Gray Island Gun Club #805/806 Individual Ownership Adaptive Habitat Management Plan

(Revised: August 2021)

Suisun Resource Conservation District

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Supporting Documentation and Scientific Information

A. Executive Summary

- The Suisun Marsh Protection Plan (SMPP), developed by the San Francisco Bay Conservation and Development Commission (BCDC) and the Department of Fish and Game (DFW) in 1976, was formally adopted as part of the Suisun Marsh Preservation Act of 1977 (SMPA 1977, Public Resources Code Section 29412.5). The SMPA 1977 required the Suisun Resource Conservation District (SRCD) to administer a Local Protection Program (LPP; SRCD 1980) including a water management program for each of the privately managed wetlands in the Suisun Marsh primary management area.

- The goal of the Individual Ownership Adaptive Habitat Management Plan (Plan) is to provide a managed wetland landowner with an overview describing existing conditions, operations, and guidance to support a diversity of waterfowl and wildlife habitats. The Plan includes a conservation map, soils map, elevation model, summary of water control structures, analysis of the water management program, and evaluation of the current conditions of levees, ditches, and water control structures.

- If wetland management is being implemented based on a certified Plan, landowners do not need a BCDC Marsh Development Permit (MDP) for routine maintenance of existing managed wetlands and water management facilities. Once the Plans are updated, annually, SRCD will make a report to BCDC's Executive Director of any minor amendments to any certified individual management plans (PRC Section 29418).

- Minor repairs or improvements are defined as those activities which are routine in management of wetland systems. Such activities as reconstruction, replacement, removal, repairs, and incidental additions are considered minor. Any management activity currently described in the certified Plan and its appendices will be considered minor and shall not require a BCDC MDP or an amendment to the certified Plan.

- This Plan is for Gray Island Gun Club (SRCD Ownership #805/806). This club is located in the Southern Marsh Region. The ownership is part of Reclamation District 2127, Simmons Wheeler.

- The ownership consists of 220 acres: 180 acres of managed wetlands, 17 acres of uplands, 22 acres of tule berm, and 1 headquarters acre. The wetland is managed as 1 unit with 6 intakes on Mud Slough and 1 dual-purpose (flood/drain) structure on Suisun Bay. Club #805 also operates 1 intake gate on Roaring River Distribution System that supplies Mud Slough. The club drains into Suisun Bay through an electric pump on the west-side of the club and 1 drain and 1 dual-purpose structure at the southern end of the club.

- The average elevation of Club #805/806 is 0.31 feet (NAVD88) including the uplands, tule berm, and headquarters acres.

- A drainage model suggests that the managed wetland can drain to one foot below shoot level in about 14 to 21 days. Based on on-site observations, this club requires the use of a pump to complete a flood and drain cycle to one foot below pond bottom within thirty days.

- Wetland habitat managers must adaptively manage their properties to achieve desired management objectives and habitat conditions. The Plan will serve as the starting point for development of long-term

and short-term management goals for each ownership. It is a baseline from which to develop yearly plans tailored to each wetland ownership.

A.1. Goals

The purpose of this Individual Ownership Adaptive Habitat Management Plan (Plan) is to provide the basic information necessary for land managers in the Suisun Marsh (the Marsh) to successfully implement Marsh management practices. The goals are to maximize waterfowl food production while maintaining a diverse wetland flora that can support a wide variety of resident and migratory wildlife.

Section 29412.5 of the Public Resources Code established under the 1977 Suisun Marsh Preservation Act requires that the Suisun Resource Conservation District (SRCD) Local Protection Program (Suisun Marsh Management Program 1980) includes a water management program for each managed wetland in the primary management area of the Marsh. The Plan provides a wetland management guidance to support a diversity of waterfowl and wildlife habitats. The Plan includes a conservation map, soils map, elevation model, summary of water control structures, analysis of the water management program, and evaluation of the condition of levees and ditches. If wetland management is being implemented based on a certified Plan, landowners do not need a San Francisco Bay Conservation and Development Commission (BCDC) Marsh Development Permit (MDP) for routine maintenance of existing managed wetlands or maintenance of existing water management facilities. However, new managed wetland water management facilities such as exterior drain pipes, rip rap, bulkhead walls, or pump platforms, or an activity that meets the BCDC definition of "development" (**see Appendix A.2**) will require a BCDC MDP. If new construction, replacement, or improvements are needed on the clubhouse area, building structures, or boat docks, the landowner should consult with Solano County Department of Resource Management (DRM) and BCDC for permitting requirements.

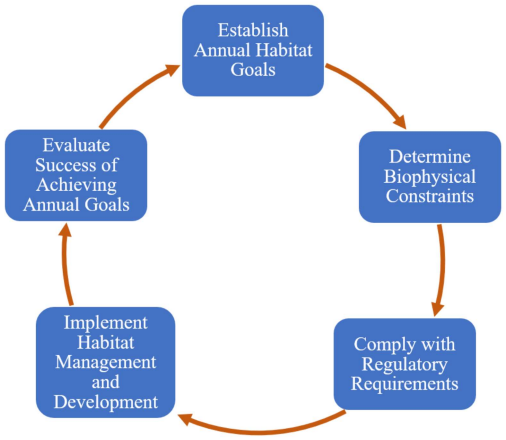


Figure 1. Annual habitat management flowchart.

The physical, regulatory, and biological conditions in the Marsh affect wetland management strategies which determine the resulting habitat quality, and ultimately the species that will use the habitat. Wetland habitat managers must adaptively manage their properties in order to achieve desired management objectives and habitat conditions **(Figure 1)**. Since conditions in the Marsh continually change, we have developed the attached Supporting Documentation and Scientific Information so as new information is obtained or changes in management strategies are identified, they can be incorporated into the Plan attachments. Minor modification of a certified Plan (such as replacing a cast iron flap gate with stainless steel) will be submitted by the landowner to SRCD annually and SRCD will record the change as a minor revision to the Plan. Minor repairs or improvements are defined as those activities which are routine in management of wetland systems. Such activities as reconstruction, replacement, removal, repairs, and incidental additions should be considered minor. Any management activity currently described in the certified Plan and its appendices will be considered minor and shall not require a BCDC MDP or an amendment to the certified Plan. SRCD will process the modifications annually in accordance with the provisions of Section 29418 of the Public Resource Code (Suisun Marsh Management Program 1980).

B. Club Information

The Gray Island Gun Club (SRCD Ownership #805/806) is located on the South side of Suisun Marsh. Access to the property is off of Grizzly Island Road and the Roaring River levee. (**Figure 2**). The original management plan for Canvasback Farms/Gray Island (SRCD Ownership #805/806) was certified by BCDC on Nov. 15, 1984.

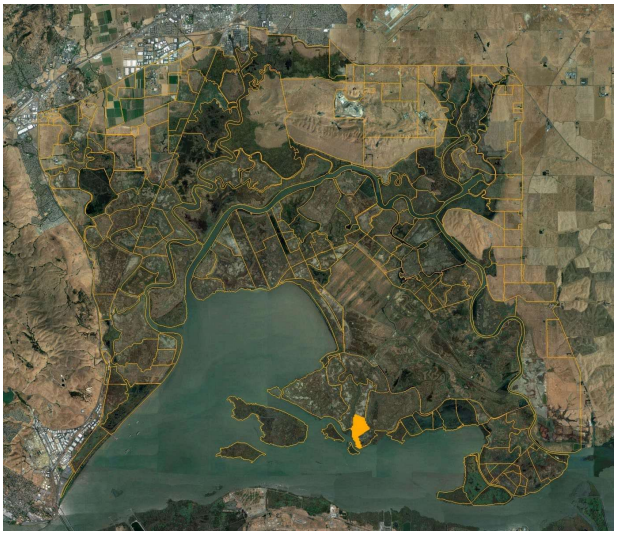


Figure 2. Property location in Google Earth.

Table 1. Land use description and estimated acreage

Land Description	Acres
Managed Wetland	180
Uplands	17
Tule Berm	22
Headquarters	1
Total	220

B.1 Club Facilities

There are several clubhouse structures with annex, along with a boat dock **(See "H" on Map 1)**. There is a single managed wetland unit with one water level. If improvements are needed on the clubhouse area or building structures, the owner should consult with Solano County DRM and BCDC for permitting requirements.

B.2 Hydrology and Infrastructure

B.2.1 Water Circulation

Club #805/806 is bordered by Club #803, St. Germain Duck Club, and Suisun Bay in the west, Club #807, Wheeler Island, in the south and east, and Mud Slough in the north. The club brings in water from Mud Slough which is supplied with water from the Roaring River Distribution System (RRDS). The water flows south through a ditch system that drains into Suisun Bay through the 1 drain, 1 dual-purpose water control structure, and an electric pump.

B.2.2 Infrastructure

Club #805/#806 operates one intake structure on RRDS (Gate **a**) that supplies water to Mud Slough. Flooding of the managed pond on Club #805/#806 is accomplished through water control structures **b**, **c**, **d**, **f**, and **g** on Mud Slough. Water flows south towards 1 drain (Gate **I**), 1 dual-purpose structure (Gate **J**), and a 50 HP electric pump where it drains into Suisun Bay.

Water movement through the club is facilitated by a system of perimeter and interior ditches. Secondary ditches connected to primary ditches move water from ponds to water control structures to facilitate water flow and drainage. Circulation is achieved across the pond in a (generally) southwest direction (**Map 2)**. See the Water Management Infrastructure Table for details and locations (**Table 2**).

Table 2. Water management infrastructure including Identification Number (ID), Pond Unit (Unit), Flow Direction (Flow), XY coordinates: WGS84 Longitude (Lon), Latitude (Lat), Pipe Material (Pipe), Year pipe installed (Year), Diameter (Dia), Length (Len), Gate Type/Gate Material (Gate), Year gate installed (Year), Invert Elevation (Elev): NAVD88, Exterior (Ext), Interior (Int)

ID	Unit	Flow	Lon	Lat	Pipe	Year	Pipe		Interior		Exterior		Invert Elev (ft)		Comments
							Dia (in)	Len (ft)	Gate	Year	Gate	Year	Ext	Int	
Exterior water control structures															
I	--	D	-121.973228	38.074245	HDPE	--	48	20	O	--	SF	--	-3.19	--	
J	--	FD	-121.973198	38.074254	HDPE	--	48	30	O	--	SF	--	-2.82	--	
+	--	D	-121.976516	38.080647	--	--	--	--	--	--	--	--	--	--	50HP Electric Pump
Interior water control structures															
a	--	F	-121.967229	38.096580	--	--	--	--	--	--	--	--	--	--	
b	--	F	-121.975159	38.086286	CPP	--	24	20	O	--	FBR	--	--	--	
c	--	F	-121.971982	38.085136	CMP	--	24	20	O	--	FBR	--	--	--	
d	--	F	-121.970322	38.084761	CPP	--	24	20	O	--	FBR	--	--	--	
e	--	F	-121.969195	38.083039	CPP	--	--	30	O	--	FBR	--	--	--	Not Operable
f	--	F	-121.975613	38.083095	--	--	--	--	--	--	--	--	--	--	
g	--	F	-121.976249	38.081658	CPP	--	30	40	O	--	FBR	--	--	--	
h	--	FD	-121.975555	38.080751	CMP	--	30	20	O	--	O	--	--	--	

ID: Pump (+), Flow: Flood (F), Drain (D), Flood and Drain (FD), Pipe: Concrete (C), Corrugated Metal Pipe (CMP), Corrugated Plastic Pipe (CPP), Fiberglass (FB), Fiberglass and Metal (FBM), High Density Polyethylene Pipe (HDPE), Plastic (PP), Gate Type: Flap (FG), Flash Board Riser (FBR), Open (O), Screw (SG), Screw Flap (SF),Weir (W), Winch Flap (WF), Gate Material: Stainless Steel (SS), Cast Iron: (CI)

B.2.3 Digital Elevation Model (DEM)

In 2018, an airborne Light Detection And Ranging (LiDAR) survey was completed to collect elevation data across the Marsh. However, dense vegetation may obscure the ability to measure the bare earth elevation. In this LiDAR-derived elevation map, we corrected for vegetation height to obtain the wetland pond bottom elevation (Buffington et al. 2016). We used multispectral airborne imagery and field surveys to improve elevation accuracy from 40% to 75% in a high-resolution image (1-m pixels). We have provided a map from the LiDAR data for Club #805/806 along with associated hardwater mark elevation data indicating shoot level collected as part of the Managed Wetland Assessment (MWA: Chappell et al. 2018) project during that same year (**Map 3**).

Elevations were measured using the North American Vertical Datum of 1988 (NAVD88). A vertical datum is used as a reference system to measure and relate elevations to the earth's surface and NAVD88 is the official vertical datum for the contiguous United States (U.S.). In 2018, the average pond bottom elevation measured for Club #805/806 was 0.17 feet (NAVD88) compared to an overall average bare earth elevation of 2.41 feet (NAVD88) for the primary management area of the Marsh. The complete LiDAR coverage is available at the U.S. Geological Survey (USGS) Science Base website (Buffington et al. 2019).

B.2.4 Target Water Levels

A goal of managed wetlands is to complete a flood and drain cycle (leach cycle) within 30 days to reduce and maintain lower soil salt concentrations **(Section B.5.1)**. Applied water salinity from adjacent channels is an important consideration for management since it affects the ability of the managed wetlands to produce vegetation and create habitat conditions necessary to support waterfowl food crop production **(Section C.2.1.4)**. Using structures **b**, **c**, **d**, **f**, and **g**, Club #805/806 can be flooded to 2.48 feet NAVD88 (elevation of the hardwater mark on the post at the boat house) in approximately 10 days. Results from the Resource Management Associates (RMA) drainage model **(Appendix M)** suggest it will take 14 to 21 days for the pond to reach 1 foot below shoot level. To complete a leach cycle, the pond should be drained until the water in the ditches is 1 foot below the pond bottom (Rollins 1981), typically, 2 feet below shoot level.

Complete drainage with the use of tide gates alone is not efficient since the club pond is too low relative to local tides. Based on on-site observations, the club is unable to complete a spring leach cycle within thirty days without the use of a pump **(Figure 3)**. Pump usage will depend upon varying tide cycles and the club's ability to use the tide gates effectively during low tides (**Section C.2.1.3)**. Since tidal datums are commonly used as references to measure local water levels, see **Appendix K** for the local tidal values relative to NAVD88 elevation values.

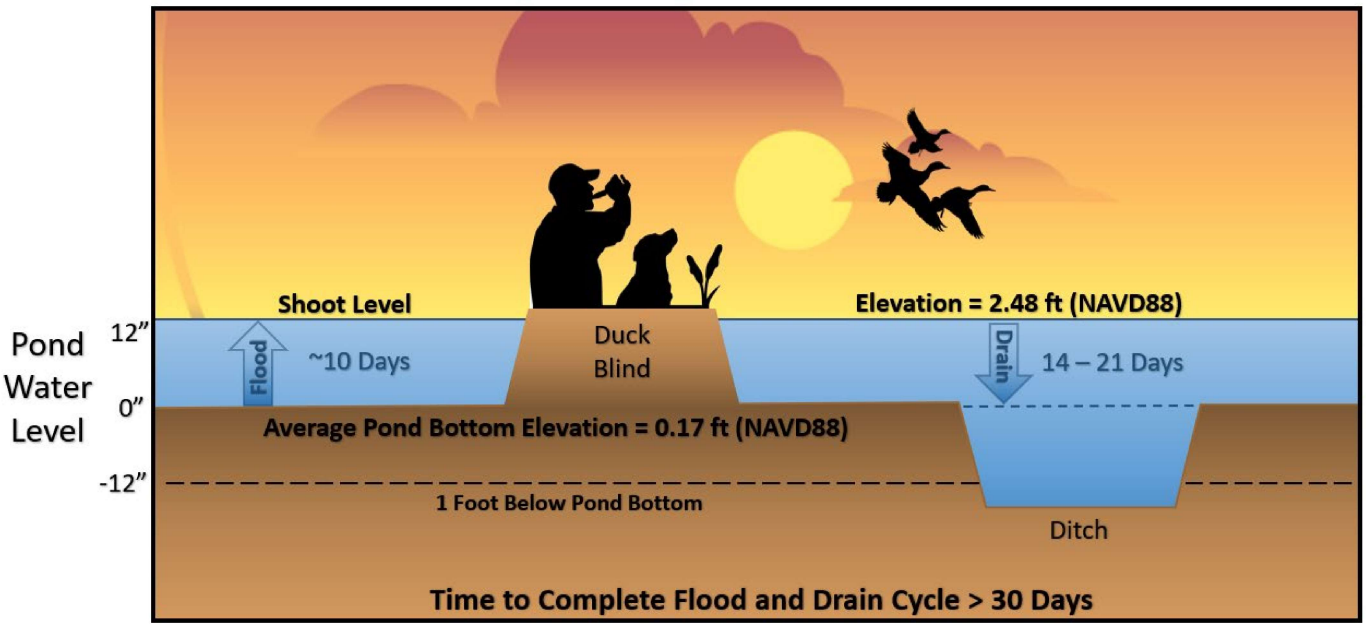


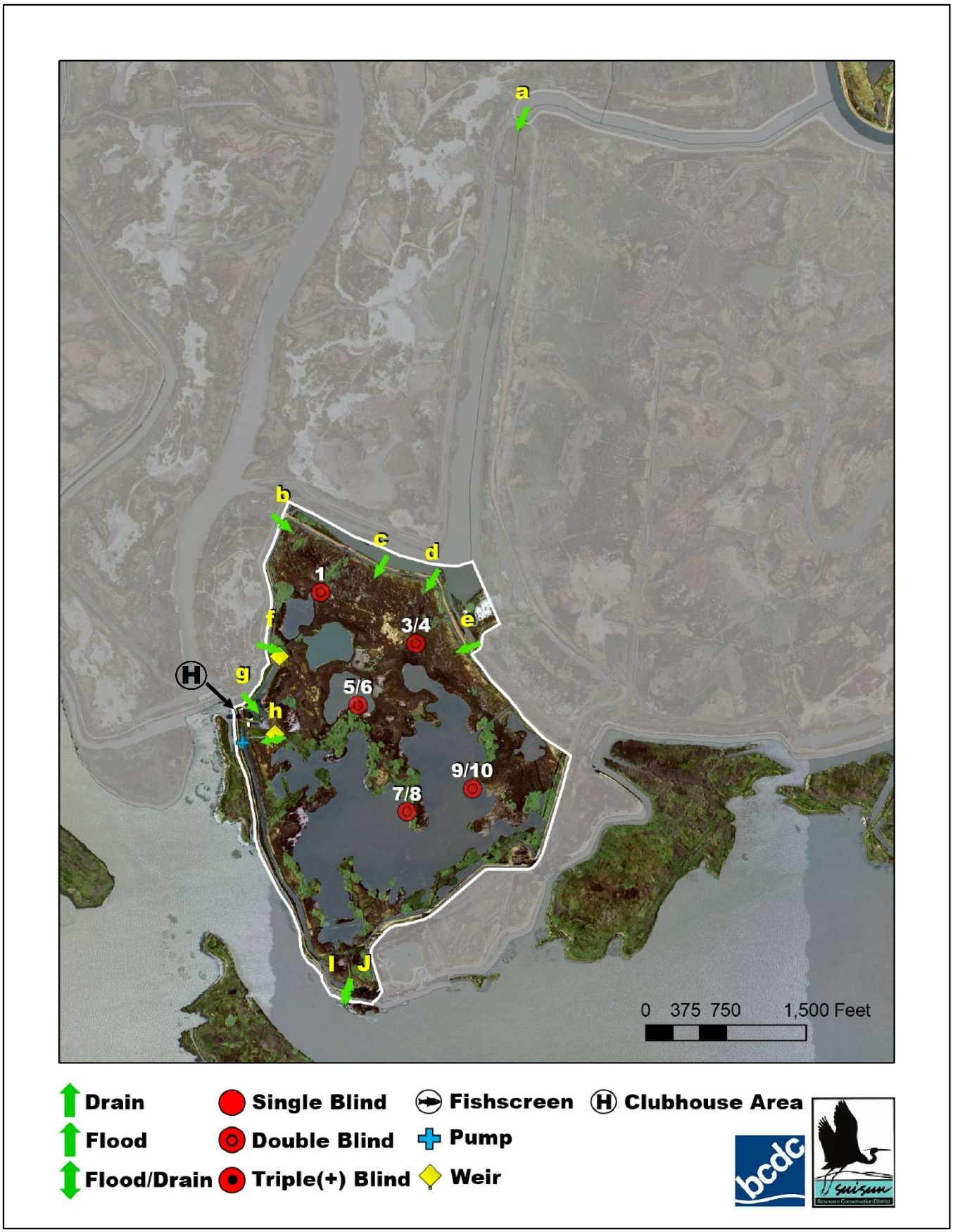
Figure 3. RMA drainage model results suggest that it will take Club #805/806 fourteen to twenty-one days to drain to one foot below shoot level. Based on on-site observations, Club #805/806 is unable to complete a spring leach cycle within thirty days without the use of a pump.

B.2.5 Shared Water Levels/Shared Infrastructure

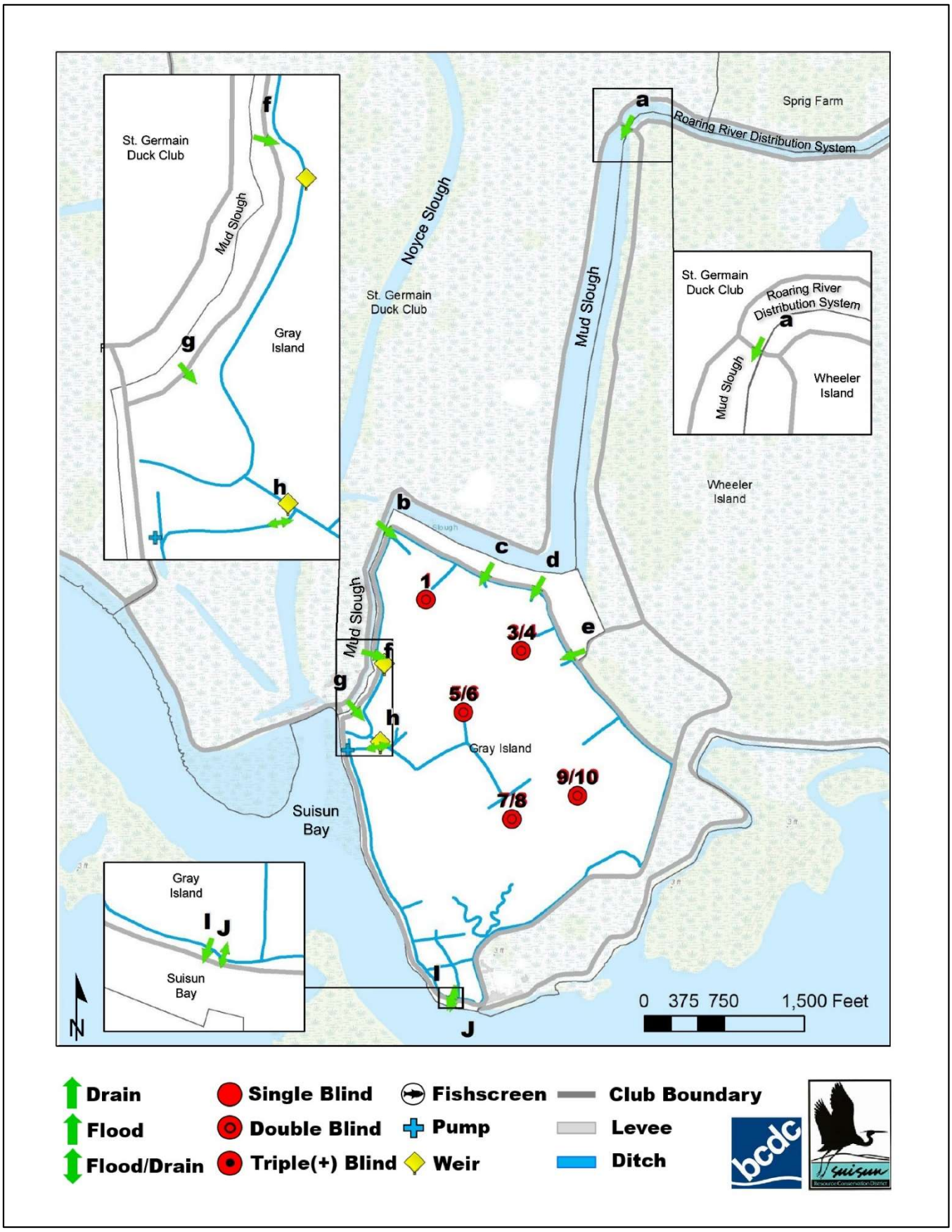
Club #805/806 does not share a water level or water control structures with other clubs, but it does share an access road and exterior levee support with RD 2127. Maintenance of exterior levees and interior levees between adjacent clubs is critical for effective water management and meeting each club's habitat objectives.

B.2.6 Soil Information

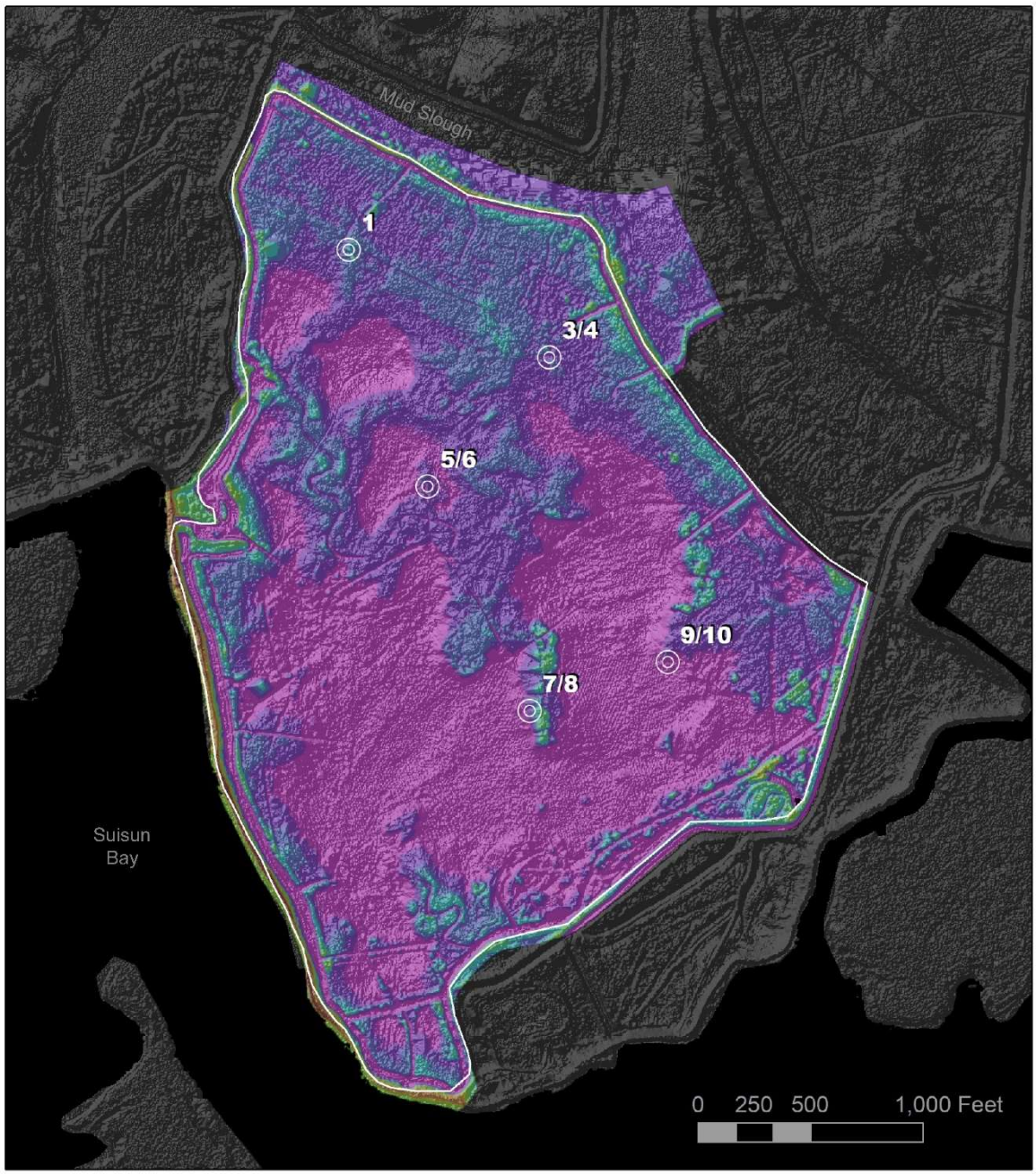
In 1978, the Soil Conservation Service surveyed the soil and provided a detailed summary map with soil descriptions for the managed wetland properties in the Marsh. The intention of the survey was to be used as a guide for wetland managers on vegetation, irrigation, and management. A current soil map was obtained from the Web Soil Survey (WSS) website. The WSS is operated by the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) and is updated and maintained as the single authoritative source of soil survey information. The primary soils on this property include Joice muck (54.1%), Reyes silty clay (22.6%), and Tamba mucky clay (19.9%) (**Map 4**). See **Appendix L** for more detailed information about Suisun Marsh soils.



Map 1. Club #805/806 aerial imagery. Source: USDA National Agriculture Imagery Program (NAIP) 2018.



Map 2. Club #805/806 water control infrastructure. Source: Geomarsh (SRCD and BCDC, 2020).



Average Pond Bottom Elevation = 0.17 feet (NAVD88)
Club Shoot Level Elevation = 2.48 feet (NAVD88)

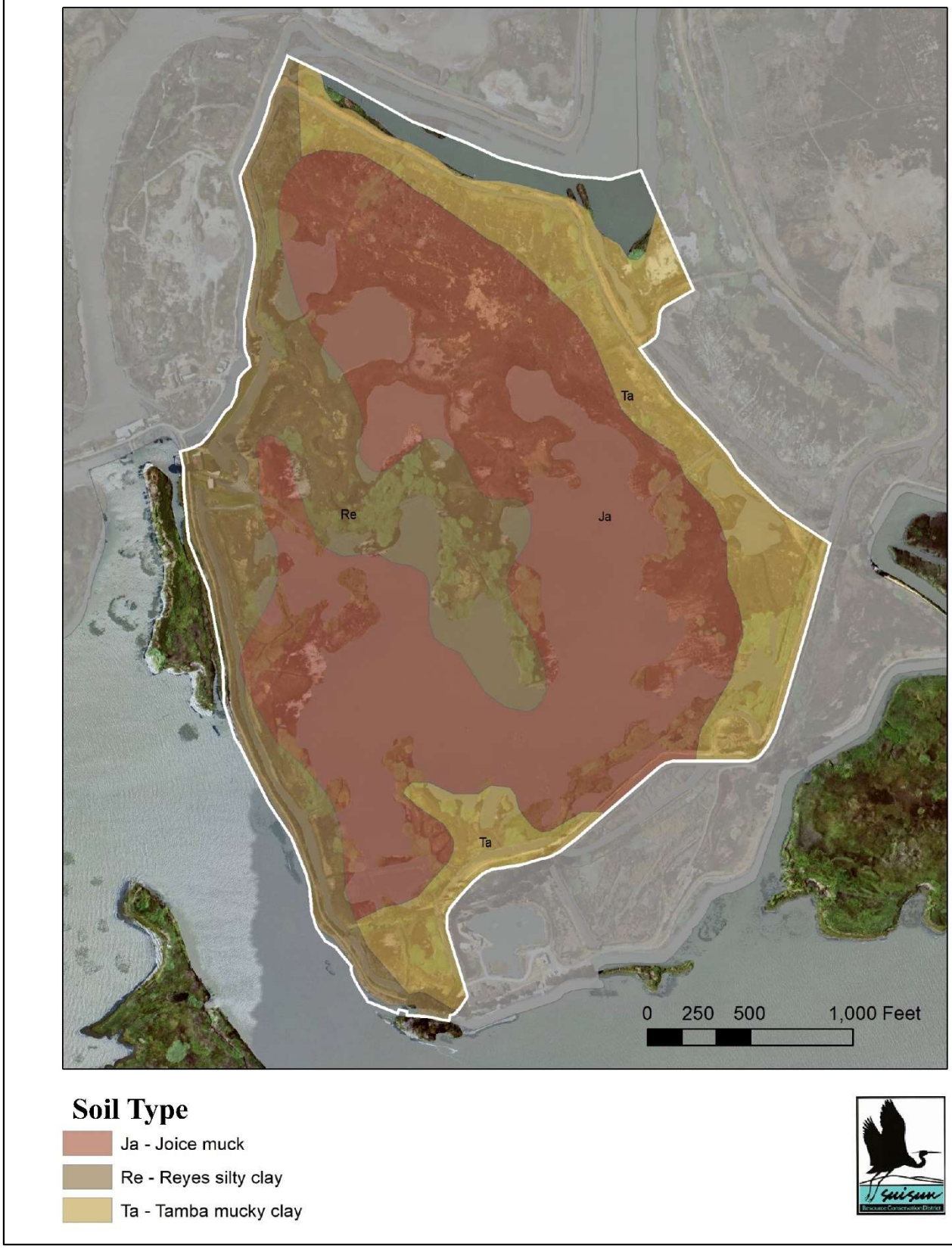
Elevation (NAVD88 feet)

Below 0	2.1 - 3.0	5.1 - 6.0	8.1+
0 - 1.0	3.1 - 4.0	6.1 - 7.0	
1.1 - 2.0	4.1 - 5.0	7.1 - 8.0	

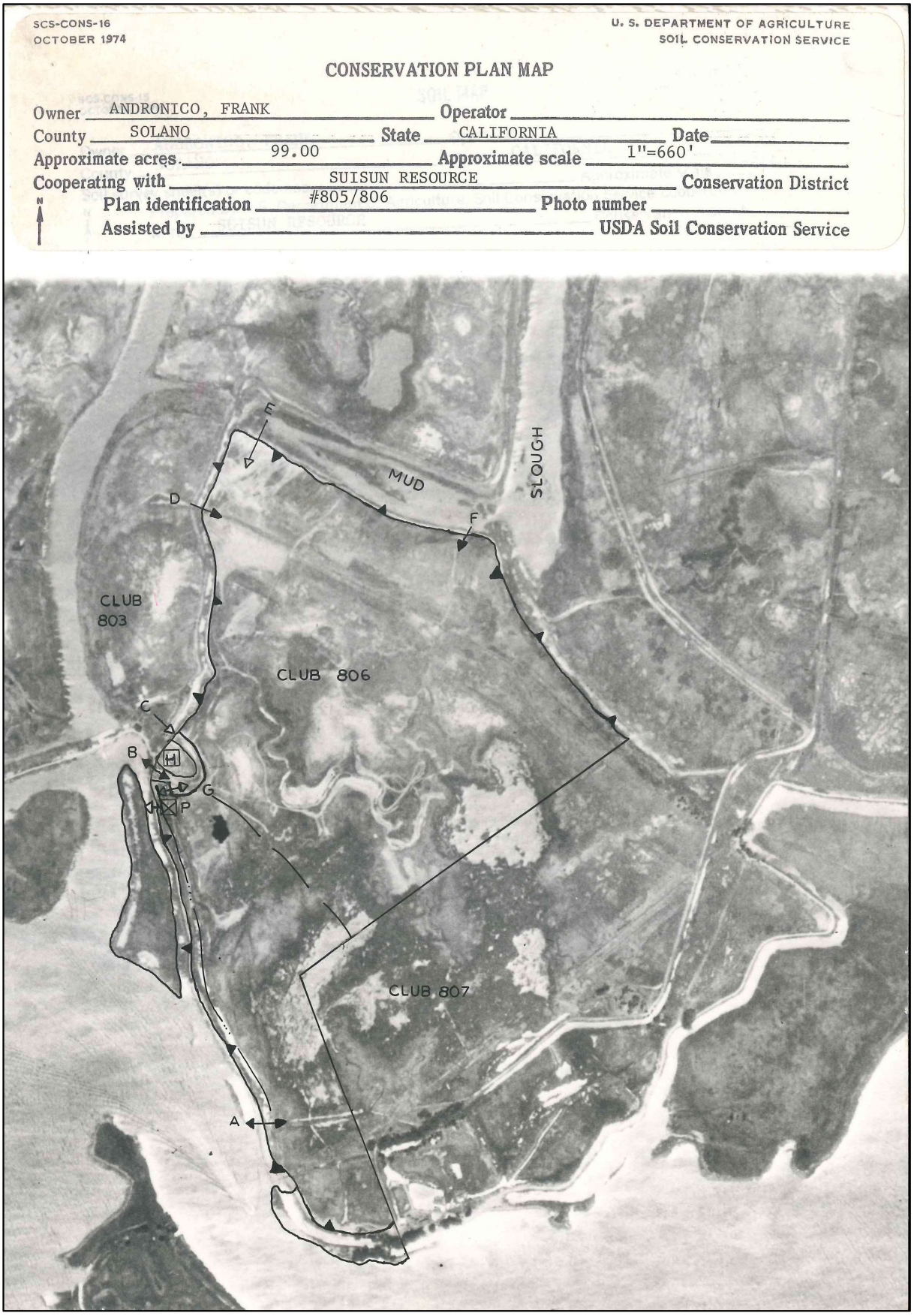
Blinds

- Single
- Double
- Triple+

Map 3. In 2018, the average pond bottom elevation for Club #805/806 was 0.17 feet (NAVD88) compared to an overall average bare earth elevation of 2.41 feet (NAVD88) for the Marsh primary management area. Sources: Buffington et al. 2019 and Chappell et al. 2018.



Map 4. The primary soils on Club #805/806 include Joice muck (54.1%), Reyes silty clay (22.6%), and Tamba mucky clay (19.9%). Source: Natural Resources Conservation Service Web Soil Survey, Version 14, May 29, 2020



Map 5. Club #805/806 Conservation Plan Map of 1978. Source: USDA Soil Conservation Service.

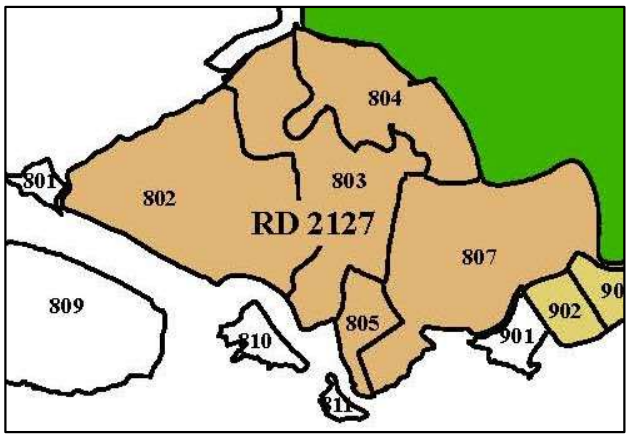
B.3 Needs for Maintenance

Since levees, ditches, and water control structures are crucial for proper water management **(Section C.2.1.1)**, they should be inspected and maintained in functional order **(Appendix I)**. Water control structures should be kept free of debris, be maintained to prevent leaks, and lubricated to ensure free-moving parts. Presently, Gate **e** is not operable. If replaced in the future, this structure should be upgraded with noncorrosive materials to extend life expectancy. All other structures are in operational order.

Levees in the Marsh are comprised of silts, clay, and organic materials that are subject to shrinkage and subsidence as well as tidal erosion and animal damage; therefore, they require periodic re-topping and other maintenance. The protective tule berms present along the exterior levees are helpful in guarding the exterior levee against tidal erosion. However, the exterior levee is especially susceptible to storm driven waves and high tides and should be carefully observed for potential weak spots and storm damages. Club #805/806 has an adequate system of primary and secondary ditches which is important for circulation and drainage. Excessive vegetation or siltation should be removed from these ditches as necessary to promote maximum waterflows.

B.4 Reclamation Districts (RD)

Club #805/806 belongs to **RD #2127, Simmons Wheeler**, along with the following duck clubs: #802, #803, #804, and #807. By definition, a Reclamation District is a type of special-purpose district that is responsible for reclaiming and/or maintaining land threatened by permanent or temporary flooding, to address flood control. The State of California passed legislation (Water Code 5000 *et seq.*) allowing RDs to form as a way to pay the costs associate with "reclaiming" the land. In the Marsh, RDs are typically comprised of private landowners that have the primary local responsibility for maintenance and repair of exterior levees, water control structures (pipes, fish screens, and pumps), water conveyance facilities, and access roads (Suisun Marsh Habitat Management, Preservation, and Restoration Plan 2011).



B.5 Water Management Program for Targeted Habitats

In light of the rapidly changing environmental conditions including climate change, a prescriptive water management plan (as originally developed in the 1980s) for each club is not being recommended in this Plan update. Instead, landowners are provided with a range of water management options that can vary from year to year based on environmental, regulatory and maintenance needs and targeted habitat objectives. Conceptual models for water management (**Figures 4 & 5**) have been developed in partnership with DFW (Barthman-Thompson et al. 2007) to provide the best managed wetland habitats in the Marsh. SRCD has identified regions in the Marsh where conditions are most suitable for particular water management scenarios. The following water management information is specific for the managed wetlands covered under this Plan **(Appendix N)**.

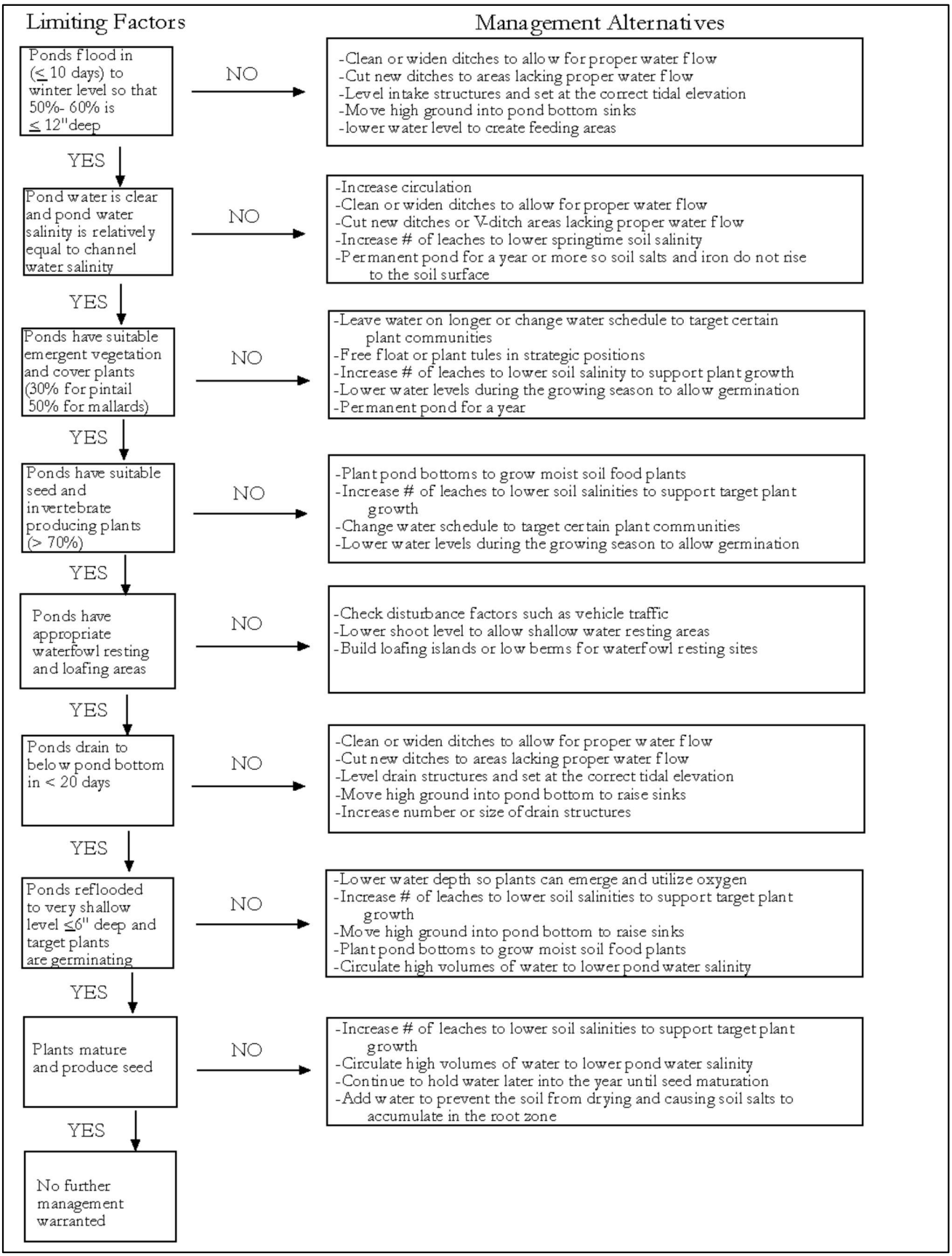


Figure 4. Example of a waterfowl pond management flowchart for typical wintering waterfowl (Barthman-Thompson et al. 2007).

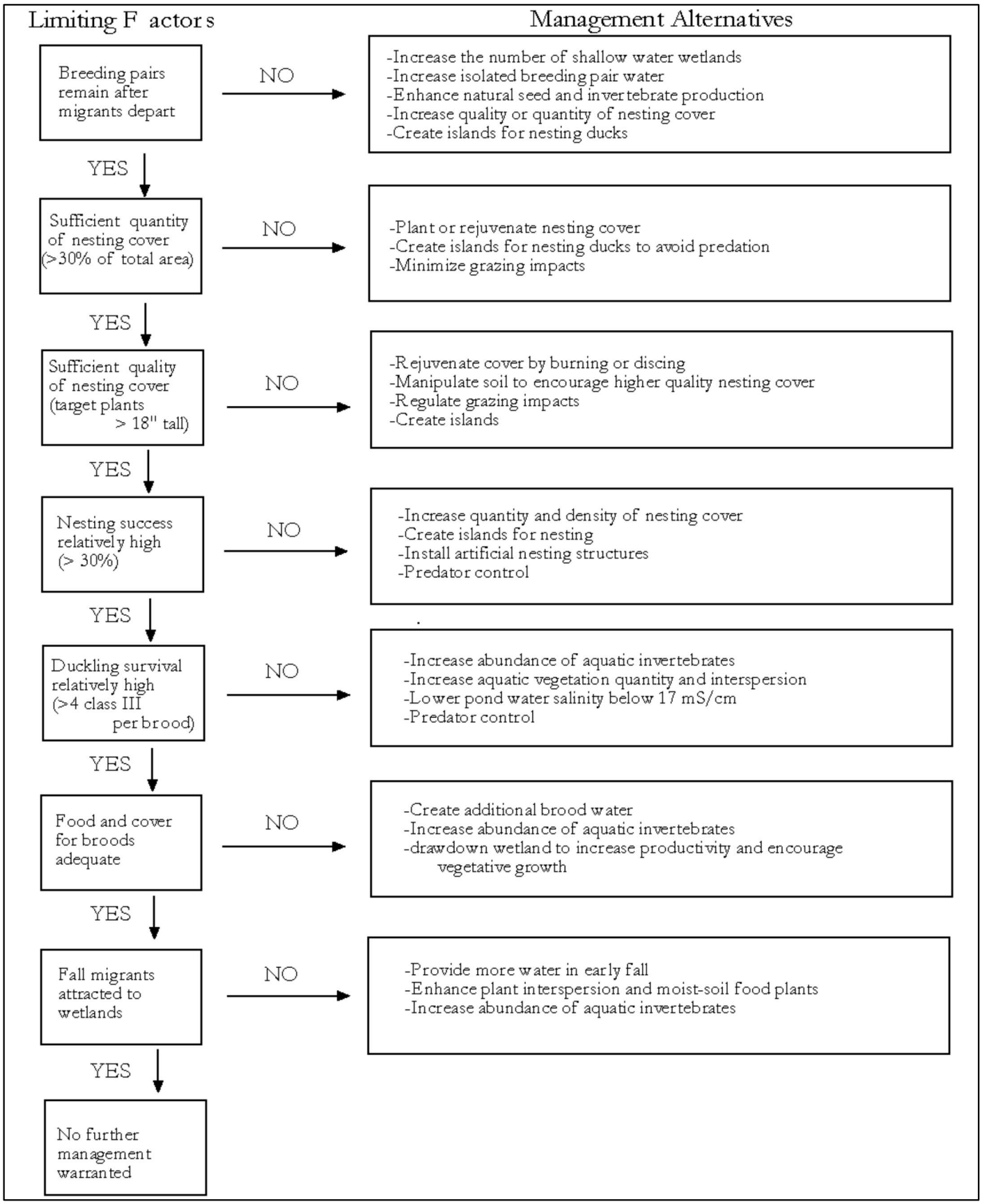


Figure 5. Example of a waterfowl pond management flowchart for typical breeding waterfowl (Barthman-Thompson et al. 2007).

B.5.1 General Management Considerations

A goal for managed wetlands is to be able to complete a flood and drain cycle within 30 days to reduce soil salt concentrations and produce a diversity of wintering waterfowl food crops in the Marsh **(Section C.2.1.2)**. To meet this 30-day objective, a pump is needed on many clubs to assist with drainage on the managed wetlands. Drainage should begin about 20 days prior to the lowest tides of the month, to use of the tide gates effectively. Pump usage will depend upon varying yearly tide cycles **(Section C.2.1.3)** and how efficiently tidal flooding and drainage can be accomplished but should be used to remove water from pond bottom sinks and primary ditches 1' below pond bottom. Levees, ditches, and water control structures should be inspected annually and maintained in functional order. Excessive vegetation or siltation should be removed from ditches as necessary to promote optimal waterflows and leach cycles.

Ponds are fully flooded targeting 12 inches of water over a majority of the pond during waterfowl season (mid-October through late-January). In mid-January, managers close pond intakes and begin to drain ponds. Ponds will be reflooded to approximately 6 to 12 inches below shoot elevation and are drained completely around mid-March to early April to initiate the first leach cycle. Water circulation and performing leach cycles in managed wetlands is crucial to reduce salinity and low dissolved oxygen (DO) accumulation from ponds and encourage a diversity of vegetation growth through the spring and early summer (**Figure 6**).

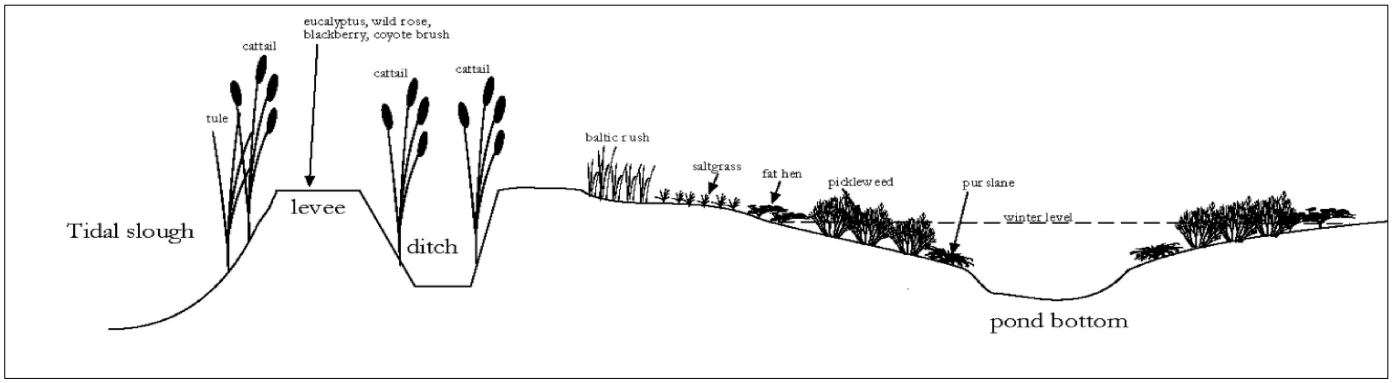


Figure 6. Schematic of typical long hydroperiod plants and elevation location (Barthman-Thompson et al. 2007).

B.5.2 Water Management Guidelines

Water management is the primary means for habitat managers to manipulate managed wetland vegetation communities in the Marsh. SRCD developed eleven water management schedule guidelines to assist the wetland property owners and managers. The schedules are intended as guidelines because site specific factors will influence actual management decisions that will be made to reach the objectives for the property, and because management schedules will change for different regions in the Marsh and for different water years (**Appendix O**). Site-specific regulatory and physical conditions will influence actual management practices on individual properties. Below are two examples of these typical water management schedules **(Figures 7 & 8,** see **Appendix O** for other schedules**)**.

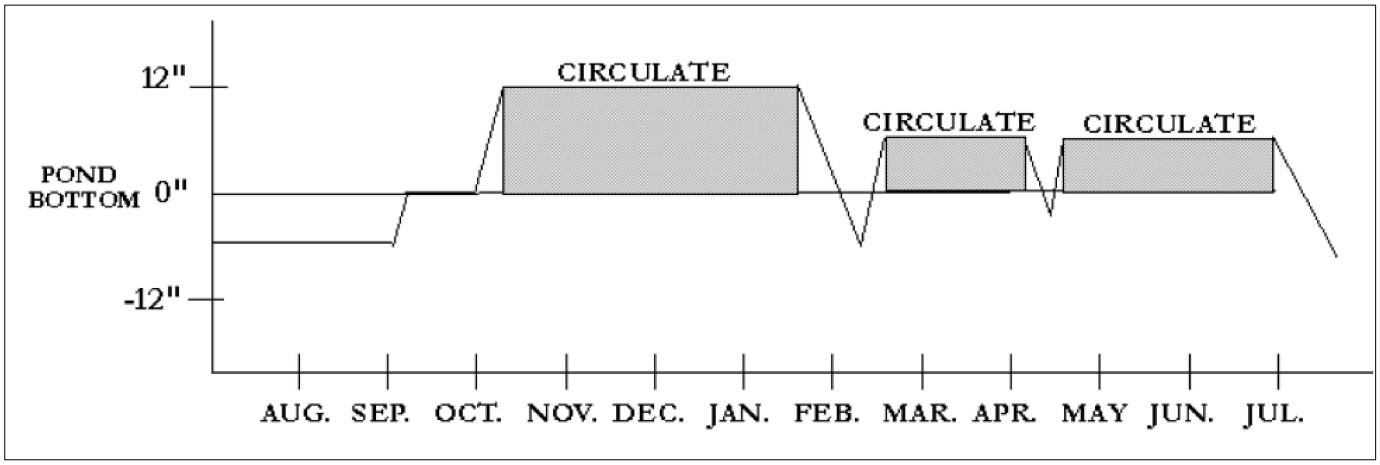


Figure 7. No Intake Restrictions / Normal Flood Date / Long Hydroperiod (Barthman-Thompson et al. 2007).

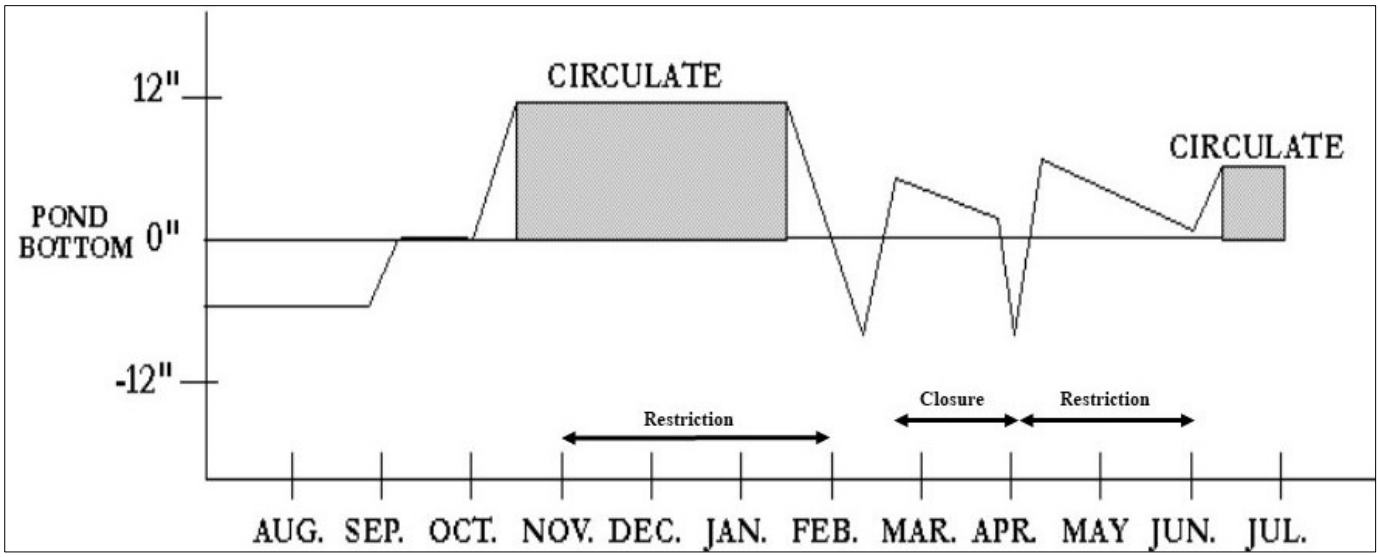


Figure 8. All potential intake restrictions/Long Hydroperiod (Barthman-Thompson et al. 2007).

B.5.3 Regional Water Management

Suisun Marsh Salinity Control Gates

The Suisun Marsh Salinity Control Gates (SMSCG) are located on Montezuma Slough about 2 miles north of its upstream confluence with the Sacramento River near Collinsville. The SMSCG were completed and began operating in October 1988. The facility consists of a boat lock, a series of three radial gates, and flashboards. The SMSCG control salinity by restricting the flow of higher salinity water from Grizzly Bay into Montezuma Slough during incoming tides and retaining lower salinity Sacramento River water from the previous ebb tide. Operation of the SMSCG in this fashion lowers salinity in the Marsh channels and results in a net movement of water from east to west. When Delta outflow is low to moderate and the SMSCG are not operating, net movement of water is from west to east, resulting in higher salinity water in Montezuma Slough.

The SMSCG usually begin operating in early October. Depending on salinity conditions, the SMSCG may continue operating through the end of the control season in May. When the channel water salinity decreases

sufficiently below the salinity standards, or at the end of the control season, the flashboards are removed and the SMSCG raised to allow unrestricted movement through Montezuma Slough.

Roaring River Distribution System

The Roaring River Distribution System (RRDS) was constructed in 1979 and 1980 to provide lower salinity water from Montezuma Slough to 5,000 acres of private wetlands and 3,000 acres of wetlands managed by CDFW on Simmons, Hammond, Van Sickle, Wheeler, and Grizzly Islands. The RRDS consists of approximately eight miles of modified channel running from the Montezuma Slough Salinity Control Gates at Montezuma Slough 3 miles north of Collinsville to the southeastern edge of Grizzly Bay.

On high tides, water is diverted through a bank of eight 60-inch-diameter culverts into the Roaring River intake pond to raise the water surface elevation in the system above the elevation of the adjacent managed wetlands. Managed wetlands north and south of the RRDS receive water, as needed, through publicly and privately owned turnouts on the system. Motorized slide gates in Montezuma Slough and flap gates in the intake pond control flows into the system. A manually operated flap gate with a flashboard riser is located at the confluence of Roaring River and Montezuma sloughs. This flap gate allows drainage back into Montezuma Slough to control water levels in the distribution system and provide flood protection. In 2017, DWR installed an additional drain gate at the West end of Roaring River to provide additional operational flexibility.

Infrastructure

Roaring River flows from east to west. The diversion point is at the Montezuma slough salinity control gates where screened diversions are operated by Department of Water Resources (DWR). During the 8-mile stretch, there are 24 diversion points supplying water to private duck clubs and 10 diversions to CDFW land. No structures drain into Roaring River.

In addition to the diversions that take water from Roaring River to supply duck clubs and the Grizzly Island Wildlife Area, there are two gates that allow Roaring River to drain directly into the sloughs. The east drain gate is a 36’ pipe, located just south of the intake screens. The west drain gate is a 48” pipe that empties into Grizzly Bay. The west drain gate is primarily a resource for flood prevention but may also be opened for circulation of water export of nutrient and food rich water into the bay, benefiting fish and other benthic species. Drivable levee exists on either side of the channel. The levees are all considered interior except for a small portion that borders Grizzly Bay at the far west end of Roaring River. The extent of the exterior levee stretches no longer than 1,000 feet and is protected from wave action by tidal vegetation and riprap. It is worth noting that many of the clubs bordering Roaring River have been tidal since 2007. Clubs #902, #903, #904, #905, and #933 are muted tidal and no longer divert water from Roaring River and overtopping of the Roaring River levee from these clubs is rare.

Operations

Department of Water Resources controls the intake gates year-round and is responsible for cleaning and maintaining the screened diversions. Drain gates are opened in preparation for flood events to prevent the overtopping of levees.

During Fall flood-up for duck season, screens are cleaned more frequently, the stage level in Roaring River is raised, and the approach velocity allowance is increased.

Fall Flood

Fall flood is a joint coordinated effort between the DWR, CDFW, SRCD, and the private landowners. There is no enforcement or authority; cooperation is imperative for a successful fall flood before duck season. Flooding begins in August, when the first of the Grizzly Island Units open their gates to take water. Private duck clubs begin taking water around September 20th-25th, although dates can be flexible. A variance to the Suisun Marsh plan directs DWR to increase the water in Roaring River beginning October 1st and lasts until flood-up demands are met (usually early November). In order to reduce demands on the system, landowners coordinate with SRCD so that as few as possible of the duck clubs are flooding at once. Since the start date of duck season varies every year, flood plans must be flexible.

Based on sums of the time to flood for each of clubs, it requires approximately 31 days of flooding to reach desired water levels in the private managed wetlands. This assumes that CDFW has completed most of their flood-up by late September and is not taking large amounts of water.

There is one gate that diverts water from Roaring River into Mud Slough (Gate **a**), which in turn supplies Club #805/806 and Club #803, St. Germain. Unlike the other clubs that divert from Roaring River, Gray Island has a flood gate along Suisun Bay, and can choose to flood from Roaring River or the bay. Roaring River provides water with lower salinity and is the preferred choice when it is available. Mud Slough is generally kept wet year-round, although much of the water may come from subbing and leaks rather than operations of the Mud Slough gate on Roaring River.

B.5.4 Regional Habitat Management Guidelines

The timing, duration, and depth of flooding is the most significant driver of marsh ecology (Mitsch and Gosselink 2000), since it influences vegetation composition, substrate character, and hydrologic connectivity. Factors that affect plant growth in the Marsh are short and long hydroperiods including frequent droughts, the east-west and north-south salinity gradients; length of soil submergence; soil salinity; water depth; salinity of applied water; competition from other plants, including nonnative invasives (DWR 2001 and SRCD 1998). Wetland managers use moist-soil management practices that encourages seed-producing plants by mimicking seasonal wet and dry cycles of natural wetlands and allows habitat management activities such as burning, mowing, and disking to be conducted annually during the summer dry cycle. Leaching cycles are conducted in the spring adding low salinity applied water to reduce soil salinities and improve plant germination and growth. Infrastructure including levees, ditches, water control structures, topography, pumps, and fish screens are used to meet management objectives. Biodiversity is retained through adaptive management and topographic variation creating microclimates with different communities present on the marsh plain, benches, and uplands. In addition, biophysical factors, such as soil chemistry or establishment of floating invasive plants in ponds and ditches, affecting different areas of the Marsh may influence the management for specific wetland habitats.

Southern Marsh Region

The bayside clubs at the southern edge of the Marsh are mostly dependent on Honker Bay and the Roaring River Distribution System (RRDS) for their water supply. This system is heavily influenced by the Suisun Marsh Salinity Control Gate (SMSCG) which provides the advantage of relatively low salinity water during the management season. The difficulty with this delivery system is coordinated water access for each managed wetland which can be unreliable during certain months.

The overall management targets of the managed wetlands in this area are variable. Some clubs perform the initial drawdown immediately after duck season, and other clubs run circulation water through the property

without lowering the water, managing for brood habitat. During typical water years, these managed wetlands can produce large amounts of Swamp Timothy, Brass Buttons, Rabbitsfoot Grass, Smartweed, and Watergrass on their upper benches and improve the overall food availability on the managed wetlands. The lower pond bottoms and ditch systems can also produce sago pondweed and widgeon grass if they do not fully drain down to dry pond bottoms. On high salinity years (low rainfall accumulation and low delta outflows), the wetland managers may shorten their water management window in the spring to prevent late irrigations with higher salinity water. The production of more salt tolerant plant communities such as Pickleweed, Fat Hen, Alkali Bulrush, ad Sea Purslane are better management targets under these conditions. The very slow time to drain and necessity for pumping typically prevent the southern clubs from running more than 1-2 leach cycles each year.

For managed wetlands that cannot flood and drain in 30 days or with pond bottom elevations below the mean low tidal elevation, the same regional habitat management decisions are applicable. These managed wetlands require the use of a pump to achieve habitat management objectives. Stationary, permanent pumps or SRCD's portable pumps may be used to accelerate drainage, thus maximizing removal of water from low areas, benefit of leach cycles, and reduce soil salinities. Multiple managed wetlands requiring pumping can also slow the drainage time on these areas. Meeting the targeted 30-day flood and drain objective can be difficult which may favor a Pickleweed, Fat Hen, Alkali Bulrush, and Sea Purslane dominated managed wetland.