

Table 1: Salinity Criteria, Guidelines, or Proposed Protective Benchmarks Included in LSJRC Beneficial Use Source Documents

Parmeter	Beneficial Uses Designated for Reach 83 of the Lower San Joaquin River																Source	
	MUN	AGR (Irrigation)	AGR (Stock Watering)	PROC	IND	POW	REC-1 (Contact)	REC-1 (Canoe + Raft)	REC-2	WARM	COLD	MIGR WARM	MIGR COLD	SPWN WARM	SPWN COLD	WILD		NAV
EC (dS/m)	0.900 - 1.600																	CDM MUN white paper; Title 22 Secondary MCL Range: recom'd - upper; incorporated into Central Valley Basin Plan by reference
EC (dS/m)		0.7																CDM AGR white paper; Central Valley Basin Plan Objtv, Vernalis max 30-day running avg of mean daily EC, Apr 1 - Aug 31 (aka southern Delta salinity objtvs)
EC (dS/m)		1																CDM AGR white paper; Central Valley Basin Plan Objtv, Vernalis max 30-day running avg of mean daily EC, Sep 1 - Mar 31 (aka southern Delta salinity objtvs)
EC (dS/m)		0.7																CVRWQCB Salinity Lit Summary; SWRCB Reg of Ag Drainage to the SJR, 1987
EC (dS/m)		1																CVRWQCB Salt Tolerance of Crops in the LSJR; salt tolerance threshold for beans; based on Maas and Hoffman (1977), Maas and Grattan (1999), and Hoffman (2010)
EC (dS/m)		2																K/J Stock Watering; Nebraska surface water quality standard Apr - Sep
EC (dS/m)		0.75																CDM AGR white paper; Green Book recommended water quality criteria (FWPCA 1968)
EC (dS/m)		0.7																CDM AGR white paper; Guidelines for irrigation adapted from Ayers and Westcot 1985
EC (dS/m)		1																CDM AGR white paper; as irrigation water, ECw; Hoffman (2010) based on Letey (2007) and Letey & Fend (2007); follow up research suggested
EC (dS/m)		0.9 - 1.1																CDM AGR white paper; range assumed to apply to irrigation water, ECw; based on Hoffman (2010)
EC (dS/m)		1.0 - 1.4																CDM AGR white paper; as irrigation water, ECw; Hoffman (2010)
EC (dS/m)		0.75																CDM AGR white paper; Central Coast RWQCB Basin Plan objtv
EC (dS/m)		0.4																CDM AGR white paper; South African guidelines for irrigation

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EC (dS/m)		1																CDM AGR white paper; Aus/NZ guidelines for irrigation for protection of bean and other sensitive crops
EC (dS/m)			2															K/J Stock Watering; Nebraska surface water quality standard Apr - Sep
EC (dS/m)			4.0, 7.0															K/J Stock Watering; South Dakota water quality standard, 30-day avg, daily max
EC (dS/m)			1.5															K/J Stock Watering; Guidelines for irrigation, Ayers and Westcot 1985
EC (dS/m)			3.0															K/J Stock Watering; Suggested K/J guideline based primarily on government guidelines rather than individual published studies
TDS (mg/L)	500 - 1,000																	CDM MUN white paper; Title 22 Secondary MCL Range: recom'd - upper; incorporated into Central Valley Basin Plan by reference
TDS (mg/L)	500																	CDM MUN white paper; Canadian Guidelines (AO/AG)
TDS (mg/L)	600, 1,000																	CDM MUN white paper; Aus/NZ Guideline (AeB); Diff values shown in CDM MUN white paper and Westcot 2012
TDS (mg/L)	500, 1,000																	CDM MUN Attachment A; Florida water quality criteria, avg monthly, max any time
TDS (mg/L)	500, 750																	CDM MUN Attachment A; Michigan water quality standard, avg monthly, max any time
TDS (mg/L)	500																	CDM MUN Attachment A; Mississippi water quality standard, maximum
TDS (mg/L)	500																	CDM MUN Attachment A; North Carolina water quality standard, maximum
TDS (mg/L)	500																	CDM MUN Attachment A; New Jersey water quality standard, maximum
TDS (mg/L)	200, 500																	CDM MUN Attachment A; New York water quality standard, pristine water body, non-pristine
TDS (mg/L)	1200 1,800 - 9,700																	CDM MUN Attachment A; Utah general water quality criterion, SSO water quality criteria range
TDS (mg/L)		415 - 430																CVRWQCB Salinity Lit Summary; SWRCB Reg of Ag Drainage to the SJR, 1987

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	MUN	AGR (Irrigation)	AGR (Stock Watering)	PROC	IND	POW	REC-1 (Contact)	REC-1 (Canoe + Raft)	REC-2	WARM	COLD	MIGR WARM	MIGR COLD	SPWN WARM	SPWN COLD	WILD		NAV
TDS (mg/L)		500																CDM AGR white paper; Green Book recommended water quality criteria (FWPCA 1968)
TDS (mg/L)		1,200																CDM AGR white paper; Utah water quality standard
TDS (mg/L)		450																CDM AGR white paper; Guideline for irrigation adapted from Ayers and Westcot 1985
TDS (mg/L)		500																CDM AGR white paper; Canadian guidelines for irrigation of strawberries, raspberries, beans and carrots
TDS (mg/L)			500, 1000															K/J Stock Watering; Nevada water quality criteria
TDS (mg/L)			3,000															K/J Stock Watering; EPA Blue Book 1973, recommended water quality criteria
TDS (mg/L)			2,500, 4,375															K/J Stock Watering; South Dakota water quality standard, 30-day avg, daily max
TDS (mg/L)			1,500															K/J Stock Watering; Canadian water quality guidelines
TDS (mg/L)			2,000															K/J Stock Watering; Aus/NZ water quality guidelines
TDS (mg/L)			1,000															K/J Stock Watering; South Africa water quality guidelines
TDS (mg/L)			2,000															K/J Stock Watering; Suggested K/J guideline based primarily on government guidelines rather than individual published studies
Sodium (mg/L)	200																	CDM MUN white paper; Canadian Guidelines (AO/AG)
Sodium (mg/L)	180																	CDM MUN white paper; Aus/NZ Guideline (AeB)
Sodium (mg/L)	100, 200																	CDM MUN Attachment A; Westcot 2012, recommended goal and max concentration
Sodium (mg/L)		69																CDM AGR white paper; Central Coast RWQCB Basin Plan objtv for foliar absorption
Sodium (mg/L)		70																CDM AGR white paper; South African guidelines for irrigation
Sodium (mg/L)		115																CDM AGR white paper; Aus/NZ guidelines for irrigation for protection of almond and other sensitive crops

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	MUN	AGR (Irrigation)	AGR (Stock Watering)	PROC	IND	POW	REC-1 (Contact)	REC-1 (Canoe + Raft)	REC-2	WARM	COLD	MIGR WARM	MIGR COLD	SPWN WARM	SPWN COLD	WILD		NAV
Sodium (mg/L)			50, 2,000															K/J Stock Watering; Canadian water quality guidelines; poultry, dairy cattle
Sodium (mg/L)			2,000															K/J Stock Watering; South Africa water quality guidelines
Sodium (mg/L)			1,000															K/J Stock Watering; Suggested K/J guideline based primarily on government guidelines rather than individual published studies
Magnesium (mg/L)			125															K/J Stock Watering; Canadian water quality guidelines
Magnesium (mg/L)			250															K/J Stock Watering; Guidelines for irrigation, Ayers and Westcot 1985
Magnesium (mg/L)			500															K/J Stock Watering; South Africa water quality guidelines
Calcium (mg/L)			500															K/J Stock Watering; Canadian water quality guidelines
Calcium (mg/L)			1,000															K/J Stock Watering; Aus/NZ water quality guidelines
Calcium (mg/L)			1,000															K/J Stock Watering; South Africa water quality guidelines
Potassium (mg/L)																		<i>no criteria advanced</i>
Carbonate (mg/L)																		<i>no criteria advanced</i>
Bicarbonate (mg/L)		90																CDM AGR white paper; Guideline for irrigation adapted from Ayers and Westcot 1985
Bicarbonate (mg/L)		90																CDM AGR white paper; Central Coast RWQCB Basin Plan objtv
Chloride (mg/L)	250 - 500																	CDM MUN white paper; Title 22 Secondary MCL Range: recom'd - upper; incorporated into Central Valley Basin Plan by reference
Chloride (mg/L)	250																	CDM MUN white paper; Canadian Guidelines (AO/AG)
Chloride (mg/L)	250																	CDM MUN white paper; Aus/NZ Guideline (AeB)
Chloride (mg/L)	250																	K/J Stock Watering; Missouri water quality criteria
Chloride (mg/L)	250																	EPA Red Book 1976, recommended water quality criteria
Chloride (mg/L)		106																CDM AGR white paper; Central Coast RWQCB Basin Plan objtv for foliar absorption

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	MUN	AGR (Irrigation)	AGR (Stock Watering)	PROC	IND	POW	REC-1 (Contact)	REC-1 (Canoe + Raft)	REC-2	WARM	COLD	MIGR WARM	MIGR COLD	SPWN WARM	SPWN COLD	WILD		NAV
Chloride (mg/L)		106																Guidelines for irrigation, Ayers and Westcot (1985)
Chloride (mg/L)		142																CDM AGR white paper; Central Coast RWQCB Basin Plan objtv for root absorption
Chloride (mg/L)		100 - 178																CDM AGR white paper; Canadian guidelines for irrigation to prevent foliar damage for almonds, apricots and plums
Chloride (mg/L)		100																CDM AGR white paper; South African guidelines for irrigation
Chloride (mg/L)		175																CDM AGR white paper; Aus/NZ guidelines for irrigation for protection of almond and other sensitive crops
Chloride (mg/L)			250															K/J Stock Watering; Nevada water quality criteria
Chloride (mg/L)			250															K/J Stock Watering; Canadian water quality guidelines
Chloride (mg/L)			1,500															K/J Stock Watering; South Africa water quality guidelines; polutry and horses
Chloride (mg/L)			1,500															K/J Stock Watering; Suggested K/J guideline based primarily on government guidelines rather than individual published studies
Chloride (mg/L)										230		*		*				Buchwalter; US EPA 1988, chronic ambient water quality criterion
Chloride (mg/L)										150		*		*				Buchwalter; British Columbia; chronic criterion based on single, most sensitive species
Chloride (mg/L)										120		*		*				Buchwalter; Canada; chronic criterion based on freshwater mussels
Chloride (mg/L)										268.1		*		*				Buchwalter; Iowa; hardness and sulfate based; chronic criterion shown for hardness = 50 mg/L, sulfate = 200 mg/L
Chloride (mg/L)											230		**		**			Buchwalter; US EPA 1988, chronic ambient water quality criterion
Chloride (mg/L)											150		**		**			Buchwalter; British Columbia; chronic criterion based on single, most sensitive species
Chloride (mg/L)											120		**		**			Buchwalter; Canada; chronic criterion based on freshwater mussels

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Chloride (mg/L)											268.1		**		**			Buchwalter; lowa; hardness and sulfate based; chronic criterion shown for hardness = 50 mg/L, sulfate = 200 mg/L
Sulfate (mg/L)	250 - 500																	CDM MUN white paper; Title 22 Secondary MCL Range: recom'd - upper; incorporated into Central Valley Basin Plan by reference
Sulfate (mg/L)	500																	CDM MUN white paper; Canadian Guidelines (AO/AG)
Sulfate (mg/L)	250																	CDM MUN white paper; Aus/NZ Guideline (AeB)
Sulfate (mg/L)	250																	K/J Stock Watering; Missouri water quality criteria
Sulfate (mg/L)	250																	EPA Red Book 1976, recommended water quality criteria
Sulfate (mg/L)			250															K/J Stock Watering; Nevada water quality criteria
Sulfate (mg/L)			250															K/J Stock Watering; Canadian water quality guidelines
Sulfate (mg/L)			1,000															K/J Stock Watering; Aus/NZ water quality guidelines
Sulfate (mg/L)			1,000															K/J Stock Watering; South Africa water quality guidelines; poultry
Sulfate (mg/L)			1,000															K/J Stock Watering; Suggested K/J guideline based primarily on government guidelines rather than individual published studies
Sulfate (mg/L)										500		*		*				Buchwalter; proposed Illinois criterion, criterion shown for hardness < 100 mg/L; criterion suspect according to author
Sulfate (mg/L)										124		*		*				Buchwalter; US EPA calculated chronic objtv with caveats
Sulfate (mg/L)											500		**		**			Buchwalter; proposed Illinois criterion, criterion shown for hardness < 100 mg/L; criterion suspect according to author
Sulfate (mg/L)											124		**		**			Buchwalter; US EPA calculated chronic objtv with caveats

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Boron (mg/L)	2.0, 0.8, 1.3																	Central Valley Basin Plan objtvs; max 2.0 Mar 15 - Sep 15; 0.8 monthly mean Mar 15 - Sep 15; 1.3 monthly mean for critical water year
Boron (mg/L)	2.6, 1.0, 1.3																	Central Valley Basin Plan objtvs; max 2.6 Sep 16 - Mar 14; 1.0 monthly mean Sep 16 - Mar 14; 1.3 monthly mean for critical water year
Boron (mg/L)	1.0																	CDM MUN white paper; CA State Action Level
Boron (mg/L)	2.4																	CDM MUN Attachment A; WHO Int'l Drinking Water Guidelines
Boron (mg/L)	5.0																	CDM MUN white paper; Canadian Guidelines (MAC)
Boron (mg/L)	4.0																	CDM MUN white paper; Aus/NZ Guideline (HB)
Boron (mg/L)	0.63, 0.60																	CVRWQCB B Lit Summary; US EPA IRIS reference dose, EPA SNARL
Boron (mg/L)		2.0, 0.8, 1.3																Central Valley Basin Plan objtvs; max 2.0 Mar 15 - Sep 15; 0.8 monthly mean Mar 15 - Sep 15; 1.3 monthly mean for critical water year
Boron (mg/L)		2.6, 1.0, 1.3																Central Valley Basin Plan objtvs; max 2.6 Sep 16 - Mar 14; 1.0 monthly mean Sep 16 - Mar 14; 1.3 monthly mean for critical water year
Boron (mg/L)		0.5																CVRWQCB B Lit Summary; water quality protective of lemon and blackberry (Maas, 1990; Francois, 1991 and 1992)
Boron (mg/L)		0.7																CVRWQCB B Lit Summary, Guideline for irrigation, Ayers and Westcot 1985
Boron (mg/L)		0.75																CVRWQCB B Lit Summary, US EPA Gold Book 1986, recommended water quality criteria
Boron (mg/L)		2																K/J Stock Watering; Missouri water quality criteria
Boron (mg/L)		0.5 - 1.0																CDM AGR white paper; Green Book recommended water quality criteria (FWPCA 1968)
Boron (mg/L)		0.75																CDM AGR white paper; Blue Book (NAS and NAE 1972), recommended water quality criteria
Boron (mg/L)		0.75																CDM AGR white paper; EPA Red Book 1976, recommended water quality criteria

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Boron (mg/L)		0.75																CDM AGR white paper; EPA Gold Book 1986, recommended water quality criteria
Boron (mg/L)		1																CDM AGR white paper; Arizona water quality standard
Boron (mg/L)		0.75																CDM AGR white paper; Colorado water quality standard
Boron (mg/L)		0.75																CDM AGR white paper; Kansas water quality standard
Boron (mg/L)		0.75																CDM AGR white paper; New Mexico water quality standard
Boron (mg/L)		0.75																CDM AGR white paper; Utah water quality standard
Boron (mg/L)		0.5																CDM AGR white paper; Canadian guidelines for irrigation of blackberries
Boron (mg/L)		0.5																CDM AGR white paper; South African guidelines for irrigation
Boron (mg/L)		0.5																CDM AGR white paper; Aus/NZ guidelines for irrigation
Boron (mg/L)			5															CVRWQCB B Lit Summary, Guideline fo irrigation, Ayers and Westcot 1985
Boron (mg/L)			5															K/J Stock Watering; Blue Book (NAS and NAE 1972), recommended water quality criteria
Boron (mg/L)			5															K/J Stock Watering; Nevada water quality criteria
Boron (mg/L)			5															K/J Stock Watering; Canadian water quality guidelines
Boron (mg/L)			5															K/J Stock Watering; Aus/NZ water quality guidelines
Boron (mg/L)			5															K/J Stock Watering; South Africa water quality guidelines
Boron (mg/L)			5															K/J Stock Watering; Suggested K/J guideline based primarily on government guidelines rather than individual published studies
Boron (mg/L)										1.13		*		*				Buchwalter; US EPA calculated chronic objtv with caveats
Boron (mg/L)											1.13		**		**			Buchwalter; US EPA calculated chronic objtv with caveats

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Bold Type and Color Coding:

Central Valley Basin Plan objectives are shown in bold type.

yellow background Used to denote potential standard or guideline based on published study or source document author recommendation that has not been used previously to regulate water quality.

Symbols:

* = Used to denote that a salinity standard, guideline or recommendation for protection of the WARM beneficial use would also be protective of the MIGR WARM and SPWN WARM beneficial uses.

** = Used to denote that a salinity standard, guideline or recommendation for protection of the COLD beneficial use would also be protective of the MIGR COLD and SPWN COLD beneficial uses.

Acronyms:

AeB = Aesthetic-based water quality guideline

AO/AG = Aesthetic Consideration/Operational Guidance Value

HB = Health-based water quality guideline

MAC = Health-based Maximum Acceptable Concentration