Gray Lodge Wildlife Area

Water Management Plan

first submittal date: 12/14/10
final plan submittal date: 7/11/11

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:* 1931

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	Feather River	01-WC-20-1755		35,400[1]
Federal level 4	Feather River	01-WC-20-1755		8,600
Appropriative	2054 Reclamation Dist	Lic. 009814	9/1-6/30	6,950[2]
Appropriative	RD 833 Lateral C	Lic. 009813	9/1 – 6/15	3,040[2]
Adjudicated	Hamilton Slough	Lic. 001032	4/1-12/15	7,694.8[2]
Adjudicated	Hamilton Slough	Lic. 009812	9/1-6/15	18,761[2]

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

"Water is used to maintain ponds and seasonal marshes and to irrigate moist soil units, crops, and pasture for waterfowl food, cover, and nesting. Before passage of the CVPIA, habitat management on Gray Lodge WA was affected by unreliable water supplies. Both the timing and quantities of water delivered were highly variable. As a result, the types and amount of wetlands area varied annually with the availability of water.

[1] Exhibit B of the contract identifies 16,559 acre feet as Contract water, and 18,841 acre feet as Non-Project water from Biggs-West Gridley Water District and State Water Project Surplus Water.

[2] Agricultural return flows which are opportunistic and unreliable both in terms of quality and quantity.

Before passage of the CVPIA, Gray Lodge WA received water from a combination of surface water and groundwater sources, just as it does now. As a landholder within of the Biggs-West Gridley Water District (BWGWD), Gray Lodge has both primary and secondary surface water rights. Gray Lodge WA receives 8,000 acre-feet of dependable water from BWGWD and Reclamation Districts 833 and 2054. Approximately 2,600 acres of the refuge are within the BWGWD Primary & Secondary Service area. The BWGWD has allocated 12,000 acre-feet of water per year to the refuge, but only 8,000 acre-feet are available during the irrigation season, from April to November. The refuge turnouts are located at the end of the BWGWD system and cannot receive water when the BWGWD canals are dewatered, from November to April (Reclamation, 1989).

The refuge has also diverted water from the R.D. 833's Drain and R.D. 2054's Drain. These canals convey agricultural return flows. The return flows are only available during the summer and early fall when the rice fields are drained. The R.D.s do not use or claim the agricultural return flows, which are diverted by the refuge under appropriative rights (Reclamation, 1989). Water may not be available in R.D. 833's Drain after rice fields are drained in the fall. Water is available from R.D. 2054's Drain from April to November (Reclamation, 1989). The amount of water available in these drains during the normal irrigation season has been decreasing as area farms improve irrigation efficiency and implement tailwater recycling programs. This is not considered a firm water supply for Gray Lodge WA.

Historically, groundwater has been used to supply a portion of the annual demand on the Gray Lodge WA. There are 21 deep groundwater wells used onsite, as necessary, to supplement surface-water deliveries and to supply water to portions of the Gray Lodge WA that cannot be reached by gravity flow from surface supplies. Other water supplies have occasionally been obtained by purchases from the State Water Project (SWP) via the Thermolito Afterbay.

Gray Lodge WA receives 8,000 acre-feet of dependable water from BWGWD. These 8,000 acre-feet are considered a firm reliable water supply."

For an early history of GLWA, see
http://www.dfg.ca.gov/lands/articles/graylodgewaterfowl99.html

5. *Land use history--Identify habitat types specific to this refuge.*

Attach a refuge map showing habitat location and size

Note: Refuge Map is attached at the end of this document

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

Habitat type	***Original size***	***1992 acres***	***1997 acres***	***2010 acres***
Seasonal wetland – timothy, smartweed, watergrass	Unknown	6,000	5,741	5,795
Permanent wetland	Unknown	520	455	246

Semi-permanent wetland/brood pond (summer water subtracted from perm. water)	NA	NA	586*	694*
Riparian	Unknown	Unknown	554	658
Upland	NA	1,644	2,203	3147
Roads, buildings, etc.	NA	156	156	156
Total (size of refuge)	2,540	8,320	9,189	9,189

* Figure derived from DFG workplan

Describe refuge habitat-type water use characteristics

Habitat type	*AF/ac*	*# of irrigations*	*Floodup date*	*Draw down date*
Seasonal wetland	6.5-8.0	1-4	TBD	TBD
Permanent wetland	13.5	NA	NA	NA
Semi-permanent wetland/brood pond	12.0	NA	2/1	9/15
Riparian	15.0	NA	NA	NA
Irrigated pasture	5.8	10	Feb-Nov	NA
Upland (not irrigated)	NA	NA	NA	NA
Upland (grains)	2.0	TBD	NA	NA
Other (>5%)	-	-	-	-
Misc. habitat (<5%)	-	-	-	-

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 first purchase of the Gray Lodge Wildlife Area was in 1931 to provide wetland and waterfowl protection via a sanctuary (non-hunted). In addition, there are many legislative acts that affect the wildlife area mission. In the 1940's, the Leah Act was passed to fund the purchase and management of public lands to decrease crop depredation in the surrounding landscape. In 1953, the Wildlife Area opened to public use and became part of the PR (Pittman-Robertson) program; providing habitat for wintering waterfowl, minimizing crop depredation and providing public hunting opportunities became themain objectives. In 1972, the Federal Endangered Species Act was passed to conserve fish and wildlife which are listed as endangered species or threatened species. In 1977, the California Endangered Species Act was passed with a similar purpose to the federal law.

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

An Annual Management Workplan is prepared each year to implement the overall management goals and objectives in the Wildlife Area Management Plan. The Work Plans follow the Wildlife

Area Habitat Committee guidelines for specific habitat management. The annual Work Plans identify habitat management efforts for the coming year.

The current Wildlife Area Habitat Committee objectives are as follows:

Permanent Wetlands:
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 to meet habitat management goals and objectives. 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 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 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 species should compliment one another in such a way as to provide for a balance of nutritional and cover qualities. The selection 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, their quality.

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 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 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 Workplan is prepared to implement the overall management goals and objectives in the Wildlife Area Management Plan. 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*

The current USBR / Biggs West Gridley Water District contract for construction and water delivery contains a four year construction period for BWGWD upgrades. Level 2 delivery amounts will be reduced during this four year construction period. Level 4 water will not be delivered until after the four-year construction period. In order to attain full level 2 during this four year period Fish and Game has entered into a contract with USBR to pump groundwater in amounts necessary to assure full level 2 amounts.

An additional constraint is mosquito abatement. The escalating costs and concerns of mosquito abatement are affecting the ability of the GLWA to meet the intent of CVPIA, both fiscally and ecologically.

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 about 20% of our total CVPIA water needs; however, BWGWD will not be able to deliver Level 4 water until the BWGWD upgrades are completed.

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

USBR / BWG contract fulfillment will address the first two constraints above. DFG is working with the statewide Mosquito Abatement Association to implement Best Management Practices that satisfies both entities objectives.

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.

Section C - Policies and Procedures

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

The September 23, 2003 USBR/Biggs-West Gridley Water District Assistance Agreement for water conveyance to Gray Lodge Wildlife Area specifies acceptable water quality criteria for delivered water as follows:

"The District shall ensure that the quality of water delivered at the Point(s) of Delivery will be maintained free of substance in concentrations that produce detrimental physiological responses in plant, animal, and aquatic life, or adversely affects any beneficial use for wetlands management. Specifically refuge water will not contain dissolved oxygen levels below 5.0 mg/l; total dissolved solids in excess of 1000 parts per million daily maximum and 450 parts per million monthly average; 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 for fish and wildlife resources."

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. The Gray Lodge Wildlife Area 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 USBR, Willows Area Office. Internal flows are monitored daily by DFG for purposes of tracking movement through the system to the proper place of use on the wildlife area. Outflow at some points is monitored by DFG as time permits.

GLWA is located at the bottom of three agricultural drainage districts. GLWA has no control over the amount of, or timing of, drainage water that flows through GLWA. Currently some of GLWA supply co-mingles with the agricultural drainage water. One of the goals of the GLWA internal distribution improvement project is to minimize the mixing of GLWA supply and the agricultural drainage water.

4.- Attach a copy of the refuge's shortage policies, drought plan, or any similar document.

Note: Area staff evaluates refuge water allocations on a yearly basis and prioritize quantities of water to be used based on mandates with priority water use being habitat for migratory birds during the fall. While CVPIA is responsible for providing specific quantities of water to the refuge boundary, DFG staff ensures that all DFG water rights are exercised and preserved in perpetuity. DFG will evaluate water allocations based on source and quantities, on a yearly basis, and use its water rights and CVPIA water to best meet the goals and objective of the Department and the CVPIA.

Section D - Inventory of Existing Facilities

1. *Mapping*

   Attach existing facilities map(s) that 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. Describe in the body of the plan the information contained in each attached map

   At the end of this document are several maps. Illustrated is the water delivery system, agricultural drains, Wildlife Area drains, deep wells and lift pumps.

2. *Water measurement*
   a. *Inflow/deliveries*

   Total # of inflow locations/points of delivery 3

   Total # of measured points of delivery 3

   Percentage of total inflow (volume) measured during report year 100% of our delivered water.

Delivering agency	*Conveyance facility*	*Measuring point*	*Refuge distribution facility*	*% of total inflow*	*Type of measurement*	*Measuring agency*
Biggs West Gridley Water District	Cassady	At WA Boundary	Cassady ditch	30	Dopler	USBR
Biggs West Gridley Water District	Traynor	At WA Boundary	Rising River ditch	20	Dopler	USBR
Biggs West Gridley Water District	Schwinn	At WA Boundary	Schwinn ditch	50	Dopler	USBR

b. Internal flow at turnouts

Total # of refuge water management units (units) 94

Total # of refuge water management unit turnouts 700+

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 undetermined

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	-	-	-	-	-	-
Metered gates	-	-	-	-	-	-
Other, stop-log and screwgates	700+	9,189	NA	Checked every 3 days when in use	NA	NA

c. Outflow

Outflow (AF/yr) 7,500
Total # of outflow locations/points of spill 18
Total # of measured outflow points 0
Percentage of total outflow (volume) measured during report year 0

Outflow point	*Measuring point*	*Type of measurement*	*Percent of total outflow (estimated)*	*Measuring agency*	*Acres drained*
GLD 1	NA	NA	50	NA	NA
GLD 2	NA	NA	4	NA	NA
GLD 3	NA	NA	4	NA	NA
GLD 4	NA	NA	4	NA	NA
GLD 5	NA	NA	4	NA	NA
GLD 7	NA	NA	4	NA	NA
GLD 8	NA	NA	4	NA	NA
GLD 9	NA	NA	2	NA	NA
GLD 10	NA	NA	4	NA	NA
GLD 11	NA	NA	4	NA	NA
GLD 12	NA	NA	4	NA	NA
GLD 13	NA	NA	4	NA	NA
GLD 14	NA	NA	4	NA	NA
GLD 15	NA	NA	4	NA	NA
Miscellaneous outflows (<1% of total outflow) GLD 16, 17, and 18	NA	NA	<1	NA	NA

Note the general flow of water is from the northeast (the three BWGWD delivery points) to the west/southwest.

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

Miles unlined canal	*Miles lined canal*	*Miles piped*	*Miles – other*
>50	0	0	0

Describe the location and types of identified leaks and areas of higher than average canal seepage, and any relation to soil type.
Wildlife Area staff has not identified any significant leaks or areas of higher than average canal seepage, but we continue to assess water systems and improve efficiency where possible. Past and current water system improvements, including techniques to reduce ditch seepage, are continuing to improve the water delivery system efficiency.

4. *Describe the refuge operational loss recovery system*

GLWA has 19 lift pumps of various sizes within the drainage system which allow for reuse of operational spills, seepage and drain water that would otherwise leave the area. Pump number, location, and pump horsepower are identified in the table below:

Pump #	Location	HP
1	NW Corner Field 23	20
2	SE Corner Field 16	20
3	SE Corner field 16	10
8	SW Corner Field 39	20
11	SE Corner Field 52	10
21	SW Corner Field 61	15
29	N Side Field 67	15
30	NW Corner Field 30	15
32	N Side Field 36	15
33	NE Corner Field 71	15
35	SE Side Field 69	8
37	Parking lot 13	20
38	SW Corner Field 77	20
39	SE Corner Field 76	5
40	SE Corner Field 33	15
46	NW Corner Field 81	15
47	NE Corner Field 89	10
51	NW Corner Field 68	10
31	SW Corner Field 47	15

5. *Groundwater*

Describe groundwater availability, quality and potential for use

Groundwater is a key component of CVPIA implementation. GLWA has used and continues to use groundwater during periods when surface water deliveries are not available and/or there is insufficient ditch capacity in the BWGWD. Groundwater availability and quality is good, and is currently used to augment delivered water supplies (up to Level 2 amounts*) while BWGWD upgrades their conveyance facilities under the September 23, 2003 USBR/BWGWD Assistance Agreement. Groundwater could potentially be used to further augment water supplies (i.e. Level 4), but can't be used on its own due to production

limitations. See USBR July 2004 "Evaluation of Groundwater Potential for Incremental Level 4 Refuge Water Supply" for more details.

*DFG is reimbursed for the production of groundwater for Level 2 use under the December 20, 2004 "Agreement for the Reimbursement of Deep Well Pumping Costs on the Gray Lodge Wildlife Area between the United States and the State of California."

Groundwater Plan *No* _____ *Yes* __X__.

Butte County's Department of Water and Resource Conservation was formed on July 1, 1999, and a September, 2004 groundwater plan is now available at: *http://www.buttecounty.net/Water%20and%20Resource%20Conservation/Butte%20IWRP/GW%20Mgmt%20Plan.aspx*

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*
Butte Basin	1,670	See report	See report	See report	See County Report above

Identify refuge-operated deep wells

#	*Location*	*Status*	*HP*	*2009 (AFY)*	*Future plans*
6	NE Corner Field 19	active	150	0	Keep using
7	NE Corner Field 36	active	60	486.201	Keep using
9	SW Corner Field 39	active	60	195.523	Keep using
10	NW Side Field 42	active	150	899.284	Keep using
12	NE Side Field 43	active	30	.009	Keep using
14	E Corner Field 30	active	60	118.534	Keep using
15	SW Corner Field 47	active	60	178.219	Keep using
17	NW Corner Field 54	active	60	245.809	Keep using
18	NE Corner Field 55	active	60	230.057	Keep using
19	Parking Lot 11	active	60	332.147	Replace
22	NE Corner Field 53	active	60	121.98	Keep using
25	N Side Field 65	active	15	6.349	Monitoring well
26	NW Corner Field 66	active	60	452.196	Keep using
28	SW Corner Field 35	active	100	350.857	Keep using
34	NE Corner Field 72	active	30	1.076	Keep using
41	SE Corner Field 81	active	25	0	Keep using
42	NE Corner Field 85	active	25	.004	Replace
43	SE Corner Field 90	active	30	167.164	Keep using
48	SW Corner Field 38	active	100	338.651	Keep using
49	NW Corner Field 55	inactive	100	0	Replace
50	S Side Field 59	active	75	668.329	Keep using
52	NE Corner Field 27	Planned	TBD	-	Proposed new

					well
				Up to 16,000*	

The safe yield is estimated at 16,000 AFY (USBR 1992 & CH2MHILL 1994). Gray Lodge has pumped as much as 16,158 AF (water year 1994).

Section E Environmental Characteristics

1. Topography - describe and discuss impact on water management

Gray Lodge Wildlife Area is typical of palustrine wetlands, being relatively flat, and sloping gently toward the Butte Creek drainage with which it is associated. The elevation is highest at the northeast Corner, being slightly more than seventy-five (75) feet above mean sea level. At the western end, some six miles distant, the elevation is just under fifty-five (55) feet above sea level. The intervening land slopes with little relief other than man-made levees.

Gray Lodge is situated in a unique location. It is bounded on the South by the Sutter Buttes and on the West by the Butte Sink. These two topographical features are advantageous to the water management of the area by disrupting the normal flow pattern of the eastern central valley from North East to South West. The uprising of the Sutter Buttes pushes water from the South Northward toward the Butte Sink to the West, this allows the area to recapture and re-circulate water at various points throughout the area. Throughout the history of GLWA, lift pumps and deep wells have been used to accomplish the distribution of water in order to meet the management objectives of the area.

Wildlife area staff has incorporated as many of the historical lift-pumps as possible into its $6 million re-vamping of the internal water conveyance system. To date, twelve lift pumps are used to recapture and mix water flowing from the North- East corner of the area (highest elevation) to the North-West corner (lowest elevation). Approximately eighty percent of the acreage comprising the Wildlife Area is now able to optimally utilize CVPIA water to manage for the goals and objectives of the area.

2. Soils - describe and discuss impact on water management

According to the U.S. Geological Survey's Bureau of Soils 1926 map, there are several related soil types at Gray Lodge. The two principal soils are Landlow Loam and Stockton Clay Adobe (normal, brown, and gray phases). In addition, sizeable quantities of Gridley Clay Loam are present, along with lesser amounts of Nord Loam and Sutter Sandy Loam (normal and heavy phases). See soils map, attached. The original habitat development took into consideration soil characteristics when the refuge was developed and there are no water management impacts.

3. Climate

The local climate is typically Mediterranean, with cool, wet winters, and warm, dry summers. Temperatures range from highs over 110 degrees Fahrenheit to lows below 30 degrees F. Average mean monthly temperatures range from 77 degrees F in July to 49 degrees F in January. Average annual rainfall is 37 inches. The prevailing wind is from the south, with a majority of the precipitation being of tropical marine origin.

National Weather Service – (Willows (049699), July 1948 to December 2001)

	Jan	*Feb*	*Mar*	*Apr*	*May*	*Jun*	*Jul*	*Aug*	*Sep*	*Oct*	*Nov*	*Dec*	*Annual*
avg precip	3.65	3.29	2.44	1.10	0.65	0.32	0.04	0.13	0.29	0.97	2.47	2.71	18.06
avg. temp	44.9	49.7	53.1	58.8	66.0	73.1	77.4	75.7	72.5	64.3	53.0	45.5	61.20
max temp	54.4	60.6	65.3	72.9	80.7	88.6	94.1	92.5	89.1	79.4	65.0	55.5	74.80
min temp	35.5	38.7	40.9	44.6	51.3	57.7	60.7	58.8	56.0	49.2	41.0	35.6	47.50
ETo	*1.2*	*1.8*	*3.0*	*4.7*	*6.1*	*7.7*	*8.5*	*7.1*	*5.4*	*3.7*	*1.6*	*1.0*	*51.80*

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

The high ETo in the summer and early fall months means that any wetlands in the summer and early fall are going to require a much higher rate of water application than areas flooded in the winter. Summer water ponds must generally be fairly deep to prohibit vegetation from quickly dominating the wetlands. Ponds can also be flooded less deeply, but then must be disced on an annual basis.

There are no known microclimates that affect water management on the area.

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*
See below			

Groundwater produced for Level 2 water supply under the December 20, 2004 "Agreement for the Reimbursement of Deep Well Pumping Costs on the Gray Lodge Wildlife Area between the United States and the State of California." is tested by the Bureau of

Reclamation for the physical and chemical constituents listed in "Table 1" of the agreement.

Discuss the impact of water quality on water management

Delivered water - Section C1 above identifies acceptable water quality criteria for contract water delivered by BWGWD. Gray Lodge has not had water quality problems with this water supply. USBR is proposing to expand surface water monitoring at major inflow and outflow points to include temperature, EC.

Appropriative rights water *- Section A2 above identifies four appropriative water rights for agricultural return flows which are opportunistic and unreliable both in terms of quality and quantity.*

Groundwater – Groundwater continues to provide a portion of wetland water supply at Gray Lodge Wildlife Area. DFG measures groundwater levels for both active and inactive wells on a monthly basis and provides this information to USBR. USBR collects monthly EC, pH and DO samples from each well used to provide surface supply. In addition, USBR tests groundwater for specific conductance, arsenic, chromium, iron, and manganese; and surface water for DO, specific conductance, chromium, hardness, and pH prior to pumping groundwater and one month after pumping stops.

DFG is a member of (and provides approximately $10,000 funding to) the Sacramento Valley Water Quality Coalition which monitors collective surface discharge from irrigated lands under the Central Valley Water Quality Control Board's Irrigated Lands Conditional Waiver Program. See Section H1.b. of this report for more information on this subject. You can also go to the following location for additional program information:
http://www.waterboards.ca.gov/centralvalley/water_issues/irrigated_lands/conditional_waivers/index.shtml

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	1989 (AF)	Use
Sacramento National Wildlife Refuge	Gray Lodge Wildlife Area	905	Level 2 habitat
See below	*TOTAL*		

GLWA received 905 acre feet of Level II supply from the Sacramento National Wildlife Area in January of the 2009 water year for habitat maintenance.

Section G Water Inventory

See Tables

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*
Environmental Education Coordinator	25	25	25
Cal Poly Water Management Course	1	1	1
Annual Refuge Management Workshop	6	6	6

Describe the specifics of each program (number of participants, topics, purpose, etc.) and attach program materials, if available.

The **Environmental Education Coordinator** will conduct fieldtrips on the wildlife area and surrounding wetlands as well as visiting classrooms. 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.

Cal Poly Water Management Course. We are interested in sending two 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.

Annual Refuge Management Workshop. Area staff will participate in annual wetland management workshops put on by USFWS/DFG.

b. Water quality monitoring

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

** Groundwater produced for Level 2 water supply under the December 20, 2004 "Agreement for the Reimbursement of Deep Well Pumping Costs on the Gray Lodge Wildlife Area Between the United States and the State of California." is tested by the Bureau of Reclamation for the physical and chemical constituents listed in "Table 1" of the agreement.*

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

Central Valley Regional Water Quality Control Board

Surface waters which exit Gray Lodge Wildlife Area to waters of the state are subject to the Central Valley Regional Water Quality Control Board (Board) July 2003 *Conditional Waiver of*

Waste Discharge Requirements for Discharges from Irrigated Lands within the Central Valley Region. The waiver includes "managed wetlands" in the definition of irrigated lands. A Monitoring and Reporting Program Plan and Watershed Evaluation Report were prepared by the Sacramento Valley Water Quality Coalition for all participating dischargers in the Sacramento Basin, including Gray Lodge Wildlife Area. The Plan and Report were submitted by the Coalition to the Board April 1, 2004, and accepted by the Board December 7, 2004. Monitoring is on-going, and currently involves monitoring below large discharge locations on the Sacramento River mainstem, tributaries, and agricultural drains. If monitoring reveals "hot spots", monitoring locations move upstream in order to locate the source. The goal of the MRPP and the Coalition is to identify if dischargers are in compliance with the Sacramento/San Joaquin River Basin Plan, and to facilitate appropriate action where required. This effort is ongoing.

c. Cooperative efforts

DFG participates with USBR through renewable annual contracts (Agreement No. 03-WC-20-2601) to pump groundwater necessary for full Level 2 water supplies while the BWGWD upgrades take place, and cannot deliver the full Level 2 amounts.

Area staff works with NGO such as CWA and DU to improve wetland units for habitat diversity and water efficiency.

d. Pump evaluations (mobile labs)

Total number of groundwater pumps on refuge ___*21*___

Total number of surface water (low-lift) pumps on refuge _____*19*_____

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

* Based on current budget constraints, we no longer have the luxury to plan for testing or replacement of equipment. When equipment breaks or fails, we may get it fixed.

e. Policy evaluation

If CVP power could be obtained, it would greatly enhance our ability to both pump and distribute water onto the wildlife area. GLWA would like the ability to change, on a real-time bases, scheduled monthly quantities so that the refuge can use available supply in response to unpredictable weather conditions and changing habitat needs. This flexibility currently does not exist.

2. Water management coordinator

Name: _____Brian Cary

Title: Environmental Scientist

Address: *830 S. Street Sacramento CA 95811*

Telephone: (916) 445-1747 *E-mail:* bcary@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*
TBD				TBD	TBD	TBD
Unit 67	228	Water efficiency	228	80	0	0
Unit 46	91	Water efficiency	30	80	0	0

*Changes to unit configurations are determined each year in the annual planning process.

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*
Various-as needed			TBD	TBD	TBD

* Based on current budget issues, we no longer have the luxury of planning on replacement of control structures. Failures are evaluated and replaced as the ability to do so presents itself.

b. Line/pipe sections of distribution system

Proposed reach/sect.	*Reason for new structure*	*Estimated cost (in $1,000s)*		
		2011	*2012*	*2013*
NA*		0	0	0

*Lined pipes are not beneficial to wildlife

c. Independent water control for each unit

Proposed control point	*Reason for new control point*	*Estimated cost (in $1,000s)*		
		2011	*2012*	*2013*
TBD*		TBD	TBD	TBD

* Based on the current budget climate, we evaluate unit and control upgrades based on availability of funds.

Internal water control configurations are determined/altered each year in the annual planning process. Independent water control structures are not planned for future years due to the existing

flow-through design/internal upgrade that maximizes water distribution across the largest area of targeted wetland acreages possible.

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*
*As needed			TBD	TBD	TBD

*Any changes to internal distribution sections are determined each year in the annual planning process based on need and or resource availability.

(GRCD only) ~~*Provide assistance to member units to improve internal distribution*~~

3. Develop a Water Use Schedule

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

Note: Development of water use schedules is currently restricted due to budget constraints associated with personnel and operations.

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	0	0	0
Estimate outflow quantity/rank	0	0	0
Develop plan	0	0	0
Estimate construction start date	0	0	0
Estimate construction completion date	0	0	0

There are eighteen total outflow points which collectively drain 1) delivered water from Biggs West Gridley Water District, 2) pumped groundwater, 3) agricultural and urban drainwater from upstream laterals and drains, and 4) winter flood flows. The large number of inputs combined with the large number of both natural and anthropocentric outflow points along with the various water rights and privileges makes measuring or quantifying this water a highly complex and expensive measure.

5. (GRCD only) ~~Incentive pricing~~

6. Construct and operate operational loss recovery systems

Proposed location	*Reason for improvement*	*Estimated cost (in $1,000s)*		
		2011	*2012*	*2013*

We do not anticipate seeking grant funding for operational loss recovery systems in the foreseeable future. The refuge completed a major ($6.9 million) construction of a multi-year partnership project with Ducks Unlimited to upgrade and expand the internal distribution system. The refuge will spend the next several years monitoring the new system to identify any problem areas.

7. Optimize conjunctive use of surface and groundwater

Proposed production/injection well	Anticipated yield	*Estimated cost (in $1,000s)*		
		2011	*2012*	*2013*

Conjunctive use has been and continues to be part of year-round water management. GLWA has the capability to pump more than 16,000 AFY. See sections A4 and D5 above for description of historic and current conjunctive use.

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.

No recycled urban wastewater is available in this area

9. Mapping

GIS map layers	*Estimated cost (in $1,000s)*		
	2011	*2012*	*2013*
Mapping has been completed- see attachments	0	0	0

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*
Himalayan blackberry						
Parrots feather						
Coon tail						
Filimentatious moss						
Arundo domax						

Etc.						
Total Cost				20	20	20

* Currently not quantified

Gray Lodge Wildlife Area (WA)

1. Describe actions that reduce nonproductive ET. (TB 46)

The most efficient method of removing invasive aquatic weeds is to spray with herbicides approved for aquatic environments such as Aquamaster and Reward, however, there is currently no National Pollution Discharge Elimination System (NPDES) permit process to allow application of aquatic herbicides to waters of the State. DFG last provided comments to the State Water Resources Control Board regarding a then current draft statewide NPDES permit process March 11, 2004.

We currently remove invasive aquatic weeds from canals, canal banks and wetland units using mechanical means such as drying up and discing wetland units, removing biomass from canals, and to a lesser degree, through drying up (where practical) and spraying canals. In addition, we also mow the sides of canals.

Section J BMP Exemption Requests

For each BMP for which the refuge is seeking an exemption, provide a detailed narrative and complete the summary table

Summary of BMP exemptions

BMP	*Constraint*[1]	*Outstanding Need*[2]
N/A	No Exemption Requests	N/A

1. *Constraint – list existing constraint. Use additional rows for multiple BMPs or constraints. Identify Legal (L), Environmental (EN), or Economic (EC) issues using code. If the BMP is not seen as beneficial, provide detailed information*
2. *Outstanding need – identify assistance required to implement the BMP. State specific funding or other assistance required*

Provide a detailed exemption request below for each BMP listed in the summary table

Non-Applicability (N/A) of Exemptible BMPs

To establish that a BMP is not applicable to the Refuge, the Plan should explain the reasons why the BMP does not apply to the Refuge. This justification must be consistent with Section A of

the Criteria titled, “Background.” Examples of non-applicability for each exemptible BMP are listed below. This list is not all-inclusive.

Section I, B. Exemptible Best Management Practices

2. Improve the Distribution System

b. Line/pipe sections of distribution system

NA if the Current system can distribute water effectively with regular maintenance and on-going improvements to open channels – thus maximizing habitat.

6. Construct and operate operational loss recovery systems

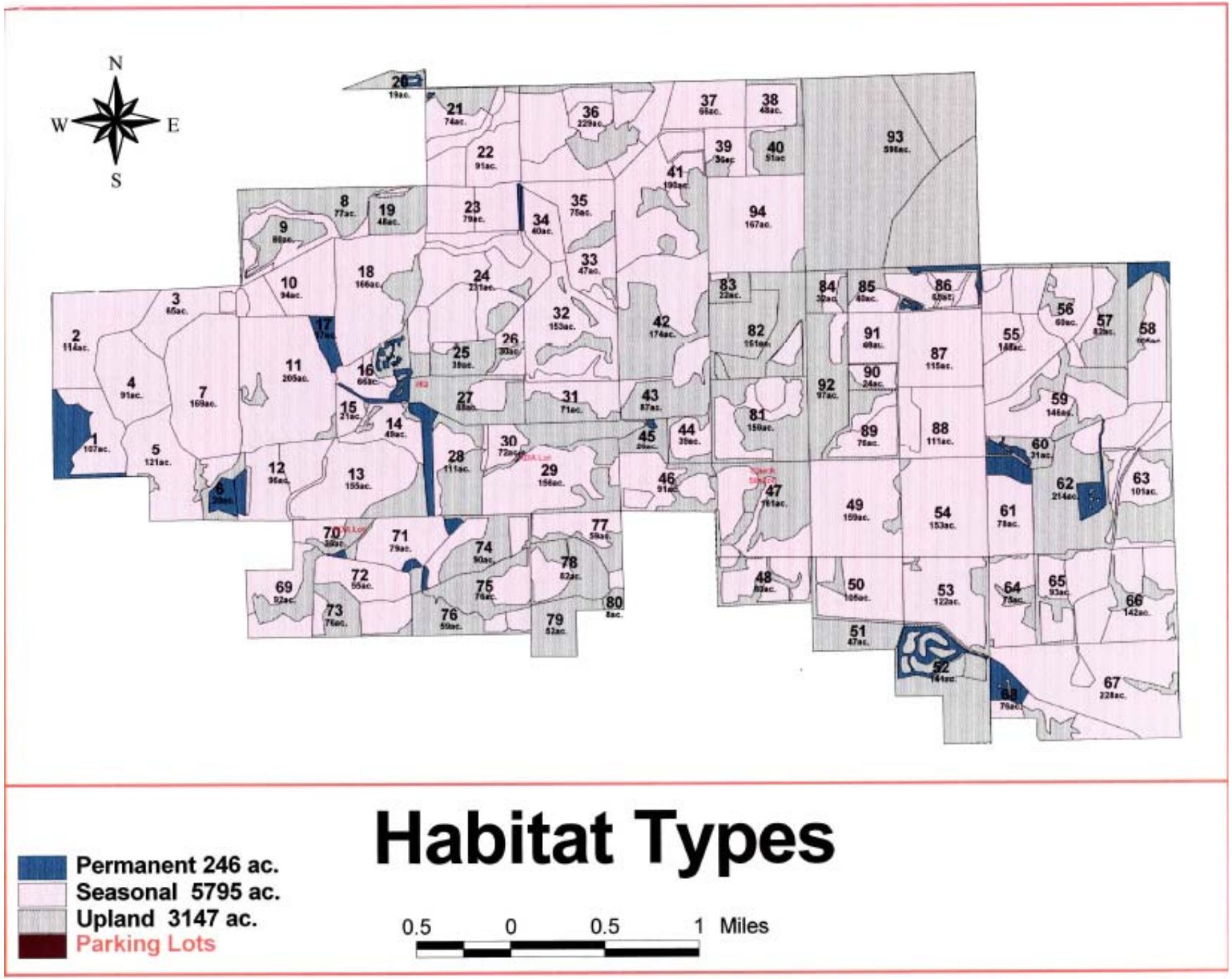
NA if system is completely piped and there are no spill points.

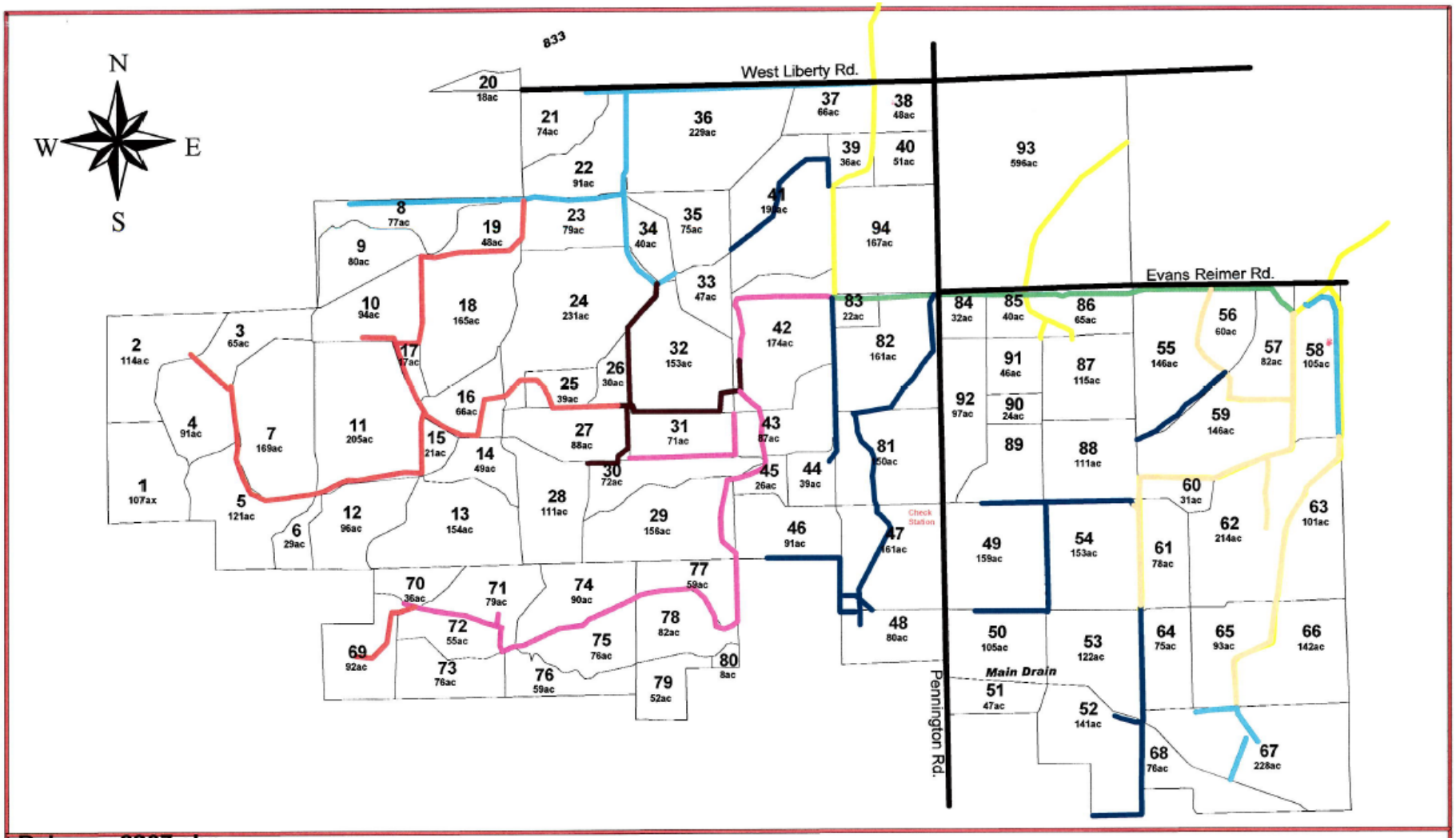
7. Optimize conjunctive use of surface and groundwater NA

NA is there is no usable groundwater

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.

NA is no recycled urban wastewater is available

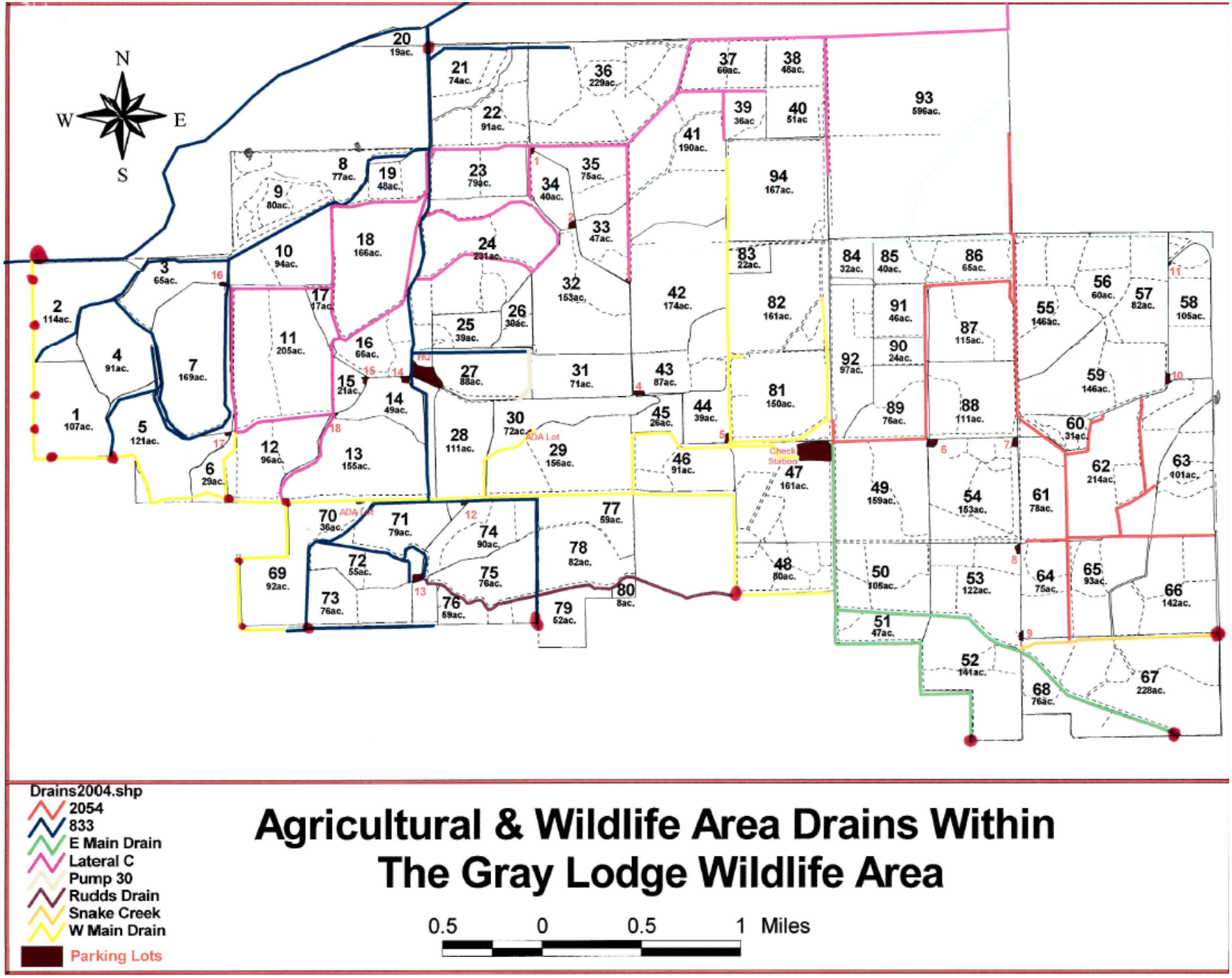

N
W
E
S
Habitat Types
Permanent 246 ac.
Seasonal 5795 ac.
Upland 3147 ac.
Parking Lots
0.5
0
0.5
1 Miles



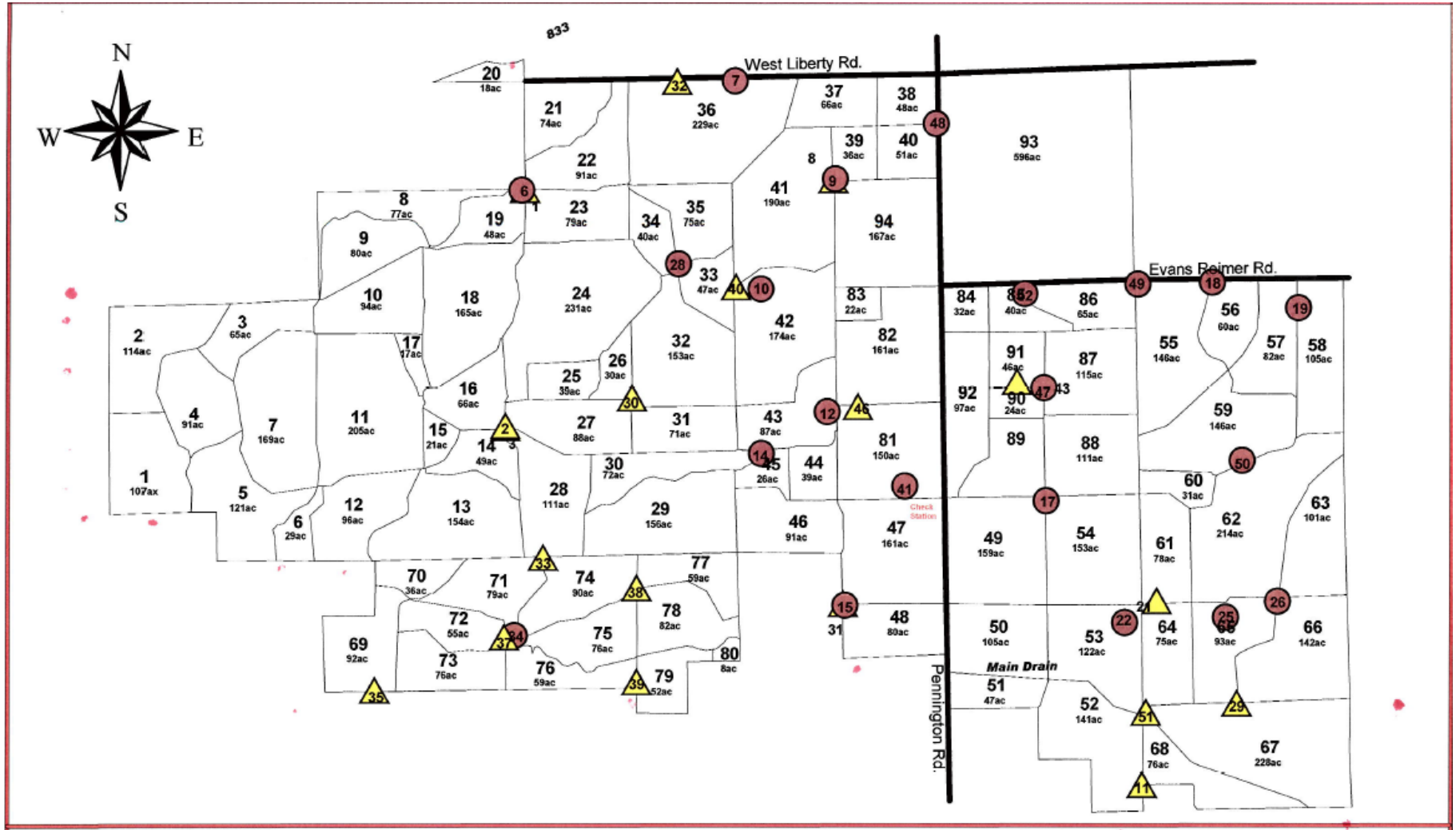
Del_sys_2007.shp
- Phase 1
- Phase 2
- Phase 3
- Phase 4
- Phase 5
- Phase 6
- Phase 7
- Original deliveries.shp
- Parking lots

Gray Lodge Wildlife Area
Current Water Delivery System

0.5 0 0.5 1 Miles



Agricultural & Wildlife Area Drains Within The Gray Lodge Wildlife Area

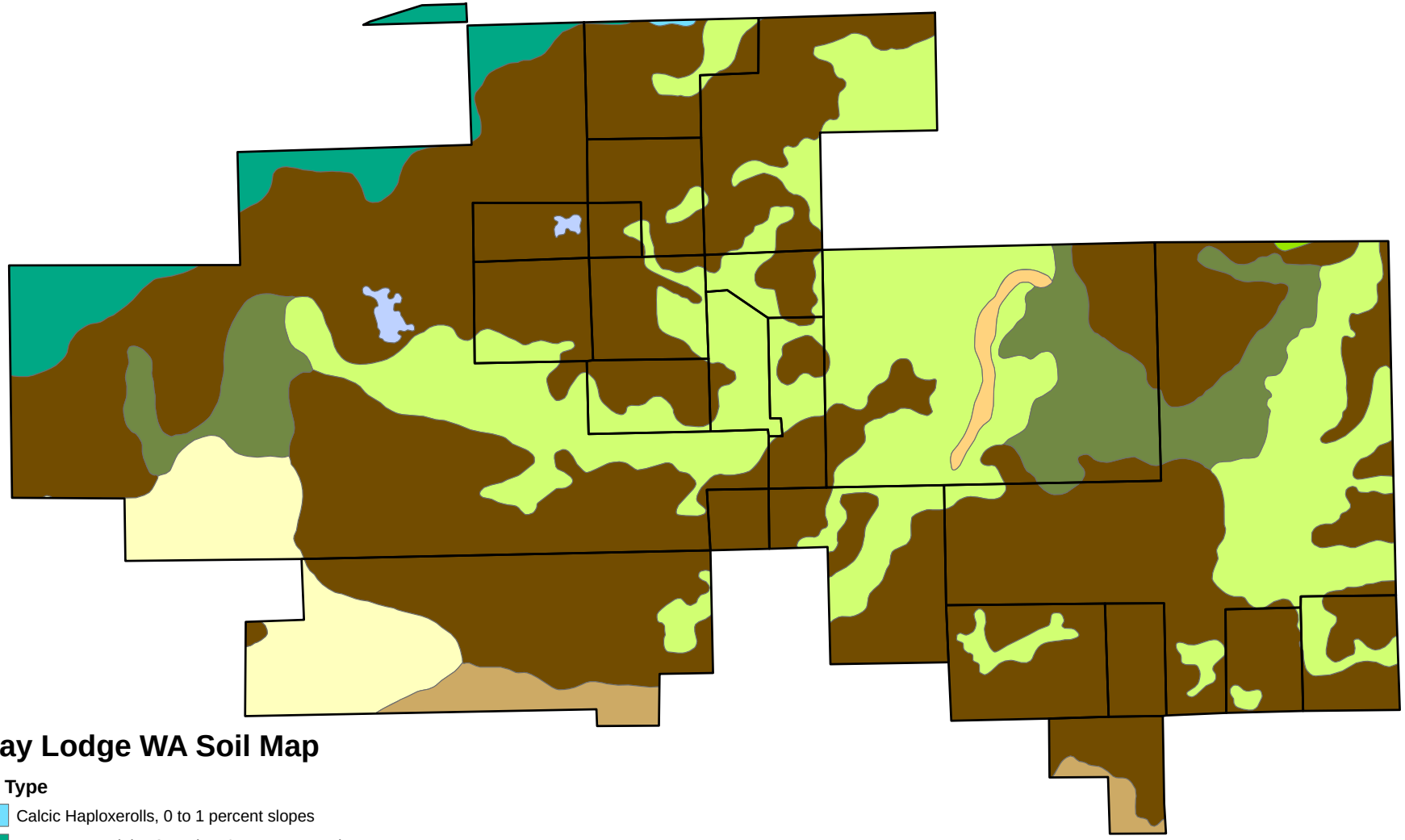


Gray Lodge Wildlife Area
Wells & Pumps

Pumps_1.shp

- Deep Well
- Lift Pumps
- Parking lots

0.5 0 0.5 1 Miles



Gray Lodge WA Soil Map

Soil Type

- Calcic Haploxerolls, 0 to 1 percent slopes
- Esquon-Neerdobe Complex, 0 to 1 percent slopes
- Gridley Taxadjunct Clay Loam, 0 to 2 percent slopes
- Gridley Taxadjunct Loam, 0 to 2 percent slopes
- Gridley Taxadjunct-Calcic Haploxerolls Complex, 0 to 2 percent slopes
- Liveoak - Galt Taxadjuncts Complex, 0 to 2 percent slopes, frequently flooded
- Liveoak Sandy Clay Loam, 0 to 2 percent slopes
- Olashes Sandy Loam, 0 to 2 percent slopes
- Subaco Taxadjunct Clay, 0 to 1 precent slopes
- Water

Map Date: August 9, 2011

Map file: K:\GIS_Local\Water_Branch\projects\water_diversion\misc\Gray_Lodge_WA_Soils

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.

Table 1

Water Supply

2010 water 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)
Method	**M1**		**M1**	**M1**	**E2**		
Dec-2006	0	0	1,566	16	2,271	0	**3,853**
Jan-07	0	0	0	365	2,107	0	**2,472**
Feb-2006	0	0	0	0	2,271	0	**2,271**
April	0	0	0	496	3,256	0	**3,752**
May	0	0	1,067	691	3,425	0	**5,183**
June	277	0	1,212	124	2,525	0	**4,138**
July	1,176	0	876	117	921	0	**3,090**
August	636	0	1,480	191	921	0	**3,228**
September	1,413	0	2,722	364	5,346	0	**9,845**
October	3,586	0	2,614	1,953	5,525	0	**13,678**
November	0	0	4,380	24	5,049	0	**9,453**
December	0	0	3,330	33	2,828	0	**6,191**
TOTAL	**7,088**	**-**	**19,247**	**4,374**	**36,445**	**-**	**67,154**

***March 1, 2010 - February 28, 2011**

Measurement Method Definitions:

M1	Measured summation from calibrated devices, accurate to within +/- 6 %.
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 diff. btwn measurements upstream & 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	2010 water year

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)
Delivery canals	177138.7	20	3,542,774	138.33	312.72	2,303	10,134	E1	**(12,612)**
Recovery canals	435,589	20	8,711,788	340.16	768.98	3,854	16,956	E1	**(21,239)**
			0	-	-				-
			0	-	-				-
			0	-	-				-
			0	-	-				-
			0	-	-				-
			0	-	-				-
			0	-	-				-
			0	-	-				-
			0	-	-				-
			0	-	-				-
			0	-	-				-
TOTAL	**612,728**		**12,254,562**	**478**	**1,082**	**6,157**	**27,090**		**(33,850)**

281 acres

Table 3

Managed Lands Water Needs

Year	2010 water

Habitat Type	Area habitat acres	Habitat Water Needs (AF/ac)	AF/ac water (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)
Seasonal wetlands: timothy	2,750	5.00	5.00	13,750	1.59	0.00	1.20	1.00	1.25	**8,642**	**Sep-March**
Seasonal wetlands: smartweed	1,250	6.00	6.00	7,500	1.59	0.00	1.20	1.00	2.00	**4,241**	**Sep-Apr, Jun**
Seasonal wetlands: watergrass	1,188	8.00	8.00	9,504	1.59	0.00	1.20	1.00	3.00	**5,218**	**Sep-Apr, Jun**
Permanent wetlands	309	13.50	13.50	4,172	1.70	0.00	3.85	3.00	3.00	**1,655**	**all months**
Semi-perm wetlands/brood pond	599	10.00	10.00	5,990	1.70	0.00	1.20	3.00	2.00	**3,296**	**all months**
Riparian	941	15.00	15.00	14,115	1.70	0.00	3.85	10.00	1.00	**1,746**	**Sep-Apr, Jun**
Irrigated pasture	596	5.80	5.80	3,457	0.35	0.00	3.30	1.00	1.00	**508**	**Apr-Dec**
Upland	3,094	5.00	5.00	15,470	0.35	0.00	3.30	0.00	1.00	**3,254**	**Apr-Aug**
Grain crops	0	2.00	-	0	0.00	0.00	0.00	0.00	0.00	**0**	**(define)**
(define)	0	-	-	0	0.00	0.00	0.00	0.00	0.00	**0**	**(define)**
Total Habitat Acres	**10,727**	**6.89**	**6.89**	**73,957**						**28,560**	**TOTALS**

Table 4

Refuge Water Inventory

Water Year	2010	Reference		
Total Water Supply		Table 1		67,154
Precipitation		Table 2	plus	478
Evaporation		Table 2	minus	1,082
Seepage		Table 2	minus	6,157
Operational Losses		Table 2	minus	27,090
			Deliveries to Managed Lands	33,304
Managed Land needs		Table 3	minus	73,957
Difference		(calculated)		(40,653)
			Balance (Table 3)	28,560
			Water Inventory Balance	(12,094)

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)	Delivery totals	
2001	9,089	0	19,443	2,726	36,385	0	**67,643**	28,532	
2002	12,577	0	18,779	1,036	36,385	0	**68,777**	31,356	
2003	4,944	0	19,734	11,564	36,385	0	**72,627**	24,678	
2004	7,672	0	17,408	5,398	36,385	0	**66,863**	25,080	
2005	10,123	0	20,228	9,620	36,385	0	**76,356**	30,351	
2006	11,245	0	17,948	6,020	36,385	0	**71,599**	29,193	
2007	10,221	0	20,067	4,295	36,385	0	**70,969**	30,288	
2008	8,245	0	20,399	6,684	36,385	0	**71,713**	28,644	
2009	10,648	0	20,525	4,792	36,385	0	**72,350**	**31173**	
2010	7,088	0	19,247	4,374	36,445	0	**67,154**	**26335**	
Total	**91,853**	**-**	**193,778**	**56,510**	**363,910**	**-**	**706,051**	**285,631**	**285,631**
Average	**9,185**	**-**	**19,378**	**5,651**	**36,391**	**-**	**70,605**		

Tranfered in 564 acre feet of Level 2 water supplies from Sacramento NWR.