Appendix K - Suisun Marsh Channel Water Salinities

Salinity is a major water quality variable for management in the Marsh since it affects the ability of the managed wetlands to produce vegetation and habitat conditions necessary to support waterfowl. Marsh salinity mainly is controlled by salinity in Suisun Bay (SMP) and Delta outflows. The applied salinity, drainage practices, and leaching cycles affects soil salinities in managed wetlands which may limit the vegetation that is considered ideal for waterfowl (DWR 2000).

In August 1978, the State Water Resources Control Board (SWRCB) issued Water Right Decision 1485 (D-1485), which set channel water salinity standards for the Marsh from October through May to preserve the area as a brackish water tidal marsh and to provide optimal waterfowl plant food production (SWRCB 1978). D-1485 placed operational conditions on water right permits for the Central Valley Project (CVP) and State Water Project (SWP). Order 7(a) of D-1485 required the permittees to develop and fully implement a management plan, in collaboration with other agencies, to ensure that the salinity standards are met in the Marsh (DWR 1999).

In 1987, DWR, USBR, DFW, and SRCD signed the Suisun Marsh Preservation Agreement (SMPA) as a contractual framework for implementing the Plan of Protection including plans for physical facilities to control channel water salinity. The Suisun Marsh Salinity Control Gate (SMSCG) was constructed on Montezuma Slough and began operation in 1988. The SMSCG proved to be effective on the east side of the Marsh to control salinity levels, however it could not meet the objectives at two of the western compliance stations. The newly revised SMPA has determined that waterfowl habitat can adequately be protected under the current salinity regime through more efficient use of channel water and improved land management (State Water Resource Control Board 1999). Leaching cycles and pond recirculation are critical components of active water management, in addition to variation in salinity between high and low tides.

In addition to the tidal stages and its influence on the Suisun Marsh, the Delta outflow is considered one of the most significant driving forces on Suisun Bay and its environment (Kimmerer 2004). Delta outflow includes total inflow from the Sacramento River (the primary source), San Joaquin River, northwest tributaries (Yolo Bypass), east side tributaries, and southwest (Siegel et al. 2010). Since 1998, the Water Quality Control Plan has been updated many times, but the Marsh salinity standards that protect the beneficial uses are still in effect in Water Rights Decision 1641 and the SMPP.

Factors affecting the salinity in the sloughs of the Suisun Marsh include, but are not limited to tides, climate, delta outflow, Suisun Marsh Salinity Control Gate (SMSCG) operations, creek inflows, managed wetland operations (as allowed under current regulatory restrictions), urban runoff, and Fairfield-Suisun Treatment Plant effluent flows. The first five factors have the greatest impacts on slough water salinity, while the last three factors have temporary or localized effects. Pond water salinity tends to be directly related to slough water salinity, but many times there is a lag in pond water salinity response to changes in channel water salinity from months to a year.

During times of high Delta outflow, the Suisun Marsh has a natural salinity gradient from east to west. The eastern Marsh, being closest to the Delta, will have lower channel salinities than the western Marsh. When Delta outflow is low, the operation of the Suisun Marsh Salinity Control Gates lowers the salinity in eastern marsh channels and maintains the east to west gradient. Without Control Gate operations during times of low Delta outflow, the salinity in the western Marsh may be lower than that at some eastern Marsh locations (Barthman-Thompson et al. 2007).

When Delta outflow increases, salinity in the eastern Marsh drops rapidly. However, the southwestern Marsh requires high outflow for a longer period of time to achieve a reduction in salinity. Field data and simulation modeling indicate that northwestern Marsh salinity is primarily affected by SMSCG operations and inflows from the watershed to the north and northwest, and by local drainage from managed wetlands. The Marsh also has a north-south salinity gradient, with the northern Marsh having lower channel salinity during wet months due to local runoff and creek flows (Barthman-Thompson et al. 2007).

The State Water Resources Control Board (SWRCB) has five water year classifications that include: wet, above normal, below normal, dry, and critical. (SWRCB 1978). Water years with more rainfall result in less saline water. The salinity of the slough water, applied water, and pond water show similar trends in salinity during different water years. However, there is often a lag in pond water salinity response to changes in channel water salinity from months to a year (DWR 2001). Pond water salinity follows the same annual trend as applied water salinity with the pond water salinity being 2-10 mS/cm higher than applied water salinity (DWR 2001).

To create the appropriate conditions for certain desired plant species, pond water salinity must be maintained at low levels. Low salinities are achieved by exchanging high salinity pond water with the lower salinity channel water in the springtime. Water exchanges are most effective when there is high river flows and channel water salinity is low. Water exchanges are conducted as necessary to keep pond water salinity below salinity tolerance levels for desired plant species (Barthman-Thompson et al. 2007).

Salinity Conversion Table

mS/cm	µS/cm	ppm	mg/l	ppt	psu	
<1	<1000	<500	<500	<0.5	<0.5	Fresh water
1	1000	550	550	0.6	0.6	↑
2	2000	1100	1100	1.1	1.1	
3	3000	1650	1650	1.7	1.7	
4	4000	2200	2200	2.2	2.2	
5	5000	2750	2750	2.8	2.8	
6	6000	3300	3300	3.3	3.3	
7	7000	3850	3850	3.9	3.9	
8	8000	4400	4400	4.4	4.4	
9	9000	4950	4950	5.0	5.0	
10	10000	5500	5500	5.5	5.5	
11	11000	6050	6050	6.1	6.1	Brackish water
12	12000	6600	6600	6.6	6.6	
13	13000	7150	7150	7.2	7.2	
14	14000	7700	7700	7.7	7.7	
15	15000	8250	8250	8.3	8.3	
16	16000	8800	8800	8.8	8.8	
17	17000	9350	9350	9.4	9.4	
18	18000	9900	9900	9.9	9.9	
19	19000	10450	10450	10.5	10.5	
20	20000	11000	11000	11.0	11.0	↓
>63.6	>63636.3	>35000	>35000	>35	>35	Saline water

Commonly used units of measurement	**Unit Conversions**
ppm = parts per million **mg/l** = milligrams per liter **µS/cm** = microSiemens per centimeter	**µS/cm = (mS/cm * 1000), ppm = (µS/cm * .55), mg/l = ppm, ppt = (ppm / 1000), psu = ppt**
mS/cm = milliSiemens per centimeter **psu** = practical salinity units	**Water is considered fresh < 0.5 ppt and saline at >35 pp**

psu is temperature and pressure dependent, and can vary from ppt when comparing data with different temperatures and pressures. For this Table assuming similar temperature and pressure, psu = ppt