Lower Wild Rice River Turbidity
Final Total Maximum Daily Load Report

For Submission to:

U.S. Environmental Protection Agency
Region 5
Chicago, Illinois

Submitted by:

Minnesota Pollution Control Agency

June 2009

wq-iw5-03e

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Executive Summary

The Clean Water Act, Section 303(d), requires that every two years states publish a list of waters that do not meet water quality standards and do not support their designated uses. These waters are then considered to be "impaired." Once a water body is placed on the impaired waters list, a Total Maximum Daily Load (TMDL) must be developed. The TMDL provides a calculation of the maximum amount of a pollutant that a water body can receive and still meet water quality standards. It is the sum of the individual wasteload allocations (WLAs) for point sources, load allocations (LAs) for nonpoint sources and natural background, a margin of safety (MOS), plus a reserve capacity (RC).

In 2006 the Minnesota Pollution Control Agency (MPCA) listed the Lower Wild Rice River as impaired for excess turbidity. This report addresses the turbidity impairment for the Wild Rice River, from the confluence with the South Branch of the Wild Rice River to the Red River of the North. Other waters within the Wild Rice River watershed listed as impaired will be addressed through subsequent TMDL reports.

The Lower Wild Rice River lies within the Wild Rice River watershed of the Red River Basin of the North. This portion of the river is 30.58 miles in length and is located entirely within Norman County, Minnesota. Land use is dominated by agricultural cropping and is extensively drained for that purpose.

This TMDL report used a flow duration curve approach to determine the pollutant loading capacity of the Lower Wild Rice River under varying flow regimes. This approach was used to calculate general allocations necessary to meet water quality standards for the impaired stream reach.

The primary contributing sources of the turbidity impairment appear to be from upland soil erosion and stream-bank erosion. The turbidity impairment can also be directly correlated with higher flows, with sediment reductions near 90 percent needed to achieve the turbidity water quality standard during moist conditions and high flows.

Introduction

Section 303(d) of the Clean Water Act provides authority for completing Total Maximum Daily Loads (TMDLs) to achieve state water quality standards and/or designated uses.

A TMDL is a calculation of the maximum amount of pollutant that a water body can receive and still meet water quality standards and/or designated uses. A TMDL is the sum of the loads of a single pollutant from all contributing point and nonpoint sources. TMDLs are approved by the U.S. Environmental Protection Agency (EPA) based on the following elements. That they;

1. Are designed for applicable water quality criteria;
2. Include a total allowable load as well as individual waste load allocations;
3. Consider the impacts of background pollutant contributions;

4. Consider critical environmental conditions;
5. Consider seasonal environmental variations;
6. Include a margin of safety;
7. Provide opportunity for public participation; and
8. Have a reasonable assurance that the TMDL can be met.

In general, the TMDL is developed according to the following relationship:

TMDL = WLA + LA + MOS + RC

Where:

WLA = wasteload allocation; the portion of the TMDL allocated to existing or future point sources of the relevant pollutant;

LA = load allocation, or the portion of the TMDL allocated to existing or future nonpoint sources of the relevant pollutant. The load allocation may also encompass "natural background" contributions;

MOS = margin of safety, or an accounting of uncertainty about the relationship between pollutant loads and receiving water quality. The margin of safety can be provided implicitly through analytical assumptions or explicitly by reserving a portion of loading capacity *(USEPA, 1999)*; and

RC = reserve capacity, an allocation for future growth. This is an MPCA-required element, if applicable, for TMDLs.

Background Information

Lower Wild Rice River Listing Information

This TMDL report applies to the turbidity impairment for the Wild Rice River, from the confluence with the South Branch of the Wild Rice River to the Red River of the North (Lower Wild Rice River).

The Lower Wild Rice River was originally listed as impaired for turbidity in Minnesota's 2006 303(d) List of Impaired Waters. The MPCA's projected schedule for TMDL completions, as indicated on this list, implicitly reflects Minnesota's priority ranking of this TMDL. This TMDL was scheduled to begin in 2006 and be completed in 2009. A summary of the information included in List of Impaired Waters for the Lower Wild Rice River is provided in Table 1.

Table 1 – Lower Wild Rice River Identification

Reach name on 303(d) list / Description	Assessment unit ID	Year Listed	Pollutant or Stressor	Affected Use	Watershed / HUC
Wild Rice River / South Branch to Red River of the North	09020108-501	2006	Turbidity	Aquatic Life	09020108

The Lower Wild Rice River was assessed to be impaired based on water quality monitoring conducted by the Minnesota Pollution Control Agency (MPCA) for the monitoring stations listed in Table 2. These stations were monitored in 2001 and 2003.

Essentially, listings occur when greater than ten percent of data points collected within the previous ten-year period exceed the 25 nephelometric turbidity units (NTUs) standard (or equivalent values for total suspended solids or transparency tube data). Impairment assessment procedures for turbidity are provided in *The Guidance Manual for Assessing the Quality of Minnesota Surface Waters for Determination of Impairment (MPCA, 2007).*

A summary of the information used to include the stream reach on the List of Impaired Waters is provided in Table 2. The entire listing dataset is included in Appendix A.

Table 2 – Lower Wild Rice River Assessment Summary

Monitoring Stations Used for Assessment – ID #	Monitoring Stations Used for Assessment – Location Description	Parameters Measured	Number of Samples	Number of Exceedences of Water Quality Standard	Number of Years of Data / Data Collection Years
S000-216	Wild Rice River, bridge on USH-75 North of Hendrum, Minnesota	Turbidity	7	6	1/2001
S002-102	Wild Rice River at County Road 25, .8 Miles East of Hendrum, Minnesota	Turbidity Transparency tube	8 8	8 8	1/2003 1/2003

Lower Wild Rice River Geographic Location

The Lower Wild Rice River is part of the Wild Rice River watershed of the larger Red River Basin of the North. This portion of the river is 30.58 miles in length and is located entirely within Norman County, Minnesota. The Wild Rice River watershed encompasses just over one million acres and is located in Clearwater, Mahnomen, Becker, Norman and Clay counties. The watershed lies within three ecoregions. The headwaters, middle portion and Lower reach of the watershed receive drainage from the Northern Lakes and Forests, North Central Hardwood Forest, and the Red River Valley ecoregions respectively.

The location of the Lower Wild Rice River within Minnesota and within the Wild Rice River watershed is shown in Figures 1 and 2 respectively.

Figure 1 – Map of Lower Wild Rice River within Minnesota

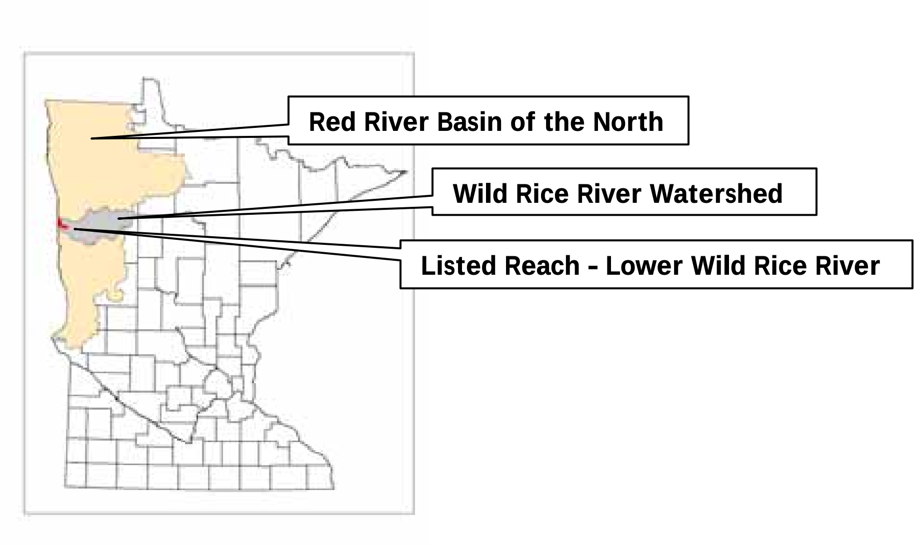
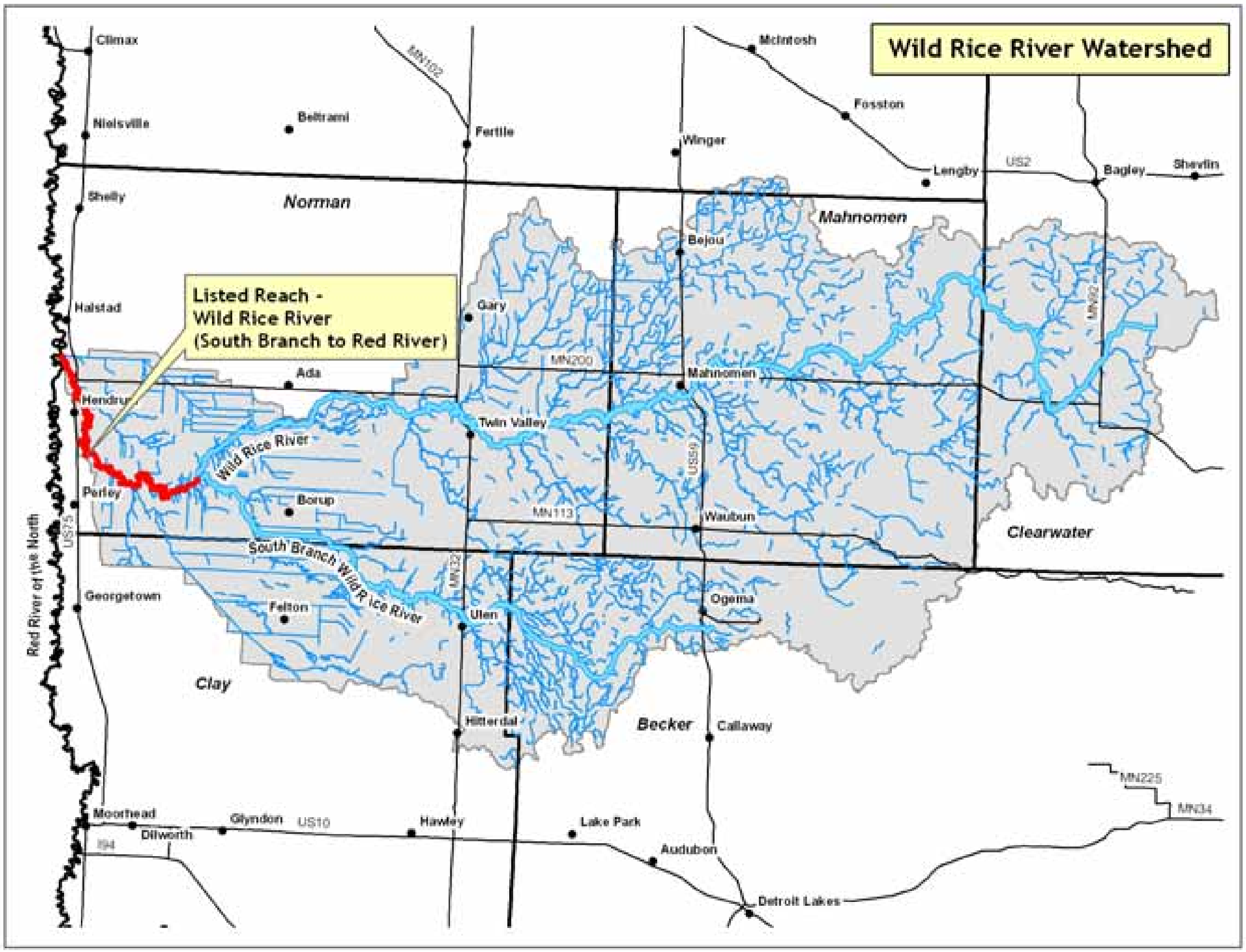


Figure 2 – Map of Lower Wild Rice River within Watershed



Land Cover

The land cover of the Wild Rice River watershed as provided by the National Land Cover Dataset, 2001, is shown in Figure 3, with the number of acres of each land cover type provided in Table 3.

Figure 3 – Map of Land Cover for the Wild Rice River Watershed

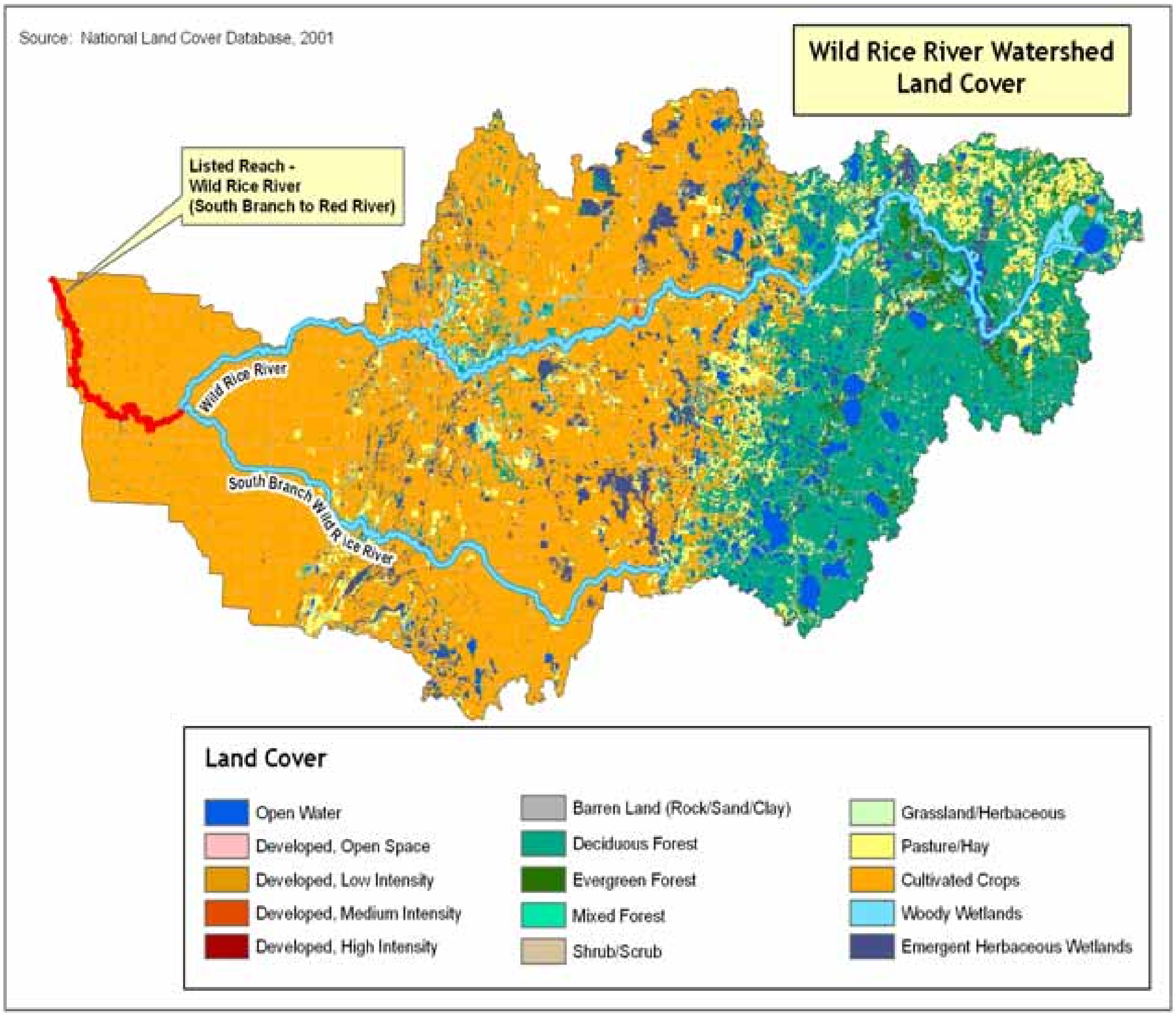


Table 3 – Acres of Land Cover for Wild Rice River Watershed

Category	Area, acres	Percent
Open Water	36,761	3.53 percent
Developed, Open Space	33,645	3.23 percent
Developed, Low Intensity	3,564	0.34 percent
Developed, Medium Intensity	351	0.03 percent
Developed, High Intensity	42	0.00 percent
Barren Land (Rock/Sand/Clay)	305	0.03 percent
Deciduous Forest	207,138	19.87 percent
Evergreen Forest	29,845	2.86 percent
Mixed Forest	705	0.07 percent
Shrub/Scrub	6,795	0.65 percent
Grassland/Herbaceous	15,121	1.45 percent
Pasture/Hay	69,864	6.70 percent

Cultivated Crops	549,550	52.71 percent
Woody Wetlands	22,347	2.14 percent
Emergent Herbaceous Wetlands	66,639	6.39 percent
Total	**1,042,672**	**100 percent**

Watershed Characteristics *(Wild Rice Watershed District, 2003)*

Geomorphology – The Lower Wild Rice River lies within physiographic region known as the Glacial Lake Plain, which is part of historic Glacial Lake Agassiz. This region is characterized by flat, extremely level deposits of lake sediments. The Lower Wild Rice River is generally contained by low banks and has for the most part high sinuosity.

Soils – The upland soils of the Lower Wild Rice River tend to be clays of low permeability, with poor internal drainage. The streambed substrates include a finer mixture of sand and silt.

Cropping – Cropping dominates the land use of the Lower Wild Rice River. In Norman County, where the Lower Wild Rice River is located wheat, soy beans and sugar beats make up the majority of the crops. The United States Department of Agriculture's National Agricultural Statistics Service (NASS) 2002 Census reported that 152,949 acre of wheat, 141,336 acres of soybeans, and 42,787 acres of sugar beats were harvested. Corn is also part of the part of the planted acres in Norman County and is becoming increasingly more common. According to the NASS 2002 Census, the number of corn acres harvested from 2002 (17,900 acres harvested) to 2007 (71,300 acres harvested) increased by 53,400 acres. The United States Department of Agriculture's Farm Service Agency's Conservation Reserve Program (CRP) Monthly Report indicates that as of May 16, 2008, in Norman County 51,716 acres of cropland were enrolled in the CRP. Of those acres, 33,010 are part of CRP contracts which are due to expire between the years 2008 and 2013.

Drainage – The upland of the Lower Wild Rice River is heavily drained by both ditch and tile drainage systems, with ditch systems being dominant. This area is subject to extensive flooding during runoff events.

Water Quality Standards

Designated Beneficial Use of Lower Wild Rice River

This TMDL addresses exceedences of the water quality standard for turbidity. According to Minn. R. ch. 7050, the Lower Wild Rice River covered in this TMDL is classified as 2B and 3B water. The designated beneficial use for 2B waters (the most protective use class) is as follows:

Class 2 waters, aquatic life and recreation. Aquatic life and recreation includes all waters of the state which do or may support fish, other aquatic life, bathing, boating, or other recreational purposes, and where quality control is or may be necessary to protect aquatic or terrestrial life or their habitats, or the public health, safety, or welfare.

Water Quality Standard for Turbidity

The turbidity water quality standard found in Minn. R. 7050.0222 for 2B and 3B water is 25 NTUs. This TMDL is written for Class 2 waters as this is the more protective class.

Turbidity in water is caused by suspended sediment, organic material, dissolved salts and stains that scatter light in the water column making the water appear cloudy. Excess turbidity can degrade aesthetic qualities of water bodies, increase the cost of treatment for drinking or food processing uses and can harm aquatic life. Aquatic organisms may have trouble finding food, gill function may be affected and spawning beds may be covered.

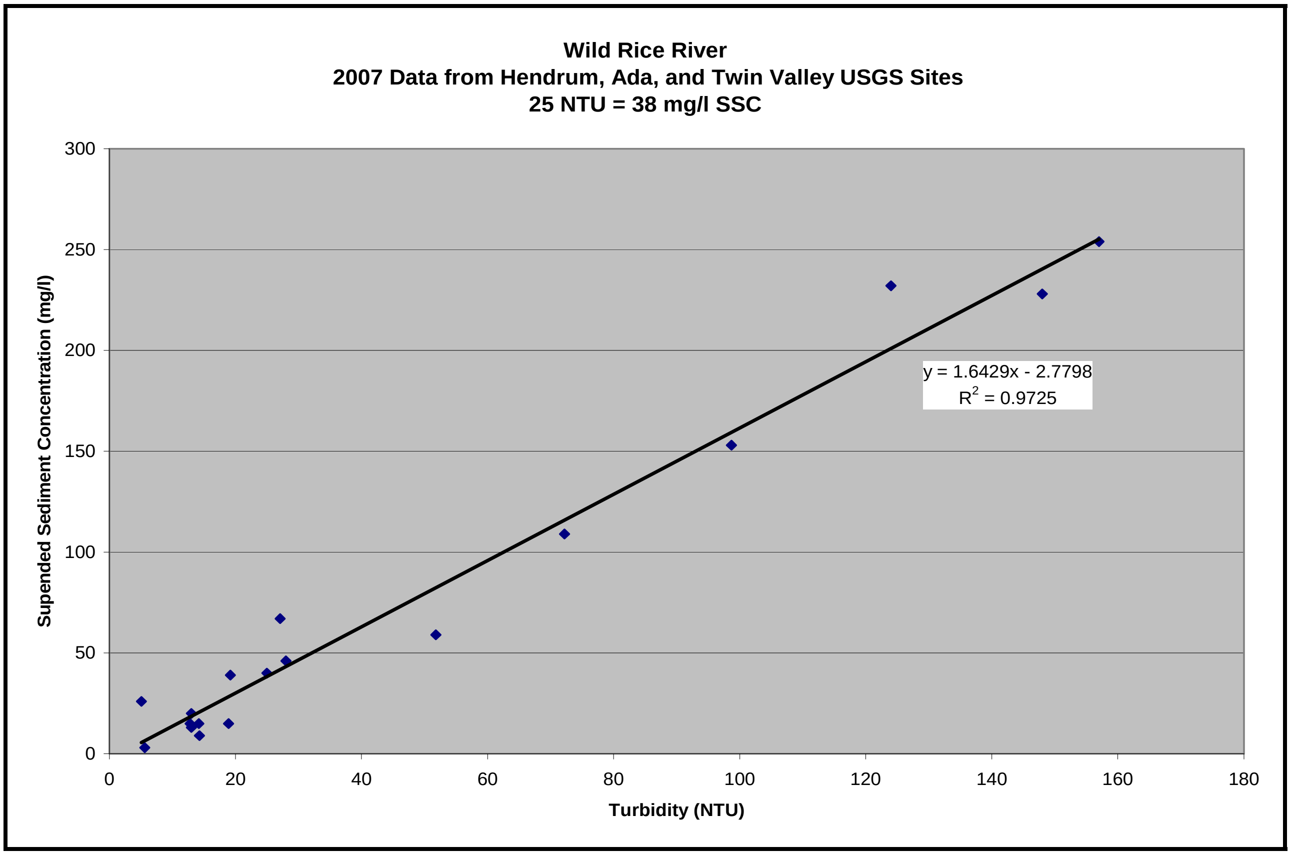
Suspended Sediment Concentration as the Surrogate Measure for Turbidity

Much of the Red River Basin of the North, particularly in the portion known as the Red River Valley, is cultivated cropland. Soil erosion from cropland contributes to the sediment load in streams. It is widely accepted that sediment sources in streams in such settings are comprised of sediment that originates both from eroded soil and from erosion of stream-bank sediments (Colby, 1963). To better understand the dominant sources of sediment, channel processes or upland soil erosion to streams in the Red River Basin of the North, the U.S. Geological Survey (USGS) in cooperation with the Legislative Commission on Minnesota Resources studied soils and suspended sediments in the Wild Rice River watershed (Brigham et al, 2001). Using suspended sediment concentration (SSC) and turbidity data that was collected by the USGS, a surrogate measure of the 25 NTU standard was calculated as SSC for this TMDL.

Numeric Water Quality Target

Turbidity cannot be converted into loads because it is a dimensionless unit. To use the 25 NTU turbidity standard in a load allocation scenario, a relationship between turbidity and SSC must be developed. The USGS conducted field sampling on the Wild Rice River in 2007. Water quality variables that were measured in 2007 included turbidity and SSC, along with other data that was collected by the USGS. The turbidity measurements were taken at the same time as SSC samples were collected, these are defined as “paired” measurements. The turbidity in the river was measured using an HF Scientific DRT 15CE turbidity meter, with the appropriate reporting unit of an NTU. SSC results were received from the USGS sediment lab. Using the paired turbidity and SSC measurements for three sites on the Wild Rice River (Hendrum, Ada, and Twin Valley), a simple regression technique was used to predict SSC based on turbidity. This regression technique results in a value of **38 mg/L for the 25 NTU-SSC equivalent**. The R^2 value indicates the strength of the correlation between the two variables. A strong correlation between SSC and turbidity is evident by a relatively high R^2 of 0.97. This analysis indicates that the turbidity standard of 25 NTU corresponds to a SSC of 38 mg/l for this dataset. The regression equation is displayed on Figure 4. The dataset used for calculating the water quality target is listed in Appendix C.

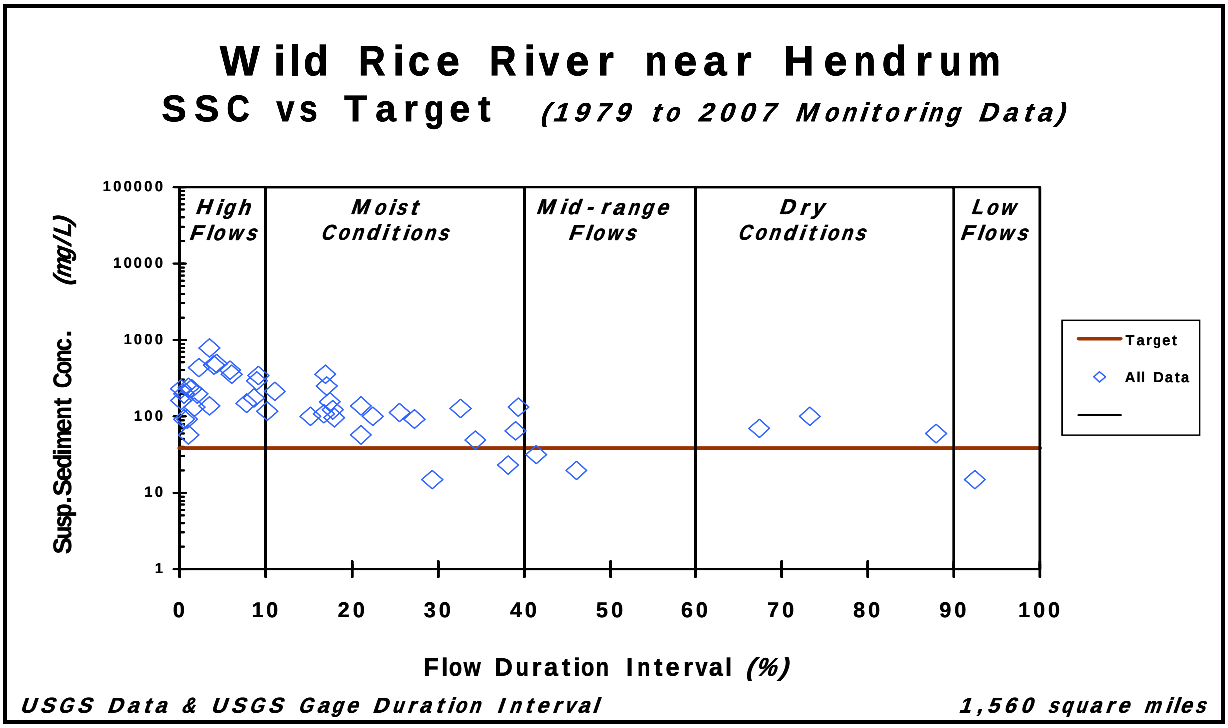
Figure 4 – Relationship of Turbidity (in NTUs) to SSC



Degree of Impairment

Based on the available data (Appendix B) the turbidity impairment in the watershed appears to be "major" when viewed across the entire sampling season. All of the turbidity readings taken during the open water season were 25 NTU or higher (Figure 5). The only turbidity measurements that were less than 25 NTU, of which there were five, were sampled during the winter season (December – March).

Figure 5 – All SSC Data in Relation to the Target of 38 mg/l SSC



Turbidity Sources

Point Sources

Point sources are the portion of the TMDL that make up the Waste Load Allocation (WLA). Point sources, for the purpose of this TMDL, are those facilities/entities that discharge or potentially discharge solids to surface water or otherwise may contribute to excess turbidity and require a National Pollutant Discharge Elimination System (NPDES)/State Disposal System (SDS) permit (i.e. water quality permit from the MPCA). In the Wild Rice River watershed, the potential point sources include, municipal wastewater treatment facilities, industrial facilities, concentrated animal feeding operations and construction activities. There are no communities subject to municipal separate storm sewer (MS4) NPDES/SDS permit requirements.

Municipal Wastewater Treatment Facilities - There are 10 municipal wastewater treatment facilities (WWTFs) located within the Wild Rice River watershed and include the cities of; Bejou, Borup, Felton, Gary, Hendrum, Mahnomen, Ogema, Twin Valley, Ulen, and Waubun. These WWTFs are all pond systems. Their NPDES/SDS permits include a mass loading limit for Total Suspended Solids (TSS) expressed in kilograms per day. This mass loading limit is the WLA for the WWTF and is calculated using the unique design flow for each facility and an effluent concentration limit of 45 mg/l TSS. The 45 mg/l TSS effluent limit requirement comes from the Minnesota Rules, Chapter 7050, which sets the standards of protection for water quality and purity in Minnesota. The permits allow for two discharge windows, between April 1st and June 30th and between September 1st and December 15th. In general, these windows coincide with high flow periods. The WWTFs are only allowed to discharge a limited volume of effluent from the pond system per day.

There are individual WLAs calculated for each of the ten WWTFs (Table 4). For the purpose of summarizing the load allocations, the WWTFs will be lumped into one WWTF allocation. Ongoing efforts by the cities as well as continued regulatory oversight by MPCA should maintain the WWTFs as a very minor contributor to the turbidity impairment.

Table 4 – WWTFs and WLAs in the Wild Rice River Watershed

City	TSS WLA in lbs/day	TSS WLA in tons/day
Bejou	57.2	0.03
Borup	41.8	0.02
Felton	83.6	0.04
Gary	92.4	0.05
Hendrum	305.8	0.15
Mahnomen	1548.8	0.77
Ogema	77.0	0.04
Twin Valley	338.8	0.17
Ulen	321.2	0.16
Waubon	176.0	0.09
Total	**3043**	**1.5 tons/day**

Construction Activities - The pollutant load from construction stormwater is estimated to be less than 1 percent of the TMDL and is difficult to quantify. For the Wild Rice River watershed, the wasteload allocation was determined based on an estimated percentage of disturbed land in the watershed. The estimate is based on the number of disturbed acres divided by the total acreage of the watershed. MPCA construction stormwater permit application records over the last 4 ½ years indicate approximately 0.17 percent of the acreage in the watershed is subject to construction on an annual basis. This estimate of current loading appears to be representative of the typical loading in the watershed from this type of activity. Construction stormwater activities requiring an NPDES permit are considered in compliance with provisions of the TMDL if they obtain a Construction General Permit under the NPDES program and properly select, install and maintain all BMPs required under the permit, or meet local construction stormwater requirements if they are more restrictive than requirements of the State General Permit.

Industrial Facilities – There are two industrial facilities located within the Wild Rice River watershed and include Ames Sand & Gravel - B-B Felton Site and Border States Paving/Marvin/Gordon Pits. Both facilities have NPDES/SDS permit coverage under the State of Minnesota General Permit for Construction Sand and Gravel, Aggregate and Hot Mix Asphalt (Permit Number MNG490000). To account for industrial stormwater in the Wild Rice River watershed, for which the MPCA does not have readily accessible acreage data, this TMDL will estimate another 0.17 percent of the land area for a combined construction and industrial stormwater percentage of 0.34 percent. Construction stormwater and industrial stormwater are lumped together into a categorical WLA based on an approximation of the land area covered by those activities. The pollutant load from industrial stormwater activities such as these is considered to be less than 1 percent of the TMDL and is difficult to quantify. Industrial storm water activities are considered in compliance with provisions of the TMDL if they obtain an industrial stormwater general permit or General Sand and Gravel general permit (MNG490000) under the NPDES program and properly select, install and maintain all BMPs required under the permit.

Concentrated Animal Feeding Operations – There are two Concentrated Animal Feeding Operations (CAFOs) located within the Wild Rice River watershed and include Burkel Turkey Farms, Inc. and Maple Leaf Enterprises, Inc. Both CAFOs have NPDES/SDS permit coverage under the State of Minnesota General Livestock Production Permit. These CAFOs are assigned a zero WLA. This is consistent with the conditions of the permit, which allows no discharge of pollutants from the production area of the CAFOs.

Non-point Sources

Non-point sources are the portion of the TMDL that make up the Load Allocation (LA). Non-point sources are not subject to NPDES/SDS permit requirements. They can include background sources, such as natural soil erosion from stream channel and upland areas. They can also include runoff from agricultural lands and non-NPDES/SDS permitted stormwater runoff. In an agricultural watershed setting, such as the Wild Rice River watershed, non-point sources dominate the sediment load and are the primary areas designated for load reduction activities.

In the Wild Rice River watershed, the sediment from non-point sources comes from two general areas, upland soil erosion and stream-bank erosion. Both sources are known to contribute with the more significant source varying depending on precipitation, flow, and time of the year

Loading Capacity of Lower Wild Rice River

General Methodology *(Duration Curve Approach, USEPA, 2007)*

Due to the wide range of variability that occurs in stream flows, hydrologists have long been interested in knowing seasonal patterns, as well as the percentage of days in a year when given flows occur. Seasonal flow patterns and the TMDL process are implicitly connected. A traditional load is the product of flow, concentration, and a conversion factor. Thus, analysis of flow patterns plays a major role when considering seasonal variation in TMDL development.

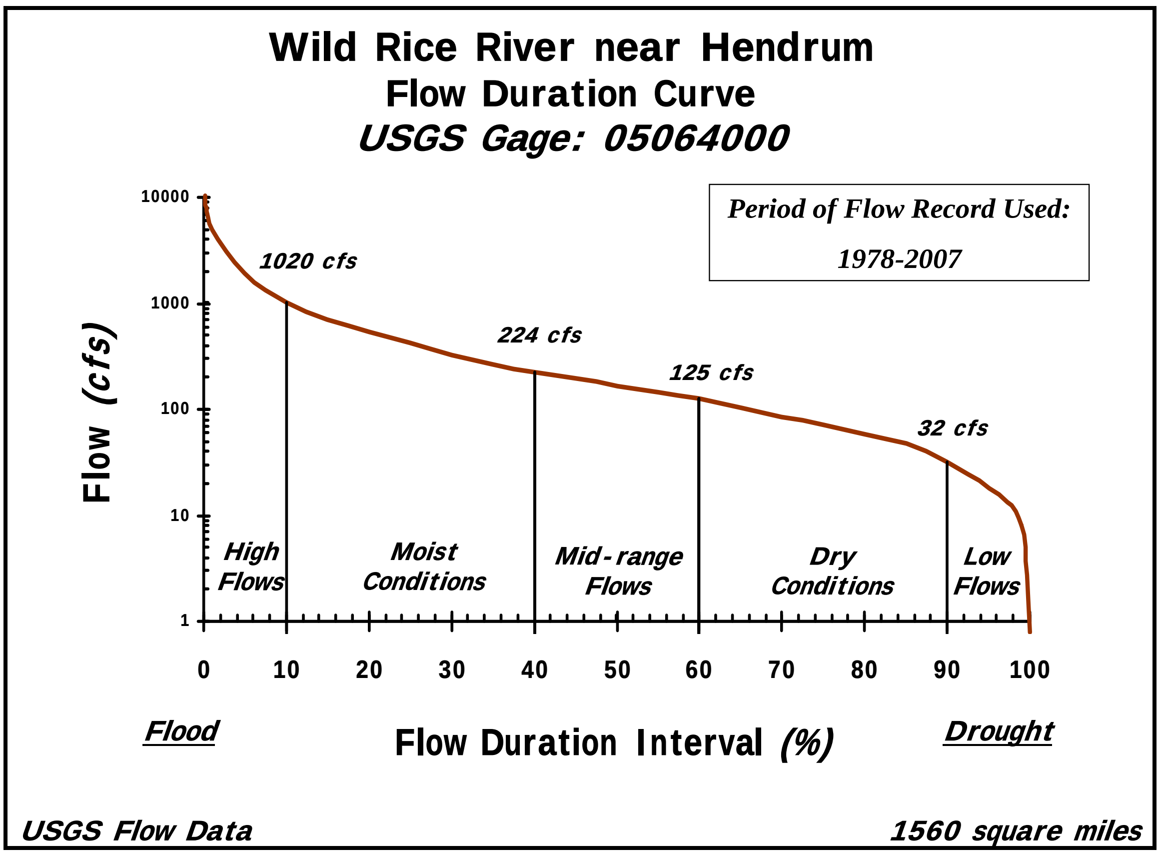
One means of flow analysis is the use of flow duration curves. Duration curves describe the percentage of time during which specified flows are equaled or exceeded *(Leopold, 1994)*. Flow duration analysis looks at the cumulative frequency of historic flow data over a specified period. Duration analysis results in a curve, which relates flow values to the percent of time those values have been met or exceeded. Thus, the full range of stream flows is considered. Low flows are exceeded a majority of the time, whereas floods are exceeded infrequently.

The initial flow duration curves plot flow values on the y-axis against the percent of time the flow is exceeded in the flow record. Flow duration curve development typically uses daily average discharge rates, which are sorted from the highest value to the lowest. Using this convention, flow duration intervals are expressed as percentage, with zero corresponding to the highest stream discharge in the record (i.e. flood conditions) and 100 to the lowest (i.e. drought conditions).

Flow duration curve intervals can be grouped into several broad categories or zones. These zones provide additional insight about conditions and patterns associated with the impairment. For example, the duration curve in Figure 6 consists of five zones: one representing ***high flows* (0-10 percent),** another for ***moist conditions* (10-40 percent),** one covering ***mid-range flows* (40-60 percent),** another for ***dry conditions* (60-90 percent),** and one representing ***low flows* (90-100 percent).**

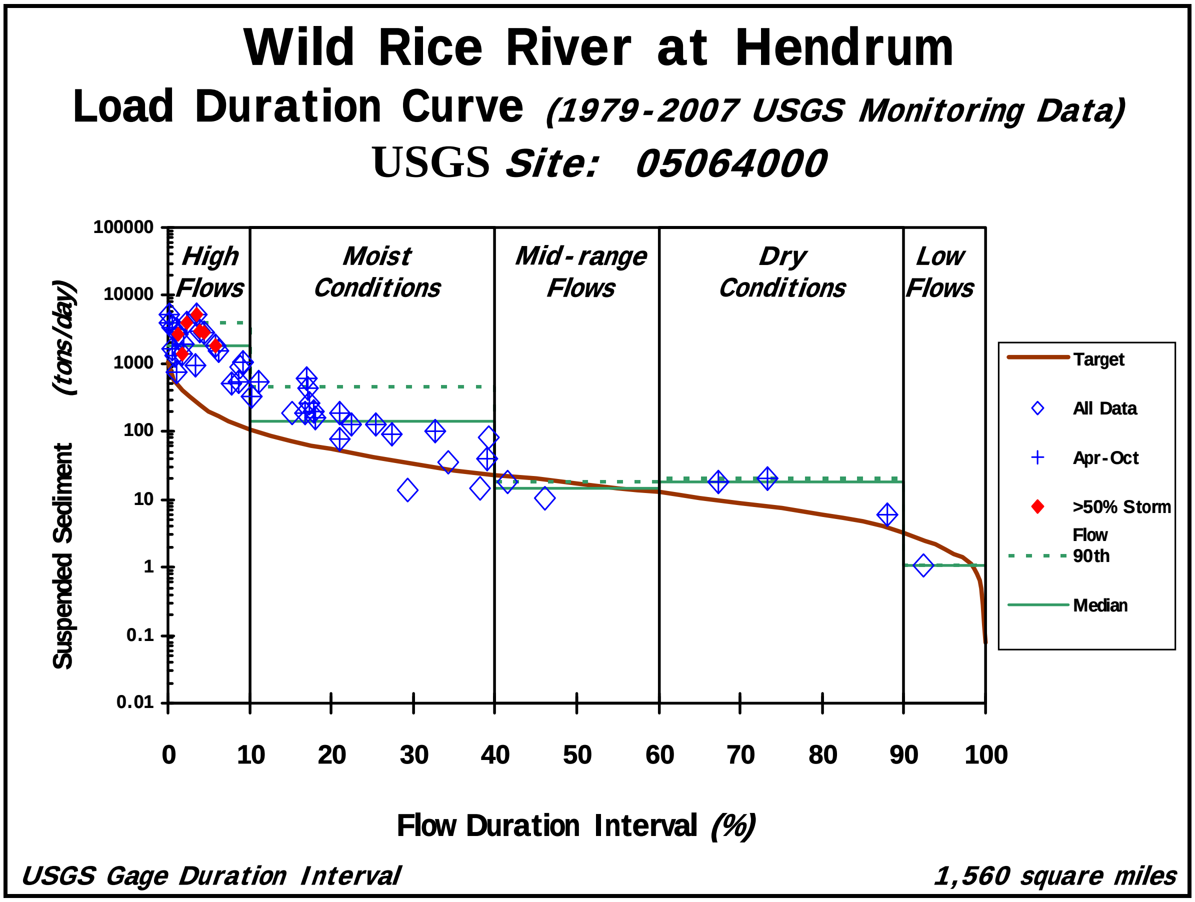
A flow duration curve was completed for the Wild Rice River gage site near Hendrum for the flow period of 1978-2007 (Figure 6).

Figure 6 – Flow Duration Curve for USGS Site 05604000



Given that the maximum load that can be carried in the river (i.e., the TMDL) at any given time is directly calculated as the target concentration times flow, the maximum load on any individual day is determined by the daily flow present. The TMDL is shown graphically as a load duration curve (Figure 7) where the flow values for each flow duration interval are multiplied by the target SSC concentration of 38 mg/l. To specify the TMDL as selected discrete values, the median flow duration interval for the flow duration zones can be used to represent the loading capacity for each zone. The total loads of SSC allowable in the Wild Rice River at Hendrum for the low flow, dry conditions, mid-range flows, moist conditions, and high flow zones are 1.8, 7.3, 16.9, 42.8, and 195.7 tons per day, respectively.

Figure 7 – Load Duration Curve for USGS Site 05604000



Methodology for Wasteload Allocation

WLAs are calculated for each of the ten WWTFs and can be found in Table 4. For the purpose of summarizing the load allocations, the WWTFs will be lumped into one WWTF allocation. The WLA was determined based on the permitted daily load of TSS. Although a daily WLA is assigned to these facilities, it is important to note that discharge occurs only during specified days during the year (April 1 through June 15 and September 15 through December 15).

The WLA calculated in Table 5 is in tons/day of TSS. The others figures in the table are in tons/day of SSC. TSS was used for the WLA because the wastewater effluent rules of Minnesota utilize this means to quantify concentrations of suspended solid-phase material in the system.

The relation between values of TSS and SSC can be difficult to compare. However, in samples taken from streams that have a large percentage of fine material (<0.062 mm), the SSC and TSS data are more or less evenly distributed around a line of equal value *(Gray et al, 2000).* The Lower Wild Rice River has a high percentage of this fine material, around 90 percent that is <0.062 mm, which suggests that the TSS and SSC numbers are very comparable in this reach of the river *(Macek-Rowland and Dressler, 2002).*

The total daily loading capacity in the low flow zone is very small due to the occurrence of very low flows in the long-term flow records. Consequently, the WLA exceeds the total daily loading capacity of the stream in the low flow zone. Of course, actual WWTF loads could never exceed the total load in the stream as it is a component of it. For the low flow zone the calculated MOS would take up all of the remaining allocation capacity. To account for this unique situation only, the WLAs and LAs are expressed as an equation rather than an absolute number. That equation is simply:

Allocation = (flow contribution from a given source) x (45 mg/L TSS, the permit limit)

In essence, this amounts to assigning a concentration-based limit to the sources for the low flow zone, with the concentration limit being the 45 mg/l of TSS from the Minnesota Rules, Chapter 7050.

Construction stormwater and industrial stormwater are lumped together into a categorical WLA based on an approximation of the land area covered by those activities. For this TMDL a figure of O.34 percent was calculated for all five of the flow zones.

Methodology for Margin of Safety

The purpose of the Margin of Safety (MOS) is to account for any uncertainty that the allocations will result in attainment of water quality standards. Because the allocations are a direct function of daily flows, accounting for potential flow variability is an appropriate way to address the MOS. This was done within each of the four highest flow zones. The MOS was calculated as the difference between the loads corresponding to the median flow and minimum flow in each zone. This method for calculating the MOS is described in *An Approach for Using Load Duration Curves in the Development of TMDLs (USEPA, 2007).*

For the low flow zone, an implicit MOS was used. An implicit MOS means that conservative assumptions were built into the TMDL and allocations. In this instance the reach is expected to meet the TMDL because the permitted wastewater point source dischargers are all pond systems that discharge only in spring and fall, which means that during a significant portion of the year a large fraction of the WLA is not being used. The WWTFs in the watershed have also consistently demonstrated discharging an effluent that is well below their permitted limits, thereby providing additional capacity. Finally, during these Lower flow conditions the stream itself is primarily being fed by ground water, this ground water typically conveys very little SSC.

Methodology for Load Allocations

Once the WLA and MOS were determined for a given reach and flow zone, the remaining loading capacity was considered LA. The LA includes non-point pollution sources that are not subject to NPDES permit requirements, as well as "natural background" sources. It is widely accepted that the non-point pollution sources for this TMDL originate from eroded soil and from erosion of stream-bank sediments.

Loading Capacity

Table 5 provides the daily SSC loading capacities for the Lower Wild Rice River, as well as the WLA, LA and MOS. The loading capacities for the five flow zones were developed using the load duration curve approach.

Table 5 – Wild Rice River near Hendrum. Suspended Sediment Loading Capacities and Allocations (AUID: 09020108-501)

	Flow Zone				
	High	Moist	Mid	Dry	Low
	Tons/day				
TOTAL DAILY L0ADING CAPACITY	195.7	42.8	16.9	7.3	1.8
Wasteload Allocation					
Permitted Wastewater Treatment Facilities*	1.5	1.5	1.5	1.5	**
NPDES Construction and Industrial Stormwater	0.7	0.15	0.06	0.03	0.006
Load Allocation	102.3	21.25	11.24	1.87	**
Margin of Safety	91.2	19.9	4.1	3.9	Implicit
	Percent of total daily loading capacity				
TOTAL DAILY L0ADING CAPACITY	100 percent	100 percent	100 percent	100 percent	100 percent
Wasteload Allocation					
Permitted Wastewater Treatment Facilities*	0.8 percent	3.5 percent	8.9 percent	20.6 percent	**
NPDES Construction and Industrial Stormwater	0.34 percent	0.34 percent	0.34 percent	0.34 percent	0.34 percent
Load Allocation	52.26 percent	49.66 percent	66.56 percent	25.66 percent	**
Margin of Safety	46.6 percent	46.5 percent	24.2 percent	53.4 percent	Implicit

*** Facilities are listed in Table 4, the results are in tons/day of TSS**

**** See the Methodology Section above for the allocations in the low flow zone.**

Critical Conditions and Seasonal Variation

The Environmental Protection Agency (EPA) states that the critical condition *"…can be thought of as the "worst case" scenario of environmental conditions in the waterbody in which the loading expressed in the TMDL for the pollutant of concern will continue to meet water quality standards. Critical conditions are the combination of environmental factors (e.g., flow, temperature, etc.) that results in attaining and maintaining the water quality criterion and has an acceptably low frequency of occurrence"* (USEPA, 1999). Turbidity levels are generally at their worst following significant storm events during the spring and summer months. Seasonal variations are somewhat more difficult to generalize given reach-specific differences. Regardless, such conditions and variation are fully captured in the duration curve methodology used in this TMDL.

Reserve Capacity

According to data from the 2000 US Census, from 1990 to 2000, four of the ten cities in the watershed have declined in population. The other 6 cities have increased in population from a range of 1.9 percent to 7.5 percent. All ten of the WWTFs in the watershed are operating well below the mass loading limits (WLA) assigned to them in their NPDES permits. Also, according to MPCA municipal point source permitting staff, there are no plans for any new or expanded wastewater discharges.

As a result of these facts, there will be no reserve capacity figured into the WLA of this TMDL. The key elements of this TMDL now and into the future are non-point source load reductions.

Reasonable Assurance

The following should be considered as reasonable assurance that implementation will occur and result in sediment load reductions in the Wild Rice River to meet the designated use over time.

There is a number of existing water management plans (e.g., Red River Basin Water Quality Plan, County Comprehensive Local Water Plans and the Wild Rice Watershed District Watershed Management Plan) that address water quality issues in the watershed. There are also a number of state and federal funding programs (e.g., Clean Water Legacy Act, EPA grants, Clean Water Partnership grants, Natural Resource Conservations Service programs, and Conservation Reserve Enhancement Program) that can address a variety of local water quality problems. These plans and programs have and will continue to play a major role in the protection and restoration of surface waters within the watershed. In addition, they demonstrate Minnesota's commitment to maintaining or improving water quality.

At the local level, County Soil and Water Conservation Districts (SWCDs), local water planners, and the Wild Rice Watershed Distinct have identified water quality related natural resource concerns and have developed plans to address surface and ground water issues. The watershed, through its Flood Damage Reduction process (FDR) will continue to play a major role (along with the State of Minnesota) in sponsoring flood control projects throughout the watershed that will result in reduced flows during high flow periods and consequently further reduce turbidity in the rivers and streams. The SWCDs and the watershed district have identified BMPs and structural controls that they will support and promote which reduce sedimentation and erosion in critical areas of the watershed *(Soil and Water Conservation District Guidebook, 2008)*. Such practices and controls include: crop residue management, grass waterways, shelter belts, filter strips, buffer strips, side inlet control structures, sediment basin, grade control structures, stream bank stabilization practices, channel restoration activities, and so on. The Wild Rice Watershed District has identified in their watershed management plan strategies to stabilize streams, implement agricultural conservation practices on land with high sediment yield, fix bank erosion, and install and maintain buffer strips for all public drainage systems *(Wild Rice Watershed District, 2003)*. The implementation of these plans and strategies will improve the conditions in the Lower Wild Rice River. The Wild Rice Watershed District and local water planners have also consented to participate and support all future TMDL implementation efforts. The support of TMDL studies for all impaired waters and the development of TMDL implementation plans at the local level is a key element of the Wild Rice Watershed District Overall Plan and in each of the Local County Water Plans.

Monitoring of water quality changes will occur on an on-going basis by the MPCA, the Red River Water Management Board, River Watch and other local units of government in order to document changes in water quality as the various activities identified in the implementation plan are put into action. Watershed Districts and Soil and Water Conservation Districts will make routine observations with regard to the effectiveness of projects and conservations practices.

The principal of adaptive management will enable those involved with TMDL implementation to periodically assess the effectiveness of implementation strategies and to make adjustments to those strategies to enhance their effectiveness.
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Monitoring Plan

There are several monitoring activities occurring in the Wild Rice River watershed and many are planned to continue into the future. Some of these monitoring activities include the Red River Basin's River Watch, the United States Geological Survey flow monitoring and sediment analysis study, and the MPCA's Milestone and condition monitoring. These existing monitoring activities will be used to track progress towards the achievement of the TMDL for the Lower Wild Rice River. A detailed monitoring plan, which will include monitoring site locations, sampling schedules and responsible parties, will be developed as part of the forthcoming implementation plan referenced in the next section of this report.

Implementation Strategy

This is an overview of the implementation strategy for the Lower Wild Rice River. A detailed implementation plan will be developed by the Wild Rice Watershed District with the assistance of its Flood Damage Reduction Project Team within one year of EPA approval of this TMDL report.

The Wild Rice Watershed District and its Flood Damage Reduction Project Team are the major stakeholders of the Lower Wild Rice River and this TMDL report. The Project Team consists of representatives from the watershed district, state, federal and tribal agency personnel, local government officials, affected landowners and interested citizen groups.

The Wild Rice Watershed District and its Flood Damage Reduction Project Team will utilize existing water management plans to develop the implementation plan. An initial focus of the plan will be to identify spatially the sources of the sediment loading to the Wild Rice River. The Wild Rice Watershed District will seek funding through existing programs for implementation activities. Some of the funding programs include the Clean Water Legacy Act, Section 319 or other EPA grants, Clean Water Partnership/State Revolving Fund Phase II program, Board of Water and Soil Resources Challenge Grants, the Natural Resource Conservations Service's Environmental Quality Incentive Program, the Ag BMP loan program, the Conservation Reserve Enhancement Program, and the Conservation Reserve Program. They will also work with the local SWCDs to leverage existing funding programs and to implement activities that will reduce non point sources of turbidity for the Lower Wild Rice River.

Tools that will be used to achieve reductions in turbidity for the Lower Wild Rice River will be a suite of best management practices (BMPs) and structural practices. The suite of BMPs could include filter strips, riparian buffers, grassed waterways, cover crops and conservation tillage. Structural practices could include water and sediment control basins and grade control structures.

Implementation and coordination of these types of activities will require a collaborative effort by many organizations and individuals if reductions in sediment loading to the Wild Rice River are to be achieved. Potential partners for this watershed effort could include:

- Land Owners
- Wild Rice Watershed District
- Minnesota Pollution Control Agency
- Minnesota Department of Natural Resources
- Minnesota Board of Water and Soil Resources
- Soil and Water Conservation Districts
- Natural Resource Conservation Service
- County Water Planning
- Minnesota Extension Service
- United States Geological Survey
- Other Citizens
- Other Organizations

A specific cost estimate to address the impairment identified in this TMDL report has not yet been generated. Specific costs will be considered when a more detailed implementation plan is developed. However, restoration cost estimates could be in the tens of millions of dollars range.

Public Participation

Public participation occurred in three phases. The first phase introduced the concept of impaired waters and TMDLs for the Red River Basin of the North. Public informational meetings were held in strategic geographic locations within the basin. The second phase engaged a specific stakeholder group on the details of the TMDL for the Lower Wild Rice River, along with the development of a comprehensive implementation plan. The third phase was the formal public comment period required by federal and state regulations. Table 6 provides the location and dates of the meetings, in addition to the stakeholder groups that were represented.

Table 6

Phase	Meeting Location	Meeting Date	Stakeholder Groups
Phase I	Moorhead, Minnesota	August11, 2005	state and local governmental units and citizens
Phase I	Moorhead, Minnesota	October 24, 2006	state and local governmental units and citizens
Phase II	Ada, Minnesota	August, 13, 2007	Wild Rice Watershed District
Phase II	Ada, Minnesota	January 16, 2008	Wild Rice Watershed District – Flood Damage Reduction Project Team
Phase II	Ada, Minnesota	April 23, 2008	Wild Rice Watershed District – Flood Damage Reduction Project Team
Public III	Public Comment Period	xxxx, xx, 2008	state and local governmental units and citizens

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Appendices

Appendix A – Water Quality Data Used for Listing the Lower Wild Rice River as Impaired for Turbidity (AUID 09020108-501)

Sample Date	Site S000-216 Turbidity (NTRU)	Site S002-102 Turbidity (NTRU)	Site S002-102 Transparency (cm)
6/12/2001	79		
6/26/2001	96		
7/16/2001	79		
7/31/2001	75		
8/19/2001	44		
9/6/2001	32		
9/18/2001	*21*		
5/13/2003		143	7
5/19/2003		674	3
5/28/2003		56	14
6/3/2003		66	12
6/10/2003		135	8
6/18/2003		156	6
6/24/2003		1938	1
6/26/2003		865	2

*Appendix B - US*GS SSC Data 1979-2007

USGS Data from Hendrum Site (05064000)			
Site	Sample date	Turbidity (2007-NTU other-NTRU)	SSC (mg/l)
5064000	2/14/2007	15	12.8
5064000	3/22/2007	15	18.9
5064000	1/20/1998	20	
5064000	12/15/1997	23	
5064000	1/31/2001	32	16
5064000	12/27/2000	48	25
5064000	4/29/1998	57	
5064000	7/2/1998	57	80
5064000	8/17/2007	59	51.8
5064000	9/14/2000	64	45
5064000	9/3/1998	71	
5064000	5/19/1998	91	99
5064000	6/30/1998	92	28
5064000	10/28/1998	92	
5064000	4/22/1998	96	
5064000	3/25/1998	99	27
5064000	9/11/1998	100	
5064000	10/25/2000	101	59
5064000	5/8/2007	109	72.2
5064000	7/17/1979	112	25
5064000	9/18/1999	117	
5064000	5/30/1979	121	25
5064000	8/6/1998	127	57
5064000	6/23/1998	131	110
5064000	12/11/1998	131	
5064000	6/18/1998	136	
5064000	7/9/1998	137	96
5064000	5/9/1979	147	
5064000	6/4/2007	153	98.7
5064000	4/15/1997	163	
5064000	6/15/1999	175	
5064000	6/25/1998	195	
5064000	5/18/1998	200	180
5064000	5/27/1998	213	120
5064000	2/27/1998	227	
5064000	4/20/1979	234	
5064000	4/17/2001	237	190
5064000	4/12/2007	254	157
5064000	3/31/1998	296	
5064000	4/8/1980	347	
5064000	5/12/1998	351	200
5064000	7/15/1998	358	200
5064000	5/10/1999	408	
5064000	5/14/1998	432	260
5064000	4/2/2007	474	347
5064000	6/22/1994	495	
5064000	5/13/1998	792	540

Appendix C - USGS Data Used for NTU-SSC Equivalent (2007)

Station number	Station name	Date	HF Scientific DRT 15CE Turbidity, NTU	Suspended sediment concentration, milligrams per liter
05063000	WILD RICE RIVER NEAR ADA, MN	2/14/2007	5.1	26
05062500	WILD RICE RIVER AT TWIN VALLEY, MN	2/14/2007	5.6	3
05064000	WILD RICE RIVER AT HENDRUM, MN	2/14/2007	12.8	15
05062500	WILD RICE RIVER AT TWIN VALLEY, MN	8/17/2007	13	13
05063000	WILD RICE RIVER NEAR ADA, MN	8/17/2007	13	20
05062500	WILD RICE RIVER AT TWIN VALLEY, MN	3/22/2007	14.2	15
05063000	WILD RICE RIVER NEAR ADA, MN	3/22/2007	14.3	9
05064000	WILD RICE RIVER AT HENDRUM, MN	3/22/2007	18.9	15
05063000	WILD RICE RIVER NEAR ADA, MN	6/4/2007	19.2	39
05062500	WILD RICE RIVER AT TWIN VALLEY, MN	5/8/2007	25	40
05063000	WILD RICE RIVER NEAR ADA, MN	5/8/2007	27.1	67
05062500	WILD RICE RIVER AT TWIN VALLEY, MN	6/4/2007	28	46
05064000	WILD RICE RIVER AT HENDRUM, MN	8/17/2007	51.8	59
05064000	WILD RICE RIVER AT HENDRUM, MN	5/8/2007	72.2	109
05064000	WILD RICE RIVER AT HENDRUM, MN	6/4/2007	98.7	153
05063000	WILD RICE RIVER NEAR ADA, MN	4/12/2007	124	232
05062500	WILD RICE RIVER AT TWIN VALLEY, MN	4/12/2007	148	228
05064000	WILD RICE RIVER AT HENDRUM, MN	4/12/2007	157	254
05064000	WILD RICE RIVER AT HENDRUM, MN	4/2/2007	347	474
05062500	WILD RICE RIVER AT TWIN VALLEY, MN	4/2/2007	403	775
05063000	WILD RICE RIVER NEAR ADA, MN	4/2/2007	685	1140