2022 Addendum to the South Dakota Mercury TMDL

1.0 Introduction

The South Dakota Department of Agriculture and Natural Resources (SDDANR) adopted the Statewide Mercury total maximum daily load (TMDL) that included 70 Assessment Units (AUs) in 2016. The original TMDL was formally approved by the United States Environmental Protection Agency (EPA) in March 2016. That year in August, an additional five AUs were added to the impairment list via EPA approval of the 2016 Mercury Addendum. The SDDANR formally seeks coverage for four more AUs under the original Mercury TMDL in accordance with Section 303(d) of the Clean Water Act (CWA). With the addition of five AUs from the 2016 Addendum and four AUs from the current addition, 79 AUs are to be covered under the original Mercury TMDL. This addendum document does not modify any aspect of the 2016 South Dakota Mercury TMDL document, and the allocations and TMDL remain as presented in the original TMDL:

Annual Statewide Mercury TMDL Calculation

TMDL (595.32 kg/yr) = WLA (4.84 Kg/yr) + LA (590.48 Kg/yr) + MOS (implicit)

Refer to Section 10.0 of the original TMDL for more information on how the SDDANR calculated the annual and daily load (3.21 Kg/day). This addendum includes information specific to four AUs in South Dakota that were identified as impaired on the 2022 section of the 303(d) list within the Integrated Report (2022). Figure 1 shows the location of the waterbodies. Fish tissue samples collected from these four AUs exhibited methylmercury concentrations exceeding the 0.3 mg/Kg human health criteria identified in the Administrative Rules of South Dakota (ARSD) Chapter 74:51:01 Appendix B. Please note that any reference to "mercury in fish or mercury in fish tissue" in this addendum refers to the organic form of mercury known as methylmercury. Table 1 identifies the four AUs in addition to the acreage of the waterbodies.

For a waterbody to be determined as impaired for mercury in fish tissue for lakes and streams, a minimum of 10 fish tissue samples are required for assessment. With at least three fish tissue samples per species available. No minimum number of sampling events are required and all available data from October 2011- September 2021 was used. The composite mean result of each fish species will be compared to Water Quality Standards (WQS). If any species mean composite result exceeds the WQS it will be considered non-supporting, or if a fish consumption advisory has been advised.

Refer to the original, approved TMDL document for details related to the overall methods and assumptions used in establishing the South Dakota Statewide Mercury TMDL. For coverage under the Statewide Mercury TMDL, a waterbody must meet the following conditions:

i. It falls entirely within state jurisdiction,
ii. If jurisdiction is shared, it may only apply to those portions of the water under South Dakota jurisdiction,
iii. The standard-length fish (SLF) tissue methylmercury concentration from the water does not exceed 0.878 mg/Kg,
iv. There are no potential impacts from current or historic gold mining processes,
v. If it is a river or stream, NPDES discharges do not exceed permitted limits,
vi. The TMDL will meet the water quality in the proposed water, and
vii. The original TMDL assumptions (e.g., source contributions, loading capacity, etc.) are still valid.

The third condition expresses a fish flesh methylmercury cap of 0.878 mg/Kg. This was the maximum concentration observed from a SLF in the original TMDL (2016). As a direct result, any waterbody with a fish flesh concentration exceeding this benchmark is void from coverage under the Statewide Mercury TMDL and will need to be addressed under a waterbody specific TMDL.

This addendum demonstrates that all four waterbodies shown in Table 1 satisfy each of the conditions described above, and in doing so, fall under the coverage of the original South Dakota Mercury TMDL.

Table 1. Proposed waterbodies to be added to the South Dakota Mercury TMDL

Assessment Unit ID	Common Name	Acres/ Miles in EPA ADP
SD-MI-L-POTTS_01	Pott's Lake*	47.1
SD-JA-L-STINK_01	Stink Lake	788.6
SD-CH-L-DURKEE_01	Durkee Lake*	152.3
SD-GR-L-EAST_LEMMON_01	East Lemmon Lake*	166.9
* Indicates Walleye fishery not supported in waterbody		

2.0 Jurisdiction

These four lakes are within jurisdiction of the State of South Dakota. Figure 1 shows the locations of the tribal reservations with respect to the waterbodies listed in this Addendum. The jurisdictional location of these waterbodies allows the state of South Dakota to manage them for the benefit of the public and provides the necessary authority needed for restoring them to full attainment of all their designated beneficial uses.

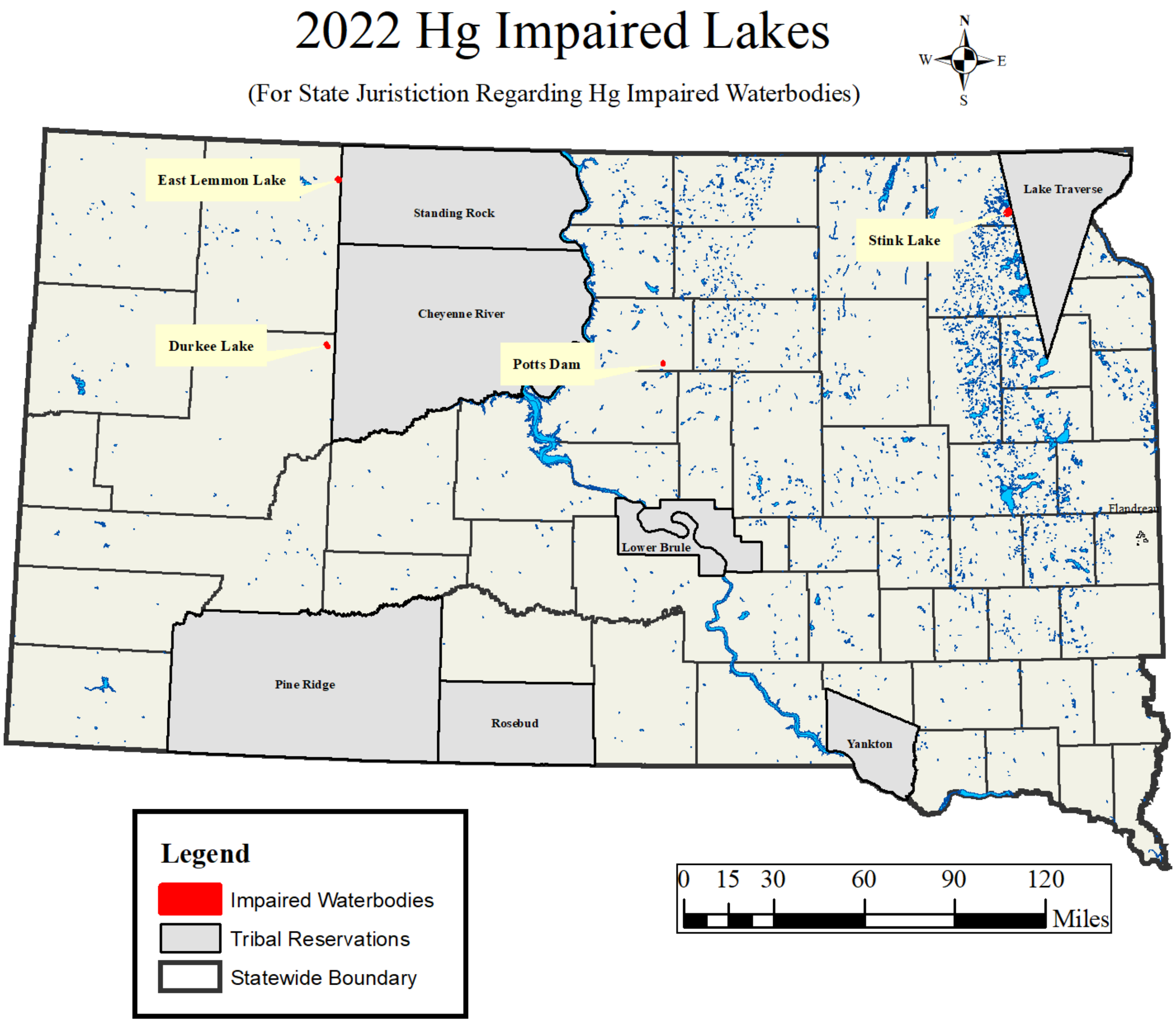

Figure 1. Locations of Four SD Waterbodies with Mercury in Fish Tissue Impairments Addressed in this Addendum

3.0 Comparable Existing Conditions

To determine the applicability of the South Dakota Mercury TMDL for additional waterbodies, including the four presented in this addendum, a review of existing conditions must be completed. This review discusses fisheries, water quality data, loadings analysis, and potential sources, both point and nonpoint, that were similarly discussed as part of the original TMDL.

3.1 Fishery

Figures 2 through 13 present the distribution of mercury concentration data observed in fish species sampled from each of the four waterbodies included in this addendum. Appendix A contains the lake name, fish species, and length of those observations of methylmercury concentration from each of the four waterbodies that exceeded the SD water quality and EPA human health standard of 0.3 mg/Kg (ARSD Chapter 74:51:01 Appendix B). Appendix B demonstrates individual fish data from all AUs used in the initial impairment assessment. Both appendices are located at the end of the document.

The components of section three compare the mercury concentrations of fish tissues collected from these four addendum waterbodies to datasets used in the original TMDL. If this evaluation demonstrates comparable concentrations, SDDANR expects to satisfy the third and sixth conditions listed above in the introduction. Stated more simply, if the fish populations in these four lakes do not exhibit notably higher concentrations of mercury, the load reductions outlined in the original TMDL will lead to WQS attainment in the four addendum waters.

Direct comparisons, however, were complicated due to the varying fish species available for sampling in each lake. The original South Dakota Mercury TMDL used Walleye *(Sander vitreus*) to derive TMDL reduction targets, but not every waterbody in the state supports a Walleye population. Walleye were used as the primary target species in the TMDL as they frequently exhibited higher mercury concentrations than similarly aged fish from other species and are the most popular fish for the angling public in South Dakota. In this addendum, Stink Lake was the only waterbody supporting a Walleye population so surrogate species were used for the remaining three lakes (Potts Dam, Durkee Lake, and East Lemmon Lake). Each lake specific data set, regardless of species, was compared to the statewide datasets used in the original TMDL to ensure the observed concentrations did not exceed 0.878 mg/Kg, i.e. the third TMDL condition. These statewide datasets included other piscivorous species as well as the Walleye data used to develop the SLF. For this addendum, in absence of a Walleye fishery, other pelagic predators such as Largemouth Bass (*Micropterus salmoides*) and Northern Pike (*Esox lucius)* were available for use as the surrogates.

3.1 Potts Dam

Potts Dam is located in southern Potter County. The reservoir is a 52-acres and managed by SD Game, Fish, and Parks (SDGFP) and was first placed on the Section 303(d) waterbody list for mercury in fish impairment in 2020. The Potts Dam (mercury in fish tissue) impairment was listed as a high priority for TMDL development in the 2022 South Dakota 303(d) List. As part of the 2018 fishery survey fish were collected for tissue analysis, SDGFP biologists reported four main species of fish present in the lake. These species included Largemouth Bass, Bluegill (*Lepomis macrochirus*), Black Bullhead (*Ameiurus melas*), and Yellow Perch (*Perca flavescens)* (SDGFP, 2018). Biologists only collected tissue from Largemouth Bass, Bluegill, and Yellow Perch. Figure 2 shows the mercury levels found in each species. Of the 54 samples collected from Potts Dam, 23 exceeded the mercury threshold. The 95th percentile from the entire Potts Dam dataset (n=54) was 0.49 mg/Kg with an average mercury concentration of 0.30 mg/Kg.

Table 2. Potts Dam Species Specific Mercury in Fish Tissue Results

Species for Potts Dam	Reporting Period	# of individuals	95th percentile of Hg (mg/Kg)	Average Hg (mg/Kg)
Bluegill	2018	10	0.31	0.25
Largemouth Bass	2018	34	0.49	0.34
Yellow Perch	2018	10	0.35	0.23
All Species	2018	54	0.49	0.30
* Shading represents a non-supporting value that exceeds EPA's WQS composite mean of 0.3 mg/Kg of mercury in fish tissue.				

In the absence of Walleye, Largemouth Bass were designated as the surrogate species for Potts Dam. Figure 2 shows Largemouth Bass as the species most susceptible to increased concentrations for methylmercury with 18 out of the 34 tissue samples exceeding the threshold.

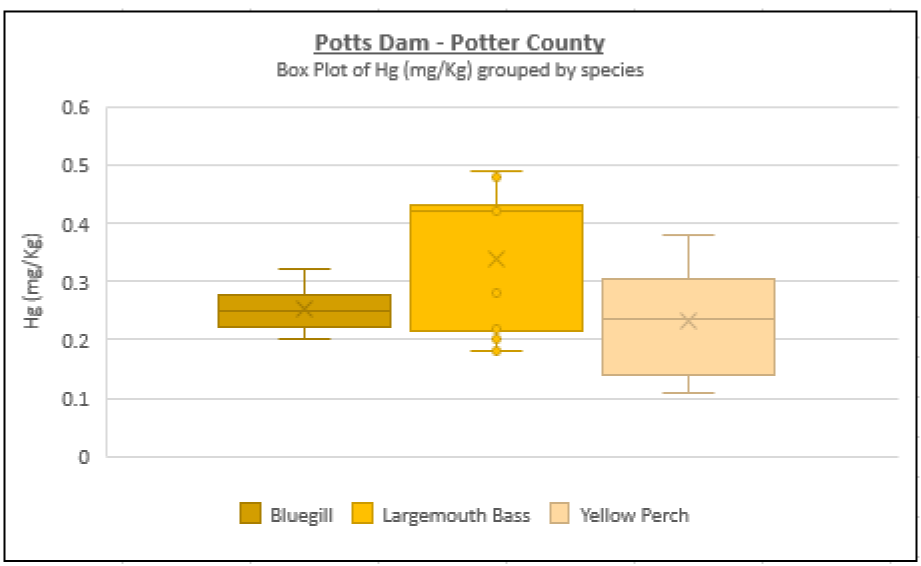

Figure 2. Potts Dam Mercury Concentration by Species

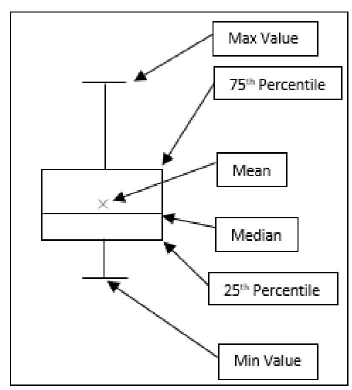

Figure 3. Box and Whisker Explanation

The 95th percentile concentration from the specific Largemouth Bass methylmercury data was 0.49 mg/Kg and the average was 0.34 mg/Kg (Table 2).

Fish tissue mercury levels from Potts Dam were also compared to the statewide Largemouth and Walleye datasets used in the original TMDL (Figures 4 and 5). The Largemouth Bass collected from Potts Dam exhibited a slightly lower mercury average concentration when compared to the statewide Largemouth Bass data. However, the range fell completely within the 25-75th percentile of both statewide Largemouth Bass and Walley data distributions (Figure 4)

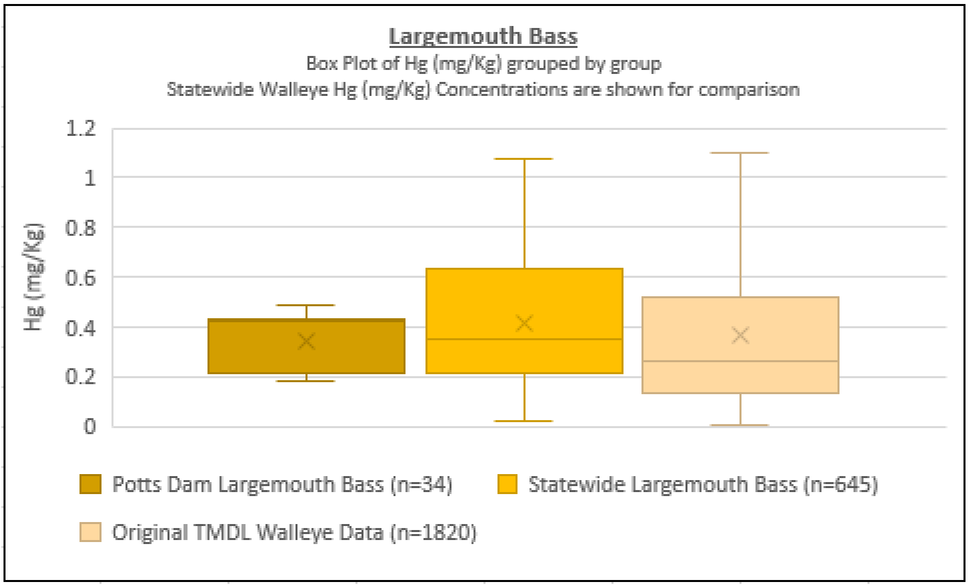

Figure 4. Mercury Concentrations in Largemouth Bass

Figure 5 shows the mercury concentrations in fish tissue plotted against Largemouth Bass length from Potts Dam and statewide data sets. There is a significant relationship between length of fish

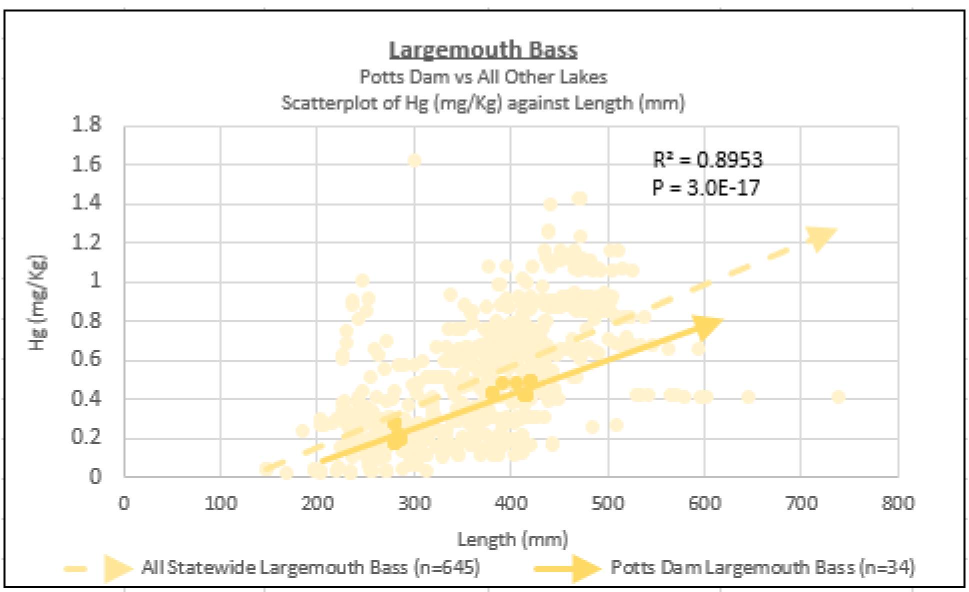

Figure 5. Methylmercury Accumulation Comparison for Largemouth Bass

and methylmercury concentration for the population in Potts Dam (r^2=0.90, $p<0.05$) similar to the statewide data. However, the regression lines indicate a slightly lower bioaccumulation rate from Potts Dam when compared to the statewide dataset as fish age. These statistical results indicate a lower rate of atmospheric mercury (Hg(II)) to methylmercury (CH_3Hg) conversion due to lake specific conditions.

3.2 Durkee Lake

Durkee Lake is 152.3 acre western SD impoundment located in northeastern Meade County three miles south of Faith, SD (Figure 1). The lake's first appearance in Section 303(d) list for mercury in fish tissue occurred during the 2020 IR cycle and was considered high priority. Durkee Lake is one of the three waterbodies in this addendum that does not support a Walleye population. In 2018 tissue samples from three fish species were collected including Northern Pike, Black Crappie (*Pomoxis nigromaculatus*), and Black Bullhead (SDGFP, 2018). The results can be found in Table 3 and are visually summarized in the box and whisker plot in Figure 6.

A total of 38 fish were observed for this waterbody. The 95th percentile of all species was 0.46 mg/Kg with and average methylmercury level of 0.27 mg/Kg. Of the 38 fish sampled, eight Northern Pike (21.1%) and two Black Crappie (5.0%) exceeded the SD water quality and EPA's consumption advisory standard.

Table 3. Durkee Lake Species Specific Mercury in Fish Tissue Results

Species for Durkee Lake	Reporting period	# of individuals	95th percentile of Hg (mg/Kg)	Average Hg (mg/Kg)
Black Bullhead	2018	15	0.26	0.21
Black Crappie	2018	15	0.30	0.23
Northern Pike	2018	8	0.54	0.43
All Species	2018	38	0.46	0.27
* Shading represents a non-supporting value that exceeds EPA's WQS composite mean of 0.3 mg/Kg of mercury in fish tissue.				

Northern Pike were used as the surrogate species because they are an apex predator similar to Walleye. Black Crappie and Black Bullhead are a mid-trophic level predator and lower trophic level omnivore. As a result, both species exhibit a lower rate of biomagnification of methylmercury. Black Bullheads are opportunistic feeders with a diet consisting of macroinvertebrates and other food types that are at or near the base of the food chain (Leunda, et al., 2008).

Figures 6 and 7 show the distribution of mercury concentrations by species and the comparison of the Northern Pike levels to statewide data. Both figures indicate an impairment of mercury in fish tissue for Durkee Lake. Figure 7 shows the range of Northern Pike data which fell completely within the 25-75th percentile of the statewide Northern Pike and the original TMDL Walleye data. Durkee Lake exhibited a similar mean with the overall methylmercury levels remaining below the TMDL criteria maximum of 0.878 mg/Kg.

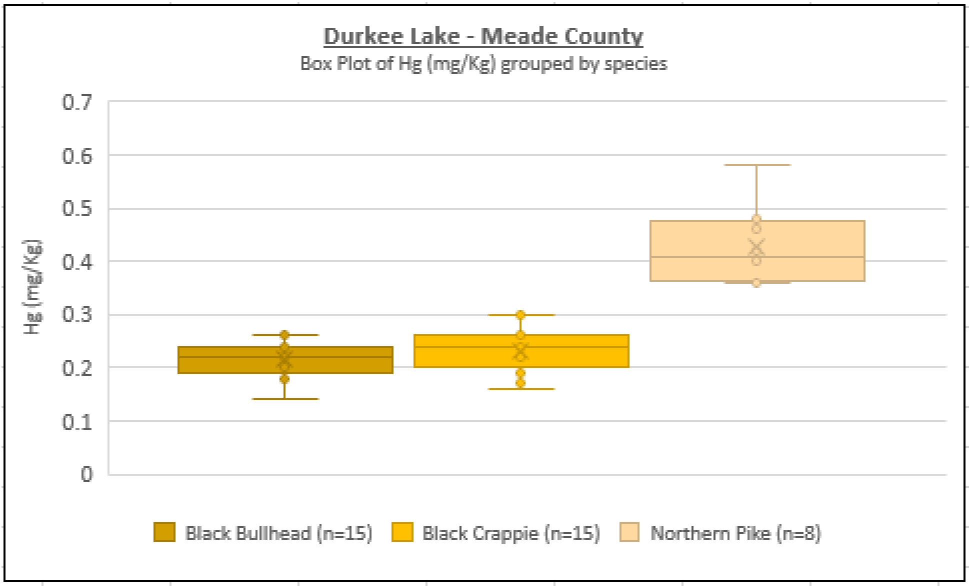

Figure 6. Durkee Lake Mercury Concentrations by Species

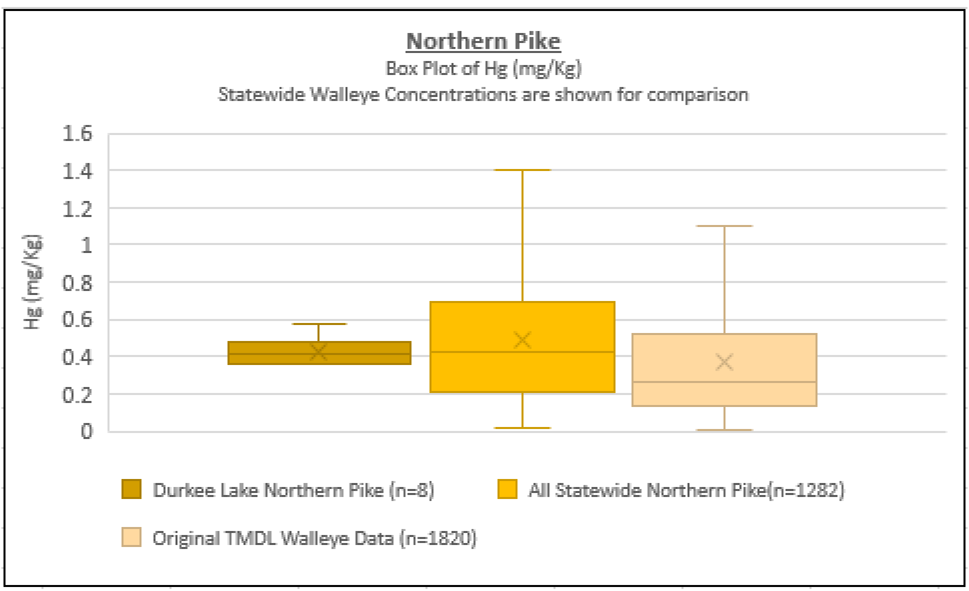

Figure 7. Mercury Concentrations in Northern Pike (Durkee Lake)

Northern Pike total length is plotted against methylmercury fish tissue concentration in Figure 8. No relationship between age and concentration was observed for Durkee Lake (r^2=0.03, p>0.05). The insignificance can be attributed to the small sample size of older Northern Pike (n=8) which were all of similar age (length class of 660-763 mm). This also explains the higher average of mercury (0.43 mg/Kg) exhibited by this dataset. The 2018 SDGFP Fishery Survey results for Durkee Lake reflects a Northern Pike population dominated by the 533 to 711mm (21-28 inch) length class.

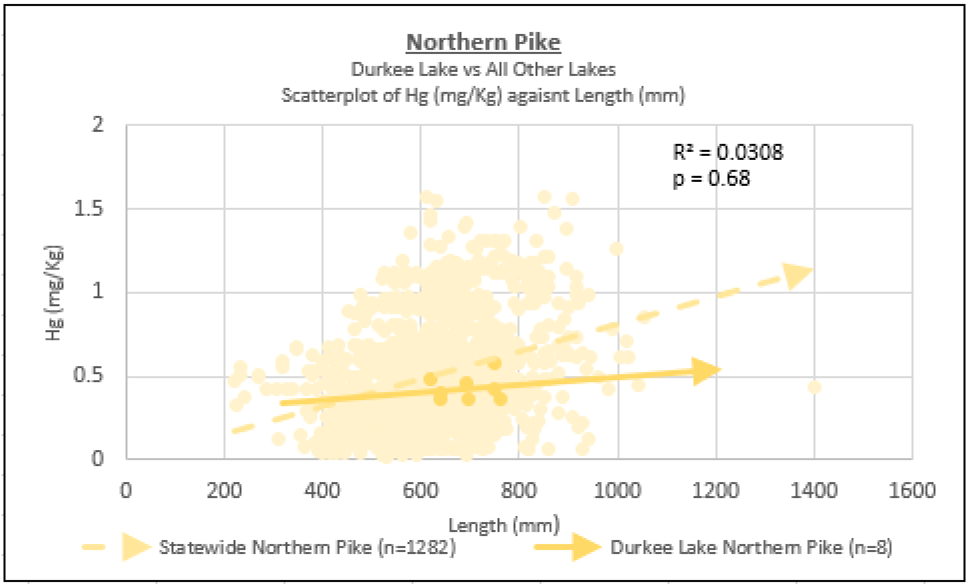

Figure 8. Methylmercury Accumulation Comparison for Northern Pike

3.3 East Lemmon Lake

East Lemmon is a 169-acre lake in Perkins County and managed by the South Dakota GFP. This waterbody is located 10.5 miles east of Shadehill, SD in Northwestern SD. East Lemmon was placed on the Section 303(d) list for a mercury in fish impairment during the 2018 IR cycle and was listed as high priority.

During the 2017 field season 20 individual specimens representing two fish species (10 Northern Pike and 10 Black Bullhead) were collected from the lake for mercury analysis (SDGFP, 2017). The mean mercury content of all the fish tissue samples collected from East Lemmon Lake resulted in 0.19 mg/Kg with a 95th percentile value of 0.50 mg/Kg. Mercury levels from East Lemmon Lake Black Bullhead and Northern Pike are shown in Figure 9. As stated in the previous fishery reviews, a significant difference in species specific bioaccumulation rate is clearly shown between species in East Lemmon Lake. The appropriate surrogate species for this lake is Northern Pike due it being the lakes apex predator and its similarity to Walleye. Of the 10 Northern Pike samples, five exceeded the SD WQC and EPA human health criteria of 0.3 mg/Kg of mercury in fish tissue. Northern Pike resulted in a 95th percentile of 0.53 mg/Kg and an average of 0.32 mg/Kg of mercury in fish tissue (Table 4). Northern Pike also exhibited a wider range of mercury levels

(0.16-0.56 mg/Kg) in comparison to the Black Bullhead range of data which was significantly narrower (0.04-0.07 mg/Kg) and smaller.

Table 4. East Lemmon Lake Species Specific Mercury in Fish Tissue Results

Species for East Lemmon Lake	Reporting period	# of individuals	95th percentile of Hg (mg/Kg)	Average Hg (mg/Kg)
Black Bullhead	2017	10	0.07	0.06
Northern Pike	2017	10	0.53	0.32
All Species	2017	20	0.50	0.19
* Shading represents a non-supporting value that exceeds EPA's WQS composite mean of 0.3 mg/Kg of mercury in fish tissue.				

The Northern Pike from East Lemmon Lake were compared against both statewide Northern Pike data and the original TMDL Walleye data in Figure 10. East Lemmon Lake Northern Pike mercury levels mean was slightly lower than the original TMDL Walleye data still fell within the 25-75th percentile of that dataset. East Lemmon Lake's Northern Pike also had a slightly lower range of mercury levels than statewide Northern Pike levels.

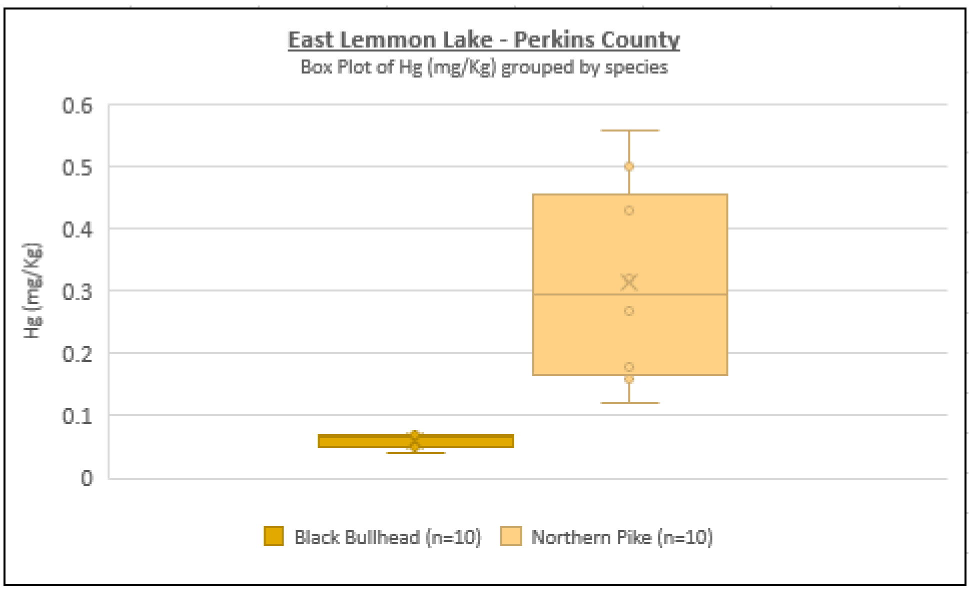

Figure 9. East Lemmon Mercury Concentrations by Species

Figure 11 shows Northern Pike total length was plotted against mercury concentration in fish tissue (meHg). The trendline from the East Lemmon's Northern Pike demonstrated a significant correlation (r^2=0.89, $p<0.05$). The Northern Pike from East Lemmon Lake increase via mercury concentration as fish grew in length. The rate of bioaccumulation signifies a slower positive relationship in comparison to the statewide data. The small number of Northern Pike sampled from East Lemmon could attribute to some of the disparity within the mercury methylation comparison (n=1,282 vs 10). For the statewide data, Northern Pike intersects the 0.3 mg/Kg threshold at a total length of approximately 425mm whereas the East Lemmon Pike cross the EPA's Water Quality Criteria (WQC) at around 800mm.

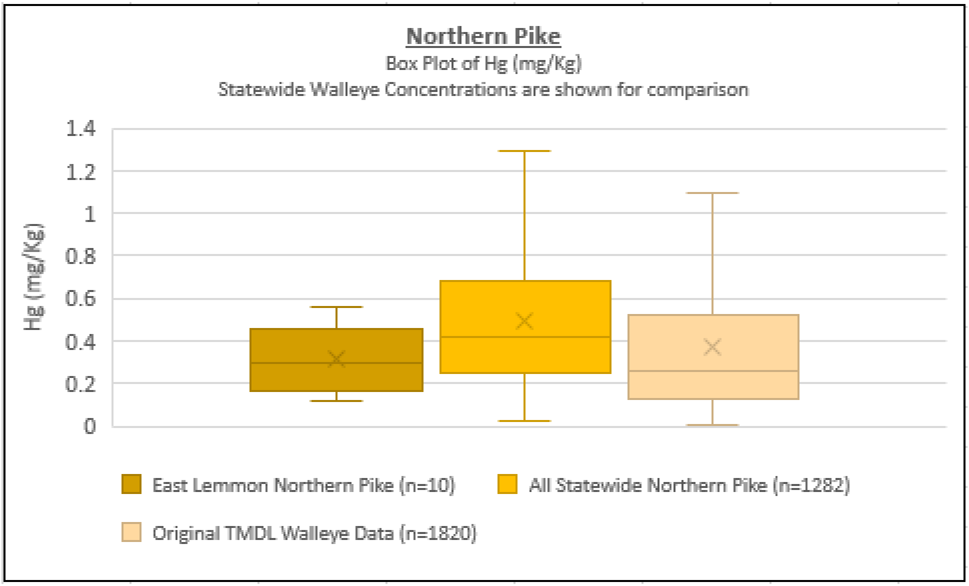

Figure 10. Mercury Concentrations in Northern Pike (East Lemmon Lake)

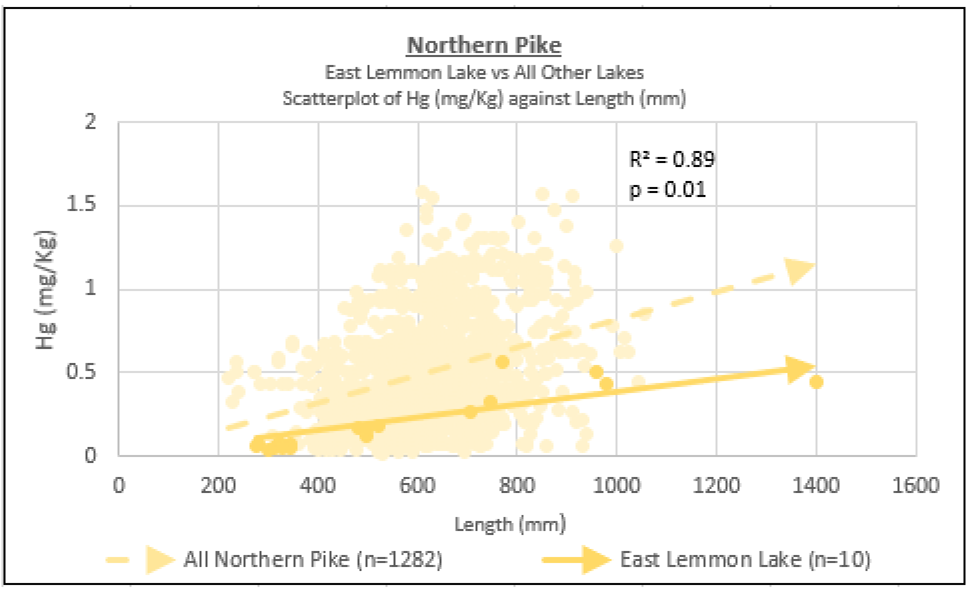

Figure 11. Methylmercury Accumulation Comparison for Northern Pike

3.4 Stink Lake

Stink Lake is a 788.6 acre lake located in Codington County that is managed as a Walleye and Yellow perch fishery (SDGFP, 2019). This waterbody is located nine miles NE of Henry, SD in Northeastern SD (Figure 1). In 2019, 10 Walleye and 10 Yellow perch were collected for mercury in fish tissue analysis. Of the 10 Walleye collected, three exceeded the threshold and the concentrations of these fish were 0.34, 0.44, and 0.74 mg/Kg. The 95th percentile of the mercury content in fish tissue for the entire Stink Lake data set measured 0.46 mg/Kg whereas the Walleye data exhibited a much higher 95th percentile concentration of 0.61 mg/Kg. The average walleye exceeded the designation threshold at 0.32 mg/kg of methylmercury within fish tissue (Table 5). Section 303(d) impaired waterbody list in the 2020 IR and listed Stink Lake as a high priority waterbody.

Table 5. Stink Lake Species Specific Mercury in Fish Tissue Results.

Species for Stink Lake	Reporting period	# of individuals	95th percentile mg/Kg	Average Hg (mg/Kg)
Walleye	2019	10	0.61	0.32
Yellow Perch	2019	10	0.15	0.10
All Species	2019	20	0.46	0.21
* Shading represents a non-supporting value that exceeds EPA's WQS composite mean of 0.3 mg/Kg of mercury in fish tissue.				

The box and whisker plot in Figure 12 shows Walleye and Perch data from Stink Lake and how it compares to the Walleye data from the original TMDL. Stink Lake Walleye data falls well within the 25th - 75th percentile range calculated in the original TMDL. Figure 13 displays the relationship between fish length and methylmercury tissue concentration for the Walleye collected from Stink Lake. In the original TMDL (Section 3.0), analysis on the statewide Walleye dataset indicated a standard length fish (Walleye) was 384 mm long. Using the equation derived from the Stink Lake data a SLF of 384 mm would have an estimated 0.25 mg/Kg of methylmercury. This meets the condition where a waterbody to be covered under the TMDL must exhibit a SLF concentration of less than 0.878 mg/Kg. It is important to note the regression results (length to meHg) for this waterbody showed relationship of (r^2=0.3, p>0.05) which is thought to be insignificant. Although, the trendline in Figure 13 visually implies a positive association exists. A larger sample size would likely strengthen this relationship similar to the SLF of the original TMDL. Additionally, the 95th percentile (0.61 mg/Kg) calculated from the 10 Walleye tissue samples fell well below the 0.878 mg/Kg threshold.

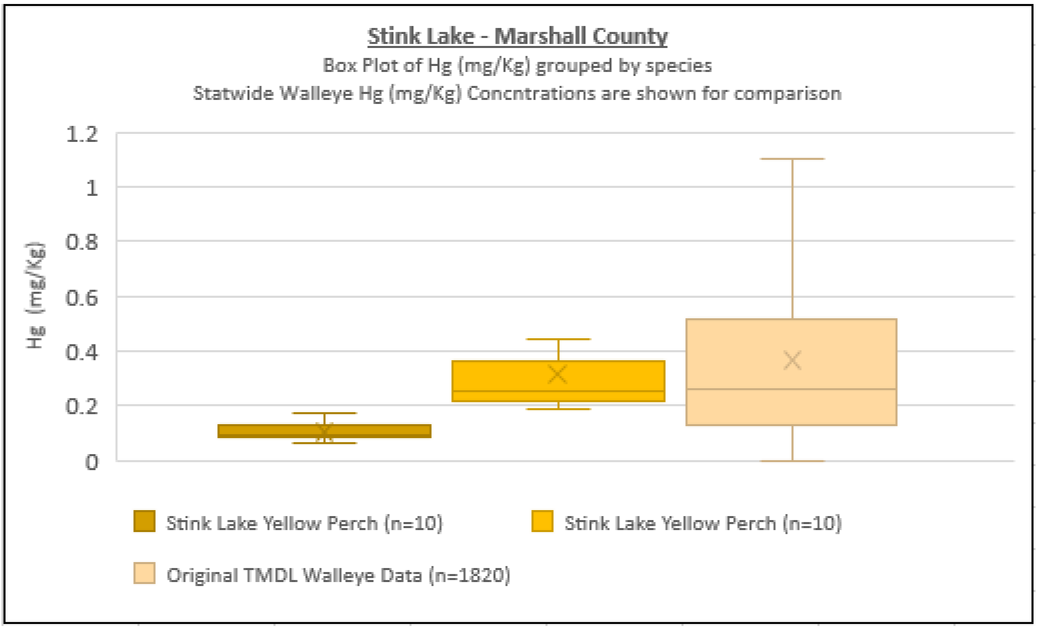

Figure 12. Stink Lake Mercury Concentration by Species

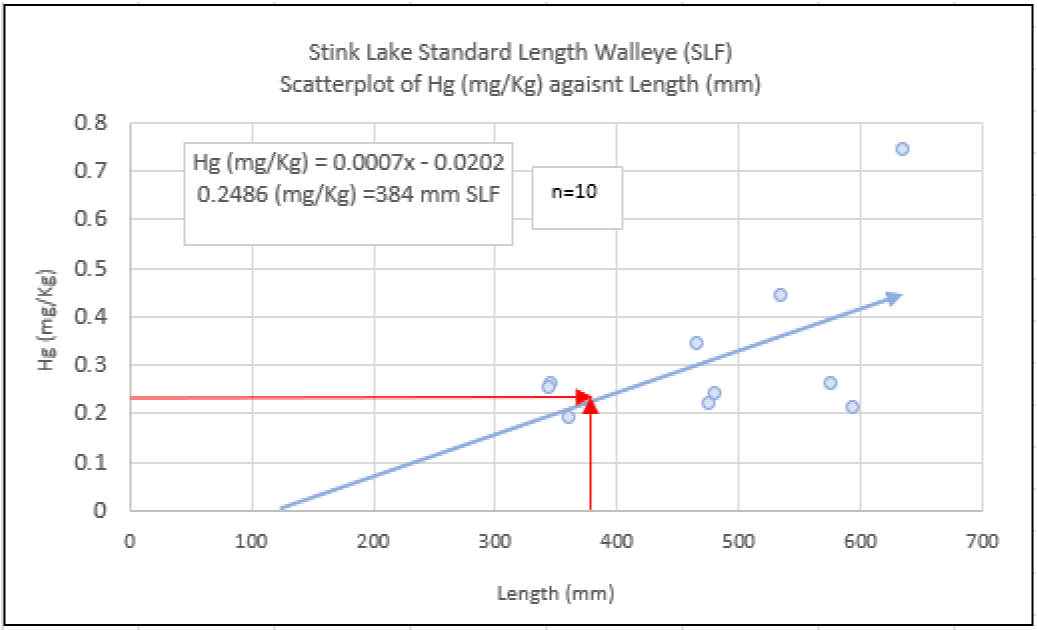

Figure 13. Stink Lake Mercury Concentrations vs Length (mm) of Walleye (n=10)

4.0 Source Assessment – Point Sources

Point sources of water pollution in the original TMDL are grouped as follows: Mining, Municipal Separate Storm Sewer Systems (MS4s), Traditional Point Sources, and National Pollutant Discharge Elimination System (NPDES) permitted facilities. Although the mercury in fish tissue impairments regarding the waterbodies listed in this 2022 addendum were not related to any specific point sources, a transparent assessment of these sources will demonstrate that each waterbody is meeting the necessary conditions for acceptance under the TMDL.

4.1 Mining

Mercury mining and the use of mercury for the extraction of gold are potential point sources of inorganic mercury. Although mercury mining ceased in the United States in 1992 and mercury amalgamation for the extraction of gold has been replaced by cyanide leaching (Wentz et al., 2014), deposits from these processes remain a localized concern in portions of the country. South Dakota has no record of mercury mining occurring within the state but has a history of gold mining in the Black Hills; where mining continues today. Because of its high volatility, any deposited mercury can readily be re-emitted to the atmosphere. The continual recycling of this large mass of mercury may partly be responsible for the high fluxes of mercury in many parts of North America, along with the high background levels of mercury in the global environment (Nriagu, 1994).

Mining has the potential to release mercury into the environment through two separate mechanisms. One way is leaching and direct runoff from tailing sites either from historic mine tailings or existing operations. The other mechanism through which mercury enters the environment is air emissions from gold mining releasing mercury during the ore extraction process (Obrist et al., 2018). SDDANR included these minor reductions in the air emissions reduction portion of the original TMDL. All the Black Hills' major mining sites have individual NPDES permits and are accounted for in Section 4.3 of the original TMDL. Mine tailings may contain elevated mercury concentrations; however, this does not always result in high fish tissue concentrations. A mercury source in union with the methylation process provides an entryway into the lower trophic levels. The transfer from prey to predator begins the biomagnification process reaching highest concentrations in terminal predators. Waters within and around the Black Hills region of South Dakota have the highest potential to be impacted by point source historic mining. These potential sources do not occur within the watersheds of the waterbodies listed in this addendum. The four lakes discussed are outside the sphere of influence from historical or present-day mining practices associated with the Black Hills region and therefore, do not pose any concern as mercury sources.

4.2 Municipal Storm Water Sewer Systems (MS4s)

The requirements of MS4 permits are to control anthropogenic loads in stormwater discharges. MS4's are considered a point source under the Clean Water Act and are typically included as a part of the point source waste load allocation (WLA) within the TMDL calculation. Factoring out atmospheric deposition, which is accounted for separately in the TMDL source assessment, and illicit discharges, which are already regulated, there should be no anthropogenic sources of mercury. Thus, the only source of mercury in MS4 loads is atmospheric deposition. The MS4 permit areas are included in the measured and modeled deposition results and are located in Table 24 (page 76) of the original TMDL. The MS4 permits included in the original TMDL, and their acreages are listed below in Table 6. The MS4s listed below have no impact on any of the four waterbodies listed in this addendum but are only included here to ensure that this potential source has been considered.

Table 6. MS4 permits, phase, and acreages in South Dakota (2016 TMDL)

MS4	Permit	Phase	Area (acres)	Km^2	Estimation Description
City of Sioux Falls	SDS0001	I	48429	196	Provided by permittee
City of Vermillion	SDR41A001	II	2410	10	The permittee provided the area within city limits, which is covered by the MS4
City of Pierre	SDR41A002	II	8340	34	Provided by permittee
City of Brookings	SDR41A003	II	7450	30	The area within Brookings, minus the SDSU campus, was provided by the permittee
Pennington County	SDR41A004	II	27320	111	Provided by permittee using GIS mapping
City of Mitchell	SDR41A005	II	7256	29	The area within Mitchell, minus Lake Mitchell, was provided by the permittee
City of Sturgis	SDR41A006	II	3100	13	The permittee provided the area within city limits, which is covered by the MS4
City of Rapid City	SDR41A007	II	35200	142	Provided by permittee
City of Aberdeen	SDR41A008	II	8960	36	Provided by permittee
SD DOT	SDR41A009	II	0	0	Already included
City of Watertown	SDR41A010	II	16596	67	Provided by permittee
City of North Sioux City	SDR41A011	II	1693	7	Provided by permittee
City of Huron	SDR41A012	II	6400	26	Provided by permittee
City of Yankton	SDR41A013	II	5278	21	Provided by permittee
City of Spearfish	SDR41A014	II	10250	41	Provided by permittee
Meade County	SDR41A015	II	3670	15	Provided by permittee

4.3 NPDES Permitted Sources

SD Administrative Rule 74:51:01:27 states that point sources discharging directly into lakes must meet WQS at the point of discharge and are not allowed a mixing zone. The original TMDL assumes that these point sources are being controlled under this regulation through NPDES permit requirements and are not causing localized WQS exceedances of mercury in lakes. Three of the four waterbodies listed in this addendum have no NPDES concerns. The city of Faith, SD has a Publicly Owned Treatment Works (POTW) permit to operate a sewage treatment plant upstream of Durkee Lake. The permit (SD0023345) is a no-discharge permit with a WLA of zero. The effect of this POTW or other existing NPDES permits as stated in the original TMDL, are too small to be of any consequence to the WLA. As stated in the original TMDL, the accepted level of mercury attributable to the state's non-stormwater point sources is 0.43% of the annual 595.32 mg/Kg of mercury load.

5.0 Source Assessment – Nonpoint Sources

Nonpoint Source mercury pollution in South Dakota consists of >99% of the mercury found in the state's waterbodies. The process is understood to be directly related to atmospheric sources. The data used for the load analysis in the original TMDL was obtained from a wet and dry mercury deposition study conducted by Dr. Stone at the South Dakota School of Mines and Technology (SDSM&T) in addition to existing data within the Mercury Deposition Network. It was determined in the original Statewide Mercury TMDL that the reductions would ultimately come from within the Nonpoint sources. It is important to note that the original Statewide Mercury TMDL stated that up to 30% of the emissions resulting in mercury consumption were from natural sources and could not be reduced. The remaining anthropogenic sources will need a 79% reduction to meet WQS obtainment.

6.0 Water Quality Standards

All waters (both lakes and streams) are assigned the beneficial use of fish and wildlife propagation, recreation, and stock watering. All streams are assigned the beneficial use of irrigation. The state assigns additional uses based on a beneficial use analysis of each water body. Each beneficial use has a set of WQC to protect those uses. The Administrative Rules of South Dakota (ARSD) contains the WQC in Chapter 74:51. South Dakota WQC specifically address mercury concentrations in the water column designed to handle human health and aquatic health. The more restrictive mercury concentrations are for human health. Table 7 shows the beneficial use classifications in South Dakota and the numeric criteria assigned to those uses. All criteria are reported in the total recoverable mercury or total methylmercury (for fish tissue) fraction.

Table 7. Beneficial Uses for Human and Aquatic Life Criteria

Use Classification	Use Description	Human Health		Aquatic Life	
		Water Column Hg	Fish Tissue CH3Hg+	Acute (CMC) Hg	Chronic (CCC) Hg
		µg/L	mg/Kg	µg/L	µg/L
(1)	Domestic water supply waters	0.050			
(2)	Coldwater permanent fish life propagation waters	0.051	0.3	1.4	0.77
(3)	Coldwater marginal fish life propagation waters	0.051	0.3	1.4	0.77
(4)	Warmwater permanent fish life propagation waters	0.051	0.3	1.4	0.77
(5)	Warmwater semipermanent fish life propagation waters	0.051	0.3	1.4	0.77
(6)	Warmwater marginal fish life propagation waters	0.051	0.3	1.4	0.77
(7)	Immersion recreation waters				
(8)	Limited contact recreation waters				
(9)	Fish and wildlife propagation, recreation, and stock watering waters	0.051	0.3	1.4	0.77
(10)	Irrigation waters				
(11)	Commerce and industry waters				

Additional water quality regulations which apply to mercury impairments include the biological integrity of waters. Elevated mercury levels may impair biological integrity, such as reduced reproductive success of Walleye (Selch, 2008). ARSD Section 74:51:01:12 states that all waters of the state must be free from substances, whether attributable to human-induced point source discharges or nonpoint source activities, in concentrations or combinations which will adversely impact the structure and function of indigenous or intentionally introduced aquatic communities. Additionally, ARSD Section 74:51:01:55 also states that toxic pollutants (including mercury) may not exist at levels that are or may become injurious to public health, safety, or welfare. Protection of these narrative criteria is best accomplished by meeting the most stringent numeric water column criteria 0.050 µg/L of total mercury.

As a part of the 2014 triennial review, SDDANR proposed the Water Management Board adopt WQC, including a fish flesh methylmercury (MeHg) standard of 0.3 mg/Kg. This concentration is the EPA recommended human health criterion applicable to beneficial uses 2, 3, 4, 5, 6, and 9. The waterbodies included in this addendum and their beneficial uses are shown in Table 8.

Table 8. Beneficial Uses for Waterbodies in this Addendum

Common Name	County	Beneficial Uses
Pott's Dam	Potter	5,7,8,9
Stink Lake	Codington County	9
Durkee Lake	Meade County	1,4,7,8,9
East Lemmon Lake	Perkins County	5,7,8,9

The original TMDL identified a target of 0.3 mg/Kg based on the approved EPA human health criterion (and approved by the State of SD). This fish flesh concentration standard and target required a linkage to protect the existing mercury water column standards. This linkage was accomplished by applying a bioaccumulation factor (BAF) discussed in Section 2.0 of the original TMDL. Bioaccumulation refers to the uptake and retention of a chemical by an aquatic organism from all surrounding media, including water, sediment, and the food it consumes. The TMDL used a BAF to verify that the target and the human health criterion of 0.3 mg/Kg would translate back to total mercury levels in the water column below the most stringent South Dakota WQC (0.050 µg/L). For more detail on these calculations, please refer to Section 2.0 in the original TMDL.

The existing conditions outlined in Section 3.0 demonstrate that the four lakes listed in this second mercury addendum fall in line with the waterbodies currently covered by the original TMDL and first addendum, both of which were completed and approved by EPA in 2016.

The original TMDL used 0.669 mg/Kg (the existing condition) as the value from which to calculate reductions. These numbers were based on the SLF calculation process outlined in Section 3.0 of the original Mercury TMDL. The reduction factor (RF) was based on this existing condition and the fish tissue standard of 0.3 mg/Kg. WE38 in the following equation refers to a (SLF) Walleye of 38.4 cm long. Reducing the methylmercury in fish flesh in these four waterbodies by 55.2% will meet all appropriate WQC.

$$RF = (WE38 - 0.3)/WE38$$
$$55.2\% = (0.669-0.3)/0.669$$

7.0 Conclusion

Provided in this addendum was a comparison of waterbody specific data to that used in the original TMDL. The review of the fish flesh data, water quality, jurisdiction, point sources, and nonpoint sources indicates that these waters meet all the conditions for coverage under the original TMDL.

No potential local sources of mercury were discovered for any of the lakes listed in this addendum. SD Administrative Rule 74:51:01:27 states that point sources discharging directly into lakes must meet WQS at the point of discharge and are not allowed a mixing zone. This addendum, and the original TMDL, assumes that point sources are being controlled under this regulation through NPDES permit requirements and are not causing localized WQS exceedances of mercury in lakes. Additionally, because of the rural nature of these four waterbodies, municipal stormwater discharges (MS4) are of no concern. The original statewide TMDL, using the regional modeling system for aerosols and deposition model (conducted by Dr. Stone from SDSM&T), calculated over 99% of the mercury deposited into these waterbodies was from atmospheric sources.

For Potts Dam, there were no Walleye present in the fishery, and Largemouth Bass was used as the surrogate species. Figures 3 and 4 provide a direct comparison to the original Mercury TMDL dataset. The mercury bioaccumulation rate calculated from the Potts Dam Largemouth Bass data was slightly lower than that exhibited by the statewide Largemouth Bass data. The data fell well within the range of 25-75th percentiles of the original TMDL Walleye and did not exceed the SLF threshold condition of 0.878 mg/kg. The 95th percentile for Pott's Dam Largemouth Bass was 0.49 mg/Kg. The estimated 55.2% Reduction Factor (RF) from the original TMDL would result in an estimated mercury concentration of 0.22 mg/Kg for the top predator in Potts Dam.

Northern Pike were used as a surrogate species for East Lemmon Lake and Durkee Lake. East Lemmon Lake exhibited a much lower average than that of the statewide Pike and fell within the 25-75th percentile of the original TMDL Walleye data in regard to mgHg in fish tissue. For Durkee Lake, all samples fell between the 25-75th percentile range of the original TMDL Walleye dataset with the exception of one Northern Pike exhibiting a concentration of 0.58 mg/Kg of methylmercury. East Lemmon Lake's linear trendline was similar to that of the statewide average in Figure 10 but had slightly lower levels of mercury present as fish aged. Durkee Lake had a much slower bioaccumulation rate of mercury when compared to the statewide Northern Pike data. Applying the TMDL RF of 55.2% to Durkee and East Lemmon Lake, Northern Pike mercury concentrations resulted in mercury in fish tissue concentrations below 0.25 mg/Kg.

The managed Walleye fishery in Stink Lake could be directly compared to the SLF Walleye data used in the original TMDL. The 95th percentile of the mercury in Walleye tissue samples from Stink Lake was 0.61 mg/Kg. Potential reductions could result in a concentration of below 0.27 mg/Kg in Walleye and the rest of the Stink Lake fish population.

The four lakes listed in this addendum are all within the state's jurisdiction, and no additional loading analysis (point or non-point) were needed to calculate reductions. The implicit margin of safety is based upon five factors explicitly stated on page 73-74 of the original Mercury TMDL (2016). The fish flesh levels of mercury in these waterbodies present a value above the EPA health standard and SD WQC of 0.3 mg/Kg. All lakes listed in this addendum will fall under the threshold designation if state reduction efforts are met.

8.0 Public Participation

A 30-day public comment period was issued for the draft TMDL Addendum. A public notice letter was published in the following local newspapers: Faith Independent, Dakota Harrold (Lemmon), Onida Watchman, Potter County News (Gettysburg) and Watertown public Opinion. The draft TMDL addendum document and ability to comment was made available on DANRs One-Stop Public Notice Page: https://danr.sd.gov/public/default.aspx. The public comment period began July 21, 2022 and ended August 29, 2022. No public comments were received during the 30-day comment period.

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APPENDIX A:

Individual Fish Collected from Four Waterbodies to be Added to the South Dakota Mercury TMDL in 2021 that Exceed 0.3 mg/Kg

Site	County	Sample Year	Species	Length (mm)	Mercury (mg/Kg)
Durkee Lake	Meade	2018	Northern Pike	751	0.58
Durkee Lake	Meade	2018	Northern Pike	620	0.48
Durkee Lake	Meade	2018	Northern Pike	692	0.46
Durkee Lake	Meade	2018	Northern Pike	751	0.42
Durkee Lake	Meade	2018	Northern Pike	638	0.40
Durkee Lake	Meade	2018	Northern Pike	763	0.37
Durkee Lake	Meade	2018	Northern Pike	639	0.36
Durkee Lake	Meade	2018	Northern Pike	698	0.36
Durkee Lake	Meade	2018	Black Crappie	231	0.30
Durkee Lake	Meade	2018	Black Crappie	225	0.30
East Lemmon Lake	Perkins	2017	Northern Pike	769	0.56
East Lemmon Lake	Perkins	2017	Northern Pike	960	0.50
East Lemmon Lake	Perkins	2017	Northern Pike	1400	0.44
East Lemmon Lake	Perkins	2017	Northern Pike	980	0.43
East Lemmon Lake	Perkins	2017	Northern Pike	746	0.32
Pott's Dam	Potter	2018	Largemouth Bass	420	0.49
Pott's Dam	Potter	2018	Largemouth Bass	420	0.49
Pott's Dam	Potter	2018	Largemouth Bass	420	0.49
Pott's Dam	Potter	2018	Largemouth Bass	420	0.49
Pott's Dam	Potter	2018	Largemouth Bass	405	0.48
Pott's Dam	Potter	2018	Largemouth Bass	391	0.48
Pott's Dam	Potter	2018	Largemouth Bass	380	0.43
Pott's Dam	Potter	2018	Largemouth Bass	380	0.43
Pott's Dam	Potter	2018	Largemouth Bass	380	0.43
Pott's Dam	Potter	2018	Largemouth Bass	380	0.43
Pott's Dam	Potter	2018	Largemouth Bass	416	0.42
Pott's Dam	Potter	2018	Largemouth Bass	416	0.42
Pott's Dam	Potter	2018	Largemouth Bass	415	0.42
Pott's Dam	Potter	2018	Largemouth Bass	415	0.42

Appendix A: Continued

Pott's Dam	Potter	2018	Largemouth Bass	415	0.42
Pott's Dam	Potter	2018	Largemouth Bass	415	0.42
Pott's Dam	Potter	2018	Largemouth Bass	416	0.42
Pott's Dam	Potter	2018	Largemouth Bass	416	0.42
Pott's Dam	Potter	2018	Yellow Perch	284	0.38
Pott's Dam	Potter	2018	Yellow Perch	277	0.32
Pott's Dam	Potter	2018	Bluegill	196	0.32
Pott's Dam	Potter	2018	Yellow Perch	281	0.30
Pott's Dam	Potter	2018	Bluegill	200	0.30
Stink Lake	Marshall	2019	Walleye	635	0.74
Stink Lake	Marshall	2019	Walleye	535	0.44
Stink Lake	Marshall	2019	Walleye	466	0.34

APPENDIX B:
Individual Fish Data Used for Mercury Impairment Assessment

Site	AUID	County	Sample Year	Species	Length (mm)	Mercury (mg/Kg)
Pott's Dam	SD-MI-L-POTTS_01	Potter	2018	Bluegill	179	0.2
Pott's Dam	SD-MI-L-POTTS_01	Potter	2018	Bluegill	172	0.24
Pott's Dam	SD-MI-L-POTTS_01	Potter	2018	Bluegill	196	0.26
Pott's Dam	SD-MI-L-POTTS_01	Potter	2018	Bluegill	171	0.2
Pott's Dam	SD-MI-L-POTTS_01	Potter	2018	Bluegill	187	0.23
Pott's Dam	SD-MI-L-POTTS_01	Potter	2018	Bluegill	196	0.32
Pott's Dam	SD-MI-L-POTTS_01	Potter	2018	Bluegill	199	0.26
Pott's Dam	SD-MI-L-POTTS_01	Potter	2018	Bluegill	210	0.27
Pott's Dam	SD-MI-L-POTTS_01	Potter	2018	Bluegill	200	0.3
Pott's Dam	SD-MI-L-POTTS_01	Potter	2018	Bluegill	204	0.24
Pott's Dam	SD-MI-L-POTTS_01	Potter	2018	Largemouth Bass	416	0.42
Pott's Dam	SD-MI-L-POTTS_01	Potter	2018	Largemouth Bass	416	0.42
Pott's Dam	SD-MI-L-POTTS_01	Potter	2018	Largemouth Bass	380	0.43
Pott's Dam	SD-MI-L-POTTS_01	Potter	2018	Largemouth Bass	284	0.22
Pott's Dam	SD-MI-L-POTTS_01	Potter	2018	Largemouth Bass	380	0.43
Pott's Dam	SD-MI-L-POTTS_01	Potter	2018	Largemouth Bass	415	0.42
Pott's Dam	SD-MI-L-POTTS_01	Potter	2018	Largemouth Bass	415	0.42
Pott's Dam	SD-MI-L-POTTS_01	Potter	2018	Largemouth Bass	380	0.43
Pott's Dam	SD-MI-L-POTTS_01	Potter	2018	Largemouth Bass	380	0.43
Pott's Dam	SD-MI-L-POTTS_01	Potter	2018	Largemouth Bass	415	0.42
Pott's Dam	SD-MI-L-POTTS_01	Potter	2018	Largemouth Bass	415	0.42
Pott's Dam	SD-MI-L-POTTS_01	Potter	2018	Largemouth Bass	280	0.28
Pott's Dam	SD-MI-L-POTTS_01	Potter	2018	Largemouth Bass	285	0.2
Pott's Dam	SD-MI-L-POTTS_01	Potter	2018	Largemouth Bass	280	0.28
Pott's Dam	SD-MI-L-POTTS_01	Potter	2018	Largemouth Bass	285	0.2
Pott's Dam	SD-MI-L-POTTS_01	Potter	2018	Largemouth Bass	285	0.2
Pott's Dam	SD-MI-L-POTTS_01	Potter	2018	Largemouth Bass	285	0.2
Pott's Dam	SD-MI-L-POTTS_01	Potter	2018	Largemouth Bass	280	0.18
Pott's Dam	SD-MI-L-POTTS_01	Potter	2018	Largemouth Bass	280	0.18
Pott's Dam	SD-MI-L-POTTS_01	Potter	2018	Largemouth Bass	280	0.28
Pott's Dam	SD-MI-L-POTTS_01	Potter	2018	Largemouth Bass	280	0.28
Pott's Dam	SD-MI-L-POTTS_01	Potter	2018	Largemouth Bass	284	0.22
Pott's Dam	SD-MI-L-POTTS_01	Potter	2018	Largemouth Bass	420	0.49
Pott's Dam	SD-MI-L-POTTS_01	Potter	2018	Largemouth Bass	420	0.49
Pott's Dam	SD-MI-L-POTTS_01	Potter	2018	Largemouth Bass	420	0.49
Pott's Dam	SD-MI-L-POTTS_01	Potter	2018	Largemouth Bass	405	0.48

Appendix B: Continued

Pott's Dam	SD-MI-L-POTTS_01	Potter	2018	Largemouth Bass	280	0.18
Pott's Dam	SD-MI-L-POTTS_01	Potter	2018	Largemouth Bass	280	0.18
Pott's Dam	SD-MI-L-POTTS_01	Potter	2018	Largemouth Bass	284	0.22
Pott's Dam	SD-MI-L-POTTS_01	Potter	2018	Largemouth Bass	284	0.22
Pott's Dam	SD-MI-L-POTTS_01	Potter	2018	Largemouth Bass	391	0.48
Pott's Dam	SD-MI-L-POTTS_01	Potter	2018	Largemouth Bass	416	0.42
Pott's Dam	SD-MI-L-POTTS_01	Potter	2018	Largemouth Bass	416	0.42
Pott's Dam	SD-MI-L-POTTS_01	Potter	2018	Largemouth Bass	420	0.49
Pott's Dam	SD-MI-L-POTTS_01	Potter	2018	Yellow Perch	277	0.32
Pott's Dam	SD-MI-L-POTTS_01	Potter	2018	Yellow Perch	210	0.14
Pott's Dam	SD-MI-L-POTTS_01	Potter	2018	Yellow Perch	203	0.14
Pott's Dam	SD-MI-L-POTTS_01	Potter	2018	Yellow Perch	284	0.38
Pott's Dam	SD-MI-L-POTTS_01	Potter	2018	Yellow Perch	281	0.3
Pott's Dam	SD-MI-L-POTTS_01	Potter	2018	Yellow Perch	241	0.24
Pott's Dam	SD-MI-L-POTTS_01	Potter	2018	Yellow Perch	241	0.27
Pott's Dam	SD-MI-L-POTTS_01	Potter	2018	Yellow Perch	247	0.23
Pott's Dam	SD-MI-L-POTTS_01	Potter	2018	Yellow Perch	263	0.19
Pott's Dam	SD-MI-L-POTTS_01	Potter	2018	Yellow Perch	214	0.11
Stink Lake	SD-JA-L-STINK_01	Marshall	2019	Walleye	577	0.26
Stink Lake	SD-JA-L-STINK_01	Marshall	2019	Walleye	362	0.19
Stink Lake	SD-JA-L-STINK_01	Marshall	2019	Walleye	466	0.34
Stink Lake	SD-JA-L-STINK_01	Marshall	2019	Walleye	635	0.74
Stink Lake	SD-JA-L-STINK_01	Marshall	2019	Walleye	347	0.26
Stink Lake	SD-JA-L-STINK_01	Marshall	2019	Walleye	345	0.25
Stink Lake	SD-JA-L-STINK_01	Marshall	2019	Walleye	476	0.22
Stink Lake	SD-JA-L-STINK_01	Marshall	2019	Walleye	535	0.44
Stink Lake	SD-JA-L-STINK_01	Marshall	2019	Walleye	482	0.24
Stink Lake	SD-JA-L-STINK_01	Marshall	2019	Walleye	594	0.21
Stink Lake	SD-JA-L-STINK_01	Marshall	2019	Yellow Perch	193	0.09
Stink Lake	SD-JA-L-STINK_01	Marshall	2019	Yellow Perch	196	0.13
Stink Lake	SD-JA-L-STINK_01	Marshall	2019	Yellow Perch	255	0.13
Stink Lake	SD-JA-L-STINK_01	Marshall	2019	Yellow Perch	220	0.1
Stink Lake	SD-JA-L-STINK_01	Marshall	2019	Yellow Perch	236	0.17
Stink Lake	SD-JA-L-STINK_01	Marshall	2019	Yellow Perch	192	0.06
Stink Lake	SD-JA-L-STINK_01	Marshall	2019	Yellow Perch	205	0.11
Stink Lake	SD-JA-L-STINK_01	Marshall	2019	Yellow Perch	225	0.09
Stink Lake	SD-JA-L-STINK_01	Marshall	2019	Yellow Perch	213	0.09

Appendix B: Continued

Stink Lake	SD-JA-L-STINK_01	Marshall	2019	Yellow Perch	189	0.07
Durkee Lake	SD-CH-L-DURKEE_01	Meade	2018	Black Bullhead	276	0.22
Durkee Lake	SD-CH-L-DURKEE_01	Meade	2018	Black Bullhead	251	0.2
Durkee Lake	SD-CH-L-DURKEE_01	Meade	2018	Black Bullhead	253	0.22
Durkee Lake	SD-CH-L-DURKEE_01	Meade	2018	Black Bullhead	242	0.18
Durkee Lake	SD-CH-L-DURKEE_01	Meade	2018	Black Bullhead	271	0.19
Durkee Lake	SD-CH-L-DURKEE_01	Meade	2018	Black Bullhead	266	0.19
Durkee Lake	SD-CH-L-DURKEE_01	Meade	2018	Black Bullhead	266	0.19
Durkee Lake	SD-CH-L-DURKEE_01	Meade	2018	Black Bullhead	253	0.14
Durkee Lake	SD-CH-L-DURKEE_01	Meade	2018	Black Bullhead	264	0.26
Durkee Lake	SD-CH-L-DURKEE_01	Meade	2018	Black Bullhead	278	0.24
Durkee Lake	SD-CH-L-DURKEE_01	Meade	2018	Black Bullhead	279	0.24
Durkee Lake	SD-CH-L-DURKEE_01	Meade	2018	Black Bullhead	255	0.24
Durkee Lake	SD-CH-L-DURKEE_01	Meade	2018	Black Bullhead	245	0.24
Durkee Lake	SD-CH-L-DURKEE_01	Meade	2018	Black Bullhead	266	0.21
Durkee Lake	SD-CH-L-DURKEE_01	Meade	2018	Black Bullhead	260	0.26
Durkee Lake	SD-CH-L-DURKEE_01	Meade	2018	Black Crappie	224	0.22
Durkee Lake	SD-CH-L-DURKEE_01	Meade	2018	Black Crappie	230	0.25
Durkee Lake	SD-CH-L-DURKEE_01	Meade	2018	Black Crappie	236	0.26
Durkee Lake	SD-CH-L-DURKEE_01	Meade	2018	Black Crappie	220	0.17
Durkee Lake	SD-CH-L-DURKEE_01	Meade	2018	Black Crappie	239	0.2
Durkee Lake	SD-CH-L-DURKEE_01	Meade	2018	Black Crappie	207	0.2
Durkee Lake	SD-CH-L-DURKEE_01	Meade	2018	Black Crappie	235	0.22
Durkee Lake	SD-CH-L-DURKEE_01	Meade	2018	Black Crappie	210	0.19
Durkee Lake	SD-CH-L-DURKEE_01	Meade	2018	Black Crappie	243	0.25
Durkee Lake	SD-CH-L-DURKEE_01	Meade	2018	Black Crappie	234	0.24
Durkee Lake	SD-CH-L-DURKEE_01	Meade	2018	Black Crappie	250	0.26
Durkee Lake	SD-CH-L-DURKEE_01	Meade	2018	Black Crappie	215	0.16
Durkee Lake	SD-CH-L-DURKEE_01	Meade	2018	Black Crappie	231	0.3
Durkee Lake	SD-CH-L-DURKEE_01	Meade	2018	Black Crappie	249	0.26
Durkee Lake	SD-CH-L-DURKEE_01	Meade	2018	Black Crappie	225	0.3
Durkee Lake	SD-CH-L-DURKEE_01	Meade	2018	Northern Pike	620	0.48
Durkee Lake	SD-CH-L-DURKEE_01	Meade	2018	Northern Pike	751	0.58
Durkee Lake	SD-CH-L-DURKEE_01	Meade	2018	Northern Pike	763	0.37
Durkee Lake	SD-CH-L-DURKEE_01	Meade	2018	Northern Pike	751	0.42
Durkee Lake	SD-CH-L-DURKEE_01	Meade	2018	Northern Pike	639	0.36
Durkee Lake	SD-CH-L-DURKEE_01	Meade	2018	Northern Pike	698	0.36

Appendix B: Continued

Durkee Lake	SD-CH-L-DURKEE_01	Meade	2018	Northern Pike	692	0.46
Durkee Lake	SD-CH-L-DURKEE_01	Meade	2018	Northern Pike	638	0.4
East Lemmon Lake	SD-GR-L-EAST_LEMMON_01	Perkins	2017	Black Bullhead	282	0.07
East Lemmon Lake	SD-GR-L-EAST_LEMMON_01	Perkins	2017	Black Bullhead	326	0.07
East Lemmon Lake	SD-GR-L-EAST_LEMMON_01	Perkins	2017	Black Bullhead	277	0.06
East Lemmon Lake	SD-GR-L-EAST_LEMMON_01	Perkins	2017	Black Bullhead	320	0.07
East Lemmon Lake	SD-GR-L-EAST_LEMMON_01	Perkins	2017	Black Bullhead	346	0.07
East Lemmon Lake	SD-GR-L-EAST_LEMMON_01	Perkins	2017	Black Bullhead	343	0.05
East Lemmon Lake	SD-GR-L-EAST_LEMMON_01	Perkins	2017	Black Bullhead	300	0.04
East Lemmon Lake	SD-GR-L-EAST_LEMMON_01	Perkins	2017	Black Bullhead	313	0.05
East Lemmon Lake	SD-GR-L-EAST_LEMMON_01	Perkins	2017	Black Bullhead	326	0.07
East Lemmon Lake	SD-GR-L-EAST_LEMMON_01	Perkins	2017	Black Bullhead	329	0.05
East Lemmon Lake	SD-GR-L-EAST_LEMMON_01	Perkins	2017	Northern Pike	1400	0.44
East Lemmon Lake	SD-GR-L-EAST_LEMMON_01	Perkins	2017	Northern Pike	769	0.56
East Lemmon Lake	SD-GR-L-EAST_LEMMON_01	Perkins	2017	Northern Pike	479	0.17
East Lemmon Lake	SD-GR-L-EAST_LEMMON_01	Perkins	2017	Northern Pike	496	0.12
East Lemmon Lake	SD-GR-L-EAST_LEMMON_01	Perkins	2017	Northern Pike	960	0.5
East Lemmon Lake	SD-GR-L-EAST_LEMMON_01	Perkins	2017	Northern Pike	980	0.43
East Lemmon Lake	SD-GR-L-EAST_LEMMON_01	Perkins	2017	Northern Pike	746	0.32
East Lemmon Lake	SD-GR-L-EAST_LEMMON_01	Perkins	2017	Northern Pike	707	0.27
East Lemmon Lake	SD-GR-L-EAST_LEMMON_01	Perkins	2017	Northern Pike	495	0.16
East Lemmon Lake	SD-GR-L-EAST_LEMMON_01	Perkins	2017	Northern Pike	521	0.18

Appendix C:
EPA Approval Letter and Decision Document

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 8
1595 Wynkoop Street
Denver, CO 80202-1129
Phone 800-227-8917
www.epa.gov/region08

September 13, 2022

Ref: 8WD-CWS

SENT VIA EMAIL

Hunter Roberts, Secretary
South Dakota Department of Agriculture and Natural Resources
Hunter.Roberts@state.sd.us

Re: Approval of 2022 Addendum to the South Dakota Mercury TMDL

Dear Mr. Roberts,

The U.S. Environmental Protection Agency (EPA) has completed review of the total maximum daily loads (TMDLs) submitted by your office on September 1, 2022. In accordance with the Clean Water Act (33 U.S.C. §1251 *et. seq*.) and the EPA's implementing regulations at 40 C.F.R. Part 130, the EPA hereby approves South Dakota's TMDLs for Durkee Lake, East Lemmon Lake, Potts Dam, and Stink Lake. The EPA has determined that the separate elements of the TMDLs listed in the enclosure adequately address the pollutant of concern, are designed to attain and maintain applicable water quality standards, consider seasonal variation and include a margin of safety. The EPA's rationale for this action is contained in the enclosure.

Thank you for submitting these TMDLs for our review and approval. If you have any questions, please contact Amy King on my staff at (303) 312-6708.

Sincerely,

JUDY BLOOM Digitally signed by JUDY BLOOM Date: 2022.09.20 22:42:44 -06'00'

Judy Bloom, Manager
Clean Water Branch

Enclosure:
EPA Decision Rationale – 2022 Addendum to the South Dakota Mercury TMDL

Cc: Barry McLaury, Watershed Protection Program Administrator, South Dakota DANR
Paul Lorenzen, Environmental Scientist Manager – TMDL Team Leader, South Dakota DANR

EPA TOTAL MAXIMUM DAILY LOAD (TMDL) DECISION RATIONALE

TMDL: 2022 Addendum to the South Dakota Mercury TMDL

ATTAINS TMDL ID: R8-SD-2022-07

LOCATION: Codington, Meade, Perkins, and Potter counties, South Dakota

IMPAIRMENTS/POLLUTANTS: The TMDL submittal addresses four lakes that are impaired due to high concentrations of mercury in fish tissue. Designated uses that are not being attained include warmwater permanent fish life propagation, warmwater semipermanent fish life propagation, and fish and wildlife propagation, recreation, and stock watering.

Waterbody/Pollutant Addressed in this TMDL Action

Assessment Unit ID	Waterbody Description	Pollutants Addressed
SD-CH-L-DURKEE_01	Meade County	Mercury in fish tissue
SD-GR-L-EAST_LEMMON_01	Perkins County	Mercury in fish tissue
SD-MI-L-POTTS_01	Potter County	Mercury in fish tissue
SD-JA-L-STINK_01	Codington County	Mercury in fish tissue

BACKGROUND: The South Dakota Department of Agriculture and Natural Resources (DANR) submitted to EPA the final 2022 Addendum to the South Dakota Mercury TMDL (Addendum) with a letter requesting review and approval dated September 1, 2022. EPA previously reviewed and provided staff comments on draft versions of the report but did not submit comments during the subsequent public comment period (July 21, 2022 to August 29, 2022). The Addendum addresses four new assessment units not approved as part of the original South Dakota Mercury TMDL on March 1, 2016 (also referred to as the Statewide Mercury TMDL).

The submittal included:

- Letter requesting EPA's review and approval of the TMDL
- Final TMDL report

APPROVAL RECOMMENDATIONS: Based on the review presented below, the reviewer recommends approval of the 2022 Addendum to the South Dakota Mercury TMDL, which includes Durkee Lake, East Lemmon Lake, Potts Dam, and Stink Lake. All the required elements of an approvable TMDL have been met.

TMDL Approval Summary	
Number of TMDLs Approved:	4
Number of Causes Addressed by TMDLs:	4

REVIEWERS: Amy King, EPA

The following review summary explains how the TMDL submission meets the statutory and regulatory requirements of TMDLs in accordance with Section 303(d) of the Clean Water Act (CWA), and EPA's implementing regulations in 40 C.F.R. Part 130.

EPA REVIEW OF THE 2022 ADDENDUM TO THE SOUTH DAKOTA MERCURY TMDL

This TMDL review document includes EPA's guidelines that summarize the currently effective statutory and regulatory requirements relating to TMDLs (CWA Section 303(d) and 40 C.F.R. Part 130). These TMDL review guidelines are not themselves regulations. Any differences between these guidelines and EPA's regulations should be resolved in favor of the regulations themselves. The italicized sections of this document describe the information generally necessary for EPA to determine if a TMDL submittal fulfills the legal requirements for approval. The sections in regular type reflect EPA's analysis of the state's compliance with these requirements. Use of the verb "must" below denotes information that is required to be submitted because it relates to elements of the TMDL required by the CWA and by regulation.

1. Identification of Waterbody, Pollutant of Concern, Pollutant Sources, and Priority Ranking

The TMDL submittal must clearly identify (40 C.F.R. §130.7(c)(1)):

- *the waterbody as it appears on the State's/Tribe's 303(d) list;*
- *the pollutant for which the TMDL is being established; and*
- *the priority ranking of the waterbody.*

The TMDL submittal must include (40 C.F.R. §130.7(c)(1); 40 C.F.R. §130.2):

- *an identification of the point and nonpoint sources of the pollutant of concern, including location of the source(s) and the quantity of the loading (e.g., lbs. per day);*
- *facility names and NPDES permit numbers for point sources within the watershed; and*
- *a description of the natural background sources, and the magnitude and location of the sources, where it is possible to separate natural background from nonpoint sources.*

This information is necessary for EPA's review of the load and wasteload allocations, which are required by regulation.

The TMDL submittal should also contain a description of any important assumptions made in developing the TMDL, such as:

- *the spatial extent of the watershed in which the impaired waterbody is located;*
- *the assumed distribution of land use in the watershed (e.g., urban, forested, agriculture);*
- *population characteristics, wildlife resources, and other relevant information affecting the characterization of the pollutant of concern and its allocation to sources;*
- *present and future growth trends, if taken into consideration in preparing the TMDL (e.g., the TMDL could include the design capacity of a wastewater treatment facility); and*
- *an explanation and analytical basis for expressing the TMDL through surrogate measures, if applicable. Surrogate measures are parameters such as percent fines and turbidity for sediment impairments; chlorophyll a and phosphorus loadings for excess algae; length of riparian buffer; or number of acres of best management practices.*

Elevated concentrations of mercury in fish tissue have caused the "fish and wildlife propagation, recreation, and stock watering waters" and respective fisheries designated uses to not be fully supported. DANR identified four assessment units as impaired because methylmercury concentrations in fish tissue exceeded the 0.3 milligram per kilogram (mg/kg) human health criteria (Sections 1.0 and 6.0). The waterbody-specific sections of the Addendum (Sections 3.1 through 3.4) indicate that each water was identified as high priority for TMDL development.

There are seven conditions that waterbodies must meet to obtain coverage under the Statewide Mercury TMDL (SD DANR, 2016). The seven conditions, or applicability criteria, are used to confirm that the assumptions and calculations of original TMDL are still valid and demonstrate that the new assessment units are within South Dakota's jurisdiction, exhibit comparable conditions to the original waters, and are expected to meet water quality standards when the Statewide Mercury TMDL and targets are met. DANR demonstrated in the Addendum that the four assessment units identified in the table above (subsequently referred to as addendum waters) are appropriate for coverage under the Statewide Mercury TMDL.

Moving west to east, the four addendum waters are Durkee Lake, East Lemmon Lake, Potts Dam, and Stink Lake. The general location of these waterbodies is shown in Figure 1 of the Addendum, which indicates no jurisdictional concerns (meeting applicability criteria one and two).

Durkee Lake (SD-CH-L-DURKEE_01) is a 152.3-acre impoundment in northeastern Meade County, approximately three miles south of Faith, South Dakota. It was assigned a high priority for TMDL development (i.e., 1) in South Dakota's 2022 303(d) list (SD DANR, 2022) after being first listed in 2020 (Section 3.2). Three fish species were sampled from the lake. The Northern Pike was identified as the top predator and surrogate species since no walleye were present. The 95^{th} percentile methylmercury concentration for Northern Pike was 0.54 mg/kg and the average concentration was 0.43 mg/kg (Table 3), with all eight Northern Pike exceeding the 0.3 mg/kg numeric target. Figures 7 and 8 compare the Durkee Lake data with those in the Statewide Mercury TMDL, demonstrating that the Durkee Lake tissue concentrations are within similar ranges (meeting applicability criterion six). The Northern Pike sampled were an older age class and had higher average concentrations than the entire dataset used for the Statewide Mercury TMDL; however, they were still below the maximum allowable concentration.

East Lemmon Lake (SD-GR-L-EAST_LEMMON_01) is 169 acres and located in Perkins County. It is 10.5 miles east of Shadehill, South Dakota, and managed by South Dakota Game, Fish, and Parks (SDGFP). First listed as impaired for mercury in 2018, East Lemmon Lake has been identified as a high priority for TMDL development (SD DANR, 2022) (Section 3.3). Two fish species were sampled in the lake and, similar to Durkee Lake, the Northern Pike was identified as the surrogate species in the absence of walleye. The average mercury concentration in Northern Pike was 0.32 mg/kg, and the 95^{th} percentile was 0.53 mg/kg (Table 4). Half of the 10 fish samples were above the 0.3 mg/kg numeric target. Figures 10 and 11 illustrate that the Northern Pike concentrations are comparable to those used in the Statewide Mercury TMDL (meeting applicability criterion six).

Potts Dam (SD-MI-L-POTTS_01), located in southern Potter County (central South Dakota), is a 52-acre reservoir managed by SDGFP. It was first listed as impaired for mercury in 2020 and was assigned a high priority (i.e., 1) for TMDL development on the most recent EPA-approved 303(d) list in 2022 (SD DANR, 2022) (Section 3.1). There are four main fish species in the lake, including largemouth bass, which was designated as the surrogate species since there is no walleye population. Eighteen of thirty-four largemouth bass exceeded the 0.3 mg/kg methylmercury numeric target (Table 2; 95^{th} percentile of 0.49 mg/kg and an average of 0.34 mg/kg). Figures 4 and 5 demonstrate that the largemouth bass data for Potts Dam are comparable to those used in the Statewide Mercury TMDL (meeting applicability criterion six).

Stink Lake (SD-JA-L-STINK_01) is the largest of the addendum waters at 788.6 acres. It is located in Codington County in northeastern South Dakota. First identified as impaired for mercury in 2020, this lake has been identified as a high priority (i.e., 1) for TMDL development on the state's 2022 303(d) list (SD DANR, 2022) (Section 3.4). This lake supports a walleye population. Of the ten walleye collected in 2019, three exceeded the numeric target for methylmercury of 0.3 mg/kg. The average methylmercury concentration was 0.32 mg/kg and the 95th percentile was 0.61 mg/kg (Table 5). Walleye concentrations from Stink Lake were compared to the Statewide Mercury TMDL in Figures 12 and 13. Because walleye data are available, a concentration can be estimated for the standard length fish (SLF; defined in the Statewide Mercury TMDL as 384 millimeters) using the regression equation in Figure 13. The estimated concentration of 0.25 mg/kg methylmercury is below the 0.878 mg/kg maximum fish tissue concentration from the Statewide Mercury TMDL, demonstrating that conditions in Stink Lake are comparable to the rest of the state (meeting applicability criterion six).

One of the seven conditions of the revision process for broadening coverage of the Statewide Mercury TMDL to additional waters, as listed in Section 1.0 of the Addendum, requires that fish tissue concentrations from the new waters not exceed a maximum concentration of the dataset used to develop the original TMDL (0.878 mg/kg). This condition ensures that the original TMDL and load reduction factor will be sufficient to meet water quality standards in addendum waters. As discussed in the waterbody-specific sections of the Addendum (Sections 3.1 through 3.4) and Appendix A, the maximum measured concentration at each lake is below 0.878 mg/kg (0.58 mg/kg for Durkee Lake, 0.56 mg/kg for East Lemmon Lake, 0.49 mg/kg for Potts Dam, and 0.74 mg/kg for Stink Lake), meeting applicability criteria three and six.

The Addendum evaluated sources for the four addendum waters (Sections 4 and 5) and built upon the pollutant source analysis from the Statewide Mercury TMDL. As described in the original TMDL, DANR investigated nonpoint sources of mercury by monitoring and modeling atmospheric deposition rates. This information was used to understand geographical and seasonal patterns of mercury deposition and derive annual loading rates. Monitoring results can be found in Appendix B of the Statewide Mercury TMDL and REMSAD model results are summarized in Figures 21-22 and Table 21 (SD DANR, 2016). Modeling runs were conducted by EPA and provided to DANR for TMDL analysis. The results indicated that the largest (93%) source of mercury either originates from outside the modeling domain (continental U.S. plus parts of Canada and Mexico) or originates within the modeling domain but is transported outside to become part of the global pool. In-state emission sources were shown to account for only 0.12% of South Dakota's total atmospheric mercury deposition. DANR assumed that 30% of the total atmospheric mercury deposition is non-anthropogenic in origin and represents natural background conditions, which is consistent with other statewide mercury TMDLs and scientific literature (SD DANR, 2016). DANR summarizes the nonpoint sources in Section 5.0.

The statewide analysis of point sources conducted in Section 4 of the original Statewide Mercury TMDL found that permitted point sources account for 0.36% of the total existing statewide load and 0.81% of the total allowable load. The Addendum reviews the potential contribution from abandoned mines and point sources near the four addendum waters. As noted in the Addendum, the four addendum waters are not influenced by current or historic mining (Section 4.1; meeting acceptance criterion four).

DANR also evaluated potential mercury loading from municipal separate storm sewer systems (MS4) and other National Pollutant Discharge Elimination System (NPDES) permits (Sections 4.2 and 4.3, respectively). The MS4s in the state (Table 6) have no impact on the addendum waters and are therefore not a potential source of mercury. In the Statewide Mercury TMDL, DANR assumed that permitted point sources are not causing localized mercury impairments to lakes because state permitting requirements (ARSD 74:51:01:27) mandate that water quality standards be met at the point of discharge (i.e., no mixing zone allowed) if the point source discharges to a lake (SD DANR, 2016) (meeting acceptance criterion five, since none of the addendum waters are a river or stream). Durkee Lake is the only addendum water potentially influenced by a NPDES-permitted facility. The city of Faith (SD0023345) has a permit to operate a sewage treatment plant upstream of Durkee Lake. This is a no discharge permit and is therefore assigned a wasteload allocation (WLA) of zero. The effect of this facility or other existing NPDES permits as stated in the original TMDL are too small to be of any consequence to the WLA (Section 4.3).

DANR's conclusion that mining activities, MS4s, and NPDES permitted sources are not causing localized mercury impairments is supported by the fish tissue comparison completed in Section 3.1 through 3.4 of the Addendum. These figures demonstrate that fish tissue mercury concentrations in the four addendum waters are similar to the statewide dataset used in the original TMDL, thereby suggesting similar sources of mercury for all waters (meeting acceptance criterion seven).

Assessment: EPA concludes that DANR adequately identified the impaired waterbodies, the pollutant of concern, the priority ranking, the identification, location and magnitude of the pollutant sources, and the important assumptions and information used to develop the TMDLs.

2. Description of the Applicable Water Quality Standards and Numeric Water Quality Target

The TMDL submittal must include:

- *a description of the applicable State/Tribal water quality standard, including the designated use(s) of the waterbody, the applicable numeric or narrative water quality criterion, and the antidegradation policy (40 C.F.R. §130.7(c)(1)); and*
- *a numeric water quality target for each TMDL. If the TMDL is based on a target other than a numeric water quality criterion, then a numeric expression must be developed from a narrative criterion and a description of the process used to derive the target must be included in the submittal (40 C.F.R. §130.2(i)).*

EPA needs this information to review the loading capacity determination, and load and wasteload allocations, which are required by regulation.

The *Water Quality Standards* section (Section 6.0) describes the water quality standards applicable to the impaired lakes with citations to relevant South Dakota regulations. Section 2.0 of the original Statewide Mercury TMDL also contains a full discussion of water quality standards including beneficial uses and criteria in South Dakota (ARSD 74:51) (SD DANR, 2016). Beneficial uses associated with each of the impaired lakes are presented in Table 8. Table 7 identifies the numeric criteria associated with each of these uses. The Addendum clearly links the beneficial uses assigned to each of the four addendum waters to numeric and narrative mercury criteria.

In 2016, EPA approved DANR's request to recognize 0.3 mg/kg total methylmercury in fish tissue as a water quality criterion for Clean Water Act purposes assigned to designated use categories 2, 3, 4, 5, 6, and 9. South Dakota also retained existing numeric criteria for mercury as measured in the water column for human health and aquatic life designated use categories. To ensure that the fish tissue criterion is protective of all uses and water column criteria, DANR conducted a bioaccumulation factor (BAF) analysis, as discussed in Section 2.0 of the Statewide Mercury TMDL. This analysis confirmed that the human health criterion of 0.3 milligrams per kilograms (mg/kg) translates to total mercury levels in the water column below the most stringent South Dakota WQC (0.050 μg/L). Establishing the TMDL to meet the methylmercury criterion will result in the protection all other mercury related criteria and uses (SD DANR, 2016).

The Statewide Mercury TMDL and Addendum (Section 6.0) directly use South Dakota's numeric criterion of 0.3 mg/kg total methylmercury in fish tissue as the TMDL target. This assumes steady-state conditions and relies on the principle of proportionality to determine the load reduction factors needed to meet the fish tissue TMDL target, which EPA recognizes as a reasonable assumption. As explained in Section 3.3 of the Statewide Mercury TMDL, DANR expects that, according to the principle of proportionality, a reduction in mercury emissions will result in a proportional reduction in deposition, mercury loading to waterways, and fish tissue methylmercury concentrations (SD DANR, 2016). Following this logic, DANR calculated that existing fish tissue methylmercury concentrations statewide require a 55.2 percent reduction to meet the 0.3 mg/kg criterion and then applied that same reduction factor to the existing total source load to derive the TMDL (Section 6.0).

The TMDLs are consistent with South Dakota antidegradation policies because they provide recommendations and establish pollutant limits at water quality levels necessary to meet criteria and fully support existing beneficial uses, including more stringent downstream uses.

Assessment: EPA concludes that DANR adequately described the applicable water quality standards and numeric water quality target for these TMDLs.

3. Loading Capacity - Linking Water Quality and Pollutant Sources

The TMDL submittal must include the loading capacity for each waterbody and pollutant of concern. EPA regulations define loading capacity as the greatest amount of a pollutant that a water can receive without violating water quality standards (40 C.F.R. §130.2(f)).

The TMDL submittal must:

- *describe the method used to establish the cause-and-effect relationship between the numeric target and the identified pollutant sources. In many instances, this method will be a water quality model;*
- *contain documentation supporting the TMDL analysis, including the basis for any assumptions; a discussion of strengths and weaknesses in the analytical process; and results from any water quality modeling; and*
- *include a description and summary of the water quality data used for the TMDL analysis.*

EPA needs this information to review the loading capacity determination, and load and wasteload allocations, which are required by regulation (40 C.F.R. §130.2).

The full water quality dataset should be made available as an appendix to the TMDL or as a separate electronic file. Other datasets used (e.g., land use, flow), if not included within the TMDL submittal, should be referenced by source and year. The TMDL analysis should make use of all readily available data for the waterbody unless the TMDL writer determines that the data are not relevant or appropriate.

The pollutant loadings may be expressed as either mass-per-time, toxicity or other appropriate measure (40 C.F.R. §130.2(i)). Most TMDLs should be expressed as daily loads (USEPA. 2006a). If the TMDL is expressed in terms other than a daily load (e.g., annual load), the submittal should explain why it is appropriate to express the TMDL in the unit of measurement chosen.

The TMDL submittal must describe the critical conditions and related physical conditions in the waterbody as part of the analysis of loading capacity (40 C.F.R. §130.7(c)(1)). The critical condition can be thought of as the "worst case" scenario of environmental conditions (e.g., stream flow, temperature, loads) in the waterbody in which the loading expressed in the TMDL for the pollutant of concern will continue to meet water quality standards. TMDLs should define the applicable critical conditions and describe the approach used to estimate both point and nonpoint source loads under such critical conditions.

The Addendum relies largely on the technical analysis completed and documented in the original Statewide Mercury TMDL. DANR developed the loading capacity at a statewide scale; however, the TMDL is still written to meet water quality standards in individual waters. DANR demonstrated this by relating the loading capacity back to numeric water quality criteria that apply statewide (i.e., there are no unique, basin-specific mercury criteria). Conservative decisions made throughout the process result in a statewide TMDL that may be more protective than necessary to meet water quality standards in some waters. The TMDL loading capacity is equal to the sum of the allocations and can be simplified as: Implicit MOS (0 kg/yr) + WLA (4.84 kg/yr) + LA (590.48 kg/yr) = TMDL (595.32 kg/yr). This balanced TMDL equation, additional source category breakouts, and derivation steps are included in Section 10.0 of the original Statewide Mercury TMDL, along with a calculation of daily loads for the TMDL (3.21 kg/day) (SD DANR, 2016).

The Addendum demonstrates that all seven conditions outlined in the Statewide Mercury TMDL's revision process are met for each addendum water individually, and thus all four waters are appropriate for coverage under the Statewide Mercury TMDL (Sections 1.0 through 5.0). The seven conditions, or applicability criteria, are used to confirm that the assumptions and calculations of original TMDL are valid and demonstrate that the new assessment units are within South Dakota's jurisdiction, exhibit comparable conditions to the original waters, and are expected to meet water quality standards when the Statewide Mercury TMDL and targets are met. The majority of the Addendum is devoted to comparing mercury concentrations of fish tissue collected from the four addendum waters to the original dataset used to calculate the Statewide Mercury TMDL.

Appendices A and B of the Addendum provide the fish tissue measurements for the four addendum waterbodies. Appendix A includes those samples that exceed the TMDL target and Appendix B includes all data. These data are summarized by species for each lake: Tables 2, 3, 4, and 5 represent Potts Dam, Durkee Lake, East Lemmon Lake, and Stink Lake, respectively. The average existing concentration at all four lakes exceeded the numeric target. Consistent with the Statewide Mercury TMDL, applying a 55.2 percent reduction to the 95th percentile concentration for the top predator resulted in fish tissue levels below the target in each lake. This condition ensures that the original TMDL and load reduction factor will be sufficient to meet water quality standards in addendum waters.

The Addendum also presented graphs of tissue concentration datasets across various fish species and lakes to assess bioaccumulation and compared tissue concentrations for the top predator in each lake to the statewide data. Figures 2-13 and the associated discussions indicated that methylmercury concentrations from all four addendum waters are similar to the statewide dataset. The Statewide

Mercury TMDL accounted for variability in mercury concentrations from fish of different age and length by using the SLF concept. DANR defined the SLF as a 384 mm walleye and the maximum methylmercury concentration for the SLF was 0.878 mg/kg (SD DANR, 2016). This sets a concentration limit for the addendum waters. Any waterbody with a fish flesh concentration exceeding this benchmark is void from coverage under the Statewide Mercury TMDL and will need to be addressed under a waterbody specific TMDL. The maximum fish tissue methylmercury concentration in all addendum waters was below 0.878 mg/kg (Appendix A). These analyses verify that conditions for the four addendum waters are similar to the statewide data and that the original TMDL and load reduction factor will result in attainment of all mercury-related water quality standards.

The Statewide Mercury TMDL included a discussion on critical conditions and seasonality (Section 9.0 of SD DANR, 2016) and considered wet deposition during periods of rainfall. Other factors that influence mercury methylation and bioaccumulation in the food chain are wetland areas, Secchi depth, and variation in lake levels since wetting and drying impacts the methylation process. The TMDL was initially calculated as an annual load to account for year-round deposition and seasonal characteristics of the lakes and drainages (SD DANR, 2016).

Assessment: EPA concludes that the loading capacities were calculated using an acceptable approach, used a water quality target consistent with water quality criteria, and have been appropriately set at a level necessary to attain and maintain the applicable water quality standards. The pollutant loads have been expressed as daily limits. The critical conditions were described and factored into the calculations and were based on a reasonable approach to establish the relationship between the target and pollutant sources.

4. Load Allocation

The TMDL submittal must include load allocations (LAs). EPA regulations define LAs as the portion of a receiving water's loading capacity that is attributed either to one of its existing or future nonpoint sources of pollution and to natural background sources. Load allocations may range from reasonably accurate estimates to gross allotments (40 C.F.R. §130.2(g)). Where possible, separate LAs should be provided for natural background and for nonpoint sources.

In the rare instance that a TMDL concludes that there are no nonpoint sources or natural background for a pollutant, the load allocation must be expressed as zero and the TMDL should include a discussion of the reasoning behind this decision.

Section 5.0 of the Addendum summarizes the nonpoint sources associated with mercury loading. In the Statewide Mercury TMDL, DANR identified and quantified sources of nonpoint source pollution through in-state atmospheric deposition monitoring and the REMSAD computer model. Using this information, DANR estimated the state receives 1,326.3 kg of mercury per year from atmospheric nonpoint sources of pollution statewide (see Section 5.1.2 and Section 10.0 of the Statewide Mercury TMDL; SD DANR, 2016). After attributing 30% of this load to natural background, the remaining human-derived nonpoint source load requires a 79% reduction to meet the atmospheric deposition LA (590.48 kg/yr) and the final TMDL loading capacity (595.32 kg/yr). All reductions in the TMDL are applied to this aggregated statewide LA representing anthropogenic loading from atmospheric deposition and reductions are expected through the implementation of international (Minamata

Convention) and national (Mercury Air Toxics Standards Rule) controls on mercury emissions, and unrelated operational adjustments to existing facilities in South Dakota (SD DANR, 2016).

Assessment: EPA concludes that the LAs provided in the TMDLs are reasonable and will result in attainment of the water quality standards.

5. Wasteload Allocations

The TMDL submittal must include wasteload allocations (WLAs). EPA regulations define WLAs as the portion of a receiving water's loading capacity that is allocated to existing and future point sources (40 C.F.R. §130.2(h)). If no point sources are present or if the TMDL recommends a zero WLA for point sources, the WLA must be expressed as zero. If the TMDL recommends a zero WLA after considering all pollutant sources, there must be a discussion of the reasoning behind this decision, since a zero WLA implies an allocation only to nonpoint sources and natural background will result in attainment of the applicable water quality standards, and all point sources have no measurable contribution.

The individual WLAs may take the form of uniform percentage reductions or individual mass based limitations for dischargers where it can be shown that this solution meets WQSs and does not result in localized impairments. In some cases, WLAs may cover more than one discharger (e.g., if the source is contained within a general permit).

DANR expanded upon the point source analysis conducted in Section 4 of the original Statewide Mercury TMDL, which calculated the allowable stormwater and non-stormwater WLAs (SD DANR, 2016). Section 4.0 provides a more detailed review of the potential contribution from mines, MS4s, and other NPDES point sources associated with the four addendum waters. This review confirmed that point sources are not causing localized mercury impairments; therefore, the WLAs derived in the original Statewide Mercury TMDL are appropriate to apply to the addendum waters.

DANR evaluated potential mining sources and found that the four lakes are outside the sphere of influence from historical or present-day mining practices associated with the Black Hills region. Mining does not pose any concern as a mercury source. In the original Statewide Mercury TMDL, DANR characterized the existing NPDES-regulated MS4 load based on the percentage of the South Dakota's land surface falling within MS4 boundaries relative to the atmospheric mercury deposition for the entire state. DANR estimated an aggregate allocation for all MS4s in the state, as identified in Table 17 of the original Statewide Mercury TMDL, without applying a reduction factor (SD DANR, 2016). The Addendum listed the MS4s in the Statewide Mercury TMDL and confirmed that these permitted areas have no impact on the addendum waters (Table 6); therefore, MS4 areas do not pose a concern as a mercury source.

DANR characterized the existing non-stormwater, NPDES-permitted, point sources in the original Statewide Mercury TMDL and established an aggregate WLA that caps the statewide load at existing conditions (see Sections 4.3 and 6.0 of the original Statewide Mercury TMDL; SD DANR, 2016). Appendix E of the original Statewide Mercury TMDL lists all the non-stormwater NPDES-permitted facilities in South Dakota included within the aggregate WLA along with permit numbers and geographical locations (SD DANR, 2016). The Addendum identifies an additional permit located upstream of Durkee Lake. This permit (SD0023345) is a no discharge facility and is not a source of mercury to Durkee Lake. It is assigned a WLA of zero and has no impact on the WLA in the original TMDL (Section 4.3).

EPA recognizes that aggregated WLAs are reasonable for this TMDL. Although the total contribution from permitted point sources appears to be very small, EPA expects that while implementing the statewide WLAs, DANR will ensure that permitted point source discharges do not have a reasonable potential to cause or contribute to an exceedance of water quality standards.

Assessment: EPA concludes that the WLAs provided in the TMDLs are reasonable, will result in the attainment of the water quality standards and will not cause localized impairments. The TMDLs account for all point sources contributing loads to impaired segments, upstream segments, and tributaries in the watershed.

6. Margin of Safety

The TMDL submittal must include a margin of safety (MOS) to account for any lack of knowledge concerning the relationship between load allocations, wasteload allocations and water quality (CWA §303(d)(1)(C), 40 C.F.R. §130.7(c)(1)). The MOS may be ***implicit*** *or* ***explicit****.*

If the MOS is ***implicit****, the conservative assumptions in the analysis that account for the MOS must be described. If the MOS is* ***explicit****, the loading set aside for the MOS must be identified.*

As described in Section 8.0 of the original Statewide Mercury TMDL (SD DANR, 2016), the TMDL incorporated an implicit margin of safety by following conservative approaches at numerous steps during TMDL development such as:

- Resampling waters with elevated fish tissue methylmercury concentrations more frequently than other waters. This results in a statewide fish tissue dataset that is biased towards egregiously impaired waters and a load reduction factor that is potentially greater than necessary for many waters. The Addendum notes that fish tissue concentrations below, sometimes well below, the methylmercury criterion is expected for all four addendum waters once the loading reduction factor is met. DANR considers the difference between the criterion and projected tissue concentrations to be an added margin of safety.
- Selecting the 90th percentile SLF tissue concentration to represent existing conditions. This also overestimates the loading reductions needed for many waters (note: the Addendum used the 95th percentile SLF concentration).
- Focusing target attainment within a top predator species (walleye or a surrogate species) where methylmercury concentrations and bioaccumulation rates are highest. This protects humans consuming other fish species.
- Comparing fish tissue analyzed for total mercury concentration directly to the methylmercury TMDL target for listing decisions and TMDL calculations. This affords a level of protection because measurements of total mercury include other forms of mercury in addition to methylmercury.
- Setting allocations without accounting for reductions in sulfur emissions realized under the Clean Air Act which is expected to affect sulfate-reducing bacteria and lower methylation rates.

Assessment: EPA concludes that the TMDLs incorporate an adequate implicit margin of safety.

7. Seasonal Variation

The TMDL submittal must be established with consideration of seasonal variations. The method chosen for including seasonal variations in the TMDL must be described (CWA §303(d)(1)(C), 40 C.F.R. §130.7(c)(1)).

The Addendum relies on the critical conditions and seasonal variation discussion contained in Section 9.0 of the original Statewide Mercury TMDL (SD DANR, 2016). DANR supported a monitoring network of atmospheric mercury deposition stations across the state for multiple years to explore temporal and geospatial differences in mercury deposition. Results indicated a positive relationship between deposition and precipitation, but overall DANR determined that deposition rates were sufficiently uniform to establish a single TMDL representative of the entire state. Sediment cores from ten lakes were also reviewed for insight into mercury loading trends, but results indicated that mercury concentrations in upper lakebed sediments were highly variable and no conclusions were drawn from the sediment cores. In addition to a daily load, the loading capacity was expressed as an annual load which incorporates seasonal variation of flow and weather. Lastly, DANR also stated that the use of a fish tissue TMDL target, representing the bioaccumulation of mercury throughout a fish's lifespan, inherently captures the variability of multiple seasons and critical conditions (SD DANR, 2016).

Assessment: EPA concludes that seasonal variations were adequately described and considered to ensure the TMDL allocations will be protective of the applicable water quality standards throughout any given year.

8. Reasonable Assurances

When a TMDL is developed for waters impaired by both point and nonpoint sources, EPA guidance (USEPA. 1991) and court decisions say that the TMDL must provide reasonable assurances that nonpoint source control measures will achieve expected load reductions in order for the TMDL to be approvable. This information is necessary for EPA to determine that the TMDL, including the load and wasteload allocations, has been established at a level necessary to implement the applicable water quality standards (CWA §303(d)(1)(C), 40 C.F.R. §130.7(c)(1)).

EPA guidance (USEPA. 1997) also directs Regions to work with States to achieve TMDL load allocations in waters impaired only by nonpoint sources. However, EPA cannot disapprove a TMDL for nonpoint source-only impaired waters, which do not have a demonstration of reasonable assurance that LAs will be achieved, because such a showing is not required by current regulations.

DANR's framework restoration strategy is outlined in the original Statewide Mercury TMDL (Section 11.0 of SD DANR, 2016). The loading analysis showed that nonpoint sources account for over 99% of the mercury loading to state waterbodies; therefore, the TMDL requires all reductions to occur through the load allocations. The amount of mercury be attributed to point sources (WLA) is small enough that reductions in any form or amount would not yield a measurable effect on fish tissue samples. Section 5.0 of the Statewide Mercury TMDL discusses various sources of mercury, noting an order of magnitude difference between instate sources and atmospheric sources (SD DANR, 2016).

There are limited reductions that can be achieved in the state and South Dakota has ranked low in mercury emissions. Various federal mandates are expected to achieve the majority of the necessary load reductions. The Statewide Mercury TMDL stresses the importance of national and international regulatory controls on mercury emissions such as the U.S. Mercury Air Toxics Standards Rule and the United Nations Minamata Convention Agreement. This TMDL will largely be implemented through control of atmospheric sources; however, to address remaining smaller sources, DANR identifies implementation opportunities and evaluation programs for point sources (including dental offices, publicly owned treatment works, and MS4s) and solid waste (Section 11.0 of SD DANR, 2016).

Assessment: EPA considered the reasonable assurances contained in the TMDL submittal and concludes that they are adequate to meet the load reductions. Nonpoint source load reductions are expected to occur through the implementation of best management practices ongoing and planned to begin in the future. Point sources with NPDES permits require that effluent limits are consistent with assumptions and requirements of WLAs for the discharges in the TMDLs.

9. Monitoring Plan

The TMDL submittal should include a monitoring plan for all:

- *Phased TMDLs; and*
- *TMDLs with both WLA(s) and LA(s) where reasonable assurances are provided.*

Under certain circumstances, a phased TMDL should be developed when there is significant uncertainty associated with the selection of appropriate numeric targets, estimates of source loadings, assimilative capacity, allocations or when limited existing data are relied upon to develop a TMDL. EPA guidance (USEPA. 2006b) recommends that a phased TMDL submittal, or a separate document (e.g., implementation plan), include a monitoring plan, an explanation of how the supplemental data will be used to address any uncertainties that may exist when the phased TMDL is prepared and a scheduled timeframe for revision of the TMDL.

For TMDLs that need to provide reasonable assurances, the monitoring plan should describe the additional data to be collected to determine if the load reductions included in the TMDL are occurring and leading to attainment of water quality standards.

EPA guidance (USEPA. 1991) recommends post-implementation monitoring for all TMDLs to determine the success of the implementation efforts. Monitoring plans are not a required part of the TMDL and are not approved by EPA but may be necessary to support the decision rationale for approval of the TMDL.

The Addendum relies on the framework monitoring strategy outlined in Section 12.0 of the original Statewide Mercury TMDL. DANR identified three monitoring categories. These future sampling efforts will address data gaps and evaluate progress towards meeting the TMDL target. The three categories of mercury monitoring are atmospheric deposition, fish tissue, and water column (SD DANR, 2016). EPA expects DANR to ensure permitted point source discharges do not have a reasonable potential to cause or contribute to an exceedance of water quality standards and stresses that collecting effluent data with sufficiently low detection limits is essential for making these determinations.

Assessment: Monitoring plans are not a required element of EPA's TMDL review and decision-making process. EPA is taking no action on the monitoring strategy included in the TMDL submittal.

10. Implementation

EPA policy (USEPA. 1997) encourages Regions to work in partnership with States/Tribes to achieve nonpoint source load allocations established for 303(d)-listed waters impaired by nonpoint sources. Regions may assist States/Tribes in developing implementation plans that include reasonable assurances that nonpoint source LAs established in TMDLs for waters impaired solely or primarily by nonpoint sources will in fact be achieved. The policy recognizes that other relevant watershed management processes may be used in the TMDL process. EPA is not required to and does not approve TMDL implementation plans.

EPA encourages States/Tribes to include restoration recommendations (e.g., framework) in all TMDLs for stakeholder and public use to guide future implementation planning. This could include identification of a range of potential management measures and practices that might be feasible for addressing the main loading sources in the watershed (see USEPA. 2008b, Chapter 10). Implementation plans are not a required part of the TMDL and are not approved by EPA but may be necessary to support the decision rationale for approval of the TMDL.

DANR's framework restoration strategy is outlined in the original Statewide Mercury TMDL (Section 11.0 of SD DANR, 2016). Because the loading analysis showed that nonpoint sources, largely outside of South Dakota, account for over 99% of the mercury loading to state waterbodies, the TMDL requires all reductions to occur through the LA and stresses the importance of national and international regulatory controls on mercury emissions such as the U.S. Mercury Air Toxics Standards Rule and the United Nations Minamata Convention Agreement. DANR also highlighted recent emission reductions observed at two South Dakota coal power plants (Ben French and SDSU) and in-state efforts to recycle mercury-containing solid waste products and avoid releases of mercury from these products into the environment. Pre-treatment programs implemented by the larger treatment plants also evaluate for mercury in the wastewater entering their system.

Assessment: Although not a required element of the TMDL approval, DANR discussed how information derived from the TMDL analysis process can be used to support implementation of the TMDLs. EPA is taking no action on the implementation portion of the TMDL submittal.

11. Public Participation

EPA policy is that there must be full and meaningful public participation in the TMDL development process. Each State/Tribe must, therefore, provide for public participation consistent with its own continuing planning process and public participation requirements (40 C.F.R. §25.3 and §130.7(c)(1)(ii)).

The final TMDL submittal must describe the State/Tribe's public participation process, including a summary of significant comments and the State/Tribe's responses to those comments (40 C.F.R. §25.3 and §25.8). Inadequate public participation could be a basis for disapproving a TMDL; however, where EPA determines that a State/Tribe has not provided adequate public participation, EPA may defer its approval action until adequate public participation has been provided for, either by the State/Tribe or by EPA.

The submittal explains the public engagement process DANR followed during development of the Addendum (Section 8.0). A draft TMDL report was released for public comment from July 21, 2022 to August 29, 2022. The opportunity for public review and comment was posted on DANR's website and announced in several local newspapers: Faith Independent, Dakota Harrold (Lemmon), Onida

Watchman, Potter County News (Gettysburg) and Watertown public Opinion. No public comments were submitted.

Assessment: EPA has reviewed DANR's public participation process and concludes that DANR involved the public during the development of the TMDLs and provided adequate opportunities for the public to comment on the draft report.

12. Submittal Letter

The final TMDL submittal must be accompanied by a submittal letter that explicitly states that the submittal is a final TMDL submitted under Section 303(d) of the Clean Water Act for EPA review and approval. This clearly establishes the State's/Tribe's intent to submit, and EPA's duty to review, the TMDL under the statute (40 C.F.R. §130.7(d)(1)). The final submittal letter should contain such identifying information as the waterbody name, location, assessment unit number and the pollutant(s) of concern.

A transmittal letter with the appropriate information was included with the final TMDL report submission from DANR, dated September 1, 2022 and signed by Paul Lorenzen, Environmental Scientist Manager – TMDL Team Leader, Water Protection Program.

Assessment: EPA concludes that the state's submittal package clearly and unambiguously requested EPA to act on the TMDLs in accordance with the Clean Water Act and the submittal contained all necessary supporting information.

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