Review of South Dakota's 2010 Section 303(d) Waterbody List

Attachment to letter from Carol L. Campbell, Assistant Regional Administrator, Office of Ecosystems Protection and Remediation, US EPA, Region VIII to Steve Pirner, Secretary, South Dakota Department of Environment and Natural Resources

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I. Introduction

South Dakota Department of Environment and Natural Resources (SDDENR) submitted their final 2010 Integrated Report (IR) to the Environmental Protection Agency (EPA) on March 29, 2010. EPA has concluded that the State developed its Section 303(d) waterbody list in partial compliance with Section 303(d) of the Act and 40 C.F.R. § 130.7. Because South Dakota's submission does not include all waters that meet Section 303(d) waterbody listing requirements, EPA is partially approving and partially disapproving South Dakota's list submission and adding the additional water, pollutant, and corresponding priority to the final 2010 list. The purpose of this review document is to describe the rationale for EPA's partial approval/partial disapproval of South Dakota's 2010 Clean Water Act (CWA) Section 303(d) waterbody list ("Section 303(d) list"). The following sections identify those key elements to be included in the list submittal based on the CWA and EPA regulations. (See 40 C.F.R. § 130.7). In May 2009, EPA issued guidance for integrating the development and submission of 2010 Section 305(b) water quality reports and Section 303(d) lists of impaired waters. This guidance, and previous EPA guidance, recommends that states develop an Integrated Report of the quality of their waters by placing all waters into one of five assessment categories. By following this guidance, Category 5 of the Integrated Report is the State's Section 303(d) list. EPA's action in review and approval of this document is only on Category 5 that comprises the Section 303(d) list within the Integrated Report.

EPA reviewed the methodology used by the State in developing the Section 303(d) list and the State's description of the data and information it considered. EPA's review of South Dakota's 2010 Section 303(d) list is based on EPA's analysis of whether the State reasonably considered existing and readily available water quality-related data and information and reasonably identified waters required to be listed.

South Dakota's 2010 list is considered an update of the State's 2008 list, and as such, the Section 303(d) list EPA is partially approving today is comprised of 151 assessment units and 220 waterbody/pollutant combinations, compared with 169 assessment units included on the 2008 list. States may add and take waters off their Section 303(d) lists based on several factors. For the 2010 cycle, South Dakota delisted 104 waterbody/pollutant combinations from its year 2008 list. A total of 24 waterbody/pollutant combinations were delisted based on an EPA-approved total maximum daily load (TMDL). In addition, as a partial disapproval, EPA is adding 12 of those waters the state is delisting back to South Dakota's list, 4 of which are listed for other pollutants. Therefore, the total number of listed assessment units is 159 and the total number of

listed waterbody/pollutant combinations is 232. The 12 lakes to be added to South Dakota's year 2010 list are: Waggoner Lake, Bierman Dam, Lake Carthage, Lake Isabel, Twin Lakes (Sanborn County), Wilmarth Lake, Rahn Lake, Cottonwood Lake (Sully County), East Vermillion Lake, Bullhead Lake (Deuel County), Lake Campbell (Campbell County), and Lake Pocasse.

II. Statutory and Regulatory Background

A. Identification of Water Quality Limited Segments (WQLSs) for Inclusion on Section 303(d) List

Section 303(d)(1) of the CWA directs states to identify those waters within its jurisdiction for which effluent limitations required by Section 301(b)(1)(A) and (B) are not stringent enough to implement any applicable water quality standard, and to establish a priority ranking for such waters, taking into account the severity of the pollution and the uses to be made of such waters. The Section 303(d) listing requirement applies to waters impaired by point and/or nonpoint sources, pursuant to EPA's long-standing interpretation of Section 303(d).

EPA regulations provide that states do not need to list waters where the following controls are adequate to implement applicable standards: (1) technology-based effluent limitations required by the CWA; (2) more stringent effluent limitations required by state or local authority; and (3) other pollution control requirements required by state, local, or federal authority. (See 40 C.F.R. § 130.7(b)(1).)

Note: The term "water quality limited segment," as defined by federal regulations, may also be referred to as "impaired waterbodies" or "impairments" throughout this document.

B. Consideration of Existing and Readily Available Water Quality-Related Data and Information

In developing Section 303(d) lists, states are required to assemble and evaluate all existing and readily available water quality-related data and information, including, at a minimum, consideration of existing and readily available data and information about the following categories of waters: (1) waters identified as not meeting designated uses, or as threatened, in the State's most recent CWA Section 305(b) report; (2) waters for which dilution calculations or predictive modeling indicate nonattainment of applicable standards; (3) waters for which water quality problems have been reported by governmental agencies, members of the public, or academic institutions; and (4) waters identified as impaired or threatened in any Section 319 nonpoint assessment submitted to EPA. (See 40 C.F.R. § 130.7(b)(5).) In addition to these minimum categories, states are required to consider any other data and information that is existing and readily available. EPA's 1991 Guidance for Water Quality-Based Decisions describes categories of water quality-related data and information that may be existing and readily available. (See Guidance for Water Quality-Based Decisions: The TMDL Process, EPA Office of Water, April 1991.) While states are required to evaluate all existing and readily available water quality-related data and information, states may decide to rely or not rely on particular data or information in determining whether to list particular waters.

In addition to requiring states to assemble and evaluate all existing and readily available water quality-related data and information, EPA regulations at 40 C.F.R. § 130.7(b)(6) require States to include, as part of their submissions to EPA, documentation to support decisions using or excluding particular data and information and decisions to list or not list waters. Such documentation needs to include, at a minimum, the following information: (1) a description of the methodology used to develop the list; (2) a description of the data and information used to identify waters; and (3) any other reasonable information requested by the Region.

C. Priority Ranking

EPA regulations also codify and interpret the requirement in Section 303(d)(1)(A) of the CWA that states establish a priority ranking for listed waters. The regulations at 40 C.F.R. § 130.7(b)(4) require states to prioritize waters on their Section 303(d) lists for TMDL development, and also to identify those water quality limited segments (WQLSs) targeted for TMDL development in the next two years. In prioritizing and targeting waters, states must, at a minimum, take into account the severity of the pollution and the uses to be made of such waters. (See CWA Section 303(d)(1)(A).) As long as these factors are taken into account, the CWA provides that states establish priorities. States may consider other factors relevant to prioritizing waters for TMDL development, including immediate programmatic needs such as wasteload allocations for permits, vulnerability of particular waters as aquatic habitats, recreational, economic, and aesthetic importance of particular waters, degree of public interest and support, and state or national policies and priorities. (See 57 FR 33040, 33045 (July 24, 1992), and EPA's 1991 Guidance.)

D. Applicable Water Quality Standards

For purposes of identifying waters for the Section 303(d) list, the terms "water quality standard applicable to such waters" and "applicable water quality standards" refer to those water quality standards established under Section 303 of the Act. On April 27, 2000, EPA promulgated a rule under which the "applicable standard" for Clean Water Act purposes depends on when the relevant state or tribe promulgated that standard. Standards that states or tribes have promulgated before May 30, 2000 are effective upon promulgation by the states or tribes. Standards that states or tribes promulgated on or after May 30, 2000 become effective only upon EPA approval. (See 65 FR 24641(April 27, 2000).)

III. Analysis of South Dakota's Submission

A. Background

In reviewing South Dakota's submittal, EPA first reviewed the methodology used by the State to develop their 2010 Section 303(d) list in light of South Dakota's approved water quality standards, and then reviewed the actual list of waters. The State's Assessment Methodology is presented on pages 22-33 of the Integrated Report. EPA has reviewed the State's submission and, with the exception of 12 lakes, has concluded that the State developed its Section 303(d) list in compliance with Section 303(d) of the CWA and 40 C.F.R. § 130.7. Details regarding EPA's

concerns with SDDENR's lake methodology are described in Section C below. EPA's review is based on its analysis of whether the State reasonably considered existing and readily available water quality-related data and information and reasonably identified waters required to be listed. South Dakota considered all data and information pertaining to the categories under 40 C.F.R. § 130.7(b)(5).

In previous guidance, EPA recommended that states develop an Integrated Report of the quality of their waters by placing all waters into one of five assessment categories. (See EPA's Guidance for 2006 Assessment, Listing and Reporting Requirements Pursuant to Sections 303(d), 305(b) and 314 of the Clean Water Act, July 21, 2005.) By following this guidance, Category 5 of the Integrated Report is the State's Section 303(d) list. EPA's action in review and approval of this document is only on Category 5 that comprises the Section 303(d) list within the Integrated Report.

The State's list was submitted to EPA enclosed with correspondence dated March 29, 2010 from Steve Pirner, Secretary, South Dakota Department of Environment and Natural Resources, in a document entitled *South Dakota 2010 Integrated Report for Surface Water Quality Assessment*.

The year 2010 Integrated Report submitted to the EPA, from the South Dakota DENR consisted of the following portions that are necessary for the Section 303(d) waterbody list:

- **Waterbodies and corresponding pollutants that make up the State's Section 303(d) list** (See Appendix F: 303(D) Summary).
- **Prioritization of waterbodies for TMDL development** (See Appendix F: 303(D) Summary).
- **Identification of waters targeted for TMDL development over the next biennium** (See Appendix F: 303(D) Summary).

EPA's partial approval/partial disapproval action of South Dakota's year 2010 Section 303(d) list extends only to the items listed immediately above.

The 2010 Section 303(d) waters are found in Appendix F (303(D) Summary) of the State's Integrated Report. Tables included in Appendix F contain the following information for each waterbody: assessment unit identifier, waterbody name and location, cause of impairment, cycle first listed, TMDL status, and the priority ranking.

B. Identification of Waters and Consideration of Existing and Readily Available Water Quality-Related Data and Information

EPA has reviewed South Dakota's description of the data and information it considered for identifying waters on the Section 303(d) list. EPA concludes that the State properly assembled and evaluated all existing and readily available data and information, including data and information relating to the categories of waters specified in 40 C.F.R. § 130.7(b)(5). In particular, the State relied on information from the 2010 Section 305(b) water quality assessments, assessments performed under the CWA Section 319 non-point source program, as

well as data and information obtained through an extensive process to solicit information from state, federal and citizen sources. The State's evaluation of data and information in each of these categories is described below.

- *Waters identified by the state in its most recent section 305(b) report as "partially meeting" or "not meeting" designated uses or as "threatened"* (40 C.F.R. § 130.7(b)(5)(i)): South Dakota produced a 2010 Integrated Report consistent with EPA's guidance regarding combined CWA 305(b) reports and 303(d) lists. EPA concludes that South Dakota made listing decisions consistent with results from the CWA Section 305(b) assessment, using all existing and readily available data and information, in development of its 2010 Section 303(d) waterbody list, with the exception of the 12 lakes discussed in Section C, below.

- *Waters for which dilution calculations or predictive models indicate non-attainment of applicable water quality standards* (40 C.F.R. § 130.7(b)(5)(ii)): South Dakota assembled and evaluated information from past and anticipated dilution calculations and predictive modeling. EPA concludes that South Dakota properly considered waters for which dilution calculations or predictive models indicate nonattainment of applicable water quality standards in development of its 2010 Section 303(d) waterbody list.

- *Waters for which water quality problems have been reported by local, state, or federal agencies; members of the public; or academic institutions* (40 C.F.R. § 130.7(b)(5)(iii)): The State solicited data and information in preparation for the 2010 Section 303(d) list. Data and information obtained as a result of this effort were evaluated and considered. The State's submittal identified several entities that contributed data or information and responded to public comments related to assessments for individual waterbodies

- *Waters identified by the State as impaired or threatened in a nonpoint assessment submitted to EPA under Section 319 of the CWA or in any updates of the assessment* (40 C.F.R. § 130.7(b)(5)(iv)): The State's 2010 Section 303(d) list includes all waters that have data to support nonpoint source pollution impairment. South Dakota's listing approach and methodologies direct CWA Section 319 activities and resources to the highest priorities. Watershed assessments are often conducted for waterbodies that are already listed in order to collect current data to support TMDL development.

Based upon its review, EPA concluded that the State's process for developing its 2010 Section 303(d) list meets the requirements of Federal regulation regarding the consideration of all existing and readily available water quality-related data and information, consistent with the expectations of 40 C.F.R. §§ 7(b)(5)(i)-(iv)), with the exception of the 12 lakes described in Section C below.

C. Section 303(d) Delistings (40 C.F.R. § 130.7(b)(6)(iv))

According to EPA regulations, each state must demonstrate good cause for not including waters on the list. (See 40 C.F.R. § 130.7(b)(6)(iv).) EPA acknowledges that states may re-evaluate the waters on their Section 303(d) lists. In an August 1997 memorandum, EPA stated

that ". . . Regions and states should keep in mind that waterbodies may be added or subtracted over time as new lists are developed." The existing EPA regulations require states, at the request of the Regional Administrator, to demonstrate good cause for not including waterbodies on their lists. (See 40 C.F.R. § 130.7(b)(6)(iv).) Accordingly, in the May 15, 2007 guidance for preparing the (previous) 2008 Integrated Report, EPA identified good cause conditions that allow states to remove previously listed waters from Section 303(d) list.

In its review of the State's 2010 Section 303(d) waterbody list, EPA carefully reviewed the methodology and resultant delistings from South Dakota's list. A full accounting of waters delisted from the 2008 list is provided in Appendix B (pages 177-187) of the Integrated Report. Appendix B includes a column describing the reason for delisting each of the waters. For the 104 assessment unit/pollutant cause combinations that have been delisted in 2010, the decisions to take the waters off the list are based on: 1) a TMDL was completed and approved by EPA (24 waterbody/pollutant combinations); 2) applicable water quality standards attained, revised assessment method (41); 3) applicable water quality standards attained, due to change in water quality standards (12); 4) applicable water quality standards attained, due to restoration activities (3); 5) applicable water quality standards attained, reason for recovery unspecified (19); 6) applicable water quality standards attained, original basis for listing incorrect (2); and 7) applicable water quality standards attained, threatened water no longer threatened (3).

SDDENR delisted 39 lakes that had been listed with Trophic State Index (TSI) as the cause, based on comparing the available data to the State's revised assessment methodology (39 of the 41 from reason 2, above). Since the revised methodology relies on an interpretation of numeric water quality standards and does not interpret the applicable narrative water quality standard, EPA reviewed all waters to determine if the State had provided a solid "good cause" basis for delisting. Based on its initial review of the final list submission, EPA determined that 12 of the 39 delisted lakes were improperly delisted from the State's list because they are not meeting applicable narrative water quality standards. The definition of "water quality standards" for purposes of §303(d) listing includes numeric criteria, narrative criteria, waterbody uses (e.g., designated uses), and antidegradation requirements. (See 40 C.F.R. § 130.7(b)(3).) For these lakes, the water quality standard not being attained is contained within the following narrative standards for South Dakota: Administrative Rules of South Dakota Articles 74:51:01:05 (Materials causing pollutants to form in waters), 74:51:01:06 (Visible pollutants prohibited), 74:51:01:08 (Taste- and odor-producing materials), and 74:51:01:09 (Nuisance aquatic life).

EPA believes that water bodies where it is known that water quality does not meet applicable water quality standards or is not expected to meet applicable water quality standards, even after the application of the technology-based effluent limitations required by sections 301(b)(1)(A) and (B) of the Clean Water Act, should qualify as water quality-limited segments. These 12 lakes meet this standard. As such, these 12 lakes should remain on the State's year 2010 list of WQLSs in need of TMDLs.

EPA will solicit public comments on the addition of these lakes to the State's list and, following consideration of any comments received, will transmit a final determination regarding the lakes to the State for incorporation in its §303(d) list. The basis for adding these lakes to the State's list is discussed below.

1. Lake Assessment Methodology.

EPA is concerned that numeric criteria alone were used to assess lakes and that narrative standards that apply to those lakes were disregarded. Prior to the release of the draft 303(d) list, EPA encouraged SDDENR to develop methods to assess lakes for narrative criteria, specifically eutrophication, while numeric nutrient criteria are in development. Narrative standards encompass a broad array of potential impacts to waters, however, only the assessment methodology for narrative criteria limiting excessive algal growth and eutrophication is at issue here. Nutrient criteria development will likely take considerable time, and in the interim, numerous other indicators should be used to assess lakes for narrative criteria. As a result of SDDENR's decision to revise their assessment methodology to no longer assess lakes for narrative criteria, 39 lakes were considered to no longer be impaired and were subsequently delisted from the State's 303(d) list.

SDDENR primarily relied on measures of dissolved oxygen and pH to determine if lakes were impaired due to excessive eutrophication. Since dissolved oxygen measures were rarely taken at the most critical time and low dissolved oxygen concentrations typically occur only in cases of severe nutrient enrichment, this measure often did not indicate impairment despite a number of other measures indicating potential problems such as high nutrient and chlorophyll-a values. It is also possible that narrative criteria (representing recreation and aesthetic uses) could be exceeded before a dissolved oxygen exceedance has occurred. An assessment of narrative criteria using multiple measures (such as those described in Section C. 3. below) to complement the dissolved oxygen sampling would provide a more complete evaluation of impacts to lakes in South Dakota.

2. Lakes classified as warm water marginal fish life propagation waters may need reassessment of beneficial uses and/or criteria.

EPA first reviewed the set of 13 lakes classified as warm water marginal fish life propagation waters. For these waters, EPA recommends that SDDENR re-evaluate these lakes and determine if they are appropriately classified and/or if they warrant a new use class designation. For example, some warm water marginal lakes may be more appropriately classified in the future as wetlands or may constitute a unique class of lakes. High levels of nutrients may be the expected condition for many of these lakes. EPA is not disapproving lakes classified as warm water marginal not included in the Section 303(d) list, but encourages further investigation. We request that SDDENR submit a plan with timelines to EPA outlining the State's approach to addressing these waters. If reducing nutrient concentrations to necessary levels is unattainable due to physical factors or other conditions, a use attainability analysis should be done, and other options should be pursued. (See Region 8 Q&A document: "Water Quality Standards Based on Natural and Irreversible Water Quality Conditions").

3. EPA analysis of delisted lakes classified as warm water permanent, warm water semi-permanent, or cold water permanent fisheries.

EPA evaluated the 26 lakes delisted by SDDENR which were classified as warm water permanent, warm water semi-permanent, and cold water permanent fish life propagation waters.

Additionally, all of these lakes were classified for immersion recreation. Of the remaining 26 delisted lakes, EPA does not plan to disapprove those listed by SDDENR this cycle for dissolved oxygen (one lake) and those with completed TMDLs for TSI (5 lakes). One lake (Dewberry Dam), with sampling access and use classification issues was also removed from analysis, as was another (Academy Lake), which had only one chlorophyll-a sample and could not be assessed. It is recommended that SDDENR reassess Academy Lake when more data is available. As a result, there were 18 remaining lakes delisted by SDDENR subjected to further analysis of water quality data.

EPA consulted several other states' eutrophication assessment methods, methods used in EPA Region 7 to determine impairment, and several scientific studies in this area of research in order to determine how narrative standards have been addressed and applied. While EPA is not necessarily expecting South Dakota to adopt any of these methods, understanding how eutrophication impairments are commonly assessed is useful in determining the condition of these lakes. While each of these methods assesses impairment for eutrophication differently, this information was compiled to develop EPA's approach to determining if the lake would be considered impaired. Due to the difficulty in assessing lakes using TSI in South Dakota, EPA decided not to use it as an indicator in this process. EPA agrees with SDDENR regarding the problems encountered with setting thresholds for TSI and the resulting difficulties in developing TMDLs for lakes where TSI was the sole cause for listing.

In our assessment, we selected a suite of indicators that, when combined, provide a useful indication of eutrophication. The parameters reviewed are:

- Chlorophyll-a
- Frequency of chlorophyll-a values above a threshold
- Nutrient concentrations (i.e., TN, TP)
- Fishery information
- Secchi depth

Since numeric nutrient criteria have not yet been developed for South Dakota, for each indicator, we selected conservative thresholds to ensure that lakes identified as impaired through this process actually reflect impaired conditions. As a result, it is possible that some impaired lakes may be excluded from this process in order to be certain that what we define as impaired truly is impaired. Thresholds related to both aquatic life use support and recreational uses were established based on multiple lines of information such as:

- Thresholds with demonstrated impacts to the designated use (aquatic life, recreation, aesthetics, or drinking water)
- Reference-based values that served as a benchmark
- Literature values linked to use support

While EPA considers TSI a valuable index of nutrient enrichment, Trophic State Index (TSI) values were not considered in our assessment because we recognize the technical issues associated with SD's current TSI thresholds. In this assessment EPA focused primarily on chlorophyll-a concentrations, since chlorophyll is the direct result of excessive nutrient inputs.

However, EPA also evaluated nutrient concentrations (e.g. TP and TN) and other indicators to aid in this assessment before reaching a final determination of whether or not to list a lake. Each potential indicator is discussed below.

Chlorophyll-a

EPA selected a threshold value of **30 µg/l chlorophyll-a** based on evaluating multiple approaches to establishing thresholds. Chlorophyll-a thresholds associated with recreational use impacts were evaluated based on the number of expected nuisance algal blooms and user perception survey results. Literature-based values for chlorophyll-a and chlorophyll-a concentrations associated with reference lakes in the Northern Glaciated Plains, Northern Great Plains, and Western Corn Belt Plains ecoregions were reviewed in the threshold setting process. We also considered chlorophyll-a values used by other states for the assessment of beneficial uses (MNPCA, 2005; TXCEQ, 2009; USEPA, 2009; USEPA Region 7, Draft 2010). These values range from 8-32 µg/l chlorophyll-a. EPA used the multiple lines of information presented in Table 1 to derive the threshold of 30 µg/l used in this assessment.

Table 1. Various Chlorophyll-a Thresholds.

Approach	State/Study	Chlorophyll-a (µg/L)
Weight of Evidence (WOE)-Based Values[1]	Minnesota	32 (Northern Glaciated Plains)
WOE-Based Values[1]	EPA Region 7	8.0 (includes Northern Great Plains; Corn Belt Plains)
User Perception Survey[2]	Texas	26.7 (Reservoirs)
Literature-Based Value[3]	EPA National Lake Survey	30 (Hypereutrophic Threshold)
Literature-Based Value[3]	Nurnberg, 1996	25 (Hypereutrophic Threshold)
Literature-Based Value[3]	World Health Organization	10-50 (Cyanotoxin Moderate Risk)

[1]WOE- Based Values: This term indicates thresholds established based on a weight of evidence approach that considers reference-based values, stressor-response studies, literature-based values, and other relevant studies.

[2]User Perception Survey: Thresholds derived based on information from input from recreational users demonstrating reductions to their use of the waterbody due to decreased aesthetics or changes to the quality of the recreational opportunities.

[3]Literature-Based Value: Values obtained from peer-reviewed studies that show demonstrated impacts of a beneficial use (i.e., aquatic life use, recreational use)

Several studies (Walmsley, 1984; Walker, 1984) have linked chlorophyll-a concentrations greater than 30 µg/L with "severe nuisance blooms" of algae. Nuisance blooms are those that result in a perceived impairment by lake users (MNPCA, 2005). **Minnesota** conducted extensive studies comparing reference values observed at lakes and reservoirs in the Northern Glaciated Plains to user perception information, trophic status information and fishery considerations. This ecoregion extends into South Dakota and many of the lakes in question are

found within it. Based on this combination of information, Minnesota adopted an assessment threshold for chlorophyll-a of 32 µg/l. In an effort to set regional benchmarks, **EPA Region 7** compiled all available lakes and reservoirs data for the entire region. The Regional Technical Advisory Group (RTAG) evaluated both reference distributions from sites identified through a rigorous screening process and percentile distributions (i.e., 25th%) of the entire dataset. These values were compared to literature-based values (Nurnberg, 1996; Downing and others, 2001) and compared to potential thresholds that may suggest human health impacts (e.g. cyanobacteria, algal blooms). Based on these considerations, Region 7 identified a final chlorophyll-a benchmark of 8 µg/L chlorophyll-a for all plains lakes and reservoirs. In **Texas**, a user perception survey showed a diminished recreational experience when chlorophyll-a exceeded 26.7 µg/L (TXCEQ, 2009; Glass, 2006).

EPA's National Lake Survey used a chlorophyll-a value of 30 µg/L in defining hypereutrophic conditions and a range of 7 to 30 µg/L for eutrophic (USEPA, 2009). This threshold between about 25 and 30 µg/L indicates a change in aesthetics, recreational use support and changes to the fish community composition. The **World Health Organization** (1999) established risk thresholds for exposure to cyanotoxins. While the highest risk was set at >50 µg/L, the range from 10-50 µg/L was considered to be moderate risk of exposure to cyanotoxins. The 30 µg/L value is in the middle of this range. Lakes with these levels should be specifically sampled for cyanobacteria and microcystin levels.

After examining the various thresholds and approaches, Region 8 chose a conservative threshold of 30 µg/L of chlorophyll-a as a growing season average (May 1 to September 30) in this assessment. It is conservative since a somewhat lower threshold could potentially be justified, but this sets a clear threshold of impairment. In addition, we also rated sites based on the frequency of chlorophyll-a excursions that exceeded the 30 µg/l threshold more than 25% of the time. As opposed to a concentration-based metric, a frequency metric assesses the duration of time a lake is experiencing high chlorophyll-a levels and, therefore, the consistency of the impacts. We used an exceedance frequency of 25%, which is a conservative level, since this still allows for recreational impacts to exist for more than one month of the summer season.

Total Phosphorus and Total Nitrogen

Table 2 presents a number of nutrient thresholds considered by EPA for this assessment. Total phosphorus values in the range of 20-200 µg/L have been used or recommended for assessment of lake beneficial uses (MNPCA, 2005; TXCEQ, 2009; USEPA Region 7, Draft 2010; USEPA, 2009). Total nitrogen threshold values range from 440 to 2447 µg/L.

Table 2. Various Nutrient Thresholds.

Approach	State/Study	Total Phosphorus (µg/L)	Total Nitrogen (µg/L)
Recreation Use Support	Minnesota	90	-----
WOE Approach	Region 7	35	700

Approach	State/Study	Total Phosphorus (µg/L)	Total Nitrogen (µg/L)
User Perception Survey	Texas	200	-----
Aquatic Life Stressor Based Values	National Lake Survey	56 (NW Great Plains Reservoirs) 159 (NW Glaciated Plains) 193 (N Glaciated Plains)	824 (NW Great Plains Reservoirs) 1355 (NW Glaciated Plains) 2447 (N Glaciated Plains)
Reference-Based Values	EPA 304(a) Ecoregional Criteria	37.5 (Corn Belt/N. Great Plains) 20 (Great Plains Grass/Shrublands) 33 (South Central Cultivated Great Plains)	781(Corn Belt/N. Great Plains) 440 (Great Plains Grass/Shrublands) 560 (South Central Cultivated Great Plains)
Literature-Based Values	Nurnberg, 1996	100 (Hypereutrophic Threshold)	1200 (Hypereutrophic Threshold)
Literature-Based Values	Downing and others (2001)	70	700

Minnesota derived their total phosphorus assessment threshold from a number of studies (MNPCA, 2005) which are also relevant to this assessment of South Dakota lakes since they share ecoregions. The risk of nuisance algae blooms was the basis for setting the total phosphorus value in that region at 90 µg/L. In the Northern Glaciated Plains within Minnesota it was found that total phosphorus values in the 70-90 µg/L range increased the frequency of severe nuisance algae blooms to about 45% of the summer and very severe nuisance bloom frequency increased to 10%. **EPA Region** 7 (2010) reviewed reference-based values compared to thresholds associated with eutrophic conditions to establish the total phosphorus benchmark of 35 µg/l. Region 7's choice of a total nitrogen benchmark of 700 µg/l balanced Nurnberg's (1996) eutrophic range of 650 – 1200 µg/L with an increase in cyanobacteria that occurs around 700 µg/L (Downing and others, 2001). The **Texas** value for total phosphorus is a screening threshold (TXCEQ, 2009).

EPA's National Lake Survey nutrient thresholds were based on regional reference sites. We applied a very conservative approach and examined thresholds used in the NLA to assign lakes as in "poor" condition. Since these values represent "poor" conditions, not reference-based values, they reflect "impaired" conditions, and it is likely that impairments exist at levels lower than those presented. These values were derived at the broad ecoregional scales and results from only similar ecoregions are presented. In addition, EPA proposed aggregated ecoregional criteria **(EPA 304(a) criteria)** based on the 25th percentile of the entire dataset. The 25th percentile was intended to represent reference-based conditions absent having reference sites identified through targeted reference site sampling.

Values from the peer-reviewed literature were also considered. **Nurnberg** (1996) values for phosphorus and nitrogen considered changes in lake trophic status. **Downing** and others (2001) found the risk of cyanobacteria dominance rose to 80% when total phosphorus concentrations exceeded 70 µg/L.

Based on these studies, Region 8 selected a conservative upper threshold for total phosphorus (100 µg/L) and total nitrogen (1000 µg/L) for the purposes of this assessment. These values were considered conservative in that lower thresholds were theoretically possible, but also included a margin of safety.

Secchi Depth (Transparency)

Transparency (the depth of which a disk can be seen in the water) is also used by states in assessment of the recreation use for lakes. One example is provided in Table 3, below (MNPCA, 2005).

Table 3. Secchi Depth Metric Used in Lake Assessment.

Study	State	Secchi Depth (m)
User Perception Survey	Minnesota	<0.7

Minnesota (Heiskary and Walker 1988) conducted user perception surveys to determine the secchi depth at which swimming impairment was likely to occur. In the Northern Glaciated Plains, once the secchi depths fell into the range of 0.6 to 0.7 meters, swimming was not considered desirable, resulting in 0.7 meters as a threshold. EPA has decided to use a threshold of 0.7 meters as an average for secchi depth for the purposes of this assessment.

Fish Community

If available, fish community data were used as another source of information. While this information was used to support the decision, no lake was proposed for listing based solely on fishery studies. The fishery information used in this assessment for South Dakota came from the Statewide Fisheries Survey reports published by the South Dakota Department of Game, Fish, and Parks.

Schupp (1992) found in Minnesota lakes that an increase in total phosphorus produced changes in the fish communities, including increases in the abundance of carp and black bullhead. The basis for the draft Colorado nutrient criteria makes note of this relationship, stating that "Fishery yield tends to increase with increasing algal productivity, but associated changes in community composition may result in a low value fishery. In a warm water setting, eutrophic lakes (average chlorophyll-a 8-25 µg/L) generally support the game fish that anglers prefer. In contrast, hypertrophic lakes (chlorophyll-a >25 µg/L) are more likely to be dominated by carp and bullheads" (CDPHE, 2009).

Water Supply

Two lakes in this assessment (Lake Isabel and Lake Waggoner) are classified for domestic water supply use. The State of Oklahoma has a chlorophyll-a criterion of 10 µg/L for lakes classified for water supply (OWRB, 2005). Downing and others (2001) also found that the risk of an increase in cyanobacteria begins when chlorophyll-a is greater than 10 µg/L. The data for these two lakes in South Dakota was compared to this value.

Assessment

Table 4 summarizes our findings regarding the existing data for each of the 18 lakes and compares this data to the assessment values chosen based on the discussion above. For assessment purposes, results from all indicators were evaluated with more weight given to the two chlorophyll indicators than other parameters (i.e., average growing season concentrations > 30 µg/l and individual concentrations >30 µg/l more than 25% of the growing season). We based our final assessment on the number of indicators exceeded in each waterbody. If the waterbody exceeded both of the chlorophyll indicators (or two out of three for the water supply lakes) we considered it impaired. If it exceeded only one of the chlorophyll indicators, then two additional supplemental indicators had to be exceeded for the lake to be considered impaired.

Table 4 indicates (using "Yes"(Y) or "No" (N)) whether or not the waterbody exceeded each individual metric. Following the summary table, a more detailed description of each waterbody and the final attainment decision is summarized. All results presented are derived from surface samples collected between May 1 and September 30 from 2000 to 2009. The chlorophyll-a samples were corrected for pheophytin. Under the fish survey results, "NR" means no report available and under the water supply column, "NA" means not applicable. Although there was often data from lower levels (profiles) in many lakes, it was unknown if stratification was occurring and this information is more valuable in assessing dissolved oxygen and pH criteria attainment. Therefore, only surface samples were used in this analysis. In addition to chemical and physical samples, fish survey reports from the South Dakota Game, Fish and Parks Department were consulted, where available. Note that all of the lakes in this analysis exceeded the total nitrogen threshold used in this assessment. It is not surprising that at least one threshold would be exceeded by all since these lakes had been identified as not meeting narrative standards in the past.

Table 4. Summary of EPA's Assessment of SDDENR Delisted Waters

Waterbody Name/ID	Chl-a >30µg/L	Chl-a >30 µg/L in more than 25% of samples	TP >100 µg/L	TN >1000 µg/L	Average Secchi Depth <0.7 m	Large #s of black bullhead or carp	Chl-a >10 µg/L (Water Supply)	N:P Ratio
Waggoner Lake (SD-BA-L-WAGGONER_01)	Y	Y	Y	Y	N	N	Y	8:1
Bullhead Lake (SD-BS-L-BULLHEAD_01)	Y	Y	Y	Y	Y	N	NA	18:1
Curlew Lake (SD-CH-L-CURLEW_01)	N	N	N	Y	N	N	NA	19:1
New Wall Lake (SD-CH-L-NEW_WALL_01)	N	N	N	Y	N	N	NA	28:1
Flat Creek Dam (SD-GR-L-FLAT_CREEK_01)	N	N	Y	Y	Y	NR	NA	12:1
Lake Isabel (SD-GR-L-ISABEL_01)	N	Y	Y	Y	N	NR	Y	7:1
Bierman Dam (SD-JA-L-BIERMAN_01)	N	Y	Y	Y	Y	NR	NA	13:1
Lake Carthage (SD-JA-L-CARTHAGE_01)	Y	Y	Y	Y	N	Y	NA	9:1
Roy Lake (SD-JA-L-ROY_01)	N	N	N	Y	N	N	NA	22:1
South Red Iron Lake (SD-JA-L-S_RED_IRON_01)	N	N	N	Y	N	N	NA	22:1

Waterbody Name/ID	Chl-a >30µg/L	Chl-a >30 µg/L in more than 25% of samples	TP >100 µg/L	TN >1000 µg/L	Average Secchi Depth <0.7 m	Large #s of black bullhead or carp	Chl-a >10 µg/L (Water Supply)	N:P Ratio
Twin Lakes (SD-JA-L-TWIN_01)	Y	Y	Y	Y	Y	Y	NA	24:1
Wilmarth Lake (SD-JA-L-WILMARTH_01)	Y	Y	Y	Y	N	Y	NA	3:1
Lake Campbell (SD-MI-L-CAMPBELL_01)	Y	Y	Y	Y	N	NR	NA	3:1
Cottonwood Lake (SD-MI-L-COTTONWOOD_01)	Y	Y	Y	Y	N	NR	NA	10:1
Lake Pocasse (SD-MI-L-POCASSE_01)	Y	Y	Y	Y	N	NR	NA	4:1
Rahn Lake (SD-NI-L-RAHN_01)	Y	Y	Y	Y	N	NR	NA	10:1
Lake Traverse (SD-RD-L-TRAVERSE_01)	N	N	Y	Y	N	NR	NA	10:1
East Vermillion Lake (SD-VM-L-E_VERMILLION_01)	Y	Y	Y	Y	N	Y	NA	4:1

Individual Lake Assessments

Waggoner Lake (Bad River Basin)

Waggoner Lake is classified as "warm water permanent fish life, domestic water supply, immersion recreation, limited contact recreation, and fish and wildlife propagation and stock watering." It is 97.68 acres in size with a maximum depth of about 21 feet and an average depth of about 10 feet. The N:P ratio was about 8:1 indicating that this lake is likely nitrogen limited. For the 2010 listing cycle, it has been delisted for TSI.

The average chlorophyll-a value was 36.1 µg/L (n=21) and 43% of samples exceeded the 30 µg/L threshold. The average secchi depth was 0.87 meters. Total phosphorus averaged 153 µg/L (n=21) and total nitrogen averaged 1290 µg/L (n=21). Compared to EPA's thresholds, Waggoner Lake exceeded the two chlorophyll-a metrics and the TP and TN thresholds. The latest fish survey (SDGFP, 2008a) found 50% of the shoreline covered by submerged vegetation and noted that submerged vegetation was a problem by mid-summer. However, the largemouth bass population was in excellent condition and the lake was not dominated by black bullhead or carp, indicating that the impacts had not yet impaired the fish community.

Finding: Impaired

Bullhead Lake (Big Sioux Basin)

Bullhead Lake is classified as "warm water semi-permanent fish life, immersion recreation, limited contact recreation, and fish and wildlife propagation and stock watering." It is 343.47 acres in size with a maximum depth of about 11 feet and an average depth of about 7 feet. The N:P ratio was about 18:1, indicating that this lake is likely phosphorus limited. For the 2010 listing cycle, it is listed for pH, but delisted for TSI.

The average chlorophyll-a value was 32.9 µg/L (n=18) and 50% of samples exceeded the 30 µg/L threshold. The average secchi depth was 0.42 meters. Total phosphorus averaged 103 µg/L (n=22) and total nitrogen averaged 1810 µg/L (n=15). Compared to EPA's proposed thresholds, Bullhead Lake exceeded both chlorophyll-a metrics and both nutrient metrics. The latest fish survey (SDGFP, 2008b) noted that the lake was "susceptible to periodic winterkill," but had a history of a quality walleye and perch fishery. At the time of this survey, however, both walleye and perch were below the management objectives and black bullhead was also low.

Finding: Impaired

Curlew Lake (Cheyenne Basin)

Curlew Lake is classified as "warm water permanent fish life, immersion recreation, limited contact recreation, and fish and wildlife propagation and stock watering." It is 150.97 acres in size with a maximum depth of about 22 feet and an average depth of about 10 feet. The N:P ratio is about 19:1, indicating that this lake is likely phosphorus limited. For the 2010 listing cycle, it is listed for temperature, but delisted for TSI.

The average chlorophyll-a value was 12.2 µg/L (n=6) and only 17% of samples exceeded the 30 µg/L threshold. However, the sample size was low. The average secchi depth was 0.75 meters. Total phosphorus averaged 58 µg/L (n=5) and total nitrogen averaged 1080 µg/L (n=5). Only the total nitrogen threshold was exceeded and the latest fish survey (SDGFP, 2007a) found large numbers of black crappie and few black bullhead, indicating that the lake was in fairly good condition.

Finding: Not Impaired, but more data needed

New Wall Lake (Cheyenne Basin)

New Wall Lake is classified as "warm water permanent fish life, immersion recreation, limited contact recreation, and fish and wildlife propagation and stock watering." It is 35.75 acres in size with a maximum depth of about 24 feet and an average depth of about 13 feet. The N:P ratio is about 28:1, indicating that this lake is likely phosphorus limited. For the 2010 listing cycle, it is listed for pH, but delisted for TSI.

The average chlorophyll-a value was 12.2 µg/L (n=5) and only 20% of samples exceeded the 30 µg/L threshold. However, the sample size was low. The average secchi depth was 0.78 meters. Total phosphorus averaged 58 µg/L (n=4) and total nitrogen averaged 1650 µg/L (n=4). Total nitrogen was the only metric exceeded and the latest fish survey (SDGFP, 2007b) found only bass but in fairly low numbers apparently due to a recent drought.

Finding: Not Impaired, but more data needed

Flat Creek Dam (Grand Basin)

Flat Creek Dam is classified as "warm water permanent fish life, immersion recreation, limited contact recreation, and fish and wildlife propagation and stock watering." It is 151.43 acres in size with a maximum depth of at least 20 feet and an average depth of about 8 feet. The N:P ratio is about 12:1, indicating that this lake is possibly both phosphorus and nitrogen limited. For the 2010 listing cycle it has been delisted for TSI.

The average chlorophyll-a value was 19.5 µg/L (n=4) and 25% of samples exceeded the 30 µg/L threshold. However, the sample size was low. The average secchi depth was 0.65 meters. Total phosphorus averaged 137 µg/L (n=4) and total nitrogen averaged 1580 µg/L (n=4). The two chlorophyll-a metrics were met (barely, in the case of the frequency metric). However, the secchi depth metric and the nutrient metrics were exceeded, but since both chlorophyll metrics were met it will not be listed. Using the thresholds developed for this assessment, Flat Creek Dam should be considered close to impairment and more samples should be collected to determine its status.

Finding: Not Impaired, but more data needed

Lake Isabel (Grand Basin)

Lake Isabel is classified as "warm water permanent fish life, domestic water supply, immersion recreation, limited contact recreation, and fish and wildlife propagation and stock watering." It is 112.58 acres in size with a maximum depth of at least 17 feet and an average depth of about 9 feet. The N:P ratio of 7:1 indicates that this lake is probably nitrogen limited. For the 2010 listing cycle this lake is listed for mercury in fish tissue, but delisted for TSI.

The average chlorophyll-a value was 24.3 µg/L (n=10) and 30% of samples exceeded the 30 µg/L threshold. Average secchi depth was 0.88 meters. Total phosphorus averaged 257 µg/L (n=12) and total nitrogen averaged 1790 µg/L (n=12). The average chlorophyll-a, total phosphorus and total nitrogen thresholds were exceeded, although the chlorophyll frequency metric and secchi depth were not. However, the chlorophyll-a level was exceeded for the water supply metric, meaning that two out of the three possible chlorophyll metrics for this waterbody were exceeded.

Finding: Impaired

Bierman Dam (James Basin)

Bierman Dam is classified as "warm water permanent fish life, immersion recreation, limited contact recreation, and fish and wildlife propagation and stock watering." It is 15.14 acres in size with a maximum depth of at about 13 feet. Average depth is unknown. The N:P ratio is about 13:1, indicating that this lake is possibly both nitrogen and phosphorus limited. For the 2010 listing cycle this lake has been delisted for TSI.

The average chlorophyll-a value was 23.9 µg/L (n=17) and 29% of samples exceeded the 30 µg/L threshold. The average secchi depth was 0.67 meters. Total phosphorus averaged 102 µg/L (n=14) and total nitrogen averaged 1410 µg/L (n=14). The chlorophyll-a frequency, secchi depth, and nutrient concentration thresholds were exceeded. Only the average chlorophyll-a concentration metric was met. While none of the metrics were exceeded by large amounts, overall they are indicating eutrophication problems in this lake.

Finding: Impaired

Lake Carthage (James Basin)

Lake Carthage is classified as "warm water permanent fish life, immersion recreation, limited contact recreation, and fish and wildlife propagation and stock watering." It is 206.93 acres in size with a maximum depth of about 23 feet and an average depth of about 8 feet. The N:P ratio was about 9:1, indicating that this lake is probably nitrogen limited. For the 2010 listing cycle this lake has been delisted for TSI.

The average chlorophyll-a value was 64.9 µg/L (n=31) and 52% of samples exceeded the 30 µg/L threshold. The average secchi depth was 1.32 meters. Total phosphorus averaged 282 µg/L (n=22) and total nitrogen averaged 2210 µg/L (n=22). Lake Carthage exceeded both chlorophyll-a metrics, both nutrient metrics, and fish information indicated nutrient enrichment. SDGFP (2007c) observed that the water was turbid and green with algae and cattails were plentiful. The fish catch was dominated by black bullhead and below the management objectives for crappie, bass, and bluegill.

Finding: Impaired

Roy Lake (James Basin)

Roy Lake is classified as "warm water permanent fish life, immersion recreation, limited contact recreation, and fish and wildlife propagation and stock watering." It is 1720.7 acres in size with a maximum depth of about 21 feet and an average depth of about 10 feet. The N:P ratio was about 22:1, indicating that this lake is likely phosphorus limited. For the 2010 listing cycle it has been delisted for TSI.

The average chlorophyll-a value was 15.6 µg/L (n=17) and 9% of samples exceeded the 30 µg/L threshold. The average secchi depth was 1.14 meters. Total phosphorus averaged 49 µg/L (n=26) and total nitrogen averaged 1090 µg/L (n=26). None of the proposed thresholds were exceeded for Roy Lake, except for total nitrogen, and in the most recent fish survey (SDGFP, 2008c) the fishery was found to be in fairly good condition although some sport fish species were below the management objective.

Finding: Not Impaired

South Red Iron Lake (James Basin)

South Red Iron Lake is classified as "warm water permanent fish life, immersion recreation, limited contact recreation, and fish and wildlife propagation and stock watering." It is 615.42 acres in size with a maximum depth of about 14 feet and an average depth of about 8 feet. The N:P ratio is about 22:1, indicating that this lake is likely phosphorus limited. For the 2010 listing cycle it has been delisted for TSI.

The average chlorophyll-a value was 17.2 µg/L (n=6) and 17% of samples exceeded the 30 µg/L threshold. However, the sample size was low. The average secchi depth was 0.83 meters. Total phosphorus averaged 48 µg/L (n=30) and total nitrogen averaged 1050 µg/L (n=30). None of the metrics were exceeded, except for total nitrogen, and in the most recent fish survey SDGFP (2006) found some sport fish species to be below the management objective, with others close to the objectives. However, carp and black bullhead numbers were low.

Finding: Not Impaired

Twin Lakes (James Basin)

Twin Lakes (Sanborn County) is classified as "warm water semi-permanent fish life, immersion recreation, limited contact recreation, and fish and wildlife propagation and stock watering." It is 213.16 acres in size with a maximum depth of about 12.5 feet and an average depth of about 6 feet. The N:P ratio is about 24:1, indicating that this lake is probably phosphorus limited. For the 2010 listing cycle this lake has been delisted for TSI.

The average chlorophyll-a value was 105.8 µg/L (n=24) and 92% of samples exceeded the 30 µg/L threshold. The average secchi depth was 0.26 meters. Total phosphorus averaged 158 µg/L (n=18) and total nitrogen averaged 4120 µg/L (n=19). All thresholds were exceeded and fish information indicated possible enrichment. SDGFP (2008d) noted that the lake had suffered a severe winterkill in 2007-08 and the lake was restocked. This particular survey was not able to collect those fish since they were too small; however, what they did catch was dominated by black bullhead, recognized as an indicator species for eutrophication, especially when dominant.

Finding: Impaired

Wilmarth Lake (James Basin)

Wilmarth Lake is classified as "warm water permanent fish life, immersion recreation, limited contact recreation, and fish and wildlife propagation and stock watering." It is 105.77 acres in size with a maximum depth of about 26 feet and an average depth of about 11 feet. The N:P ratio is about 3:1, indicating that this lake is probably nitrogen limited. For the 2010 listing cycle this lake has been delisted for TSI.

The average chlorophyll-a value was 32.7 µg/L (n=24) and 33% of samples exceeded the 30 µg/L threshold. The average secchi depth was 1.26 meters. Total phosphorus averaged 560 µg/L (n=18) and total nitrogen averaged 1640 µg/L (n=19). All thresholds except secchi depth were exceeded and fish survey information indicated possible enrichment issues. Specifically, the most recent fish survey (SDGFP, 2007d) noted that the water was turbid and, while bass and crappie numbers were good, there were high numbers of black bullhead.

Finding: Impaired

Lake Campbell (Missouri Basin)

Lake Campbell is classified as "warm water semi-permanent fish life, immersion recreation, limited contact recreation, and fish and wildlife propagation and stock watering." It is 45.45 acres in size with a maximum depth of about 17 feet and an average depth of about 7 feet. The N:P ratio is about 3:1, indicating that this lake is probably nitrogen limited. For the 2010 listing cycle this lake has been delisted for TSI, but listed as impaired for pH.

The average chlorophyll-a value was 30.3 µg/L (n=34) and 35% of samples exceeded the 30 µg/L threshold. The average secchi depth was 1.75 meters. Total phosphorus averaged 748 µg/L (n=36) and total nitrogen averaged 2180 µg/L (n=40). All the thresholds except for secchi depth were exceeded for Lake Campbell.

Finding: Impaired

Cottonwood Lake (Missouri Basin)

Cottonwood Lake is classified as "warm water semi-permanent fish life, immersion recreation, limited contact recreation, and fish and wildlife propagation and stock watering." It is 450.1 acres in size with a maximum depth of about 13 feet and an average depth of about 9 feet. The N:P ratio is about 10:1, indicating that this lake is probably nitrogen limited. For the 2010 listing cycle this lake has been delisted for TSI.

The average chlorophyll-a value was 34.9 µg/L (n=19) and 42 of samples exceeded the 30 µg/L threshold. The average secchi depth was 0.79 meters. Total phosphorus averaged 249 µg/L (n=18) and total nitrogen averaged 2570 µg/L (n=17). All the thresholds except for secchi depth were exceeded for Cottonwood Lake.

Finding: Impaired

Lake Pocasse (Missouri Basin)

Lake Pocasse is classified as "warm water permanent fish life, immersion recreation, limited contact recreation, and fish and wildlife propagation and stock watering." It is 1457.23 acres in size with a maximum depth of about 13 feet. Average depth is unknown. The N:P ratio is about 4:1, indicating that this lake is probably nitrogen limited. For the 2010 listing cycle this lake has been delisted for TSI, but was listed for *E. coli*.

The average chlorophyll-a value was 60.2 µg/L (n=26) and 54% of samples exceeded the 30 µg/L threshold. The average secchi depth was 0.84 meters. Total phosphorus averaged 977 µg/L (n=8) and total nitrogen averaged 3710 µg/L (n=29). All the thresholds except for secchi depth were exceeded for Lake Pocasse.

Finding: Impaired

Rahn Lake (Niobara Basin)

Rahn Lake is classified as "warm water permanent fish life, immersion recreation, limited contact recreation, and fish and wildlife propagation and stock watering." It is 19.11 acres in size with a maximum depth of about 14 feet and an average depth of about 6 feet. The N:P ratio is about 10:1, indicating that this lake is probably nitrogen limited. For the 2010 listing cycle this lake has been delisted for TSI.

The average chlorophyll-a value was 46.9 µg/L (n=12) and 83 % of samples exceeded the 30 µg/L threshold. The average secchi depth was 1.02 meters. Total phosphorus averaged 251 µg/L (n=23) and total nitrogen averaged 2270 µg/L (n=23). All the thresholds except for secchi depth were exceeded for Rahn Lake.

Finding: Impaired

Lake Traverse (Red Basin)

Lake Traverse is classified as "warm water permanent fish life, immersion recreation, irrigation, limited contact recreation, and fish and wildlife propagation and stock watering." It is 13,114.8 acres in size with a maximum depth of about 12 feet. The average depth is unknown. The N:P ratio is about 10:1, indicating that this lake is probably nitrogen limited. For the 2010 listing cycle this lake has been delisted for TSI.

The average chlorophyll-a value was 29.0 µg/L (n=33) and 24% of samples exceeded the 30 µg/L threshold. The average secchi depth was 1.21 meters. Total phosphorus averaged 174 µg/L (n=41) and total nitrogen averaged 1680 µg/L (n=41). Only the nutrient concentration thresholds were exceeded for Lake Traverse and since the chlorophyll metrics were not exceeded this lake is not considered impaired at this time.

Finding: Not Impaired

East Vermillion Lake (Vermillion Basin)

East Vermillion Lake is classified as "warm water permanent fish life, immersion recreation, limited contact recreation, and fish and wildlife propagation and stock watering." It is 577.71 acres in size with a maximum depth of at about 23 feet and an average depth of about 12 feet. The N:P ratio is about 4:1, indicating that this lake is probably nitrogen limited. For the 2010 listing cycle this lake has been delisted for TSI.

The average chlorophyll-a value was 51.9 µg/L (n=31) and 32% of samples exceeded the 30 µg/L threshold. The average secchi depth was 1.02 meters. Total phosphorus averaged 433 µg/L (n=42) and total nitrogen averaged 1730 µg/L (n=42). Both of the chlorophyll-a thresholds and nutrient concentration thresholds were exceeded for East Vermillion Lake and fish survey information indicated possible enrichment. Specifically, the latest fish Survey (SDGFP, 2008e)

found fish catch samples dominated by black bullhead and walleye was "surprisingly low". Black bullhead was actually below the management standard of <100 but it was noted that this was for only the third time since 1990.

Finding: Impaired

The process used by EPA in this analysis is not the only possible way to determine risk to lakes and SDDENR is encouraged to develop its own method to address these issues before the 2012 303(d) list is due. Nevertheless, using criteria from a number of states and eutrophication studies, EPA has determined that, for the 2010 cycle, 12 lakes are impaired for South Dakota's narrative standards prohibiting eutrophication. Based on EPA's review and evaluation, we are disapproving the following waters and adding them to South Dakota's 2010 Section 303(d) list: Waggoner Lake, Bierman Dam, Lake Carthage, Lake Isabel, Twin Lakes (Sanborn County), Wilmarth Lake, Rahn Lake, Cottonwood Lake (Sully County), East Vermillion Lake, Bullhead Lake (Deuel County), Lake Campbell (Campbell County), and Lake Pocasse.

D. Priority Ranking and Schedule for Development of TMDLS for Listed Waters and Pollutants

Pursuant to the listing methodology set out in the State's submittal, South Dakota prioritized water quality limited segments for TMDL development according to the severity of the impairment and the designated uses of the segment, taking into account the most serious water quality problems, most valuable and threatened resources, and risk to human health and aquatic life. South Dakota's TMDL prioritization strategy is fully described on pages 16-17 of the Integrated Report.

EPA reviewed the State's priority ranking of listed waters for TMDL development, and concluded that the State properly took into account the severity of pollution and the uses to be made of such waters, as well as other relevant factors such as imminent human health problems or local support for water quality improvement. In addition, EPA reviewed the State's list of WQLS targeted for TMDL development in the next two years, and concluded that the targeted waters are appropriate for TMDL development in this time frame.

IV. Final Recommendation on South Dakota's 2010 Section 303(d) List Submittal

After careful review of South Dakota's final Section 303(d) list submittal package, EPA has determined that South Dakota's 2010 Section 303(d) list partially meets the requirements of Section 303(d) of the Clean Water Act (CWA) and EPA's implementing regulations. EPA partially approves/partially disapproves South Dakota's 2010 Section 303(d) list.

V. References

The following list includes documents that were used directly or indirectly as a basis for EPA's review and approval of the State's Section 303(d) waterbody list. This list is not meant to be an exhaustive list of all records, but to provide the primary documents the Region relied upon in making its decisions to approve the State's list.

Correspondence/Guidance Documents

40 C.F.R. Part 130 Water Quality Planning and Management

40 C.F.R. Part 131 Water Quality Standards

July 29, 2005 memorandum from Diane Regas, Director, Office of Wetlands, Oceans, and Watersheds, US EPA to Water Division Directors transmitting EPA's "Guidance for 2006 Assessment, Listing and Reporting Requirements Pursuant to Sections 303(d), 305(b) and 314 of the Clean Water Act."

October 12, 2006 Memorandum from Diane Regas, Director, Office of Oceans, Wetlands, and Watersheds entitled *Information Concerning 2008 Clean Water Act Sections 303(d), 305(b), and 314 Integrated Reporting and Listing Decisions.*

May 15, 2007 letter from Humberto Garcia, Director, Ecosystems Protection Program, EPA Region VIII to Tim Tollefsrud, Division Director, Environmental Services, South Dakota Department of Environment and Natural Resources regarding 2010 Cycle Integrated Reports.

May 5, 2009 Memorandum from Suzanne Schwartz, Acting Director, Office of Wetlands, Oceans, and Watersheds, entitled *Information Concerning 2010 Clean Water Act Sections 303(d), 305(b), and 314 Integrated Reporting and Listing Decisions.*

April 1991, "Guidance for Water Quality-Based Decisions: The TMDL Process," EPA 440/4-91-001.

July 24, 1992 Federal Register Notice, *40 C.F.R. Parts 122, 123, 130, Revision of Regulation*, 57 FR 33040.

August 8, 1997 Memorandum from Robert Perciasepe, Assistant Administrator for Water, US EPA, regarding "New Policies for Establishing and Implementing TMDLs."

September, 1997 Guidance from Office of Water, Headquarters, US EPA regarding "Guidelines for Preparation of the Comprehensive State Water Quality Assessments (305(b) Reports) and Electronic Updates" Supplement, EPA-841-B-97-002B.

November 5, 1997 Memorandum from Tudor Davies, Director, Office of Science and Technology to Water Management Division Directors entitled "Establishing Site Specific Aquatic Life Criteria Equal to Natural Background."

August 23, 1999. Federal Register Notice. *Proposed Revisions to the Water Quality Management and Planning Regulations,* 64 FR 46012.

April 27, 2000 Federal Register Notice, *EPA Review and Approval of State and Tribal Water Quality Standards*, 65 FR 24641

January 26, 2010 notice from Shannon Minerich, Environmental Program Scientist, South Dakota Department of Environment and Natural Resources announcing the availability of South Dakota's 2010 Draft Integrated Report for public comment.

March 1, 2010 letter from Thomas Johnson, Environmental Scientist, Office of Ecosystems Protection and Remediation, Ecosystems Protection Program, US EPA Region VIII, to Shannon Minerich, Environmental Program Scientist, South Dakota Department of Environment and Natural Resources.

South Dakota Department of Environment and Natural Resources response regarding EPA's comments on South Dakota's 2010 draft Integrated Report (included in the final Integrated Report).

Technical References

Colorado Department of Public Health and Environment. 2009. Draft Nutrient Criteria for lakes, Status/Update. August 19, 2009.

Glass, P. W. 2006. Development of Use-based Chlorophyll Criteria for Recreational Uses of Reservoirs. Water Environment Federation.

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Nurnberg, G. K. 1996. Trophic State of Clear and Colored, Soft- and Hardwater Lakes with Special Consideration of Nutrients, Anoxia, Phytoplankton and Fish. Lake and Reservoir Management. Vol. 12, Issue 4, pp. 432-447. December 1996.

Oklahoma Water Resources Board. 2005. Justification for Chlorophyll-a Criteria to Protect the Public and Private Water Supply Beneficial Use of Sensitive Water Supplies. Water Quality Programs Division. October 21, 2005.

Schupp, D. 1992. An ecological classification of Minnesota lakes with associated fish communities. Section of Fisheries Investigational Report No. 417. MN Department of Natural Resources. St. Paul MN.

South Dakota Game Fish and Parks Department. 2006. Statewide Fisheries Survey. South Red Iron Lake.

South Dakota Game Fish and Parks Department. 2007a. Statewide Fisheries Survey. Curlew Lake.

South Dakota Game Fish and Parks Department. 2007b. Statewide Fisheries Survey. New Wall Lake.

South Dakota Game Fish and Parks Department. 2007c. Statewide Fisheries Survey. Lake Carthage.

South Dakota Game Fish and Parks Department. 2007d. Statewide Fisheries Survey. Wilmarth Lake.

South Dakota Game Fish and Parks Department. 2008a. Statewide Fisheries Survey. Waggoner Lake.

South Dakota Game Fish and Parks Department. 2008b. Statewide Fisheries Survey. Bullhead Lake.

South Dakota Game Fish and Parks Department. 2008c. Statewide Fisheries Survey. Roy Lake.

South Dakota Game Fish and Parks Department. 2008d. Statewide Fisheries Survey. Twin Lakes (Sanborn County).

South Dakota Game Fish and Parks Department. 2008e. Statewide Fisheries Survey. East Vermillion Lake.

Texas Commission on Environmental Quality. 2009. Draft 2010 Guidance for Assessing and Reporting Surface Water Quality in Texas. Surface Water Quality Monitoring Program. June, 9, 2009.

US Environmental Protection Agency, Region 7. Draft 2010. Nutrient Reference Condition Identification and Ambient Water Quality Benchmark Development Process. Draft Report. 37 pp. USEPA Region 7, Kansas City, KS.

US Environmental Protection Agency. 2000. Ambient Water Quality Criteria Recommendations, Information Supporting the Development of State and Tribal Nutrient Criteria, Lakes and Reservoirs in Nutrient Ecoregion VI, EPA 822-B-00-008.

US Environmental Protection Agency. 2001a. Ambient Water Quality Criteria Recommendations, Information Supporting the Development of State and Tribal Nutrient Criteria, Lakes and Reservoirs in Nutrient Ecoregion IV, EPA 822-B-01-009.

US Environmental Protection Agency. 2001b. Ambient Water Quality Criteria Recommendations, Information Supporting the Development of State and Tribal Nutrient Criteria, Lakes and Reservoirs in Nutrient Ecoregion V, EPA 822-B-01-010.

US Environmental Protection Agency. 2009. National Lakes Assessment. A Collaborative Survey of the Nation's Lakes. Draft. Washington, DC. 101 pp.

Walker, W.W., Jr. 1984. Statistical bases for mean chlorophyll-a criteria. Lake and Reservoir Management. 2:57-62.

Walmsley, R.D. 1984. A chlorophyll-a trophic status classification system for South African impoundments. J. Environ. Qual. 13:97-104.

World Health Organization. 1999. Toxic Cyanobacteria in Water: A guide to their public health consequences, monitoring and management. Ingrid Chorus and Jamie Bartram, Eds. 400 pp.