to the Mendota Pool in the San Joaquin River. The Tracy Pumping Plant and the canal immediately downstream were designed to carry 4,600 cfs, but physical and institutional factors now limit that capacity. Water is delivered to users at numerous turnouts. San Luis Reservoir withdrawals are conveyed south in the San Luis Canal, or west to Santa Clara and San Benito Counties (the San Felipe Division) via the Pacheco Tunnel and to CVP contractors on the lower DMC and Mendota Pool.

The Westside water supply is comprised of CVP water, groundwater, and local surface water. Since 1989, CVP water supply allocations have decreased significantly for Westside CVP contractors. Current water supply modeling efforts have shown that this decline is primarily attributable to implementation of the following laws and regulations:

- State Water Resources Control Board water quality standards for the Bay-Delta; Decision-1485 and Decision-1641.
- State and Federal Endangered Species Act provisions.
- Central Valley Project Improvement Act (P.L. 102-575) implementation. Prior to the State Water Resources Control Board adopting water quality standards, the listing of several species as either threatened or endangered, and the passage of the CVPIA, Westside agricultural contractors received 100% percent of their CVP contracted supply in almost every year since deliveries to the region began in June, 1951.

The only supply shortages experienced occurred as a result of severe drought conditions. Today, the long-term average allocation has been reduced to approximately 70 percent. The current M&I long-term average supply allocation has been reduced to approximately 90 percent under current conditions.

3.1.2 Environmental Consequences

No Action

Under the no action alternative, Reclamation would not provide funds under ARRA for the installation of two production wells along the Wasteway in the VWA. SLDMWA would not receive CVP surface water supply made available through groundwater substitution at VWA. Reclamation would look for other means to diversify refuge water supply.

Proposed Action

With ARRA funds from Reclamation, two groundwater wells would be installed at the VWA. The Refuge would then pump groundwater in-lieu of receiving a portion of their CVP supply. The accepted ratio is two acre-feet of groundwater: one acre-foot of CVP surface water. The CVP supply freed up by groundwater would be delivered to SLDMWA member units through their existing conveyance facilities and within the CVP place of use. SLDMWA would determine which member units receive the CVP supply. CVP surface water would continue to be delivered through the DMC and the Wasteway to VWA and GRCD. Although a reduction in surface water delivery to the Refuges would occur, twice as much groundwater being pumped would actually increase the amount of water delivery. There is, however, a small risk of increased seepage loss.

The Proposed Action would not impact surface water because a net increase or decrease in CVP surface water supplies being delivered south of the Delta would not occur. The total amount of CVP surface water delivered south of the Delta would remain the same; however, the ultimate location south of the Delta where the CVP surface water would be utilized would change. The change in location would not impact surface water resources, delivery of water to SLDMWA member units has been analyzed in. Surface water would be used for reasonable and beneficial use within SLDMWA. Furthermore, the proposed action is of limited duration (3 years), after which time a determination would be made to continue or cease the diversification project.

Cumulative Impacts

There are no adverse impacts to surface water resources which would result from implementation of the Proposed Action, therefore, the Proposed Action would not contribute to cumulative impacts to the resource.

3.2 Groundwater and Geologic Resources

3.2.1 Affected Environment

Volta Wildlife Area

Hydrologically, the VWA is located in the Merced sub-basin of the San Joaquin Valley Basin. Groundwater supplies are present in unconsolidated deposits extending to 900 feet or more below grade. An upper, semi-confined aquifer extends from approximately 50 to 250 feet below grade. The Corcoran Clay aquitard, provides a confining layer that is thick enough to separate the upper semi-confined aquifer from deeper alluvial deposits, which form the lower aquifer.

Groundwater has not been used on the refuge, and well infrastructure does not currently exist. Wells screened above the Corcoran Clay may be in hydraulic communication with overlying surface water features, such as refuge wetlands whereas wells screened in the lower aquifer are

not likely to affect surface waters. Due to the potential mixing of waters between the two aquifer units, the Merced County Environmental Health Department prohibits the construction of wells that are open to both aquifers within the same casing.

San Luis Delta Mendota Water Authority

The SLDMWA operates and provides services throughout the San Joaquin River hydrologic region (HR). The San Joaquin River HR covers approximately 9.7 million acres (15,200 square miles) and includes all of Calaveras, Tuolumne, Mariposa, Madera, San Joaquin, and Stanislaus counties, most of Merced and Amador counties, and parts of Alpine, Fresno, Alameda, Contra Costa, Sacramento, El Dorado and San Benito Counties. The region corresponds to a portion near the middle of Regional Water Quality Control Board (RWQCB) 5. Significant geographic features include the northern half of the San Joaquin Delta, the Sierra Nevada and Diablo Range. The region contains two entire groundwater basins and part of the San Joaquin Valley Groundwater Basin, which constitutes south into the Tulare Lake HR. The San Joaquin Valley Groundwater Basin is divided into nine sub basins in this region. The basin underlies 3.73 million acres (5,830 square miles) or about 38 percent of the entire HR area.

The development of the west side of the San Joaquin Valley for irrigated agriculture and the advent of deep-well turbine pumps in the 1920s drastically changed the groundwater flow system. Groundwater became an important component of irrigation water and, responding to the post-World War II boom in the economy, groundwater pumping increased by a factor of four, reaching a maximum of about a million acre-feet per year between 1950 and 1970. Most of this pumping was from the confined aquifer below the Corcoran Clay. Water tables dropped and there was pervasive land subsidence on the west side. This led to an increase in the cost of pumping and a call for a reduction in the volume of groundwater pumped on an annual basis. This led to the construction of the CVP and SWP conveyance facilities and the importation of surface water from the Delta..

Irrigated agriculture has been practiced on the west-side of the San Joaquin Valley for over a century. Irrigation activities of surface recharge and groundwater withdrawal have modified the pre-existing groundwater flow patterns, especially recharge-area and discharge-area relationships. Application of irrigation water causes water tables to rise in the shallow semi-confined aquifer, leading to an increase in the vertically downward movement of water. Because of the large areal extent of applied irrigation water on the west side, the resulting artificial recharge has significantly exceeded natural groundwater recharge by rainfall and stream flows.

The region is heavily groundwater reliant. Within the region, groundwater accounts for about 30 percent of the annual supply used for agricultural and urban purposes. Groundwater use in the region accounts for about 18 percent of statewide groundwater use for agricultural and urban needs. Groundwater use in the region accounts for 5 percent of the State's overall supply from all sources for agricultural and urban uses (DWR 1998).

Groundwater wells commonly extend to depths of up to 800 feet. Aquifers include unconsolidated alluvium and consolidated rocks with unconfined and confined groundwater conditions. Typical well yields in the San Joaquin Valley range from 300 to 2,000 gallons per minute (gpm) with yields of 5,000 gpm possible. The region's only significant basin located

outside the San Joaquin Valley is Yosemite Valley. The Yosemite Valley Basin supplies water to Yosemite National Park and groundwater wells in the basin have substantial well yields.

In addition to reduced CVP supply allocations, groundwater supplies in the region are declining due to a long-term overdraft condition caused by over-pumping. To protect the long-term sustainability of this resource, groundwater pumping has been significantly reduced, especially when compared to historic use. This, however, has further reduced available water supplies in the region.

Inelastic Land Subsidence

Land subsidence due to groundwater withdrawal is triggered by decreases in pore pressure in a confined aquifer system containing clay layers (typically, montmorillonite, or kaolinite clay). The decrease in pore pressure increases the effective stress on the aquifer skeleton. If this effective stress exceeds the maximum stress to which the aquifer skeleton has been subjected in the past, the clay layers can undergo permanent compaction.

Elastic subsidence occurs in response to seasonal changes in pore pressure within the aquifer system. Elastic subsidence is a characteristic of any confined aquifer system and does not result in permanent compaction. (USGS 2009)

3.2.2 Environmental Consequences

No Action

Under the no action alternative, groundwater development would not occur at VWA. Reclamation would not provide ARRA funds for the proposed action and production wells would not be installed at VWA. Groundwater use would continue as it presently does within SLDMWA.

Proposed Action

Under the proposed action, groundwater would be produced from below the Corcoran Clay for use within VWA and GRCD. Following the installation of two new production wells at VWA, groundwater would be pumped in an amount up to 2,000 acre-feet between September/October and January/February (four to five months) each year during the pilot project. This five month period coincides with the highest demand period for refuge water supply and would ensure blending with surface water would be maximized. The actual amount of groundwater produced would be dependent on the productivity of the wells and other factors, such as water quality, groundwater drawdown, and impacts to other users. All groundwater produced by the production wells would be discharged into the Wasteway and mixed with surface water for dilution (if necessary). All groundwater produced during the pilot project would be used for refuge management purposes at VWA and GRCD.

Additional pumping may only occur after the first year of the pilot project if monitoring data indicates water quality and water levels are suitable for refuge use. If the additional pumping occurs, it would continue year round as needed, and total production would increase “up to 5,000

acre-feet per year" during years 2011-2013. Surface water flows must be available in the Wasteway to meet dilution requirements, if necessary

Since VWA does not currently utilize groundwater, the installation of the production wells and their operation during the pilot period would cause a slight increase in groundwater use in the area. Current groundwater withdrawal is zero in the VWA. The total amount of groundwater which could be pumped during the three-year pilot period would be up to 12,000 acre feet.

Increased use of groundwater in Merced County could potentially affect groundwater levels, water quality, surface water/groundwater interactions, and rates of inelastic land subsidence. These types of potential impacts are not anticipated to occur beyond the VWA. Although an increase in groundwater extraction would occur, the amount is minimal when compared to the groundwater use in the San Joaquin River HR. Average groundwater usage in the region accounts for about 30 percent of the annual supply used for agricultural and urban purposes (DWR, 2003). Average pumping from beneath the Corcoran Clay in the general area of VWA is minimal. There are local landowner wells in the vicinity of VWA, as well as production wells in operation at two tomato processing plants. These plants are located within a two mile radius of the VWA proposed well locations. Under the proposed action, 2,000 acre-feet to 5,000 acre-feet per year would be a minimal increase to the average regional groundwater use. If monitoring indicates a significant decline in groundwater levels in the relevant vicinity of the test pumps, and that any such decline is not directly attributable to a cause other than the proposed action, then the test pumping would be modified or terminated as necessary to avoid any significant adverse impacts.

One of the generally unrecognized limitations in groundwater availability is subsidence from groundwater withdrawal. If pumpage demands are large enough, subsidence can occur. In the San Joaquin Valley, land subsidence has resulted in damage to buildings, aqueducts, well casings, bridges, and highways and has caused flooding. These damages have cost millions of dollars (USGS 2009). Subsidence is unlikely to occur as a result of the Proposed Action. Although pumping would occur from beneath the Corocoran Clay, the total volume of groundwater produced is minimal when compared to regional groundwater pumping in the San Joaquin Valley. Most groundwater production in the San Joaquin Valley occurs above the Corcoran Clay. In addition, there would be sufficient recharge during non-pumping periods which would offset any decreases in pore pressure caused by the Proposed Action. Reclamation has an interagency agreement with the United States Geologic Survey (USGS) to monitor subsidence along the Delta Mendota Canal. The study, "*Evaluation of Groundwater Conditions and Land Subsidence along the Delta Mendota Canal*" would incorporate VWA groundwater production as a factor in analyzing subsidence.

Table 1. Estimated Groundwater Pumping Durations, Rates and Volumes by Test Phase per Test-Production Well

Test Phase	Approximate Pumping Duration (days)	Assumed Average Pumping Rate (gallons per minute)	Estimated Groundwater Volume (af)/well	Total Groundwater Volume (af) - based on 2 wells
Well Development	5 days (50 hours)	1,000	9.2	18.4
1 – Step Test	1 day (6hours)	1,500	1.66	3.31
2 – Constant Rate Test	5 days (120 hours)	1,500	33.14	66.3
3 – Operational Test	*450 days	1,500	2,985	5,970
		Total =	3,029	6,058

*Based on 5 months at 30 days/month for 3 years total time. This operational time period may be extended to other times during the year (only after the first year); the total groundwater production would not exceed 5,000 acre-feet/year.

Cumulative Effects

When added to past, present, and future foreseeable action, the proposed action would contribute a minor increase in groundwater production in the general vicinity for three years. Private wells and local municipalities in and near the study area would continue to utilize groundwater during the proposed action. Most of the private and local wells would be pumping from water bearing strata above the Corcoran Clay, not at the same depths as the proposed wells in VWA. It is not anticipated that pumping during the proposed action would impact the upper aquifer system.

Although most wells in the general area pump from water bearing strata above the Corcoran clay, two tomato packing plants pump groundwater from below the Corcoran Clay, Ingomar Packing Company and Morning Star Packing Company.

Facility 1 – Ingomar Packing Company. The facility and production wells are located at 9950 S. Ingomar Grade, Los Banos, CA. The Ingomar facility is approximately three miles north of the proposed locations for the VWA production wells. Ingomar operates five wells during the packing season (July – October), typically 100 days. The wells range in depth from 195 feet below ground surface (bgs) to 620 feet bgs. Water level data is not collected from the wells. The water quality data in Table 2 was collected between 2003 and 2008. Three wells, wells #1, #2, and #3 pump from beneath the Corcoran Clay. Assuming operation occurs for 24 hours for 100 days, the production for wells #1, #2, and #3 would be 24.4 acre-feet/day or 2,440 acre-feet/100 days at a maximum.

Table 2 Ingomar Well Information

INGOMAR PACKING COMPANY
WATER PRODUCTION WELL INFORMATION

WELL #	TOTAL WELL DEPTH FEET	PUMPING RATE GPM	Average Pump Time	BOWL SETTING FEET	Screen	EC Min/Max	TDS Min/Max	PH Min/Max
#1	620	1650	100 Days	240	Cone Length 10'	1400/2500	810/1500	8.0/8.2
#2	600	1975	100 Days	240	Cone Length 10'	1300/2100	760/1200	8.1/8.2
#3	500	1990	100 Days	270	Cone Length 10'	1000/3400	570/2000	7.8/8.1
#4	195	400	100 Days	160	Cone Length 10'	1200/1400	710/880	8.0/8.1
#6	219	870	100 Days	200	Cone Length 10'	940/4800	540/5800	7.9/8.2

Facility 2 – Morning Star Packing Company. The facility's closest production wells are located at 13448 Volta Road, Los Banos, CA. This facility is approximately ¾ miles south of the proposed locations for the VWA production wells. Currently, Morning Star operates their wells only during the packing season (July – October). They do not collect water level data from the wells. Reclamation is unable to gather specific information on this pumping plant. However, Reclamation assumes that production at Morning Star is similar to that of Ingomar.

The incremental impact of pumping up to 5,000 acre-feet/year under the Proposed Action when added to the pumping that occurs at the packaging plants, would contribute a minimal increase to groundwater pumping from below the Corcoran Clay during the 3 year pilot project. This cumulative impact would not be substantial because groundwater levels would be monitored for drawdown to avoid adverse impacts. In addition, some overlap in production time may result from simultaneous pumping at VWA and the packing plants between September and October. However, the time period would be short (2 months) and the additional pumping of the VWA wells would only contribute up to 6.63 acre-feet/day maximum for the two month period (60 days max). This additional amount of pumping would not substantially impact groundwater resources.

3.3 Water Quality

3.3.1 Affected Environment

Volta Wildlife Management Area

The groundwater quality within the Merced sub-basin varies with location and depth both within the upper aquifer above the Corcoran Clay and in the lower aquifer beneath the Corcoran Clay. Total dissolved solids (TDS) concentrations generally range from 100 to 3,600 milligrams per

liter (mg/L). In two test holes drilled in the VWA, TDS range from 300 to over 1,500 mg/L. Based on this limited data, and discussions with local drillers familiar with the area, the water quality of the deep aquifer is highly variable. Elevated mineral or other constituents (e.g. Arsenic, Selenium, or Boron) may require that the groundwater be diluted or mixed with surface water to comply with Total Maximum Daily Load (TMDL) regulations and/or refuge water quality requirements.

Good water quality might be in the range of 1,000 - 2,500 micro-siemens (uS)/cm electrical conductivity (EC) and 700 - 1,700 mg/l TDS. Typically groundwater quality above 3,000 uS/cm can be used only after blending with better quality water supply. Reconnaissance test wells that were drilled close to the current site of Well 1 and approximately 1/2 mile east of the VWA gate revealed water of good quality sub-Corcoran at the first test well. Water at the second test well was of poorer quality and unsuitable for direct use within the VWA. . Production wells approximately one mile to the northwest and one mile to the southwest of the current Well 1 site also report water of good quality. These wells are actively pumping groundwater for use in the processing plants situated along Ingomar Grade. From this information it can be surmised that sub-Corcoran aquifer water quality generally improves as one moves west from the Ingomar Grade alignment. Wells drilled close to the alignment of the Wasteway might also benefit from slow recharge of good quality surface water from the Wasteway itself. Although these rates of recharge are likely very slow, over time these cross-Corcoran fluxes could help to improve water quality. Recharge to the aquifer beneath the Corcoran Clay is from the west.

San Luis Delta Mendota Water Authority

Water quality is highly variable within the service area of the SLDMWA. In general water deteriorates in water from west to east – with the poorest water quality in the trough of the Valley. In the Valley trough the presence of A and C clay lenses impede drainage and vertical flow – allowing more refluxing of shallow groundwater before it moves deeper into the lower semi-confined aquifer. Evidence of the suitability of groundwater for conjunctive use purposes can be found by observation of the number of groundwater wells in the SLDMWA service area. Production wells tend to be clustered in areas of good well yield and suitable water quality. The Central California Irrigation District (a 110,000 acre Irrigation District within the SLDMWA) operates several dozen district owned wells – these are mostly screened above the Corcoran Clay and located throughout the District west of the Valley trough.

3.3.2 Environmental Consequences

No Action

Under the No Action alternative, groundwater development would not occur at VWA. Reclamation would not fund the pilot project and production wells would not be installed at VWA. CVP surface water would not be delivered to SLDMWA. Groundwater use would continue as it presently does within SLDMWA.

Proposed Action

Monitoring data from the Ingomar Packaging Company indicates a range of water quality measurements. Groundwater quality data are necessary for the protection of groundwater

resources because deterioration of groundwater quality may be irreversible, and treatment of contaminated groundwater can be expensive. Water quality impacts that could occur to surface water by pumping groundwater of poor quality and discharging it into the Wasteway are minimal. This type of impact is unlikely to occur since the ratio of surface water moving through the Wasteway would be greater than the amount groundwater that is pumped into the Wasteway. Sub-Corcoran groundwater is assumed to be of suitable quality for refuge use. If necessary, surface water in the Wasteway would be used to dilute the groundwater to a suitable level for further delivery to VWA and GRCD. Dilution of groundwater with surface water is a common practice. Furthermore, based on monitoring data from Ingomar, it appears that the EC readings indicate suitable water quality, except for Well #3's maximum EC measurement.

Various water-management actions potentially have groundwater-quality effects. Therefore, water quality needs to be considered in conjunction with information about changes in water levels and water in storage in evaluating the availability and sustainability of groundwater. The Proposed Action would implement a water quality monitoring plan to ensure that water quality standards for selenium and boron are not exceeded. If water quality monitoring indicates unsuitable water quality levels, pumping operation would cease. The Project Monitoring Plan is included in Appendix B.

The potential for poor water quality to be extracted under the Proposed Action exists, however, the Project Monitoring Plan (Appendix B) would avoid or mitigate for unsuitable water quality to ensure that no adverse impacts occur to water supply during the pilot project.

Cumulative Impacts

Under the Proposed Action, impacts to water quality would not occur since continual monitoring would occur along with any follow-on mitigation. Therefore, the Proposed Action would not contribute to cumulative impacts to water quality.

3.4 Land Use

3.4.1 Affected Environment

Volta Wildlife Area

The VWA has primarily been managed as a seasonally flooded wetland to provide the habitat needs of migratory waterfowl and associated species. Approximately 1,970 acres of the area are managed as seasonally and semi-permanently flooded wetlands. In recent years research has indicated there can be positive benefits to wildlife by maintaining some of this seasonally flooded wetland during seasons other than fall and winter. Management at VWA has begun to evolve to reflect this new management paradigm. These flooded areas need not be large to be effective habitat components. Also by carefully managing depth, location, and topography, normal habitat manipulations can still be accommodated in the major portion of each cell, while one or more edges remain flooded.

San Luis Delta Mendota Water Authority

Land use in SLDMWA is characterized as agricultural, M&I, or habitat management. Agriculture is the predominant land use occurring on approximately 850,000 irrigated acres on

the Westside. The current M&I water supply provides a portion of the water supply needs for approximately two million people in Santa Clara and San Benito Counties as well as the San Joaquin Valley. Land use for habitat management occurs on approximately 120,000 acres of refuge lands

3.4.2 Environmental Consequences

No Action

Under the No Action alternative, groundwater development would not occur at VWA. Reclamation would not fund the pilot project and production wells would not be installed at VWA. Ongoing land use would continue in VWA and SLDMWA.

Proposed Action

Under the Proposed Action alternative, construction of each test-production well would occur within an area of approximately 150-feet by 150-feet and the completed production well facilities would occupy a smaller area within the construction zone.

The total land area affected by production well construction is minimal when compared to the total area (3,000 acres) in VWA. Changes in land use would not occur as a result of the proposed action in VWA, SLDMWA or GRCD. Therefore, the Proposed Action would not impact existing land use.

Cumulative Impacts

Since the Proposed Action would not impact existing land use, it would not contribute to cumulative impacts on land use.

3.5 Air Quality

3.5.1 Affected Environment

Volta Wildlife Area

Merced County falls within the San Joaquin Valley Air Pollution Control District. Merced County's air quality emissions exceed Federal/State ozone standards and State PM10 standards. This is a result of the topography and climate creating inversion layers and the high volumes of air pollutant emissions from Merced County's major sources: automobiles, confined animal facilities, on and off-road vehicles, and other industrial activities. The air quality attainment status for Merced County is summarized in Table 3.

Table 3. Status of Air Quality Attainment for Merced County (Source: California Air Resources Board 2006),

	Air Pollutant		
County	Ozone State and Federal	PM10 State/Federal	Carbon Monoxide
Merced	Non-attainment	Non-attainment/Attainment	Unclassified

3.5.2 Environmental Consequences

No Action

Under the No Action alternative, there would be no change to existing air quality conditions, regulation, or attainment of standards.

Proposed Action

Under the Proposed Action, there would be temporary effects on air quality due to emission of air pollutants from diesel powered equipment during the period of construction. Average fuel use rate is approximately 25gallons/hour. Based on that the following assumptions have been made:

Production wells

1. Rig time estimate is 10 hours/day
2. Production Wells would require rig use for drilling, reaming, construction and development of the wells. Total hours of operation for one production well= 25 days, (250 hours)=6,250 gallons of fuel.
3. Total fuel for two production wells =12,500 gallons

Monitoring Wells

1. Rig time estimate is 15 gallons per hour use for 10 hours/day
2. Monitoring wells would require rig use for drilling, construction and development of the wells. Total hours of operation for five monitoring wells =18 days=180 hours=2,700 gallons of fuel.

Aquifer Testing

1. Diesel generator estimate burning 15 gallons/hour
2. Two constant rate tests=120 hours/test.
3. Total hours of operation=260 hours=3,900 gallons.

Prior to project construction, the contractor would be responsible for obtaining permits, if required, from the San Joaquin Valley Air Pollution Control District. Combined, there is an estimated 550 hours of equipment operation required for the construction of the proposed wells. Total fuel consumption during well construction is estimated to be 19,100 gallons. There would be temporary emissions (impacts) resulting from the use of the construction equipment. The wells are electric and would not contribute impacts to air quality.

Cumulative Impacts

Although there are temporary impacts to air quality as a result of the Proposed Action, the magnitude of those impacts would not contribute to long term, cumulative impacts on air quality. The air quality impacts associated with the construction of the two wells would be temporary and would not continue for the three year pilot project, therefore, a small impact may occur during construction.

3.6 Biological Resources

3.6.1 Affected Environment

Volta Wildlife Area and Grassland Resource Conservation District

Wetland

The wetlands of VWA are maintained by surface irrigation water and a water conveyance infrastructure is in place to service each of the numerous ponds or cells. Three low lift pumps, installed and owned by the California Department of Fish and Game, are located on the Volta Wasteway at Ingomar Grade and facilitate water conveyance to the higher elevations of the wildlife area and to irrigate feed or cover plantings. Vernal pools or seasonal wetlands occur within the VWA. A search of the California Natural Diversity Database indicated presence of wetlands within the USGS 7.5 minute quadrangles of Ingomar (403B) and Volta (403C). These quadrangles encompass the well locations identified in the Proposed Action area (Appendix C).

In VWA and GRCD, wetland habitats consist of seasonally flooded marshes, including moist soil impoundments, and permanent ponds/summer water.

Seasonally flooded marsh is by far the most numerous and diverse of the wetland habitat types on the state and federal refuges and private wetland areas of the San Joaquin River Basin. Seasonal wetlands are inundated fields or ponds that are managed primarily to grow seed and to produce invertebrates for migratory waterfowl, shorebirds and other wetland-dependent wildlife. These wetlands are usually flooded from October through March, and are dry for the rest of the year except for summer irrigation.

The diversity of seasonal wetlands is the product of a variety of water depths that result in an array of vegetative species that, in combination, provide habitat for the greatest number of wildlife species throughout the course of a year. Through the fall and winter, seasonally flooded marshes are sued by large concentrations of waterfowl and smaller numbers of egrets, herons, ibis, and grebes, to name a few. In addition, a full complement of raptors take advantage of the water bird prey base. Water is removed in the spring, so large concentrations of shorebirds use the shallow depth and exposed mudflats on the northern migration. See-producing plants germinate and grow to maturity on the moist pond bottoms during the springs and early summer. Wetland flooding in the fall makes this food available to early migrant waterfowl and other waterfowl.

Moist soil impoundments are similar to seasonally flooded marshes, except that they are irrigated in the summer to improve production of water grass, sprangletop, and swamp timothy, the primary food species for waterfowl. Moist soil impoundments are typically irrigated during the summer to bolster plant growth and to enhance seed production. During irrigation periods, these units are often used by locally nesting colonial water birds (egrets, herons). Once flooded, these units provide an abundant food source for waterfowl. In addition, a number of wading bird species frequent them throughout the year.

Semi-permanent/permanent wetlands provide wetland habitat for year-round and summer resident species. Semi-permanent wetlands are flooded for 8 or months of the year, while permanent wetlands remain flooded throughout the year. Characterized by both emergent and submergent aquatic plants, semi-permanent/permanent wetlands provide brood and molting areas for waterfowl, secure roosting and nesting sites for wading birds and other over-water nesters, and provide feeding areas for species like cormorants and pelicans.

Riparian
There are no riparian habitats that occur in the proposed construction action area or near the water delivery areas.

Developed/Disturbed
Developed and disturbed areas include major roads, highways, and buildings and structures within more urban areas, but also facilities and access roads which are located throughout the VWA near each proposed well location.

Wildlife
The following list was obtained on July 20, 2009 by accessing the U.S. Fish and Wildlife database at http//www.fws.gov/sacramento/es/spp_list.htm. The list was regenerated October 26, 2009. This list is for the following 7 ½- minute U.S. Geological Survey quadrangles: INGOMAR (403B) Listed Species and VOLTA (403C) Listed Species.

Table 4 Federally Listed, Proposed & Candidate Species and Migratory Birds Potentially Occurring In Proposed Action Area

SCIENTIFIC NAME	COMMON NAME	FEDERAL STATUS
INVERTEBRATES		
Branchinecta longiantenna	Longhorn fairy shrimp	Endangered
Lepidurus packardi	Vernal pool tadpole shrimp	Endangered
Branchinecta lynchi	Vernal pool fairy shrimp	Threatened
Desmocerus californicus dimorphus	Valley elderberry longhorn beetle	Threatened
FISH		
Hypomesus transpacificus	Delta smelt	Threatened
Oncorhynchus mykiss	Central Valley Steelhead	Threatened (NMFS)
AMPHIBIANS		
Ambystoma californiense	California tiger salamander, central population	Threatened

Rana aurora draytonii	California red-legged frog	Threatened
REPTILES		
Gambelia (=Crotaphytus) sila	Blunt-nosed leopard lizard	Endangered
Thamnophis gigas	**Giant garter snake**	**Threatened**
MAMMALS		
Dipodomys nitratoides exilis	Fresno kangaroo rat	Endangered
Vulpes macrotis mutica	San Joaquin kit fox	Endangered
BIRDS2		
Charadrius alexandrinus nivosus	Western snowy plover	Threatened (Kern County)
Coccyzus americanus occidentalis	Western yellow-billed cuckoo	Candidate (Kern County)
Empidonax traillii extimus	Southwestern willow flycatcher	Endangered (Kern County) (critical habitat)
Gymnogyps californianus	California condor	Endangered (Kern & Tulare counties) (critical habitat)
Vireo bellii pusillus	Least Bell's vireo	Endangered (Kern County)
PLANTS		
Monolopia congdonii (=Lembertia congdonii)	San Joaquin woolly-threads	Endangered

Although there are several species identified in the list, only those species that could potentially occur in the action area (proposed construction areas) are analyzed in detail. The giant garter snake (GGS) (*Thamnophis gigas*) is the only species with potential habitat in the action area which may be impacted by the Proposed Action.

Sensitive Plants

Major representative plant communities and habitat types present include seasonally flooded freshwater emergent wetland and alkali sink scrub. CNDDB records and USFWS species list for Merced County indicate the following rare, threatened, or endangered plant species have been sighted on or near the area in recent times:

Hispids' bird's-beak (State- and Federally-listed endangered)	*Cordylanthus mollis hispids*
Owl's clover (Endangered)	*Calstilleja campestris ssp. Succlenta*
Hoover's spurge (Threatened)	*Chamaesyce hooveri*
Colusa grass	*Neostapfia coulusana*

(Threatened)	
San Joaquin Valley Orcutt grass (Threatened)	*Orcuttia inaequalis*
Hairy Orcutt grass (Endangered)	*Orcuttia pilosa*
Greene's tuctoria (Endangered)	*Greene's tuctoria* (=Orcutt grass)

Suitable habitat does not exist within the Proposed Action area for any sensitive plant species.

Giant Garter Snake

The giant garter snake inhabits wetland habitats and vegetated permanent water channels in scattered subpopulations in the Central Valley from Butte County in the north to Fresno County in the south. It is believed extirpated from the vicinity of Buena Vista and Tulare Lakes south of Fresno County. Giant garter snakes are present within the VWA.

Giant garter snakes are always found in close proximity to permanent or semi-permanent water with vegetated perimeters. The giant garter snake is an aquatic feeder specializing in capturing small fish and frogs in or under water. The giant garter snake spends the winter in upland retreats above the high water level.

The project, as planned, may potentially impact this species and its habitat. It is expected that achievement of project goals through implementation of stated objectives would result in a net increase of usable habitat for the species.

Measures to Avoid or Minimize Impacts

1. Operation and maintenance activities conducted within or near habitat suitable for giant garter snakes should be conducted between May 1 and October 1, during the snakes' active period.

2. Cleaning of ditches and canals should be done from one side of the canal only. This would ensure the maintenance of suitable escape cover for any snakes in the area.

3. Canals in which construction or maintenance activities are planned should be dewatered at least 15 days prior to construction.

4. Rip rap installed around water control structures and erodible ditch banks should be placed in a manner which would provide escape cover for snakes. A base of river rock should be placed on the levee for levee protection and covered with large pieces of concrete rubble to provide the escape cover.

Aleutian Canada Goose, Bald Eagle, Peregrine Falcon, and Yellow-Billed Cuckoo
The Aleutian Canada goose, Bald Eagle, Peregrine Falcon, and Yellow-Billed Cuckoo are occasional visitors to the project area. The proposed action would have no adverse impact upon or jeopardize the continued existence of these species. The project would provide additional loafing, foraging, and roosting sites within the VWA and GRCD for Aleutian Canada Geese, Bald Eagles, and Peregrine Falcons. Future tasks within the VWA would focus on improvement of foraging habitat for these species. Continued growth and expansion of riparian habitat within VWA would improve habitat conditions for the Yellow-billed Cuckoo.

Swainson's Hawk
This species is the most migratory of all North American buteos. It breeds and summers in the arid and semiarid regions of western North America and winters on the pampas of Argentina. The breeding population in California has declined by an estimated 90 percent. In 1979, the breeding population in California was estimated at 375 pairs. This species arrives in the vicinity of the North Grasslands Wildlife Area and Los Banos Wildlife Area in late February to early March each year. It nests within an intermix of trees. Trees commonly used for nesting in this area are cottonwoods, willows, and valley oaks. The principal foods in the Central Valley are meadow mice and small birds. Use of the area by Swainson's hawk coincides with the time of year when most of the seasonal wetlands have been allowed to dry for their annual growing season. Likewise, this species migrates south prior to the seasonal wetlands being flooded for wintering wildlife populations arriving in the fall.

Based upon CNDDB records and observations by CDFG staff, no known Swainson's hawk nest sites occur within the VWA Comprehensive Management Plan project area. Nest sites do occur along the San Joaquin River, which is not located in the Proposed Action area. Swainson's hawks are featured species in the VWA management plan and would benefit from proposed projects. Grassland foraging areas and potential nest trees would be protected and maintained. The proposed project would not effect this species in this region of its range.

San Joaquin Kit Fox
The San Joaquin kit fox, a State-listed threatened and Federally-listed endangered species, is a small nocturnal canid which now occurs in scattered populations from Contra Costa County south to Kern County. Historically, this species occupied extensive areas of semiarid lands in the San Joaquin Valley. Flat topography in valley bottoms with valley sink scrub, valley saltbush scrub, interior coast range saltbush scrub, nonnative grassland and alkali playa plain communities (described in Holland, 1986) are the typical habitat, but substantial populations have always inhabited the surrounding low foothills where slopes do not exceed 40 degrees (O'farrell 1983). Agricultural, industrial, and urban developments have caused rapidly increasing rates of habitat loss.

The San Joaquin kit fox is an obligate year-round burrow dweller which feeds largely upon lagamorphs and kangaroo rats (but would utilize whatever prey is locally abundant). Numerous dens are excavated and inhabited in the course of a year and individuals may cover great distances while foraging and/or dispersing.

The San Joaquin kit fox is considered here because of the potential foraging habitat (irrigated pasture and seasonally flooded grassland and alkali sink scrub). No known active or potential kit fox dens have been observed within the project area.

3.6.2 Environmental Consequences

No Action

Under the No Action alternative, conditions would remain the same as existing conditions. There would be no new impacts to wildlife, including threatened and endangered species, their critical habitat, or general habitat types.

Proposed Action

The installation of test holes, production wells and the subsequent pumping and conveyance of groundwater would not affect aquatic species and/or their habitat. Habitat for Delta smelt, Chinook salmon (spring and winter run), central valley steelhead, or green sturgeon would not be affected because no construction or flow modifications are proposed on natural waterways. All construction would tie into existing conveyance facilities (i.e. Volta Wasteway, GRCD ditches). The conveyance facilities to be used in the proposed action are not managed for fisheries. There would be no effect to federally listed fish species mentioned above and there would be no modification of critical habitat for the species as a result of the proposed action.

A biological assessment (BA) has been prepared under Section 7(a)(2) of the Endangered Species Act (ESA) for effects to the GGS (Appendix C) Reclamation has determined that the proposed action *may affect, is likely to adversely affect GGS.*

Direct impacts may occur as a result of construction. Placement of the two wells would be limited in extent to only the immediate vicinity of the Wasteway. Total disturbance to the action area would include temporarily increased truck and worker foot traffic in what is currently a highly-frequented area as a result of well placement. Some vegetation would be removed along the north and south embankments of the Wasteway for placement of erosion control structures (approximately 4 feet by 20 feet) and could potentially affect GGS if in the area as this is potential GGS habitat.

Indirect impacts may occur if water quality has an impact on the prey base of GGS. Groundwater from the production wells placed on either side of the Wasteway would be pumped into the Wasteway and delivered downstream throughout the VWA and to GRCD. Water quality would be continually tested during the three-year pilot project at the outflow of the production wells, at monitoring well sites, and immediately upstream and downstream of the proposed well locations. If water quality is determined to be of unsuitable quality, pumping into the Wasteway would cease. Temporary or permanent impacts to water quality are not anticipated as the quality would be continuously tested and mitigation would occur as defined in the Surface Water Quality Degradation Avoidance Protocol included in the Project Monitoring Plan (Appendix B). In addition, Reclamation has included extra avoidance protocol for potential impacts to the GGS in the BA (Appendix C). Groundwater would be diluted with surface water if necessary. Pumping would cease if water quality is compromised or, if there is not enough surface water to dilute the groundwater to a suitable level for refuge management.

Overall, the Proposed Action would provide a benefit to waterfowl, shorebirds, and raptors, as the water would be used for refuge management to sustain wetland habitats.

The proposed action may benefit GGS in that it would provide water during the snake's active period (spring and summer). Restrictions during well placements and avoidance and minimization measures would help to reduce the potential for take of GGS.

During construction, avoidance and minimization measures would be followed to ensure minimal impacts to GGS. The measures include:

1. Avoid construction activities within the banks of potential GGS aquatic habitat. Confine movement of heavy equipment to existing roadways to minimize habitat disturbance.

2. Construction activity within known habitat areas should be conducted between May 1 and October 1. This is the active period for GGS and direct mortality is lessened because snakes are expected to actively move and avoid danger. Between October 2 and April 30 contact the Service's Sacramento Fish and Wildlife Office to determine if additional measures are necessary to minimize and avoid take.

3. Confine clearing to the minimal area necessary to facilitate construction activities. Flag and designate avoided GGS habitat within or adjacent to the project area as Environmentally Sensitive Areas. These areas should be avoided by all construction personnel.

4. Construction personnel would receive Service-approved worker environmental awareness training. This training instructs workers to recognize GGS and their habitat(s).

5. The project area should be surveyed for GGS by a Fish and Wildlife Service approved biologist 24-hours prior to construction activities, ,. The survey of the project area would be repeated if a lapse in construction activity of two weeks or great has occurred. If a snake is encountered during construction, activities shall cease until appropriate corrective measures have been completed or it has been determined that the snake would not be harmed. Report any sightings and any incidental take to the Service immediately by telephone (916) 414-6620.

6. After completion of construction activities, remove any temporary fill and construction debris and, wherever feasible, restore disturbed areas to pre-project conditions.

Cumulative Impacts

Implementation of the Proposed Action would not result in cumulative effects to biological resources. Although there may be potential impacts to potential GGS habitat and prey base, the impacts would not jeopardize the continued existence of the species. The Proposed Action would not contribute to cumulative impacts when added to other past, present or future foreseeable actions carried out by any other federal, state or local agency.

3.7 Indian Trust Assets

3.7.1 Affected Environment

Indian Trust Assets (ITAs) are legal interests in property held in trust by the U.S. for federally-recognized Indian tribes or individual Indians. An Indian trust has three components: (1) the trustee, (2) the beneficiary, and (3) the trust asset. ITAs can include land, minerals, federally-reserved hunting and fishing rights, federally-reserved water rights, and in-stream flows associated with trust land. Beneficiaries of the Indian trust relationship are federally-recognized Indian tribes with trust land; the U.S. is the trustee. By definition, ITAs cannot be sold, leased, or otherwise encumbered without approval of the U.S. The characterization and application of the U.S. trust relationship have been defined by case law that interprets Congressional acts, executive orders, and historic treaty provisions.

Consistent with President William J. Clinton's 1994 memorandum, "Government-to-Government Relations with Native American Tribal Governments," Bureau of Reclamation (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 government-to-government level (59 Federal Register 1994) when its actions affect ITAs. The U.S. Department of the Interior (DOI) Departmental Manual Part 512.2 ascribes the responsibility for ensuring protection of ITAs to the heads of bureaus and offices (DOI 1995). DOI is required to "protect and preserve Indian trust assets from loss, damage, unlawful alienation, waste, and depletion" (DOI 2000). Reclamation is responsible for assessing whether the Proposed Action has the potential to impact ITAs.

It is the general policy of the DOI to perform its activities and programs in such a way as to protect ITAs and avoid adverse effects whenever possible. The proposed action would be implemented to ensure compliance with this policy. In addition, Reclamation would comply with the procedures contained in Departmental Manual Part 512.2, guidelines, which protect ITAs.

3.7.2 Environmental Consequences

No Action

Under the No Action alternative, there are no impacts to ITAs, as no new facilities would be constructed and existing operations would continue to operate as have historically occurred.

Proposed Action

There are no tribes possessing legal property interests held in trust by the United States in the water involved with this Proposed Action, nor is there such a property interest in the lands designated to receive the water proposed in this action. The nearest ITA is the Chicken Ranch Rancheria approximately 62 miles northeast of the Proposed Action location. There would be no impacts to ITAs as a result of Proposed Action.

Cumulative Impacts

Because there are no impacts to ITAs as a result of the Proposed Action, the Proposed Action would not contribute to any cumulative impacts to ITAs.

3.8 Environmental Justice

3.8.1 Affected Environment

As mandated by Executive Order 12898 (E.O. 12898), published February 11, 1994, entitled, "Federal Action to Address Environmental Justice in Minority Populations and Low-Income Populations", this EA addresses potential environmental justice concerns. The population of some small communities in the Central Valley typically increases during late summer harvest. The market for seasonal workers on local farms draws significant numbers of migrant workers, commonly of Hispanic origin from Mexico and Central America.

3.8.2 Environmental Consequences

No Action

The No Action Alternative would have no impact on environmental justice. VWA and SLDMWA would continue to manage their water supplies to meet the needs. Conditions would be the same as the existing conditions; therefore, no additional impacts are associated with this alternative.

Proposed Action

The Proposed Action involves a temporary construction to install groundwater production wells and the subsequent pumping of those wells to diversify refuge water supply within the VWA. The Proposed Action would not cause dislocation, changes in employment, or increase flood, drought, or disease. The Proposed Action would not disproportionately impact economically disadvantaged or minority populations. No impacts relevant to Environmental Justice are anticipated because the project does not result in any change in operations that would affect the general public.

Cumulative Impacts

Because the Proposed Action would have no impact on minority or disadvantaged populations, the Proposed Action would not contribute to cumulative impacts on those populations.

3.9 Cultural Resources

3.9.1 Affected Environment

This section discusses the identification of cultural resources and the potential for well installation to affect historic properties.

Regulatory Setting

A cultural resource is a broad term that includes prehistoric, historic, architectural, and traditional cultural properties. The National Historic Preservation Act (NHPA) of 1966, as amended (16 USC 470 *et. seq*.), is the primary Federal legislation that outlines the Federal Government's responsibility to cultural resources. Section 106 of the NHPA requires the Federal Government to take into consideration the effects of an undertaking on cultural resources listed on or eligible for inclusion in the National Register of Historic Places (NRHP). Those resources that are on, or eligible for inclusion on, the NRHP are referred to as historic properties. The criteria for NRHP eligibility are located at 36 CFR Part 60.

The Section 106 process is outlined in the Federal regulations at 36 CFR Part 800. These regulations describe the process that the Federal agency (Reclamation) takes to identify cultural resources and the level of effect that the proposed undertaking will have on historic properties. In summary, Reclamation must first determine if the action is the type of action that has the potential to affect historic properties. If the action is the type of action to affect historic properties, Reclamation must identify the area of potential effects (APE), determine if historic properties are present within that APE, determine the effect that the undertaking will have on historic properties, and consult with the State Historic Preservation Office (SHPO), to seek concurrence on Reclamation's findings. In addition, Reclamation is required through the Section 106 process to consult with Indian Tribes concerning the identification of sites of religious or cultural significance, and consult with individuals or groups who are entitled to be consulting parties or have requested to be consulting parties.

Cultural Resource Identification

In an effort to identify historic properties, Reclamation reviewed its archaeological site index and project data. The only cultural resource located within the project area is the Volta Wasteway (Wasteway), which is part of the Delta-Mendota Canal (DMC). The DMC was completed in 1951 as part of the Delta Division of the Central Valley Project (CVP) to convey water from the Tracy (C.W. "Bill" Jones) Pumping Plant along the west side of the San Joaquin Valley. Water in the DMC is used in the San Luis Unit, the Friant-Kern and Madera systems, and replaces San Joaquin River water stored at Friant Dam. The DMC is approximately 117 miles long and is about is 16 feet deep with a bottom width of 100 feet. The canal terminates at the Mendota Pool about 30 miles west of Fresno. The first 95 miles of the DMC are concrete lined, while the remaining 22 miles are unlined.

Reclamation is in the process of nominating the Central Valley Project (CVP) to the National Register of Historic Places (National Register). As part of the CVP, the DMC has been found eligible for inclusion in the National Register under Criterion A for its association with irrigation and agricultural development of California. The Wasteway is a contributing feature to the DMC and has been determined eligible for the National Register under Criterion A for its contribution to the broad patterns of history.

The proposed construction of two production wells and two series of monitoring wells will not affect the function or design of the Wasteway, will not affect its ability to deliver water, and would not affect the qualities that make the Wasteway eligible for listing on the NRHP under Criterion A. All work will be confined to already disturbed and constructed areas within the canal prism and adjacent canal berms; therefore, there is no potential for intact archaeological

deposits within the canal bed or along the berms. The proposed well installation will result in no adverse affect on historic properties pursuant to 36 CFR Part 800.5(b). This determination is pending SHPO concurrence.

Table 6 Location of Test-Production Wells

	Location	Quadrangle	Facility
Well 1	NW¼NW¼ Sec. 18, T. 22 N., R. 2 W.	Volta	Volta Wasteway
Well 2	NW¼NW¼ Sec. 29, T. 22 N., R. 2 W.	Volta	Volta Wasteway

3.9.2 Environmental Consequence

No Action

Under the No Action Alternative, there are no impacts to cultural resources since there would be no change in operations and no ground disturbance. Conditions related to cultural resources would remain the same as existing conditions.

Proposed Action

The Proposed Action is the type of activity that has the potential to affect historic properties. The only historic property identified within the project area was the Wasteway. The proposed well installation would result in no adverse affect to historic properties pursuant to 36 CFR Part 800.5(b). Since no historic properties will be affected, no cultural resources will be impacted as a result of implementing the proposed action.

Cumulative Impacts

Under the Proposed Action, no historic properties would be impacted; therefore, cultural resources would not be impacted. Since there are no impacts to cultural resources, the Proposed Action would not contribute to cumulative impacts on cultural resources.

3.10 Climate Change

3.10.1 Affected environment

The United Nations Intergovernmental Panel on Climate Change predicts that changes in the earth's climate would continue through the 21st century and that the rate of change may increase significantly in the future because of human activity (IPCC, 2001). Many researchers studying California's climate believe that changes in the earth's climate have already affected California and would continue to do so in the future. Climate change may seriously affect the State's water resources. Temperature increases could affect water demand and aquatic ecosystems. Changes in the timing and amount of precipitation and runoff could occur. Sea level rise could adversely affect the Sacramento-San Joaquin River Delta and coastal areas of the State.

Climate change is identified in the 2005 update of the California Water Plan (Bulletin 160-05) as a key consideration in planning for the State's future water management (DWR, 2005). The 2005 Water Plan update qualitatively describes the effects that climate change may have on the State's water supply. It also describes efforts that should be taken to quantitatively evaluate climate change effects for the next Water Plan update.

Sea level rise would conceptually affect water project operations by increasing the need for operations to repulse salt water intruding into the Delta. Such effects were not examined during preparation of the DWR report due to lack of existing tools for that type of analysis (current Work Team activities involve collaborations to develop these necessary tools). The report does discuss surrogates that provide indication of increased operation challenges associated with repulsing saltwater intrusion caused by sea level rise.

3.10.2 Environmental consequences

No Action

Under the No Action Alternative, there would be no impacts to climate change.

Proposed Action

Under the Proposed Action, the small construction element would not contribute to increased temperatures or sea level rise. The use of the Volta Wasteway is within the range of normal operations would have no impact on climate change.

Cumulative Impacts

Since there are no impacts to climate changes as a result of the Proposed Action, the Proposed Action would not contribute cumulative impacts to climate change.

Section 4 Consultation and Coordination

During preparation of this environmental assessment, the following agencies were coordinated with and/or assisted in preparing the document:

- U.S. Fish and Wildlife Service (Service)
- California Department of Fish and Game
- Grassland Water District
- San Luis Delta Mendota Water Authority
- State of California Historic Preservation Office (SHPO)

Endangered Species Act Section 7 Consultation

On October 26, 2009 Reclamation initiated formal consultation under Section 7 of the Endangered Species Act (ESA) with the United States Fish and Wildlife Service (USFWS), by submitting a Biological Assessment (BA) analyzing the impacts of the Proposed Action to the giant garter snake (ggs). A revised BA which included a Water Quality Monitoring Plan (WQMP) was submitted to the Service on March 17, 2010. Reclamation and the USFWS met on several occasions to discuss the WQMP and potential impacts to ggs. Ultimately, an agreement was reached on the WQMP and a biological monitoring plan to avoid and/or mitigate any impacts to ggs. The revisions to the WQMP resulted in Reclamation changing their determination of "*may affect, likely to adversely affect*", to a "*may affect, is not likely to adversely affect*" ggs . Reclamation requested informal consultation on May 26, 2010. The

USFWS concurred with Reclamation's determination on May 27, 2010. The USFWS concurrence memo is attached in Appendix C.

Reclamation consulted with USFWS on the applicability of the Fish and Wildlife Coordination Act. The Coordination Act Report is included in Appendix C.

National Historic Preservation Act Section 106 Consultation

Reclamation consulted with SHPO pursuant to Section 106 of the National Historic Preservation Act on January 22, 2010. Reclamation received a letter from SHPO on February 11, 2010 concurring with Reclamation's findings.

Public Review

The Draft EA and Finding of No Significant Impact (FONSI) were released for a 25-day public review period beginning on March 1, 2010 and ended March 26, 2010. The documents were posted on Reclamation's website. A press release was issued March 1, 2010 by the Bureau of Reclamation's Mid-Pacific Regional Public Affairs Office. Reclamation did not receive any comments on the Draft EA. The Final EA reflects edits based on ESA consultation with USFWS.

Section 5 List of Preparers and Reviewers

Tamara LaFramboise, Natural Resource Specialist, Bureau of Reclamation
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Amy Barnes, Archaeologist, Bureau of Reclamation
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Section 6 References

Bureau of Reclamation, U.S. Fish Wildlife Service, Calfironia Department of Fish and Game, and Grassland Water District. 2001. "*Final NEPA Environmental Assessment and CEQA Initial Studies. Refuge Water Supply Long-term Water Supply Agreements. San Joaquin River Basin*.

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U.S. Fish &Wildlife Service, 2006. Sacramento Fish and Wildlife Office. *Giant Garter Snake (Thamnopsis gigas) 5-Year Review: Summary and Evaluation*

U.S. Geological Survey. 2009. Groundwater Resources Program. Professional paper 1766. *Groundwater Availability of the Central Valley Aquifer, California*.

liter (mg/L). In two test holes drilled in the VWA, TDS range from 300 to over 1,500 mg/L. Based on this limited data, and discussions with local drillers familiar with the area, the water quality of the deep aquifer is highly variable. Elevated mineral or other constituents (e.g. Arsenic, Selenium, or Boron) may require that the groundwater be diluted or mixed with surface water to comply with Total Maximum Daily Load (TMDL) regulations and/or refuge water quality requirements.

Good water quality might be in the range of 1,000 - 2,500 micro-siemens (uS)/cm electrical conductivity (EC) and 700 - 1,700 mg/l TDS. Typically groundwater quality above 3,000 uS/cm can be used only after blending with better quality water supply. Reconnaissance test wells that were drilled close to the current site of Well 1 and approximately 1/2 mile east of the VWA gate revealed water of good quality sub-Corcoran at the first test well. Water at the second test well was of poorer quality and unsuitable for direct use within the VWA. . Production wells approximately one mile to the northwest and one mile to the southwest of the current Well 1 site also report water of good quality. These wells are actively pumping groundwater for use in the processing plants situated along Ingomar Grade. From this information it can be surmised that sub-Corcoran aquifer water quality generally improves as one moves west from the Ingomar Grade alignment. Wells drilled close to the alignment of the Wasteway might also benefit from slow recharge of good quality surface water from the Wasteway itself. Although these rates of recharge are likely very slow, over time these cross-Corcoran fluxes could help to improve water quality. Recharge to the aquifer beneath the Corcoran Clay is from the west.

San Luis Delta Mendota Water Authority

Water quality is highly variable within the service area of the SLDMWA. In general water deteriorates in water from west to east – with the poorest water quality in the trough of the Valley. In the Valley trough the presence of A and C clay lenses impede drainage and vertical flow – allowing more refluxing of shallow groundwater before it moves deeper into the lower semi-confined aquifer. Evidence of the suitability of groundwater for conjunctive use purposes can be found by observation of the number of groundwater wells in the SLDMWA service area. Production wells tend to be clustered in areas of good well yield and suitable water quality. The Central California Irrigation District (a 110,000 acre Irrigation District within the SLDMWA) operates several dozen district owned wells – these are mostly screened above the Corcoran Clay and located throughout the District west of the Valley trough.

3.3.2 Environmental Consequences

No Action

Under the No Action alternative, groundwater development would not occur at VWA. Reclamation would not fund the pilot project and production wells would not be installed at VWA. CVP surface water would not be delivered to SLDMWA. Groundwater use would continue as it presently does within SLDMWA.

Proposed Action

Monitoring data from the Ingomar Packaging Company indicates a range of water quality measurements. Groundwater quality data are necessary for the protection of groundwater

Appendix B – Project Monitoring Plan

FINAL PROJECT MONITORING PLAN

MAY 2010

VOLTA WILDLIFE AREA LEVEL 2 DIVERSIFICATION / INCREMENTAL LEVEL 4 DEVELOPMENT PILOT PROJECT

1. Introduction

The Central Valley Project Improvement Act (CVPIA) of 1992 requires that the Department of the Interior acquire additional water supplies to meet optimal waterfowl and wildlife habitat management needs on refuges within California's Central Valley. These refuges collectively encompass National Wildlife Refuges, State Wildlife Management Areas and the Grassland Resource Conservation District (GRCD). The Bureau of Reclamation (Reclamation) is acting on behalf of the Department of Interior to fulfill these requirements.

Specific water management goals have been determined for two independent water supply levels termed Level 2 and Level 4. Level 2 refuge water refers to the average amount of water the refuges received between 1977 and 1984. Level 4 water is the amount of water required for full development of the refuges based upon the management goals of individual refuges and wildlife areas, consistent with CVPIA 3406(d)1 and (d)2. Incremental Level 4 water is the difference between full Level 4 and Level 2 water supply. Level 2 refuge water is normally utilized between September 1st and March 15th where as the Level 4 supply is used for summer brood habitat maintenance and spring/summer irrigations. In order to meet goals associated the CVPIA, Reclamation desires to increase the use of alternative refuge water supply sources by diversifying Level 2 refuge water supplies while increasing local sources of Incremental Level 4 refuge water supply. The Volta Wasteway Level 2 Diversification/Incremental Level 4 Development Pilot Project (Pilot Project) is a three-year demonstration project to evaluate the feasibility of groundwater utilization to diversify a portion of Level 2 supply and to supplement Incremental Level 4 supplies to wildlife refuges within California's San Joaquin (SJ) Valley.

Wetlands in the Central Valley are intensively managed to produce standing crops of plants and invertebrates with high value to wildlife. An effective method of wildlife food production is moist soil management. Moist soil management includes the timing of hydro-periods to optimize germination and plant growth. Grassland Water District (GWD) is responsible for the annual delivery of over 180,000 acre feet (AF) of water to seasonal and semi-permanent federal, state and private wetlands within the GRCD. The 180,000 AF of water that the GWD is responsible for delivering is composed of 125,000 AF of Level 2 supply, and 55,000 AF of Level 4 supply. In 13 of 14 years, Reclamation has been unable to provide the 55,000 AF of Incremental Level 4 water deliveries annually, as required by the CVPIA of 1992. In 2008 and 2009 the GWD received less than 24% of its obligated Level 4 surface water supply. Level 4 water supplies are critical for the optimization of seed and biomass production, the health and survival of locally breeding shorebirds and waterfowl, the state and federally threatened Giant Garter Snake (GGS) and the productivity of the largest of California's remaining wetlands.

The Pilot Project proposes the installation of two deep groundwater wells to develop up to 2,000 AF between September 1, 2010 and February 28, 2011 in year 1 and potentially up to 5,000 AF/year in years 2 and 3 of new CVPIA Level 2 and Incremental Level 4 water supplies. The additional water developed through this Pilot Project would augment south of Delta shortages to the wetlands by annually supplying up to 2,500 AF of Level 2 and up to 2,500 AF of Incremental Level 4 supplies (years 2 and 3). Agricultural contractors would benefit by receiving up to 2,500 AF of Central Valley Project surface water annually made available by the groundwater pumping at Volta Wildlife Management Area (WMA).

Project Setting

The Volta Wasteway is located approximately six miles northwest of Los Banos in western Merced County (Figure 1). The Volta WMA is owned by Reclamation and has been operated by the California Department of Fish and Game (CDFG) since 1952 under a lease agreement. The Volta Wasteway is the primary supply canal for the Northern Division of the GRCD. Water is released from the Delta Mendota Canal (DMC) to the Wasteway through a variety of control structures for distribution throughout the Northern GRCD. The Wasteway conveys flows directly to the Volta WMA through lift pumps, and to the GRCD through releases out of control structures located in Pond 10[1]. Pond 10 structures are located at the terminus of the Wasteway and directly feed into the Santa Fe Canal Cross Channel, Mosquito Ditch and Malia Ditch. Wetlands in this region are typically flooded in late August to early September with flows in the Wasteway reaching 450 cubic feet per second (cfs). Wetland water elevations are maintained throughout the GRCD with maintenance flows from late October through the winter months to provide foraging and loafing habitat for waterfowl, shorebirds and other species. During the fall and winter maintenance flow periods, the Wasteway experiences flows up to 100 cfs. In the spring when soil temperatures are optimal for seed germination and successive plant growth, the wetlands are drained. Waters drained from these wetlands are conveyed to Mud Slough and Los Banos Creek which ultimately discharge to the San Joaquin River. Beginning in late April and continuing through the summer months, irrigation flows are delivered to the wetlands, filled and subsequently drained. During these periods the Wasteway can experience flows up to 150 cfs.

[1] Pond 10 and Field 10 are used interchangeably throughout this document.

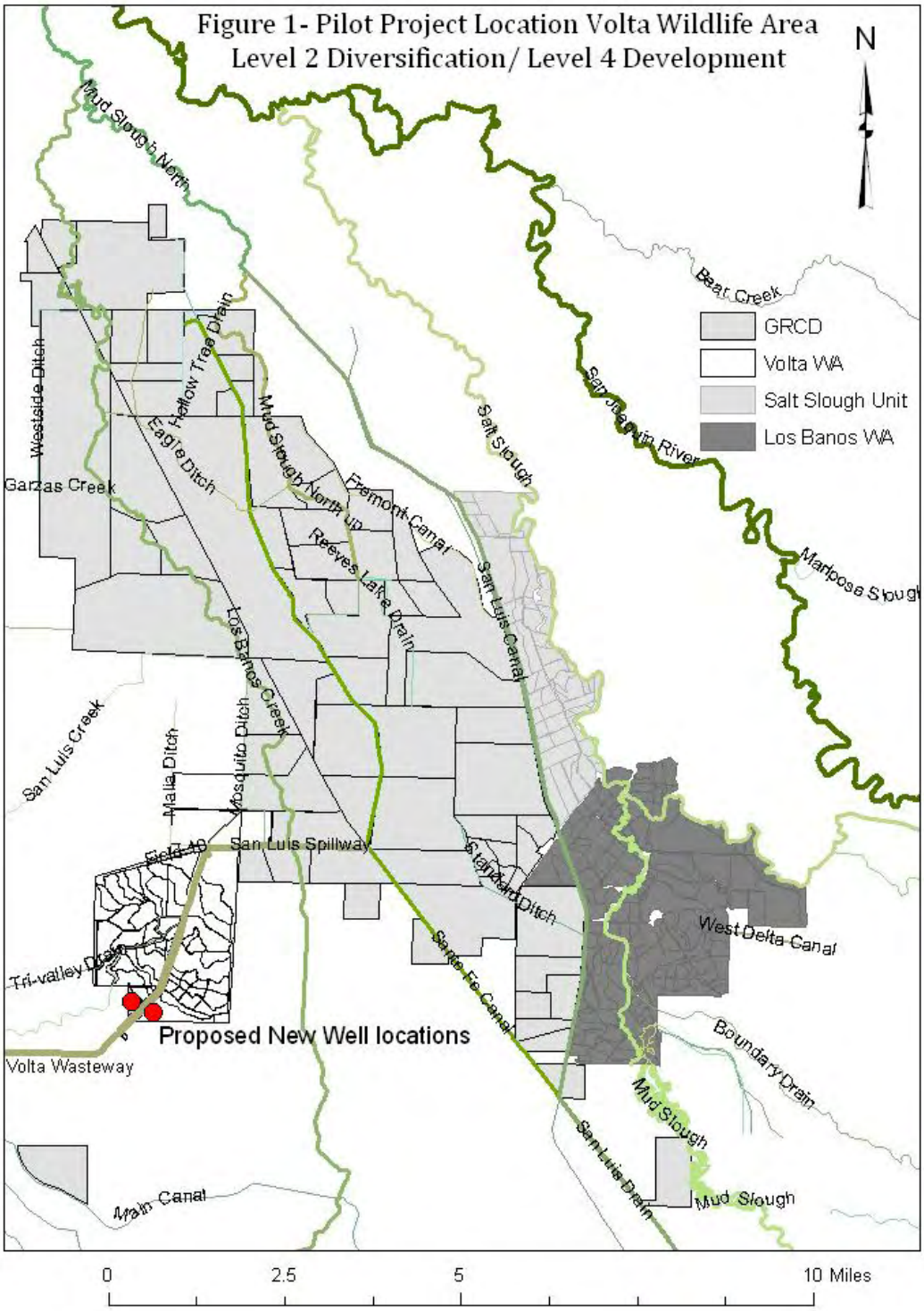
Figure 1- Pilot Project Location Volta Wildlife Area
Level 2 Diversification/ Level 4 Development
N
GRCD
Volta WA
Salt Slough Unit
Los Banos WA
Mud Slough North
Beat Creek
San Joaquin River
Mariposa Slough
Westside Ditch
Hollow Tree Drain
Eagle Ditch
Mud Slough North up
Salt Slough
Garzas Creek
Fremont Canal
Reeves Lake Drain
San Luis Canal
Los Banos Creek
San Luis Creek
Mosquito Ditch
Malia Ditch
Field 48
San Luis Spillway
Standard Ditch
West Delta Canal
Tri-valley Drain
Santa Fe Canal
Proposed New Well locations
Volta Wasteway
Boundary Drain
Mud Slough
San Luis Drain
Main Canal
Mud Slough
0
2.5
5
10 Miles

Project Objectives

The objectives of this Pilot Project are to: (1) develop a long-term groundwater supply that can be used to diversify CVP water supply sources and improve water supply reliability for CVP contractors, as well as supplementing Incremental Level 4 supplies for the SJ Valley Refuges, and (2) to confirm that the groundwater quality is acceptable for refuge use. Reclamation's goal is to pump up to 2,000 AF between September 1, 2010 and February 28, 2011 in year one, potentially producing up to 5,000 AF of groundwater per year (2011-2013) from this Pilot Project. Two production wells are to be installed and operated at maximum capacity (target of approximately 1,500 gpm per well) for three years. If target maximum capacity of 1,500 gpm per well is achieved, the two wells will produce 2,000 AF in 151 days of operation. Production well operation, timing and duration will be determined by Reclamation in coordination with GWD and CDFG based on water demand and both well and surface water quality. If the well operational goal of September 1, 2010 is achieved, as well as the target maximum capacity of 1,500 gpm, pumping could occur through January 29, 2011 but no later than February 28, 2011 in year one. In years two and three, Reclamation's goal is to pump up to 5,000 AF. The project water will be supplied to south of Delta refuges that are entitled to receive CVP water pursuant to Section 3406(d) of the CVPIA, show a demonstrated need or shortfall, and can receive the water by direct delivery from the Volta Wasteway.

Project Viability

The key elements of project viability are the sustainable yield of the two new production wells to be screened below the Corcoran Clay and the quality of the water ascertained. Surface water and production well water quality monitoring will determine if and when adequate surface water dilution is available to meet State Water Resource Control Board's (SWRCB) water quality objectives outlined in the Central Valley Basin Plan and determine timing of well usage. This Project Monitoring Plan describes the data to be collected during the three-year demonstration period to address the project objectives and assess the long-term viability of the project.

2. Hydrogeologic Setting

The Volta WMA is located in the Merced sub-basin of the San Joaquin Valley basin. Groundwater supplies are present in unconsolidated deposits extending to 900 feet or more below grade. An upper, semi-confined aquifer extends from approximately 50 feet to 250 feet below grade. The Corcoran Clay, a regional aquitard that acts as a semi-confining unit, separates the upper semi-confined aquifer from deeper alluvial deposits, which form the lower confined aquifer. In the project area, the Corcoran Clay is found at approximately 250 feet to 450 feet below ground surface (bgs).

Wells screened in the semi-confined aquifer above the Corcoran Clay are likely to be in hydraulic communication with overlying surface water features, such as the Volta Wasteway and wetlands areas in the Volta WMA. Wells screened in the lower confined aquifer are not as likely to be in communication with surface water resources. Due to the potential mixing of waters between the two aquifer units, the Merced County Environmental Health Department (MCEHD) prohibits the construction of wells that are open to both aquifers within the same borehole.

Aquifer Yields

High-capacity wells screened in the lower confined aquifer in the vicinity of the Volta WMA reportedly yield from 1,000 to 1,500 gpm and as high as 2,000 gpm. Well yields are known to vary considerably in this area.

Groundwater Quality

The groundwater quality within the Merced sub-basin varies with location and depth both within the upper semi-confined and lower confined aquifers. In the lower confined aquifer, total dissolved solids (TDS) concentrations generally range from 100 to 3,600 milligrams per liter (mg/L). In two test holes drilled in the Volta WMA, TDS ranged from 300 mg/L (near the southern property boundary in close proximity to the proposed well locations) to over 1,500 mg/L (near the northern property boundary approximately 3 miles from proposed well locations). Wells operated by a local food processing plant yield groundwater from the lower confined aquifer with TDS concentrations ranging from 570 mg/L to 2,000 mg/L and electrical conductivity measurements ranging from 1,000 to 3,400 micro-Siemens (µS). Based on this limited data, and discussions with local drillers familiar with the area, it is evident that the water quality of the lower confined aquifer is variable throughout the Merced sub-basin.

According to MCEHD and the California Regional Water Quality Control Board, Central Valley Region (CRWQCB-SJR), constituents other than TDS that can affect water quality in the area include dissolved metals and nutrients.

3. Project Monitoring Plan Objectives

To meet the overall project objectives, this Project Monitoring Plan has the following objectives: (1) identify the data to be collected during the three-year Pilot Project to evaluate the overall project objectives; (2) specify the data collection procedures; and (3) clarify the responsibilities for data collection and interpretation for implementation of the Project Monitoring Plan. The information collected, interpreted, and reported in this monitoring program will address the project objectives for this Pilot Project.

There are four primary components that will be monitored as part of this program. These components are as follows:

- Hydrogeology – groundwater supply issues associated with the extraction and discharge of groundwater to the Volta Wasteway. This Project Monitoring Plan specifies the data to be collected to evaluate (1) the performance of the two new wells (i.e., well efficiency and long-term yield), (2) the affect the wells have on the surrounding area (i.e., radius of influence and potential interference between the two wells), and (3) whether there is any potential interconnection across the Corcoran Clay between the upper semi-confined and lower confined aquifers as well as within vertically separated water-bearing zones within the upper semi-confined aquifer.

- Water Quality – both ambient groundwater quality in the upper semi-confined and lower confined aquifers and potential changes to surface water quality in the Volta Wasteway due to the discharge of groundwater. This Project Monitoring Plan provides procedures for collecting and analyzing groundwater samples for a range of constituents to initially characterize and then monitor water quality during the three-year demonstration period.

- Biological – monitoring and evaluation of GGS is necessary to determine what effect, if any, the Pilot Project will have on existing GGS populations. This Project Monitoring Plan provides parameters to explore mechanisms leading to population or habitat change, if any, to GGS at the Volta WMA.

- Ground Subsidence – the potential lowering of the ground surface elevation due to the removal of groundwater from beneath the Corcoran Clay. Subsidence monitoring procedures will be developed by Reclamation in consultation with the U.S. Geological Survey (USGS).

4. Implementation Responsibilities

The overall implementation of this Project Monitoring Plan is the responsibility of Reclamation. The specific responsibilities for implementation of the four main components noted previously are as follows:

- Hydrogeology – Each Volta well will have a cluster of monitoring wells that will be outfitted with vented pressure transducers permanently connected to a data logger and tethered EC probes with on board logging. The GWD Water Quality Monitoring Plan (WQMP) will be responsible for the collection and transmission of data to Reclamation (specifically a technical consultant from Lawrence Berkeley National Laboratory under contract to Reclamation; Reclamation contractor). The Reclamation contractor will be responsible for the interpretation, and reporting of the hydrogeologic data. The GWD

WQMP will be supported by Reclamation for the collection of water level, groundwater pumping (i.e., pumping rate and total volume), and electricity use data.

- Water Quality – the GWD WQMP and Reclamation (specifically the Reclamation contractor) will share the responsibility for implementation of this component. The GWD WQMP will be responsible for the collection, storage and transmission of EC, Flow, and grab sample water quality data to the Reclamation contractor. The Reclamation contractor will be responsible for the interpretation and reporting of discrete groundwater and surface water quality data. The Reclamation contractor will be responsible for the selection of monitoring equipment to measure and log groundwater extraction rates of the water at the production wells. Each well will be outfitted with a digital output totalizing flow meter and a data logger to insure the preservation of data. The GWD WQMP will continue to be responsible for the collection, storage and transmission of data from the existing real time surface water monitoring station located downstream of Field 26. Reclamation will be responsible for the purchase of equipment at each production well. The GWD (with assistance of the Reclamation contractor for troubleshooting) will be responsible the installation and maintenance of the instrumentation for the monitoring stations at each production well.

- Biological - Reclamation proposes that a USFWS-approved giant garter snake (GGS) research scientist (with required USFWS Section 10(a)(1)(A) and CDFG scientific collecting permit(s) conduct biological monitoring at the Volta WMA in conjunction with Pilot Project. The monitoring and evaluation is necessary to determine what effect, if any, the Pilot Project will have on existing GGS populations. The current GGS population at Volta is one of the few extant populations in the San Joaquin Valley and therefore conservation of this population is paramount to the range-wide recovery of this species.

- Ground Subsidence – Reclamation (specifically the Reclamation contractor) will be responsible for coordinating with the USGS for the collection, interpretation, and reporting of ground subsidence data in the Volta WMA.

GWD will be responsible for maintaining the project water quality database, conducting initial quality assurance and quality control reviews of the data, and producing data transmittal reports to the Reclamation contractor and Reclamation. The Reclamation contractor will assist GWD with improvements to data management procedures over the project term. The GWD WQMP, with the assistance of the Reclamation contractor, will produce a final evaluation report, which will be delivered to Reclamation following completion of the demonstration project.

5. Scope of Work

The Pilot Project will be assessed by collecting hydrogeologic, water quality, biological, and subsidence data within the Volta Wasteway and at the Volta WMA, as described below.

Hydrogeology

Two water production wells are to be installed and operated at maximum capacity (target of approximately 1,500 gpm per well) for three years. If target maximum capacity of 1,500 gpm per well is achieved, the two wells will produce 2,000 AF in 151 days of operation. Production well operation, timing and duration will be determined by Reclamation in coordination with GWD and CDFG based on water demand, well and surface water quality, and habitat quality. Prior to the initiation of pumping in year one, baseline depth to water measurements will be taken manually using an electronic water level indicator in the two production wells. During the first month of operation, continuous hourly depth to water measurements will be taken in the two production wells. The GWD WQMP will also collect manual Quality Assurance (QA) depth to water measurements using an electronic water level indicator on a daily basis within the first week of operation, weekly within the first month of operation, and monthly during the operation period. Each well will have a cluster of monitoring wells that will be outfitted with vented pressure transducers permanently connected to a data logger and a tethered EC probe with on board logging. Continuous (hourly) data will be collected at the five Volta monitoring wells (2 clusters of wells; shallow semi-confined, deep semi-confined and sub-Corcoran). Monitoring well EC data will be downloaded on a monthly basis from the tethered probes. During the year one operation period (September 1, 2010-February 28, 2011), the GWD WQMP will collect continuous flow measurements (flow rates and totalizer digital output to data logger) from the two production wells. Hourly rainfall and evaporation pan data will be collected at a site closest to the production wells. Reclamation will obtain electricity use information throughout the operation period in bills received directly.

Water Quality

SALINITY THRESHOLD & POINTS OF COMPLIANCE

The Volta Wells EC pumping threshold will be the California Department of Fish and Game 5-year Observed Monthly Mean EC + Mean Standard Error (EC Threshold) derived from weekly grab samples from 2005-2009 at the Volta Wasteway Bridge (Table 1.0). The 30 day running average, as measured at the downstream compliance point located at the Volta Wasteway Bridge Real Time Monitoring Station, will be used to determine if the Wasteway EC concentration has exceeded the EC Threshold and will determine well operation for the week(s) to come. A Salinity Threshold Exceedance Provision (STEP Threshold) allows pumping to occur when well water provides salinity dilution to Wasteway surface water, as measured at the newly proposed upstream Real Time Monitoring Station/ Grab Sample Location (Figure 2.0). Thus, if the EC at the Volta Bridge is below

the EC Threshold well pumping is allowed; if the EC at the Volta Bridge is above the EC Threshold but the well water EC is equal to or below the STEP Threshold (EC in the Wasteway upstream of the wells) pumping is allowed; if the EC at the Volta Bridge is above the EC Threshold and the well water is above the STEP Threshold no pumping is allowed the coming week(s).

Table 1.0- Volta Wells EC Pumping Threshold – 5 Yr MONTHLY MEAN EC + 5 Yr MEAN SE (108)
SE(Standard Error) = 5 Year Mean of observed variance of weekly grab sample EC data applied to 5 Year Monthly Mean EC to establish EC Threshold. 30 Day Running Average Compliance Monitored Weekly.

VOLTA WASTEWAY SURFACE WATER QUALITY DEGRADATION AVOIDANCE PROTOCOL								
MONTHLY MEAN EC DATA FROM WEEKLY CDFG GRAB SAMPLES WASTEWAY BRIDGE, VOLTA WMA 2005-2009								
Month	2005	2006	2007	2008	2009	MONTHLY MEAN EC 2005-2009	MEAN SE 2005-2009	MONTHLY MEAN EC+ MEAN SE 2005-2009
Jan	n/d	1607	942	1550	1321	1355	108	1463
Feb	n/d	966	1664	1207	1446	1321	108	1429
Mar	n/d	1510	1465	1721	1627	1581	108	1689
Apr	1690	1836	1387	1625	1620	1631	108	1739
May	897	824	597	897	956	834	108	942
June	543	712	762	1038	1299	871	108	979
July	718	1059	1246	1161	1187	1074	108	1182
Aug	713	598	1492	912	1089	961	108	1069
Sep	489	389	610	606	583	535	108	643
Oct	487	418	594	725	1038	652	108	760
Nov	760	658	629	1100	n/d	787	108	895
Dec	875	728	1126	1350	n/d	1020	108	1128
Pilot Project Year 1 pumping duration (September 1 - Feb 28) - Giant Garter Snake Prey Avoidance Precaution								
EC Threshold = 5 yr Monthly Mean EC + 5 yr Mean Standard Error observed from 2005-2009 > Pumping Ceases								
Pumping will CEASE at Production Wells if 5 yr Monthly Mean EC + 5 yr Mean SE Threshold is exceeded								
< 5 yr Monthly Mean EC + 5 yr Mean SE Observed from 2005-2009 - Pumping OK								
Threshold Exceedance Provision = Pumping when well WQ < Wasteway WQ (upstream monitoring station)								
EC Compliance Point @ Wasteway Bridge Downstream of Production Wells								
SE= STANDARD ERROR EC= Electrical Conductivity n/d= NO DATA								
WQ= Water Quality (EC & Constituent Concentrations) Constituent= Se, B, Hg								

SALINITY MONITORING & THRESHOLD COMPLIANCE

1) The Downstream EC Threshold Compliance Point will be located at the Wasteway Bridge Real Time Water Quality Monitoring Station (See Figure 2.0).

2) Pumping will be allowed when the ambient Wasteway surface water EC is no greater than the CDFG observed 2005-2009 Monthly Mean EC + the Mean Standard Error. The 30-day running average, analyzed on a weekly basis, will be used to determine whether salinity concentration has exceeded the allowable EC trigger and determine well operations in the week(s) to come.

3) The Upstream Real Time Water Quality Monitoring Station and Grab Sample Collection Point will be located >0.25 miles upstream of the well discharge points (See Figure 2.0). The baseline water quality data collected at the upstream sample location in combination with well head water quality data will determine if well discharge can improve salinity concentrations in the Volta Wasteway surface water.

4) In an effort to improve ambient Wasteway surface water quality, a Salinity Threshold Exceedance Provision (STEP Threshold) will override the surface water EC threshold. This provision will allow pumping during times when the ambient water quality produced by either production well provides salinity dilution to surface water delivered to the Volta WMA (defined as the 30-day running average EC) as measured at the Wasteway Upstream Real Time Water Quality Monitoring Station (See Figure 2.0).

5) An assessment of salinity inputs from outside the Volta WA will be conducted. In particular, how do facilities, subsurface drainage, surface discharges, or other activities adjacent to the Volta Wasteway and the Tri-valley Drain impact salinity. This should include an assessment of how wetland management practices impact salinity levels at the Wasteway Bridge (e.g. do seasonal wetland drawdowns in February/March drive EC levels at the Wasteway Bridge or are off-site sources the driving factors).

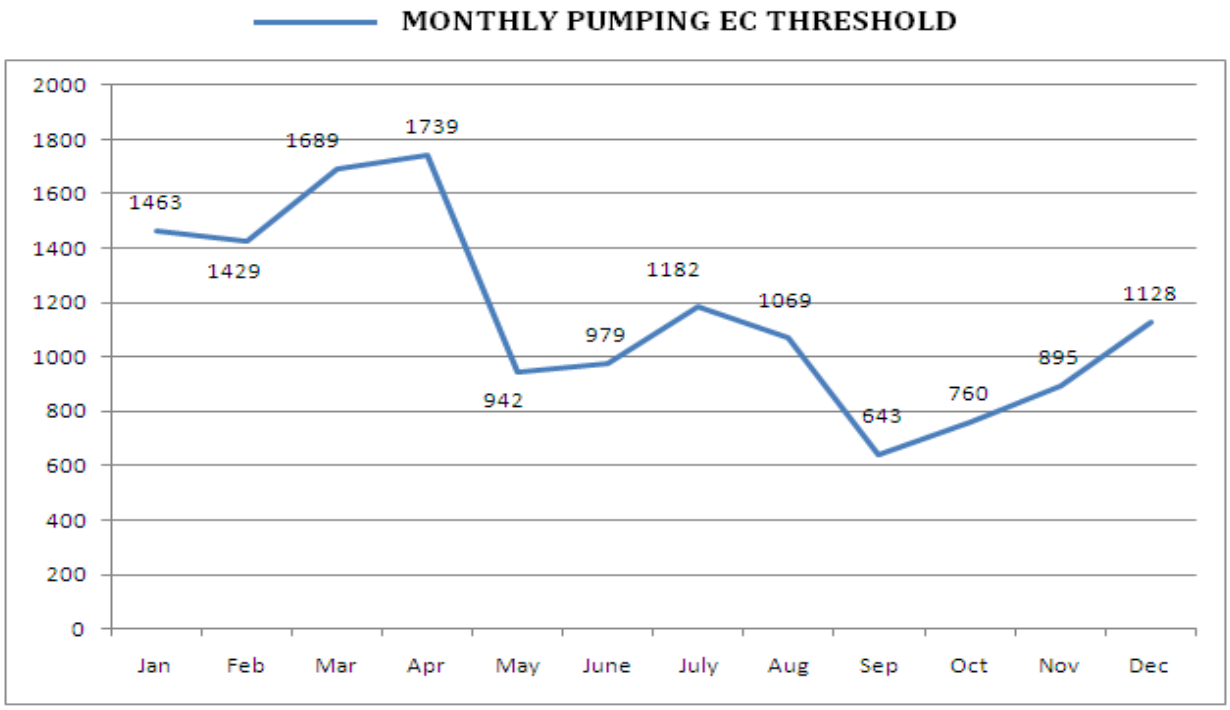

Figure 1.0- EC Threshold (CDFG Observed 2005-2009 Monthly Mean EC + 5 Yr Mean Standard Error)

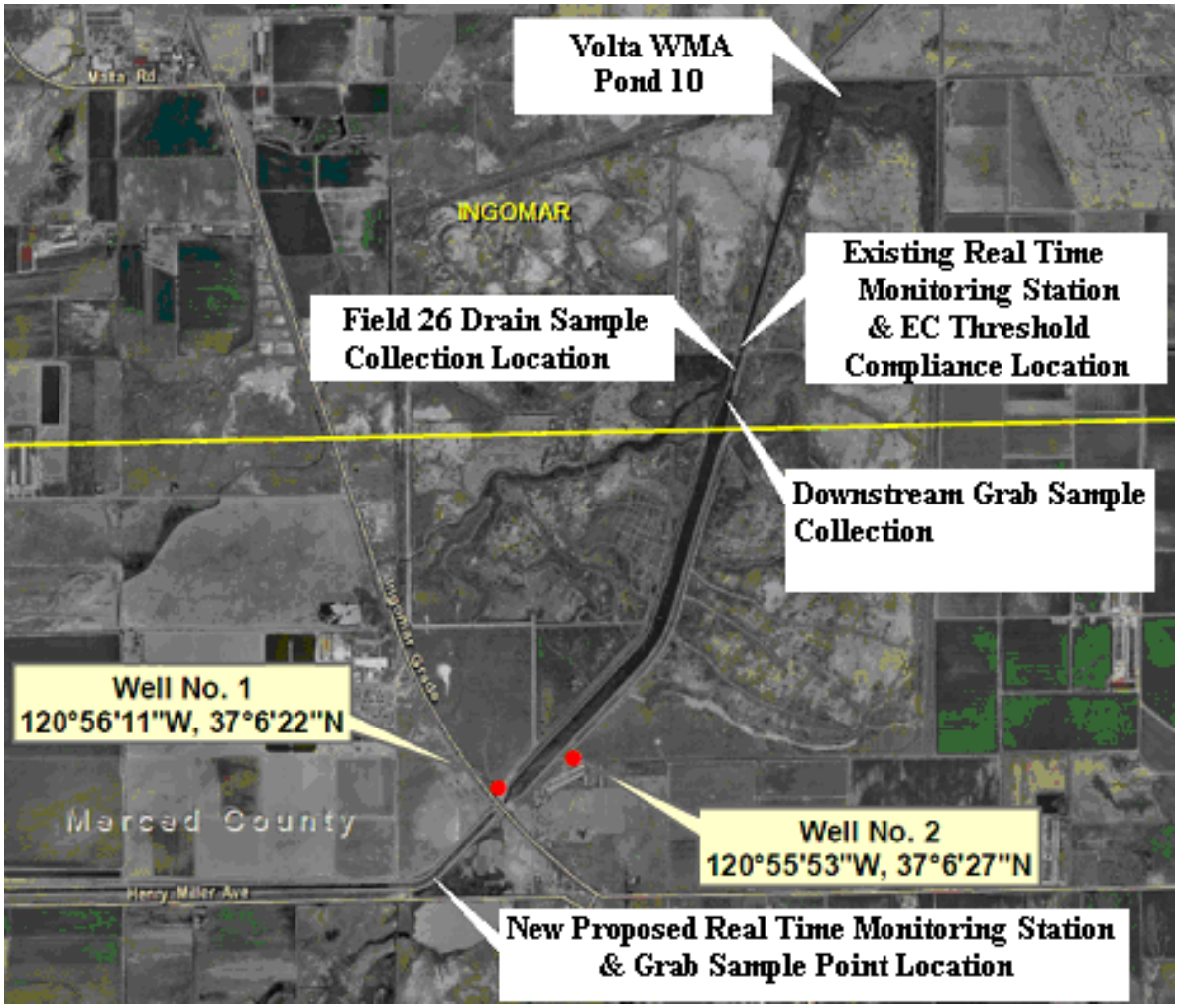

Figure 2.0 – New Proposed Upstream Monitoring Station / Sample Collection Location; Existing Downstream Real Time Monitoring Station/ Sample Collection Locations; Field 26 Drain Sample Location; Downstream Salinity Compliance Location; Year 1 Constituent Compliance at Well Heads.

CONSTITUENT MONITORING & THRESHOLD COMPLIANCE

1) In an effort to comprehensively characterize the sources of and the relative ambient constituent concentrations, weekly grab sampling will occur in the first month of pumping and monthly throughout the Pilot Project Year 1 Giant Garter Snake Prey Avoidance Restricted Pumping Duration (September 1, 2010- February 28, 2011) Samples will be collected at the:

    - Upstream Monitoring Station
    - Production Well Heads
    - Downstream Grab Sample Location (upstream of the field 26 drain)
    - Field 26 Drain

2) Interim grab sample collection and analysis of production well head discharge constituent concentrations (Se, B, Methyl Hg, LL Hg, Total Hg) and upstream surface water constituent concentrations, will be conducted at the downstream grab sample location (upstream of the Field 26 drain- See Figure 2.0), to insure the State Water Resource Control Board water quality objectives outlined in the Central Valley Basin Plan and in the Lower San Joaquin River Total Maximum Daily Load are met. The thresholds for the following water quality constituents should be met for the pumped groundwater at the production well heads:

    - Selenium: 2.0 ug/L
    - Methyl Mercury should not exceed Volta Wasteway Methyl Mercury levels at the upstream sample point location.
    - Boron:
        1. Irrigation season (March 15 – September 15)
            a. 0.8 mg/L (monthly mean)
            b. 2 mg/L (maximum)
        2. Non-irrigation season (September 16-March 14)
            a. 1 mg/L (monthly mean)
            b. 2.6 mg/L (maximum)

3) At the end of the Pilot Project Year 1 Giant Garter Snake Prey Avoidance Restricted Pumping Duration (September 1, 2010- February 28, 2011), Reclamation in consultation with SLDMWA, GWD, CDFG, the research scientist who conducted the GGS monitoring, and the USFWS will evaluate the water quality monitoring and biological (GGS) data. Adjustments to the use of the

Volta wells; refinement of water quality monitoring, and implementation of measures to further protect and enhance GGS and associated habitat will be incorporated.

4). General Minerals (anions and cations, Nitrate, TDS, EC, and Trace Elements (Se, B, As, U, LL Hg, M Hg, Total Hg) will be collected as previously agreed. Interim surface and production well water quality samples will be analyzed for general minerals, nutrients and TDS, unless the baseline sampling event indicates that metals or organics are of potential concern.

THRESHOLD QUALIFICATIONS

Reclamation recognizes that salinity and other constituent levels in water are both spatially and temporally dynamic, thus, Reclamation believes an adaptive approach that provides flexibility in water operations while addressing salinity and other water constituent conditions in the Volta Wasteway is beneficial. Such an approach requires the collection of important ground and surface water quality data. The monitoring plan and water quality-based thresholds are specific to the Volta Project and are not intended to establish set water quality thresholds for other water conveyance systems. Reclamation worked with the project proponents and the Service to develop the monitoring plan and thresholds specifically in response to the proximity of the project to one of the few breeding GGS populations within the San Joaquin Valley and water conditions within the Volta Wasteway. These thresholds are based on constituent levels within the Volta Project conveyance channels and at the well heads, and take into consideration dynamic conditions associated with many factors such as, but not limited to, flow, seepage, runoff, water management operations, and water table influence. Other projects should be evaluated independently and water quality thresholds for those projects should be based on project objectives, habitat conditions, species of concern, management goals, and water quality conditions in the associated conveyance system.

Biological Monitoring

Reclamation's Biological Assessment (March 2010) describes the following practices that will be implemented to minimize environmental impacts to GGS:

- Disturbance of vegetation shall be kept to a minimum.
- No debris, soil, etc., other than that already present within the well shall be allowed to enter the water.
- No equipment shall be operated in stream channels.
- No intentional harassment, killing, or collection of plants or animals at or around the work sites is allowed.
- No firearms are allowed on site, except for those used by peace officers or CDFG wardens.
- No pets allowed.

- All persons must stay within the boundaries of the work sites, which consist of the top of the levees, walkways, public and private roadways and waters, and water-side levee slopes.

- No off-road travel or work is permitted; all vehicles must be confined to existing levee roads.

- All trash, including food-related trash and cigarette butts, must be properly disposed of and removed.

- Storage of hazardous material, such as fuel, oil, etc. shall not be allowed within 150 feet of waterways. Any chemical spills must be cleaned up immediately and reported to the Service as soon as possible.

Reclamation's Biological Assessment adopts the following Service guidelines which shall be implemented:

- Confine movement of heavy equipment to existing roadways to minimize habitat disturbance.

- Construction activity within habitat shall be conducted between May1 and October 1. This is the active period for the snake and direct mortality is assumed to be lessened, because snakes sometimes move to avoid danger.

- Confine clearing to the minimal area necessary to facilitate construction activities. Flag and designate avoided giant garter snake habitat within or adjacent to the project area as Environmentally Sensitive Areas. This area should be avoided by all construction personnel.

- Construction personnel shall receive FWS-approved worker environmental awareness training. This training instructs workers to recognize the snake and its habitat(s).

- The project area shall be surveyed for GGS 24 hours before construction activities. Survey of the project area should be repeated if a lapse in construction activity for two weeks or greater has occurred. If a snake is encountered during construction, activities shall cease until appropriate corrective measures have been completed or it has been determined that the snake will not be harmed. Report any sightings and any "take" to the FWS immediately by telephone at (916) 414-6600.

Pilot borings are to precede the production well boring. Associated with these borings will be a mud pit, dug with a backhoe. The Service believes these actions may result in take of GGS. Therefore Reclamation shall provide barriers impenetrable by GGS from neonate to adult body size such as silt fencing that would prohibit entry or perhaps accidental entrapment of the giant garter snake in the mud pit. It is not clear as to the final disposal of drill cuttings other than that a location will be determined in consultation with Reclamation and CDFG which implies a location on Volta WA.

Cuttings shall not be placed in an area that may impact GGS individuals, their aquatic or upland habitat (i.e., within 200 feet of aquatic habitat).

After completion of construction activities, Reclamation shall remove any temporary fill and construction debris, and wherever feasible, restore, disturbed areas to pre-project conditions. Restoration work may include replanting species removed from banks or with emergent vegetation in the active channel. Concrete pads and locking steel monuments would be installed around the monitoring wells.

The initial water may contain high loads of sediment and constituents of Boron, Arsenic, Selenium, Mercury and more. The production wells would be sampled for the presence of selected constituents (e.g., boron, arsenic, selenium, total mercury, and methylmercury) following well development and prior to performing the aquifer tests. Results of the analyses shall be available for review by the Service prior to performing the aquifer tests. The water quality results may factor into the management decision for the large volume of water to be discharged during the aquifer tests.

BIOLOGICAL EVALUATION PLAN

Reclamation proposes that a USFWS-approved giant garter snake (GGS) research scientist (with required USFWS Section 10(a)(1)(A) and CDFG scientific collecting permit(s) conduct biological monitoring at the Volta WMA in conjunction with the Pilot Project. The monitoring and evaluation is necessary to determine what effect, if any, the Pilot Project will have on existing GGS populations. The current GGS population at Volta is one of the few extant populations in the San Joaquin Valley and therefore conservation of this population is paramount to the range-wide recovery of this species. The small number of snakes in this population requires sophisticated techniques for detecting changes in population abundance. Additionally, precise mark/recapture estimates are precluded by low recapture probabilities typical of GGS. Recent statistical developments by USGS scientists allow estimation of population size when mark/recapture estimates are not practical (Halstead et al. in press 2010). These developments are very recent and require a Bayesian statistical approach. Any such statistical analysis shall be undertaken by the research scientist. To explore mechanisms leading to population or habitat change, data shall be collected on the following:

1. GGS habitat condition assessment
2. Population survey via floating minnow trap capture and release (use of PIT tags/microbranding)
3. Prey type and relative abundance
4. GGS distribution
5. Water temperature monitoring including new well water
6. Occupied habitat assessment

7. GGS health assessment (body condition observations)

8. Food chain assessment and condition

9. Reporting and recommendations for management actions

USFWS and the research scientist will confer on a data collection design that examines contaminants in animal body tissue. The research scientist will implement or will oversee implementation of that data collection over the three year biological evaluation period.

An effective evaluation must include establishing baseline data (i.e., species presence and abundance, size/age and gender distribution, etc.) prior to project implementation for comparison with post-project conditions. In order to evaluate the response of GGS to groundwater pumping at Volta WMA, the study will be conducted annually for a three-year period (the life of the pilot project). The following sections further describe how the evaluation plan will be implemented:

1. GGS Habitat Condition Assessment

The habitat condition assessment may evaluate all or some of the following baseline conditions: aquatic vegetation, cover, water temperature, water velocity, thermo-regulatory habitat, and relative access to upland habitat. Habitat variables will be quantified at GGS sampling locations.

2. Population Survey

A population survey of GGS shall commence as soon as possible and no later than June 2010. The survey shall extend throughout the three-year pilot project. Initial data will be collected prior to construction of the groundwater wells and shall continue following construction and operation of the wells. The survey will use modified floating minnow traps and other methods if determined to be warranted by the research scientist. Captured snakes will be marked (PIT tags/microbrand) and immediately released. This data will be analyzed to estimate the size of the Volta population of GGS over the three year period.

3. Prey Type and Relative Abundance

Prey type (fish, frogs, tadpoles) will be sampled in the same modified floating traps set for GGS annually and their relative abundance determined. Baseline sampling will occur prior to construction annually during the three-year pilot period. Representative samples of prey items will be sent to a lab and analyzed for levels of contaminants of concern to USFWS (e.g., selenium, mercury *see* Wylie *et al.* 2009).

4. GGS Distribution

Sampling shall determine the dynamic spatial distribution of GGS in all areas receiving the Pilot Project pumped water within Volta WMA.

5. Water temperature monitoring

Temperature evaluation will occur prior to initial well development and during groundwater pumping throughout the three-year pilot period.

6. Occupied Habitat Assessment

The final report shall detail areas where GGS were located and where they were not and provide restoration recommendations as to how to improve habitats and suitability for GGS.

7. GGS Health Assessment

During population surveys, GGS body condition will be compared to known values reported in the literature. These measurements will be obtained over the entire three year period to assess any apparent changes over time. In addition, snakes will be visually inspected for lesions or parasitic cysts and analyzed for temporal changes.

8. Food Chain Assessment and Condition

A food chain assessment and condition shall include an examination of effects due to the change in water regime, including but not limited to water velocities. Results from part #3 above will be used to compare the prey base at Volta to other sites with existing GGS populations.

9. Reporting and Recommendations for Management Actions

Preliminary reports shall be produced and provided following each of the three years of the Pilot Project. These shall be combined into a final report due no later than eight months after the end of the 3-year Pilot Project. The report shall include management recommendations to conserve and enhance the Volta GGS population. Copies shall be provided to the Service and the California Department of Fish and Game. If GGS populations are determined by the research scientist to be adversely affected due to the Pilot Project, this information shall be provided in writing within one calendar week. If the Pilot Project results in "take" at any time during the three years, this information shall be provided within 24 hours. No "take" incidental or otherwise is authorized with this document.

Ground Subsidence

The Reclamation contractor will coordinate with the USGS to collect ground surface elevation data (INSAR time-series data) in the vicinity of the two production wells to assess the potential for land subsidence due to groundwater extraction. A schedule for collection of the subsidence data will be determined. Reclamation will provide USGS data to the Authority, GWD WQMP and CDFG for their evaluation.

6. Field Data and Sample Collection

The various team members will strive to minimize hand-entered data and provide electronic data that can be efficiently entered into project database housed at the GWD in a timely fashion. Electronic forms will be developed and used to collect basic site information at each site visit. Data quality assurance checks will also be entered into the project database. This database will be backed up and shared with the Reclamation contractor monthly or an as needed basis. The GWD WQMP will record hydrogeologic and well sampling information on project-specific electronic field logs, included in Appendices A and B. These data will also be entered into the project database.

Hydrogeology

Monitoring wells will be outfitted with vented pressure transducers and the data reported to a data logger (logged hourly) installed adjacent to each well. Monitoring wells will also be outfitted with tethered EC probes with on board logging and down loaded on a monthly basis. The GWD WQMP will collect manual QA depth to water measurements using an electronic water level indicator on a daily basis within the first week of operation, weekly within the first month of operation, and monthly during the operation period. The GWD WQMP will all collect depth to water measurements, no less than 24 hours after the onset of operation and no less than 24 hours after the end of the operational period, to characterize ground water recovery and residual drawdown of the two production wells. Each production well will be outfitted with a totalizing flow meter, solar powered data logger and security enclosure. Flow data will be logged continuously on an hourly basis. Prior to collecting the water level measurements from each production well during the pumping season, the flow rate, total flow, and electric meter reading will be recorded in the electronic field log. The procedure for groundwater level measurement and the project field log form can be found in Appendix A. If early monitoring events indicate greater variability than expected, additional monitoring events may be added.

Water Quality

The GWD WQMP will collect water samples for laboratory analysis from the two production wells and the Volta Wasteway as described above prior to the first day of pumping (baseline sampling event). Sampling procedures are briefly described below. A detailed description of the sampling procedures, monitoring well purging requirements and a project field log form are included in Appendix B.

- Production Well Sampling- Baseline production well grab sampling will be conducted in conjunction with USGS during the installation of each well. Interim, monthly water samples from the two production wells will be collected using the sample tap installed at each wellhead. To collect a sample, staff will open the tap and allow a minimum of 10 gallons of water to run through the tap. Once the sample tap has been purged, and clear

water is being produced, staff will fill the laboratory-supplied sample bottles directly from the tap. Field water quality parameters (temperature, pH, and EC) will be measured during the sample collection process. Samples will be stored in a cooler containing ice until they are delivered to the analytical laboratory. Temperature and EC will be continuously logged on an hourly basis throughout the duration of the project.

- Monitoring Well Water Quality- Tethered EC probes will continuously log data throughout the duration of the project and will be manually downloaded on a monthly basis.

- Volta Wasteway Sampling- Samples will be collected using a sample bottle connected to an extension pole. The water will then be transferred to laboratory-supplied sample bottles. Samples will be stored in a cooler containing ice until they are delivered to the analytical laboratory. Field water quality parameters will be measured during the sample collection process.

Biological Monitoring

Reclamation, in conjunction with USFWS and CDFG, will be responsible for the collection, interpretation, and reporting of GGS habitat (physical and biological) information in and around the Volta Wasteway and the Volta WMA.

Land Subsidence

The USGS will collect ground surface elevation data (INSAR time-series data) in the vicinity of the two production wells in accordance with the plan to be developed by Reclamation.

Operational Information

Production well operation, timing and duration will be determined by GWD and CDFG based on water demand, well and surface water quality, and habitat quality. In year one, pumping will occur between September 1, 2010 and February 28, 2011 and will not exceed 2,000 AF. If the well operational goal of September 1, 2010 is achieved, as well as the target maximum capacity of 1,500 gpm, pumping could occur through January 29, 2011 but no later than February 28, 2011 in year one. In years two and three, Reclamation's goal is to pump up to 5,000 AF.

During sampling or monitoring events, the status of the production wells, monitoring wells, and operating equipment will be recorded in an electronic form and photo documented periodically. These data will also be entered into the project database. Broken, damaged, vandalized and/or otherwise inoperable equipment and appurtenances will be immediately reported to Reclamation by the person who observed the damage. Field records will also note any maintenance performed on the equipment.

The condition of the erosion control features will also be recorded and photo-documented during each sampling or monitoring event. As part of the habitat observations to be conducted, appropriate environmental conditions of the Volta Wasteway and the Volta WMA will be photo-documented.

7. Data Collection and Management

The GWD WQMP will collect data as described previously throughout the project duration. Field data will be entered into a master project database and protocols developed for electronic sharing of this data. The Reclamation contractor will provide technical assistance to improve the database management system through the course of the study. Electronic data will be obtained from the analytical laboratory, the monitoring stations, the USGS INSAR database, and local weather station and this will also be entered into the master project database. Field data will include water level and field water quality measurements, well purging and sampling information, and environmental and biological observations. These data will also be entered into the master project database.

Electronic Data

Throughout the duration of the project, electronic data will be downloaded from multiple sources as described above. Each data source will have a unique set of download and data quality control procedures. The specific procedures are provided below.

- Laboratory data – will be uploaded to a data validation program to ensure completeness. Once the data has been electronically validated, the data file will be uploaded to the project-master database. A summary report will be generated and validated against the PDF file provided by the laboratory. The Reclamation contractor will be provided with copies of the validated quarterly via e-mail.

- Real Time Monitoring Station data – will be downloaded by the GWD WQMP as an ASCII text file. This data will be uploaded to a data quality validation program and adjustments made to the data to match QA checks. The QA validated data will be uploaded to the master project database and a summary report will be generated. The summary report will be provided by the GWD WQMP to the Reclamation contractor.

- USGS INSAR data – the USGS will provide both raw and interpreted INSAR data to the Reclamation contractor for dissemination to the GWD and the larger project team. Data formats will be chosen so that the data is compatible with the master project database housed at the GWD.

- Weather data – will be downloaded via the internet from a local weather station. The data will be exported to both a PDF file and an ASCII text data file and uploaded to the master project-database.

Field Data

Field notes and photographs (as applicable) will be entered into the master project database. Depth-to-water and field water quality measurements will also be entered into the database. A summary report will be generated and validated against the hard copy field data sheets. Digital images of site photographs collected throughout the project duration will be stored in the electronic database and linked to a GIS map of the project area. Backups of the master project database will be performed weekly. These data will be provided to the Reclamation contractor quarterly.

8. Reporting

The schedule for implementing the Project Monitoring Plan is based on the assumption that the two production wells and five monitoring wells will be constructed and operational by August 2010, with the first month of operation September 2010. The GWD WQMP, with the assistance of the Reclamation contractor, will submit annual reports to Reclamation, USFWS and CDFG in March 2011 and March 2012 following the completion of pumping in January of each year. The final project evaluation report, which will transmit all project data and provide an evaluation of the three-year demonstration project, will be submitted to Reclamation, USFWS and CDFG in April 2013, following completion of the monitoring program.

Data transmittal reports will include a brief description of the activities conducted during the previous pumping season, and a summary of the data collected. The data transmittal reports will also identify work that deviated from the planned activities, and provide an explanation for the deviation. A summary of the activities to be conducted during the subsequent year will also be provided.

The final report to be delivered to Reclamation, USFWS and CDFG will summarize the data collected throughout the duration of the demonstration project and provide evaluations of the various physical and environmental parameters monitored. Hydrogeologic data will be used to evaluate the specific capacity and long-term yield of the two production wells; estimate radius of influence and pumping interferences of the two production wells; and provide an assessment of the interconnection between surface water and the upper and lower aquifers, if any. Any measureable land subsidence, due to the pumping of groundwater from the lower aquifer, will also be reported.

Water quality data, including EC, temperature and dissolved metals concentrations, will be summarized and evaluated relative to any noticeable changes in the habitat documented by Reclamation over the duration of the demonstration project.

9. Program Schedule

The three-year monitoring program will begin in September 2010 and will be completed by January 2013. The schedule for field sampling and data collection events is described above and summarized in Table 1. The Reclamation contractor will submit annual reports in March 2011 and March 2012, and the final report in April 2013.

Prior to the installation and development of the production wells, Reclamation will provide contractors, USFWS, CDFG and other government agencies involved in the monitoring program a copy of the monitoring plan and initial monitoring program schedule. Reclamation will keep these parties apprised of any changes to the sampling schedule or project scope.

APPENDIX A

Procedure for Groundwater Level Measurement

Purpose/Application

The objective of these guidelines is to provide general reference information and technical guidance on the measurement of the depth to groundwater in an open borehole, cased borehole, monitoring well, or piezometer.

Method Summary

When measuring groundwater levels, there should be a clearly established reference point of known elevation, which is normally the top of the well casing. The reference point should be scored or permanently marked on the rim of the casing if the casing rim is not even and level. To be useful, the reference point should be tied to a USGS benchmark or a local datum. The field notes recorded should clearly describe the reference used. An arbitrary datum could be used for an isolated group of wells if necessary.

Before measurements are made within the production well casing - water levels should be allowed to stabilize for a minimum of 24 hours after well construction and development. In low-yield conditions, recovery of water levels to equilibrium may take longer. Groundwater levels should be measured and recorded to the nearest 0.1 foot. Water level measuring equipment must be decontaminated prior to and between each use. Water level readings from adjacent monitoring wells do not require that the production well be turned off. Pressure transducers placed within monitoring wells should be withdrawn periodically for cleaning and maintenance (especially when deployed in highly saline aquifers).

The condition of the wells, piezometers, or boreholes should be recorded along with the name of the individual who has measured the groundwater levels. The frequency of such measurements should be pre-established.

Limitations

These guidelines give overall technical guidance only and should be modified as necessary based upon specified requirements of project-specific plans, site conditions, or equipment limitations. Agency protocols, such as those established by the USGS, can also be substituted for these guidelines given the anticipated collaboration with the USGS on this project.

Definitions

- Water table- The surface in an unconfined aquifer where groundwater pressure is equal to atmospheric pressure.
- Potentiometric (or piezometric) surface. An imaginary surface representing the total head of groundwater in an aquifer that is defined as the level to which water would rise in a well screened at and/or beneath the water bearing zone. The water table is a particular potentiometric surface.

Equipment

- Electronic Water Level Indicator with an accuracy of 0.1 foot or a pressure transducer selected for optimal sensitivity within the appropriate hydrostatic head range (this is typically in the range of 0 -50 ft for most monitoring well applications).
- Field notebook or data logger compatible with pressure transducer selected (battery powered transducers typically use a SDI-12 or 4-20 mA sensor interface).
- Decontamination materials (deionized water and bleach or equivalent).

An electronic water level indicator consists of a spool of graduated, small-diameter cable and a probe attached to the end. When the probe comes into contact with water, the circuit is closed and a meter, light, and/or buzzer attached to the spool will signal the contact. Nine-volt batteries are typically used for a power source. Pressure transducers contain miniature strain-gauge sensors that measure changes in electrical resistance and convert these measurements into digital signals within the solid state circuitry of the instrument. These transducers can be deployed autonomously, whereby the data is downloaded from the instrument periodically through a portable interface or continuously in cases where the instrument reports to a data logger and data is downloaded directly or via telemetry from the data logger.

Procedures

The quality assurance procedures for measuring groundwater levels are as follows:

1. Check operation of equipment.
2. Clean all equipment entering the well by washing with an Alconox solution followed by a deionized water rinse.
3. Remove well cap, note well ID, time of day and date in site logbook or an appropriate groundwater level data form.
4. Ensure well is at equilibrium with atmospheric pressure. In wells with air tight plugs, or without vents, the hydraulic head may not be the same as in an open or vented well. Allow sufficient time for the well to equilibrate to atmospheric pressure. Several measurements may be needed to verify if equilibrium has been reached. This is especially important for wells screened in confined aquifers.
5. The probe should be lowered slowly into the well and once the buzzer sounds, slowly raised and lowered until the depth where the meter first creates a sound is determined. At this point, the depth to water is read directly from the graduated cable at the reference point, and recorded to the nearest 0.1 feet.

6. Pressure transducers that are either deployed autonomously or hard-wired to a data logger will collect hourly hydrostatic head measurements. Data will be downloaded at regular intervals. A barometric probe will be required if the pressure transducer probes are non-vented.

Potential Problems/Troubleshooting

When there is high or low specific conductance, groundwater cascading in the well, or a turbulent water surface in the well, measuring groundwater levels with an electronic sounder may be difficult. Before lowering the probe into the well, the circuitry can be checked by dipping the probe in water and observing the indicator. These issues are not of concern with pressure transducer sensors. However continuous sensors can drift over time and need to be checked against well soundings at least quarterly to ensure data quality. In highly saline environments even stainless steel jacketed sensors can corrode over time. Titanium instrument casings should be chosen where possible in these situations if not cost-prohibitive.

References

Fetter, C.W., 1994, Applied Hydrogeology, Third Edition, Prentice Hall Inc., pp. 691.

United States Environmental Protection Agency (USEPA) 2000, USEPA Environmental Response Team Standard Operating Procedures, Manual Water Level Measurements.

Appendix A-2

Record Form for Groundwater Level Measurement

Groundwater Level Record Form

PROJECT NAME: _____

PROJECT LOCATION: _____

PROJECT NUMBER: _____

DATE: _____

SAMPLER(S): _____

Well ID	Date	Depth to Water	Well Condition
Production Well 1			
Production Well 2			
MW-1			
MW-2			
MW-3			
MW-4			
MW-5			

PHOTO TAKEN _____ YES Photo Number:
_____ NO

COMMENTS: _____

APPENDIX B

Procedure for Groundwater Sampling

Purpose/Application

This groundwater purging and sampling procedure presents a standard method for collecting groundwater samples from production and monitoring wells that are representative of the formation from which they are being withdrawn. USGS standard protocols will be substituted where groundwater sampling is conducted in collaboration with USGS field personnel who have customized equipment and associated field techniques for collecting water quality samples.

Equipment

Production well sampling requires the following equipment:

- Flow measurement device (instantaneous and totalizing flow meter)
- Water level probe or pressure transducer
- 5-gallon bucket
- Multi-parameter water quality monitoring system

Pre-Sampling Procedures

The pre-sampling procedures for groundwater purging and sampling are as follows:

1. Position a 5-gallon bucket beneath the well's sampling port.
2. Measure and record the depth to water in the production well.

Sampling Procedures

Sampling procedures for groundwater purging and sampling are as follows:

1. Purging- Begin purging the well by opening the sampling port and allowing water to fill the
   5-gallon bucket. Purge a minimum of 10 gallons of water from the well.

2. Field Parameter Monitoring- After purging 10 gallons, measure the temperature, pH, conductivity in the purge water. Continue purging, collecting one set of measurements for each 5 gallons purged. Record measurements on the field purge log. The well is ready to be sampled once a minimum of 20 gallons of water has been purged from the well and the field parameters are stable over three consecutive readings. The following criteria identify stabilized field parameters:

   ± 0.1 for pH
   ± 3.0 percent for EC

3. Sample Collection- Fill all sample containers directly from the sample port. Allow water to flow from the port, tap gently down the inside of the containers to minimize turbulence during collection. Collect groundwater samples in order of importance, according to the project requirements.

Appendix C – Section 7 Endangered Species Act Consultation / Fish and Wildlife Coordination Act

United States Department of the Interior

BUREAU OF RECLAMATION
Mid-Pacific Regional Office
2800 Cottage Way
Sacramento, California 95825-1898

MAY 2 6 2010

IN REPLY
REFER TO:
MP-410
WTR-1.10

MEMORANDUM

To: Susan Moore
Field Supervisor

From: Richard J. Woodley /S/ RICHARD J. WOODLEY
Regional Resources Manager

Subject: Request for Concurrence that the Volta Wildlife Area Level 2 Diversification and Incremental Level 4 Development Pilot Project Is Not Likely to Adversely Affect Giant Garter Snake

The Bureau of Reclamation proposes to provide American Recovery and Reinvestment Act (ARRA) funding for the installation of two groundwater production wells and two monitoring well clusters along the Volta Wasteway. This Volta Wildlife Area (Volta WA) Level 2 Diversification and Incremental Level 4 Development Pilot Project (Pilot Project) is proposed for a period of 3 years. Based on implementation of the proposed avoidance measures Reclamation has committed to, as described in the *Project Monitoring Plan for the Volta Level 2 Diversification/Incremental Level 4 Development Pilot Project* and the biological assessment, Reclamation is requesting concurrence from the Service that the proposed Pilot Project is not likely to adversely affect the federally-threatened giant garter snake (GGS) (*Thamnopsis gigas*).

The proposed Pilot Project is located at the southern end of Reclamation-owned and California Department of Fish and Game-managed Volta WA in west-central Merced County, northwest of the city of Los Banos, California. The proposed well sites are located on each side of the Wasteway within the Volta WA and are described in Reclamation's revised Biological Assessment submitted to the Service on March 16, 2010, as well as the Draft Environmental Assessment posted on Reclamation's Web site on March 2010. The pumped groundwater would be used to diversify Level 2 Refuge Water Supply sources, supplement the source of Incremental Level 4 Water Supply, and improve water supply reliability for Central Valley Project (CVP) contractors. The San Luis Delta Mendota Water Authority and the Grassland Resource Conservation District are among the beneficiaries of the proposed Pilot Project.

Reclamation proposes to pump up to 2,000 acre-feet (AF) of groundwater for the first year (September/October through January/February). In years two and three, the duration and volume of groundwater pumped annually may increase to year-round pumping of up to 5,000 AF. An increase would occur only if, after the first year of production at the 2,000 AF level, the monitoring data show suitable water quality and water levels that would sustain additional pumping.

The proposed Pilot Project would plan for, design, and construct the needed facilities (June 2010 start), and then operate the wells and monitor well production, water quality, and water levels during the

three-year period (September 2010 to February 2013). The total amount of groundwater pumped annually would be split 50/50 between Level 2 and Incremental Level 4 water supply in order to comply with CVPIA Section 3406(d)(1) diversification goal. The pumped groundwater would be delivered in-lieu of south-of-Delta Refuges receiving a portion their CVP Level 2 surface water supply. The expected substitution ratio is 2 AF of groundwater to 1 AF of surface water.

In discussions between our agencies during the past few weeks, Reclamation recognizes that salinity and other constituent levels in water are both spatially and temporally dynamic. Therefore Reclamation proposes an adaptive approach that provides flexibility in water operations while addressing salinity and other water constituent conditions in the Volta Wasteway. Such an adaptive approach requires the collection of important ground and surface water quality data; therefore, Reclamation has worked with the project proponents and the Service to develop the monitoring plan and thresholds specifically in response to the proximity of the project to one of the few breeding GGS populations within the San Joaquin Valley and to water conditions within the Volta Wasteway. These thresholds are based on constituent levels within the Volta Project conveyance channels and at the well heads, and take into consideration dynamic conditions associated with many factors such as, but not limited to, flow seepage, runoff, water management operations, and water table influence. Any other projects with similar issues should be evaluated independently and water quality thresholds for those projects should be based on project objectives, habitat conditions, species of concern, management goals, and water quality conditions in the associated conveyance system.

Reclamation has revised the original monitoring plan (provided as Appendix C to the Biological Assessment, dated March 2010) to incorporate changes to the water quality monitoring and biological evaluation plans as discussed between our agencies and as summarized above. The revised monitoring plan has been provided to the Service and now supersedes the March 2010 version of the plan. The monitoring plan and water quality-based thresholds are specific to the Volta Project and are not intended to establish water quality thresholds for other water conveyance systems.

Reclamation recognizes that the requirement of meeting 2 ug/L of selenium at the well heads is currently not a regulatory requirement or consistent with SWRCB water quality objectives outlined in the Central Valley Basin Plan. However, we have reached agreement with the Service on applying these thresholds for this Pilot Project in an effort to ensure that project implementation will not adversely affect GGS in the Volta WA, as well as to retain selenium assimilative capacity of the water supply in the North Grasslands area so that downstream users are provided flexibility in diversifying their water supplies. Any other projects that arise with similar issues should be evaluated in a similar independent fashion, and water quality thresholds for those projects should be based on project objectives, habitat conditions, species of concern, management goals, and water quality conditions in the associated conveyance system. This Pilot Project will provide additional water quality data combined with the biological data specific to GGS habitat to assist in the refinement of measures to protect the species for a long-term Volta Project.

We appreciate the effort that has been expended by the Service in assisting us with this project. If you have any questions please contact Ms. Shelly Hatleberg, Natural Resources Specialist, at 916-978-5050 or shatleberg@usbr.gov.

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Surname: MP-410(2),MP-400

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
2800 Cottage Way, Room W-2605
Sacramento, California 95825-1846

In reply refer to
81420-2010-TA-0715

MAY 27 2010

Memorandum

To: Regional Resources Management Division, Bureau of Reclamation, Mid-Pacific Regional Office

From: Field Supervisor, Sacramento Fish and Wildlife Service Office, Sacramento, California

Subject: Volta Wildlife Area Level 2 Diversification and Incremental Level 4 Development Pilot Project

This memorandum is in response to the Bureau of Reclamation's (Reclamation) May 27, 2010 memorandum received in the office of the U.S. Fish and Wildlife Service (Service) on May 27, 2010. The memorandum and attached *May 2010 Final Monitoring Plan* request concurrence from the U.S. Fish and Wildlife Service that the proposed Volta Wildlife Area (Volta WA) Level 2 Diversification and Incremental Level 4 Development Pilot Project (Pilot Project) is not likely to adversely affect the federally-listed giant garter snake (*Thamnophis gigas*). Details of the proposed Pilot Project are described in Reclamation's May 27, 2010 memorandum, the March 17, 2010 biological assessment and their *May 2010 Final Monitoring Plan* as well as the Draft Environmental Assessment posted on Reclamation's website dated March 2010. The proposed Pilot Project is located at the southern end of the Bureau of Reclamation-owned and California Department of Fish and Game-managed Volta WA in west-central Merced County, northwest of the city of Los Banos, California. The proposed well sites are located on each side of the Wasteway within the Volta WA and are described in Reclamation's documents listed above.

We have reviewed Reclamation's documents and conclude that based on implementation of the proposed avoidance measures, and other information described in Reclamation's documents listed above as well as information in our files, the Pilot Project as proposed is not likely to adversely affect the giant garter snake.

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Unless new information reveals effects of the proposed action that may affect listed species or critical habitat in a manner or to an extent not considered, or a new species or critical habitat is designated that may be affected by the proposed actions, or the action is subsequently modified in a manner that was not considered in this determination, no further action pursuant to the Act is necessary.

We appreciate your efforts to conserve federally listed species and your efforts to avoid adverse effects to listed species that may result from the proposed Pilot Project. If you have questions about this memorandum, please contact Daniel Russell at (916) 414-6600.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
2800 Cottage Way, Room W-2605
Sacramento, California 95825-1846

In Reply Refer To:
Volta Water Diversification

APR 16 2010

Memorandum

To: Regional Manager, Bureau of Reclamation, Mid-Pacific Region, Sacramento, California (Attn: Tammy LaFramboise)

From: Assistant Field Supervisor, Sacramento Fish and Wildlife Office, Sacramento, California

Subject: Fish and Wildlife Coordination Act Report for the U.S. Bureau of Reclamation's Volta Wildlife Area Level 2 Diversification/Incremental Level 4 Development Pilot Project

In accordance with 48 Stat. 401, as amended; 16 U.S.C. 661 et seq., this document constitutes the U. S. Fish and Wildlife Service's (Service) Fish and Wildlife Coordination Act (FWCA) report to the U. S. Bureau of Reclamation (Reclamation) for the Volta Wildlife Area Level 2 Diversification/Incremental Level 4 Development Pilot Project (Project). The FWCA requires Federal agencies proposing water resource development projects or involved in issuance of related permits or licenses to consult with the Service and provide equal consideration to the conservation, rehabilitation, and enhancement of fish and wildlife resources with other project purposes. The findings of this report are based on information provided in the March 2010 Draft Environmental Assessment/Finding of No Significant Impact report (Reclamation 2010a) and review of available scientific literature. Our report addresses the proposed Project-related beneficial and adverse effects on fish and wildlife resources and provides recommendations for Project implementation. Details of the project's effects on federally listed species, pursuant to section 7 of the Endangered Species Act of 1973, as amended, are being addressed separately.

Project Description

Reclamation is proposing the construction of two production wells and five monitoring wells along the Volta Wasteway in the Volta Wildlife Area. The 3year pilot project would pump groundwater to provide a portion of Level 2 Refuge Water Supply to Volta Wildlife Area and the Grassland Resource Conservation District. Additionally, the groundwater would be used for the development of Incremental Level 4 water supplies for these wildlife management areas. Level 2 Refuge Water Supply is defined as the annual average volume of water refuges received between 1977 and 1984. The annual amount of water needed for full development of the refuges (as determined by management goals set in the 1980s) is the Level 4 supply, and Incremental

TAKE PRIDE IN AMERICA

Level 4 refuge water supply is the difference between the historical water deliveries (Level 2) and the supplies required to achieve optimum habitat management (Level 4).

Currently, Reclamation's Refuge Water Supply Program delivers Level 2 water supplies to Volta Wildlife Area from the Central Valley Project's (CVP) surface water. Under the Central Valley Project Improvement Act, Section 3406(d), the Secretary of the Interior, through Reclamation, is responsible for continuing to provide a firm water source of acceptable water quality to refuges and wildlife management areas as well as diversify the sources of supply. Additionally, Reclamation was to have provided full Level 4 water supplies to all refuges by 2002 under Section 3406(d)(1,2). To alleviate the supply concerns, Reclamation, San Luis Delta Mendota Water Authority, several CVP water contractors and south Delta refuge water contractors have proposed to diversify the water supplied to Volta Wildlife Area and Grassland Resource Conservation District by substituting a portion of the surface water needs of the wildlife areas with pumped groundwater to meet both Level 2 and Incremental Level 4 requirements. Volta Wildlife Area's refuge water supply need totals 16,000 acre-feet annually (afa), of which, 10,000 afa is required to meet standards for Level 2 water supply, the remaining 6,000 afa is Incremental Level 4 supply need. The total volume of anticipated pumped groundwater in the first year of operation from the production wells is 2,000 acre-feet with an increase to 5,000 afa in the following 2 years, if well production and water quality are suitable. The total amount of groundwater pumped would be allocated to Level 2 and Incremental Level 4 water supply in a 50/50 split, thus, 2,500 afa for Level 2 and 2,500 afa for Incremental Level 4 supply, if maximum withdrawal is met. An additional 7,500 afa is required for Level 2 supply from the CVP surface water. The 2,500 afa freed up by pumped groundwater would be delivered to San Luis Delta Mendota Water Authority.

Project Area

Volta Wildlife Area and Grassland Resource Conservation District are located in the western portion of Merced County. Currently, water sources are delivered from San Luis Reservoir and O'Neill Forebay via the Delta Mendota Canal and released into the Volta Wasteway. The supply flows through the Volta Wasteway for use by Volta Wildlife Area, and then flows to the northern end of Volta Wildlife Area to be delivered to the Grassland Resource Conservation District. The water supply is used to manage about 1,970 acres (of the 2,891 acres) at the Volta Wildlife Area as seasonal and semi-permanent flooded wetlands (CDFG 2010). Based on Reclamation's Project report (2010a), it is unclear how many acres of wetlands in the Northern Division of the Grassland Resource Conservation District are managed with Volta Wasteway water. The Volta Wildlife Area wetlands are known to support the federally listed giant garter snake (*Thamnophis gigas*) in the perennial water at the north end (Field 10), and provide habitat, breeding areas and food sources for about 150 species of birds, including many waterfowl and shorebirds (CDFG 2010).

Construction and Monitoring

Reclamation plans to construct two production wells and five monitoring wells between May 1, 2010 and October 1, 2010. The production wells would be drilled to a depth of 500 to 900 feet below ground surface (bgs) to reach the aquifer below the Sub-Corcoran Clay. A pair of

monitoring wells would be clustered around each of the production wells, with one monitoring well set below the Sub-Corcoran Clay and another above the Clay in a shallower aquifer. An additional monitoring well would be set 100 feet bgs near Well #1. It is estimated that each production well would take 15 days to construct (10 hours per day). At each production well site, an 8-foot by 10-foot concrete pad and 20-inch discharge pipe routed to the Volta Wasteway would be constructed. The construction area would consist of a 150-foot by 150-foot zone around each production well and a 300-foot long access road from the main road to Well #2. The drill cuttings would be contained in a settling pond on-site.

Upon completion of construction activities, pumped groundwater would be monitored monthly at the production wells and surface water would be monitored weekly in the Volta Wasteway (in the first year) for concentrations of the following constituents:

- Trace Elements (Selenium, Boron, Arsenic, Mercury, Uranium)
- General Minerals (anions, cations)
- Nitrate
- Total dissolved solids (TDS)

If necessary, the pumped groundwater would be diluted with Volta Wasteway water to meet water quality standards and pumping would cease if water quality exceeds the standards. The State Water Resource Control Board water quality objectives in the Central Valley Basin Plan as outlined in the Reclamation Project Report (2010a) are:

- Selenium < 2.0 μg/L
- Boron < 2.0 mg/L March 15 – September 15
- Boron < 2.6 mg/L September 16 – March 14

Environmental Impacts

Atmospheric and Terrestrial

Construction of the wells and initial aquifer testing would consist of about 550 hours of equipment operation and a total fuel consumption of about 19,100 gallons of diesel, leading to the production of greenhouse gas emissions. Construction of the wells would also require the temporary disturbance of two 150-foot by 150-foot areas at the well sites and the disturbance of land associated with the construction of a 300-foot long access road to Well #2. In addition, the timing of the construction activity coincides and could interfere with the nesting season of birds known to occur in the area.

Groundwater

The pumping of groundwater from the Sub-Corcoran aquifer could lower groundwater elevation and potentially cause land subsidence, in an area well known for large subsidence events (Alley et al. 2002). Subsidence at a local level, such as at the production well sites, could result in a change in directional draining patterns in the gravity fed system at Volta Wildlife Area,

potentially causing the draining of the wetlands in the area and a subsequent loss of habitat for migratory birds and wetland plant species.

Of even greater concern are the cumulative effects of groundwater pumping at Volta Wildlife Area in addition to pumping activities already occurring in the San Joaquin Valley (Valley). Groundwater pumping on regional scales can have dramatic effects on the natural resources in the area. The lowering of surface elevation can drop the water table and alter the stream course gradients of the channels flowing downstream (Sun et al. 1999), such as into the Valley. The result of which can cause the steepening of the watercourses draining into the Valley and the subsequent head-cutting (erosion) of the channel upstream of the disturbance area (Wilcox et al. 2001, NCDWQ 2005). The lower water table and increased stream gradient can unnaturally dewater wetland areas and disconnect floodplains from perennial water sources (Yuill et al. 2009); resulting in habitat loss for migratory birds and wetland plants. Furthermore, the advancing upstream erosion can degrade downstream water quality and aquatic habitat by increasing sediment loading (USGS 2000).

Water Quality

Elevated concentrations of various chemical constituents, such as selenium, boron, salts and mercury can have adverse effects on wildlife. The lower San Joaquin River, tributaries, and water supply channels have been listed as impaired under section 303(d) of the Clean Water Act for these and other pollutants. The Central Valley Regional Water Quality Control Board (Regional Board) has adopted several relevant Total Maximum Daily Loads (TMDLs) and is working on additional TMDLs for these water bodies (CVRWQCB 2010).

The Draft Environmental Assessment/Finding of No Significant Impact report does not discuss impacts to water resources downstream of the Volta Wildlife Area. The Volta Wildlife Area currently has relatively good water quality since it is at the top of the water supply system and receives water directly from the Delta Mendota Canal, but water quality diminishes as it cascades through the wetlands downstream of Volta Wildlife Area (Beckon and Milar 2003). The degradation of downstream areas makes it difficult for wetland operators to manage wetlands to meet load allocations and other requirements under Regional Board TMDL limits in a manner that will not harm habitat quality and diversity.

Selenium

Bioaccumulation of selenium (Se) has caused reproductive failure and mortality in aquatic birds foraging on insects and plant material from the wetlands of the Kesterson National Wildlife Refuge (Kesterson) near Volta Wildlife Area and Grassland Resource Conservation District (Ohlendorf et al. 1988). Schuler et al. (1990) found that the Se concentrations were 1,000 to 5,000 times greater in the aquatic plants and aquatic insects than waterborne levels at Kesterson. However, the concentrations at Kesterson during the 1984 studies of Schuler et al. (1990) and Ohlendorf et al. (1988) were much higher than Volta Wildlife Area during the same year (300 μg/L versus 2μg/L). The difference was largely due to the collection of agricultural drainwater at Kesterson and its use as a storage and evaporation facility. Nevertheless, Se levels could become more concentrated on the refuges through evaporation and bioaccumulation, thus, having greater potential to negatively impact waterfowl and other biota feeding at Volta Wildlife

Area or Grassland Resource Conservation District. Higher Se concentrations in the pumped groundwater as compared to the Volta Wasteway (from CVP surface water supply) could exacerbate these impacts, as a short pulse of elevated Se could have lasting effects on the aquatic system (Maier et al. 1998).

The Project Monitoring Plan in the Environmental Assessment (Reclamation 2010a) suggests that Delta Mendota Canal water will dilute the pumped groundwater to assure Se concentrations do not exceed 2 µg/L in the Volta Wasteway. However, Se levels from the pumped groundwater could be significantly higher than 2 µg/L, and since Se levels have historically been low at Volta Wildlife Area, allowing Se levels to rise to 2 µg/L would be counter to state and federal antidegradation policies. The Regional Board determined that mean monthly concentrations of Se should not exceed 2 µg/L (2 parts per billion), as this threshold would be protective of waterfowl (CVRWQCB 1996). Although this level appears to be protective of many species, it is unknown whether this threshold is protective of all fauna.

Boron

In addition to Se, elevated boron (B) concentrations in waterfowl can adversely affect growth rates, and higher levels can decrease survival (Eisler 1990, USDOI 1998). Crops and aquatic plants are also impacted, at levels as low as 0.5 mg/L (USDOI 1998). Wetlands are managed to provide aquatic and moist soil plants for habitat and food sources for waterfowl, thus elevated B concentrations that may impact these plants are of particular concern. The Project Monitoring Plan in the Environmental Assessment (Reclamation 2010a) suggests using the Central Valley Basin Plan water quality objectives for B thresholds, as follows:

- < 2.0 mg/L (March 15 – September 15)
- < 2.6 mg/L (September 16 – March 14)

However, these B concentrations described in the Project Monitoring Plan are maximum values and do not represent the lower monthly mean concentrations, as outlined in the Central Valley Basin Plan. The Regional Board adopted the following water quality objectives for B (CVRWQCB 2002):

- Irrigation Season (March 15 – September 15)
    - **a. 0.8 mg/L (monthly mean)**
    - b. 2 mg/L (maximum)
- Non-Irrigation Season (September 16 – March 14)
    - **a. 1 mg/L (monthly mean)**
    - b. 2.6 mg/L (maximum)

The B objectives put forth by the Regional Board are primarily irrigation standards for crops, however, the Service has generally been supportive of the B objectives as being protective of fish and wildlife resources, particularly aquatic plants.

Salinity

Elevated salinity levels in freshwater systems, such as wetlands, can have adverse effects on the flora and fauna inhabiting these ecosystems (Nielsen et al. 2003). At salinities above 1,000 mg/L, aquatic plants seem to exhibit adverse effects, like reduced root and leaf development and decreased growth rates (Nielsen et al. 2003). Although tolerance to elevated salinity levels may differ across biotic groups, high salinity in the water used at Volta Wildlife Area and Grassland Resource Conservation District could adversely affect the species using these areas.

The Project Monitoring Plan (Reclamation 2010a) does not suggest a salinity threshold for the production wells specifically, but Reclamation's 2010 Delta-Mendota Canal Pump-in Program Water Quality Monitoring Plan (Reclamation 2010b) has requirements for pump-ins of 1,500 mg/L TDS and upper limits for Delta Mendota Canal salinity that would be suitable threshold criteria for the Project. Although the Project Monitoring Plan did not propose salinity thresholds for the wells, it did suggest limits for the Volta Wasteway downstream of the well pump-ins. These monthly Electrical Conductivity (EC) thresholds are the maximum average monthly values for the five year period from 2005 to 2009, plus the standard error for that month with the maximum EC across the five years. However, the past five years of data include three years of drought conditions; therefore the maximum values represent "worse-case" levels. While the Project description and monitoring plan suggest no increase in salinity beyond the thresholds calculated from the previous five year period, the Project, as proposed, would allow for increased salinity in water at Volta Wildlife Area relative to previous years. The water quality at the Volta Wasteway bridge (where the data had been collected for the threshold calculations) is significantly higher than Delta Mendota Canal water measured at Check 13[1], thus, water quality in the Volta Wildlife Area is degraded relative to the Delta Mendota Canal. For example, in 2009, the average EC at Check 13 was 571 µS/cm (range 248-1,023 µS/cm), compared to 1,253 µS/cm (range 583-1,834 µS/cm) at the Volta Wasteway bridge. It is unclear why the salinity levels at the Volta Wasteway bridge are elevated relative to Check 13 considering the short distance between the bridge and the Delta Mendota Canal, but could be the result of high salinity drainage water entering the Volta Wildlife Area between Check 13 and the Volta Wasteway (*e.g.*, the Tri-Valley Drain).

Mercury

Mercury (Hg) contamination and bioaccumulation is also a concern for humans and wildlife (Sedlak and Ulrich 2009). Hg levels in the outlying areas of Volta Wildlife Area and Grassland Resource Conservation District, such as Mud Slough and the San Joaquin River, are elevated. The higher Hg concentrations in the area are a result of anthropogenic factors exacerbating the release of naturally occurring Hg in the Coastal Range, as well as, the use of Hg in gold mining operations on the eastern side of the Valley. It is unknown whether the Volta Wildlife Area and Grassland Resource Conservation District are accumulating significant amounts of Hg since no monitoring efforts have been initiated at these sites. The lower San Joaquin River and Mud Slough are listed as Hg impaired under the Clean Water Act and TMDLs are being developed. Under the draft Basin Plan amendment for Delta waters, wetlands are identified as significant sources of methylmercury and will receive load allocations. Similar methylmercury load

[1] Accessed on April 14, 2010, from: http://www.usbr.gov/mp/cvo/wqrpt.html

allocations for the San Joaquin River and Mud Slough are expected in the near future. Thus, any additional sources of Hg into Volta Wildlife Area and the Grassland Resource Conservation District will exacerbate the problem.

Special Status Species

A viable, reproducing population of the federally threatened giant garter snake is known to inhabit Field 10 and permanent waters of the Volta Wildlife Area. Elevated Se and Hg concentrations and general poor water quality may have direct and indirect impacts on the giant garter snake. Formal consultation pursuant to section 7(a) of the Endangered Species Act will be addressed separately.

Recommendations

The proposed Volta Wildlife Area Level 2 Diversification/Incremental Level 4 Development Pilot Project could have temporary adverse effects to fish and wildlife and their habitat. If Reclamation proceeds with the project as described, the Service recommends that Reclamation:

- Minimize impacts to annual grassland habitat that is temporarily disturbed during construction by reseeding with native grasses and forbs after the construction is complete.

- Survey the construction sites for ground nesting birds and if nests with eggs are found, it is recommended that either: (1) eggs are removed from the nest and placed in a facility for incubation, or (2) construction is delayed until nesting season is completed.

- Work towards making the proposed project carbon neutral. Consistent with the Intergovernmental Panel on Climate change (IPCC) (2007) adaptation strategies/mitigation recommendations, the Service recommends compensating for the proposed project's carbon footprint by purchasing carbon offsets. Alternatively, carbon offsets could be achieved through sequestering carbon (converting tilled agricultural fields near the project area to native grasslands).

- Monitor and record the groundwater elevation changes at the production and monitoring wells and report results on an annual basis.

- Coordinate with the U.S. Geological Survey to monitor and assess subsidence risk at the well sites as outlined in the Project Monitoring Plan in the Environmental Assessment (Reclamation 2010a).

- Document and map all groundwater pumping activities near the Volta Wildlife Area to better identify subsidence risk.

- Monitor and record water quality data and concentrations of chemical constituents of the surface water and the production wells as outlined in the Project Monitoring Plan for Year 1. Surface water and production well monitoring in Years 2 and 3 should be conducted at the same frequency as in Year 1 (weekly rather than twice a year) since pumping is expected to double during Years 2 and 3 and changes in water quality could occur rapidly.

- The thresholds for the following water quality constituents should be met for the pumped groundwater at the production well heads:

  - Selenium: 2 μg/L (mean monthly concentration)
  - Boron:
    - Irrigation Season (March 15 – September 15)
      - 0.8 mg/L (monthly mean)
      - 2 mg/L (maximum)
    - Non-Irrigation Season (September 16 – March 14)
      - 1 mg/L (monthly mean)
      - 2.6 mg/L (maximum)

- Follow the salinity requirements for Groundwater Pump-Ins as documented in Reclamation's 2010 Delta-Mendota Canal Pump-in Program Water Quality Monitoring Plan (Reclamation 2010b):

  - Wells must test ≤ 1,500 mg/L TDS at the well heads,
  - Surface water must not exceed 450 mg/L TDS when pumped groundwater is added, and
  - An increase of 30 mg/L TDS due to the well pump-ins shall not occur.

- Monitor methylmercury levels at the production wells and at the Volta Wildlife Area discharge point(s) near the northeast boundary at Field 10 and ensure concentrations do not exceed Delta-Mendota Canal surface water levels at Check 13.

- Cease pumping operations if the water quality is found to be above the thresholds listed above.

- Reassess the project after 3 years. It is also recommended that the proposed project, once completed, not be used in perpetuity, but rather be used only in dry and critically dry water years as an additional source of water for the Volta Wildlife Area.

- Establish assurances that full Level 2 Refuge Water Supply will be delivered if maximum groundwater withdrawal volume is not met.

If you have any questions regarding this report, please contact Mark Littlefield or Becky Walther at (916) 414-6600.

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Appendix D – Cultural Resource

OFFICE OF HISTORIC PRESERVATION
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BUREAU OF RECLAMATION
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CODE	ACTION	SURNAME & DATE
150	✓	Barnes 2-17-10

February 11, 2010

In Reply Refer To: BUR100128A

Michael A. Chotkowski
Regional Environmental Officer
United States Department of the Interior
Bureau of Reclamation
Mid-Pacific Regional Office
2800 Cottage Way
Sacramento, CA 95825-1898

Re: Volta Wildlife Area Level 2 & 4 Refuge Water Diversification, Merced County, California (Project No. 09-MPRO-269)

Dear Mr. Chotkowski:

Thank you for seeking my consultation regarding the above noted undertaking. Pursuant to 36 CFR Part 800 (as amended 8-05-04) regulations implementing Section 106 of the National Historic Preservation Act (NHPA), the Bureau of Reclamation (BUR) is seeking my comments regarding the effects that the subject project will have on historic properties. The proposed undertaking, the installation of two wells and two monitoring wells, has been identified by the BUR as an undertaking pursuant to review under Section 106 regulations. The project is located in two locations within the Federal right-of way along the Volta Wasteway, spaced approximately 2,000 feet apart. Well site 1 is located on the north side of the wasteway and Ingomar Grade Road intersection. Well site 2 is located on the south side and adjacent to the wasteway about 1,600 feet northeast of Ingomar Grade Road. The BUR has determined that the Area of Potential Effects (APE) consists of an area approximately 0.5 acre that encompasses both the footprint of the new wells and associated pipes, pads, parking lot, road, and power lines and the adjacent access/staging area.

The undertaking will consist of drilling three holes to depths 50-80 feet, 200-240 feet, and 460-480 feet for each of the monitoring wells and pouring of a 5-foot square cement pad for each of the monitoring well heads. For each production well, a 10-foot by 20-foot concrete pad will be constructed to support the well pump mechanics. One discharge line for each well will be installed involving 12-inch underground PVC pipes set in 3-foot deep trenches. There will also be 100 feet of power line for well site 1, and 90 feet of power line for well site 2. Additionally there will be an enlargement of the existing parking area by about 1,250 square feet and a 300-foot long, 10-foot wide gravel road. This will involve a truck-mounted reverse circulation rotary drilling rig equipped with a mud pump, pipe rack, and drilling fluid holding tank/shaker system. All bores dug for all the wells will be 9 inches in diameter. The trench for the discharge pipelines will be dug using a backhoe. Other construction equipment will include a water tender, front-end loader, pipe truck, and pickup trucks. Access to each production well site will be via existing paved and dirt/gravel access roads. Equipment and materials will be staged on existing access routes and on the site of well pipeline construction.

Classification	ENV-3.00
Project	214
Control No.	10010662
Folder I.D.	1114652
Date Input & Initials	2/17/2010

Identification efforts by the BUR have concluded that there are no historic properties in the project APE. Accordingly, the BUR has determined that a finding of No Historic Properties Affected is appropriate pursuant to 36 CFR Part 800.4(d)(1).

In addition to your letter of January 22, 2010, you have submitted maps and photographs of the project location. I have no objection to your finding of No Historic Properties Affected.

Be advised that under certain circumstances, such as unanticipated discovery or a change in project description, the BUR may have additional future responsibilities for this undertaking under 36 CFR Part 800. Thank you for seeking my comments and for considering historic properties in planning your project. If you require further information, please contact Trevor Pratt, Assistant State Archeologist, at phone 916-651-0831 or email tpratt@parks.ca.gov.

Sincerely,

Susan K Stratton for

Milford Wayne Donaldson, FAIA
State Historic Preservation Officer