North Grasslands Wildlife Area
Salt Slough Unit

Water Management Plan

first submittal 20 Dec 2010
final plan submittal 16 Feb 2011

Data, including estimated habitat acreages and water requirements for optimal production and maintenance, included in this document and associated tables are referenced from the San Joaquin Basin Action Plan/Kesterson Mitigation Plan Report (1989) and Report on Refuge Water Supply Investigations (1989), developed by the Bureau of Reclamation, Fish and Wildlife Service, and the Department of Fish and Game. Precipitation data was drawn from local weather stations and may be unrepresentative given the expansive distribution of the CVPIA wetlands. Evaporation and seepage data were derived from gross estimates and are unrepresentative of actual conditions given the high variability in vegetation and soil type. Furthermore, estimated applied acre feet per wetland acre data was calculated based on the aforementioned assumptions and water delivery estimates. Given the inherent numerous assumptions utilized to generate the data included in this document and associated tables, this information is not intended for any other purpose and should not be used without the written consent of the author agencies.

Section A - Background

1. *Identify the staff member responsible for developing and implementing the Plan. Provide their contact information*

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2. *Year refuge established* 1990

Define year-type used consistently throughout plan March 1 through February 28

3. *Water supplies*

   List each annual entitlement of surface water under each water right and/or contract

Supplier	*Water source*	*Contract #*	*Contract restrictions*	*Acre-feet/year*
Federal level 2	Grasslands WD	1425-98-FC-20-16760		6,680
Federal level 4	Grasslands WD	1425-98-FC-20-16760		3,340
Appropriative	Salt Slough	A014582	Timing of use, quality, quantity	13,500
Appropriative	Salt Slough	A013508	Timing of use , quantity, quality	3 cu. ft./ sec.
Other, riparian	Salt Slough	Statement S009611	Timing of use, quantity, quality	30 CFS

4. *Provide a narrative on pre-CVPIA refuge water supplies and water management*

The Salt Slough Unit, formerly the San Luis Ranch, consisted of primarily irrigated pasture land and was managed as a cattle ranch. The Salt Slough Unit had some of its water conveyance system in place at the time of purchase. The system consisted of delivery canals, both dirt and concrete, low lift pumps and concrete irrigation pipelines.

The Salt Slough Unit has an appropriative water right of 8,891 acre feet from Salt Slough. Most of the water in the Salt Slough originates from operational spills and return flows from the Grasslands Water District (GWD), San Luis Canal Company (SLCC), and the Central California Irrigation District (CCID).

5. *Land use history*

List refuge habitat-types with 5% or more of total acreage

Habitat type	*Original size*	*1992 acres*	*1999 acres*	*2010 acres*
Seasonal wetland – timothy (not irrig)	None	None	None	None
Seasonal wetland – timothy (irrigated)	40	40	236	313
Seasonal wetland – smartweed	0	0	80	109
Seasonal wetland - watergrass	0	0	405	419
Permanent wetland	0	0	11	11
Semi-permanent wetland/brood pond	0	0	96	162
Reverse cycle wetlands				
Riparian	200	200	200	220
Irrigated pasture	1,718	1,711	617	0
Upland				
Upland (not irrigated)	283	283	190	190
Upland (managed)	0	0	272	545
Upland (grains)	0	0	107	35
Other (>5%)	0	0	0	210
Misc. habitat (<5%)	0	0	12	12
Sub-total – habitat acres	2,241	2,234	2,226	2,226
Roads, buildings, etc.	0	7	15	15
Total (size of refuge)	2,241	2,241	2,241	2,241

Habitat type maps attached.

Describe refuge habitat-type water use characteristics

Habitat type	*AF/ac*	*# of irrigations*	*Floodup date*	*Draw down date*
Seasonal wetland -timothy	5.0	1	8/1-10/30	3/1-4/1
Seasonal wetland -smartweed	6.0	1	8/1-10/30	3/1-4/1
Seasonal wetland - watergrass	8.0	1-3	8/1-10/30	4/1-5/1
Permanent wetland	12.0			
Semi-permanent wetland/brood pond	10.0		December	8/15
Riparian	4.0			
Upland (not irrigated)				
Upland (managed)	1.5	3-5	Jan-Mar	
Upland (grains)	2.0	3-5	Mar-Aug	
Other (>5%)				
Misc. habitat (<5%)	2.0	1-3		

Section B - Water Management Related Goals and Objectives

1. *Describe the refuge mission relative to water management. (i.e. crop depredation, legislative mandates, service to landowners)*

The China Island Unit, along with the Salt Slough Unit, was part of the initial purchase of new lands to implement the San Joaquin Basin Action Plan/ Kesterson Mitigation Plan. The San Joaquin Basin Action Plan (SJBAP) provides a framework within which 23,500 acres of contiguous State and Federal wildlife areas can be developed and managed in a coordinated manner. The SJBAP describes the acquisition of additional lands and installation of water delivery features primarily to protect and enhance existing wetlands and to restore and develop new wetlands for migratory bird habitat in the North Grasslands area of Merced County, California.

This action plan meets the requirement for long-term mitigation for Kesterson Reservoir and contributes towards achieving the objectives for the San Joaquin Basin Action Plan adopted by the Central Valley Habitat Joint Venture in support of the North American Waterfowl Management Plan. The SJBAP was initiated on October 9, 1990 by a cooperative agreement between the Bureau of Reclamation (Reclamation), U.S. Fish and Wildlife Service (Service) and the California Department of Fish and Game (DFG) to implement the concepts in the San Joaquin Basin Action Plan/ Kesterson Mitigation Plan report published in 1989. The SJBAP lands are owned by separate agencies but managed in a cooperative manner to form a large block of diverse wildlife habitat. This increase of wetlands and other habitats will fulfill the requirements of mitigation for Kesterson Reservoir and will contribute to meeting objectives of the Central Valley Habitat Joint Venture and the North American Waterfowl Management Plan.

In 1972, The Federal Endangered Species Act (ESA) was passed to protect and conserve fish and wildlife species which are listed as endangered or threatened. In 1977, the California Endangered Species Act (CESA) was passed with intents similar to federal act.

In 1990, the China Island Unit opened to public use and became part of the Pittman-Robertson (PR) program with the main objectives of providing habitat for wintering waterfowl , minimizing crop depredation by waterfowl, and providing public hunting opportunities.

2. *Describe specific habitat management objectives. Include pertinent information from refuge management plans*

The wildlife area prepares annual Work Plans which identify habitat management efforts for the coming year. The Work Plans follow the Wildlife Area Habitat Committee guidelines for specific habitat management. In addition, the wildlife area is also guided by the San Joaquin Basin Action Plan. The current Wildlife Area Habitat Committee objectives are as follows:

<u>Permanent Wetlands:</u>

Permanent wetlands are wetlands which remain flooded year-round. Typical permanent wetland habitat includes ditches, deep ponds, and sloughs. Area management plans must identify permanent wetland habitat, ideally ranging in size from two to 20 acres and no less than three percent of total wetland acreage. Permanent wetlands should be spaced at a maximum of one-mile intervals.

Semi-permanent Wetlands (Spring/Summer Wetlands):
Habitat must be flooded from February 1 to September 15 annually, but may be drained as early as August 15 when habitat management is needed. Semi-permanent wetlands typically provide key brood habitat for waterfowl and shorebird populations as well as summer water essential to resident wildlife. The management goal is to provide no less than three percent of the total wetland acreage in this habitat type. Semi-permanent wetlands should range in size from two to 20 acres, have shallow edges, and be scattered at approximately ½ -mile intervals throughout the wildlife area.

Diverse Moist Soil Vegetation:
This habitat is managed primarily for production of moist soil plant species which produce desirable seed and sustain invertebrates important to waterfowl and other wetland wildlife species. At least three major vegetation species, which may include but are not restricted to swamp timothy, watergrass, and smartweed, must be provided for in the area plan. Each of the three plant species should account for a minimum of 25 percent of the total seasonal wetland acreage and, ideally, the three species should cumulatively provide a high level of nutrition and forage availability. The three species should compliment one another in such a way as to provide for a balance of nutritional and cover qualities. The selection of moist soil vegetation should also take into account the abundance and availability of other moist soil habitats within the surrounding geographic area.

Fall flooding and moist soil habitat which creates what is known as "seasonal wetlands" and provides an important resting and food source for wildlife should be timed to meet the needs of wildlife. Staged flooding should begin in early August as migratory shorebirds and waterfowl begin to move into California and continue through early December. Up to 25 percent of managed moist soil habitat should be flooded by September 15. Drawdown should occur during late-winter to late-spring, depending on target species' germination requirements.

Special Ecological Communities:
These include communities identified by area managers or recognized by the Natural Diversity Data Base (NDDB) as occurring on or within the vicinity of a wildlife area. The objective is to protect existing habitat types with no net loss of acreage and to enhance, where possible, the quality of the habitat.

Riparian Habitat:
Riparian habitat on wildlife areas has been most commonly associated with the water management system of the area (e.g., delivery ditches, natural sloughs, creek banks). The standard is to maintain existing riparian habitat and to expand its acreage by 50 percent over the next 10 years.

Managed Nesting Habitat:
The goal for management of upland nesting cover is to optimize such habitat for resident breeding birds such as short-eared owls, northern harriers, ducks, and pheasants. The habitat management objective is to manage the structure of the habitat (height, density, species composition, and soil moisture) to optimize nesting density and success. The standard is to

maintain a minimum of 25 percent of the total upland habitat managed as dense nesting habitat with a minimum plot size of five acres.

Upland Foraging Areas:
These areas are managed primarily for grazing and upland foraging wildlife species such as raptors, greater and lesser sandhill cranes, and geese. Where appropriate, the standard is to manage a total 25 percent of the total upland habitat as upland foraging areas with a minimum plot size of 50 acres.

Cereal Grain Plantings:
The standard for cereal grain plantings is a minimum of 10 percent of the total upland habitat. Ideally, plots of five to 20 acres will be managed for pheasants and other species (raptors), and 50 acre minimum size plots will be managed for geese and Sandhill cranes. Cereal grains planted early in the fall (prior to December 1) can be considered as both managed nesting habitat and upland forage areas.

3. *Describe the strategies used to attain objectives listed above*

An Annual Management Work plan is prepared each year to implement the overall management goals and objectives in the Wildlife Area Management Plan.
On an annual basis, the wildlife area staff in conjunction with statewide representatives from the Wildlife Area Habitat Committee conduct site visits and review/assess the current habitat management plan and make changes as necessary to meet the habitat objectives.

4. *Describe constraints that prevent attainment of objectives and explain the effect on operations*

Every year, we seek in our annual Work Plans to accomplish more than can be currently implemented given current budgetary and personnel levels. In addition, Level 4 water comprises 1/3 of CVPIA Salt Slough refuge water supply; however, the water is not yet delivered at proposed levels or at the needed times in most years. Water delivery agencies are not always able to deliver Level 2 or Level 4 water due to maintenance or other issues during some portions of some years. A further constraint may be mosquito abatement regulations which constrain our ability to flood certain portions of the wildlife area during summer and fall months. To address Mosquito abatement/wetland issues the Central Valley Joint Venture has published a technical guide to provide information on habitat management strategies to reduce mosquito production on managed wetlands. (Technical Guide to Best Management Practices for Mosquito Control in Managed Wetlands, June 2004).

5. *Describe the strategies used to remedy the constraints listed above*

Additional funding and personnel would help meet the first two constraints. Continue to work with the Bureau to address the Level 4 situation. Continue to seek solutions with water delivery agencies to deliver water in a more consistent fashion. Implement best management practices (BMP) as outlined in the CVJV Technical Guide to Best Management Practices for Mosquito Control in Managed Wetlands, June 2004).

Section C - Policies and Procedures

1. Describe the refuge policies/procedures on accepting agricultural drainage water as supply

The Salt Slough Unit water delivery contract states that we will not accept water which contains "dissolved oxygen levels below 5.0 mg/l; a pH level below 6.5 or greater than 8.5; or chemical constituents, pesticides, or salinity levels; that adversely affect beneficial uses of the refuge water" (from wheeling agreement with San Luis Canal Company). In addition, we currently accept agricultural drainage water as long as the selenium level is less than 2 ppm (Federal EPA standard), the boron level is less than 6 ppm (based on Grassland Water District standards), and the salinity level is less than 1,500 ECs (standard based on local historical knowledge).

2. Describe the refuge policies/procedures on water pooling, transfers, reallocations or exchanges

The January 2001 USBR/DFG refuge water supply contract addresses pooling in Article 6, and transfers, reallocations, and exchanges of water in Article 7.

POOLING OF WATER SUPPLIES

6. (a) Whenever the maximum quantities of Level 2 Water Supplies and/or the Incremental Level 4 Water Supplies depicted in Exhibit AB@ are reduced pursuant to Article 9 of this Contract, the remaining Level 2 Water Supplies and/or the Incremental Level 4 Water Supplies may be pooled for use on other Refuge(s); Provided, that no individual Refuge shall receive more Level 2 Water Supplies than would have been made available to it absent a reduction pursuant to Article 9 of this Contract; or be reduced by more than twenty-five (25) percent; Provided further, that the Contracting Officer makes a written determination that pooling of water for use on other Refuge(s) would not have an adverse impact, that cannot be reasonably mitigated, on Project operations, other Project Contractors, or other Project purposes; Provided further, that the Contracting Officer determines that such reallocation is permitted under the terms and conditions of the applicable underlying water right permit and/or license; and Provided still further, that water made available under this contract may not be scheduled for delivery outside the Contractor's Boundary without prior written approval of the Contracting Officer.

(b) An Interagency Refuge Water Management Team, to be chaired by the Contracting Officer and to be established upon execution of this Contract, shall be entitled to collaboratively allocate the pooled water supplies and provide a schedule for delivery of the pooled supplies to meet the highest priority needs of the Refuge(s) as depicted in Exhibit AB@; Provided, however, nothing in this Article is intended to require the Contractor to pool the water supply provided for in this Contract. The Interagency Refuge Water Management Team shall be composed of designees of the Bureau of Reclamation, the United States Fish and Wildlife Service, the California Department of Fish and Game, and the Grassland Water District.

TRANSFERS, REALLOCATIONS OR EXCHANGES OF WATER

7. Subject to the prior written approval of the Contracting Officer, the Project Water made available under this Contract may be transferred, reallocated or exchanged in that Year to other Refuge(s) or Project contractors if such transfer, reallocation or

exchange is requested by the Contractor and is authorized by applicable Federal and California State laws, and then-current applicable guidelines or regulations.

The North Grasslands Wildlife Area, Salt Slough Unit has no additional policies or procedures on pooling, transfers, reallocations, or exchanges.

3. Describe the refuge water accounting policies/procedures for inflow, internal flow and outflow

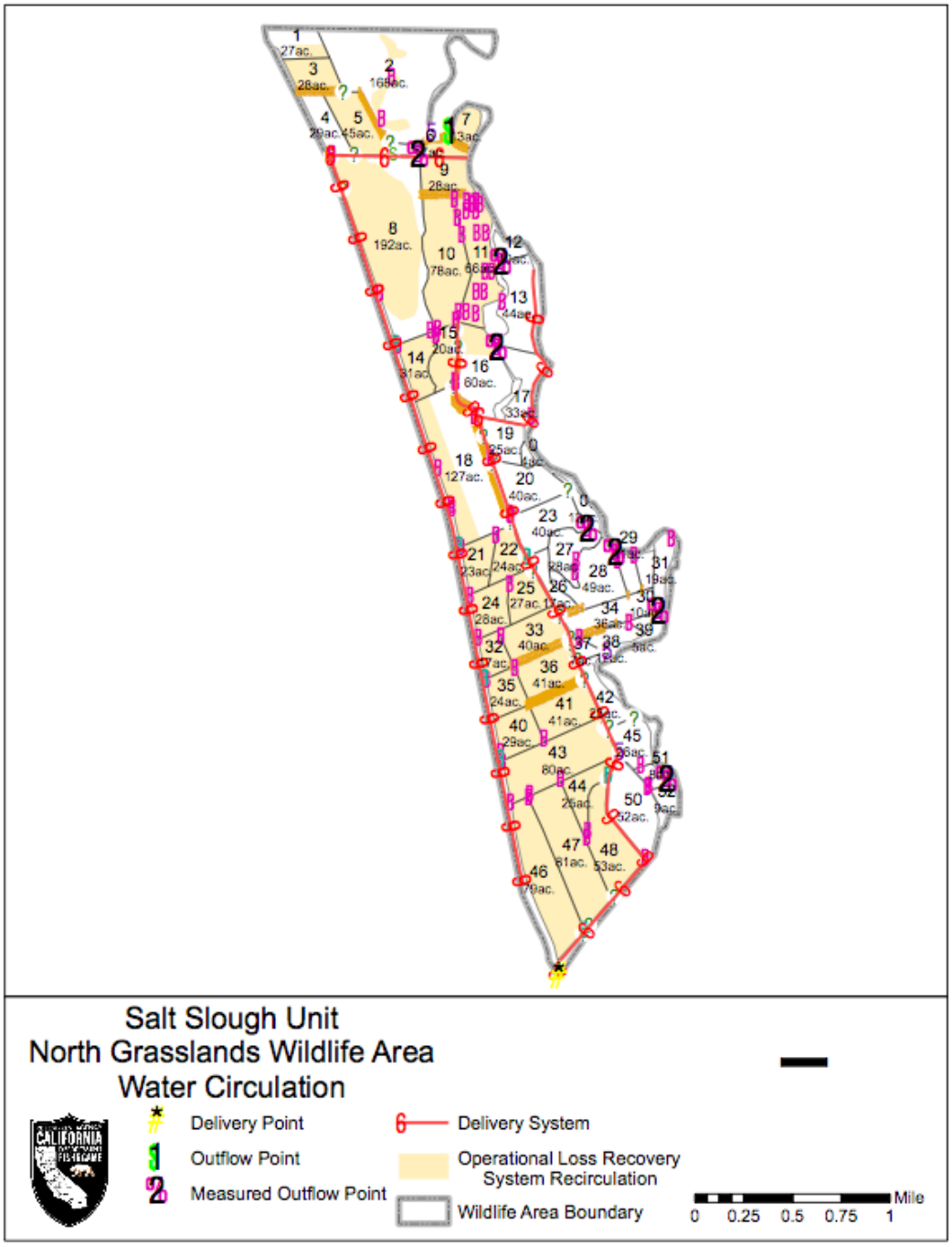
Inflows are measured by the Grassland Water District. Internal flows are monitored daily for purposes of tracking movement through the system to the proper place of use on the wildlife area. Outflows at selected points are monitored by area staff as time permits.

4.-The salt Slough Unit has a Drought Contingency Plan in place that is still applicable.

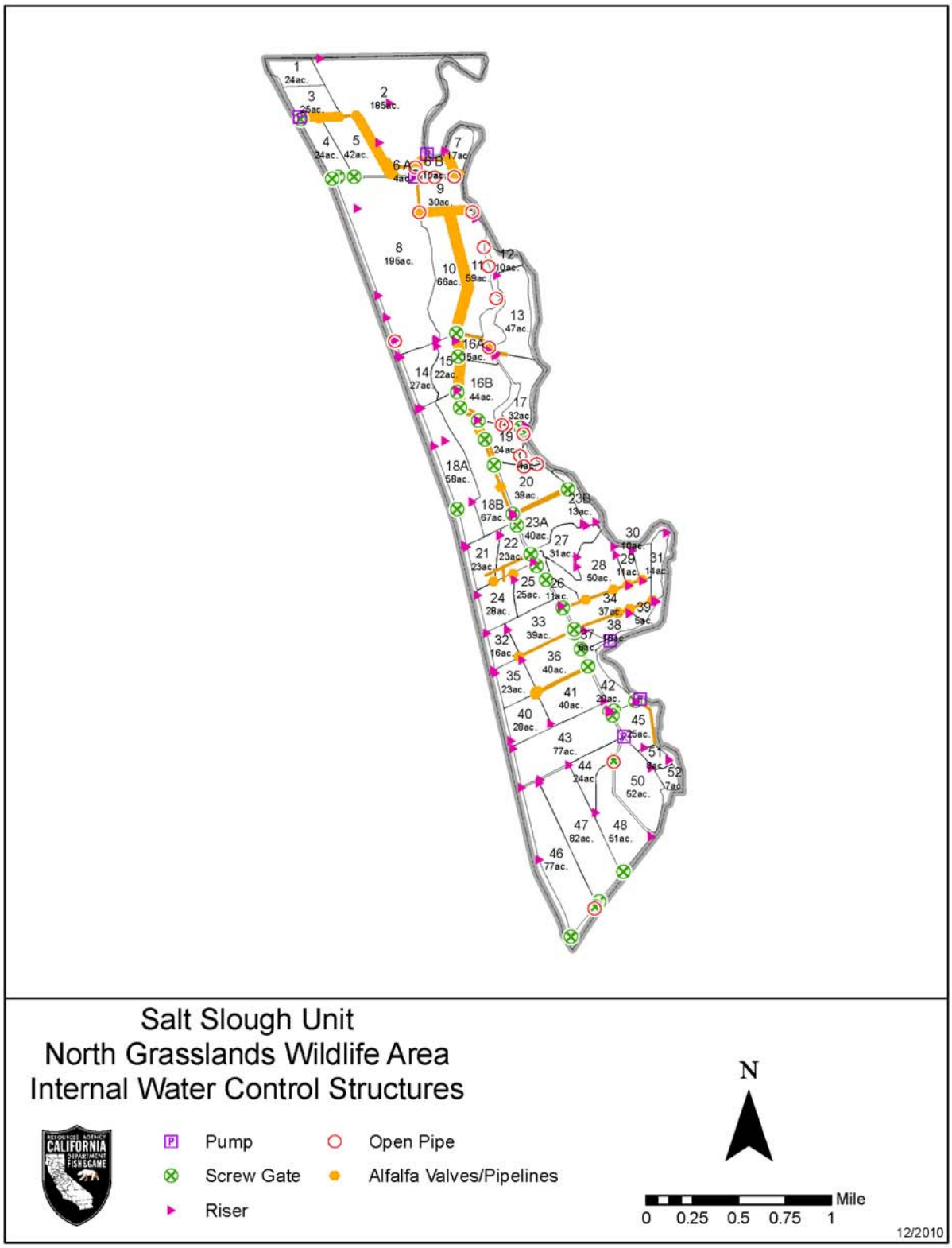
Section D - Inventory of Existing Facilities

1. Mapping

The following map(s) show points of delivery, turnouts (internal flow), and outflow (spill) points, measurement locations, conveyance system, storage facilities, operational loss recovery system, wells, and water quality monitoring locations.



Water delivery and exit points on the North Grasslands – Salt Slough Wildlife Area. See Tables 2 and 3 below for more information.



Internal turn-outs and wells on the North Grasslands– Salt Slough Wildlife Area. (See Table 2 for details.)

2. *Water measurement*

a. *Inflow/deliveries*

Total # of inflow locations/points of delivery 1

Total # of measured points of delivery 1

Percentage of total inflow (volume) measured during report year 100% of the total delivered amount is currently measured by GWD

Delivering agency	*Conveyance facility*	*Measuring point*	*Refuge distribution facility*	*% of total inflow*	*Type of measurement*	*Measuring agency*
GWD	San Luis Canal	Refuge boundary	Salt Slough Main Canal	100%	Clausen Weir	GWD

b. *Internal flow at turnouts*

Total # of refuge water management units (units) 54

Total # of refuge water management unit turnouts 777

Total # of measured turnouts 0

Estimated % of total internal flow (volume) during report year that was measured at a turnout 0%

Number of turnouts supplying more than one unit or not directly off delivery system 0

Measurement type	*Number of devices*	*Acres served*	*Accuracy (avg or range)*	*Reading frequency*	*Calibration frequency (months)*	*Maintenance frequency (months/days)*
Orifices						
Propeller						
Weirs						
Flumes						
Venturi						
Alfalfa valves	426	790	NA	Daily , but not measured, when in use	NA	As needed
Metered gates						
Other, stop-log and screwgates	351	2,051	NA	Daily, but		As needed

c. *Outflow*

Outflow (AF/yr) 2,800

Total # of outflow locations/points of spill 8

Total # of measured outflow points 7

Percentage of total outflow (volume) measured during report year 85%

Outflow point	*Measuring point*	*Type of measurement*	*Percent of total outflow (estimated)*	*Measuring agency*	*Acres drained*
Recirculation Ditch	Recirc Weir	Clausen Weir	75%	DFG	864
Field 13	NW corner	Clausen Weir	7%	DFG	78
Field 17	NW corner	Clausen Weir	2%	DFG	32
Field 27	East side	Clausen Weir	8%	DFG	108
Field 29	NW corner	Clausen Weir	2%	DFG	33
Field 39	NE corner	Clausen Weir	2%	DFG	27
Field 51	SE corner	Clausen Weir	2%	DFG	54
Field 7	SW corner	Not measured	1%	DFG	6

3. *Identify the type and length of the refuge internal distribution system*

Miles unlined canal	*Miles lined canal*	*Miles piped*	*Miles – other*
9.0	1.5	7.5	0

Describe the location and types of identified leaks and areas of higher than average canal seepage, and any relation to soil type.

The wildlife area staff has not identified any significant leaks or areas of higher than normal canal seepage. The staff continues to assess the water distribution system and improve the system when feasible. Past water conveyance improvements have improved water delivery efficiency on the wildlife area. These improvements include pipelines and replacement of old leaking water control structures.

4. *Describe the refuge operational loss recovery system*

There is one recirculation pump. The Recirculation Pump located on the Wolfsen Drain between fields 8 and 6, has the capability to pump water out of the Wolfsen Drain into pipelines for redistribution to fields 1-16 or the water can be allowed to flow out to Salt Slough.

Pump #	Location	HP
SS-2	Wolfsen Drain Ditch	25

5. Groundwater

Describe groundwater availability, quality and potential for use

There is one 100 hp ground water well (565 ft) along the west side of Field 45. It was developed in 1991 and is periodically used to augment Central Valley Project (CVP) water supplies. It produces 4 cfs and pumps directly into the main delivery canal. Because the EC is above 2,000, the pumped water is blended with surface supplies. Water is pumped predominantly for augmenting delivered water when irrigating upland habitat. For more details, see USBR July 2004 "evaluation of Groundwater Potential for Incremental Level 4 Refuge Water Supply."

Groundwater plan *No* ___X___ *Yes* ___ *(please attach or provide web link).*

Groundwater basin(s) that underlie the refuge

Name of basin underlying refuge	*Size (sq. mi.)*	*Usable capacity (AF)*	*Safe yield (AF/Y)*	*Management agency*	*Relevant reports*
San Joaquin/ Delta Mendota Sub-basin	1,170	50,000,000	Unknown	None	CH2M Hill

Identify refuge-operated ground water wells

#	*Location*	*Status*	*HP*	*2003 (AFY)*	*Future plans*
SS-4	West side Field 45	Operational	100	50	Utilize as funding and needs allow.

Section E Environmental Characteristics

1. Topography - describe and discuss impact on water management

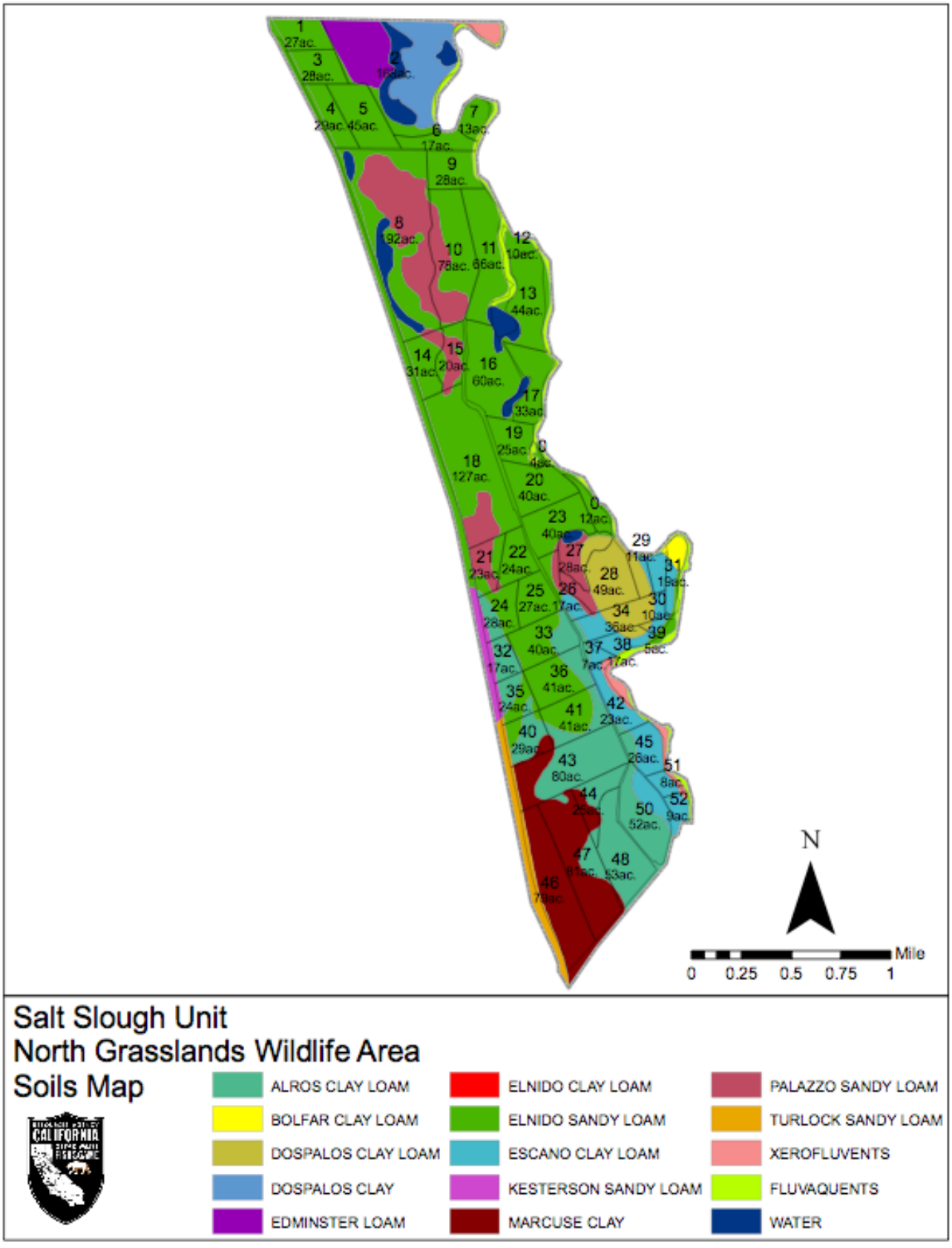
The topography is mostly flat. There is some localized fall from the main water delivery canal to the east towards Salt Slough and from the main canal to the west towards the West Drain Ditch. Most of the levees have been constructed on a one foot or less contour thus providing a fairly high level of control over water depth in the wetlands. This control enables staff to manage the wetlands for a diversity of water-dependent wildlife species that require different water depth needs.

2. Soils - describe and discuss impact on water management (see attached map)

The Salt Slough Unit soils are similar to those found at the China Island Unit. The majority of the soil is El Nido sandy loam from north to south with some Marcuse clay in the southwest portion and Dos Palos clay along Salt Slough.

There a few pockets of sandy loam that requires 35 feet of constant flow to maintain desirable water levels.
Possible impacts on water management are the potential for over drafting of ground water resulting in subsidence. Between 1 and 2 feet of subsidence has occurred in the vicinity of the

wildlife area (Dept. of Water Resources, 2003a). Data from DWR indicate that ground water levels are shallow ranging between 5 to 10 feet below ground surface along the west side of the area.


Salt Slough Unit
North Grasslands Wildlife Area
Soils Map
ALROS CLAY LOAM
BOLFAR CLAY LOAM
DOSPALOS CLAY LOAM
DOSPALOS CLAY
EDMINSTER LOAM
ELNIDO CLAY LOAM
ELNIDO SANDY LOAM
ESCANO CLAY LOAM
KESTERSON SANDY LOAM
MARCUSE CLAY
PALAZZO SANDY LOAM
TURLOCK SANDY LOAM
XEROFLUVENTS
FLUVAQUENTS
WATER
N
Mile
0
0.25
0.5
0.75
1

3. Climate

National Weather Service – (weather station name and id, data period - years)

	Jan	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*	*Annual*
avg precip	1.6	1.6	1.4	0.8	0.3	0.0	0.0	0.0	0.2	0.5	1.0	1.5	9.0
avg. temp	46	52	56	61	67	73	78	77	73	65	53	45	62
max temp	54.5	62.6	67.6	74.3	82.0	89.6	95.5	93.9	88.7	79.7	64.9	54.5	75.6
min temp	36.0	39.7	42.8	46.0	51.4	56.8	60.3	59.5	56.1	49.8	41.9	36.0	48.0
ETo	1.24	2.24	3.72	5.70	7.44	8.10	8.68	7.75	5.70	4.03	2.10	1.24	57.9

Discuss the impact of climate, and any microclimates, on water management

Summers are hot and dry with low humidity. Summer daytime highs range from the low-90s to 110 degrees Fahrenheit. Nighttime lows in the summer range from the mid-60s to high-50s.Spring and Fall weather is generally mild. Spring and Fall temperatures typically range from nighttime lows in the 40's to daytime highs in the 70's. Spring is usually windy and Fall is usually hazy. Winter daytime highs are in the 50's and 60's with overnight lows in the low 30's to mid-40's. Dense ground fog (Tule fog) usually forms from winter through early Spring, depending on conditions.
Hot dry summers and dry springs require the irrigation of wetlands and upland habitats to produce quality plant growth. Drier than normal weather also has the potential to increase salinity in ponds.
Higher than normal rainfall can result in the utilization of less allocated water for the refuge.

4. Water quality monitoring (attach water quality test result forms)

If the refuge has a water quality monitoring program complete this table

Analyses performed	*Frequency range*	*Concentration range*	*Average*
EC reading/ outflow	Weekly when possible.	520-1800	1200

Real-time data is available at the following website:
www.ysieconet.com/public/WebUI/Default.aspx?hidCustomerID=99

These readings are taken from the one point of inflow and 7 of the monitored outflow points. Parameters that are monitored are specific conductivity (uS/cm), flow (ft3/sec.), water temperature (F), flow velocity (ft./ sec., and total dissolved solids (TDS).

Discuss the impact of water quality on water management

We currently accept agricultural drain water as long as the selenium level is less than 2 parts per million (ppm), (Federal Environmental Protection Agency standard), the boron level is less than 6 ppm (based on Grasslands Water District standards), and the salinity level is less than 1,500 ECs. Due to high salinity in groundwater, it is pumped only when it can be diluted with higher quality water.

Section F Transfers, Exchanges and Trades

Provide information on any transfers, exchanges and/or trades into or out of the refuge

From whom	To whom	Report year (AF)	Use
None			
	TOTAL		

Section G Water Inventory

1. Refuge Water Supplies Quantified
   - Table 1 -
     - Surface water supplies, imported and originating within the District, by month.
     - Ground water extracted by the refuge, by month.
     - Upslope Drain Water, by month.
     - Other supplies, by month
   - Table 3 - Precipitation by habitat type
   - Table 4 - Refuge Water Inventory
   - Table 5 - Ten Year History of Refuge Water Supplies

2. Water Use Quantified
   - Table 2 - Conveyance losses, including seepage, evaporation and operational losses
   - Table 3 -
     - Managed habitat water needs
     - Evapotranspiration
     - Cultural Practices (water for disease control, invasive weed control.)
   - Table 4 - Habitat spills or drain water leaving the Refuge

See tables for details.

Section H Critical Best Management Practices

Describe the 5-year implementation plan and the proposed 3-year funding budget.

1. Management programs

a. Education

Program	*Estimated cost (in $1,000s)*		
	2011	*2012*	*2013*
Annual USFWS/DFG Marsh Management Workshop*****	$3	$3	$3
Public Outreach- Environmental Education Coordinator (1/4 tome on water issues)*****	$4.6	$4.6	$4.6
Cal Poly Water Management Course*****	$.5	$.5	$.5

*** North Grasslands (Salt Slough, China Island) and Los Banos (Los Banos, Volta) Wildlife Area Complex.**

Describe the specifics of each program (number of participants, topics, purpose, etc.)

Annual USFW/DFG Marsh Management Workshop. We are interested in sending 3 or 4 area managers to the workshop - costs are for travel and per diem. The workshop presents new wetland management strategies and techniques, including water conservation practices.

The **Environmental Education Coordinator** conducts field trips on the wildlife area and surrounding wetlands as well as visiting classrooms throughout Merced County. The outdoor education program has provide service for over 5,300 children and adults in the past two years. A portion of the curriculum focuses on the importance of wetlands to water quality and flood control as well as the importance of clean water to the wetlands themselves. The dollar amount shown is the total amounts spent by the Complex wildlife areas.

Cal Poly Water Management Course. We are interested in sending one person per year to the Cal Poly water management course conducted by Dr. Charles Bart and Stewart Stiles. Cost is for travel costs, though the course itself in free of charge.

b. Water quality monitoring

Type of water	*Existing Estimated cost (in $1,000s)*		
	2011	*2012*	*2013*
Surface – USBR and riparian	$1	$1	$1
Upslope drain			
Groundwater			
Outflow	$4	$4	$4

Short description of existing or planned program – i.e., required by which agency, coordinated with whom, constituents monitored and frequency

The wildlife area staff currently monitors on a weekly basis water salinity and flow rates at 7 points (1 inflow point and 6 outflow points). Estimated cost is $4,000 per year.
In addition, Grasslands Water District monitors outflow at the Wolfsen Drain as part of the Real Time Water Quality Monitoring Program (RTWQM) for the Grasslands Resource Conservation District.

c. Cooperative efforts

The DFG partners with the Westside San Joaquin River Watershed Coalition to implement the Central Valley Regional Water Quality Control Board Agricultural waiver. We are currently a partner with PG & E for pump efficiency testing. The wildlife area is partners with Grasslands Water District's RTWQM Program for the Grasslands Resource Conservation District.

d. Pump evaluations

Total number of groundwater pumps on refuge 1

Total number of surface water (low-lift) pumps on refuge 3

Groundwater pumps	*Estimated cost (in $1,000s)*		
	2011	*2012*	*2013*
# of groundwater pumps tested			1 @ $1.5
# of pumps to be fixed or replaced			
# of low-lift pumps to be tested		1 @ $1.5	
# of pumps to be fixed or replaced	1 @ $12	1 @ $12	1 @ $12

e. Policy evaluation

If Central Valley Project power could be obtained to operate pumps, it would greatly enhance our ability to operate pumps and distribute CVPIA water onto the wildlife area.

Having the ability to change scheduled monthly water allotments so that the refuge can use the available water supply in response to climatic conditions and change in habitat water needs would allow for greater flexibility for utilization of water allotments.

During the normal water management activities, water conveyance evaluation and water management planning, water conservation issues are discussed and planning for water conservation is done on a continuous basis by the staff..

4. Water management coordinator

Name: Steven T. Miyamoto *Title:* Wildlife Habitat Supervisor II

Address: 18110 West Henry Miller Ave., Los Banos, CA 93635

Telephone: (209) 826-0463 *E-mail:* smiyamoto@dfg.ca.gov

Section I Exemptible Best Management Practices

Describe the 5-year implementation plan and the proposed 3-year funding budget.

1. Improve management unit configuration

Unit name	*Current acres*	*Reason for change*	*Proposed acres*	*Estimated cost (in $1,000s)*		
				2011	*2012*	*2013*
Field 46	77	Improve flooding/draining capabilities to improve habitat and follow BMP for mosquito population control	77		$23	
Field 47	82	Improve flood/drain capabilities for habitat and mosquito population BMP	82		$25	
Field 48	51	Improve flood/ drain capabilities for habitat and mosquito population control	51		$20	
Field 12	10	Improve flood/ drain capabilities for improving wetland habitat.	6	$6		
Field 13	47	Improve flood/drain capabilities to improve wetland habitat.	47	$18		
Field 17	32	Improve flood/drain capabilities to improving wetland habitat.	32	$18		

2. Improve internal distribution system

a. New control structures within distribution system

Proposed location	*Type of structure*	*Reason for new structure*	*Estimated cost (in $1,000s)*		
			2011	*2012*	*2013*
Throughout refuge; 4-6 yearly	Concrete weirs/ HDPE pipe	Replace old corrugated water control structures with HDPE pipe and concrete weirs to increase WC's life expectancy.	$3-$9	$3-$9	$3-$9

b. Line/pipe sections of distribution system

Proposed reach/sect.	*Reason for new structure*	*Estimated cost (in $1,000s)*		
		2011	*2012*	*2013*

No new pipelines or extensions to existing pipelines are currently planned.

c. Independent water control for each unit

Proposed control point	*Reason for new control point*	*Estimated cost (in $1,000s)*		
		2011	*2012*	*2013*
Field 12	Provide drainage for field.	$4		

d. New internal distribution sections (pipe, canal) to provide water to existing and new habitat units

Proposed new section	*Units served*	*Reason for new section*	*Estimated cost (in $1,000s)*		
			2011	*2012*	*2013*

No new internal distribution sections (canals, pipelines) are currently planned for the refuge.

3. Develop a Water Use Schedule

Plan element	*Completion date*	*Estimated development/update cost (in $1,000s)*		
		2011	*2012*	*2013*
Floodup dates by unit	See details below			
Drawdown dates by unit	See details below			
Irrigation dates by unit	See details below			

Field management plans are developed each year to determine floodup, drawdown and irrigations dates. Dates may change according to weather, water allotments and individual pond management goals for the year.

4. Plan to measure outflow

Identify locations, prioritize, determine best measurement method/cost, submit funding proposal

	Estimated cost (in $1,000s)		
	2011	*2012*	*2013*
Identify locations			
Estimate outflow quantity/rank			
Develop plan			
Estimate construction start date			
Estimate construction completion date			

An estimated 80% of refuge outflow is currently being measured as part of the RTWQM Program. The site is located on the Wolfsen Drain and is maintained and monitored by the Grasslands Water District. There are no plans at this time to establish additional outflow monitoring sites.

6. Construct and operate operational loss recovery systems

Proposed location	*Reason for improvement*	*Estimated cost (in $1,000s)*		
		2011	*2012*	*2013*
None	See details below			

The refuge has one recirculation pump that has the capability via pipelines, to redistribute water to fields 1-18. Any outflow from the refuge is used to maintain habitat quality downstream in Salt Slough.

7. Optimize conjunctive use of surface and groundwater

Proposed production/injection well	*Anticipated yield*	*Estimated cost (in $1,000s)*		
		2011	*2012*	*2013*
None	See details below			

The refuge currently has the potential for a conjunctive use program with the one operating groundwater well. Groundwater can be used to supplement surface water deliveries.

8. Facilitate use of available recycled urban wastewater that otherwise would not be used beneficially, meets all health and safety criteria, and does not cause harm to wildlife management goals.

Not applicable. There is no recycled urban wastewater available in this area.

9. Mapping

GIS map layers	*Estimated cost (in $1,000s)*		
	2011	*2012*	*2013*
Map 1 – Water Distribution System	$1	$1	$1
Map 2 – Drainage System	$1	$1	$1

Mapping was completed in 2010. We are currently reviewing the data for accuracy.

10. CALFED Quantifiable Objectives

Describe any past, present, or future plans that address the goals identified for this refuge

If reducing nonproductive ET involves removing invasive plants, complete the following:

Invasive unwanted species name	Estimated acres			*Estimated cost (in $1,000s)*		
	2011	*2012*	*2013*	*2011*	*2012*	*2013*
Perennial Pepper Weed	20-30	20-30	20-30	$2-$3	$2-$3	$2-$3
Yellow Star Thistle	10-15	10-15	10-15	$1	$1	$1
Bermuda Grass	10-20	10-20	10-20	$2	$2	$2

Estimated dollar amounts include cost of herbicides, equipment and maintenance and repairs to equipment.

North Grassland, Volta, and Los Banos WA's

1. Describe actions that reduce selenium concentration in the Grassland Marshes. Reduce selenium concentration to 5 ug/L in the Grassland Marshes. (TB 95)

The refuge currently accepts only water with a selenium level of less than 2 parts per million (ppm) –
Federal Environmental Protection Agency standards.

2. Describe actions that reduce San Joaquin River selenium and boron concentrations. Reduce San Joaquin River selenium concentration to 5 ug/L and boron concentration to 2 mg/L from March 15 to September 15 and to 2.6 mg/L September 16 to March 14. (TB 98)

Th refuge currently accepts only water with a selenium level of 2 ppm (Federal EPA standards) and a boron level of less than 6ppm (Grasslands Water District standards).

3. Describe actions that reduce salinity in the Grassland Marshes and Mud and Salt Sloughs. Reduce salinity in the Grassland Marshes and Mud and Salt Sloughs. (TB 102, 103)

The refuge currently accepts only water with a salinity level of less than 1,500 EC (standard based on local historical knowledge).

4. Describe actions that reduce nonproductive ET. Reduce unwanted ET. (TB 107)

Staff removes and/ or controls non-native invasive plant species to reduce non-productive evapotranspiration.

Section J BMP Exemption Requests

No exemption requests.

Table 1

Water Supply

2009	Federal Wtr Level 2 (acre-feet)	Federal Wtr Level 4 (acre-feet)	Local Water Supply (acre-feet)	Refuge Groundwtr (acre-feet)	Up Slope Drain Wtr (acre-feet)	other (define) (acre-feet)	Total (acre-feet)
Method	**M1**	**M1**					
Jan-2010	903	0	0	0	0	0	**903**
February	734	0	0	0	0	0	**734**
Mar-2009	464	0	0	0	0	0	**464**
April	179	0	0	0	0	0	**179**
May	0	357	0	0	0	0	**357**
June		357	0	0	0	0	**357**
July	0	230	0	0	0	0	**230**
August	813	256	0	0	0	0	**1,069**
September	992	0	0	0	0	0	**992**
October	952	0	0	0	0	0	**952**
November	1,359	0	0	0	0	0	**1,359**
December	748	0	0	0	0	0	**748**
TOTAL	**7,144**	**1,200**	**0**	**0**	**0**	**0**	**8,344**

***March 1, 2009 - February 28, 2010**

Table 2

Measurement Method Definitions:

M1	Measured summation from calibrated measuring devices, accurate to within +/- 6 percent.
M2	Measured summation from calibrated measuring devices.
M3	Measured summation from measuring devices.
C1	Calculated (more than summation) using information from calibrated devices (such as the difference between measurements upstream and down stream of diversion).
C2	Calculated using information from measuring devices.
C3	Calculated using estimates from pump run-times and pump efficiency.
E1	Estimated using measured information from similar conditions.
E2	Estimated using historical information.
E3	Estimated using observation.
O1	Other (attach a note with descriptions of other methods used).

Table 2

Internal Distribution System

Year	2009								
Canal, lateral	Length (feet)	Width (feet)	Surface Area (square feet)	Precip. (acre-feet)	Evaporation (acre-feet)	Seepage (acre-feet)	Operational losses (acre-feet)	Measure method (see Cell K5)	Total (acre-feet)
Unlined canal	47,520	25	1,188,000	23.84	129.59			E3	**(106)**
Lined canal	7,920	15	118,800	2.38	12.96			E3	**(11)**
Pipeline	39,600		0	0.00	0.00			E3	**0**
			0	0.00	0.00				**0**
			0	0.00	0.00				**0**
			0	0.00	0.00				**0**
			0	0.00	0.00				**0**
			0	0.00	0.00				**0**
			0	0.00	0.00				**0**
			0	0.00	0.00				**0**
			0	0.00	0.00				**0**
			0	0.00	0.00				**0**
			0	0.00	0.00				**0**
TOTAL	**95,040**		**1,306,800**	**26**	**143**	**0**	**0**		**(116)**
			30	**acres**					

Enter precipitation and evaporation data only for months the distribution system was in use.

AFY carried by canal	length miles	Distribution System Precip work sheet					Distribution System Evaporation work sheet				
			inches precip	ft precip	acres	AF/Y		inches evap	ft evap	acres	AF/Y
14,600	9.00	**Jan-10**	2.88	0.24	27.27	23.84	**Jan-10**	1.06	0.09	27.27	129.59
2,000	1.50	**Feb-10**	2.84	0.24	2.73	2.38	**Feb-10**	1.98	0.17	2.73	12.96
variable flows	7.50	**Mar-09**	0.43	0.04	0.00	0.00	**Mar-09**	3.95	0.33	0.00	0.00
		Apr	0.26	0.02	0.00	0.00	**Apr**	5.61	0.47	0.00	0.00
		May	0.28	0.02	0.00	0.00	**May**	7.84	0.65	0.00	0.00
		Jun	0	0.00	0.00	0.00	**Jun**	8.53	0.71	0.00	0.00
		Jul	0	0.00	0.00	0.00	**Jul**	8.3	0.69	0.00	0.00
		Aug	0	0.00	0.00	0.00	**Aug**	7.24	0.60	0.00	0.00
		Sept	0.07	0.01	0.00	0.00	**Sept**	5.65	0.47	0.00	0.00
		Oct	1.53	0.13	0.00	0.00	**Oct**	3.93	0.33	0.00	0.00
		Nov	0.36	0.03	0.00	0.00	**Nov**	1.75	0.15	0.00	0.00
		Dec	1.84	0.15	0.00	0.00	**Dec**	1.18	0.10	0.00	0.00
		TOTAL	**10.49**	**0.87**	0.00	0.00	**TOTAL**	**57.02**	**4.75**	0.00	0.00
	18				**30.00**	**26.23**				**30.00**	**142.55**

Table 3

Managed Lands Water Needs

Year	2009																	
Habitat Type	**Area (habitat acres)**	**Habitat Water Needs (AF/ac)**	**AF/ac water Delivered (AF/ac)**	**Delivered Water (Total AF)**	**Precip (AF/Ac)**	**Shallow Groundwtr (AF/Ac)**	**Evap (AF/Ac)**	**Cultural Practices (AF/Ac)**	**Seepage (AF/Ac)**	**Balance (acre-feet)**	**Months irrigated (list all)**		**Evap**	**Cultural**	**Seepage**	**Balance**	**Total**
Seasonal wetlands: timothy	336	5.00	4.00	1,344	0.83	0.00	1.69	1.50	1.25	**467**	**Apr, May**		568	504	420	467	1,959
Seasonal wetlands: smartweed	34	6.00	4.50	153	0.83	0.00	2.84	1.50	1.50	**34**	**Apr-July**		97	51	51	34	232
Seasonal wetlands: watergrass	370	8.00	7.00	2590	0.83	0.00	2.84	1.50	2.00	**921**	**May-July**		1,051	555	740	921	3,267
Permanent wetlands	85	12.00	10.00	850	0.87	0.00	4.83	3.00	3.00	**174**	**all months**		411	255	255	174	1,094
Semi-perm wetlands/brood pond	108	8.00	7.50	810	0.87	0.00	4.83	2.00	2.50	**167**	**Feb-Sept**		522	216	270	167	1,174
Riparian	77	12.00	7.5	577	0.87	0.00	4.83	0.00	1.00	**542**	**Sep-Apr, Jun**		372	0	77	542	991
Upland (Unmanaged)	185			0	0.21	0.00	3.14	0.00	1.25	**(773)**			581	0	231	(773)	40
Upland (Managed)	643	4.00	4.00	1929	0.21	0.00	3.14	0.00	0.00	**691**	**Dec-Mar**		2,019	0	0	691	2,710
Uplands (Small Grain Crops)	61	1.50	1.50	92	0.00	0.00	2.49	0.00	0.38	**(84)**	**Mar-Sept**		0	0	23	(84)	(60)
Roads, Buildings, Parking Lots	33			0	0.00	0.00	0.00	0.00	0.00	**0**	**(define)**		0	0	0	0	0
Total Habitat Acres	**1,932**	**5.45**	**5.45**	**8345**						**2,139**		**TOTALS**	**5,619**	**1,581**	**2,067**	**2,139**	**11,407**

	Evap	Cultural	Seepage	Balance	Total	B1 Wtr Needs
	568	504	420	467	1,959	1,680
	97	51	51	34	232	204
	1,051	555	740	921	3,267	2,960
	411	255	255	174	1,094	1,020
	522	216	270	167	1,174	1,080
	372	0	77	542	991	924
	581	0	231	(773)	40	0
	2,019	0	0	691	2,710	2,572
	0	0	23	(84)	(60)	92
	0	0	0	0	0	0
TOTALS	**5,619**	**1,581**	**2,067**	**2,139**	**11,407**	10,532

Table 4

Refuge Water Inventory

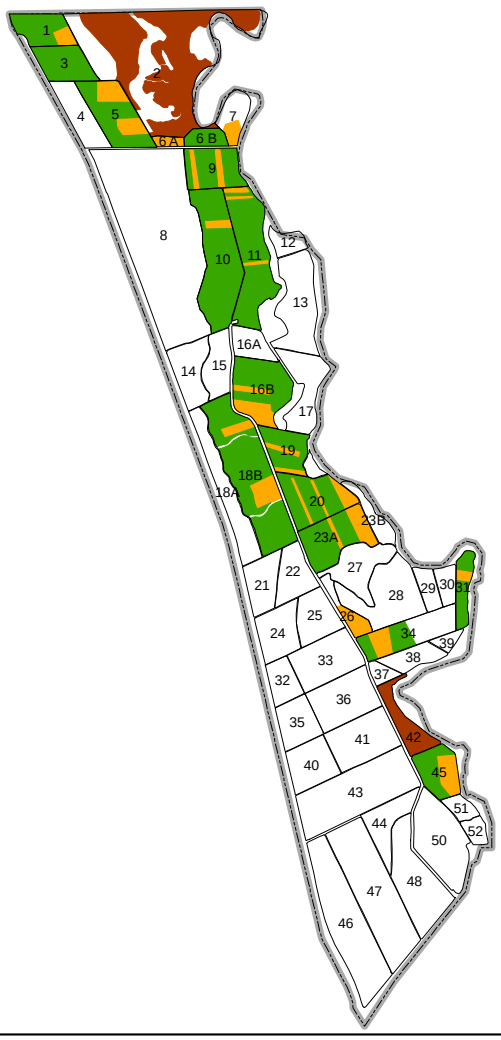
Year	**2009**	**Reference**		
Total Water Supply		**Table 1**		8,344
Precipitation		**Table 2**	**plus**	26
Evaporation		**Table 2**	**minus**	143
Seepage		**Table 2**	**minus**	0
Operational Losses		**Table 2**	**minus**	0
			Deliveries to Managed Lands	8,228
Managed Land needs		**Table 3**	**minus**	10,532
Difference		**(calculated)**		(2,304)
			Balance (outflow?) (Table 3)	2,139

Water Inventory Balance (165)

Table 5

Annual Water Quantities Delivered Under Each Right or Contract

Year	Federal Wtr Level 2 (acre-feet)	Federal Wtr Level 4 (acre-feet)	Local Water Supply (acre-feet)	Refuge Groundwtr (acre-feet)	Up Slope Drain Wtr (acre-feet)	other (define) (acre-feet)	Total (acre-feet)
2001	6,411	3,183	0	0	0	0	**9,594**
2002	6,414	3,277	0	80	0	0	**9,771**
2003	7,426	2,900	0	85	0	0	**10,411**
2004	7,262	2,816	0	85	0	0	**10,163**
2005	6,617	3,340	0	70	0	0	**10,027**
2006	6,957	3,340	0	80	0	0	**10,377**
2007	6,805	1,544	0	85	0	0	**8,434**
2008	7,244	823	0	85	0	0	**8,152**
2009	7,154	1,200	0	80	0	0	**8,434**
2010	7,144	1,200	0	0	0	0	**8,344**
Total	**69,434**	**23,623**	**0**	**650**	**0**	**0**	**93,707**
Average	**6,943**	**2,362**	**0**	**65**	**0**	**0**	**9,371**



Salt Slough Unit
North Grasslands Wildlife Area
Upland Habitats

Grain Crops

Upland (non-irrigated)

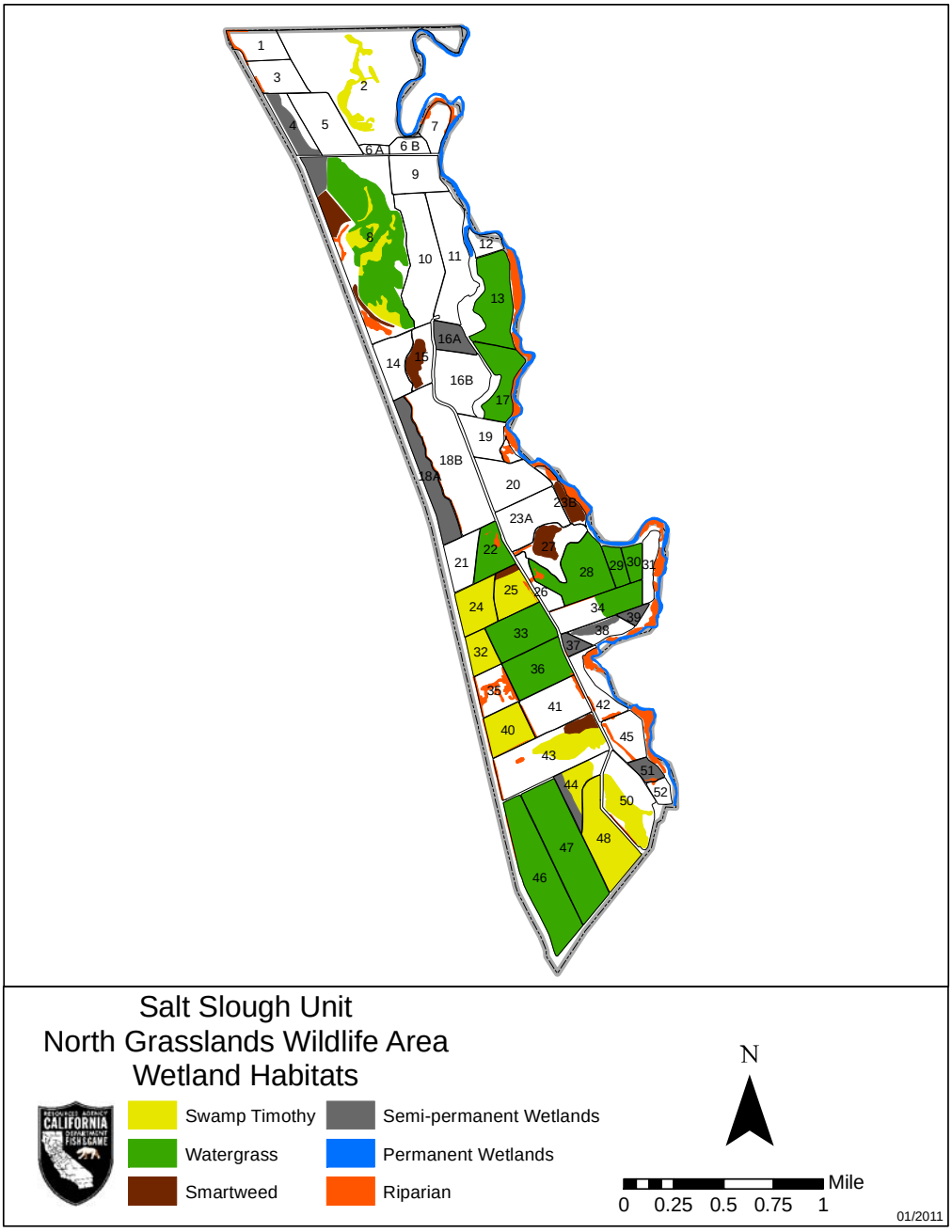
Upland (managed)

N

Mile

0 0.25 0.5 0.75 1

01/2011


Salt Slough Unit
North Grasslands Wildlife Area
Wetland Habitats
Swamp Timothy
Watergrass
Smartweed
Semi-permanent Wetlands
Permanent Wetlands
Riparian
N
Mile
0 0.25 0.5 0.75 1
01/2011