

## Meyerhoff, Richard

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**From:** Thorme, Melissa <mthorme@DowneyBrand.com>  
**Sent:** Friday, September 30, 2016 3:49 PM  
**To:** 'Michael Bryan'; Meyerhoff, Richard; tomg@lwa.com  
**Cc:** Russell Emerson (remerson@valleywatermanagement.org)  
**Subject:** RE: Boron addition information  
**Attachments:** WEST-#1458907-v2-Justification\_for\_adding\_Boron\_to\_Exceptions.DOCX

**Follow Up Flag:** Follow up  
**Flag Status:** Completed

Per Michael's suggestion, I have removed references to the SMS and just discuss the option of adding boron to the exceptions policy. We will discuss the larger issue in the policy committee.

Thank you,

Melissa

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**From:** Michael Bryan [mailto:bryan@robertson-bryan.com]  
**Sent:** Friday, September 30, 2016 2:12 PM  
**To:** Thorme, Melissa; 'meyerhoffrd@cdmsmith.com'; tomg@lwa.com  
**Cc:** Russell Emerson (remerson@valleywatermanagement.org)  
**Subject:** RE: Boron addition information

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To be addressed in the SED, all comments were due to RBI by COB Sept 28<sup>th</sup>. Also, RBI is not at liberty to change the Proposed Project components/Options; rather, we are only able to address comments to improve the SED in its analysis of the Project Description/Options already approved by the project Committee. Finally, all our work is being completed today/Monday, and our contract does not allow us to work on this past Monday. Hence, do not have time to coordinate this through the Project Committee at this point. LWA would not have time to address it in their Antideg and economics document either.

I recommend you discuss this matter with Project Committee members.

Thanks.

**Michael Bryan, Ph.D.**



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**From:** Thorme, Melissa [<mailto:mthorme@DowneyBrand.com>]  
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**To:** 'meyerhoffrd@cdmsmith.com'; Michael Bryan; [tomg@lwa.com](mailto:tomg@lwa.com)  
**Cc:** Russell Emerson ([remerson@valleywatermanagement.org](mailto:remerson@valleywatermanagement.org))  
**Subject:** Boron addition information

Attached please find a copy of a document justifying including boron in with the salinity management strategy and/or exceptions policy. As you may know, Valley Water Management Company (and other oil field produced water dischargers) has compliance issues not only with constituents of salinity, but also with boron. All of these constituents are naturally occurring and have similar regulatory and treatment challenges. We commented on the draft policies and believe that this suggested modification is a logical outgrowth of the comments made during the Basin Planning and CEQA processes to allow such a modification to occur.

Please let me know if there is additional information or justification needed.

Thank you,

Melissa A. Thorme

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## Draft Policy No. X: Addition of Boron as an Option to the Exceptions Policy

### 1.0 Regulatory Basis for Including Boron in the Exceptions Policy for Waste Discharges to Groundwater

#### 1.1 Background

The Central Valley Regional Board is required to implement the Basin Plans when authorizing discharges through the adoption of waste discharge requirements (WDRs) and conditional waivers. This requirement includes ensuring that beneficial uses are protected, and that receiving waters meet or exceed the applicable water quality objectives adopted to protect those uses.

The Central Valley Water Board has recognized that with respect to some pollutants (e.g., salts), it may not be reasonable, feasible, or practical to prohibit the discharge of these constituents or issue a time schedule with the expectation that the discharge can meet applicable water quality objectives in a reasonable time period. Further, the Central Valley Water Board is hesitant to revise water quality standards, which could modify the objective or modify or remove the beneficial use. Accordingly, the Central Valley Water Board adopted a Policy for Exceptions from Implementing Water Quality Objectives for Salinity (Exceptions Policy) in Resolution No. R5-2014-0074, on June 6, 2014. The State Water Board approved that policy in Resolution No. 2015-0010, on March 17, 2015. The Policy amended the Basin Plans and established *“procedures for dischargers that are subject to WDRs and conditional waivers to obtain a short-term exception from meeting effluent or groundwater limitations for salinity constituents.”*<sup>1</sup>

Under the 2014 Exceptions Policy, the Central Valley Water Board established a Salinity Exception Program that is *“in effect during the development and initial implementation of the Salt and Nitrate Management Plans,”*<sup>2</sup> which at the time were being prepared through the CV-SALTS process. The Salinity Exception Program (aka “Streamlined Policy”) applies only to electrical conductivity (EC), total dissolved solids (TDS), chloride, sulfate, and sodium.<sup>3</sup>

In accordance with the Central Valley Water Board’s direction in developing the current Salinity Exceptions Program, this SNMP includes an option that the Exceptions Policy be revised to include boron. This option is justified below.

#### 1.2 Justification for Extending/Expanding the Current Policies to Include Boron

The Central Valley Water Board's original rationale for adopting the current Exceptions Policy was to provide temporary permitting flexibility while CV-SALTS was developing the SNMP, and to encourage dischargers throughout the region to actively participate in that process. If CV-SALTS stakeholders determined that a permanent Exceptions Policy was necessary to assure successful implementation, the

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<sup>1</sup> Central Valley Water Board Amendments to the Water Quality Control Plan for the Sacramento River and San Joaquin River Basins and the Water Quality Control Plan for the Tulare Lake Basin To add Policies for Variances from Surface Water Quality Standards for Point Source Dischargers, Variance Program for Salinity, and Exception from Implementation of Water Quality Objectives for Salinity; Final Staff Report, June 2014, Final Staff Report (“Variance & Exceptions Policy”); page ES-3.

<sup>2</sup> Variance & Exceptions Policy; page ES-3.

<sup>3</sup> Variance & Exceptions Policy; page 51.

Central Valley Water Board instructed the stakeholders to describe and justify their recommendations in the SNMP itself. CV-SALTS recommended changes to the Exceptions Policy to cover nutrients in addition to salinity. As a result of comments made on draft policies, this document is intended to justify the option to expand the Exceptions Policy to include boron.

The SNMP finds that there may be instances where it is infeasible, impracticable or unreasonable for dischargers to comply with certain WDRs, even with a compliance schedule. Under such circumstances, and when little or no assimilative capacity exists, the Central Valley Water Board presently has only two regulatory options available: (a) where appropriate, revise the applicable water quality standards and related WDRs, or (b) disallow the discharge.

Revising water quality standards (uses and/or objectives) or applicable effluent limitations is a complex, timely process requiring considerable documentation and opportunities for public comment. Consequently, legally allowing for an exception to meeting the objective or applicable effluent limitations may be needed to provide time to complete the full regulatory review and approval process for revising the water quality standard. Where the Central Valley Water Board is hesitant to revise the water quality standard, an exception presents a time-limited option other than permanently revising a water quality standard or otherwise applicable effluent limitation.

Prohibiting the discharge may also be infeasible, impracticable or unreasonable. If the Central Valley Water Board determines that a non-compliant discharge cannot or should not be prohibited, then some form of exception may be required. Examples of situations where the Central Valley Water Board may conclude that it is infeasible, impracticable or unreasonable to prohibit the non-compliant discharge include, but are not limited to:

- 1) Situations where compelling the discharge to comply with the applicable WDR (assuming it is possible to do so) would not significantly improve water quality or assure attainment of the related standards in the foreseeable future ( $\approx 20$  years).
- 2) Situations where allowing the discharge is likely to result in nominal but insignificant changes in receiving water quality with no meaningful increase in public health risk.
- 3) Situations where disallowing the discharge would likely result in widespread and substantial adverse social and economic impacts in the region.
- 4) Situations where allowing the discharge is projected to improve existing or expected quality in the receiving water; or, where disallowing the discharge would be more harmful to water quality and/or the environment than allowing the discharge to continue despite the failure to comply with the WDR for which the exception is sought.
- 5) Situations where allowing the discharge to continue is necessary to preserve or sustain other beneficial uses, or to implement other important water resource management policies established by state authorities (e.g., increased water conservation, increased use of alternative water sources such as produced water, increased groundwater recharge/storage, increased drought protection, etc.).
- 6) Situations where allowing the discharge to continue facilitates the Central Valley Water Board's larger and more comprehensive long-term program to achieve salt balance and groundwater use



sustainability and, where feasible, attain water quality standards in the groundwater (aka “restoration”).

## **2.0 Proposed Revisions to Exceptions Policy**

### **2.1 Summary of Current Exceptions Policy**

The 2014 Exceptions Policy restricts the Central Valley Water Board's authority solely to exceptions for salinity-related constituents. Presently, the definition of “salinity” includes only: EC, TDS, chloride, sulfate and sodium. The current Policy does not provide the Central Valley Water Board with legal authority to approve exceptions for any other pollutants, including boron although high salinity water often includes boron. All other requirements for receiving or implementing an exception would not be modified by this addition.

### **2.2 Recommendations for Revising Current Exceptions Policy**

Because ample reasons exist for exceptions to apply to more than just salinity, the current policy should be broadened to include boron.<sup>4</sup> The SNMP includes an option for the current Exceptions Policy to add boron in order to provide the Central Valley Water Board with the necessary authority and flexibility to permit discharges containing boron in a manner that the Central Valley Water Board deems to be appropriate.

As set forth in the other policy related to Exceptions, the requirements should be revised to specify that the requirements applicable when seeking an exception from a salinity-based water quality objective apply as well to boron.

The current policy may also need to be amended to identify application requirements that apply to dischargers seeking an exception as part of a Management Zone rather than as an individual discharger. Management zones should be amended to allow boron in addition to salinity and/or nitrogen issues.

### **2.3 Authorization of Exceptions**

The SNMP includes an option that exceptions be authorized by the Central Valley Water Board for boron subject to the same conditions and performance obligations on the discharger(s) as for other constituents for which exceptions are authorized.

Under the SNMP’s option, authorization for exceptions applicable to boron may be granted by the Central Valley Water Board for individual dischargers, or for multiple dischargers under a Management Zone. Terms and conditions associated with the granting of an exception will be incorporated into relevant WDRs, and failure to comply with such terms and conditions may result in the termination of the exception and/or an enforcement action.

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<sup>4</sup> Another option would be to broaden the scope even further to include any other constituents that need an exception to allow discharges of other pollutants that are adequately justified to the Central Valley Water Board under the Exception Policy to continue discharges through an exception.

### **3.0 Proposed Modifications to the Basin Plans to Support Policy Implementation relative to Boron**

The following subsections summarize the key changes anticipated for each Basin Plan to support adoption of this policy.

#### *Existing and Potential Beneficial Uses*

No modifications anticipated.

#### *Water Quality Objectives*

No modifications anticipated.

#### *Implementation*

Revise the recommended modifications to the current Exceptions Policy in the Basin Plans to authorize exceptions from applicable water quality objectives and effluent limitations for boron.

## **4.0 Justification for the Proposed Policy Change**

### **4.1 Background on Boron**

Many areas experiencing salinity issues may also have similar issues with boron. Boron is a natural multipurpose element, which is a crucial nutrient for plants, but can adversely impact plants at high concentrations. In the environment, boron is combined with oxygen and other elements in compounds called borates. Borates are widely found in nature, and are present in oceans, sedimentary rocks, coal, shale, and some soils. Boron excesses usually occur in soil solutions from geologically young deposits, arid soils, and soils derived from marine sediments.<sup>5</sup>

Boron enters the environment mainly from the weathering of boron-containing rocks, from seawater in the form of boric acid vapor and from volcanic and other geothermal activity such as geothermal steam. Boron is also released, though to a lesser extent, from human activities. These include the use of borate-containing fertilizers and herbicides, the burning of plant-based products such as wood, coal, or oil, and the release of waste from borate mining and processing. Borates also reach the environment due to the use of borates and perborates in the home and in industry, through leaching from treated wood or paper, and from sewage and sewage sludge disposal.<sup>6</sup>

Boron is also adsorbed onto soil particles. The type of soil determines the degree of adsorption and to what extent the adsorption is reversible or irreversible, i.e. whether boron can be removed again by water running through the soil or not. The soil characteristics which affect the amount and type of

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<sup>5</sup> <http://www.greenfacts.org/en/boron/boron-1.htm>

<sup>6</sup> *Id.*

boron binding to soil include soil pH as well as the amount of salt, organic matter, iron and aluminium oxides and hydroxy-oxides, and clay present in the soil.<sup>7</sup>

Boron occurs in soils at concentrations ranging from 10 to 300 mg/kg (average 30 mg/kg), depending on the type of soil, amount of organic matter, and amount of rainfall. Concentrations of boron in surface water are dependent on such factors as the geochemical nature of the drainage area, proximity to marine coastal regions, and inputs from industrial and municipal effluent discharges. Concentrations of boron in surface water range widely, from 0.001 to as much as 360 mg/l. Boron accumulates in aquatic and terrestrial plants, but does not magnify through the food-chain.<sup>8</sup>

Treating boron similarly to salts is recommended because boron is often found in high concentrations in association with saline soils and saline well water.<sup>9</sup>

Safe concentrations of Boron in irrigation water range from 0.3 mg/L for sensitive plants [i.e., avocado (*Persea americana*), apple (*Malus domestica*) and bean (*Phaseolus vulgaris*)], 1–2 mg/L for semi tolerant plants [i.e., oat (*Avena sativa*), maize (*Zea mays*), potato (*Solanum tuberosum*)], and 2–4 mg/L for tolerant plants [i.e., carrot (*Daucus carota*), alfalfa (*Medicago sativum*) and sugar beet (*Beta vulgaris*)].<sup>10</sup> Irrigation water containing these levels of boron may not be immediately toxic to plants, but after prolonged irrigation with such water, soluble soil boron levels will equal or exceed those of the irrigation water, especially in regions of low rainfall or where water used for leaching is unavailable. As with salts, when excess accumulation occurs, soils must be reclaimed or boron sensitive plants may be adversely affected or plants more tolerant to boron will have to be grown.<sup>11</sup> A commonly used method of reclaiming high boron soils is to extensively leach with water in excess of a plant's water requirement.<sup>12</sup> For efficient and continued crop production, the leaching fraction must be high enough to remove excess boron, but low enough to prevent loss of essential plant nutrients from the soil. The quantity of water necessary to leach boron to a particular depth varies widely.<sup>13</sup>

From sampling taken in 1984, historic boron levels in groundwater in the Central Valley ranged from 0.14 to 120 mg/L, with a median of 3.1 mg/L, which exceeds the 1 mg/L effluent limit included in the Tulare Lake Basin Plan.<sup>14</sup> The highest values were located in the alluvial fan zone, with lower levels seen in the basin rim zone, and lower yet in the basin trough zone.<sup>15</sup> In the area of the San Luis Drain, 80% of the groundwater samples contained high levels of boron, with 80 percent of the samples exceeding 0.75

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<sup>7</sup> *Id.*

<sup>8</sup> *Id.*

<sup>9</sup> Dhankhar D.P. and Dahiya S.S., 1980, The effect of different levels of boron and soil salinity on the yield of dry matter and its mineral composition in Ber (*Zizyphus rotundifolia*). Int. Symp. on Salt Affected Soils. Karnal, India, pp 396–403.

<sup>10</sup> Ross O. Nable, Gary S. Banuelos, and Jeffrey G. Paull, Boron toxicity, Plant and Soil 193: 181–198 at p 182, 1997

<sup>11</sup> *Id.* at p. 183.

<sup>12</sup> Ayars J E, Hoffman G J and Schrale G 1990 Strategies to reduce salt load in drainage water. Proceedings of the 1990 National Conference IrDiv/ASCE. Durango, CO. pp 331–338.

<sup>13</sup> Nable *et al* (1997) at p. 184.

<sup>14</sup> U.S.G.S., Areal Distribution of Selenium and other Inorganic Constituents in Shallow Ground Water of the San Luis Drain Service Area, San Joaquin Valley, California: A Preliminary Study., Water Resources Investigations Report 84-4319 (1984) at p. 26.

<sup>15</sup> *Id.* at p. 27.

mg/L.<sup>16</sup> Subsequent sampling in 1990 of Central Valley creeks confirmed much lower ranges of boron, from <1 to 16 µg/L.<sup>17</sup>

#### 4.2 Boron Treatment is similar to Salt Removal

The reason for applying exceptions to salinity revolves around the high cost and high energy involved with reverse osmosis (RO). As for salt, RO membranes are very efficient at removing charged species like the borate ion. Typical Boron removal rates at pH 8 are between 73 and 90% for standard High Rejection Seawater RO membranes, depending on the water temperature. Special High Boron Removal membrane can achieve a 95% removal.<sup>18</sup> Costs for boron removal often exceed salt removal costs because either a second pass of RO or use of a Selective Boron Ion Exchange process is needed in addition to just RO to achieve maximum removal. Costs of such a system range from \$0.15 to over \$0.60 per barrel or per 42 gallons of treated water. These processes produce large volumes of brine and sludge that must be disposed of for additional cost. Power consumption for these processes can be large, with an estimate of 260 KW for a 10,000 barrel per day facility. In addition, these processes have not been utilized in full scale in many industries to date.<sup>19</sup>

Allowing an exception for boron, individually or in Management Zones, would facilitate solving the boron problem along with salinity in the Central Valley. Precedent already exists in the Central Valley for combining implementation plans for salt and boron, including in an adopted Total Maximum Daily Load for the San Joaquin River at Vernalis.<sup>20</sup>

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<sup>16</sup> *Id.* at p. 25.

<sup>17</sup> U.S.G.S., Geologic Sources, Mobilization, and Transport of Selenium from the California Coast Ranges to the Western San Joaquin Valley: A Reconnaissance Study, Water Resources Investigations Report 90-4070 (1990).

<sup>18</sup> <http://www.lenntech.com/processes/desalination/post-treatment/post-treatments/boron-removal.htm#ixzz4LLqFr2R>

<sup>19</sup> Information from pilot projects undertaken by CV-SALTS member, Valley Water Management Company.

<sup>20</sup> Relevant documents located at the following web page:

[http://www.waterboards.ca.gov/centralvalley/water\\_issues/tmdl/central\\_valley\\_projects/vernalissaltboron/index.shtml](http://www.waterboards.ca.gov/centralvalley/water_issues/tmdl/central_valley_projects/vernalissaltboron/index.shtml)