



Regulating Salinity to Provide Reasonable Protection of the Agricultural (AGR) Beneficial Use in Groundwater

Summary of the Current Approach

- 1) The Basin Plans define AGR as "uses of water for farming, horticulture, or ranching including, but not limited to, irrigation (including leaching of salts), stock watering, or support of vegetation for range grazing."
- 2) "Unless otherwise designated by the Regional Water Board, all ground waters of the Region are considered suitable or potentially suitable, at a minimum, ...for agricultural supply (AGR)... In making any exception to the AGR beneficial use designation, the Regional Water Board will consider whether this is a pollution, either by natural processes or human activity (unrelated to a specific pollution incident), that cannot reasonably be treated for agricultural use using either BMPs or best economically achievable treatment practices."¹
- 3) The Basin Plans do not establish explicit numeric water quality objectives for salinity in groundwater for the AGR beneficial use. However, the TLBP does regulate the maximum average annual increase in groundwater salinity (aka "managed degradation" policy). And, both Basin Plans include the following narrative water quality objective: "Ground waters shall not contain chemical constituents in concentrations that adversely affect beneficial uses."
- 4) Historically, the Regional Board has assumed that TDS concentrations <450 mg/L and EC levels <700 μ S/cm would not adversely affect the AGR beneficial use (including salt sensitive crops). These values, based on guidelines originally published by Ayers and Westcott (1976, 1985), are used to translate the narrative objective into Waste Discharge Requirements (WDRs), receiving water limitations, and/or effluent limits where warranted.
- 5) The Regional Board requires dischargers to achieve compliance with narrative or numeric salinity objectives at "First Encountered Groundwater" (e.g. at the top of the saturated zone).

¹ Water Quality Control Plan (Basin Plan) for the California Regional Water Quality Control Board Central Valley Region - 4th Ed. The Sacramento River Basin and the San Joaquin River Basin. Revised Sept., 2009. Pg. II-3.00.

Implementation Issues and Concerns

- 1) The fact that all ground waters are considered "suitable or potentially suitable" for AGR does not mean that subsurface water quality is, or should be, capable of sustaining maximum yield for every conceivable crop. This is particularly true where imported surface water is used to produce crops that would not otherwise be commercially viable if forced to rely on native ground water as the sole source of irrigation supply.
- 2) Ayers & Wescott's salinity guideline (<700 $\mu\text{S}/\text{cm}$) is frequently applied as the default translator for implementing the narrative water quality objective without careful consideration of the existing or reasonably probable future crops that are or may be irrigated with the underlying groundwater.
- 3) Given the average salinity of available water supplies and applied water, it is often impossible to comply with the 700 $\mu\text{S}/\text{cm}$ even after implementing Best Management Practices. There is no feasible or practicable means of meeting the translated narrative objective at First Encountered Groundwater.
- 4) Focusing on salinity concentration as the primary metric for evaluating beneficial use protection and potential water quality degradation penalizes water conservation BMPs that minimize the total salt mass moving through the vadoze zone.
- 5) The regional economy depends on efficient use and re-use of water to maximize agricultural production and minimize waste. Reliance on a single salinity threshold undermines this principle and jeopardizes the industry's ability to grow a variety of different crops with widely varying salt tolerances.
- 6) Ayers and Westcott's recommended salinity guideline for "Unrestricted Use" (<700 $\mu\text{S}/\text{cm}$) has been misinterpreted and applied in a manner inconsistent with the author's conclusions. Some salinity impacts can be mitigated by modern irrigation strategies without unreasonably affecting the beneficial use.
- 7) Evaluating compliance with salinity standards at First Encountered Groundwater does not adequately consider the availability of assimilative capacity in the receiving water to mitigate any adverse effect on AGR uses (subject to state antideg policy).
- 8) Irrigation water is the largest single source of new salt loads to ground waters in the Central Valley. Some salinity degradation is both inevitable and unavoidable. Irrigation practices designed to move salts past the root zone are considered an integral part of the AGR beneficial use. It is appropriate to require BMPs to minimize salt loading to the vadoze zone but irrigation and leaching should not be deemed "waste transport" per se.

Outcome Sought

- 1) A salinity control strategy that provides "reasonable protection" for all existing and reasonably probable future AGR uses in the Central Valley in a manner consistent with the decision criteria describe in §13000 of the California Water Code.
- 2) A salinity control strategy that preserves the economic viability of the greater agricultural industry while minimizing or mitigating the adverse effects of increasing salinity on any particular crop
- 3) A salinity control strategy that is implemented through an objective, transparent and consistent process to evaluate the real-world probability for the occurrence of adverse effects resulting from increasing salinity loads in ground water.
- 4) A salinity control strategy that recognizes the intrinsic differences between surface water and ground water and provides the flexibility to regulate each in accordance with those distinctions.
- 5) A salinity control strategy that recognizes the unique characteristics of the AGR beneficial use, particularly the ability to adapt to changing environmental conditions, that bear upon the question of what constitutes "reasonable protection."

Caveats

- 1) Nothing in the proposed approach to managing salinity in ground water is intended to revise any other numeric water quality objectives for salinity that have been previously established for surface water bodies in the Central Valley Region (including those adopted for the Bay Delta as part of the SWRCB's 1995 Salinity Plan).
- 2) The proposed approach for managing salinity in ground water is intended to implement, not circumvent, the statewide Antidegradation Policy (Res. No. 68-16).
- 3) Establishing more flexible salinity standards for the AGR use in ground water does not waive the legal obligation to comply with more stringent salinity standards where necessary to protect other designated uses (e.g. MUN, IND, PRO).
- 4) As always, the Regional Board retains the authority and the discretion to establish appropriate Waste Discharge Requirements, Receiving Water Limitations or Effluent Limits based on site-specific conditions.

First Principles

- 1) Given the enormous number of relevant factors and complex interrelationships between these factors, it is difficult to establish a single numeric water quality objective for salinity in ground waters designated AGR. Therefore, it is appropriate to continue regulating salinity discharges to ground water using a narrative implementation procedure.
- 2) Absent a specific numeric water quality objective for salinity in ground waters designated AGR, and particularly where there is little or no reliance on local ground water to irrigate existing crops, the primary focus should be on preserving existing quality in a manner consistent with the statewide Antidegradation Policy. This policy allows the Regional Board to authorize higher salinity under certain conditions. The first of these conditions is that lowering water quality cannot unreasonably affect beneficial uses. Thus, the AD policy incorporates the requirement to protect existing uses and encourages a more site-specific analysis. Second, lowering water quality must provide "maximum benefit" to the people of California. This allows a more holistic assessment of both the costs and benefits of increasing salinity in groundwater. Finally, the AD policy requires dischargers to Best Practicable Treatment or Controls to minimize water quality degradation. The 3-part AD test
- 3) While salinity concentrations <700 uS/cm are presumed to fully protect nearly all crops, salinity concentrations greater than 700 uS/cm do not necessarily render water quality "unsuitable" for the AGR use. Ground water salinity in the range between 700-1,500 uS/cm (500-1,000 mg/L as TDS) remains suitable for all but the most salt-sensitive crops. The obligation to apply cost-effective and reasonable BMPs applies equally to all stakeholders (dischargers and water users) in order to assure the most efficient use and reuse of available water supplies in the Region.
- 4) There is a long-standing working assumption that designing water quality objectives to protect the most sensitive species or sub-populations will also protect other less sensitive species and the general population. This assumption does not work well when applied to commercial agriculture where crop yield is the primary measure of use attainment or impairment. While it is true that conservative salinity objectives will protect the yields of both salt-sensitive and salt-tolerant crops, the cost reducing salinity to protect the most salt-sensitive crops may alter the economic viability of many other crops. If the result is a net loss of commercial production, the general AGR use has been adversely affected despite the best intentions.
- 5) The salinity guidelines recommended by Ayers & Westcott and the FWPCA are best employed as thresholds to trigger more detailed water quality analysis rather than as direct translators of the current narrative objective for chemical constituents (as shown in the following flowchart).

Evaluating Whether Salinity is Unreasonably Affecting Existing AGR Uses

(Example to illustrate conceptual flowchart)

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| 1) Salinity in discharge is <700 $\mu\text{S}/\text{cm}$ at First Encountered Groundwater. | ➔ 1) AGR is fully presumed to be fully protected; burden-of-proof is on those who oppose the discharge to demonstrate otherwise. |
| 2) Salinity in discharge is less than average salinity in receiving water (and particularly in the discharger's Zone-of-Influence) | ➔ 2) Discharge does not lower water quality and the AGR beneficial use is not unreasonably affected. Burden of proof is on opponents of the discharge. |
| 3) Salinity in discharge is >700 $\mu\text{S}/\text{cm}$ and <1000 $\mu\text{S}/\text{cm}$ but there is assimilative capacity available <u>and</u> the average salinity concentration in the receiving water will remain <700 $\mu\text{S}/\text{cm}$. | ➔ 3) Discharge lowers water quality but does not unreasonably affect the AGR use. Burden-of-Proof is on discharger; must also make other Antideg demonstrations (e.g. BPTC & Max. Benefit). |
| 4) Salinity in discharge is >700 $\mu\text{S}/\text{cm}$ and <1000 $\mu\text{S}/\text{cm}$, but there is assimilative capacity available <u>and</u> the average salinity concentration in the receiving water will remain <1000 $\mu\text{S}/\text{cm}$ and there are no existing salt-sensitive crops dependent on groundwater in the discharger's Zone-of-Influence. | ➔ 4) Discharge lowers water quality but does not unreasonably affect the existing AGR use. Burden of proof is on discharger to demonstrate availability and adequacy of assimilative capacity and the absence of salt-sensitive crops in the Zone-of-Influence. |
| 5) Salinity in discharge is >1000 $\mu\text{S}/\text{cm}$ | ➔ 5) Discharge lowers water quality and may adversely affect existing beneficial uses. Burden of proof is on discharger to demonstrate otherwise. Demonstration can be made by submitting affidavits from ag operators within the Zone-of-Influence certifying that their crop yields are not unreasonably affected or the operator has received acceptable mitigation. |



The following table (adapted from FWPCA, 1968 and from Ayers and Westcot, 1985) describes one possible appropriate construct for evaluating salinity-related risks along a continuum for the purpose of interpreting compliance with and attainment of the narrative water quality objectives established to protect the AGR use.

Unrestricted AGR Use	Managed AGR Use	Limited AGR Use	Severely Restricted AGR
EC<700 uS/cm	EC @ 700-1,500 uS/cm	EC @ 1,500 - 3,000 uS/cm	EC>3,000 uS/cm
TDS<500 mg/L	500-1,000 mg/L TDS	1,000-2,000 mg/L TDS	>2,000 mg/L TDS
Salinity levels below this threshold impose no significant restriction on AGR use. Changes in salinity concentrations that remain below this threshold are presumed to pose no risk of impairment to any existing or potential AGR use. This presumption is rebuttable on a case-by-case basis with the burden of proof falling on those claiming that EC levels less than 700 uS/cm do not provide reasonable protection of the AGR use in specific circumstances.	Salinity in this range may impose some limited restrictions on the time, place and manner where such water could be used for irrigation but, with modern management practices, remains suitable for all but the most salt-sensitive crops. This presumption is rebuttable on a case-by-case basis with the burden of proof falling on those claiming that EC levels in this range provides reasonable protection for the actual and expected AGR uses in a given management zone.	Salinity concentrations in this range may adversely affect the expected yield of many crops and, as such, imposes significant limitations on the use of such supplies for agricultural irrigation. Very careful consideration must be given to crop selection where EC exceeds 1,500 uS/cm. The Regional Board will actively discourage EC levels from degrading beyond 1,500 uS/cm where existing water quality is currently better than that threshold value and will prohibit further degradation where EC levels already exceed 1,500 uS/cm.	Salinity concentrations in this range effectively preclude the AGR use from being attained except in the most extreme circumstances. EC levels greater than 3,000 uS/cm are presumed to impair the AGR beneficial use for all but the most salt-tolerant crops. This presumption is not rebuttable except in instances where EC levels exceed 3,000 uS/cm due to natural causes.

CALIFORNIA WATER CODE
Section 13000

“...activities and factors which may affect the quality of the waters of the state shall be regulated to attain the highest water quality which is reasonable, considering all demands being made and to be made on those waters and the total values involved, beneficial and detrimental, economic and social, tangible and intangible.”

CALIFORNIA WATER CODE
Section 13241

“It is recognized that it may be possible for the quality of water to be changed to some degree without unreasonably affecting beneficial uses. Factors to be considered by a regional board in establishing water quality objectives shall include, but not necessarily be limited to, all of the following:

- a) Past, present, and probable future beneficial uses of water.
- b) Environmental characteristics of the hydrographic unit under consideration, including quality of water available thereto.
- c) Water quality conditions that could reasonably be achieved through the coordinated control of all factors which affect water quality in the area.
- d) Economic considerations.
- e) The need for developing housing within the region
- f) The need to develop and use recycled water.”