



# California Regional Water Quality Control Board Central Valley Region

Katherine Hart, Chair



Linda S. Adams  
Acting Secretary for  
Environmental Protection

415 Knollcrest Drive, Suite 100, Redding, California 96002  
(530) 224-4845 • FAX (530) 224-4857  
<http://www.waterboards.ca.gov/centralvalley>

Edmund G. Brown Jr.  
Governor

25 May 2011

Mr. David Guy, President  
Northern California Water Association  
Sacramento Valley Water Quality Coalition  
455 Capitol Mall, Suite 335  
Sacramento, CA 95814

## REQUEST TO ELIMINATE DO AND pH MANAGEMENT PLAN REQUIREMENTS FOR THE UPPER FEATHER RIVER SUBWATERSHED

Thank you for your letter submitted on 19 October 2010 requesting a determination be made that dissolved oxygen (DO) and pH management plan requirements are complete for the Upper Feather River Subwatershed. Based on the available information summarized below, I have determined that the DO and pH management plan requirements for the Upper Feather River Subwatershed are complete, and further management plan actions are not required.

The DO management plan requirements were originally triggered in 2006 by two measurements less than the minimum DO water quality objective (7.0 mg/L) in Indian Creek and five measurements less than the DO minimum in the Middle Fork Feather River. Water quality objectives for pH (6.5-8.5) were exceeded in the Middle Fork Feather River twice in 2006 and four times in 2007. Central Valley Water Board staff prepared a memorandum that summarizes and discusses the information presented by the Coalition in a Special Studies report (see enclosure). The determination of management plan completion is based on the following:

- 1) Nitrogen, phosphorus, and dissolved organic carbon concentrations were very low in Indian Creek, indicating that excessive nutrient levels were not likely driving the observed low DO concentrations;
- 2) Nitrogen and phosphorus concentrations were very low in the Middle Fork Feather River, suggesting they are not a factor in the observed DO and pH fluctuations;
- 3) Concentrations of dissolved organic carbon (DOC) were elevated in the Middle Fork Feather River (> 8ppm), suggesting that DOC is associated with high microbial oxygen demand, resulting in the large DO and pH fluctuations that were observed; and
- 4) Due to its large extent and location, the naturally-occurring emergent wetland system, which feeds the Middle Fork Feather River, is likely the primary contributor of the observed DOC concentrations.

If you have any questions or comments regarding this approval, please contact Ben Letton at (530) 224-4129, or by email at [bletton@waterboards.ca.gov](mailto:bletton@waterboards.ca.gov).

*Original signed by*

Pamela C. Creedon  
Executive Officer



# California Regional Water Quality Control Board Central Valley Region

Katherine Hart, Chair



Linda S. Adams  
Secretary for  
Environmental  
Protection

11020 Sun Center Drive #200, Rancho Cordova, California 95670-6114  
Phone (916) 464-3291 • FAX (916) 464-4645  
<http://www.waterboards.ca.gov/centralvalley>

Arnold  
Schwarzenegger  
Governor

**TO:** Susan Fregien  
Senior Environmental Scientist  
Irrigated Lands Regulatory  
Program

**FROM:** Ben Letton  
Engineering Geologist  
Irrigated Lands Regulatory  
Program

**DATE:** 9 May 2011

**SIGNATURE:** 

## REVIEW OF UPPER FEATHER RIVER WATERSHED SPECIAL MONITORING STUDY OF DO AND pH

On 10 October 2010, the Sacramento Valley Water Quality Coalition (Coalition) submitted a Special Studies report to be reviewed by Regional Board staff to satisfy DO and pH Management Plan requirements for Indian Creek and Middle Fork Feather River (Sierra Valley).<sup>1</sup> The report, titled *Special Monitoring of Dissolved Oxygen and pH in the Upper Feather River Watershed*, was authored by University of California Cooperative Extension, the Upper Feather River Watershed Group (UFRWG), and faculty at University California Davis. The Coalition views the Special Study as satisfying the DO and pH management plan requirements for Indian Creek and Middle Fork Feather River based on the following findings and conclusions:

- 1) Nitrogen, phosphorus, and dissolved organic carbon (DOC<sup>2</sup>) concentrations were very low for all sites sampled, except for DOC in Sierra Valley samples;
- 2) DO concentrations in Indian Valley do not appear to be driven by excessive nutrient (N, P, DOC) levels which could stimulate aquatic plant and microbial oxygen demand; and
- 3) Sierra Valley diurnal fluctuations in DO and pH were indicative of aquatic plant photosynthesis and respiration; however, limited aquatic macrophytes were observed at this sample location.

<sup>1</sup> The management plan requirements were originally triggered in 2006 by two exceedances of DO water quality standards for cold water designation (7.0 mg/L) on Indian Creek below Indian Valley and five exceedances on the Middle Fork Feather River in Sierra Valley. The following year in 2007, there were two exceedances of DO recorded below Indian Valley. During the 2006 and 2007 irrigation season, water quality standards for pH were exceeded at monitoring locations below Sierra Valley twice in 2006 and four times in 2007.

<sup>2</sup> Dissolved organic carbon (DOC) is a broad classification for organic molecules of varied origin and composition within aquatic systems. DOC is a food supplement, supporting growth of microorganisms. Moreover it is an indicator of organic loadings in streams, as well as supporting terrestrial processing (e.g., within soil, forests, and wetlands) of organic matter. Yellow to black in color, this humic type of DOC is the most abundant kind found in lakes and streams and can have a great influence on water color. Occasionally, high concentrations of organic carbon indicate anthropogenic influences, but most DOC originates naturally (Mitsch and Gosselink, 2000).

After reviewing the Special Studies report, Regional Water Board staff determined that the findings and conclusions for Indian Creek below Indian Valley supported the elimination of the required management plan for DO; however conclusions and findings from the Sierra Valley data did not adequately support the hypothesis that diurnal fluctuations in DO and pH were not being influenced by nutrients loading from agricultural activities. Significant diurnal fluctuations in DO and pH were observed in Sierra Valley during the 2008 irrigation season suggesting that aquatic plant growth or microbial oxygen demand could have been a contributing factor. Although nitrogen and phosphorus concentrations were very low, DOC and volatile total suspended solids (VTSS is an indicator of particulate organic matter) levels were high for the sampling period, which supports the concept of elevated microbial oxygen demand and subsequent diurnal fluctuations in DO and pH; however, there was no discussion of whether potential sources of DOC and VTSS were naturally occurring or originate from agricultural operations in Sierra Valley.

Regional Water Board staff contacted SVWQC representatives and requested that additional information be submitted to support the role that agricultural operations may or may not be playing in diurnal fluctuations of DO and pH observed in Sierra Valley. On 21 February 2011, faculty at University of California Davis submitted the following information as an addendum to the Special Studies report:

*Dissolved oxygen and pH can be driven by microorganisms as they convert organic matter to carbon dioxide, and consume oxygen in the process. This would be driven by excessive C loading in the form of dissolved organic C (DOC) and particulate organic matter (POM). DOC and volatile total suspended solids (VTSS) (an indicator of POM) levels were relatively high at Sierra Valley, and could create microbial oxygen demand which contributes to diurnal DO and pH fluctuations observed at this site. There is a major wetland system spanning 1.5 to 3 miles upstream of the Sierra Valley sampling site. This wetland system is very likely the source of the elevated DOC and VTSS concentrations (>8 ppm) at Sierra Valley (excessive C loading) compared to Indian and American Valley (<3 ppm), and could be the factor driving DO and pH exceedances at Sierra Valley.*

*Kenneth W. Tate  
Department of Plant Sciences  
University California Davis*

### **Wetland Characterization and Extent**

The Sierra Valley watershed encompasses 297,657 acres and is located in northeastern California in the Sierra Nevada Mountain Range. The valley is known as the largest high-alpine valley in the continental United States. Average elevation throughout the valley is 5,500 feet and annual precipitation ranges from 32 inches on the west side of the valley to 12 inches on the east side of the valley.

The valley is the headwaters of the Middle Fork of the Feather River. A monitoring site intended to sample surface water downstream from agricultural activities (UFRW Site 11.5) is located at the downstream end of Sierra Valley. Ranching, farming, and timber are the

primary resource activities throughout the watershed. Cattle grazing, pasture and range, wild hay, alfalfa hay, and grain hay dominate the agricultural activities (VESTRA, 2004).

There is an estimated 5,000 acres of flooded and seasonally flooded wetlands in Sierra Valley (USFS, 1981). The largest contiguous wetland is approximately 3,000 acres of fresh emergent wetland, characterized by marshes where the Feather River is braided into multiple channels and pools to the southeast of the community of Beckwourth (Figure 1). The wetland's channels and pools converge at the downstream end of Sierra Valley near Beckwourth to form a single channel that then flows through a narrow canyon below Sierra Valley.

### **Conclusion**

Concentrations of DOC and VTSS measured in the Special Study were on average 4-5 times as high as concentrations in Indian Valley taken on the same date at approximately the same time of day. Nitrogen and phosphorus concentrations were low in both Indian Valley and Sierra Valley samples. Based on the nature and extent of the wetland system located in Sierra Valley (Figure 1), elevated concentrations of DOC and VTSS originating from natural wetland conditions is likely contributing to increased levels of biological activity and subsequent diurnal fluctuations in DO and pH.

It is my recommendation that the Special Studies report and supplemental information provided by the Coalition for the DO and pH management plan requirements of the Middle Fork Feather River and Indian Creek be considered satisfied, as referenced in the conditions of the SVWQC Water Quality Management Plan.

### **References**

Mitsch and Gooselink. 2000. *Wetlands, 3<sup>rd</sup> Edition*.

US Forest Service. 1981. Calveg Categories.

VESTRA Resources. 2004. *Sierra Valley Watershed Assessment*. Available from World Wide Web: < <http://www.sierravalleyrcd.org/nodes/aboutwatershed/reports/>>

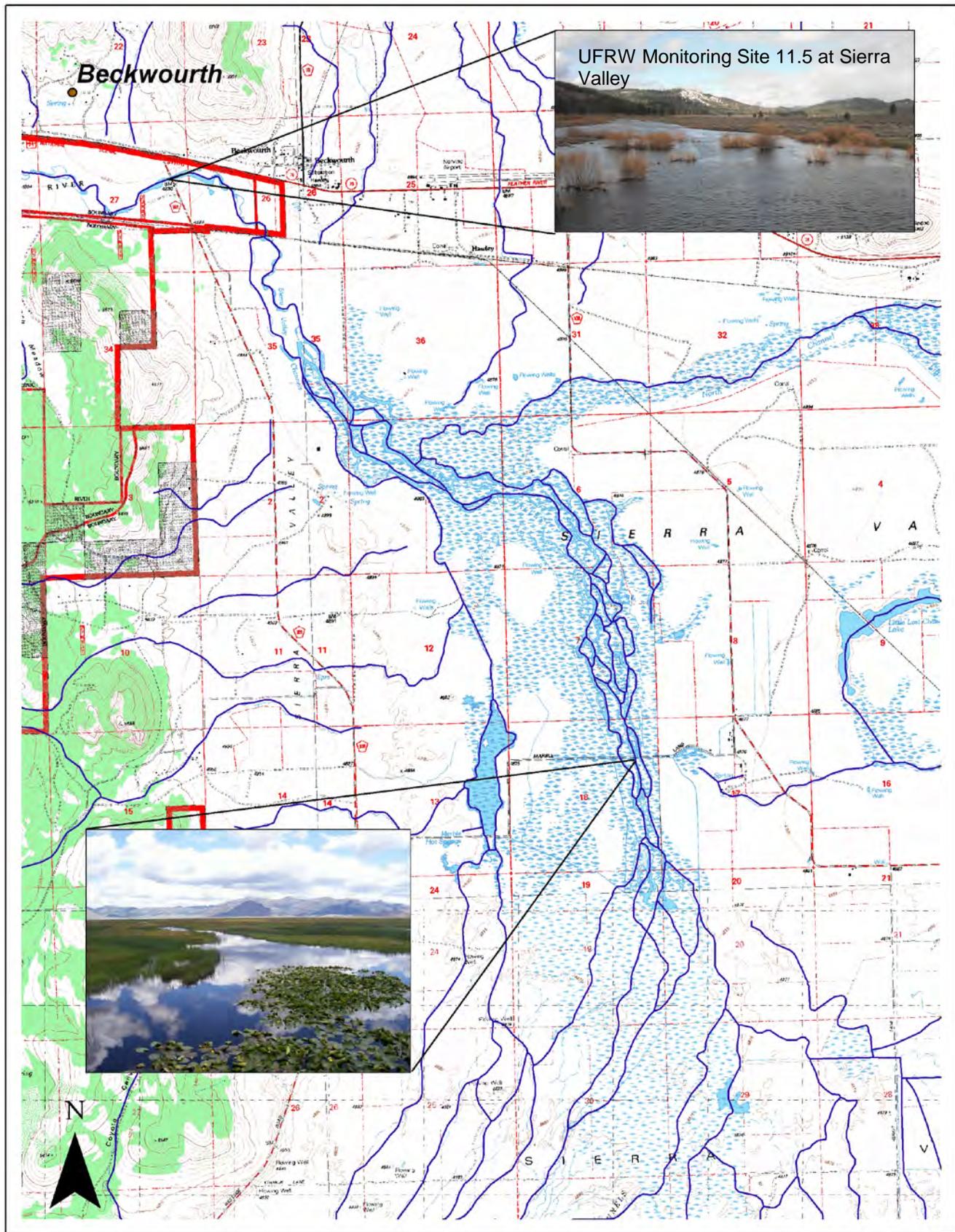


Figure 1. Sierra Valley wetland system (Scale = 1:48,000).