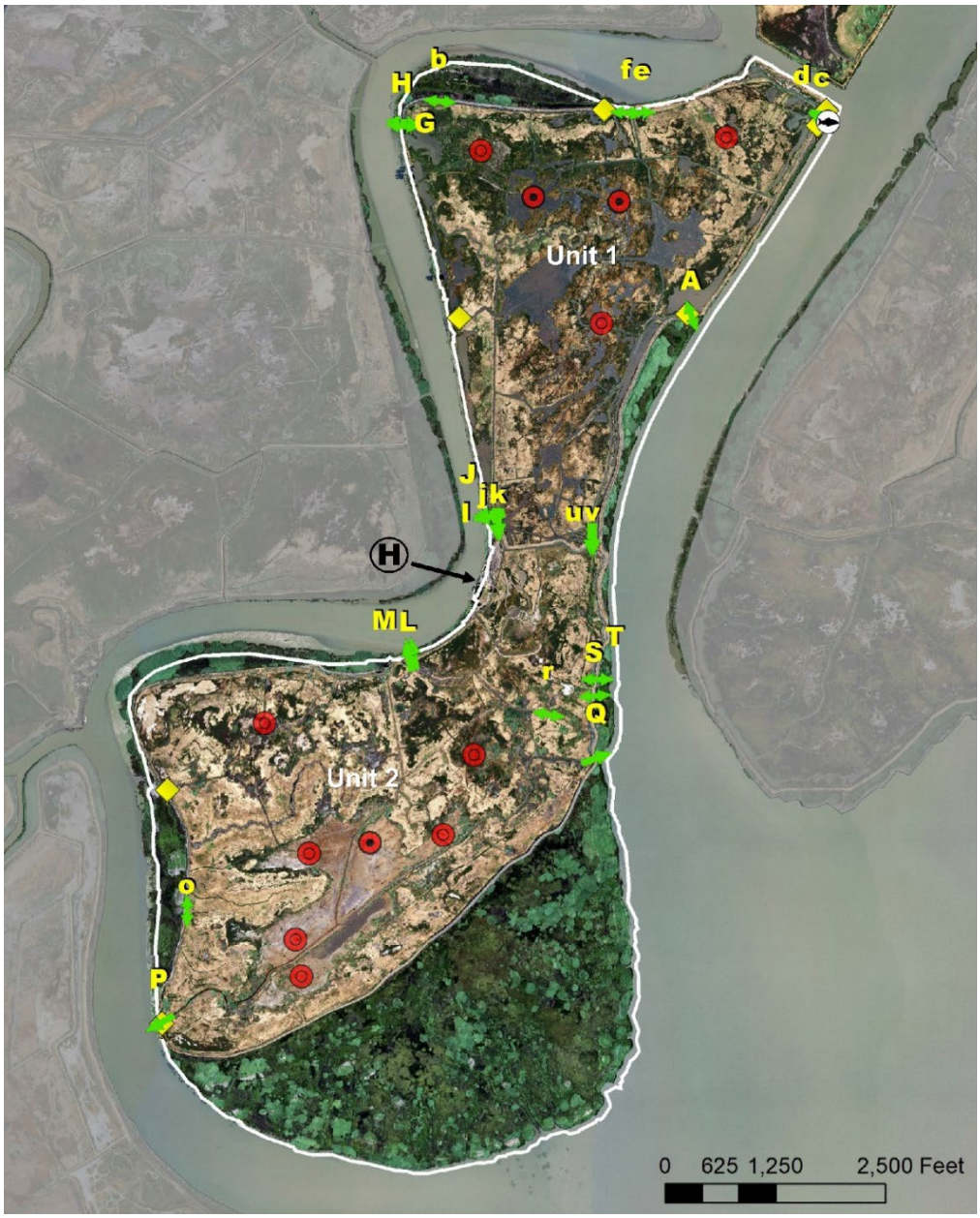
# Lower Joice Island #424
# Individual Ownership Adaptive Habitat Management Plan




**Certified by BCDC: March 17, 2022**
**(Updated: August 2021)**

**Suisun Resource Conservation District**

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## Table of Contents



## 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 Lower Joice Island (SRCD Ownership #424). This club is located in the Central Marsh Region West of Belden's Landing.

- The ownership consists of 1,101 acres: 752 acres of managed wetlands, 346 tidal acres, and 3 clubhouse acres. The wetland is managed as 2 units, Unit 1: North Pond and Unit 2: South Pond. Unit 1 has 4 intakes and 5 gates with drain ability. Unit 2 has 2 intakes and 6 gates with drainage ability. The club brings in water from Montezuma Slough and Suisun Slough in the North and drains into Suisun Slough in the South.

- The average elevation of Club #424 is 4.21 feet (NAVD88) including the upland and tidal acres.

- A drainage model suggests that both ponds can drain to one foot below shoot level in about 0 to 3 days each. Based on on-site observations, this club does not require 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.

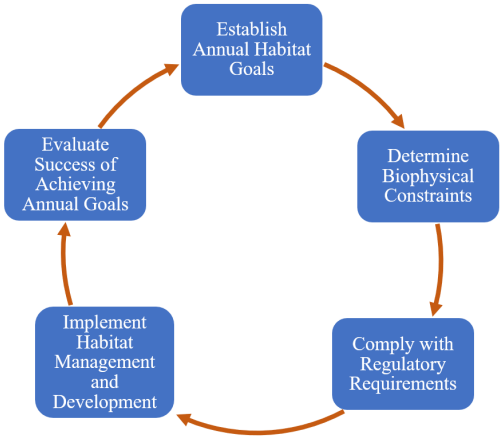



**Figure 1**. Annual habitat management flowchart.

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.

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

Lower Joice Island (SRCD Ownership #424) is located on the southwest side of Suisun Marsh. Access to the property is off Goodyear Road, east to the end of Pierce Lane across the railroad tracks and to the north approximately 0.5 miles. The property is accessed only by boat from Pierce Harbor. (**Figure 2**). The original management plan for Joice Island Gun Club (SRCD parcel #424) was certified by the San Francisco Bay Conservation & Development Commission on Nov. 15, 1984.

**Figure 2.** Property location in Google Earth.

**Table 1.** Land use description and estimated acreage

| Land Description | Acres |
|---|---|
| Managed Wetland | 752 |
| Tidal | 346 |
| Clubhouse | 3 |
| **Total** | 1101 |

### B.1 Club Facilities

There is one clubhouse with annex, an exterior and interior boat dock and walkway, caretaker house, storage barn, storage container, and two wetland units **(See "H" on Map 1**). 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 #424 is an island in Suisun Marsh that is bordered by Montezuma Slough on the east, Suisun Slough on the west, and Hunter's Cut on the north. A single levee around the exterior of the club and one small interior levee that separate and surround the two large managed ponds, or units. The club brings in water from Montezuma and Suisun Sloughs at the northern end of the property. The water flows through a ditch system that heads south. Water flows south to the east and west sides of the property where it drains from the southern pond into Montezuma and Suisun Slough.

#### B.2.2 Infrastructure

Unit 1: North Pond

Flooding of this managed pond is accomplished through four water control structures (Gates **A**, **G**, **H**, and a **fish screen**) on the northern end of the pond. A 12' **fish screen** and a dual-purpose water control structure (Gate **A**) bring in water from Montezuma Slough and two dual-purpose structures (Gates **G** and **H)** bring in water from Suisun Sloughs. Water typically flows from these structures and circulates through four interior water control structures (Gates **j**, **k**, **u,** and **v**) into Unit 2 and drains through drain structures to the south. Unit 1 can also be circulated in a circular pattern and drain through the three dual-purpose exterior water control structures (Gates **A**, **G**, and **H**) or through two exterior drain gates (Gates **I** and **J**) located near the interior levee on the southwest corner of the north pond.

Unit 2: South Pond

Flooding of this managed pond is accomplished through two water control structures (Gates **S** and **T**) on the northeast side of the pond. Both gates have flood and drain capacity. Water flows from Montezuma Slough through Gates **S** and **T** across the pond to the west and southwest to four exterior water control drain structures (Gates **L**, **M**, **P**, and **Q**). The property can also flood or supplement flooding the south pond unit from the interior water controls located along the north interior levee (gates **j**, **k**, **u**, and **v**) which circulate water from Unit 1 into the south.

Water movement through the club is facilitated by a system of perimeter and interior ditches which partition the club into two pond areas. 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 ponds in a southern 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** | | | | | | | | | | | | | | | |
| A | 1 | FD | -122.059053 | 38.149042 | HDPE | -- | 36 | 40 | FBR | -- | SF | -- | 0.77 | 1.38 | |
| G | 1 | FD | -122.070436 | 38.155119 | HDPE | 2010 | 36 | 40 | FBR | -- | SF | -- | -2.51 | -1.76 | |
| H | 1 | FD | -122.070439 | 38.155066 | HDPE | -- | 36 | -- | FBR | -- | SF | -- | -2.13 | -2.04 | |
| I | 1 | D | -122.067210 | 38.142870 | HDPE | -- | 12 | 40 | FBR | -- | FG | -- | 1.18 | 1.34 | |
| J | 1 | D | -122.067195 | 38.142826 | HDPE | -- | 12 | 40 | FBR | -- | FG | -- | 1.71 | 1.61 | |
| L | 2 | D | -122.070342 | 38.138564 | HDPE | -- | 24 | 40 | FBR | -- | FG | -- | -1.07 | -0.80 | |
| M | 2 | D | -122.070410 | 38.138558 | HDPE | -- | 24 | 40 | FBR | -- | FG | -- | -0.95 | -0.88 | |
| P | 2 | D | -122.080408 | 38.127131 | HDPE | -- | 36 | 40 | FBR | -- | FG | -- | -0.74 | 1.09 | |
| Q | 2 | D | -122.062973 | 38.135285 | HDPE | -- | 36 | 50 | FBR | -- | FG/SS | 2020 | -1.06 | -2.38 | |
| S | 2 | FD | -122.063058 | 38.137224 | HDPE | -- | 36 | 50 | FBR | -- | WF | -- | -0.81 | 0.09 | |
| T | 2 | FD | -122.062947 | 38.137737 | HDPE | -- | 36 | 40 | FBR | -- | WF | -- | -0.48 | 0.44 | |
| FS | -- | F | -122.053565 | 38.155032 | HDPE | 2000 | 30 | 30 | SG | -- | -- | -- | -- | -- | 12' Fish Screen |
| **Interior water control structures** | | | | | | | | | | | | | | | |
| b | -- | FD | -122.068955 | 38.155796 | HDPE | -- | 36 | -- | O | -- | O | -- | -- | -- | |
| c | -- | FD | -122.053745 | 38.155103 | CMP | 1998 | 36 | 30 | O | -- | O | -- | -- | -- | |
| d | -- | FD | -122.053729 | 38.155127 | HDPE | -- | 36 | 30 | O | -- | O | -- | -- | -- | |
| e | -- | FD | -122.061118 | 38.155368 | CPP | -- | 36 | 30 | O | -- | O | -- | -- | -- | |
| f | -- | FD | -122.061483 | 38.155371 | CPP | -- | 36 | 30 | O | -- | O | -- | -- | -- | |
| j | -- | D | -122.066850 | 38.142574 | HDPE | -- | 36 | 20 | FBR | -- | O | -- | -- | -- | |
| k | -- | D | -122.066801 | 38.142576 | HDPE | -- | 36 | 20 | FBR | -- | O | -- | -- | -- | |
| o | -- | FD | -122.079268 | 38.130637 | HDPE | -- | 36 | 20 | O | -- | O | -- | -- | -- | |
| r | -- | FD | -122.064880 | 38.136657 | CMP | 1998 | 48 | 15 | O | -- | O | -- | -- | -- | |
| u | -- | D | -122.063118 | 38.142058 | HDPE | -- | 36 | 20 | FBR | -- | O | -- | -- | -- | |
| v | -- | D | -122.063065 | 38.142059 | HDPE | -- | 36 | 20 | FBR | -- | O | -- | -- | -- | |

ID: Fish Screen (FS), 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 #424 along with associated target staff gauge elevation data 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 Unit 1 was 3.23 feet (NAVD88) and the average pond bottom elevation measured for Unit 2 was 3.44 feet (NAVD88) compared to an overall average bare earth elevation of 2.41 feet (NAVD88) for the Suisun Marsh primary management area. 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 **A**, **G**, **H**, and the **fish screen**, Unit 1 can be flooded to 4.34 feet NAVD88 (1.8 on the staff gauge) in approximately 7 days and, using structures **S** and **T**, Unit 2 can be flooded to 3.98 feet NAVD88 (1.2 on the staff gauge on the boat dock) in approximately 7 to 10 days. Results from the Resource Management Associates (RMA) drainage model **(Appendix M)** suggest it will take 0 – 3 days for each 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.

Based on on-site observations, the club is able to complete a spring leach cycle within thirty days without the use of a pump **(Figure 3)**. Drainage 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.

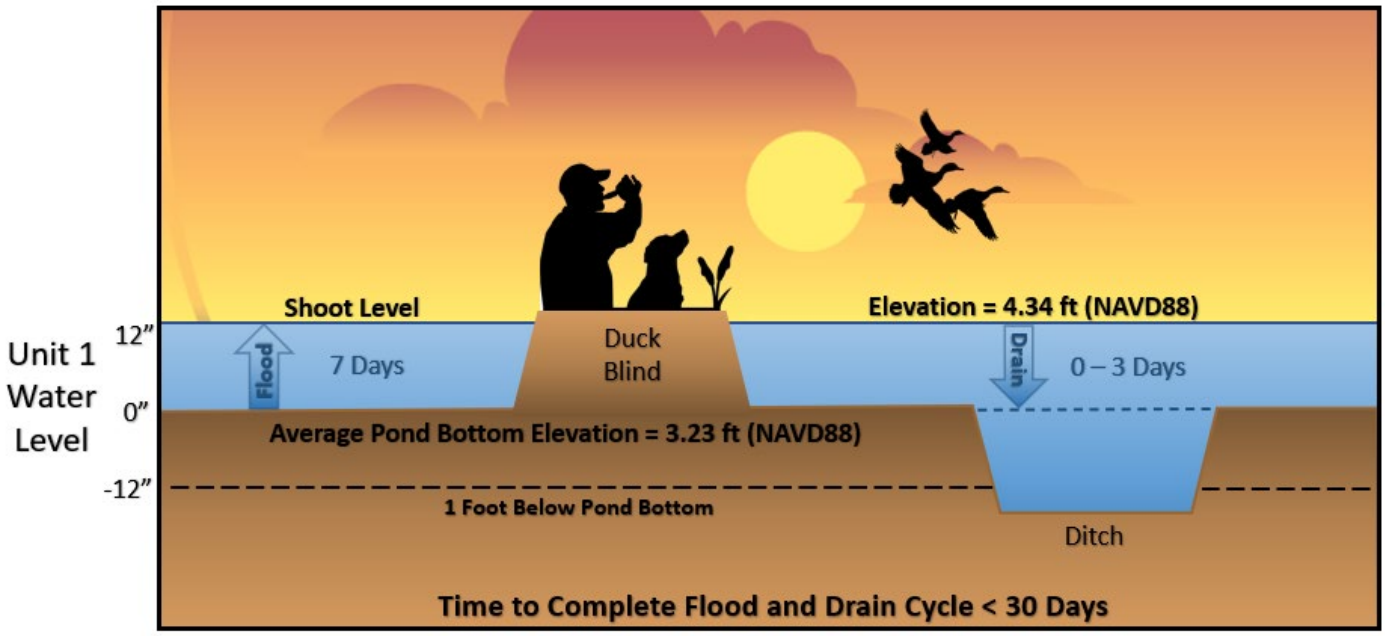



**Figure 3a.** RMA drainage model results suggest that it will take the Unit 1 zero to three days to drain to one foot below shoot level. Based on on-site observations, Unit 1 is able to complete a spring leach cycle within thirty days without the use of a pump.

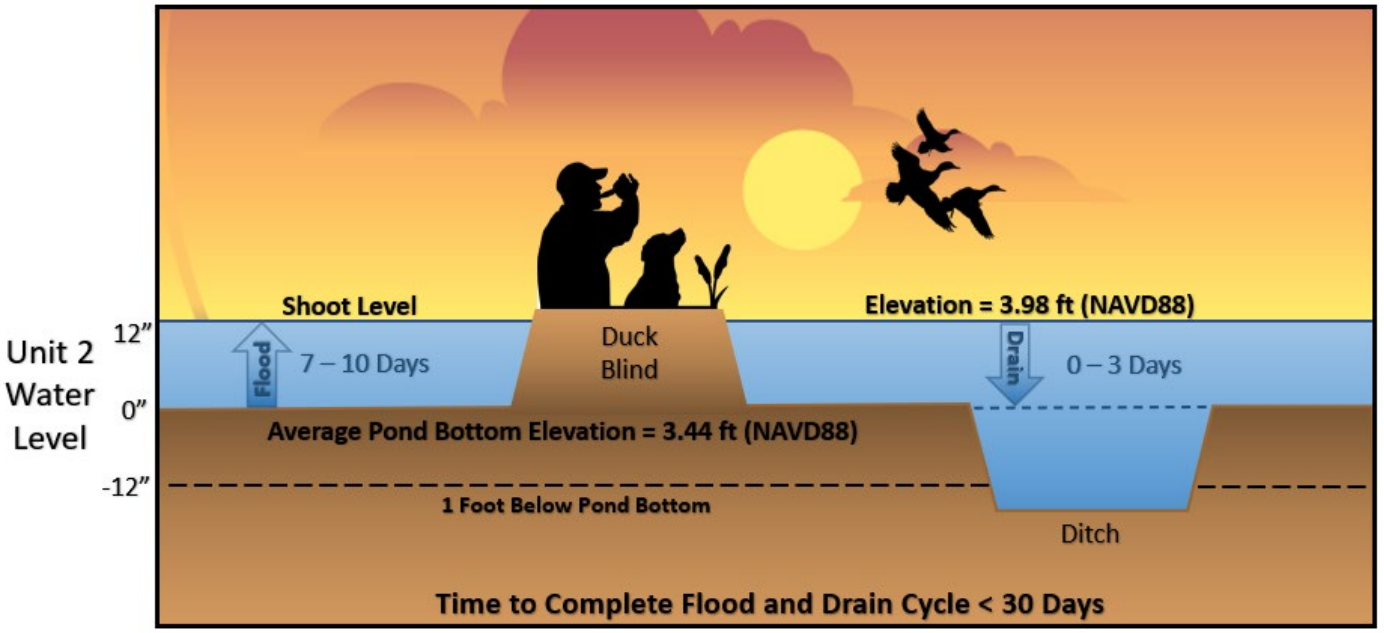


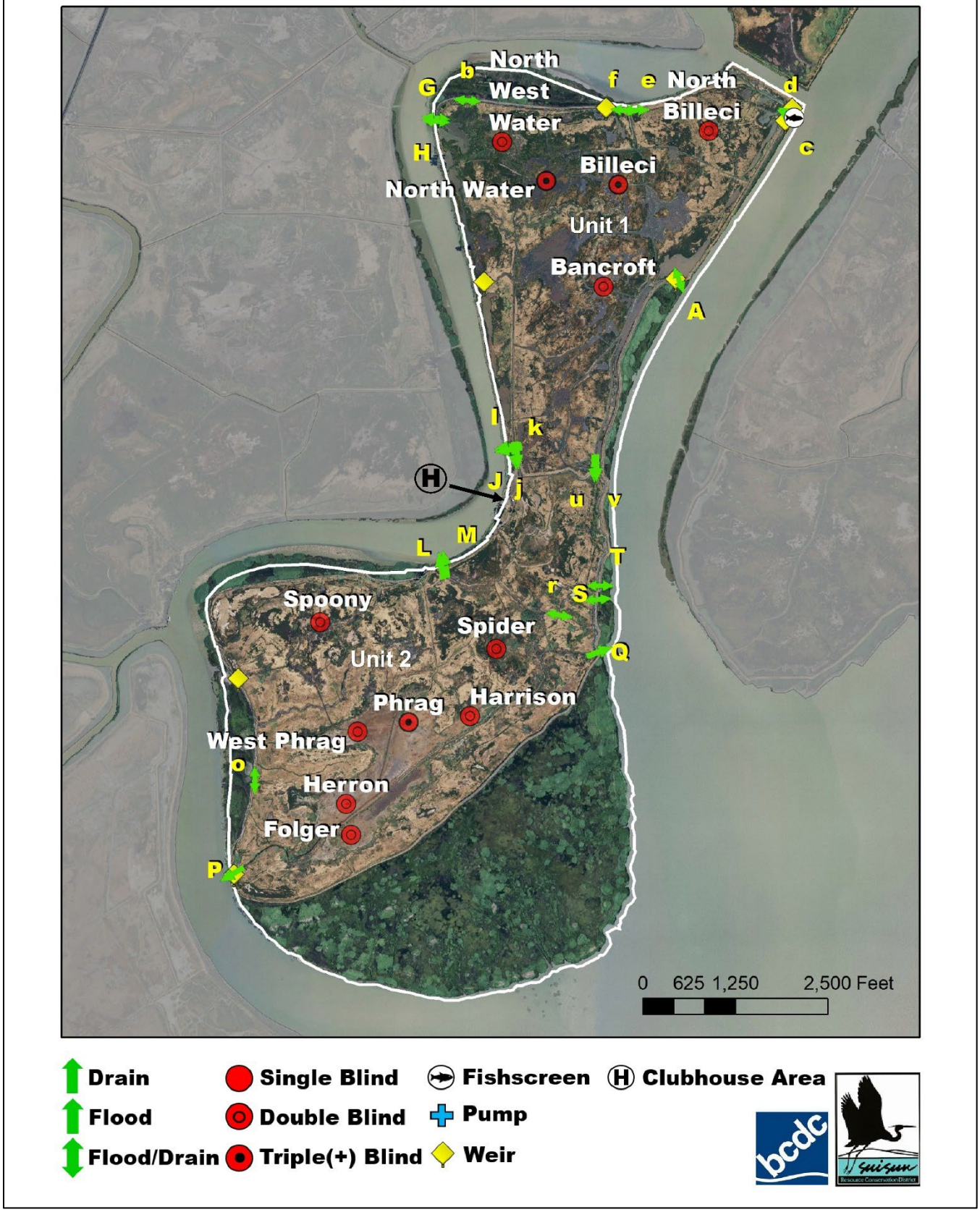

**Figure 3b.** RMA drainage model results suggest that it will take the Unit 2 zero to three days to drain to one foot below shoot level. Based on on-site observations, Unit 2 is able to complete a spring leach cycle within thirty days without the use of a pump.

### B.2.5 Shared Water Levels/Shared Infrastructure

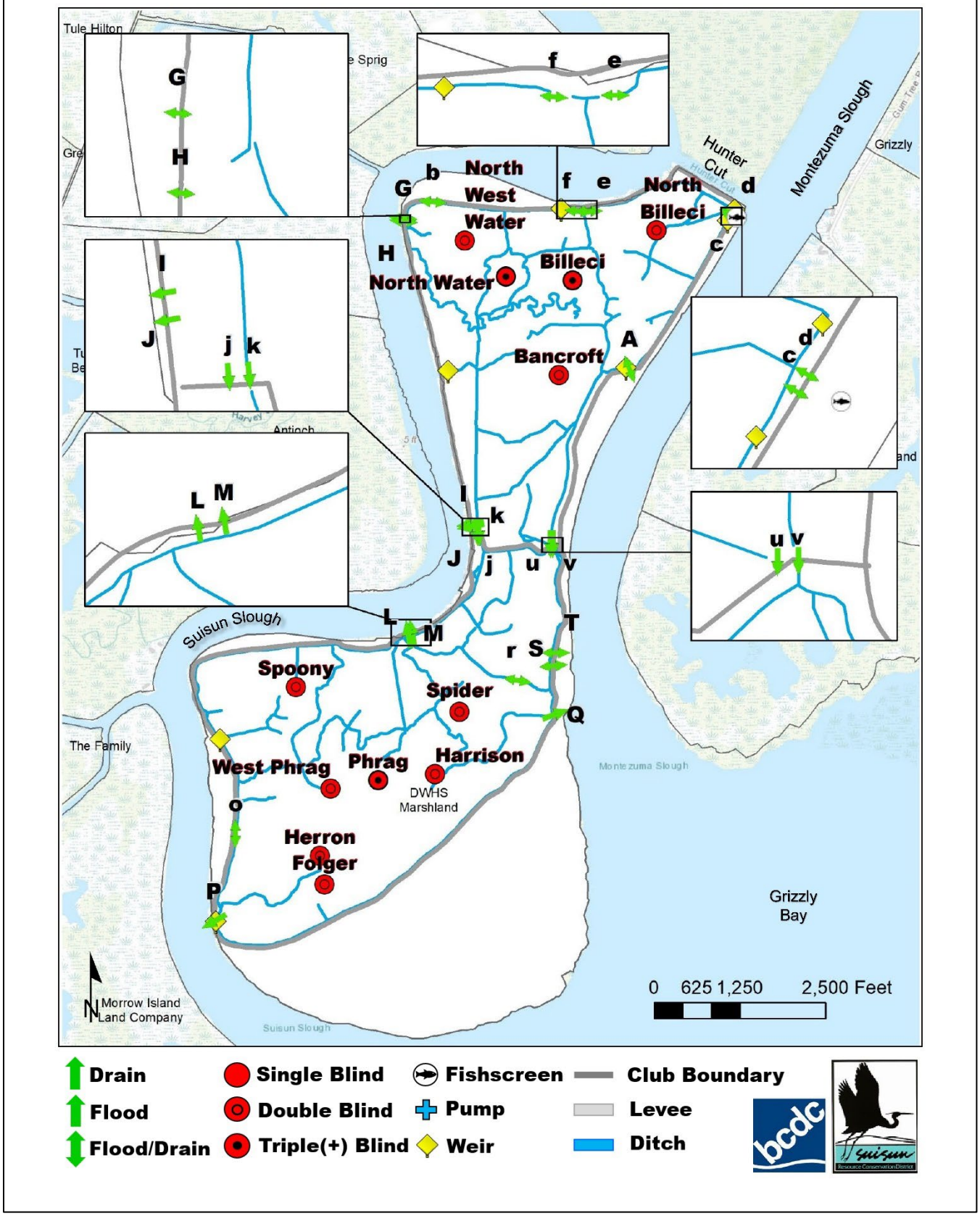
Club #424 does not share water levels, water control structures or levees with any other clubs.

### B.2.6 Soil Information

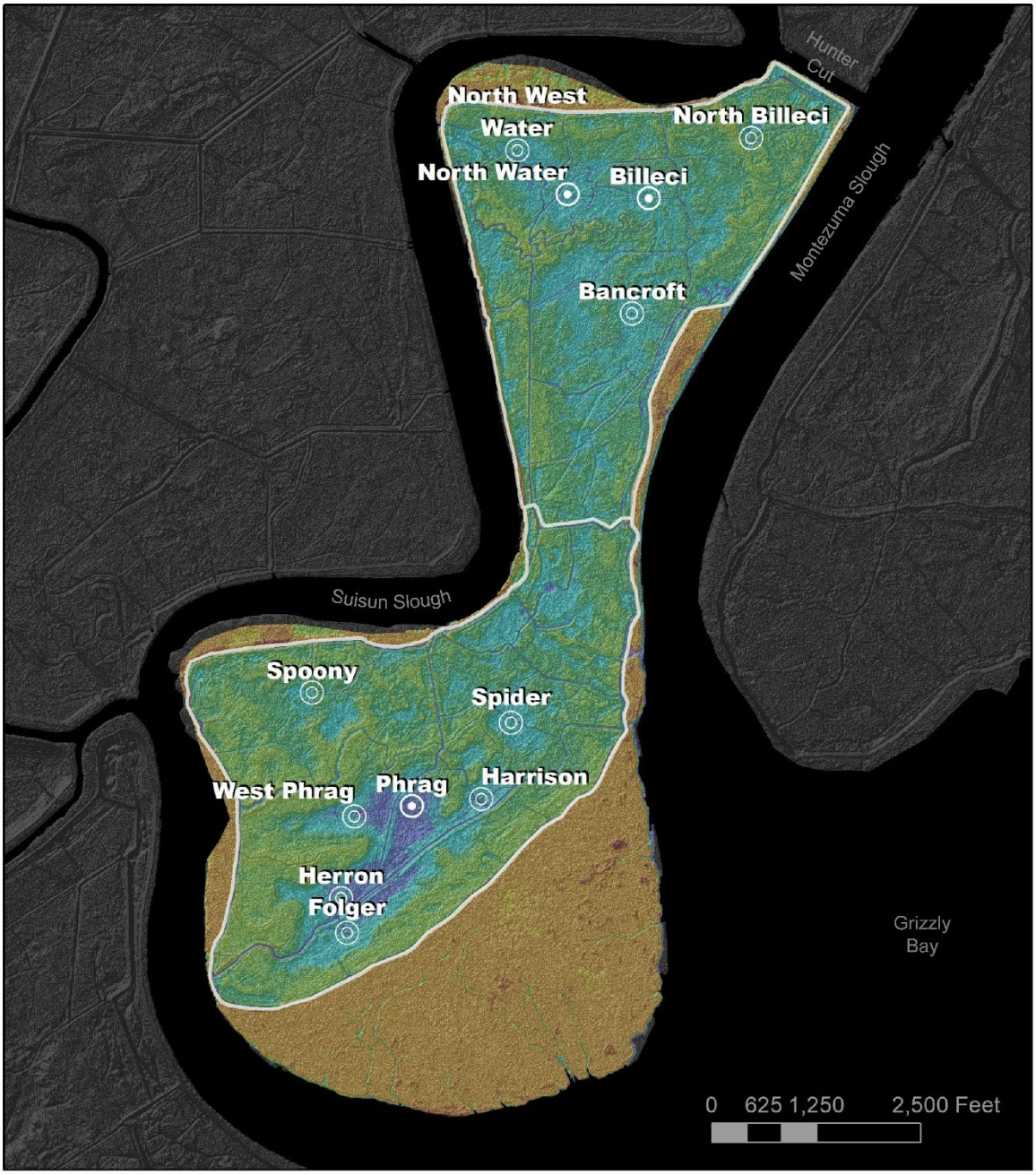
In 1978, the Soil Conservation Service surveyed the soil and provided a detailed summary map with soil descriptions for the managed wetland properties in the Marsh. The intention of the survey was to be used as a guide for wetland managers on vegetation, irrigation, and management. A current soil map 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 (33.3%), Reyes silty clay (43.1%), and Tamba mucky clay (11.6%) (**Map 4**). See **Appendix L** for more detailed information about Suisun Marsh soils.




**Map 1.** Club #424 aerial imagery. Source: USDA National Agriculture Imagery Program (NAIP) 2018.




**Map 2.** Club #424 water control infrastructure. Source: Geomarsh (SRCD and BCDC, 2020).




**Map 3.** In 2018, the average pond bottom elevation for the north pond was 3.23 feet (NAVD88) and for the south pond was 3.44 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.


**Soil Type**

Ja - Joice muck

Re - Reyes silty clay

Ta - Tamba mucky clay

**Map 4**. The primary soils on Club #424 include Joice muck (33.3%), Reyes silty clay (43.1%), and Tamba mucky clay (11.6 %). Source: Natural Resources Conservation Service Web Soil Survey, Version 14, May 29, 2020.


**Map 5.** Club #424 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, all structures on Club #424 are operational and in good condition.

Levees in the Marsh are comprised of silts, clay, and organic materials and are subject to shrinkage and subsidence as well as tidal erosion and animal damage and therefore 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 #424 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 #424 does not belong to a Reclamation District.

### 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)**.

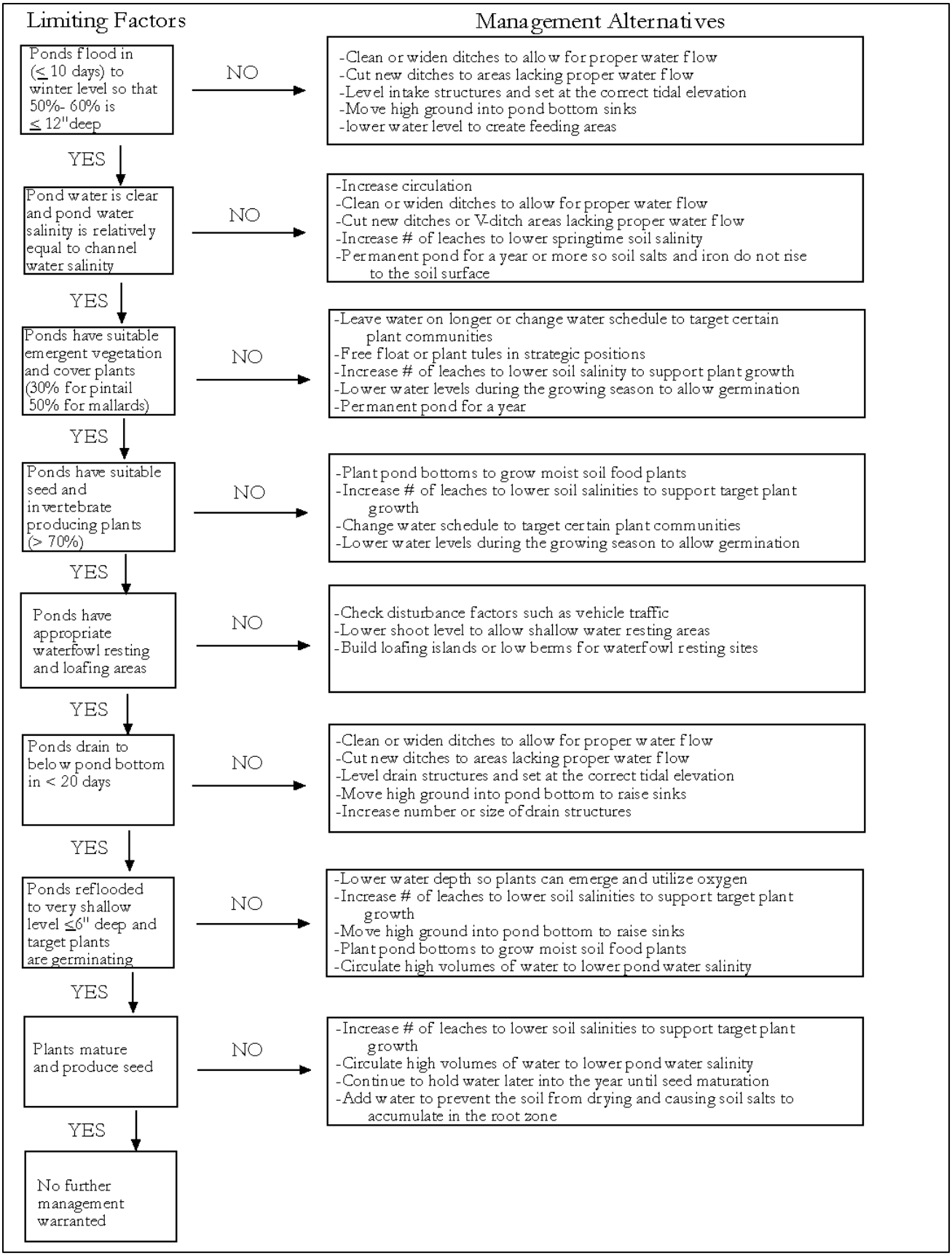



**Figure 4.** Example of a waterfowl pond management flowchart for typical wintering waterfowl (Barthman-Thompson et al. 2007).

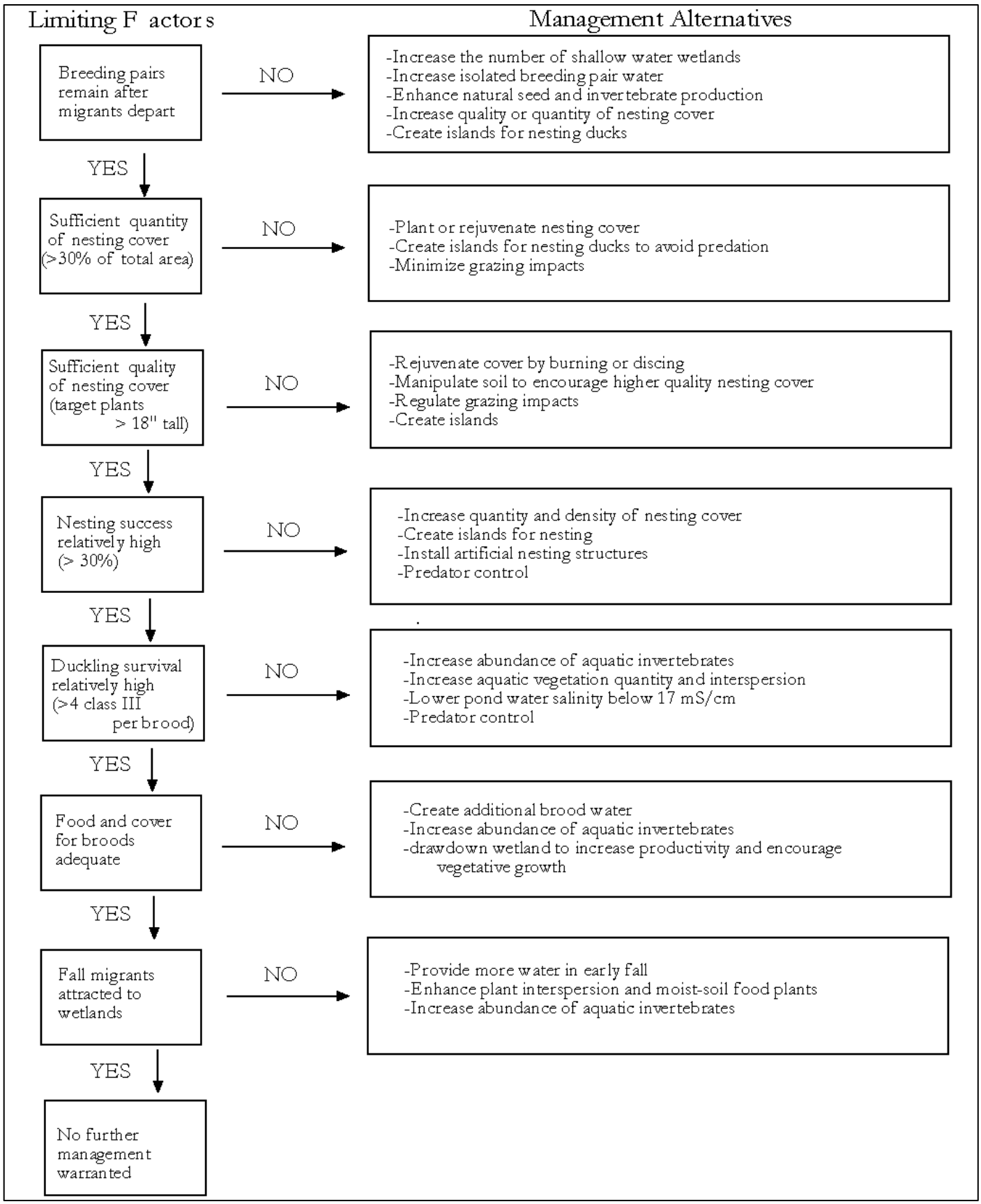



**Figure 5.** Example of a waterfowl pond management flowchart for typical breeding waterfowl (Barthman-Thompson et al. 2007).

### 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**).

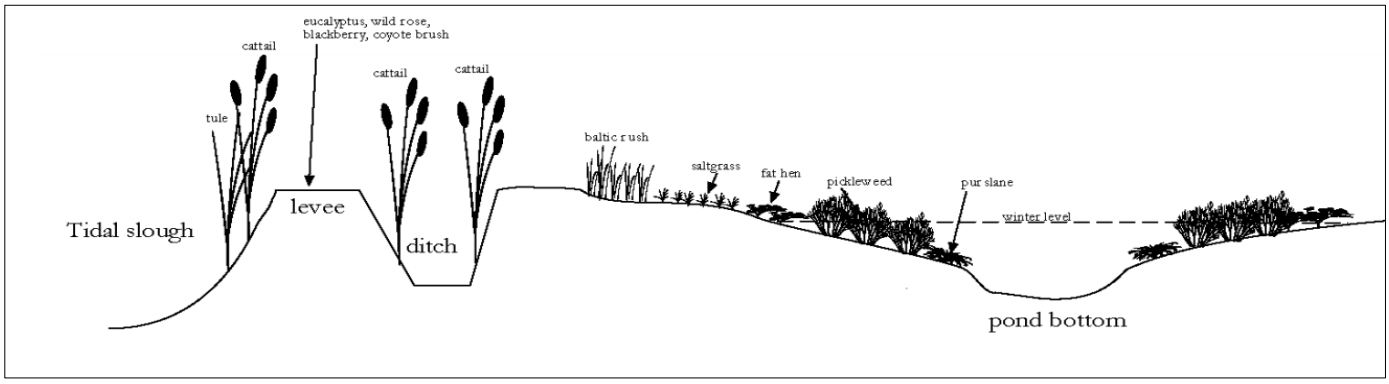



**Figure 6**. Schematic of typical long hydroperiod plants and elevation location (Barthman-Thompson et al. 2007).

### 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**)**.

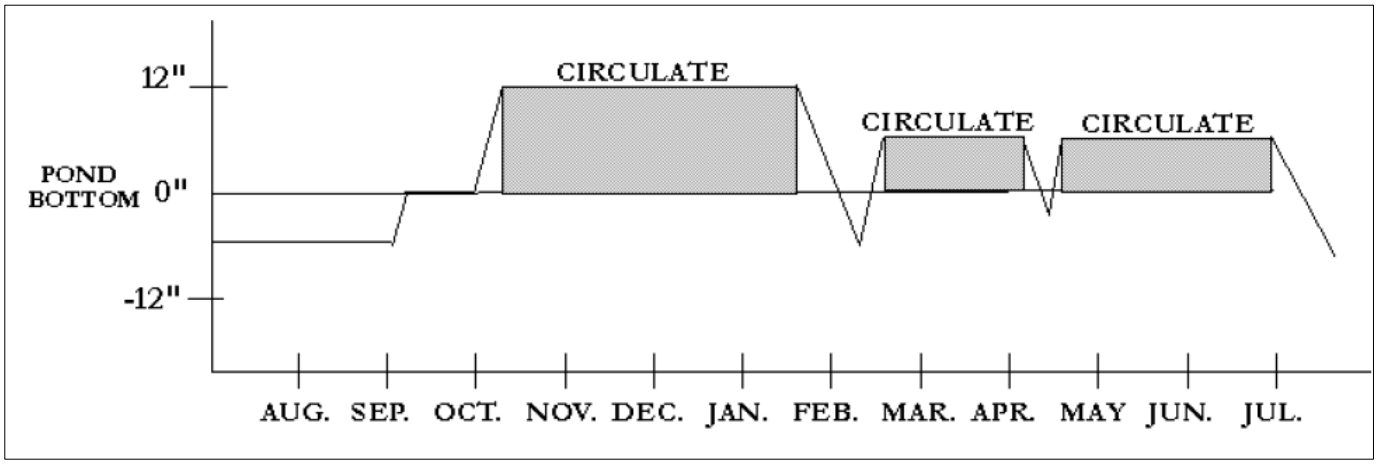



**Figure 7.** No Intake Restrictions / Normal Flood Date / Long Hydroperiod (Barthman-Thompson et al. 2007).

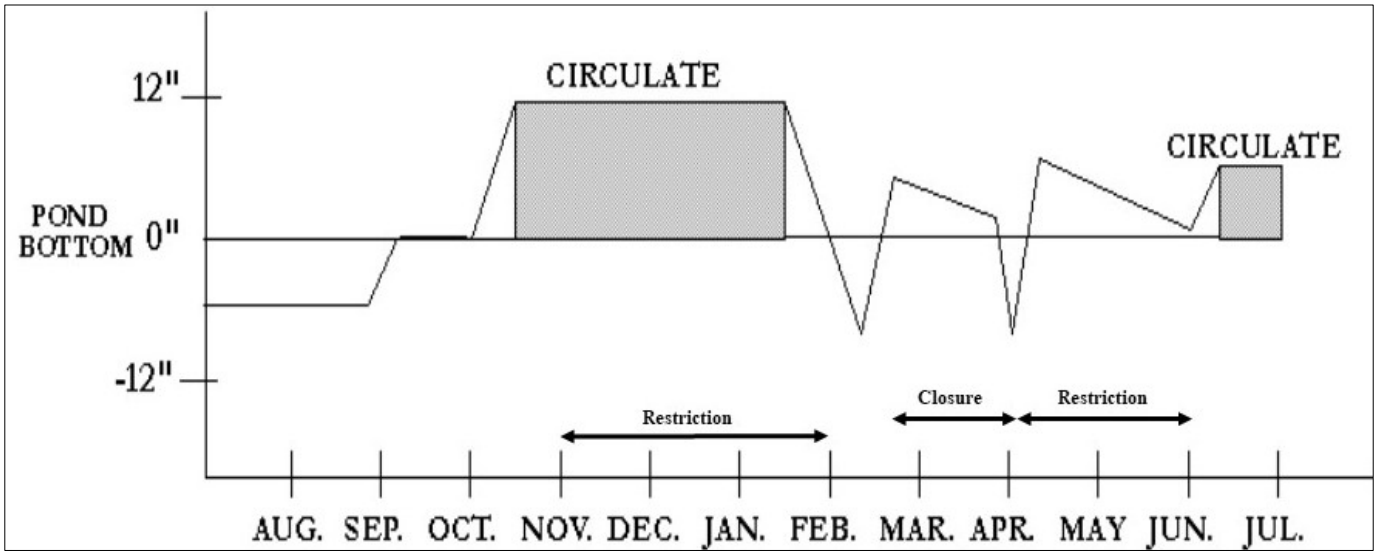



**Figure 8.** All potential intake restrictions/Long Hydroperiod (Barthman-Thompson et al. 2007).

### 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.

### 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.

***Central Marsh Region West of Belden's Landing***

This region encompasses Grizzly Island properties west of Belden's Landing downstream to Grizzly Bay. Belden's Landing is located at the northernmost point on Montezuma Slough near the Grizzly Island Road Bridge ~7 miles from the western mouth on Grizzly Bay. DWR operates the Suisun Marsh Salinity Control Gates (SMSCG) to meet water quality objectives from October through May, but the SMSCG operations have limited effects to reduce salinity in this region. The salinity levels typically increase along Montezuma Slough downstream towards Grizzly Bay. This region can have highly variable salinities throughout the year. In late summer, early fall, or during periods of drought, channel salinities effect managed wetland operations. Higher salinity water affects the timing and duration of flooding that influence plant growth.

Managed wetlands with adequate drainage should draw down after waterfowl season to remove higher salinity water that has been circulated during the waterfowl season. The managed wetlands exchange 50-80% of the water with lower salinity water in early February. Depending on the water year and tide cycles, the managed wetlands may flood, circulate, and drain water 2-3 times during the spring. These leach cycles remove accumulated soil salts and aid in producing high quality wetland habitats and waterfowl food crops. Leach cycles foster wetland plant germination and aid in production of waterfowl food crops and wetland habitats. Managed wetland habitats in this region are typically dominated by Pickleweed, Fat Hen, Alkali Bulrush, and Sea Purslane. In freshwater years, a large amount of Swamp Timothy, Brass Buttons, Rabbitsfoot Grass, Smartweed, and Watergrass can be produced that improves the overall waterfowl food availability. During higher salinity years or periods of low rainfall, drought conditions, and low delta outflow, the water management window must be earlier and shorter to prevent accumulation of soil salts as salinities rise. The production of more salt tolerant plant communities such as Pickleweed, Fat Hen, Alkali Bulrush, and Sea Purslane are better management targets under these conditions. However, reducing accumulation of soil salts during years with shortened water management windows will minimize the need for multiple years of management to lower soil salinities and allow for growth of salt-sensitive plants such as Swamp Timothy and Watergrass.