STATE OF IDAHO
DEPARTMENT OF
ENVIRONMENTAL QUALITY

1445 North Hilton • Boise, ID 83706 • (208) 373-0550

C. L. "Butch" Otter, Governor
Curt Fransen, Director

MEMORANDUM

Date: January 8, 2013

From: Troy Smith, Watershed Coordinator, DEQ

To: Lower Boise Watershed Council

RE: Benthic Chlorophyll-a Target Recommendation for the Lower Boise River Total Phosphorus TMDL

Background

At the TAC (Technical Advisory Committee) meetings on November 29, 2012 and January 3, 2013, the Idaho Department of Environmental Quality (DEQ) presented, benthic chlorophyll-a biomass $\leq$ 150 mg/m^2 as the preferred response variable target to be used for developing the Lower Boise River Total Phosphorus (TP) Maximum Daily Load (TMDL). As requested by Lower Boise Watershed Council (LBWC) members at the January 3, 2013 TAC meeting, DEQ is providing the following expanded description and rationale for this target.

Recommended Target

DEQ recommends mean benthic chlorophyll-a biomass $\leq$ 150 mg/m^2 as the appropriate response variable target for determining support/impairment of beneficial uses that are likely due to excess nutrients, within impaired Assessment Units (AUs) of the Lower Boise River, Sand Hollow Creek, and Mason Creek, along with Indian Creek and Fivemile Creek, should they become re-listed during the development of Lower Boise River TP TMDL.

This target is based on a review of scientific and technical literature, LBWC and public feedback, and particularly emphasizes similar nutrient and chlorophyll-a analyses conducted in Montana's rivers and streams (Suplee et al. 2008, 2009, Flynn and Suplee 2011, Suplee and Sada de Suplee 2012). Based on the best information currently available, DEQ believes this target is supportive of Primary/Secondary Contact Recreation and Cold Water Aquatic Life beneficial uses, and will help in the development, implementation, and monitoring of the Lower Boise River TP TMDL.

Further, DEQ recommends the benthic chlorophyll-a target also contain the following general conditions, as more specific details will continue to be developed in coordination with the LBWC, Environmental Protection Agency (EPA), and others:

1. *Location*: We recommend mean benthic chlorophyll-a biomass $\leq$ 150 mg/m^2 as the target within wadeable areas of each impaired AU. Applying the chlorophyll-a target to non-wadeable areas

could lead to an underestimation of the chlorophyll-a biomass and associated impacts on recreation and aquatic life. That is because light gradients predispose rivers to algal growth in shallower regions, whereas deeper sections become light-limited, are not as productive, and therefore will often naturally have lower corresponding benthic chlorophyll-a biomass (Flynn and Suplee 2011).

2. *Timing and Duration*: We recommend mean benthic chlorophyll-a biomass $\leq$ 150 mg/m^2 as the target within each impaired AU throughout the year. The year-round target is recommended because, although most research largely suggests that secondary responses related to elevated algae levels, such as harmful Dissolved Oxygen (DO) concentrations, super-saturation, and pH fluctuations most often occur during and shortly after the growing season, other data has shown benthic algae can continue growing or sustaining beyond the typical growing season (Lee et al. 2012). As a result, this extended period of potential growth and senescence may negatively impact aquatic life and recreation beneficial uses beyond the time period normally expected.

3. *Monitoring (and Sampling)*: Ideal spatial and temporal sampling would be designed and carried out using biologically-meaningful and statistically-valid methodologies in order to maximize our ability to clearly: A) meet monitoring objectives, B) determine if the target is being met and/or is appropriate, and C) quantify the accuracy and precision of the estimates.

   Sampling should take place in a sufficient number of pre-selected, representative, stratified, and/or randomly-selected locations, or “sample reaches” within wadeable portions of each impaired AU. Sample reaches would be discrete sub-segments of impaired AUs identified by DEQ, in coordination with the LBWC, EPA and others. These sample reaches could be defined broadly (for example, Middleton to Notus and Notus to the mouth) or at a finer scale (for example, reaches similar to those identified in the previous AQUATOX modeling efforts) depending on available resources and objectives (for example, modeling vs. monitoring). The sampling protocol would be designed and conducted to provide estimates of the mean benthic chlorophyll-a biomass for each sample reach and AU in order to compare the spatial distribution of the benthic chlorophyll-a within and among AUs relative to the target value.

   Sampling could take place annually, on alternating years, or at any frequency that adequately meets monitoring objectives. Within a monitoring period, sampling should occur at designated intervals throughout the year; however, more effort should be focused on periods most likely to experience potential negative impacts, such as during and following the growing season. And temporal sampling should allow for comparisons among intervals (for example, seasons and years).

   Finally, funding, personnel resources, and monitoring objectives will largely determine the monitoring plan and sampling methodologies (for example, locations, timing, frequency, duration, and intensity) to be developed in the coming months/years. These biologically- and statistically-meaningful, robust, and defensible plans and methodologies will be developed in coordination with DEQ, LBWC, EPA, USGS, academic subject professionals, and other partners who are willing and able to contribute financial assistance, personnel, and subject expertise. However, because DEQ recognizes that over time, changes in available resources, information, and objectives may necessitate changes to monitoring and sampling plans, we intend to incorporate an adaptive management-type of approach, as necessary.

Other Considerations

1. *Snake River-Hells Canyon TMDL*: DEQ recognizes that regardless of identified or modeled nutrient-algae correlations, the Lower Boise River TP TMDL is required to meet the Snake River-Hells Canyon TMDL target of 0.07 mg/L at the mouth of the Lower Boise River from May 1 through September 30.

2. *Idaho Water Quality Standards*: DEQ recognizes that in addition to benthic chlorophyll-a and other targets that may be identified in the Lower Boise River TP TMDL, statewide numeric Idaho Water Quality Standards must be met, as well as those specifically for the Lower Boise River Subbasin (58.01.02.278.01-05). These numeric targets include, but are not limited to, standards for DO, pH, and others that may indicate the impairment of beneficial uses due to excess nutrients or other pollutants.

Literature Cited

All of DEQ's presentations, scientific and technical literature sources, and formal input from LBWC and others used in this analysis can be found on the DEQ Lower Boise River Watershed Advisory Group webpage at: http://www.deq.idaho.gov/regional-offices-issues/boise/basin-watershed-advisory-groups/lower-boise-river-wag.aspx.

Flynn, K. and M. Suplee. 2011. Using a computer water quality model to derive numeric nutrient criteria: Lower Yellowstone River. WQPBDMSTECH-22. Helena, MT. Montana Department of Environmental Quality.

Lee, K.E., D.L. Lorenz, J.C. Petersen, and J.B. Greene. 2012. Seasonal patterns in nutrients, carbon, and algal responses in wadeable streams within three geographically distinct areas of the United States, 2007-08: U.S. Geological Survey Scientific Investigations Report 2012-5086, 55p.

Suplee, M.W. and R. Sada de Suplee. 2012. Assessment methodology for determining wadeable stream impairment due to excess nitrogen and phosphorus levels. Montana Department of Environmental Quality, 24 pp. + appendices.

Suplee, M., V. Watson, A. Varghese, and J. Cleland. 2008. Scientific and technical basis of the numeric criteria for Montana's wadeable streams and rivers. Montana Department of Environmental Quality. 86 pp.

Suplee, M., V. Watson, M. Teply, AND M. McKee. 2009. How green is too green? Public opinion of what constitutes undesirable algae levels in streams. Journal of American Water Resources Association 45:123-140.