METHODS AND IMPLEMENTATION ACTIONS				SUMMARY
METHODS TO REDUCE SALT AND BORON IN THE LSJR	SUB-METHODS[a]	IMPLEMENTATION ACTIONS	EXAMPLES	
REDUCING SALT AND BORON LOADING FROM POINT AND/OR NONPOINT SOURCES	Reductions in salt loading to system	1. Reduced Water Use	a. Pipelines to replace canals	Conserve water by reducing seepage to reduce diversion of tributary flows. Main salt reductions relate to a) less water volume & attendant salt load need to be imported to meet irrigation demands, and b) where shallow groundwater is saline, reduction in saline drainage volume due to reductions in seepage will reduce salt loading into and out of the system. Recognize that incidental benefits of seepage (groundwater recharge and canal-dependent vegetation) will be lost.
			b. Increase irrigation efficiency	Similar to (a). Note that irrigation systems are being updated at a rapid pace, primarily because the production benefits of drip and microspray systems on certain crops have proven to be very significant, and the cost of the systems has come down.
		1a. High-efficiency irrigation systems, per se	c. Reduce application of solid salts	Solid salt (fertilizer and amendment) loads can be reduced when these materials are used more efficiently. This is often the case for fertilizer when more efficient, uniform irrigation is employed.
	Increased salt retention in system	1a. High-efficiency irrigation systems, per se	d. Increase retention of soluble salts	Conventional notions of leaching excess salt through the soil to maintain production change somewhat with drip and microspray irrigation, in which salts may accumulate harmlessly beyond the soil zone accessed by plants to uptake water.
		2. Sequential Reuse & volume Reduction (IFDM) (Salt sensitive crops & solar evap)	IFDM	Same as 6a, but implies eventual salt export to an alternative sink. Another notable difference is that reuse is not incidental on farmland, but rather on dedicated facilities with attendant costs. Thus, one precondition to success may be a source of revenue to support the cost of this facility. One such source would be a reliable market for the recovered salt products.
		3. Evaporation Ponds	a. Evaporation Ponds	Established track record in areas such as Tulare Lake Drainage District (TLDD).
			b. Regional Evap Pond Systems	Systems to be located on retired land.
			c. Regional Evap Ponds and De-designation of MUN groundwater	Systems to be located on retired land.
			d. Solar Evaporators	This practice implies ultimate in-Basin disposal or out-of-Basin export of salts for long term sustainability.
		4. Direct Well Injection		In-basin disposal of concentrated salts generated from evaporation ponds, solar evaporators, drainage treatment facilities, industrial brine waste, etc..
		5. Active Alternative Land Mgmt (sequential reuse/crop selection etc)		A blend between 2 and 6b, mainly distinguished by the intentional nature of land management, without creating a completely dedicated facility.
	Source control with increased retention	6a. Surface Drainage Recirculation (tailwater recovery)		Tailwater can have relatively low-levels of salinity, so it can be reused even on relatively sensitive crops. Where reuse replaces irrigation with imported water, the new salt load that would come with that imported water does not need to be imported. Where crops tolerate the additional salinity that this practice may entail, it allows for further concentration and retention of salt. However, the total salt mass is not reduced, and the same mass ultimately needs to leave the system to maintain balance. This practice relies on a disposal practice for long term sustainability.
		6b. Subsurface Drainage Recirculation (tilewater recovery)	Re-route drainage water	Same as 6a, but entails recirculation of greater salt concentration from the outset.
		7. Water Treatment (drainage water)	Regional treatment facility	Facility to be located on retired land. Relies on an ultimate disposal practice for long-term sustainability.
		8a. Land Retirement	a. Retired lands as Reuse Facilities	Same as 8b, but also functions to retain salt by accepting recycled water, along with its salt load. Regional reuse could include active alternative land management (similar to 5), or use of lands for drainage, treatment and disposal, etc.
	Reductions in salt loading to system	8b. Land Retirement	b. Retire lands to non-irrigated uses	The salt previously imported to irrigate these lands is not needed, and salt loading to the basin is reduced by the amount of dissolved salt in that water. Lands could be converted to commercial, industrial purposes, flood control, habitat purposes, etc.
		9. Reduce M&I Sources of Salts	SRWS Ban or restrictions	Would be an option for Turlock or Modesto but assume low priority for BPA
			New or Improved (less saline) surface water supply	Turlock and Modesto are both working toward this, but assume low priority for BPA
			Ind/Food Processing Source Control	Potential option for POTWs implementing industrial source control. For industries discharging to land, source reductions may potentially benefit the LSJR through reduced salt loadings via groundwater accretion. TMDL stated that there are no industries discharging directly to SJR
		10. Reduce Other Nonpoint Sources of Salts (fertilizer/animal wastes etc)		One likely outcome of the Dairy and ILRP WDRs. Otherwise, an outcome of efficient use of nutrients for a given level of production. Occasionally, as yields (and uptake) increase, increased efficiency is realized without realizing an actual reduction in the amount of applied fertilizer, or of fertilizer mass lost to the environment.
		11. Groundwater Management		General category. Mainly entails reduction in shallow groundwater levels to reduce subsurface drainage (and salt) loading into subsurface drain systems. Note that drains only run when the soil surrounding them is saturated, so that when shallow groundwater surfaces fall to a lower elevation, drains collect and discharge less water. The areas where this is hydrogeologically feasible may be fairly limited.

METHODS AND IMPLEMENTATION ACTIONS				SUMMARY
METHODS TO REDUCE SALT AND BORON IN THE LSJR	SUB-METHODS[a]	IMPLEMENTATION ACTIONS	EXAMPLES	
INCREASE AMT OF SALT EXPORTED FROM LSJR WATERSHED	Export of salt to alternative sinks	12. Salt Disposal/Out of Basin Transport	a) Brine Line to Ocean	Should such a facility be constructed, it would be an efficient means to export salts, particularly once they were concentrated in systems such as evap ponds, IFDM, and other on-farm drainage reduction activities. The San Luis Unit Ocean Outfall alternative also assumed significant land retirement.
			b) Truck to WWTP with ocean outfall	Similar to 12a.
			c) Landfill disposal	Similar to 12a.
			d) Out of Basin Salt Sink	Similar to 12a.
			e) Commercial market for reclaimed salt	Net effect depends on the fate of the salt after sale. If it is exported, or if it replaces imported salt, then the effect is similar to 12a. If is otherwise retained in-basin, the direct effect on the overall salt balance would be nil.
	Export to SJR & treatment backup.	13a. Controlled Timing of Discharges (Real Time Management)	a) RTM (No re-operation) (includes treatment/disposal if no AC in LSJR)	Like 13b, but instead of system storage (SS), flow is treated when the LSJR assimilative capacity (AC) limits discharges, then disposed within or out of basin
	Export through San Joaquin River	13 b,c,d. Controlled Timing of Discharges (Real Time Management)	b) RTM with re-operation (temporary retention ponds)	Real-time management takes advantage of flow variations to convey salt to its natural endpoint, the ocean, in an environmentally sound manner. System storage (SS) helps when assimilative capacity (AC) is low. In this case, SS is provided by retention ponds.
			c) RTM of wetland releases	Like 13b, but focused on wetland releases. Reduced release volume reduces the need for SS.
			d) Ag Drainage Artificial Wetlands/seasonal releases	Like 13b, but system storage (SS) provided by artificial wetlands. Seasonal release reduces the need for SS.

Salt and boron water quality improvement in the LSJR can be achieved through two general methods: 1) Reducing salt and boron loading into the Basin from point and nonpoint sources, and; 2) Increasing the amount of salt exported from the LSRJ watershed.

[a]Sub-methods pertain to the part of the system on which the practice acts to reduce salt loading to the San Joaquin River. A system is the immediate environment into which salt is introduced, and from which it may be discharged. In irrigated agriculture, for example, this system is the land surface and root zone to which salts are applied, and from which salts may be removed as drainage. Explanations:

Reductions in salt loading to system occur when a lesser mass of salt is imported into the system (whether ag, industrial, or municipal), thus reducing the mass that must be discharged from the system.

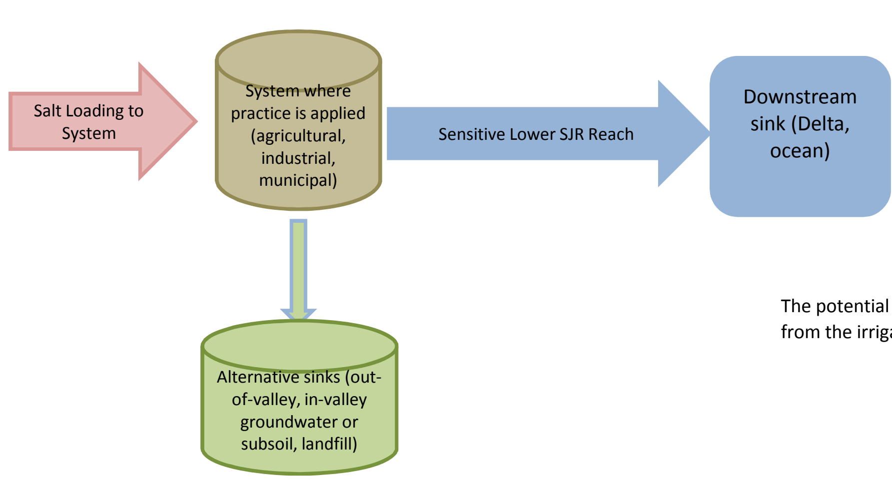
Increased salt retention in system occurs when a benign or acceptable sink is located within the system, and the mass of salt retained there is increased.

Source control with increased retention occurs when return flows (with their salt load) are reused for irrigation, replacing surface water supply. This results in less salt import in surface water, while retaining salts that would otherwise be discharged.

Export of salt to alternative sinks occurs when salt mass is moved out of the system to a sink by other means than river discharge.

Export SJR & treatment backup means that drainage could be treated when assimilative capacity were too limiting.

Export through San Joaquin River entails acceptable means of transporting salt load out of the system in river flow.



The potential to recycle is finite. As with freshwater irrigation, at some point, salt must be exported from the irrigated system for crop production to be sustained.