UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
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CHICAGO, IL 60604-3590

RECEIVED
OCT 05 2009
MPCA COMMISSIONERS OFFICE

SEP 29 2009

REPLY TO THE ATTENTION OF:
WW-16J

Paul Eger, Commissioner
Minnesota Pollution Control Agency
520 Lafayette Road North
St. Paul, Minnesota 55155-4194

Dear Mr. Eger:

The U. S. Environmental Protection Agency has conducted a complete review of the final Total Maximum Daily Load (TMDL) for the Lower Vermillion River Watershed, including supporting documentation and follow up information. The Lower Vermillion River, assessment unit 07040001-504, extends from Hastings, Minnesota to the confluence of the Mississippi River south of Lock and Dam 3. The TMDL addresses the Aquatic Life Use impairment for turbidity due to excessive total suspended solids.

The TMDL meets the requirements of Section 303(d) of the Clean Water Act and EPA's implementing regulations at 40 C.F.R. Part 130. Therefore, EPA hereby approves Minnesota's one TMDL for total suspended solids for the Lower Vermillion River. 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 effort in submitting this TMDL and look forward to future TMDL submissions by the State of Minnesota. If you have any questions, please contact Mr. Dean Maraldo, Acting Chief of the Watersheds and Wetlands Branch, at 312-353-2098.

Sincerely,

Tinka G. Hyde
Director, Water Division

Enclosure

cc: Justin Watkins, MPCA
Dave Johnson, MPCA

wq-iw9-05g

TMDL: Turbidity (TSS) TMDL for the Lower Vermillion River Watershed, Minnesota
Approval Date: SEP 29 2009

DECISION DOCUMENT FOR THE APPROVAL OF THE LOWER VERMILLION RIVER WATERSHED TOTAL SUSPENDED SOLIDS TMDL

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 Total Maximum Daily Loads (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 National Pollutant Discharge Elimination System (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:

Identification of the water body

The Vermillion River travels approximately 59 miles from the headwaters in southeastern Scott County near New Market to the confluence with the Mississippi River south of Lock and Dam 3. The entire Vermillion River watershed drains 356 square miles and consists of 17 subwatersheds.

The Vermillion River splits below the Old Peavey Mill Dam, in Hastings, downstream of the falls. One branch (Vermillion Slough) flows to the north to join the Mississippi River near river mile 813. The other branch (the Lower Vermillion River) flows south to join the floodplain of the Mississippi River. The Lower Vermillion River (LVR) parallels the Mississippi River for approximately 20 miles before joining the confluence of the Mississippi River just downstream from Lock and Dam 3 near Red Wing, Minnesota. The LVR watershed consists of two subwatersheds draining approximately 77 square miles. Refer to Figures 1-1, 2-1 and 3-3 in the TMDL report and Figures 1 and 2 in Appendix B to the TMDL report for maps of the LVR.

Water quality monitoring on the LVR has shown that its turbidity levels frequently exceed the Minnesota Pollution Control Agency's (MPCA) standard of 25 nephelometric turbidity units (NTU). Turbidity data has been collected at several stations along the LVR (refer to Figure 3-3 of the TMDL report for data collection locations). Table 3-2 of the TMDL report provides a summary of the available data for all stations with a minimum of five samples. The information presented in Table 3-2 indicates that approximately 40 percent of the samples at the confluence with the Mississippi River have exceeded the turbidity water quality standard. According to Minnesota's 303(d) list of impaired waters, the LVR, assessment unit 07040001-504, has been identified as being impaired and included on Minnesota's list of impaired waters since 1994. Minnesota's 2008 Section 303(d) list information for the LVR is shown in Table 1 below, in the TMDL Summary Table in the TMDL report, and Table 1-1 of the TMDL report.

Table 1: 2008 Integrated Report Category 5 Information for the Lower Vermillion River

Water body Name	Water body Description	River ID	Cause of Impairment	Impaired Designated Use
Vermillion River	Vermillion R/Vermillion Slough, Hastings dam to Mississippi R	07040001-504	Turbidity	Aquatic Life

Pollutant of Concern

Turbidity is a measure of water clarity. When turbidity is elevated, the water appears cloudy and visibility is reduced. In addition to aesthetics, elevated turbidity has adverse impacts on aquatic life. For example, elevated turbidity reduces the ability of sight-feeding game fish to find their prey and reduces the vigor of the submerged aquatic vegetation that forms the basis of a healthy ecosystem in most Minnesota rivers. Elevated turbidity can be caused by a number of factors, including loads of fine sediment, growth of microscopic floating algae exacerbated by nutrient loads, and dissolved organic material.

Turbidity is not a pollutant. Since TMDLs must be written for a pollutant MPCA selected total suspended solids (TSS) as the pollutant of concern. Light scatter and adsorption is strongly influenced by the amount of solid materials suspended in the water column thus forming a relationship between TSS and turbidity. TSS is used to quantify concentrations of suspended solid-phase material in surface waters. There are two advantages for expressing the TMDL and allocations as TSS load. The first advantage is that upstream point sources have TSS effluent limits, concentration (mg/l), and load (kg/day), already in their NPDES permits. Because of this, impacts from these point sources were easily considered in the establishment of the loading capacities and allocations. Use of TSS loads in the wasteload allocations (WLAs) will also aid in the implementation of the WLAs since the allocations are already in terms that permit-holders and permit-writers are familiar with implementing. The second advantage is that sediment delivery and soil erosion are commonly expressed in terms of mass loads. Minnesota has selected TSS as the water quality target for this TMDL.

Land Use
The State considered eight land use classes within the LVR watershed. Table 2-1 in the TMDL report summarizes the distribution of land use/land cover. Seven of the eight land uses considered by the State were derived from the year 2000 statewide raster data which was developed from satellite images by the University of Minnesota Remote Sensing and Geospatial Laboratory. The State also considered more local land use data, however, the statewide data was determined to provide similar resolution as the local data and, since the statewide data covered the entire watershed, it was favored. The eighth land use, corn-soy rotation with mulch tillage, was included in the land use classifications to represent areas within the watershed where conservation tillage is practiced. As discussed in Appendix B, section B.3, to the TMDL report, Dakota County Soil and Water Conservation District approximates that half of the row crop agriculture is in conservation tillage.

Hydrology
As discussed in Section 2 of the TMDL report and in the appendices to the TMDL report, the LVR is a hydrologically complex system. Flow enters the LVR system from the Upper Vermillion at Hastings, Minnesota via local tributaries, through movement of groundwater, and by interflow with the Mississippi River. As discussed in the appendices of the TMDL report, the State found that on a long-term basis the Mississippi River has more inflow than the other sources of flow and has significant influence over cumulative pollutant loadings to the LVR system.

The LVR occupies the floodplain of the Mississippi River and has a naturally low gradient. The last component is particularly important to understanding the LVR. Because of the operation of Mississippi Lock and Dam 3 for navigation, the normal pool in the Mississippi River Pool 3 is typically greater than 5 feet above the water surface elevation in the LVR. This creates a tendency for water from the Mississippi to flow into the LVR, seeking a steeper gradient to the channel below Lock and Dam 3. It also creates a positive groundwater gradient from the Mississippi to the LVR. Finally, because of its own low channel gradient, flow within the LVR can be affected by the water surface elevation at its confluence with the Mississippi, below Lock and Dam 3. The interchange of water between the LVR and Pool 3 depends on the relative stage in the two systems. When stage at Prescott is above 676 feet, there is strong inflow from Pool 3 into the LVR (inflow begins at about 675.2 feet, but does not exceed the normal flow from the Upper Vermillion River until reaching about 676 feet).

To account for the influence of Pool 3 on the LVR, the State used two flow modes in modeling scenarios used to estimate TSS and other pollutant loadings to the LVR. The first mode, Mode 0, represents the LVR system when the stage in the Mississippi River is low enough to prevent flow from the Mississippi River to the LVR. Section 2.2.2 of the TMDL report states that this mode occurs about 214 days a year, approximately 58.5 percent of the year. The second mode considered by the State, Mode 1, is when the stage at Prescott is above 676 feet and there is strong inflow from Pool 3 into the LVR. Section 2.2.2 of the TMDL report states that Mode 1 occurs about 151 days per year, approximately 41.5 percent of the year. Section 4.1.6.1 of Appendix A provides further discussion on the interchange of flow between the Mississippi River and the LVR.

Existing Sources of Pollutant Loads

Section 5.0 of the TMDL report identifies five broad sources of flow and TSS to the LVR: the Upper Vermillion River[1], Mississippi River Pool 3, Mississippi River Pool 4, local tributaries, and internal sources. Table 4-1 in the TMDL report identifies the existing flow and TSS contribution from each of these sources to the LVR.[2] Appendix A, Sections 3 and 4, discuss flow and water quality data for these five sources. Appendix B to the TMDL report provides details of how these sources were considered in the models used to establish existing loads.

Table 6-3 in the TMDL report identifies point sources within the Vermillion River watershed with TSS limits in either their NPDES permit or their State Disposal System (SDS) permit. The four individual point sources[3] identified by the State discharge upstream of Hastings, into the Upper Vermillion River. The existing flow and TSS loads presented in Table 4-1 in the TMDL report for the Upper Vermillion River include contributions from these individual point sources. Table 6-4 in the TMDL report identifies ten municipal storm sewer system (MS4) permits[4]

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[1] The Lower Vermillion begins at Hastings, Minnesota. The portion of the river above Hastings is considered the Upper Vermillion River, which is meeting the turbidity standard.

[2] Note that Table 4-1 has divided Pool 3 into three sloughs that connect Pool 3 to the LVR. Collectively these three sloughs represent the contributions from Pool 3 to the LVR.

[3] The four individual point sources identified by the State are Elko/New Market WWTP, permit number MN0056219; Intek Plastics Inc., permit number MN0003417; Met Council-Empire WWTP, permit number MN0045845; and Vermillion WWTP, permit number MN0025101.

[4] The ten MS4 storm water permits identified by the State include: Apple Valley, MS400074; Burnsville, MS400076; Lakeville, MS400099; Farmington, MS400090; Rosemount, MS400117; Empire Township,

within the Vermillion River watershed. Similar to the individual point sources, all these storm water sources are located upstream of Hastings, therefore, their existing contributions of flow and TSS are included in the Upper Vermillion River's flow and TSS loads presented in Table 4-1 in the TMDL report. The U.S. Army Corp of Engineer FLUX program,[5] updated through the end of water year 2006, was used to estimate existing flow and TSS concentrations in the Vermillion River at Hastings. As shown in Table 4-1 in the TMDL report, the Upper Vermillion River contributes 21 percent of the flow volume and 7.8 percent of the TSS load to the LVR.

As mentioned above in the *Hydrology* discussion, the interflow between Pool 3 and the LVR has significant influence over the flow and cumulative pollutant loadings to the LVR system. In estimating the existing flow and TSS load from Pool 3 to the LVR, the State looked at the three major sloughs that are connected with Pool 3 along the LVR: Vermillion Slough at river mile 813.2, Truedale Slough at river mile 808.5, and Carter Slough at river mile 807.3. At the conjunctions of Pool 3 and the sloughs, water can flow freely and elevations in Pool 3 and the sloughs determine the magnitude and direction of the flow, i.e., whether or not water flows from Pool 3 through the sloughs or visa versa. Measured elevations[6] are available for Mississippi River miles 815.0, 811.4 and 796.91. The State used linear interpolations of the measured elevations to estimate Pool 3 elevations at the mouth of the three sloughs. Existing flows and loads from Pool 3 via each of the three sloughs into the LVR were calculated using linear interpolation to estimate daily water quality concentrations along with computed flows. These existing flows and TSS loads are included in Table 4-1 in the TMDL report. Flows and TSS loads are presented for each of the three sloughs. Collectively, the existing flow and TSS load into the LVR from Pool 3 were calculated by the State to be approximately 67 percent and 73 percent, respectively. The contributions from Pool 3 are considered a nonpoint source.

Another nonpoint source that the State identified as a contributor of flow and TSS load to the LVR is Pool 4 of the Mississippi River. The elevations of Pool 4 affect the hydrodynamics of the LVR thereby affecting pollutant concentrations. Pool 4 was defined as the downstream boundary of the CE-QUAL-W2 model used to estimate existing loads to the LVR. As summarized in Table 4-1 in the TMDL report, the State determined Pool 4 to contribute approximately 1 percent of the flow volume and less than 1 percent of the TSS load to the LVR. Section 3.4.3 of Appendix B to the TMDL report discusses how Pool 4 was considered in the CE-QUAL-W2 model.

Local watersheds and tributaries drain to the LVR downstream of Hastings and are sources of flow and TSS load to the LVR. These local tributaries were collectively considered nonpoint sources of TSS load to the LVR. No TSS data are available for these tributaries, so TSS contributions from these areas were estimated using the Soil and Water Assessment Tool (SWAT) watershed model. Both upland (i.e. sheet and rill) and streambank erosion loads were

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MS400135; Hastings, MS400240; MnDOT Metro, MS400170; Dakota County, MS400132; and Scott County, MS400154.

[5] Refer to Appendix A included in Appendix B of the TMDL report for further discussion of how the State conducted the FLUX analysis.

[6] Elevation data is available from the U.S. Army Corp of Engineers

estimated with SWAT and the resulting annual average loads are summarized in Table 4-1 in the TMDL report. Due to the lack of local tributary data, the SWAT model was not calibrated. Except as explained in Section 5.2 of the TMDL report and in Appendix B included in Appendix B to the TMDL report, default values were used in SWAT. As stated in Table 4-1 in the TMDL report and in Table B-7 in Appendix B, local tributaries contribute approximately 5 percent of the flow volume and 16 percent of the TSS load to the LVR. Appendix B included in Appendix B to the TMDL report provides a detailed discussion of the SWAT analysis conducted by the State for the local tributaries.

Internal sources were also considered by MPCA. Several potentially significant sources of summer turbidity in the LVR are wind-and fish-induced resuspension of fine sediments in the LVR lakes and the draining of wetlands in the system following the spring floods. Additionally, the solids load in these shallow areas may be replenished by other disturbances in the wetland areas, such as rough fish activity. Re-suspension and the phenomenon of storage and release of solids load in wetland areas are not readily handled in the CE-QUAL-W2 model. Therefore, the missing load component was handled in post-processing of the model. Specifically, the original model output underpredicted turbidity during low-to-moderate flow conditions following the spring flood and persisting into the fall. After some experimentation, it was determined by MPCA that the missing load component was best represented by adding a fixed concentration of inorganic suspended solids to the system during the summer and fall (see Appendix B to the TMDL report for details). The results indicate that this added source contributes approximately 3 percent of the sediment load on an annual basis. As discussed in Section 6.0 of the TMDL report, despite the relatively small load contribution from this source, it has a significant impact on turbidity during periods when there is little inflow from Pool 3, i.e. during Mode 0.

Priority Ranking

Minnesota has consistently included turbidity impaired waters on its 303(d) lists. Section 303(d)(1)(A) of the Clean Water Act requires States to establish a priority ranking for the impaired waters, taking into account the severity of the pollution and the designated uses of the impaired waters. The target schedule on Minnesota's 303(d) list reflects the State's priority ranking. In establishing the priority ranking, i.e. the target schedule for developing TMDLs, the State considers factors such as the severity of the pollutant, available monitoring data and targeted monitoring schedule, designated use of the water body, and available resources. Minnesota's 2008 Integrated Report targeted the LVR for TMDL completion in 2007.

EPA finds that the LVR TMDL report and supporting documentation submitted by the State adequately identifies the water body, pollutant of concern, pollutant sources, priority ranking, and important assumptions used in developing the TMDL.

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.

Comments:
Applicable Water Quality Standards and TMDL Target
Water quality standards and related provisions can be found in several Minnesota rules, but the primary rule for statewide water quality standards is Minnesota Rules Chapter 7050. Included in this rule are the following:

- A classification system of beneficial uses for both surface and groundwater;
- Numeric and narrative water quality standards;
- Nondegradation provisions;
- Provisions for the protection of wetlands;
- Treatment requirements and effluent limits for wastewater discharges; and
- Other provisions related to protecting Minnesota's water resources from pollution.

Although portions of the Vermillion River upstream of Hastings (the Upper Vermillion River) are designated Class 2A (trout streams), the LVR is not specifically listed in the rules and therefore has a default classification of 2B.

The Minnesota Rules specify that Class 2B surface waters must permit the propagation and maintenance of a healthy community of cool or warm water sport or commercial fish and associated aquatic life and their habitats. The chronic turbidity standard for Class 2B waters is 25 NTU.[7]

[7] Minnesota Administrative Rules. 7050.0220. Subpart. 4a.

The State selected 20 NTU as the TMDL target. The application of a more stringent TMDL target than the required water quality standard was incorporated by the State into the margin of safety. See section 6.1.3 of the TMDL report and section 6 of this Decision Document for further discussion on margin of safety.

Linking Total Suspended Solids to Turbidity Water Quality Standard
Turbidity is not a pollutant. Since TMDLs must be written for a pollutant, MPCA selected TSS as the pollutant of concern.

Turbidity is defined as a measure of water clarity that refers to the scattering of light by suspended matter, dissolved organic compounds, and plankton in the water. If the water becomes too turbid, it loses the ability to support a wide variety of plants and aquatic organisms. Suspended particles can clog fish gills, lowering a fish's resistance to disease, affect their growth rate, and affect egg and larval development. Turbidity is used as an indirect indicator of the concentration of suspended matter.

TSS is used to quantify concentrations of suspended solid-phase material in surface waters. As TSS settles to the bottom of a stream, critical habitats such as spawning sites and macroinvertebrate habitats can be covered by sediment. Excess sediment on the stream bottom can reduce dissolved oxygen concentrations in the stream bottom substrates and can reduce the quality and quantity of habitats for aquatic organisms. Loose, stable sediment is not suitable for many species of fish eggs and cannot support many populations of macroinvertebrates.

The State explains in the TMDL report that turbidity in the water column results from a combination of inorganic sediment, living algae, organic detritus, and color associated with dissolved organic compounds. Figure 3-1 of the TMDL report provides a conceptual framework for turbidity in the LVR. Each pathway through the figure can be considered a risk hypothesis for elevated turbidity. A main conclusion that the State made from the study that led to the creation of the conceptual framework is that inorganic sediment, measured as inorganic suspended solids, is a primary cause of elevated turbidity. The risk pathways through the "Sediment Input" box in the conceptual framework were determined to be the most important. This analysis by the State provides support for the State's selection of TSS as the pollutant of concern to address the turbidity problem in the LVR.

Section 4.2.1.1 of Appendix A to the TMDL report explains the theory behind the relationship of suspended matter concentrations and the optical properties of water. In studies, a linear relationship between turbidity and TSS has been documented. Empirical equations have been developed to describe the relationship between the inorganic sediment contribution to turbidity and inorganic suspended solids. Table 4-11 of Appendix A to the TMDL report presents the results of regression models for prediction of turbidity based on TSS for both the LVR and the Upper Vermillion River. Figures 4-38 through 4-40 in Appendix A to the TMDL report shows the relationship between turbidity and TSS for Pool 3, the LVR, and the Upper Vermillion River.

EPA finds that the State adequately identified applicable water quality standards for the LVR, identified a TMDL target that will attain the applicable water quality standards, and provided an analysis linking the TMDL target to the applicable water quality standards.

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 stream 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:
Table 6-2 and the TMDL Summary Table in the TMDL report submitted by the State establish 7,793 kg/day TSS as the loading capacity during Mode 0 and 70,321 kg/day TSS during Mode 1. The State arrived at these loading capacities by adding the allowable loads from the Upper Vermillion River, Pool 3, Pool 4, internal sources, and local tributaries. The State calculated the allowable loads using various iterations of the CE-QUAL-W2 (W2) model.

The discussion below explains how EPA considered the information provided by the State in the TMDL report and supporting documentation in EPA's review and approval of these loading capacities.

<u>Modeling</u>
The U.S. Army Corps of Engineers W2 model was chosen to evaluate the impact of sediment, nutrients, and algae on the LVR. Section 4 and Appendix B to the TMDL report state that W2 is a two-dimensional, longitudinal/vertical (laterally averaged), coupled hydrodynamic and water

quality model. The TMDL report also states that the model is applicable to lakes, rivers, and estuaries that do not exhibit significant lateral variability in water quality conditions. W2 allows the user to specify multiple branches for geometrically complex water bodies, variable grid spacing, time variable boundary conditions, hydraulic structures, and multiple inflows and outflows from point/nonpoint sources and precipitation. The two major components of the W2 model include hydrodynamics and water quality kinetics. These two components are coupled in the model meaning that the hydrodynamic output is used to drive water quality at every time step.

Section 2 of Appendix B to the TMDL report identifies the following advantages to choosing W2 for the LVR modeling application:

- W2 is able to address the pollutant of concern, TSS, and other pollutants of interest and concern within the LVR, e.g. inorganic suspended solids, total phosphorus, NH4, nitrate+nitrite, dissolved oxygen, and chlorophyll *a*. These pollutants were in turn used to estimate turbidity using relationships identified during the Phase I analysis.
- W2 is appropriate for a long and narrow river with spatially varying depths.
- W2 has been successfully linked in previous applications to SWAT, which is used to estimate pollutant loads from the local tributaries to the LVR.
- W2 is able to predict increased light availability due to a decrease in sediment.
- W2 provides the advantage of using a tested and widely accepted model, although some code modification was needed to address the simulation of total phosphorus (see Appendix B to the TMDL report for details).
- W2 is capable of simulating cause-and-effect relationships between loading from various sources and river response.
- Application of W2 was consistent with the schedule and budget.

Calibration of the W2 included two steps, calibration of the hydrodynamic simulation, which determined the flow and mixing coefficients for solute transport and water quality calibration conducted without any change to coefficients related to the hydrodynamics simulation. Table 2 in Appendix B to the TMDL report identifies the parameter values for the LVR model calibration. Calibration was performed for the period January 1, 1995 to August 31, 2006. Validation was performed for the period September 1, 2006 to December 31, 2006. Visual examination of the comparison of model results with observed data were made at seven locations. Refer to Figure 3-2 of the TMDL report and Figure 3 in Appendix B for a map of the seven locations. Figures 4 through 48 in Appendix B to the TMDL report display results of observed and simulated data for both hydrodynamics and water quality components.

W2 does not directly simulate turbidity. The State estimated turbidity from the W2 output for suspended solids using the following equation.

$$\text{Turbidity} = -1.098 + \text{TSS}^{0.974}$$

As mentioned above in the *Linking Total Suspended Solids to Turbidity Water Quality Standard* section, this equation was developed through a series of linear and nonlinear regressions. Appendix A to the TMDL report provides detailed discussion on the derivation of this equation.

Using TSS results from the original calibration of the W2 model and observed turbidity data, the State compared the simulated and observed turbidity at monitoring stations MS296, MS297, and VM00.1M (refer to Figure 3-3 of the TMDL report for monitoring station locations). Figures 49 through 51 in Appendix B to the TMDL report display the results of this comparison. According to information presented in Appendix B, the State concluded that the model does a good job of matching temporal trends and event peak concentrations of turbidity at station VM00.1M. The results also indicate that the model tends to underpredict turbidity in the period after the spring flood, particularly during non-event conditions. The State concluded that for the entire simulation the model tends to underpredict turbidity.

Further analysis was conducted by the State to better define the ability of the model to accurately predict excursions of Minnesota's turbidity water quality standard, 25 NTU. The State compared predicted excursions and observed excursions for both modes, Mode 0 and Mode 1. The analysis of Mode 1 predicted 43.7 percent of days with turbidity greater than 25 NTU compared to 42.2 percent of observed days exceeding the water quality standard. The model predicted 7.7 percent of days with turbidity greater than 25 NTU compared to 44.2 percent of observed excursions. From this comparison, the State determined that the model does not sufficiently predict excursions of the turbidity water quality standard during Mode 0.

Appendix B to the TMDL report explains that the discrepancy between modeled output and observed data during Mode 0 is mostly due to low to moderate flow conditions following the spring flood and persisting into the fall. Wetland areas of the LVR floodplain are thought to store highly turbid water which gradually drains into the LVR during the summer and fall leading to high turbidity during non-event conditions. The phenomenon of storage and release of the solid load in wetland areas is not readily handled in the W2 model. The State concluded that this missing turbidity load was best handled by adding a fixed concentration of inorganic suspended sediment (ISS) to the system during the summer and fall and was determined by the State to be 22.3 mg/L ISS. This fixed concentration was added during Mode 0 and for the months of April through November. Figure 52 of Appendix B shows the results of the observed turbidity compared to the predicted turbidity with the addition of the fixed ISS concentration. These adjusted predicted turbidity values now show a good correlation to the observed turbidity values.

<u>Calculating Loading Capacity</u>

Table 6-1 in the TMDL report presents allowable TSS loads as established by iterations of the calibrated W2 model targeted to attain the TMDL target of 20 NTU. The modeled allowable TSS loads presented in Table 6-1 in the TMDL report were generated by the W2 model and the turbidity equation as shown above in the modeling discussion and in Section 4.5 of Appendix B to the TMDL report. The model and equation were used to calculate running 30-day average turbidity values at four assessment locations on the LVR.[8] Through iterative model runs, a combination of loads as shown in Table 6-1 in the TMDL report were identified as the TSS loads that when attained would achieve an average 30-day turbidity value of less than 20 NTUs at each of the four assessment locations. In establishing the TSS loads in Table 6-1 in the TMDL report the State did not impose any reductions on the TSS load from Pool 3[9] nor were reductions imposed on point and nonpoint sources discharging into the Upper Vermillion River.[10] Pool 4 TSS loads were also not reduced in the iterations since Pool 4's existing load was a very small contribution of TSS and flow to the LVR system. The TSS loads established in Table 6-1 in the TMDL report, were based on iterative reductions of TSS loading from internal sources and local tributaries.

As discussed in the modeling section of this Decision Document the State used an equation to relate turbidity and TSS. The regression analysis used to derive this equation was done mostly using turbidity data from monitoring station VM00.1M. Additionally, the calibration results presented in Figures 49-51 of Appendix B to the TMDL report show that most of the observed data used in the calibration was from monitoring station VM00.1M. The data available from monitoring station VM00.1M was recorded using portable turbidimeters that report nephelometric turbidity ratio units (NTRU)[11] turbidity values. Minnesota's water quality standard is written to NTU. The State has chosen to use the Metropolitan Council's (MCES) turbidity meter as the standard for turbidity assessment and TMDL work. MCES's meter reports NTU turbidity values. Because the relationship between turbidity and TSS for the LVR was documented using a dataset that consists primarily of NTRU turbidity values, the TSS loads established in Table 6-1 in the TMDL report need to be adjusted.

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[8] The four assessment locations are: LVR at 5 miles southeast of Hastings (MS297), LVR at High 68 Bridge (MS299), LVR at River Mile 2 (VR002.0), and LVR at the confluence with Mississippi River (VM00.1M). Refer to Figure 3-3 of the TMDL report for a map of these assessment locations.

[9] During the model iterations the State kept the TSS load from Pool 3 static. No reductions were made to the Pool 3 TSS load because the Pool 3 load was simulated as achieving water quality standards based upon the assumption that on-going efforts from the planned Lake Pepin TMDL will cause Pool 3 to attain water quality standards sometime in the future. The allowable TSS load used in the model runs for Pool 3 was established by reducing daily values of inorganic suspended sediment and chlorophyll *a* by approximately 78 percent from their existing load from Pool 3 as it enters the LVR.

[10] No reductions in the existing TSS load were considered for the Upper Vermillion River in the model iterations. The existing TSS loads from the Upper Vermillion River were held static. As stated in Section 6.0 of the TMDL report, the turbidity in the Upper Vermillion River is currently meeting water quality standards. Additionally, the State concluded that the Upper Vermillion River has little controlling impact on the LVR. One change the State did make to the existing TSS load estimate for the Upper Vermillion River was to adjust the load estimate to reflect the re-routing of the discharge from Empire WWTP to the Mississippi River in early 2008. Prior to early 2008, Empire WWTP discharged to the Vermillion River. Appendix C of the TMDL report explains how the adjustments were calculated and applied to the existing TSS load estimate for the Upper Vermillion River.

[11] NTU – White light, 90 degree detection, only and NTRU – white light, 90 degree detection is with additional correction detectors.

According to the data presented by the State in the TMDL report and response to comments,[12] TSS values that correspond to 20 NTRU are less than those that correspond to 20 NTU. The State presented the following comparison in the TMDL report and respond to comments:

- Pool 3 data that was MCES generated suggest a 20 NTU equivalent of approximately 60 mg/L TSS;
- Upper Vermillion River data that was MCES generated suggest a 20 NTU equivalent of approximately 80 mg/L; and
- LVR data from VM00.1M that was not MCES generated suggests a 20 NTRU equivalent of 25 mg/L.

The model iterations completed to generate the allowable TSS loads in Table 6-1 in the TMDL report were done with the goal of attaining a 25 mg/L TSS, which as suggested by the State equates to 20 NTRU. Had the iterations been done to attain the TSS load equivalent to 20 NTU the State's data indicate that the TSS goal would be somewhere between 60 mg/L and 80 mg/L, rather than 25 mg/L. Adjusting for the difference between MCES turbidity values (NTU) and the turbidity values at VM00.1M (NTRU) will result in a greater allowable TSS load than those shown in Table 6-1in the TMDL report.

The State selected a conservative ratio of 1.5 (increase of 50 percent from NTRU-modeled reductions) to apply to the applicable modeled allowable loads, i.e. the allowable loads shown in Table 6-1 in the TMDL report. The ratio was applied and final TMDL allowable loads were established and presented by the State in Table 6-2 and the TMDL Summary Table in the TMDL report. The allowable loads were added together to establish a loading capacity for the LVR. Further discussion regarding how the allowable loads were assigned between point and nonpoint, i.e. load allocation and wasteload allocation, is discussed in the appropriate section below.

Critical Condition
The critical conditions (the periods when the greatest reductions are required) were inherently addressed through the use of continuous modeling over a twelve-year period and by identifying load reductions that will achieve water quality standards at all times during this time period. The final TMDL is therefore based on a scenario that results in meeting water quality standards at all locations during all seasons.

*EPA finds the State's approach to establishing the loading capacities for the LVR during Mode 0 and Mode 1 acceptable. EPA hereby approves the loading capacity for Mode 0 (minimal Pool 3 inflow) as **7,793 kg/day** for TSS related to turbidity in NTU and for Mode 1 (significant Pool 3 inflow) as **70,321 kg/day** for TSS related to turbidity in NTU.*

[12] See 4-15-09 MPCA electronic mail reply to Rob Buris, MN DNR and 6-4-09 MPCA electronic mail reply to Donna Keclik, EPA.

4. Load Allocations (LAs)

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:
According to MPCA, the turbidity impairment is a result of increased TSS loads to the LVR. As previously discussed in this Decision Document and in the TMDL report, the State considered TSS loads from five sources: the Upper Vermillion River, local tributaries, Pool 3, Pool 4, and internal sources. Load allocations were established for each of these five sources. The TMDL Summary Table in the TMDL report and Table 6-2 in the TMDL report show the load allocations that were considered in EPA's decision. As discussed in the loading capacity section of this Decision Document, the State used W2 model iterations and a 1.5 adjustment factor to account for the relationship between NTRU, NTU, and TSS to establish the allocations.

The Upper Vermillion River was modeled as one contributing source of TSS without consideration for specific nonpoint and point source contribution of TSS. However, for purposes of establishing final allocations, the point sources discharging to the Upper Vermillion River were assigned wasteload allocations based upon existing permit conditions. The remainder of allowable load for the Upper Vermillion River after removing the existing point source allocation was established as load allocation for nonpoint sources in the Upper Vermillion River. During the model iterations, the Upper Vermillion River TSS loads were held static. The Upper Vermillion River is currently meeting water quality standards and the State has not identified any needed reductions from discharges of existing point sources on the Upper Vermillion River, therefore, no reduction from existing TSS loading is reflected in the final load allocation for the Upper Vermillion River in Mode 0 or Mode 1.

The entire allowable load for Pool 3 was considered load allocation by the State. EPA concurs that for the LVR TMDL, collectively considering all possible sources discharging into Pool 3 as one source to the LVR is reasonable. Point sources discharging in or upstream of Pool 3 and nonpoint sources impacting water quality in Pool 3 together contribute to the conditions of Pool 3 that impact the LVR. Therefore, the State's consideration of Pool 3 as one source of sediment load and flow to the LVR rather than looking at each individual point source or nonpoint source in Pool 3 is reasonable for development of the LVR TMDL. EPA considers the load allocation established by the State for Pool 3 as an upstream loading not specific to point or nonpoint sources. The State established the allocation for TSS for Pool 3 by simulating TSS load in Pool 3 as achieving water quality standards based upon the assumption that this will occur in the future due to ongoing Lake Pepin TMDL efforts. During the model iterations, the State applied reductions to daily ISS and chlorophyll *a* values for Pool 3 until an average 30-day turbidity value less than 20 NTUs was achieved. A 78% reduction in the load from Pool 3 to the LVR was needed before turbidity values less than 20 NTUs were achieved. The State applied this

78% reduction only to the existing TSS load for Mode 1. No reduction is required for Pool 3 during Mode 0 because Mode 0 is representative of minimal inflow from Pool 3 to the LVR.

Similar to how the allocation for Pool 3 was established, the State did not distinguish between point source and nonpoint source contributions from the local tributaries. The State considered the local tributaries as one source of sediment load and flow to the LVR , therefore, the allocation established applies to all sources of TSS in the local tributaries. Table 6-1 in the TMDL report presents the allowable load of TSS from the model iterations. As previously mentioned, the State held the TSS load from the Upper Vermillion River and Pool 3 static in the model iterations. The local tributary loads were not held static, therefore, an adjustment of 1.5 was applied to the modeled allowable load for the local tributaries to adjust for the relationship between NTRU, NTU, and TSS. (See the discussion regarding the 1.5 adjustment in the *Loading Capacity* section of this Decision Document.) Table 6-2 in the TMDL report and the TMDL Summary Table in the TMDL report present the final allocation for the local tributaries for Mode 0 and Mode 1.

Internal sources discussed in the TMDL report were considered to be nonpoint sources, therefore, the entire allowable load as presented in Table 6-2 in the TMDL report is considered load allocation. No reduction is required during Mode 1. This is reasonable since internal sources are not a significant source of flow or sediment during Mode 1. During Mode 0, when Pool 3 has minimal inflow to the LVR, the State is establishing a 50 percent reduction from the existing TSS load from internal sources. Note that in Table 6-1 in the TMDL report, the model iterations show that internal source loadings should be reduced by almost 100%. However, due to the limitations of the W2 model to consider internal sources and due to the lack of a robust LVR dataset to explain the impacts of the internal sources within the river, the State is establishing a 50% reduction from existing TSS loads for internal sources instead of a 100% reduction. EPA finds this acceptable at this time. In 2008, the State initiated monitoring in the LVR to collect continuous turbidity data to help better understand, among other things, internal sources in the river. EPA expects the State to utilize data generated from this effort to re-evaluate, if necessary, the internal source existing and allowable loads used in this TMDL. If data supports changing the existing and allowable loads, EPA encourages the State to consider revising this TMDL report.

Although not determined to be a significant source of flow and TSS load to the LVR, Pool 4 was also identified as a potential nonpoint source contributing to the turbidity impairment. The load allocation for Pool 4 does not include a reduction from existing TSS loads.

Table 2 below includes the load allocations being approved by EPA for the LVR TMDL. Note that, although identified by the State as single load allocations, the allocation for Pool 3 and for the local tributaries is applicable to the collective load of these sources entering the LVR.

Table 2: EPA Approved Load Allocations for the Lower Vermillion River

Load Allocation Source	Mode 0 (Minimal inflow from Pool 3) kg/day	Mode 1 (Significant inflow from Pool 3) kg/day
Upper Vermillion River	1,478	9,383
Pool 3	1	45,081
Pool 4	1	1
Internal sources	3,464	1
Local Tributaries	1,788	10,052
Total	6,732	64,518

EPA finds that the load allocations presented in Table 2 above and in Table 6-2 and the TMDL Summary Table in the TMDL report are acceptable.

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 water quality standards 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 permitees 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:

WLAs considered for this decision are found in the TMDL Summary Table of the TMDL report, Tables 6-3 and 6-4 of the TMDL Report, and Tables 3 and 4 below. WLAs are expressed as daily TSS loads. WLAs remain the same regardless of the mode, i.e. the WLAs for Mode 0 and Mode 1 are the same.

Table 3: Wasteload Allocations for the individual permitted dischargers in the LVR

Facility Name	Permit number	TSS WLA and Limits
Elko/New Market WWTP	MN0056219	125.2 kg/day
Intek Plastic Inc.	MN0003417	14.4 kg/day
Met Council- Empire WWTP	MN0045845	0 (no longer discharges to VR)
Vermillion WWTP	MN0025101	9.2 kg/day
Total		148.8 kg/day rounded to 149 kg/day

The individual permitted dischargers listed above in Table 3 are in the Vermillion River watershed. All of these discharges are located in the Upper Vermillion River, the portion of the river which is upstream of Hastings. As previously mentioned in this Decision Document, the Upper Vermillion River was modeled as one source of sediment and flow into the LVR. The total allowable load for the Upper Vermillion River as calculated through the model iterations included both point and nonpoint sources. The State is not requiring reductions from any of the point sources that discharge to the Upper Vermillion River, therefore, the wasteload allocations in Table 3 above were established from current permits conditions. Section 6.1.1.1 of the TMDL report states, "There are also a number of other permittees in the Upper Vermillion River, but most of them do not have any kind of water discharge or do not discharge TSS ..." The State did not provide an extensive list of all permittees in the watershed, however, EPA considers all permittees that do not discharge TSS as having a zero (0) wasteload allocation.

The following cities and townships within the Vermillion River watershed fall under the Phase II storm water guidelines and have MS4 permits: City of Apple Valley, City of Burnsville, City of Hastings, Empire Township, City of Farmington, City of Lakeville, and City of Rosemount. These entities are located upstream of Hastings on the Upper Vermillion River. Other MS4 permit holders are MNDOT, Dakota County, and Scott County. WLAs were calculated for these entities and, similar to the municipal and industrial facilities, were subtracted from the total load contributed by the Upper Vermillion River to determine the nonpoint source load portion of the Upper Vermillion River. Table 4 below and Table 6-4 of the TMDL Report identify the specific WLAs for these entities under both Mode 0 and Mode 1.

Table 4: MS4 permit WLAs

MS4 Permittee/Number	Mode 0 WLA (kg/day)	Mode 1 WLA (kg/day)
Apple Valley (MS400074)	75	464
Burnsville (MS400076	11	68
Lakeville (MS400099)	363	2,250
Farmington (MS400090)	94	582
Rosemount (MS400117)	26	164
Empire Township (MS400135)	279	1,730
Hastings (MS400240)	64	396
MnDOT Metro (MS400170)	Wasteload allocations for MNDOT and county	

MS4 Permittee/Numbers	Mode 0 WLA (kg/day)	Mode 1 WLA (kg/day)
Dakota County (MS400132)	roads are included in respective wasteload allocations for the municipalities that contain them.	
Scott County (MS400154)		
Total	912	5,654

EPA finds that the State has established WLAs for point sources contributing to the turbidity impairment in the LVR.

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.

Comment:
The MOS is discussed in section 6.1.3 of the TMDL Report. An implicit MOS has been applied as part of the LVR by running the model to achieve a 30-day turbidity value of 20 NTUs instead of 25 NTUs. This 20 percent reduction in the standard is used because of the considerable uncertainty associated with understanding and modeling a system as complex as the LVR. The LVR system is hydrologically complex with flow entering the system from the Upper Vermillion at Hastings, local tributaries, through movement of groundwater, and by interflow with the pools of the Mississippi. As discussed in the model calibration section above sediment resuspension due to fish activity and the phenomenon of storage and release of solid load in wetland areas are not readily handled in the W2 model thus creating additional uncertainty. Additional uncertainty is introduced into the allocations due to the lack of calibration of the SWAT model for local tributary loads due to lack of sampling within the tributaries.

Another conservative approach considered in establishing the allocations was the value of 1.5 used to adjust the local tributary allowable load to account for the relationship between NTRU, NTU and TSS. The data presented by the State shows that a TSS value that corresponds to a 20 NTU is often double or more that which corresponds to a 20 NTRU. Therefore, the 1.5 adjustment applied by the State is considered conservative and helps provide MOS.

EPA finds the State's approach acceptable and it meets the requirements of this section.

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)).

Comment:
According to Section 6.2 of the TMDL report, the State considers seasonal variation to be inherently addressed through the use of continuous modeling over a twelve-year period. The modeling period used for model calibration and establishment of allocations was the time period, January 1, 1995 to December 31, 2006. The continuous modeling allowed the State to establish allocations that will attain water quality standards during all seasons over multiple years.

Additionally, EPA considered the fact that the State established allocations for two modes of the LVR system as a way to account for seasonal variations. The distinction between modes is based upon stage of the Mississippi River. Mode 0 is representative of low to moderate flow conditions while Mode 1 is more representative of high flow conditions. Appendix B to the TMDL report states that "on a long-term basis" the LVR system receives more than twice the flow of other sources from Pool 3. Looking at flow over the long-term and establishing allocations based on long-term flows is considered by EPA a method of including seasonal variations into the TMDL.

EPA finds the State's approach acceptable and it meets the requirements of this section.

8. Reasonable Assurances

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:
EPA is taking no action on any reasonable assurance presented in the LVR TMDL report. Section 6.1.1 states that further reductions from existing permit limits are not expected for the four individual point sources discharging to the Upper Vermillion River. These WLAs were established using permit limits and were not established dependent upon nonpoint source reductions. The State did not include a specific section regarding reasonable assurance that nonpoint source reductions would occur, however, the State does discuss potential implementation actions for attaining needed nonpoint source reductions in Section 7 of the TMDL report. This section of the TMDL report also notes that successful implementation of the LVR TMDL will require improvements of the water quality in Pool 3. The TMDL report acknowledges that the State's completion of the Lake Pepin TMDL is an initial effort needed to move toward improved water quality in Pool 3.

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:
A detailed monitoring plan has not been developed as part of this TMDL; however, general recommendations are made to continue existing monitoring efforts and to collect new data for internal sources and for the local tributaries as discussed in section 7.2 of the TMDL report. Future monitoring must focus on (1) documenting changes in water quality, (2) understanding effectiveness of various best management practices on the land, and (3) evaluating water level management exercises and decisions, as well as the State identified five core components of a LVR monitoring plan.

EPA finds that the State has set forth its plans for future monitoring and encourages the State to continue to fund existing monitoring programs and future programs to achieve the monitoring plans established in the TMDL report.

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:
EPA is not required to and does not approve TMDL implementation plans. MPCA did identify implementation activities in the watershed. Section 7.1 of the TMDL report describes proposed implementation activities in detail.

According to Section 7 of the TMDL report implementation measures could include:

- Water Level Management – MDNR has identified three water level management strategies that could be used in the LVR.
- Fish Management - MDNR believes it may be possible to induce rough fish to leave and largely stay out of backwater lakes following the spring flood.
- Agricultural and Urban Best Management Practices – MDNR identified several best management practices for sediment control including tillage practices, cover crop, vegetative controls, riparian buffers.
- WLA's for various point sources have been calculated and will be implemented by NPDES program.

EPA finds that the LVR TMDL report and supporting documentation submitted by Minnesota addresses this tenth element.

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:
Public participation in the development of the LVR TMDL included a "kickoff" public meeting, which was held February 26, 2004 at the Hastings City Hall. Another meeting was held November 30, 2006 in Farmington to present the results of Phases I and II of the study. A final public meeting was held on March 19, 2008 at the Pleasant Hill Library in Hastings to present

the draft TMDL report. A formal public notice and comment period ran from March 23, 2009 until April 22, 2009. The State received and responded to eight comment letters, including comments from EPA.

EPA finds that the State provided adequate public participation in the establishment of the LVR TMDL.

12. Submittal Letter

A submittal letter should be included with the TMDL, 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:
EPA received the LVR Turbidity TMDL on July 21, 2009, accompanied by a submittal letter dated July 13, 2009. In the submittal letter, MPCA states: "MPCA is pleased to submit the Lower Vermillion River Turbidity Total Maximum Daily Load (TMDL) study for Turbidity to the U.S. Environmental Protection Agency (EPA) for final review and approval." The submittal letter also includes the date of the public notice and comment period for the TMDL.

13. Conclusion

After a full and complete review, EPA finds that the TMDL for the Lower Vermillion River satisfies all of the elements of an approvable TMDL. This approval addresses one assessment unit on the Vermillion River, Vermillion River/Vermillion Slough, Hastings dam to Mississippi River, assessment unit ID 07040001-504 and one impairment (turbidity) and one use (aquatic life) on the 303(d) list. The TMDL is developed for TSS as discussed in this document.

EPA's approval of this TMDL does not extend to those waters that are within Indian Country, as defined in 18 U.S.C. Section 1151. EPA is taking no action to approve or disapprove TMDLs for those waters at this time. EPA, or eligible Indian Tribes, as appropriate, will retain responsibilities under the CWA Section 303(d) for those waters.

TMDL: Turbidity (TSS) TMDL for the Lower Vermillion River Watershed, Minnesota
Approval Date: SEP 29 2009

DECISION DOCUMENT FOR THE APPROVAL OF THE LOWER VERMILLION RIVER WATERSHED TOTAL SUSPENDED SOLIDS TMDL

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 Total Maximum Daily Loads (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 National Pollutant Discharge Elimination System (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:

Identification of the water body

The Vermillion River travels approximately 59 miles from the headwaters in southeastern Scott County near New Market to the confluence with the Mississippi River south of Lock and Dam 3. The entire Vermillion River watershed drains 356 square miles and consists of 17 subwatersheds.

The Vermillion River splits below the Old Peavey Mill Dam, in Hastings, downstream of the falls. One branch (Vermillion Slough) flows to the north to join the Mississippi River near river mile 813. The other branch (the Lower Vermillion River) flows south to join the floodplain of the Mississippi River. The Lower Vermillion River (LVR) parallels the Mississippi River for approximately 20 miles before joining the confluence of the Mississippi River just downstream from Lock and Dam 3 near Red Wing, Minnesota. The LVR watershed consists of two subwatersheds draining approximately 77 square miles. Refer to Figures 1-1, 2-1 and 3-3 in the TMDL report and Figures 1 and 2 in Appendix B to the TMDL report for maps of the LVR.

Water quality monitoring on the LVR has shown that its turbidity levels frequently exceed the Minnesota Pollution Control Agency's (MPCA) standard of 25 nephelometric turbidity units (NTU). Turbidity data has been collected at several stations along the LVR (refer to Figure 3-3 of the TMDL report for data collection locations). Table 3-2 of the TMDL report provides a summary of the available data for all stations with a minimum of five samples. The information presented in Table 3-2 indicates that approximately 40 percent of the samples at the confluence with the Mississippi River have exceeded the turbidity water quality standard. According to Minnesota's 303(d) list of impaired waters, the LVR, assessment unit 07040001-504, has been identified as being impaired and included on Minnesota's list of impaired waters since 1994. Minnesota's 2008 Section 303(d) list information for the LVR is shown in Table 1 below, in the TMDL Summary Table in the TMDL report, and Table 1-1 of the TMDL report.

Table 1: 2008 Integrated Report Category 5 Information for the Lower Vermillion River

Water body Name	Water body Description	River ID	Cause of Impairment	Impaired Designated Use
Vermillion River	Vermillion R/Vermillion Slough, Hastings dam to Mississippi R	07040001-504	Turbidity	Aquatic Life

Pollutant of Concern

Turbidity is a measure of water clarity. When turbidity is elevated, the water appears cloudy and visibility is reduced. In addition to aesthetics, elevated turbidity has adverse impacts on aquatic life. For example, elevated turbidity reduces the ability of sight-feeding game fish to find their prey and reduces the vigor of the submerged aquatic vegetation that forms the basis of a healthy ecosystem in most Minnesota rivers. Elevated turbidity can be caused by a number of factors, including loads of fine sediment, growth of microscopic floating algae exacerbated by nutrient loads, and dissolved organic material.

Turbidity is not a pollutant. Since TMDLs must be written for a pollutant MPCA selected total suspended solids (TSS) as the pollutant of concern. Light scatter and adsorption is strongly influenced by the amount of solid materials suspended in the water column thus forming a relationship between TSS and turbidity. TSS is used to quantify concentrations of suspended solid-phase material in surface waters. There are two advantages for expressing the TMDL and allocations as TSS load. The first advantage is that upstream point sources have TSS effluent limits, concentration (mg/l), and load (kg/day), already in their NPDES permits. Because of this, impacts from these point sources were easily considered in the establishment of the loading capacities and allocations. Use of TSS loads in the wasteload allocations (WLAs) will also aid in the implementation of the WLAs since the allocations are already in terms that permit-holders and permit-writers are familiar with implementing. The second advantage is that sediment delivery and soil erosion are commonly expressed in terms of mass loads. Minnesota has selected TSS as the water quality target for this TMDL.

Land Use

The State considered eight land use classes within the LVR watershed. Table 2-1 in the TMDL report summarizes the distribution of land use/land cover. Seven of the eight land uses considered by the State were derived from the year 2000 statewide raster data which was developed from satellite images by the University of Minnesota Remote Sensing and Geospatial Laboratory. The State also considered more local land use data, however, the statewide data was determined to provide similar resolution as the local data and, since the statewide data covered the entire watershed, it was favored. The eighth land use, corn-soy rotation with mulch tillage, was included in the land use classifications to represent areas within the watershed where conservation tillage is practiced. As discussed in Appendix B, section B.3, to the TMDL report, Dakota County Soil and Water Conservation District approximates that half of the row crop agriculture is in conservation tillage.

Hydrology

As discussed in Section 2 of the TMDL report and in the appendices to the TMDL report, the LVR is a hydrologically complex system. Flow enters the LVR system from the Upper Vermillion at Hastings, Minnesota via local tributaries, through movement of groundwater, and by interflow with the Mississippi River. As discussed in the appendices of the TMDL report, the State found that on a long-term basis the Mississippi River has more inflow than the other sources of flow and has significant influence over cumulative pollutant loadings to the LVR system.

The LVR occupies the floodplain of the Mississippi River and has a naturally low gradient. The last component is particularly important to understanding the LVR. Because of the operation of Mississippi Lock and Dam 3 for navigation, the normal pool in the Mississippi River Pool 3 is typically greater than 5 feet above the water surface elevation in the LVR. This creates a tendency for water from the Mississippi to flow into the LVR, seeking a steeper gradient to the channel below Lock and Dam 3. It also creates a positive groundwater gradient from the Mississippi to the LVR. Finally, because of its own low channel gradient, flow within the LVR can be affected by the water surface elevation at its confluence with the Mississippi, below Lock and Dam 3. The interchange of water between the LVR and Pool 3 depends on the relative stage in the two systems. When stage at Prescott is above 676 feet, there is strong inflow from Pool 3 into the LVR (inflow begins at about 675.2 feet, but does not exceed the normal flow from the Upper Vermillion River until reaching about 676 feet).

To account for the influence of Pool 3 on the LVR, the State used two flow modes in modeling scenarios used to estimate TSS and other pollutant loadings to the LVR. The first mode, Mode 0, represents the LVR system when the stage in the Mississippi River is low enough to prevent flow from the Mississippi River to the LVR. Section 2.2.2 of the TMDL report states that this mode occurs about 214 days a year, approximately 58.5 percent of the year. The second mode considered by the State, Mode 1, is when the stage at Prescott is above 676 feet and there is strong inflow from Pool 3 into the LVR. Section 2.2.2 of the TMDL report states that Mode 1 occurs about 151 days per year, approximately 41.5 percent of the year. Section 4.1.6.1 of Appendix A provides further discussion on the interchange of flow between the Mississippi River and the LVR.

Existing Sources of Pollutant Loads

Section 5.0 of the TMDL report identifies five broad sources of flow and TSS to the LVR: the Upper Vermillion River[1], Mississippi River Pool 3, Mississippi River Pool 4, local tributaries, and internal sources. Table 4-1 in the TMDL report identifies the existing flow and TSS contribution from each of these sources to the LVR.[2] Appendix A, Sections 3 and 4, discuss flow and water quality data for these five sources. Appendix B to the TMDL report provides details of how these sources were considered in the models used to establish existing loads.

Table 6-3 in the TMDL report identifies point sources within the Vermillion River watershed with TSS limits in either their NPDES permit or their State Disposal System (SDS) permit. The four individual point sources[3] identified by the State discharge upstream of Hastings, into the Upper Vermillion River. The existing flow and TSS loads presented in Table 4-1 in the TMDL report for the Upper Vermillion River include contributions from these individual point sources. Table 6-4 in the TMDL report identifies ten municipal storm sewer system (MS4) permits[4]

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[1] The Lower Vermillion begins at Hastings, Minnesota. The portion of the river above Hastings is considered the Upper Vermillion River, which is meeting the turbidity standard.

[2] Note that Table 4-1 has divided Pool 3 into three sloughs that connect Pool 3 to the LVR. Collectively these three sloughs represent the contributions from Pool 3 to the LVR.

[3] The four individual point sources identified by the State are Elko/New Market WWTP, permit number MN0056219; Intek Plastics Inc., permit number MN0003417; Met Council-Empire WWTP, permit number MN0045845; and Vermillion WWTP, permit number MN0025101.

[4] The ten MS4 storm water permits identified by the State include: Apple Valley, MS400074; Burnsville, MS400076; Lakeville, MS400099; Farmington, MS400090; Rosemount, MS400117; Empire Township,

within the Vermillion River watershed. Similar to the individual point sources, all these storm water sources are located upstream of Hastings, therefore, their existing contributions of flow and TSS are included in the Upper Vermillion River's flow and TSS loads presented in Table 4-1 in the TMDL report. The U.S. Army Corp of Engineer FLUX program,[5] updated through the end of water year 2006, was used to estimate existing flow and TSS concentrations in the Vermillion River at Hastings. As shown in Table 4-1 in the TMDL report, the Upper Vermillion River contributes 21 percent of the flow volume and 7.8 percent of the TSS load to the LVR.

As mentioned above in the *Hydrology* discussion, the interflow between Pool 3 and the LVR has significant influence over the flow and cumulative pollutant loadings to the LVR system. In estimating the existing flow and TSS load from Pool 3 to the LVR, the State looked at the three major sloughs that are connected with Pool 3 along the LVR: Vermillion Slough at river mile 813.2, Truedale Slough at river mile 808.5, and Carter Slough at river mile 807.3. At the conjunctions of Pool 3 and the sloughs, water can flow freely and elevations in Pool 3 and the sloughs determine the magnitude and direction of the flow, i.e., whether or not water flows from Pool 3 through the sloughs or visa versa. Measured elevations[6] are available for Mississippi River miles 815.0, 811.4 and 796.91. The State used linear interpolations of the measured elevations to estimate Pool 3 elevations at the mouth of the three sloughs. Existing flows and loads from Pool 3 via each of the three sloughs into the LVR were calculated using linear interpolation to estimate daily water quality concentrations along with computed flows. These existing flows and TSS loads are included in Table 4-1 in the TMDL report. Flows and TSS loads are presented for each of the three sloughs. Collectively, the existing flow and TSS load into the LVR from Pool 3 were calculated by the State to be approximately 67 percent and 73 percent, respectively. The contributions from Pool 3 are considered a nonpoint source.

Another nonpoint source that the State identified as a contributor of flow and TSS load to the LVR is Pool 4 of the Mississippi River. The elevations of Pool 4 affect the hydrodynamics of the LVR thereby affecting pollutant concentrations. Pool 4 was defined as the downstream boundary of the CE-QUAL-W2 model used to estimate existing loads to the LVR. As summarized in Table 4-1 in the TMDL report, the State determined Pool 4 to contribute approximately 1 percent of the flow volume and less than 1 percent of the TSS load to the LVR. Section 3.4.3 of Appendix B to the TMDL report discusses how Pool 4 was considered in the CE-QUAL-W2 model.

Local watersheds and tributaries drain to the LVR downstream of Hastings and are sources of flow and TSS load to the LVR. These local tributaries were collectively considered nonpoint sources of TSS load to the LVR. No TSS data are available for these tributaries, so TSS contributions from these areas were estimated using the Soil and Water Assessment Tool (SWAT) watershed model. Both upland (i.e. sheet and rill) and streambank erosion loads were

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MS400135; Hastings, MS400240; MnDOT Metro, MS400170; Dakota County, MS400132; and Scott County, MS400154.

[5] Refer to Appendix A included in Appendix B of the TMDL report for further discussion of how the State conducted the FLUX analysis.

[6] Elevation data is available from the U.S. Army Corp of Engineers

estimated with SWAT and the resulting annual average loads are summarized in Table 4-1 in the TMDL report. Due to the lack of local tributary data, the SWAT model was not calibrated. Except as explained in Section 5.2 of the TMDL report and in Appendix B included in Appendix B to the TMDL report, default values were used in SWAT. As stated in Table 4-1 in the TMDL report and in Table B-7 in Appendix B, local tributaries contribute approximately 5 percent of the flow volume and 16 percent of the TSS load to the LVR. Appendix B included in Appendix B to the TMDL report provides a detailed discussion of the SWAT analysis conducted by the State for the local tributaries.

Internal sources were also considered by MPCA. Several potentially significant sources of summer turbidity in the LVR are wind-and fish-induced resuspension of fine sediments in the LVR lakes and the draining of wetlands in the system following the spring floods. Additionally, the solids load in these shallow areas may be replenished by other disturbances in the wetland areas, such as rough fish activity. Re-suspension and the phenomenon of storage and release of solids load in wetland areas are not readily handled in the CE-QUAL-W2 model. Therefore, the missing load component was handled in post-processing of the model. Specifically, the original model output underpredicted turbidity during low-to-moderate flow conditions following the spring flood and persisting into the fall. After some experimentation, it was determined by MPCA that the missing load component was best represented by adding a fixed concentration of inorganic suspended solids to the system during the summer and fall (see Appendix B to the TMDL report for details). The results indicate that this added source contributes approximately 3 percent of the sediment load on an annual basis. As discussed in Section 6.0 of the TMDL report, despite the relatively small load contribution from this source, it has a significant impact on turbidity during periods when there is little inflow from Pool 3, i.e. during Mode 0.

Priority Ranking

Minnesota has consistently included turbidity impaired waters on its 303(d) lists. Section 303(d)(1)(A) of the Clean Water Act requires States to establish a priority ranking for the impaired waters, taking into account the severity of the pollution and the designated uses of the impaired waters. The target schedule on Minnesota's 303(d) list reflects the State's priority ranking. In establishing the priority ranking, i.e. the target schedule for developing TMDLs, the State considers factors such as the severity of the pollutant, available monitoring data and targeted monitoring schedule, designated use of the water body, and available resources. Minnesota's 2008 Integrated Report targeted the LVR for TMDL completion in 2007.

EPA finds that the LVR TMDL report and supporting documentation submitted by the State adequately identifies the water body, pollutant of concern, pollutant sources, priority ranking, and important assumptions used in developing the TMDL.

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.

Comments:
Applicable Water Quality Standards and TMDL Target
Water quality standards and related provisions can be found in several Minnesota rules, but the primary rule for statewide water quality standards is Minnesota Rules Chapter 7050. Included in this rule are the following:

- A classification system of beneficial uses for both surface and groundwater;
- Numeric and narrative water quality standards;
- Nondegradation provisions;
- Provisions for the protection of wetlands;
- Treatment requirements and effluent limits for wastewater discharges; and
- Other provisions related to protecting Minnesota's water resources from pollution.

Although portions of the Vermillion River upstream of Hastings (the Upper Vermillion River) are designated Class 2A (trout streams), the LVR is not specifically listed in the rules and therefore has a default classification of 2B.

The Minnesota Rules specify that Class 2B surface waters must permit the propagation and maintenance of a healthy community of cool or warm water sport or commercial fish and associated aquatic life and their habitats. The chronic turbidity standard for Class 2B waters is 25 NTU.[7]

[7] Minnesota Administrative Rules. 7050.0220. Subpart. 4a.

The State selected 20 NTU as the TMDL target. The application of a more stringent TMDL target than the required water quality standard was incorporated by the State into the margin of safety. See section 6.1.3 of the TMDL report and section 6 of this Decision Document for further discussion on margin of safety.

Linking Total Suspended Solids to Turbidity Water Quality Standard
Turbidity is not a pollutant. Since TMDLs must be written for a pollutant, MPCA selected TSS as the pollutant of concern.

Turbidity is defined as a measure of water clarity that refers to the scattering of light by suspended matter, dissolved organic compounds, and plankton in the water. If the water becomes too turbid, it loses the ability to support a wide variety of plants and aquatic organisms. Suspended particles can clog fish gills, lowering a fish's resistance to disease, affect their growth rate, and affect egg and larval development. Turbidity is used as an indirect indicator of the concentration of suspended matter.

TSS is used to quantify concentrations of suspended solid-phase material in surface waters. As TSS settles to the bottom of a stream, critical habitats such as spawning sites and macroinvertebrate habitats can be covered by sediment. Excess sediment on the stream bottom can reduce dissolved oxygen concentrations in the stream bottom substrates and can reduce the quality and quantity of habitats for aquatic organisms. Loose, stable sediment is not suitable for many species of fish eggs and cannot support many populations of macroinvertebrates.

The State explains in the TMDL report that turbidity in the water column results from a combination of inorganic sediment, living algae, organic detritus, and color associated with dissolved organic compounds. Figure 3-1 of the TMDL report provides a conceptual framework for turbidity in the LVR. Each pathway through the figure can be considered a risk hypothesis for elevated turbidity. A main conclusion that the State made from the study that led to the creation of the conceptual framework is that inorganic sediment, measured as inorganic suspended solids, is a primary cause of elevated turbidity. The risk pathways through the "Sediment Input" box in the conceptual framework were determined to be the most important. This analysis by the State provides support for the State's selection of TSS as the pollutant of concern to address the turbidity problem in the LVR.

Section 4.2.1.1 of Appendix A to the TMDL report explains the theory behind the relationship of suspended matter concentrations and the optical properties of water. In studies, a linear relationship between turbidity and TSS has been documented. Empirical equations have been developed to describe the relationship between the inorganic sediment contribution to turbidity and inorganic suspended solids. Table 4-11 of Appendix A to the TMDL report presents the results of regression models for prediction of turbidity based on TSS for both the LVR and the Upper Vermillion River. Figures 4-38 through 4-40 in Appendix A to the TMDL report shows the relationship between turbidity and TSS for Pool 3, the LVR, and the Upper Vermillion River.

EPA finds that the State adequately identified applicable water quality standards for the LVR, identified a TMDL target that will attain the applicable water quality standards, and provided an analysis linking the TMDL target to the applicable water quality standards.

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 stream 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:
Table 6-2 and the TMDL Summary Table in the TMDL report submitted by the State establish 7,793 kg/day TSS as the loading capacity during Mode 0 and 70,321 kg/day TSS during Mode 1. The State arrived at these loading capacities by adding the allowable loads from the Upper Vermillion River, Pool 3, Pool 4, internal sources, and local tributaries. The State calculated the allowable loads using various iterations of the CE-QUAL-W2 (W2) model.

The discussion below explains how EPA considered the information provided by the State in the TMDL report and supporting documentation in EPA's review and approval of these loading capacities.

<u>Modeling</u>
The U.S. Army Corps of Engineers W2 model was chosen to evaluate the impact of sediment, nutrients, and algae on the LVR. Section 4 and Appendix B to the TMDL report state that W2 is a two-dimensional, longitudinal/vertical (laterally averaged), coupled hydrodynamic and water

quality model. The TMDL report also states that the model is applicable to lakes, rivers, and estuaries that do not exhibit significant lateral variability in water quality conditions. W2 allows the user to specify multiple branches for geometrically complex water bodies, variable grid spacing, time variable boundary conditions, hydraulic structures, and multiple inflows and outflows from point/nonpoint sources and precipitation. The two major components of the W2 model include hydrodynamics and water quality kinetics. These two components are coupled in the model meaning that the hydrodynamic output is used to drive water quality at every time step.

Section 2 of Appendix B to the TMDL report identifies the following advantages to choosing W2 for the LVR modeling application:

- W2 is able to address the pollutant of concern, TSS, and other pollutants of interest and concern within the LVR, e.g. inorganic suspended solids, total phosphorus, NH4, nitrate+nitrite, dissolved oxygen, and chlorophyll *a*. These pollutants were in turn used to estimate turbidity using relationships identified during the Phase I analysis.
- W2 is appropriate for a long and narrow river with spatially varying depths.
- W2 has been successfully linked in previous applications to SWAT, which is used to estimate pollutant loads from the local tributaries to the LVR.
- W2 is able to predict increased light availability due to a decrease in sediment.
- W2 provides the advantage of using a tested and widely accepted model, although some code modification was needed to address the simulation of total phosphorus (see Appendix B to the TMDL report for details).
- W2 is capable of simulating cause-and-effect relationships between loading from various sources and river response.
- Application of W2 was consistent with the schedule and budget.

Calibration of the W2 included two steps, calibration of the hydrodynamic simulation, which determined the flow and mixing coefficients for solute transport and water quality calibration conducted without any change to coefficients related to the hydrodynamics simulation. Table 2 in Appendix B to the TMDL report identifies the parameter values for the LVR model calibration. Calibration was performed for the period January 1, 1995 to August 31, 2006. Validation was performed for the period September 1, 2006 to December 31, 2006. Visual examination of the comparison of model results with observed data were made at seven locations. Refer to Figure 3-2 of the TMDL report and Figure 3 in Appendix B for a map of the seven locations. Figures 4 through 48 in Appendix B to the TMDL report display results of observed and simulated data for both hydrodynamics and water quality components.

W2 does not directly simulate turbidity. The State estimated turbidity from the W2 output for suspended solids using the following equation.

$$\text{Turbidity} = -1.098 + \text{TSS}^{0.974}$$

As mentioned above in the *Linking Total Suspended Solids to Turbidity Water Quality Standard* section, this equation was developed through a series of linear and nonlinear regressions. Appendix A to the TMDL report provides detailed discussion on the derivation of this equation.

Using TSS results from the original calibration of the W2 model and observed turbidity data, the State compared the simulated and observed turbidity at monitoring stations MS296, MS297, and VM00.1M (refer to Figure 3-3 of the TMDL report for monitoring station locations). Figures 49 through 51 in Appendix B to the TMDL report display the results of this comparison. According to information presented in Appendix B, the State concluded that the model does a good job of matching temporal trends and event peak concentrations of turbidity at station VM00.1M. The results also indicate that the model tends to underpredict turbidity in the period after the spring flood, particularly during non-event conditions. The State concluded that for the entire simulation the model tends to underpredict turbidity.

Further analysis was conducted by the State to better define the ability of the model to accurately predict excursions of Minnesota's turbidity water quality standard, 25 NTU. The State compared predicted excursions and observed excursions for both modes, Mode 0 and Mode 1. The analysis of Mode 1 predicted 43.7 percent of days with turbidity greater than 25 NTU compared to 42.2 percent of observed days exceeding the water quality standard. The model predicted 7.7 percent of days with turbidity greater than 25 NTU compared to 44.2 percent of observed excursions. From this comparison, the State determined that the model does not sufficiently predict excursions of the turbidity water quality standard during Mode 0.

Appendix B to the TMDL report explains that the discrepancy between modeled output and observed data during Mode 0 is mostly due to low to moderate flow conditions following the spring flood and persisting into the fall. Wetland areas of the LVR floodplain are thought to store highly turbid water which gradually drains into the LVR during the summer and fall leading to high turbidity during non-event conditions. The phenomenon of storage and release of the solid load in wetland areas is not readily handled in the W2 model. The State concluded that this missing turbidity load was best handled by adding a fixed concentration of inorganic suspended sediment (ISS) to the system during the summer and fall and was determined by the State to be 22.3 mg/L ISS. This fixed concentration was added during Mode 0 and for the months of April through November. Figure 52 of Appendix B shows the results of the observed turbidity compared to the predicted turbidity with the addition of the fixed ISS concentration. These adjusted predicted turbidity values now show a good correlation to the observed turbidity values.

<u>Calculating Loading Capacity</u>
Table 6-1 in the TMDL report presents allowable TSS loads as established by iterations of the calibrated W2 model targeted to attain the TMDL target of 20 NTU. The modeled allowable TSS loads presented in Table 6-1 in the TMDL report were generated by the W2 model and the turbidity equation as shown above in the modeling discussion and in Section 4.5 of Appendix B to the TMDL report. The model and equation were used to calculate running 30-day average

turbidity values at four assessment locations on the LVR.[8] Through iterative model runs, a combination of loads as shown in Table 6-1 in the TMDL report were identified as the TSS loads that when attained would achieve an average 30-day turbidity value of less than 20 NTUs at each of the four assessment locations. In establishing the TSS loads in Table 6-1 in the TMDL report the State did not impose any reductions on the TSS load from Pool 3[9] nor were reductions imposed on point and nonpoint sources discharging into the Upper Vermillion River.[10] Pool 4 TSS loads were also not reduced in the iterations since Pool 4's existing load was a very small contribution of TSS and flow to the LVR system. The TSS loads established in Table 6-1 in the TMDL report, were based on iterative reductions of TSS loading from internal sources and local tributaries.

As discussed in the modeling section of this Decision Document the State used an equation to relate turbidity and TSS. The regression analysis used to derive this equation was done mostly using turbidity data from monitoring station VM00.1M. Additionally, the calibration results presented in Figures 49-51 of Appendix B to the TMDL report show that most of the observed data used in the calibration was from monitoring station VM00.1M. The data available from monitoring station VM00.1M was recorded using portable turbidimeters that report nephelometric turbidity ratio units (NTRU)[11] turbidity values. Minnesota's water quality standard is written to NTU. The State has chosen to use the Metropolitan Council's (MCES) turbidity meter as the standard for turbidity assessment and TMDL work. MCES's meter reports NTU turbidity values. Because the relationship between turbidity and TSS for the LVR was documented using a dataset that consists primarily of NTRU turbidity values, the TSS loads established in Table 6-1 in the TMDL report need to be adjusted.

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[8] The four assessment locations are: LVR at 5 miles southeast of Hastings (MS297), LVR at High 68 Bridge (MS299), LVR at River Mile 2 (VR002.0), and LVR at the confluence with Mississippi River (VM00.1M). Refer to Figure 3-3 of the TMDL report for a map of these assessment locations.

[9] During the model iterations the State kept the TSS load from Pool 3 static. No reductions were made to the Pool 3 TSS load because the Pool 3 load was simulated as achieving water quality standards based upon the assumption that on-going efforts from the planned Lake Pepin TMDL will cause Pool 3 to attain water quality standards sometime in the future. The allowable TSS load used in the model runs for Pool 3 was established by reducing daily values of inorganic suspended sediment and chlorophyll *a* by approximately 78 percent from their existing load from Pool 3 as it enters the LVR.

[10] No reductions in the existing TSS load were considered for the Upper Vermillion River in the model iterations. The existing TSS loads from the Upper Vermillion River were held static. As stated in Section 6.0 of the TMDL report, the turbidity in the Upper Vermillion River is currently meeting water quality standards. Additionally, the State concluded that the Upper Vermillion River has little controlling impact on the LVR. One change the State did make to the existing TSS load estimate for the Upper Vermillion River was to adjust the load estimate to reflect the re-routing of the discharge from Empire WWTP to the Mississippi River in early 2008. Prior to early 2008, Empire WWTP discharged to the Vermillion River. Appendix C of the TMDL report explains how the adjustments were calculated and applied to the existing TSS load estimate for the Upper Vermillion River.

[11] NTU – White light, 90 degree detection, only and NTRU – white light, 90 degree detection is with additional correction detectors.

According to the data presented by the State in the TMDL report and response to comments,[12] TSS values that correspond to 20 NTRU are less than those that correspond to 20 NTU. The State presented the following comparison in the TMDL report and respond to comments:

- Pool 3 data that was MCES generated suggest a 20 NTU equivalent of approximately 60 mg/L TSS;
- Upper Vermillion River data that was MCES generated suggest a 20 NTU equivalent of approximately 80 mg/L; and
- LVR data from VM00.1M that was not MCES generated suggests a 20 NTRU equivalent of 25 mg/L.

The model iterations completed to generate the allowable TSS loads in Table 6-1 in the TMDL report were done with the goal of attaining a 25 mg/L TSS, which as suggested by the State equates to 20 NTRU. Had the iterations been done to attain the TSS load equivalent to 20 NTU the State's data indicate that the TSS goal would be somewhere between 60 mg/L and 80 mg/L, rather than 25 mg/L. Adjusting for the difference between MCES turbidity values (NTU) and the turbidity values at VM00.1M (NTRU) will result in a greater allowable TSS load than those shown in Table 6-1in the TMDL report.

The State selected a conservative ratio of 1.5 (increase of 50 percent from NTRU-modeled reductions) to apply to the applicable modeled allowable loads, i.e. the allowable loads shown in Table 6-1 in the TMDL report. The ratio was applied and final TMDL allowable loads were established and presented by the State in Table 6-2 and the TMDL Summary Table in the TMDL report. The allowable loads were added together to establish a loading capacity for the LVR. Further discussion regarding how the allowable loads were assigned between point and nonpoint, i.e. load allocation and wasteload allocation, is discussed in the appropriate section below.

Critical Condition

The critical conditions (the periods when the greatest reductions are required) were inherently addressed through the use of continuous modeling over a twelve-year period and by identifying load reductions that will achieve water quality standards at all times during this time period. The final TMDL is therefore based on a scenario that results in meeting water quality standards at all locations during all seasons.

*EPA finds the State's approach to establishing the loading capacities for the LVR during Mode 0 and Mode 1 acceptable. EPA hereby approves the loading capacity for Mode 0 (minimal Pool 3 inflow) as **7,793 kg/day** for TSS related to turbidity in NTU and for Mode 1 (significant Pool 3 inflow) as **70,321 kg/day** for TSS related to turbidity in NTU.*

[12] See 4-15-09 MPCA electronic mail reply to Rob Buris, MN DNR and 6-4-09 MPCA electronic mail reply to Donna Keclik, EPA.

4. Load Allocations (LAs)

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:
According to MPCA, the turbidity impairment is a result of increased TSS loads to the LVR. As previously discussed in this Decision Document and in the TMDL report, the State considered TSS loads from five sources: the Upper Vermillion River, local tributaries, Pool 3, Pool 4, and internal sources. Load allocations were established for each of these five sources. The TMDL Summary Table in the TMDL report and Table 6-2 in the TMDL report show the load allocations that were considered in EPA's decision. As discussed in the loading capacity section of this Decision Document, the State used W2 model iterations and a 1.5 adjustment factor to account for the relationship between NTRU, NTU, and TSS to establish the allocations.

The Upper Vermillion River was modeled as one contributing source of TSS without consideration for specific nonpoint and point source contribution of TSS. However, for purposes of establishing final allocations, the point sources discharging to the Upper Vermillion River were assigned wasteload allocations based upon existing permit conditions. The remainder of allowable load for the Upper Vermillion River after removing the existing point source allocation was established as load allocation for nonpoint sources in the Upper Vermillion River. During the model iterations, the Upper Vermillion River TSS loads were held static. The Upper Vermillion River is currently meeting water quality standards and the State has not identified any needed reductions from discharges of existing point sources on the Upper Vermillion River, therefore, no reduction from existing TSS loading is reflected in the final load allocation for the Upper Vermillion River in Mode 0 or Mode 1.

The entire allowable load for Pool 3 was considered load allocation by the State. EPA concurs that for the LVR TMDL, collectively considering all possible sources discharging into Pool 3 as one source to the LVR is reasonable. Point sources discharging in or upstream of Pool 3 and nonpoint sources impacting water quality in Pool 3 together contribute to the conditions of Pool 3 that impact the LVR. Therefore, the State's consideration of Pool 3 as one source of sediment load and flow to the LVR rather than looking at each individual point source or nonpoint source in Pool 3 is reasonable for development of the LVR TMDL. EPA considers the load allocation established by the State for Pool 3 as an upstream loading not specific to point or nonpoint sources. The State established the allocation for TSS for Pool 3 by simulating TSS load in Pool 3 as achieving water quality standards based upon the assumption that this will occur in the future due to ongoing Lake Pepin TMDL efforts. During the model iterations, the State applied reductions to daily ISS and chlorophyll *a* values for Pool 3 until an average 30-day turbidity value less than 20 NTUs was achieved. A 78% reduction in the load from Pool 3 to the LVR was needed before turbidity values less than 20 NTUs were achieved. The State applied this

78% reduction only to the existing TSS load for Mode 1. No reduction is required for Pool 3 during Mode 0 because Mode 0 is representative of minimal inflow from Pool 3 to the LVR.

Similar to how the allocation for Pool 3 was established, the State did not distinguish between point source and nonpoint source contributions from the local tributaries. The State considered the local tributaries as one source of sediment load and flow to the LVR , therefore, the allocation established applies to all sources of TSS in the local tributaries. Table 6-1 in the TMDL report presents the allowable load of TSS from the model iterations. As previously mentioned, the State held the TSS load from the Upper Vermillion River and Pool 3 static in the model iterations. The local tributary loads were not held static, therefore, an adjustment of 1.5 was applied to the modeled allowable load for the local tributaries to adjust for the relationship between NTRU, NTU, and TSS. (See the discussion regarding the 1.5 adjustment in the *Loading Capacity* section of this Decision Document.) Table 6-2 in the TMDL report and the TMDL Summary Table in the TMDL report present the final allocation for the local tributaries for Mode 0 and Mode 1.

Internal sources discussed in the TMDL report were considered to be nonpoint sources, therefore, the entire allowable load as presented in Table 6-2 in the TMDL report is considered load allocation. No reduction is required during Mode 1. This is reasonable since internal sources are not a significant source of flow or sediment during Mode 1. During Mode 0, when Pool 3 has minimal inflow to the LVR, the State is establishing a 50 percent reduction from the existing TSS load from internal sources. Note that in Table 6-1 in the TMDL report, the model iterations show that internal source loadings should be reduced by almost 100%. However, due to the limitations of the W2 model to consider internal sources and due to the lack of a robust LVR dataset to explain the impacts of the internal sources within the river, the State is establishing a 50% reduction from existing TSS loads for internal sources instead of a 100% reduction. EPA finds this acceptable at this time. In 2008, the State initiated monitoring in the LVR to collect continuous turbidity data to help better understand, among other things, internal sources in the river. EPA expects the State to utilize data generated from this effort to re-evaluate, if necessary, the internal source existing and allowable loads used in this TMDL. If data supports changing the existing and allowable loads, EPA encourages the State to consider revising this TMDL report.

Although not determined to be a significant source of flow and TSS load to the LVR, Pool 4 was also identified as a potential nonpoint source contributing to the turbidity impairment. The load allocation for Pool 4 does not include a reduction from existing TSS loads.

Table 2 below includes the load allocations being approved by EPA for the LVR TMDL. Note that, although identified by the State as single load allocations, the allocation for Pool 3 and for the local tributaries is applicable to the collective load of these sources entering the LVR.

Table 2: EPA Approved Load Allocations for the Lower Vermillion River

Load Allocation Source	Mode 0 (Minimal inflow from Pool 3) kg/day	Mode 1 (Significant inflow from Pool 3) kg/day
Upper Vermillion River	1,478	9,383
Pool 3	1	45,081
Pool 4	1	1
Internal sources	3,464	1
Local Tributaries	1,788	10,052
Total	6,732	64,518

EPA finds that the load allocations presented in Table 2 above and in Table 6-2 and the TMDL Summary Table in the TMDL report are acceptable.

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 water quality standards 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 permitees 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:
WLAs considered for this decision are found in the TMDL Summary Table of the TMDL report, Tables 6-3 and 6-4 of the TMDL Report, and Tables 3 and 4 below. WLAs are expressed as daily TSS loads. WLAs remain the same regardless of the mode, i.e. the WLAs for Mode 0 and Mode 1 are the same.

Table 3: Wasteload Allocations for the individual permitted dischargers in the LVR

Facility Name	Permit number	TSS WLA and Limits
Elko/New Market WWTP	MN0056219	125.2 kg/day
Intek Plastic Inc.	MN0003417	14.4 kg/day
Met Council- Empire WWTP	MN0045845	0 (no longer discharges to VR)
Vermillion WWTP	MN0025101	9.2 kg/day
Total		148.8 kg/day rounded to 149 kg/day

The individual permitted dischargers listed above in Table 3 are in the Vermillion River watershed. All of these discharges are located in the Upper Vermillion River, the portion of the river which is upstream of Hastings. As previously mentioned in this Decision Document, the Upper Vermillion River was modeled as one source of sediment and flow into the LVR. The total allowable load for the Upper Vermillion River as calculated through the model iterations included both point and nonpoint sources. The State is not requiring reductions from any of the point sources that discharge to the Upper Vermillion River, therefore, the wasteload allocations in Table 3 above were established from current permits conditions. Section 6.1.1.1 of the TMDL report states, "There are also a number of other permittees in the Upper Vermillion River, but most of them do not have any kind of water discharge or do not discharge TSS …" The State did not provide an extensive list of all permittees in the watershed, however, EPA considers all permittees that do not discharge TSS as having a zero (0) wasteload allocation.

The following cities and townships within the Vermillion River watershed fall under the Phase II storm water guidelines and have MS4 permits: City of Apple Valley, City of Burnsville, City of Hastings, Empire Township, City of Farmington, City of Lakeville, and City of Rosemount. These entities are located upstream of Hastings on the Upper Vermillion River. Other MS4 permit holders are MNDOT, Dakota County, and Scott County. WLAs were calculated for these entities and, similar to the municipal and industrial facilities, were subtracted from the total load contributed by the Upper Vermillion River to determine the nonpoint source load portion of the Upper Vermillion River. Table 4 below and Table 6-4 of the TMDL Report identify the specific WLAs for these entities under both Mode 0 and Mode 1.

Table 4: MS4 permit WLAs

MS4 Permittee/Number	Mode 0 WLA (kg/day)	Mode 1 WLA (kg/day)
Apple Valley (MS400074)	75	464
Burnsville (MS400076	11	68
Lakeville (MS400099)	363	2,250
Farmington (MS400090)	94	582
Rosemount (MS400117)	26	164
Empire Township (MS400135)	279	1,730
Hastings (MS400240)	64	396
MnDOT Metro (MS400170)	Wasteload allocations for MNDOT and county	

MS4 Permittee/Numbers	Mode 0 WLA (kg/day)	Mode 1 WLA (kg/day)
Dakota County (MS400132)	roads are included in respective wasteload allocations for the municipalities that contain them.	
Scott County (MS400154)		
Total	912	5,654

EPA finds that the State has established WLAs for point sources contributing to the turbidity impairment in the LVR.

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.

Comment:
The MOS is discussed in section 6.1.3 of the TMDL Report. An implicit MOS has been applied as part of the LVR by running the model to achieve a 30-day turbidity value of 20 NTUs instead of 25 NTUs. This 20 percent reduction in the standard is used because of the considerable uncertainty associated with understanding and modeling a system as complex as the LVR. The LVR system is hydrologically complex with flow entering the system from the Upper Vermillion at Hastings, local tributaries, through movement of groundwater, and by interflow with the pools of the Mississippi. As discussed in the model calibration section above sediment resuspension due to fish activity and the phenomenon of storage and release of solid load in wetland areas are not readily handled in the W2 model thus creating additional uncertainty. Additional uncertainty is introduced into the allocations due to the lack of calibration of the SWAT model for local tributary loads due to lack of sampling within the tributaries.

Another conservative approach considered in establishing the allocations was the value of 1.5 used to adjust the local tributary allowable load to account for the relationship between NTRU, NTU and TSS. The data presented by the State shows that a TSS value that corresponds to a 20 NTU is often double or more that which corresponds to a 20 NTRU. Therefore, the 1.5 adjustment applied by the State is considered conservative and helps provide MOS.

EPA finds the State's approach acceptable and it meets the requirements of this section.

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)).

Comment:
According to Section 6.2 of the TMDL report, the State considers seasonal variation to be inherently addressed through the use of continuous modeling over a twelve-year period. The modeling period used for model calibration and establishment of allocations was the time period, January 1, 1995 to December 31, 2006. The continuous modeling allowed the State to establish allocations that will attain water quality standards during all seasons over multiple years.

Additionally, EPA considered the fact that the State established allocations for two modes of the LVR system as a way to account for seasonal variations. The distinction between modes is based upon stage of the Mississippi River. Mode 0 is representative of low to moderate flow conditions while Mode 1 is more representative of high flow conditions. Appendix B to the TMDL report states that "on a long-term basis" the LVR system receives more than twice the flow of other sources from Pool 3. Looking at flow over the long-term and establishing allocations based on long-term flows is considered by EPA a method of including seasonal variations into the TMDL.

EPA finds the State's approach acceptable and it meets the requirements of this section.

8. Reasonable Assurances

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:
EPA is taking no action on any reasonable assurance presented in the LVR TMDL report. Section 6.1.1 states that further reductions from existing permit limits are not expected for the four individual point sources discharging to the Upper Vermillion River. These WLAs were established using permit limits and were not established dependent upon nonpoint source reductions. The State did not include a specific section regarding reasonable assurance that nonpoint source reductions would occur, however, the State does discuss potential implementation actions for attaining needed nonpoint source reductions in Section 7 of the TMDL report. This section of the TMDL report also notes that successful implementation of the LVR TMDL will require improvements of the water quality in Pool 3. The TMDL report acknowledges that the State's completion of the Lake Pepin TMDL is an initial effort needed to move toward improved water quality in Pool 3.

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:
A detailed monitoring plan has not been developed as part of this TMDL; however, general recommendations are made to continue existing monitoring efforts and to collect new data for internal sources and for the local tributaries as discussed in section 7.2 of the TMDL report. Future monitoring must focus on (1) documenting changes in water quality, (2) understanding effectiveness of various best management practices on the land, and (3) evaluating water level management exercises and decisions, as well as the State identified five core components of a LVR monitoring plan.

EPA finds that the State has set forth its plans for future monitoring and encourages the State to continue to fund existing monitoring programs and future programs to achieve the monitoring plans established in the TMDL report.

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:
EPA is not required to and does not approve TMDL implementation plans. MPCA did identify implementation activities in the watershed. Section 7.1 of the TMDL report describes proposed implementation activities in detail.

According to Section 7 of the TMDL report implementation measures could include:

- Water Level Management – MDNR has identified three water level management strategies that could be used in the LVR.
- Fish Management - MDNR believes it may be possible to induce rough fish to leave and largely stay out of backwater lakes following the spring flood.
- Agricultural and Urban Best Management Practices – MDNR identified several best management practices for sediment control including tillage practices, cover crop, vegetative controls, riparian buffers.
- WLA's for various point sources have been calculated and will be implemented by NPDES program.

EPA finds that the LVR TMDL report and supporting documentation submitted by Minnesota addresses this tenth element.

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:
Public participation in the development of the LVR TMDL included a "kickoff" public meeting, which was held February 26, 2004 at the Hastings City Hall. Another meeting was held November 30, 2006 in Farmington to present the results of Phases I and II of the study. A final public meeting was held on March 19, 2008 at the Pleasant Hill Library in Hastings to present

the draft TMDL report. A formal public notice and comment period ran from March 23, 2009 until April 22, 2009. The State received and responded to eight comment letters, including comments from EPA.

EPA finds that the State provided adequate public participation in the establishment of the LVR TMDL.

12. Submittal Letter

A submittal letter should be included with the TMDL, 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:
EPA received the LVR Turbidity TMDL on July 21, 2009, accompanied by a submittal letter dated July 13, 2009. In the submittal letter, MPCA states: "MPCA is pleased to submit the Lower Vermillion River Turbidity Total Maximum Daily Load (TMDL) study for Turbidity to the U.S. Environmental Protection Agency (EPA) for final review and approval." The submittal letter also includes the date of the public notice and comment period for the TMDL.

13. Conclusion

After a full and complete review, EPA finds that the TMDL for the Lower Vermillion River satisfies all of the elements of an approvable TMDL. This approval addresses one assessment unit on the Vermillion River, Vermillion River/Vermillion Slough, Hastings dam to Mississippi River, assessment unit ID 07040001-504 and one impairment (turbidity) and one use (aquatic life) on the 303(d) list. The TMDL is developed for TSS as discussed in this document.

EPA's approval of this TMDL does not extend to those waters that are within Indian Country, as defined in 18 U.S.C. Section 1151. EPA is taking no action to approve or disapprove TMDLs for those waters at this time. EPA, or eligible Indian Tribes, as appropriate, will retain responsibilities under the CWA Section 303(d) for those waters.