UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

MAR 3 1 2014

REPLY TO THE ATTENTION OF:
WW-16J

Rebecca J. Flood, Assistant Commissioner
Minnesota Pollution Control Agency
520 Lafayette Road North
St. Paul, Minnesota 55155-4194

Dear Ms. Flood:

The U.S. Environmental Protection Agency has conducted a complete review of the final Total Maximum Daily Loads (TMDL) for segments within the Snake River watershed, including support documentation and follow up information. The Snake River watershed is in central Minnesota in Aitkin, Kanabec, Mille Lacs, Pine, Chisago and Isanti Counties. The Snake River watershed TMDLs address impaired aquatic recreation due to excessive nutrients (phosphorus), impaired aquatic recreation due to excessive bacteria (*E. coli*) and impaired aquatic life use due to sediment.

EPA has determined that the Snake River watershed TMDLs meet the requirements of Section 303(d) of the Clean Water Act and EPA's implementing regulations set forth at 40 C.F.R. Part 130. Therefore, EPA approves Minnesota's four nutrient TMDLs, three bacteria TMDLs and 1 biota (sediment) TMDL. The statutory and regulatory requirements, and EPA's review of Minnesota's compliance with each requirement, are described in the enclosed decision document.

We wish to acknowledge Minnesota's efforts in submitting these TMDLs and look forward to future TMDL submissions by the State of Minnesota. If you have any questions, please contact Mr. Peter Swenson, Chief of the Watersheds and Wetlands Branch, at 312-886-0236.

Sincerely,

Tinka G. Hyde
Director, Water Division

Enclosure
cc: Celine Lyman, MPCA
Christopher Klucas, MPCA

wq-iw6-11g

TMDL: Snake River watershed nutrient, sediment (biota) & bacteria TMDLs, Aitkin, Kanabec, Mille Lacs, Pine, Chisago and Isanti Counties, MN
Date: March 31, 2014

DECISION DOCUMENT
FOR THE SNAKE RIVER WATERSHED NUTRIENT, SEDIMENT & BACTERIA TMDLS, AITKIN, KANABEC, MILLE LACS, PINE, CHISAGO & ISANTI COUNTIES, MN

Section 303(d) of the Clean Water Act (CWA) and EPA's implementing regulations at 40 C.F.R. Part 130 describe the statutory and regulatory requirements for approvable TMDLs. Additional information is generally necessary for EPA to determine if a submitted TMDL fulfills the legal requirements for approval under Section 303(d) and EPA regulations, and should be included in the submittal package. 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. Use of the term "should" below denotes information that is generally necessary for EPA to determine if a submitted TMDL is approvable. These TMDL review guidelines are not themselves regulations. They are an attempt to summarize and provide guidance regarding currently effective statutory and regulatory requirements relating to TMDLs. Any differences between these guidelines and EPA's TMDL regulations should be resolved in favor of the regulations themselves.

1. Identification of Water body, Pollutant of Concern, Pollutant Sources, and Priority Ranking

The TMDL submittal should identify the water body as it appears on the State's/Tribe's 303(d) list. The water body should be identified/georeferenced using the National Hydrography Dataset (NHD), and the TMDL should clearly identify the pollutant for which the TMDL is being established. In addition, the TMDL should identify the priority ranking of the water body and specify the link between the pollutant of concern and the water quality standard (see Section 2 below).

The TMDL submittal should include 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. The TMDL should provide the identification numbers of the NPDES permits within the water body. Where it is possible to separate natural background from nonpoint sources, the TMDL should include a description of the natural background. 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:

(1) the spatial extent of the watershed in which the impaired water body is located;
(2) the assumed distribution of land use in the watershed (e.g., urban, forested, agriculture);
(3) population characteristics, wildlife resources, and other relevant information affecting the characterization of the pollutant of concern and its allocation to sources;
(4) 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

(5) 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.

Comment:

Location Description/Spatial Extent:

The Snake River watershed (SRW) (HUC-8 #07030004) is located in the St. Croix River Basin (SCRB) in central Minnesota. The SCRB covers areas in Minnesota and Wisconsin. The portion of the SCRB which lies on the western side of the St. Croix River (i.e., in Minnesota), is approximately 3,570 square miles. The SRW is the westernmost subwatershed of the SCRB and one of the four subwatersheds which make up the SCRB.[1] The SRW is approximately 1,006 square miles (643,534 acres) and spans Aitkin, Kanabec, Mille Lacs, Pine, Chisago and Isanti counties in central Minnesota. The SRW occupies approximately 28 percent of the SCRB on the Minnesota side of St. Croix River. The headwaters of the SRW are located in the southeastern portion of Aitkin County. The Snake River flows in a southeasterly direction toward its confluence with the St. Croix River in Pine County, Minnesota.

The Snake River watershed TMDL addresses four nutrient impaired lakes, three creek segments for bacteria impairments and one creek segment for impaired biota. The lakes and creek segments of the Snake River watershed TMDL are:

- Quamba Lake (33-0015-00) for nutrients;
- Knife Lake (33-0028-00) for nutrients;
- Cross Lake (58-0119-00) for nutrients;
- Pokegama Lake (58-0142-00) for nutrients;
- Bear Creek (07030004-514) for bacteria (*E. coli*);
- Mud Creek (07030004-566)for bacteria (*E. coli*), for fish bioassessment and macroinvertebrate bioassessment; and
- Mud Creek (07030004-567) for bacteria (*E. coli*).

All segments of the SRW TMDL are within the boundaries of the North Central Hardwood Forest (NCHF) ecoregion (Table 1 of this Decision Document).

Table 1: Snake River watershed impaired waters addressed by this TMDL

Water body name	Assessment Unit ID	Affected Use	Pollutant or stressor
Quamba Lake	33-0015-00	Aquatic Recreation	Excess Nutrients (total phosphorus)
Knife Lake	33-0028-00	Aquatic Recreation	Excess Nutrients (total phosphorus)
Cross Lake	58-0119-00	Aquatic Recreation	Excess Nutrients (total phosphorus)
Pokegama Lake	58-0142-00	Aquatic Recreation	Excess Nutrients (total phosphorus)
Bear Creek (Headwaters to Snake River)	07030004-514	Aquatic Recreation	Bacteria (*E. coli*)
Mud Creek (Headwaters to Quamba Lake)	07030004-566	Aquatic Life	Fish Bioassessment & Macroinvertebrate bioassessment

[1] Map of St. Croix River Basin (Minnesota side): http://www.pca.state.mn.us/index.php/view-document.html?gid=9986

Mud Creek (Headwaters to Quamba Lake)	07030004-566	Aquatic Recreation	Bacteria (*E. coli*)
Mud Creek (Quamba Lake to Snake River)	07030004-567	Aquatic Recreation	Bacteria (*E. coli*)

Knife Lake is the most upstream lake within the SRW (Figure 1.1 of the final TMDL document). Mud Creek and Quamba Lake are in the central portion of the SRW with Mud Creek entering and exiting Quamba Lake in the northeastern portion of Quamba Lake. Pokegama Lake and Cross Lake are downstream of Knife Lake, Mud Creek and Quamba Lake. Both Pokegama Lake and Cross Lake are on main stem of the Snake River and contribute flow to the Snake River. Bear Creek is the segment closest to the Snake River's confluence with the St. Croix River.

The Minnesota Pollution Control Agency (MPCA) classified Pokegama Lake and Cross Lake as deep lakes and Knife Lake and Quamba Lake as shallow lakes. MPCA defines deep lakes as enclosed basins with maximum depths greater than 15 feet (Table 2 of this Decision Document) and shallow lakes as lakes with a maximum depth less than 15 feet. MPCA subdivided Cross Lake into three basins, the northern basin, the central basin and the southern basin (Appendix G of the final TMDL document). These three basin were delineated based on morphometric characteristics of Cross Lake and hydrologic characteristics of Cross Lake in response to flows from the Snake River. The Snake River flows through Cross Lake in the southern basin. The Snake River impacts the water budget and water chemistry of the central and northern basins.

Table 2: Morphometric and watershed characteristics of lakes addressed in the Snake River watershed TMDL

Parameter	Knife Lake	Quamba Lake	Pokegama Lake
Surface Area (acres)	1,259	226	1,515
Average Depth (ft)	8.5	5.6	11.8
Maximum Depth (ft)	15	11	25
Volume (acre-ft)	10,740	1264	17,868
Residence Time (years)	0.21	0.06	0.35
Littoral Area (acres)	1259	226	903
Littoral Area (%)	100	100	60
Watershed (acres)	58,518	24,125	50,630

Parameter	Cross Lake (All Basins)	Cross Lake (South Basin)	Cross Lake (Central Basin)	Cross Lake (North Basin)
Surface Area (acres)	924	311	269	344
Average Depth (ft)	13.8	10.4	15.5	15.7
Maximum Depth (ft)	30	30	22	27
Volume (acre-ft)	12,807	3238	4,171	5,398
Residence Time (years)	0.02	<0.01	0.80	1.45
Littoral Area (acres)	472	57	198	217
Littoral Area (%)	51	18	73	63
Watershed (acres)	618,806	613,563	1,470	3,773

Land Use:

Land use in the SRW is comprised of hay/pasture lands, croplands, forested lands, wetlands, urban lands or areas covered by roads, and open water (Table 3 of this Decision Document). MPCA estimated that land use within the SRW is primarily composed of hay/pasture lands and forested areas. Significant development is not expected in the Snake River watershed. The land use within the watershed is primarily agricultural and according to MPCA is expected to remain agricultural for the foreseeable future. There may be a shift in crop usage within the watershed (i.e. pasture/hay land uses to row crop land uses) but MPCA does not believe that this will have a significant impact on nutrient loading to waterbodies within the SRW.

Table 3: Land Use* in the Snake River watershed

Land Use*	Knife Lake watershed		Quamba Lake watershed		Pokegama Lake watershed	
	Acres	Percent	Acres	Percent	Acres	Percent
Hay/Pasture	10,162	17%	9,010	37%	17,208	33%
Cropland	598	1%	487	2%	1,043	2%
Forested	28,095	47%	7,062	29%	15,122	29%
Wetlands	16,738	28%	6,331	26%	15,644	30%
Urban/Roads	1,196	2%	731	3%	1,564	3%
Open Water	2,391	4%	731	3%	1,564	3%
TOTAL	59,777	100%	24,350	100%	52,146	100%

Land Use*	Cross Lake watershed (Snake)		Cross Lake watershed (direct)	
	Acres	Percent	Acres	Percent
Hay/Pasture	94,166	22%	2,809	35%
Cropland	25,682	6%	642	8%
Forested	154,089	36%	1,605	20%
Wetlands	132,688	31%	1,284	16%
Urban/Roads	12,841	3%	642	8%
Open Water	8,561	2%	1,044	13%
TOTAL	428,025	100%	8,027	100%

Land Use*	Upper Mud Creek subwatershed[1]		Lower Mud Creek subwatershed[1]		Bear Creek subwatershed[1]	
	Acres	Percent	Acres	Percent	Acres	Percent
Hay/Pasture	7,124	35%	9,500	36%	2,339	38%
Cropland	407	2%	2,111	8%	985	16%
Forested	6,309	31%	6,333	24%	1,724	28%
Wetlands	5,495	27%	7,389	28%	923	15%
Urban/Roads	611	3%	1,056	4%	185	3%
Open Water	407	2%	264	1%	0	0%
TOTAL	20,353	100%	26,389	100%	6,156	100%

* Land use data compiled from the 2010 National Agricultural Statistics Services (NASS) land coverages

[1] = Includes only subwatersheds that drain to impaired reaches

Problem Identification:
Quamba Lake, Knife Lake, Cross Lake and Pokegama Lake were originally listed on the 2004 Minnesota 303(d) list due to excessive nutrients (phosphorus). All 4 lakes are on the draft 2014 Minnesota 303(d) list for impaired aquatic recreation due to nutrient exceedances. Summer average total phosphorus (TP) concentrations for Quamba Lake and Knife Lake consistently exceeded the 60 µg/L TP water quality standard (WQS) for shallow lakes in the NCHF. Summer average TP concentrations for Cross Lake and Pokegama Lake consistently exceeded the 40 µg/L TP WQS for deep lakes in the NCHF. TP was monitored at multiple locations in all four lakes in 2010 and 2011.

Bear Creek (07030004-514) and Mud Creek (07030004-566 & 07030004-567) were listed on the 2010 Minnesota 303(d) list for a bacteria impairment (*E. coli*). Bear and Mud Creek are both found on the draft 2014 Minnesota 303(d) list for impaired aquatic recreation due to bacteria. Mud Creek (07030004-566) was listed on the 2002 Minnesota 303(d) list due to impaired fish and macroinvertebrate communities. This impairment is found on the draft 2014 Minnesota 303(d) list.

TP, chlorophyll-*a* (chl-a) and Secchi depth (SD) measurements between 2010 and 2011 indicated that Quamba Lake, Knife Lake, Cross Lake and Pokegama Lake were not attaining their designated aquatic recreation uses due to exceedances of nutrient criteria. Water quality monitoring within the SRW was completed at several locations within each impaired segment's subwatershed. Data collected during these efforts was the foundation for modeling efforts completed in this TMDL study.

The Snake River Watershed Management Bureau (SRWMB), the Kanabec County Soil and Water Conservation District (SWCD), the Pine County SWCD and the MPCA all completed bacteria sampling within the SRW. These groups sampled SRW waters in 2004-2006 and 2008-2010 for bacteria indicators (fecal coliform and *E. coli*). Bacteria data collected indicated that Bear Creek and Mud Creek were not attaining their designated aquatic recreation uses due to exceedances of bacteria.

Biological monitoring (i.e., fish and macroinvertebrate sampling) was completed in 1996, 1998 and 2006-2009. The biological sampling in the 2000s was used to confirm the earlier biological sampling and to inform the Stressor Identification Study completed in 2012. The biological monitoring confirmed that Mud Creek (07030004-566) was not attaining its designated aquatic life uses due to excessive sediment within Mud Creek.

Bacteria: Bacteria exceedances can negatively impact recreational uses (fishing, swimming, wading, boating, etc.) and public health. At elevated levels, bacteria may cause illness within humans who have contact with or ingest bacteria laden water. Recreation-based contact can lead to ear, nose, and throat infections, and stomach illness.

Nutrients: While total phosphorus (TP) is an essential nutrient for aquatic life, elevated concentrations of TP can lead to nuisance algal blooms that negatively impact aquatic life and recreation (swimming, boating, fishing, etc.). Algal decomposition depletes oxygen levels which stresses benthic macroinvertebrates and fish. Excess algae can shade the water column which limits the distribution of aquatic vegetation. Aquatic vegetation stabilizes bottom sediments, and also is an important habitat for macroinvertebrates and fish. Furthermore, depletion of oxygen can cause phosphorus release from bottom sediments (i.e. internal loading).

Degradations in aquatic habitats or water quality (ex. low dissolved oxygen) can negatively impact aquatic life use. Increased turbidity, brought on by elevated levels of nutrients within the water column, can reduce dissolved oxygen in the water column, and cause large shifts in dissolved oxygen and pH throughout the day. Shifting chemical conditions within the water column may stress aquatic biota (fish and macroinvertebrate species). In some instances, degradations in aquatic habitats or water quality have reduced fish populations or altered fish communities from those communities supporting sport fish species to communities which support more tolerant rough fish species.

Sediment: Excess siltation and flow alteration in streams may impact aquatic life by altering habitats. Excess sediment can fill pools, embed substrates, and reduce connectivity between different stream habitats. The result is a decline in habitat types that in healthy streams support diverse macroinvertebrate communities. Excess sediment can also reduce spawning and rearing habitats for certain fish species. In addition, excess suspended sediment can clog the gills of fish and thus reduce fish health. Flow alterations within the SRW due to drainage improvements on or near agricultural lands, have in some instances resulted in increased peak flows. Higher peak flows in stream environments, which typically occur during storm events, can carry increased sediment loads to streams and erode streambanks. In the SRW, MPCA has noted that deposited fine sediments have embedded substrates leading to habitat loss. Similar to the nutrient effects discussed above, this may result in reduced fish populations or altered fish communities from those communities supporting sport fish species to communities which support rough fish species.

Priority Ranking:
The water bodies addressed by the SRW TMDLs were given a priority ranking for TMDL development due to: the impairment impacts on public health and aquatic life, the public value of the impaired water resource, the likelihood of completing the TMDL in an expedient manner, the inclusion of a strong base of existing data and the restorability of the water body, the technical capability and the willingness of local partners to assist with the TMDL, and the appropriate sequencing of TMDLs within a watershed or basin. Areas within the SRW are popular locations for aquatic recreation. Water quality degradation has led to efforts to improve the overall water quality within the SRW, and to the development of TMDLs for these water bodies.

Pollutants of Concern:
The pollutants of concern are <u>phosphorus</u> for nutrient impaired water bodies (Quamba Lake, Knife Lake, Cross Lake and Pokegama Lake), <u>bacteria</u> (*E. coli*) for bacteria impaired water bodies (Bear Creek and Mud Creek), and <u>sediment</u> for the Mud Creek (07030004-566) segment with evidence of fish and macroinvertebrate impairments.

Source Identification (point and nonpoint sources):

Point Source Identification: The potential point sources to the Snake River watershed are:

<u>Snake River watershed bacteria (*E. coli*) TMDLs:</u>
National Pollutant Discharge Elimination Systems (NPDES) permitted facilities: NPDES permitted facilities may contribute bacteria loads to surface waters through discharges of treated wastewater. Permitted facilities must discharge treated wastewater according to their NPDES permit. MPCA determined that permitted NPDES dischargers do not discharge bacteria within the Bear Creek

subwatershed (07030004-514) and the Mud Creek subwatershed (07030004-566 and 07030004-567). Therefore, individual NPDES permitted facilities were not assigned a portion of the wasteload allocation (WLA) for the Minnehaha Creek bacteria TMDL.

Municipal Separate Storm Sewer System (MS4) communities: There are no MS4 communities within Mud & Bear Creek subwatersheds.

Concentrated Animal Feedlot Operations (CAFOs): There are no CAFOs within the Mud and Bear Creek subwatersheds.

Snake River watershed nutrient TMDLs:
NPDES permitted facilities: NPDES permitted facilities may contribute phosphorus loads to surface waters through discharges of treated wastewater. Permitted facilities must discharge treated wastewater according to their NPDES permit. MPCA identified five NPDES permit holders in the Knife Lake and Cross Lake subwatersheds (Table 4 in this Decision Document).

Table 4: Permitted NPDES dischargers in the Knife Lake and Cross Lake subwatersheds

NPDES ID	Facility Name	Subwatershed	Receiving Water
MN0047066	Wahkon Wastewater Treatment Facility (WWTF)	Knife Lake	Unnamed dry run
MN0023809	Isle WWTF	Knife Lake	Unnamed wetland
MN0021997	Ogilvie WWTF	Cross Lake	Groundhouse River
MN0021156	Mora WWTF	Cross Lake	Snake River
MN0025691	Grasston WWTF	Cross Lake	Snake River

MS4 communities: There are no MS4 communities in the Knife, Quamba, Pokegama and Cross Lake subwatersheds.

Permitted construction and industrial areas: Construction and industrial sites may contribute phosphorus via sediment runoff during stormwater events. These areas within the SRW must comply with the requirements of the MPCA's NPDES Stormwater Program. The NPDES program requires construction and industrial sites to create a Stormwater Pollution Prevention Plan (SWPPP) that summarizes how stormwater will be minimized from the site.

Subsurface Sewage Treatment Systems (SSTS): Failing septic systems are a potential source of nutrients within the SRW. Septic systems generally do not discharge directly into a water body, but effluents from SSTS may leach into groundwater or pond at the surface where they can be washed into surface waters via stormwater runoff events. Age, construction and use of SSTS can vary throughout a watershed and influence the nutrient contribution from these systems.

SSTS or imminent threat to public health and safety (ITPHS) septics (i.e., failing septics) were accounted for as part of the point source discussion for the nutrient TMDLs. The Minnesota Center for Environmental Advocacy (MCEA) requested that MPCA classify SSTS as point sources and to not place theses sources as sources to be covered by the load allocation (LA). This request was made within a public comment letter from MCEA submitted to MPCA during the public notice period. MPCA agreed to this request from MCEA and moved the SSTS into the point source grouping of the TMDL equation.

CAFOs: There are no CAFOs within the Knife, Quamba, Pokegama and Cross Lake subwatersheds.

Snake River watershed sediment (biota) TMDL:
NPDES permitted facilities: NPDES permitted facilities may contribute sediment loads to surface waters through discharges of treated wastewater. Permitted facilities must discharge treated wastewater according to their NPDES permit. MPCA determined that there are no permitted NPDES dischargers that discharge to the Mud Creek subwatershed (07030004-566).

MS4 communities: There are no MS4 communities within the Mud Creek subwatershed.

Permitted construction and industrial areas: Construction and industrial sites may contribute sediment via runoff during stormwater events. These areas within the SRW must comply with the requirements of the MPCA's NPDES Stormwater Program. The NPDES program requires construction and industrial sites to create a SWPPP that summarizes how stormwater will be minimized from the site.

Nonpoint Source Identification: The potential nonpoint sources to the Snake River watershed are:

Snake River watershed bacteria (*E. coli*) TMDLs:
Stormwater from agricultural land use practices and feedlots near surface waters: Animal Feeding Operations (AFOs) in close proximity to surface waters can be a source of bacteria to water bodies in the SRW via the mobilization and transportation of pollutant laden waters from feeding, holding and manure storage sites. Runoff from agricultural lands may contain significant amounts of bacteria which may lead to impairments in the SRW. Feedlots generate manure which may be spread onto fields. Runoff from fields with spread manure from can be exacerbated by tile drainage lines, which channelize the stormwater flows and reduce the time available for bacteria to die-off. MPCA identified feedlot facilities within the Upper Mud Creek subwatershed (07030004-566), the Lower Mud Creek subwatershed (07030004-567) and the Bear Creek subwatershed (07030004-514) in Table 3-10 and Appendices A-C of the final TMDL document.

Subsurface Sewage Treatment Systems (SSTS): Failing septic systems are a potential source of bacteria within the SRW. Septic systems generally do not discharge directly into a water body, but effluents from SSTS may leach into groundwater or pond at the surface where they can be washed into surface waters via stormwater runoff events. Age, construction and use of SSTS can vary throughout a watershed and influence the bacteria contribution from these systems.

Straight pipe septic systems: 'Straight pipe' septic systems are also a potential source of bacteria within the SRW. Straight pipe systems may contribute bacteria via direct discharge to the surface waters of the watershed. Straight pipe discharges from septics into the streams are illegal but are suspected to be a large contributor of bacteria, especially when high counts at low flow are observed. Septic systems with illegal straight pipe connection to tiling or stormwater drainage systems within the SRW are likely, but their contribution of bacteria is unknown.

Unrestricted livestock access to streams: Livestock with access to stream environments may add bacteria directly to the surface waters or resuspend particles that had settled on the stream bottom. Direct deposition of animal wastes can result in very high localized bacteria and nutrient counts and may contribute to downstream impairments. Smaller animal facilities may add bacteria to surface waters via wastewater from these facilities or stormwater runoff from near-stream pastures. This potential nonpoint bacteria source should mainly be an issue for smaller animal feeding operations.

Urban stormwater runoff: Runoff from urban areas (urban, residential, commercial or industrial land uses) can contribute various pollutants, including bacteria to local water bodies. Stormwater from urban areas, which drain impervious surfaces, may introduce pollutants to surface waters. Potential urban sources of bacteria can also include wildlife or pet wastes.

Wildlife: Wildlife is a known source of bacteria in water bodies as many animals spend time in or around water bodies. Deer, geese, ducks, raccoons, and other animals all create potential sources of nutrients. Wildlife contributes to the potential impact of contaminated runoff from animal habitats, such as urban park areas, forest, and rural areas.

Snake River watershed nutrient TMDLs:
Internal loading: The release of phosphorus from lake sediments, the release of phosphorus from lake sediments via physical disturbance from benthic fish (rough fish, ex. carp), the release of phosphorus from wind mixing the water column, and the release of phosphorus from decaying curly-leaf pondweeds, may all contribute internal phosphorus loading to Quamba Lake, Knife Lake, Cross Lake and Pokegama Lake. Phosphorus may build up in the bottom waters of the lake and may be resuspended or mixed into the water column when the thermocline decreases and the lake water mixes.

Stormwater runoff from agricultural land use practices: Runoff from agricultural lands may contain significant amounts of nutrients which may lead to impairments in the SRW. Manure spread onto fields is often a source of phosphorus, and can be exacerbated by tile drainage lines, which channelize the stormwater. Tile lined fields and channelized ditches enable particles to move more efficiently into surface waters. Phosphorus may be added via surface runoff from upland areas which are being used for Conservation Reserve Program (CRP) lands, grasslands, and agricultural lands used for growing hay or other crops. Stormwater runoff may contribute nutrients to surface waters from livestock manure, fertilizers, vegetation and erodible soils.

Unrestricted livestock access to streams: Livestock with access to stream environments may add nutrients directly to the surface waters or resuspend particles that had settled on the stream bottom. Direct deposition of animal wastes can result in very high localized nutrient concentrations and may contribute to downstream impairments. Smaller animal facilities may add nutrients to surface waters via wastewater from these facilities or stormwater runoff from near-stream pastures.

Stream channelization and stream erosion: Eroding streambanks and channelization efforts may add nutrients to local surface waters. Nutrients may be added if there is particulate phosphorus bound with eroding soils. Eroding riparian areas may be linked to soil inputs within the water column and potentially to changes in flow patterns. Changes in flow patterns may also encourage down-cutting of the streambed and streambanks. Stream channelization efforts can increase the velocity of flow (via the removal of the sinuosity of a natural channel) and disturb the natural sedimentation processes of the streambed.

Atmospheric deposition: Phosphorus may be added via particulate deposition. Particles from the atmosphere may fall onto lake surfaces or other surfaces within the SRW. Phosphorus can be bound to these particles which may add to the phosphorus inputs to surface water environments.

Urban/residential sources: Nutrients may be added via runoff from urban/developed areas near Quamba Lake, Knife Lake, Cross Lake and Pokegama Lake. Runoff from urban/developed areas can include phosphorus derived from fertilizers, leaf and grass litter, pet wastes, and other sources of anthropogenic derived nutrients.

Wetland Sources: Phosphorus may be added to surface waters by stormwater flows through wetland areas in the SRW. Storm events may mobilize phosphorus through the transport of suspended solids and other organic debris.

Forest Sources: Phosphorus may be added to surface waters via runoff from forested areas within the watershed. Runoff from forested areas may include debris from decomposing vegetation and organic soil particles.

Wildlife: Wildlife is a known source of nutrients in water bodies as many animals spend time in or around water bodies. Deer, geese, ducks, raccoons, and other animals all create potential sources of nutrients. Wildlife contributes to the potential impact of contaminated runoff from animal habitats, such as urban park areas, forest, and rural areas.

Snake River watershed sediment (biota) TMDL:
Stream channelization and streambank erosion: Eroding streambanks and channelization efforts may add sediment to local surface waters. Eroding riparian areas may be linked to soil inputs within the water column and potentially to changes in flow patterns. Changes in flow patterns may also encourage down-cutting of the streambed and streambanks. Stream channelization efforts can increase the velocity of flow (via the removal of the sinuosity of a natural channel) and disturb the natural sedimentation processes of the streambed. Unrestricted livestock access to streams and streambank areas may lead to streambank degradation and sediment additions to stream environments.

Stormwater runoff from agricultural land use practices: Runoff from agricultural lands may contain significant amounts of sediment which may lead to impairments in the SRW. Sediment inputs to surface waters can be exacerbated by tile drainage lines, which channelize the stormwater flows. Tile lined fields and channelized ditches enable particles to move more efficiently into surface waters.

Wetland Sources: Sediment may be added to surface waters by stormwater flows through wetland areas in the SRW. Storm events may mobilize particulates through the transport of suspended solids and other organic debris.

Forest Sources: Sediment may be added to surface waters via runoff from forested areas within the watershed. Runoff from forested areas may include debris from decomposing vegetation and organic soil particles.

Atmospheric deposition: Sediment may be added via particulate deposition. Particles from the atmosphere may fall onto lake surfaces or other surfaces within the SRW.

Future Growth:
Significant development is not expected in the SRW. The land use within the watershed is primarily agricultural and according to MPCA is expected to remain agricultural for the foreseeable future. The WLA and load allocations for the SRW TMDLs were calculated for all current and future sources. Any expansion of point or nonpoint sources will need to comply with the respective WLA and LA values calculated in the SRW TMDLs.

The EPA finds that the TMDL document submitted by MPCA satisfies the requirements of the first criterion.

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 water body, the applicable numeric or narrative water quality criterion, and the antidegradation policy (40 C.F.R. §130.7(c)(1)). EPA needs this information to review the loading capacity determination, and load and wasteload allocations, which are required by regulation.

The TMDL submittal must identify a numeric water quality target(s) – a quantitative value used to measure whether or not the applicable water quality standard is attained. Generally, the pollutant of concern and the numeric water quality target are, respectively, the chemical causing the impairment and the numeric criteria for that chemical (e.g., chromium) contained in the water quality standard. The TMDL expresses the relationship between any necessary reduction of the pollutant of concern and the attainment of the numeric water quality target. Occasionally, the pollutant of concern is different from the pollutant that is the subject of the numeric water quality target (e.g., when the pollutant of concern is phosphorus and the numeric water quality target is expressed as Dissolved Oxygen (DO) criteria). In such cases, the TMDL submittal should explain the linkage between the pollutant of concern and the chosen numeric water quality target.

Comment:
Designated Uses:
Minnesota Rule Chapter 7050 designates uses for waters of the state. The segments addressed by the Snake River watershed TMDLs are designated as Class 2B water for aquatic recreation use (boating, swimming, fishing etc.). The Class 2 aquatic recreation designated use is described in Minnesota Rule 7050.0140 (3):

> *"Aquatic life and recreation includes all waters of the state that support or may support fish, other aquatic life, bathing, boating, or other recreational purposes and for which quality control is or may be necessary to protect aquatic or terrestrial life or their habitats or the public health, safety, or welfare."*

Standards:
Narrative Criteria: Minnesota Rule 7050.0150 (3) set forth narrative criteria for Class 2 waters of the State:

"For all Class 2 waters, the aquatic habitat, which includes the waters of the state and stream bed, shall not be degraded in any material manner, there shall be no material increase in undesirable slime growths or aquatic plants, including algae, nor shall there be any significant increase in harmful pesticide or other residues in the waters, sediments, and aquatic flora and fauna; the normal fishery and lower aquatic biota upon which it is dependent and the use thereof shall not be seriously impaired or endangered, the species composition shall not be altered materially, and the propagation or migration of the fish and other biota normally present shall not be prevented or hindered by the discharge of any sewage, industrial waste, or other wastes to the waters."

Numeric criteria:

For bacteria impaired waters:

Water quality standards are the fundamental benchmarks by which the quality of surface waters are measured. Within the State of Minnesota, WQS are developed pursuant to the Minnesota Statutes Chapter 115, Sections 03 and 44. Authority to adopt rules, regulations, and standards as are necessary and feasible to protect the environment and health of the citizens of the State is vested with the MPCA. Through adoption of WQS into Minnesota's administrative rules (principally Chapters 7050 and 7052), MPCA has identified designated uses to be protected in each of its drainage basins and the criteria necessary to protect these uses. The bacteria water quality standards which apply to Snake River watershed are:

Table 5: Bacteria Water Quality Standards Applicable to the Snake River watershed TMDLs

Parameter	Units	Water Quality Standard
E. coli [1]	# / 100 mL	1,260 in < 10% of samples [2]
		Geometric Mean < 126 [3]
[1] = *E. coli* standards apply only between April 1 and October 31		
[2] = Standard shall not be exceeded by more than 10% of the samples taken within any calendar month		
[3] = Geometric mean based on minimum of 5 samples taken within any calendar month		

TMDL Bacteria Target: The target is the standard as stated above, for both the geometric mean portion and the daily maximum portion, which is applicable from April 1st through October 31st. However, the focus of this TMDL is on the 'chronic' standard of 126 cfu/100ml. MPCA believes that utilizing the 126 cfu/100 mL portion of the water quality standard will result in the greatest bacteria reductions within the Snake River watershed. Additionally, MPCA believes that the geometric mean is the more relevant value in determining water quality. MPCA stated that while the TMDL will focus on the geometric mean portion of the water quality standard, compliance is required with both parts of the water quality standard.

For nutrient impaired waters:

Numeric criteria for TP, chl-a, and SD depth are set forth in Minnesota Rules 7050.0222. These three parameters are the eutrophication standards that must be achieved to attain the aquatic recreation designated use. The numeric eutrophication standards which are applicable to Pokegama Lake and Cross Lake are those set forth for Class 2B deep lakes in the NCHF Ecoregion (Table 6 of this Decision Document). The numeric eutrophication standards which are applicable to Knife Lake and Quamba Lake are those set forth for Class 2B shallow lakes in the NCHF Ecoregion (Table 6 of this Decision

Document). In developing the lake nutrient standards for Minnesota lakes, MPCA evaluated data from a large cross-section of lakes within each of the State's ecoregions. Clear relationships were established between the causal factor, TP, and the response variables, chl-a and SD depth.

MPCA anticipates that by meeting the TP concentrations of 40 µg/L and 60 µg/L, the response variables chl-a and SD will be attained and the lakes addressed by the Snake River watershed TMDL will achieve their designated beneficial uses. For lakes to achieve their designated beneficial use, the lake must not exhibit signs of eutrophication and allow water-related recreation, fishing and aesthetic enjoyment. MPCA views the control of eutrophication as the lake enduring minimal nuisance algal blooms and exhibiting desirable water clarity.

Table 6: Minnesota Eutrophication Standards for Deep and Shallow lakes within the North Central Hardwood Forest ecoregion

Parameter	**NCHF Eutrophication Standard (deep lakes)**[1]	**NCHF Eutrophication Standard (shallow lakes)**[2]
	(Pokegama Lake & Cross Lake)	*(Knife Lake & Quamba Lake)*
Total Phosphorus (µg/L)	TP < 40	TP < 60
Chlorophyll-a (µg/L)	chl-a < 14	chl-a < 20
Secchi Depth (m)	SD > 1.4	SD > 1.0

[1] = Deep lakes are defined as enclosed basins with a maximum depth greater than 15-feet

[2] = Shallow lakes are defined as lakes with a maximum depth less than 15-feet, or with more than 80% of the lake area shallow enough to support emergent and submerged rooted aquatic plants (littoral zone).

<u>*TMDL Nutrient Target:*</u> MPCA selected a target of 40 µg/L of TP to develop the TMDLs for Cross Lake and Pokegama Lake and a target of 60 µg/L of TP to develop the TMDLs for Quamba Lake and Knife Lake. MPCA selected TP as the appropriate target parameter to address eutrophication problems at Quamba Lake, Knife Lake, Cross Lake and Pokegama Lake because of the interrelationships between TP and chl-a, as well as SD depth. Algal abundance is measured by chl-a, which is a pigment found in algal cells. As more phosphorus becomes available, algae growth can increase. Increased algae in the water column will decrease water clarity that is measured by SD depth.

<u>For the fish and macroinvertebrate bioassessment impaired waters:</u>
Minnesota's narrative standard for biotic integrity is set forth in Minnesota Rules 7050.0150 (3) and (6). The standard uses an Index of Biotic Integrity (IBI), which evaluates and integrates multiple attributes of the aquatic community, or "metrics," to evaluate a complex biological system. Each metric is based upon a structural (e.g., species composition) or functional (e.g., feeding habits) aspect of the aquatic community that changes in a predictable way in response to human disturbance.

MPCA evaluates biological systems through measurement of fish and macroinvertebrate IBIs. Fish and macroinvertebrate IBIs are expressed as a score that ranges from 0 to 100, with 100 being the best score possible. MPCA has evaluated fish and macroinvertebrate communities at numerous reference sites across Minnesota. These reference sites have been minimally impacted by human activity and MPCA has established IBI impairment targets based on stream drainage area, ecoregion, and major basin at select reference locations. MPCA considers the biota of a stream to be impaired when the estimated IBI scores falls below the threshold (i.e., target) established for that category of stream.

MPCA selected a fish IBI score of 40 for the Northern Headwater Streams ecoregion to evaluate the fish biological scores in the Mud Creek subwatershed (07030004-566). MPCA selected a macroinvertebrate IBI score of 52.4 for the Northern Forest Glide-Pool ecoregion to evaluate the macroinvertebrate biological scores in the Mud Creek subwatershed.

MPCA completed a Stressor Identification exercise to identify potential causes impacting biotic integrity in the Mud Creek subwatershed. This exercise was completed using EPA's Causal Analysis/Diagnosis Decision Information System (CADDIS), which allows the user to analyze potential causes of impairment via a "strength of evidence" approach. MPCA determined that the biotic integrity was most likely impacted by bedded sediment, low dissolved oxygen (DO), riparian habitat degradation, loss of connectivity due to ditching and altered flow due to ditching. The CADDIS exercise provided strong evidence that sedimentation was the primary stressor to aquatic life in Upper Mud Creek. Riparian degradation and low DO concentrations were recognized as important co-stressors while the loss of connectivity and altered hydrology are likely contributors to the impairment.

TMDL Sediment Target: Minnesota does not currently have a water quality target for bedded sediment. The CADDIS exercise concluded that sediment in Mud Creek falls within the lower percentile of ecoregion reference streams, and that the main sources of excess sediment are from sediment from eroded streambanks and channel bottom scour.

To determine the sediment target for Mud Creek, MPCA determined the amount of sediment conveyed from the landscape (via watershed sources) and the sediment entering the stream through streambank erosion (Section 5.2 of the final TMDL document). Field analysis indicated the streambanks within the Upper Mud Creek subwatershed were highly unstable, and this source was contributing a disproportionate amount of eroded sediment to the waters of Upper Mud Creek. In order to estimate a sediment loading values (i.e., a TMDL sediment load in lbs/year), MPCA estimated a streambank recessional rate (measured in feet/year). This rate was based on the comparison of streambank recessional rates of minimally eroding reaches to the observed recessional rates in the Upper Mud Creek reach. MPCA set the sediment TMDL target at a recession rate of 0.025 feet per year which was then translated to a TMDL load measured in lbs/year (Section 5.3.2 of the final TMDL document). MPCA explained that it expected the sediment loading contribution, based on the 0.025 ft/year streambank recession rate, to result in sufficient sediment reduction within the Upper Mud Creek reach and ultimately the reach would attain appropriate conditions for supporting biotic communities.

The EPA finds that the TMDL document submitted by MPCA satisfies the requirements of the second criterion.

3. Loading Capacity - Linking Water Quality and Pollutant Sources

A TMDL must identify the loading capacity of a water body for the applicable pollutant. 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 pollutant loadings may be expressed as either mass-per-time, toxicity or other appropriate measure (40 C.F.R. §130.2(i)). If the TMDL is expressed in terms other than a daily load, e.g., an annual load, the submittal should explain why it is appropriate to express the TMDL in the unit of measurement chosen. The TMDL submittal should 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.

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

TMDLs must take into account *critical conditions* for steam flow, loading, and water quality parameters as part of the analysis of loading capacity (40 C.F.R. §130.7(c)(1)). TMDLs should define applicable *critical conditions* and describe their approach to estimating both point and nonpoint source loadings under such *critical conditions*. In particular, the TMDL should discuss the approach used to compute and allocate nonpoint source loadings, e.g., meteorological conditions and land use distribution.

Comment:

Snake River watershed bacteria (*E. coli*) TMDLs:

For all *E. coli* TMDLs addressed by the SRW TMDL, a geometric mean of **126 cfu/100 ml** for five samples equally spaced over a 30-day period was used to set the loading capacity of the TMDL. MPCA believes the geometric mean portion of the WQS provides the best overall characterization of the status of the watershed. The EPA agrees with this assertion, as stated in the preamble of, *"The Water Quality Standards for Coastal and Great Lakes Recreation Waters Final Rule"* (69 FR 67218-67243, November 16, 2004) on page 67224, "...the geometric mean is the more relevant value for ensuring that appropriate actions are taken to protect and improve water quality because it is a more reliable measure, being less subject to random variation, and more directly linked to the underlying studies on which the 1986 bacteria criteria were based."

MPCA believes that bacteria reductions necessary to restore water quality will occur in the SRW by calculating the bacteria TMDLs to the chronic water quality standard of 126 cfu/100 mL instead of the acute water quality standard of 1,260 cfu/100 mL. MPCA stated that the bacteria TMDLs will focus on the geometric mean portion of the water quality standard (126 cfu/100mL). MPCA expects that compliance with the chronic WQS (126 cfu/100 mL) will result in the acute WQS (1,260 cfu/100 mL) being met. EPA finds these assumption to be reasonable.

Typically loading capacities are expressed as a mass per time (e.g. pounds per day). However, for *E. coli* loading capacity calculations, mass is not always an appropriate measure because *E. coli* is expressed in terms of organism counts. This approach is consistent with the EPA's regulations which define "load" as "an amount of matter that is introduced into a receiving water" (40 CFR §130.2). To establish the loading capacities for the SRW bacteria TMDLs, MPCA used Minnesota's WQS for *E. coli* (126 cfu/100 mL). A loading capacity is, "the greatest amount of loading that a water can receive without violating water quality standards." (40 CFR §130.2). Therefore, a loading capacity set at the WQS will assure that the water does not violate WQS. MPCA's *E. coli* TMDL approach is based upon the premise that all discharges (point and nonpoint) must meet the WQS when entering the water body. If all sources meet the WQS at discharge, then the water body should meet the WQS and the designated use.

Separate flow duration curves (FDC) were created for the Upper and Lower Bear Creek bacteria TMDLs and the Mud Creek bacteria TMDL in the SRW. The Upper and Lower Mud Creek FDC were developed based on measured flows from MPCA streamflow stations in Mud Creek and flow values from Mud Creek were correlated to a USGS gage in the Snake River (#05338500). MPCA calculated regression relationships between the Mud Creek flow data and the Snake River USGS station (r^2 of 0.65 to 0.71). The regression equations were used to fill data gaps and predict non-monitored flows in Mud Creek between 2001-2011.

In Bear Creek MPCA collected flow measurements during field sampling and correlated these flow measurements to a nearby gage on Pokegama Creek (S005-286). Similar to Mud Creek, MPCA calculated regression relationships between Bear Creek flow data and flow information in Pokegama Creek (r^2 of 0.97). The regression equation was used to fill data gaps in the Bear Creek flow data between 2001-2011. Flow data from these sources focused on dates within the recreation season (April 1 to October 31). Dates outside of the recreation season were excluded from the flow record. Daily stream flows were necessary to implement the load duration curve (LDC) approach.

FDC graphs have flow duration interval (percentage of time flow exceeded) on the X-axis and discharge (flow per unit time) on the Y-axis. The FDC were transformed into LDC by multiplying individual flow values by the WQS (126 cfu/100 mL) and then multiplying that value by a conversion factor. The resulting points are plotted onto a load duration curve graph. LDC graphs, for the SRW bacteria TMDLs, have flow duration interval (percentage of time flow exceeded) on the X-axis and *E. coli* concentrations (number of bacteria per unit time) on the Y-axis. The SRW LDC used *E. coli* measurements in billions of bacteria per day. The curved line on a LDC graph represents the TMDL of the respective flow conditions observed at that location.

Water quality monitoring was completed in the SRW between 2004-2006 and 2008-2010 and measured *E. coli* concentrations were converted to individual sampling loads by multiplying the sample concentration by the instantaneous flow measurement observed/estimated at the time of sample collection. The individual sampling loads were plotted on the same figure with the created LDC.

The LDC plots were subdivided into five flow regimes; high flows (exceeded 0–10% of the time), moist conditions (exceeded 10–40% of the time), mid-range flows (exceeded 40–60% of the time), dry conditions (exceeded 60–90% of the time), and low flows (exceeded 90–100% of the time). LDC plots can be organized to display individual sampling loads and the calculated LDC. Watershed managers can interpret these plots (individual sampling points plotted with the LDC) to understand the relationship between flow conditions and water quality exceedances within the watershed. Individual sampling loads which plot above the LDC represent violations of the WQS and the allowable load under those flow conditions at those locations. The difference between individual sampling loads plotting above the LDC and the LDC, measured at the same flow is the amount of reduction necessary to meet WQS.

The strengths of using the LDC method are that critical conditions and seasonal variation are considered in the creation of the FDC by plotting hydrologic conditions over the flows measured during the recreation season. Additionally, the LDC methodology is relatively easy to use and cost-effective. The weaknesses of the LDC method are that nonpoint source allocations cannot be assigned to specific sources, and specific source reductions are not quantified. Overall, MPCA believes and EPA concurs that the strengths outweigh the weaknesses for the LDC method.

Implementing the results shown by the LDC requires watershed managers to understand the sources contributing to the water quality impairment and which Best Management Practices (BMPs) may be the most effective for reducing bacteria loads based on flow magnitudes. Different sources will contribute bacteria loads under varying flow conditions. For example, if exceedances are significant during high flow events this would suggest storm events are the cause and implementation efforts can target BMPs that will reduce stormwater runoff and consequently bacteria loading into surface waters. This allows for a more efficient implementation effort.

TMDLs for Upper Mud Creek, Lower Mud Creek and Bear Creek were calculated (Table 7 of this Decision Document). The load allocation was calculated after the determination of the WLA, and the Margin of Safety (5% of the loading capacity). Load allocations (ex. stormwater runoff from agricultural land use practices and feedlots, inadequate SSTS, wildlife inputs etc.) were not split among individual nonpoint contributors. Instead, load allocations were combined together into a one value to cover all nonpoint source contributions.

Table 7 of this Decision Document reports five points (the midpoints of the designated flow regime) on the loading capacity curve. However, it should be understood that the components of the TMDL equation could be illustrated for any point on the entire loading capacity curve. The LDC method can be used to display collected bacteria monitoring data and allows for the estimation of load reductions necessary for attainment of the bacteria water quality standard. Using this method, daily loads were developed based upon the flow in the water body. Loading capacities were determined for the segment for multiple flow regimes. This allows the TMDL to be represented by an allowable daily load across all flow conditions. Table 7 of this Decision Document identifies the loading capacity for the water body at each flow regime. Although there are numeric loads for each flow regime, the LDC is what is being approved for this TMDL.

Table 7: Bacteria (*E. coli*) TMDLs for Snake River watershed

Flow Regime TMDL analysis *E. coli* (billions of bacteria/day)	Very High Flow	High Flow	Mid-Range Flow	Low Flow	Dry Flow
Bear Creek (07030004-514)					
Wasteload Allocation (WLA)	0.00	0.00	0.00	0.00	0.00
Load Allocation (LA)	58.40	18.30	7.30	4.40	2.90
Margin Of Safety (MOS) (5%)	3.10	1.00	0.40	0.20	0.200
TMDL	**61.50**	**19.30**	**7.70**	**4.60**	**3.10**
Upper Mud Creek (07030004-566)					
Wasteload Allocation (WLA)	0.00	0.00	0.00	0.00	0.00
Load Allocation (LA)	335.50	63.50	21.30	10.40	6.20
Margin Of Safety (MOS) (5%)	17.70	3.30	1.10	0.60	0.300
TMDL	**353.20**	**66.80**	**22.40**	**11.00**	**6.50**
Lower Mud Creek (07030004-567)					
Wasteload Allocation (WLA)	0.00	0.00	0.00	0.00	0.00
Load Allocation (LA)	1366.40	184.00	43.70	18.50	9.30
Margin Of Safety (MOS) (5%)	71.90	9.70	2.30	1.00	0.500
TMDL	**1438.30**	**193.70**	**46.00**	**19.50**	**9.80**

The reduction from current conditions needed to meet the bacteria water quality standards was estimated for each reach, where data were sufficient. The reductions were calculated from the geometric mean of fecal coliform observed in each reach. The calculation used was:

(observed geometric mean – 126 cfu per 100 ml) / observed geometric mean)

MPCA states that these estimated reductions needed are intended to be approximate, and does not account for variability in flow and bacteria itself can be a highly variable parameter. The estimates are intended to give a relative magnitude of reductions needed across the three reaches (Figures 3.3 to 3.5 of the final TMDL). Table 8 in this Decision Document summarizes the estimated reductions needed in each reach and by calendar month.

Table 8: Bacteria (*E. coli*) reductions for the Snake River watershed Bacteria TMDLs

	Very High Flow	High Flow	Mid-Range Flow	Low Flow	Dry Flow
Bear Creek (07030004-514)					
Reduction (%)	0.0	60.0	72.0	52.0	43.0
Upper Mud Creek (07030004-566)					
Reduction (%)	0.0	0.0	0.0	44.0	73.0
Lower Mud Creek (07030004-567)					
Reduction (%)	0.0	9.0	31.0	0.0	64.0

EPA concurs with the data analysis and LDC approach utilized by MPCA in its calculation of loading capacities, wasteload allocations, load allocations and the margin of safety for the SRW bacteria TMDLs. The methods used for determining the TMDL are consistent with U.S. EPA technical memos.[2]

Snake River watershed nutrient TMDLs:

The approach utilized by MPCA to calculate the loading capacity for the Quamba Lake, Knife Lake, Quamba Lake, Cross Lake and Pokegama Lake nutrient TMDLs is described in Section 4.0 of the final TMDL document. MPCA determined the nutrient budget for each lake based on inputs from; direct watershed sources, upstream lakes, failing septic systems (SSTS), wastewater treatment facilities, construction and industrial stormwater inputs, internal load, and atmospheric load. After estimating the current/existing phosphorus loads budgets, MPCA used the BATHTUB model to set the loading capacity for each lake.

MPCA used total phosphorus and ortho-phosphorus water quality sampling information to develop their estimates of nutrient inputs from watershed sources. The water quality sampling information was collected by local organizations (ex. member of the Kanabec SWCD) at various main-stem river and tributary monitoring stations upstream of the four impaired lakes over the past 10 years. MPCA also compiled flow data from several monitoring stations throughout the SRW. TP loads for certain monitoring locations were estimated using the FLUX32 load estimation software from the U.S. Army Corps of Engineers (USACE). The FLUX32 software package uses TP sample data and continuous flow data to calculate mass discharge (load) estimates. These mass discharge estimates were applied to subwatersheds within the SRW.

MPCA subdivided watershed load estimates by land use category. A Generalized Watershed Loading Function (GWLF) model was developed for each of the subwatersheds (Quamba, Knife, Cross and Pokegama). The GWLF model is a GIS-based continuous simulation model which uses daily weather data to calculate water balance and simulate runoff, sediment and nutrient loading. Within the GWLF, MPCA employed GIS information from the Minnesota Department of Natural Resource ditch/stream network, 30-meter digital elevation models (DEM), the Soil Survey Geographic (SSURGO) databases and the 2010 National Agricultural Statistics Service (NASS) land use database. The GWLF modeling efforts helped to inform the predicted TP loading rates in each subwatershed.

Upstream lake inputs were calculated for only the Cross Lake TMDL. MCPA determined that Quamba Lake, Knife Lake and Pokegama Lake did not have upstream lakes which contributed to their nutrient budgets. Cross Lake, being the lake furthest downstream within the SRW, receives flow and TP load from upstream lakes. Discharge volume from upstream lakes was calculated using annual runoff from flow stations located in each impaired lake's subwatershed. TP loads from upstream lakes were calculated by multiplying each lake's flow weighted mean TP concentration by the estimated outflow volume.

Failing SSTS were recognized by MPCA as a potential source of phosphorus to surface waters in the SRW. MPCA estimated the total number of failing SSTS in each of the four lake subwatersheds. These estimates were based on 2010 Census data. MPCA's calculation of failing SSTS per subwatershed was based on county failure rates and rural population estimates. Loading calculations for SSTS were

[2] U.S. Environmental Protection Agency. August 2007. *An Approach for Using Load Duration Curves in the Development of TMDLs*. Office of Water. EPA-841-B-07-006. Washington, D.C.

founded on values within the University of Minnesota Water Resource Center's Septic System Improvement Estimator (SSIE) (Version 2012). The SSIE is a spreadsheet-based model that uses published literature rates to calculate annual pollutant loads from failing SSTS.

There are two NPDES facilities which contribute nutrient loading to Knife Lake subwatershed and two NPDES facilities which contribute nutrient loading to the Cross Lake subwatershed (Table 4 of this Decision Document).

- The Wahkon Wastewater Treatment Facility (WWTF) and Isle WWTF are located in the Knife Lake subwatershed and discharge to tributaries and wetlands near the headwaters of the Knife River. Both of these facilities were assigned a portion of the nutrient TMDL for Knife Lake.
- The Ogilvie WWTF, Mora WWTF and Grasston WWTF are located in the Snake River watershed and discharge directly to the Snake River or a major tributary of the Snake River upstream of Cross Lake's south basin. These three facilities were assigned a portion of the nutrient TMDL for Knife Lake.

In 2012, MPCA completed the Lake St. Croix nutrient TMDL which included assigning nutrient loads WWTFs within the SRW. These nutrient loads were calculated in order for Lake St. Croix to meet its nutrient reduction goals and attain WQS. The WLAs established in the Lake St. Croix TMDL were applied to the WWTFs in the SRW.

Internal load estimates were calculated by MPCA utilizing anoxia and sediment phosphorus release rate data in order to determine the mass of phosphorus released during the summer growing season. MPCA examined dissolved oxygen data for each of the lakes and used this water quality data to help estimate internal load values. MPCA calculated atmospheric load for each of the lakes by multiplying the lake area (acres) by the atmospheric deposition rate (pounds/acre-year). Atmospheric inputs of phosphorus from wet and dry deposition were estimated using rates from a MPCA report *Detailed Assessment of Phosphorus Sources to Minnesota Watersheds* and are based on annual precipitation. The values used for dry conditions (less than 25-inches of precipitation), average, and wet conditions (more than 38-inches of precipitation) are 24.9 kg/km^2-year (0.22 pounds/acre-year) for dry conditions, 26.8 kg/km^2-year (0.24 pounds/acre-year) for average conditions, and 29.0 kg/km^2-year (0.26 pounds/acre-year) for wet conditions.

The BATHTUB model was utilized to link phosphorus loads with in-lake water quality and to calculate loading capacity values for Quamba Lake, Knife Lake, Cross Lake and Pokegama Lake. BATHTUB has previously been used successfully in many lake studies in Minnesota. BATHTUB is a steady-state annual or seasonal model that predicts a lake's growing season (June 1 – September 30) average surface water quality. BATHTUB utilizes annual or seasonal time-scales which are appropriate because watershed TP loads are normally impacted by seasonal conditions.

BATHTUB has built-in statistical calculations which account for data variability and provide a means for estimating confidence in model predictions. BATHTUB employs a mass-balance TP model that accounts for water and TP inputs from tributaries, direct watershed runoff, the atmosphere, and sources internal to the lake, and outputs through the lake outlet, water loss via evaporation, and TP sedimentation and retention in the lake sediments. BATHTUB provides flexibility to tailor model inputs to specific lake morphometry, watershed characteristics and watershed inputs. The BATHTUB model also allows MPCA to assess different impacts of changes in nutrient loading. BATHTUB allows choice among several different mass-balance TP models.

The loading capacity of the lake was determined through the use of BATHTUB and the Canfield-Bachmann subroutine and then allocated to the WLA, LA, Margin of Safety (MOS) and Reserve Capacity. To simulate the load reductions needed to achieve the WQS, a series of model simulations were performed. Each simulation reduced the total amount of TP entering each of the water bodies during the growing season (or summer season, June 1 through September 30) and computed the anticipated water quality response within the lake. The goal of the modeling simulations was to identify the loading capacity of Quamba Lake, Knife Lake, Cross Lake, and Pokegama Lake (i.e., the maximum allowable load to the system, while allowing it to meet WQS) from June 1 to September 30. The modeling simulations focused on reducing the TP to the system.

The BATHTUB modeling efforts were used to calculate the loading capacity for each lake. The loading capacity is the maximum phosphorus load which each of these water bodies can receive over an annual period and still meet the shallow and deep lake NCHF WQS (Table 6 of this Decision Document). Loading capacities on the annual scale (lbs/year) were calculated to meet the WQS during the growing season (June 1 through September 30). The time period of June to September was chosen by MPCA as the growing season because it corresponds to the eutrophication criteria, contains the months that the general public typically uses Quamba Lake, Knife Lake, Cross Lake, and Pokegama Lake for aquatic recreation, and is the time of the year when water quality is likely to be impaired by excessive nutrient loading. Loading capacities were divided by 365 to calculate the daily loading capacities.

MPCA subdivided the loading capacity among the WLA, LA, MOS components and reserve capacity (RC) of the TMDL (Tables 8-11 of this Decision Document). The LA accounted for a majority of the loading capacity. These calculations were based on the critical condition, the summer growing season, which is typically when the water quality in the lake is degraded and phosphorus loading inputs are the greatest. TMDL allocations assigned during the summer growing season will protect Quamba Lake, Knife Lake, Cross Lake, and Pokegama Lake during the worst water quality conditions of the year. MPCA assumed that the loading capacities established by the TMDL will be protective of water quality during the remainder of the calendar year (October through May).

The Knife Lake TMDL and the Cross Lake TMDL both included a portion of their loading capacity for reserve capacity. In Minnesota, RC is established for projects that address failing or nonconforming septic systems and unsewered communities. MPCA only makes RC available to new WWTPs or existing WWTPs that provide service to existing populations with failing or nonconforming systems. MPCA explained that in the SRW TMDLs the RC was available to establish WLAs for the conversion of existing phosphorus loads and is not intended to provide additional capacity (via increasing the WLA) to new or expanding industrial or municipal discharges. The determination of the RC for the Knife Lake TMDL and the Cross Lake TMDL was completed according to methodology set forth in the Lake St. Croix TMDL (2012).

In developing the lake nutrient standards for Minnesota lakes (Minn. Rule 7050), the MPCA evaluated data from a large cross-section of lakes within each of the state's ecoregions. Clear relationships were established between the causal factor TP and the response variables chl-a and SD depth. Based on these relationships it is expected that the allocations set forth in this TMDL to meet the phosphorus targets of 60 μg/L and 40 μg/L for shallow and deep lakes will result in the chlorophyll-a and Secchi standards being met.

Table 9: Nutrient TMDL for Quamba Lake in the Snake River watershed

Allocation	Source	Existing TP Load[1] (lbs/yr)	Existing TP Load[1] (lbs/day)[2]	TMDL (lbs/yr)	TMDL (lbs/day)[2]	Load Reduction (lbs/yr)	Load Reduction (%)
Wasteload Allocation	Construction (1.0%) Stormwater & Industrial (0.5%) Stormwater	55	0.15	55	0.15	0.00	0%
	Failing SSTS	15	0.04	0	0.00	15.00	100%
	WLA Totals	*70*	*0.19*	*55*	*0.15*	--	--
Load Allocation	Watershed contributions	5,490	15.03	3,516	9.63	1,974	36%
	Internal Load	1,347	3.69	113	0.31	1,234	92%
	Atmospheric Deposition	54	0.15	54	0.15	0.00	0%
	LA Totals	*6,891*	*18.87*	*3,683*	*10.08*	*3,208*	*47%*
Margin Of Safety (5 %)		--	--	197	0.54	--	--
	Total	**6,961**	**19.06**	**3,935**	**10.77**	**3,223**	**46%**

1 = Existing load is the average for the years 2010 and 2011

2 = Annual loads converted to daily loads by dividing by 365.25 days per year

Table 10: Nutrient TMDL for Knife Lake in the Snake River watershed

Allocation	Source	Existing TP Load (lbs/yr)	Existing TP Load (lbs/day)[2]	TMDL (lbs/yr)	TMDL (lbs/day)[2]	Load Reduction (lbs/yr)	Load Reduction (%)
Wasteload Allocation	Construction & Industrial Stormwater	121	0.33	121	0.30	0	0%
	Wahkon WWTF (MN0047066)	100 [1]	0.27	369 [3]	8.00	--	0%
	Isle WWTF (MN0023809)	204 [1]	0.56	609 [4]	10.10	--	0%
	Failing SSTS	60	0.16	0.00	0.00	60	100%
	WLA Totals	*485*	*1.33*	*1,099*	*18.40*	--	--
Load Allocation	Watershed contributions	11,689	32.00	7,639	20.91	4050	35%
	Internal Load	6,764	18.52	1,297	3.55	5467	81%
	Atmospheric Deposition	301	0.82	301	0.82	0	0%
	LA Totals	*18,754*	*51.35*	*9,237*	*25.29*	*9,517*	*51%*
Reserve Capacity		--	--	47	0.13	--	
Margin Of Safety (5 %)		--	--	547	1.50	--	
	Total	**19,239**	**52.67**	**10,930**	**45.32**	**9,577**	**50%**

1 = Based on the averaged monitoring data and Discharge Monitoring Reports from 2010 and 2011

2 = Annual loads converted to daily loads by dividing by 365.25 days per year

3 = WLA calculated using 1.0 mg/L concentration limit (369 lb/year annual load)

4 = Based on WLAs established in the Lake St. Croix nutrient TMDL (MPCA, 2012)

Table 11: Nutrient TMDL for Cross Lake in the Snake River watershed

Allocation	Source	Existing TP Load		TMDL		Load Reduction	
		(lbs/yr)	*(lbs/day)*[2]	*(lbs/yr)*	*(lbs/day)*[2]	*(lbs/yr)*	*(%)*
Wasteload Allocation	North & Central Basin Watershed Construction & Industrial Stormwater	21	0.06	21	0.06	0.00	--
	South Basin Diffusive Flux Construction & Industrial Stormwater	21	0.06	21	0.06	0.00	--
	Ogilvie WWTF (MN0021997) [3]	6 [1]	0.02	6 [4]	0.02	0.00	--
	Mora WWTF (MN0021156) [3]	39 [1]	0.11	19 [4]	0.05	20.00	51%
	Grasston WWTF (MN0025691) [3]	--	--	4 [4]	0.01	--	--
	Failing SSTS	111	0.30	0	0.00	111	100%
	WLA Totals	***198***	***0.54***	***71***	***0.19***	***131.00***	***66%***
Load Allocation	South Basin Diffusive Flux	1,078	2.95	1,947	5.33	+(869)	--
	Direct Watershed Load	2,356	6.45	1,220	3.34	1,136	48%
	Internal Load	8,408	23.02	3,053	8.36	5,355	64%
	Atmospheric Deposition	147	0.40	147	0.40	0.00	0%
	LA Totals	***11,989***	***32.82***	***6,367***	***17.43***	***5,622***	***47%***
Reserve Capacity		--	--	7	0.02	--	--
Margin Of Safety (5 %)		--	--	339	0.93	--	--
	Total	**12,187**	**33.37**	**6,784**	**18.55**	**5,753**	**47%**

1 = Based on the averaged monitoring data and Discharge Monitoring Reports from 2010 and 2011

2 = Annual loads converted to daily loads by dividing by 365.25 days per year

3 = Estimated values of diffusive load (from the south basin) to the north and central basin of Cross Lake

4 = Based on WLAs established in the Lake St. Croix nutrient TMDL (MPCA, 2012)

For the purposes of the SRW TMDL study, the Cross Lake nutrient TMDL was calculated as one TMDL and loads were determined to apply to the entire lake (i.e., loads were not specified to a particular sub-basin of Cross Lake).

Table 12: Nutrient TMDL for Pokegama Lake in the Snake River watershed

Allocation	Source	Existing TP Load[1]		TMDL		Load Reduction	
		(lbs/yr)	(lbs/day)[2]	(lbs/yr)	(lbs/day)[2]	(lbs/yr)	(%)
Wasteload Allocation	Construction (1.0%) Stormwater & Industrial (0.5%) Stormwater	108	0.30	108	0.30	0.00	0%
	Failing SSTS	808	2.21	0	0.00	808	100%
	WLA Totals	***916***	***2.51***	***108***	***0.30***	***808***	***88%***
Load Allocation	Pokegama Brook Watershed Load	9,631	26.37	5,777	15.82	3,854	40%
	Direct Watershed Load	9,163	25.09	1,055	2.89	8,108	88%
	Internal Load	13,203	36.15	1,356	3.71	11,847	90%
	Atmospheric Deposition	362	0.99	362	0.99	0.00	0%
	LA Totals	***32,359***	***88.59***	***8,550***	***23.41***	***23,809***	***74%***
Margin Of Safety (5 %)		--	--	456	1.25	--	--
	Total	**33,275**	**91.10**	**9,114**	**24.95**	**24,617**	**74%**

1 = Existing load is the average for the years 2001, 2002, 2008 and 2010

2 = Annual loads converted to daily loads by dividing by 365.25 days per year

Tables 9 to 12 of this Decision Document discusses MPCA's estimates of the reductions required for Quamba Lake, Knife Lake, Cross Lake and Pokegama Lake to meet their water quality targets. These loading reductions (i.e., the percentage column) were estimated from existing and TMDL load calculations. MPCA expects that these reductions will result in the attainment of the water quality targets and the lake water quality will return to a level where their designated uses are no longer considered impaired.

EPA supports the data analysis and modeling approach utilized by MPCA in its calculation of wasteload allocations, load allocations and the margin of safety for the Quamba Lake, Knife Lake, Cross Lake and Pokegama Lake nutrient TMDLs. Additionally, EPA concurs with the loading capacities calculated by the MPCA in these four nutrient TMDLs. EPA finds MPCA's approach for calculating the loading capacity for Quamba Lake, Knife Lake, Cross Lake and Pokegama Lake to be reasonable and consistent with EPA guidance.

Snake River watershed sediment (biota) TMDL:

MPCA attributed sediment inputs as the main stressor on aquatic life in Upper Mud Creek. MPCA determined that the primary source of sediment to Upper Mud Creek is from eroding streambanks. This source was recognized as a nonpoint source to Upper Mud Creek and assigned a portion of the load allocation (Table 13 of this Decision Document). Additionally, MPCA determined that 'watershed sources' of sediment also contribute as a nonpoint source. These sources were recognized as originating from deforestation, high-density agricultural activities and pastures, removal or lack of vegetative buffers adjacent to ditches, channels and streams, and other land use alterations to the surrounding landscape (i.e., such as changes in land cover from forest to grass or shrub lands). These changes in land cover can increase sediment delivery if the watershed is ditched or tiled, or if there is a lack of intervening buffer vegetation to filter sediment from overland flow. The watershed sources were recognized as a nonpoint source to Upper Mud Creek and assigned a portion of the load allocation (Table 13 of this Decision Document).

The Universal Soil Loss Equation (USLE) was used by MPCA to estimate the potential amount of sediment delivered to Upper Mud Creek from watershed sources. The USLE is a widely-used model developed by the Natural Resources Conservation Service (NRCS) which incorporates factors such as soil erodibility, topography, and cropping practices to estimate potential soil loss. MPCA explained that soil loss estimates from the USLE required a correction factor to adjust for the local delivery conditions of the Upper Mud Creek subwatershed. This correction factor was the Sediment Delivery Ratio (SDR) which estimates the downstream delivery of soil loss from a drainage area.

$$SDR = 0.451 * (b)^{-0.298}$$

Where b = watershed size in square kilometers

The USLE predicted that the annual potential soil loss in the Upper Mud Creek subwatershed (approx. 20,366 acres) was 405 tons per year. MPCA estimated that the sediment delivery ratio was 0.121, which resulted in an annual estimated watershed load (i.e., mass of sediment delivered from the watershed) to Mud Creek at 49.05 tons/year (405 tons/year multiplied by the sediment delivery ration of 0.121).

Streambank erosion was also identified as a main source of sediment. Changes in land cover within the riparian corridor have been identified as weakening streambanks. The reduction or elimination of long-rooted vegetation, which stabilized streambank areas and changes in flow regime are the likely contributors to destabilized streambank areas within the Upper Mud Creek subwatershed. Animal activity in the riparian corridor, either grazing on vegetation which stabilizes streambanks, or the physical degradation of the streambank through animals accessing the stream was attributed as contributing to streambank degradation in the Upper Mud Creek subwatershed.

MPCA evaluated the soil loss from streambank erosion by observing the severity of soil loss on representative stream reaches on both Upper and Lower Mud Creek. Annual soil loss estimates were calculated based on land use type and extrapolated to the length of the impaired segment. Annual soil loss estimates were made using field collected data and the NRCS' *Direct Volume Method* (also known as the *Wisconsin Method*). In the Direct Volume Method soil loss is calculated by;

- Measuring the amount of exposed stream bank in a known length of stream;
- Multiplying that by a rate of loss per year;
- Multiplying that volume by soil density to obtain the annual mass for that stream length; and
- Converting that mass into a mass per stream mile.

The Direct Volume Method is summarized in the following equation:

$$\frac{\text{(eroding area)} * \text{(lateral recession rate)} * \text{(density)}}{2{,}000 \text{ lbs / ton}} = \text{erosion in tons/year}$$

Field and observational data were compiled by MPCA into a database which included; stream length, total eroding area, bank condition severity rating, and soil texture. MPCA estimated the soil recession rate and multiplied this estimate by the total eroding area to obtain the estimated total annual volume of soil loss. This annual volume of soil loss was converted to annual tons of soil loss to via using soil texture and soil volume weight estimated values. To estimate the total annual soil loss from streambank erosion on Upper Mud Creek, the surveyed annual soil loss rates were assumed to be representative of rates for all the segments of Upper Mud Creek that were similar in land use and land cover. Annual soil loss rates were estimated for each land use category based on the erosion observations taken in Upper Mud Creek. MPCA estimated the existing streambank load, based on estimated soil loss from the impaired Upper Mud Creek segment to be approximately 225 tons/year (Table 13 of this Decision Document).

The Bedded Sediment WLA for the Upper Mud Creek segment was calculated by assigning 1.0% of the total loading capacity to construction and industrial stormwater. MPCA explained that there is a limited amount of construction activity within the Upper Mud Creek subwatershed. MPCA felt it was appropriate to attribute 1.0% of the total loading capacity toward construction and industrial stormwater to account for any future activities (Table 13 of this Decision Document). The primary sources of sediment assigned to the load allocations were due to watershed load delivered directly to the segment from the landscape or conveyance channels, tiles, or pipes and streambank load delivered directly to the segment from erosion and mass wasting.

Table 13: Sediment (biota) TMDL for Upper Mud Creek in the Snake River watershed

Allocation	Source	Existing Bedded Sediment Load		Bedded Sediment TMDL[3]		Load Reduction	
		(tons/yr)[1]	*(tons/day)*[2]	*(tons/yr)*	*(tons/day)*[2]	*(lbs/yr)*	*(%)*
Wasteload Allocation	Construction & Industrial Stormwater	3	0.008	3	0.008	0.00	0%
	WLA Totals	***3***	***0.008***	***3***	***0.008***	--	--
Load Allocation	Watershed Load	49	0.134	49	0.134	0.00	0%
	Streambank Load	225	0.616	41	0.112	184	82%
	LA Totals	***274***	***0.750***	***90***	***0.246***	***184***	***67%***
Margin Of Safety (10 %)		--	--	5	0.014	--	--
	Total	**277**	**0.758**	**98**	**0.27**	**184**	**66%**

1 = All fractional loads were rounded up to the next whole number to provide a conservative estimate

2 = Annual loads converted to daily loads by dividing by 365.25 days per year

3 = The Bedded Sediment TMDL was based on MPCA's estimated streambank recessional rate of 0.025 feet/year for Mud Creek (Discussed on page 14 of this Decision Document)

Table 13 this Decision Document discusses MPCA's estimates of the reductions required for Upper Mud Creek to meet its water quality targets. These loading reductions (i.e., the Percentage column) were estimated from existing and TMDL load calculations. MPCA expects that these reductions will result in the attainment of the water quality target and the creek's water quality and biota will return to a level where its designated use is no longer considered impaired.

EPA supports the data analysis and modeling approach utilized by MPCA in its calculation of wasteload allocations, load allocations and the margin of safety for the Mud Creek sediment (biota) TMDL. Additionally, EPA concurs with the loading capacities calculated by the MPCA in the Mud Creek sediment (biota) TMDL. EPA finds MPCA's approach for calculating the loading capacity for the Mud Creek sediment (biota) to be reasonable and consistent with EPA guidance.

The EPA finds that the TMDL document submitted by MPCA satisfies the requirements of the third criterion.

4. Load Allocations (LA)

EPA regulations require that a TMDL include LAs, which identify the portion of the loading capacity attributed to existing and future nonpoint sources and to natural background. Load allocations may range from reasonably accurate estimates to gross allotments (40 C.F.R. §130.2(g)). Where possible, load allocations should be described separately for natural background and nonpoint sources.

Comment:
MPCA determined the LA calculations for each of the TMDLs based on the applicable WQS or water quality targets. MPCA recognized that LAs for each of the individual TMDLs addressed by the SRW TMDLs can be attributed to different nonpoint sources.

Snake River watershed bacteria (*E. coli*) TMDLs:
The calculated LA values for the bacteria TMDLs (07030004-514, 07030004-566 & 07030004-567) are applicable across all flow conditions in the Bear Creek and Mud Creek subwatersheds (Table 7 of this Decision Document). MPCA identified several nonpoint sources which contribute bacteria loads to the surface waters in the SRW. Load allocations were recognized as originating from many diverse nonpoint sources including; stormwater from agricultural and feedlot areas, failing septic systems, livestock with access to stream areas, urban stormwater runoff, and wildlife (deer, geese, ducks, raccoons, turkeys and other animals). MPCA did not determine individual load allocation values for each of these potential nonpoint source considerations, but aggregated the nonpoint sources into one LA value.

Snake River watershed nutrient TMDLs:
MPCA divided the LA for the Quamba Lake, Knife Lake, Cross Lake and Pokegama Lake nutrient TMDLs between a variety of nonpoint sources. These nonpoint sources included; watershed contributions from each lake's direct watershed, watershed contributions from upstream watersheds, atmospheric deposition, and internal loading sources. The direct watershed nonpoint sources for all four water bodies include TP inputs from agricultural nonpoint source runoff, urban nonpoint source runoff and wetland nonpoint source contributions. MPCA calculated estimated percent reductions for different LA sources. These reductions represent the estimated decreases necessary to meet the NCHF WQS (Tables 9 to 12 of this Decision Document). The reductions necessary from nonpoint sources ranged from 32% to 92%.

The Cross Lake TMDL incorporated a 'South Basin Diffusive Flux' load as part of the load allocation (Table 11 of this Decision Document). This load was based on estimated TP concentrations added to the Cross Lake from the Snake River, the unique hydrologic characteristics of flow in the lake in response to flows from the Snake River (Appendix G of the final TMDL document).

MPCA recommended that stakeholders prioritize their efforts for decreasing nonpoint phosphorus inputs to the four lakes addressed in the SRW nutrient TMDLs. MPCA explained that its strategy for assigning nonpoint source reductions to each individual lake was based on targeting external (or direct) watershed nonpoint sources first. After fully investigating the nonpoint source load which could reasonably be expected to be reduced from external watershed sources, MPCA then focused their reduction efforts on internal load to each of the individual lakes. MPCA believes that external watershed loads should be addressed prior to internal loads because loading from external watershed sources oftentimes contributes to phosphorus available in the lake bottom sediments. Without mitigating one of the main sources to internal load MPCA explained stakeholders may be presented with the ongoing challenge of managing internal load.

Quamba Lake, Knife Lake, Cross Lake and Pokegama Lake have considerable internal loading and substantial internal load reductions are necessary in order for these lakes to eventually attain WQS. MPCA recognizes that its load reductions goals for internal load are aggressive but these goals are based on the on the best available information for the SRW nutrient TMDLs and the reduction targets are within the range of reductions required for other lakes in Minnesota. Once implementation actions are conducted to address both internal loads (e.g. alum treatment) and watershed loads (e.g. stormwater treatment) and additional water quality monitoring is completed to assess the progress, MPCA and local partners plan to revisit the reduction goals of the SRW nutrient TMDLs. Through this adaptive management approach, MPCA and local partners will be able to decide whether further implementation actions are needed or if MPCA should consider a site-specific water quality standard.

Snake River watershed sediment (biota) TMDL:

The calculated LA values for the sediment (biota) TMDL (07030004-566) were divided into a watershed load and a streambed load (Table 13 of this Decision Document). MPCA identified several nonpoint sources which contribute sediment loads to the surface waters in the SRW. Load allocations were recognized as originating from many diverse nonpoint sources including; stormwater contributions from agricultural lands, stream channelization and streambank erosion, livestock with access to stream areas, wetland and forest sources, and atmospheric deposition.

EPA finds MPCA's approach for calculating the LA to be reasonable.

The EPA finds that the TMDL document submitted by MPCA satisfies the requirements of the fourth criterion.

5. Wasteload Allocations (WLAs)

EPA regulations require that a TMDL include WLAs, which identify the portion of the loading capacity allocated to individual existing and future point source(s) (40 C.F.R. §130.2(h), 40 C.F.R. §130.2(i)). In some cases, WLAs may cover more than one discharger, e.g., if the source is contained within a general permit.

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. These individual WLAs may be adjusted during the NPDES permitting process. If the WLAs are adjusted, the individual effluent limits for each permit issued to a discharger on the impaired water must be consistent with the assumptions and requirements of the adjusted WLAs in the TMDL. If the WLAs are not adjusted, effluent limits contained in the permit must be consistent with the individual WLAs specified in the TMDL. If a draft permit provides for a higher load for a discharger than the corresponding individual WLA in the TMDL, the State/Tribe must demonstrate that the total WLA in the TMDL will be achieved through reductions in the remaining individual WLAs and that localized impairments will not result. All permittees should be notified of any deviations from the initial individual WLAs contained in the TMDL. EPA does not require the establishment of a new TMDL to reflect these revised allocations as long as the total WLA, as expressed in the TMDL, remains the same or decreases, and there is no reallocation between the total WLA and the total LA.

Comment:

Snake River watershed bacteria (*E. coli*) TMDLs:

The WLA for the bacteria TMDLs (07030004-514, 07030004-566 & 07030004-567) were all set to 0 (WLA = 0). MPCA concluded that there were no NPDES permitted facilities, MS4 communities, nor other potential point sources which should have been assigned a portion of the loading capacity for the bacteria TMDLs.

Snake River watershed nutrient TMDLs:

WLA details applicable to all four nutrient TMDLs:

MPCA calculated the construction stormwater and industrial stormwater WLA based on the watershed TMDL loads. MPCA determined that 53 active NPDES construction permits existed within the four impaired subwatersheds. To account for these facilities and future growth in the watershed (reserve capacity), construction stormwater allocations in each of the nutrient TMDL were set to one percent (1.0%) of the watershed TMDL load prior to the subtraction of the MOS and LA. For industrial stormwater contribution MPCA set the industrial stormwater WLA contribution at one half Percent (0.5%) of the watershed TMDL load allocation before the MOS and LA are subtracted.

MPCA explained that BMPs and other stormwater control measures should be implemented at active construction sites to limit the discharge of pollutants of concern. BMPs and other stormwater control measures which should be implemented at construction sites are defined in the State's NPDES/SDS General Stormwater Permit for Construction Activity (MNR100001). In the final TMDL document MPCA explained that if a construction site owner/operator obtains coverage under the NPDES/SDS General Stormwater Permit (MNR100001) and properly selects, installs and maintains all BMPs required under MNR1000001 and applicable local construction stormwater ordinances, including those related to impaired waters discharges and any applicable additional requirements found in Appendix A of the Construction General Permit, the stormwater discharges would be expected to be consistent with the WLA in this TMDL.

Industrial sites within the Snake River watershed are expected to comply with the requirements of the State's NPDES/SDS Industrial Stormwater Multi-Sector General Permit (MNR050000) or NPDES/SDS General Permit for Construction Sand & Gravel, Rock Quarrying and Hot Mix Asphalt Production facilities (MNG490000). In the final TMDL document MPCA explained that if a facility owner/operator obtains coverage under the appropriate NPDES/SDS General Stormwater Permit and properly selects, installs and maintains all BMPs required under the permit, the stormwater discharges would be expected to be consistent with the WLA in this TMDL. BMPs and other stormwater control measures which act to limit the discharge of the pollutant of concern (phosphorus) are defined in MNR050000 and MNG490000.

The NPDES program requires construction and industrial sites to create SWPPPs which summarize how stormwater pollutant discharges will be minimized from construction and industrial sites. Under the MPCA's Stormwater General Permit (MNR100001) and applicable local construction stormwater ordinances, managers of sites under construction or industrial stormwater permits must review the adequacy of local SWPPPs to ensure that each plan complies with the applicable requirements in the State permits and local ordinances. As noted above, MPCA has explained that meeting the terms of the applicable permits will be consistent with the WLAs set in the Quamba Lake, Knife Lake, Cross Lake and Pokegama Lake nutrient TMDLs. In the event that the SWPPP does not meet the WLA, the SWPPP will need to be modified within 18-months of the approval of the TMDL by the U.S. EPA. This applies to sites under permits for MNR100001, MNR050000 and MNG490000.

SSTS (i.e., failing septics and ITHPS) were recognized as point sources and given a portion of the WLA for the Quamba Lake, Knife Lake, Cross Lake, and Pokegama Lake nutrient TMDLs. ITHPS septic systems are acknowledged as septic systems which discharge directly to surface waters. MPCA received a request from MCEA which requested that ITHPS septic systems be recognized as point sources. MPCA agreed with this request from MCEA and moved the SSTS septics into the point source grouping of the TMDL equation. MPCA anticipates that any existing loads from SSTS will be reduced to 0.0 lbs/year of TP (i.e., WLA = 0.0 lbs/year of TP) via efforts within the watershed to identify and address failing septic systems. Those systems which are deemed as ITHPS and not meeting septic ordinances are anticipated to be fixed or upgraded so that those systems no longer contribute pollutants to the Quamba Lake, Knife Lake, Cross Lake, and Pokegama Lake subwatersheds. MPCA aims to greatly reduce the number of failing SSTS in the future via local septic management programs.

WLA details for Knife Lake and Cross Lake nutrient TMDLs:
The Knife Lake TMDL and the Cross Lake TMDLs assigned WLAs to construction and industrial stormwater, failing SSTS and NPDES permitted facilities (Tables 10 and 11 of this Decision Document). There are five active NPDES permitted facilities in the Knife Lake and Cross Lake subwatersheds. The Wahkon WWTF (MN0047066) and the Isle WWTF (MN0023809) are within the Knife Lake subwatershed and discharge to tributaries and wetlands near the headwaters of the Knife River. The Ogilvie WWTF (MN0021997), Mora WWTF (MN0021156) and Grasston WWTF (MN0025691) are located in the Snake River watershed and discharge directly to the Snake River or a major tributary of the Snake River upstream of Cross Lake's south basin. MPCA explained that the WWTFs in the Knife and Cross Lake subwatersheds do not currently have TP concentrations or loading limits within their discharge permits.

MPCA completed the Lake St. Croix nutrient TMDL in 2012 and assigned nutrient loads to the five facilities in the Knife Lake and Cross Lake subwatersheds (Appendix A, Tables A.1 and A.2 of the final St. Croix TMDL). The St. Croix nutrient TMDL assigned WLAs to each facility based on nutrient concentration targets of 1.0 mg/L or 2.0 mg/L and the facility's wet weather design flow (WWDFs). The nutrient concentration targets were determined from the individual facility's WWDF. Facilities with WWDFs of 0.2 to 1.0 mgd received a WLA based on a TP concentration of 1.0 mg/L and facilities with WWDFs less than 0.2 mgd were assigned a WLA based on a TP concentration of 2.0 mg/L (Table 4-8 of the final TMDL document).

MPCA used the WLAs established in the Lake St. Croix TMDL for the Isle WWTF, the Ogilvie WWTF, the Mora WWTF and the Grasston WWTF. For the Knife Lake TMDL's Wahkon WWTF WLA MPCA adjusted the Wahkon WLA from 736 lbs/year (assigned in the Lake St. Croix TMDL) to 369 lbs/year. This adjustment to the Wahkon WLA was accomplished by using a 1.0 mg/L concentration target for the Wahkon WLA in the Knife Lake TMDL instead of the 2.0 mg/L concentration target for the Wahkon WLA. The 2.0 mg/L concentration target for Wahkon was assigned in the Lake St. Croix TMDL. MPCA explained that setting the Wahkon WWTF's nutrient concentration target to 1.0 mg/L, instead of the 2.0 mg/L target used in the Lake St. Croix TMDL, was more appropriate for the Knife Lake TMDL.

MPCA ensured that the WWTFs WLAs were consistent across the Lake St. Croix nutrient TMDL and the Knife and Cross Lake nutrient TMDLs, save for the Wahkon WWTF. MPCA verified that the WLAs of the Lake St. Croix TMDL were appropriate to use for the Knife and Cross Lake nutrient TMDLs via BATHTUB modeling efforts. MPCA determined that the WLA employed in the Lake St. Croix TMDL were reasonable for inclusion in the Knife Lake TMDL and the Cross Lake TMDL, again, save for the Wahkon WWTF, which was recalculated.

For Cross Lake, construction and industrial stormwater from the south basin's direct watershed and Snake River via diffusive flux from the south basin was estimated similar to WWTF allocations using the following equation:

$$\text{C \& I WLA} = (\text{WAL}_{total} * 0.015) / \text{South}_{total} * \text{Diff}_{total}$$

C & I WLA = construction and industrial stormwater WLA from the south basin via diffusion
WAL_{total} = Total watershed phosphorus load to the south basin
South_{total} = Total phosphorus load to the south basin
Diff_{total} = Total diffusive phosphorus flux from the south basin to the north and central basins

Snake River watershed sediment (biota) TMDL:
MPCA concluded that there were no NPDES permitted facilities, MS4 communities nor other potential point sources which should have been assigned a portion of the loading capacity for the sediment TMDL. The WLA for the sediment (biota) TMDL (07030004-566) was assigned to potential future construction stormwater sources and industrial stormwater sources. MPCA explained in Section 5.3.1 that there is a limited amount of construction activity within the Upper Mud Creek subwatershed. The WLA calculated for construction and industrial stormwater inputs in this subwatershed was determined based on 0.1% of the loading capacity (Table 13 of this Decision Document).

EPA finds the MPCA's approach for calculating the WLA for the SRW TMDLs to be reasonable and consistent with EPA guidance.

The EPA finds that the TMDL document submitted by MPCA satisfies the requirements of the fifth criterion.

6. Margin of Safety (MOS)

The statute and regulations require that a TMDL include a margin of safety (MOS) to account for any lack of knowledge concerning the relationship between load and wasteload allocations and water quality (CWA §303(d)(1)(C), 40 C.F.R. §130.7(c)(1)). EPA's 1991 TMDL Guidance explains that the MOS may be implicit, i.e., incorporated into the TMDL through conservative assumptions in the analysis, or explicit, i.e., expressed in the TMDL as loadings set aside for the MOS. 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.

<u>Comment:</u>
The final TMDL submittal outlines the determination of the Margin of Safety for the bacteria TMDLs (an explicit MOS set at 5% of the loading capacity), the sediment (biota) TMDL (an explicit MOS set at 10% of the loading capacity) and the nutrient TMDLs (an explicit MOS set at 5% of the loading capacity). The explicit MOS was applied by reserving approximately 5% or 10% of the total loading capacity, and then allocating the remaining loads to point and nonpoint sources (Tables 7 to 12 of this Decision Document). The use of an explicit MOS accounted for environmental variability in pollutant loading, variability in water quality data (i.e., collected water quality monitoring data), calibration and validation processes of modeling efforts, uncertainty in modeling outputs, and conservative assumptions made during the modeling efforts.

<u>Snake River watershed bacteria (*E. coli*) TMDLs:</u>
The bacteria TMDLs (07030004-514, 07030004-566 & 07030004-567) employed an explicit MOS (5% of the total loading capacity). The use of the LDC approach minimized variability associated with the development of the SRW bacteria TMDLs because the calculation of the loading capacity was a function of flow multiplied by the target value. The MOS was set at 5% to account for uncertainty due to field sampling error and assumptions made during the TMDL development process.

Challenges associated with quantifying *E. coli* loads include the dynamics and complexity of bacteria in stream environments. Factors such as die-off and re-growth contribute to general uncertainty that makes quantifying stormwater bacteria loads particularly difficult. The MOS for the SRW bacteria TMDLs also incorporated certain conservative assumptions in the calculation of the TMDLs. No rate of decay, or die-off rate of pathogen species, was used in the TMDL calculations or in the creation of load duration curves for *E. coli*. Bacteria have a limited capability of surviving outside their hosts, and normally a rate of decay would be incorporated. MPCA determined that it was more conservative to use the WQS (126 cfu/100 mL) and not to apply a rate of decay, which could result in a discharge limit greater than the WQS.

As stated in *EPA's Protocol for Developing Pathogen TMDLs* (EPA 841-R-00-002), many different factors affect the survival of pathogens, including the physical condition of the water. These factors include, but are not limited to sunlight, temperature, salinity, and nutrient deficiencies. These factors vary depending on the environmental condition/circumstances of the water, and therefore it would be difficult to assert that the rate of decay caused by any given combination of these environmental variables was sufficient enough to meet the WQS of 126 cfu/100 mL. Thus, it is more conservative to apply the State's WQS as the bacteria target value, because this standard must be met at all times under all environmental conditions.

<u>Snake River watershed nutrient TMDLs:</u>
The Quamba Lake, Knife Lake, Cross Lake and Pokegama Lake nutrient TMDLs employed an explicit MOS set at 5% of the loading capacity. MPCA explained that the explicit MOS was set at 5% due to the following factors discovered during the development of the SRW nutrient TMDLs:

- The robust dataset that includes lake water quality monitoring data collected over multiple years and basins;

- An extensive tributary flow dataset collected from multiple basins which contribute flow to Quamba Lake, Knife Lake, Cross Lake and Pokegama Lake;
- Internal loading total phosphorus release rate chemical data; and
- MPCA's confidence in the Canfield-Bachmann model's performance during the development of nutrient TMDLs.

<u>Snake River watershed sediment (biota) TMDL:</u>
The sediment (biota) TMDL used an explicit MOS set at 10% of the loading capacity. MPCA's justification for selecting an explicit MOS was based on the review of field conditions, aerial photos of the Upper Mud Creek subwatershed, as well as local knowledge and professional judgment of MPCA field and TMDL staff. MPCA explained that it felt a MOS of 10% of the stream bank load was appropriate to account for uncertainties in the sediment loading estimates used in streambank loss calculations and other estimates made by MPCA in the development of the sediment TMDL.

The EPA finds that the TMDL document submitted by MPCA contains an appropriate MOS satisfying the requirements of the sixth criterion.

7. Seasonal Variation

The statute and regulations require that a TMDL be established with consideration of seasonal variations. The TMDL must describe the method chosen for including seasonal variations. (CWA §303(d)(1)(C), 40 C.F.R. §130.7(c)(1)).

<u>Comment:</u>
<u>Snake River watershed bacteria (*E. coli*) TMDLs:</u>
Bacterial loads vary by season, typically reaching higher numbers in the dry summer months when low flows and bacterial growth rates contribute to their abundance, and reaching relatively lower values in colder months when bacterial growth rates attenuate and loading events, driven by stormwater runoff events aren't as frequent. Bacterial WQS need to be met between April 1st to October 31st, regardless of the flow condition. The development of the LDCs utilized flow measurements from local flow gages. These flow measurements were collected over a variety of flow conditions observed during the recreation season. LDCs developed from these flow records represented a range of flow conditions within the SRW and thereby accounted for seasonal variability over the recreation season.

Critical conditions for *E. coli* loading occur in the dry summer months. This is typically when stream flows are lowest, and bacterial growth rates can be high. By meeting the water quality targets during the summer months, it can reasonably be assumed that the loading capacity values will be protective of water quality during the remainder of the calendar year (November through March).

<u>Snake River watershed nutrient TMDLs:</u>
Seasonal variation was considered for the nutrient TMDLs as described in Section 5 of the final TMDL document. The nutrient targets employed in the Quamba Lake, Knife Lake, Cross Lake and Pokegama Lake TMDLs were based on the average nutrient values collected during the growing season (June 1 to September 30). The water quality targets were designed to meet the NCHF eutrophication WQS during the period of the year where the frequency and severity of algal growth is the greatest.

The Minnesota eutrophication standards state that total phosphorus WQS are defined as the mean concentration of phosphorus values measured during the growing season. In the Quamba Lake, Knife Lake, Cross Lake and Pokegama Lake phosphorus TMDL efforts, the LA and WLA estimates were calculated from modeling efforts which incorporated mean growing season total phosphorus values. Nutrient loading capacities were set in the TMDL development process to meet the WQS during the most critical period. The mid-late summer time period is typically when eutrophication standards are exceeded and water quality within the SRW is deficient. By calibrating the modeling efforts to protect these water bodies during the worst water quality conditions of the year, it is assumed that the loading capacities established by the TMDLs will be protective of water quality during the remainder of the calendar year (October through May).

Snake River watershed sediment (biota) TMDL:
The daily load reduction targets in this TMDL are calculated from annual rescission rates observed by the Wisconsin NRCS on a variety of streams over numerous years and reflect a wide variety of seasonal and annual variation in conditions. Consequently, using these average rates addresses both seasonal and annual variability. Given the amount of agricultural (pasture) land and wetlands in the Snake River watershed, sediment loadings in the SRW vary with agricultural activity. Sediment inputs to surface waters typically occur primarily through wet weather events. Critical conditions that impact the response of SRW water bodies to sediment inputs may typically occur during periods of low flow. During low flow periods, sediment can accumulate within the impacted water bodies, there is less assimilative capacity within the water body, and generally sediment is not transported through the water body at the same rate it is under normal flow conditions.

Critical conditions that impact loading, or the rate that sediment is delivered to the water body, were identified as those periods where large precipitation events coincide with periods of minimal vegetative cover on fields. Large precipitation events and minimally covered land surfaces can lead to large runoff volumes, especially to those areas which drain agricultural fields. The conditions generally occur in the spring and early summer seasons.

The EPA finds that the TMDL document submitted by MPCA satisfies the requirements of the seventh criterion.

8. Reasonable Assurance

When a TMDL is developed for waters impaired by point sources only, the issuance of a NPDES permit(s) provides the reasonable assurance that the wasteload allocations contained in the TMDL will be achieved. This is because 40 C.F.R. 122.44(d)(1)(vii)(B) requires that effluent limits in permits be consistent with, "the assumptions and requirements of any available wasteload allocation" in an approved TMDL.

When a TMDL is developed for waters impaired by both point and nonpoint sources, and the WLA is based on an assumption that nonpoint source load reductions will occur, EPA's 1991 TMDL Guidance states that the TMDL should 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 water quality standards.

EPA's August 1997 TMDL Guidance 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.

Comment:

The Snake River watershed bacteria, nutrient and sediment (biota) TMDLs provide reasonable assurance that actions identified in the implementation strategy, as discussed in the TMDL in Section 8.0, will be applied to attain the loading capacities and allocations calculated for the impaired reaches within the SRW. The recommendations made by MPCA will be successful at improving water quality if the appropriate local groups work to implement these recommendations. Those mitigation suggestions, which fall outside of regulatory authority, will require commitment from state agencies and local stakeholders to carry out the suggested actions.

MPCA has identified several local partners which have expressed interest in working to improve water quality within the SRW. Implementation practices will be implemented over the next several years. The following groups are expected to work closely with one another to ensure that pollutant reduction efforts via BMPs are being implemented within the SRW: the Snake River Watershed Management Board, the Aitkin County SWCD, the Kanabec County SWCD, the Mille Lacs County SWCD, and the Pine County SWCD.

Continued water quality monitoring within the basin is supported by MPCA. Additional water quality monitoring results could provide insight into the success or failure of BMP systems designed to reduce bacteria and nutrient effluent loading into the surface waters of the watershed. Local watershed managers would be able to reflect on the progress of the various pollutant removal strategies and would have the opportunity to change course if observed progress is unsatisfactory.

Various funding mechanisms will be utilized to execute the recommendations made in the implementation section of this TMDL. An implementation plan based on the recommendations from the SRW TMDLs will be finalized within one year of the approval of the SRW TMDLs. Funding for implementation efforts will be a mixture of local, state and federal funding vehicles. Local funding may be through SWCD cost-share funds, Natural Resources Conservation Service (NRCS) cost-share funds, and SRWD and local government cost-share funds. Federal funding, via the Section 319 grants program, may provide money to implement voluntary nonpoint source programs within the Snake River watershed. State efforts may be via Clean Water Legacy Act (CWLA) grant money and the Minnesota Clean Water Partnership program.

<u>Clean Water Legacy Act:</u> The CWLA is a statute passed in Minnesota in 2006 for the purposes of protecting, restoring, and preserving Minnesota water and providing the funding to do so. The Act discusses how MPCA and the involved public agencies and private entities will coordinate efforts regarding land use, land management, water management, etc. Cooperation is also expected between agencies and other entities regarding planning efforts, and various local authorities and responsibilities. This would also include informal and formal agreements to jointly use technical, educational, and

financial resources. The CWLA provides the process to be used in Minnesota to develop TMDL implementation plans, which detail the restoration activities needed to achieve the allocations in the TMDL. The TMDL implementation plans are required by the State to obtain funding from the Clean Water Fund. MPCA expects the implementation plans to be developed within a year of TMDL approval.

The CWLA also provides details on public and stakeholder participation, and how the funding will be used. The implementation plans are required to contain ranges of cost estimates for point and nonpoint source load reductions, as well as monitoring efforts to determine effectiveness. MPCA has developed guidance on what is required in the implementation plans (Implementation Plan Review Combined Checklist and Comment, MPCA), which includes cost estimates, general timelines for implementation, and interim milestones and measures. The Minnesota Board of Soil and Water Resources administers the Clean Water Fund as well, and has developed a detailed grants policy explaining what is required to be eligible to receive Clean Water Fund money (FY '11 Clean Water Fund Competitive Grants Policy; Minnesota Board of Soil and Water Resources, 2011).

Reasonable assurance that the WLA set forth will be implemented is provided by regulatory actions. According to 40 CFR 122.44(d)(1)(vii)(B), NPDES permit effluent limits must be consistent with assumptions and requirements of all WLAs in an approved TMDL. MPCA's stormwater program and the NPDES permit program are some of the implementing programs for ensuring effluent limits are consistent with the TMDL. The NPDES program requires construction and industrial sites to create a SWPPP that summarizes how stormwater will be minimized from the site.

The NPDES program requires construction and industrial sites to create SWPPPs which summarize how stormwater will be minimized from construction and industrial sites. Under the MPCA's Stormwater General Permit, managers of sites under construction or industrial stormwater permits must review the adequacy of local SWPPPs to ensure that each plan meets WLA set in the Snake River watershed TMDLs. In the event that the SWPPP does not meet the WLA, the SWPPP will need to be modified within 18-months of the approval of the TMDL by the U.S. EPA. This applies to sites under the MPCA's General Stormwater Permit for Construction Activity (MNR100001) and its NPDES/SDS Industrial Stormwater Multi-Sector General Permit (MNR050000) or NPDES/SDS General Permit for Construction Sand & Gravel, Rock Quarrying and Hot Mix Asphalt Production facilities (MNG490000).

The EPA finds that this criterion has been adequately addressed.

9. Monitoring Plan to Track TMDL Effectiveness

EPA's 1991 document, *Guidance for Water Quality-Based Decisions: The TMDL Process* (EPA 440/4-91-001), recommends a monitoring plan to track the effectiveness of a TMDL, particularly when a TMDL involves both point and nonpoint sources, and the WLA is based on an assumption that nonpoint source load reductions will occur. Such a TMDL should provide assurances that nonpoint source controls will achieve expected load reductions and, such TMDL should include a monitoring plan that describes the additional data to be collected to determine if the load reductions provided for in the TMDL are occurring and leading to attainment of water quality standards.

Comment:
The final TMDL document outlines the water monitoring efforts in the Snake River watershed. Progress of TMDL implementation will be measured through regular monitoring efforts of water quality and total BMPs completed. MPCA anticipates that monitoring will be completed by local groups (e.g., SRWMB) as long as there is sufficient funding to support the efforts of these local entities. At a minimum, the Snake River watershed will be monitored in 2017 by MPCA, as part of the MPCA lead 10-year Intensive Watershed Monitoring cycle.

Water quality monitoring is a critical component of the adaptive management strategy employed as part of the implementation efforts utilized in the Snake River watershed. Water quality information will aid watershed managers in understanding how BMP pollutant removal efforts are impacting water quality within the SRW. Water quality monitoring combined with an annual review of BMP efficiency will provide information on the success or failure of BMP systems designed to reduce pollutant loading into water bodies of the SRW. Watershed managers will have the opportunity to reflect on the progress or lack of progress, and will have the opportunity to change course if progress is unsatisfactory. Review of BMP efficiency is expected to be completed by the local and county partners.

Stream Monitoring:
River and stream monitoring in the SRW (Bear Creek and Mud Creek), has been coordinated largely by the SRWMB. The SRWMB has been funded via Clean Water Partnership Grants, and other available local funds. MPCA anticipates that stream monitoring in the Upper Mud, Lower Mud and Bear Creeks should at a minimum continue at the most downstream site to continue to build on the current dataset and track changes based implementation progress.

Continuing to monitor water quality and biota scores in the listed segments will determine whether or not stream habitat restoration measures are required to bring the watershed into attainment with water quality standards. At a minimum, fish and macroinvertebrate sampling should be conducted by the MPCA, MN DNR, or other agencies every five to ten years during the summer season at each established location until attainment is observed for at least two consecutive assessments. It will also be important to continue to conduct streambank assessments before and after any major stabilization BMP is implemented to track if instream erosion is improving, or if more work is needed.

Lake Monitoring:
Quamba Lake, Knife Lake, Cross Lake and Pokegama Lake have all been periodically monitored by volunteers and staff over the years. This monitoring is planned to continue in order to keep a record of the changing water quality as funding allows. Lakes are generally monitored for TP, chl-a, and Secchi disk transparency. MPCA expects that in-lake monitoring will continue as implementation activities are installed across the watersheds. These monitoring activities should continue until water quality goals are met. Some tributary monitoring has been completed on the inlets to the lakes and may be important to continue as implementation activities take place throughout the sub-watersheds.

The EPA finds that this criterion has been adequately addressed.

10. Implementation

EPA policy 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. In addition, EPA 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.

Comment:
Implementation strategies are outlined in Section 7 of the final TMDL document. MPCA presented a variety of possible implementation activities which could be undertaken within the SRW. Reduction goals for the bacteria, nutrient and sediment (biota) TMDLs will be met via components of the following strategies:

Snake River watershed bacteria (*E. coli*) TMDLs:
Pasture management/livestock exclusion plans: Reducing livestock access to stream environments will lower the opportunity for direct transport of bacteria to surface waters. The installation of exclusion fencing near stream and river environments to prevent direct access for livestock, installing alternative water supplies, and installing stream crossings between pastures, would work to reduce the influxes of bacteria and improve water quality within the watershed. Additionally, introducing rotational grazing to increase grass coverage in pastures, and maintaining appropriate numbers of livestock per acre for grazing, can also aid in the reduction of bacteria inputs.

Manure Collection and Storage Practices: Manure has been identified as a source of bacteria. Bacteria can be transported to surface water bodies via stormwater runoff. Bacteria laden water can also leach into groundwater resources. Improved strategies for the collection, storage and management of manure can ensure that minimal impacts of bacteria entering the surface and groundwater system. Repairing manure storage facilities or building roofs over manure storage areas may decrease the amount of bacteria in stormwater runoff.

Manure management plans: Developing manure management plans to ensure that the storage and application rates of manure are appropriate for land conditions. Determining application rates that take into account the crop to be grown on that particular field and soil type will ensure that the correct amount of manure is spread on a field given the conditions. Spreading the correct amount of manure will reduce the availability of bacteria to migrate to surface waters.

Feedlot runoff controls: Treatment of feedlot runoff via diversion structures, holding/storage areas, and stream buffering areas can all reduce the transmission of bacteria to surface water environments. Additionally, cleaner stormwater runoff can be diverted away from feedlots so as to not liberate bacteria.

Subsurface septic treatment systems: Improvements to septic management programs and educational opportunities can reduce the occurrence of septic pollution. Educating the public on proper septic maintenance, finding and eliminating illicit discharges and repairing failing systems could lessen the impacts of septic derived bacteria inputs into the SRW.

Riparian Area Management Practices: Protection of streambanks within the watershed through planting of vegetated/buffer areas with grasses, legumes, shrubs or trees will mitigate bacteria inputs into surface waters. These areas will filter stormwater runoff before the runoff enters the main stem or tributaries of the SRW.

Snake River watershed nutrient TMDLs:

Septic Field Maintenance: Septic systems are believed to be a source of nutrients to waters in the SRW. Failing systems are expected to be identified and addressed via upgrades to those SSTS not meeting septic ordinances. MPCA explained that SSTS improvement priority should be given to those failing SSTS on lakeshore properties or those SSTS adjacent to streams within the direct watersheds for each water body. MPCA aims to greatly reduce the number of failing SSTS in the future via local septic management programs and educational opportunities. Educating the public on proper septic maintenance, finding and eliminating illicit discharges, and repairing failing systems could lessen the impacts of septic derived nutrients inputs into the Snake River watershed.

Manure management (feedlot and manure stockpile runoff controls): Manure has been identified as a potential source of nutrients. Nutrients derived from manure can be transported to surface water bodies via stormwater runoff. Nutrient laden water can also leach into groundwater resources. Improved strategies in the collection, storage and management of manure can minimize impacts of nutrients entering the surface and groundwater system. Repairing manure storage facilities or building roofs over manure storage areas may decrease the amount of nutrients in stormwater runoff.

Pasture management and agricultural reduction strategies: These strategies involve reducing nutrient transport from fields and minimizing soil loss. Specific practices would include; erosion control through conservation tillage, reduction of winter spreading of fertilizers, elimination of fertilizer spreading near open inlets and sensitive areas, installation of stream and lake shore buffer strips, streambank stabilization practices (gully stabilization and installation of fencing near streams), and nutrient management planning.

Urban/Residential Nutrient Reduction Strategies: These strategies involve reducing stormwater runoff from lakeshore homes and other residences within the SRW. These practices would include; rain gardens, lawn fertilizer reduction, lake shore buffer strips, vegetation management and replacement of failing septic systems. Water quality educational programs could also be utilized to inform the general public on nutrient reduction efforts and their impact on water quality.

Protection and restoration of high-value wetlands: The SRW contains numerous high-value wetlands. MPCA recommends protecting these high-value wetlands from unnecessary stormwater introductions, which could potentially turn wetland areas from nutrient sinks to nutrient sources. Additionally, addressing those wetlands which are discharging phosphorus into Quamba Lake, Knife Lake, Cross Lake and Pokegama Lake will aid in the reduction of nonpoint source loads.

Public Education Efforts: Public programs will be developed to provide guidance to the general public on nutrient reduction efforts and their impact on water quality. These educational efforts could also be used to inform the general public on what they can do to protect the overall health of Quamba Lake, Knife Lake, Cross Lake and Pokegama Lake. The SRWMB could mail annual newsletters to local property owners encouraging them to visit the SRWMB website or to consult information within the newsletter which would outline nutrient reduction strategies.

Snake River watershed sediment (biota) TMDL:
Improved Agricultural Drainage Practices: A review of local agricultural drainage networks should be completed to examine how improving drainage ditches and drainage channels could be reorganized to reduce the influx of sediments to the surface waters in the SRW. The reorganization of the drainage network could include the installation of drainage ditches or sediment traps to encourage particle settling during high flow events. Additionally, cover cropping and residue management is recommended to reduce erosion and thus siltation and runoff into streams.

Reducing Livestock Access to Stream Environments: Livestock managers should be encouraged to implement measures to protect riparian areas. Managers should install exclusion fencing near stream environments to prevent direct access to these areas by livestock. Additionally, installing alternative watering locations and stream crossings between pastures may aid in reducing sediments to surface waters.

Identification of Stream, River, and Lakeshore Erosional Areas: An assessment of stream channel, river channel, and lakeshore erosional areas should be completed to evaluate areas where erosion control strategies could be implemented in the SRW. Implementation actions (ex. planting deep-rooted vegetation near water bodies to stabilize streambanks) could be prioritized to target areas which are actively eroding. This strategy could prevent additional sediment inputs into surface waters of the SRW and minimize or eliminate degradation of habitat.

The EPA finds that this criterion has been adequately addressed. The EPA reviews but does not approve implementation plans.

11. Public Participation

EPA policy is that there should be full and meaningful public participation in the TMDL development process. The TMDL regulations require that each State/Tribe must subject calculations to establish TMDLs to public review consistent with its own continuing planning process (40 C.F.R. §130.7(c)(1)(ii)). In guidance, EPA has explained that final TMDLs submitted to EPA for review and approval should describe the State's/Tribe's public participation process, including a summary of significant comments and the State's/Tribe's responses to those comments. When EPA establishes a TMDL, EPA regulations require EPA to publish a notice seeking public comment (40 C.F.R. §130.7(d)(2)).

Provision of inadequate public participation may be a basis for disapproving a TMDL. If 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.

Comment:
The public participation section of the TMDL submittal is found in Section 10 of the final TMDL document. Throughout the development of the SRW TMDLs the public was given various opportunities

to participate. MPCA encouraged public participation through public meetings and small group discussions. MPCA worked with members of the Technical Advisory Committee, which is composed of local stakeholders, technical staff, city officials, members of the NRCS, members of county SWCDs, and members from local lake associations, to solicit their input for potential implementation strategies. Members of the Technical Advisory Committee are the main groups which will ultimately be responsible for the implementation efforts within the Snake River watershed. The meetings between MPCA and the Technical Advisory Committee were held in 2012 and 2013. These discussions allowed MPCA to share information about the TMDL development efforts, monitoring data, and to present the public notice draft of the SRW TMDL.

In addition to the Technical Advisory Committee meetings, MPCA hosted public meetings in 2010, 2011, 2012 and 2013. Members of the general public and lake associations were invited to a series of stakeholder meetings to discuss the progress of the Snake River watershed TMDLs. The draft TMDL was posted online by MPCA at (http://www.pca.state.mn.us/water/tmdl). The 30-day public comment period was started on September 3, 2013 and ended on October 3, 2013. MPCA received 2 public comments during the public comment period.

One comment was from the Minnesota Department of Agriculture (MDA) and requested the inclusion of additional language within the SRW TMDL within the implementation section of the final TMDL. Specifically the MDA asked that the MPCA include discussion toward the importance of discussions with local livestock groups, the importance of pasture and grazing management plans to be included within the implementation section of the TMDL, a reference to the MDA Agricultural BMP Handbook and MDA's Agricultural BMP loan program, and the importance of prioritization of livestock exclusion areas (via fencing, alternative watering sources, etc.) by local governments. MPCA agreed to update language within the SRW TMDL and the St. Croix River Watershed Restoration and Protection Study (WRAPs) to meet the requests of the MDA.

The second comment was from the MCEA and requested that MPCA provide further clarification on: contributions from failing septic systems and whether they should be recognized as part of the WLA or the LA, the MPCA's calculation of loads being contributed by failing septics, the MPCA's rationale for its estimate of internal load for Quamba Lake, Knife Lake, Cross Lake and Pokegama Lake TMDLs, and guidance on how to restore the hydrology in upstream areas of Mud Creek. MPCA answered all of MCEA's questions and requests, in detail, within a response to MCEA's comments submitted with the final TMDL package received by EPA on December 11, 2013.

EPA believes that MPCA adequately addressed each of these comments and updated the final TMDL with appropriate language to address these comments. The MPCA submitted all of the public comments and responses in the final TMDL submittal packet received by the EPA on December 11, 2013.

The EPA finds that the TMDL document submitted by MPCA satisfies the requirements of this eleventh element.

12. Submittal Letter

A submittal letter should be included with the TMDL submittal, and should specify whether the TMDL is being submitted for a *technical review* or *final review and approval*. Each final TMDL submitted to EPA should 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. The submittal letter, whether for technical review or final review and approval, should contain such identifying information as the name and location of the water body, and the pollutant(s) of concern.

Comment:

The EPA received the final Snake River watershed TMDL document, submittal letter and accompanying documentation from MPCA on December 11, 2013. The transmittal letter explicitly stated that the following final TMDLs were being submitted to EPA pursuant to Section 303(d) of the Clean Water Act for EPA review and approval.

- Quamba Lake (33-0015-00) for nutrients;
- Knife Lake (33-0028-00) for nutrients;
- Cross Lake (58-0119-00) for nutrients;
- Pokegama Lake (58-0142-00) for nutrients;
- Bear Creek (07030004-514) for bacteria (*E. coli*);
- Mud Creek (07030004-566)for bacteria (*E. coli*), for fish bioassessment and macroinvertebrate bioassessment; and
- Mud Creek (07030004-567) for bacteria (*E. coli*).

The letter clearly stated that this was a final TMDL submittal under Section 303(d) of CWA. The letter also contained the name of the watershed as it appears on Minnesota's 303(d) list, and the causes/pollutants of concern. This TMDL was submitted per the requirements under Section 303(d) of the Clean Water Act and 40 CFR 130.

The EPA finds that the TMDL transmittal letter submitted for the Snake River watershed TMDLs by MPCA satisfies the requirements of this twelfth element.

13. Conclusion

After a full and complete review, the EPA finds that the TMDLs for:

- Quamba Lake (33-0015-00) for nutrients;
- Knife Lake (33-0028-00) for nutrients;
- Cross Lake (58-0119-00) for nutrients;
- Pokegama Lake (58-0142-00) for nutrients;
- Bear Creek (07030004-514) for bacteria (*E. coli*);
- Mud Creek (07030004-566) for bacteria (*E. coli*), for fish bioassessment and macroinvertebrate bioassessment; and
- Mud Creek (07030004-567) for bacteria (*E. coli*).

satisfy all of the elements of approvable TMDLs. This TMDL approval is for eight TMDLs, addressing six different water bodies for aquatic recreational and aquatic life use impairments.

The EPA's approval of these TMDLs extends to the water bodies which are identified above with the exception of any portions of the water bodies that are within Indian Country, as defined in 18 U.S.C. Section 1151. The EPA is taking no action to approve or disapprove TMDLs for those waters at this time. The EPA, or eligible Indian Tribes, as appropriate, will retain responsibilities under the CWA Section 303(d) for those waters.