

# Grand Marais Creek Watershed Conditions Report

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## 1 Purpose

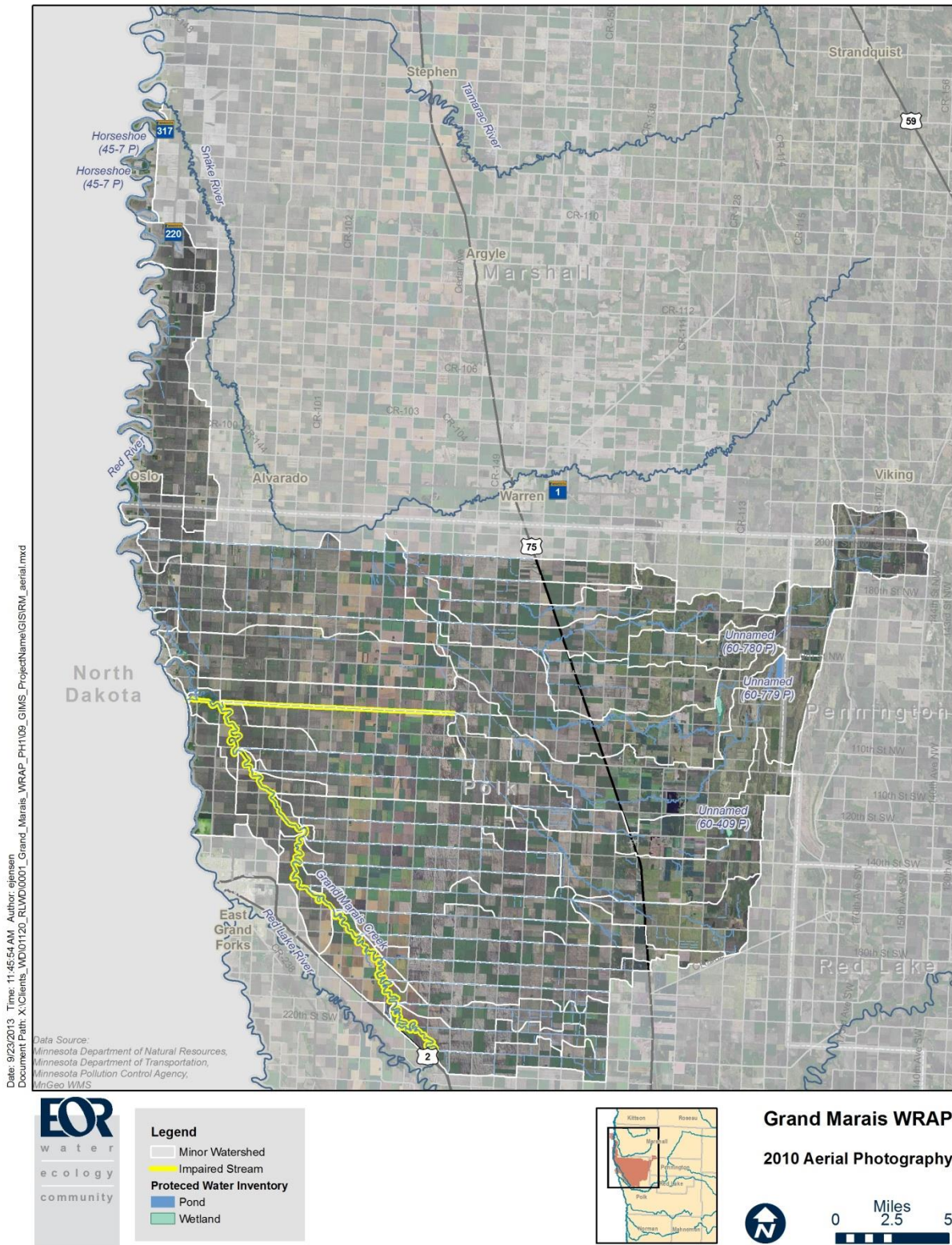
This Watershed Conditions Report is intended to provide a summary of the information currently available regarding the condition of the Grand Marais Creek watershed (HUC: 09020306).

Monitoring of the watershed is being conducted in 2012 and 2013, so only partial information is available at this time. Evaluations of which water bodies will be listed as impaired is not fully complete at this time either. These determinations rely on monitoring data, so the transparency documents that discuss the basis for listing determinations and determinations of support or insufficient data will not be completed by the MPCA until 2014. In addition, the stressor identification process will not be completed until 2014. Given these caveats, the information that is currently available for the watershed is summarized in this report.

## 2 Watershed Setting

The Grand Marais Creek Watershed covers 563 square miles primarily in Polk County, but with area also in Marshall and Pennington counties (Figure 1). The watershed is located in the Red River Valley ecoregion. The Red River Valley is characterized by flat topography covered by lake deposit soils. Cropland intersected by drainage ditches dominates the landscape. Spring wheat, soybeans, and sugar beets are the main crops grown in the watershed.

The Grand Marais Creek Watershed Restoration and Protection Strategy (WRAPS) project boundary is comprised of nearly all of HUC 09020306. A small portion of this HUC, located west of the town of Stephen (CD7, JD9 and CD12) has been removed from this WRAPS project boundary and included with the Snake River WRAPS currently underway. The Grand Marais Creek WRAPS includes portions of the Red Lake Watershed District and Middle-Snake-Tamarac Rivers Watershed District. See Figure 6 illustrating the two watershed districts.



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## 2.1 Streams and Lakes

The Grand Marais Creek Watershed includes 19 assessed streams (Table 1). Many of these streams are drainage ditches excavated to improve agricultural production. A few lakes and large wetlands are also present in the watershed, primarily in the very eastern portion of the watershed or along the Red River (Table 2). See Figure 6 for locations of all AUIDs in the project area.

**Table 1. Summary of Stream Reaches in the Grand Marais Creek Watershed**

AUID	REACH NAME	REACH DESCRIPTION	USE CLASS	MILES
09020306-501	Red River of the North	Grand Marais Cr to North Marais R (ND)	1C, 2Bd, 3C	41.82
09020306-502	Red River of the North	English Coulee (ND) to Grand Marais Cr	1C, 2Bd, 3C	6.88
09020306-503	Red River of the North	North Marais R (ND) to Forest R (ND)	1C, 2Bd, 3C	3.68
09020306-504	Red River of the North	Forest R (ND) to Snake R	1C, 2Bd, 3C	13.56
09020306-507	Grand Marais Creek	Headwaters to CD 2	2B, 3C	38.17
09020306-509	Unnamed creek	Headwaters to CD 66	2B, 3C	24.69
09020306-510	Unnamed ditch	Headwaters to CD 66	2B, 3C	6.71
09020306-511	County Ditch 126	Unnamed cr to Grand Marais Cr	2B, 3C	11.91
09020306-512	Grand Marais Creek	CD 2 to Red R	2B, 3C	1.8
09020306-513	Grand Marais Creek	Diversion ditch to Red R	2B, 3C	4.44
09020306-514	County Ditch 66	Headwaters to CD 2	2B, 3C	14.85
09020306-515	County Ditch 2	CD 66 to Grand Marais Cr	2B, 3C	10.74
09020306-516	Unnamed creek (County Ditch 44)	Headwaters to CD 7	2B, 3C	30.1
09020306-517	County Ditch 43 (Judicial Ditch 75)	Unnamed ditch to CD 7	2B, 3C	23.61
09020306-518	County Ditch 7	CD 43 to Unnamed ditch	2B, 3C	5.38
09020306-519	Judicial Ditch 1	County Ditch 7 to Red River	2B, 3C	10.67
09020306-520	Judicial Ditch 75	County Ditch 7 to Red River	2B, 3C	12.83

**Table 2. Summary of Lakes and Wetlands in the Grand Marais Creek Watershed**

LAKE NAME (ID)	AREA (ac)
Horseshoe (45-7 P)	50
Unnamed (60-409 P)	60
Unnamed (60-775 W)	28
Unnamed (60-777 W)	112
Unnamed (60-778 W)	160
Unnamed (60-779 P)	149
Unnamed (60-780 P)	331
Unnamed (60-781 W)	73

## 2.2 Soils

Soils in the Grand Marais Creek Watershed are generally poorly to somewhat poorly drained (Table 3). Only about 25% of the watershed contains soils that are not hydric (Table 4). Somewhat more than half of the watershed has hydrologic soil group B soils with about 30 having B soils if drained and D soils if undrained (Table 5 and Figure 2).

**Table 3. Soil Drainage Class within the Grand Marais Creek Watershed**

SOIL DRAINAGE CLASS	% of WATERSHED
Somewhat poorly drained	45%
Poorly drained	36%
Moderately well drained	16%
Very poorly drained	1.7%

**Table 4. Hydric Soil Class within the Grand Marais Creek Watershed**

HYDRIC SOIL CLASS	% of WATERSHED
Partially hydric	42%
All hydric	33%
Not hydric	24%

**Table 5. Hydrologic Soil Group within the Grand Marais Creek Watershed**

HYDROLOGIC SOIL GROUP	% of WATERSHED
B	57%
B/D	30%
C/D	4.5%
D	2.9%
C	2.5%
A	1.6%
A/D	1.1%



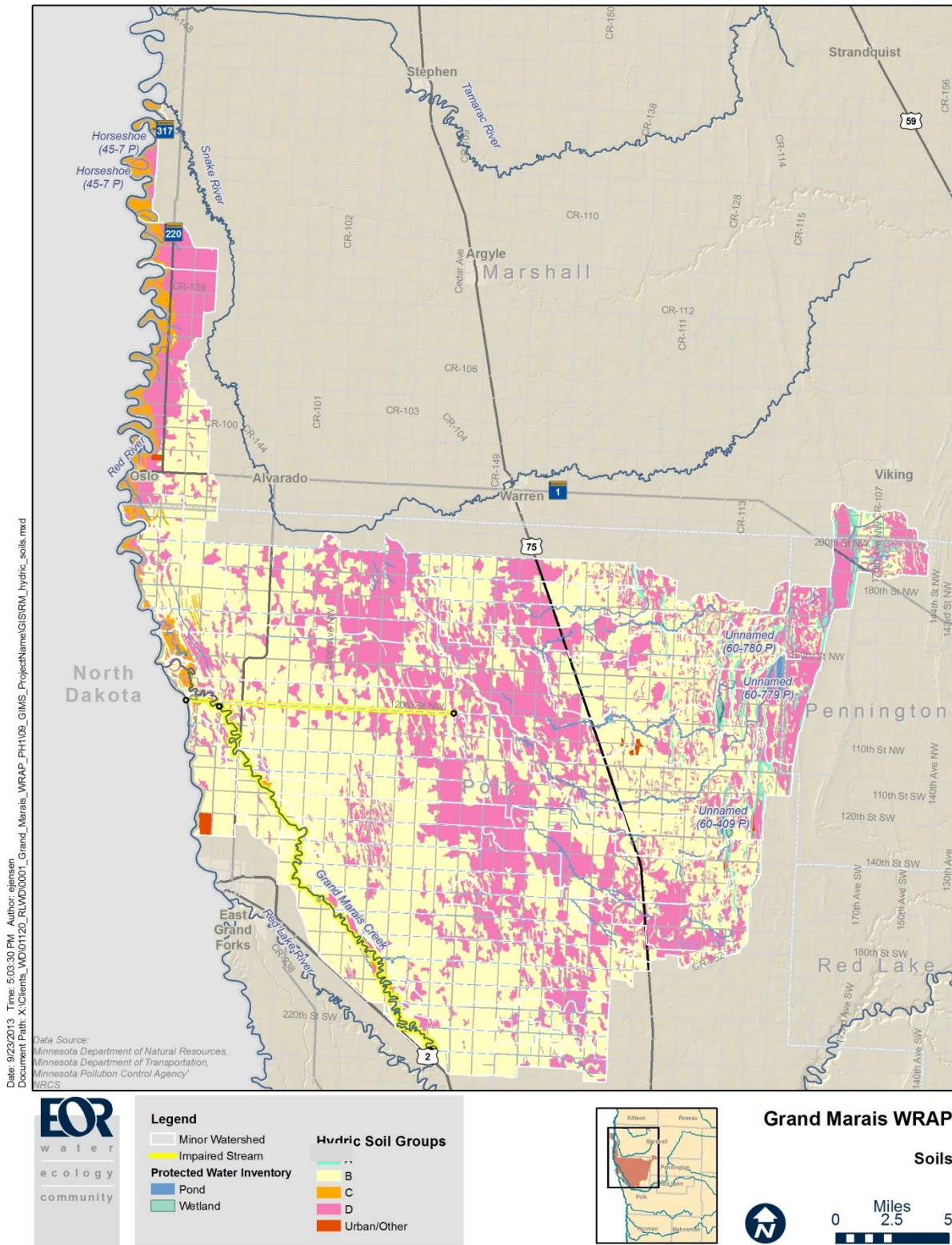


Figure 2. Soils in the Grand Marais Creek Watershed: Hydrologic Soil Groups

### 2.3 Topography

Elevations in the Grand Marais Creek Watershed range from 1098 feet on the Beach Ridge to 744 feet along the river in the Lake Plain. Both a 3-meter National Elevation Dataset (NED) from the USGS and LiDAR-derived high-resolution elevation data are available for the Grand Marais Watershed.

### 2.4 Land cover / Land use

Land cover in the Grand Marais Creek Watershed is primarily cultivated crops (90%) with a small area of developed open space and open water (Table 6). Crops grown are primarily spring wheat, soybeans, and sugar beets with some production of dry beans and corn (Table 7). Five registered feedlots are also present in the watershed (Table 8). Conservation practices are likely used throughout the watershed, when requested data is received from the Minnesota State Office of the USDA FSA, this data will be evaluated and included in the WRAPS report.

**Table 6. Land Cover/Use in the Grand Marais Creek Watershed (NLCD, 2006)**

LAND USE	% of WATERSHED
Cultivated Crops	90%
Developed, Open Space	6.4%
Open Water	1.0%
Deciduous Forest	0.8%
Woody Wetlands	0.8%
Developed, Low Intensity	0.4%
Pasture/Hay	0.3%
Emergent Herbaceous Wetlands	0.2%
Evergreen Forest	0.1%

**Table 7. Land Cover/Use in the Grand Marais Creek Watershed (NASS, 2012)**

LAND USE	% of WATERSHED
Spring Wheat	28%
Soybeans	21%
Sugarbeets	13%
Dry Beans	7.4%
Corn	6.2%
Open Water	5.5%
Developed/Open Space	4.3%
Herbaceous Wetlands	4.1%
Other Hay/Non Alfalfa	3.8%
Alfalfa	1.6%
Woody Wetlands	1.2%

**Table 8. Registered Feedlots in the Grand Marais Creek Watershed**

COUNTY REGISTRATION ID	TOTAL ANIMAL UNITS
113-63637	24
113-64175	40.8
119-08	35
119-103533	175
119-136	131.5



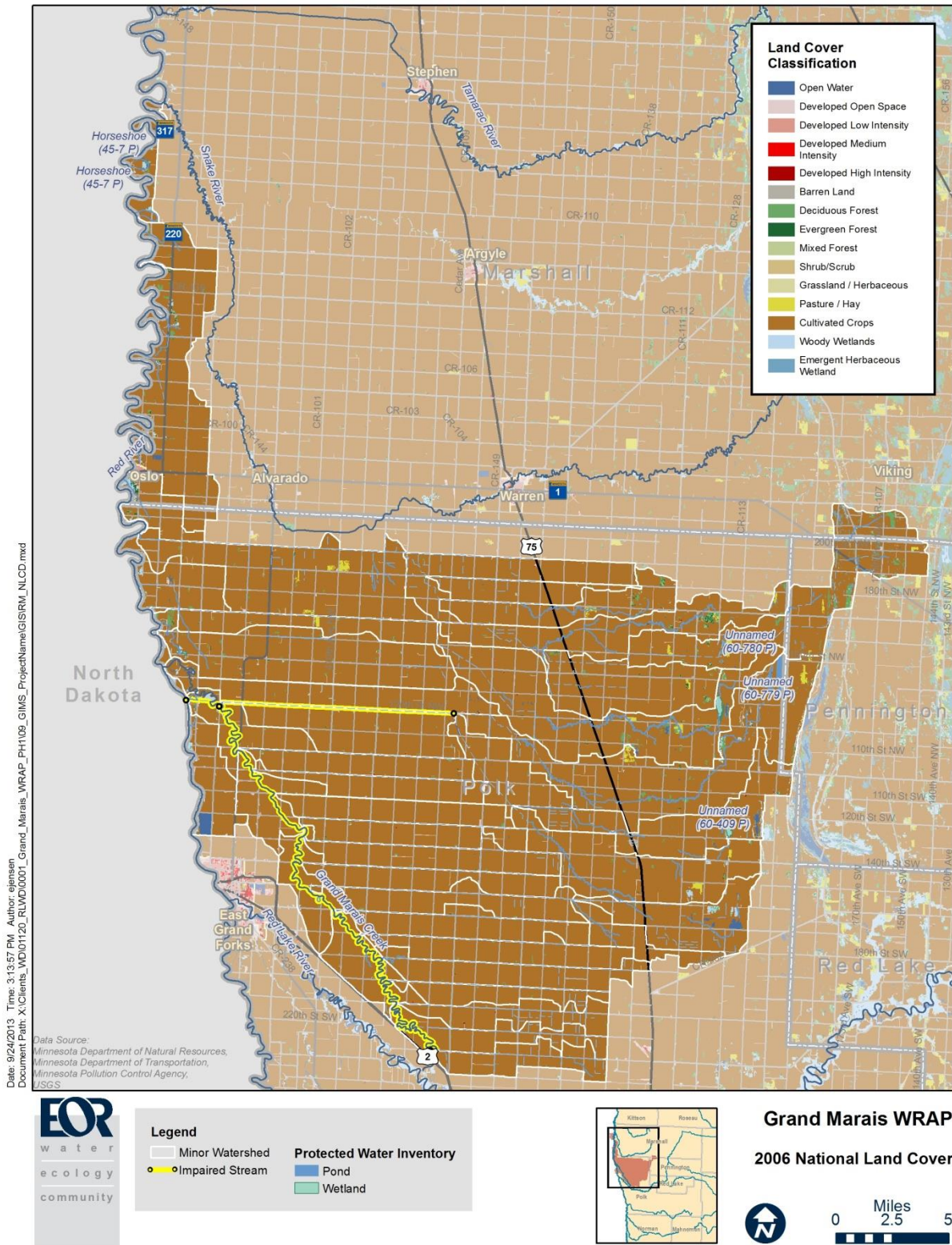


Figure 3. Land Cover in the Grand Marais Creek Watershed (NLCD, 2006)



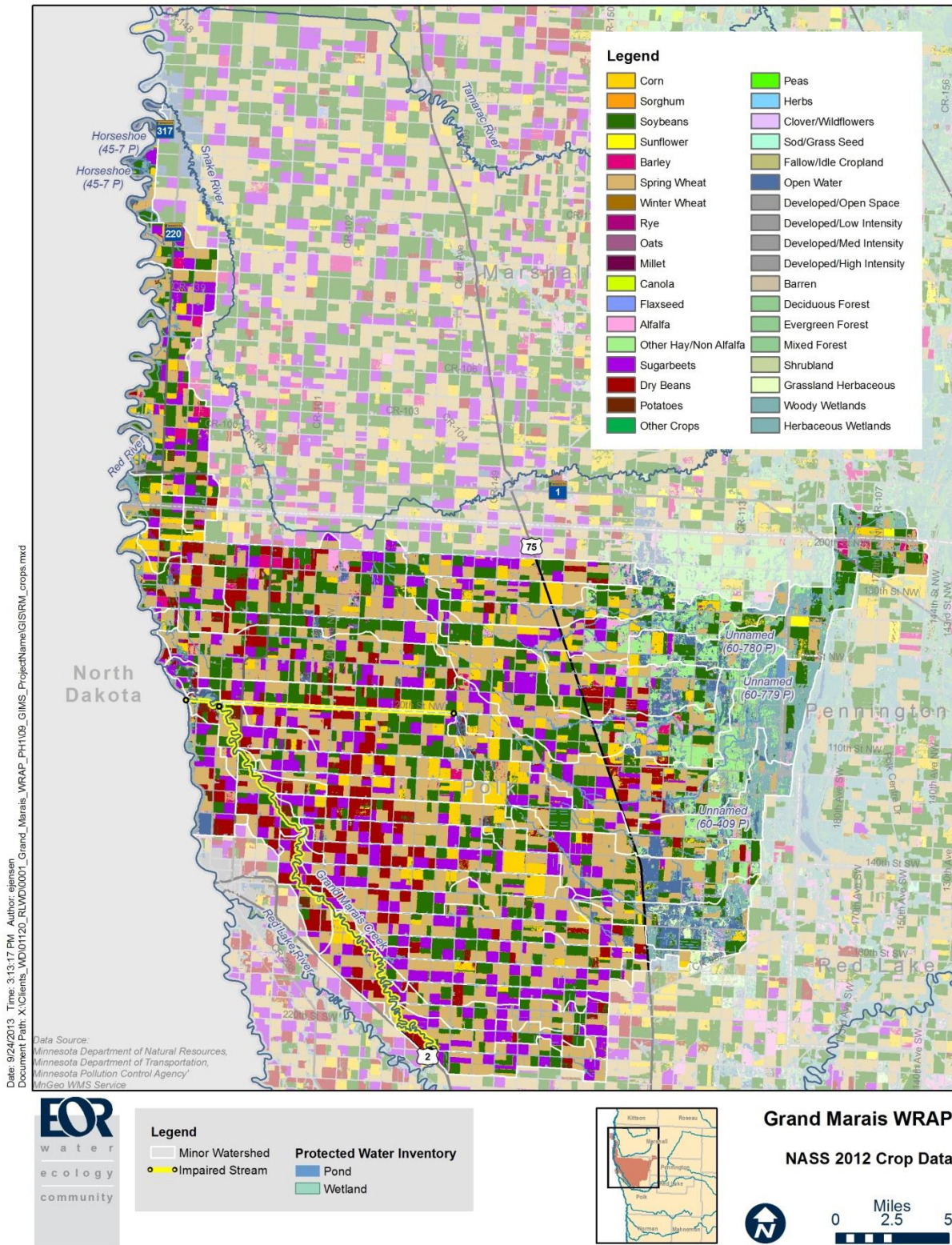


Figure 4. Agricultural Crops in the Grand Marais Creek Watershed (NASS, 2012)



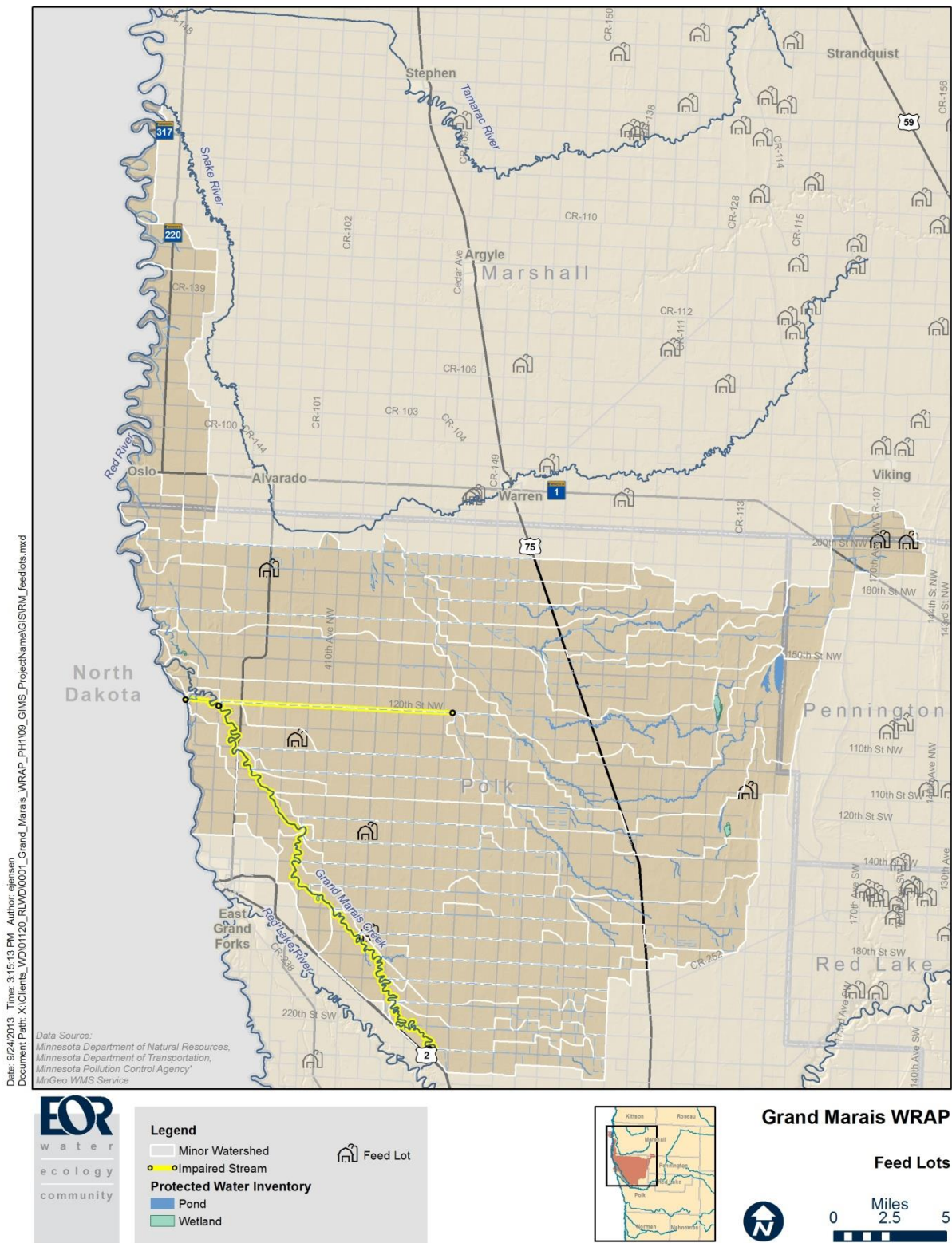


Figure 5. Registered Feedlots in the Grand Marais Creek Watershed

## 2.5 Demographics

The watershed population is estimated as 2,578 according to 2010 census data. No urban areas are located within the Grand Marais Creek Watershed. All 2010 U.S. Census data are now available including data such as population density, population change, and demographics such as race, age, gender, and housing status (<http://www.census.gov/2010census/data/>).

## 2.6 Point Sources

Three permitted wastewater treatment facilities (WWTF) and one water treatment plant (WTP) with surface water discharges are known to exist in the Grand Marais Watershed (Table 9). A formal regulated data request to MPCA's Data Desk will be completed prior to calculation of the TMDL. The data presented here is based on the Grand Marais SWAT model documentation and associated shapefiles.

**Table 9. NPDES-permitted facilities in the Grand Marais Watershed.**

NPDES PERMIT ID	FACILITY NAME	SURFACE DISCHARGE (SD) STATION	AUID (REACH NAME)	HUC 12 WATERSHED	SWAT MODEL WATER-SHED
MNG640106	Marshall & Polk Rural Water System	SD-1: WTP Fanny Township (Euclid) Discharge	09020306-999, Unassessed reach	090203060206, County Ditch No 31	85
MN0021814	East Grand Forks WWTP	SD-6: Main Facility Discharge	09020306-502, Red River of the North [English Coulee (ND) to Grand Marais Creek]	090203060504, Town of North Grand Forks-Red River	47
MN0024431	Oslo WWTP	SD-1: 6 <sup>th</sup> Ave Lift Station Overflow, SD-2: Main Facility Discharge	09020306-501, Red River of the North [Grand Marais Creek to North Marais R (ND)]	090203060601, City of Oslo-Red River	6

WWTP = wastewater treatment plant = wastewater treatment facility (WWTF)

## 3 Impairments

There are three impaired stream reaches currently identified in the Grand Marais Creek Watershed (Table 10 and Figure 6). These stream reaches are included in the 2012 Impaired Waters list or identified in the 2012 MPCA assessment cycle for the draft 2014 Impaired Waters list. Three additional stream reaches are impaired for aquatic consumption due to mercury and PCBs in fish tissues (Table 11) that were addressed in the 2010 State-wide Mercury TMDL and will not be included in this TMDL or WRAPS. Pollutants and stressors addressed in this report include dissolved oxygen (DO), *Escherichia coli* (*E. coli*), turbidity, and pH.

**Table 10. Stream impairments addressed in the Grand Marais Creek Watershed TMDL**

ASSESSMENT UNIT	DESCRIPTION	AFFECTED USE	POLLUTANT/STRESSOR	YEAR LISTED
09020306-507	Grand Marais Creek: Headwaters to CD 2	Aquatic Life	DO Turbidity pH <i>E. coli</i>	2006 2006 2008 2014*
09020306-512	Grand Marais Creek: CD2 to Red River	Aquatic Life	Turbidity	2006
09020306-515	County Ditch 2: CD66 to Grand Marais Cr	Aquatic Life	Turbidity	2016**

\* Expected to be listed in 2014

\*\* Expected to be listed following incorporation of tiered aquatic life use framework into state water quality standards

**Table 11. Additional stream impairments addressed in the 2010 State-wide Mercury TMDL**

ASSESSMENT UNIT	DESCRIPTION	AFFECTED USE	POLLUTANT/STRESSOR	YEAR LISTED
09020306-501	Red River: Grand Marais Creek to North Marais R (ND)	Aquatic Consumption	Mercury in water column Mercury in fish tissue PCB in fish tissue	2008 1998 1998
09020306-502	Red River: English Coulee (ND) to Grand Marais Creek	Aquatic Consumption	Mercury in fish tissue PCB in fish tissue	1998
09020306-503	Red River: North Marais R (ND) to Forest R (ND)	Aquatic Consumption	Mercury in fish tissue PCB in fish tissue	1998



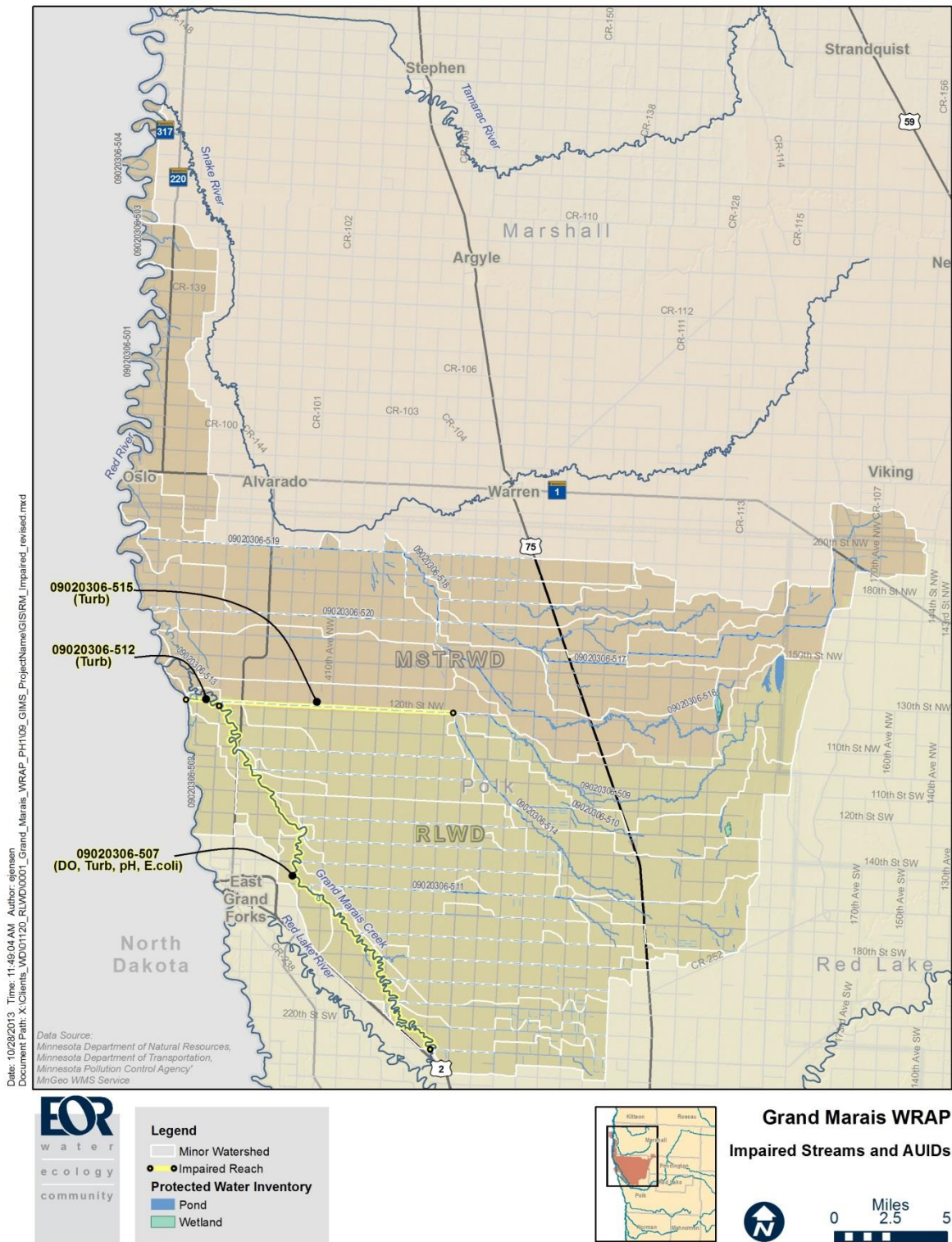


Figure 6. Impaired stream reaches and AUIDs in the Grand Marais Creek Watershed

## 4 Monitoring Stations and Monitoring Programs

Water quality data collected during 2003-2012 are available from thirteen monitoring stations across nine stream reaches in the Grand Marais Creek watershed (Table 12, Figure 7). These data have been collected by at least eight monitoring programs sampling in the Grand Marais Creek watershed from 2003 to 2012 (Table 13).

**Table 12. Monitoring stations with available water quality data from 2003-2012.**  
(Impaired reaches are highlighted in gray)

AUID (09020306- XXX)	MONITORING STATION	MONITORING STATION LOCATION
-501	S002-325	RED R 250 FT UPST OF MN-1 BR, W OF OSLO IN N. DAKOTA
-507	S002-983	GRAND MARAIS CK AT 130TH AVE SW, 2.5 MI NW OF FISHER
	S002-984	GRAND MARAIS CK AT CSAH-19, 5 MI E OF E GRAND FORKS
	S002-083	GRAND MARAIS CK ON CSAH-220 BRG, 3 MI N OF EAST GRAND FORKS
-509	S004-132	UNNAMED CK ON US-75, 2 MI NW OF EUCLID
	S004-133	UNNAMED CK ON CSAH-21, 2.5 MI NE OF EUCLID
	S003-276	UNNAMED CREEK AT 260TH AVE NW, 2 MI NE OF EUCLID
-510	S003-277	BRANCH C OF CD #66 AT 270TH AVE SW, 0.5 MI NE OF EUCLID
-512	S002-126	GRAND MARAIS CK AT CR-64, 9 MI N OF EAST GRAND FORKS
-515	S004-131	CD #2 AT CR-62, 7 MI NE OF EAST GRAND FORKS
-519	S005-571	JD #1 AT CSAH-22, 14 MI NE OF EAST GRAND FORKS
-520	S005-570	JD #75 AT CSAH-22, 11 MI N OF EAST GRAND FORKS
-999	S002-974	CD #126 AT KEYWEST ON CSAH-20, 10 MI NE OF FISHER

**Table 13. Stream monitoring programs in the Grand Marais Watershed, 2003-2012.**

MONITORING PROJECT	NOTES	DESCRIPTION
Citizen Stream Monitoring Program	<b>2005 &amp; 2007</b> (March-Oct) Weekly in 2007 10 sites	Condition monitoring providing an expanded monitoring network. Of the parameters relevant for this project only temperature data is available.
Major Watershed Pollutant Load Monitoring Network	<b>2008 – 2012</b> (year-round) Twice per month in growing season, else, monthly 3 sites	The purpose of the project is to meet the information goal of determining status and trends (temporal and spatial) in nutrient and sediment loads carried by streams in the state. Basin planners and resource management partners at all levels will use river nutrient and sediment loads at the mouths of the 81 DNR major watersheds (8 digit USGS HUCs), in order to develop goals for long-term management.
Red Lake Watershed District CWP Monitoring	<b>2003 – 2012</b> (May – July) Every other week 5 sites	Condition monitoring, sample identified sites to provide necessary data to assess streams in the Red Lake Watershed.
WQ Assmnt on Upper Lost R & Nasset Bk Trib (SWAG) Red Lk WD; 2011-2012 Thief River Wtshd Assmt Monit SWAG	<b>2012</b> (May/June – Aug/Sept) Every other week 4 sites	Condition monitoring, sample identified sites to provide necessary data to assess streams in the Red River Basin.
Red River Basin Stream Monitoring & Assessment;(and 5/11/2011 Sand Hill Intensive Watershed Monitoring SWAG)	<b>2008 – 2010</b> (Jun/Jul – Sep/Oct) Weekly 4 sites	Condition monitoring, sample identified sites to provide necessary data to assess streams in the Red River Basin.
Red River Basin Condition Monitoring Network	<b>2003 – 2007, 2009 – 2012</b> (April – October) Weekly in summer, else, less 4 sites	The purpose of the Red River Basin Monitoring Network is to provide accurate, long-term information concerning the condition of the Red River and its tributaries to the resource managers of the Red River Basin.
Red River Basin GAP	<b>2009</b> (April – June) Weekly 1 site	Condition to provide the necessary data to support the development of multi-parameter, watershed-based TMDLs within the Red River Basin.
Red River Basin River Watch Project	<b>2003 – 2006</b> <b>2008 – 2012</b> (April – October) Monthly 12 sites	To develop reliable baseline data using standard scientific methods comparable between sampling organizations and water bodies. Also to provide students and citizens with hands-on opportunities to foster greater awareness and understanding of their local watersheds. Most of the sampling done for this project will be via volunteers.



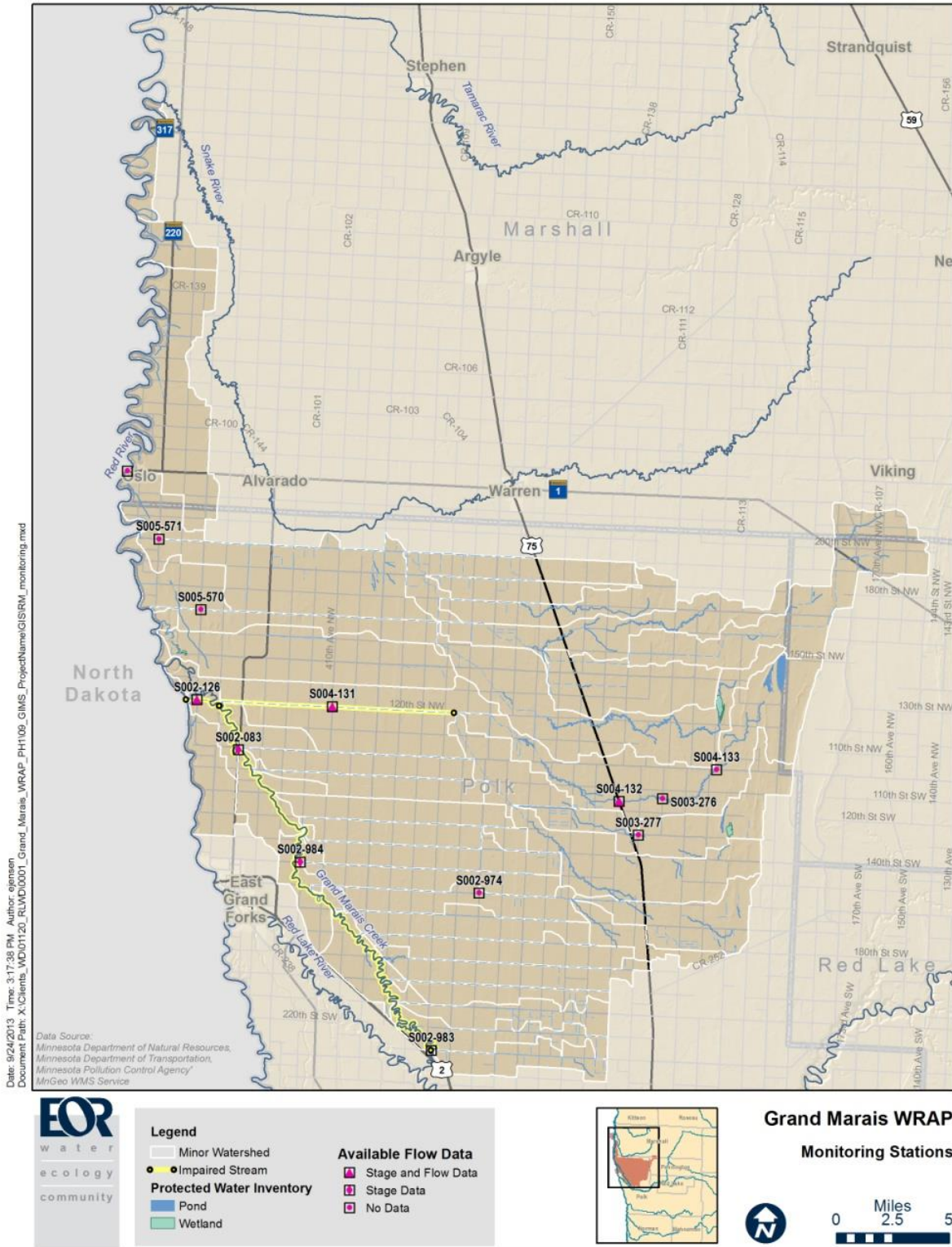


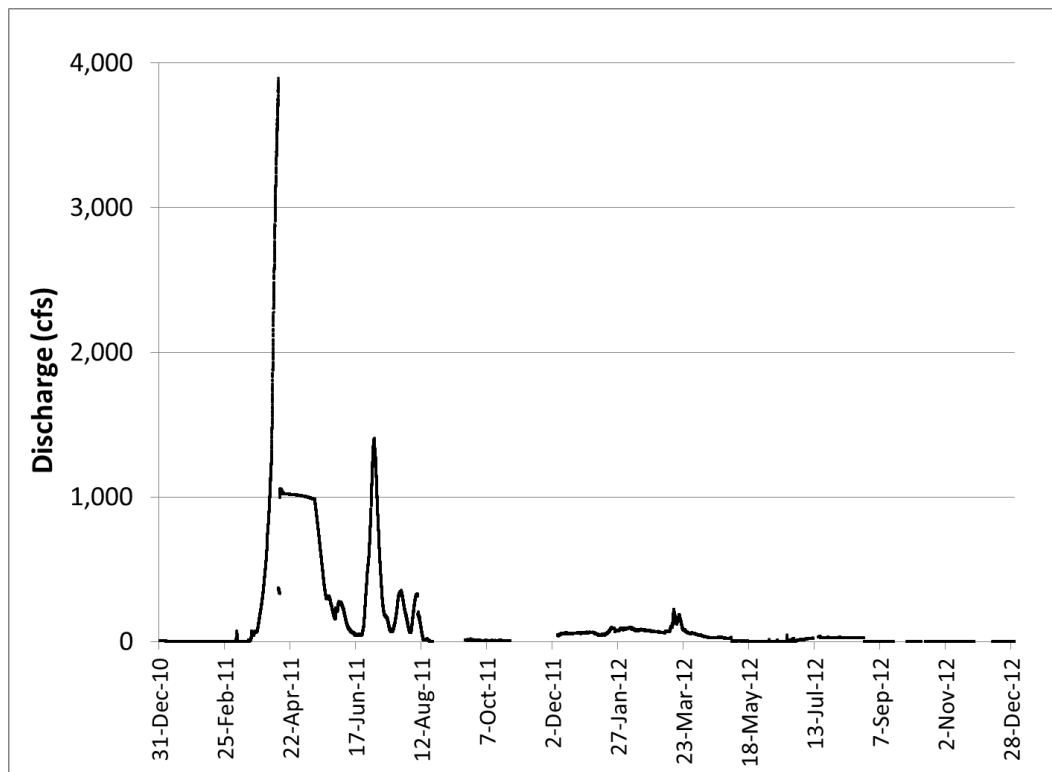
Figure 7. Monitoring stations with available water quantity data



Continuous flow data have been collected at three monitoring stations located in the Grand Marais Creek watershed over the most recent 10-year period (Table 14, Figure 7). Continuous flow is available from January 1, 2011 through December 31, 2012 at a station operated by the MN DNR in cooperation with the MPCA in the Grand Marais Creek from CD 2 to the Red River (Figure 8). In addition, the Red Lake Watershed District measured continuous flow from April 14, 2006 to October 23, 2006 and from March 13, 2007 to November 9, 2007 in CD 2 (Figure 9) and in the outlet of the Brant impoundment (not shown).

**Table 14. Available flow data in the Grand Marais Creek Watershed, 2003-2012.**

STATION ID	COLLECTED BY	WATERBODY	YEARS OF AVAILABLE DATA
67014001 / S002-126	MN DNR / MPCA	Grand Marais Creek, near East Grand Forks, MN	2011-2012
S004-131	RLWD	CD #2 at CR-62, 7 mi NE of East Grand Forks, MN	2006, 2007
S004-132	RLWD	Unnamed creek on US-75, 2 mi NW of Euclid, MN	2006, 2007, 2010



**Figure 8. Continuous stream discharge, Grand Marais Creek (S002-126), 2011-12**

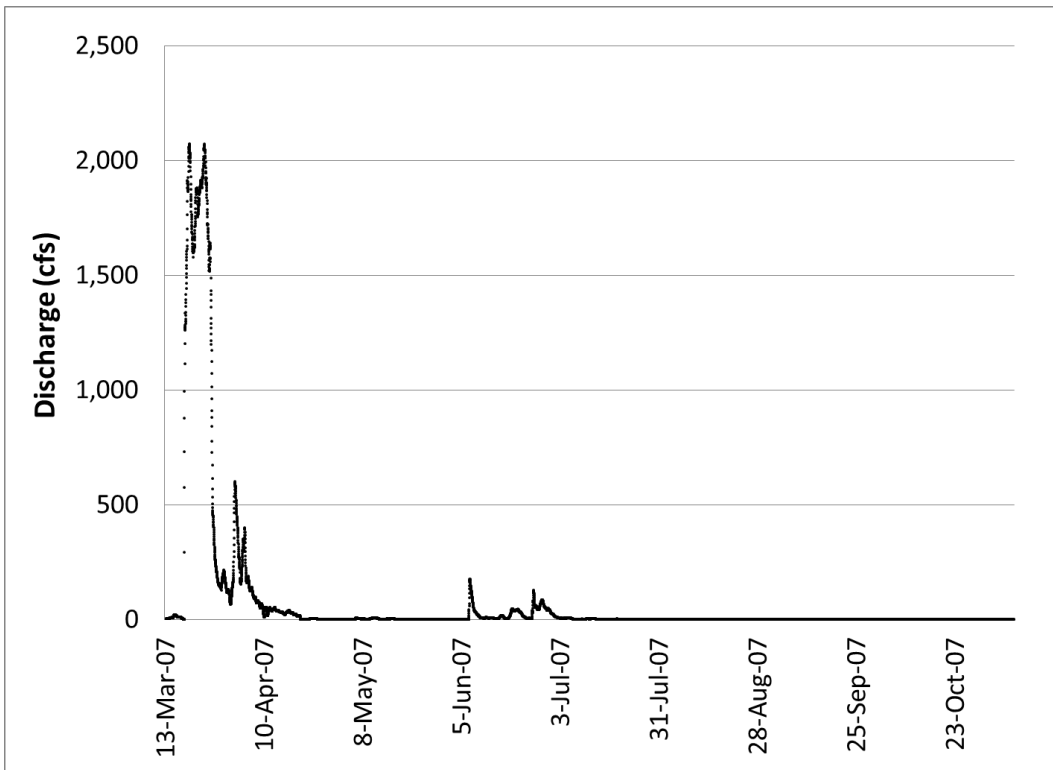
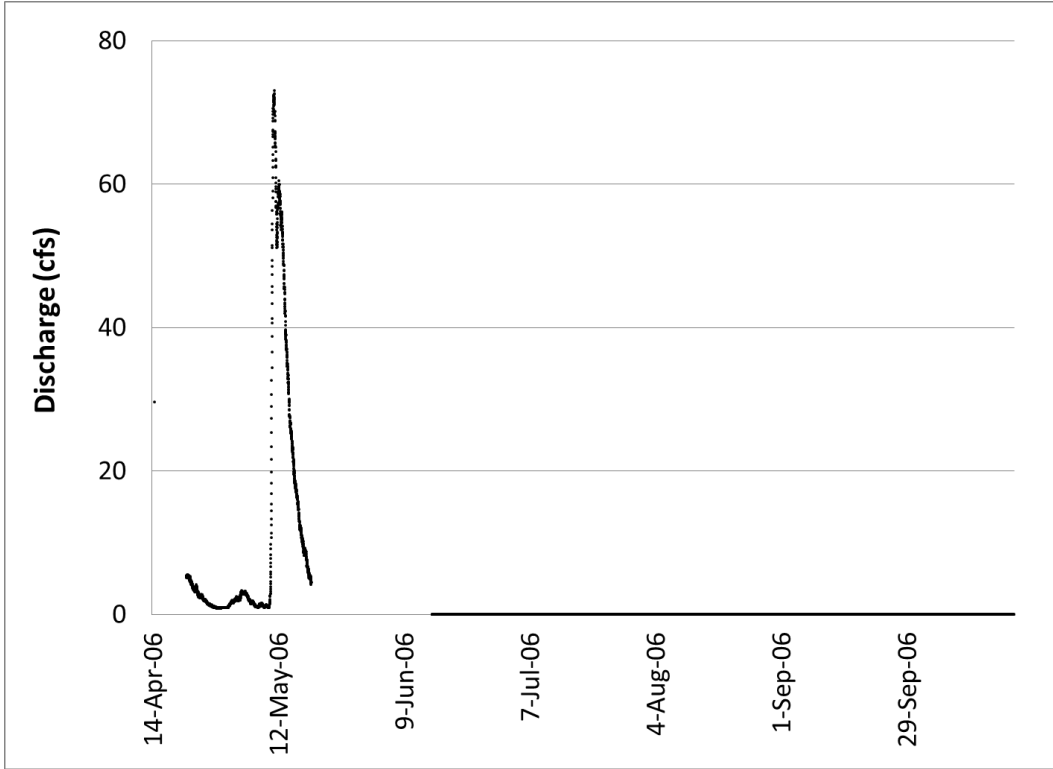


Figure 9. Continuous stream discharge, CD #2 (S004-131), 2006 (top) and 2007 (bottom)

## 5 Water Quality Data

Water quality data have been collected at multiple sites in the watershed over the last several decades. All water quality summarized here was retrieved from the MPCA EQuIS database in mid-February, 2013. An inventory of available water quality data for the most recent 10-year period (2003-2012) was summarized by monitoring station, year, and water quality parameter for impaired reaches in Table 16 and unimpaired reaches on the Red River (Table 17), tributary creeks to CD 2 (Table 18), and other unimpaired and/or unassessed reaches (Table 19). The most intensively monitored reaches (AUIDs) within the Grand Marais Creek Watershed are the Grand Marais Creek (09020306-512, CD 2 to Red River) and County Ditch 2 (09020306-515). Data collected from the Grand Marais Creek (09020306-512) may be the best indicator of long-term changes within the Grand Marais Creek Watershed.

The parameters of interest for the data inventory include the pollutants identified for the impairment listing and those directly related to the potential stressors to aquatic life, such as stream flow, dissolved oxygen, pH, temperature, clarity, and nutrients. Stressors most likely leading to aquatic life impairments in the Red River Valley were identified in the Red River Valley Biotic Impairment Assessment<sup>1</sup> (Table 15). Specific stressors to aquatic life in the Grand Marais Creek watershed will be determined through the stressor identification process, currently underway.

**Table 15. Potential stressors and water quality parameters**

Potential Stressor	Water Quality Parameter
In-stream sediment from field and gully erosion	Turbidity, TSS
Intermittent stream flow	*
Channelization	*
Pesticides	Pesticides
Low dissolved oxygen	Dissolved oxygen
High temperature	Temperature
Fish passage blockage	*

\* These potential stressors cannot be evaluated with water quality data.

## 6 Biology & Habitat Data

In 2012 the MPCA sampled 7 sites in the Grand Marais Creek watershed as part of the IWM biological monitoring effort; monitoring results are not yet available. Desktop assessment of data collected in the Grand Marais Creek watershed is likely in 2014.

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<sup>1</sup> EOR 2009. Red River Valley Biotic Impairment Assessment. Prepared for the Minnesota Pollution Control Agency.





**Table 17. Flow, physical characteristics, clarity, nutrient, and *E. coli* data summary for monitoring stations located on the Red River in the Grand Marais Creek Watershed (2003-2012).**

The numbers of samples are listed by parameter and year and shaded from light (low) to dark (high).

PARAMETER	Red River (S005-570)											Red River (S005-571)											Red River (S002-325)															
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012								
<b>FLOW</b>																																						
Flow																																						
Gage Height																																						
Stream Stage																																						
<b>PHYSICAL</b>																																						
Dissolved oxygen							13	11														11	12	15	1	2	2											
pH							13	11														11	12	15	1	2	2											
Hardness																								9	1	2	1	1										
Specific conductance							13	11														11	12	15	1	2	2											
Temperature							13	11														11	12	15	1	2	2											
<b>CLARITY</b>																																						
Total suspended solids							10	10														8	12	10	2	4	2											
Total volatile solids																								10														
Transparency							13	11														11	12	14														
Turbidity							13	11														11	12	13														
<b>NUTRIENTS</b>																																						
Ammonia							5	1														4	2	10	1	2	1	2										
Chloride							5	1														4	2	10														
Nitrate/Nitrite							5	5														4	6	10	1	2	1											
Total nitrogen																								10														
Orthophosphate																								1														
Phosphorus							5	5														4	6	10	1	2	1	2										
Sulfate																								10	1	2	1	1										
<b>E. COLI</b>																																						
<i>Escherichia coli</i>							9	6														6	7	8														

**Table 18. Flow, physical characteristics, clarity, nutrient, and *E. coli* data summary for monitoring stations located on tributary creeks to CD 2 in the Grand Marais Creek Watershed (2003-2012).**

The numbers of samples are listed by parameter and year and shaded from light (low) to dark (high).

PARAMETER	Tributary Creek of CD-2 (S004-132)											Tributary Creek of CD-2 (S003-276)											Tributary Creek of CD-2 (S004-133)																					
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012														
<b>FLOW</b>																																												
Flow							6	1	4																																			
Gage Height							11																																					
Stream Stage							13	27	49																																			
<b>PHYSICAL</b>																																												
Dissolved oxygen							2	6	9	17	19	7	4												4	2	2	3	4	8	7	4												
pH							1	6	9	17	18	7	4												3	1	2	3	4	8	7	4												
Hardness																																												
Specific conductance							2	6	9	16	18	7	4												4	2	2	3	4	8	7	4												
Temperature							2	6	9	17	19	7	4												4	2	2	3	4	8	7	4												
<b>CLARITY</b>																																												
Total suspended solids							2	2	4	3	7	7	4												4	2	2	3	2	7	7	4												
Total volatile solids																						1																						
Transparency							1	2	4	4	7	7	4												4	1	2	3	4	7	7	4												
Turbidity							2	9	13	17	19	7	4												4	2	2	3	4	8	7	4												
<b>NUTRIENTS</b>																																												
Ammonia																																												
Chloride																																												
Nitrate/Nitrite							2	2	4	3	7	7	4												4	2	2	3	2	7	7	4												
Total nitrogen																																												
Orthophosphate							2	2	4	3	7	7	4												3	2	2	3	2	7	7	4												
Phosphorus							2	2	4	3	7	7	4												4	2	2	3	2	7	7	4												
Sulfate																																												
<b>E. COLI</b>																																												
<i>Escherichia coli</i>																																												

**Table 19. Flow, physical characteristics, clarity, nutrient, and *E. coli* data summary for monitoring stations located on other unimpaired or unassessed stream reaches in the Grand Marais Creek Watershed (2003-2012).**

The numbers of samples are listed by parameter and year and shaded from light (low) to dark (high).

PARAMETER	Grand Marais Ck at CD-66 (S002-083)												Tributary Creek of CD-66 (S003-277)												CD-126 (S002-974)											
	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012						
FLOW	Flow					1																														
	Gage Height					4																														
	Stream Stage	4	3	6	4		4	5	1																											
PHYSICAL	Dissolved oxygen	4	4	8	4	9	4	6	1			3		2	2	2	3	5	3	2			4													
	pH	4	4	9	4	9	4	6	1			2		1	2	2	3	5	3	2			4													
	Hardness																																			
	Specific conductance	4	4	9	4	9	4	6	1			3		2	2	2	3	5	3	2			4													
	Temperature	4	4	9	4	9	4	6	1			3		2	2	2	3	5	3	2			4													
	Total suspended solids	4	4	4	3	2	3	4					3		2	2	2	2	5	3	2															
CLARITY	Total volatile solids																																			
	Transparency	2	4	5	4	8	1	2				3		1	2	2	3	5	3	2			4													
	Turbidity	3	3	9	8	13	8	10	1			3		2	2	2	3	5	3	2			4													
	Ammonia Chloride	4	4	4	3	2	3	4																												
NUTRIENTS	Nitrate/Nitrite	4	4	4	3	2	3	4				3		2	2	2	2	5	3	2																
	Total nitrogen	4	4	4	3	2	3	4																												
	Orthophosphate	4	4	4	3	2	3	4				2		2	2	2	2	5	3	2																
	Phosphorus	4	4	4	3	2	3	4				3		2	2	2	2	5	3	2																
	Sulfate																																			
E. COLI	<i>Escherichia coli</i>			3	4	3	4	4																												

## 7 Related Plans and Studies

Extensive planning and studies have been conducted in the Grand Marais Creek watershed. It is the intent of the WRAPS to utilize existing documentation to the greatest extent possible. An annotated bibliography is being developed for the inclusion in the Watershed Conditions Report to ensure all pertinent plans and studies are acknowledged. Following is a brief description of plans and studies that are important for development of the Grand Marais Creek WRAPS:

Energy & Environmental Research Center, University of North Dakota. 2009. Development of the Soil and Water Assessment Tool (SWAT) to Assess Water Quality in the Grand Marais Watershed

- Model results may guide TMDLs, existing load determinations, and implementation strategy.

HDR, Inc. 2006. Red Lake Watershed District 10-Year Comprehensive Plan

- Useful reference for watershed and water resource characteristics. Identifies watershed goals and objectives, subwatershed implementation plans, annual monitoring and evaluation program, and Red Lake Watershed District policies.

Houston Engineering, Inc. 2012. Grand Marais Creek Outlet Restoration and Cutoff Ditch Stabilization: Red Lake Watershed District Project 60F and 60FF, Project Team Update.

- This is a set of presentation slides, which entails photos of existing conditions of the outlet to the Red River and stations along the County Ditch 2 cutoff ditch. Plans for the steel sheet pile drop structure and ditch stabilization are also included.

Kurz, B.A., Glazewski, K.A. 2011. Development of the Soil and Water Assessment Tool (SWAT) to Assess Water Quality in the Grand Marais Watershed – Final Report for the period of September 10, 2008, through June 30, 2009. Energy & Environmental Research Center, University of North Dakota, 2011-EERC-06-28. Prepared for the MPCA.

- This report is a description of the SWAT model developed by the EERC for the Grand Marais Watershed. The report entails a description of SWAT including the methods used for simulation modules (e.g. rainfall runoff estimation, flow routing). In addition, the report defines data inputs (e.g. topography, soils data), model development (e.g. watershed delineation), and calibration. Some hypothetical scenarios for implementation of best management practices were simulated and described in this report. The SWAT model shapefiles and model files have also been obtained as a part of this project.

Middle-Snake-Tamarac Rivers Watershed District (MSTRWD). 2011. *Final Ten Year Watershed Management Plan, Report No. 3429-038*.

- Useful reference for watershed and water resource characteristics. Identifies watershed goals and objectives, implementation plans, and Middle-Snake-Tamarac Rivers Watershed District policies.
- The MSTRWD's Final Ten Year Watershed Management Plan (10-Year Plan) entails specific report sections dedicated to the Angus-Oslo Watershed Planning Region, which is the portion of the Grand Marais Watershed that is in the MSTRWD, including:
  - o Planning region issues (Page 3-23+)
  - o Implementation strategies: hydrology, water quality, and permanent cover (Page 5-56+)
  - o Natural resources:
    - Existing and restorable resources
    - Natural resources planning worksheet
    - Natural resource goals
- Physical watershed characteristics for the entire MSTRWD are mapped and discussed in general. Page 1-11 describes the Angus Oslo Site #4 off-channel impoundment (diversion from JD 25-2 into a 900-acre storage area) constructed in 1994/1995. Page 1-12 describes the proposed Brandt/Angus flood control project in sections 18 and 19 of Brandt Township in Polk County with 5,000 AF of flood storage from a drainage area of approximately 14 square miles. A total of three flood control project sites in the Anglo-Oslo Watershed are mapped in Figure 2.13. A HEC-HMS model and results for the MSTRWD is discussed in the 10-Year Plan as well.

Minnesota Board of Water & Soil Resources (BWSR). 2011. Grand Marais Creek Cut Channel Stabilization: Project Narrative

- A narrative of the 2011 Clean Water Fund grant for the Grand Marais outlet channel stabilization (including drop structures/spillways to flatten the profile) and subsequent diversion of some flow back to the natural 6-mile reach.

Red Lake Watershed District (RLWD). 2011. *2011 Annual Report*.

- Includes status updates of three 2011 District Projects in the Grand Marais Watershed.

Red Lake Watershed District (RLWD). *Project Highlight – RLWD Project 60.*

- A memo entails a description of water quality conditions before and after the Brandt and Euclid East impoundments were constructed.

RLWD/MSTRWD Joint Board. 2009. Environmental Assessment Worksheet: Grand Marais Creek Outlet Restoration – Red Lake Watershed District Project 60F

- An environmental assessment worksheet for the Grand Marais Creek Outlet Restoration (Project 60F). The project is summarized in the EAW as follows:

*Grand Marais Creek discharges into the Red River. The original channel meandered to the northwest to the River until the early 1900's when a legal ditch was constructed to divert flow west to the River. This Project will restore the original meander (~6 miles) for purposes of natural resource enhancement.*

- Preliminary plan sheets are included in the EAW including for the diversion structure/weir, channel restoration, levee construction, grade control structures, and road and driveway crossings.

RLWD (Red Lake Watershed District). 2006. 10-Year Comprehensive Plan.

- The RLWD's 10-Year Comprehensive Plan (10-Year Plan) entails some specific information about the Grand Marais Watershed. Physical, surface water, and groundwater characteristics are summarized. In particular, Section 7.4, beginning on Page 128, entails the Grand Marais Subwatershed Plan. It includes a separate implementation plan for natural resources, water quantity, water quality, and erosion and sedimentation. The 300 square mile, 5,000 acre-feet flood damage reduction (FDR) Project 60 is described on Page 137. Appendix 4 of the 10-Year Plan includes a description of the following three water management projects (impoundments) planned (as of 2006) in the Grand Marais Watershed: Parnell, Louisville-Parnell, and Flood Storage Easement Sites 1 and 2.

RLWD (Red Lake Watershed District). 2011. 2011 Annual Report.

- This report entails a status update of three 2011 District Projects in the Grand Marais Watershed: Grand Marais Sub Watershed Project (RLWD Project #60B), Grand Marais Creek Outlet Restoration (RLWD Project 60F), and Grand Marais Creek "Cut Channel" (RLWD Project 60FF). The status of Grand Marais Watershed Flood Control Impoundment Projects are also updated: Euclid East Impoundment (RLWD Project #60C), Brandt Impoundment (RLWD Project #60D), and Parnell Impoundment (RLWD Project #81). The Euclid East Impoundment became operational in the summer of 2007. The Brandt Impoundment became operational in the spring of 2008. The Parnell Impoundment's original design became operational in 1999; the modified plan became operational in 2004. The 2012 Annual Report does not appear to be available at this time.

RLWD (Red Lake Watershed District). *Project Highlight – RLWD Project 60.*

- This one-page memo entails a description of water quality conditions before and after the Brandt and Euclid East impoundments were constructed. Pre- and post- construction



water quality data are summarized at locations upstream and downstream of the project site. It appears that tangible results were realized for TP and TSS.

U.S. Department of Agriculture, Natural Resources Conservation Service. *Rapid Watershed Assessment, Grand Marais – Red (MN/ND) HUC: 09020306*

- An assessment of the Grand Marais Watershed, which entails information on ownership/land use, 303d listed streams, common resource areas of which there are two (Red River Valley and Glacial Lake Agassiz Basin), soil drainage classifications, farmland classification, tabular conservation practices implementation, and some threatened and endangered species and demographics data.
- This is a less than 20 page assessment of the Grand Marais Watershed, which entails information on ownership/land use, 303d listed streams, common resource areas (CRA) of which there are two (Red River Valley and Glacial Lake Agassiz Basin), soil drainage classifications, farmland classification, tabular conservation practices implementation, and some threatened and endangered species and demographics data. The following summary from the website is useful:

*The watershed occurs in the Glacial Lake Agassiz Plain Level III Ecoregion.*

*The Red River has a poorly defined floodplain and low gradient that combine with extensive drainage, widespread conversion of tallgrass prairie to farmland, and urban/suburban development to leave the basin subject to frequent floods that affect urban and rural infrastructure and agricultural production.*

*The main resource concerns in the watershed are wind and water erosion, nutrient management, wetland management, surface water quality, flood damage reduction, and wildlife habitat. Many of the resource concerns relate directly to flooding and increased sediment and pollutant loadings to surface waters.*