Guide to Documents for WPCAC and the Board of Environmental Review for Reviewing the Basis of the Base Numeric Nutrient Standards

Links to cited documents are found in the Reference Section at the end of this guide. In some cases cited documents may have been provided to you directly.

I. Geographic Framework for the Base Numeric Nutrient Standards

1. Section 4.8 of Suplee et al. (2008); more details are in Section 4.7 of the same.

2. Section 2.1 of Suplee and Watson (2013). See also, individual ecoregion maps throughout Section 3.0 of same document.

3. Omernik (1987); this article describes ecoregions as a concept.

II. The Ecoregionally Based Wadeable-stream Standards

A. Overall Approach to Deriving the Numeric Nutrient Criteria

1. Executive Summary, Suplee and Watson (2013).

2. See Figure 1-2 in Suplee and Watson (2013).

2. See Section 2.6 in Suplee and Watson (2013).

B. Dose-response Studies

1. Section 3.0 of Suplee and Watson (2013); it's organized by ecoregion so choose a region of Montana that interests you.

2. Abstract, Suplee et al. (2009); describes how the recreational algae threshold was derived. See also, Figure 2 in the article.

3. Appendix B.1.2, Suplee and Sada de Suplee (2011); demonstrates the linkage between nutrients, algae density, and low dissolved oxygen in a controlled whole-stream study in MT.

4. Abstract of Appendix A, in Suplee et al. (2008); provides linkage between nutrient concentrations and dissolved oxygen levels for MT prairie streams.

C. Reference Data

1. Section 1.2 in Suplee et al. (2005); provides an overview of the Reference Stream Project.

2. "Selection of Reference Sites", page 459 in Methods section of Suplee et al. (2007).

3. Section 2.4 in Suplee and Watson (2013); details data-handling methods for reference data.

III. Period of Application for the Base Numeric Nutrient Standards

1. "Development of Seasonal Periods to Partition Nutrient Data", page 457 in Methods section of Suplee et al. (2007).

2. Section 2.3 in Suplee and Watson (2013).

IV. Basis of Site-specific Numeric Nutrient Standards

1. Section 4.0, Suplee and Watson (2013); provides two methods for deriving reach-specific numeric nutrient criteria. One method accounts for the downstream effects of a large reservoir, the other is based on the downstream effects from a small-scale ecoregion which has naturally-elevated phosphorus concentrations.

2. Addendum A to Suplee and Watson (2013), by Suplee and Schmidt (2013); reach-specific criteria are developed for a set of streams in the upper Clark Fork River basin influenced by volcanic geology.

V. Numeric Nutrient Standards for Large Rivers

1. Executive Summary, Flynn and Suplee (2010); definition of a large river.

2. Executive Summary, Flynn and Suplee (2013); overview of how criteria were derived for the lower Yellowstone River (only large river with nutrient standards at this time).

VI. Development of an Appropriate Low-flow Design Flow (14Q5) for Permitting Numeric Nutrient Standards (Applicable to Wadeable Streams and Large Rivers)

1. Section 12.1 to section 12.4, Flynn and Suplee (2013).

2. McCarthy (2005); provides seasonal 14Q5 values for Montana streams and rivers.

VII. References

Flynn, K., and M.W. Suplee, 2010. Defining Large Rivers in Montana using a Wadeability Index. Helena, MT: Montana Department of Environmental Quality, 14 p. http://deq.mt.gov/wqinfo/Standards/default.mcpx (at bottom of the webpage)

Flynn, Kyle and Michael W. Suplee. 2013. Using a Computer Water Quality Model to Derive Numeric Nutrient Criteria: Lower Yellowstone River. WQPBDMSTECH-22. Helena, MT: Montana Dept. of Environmental Quality. http://deq.mt.gov/wqinfo/standards/NumericNutrientCriteria.mcpx

McCarthy, P.M., 2005. Statistical Summaries of Streamflow in Montana and Adjacent Areas, Water years 1900 through 2002. U.S. Geological Survey Scientific Investigations Report 2004-5266, 317 p. http://pubs.usgs.gov/sir/2004/5266/

Omernik, J.M., 1987. Ecoregions of the Conterminous United States. Annals of the Association of American Geographers 77: 118-125. http://dusk2.geo.orst.edu/prosem/PDFs/lozano_Ecoregions.pdf

Suplee, M., R. Sada de Suplee, D. Feldman, and T. Laidlaw, 2005. Identification and Assessment of Montana Reference Streams: A Follow-up and Expansion of the 1992 Benchmark Biology Study. Helena, MT: Montana Department of Environmental Quality, 41 p. http://deq.mt.gov/wqinfo/standards/NumericNutrientCriteria.mcpx (shown as "Reference Study Report 2005" under Criteria Technical Reports - Wadeable Streams).

Suplee, M.W., A. Varghese, and J. Cleland, 2007. Developing Nutrient Criteria for Streams: An Evaluation of the Frequency Distribution Method. Journal of the American Water Resources Association 43: 453-472.

Suplee, M.W., V. Watson, A. Varghese, and J. Cleland, 2008. Scientific and Technical Basis of the Numeric Nutrient Criteria for Montana's Wadeable Streams and Rivers. Helena, MT: Montana Department of Environmental Quality, 86 p. http://deq.mt.gov/wqinfo/standards/NumericNutrientCriteria.mcpx

Suplee, M.W., V. Watson, M. Teply, and H. McKee, 2009. How Green is too Green? Public Opinion of what Constitutes Undesirable Algae Levels in Streams. Journal of the American Water Resources Association 45: 123-140.

Suplee, M.W., and R. Sada de Suplee, 2011. Assessment Methodology for Determining Wadeable Stream Impairment Due to Excess Nitrogen and Phosphorus Levels. Helena, MT: Montana Department of Environmental Quality. Available at http://deq.mt.gov/wqinfo/qaprogram/sops.mcpx (click on "nutrient assessment method").

Suplee, M.W., and V. Watson, 2013. Scientific and Technical Basis of the Numeric Nutrient Criteria for Montana's Wadeable Streams and Rivers—Update 1, *and addendums*. Helena, MT: Montana Dept. of Environmental Quality. http://deq.mt.gov/wqinfo/standards/NumericNutrientCriteria.mcpx

Suplee, M.W. and C. Schmidt, 2013. Derivation of Site-specific Numeric Nutrient Criteria for Selected Streams in the Upper Clark Fork Basin—*Addendum A to Scientific and Technical Basis of the Numeric Nutrient Criteria for Montana's Wadeable Streams and Rivers-Update 1*. Helena, MT: Montana Dept. of Environmental Quality. http://deq.mt.gov/wqinfo/standards/NumericNutrientCriteria.mcpx