

# Unnamed Creek, Total Maximum Daily Load (TMDL) Implementation Plan



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**Submitted by: Sauk River Watershed District**



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## Unnamed Creek TMDL Implementation Plan Executive Summary

Unnamed Creek is located in the North Central Hardwood Forest Ecoregion. The Unnamed Creek watershed comprises 10,912 acres and is dominated by fine, deep loamy soils, with relatively lower drainage relative to neighboring watersheds. Higher slopes are characteristic of the watershed, with 25% of the area containing slopes greater than 3%. Flow from Unnamed Creek discharges to the Sauk River, which then discharges to the Mississippi River.

A Total Maximum Daily Load (TMDL) Study was conducted for the Unnamed Creek basin to qualitatively assess potential sediment sources to the channel. The potential contribution of sediment to the stream channel from field erosion out-weighed estimated in-channel sediment delivery by almost 10 to 1 suggesting that field erosion is likely a more important source of sediment in the Unnamed Creek watershed. However, serious signs of bank failure and erosion suggest that active bank erosion is occurring in the stream system.

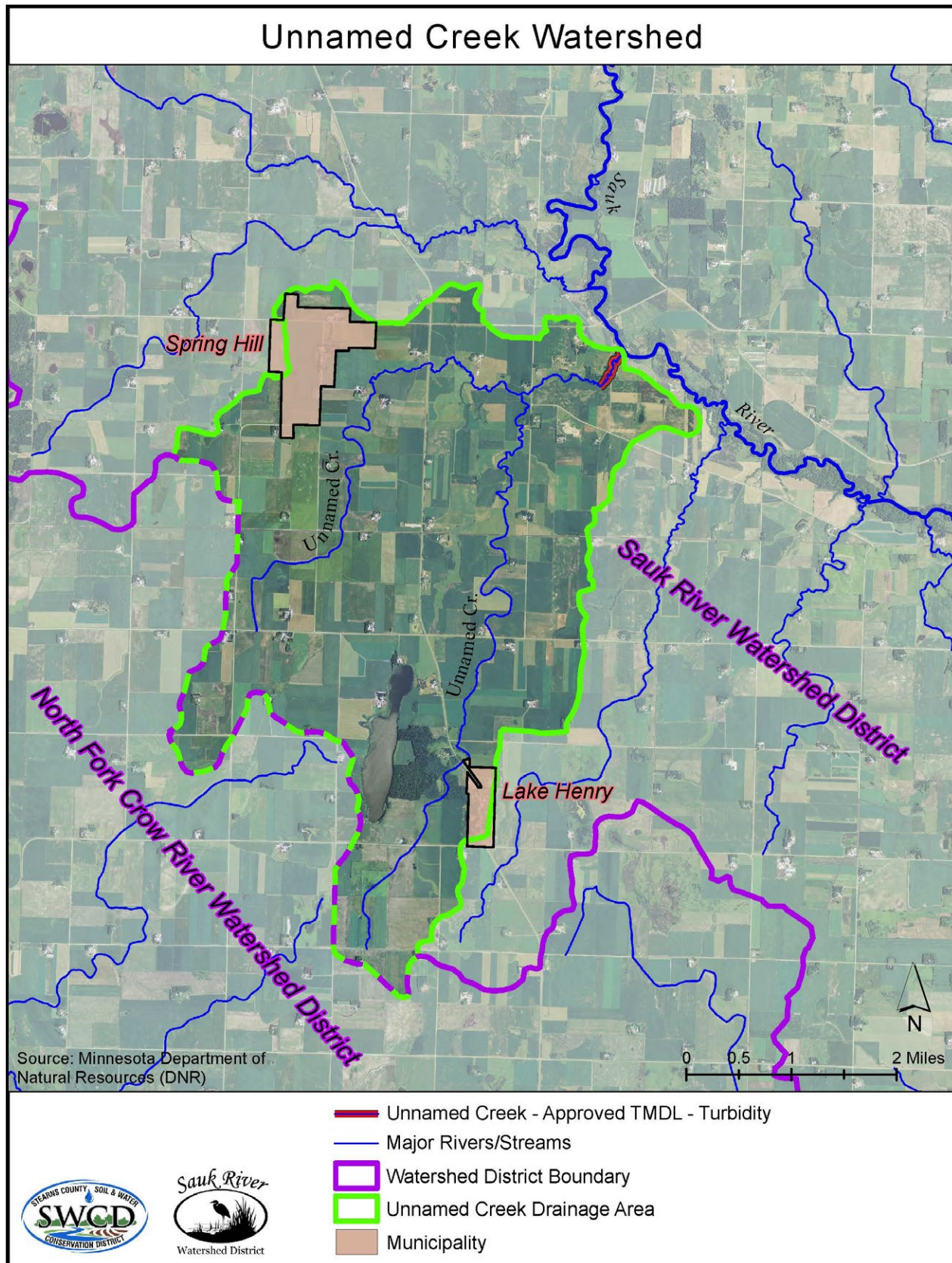
For the Unnamed Creek TMDL Study the turbidity surrogate 79mg/L of total suspended solids (TSS) was used to equate the state standard of 25 nephelometric turbidity units (NTUs). The surrogate was adopted from the adjacent watershed, North Fork Crow River Watershed. The 79mg/L of TSS was used as a benchmark concentration for discharges in the Unnamed Creek watershed. Water quality data collected from 1994-2008 by the Sauk River Watershed District (SRWD) have shown that turbidity in Unnamed Creek exceeds water quality standards (25NTU) for Class 2B aquatic life uses. A majority of these violations occurred from 1994-2002. Unnamed Creek had 37 samples (~55%) exceeding the TSS standard all of which were collected prior to 2003.

The data for Unnamed Creek indicate that a majority of samples exceeding the TSS standard occur during the very high and high flow regimes (53% and 67%, respectively). Approximately 25% of Unnamed Creek samples above the TSS standard occurred under low and dry conditions. The TMDL was established for Unnamed Creek using the load duration curve approach. It was estimated that a 35% to 95% reduction in total suspended solids is required for Unnamed Creek during the higher flows and 7% to 66% reduction during the lower flows to meet current state standards.

The goals outlined in this TMDL implementation plan are consistent with objectives outlined in the Stearns County Comprehensive Local Water Management Plan and the Sauk River Watershed District Watershed Management Plan. These plans have the same objective of developing and implementing strategies to bring impaired waters into compliance with appropriate water quality standards and thereby establish the basis for removing those impaired waters from the 303(d) Impaired Waters List. This plan provides the watershed management framework for addressing water quality issues. In addition, stakeholders associated with the Unnamed Creek TMDL have generated commitment and support from the local government units and will help ensure that this TMDL project is carried successfully through implementation.



Figure 1. Map of Unnamed Creek watershed



## Unnamed Creek TMDL Summary

The Sauk River Watershed lies in the heart of the North Central Hardwood Forest Ecoregion and discharges to the Upper Mississippi River. The major land use in the Unnamed Creek watershed is corn and soybean rotation, which comprises 41% of the watershed area, with pasture cropland the second major land use. Less than 1% of the land is utilized for road networks and buildings (Table 1). Unnamed Creek is located within the larger Getchell, Unnamed and Stony (GUS) subwatershed located in the middle section of the Sauk River. Unnamed Creek was included on Minnesota's 303(d) TMDL list for excess turbidity in 2008.

**Table 1. Land cover for the Un-named Creek Watersheds**

NASS Land Cover Category	Area (acres)	Percent
Pasture/Hay	3,495	32.0
Corn	3,314	30.4
Soybeans	1,119	10.3
Alfalfa	705	6.5
Small grain –oats, barley, spring wheat	688	6.3
Open Space	627	5.7
Deciduous Forest	373	3.4
Open Water	203	1.9
Herbaceous Wetlands	152	1.4
Grass Pasture	68	0.6
Developed/Low-Med Intensity	35	0.3
Other	134	1.2
<b>TOTAL</b>	<b>10,912</b>	<b>100%</b>

Turbidity is a measure of water clarity typically determined using a meter that measures the scatter of a beam of light passed through a water sample. Turbidity is caused by suspended soil particles, algae, dissolved salts, and other organic materials that scatter light in the water column, making the water appear cloudy. Excessive levels of turbidity can harm aquatic life by making it more difficult for sight-feeding organisms to find food, adversely affecting gill function, and smothering food organisms as well as spawning habitat.

Turbidity can be caused by increased suspended soil or sediment particles, phytoplankton growth, and dissolved substances in the water column. Since turbidity is a measure of light scatter and adsorption, loads need to be developed for a surrogate parameter. Total suspended solids (TSS) is a measurement of the amount of sediment and organic matter suspended in water and is often used as a turbidity surrogate to define allocations and capacities in terms of daily mass loads. For the Unnamed Creek TMDL Study the turbidity surrogate 79mg/L of TSS was adopted from the adjacent similar watershed, North Fork Crow River Watershed. The 79mg/L was approved to use as a benchmark concentration for discharges in the Unnamed Creek watershed.

The TMDL for Unnamed Creek was established using the load duration curve approach (Cleland 2002). It was estimated that a 35% to 95% reduction in total suspended solids is required for Unnamed Creek during the higher flows and 7% to 66% reduction during the lower flows to meet current state standards.

A source assessment was conducted for the Unnamed Creek basin to qualitatively assess potential sediment sources to the channel. The potential contribution of sediment to the stream channel from field erosion out-weighed estimated in-channel sediment delivery by almost 10 to 1 suggesting that field erosion is likely a more important source of sediment in the Unnamed Creek watershed. However, serious signs of bank failure and erosion suggest that active bank erosion is occurring in the stream system. Although both of these potential sources should be addressed, field erosion warrants greater attention because of the magnitude of sediment potentially delivered to the stream. Neither point sources nor stormwater are important contributors of suspended particles to Unnamed Creek.

### **Problem Identification**

Water quality data collected from 1994-2008 by the Sauk River Watershed District (SRWD) have shown that turbidity in Unnamed Creek exceeds water quality standards for Class 2B aquatic life uses. Excess turbidity affects sight-feeding organisms, reduces and/or clogs fish gills, and covers spawning habitat with sediment. MPCA found that total suspended sediment (TSS) concentrations, collected by the SRWD in the Sauk River, increased immediately downstream of the Unnamed Creek watershed, indicating mass loading of TSS from this watershed.

**Source Identification (point and nonpoint sources)** The following sources were identified as possible contributions to Unnamed Creek: field erosion, stream bank erosion, algae and plant production, stormwater, and point sources. Field erosion appeared to be the most significant source in the watershed. Active signs of erosion, particularly on 4th order streams, indicated that stream bank erosion contributes TSS to the stream.

Potential field erosion was measured with the Soil Water Assessment Tool (SWAT) which incorporates land cover, soils, and slope information to determine the mass of soil loss from fields based on the Modified Universal Soils Loss Equation (MUSLE). Once removal of sediments in wetlands was accounted for, sediment yield from field erosion was estimated at 4,001 tons/year in Unnamed Creek watershed (Section 4.2.1 of the TMDL). Stream bank erosion was estimated using field data and the Natural Resources Conservation Service direct volume method. Randomly sampled transects were throughout the watershed were used to conduct further assessments to provided an estimated rate of annual soil loss based on 1st through 4th order streams. The resulting estimate for soil loss from stream bank erosion was 76 to 212 tons/year (Section 4.2.2 of the TMDL).

There are no Municipal Separate Storm Sewer Systems (MS4s) in this watershed. Only a low density road network and few farm buildings comprise impervious surfaces in the watershed. Thus urban stormwater is not expected to be a large source of suspended solids, or increased turbidity in Unnamed Creek. There are no individually permitted point sources in the Unnamed Creek watershed.

## **Water Quality Standard**

The turbidity standard found in Minn. R. 7050.0222 subpart 4 for 2B waters is 25 (NTUs). The water body is added to the impaired waters list when greater than 10% of the data points collected within the previous 10 year period exceed the 25 NTU standard (or equivalent TSS values, i.e. surrogate 79mg/L). Data collected between 1994-2008 on Un-named Creek recorded 37 samples (~55%) exceeding the TSS standard all of which were collected prior to 2003. Based on this data Unnamed Creek, a Class 2B water resource, was listed as impaired for turbidity.

### TMDL Goal for Unnamed Creek

Specific numeric goals for Unnamed Creek are based on the water quality standard for turbidity in class 2B waters. The results of the Unnamed Creek TMDL study states that an estimated 35% to 95% reduction in total suspended solids is required for Unnamed Creek during the higher flows and 7% to 66% reduction during the lower flows in order to meet current state water quality standards. The goal of this TMDL implementation plan is to have less than 10% of the TSS data exceeding the surrogate 79mg/L TSS concentration. The turbidity TMDL for Unnamed Creek is found in Table 2.

**Table 2. TSS load allocations (tons/day) per flow ranges**

TMDL component	Very High	High	Mid-Range	Low	Dry
Wasteload Allocation	0.036	0.016	0.012	0.010	0.010
Load Allocation	2.317	1.048	0.731	0.670	0.647
Margin of Safety (MOS)	0.069	0.012	0.008	0.002	<0.001
<b>Total Maximum Daily Load (TMDL)</b>	<b>2.422</b>	<b>1.076</b>	<b>0.751</b>	<b>0.682</b>	<b>0.657</b>

### Implementation Plan- Activities and Cost

The data for Unnamed Creek indicate that a majority of samples exceeding the TSS standard occur during the very high and high flow regimes (53% and 67%, respectively). Approximately 25% of Unnamed Creek samples above the TSS standard occurred under low and dry conditions. Management alternatives and strategies have been developed for Unnamed Creek to reduce total suspended solids from non-point sources in the watershed affected by surface erosion. The list below outlines activities and practices that have been used in the Sauk River Watershed in the past and/or have been suggested as practices to be considered for reducing turbidity in the Unnamed Creek watershed.

#### Public Educations and Outreach

- public relations, marketing, civic engagement,
- public involvement, technical assistance, and training

#### Livestock and Manure Management

- Manure Management plans
- Vegetative buffers
- Feedlot runoff control
- Agricultural waste pit closures
- Pasture management
- Agricultural waste pit investigations

#### Structural Practices

- Terraces
- Water and sediment control basins
- Stream barbs or j-hooks -for bank stabilization
- Side inlets
- Alternative tile intakes
- Controlled drainage
- Pattern tile



- Two-stage ditch design
- Subsurface Sewage Treatment Systems

#### **Vegetative Practices**

- Wetland restorations
- Buffer strips, cover crops
- Conservation tillage
- Residue management
- Grass waterways
- Biomass harvesting
- Riparian restoration

#### **District Initiated Activities**

The Sauk River Watershed District's focus will be to improve the water quality in Unnamed Creek. The District will undertake the following priority implementation actions to achieve water quality standards in Unnamed Creek.

#### **Education and Public Outreach**

The District operates an ongoing education and outreach program. An extensive outreach program for the residents of the Unnamed Creek watershed will be developed to inform these residents of the issues facing Unnamed Creek and their roles in addressing these issues. This public education program will promote community awareness and clearly identify the contribution from sources such as stream bank stabilization and upland runoff. This education program will integrate public relations advertising, marketing, civic engagement, public involvement, technical assistance, and training to optimize sediment reductions from all sources within the overall watershed.

***Estimated Cost:*** \$2,500 annually

***Funding Source:*** General operating budget and grant funding

#### **Implement the Management Unit Charge**

The District will establish a basis for the water management unit charge (MU) and hold public hearings to establish the ten water management districts as described in the 2013-2023 District Comprehensive Management Plan. Funding from the established water management units (or districts) will be used to provide an incentive for landowners to participate in implementing BMPs to improve the water quality of Unnamed Creek.

***Estimated Cost:*** \$50,000

***Funding Source:*** General operating budget and grant funding

#### **Stream Bank Inventory**

The turbidity assessment for Unnamed Creek identified the need to reduce sediment loading in Unnamed Creek by 35-95% depending on flow regime. These reductions can be achieved through stream bank stabilization and reduction of sediment loads from the watershed. The District will complete an inventory of stream conditions and prioritize target areas for the entire creek.

***Estimated Cost:*** \$25,000



***Funding Source:*** SRWD General operating budget, SWCD and grant funding

#### **Sediment Reduction Initiative**

To reduce sediment loading to Unnamed Creek will require participation from the watershed residents. The District will pursue grant funds to offer landowners an incentive to enroll in erosion control and sediment reduction programs offered by the Stearns Soil and Water Conservation District (SWCD) and Natural Resource Conservation Service (NRCS) or to implement other sediment reduction BMPs. The District will require landowners to sign a financial agreement and operation and maintenance plan to ensure project integrity is maintained for the life expectancy of the BMP installed.

***Estimated Cost:*** \$25,000 annually

***Funding Source:*** SRWD General operating budget, SWCD and grant funding

#### **Technical Advisory Committee (TAC)**

The District will form a technical advisory committee to provide recommendations on BMPs. Staff from the local agencies will be invited to participate in the TAC to ensure success of the Unnamed Creek TMDL implementation plan. Committee members will consist of, but not limited to, staff from the SRWD, Stearns County SWCD, NRCS, Stearns County Environmental Services (SES) and the Minnesota Department of Natural Resources (MNDNR).

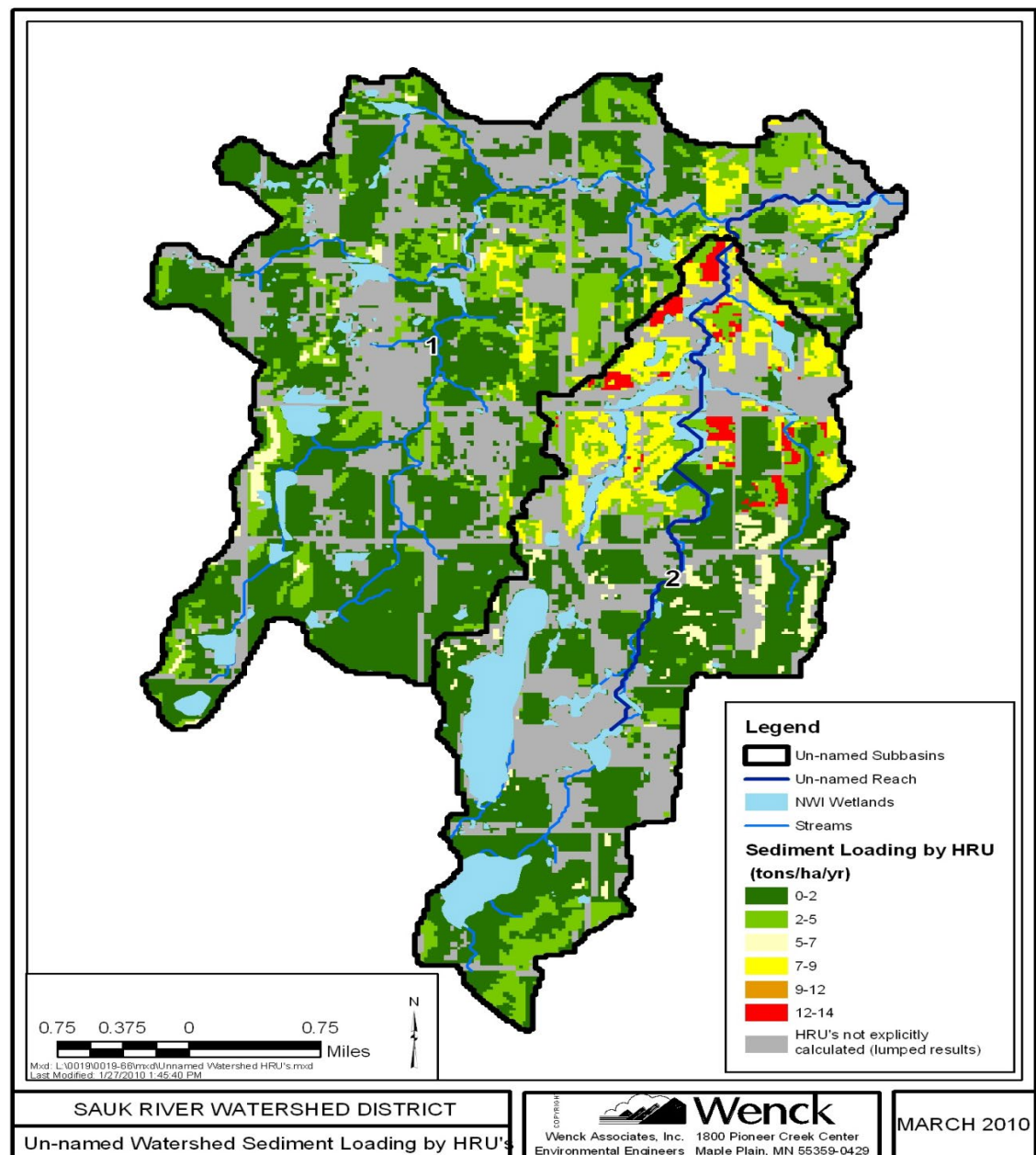
***Estimated Cost:*** \$1500 annually

***Funding Source:*** General operating budgets of participating agencies

#### **Partner Initiated Activities**

The SRWD will partner with the Stearns County SWCD and NRCS to target nutrient management actions on approximately 2,500 acres in the high potential delivery areas identified in the TMDL study (see Figure 1). These actions may include practices such as manure management plans; conservation tillage; filter strips and enhanced buffers; and restored wetlands. The District will assist the SWCD with promotion of these programs and assist in identifying participants. The District may provide cost-share to supplement other funds available to the SWCDs for these programs to reduce participant out of pocket cost. Of highest priority are approximately 1,800 acres with a high sediment delivery potential that are adjacent to streams and private waterways.

Figure 2. Unnamed Creek Watershed Sediment Loading



### Vegetative management practices

Vegetative practices include those focusing on the establishment and protection of crop and non-crop vegetation to minimize sediment mobilization from agricultural lands and decrease sediment transport to receiving waters. The recommended cropping practices are designed to slow the speed of runoff over bare soil to minimize its ability to transport sediment. Other practices, such as alternative crop rotations, forest management, and field windbreaks are designed to minimize exposure of bare soils to wind and water which can transport soil off-site. Pasture management emphasizes rotational grazing techniques to prevent over-grazing and exposed soil. Maintaining vegetation allows for greater water infiltration, reducing runoff and associated sediment transport.

There are a number of programs available to compensate land owners for moving environmentally sensitive cropland out of production for varying periods of time. These include the Conservation Reserve Program (CRP), Re-Invest in Minnesota (RIM) Reserve Program, and the Conservation Reserve Enhancement Program-Minnesota II (CREP-II). Anticipated benefits in reducing soil erosion and improving water quality are key considerations in deciding what lands can be enrolled in each program.

**Estimated Cost:** \$50,000 annually

**Funding Source:** CRP, RIM and CREP-II programs

### **Conservation Tillage Practices**

Certain kinds of tillage practices can significantly reduce the generation and transport of soil from fields. Conservation tillage techniques emphasize the practice of leaving at least some vegetation cover or crop residue on fields as a means of reducing the exposure of the underlying soil to wind and water which leads to erosion. Managed properly, conservation tillage can reduce soil erosion from active fields.

**Estimated Cost:** Ongoing, depending on participation

**Funding Source:** State Revolving Fund (SRF) loan program and EQIP

### **Structural Practices**

Structural practices generally require a more site-specific planning and an engineered design. Most structural practices focus on slowing water down in the watershed to decrease sediment loading to the receiving water. An example of this would be a wetland restoration which creates a natural method of slowing runoff and storing it for a period of time, which can improve channel stability and reduce flooding downstream. The calmer conditions of a wetland can effectively settle out sediment particles from runoff. However, too much sediment accumulation at a rapid rate can compromise other important functions of the wetland. Livestock exclusion involves fencing or other structural barriers to limit, or eliminate, access to a stream and may involve alternative watering systems. Feedlot structures to reduce runoff from open lots will require site specific engineered designs.

**Estimated Cost:** \$15,000 annually, depending on participation

**Funding Source:** SWCD and NRCS programs, SRWD water management unit (MU) funds and other grant funds

### **Stream and Channel Restoration**

Other best management practices considered for the Unnamed Creek watershed include improving to the stability of the stream banks to decrease in-stream sources of sediment. In-stream structures, such as a stream barbs, need to be carefully designed to direct flow appropriately under a wide range of flow conditions and ensure that the solution to one channel stability problem doesn't create another elsewhere. Floodplain areas will need to be considered when designing a stream BMP. The established natural vegetation in the floodplain also acts to slow flow velocities and encourages deposition and permanent capture of sediment.

**Estimated Cost:** \$ 10,000 annually depending on participation

**Funding Source:** SWCD and NRCS programs, SRWD WMU funds and other grant funds

When dealing with impairments due to non point sources, no single practice or activity will improve water quality to the point of achieving standards. It will take a number of practices in different areas to improve water quality across the watershed ranging from simple, small-scale fixes, to changes in mindsets when dealing with water and watershed management.

## **Monitoring Plan to Track TMDL Effectiveness**

Two types of monitoring are necessary to track progress toward achieving the load reduction required in the TMDL and the attainment of water quality standards. The first type of monitoring is tracking implementation of Best Management Practices and capital projects. The Sauk River Watershed District and the Stearns County Soil and Water Conservation District will track the implementation of these projects annually. The second type of monitoring is physical and chemical monitoring of the resource. The Sauk River Watershed District will monitor Unnamed Creek routinely.

For years in which monitoring is conducted (e.g., just prior to and after implementation), watershed monitoring will be conducted at a frequency of once every two weeks for the period of April through November. The following parameters will be collected from the Unnamed Creek watershed monitoring location(s):

- Total phosphorus
- Dissolved phosphorus
- Total suspended solids
- Flow

This type of effectiveness monitoring is critical in the adaptive management approach. Results of the monitoring identify progress toward benchmarks as well as shape the next course of action for implementation. Adaptive management combined with obtainable benchmark goals and monitoring is the best approach for implementing the Unnamed Creek TMDL.

**Estimated Cost:** \$ 10,000 annually depending on number of monitoring stations

**Funding Source:** SRWD operating funds and other grant funds

## **Management Plan Coordination**

The goals outlined in this TMDL implementation plan are consistent with objectives outlined in the Stearns County Comprehensive Local Water Management Plan and the Sauk River Watershed District Watershed Management Plan. These plans have the same objective of developing and implementing strategies to bring impaired waters into compliance with appropriate water quality standards and thereby establish the basis for removing those impaired waters from the 303(d) Impaired Waters List. This plan provides the watershed management framework for addressing water quality issues. In addition, stakeholders associated with the Unnamed Creek TMDL have generated commitment and support from the local government units and will help ensure that this TMDL project is carried successfully through implementation.

Various technical and funding sources will be used to execute measures listed above. Technical resources include the Sauk River Watershed District and Stearns County Soil and Water Conservation District, West Central Area Technical Services as well as the Minnesota Department of Natural

Resources. Funding resources include a mixture of state and federal programs, including (but not limited to) the following:

- Conservation Reserve Program
- Federal Section 319 program for watershed improvements
- Funds ear-marked to support TMDL implementation from the Clean Water, Land, and Legacy constitutional amendment, approved by the state's citizens in November 2008.
- Sauk River Watershed District program funds
- Local government cost-share funds

## **Roles and Responsibilities of Project Partners**

### **Sauk River Watershed District (SRWD)**

The SRWD will provide staff and equipment to conduct the stream inventory, education and public outreach activities, and make contacts for BMP implementation. Staff will also participate in the technical advisory committee.

### **Stearns County Soil and Water Conservation District (SWCD)**

The Stearns County SWCD will provide staff and equipment to make contacts for BMP implementation, design and layout of BMPs, and assist with the information and education program. Staff will also participate in the technical advisory committee.

### **Stearns County Environmental Services (ESD)**

The SES will provide feedlot inspectors, and applicable planning and zoning personnel will assist with programs at a county level. Included may be shoreland/riparian ordinance, feedlot requirements, ditches or other projects. Staff will also participate in the technical advisory committee

### **Stearns County Natural Resource Conservation Service (NRCS)**

The Stearns County NRCS in conjunction with the SWCD will help administer related practices such as EQIP, WRP, and other federal incentive programs. Staff will also participate in the technical advisory committee.

### **Minnesota Pollution Control Agency (MPCA)**

The MPCA will provide project support through the assigned watershed project manager and provide technical assistance where applicable with reporting and assistance in monitoring. The MPCA is the lead agency in the TMDL process. The project manager may be asked to attend technical advisory committee meetings.

### **Minnesota Department of Natural Resources (DNR)**

The DNR will assist in technical aspects of project implementation including assistance, permit issuance where applicable. Individuals from this organization may be asked to attend technical advisory committee meetings.

### **Board of Water and Soil Resources (BWSR)**

An individual representing BWSR will provide technical assistance as well as assistance in applying for Clean Water Fund grants. They may also be asked to attend technical advisory committee meetings.



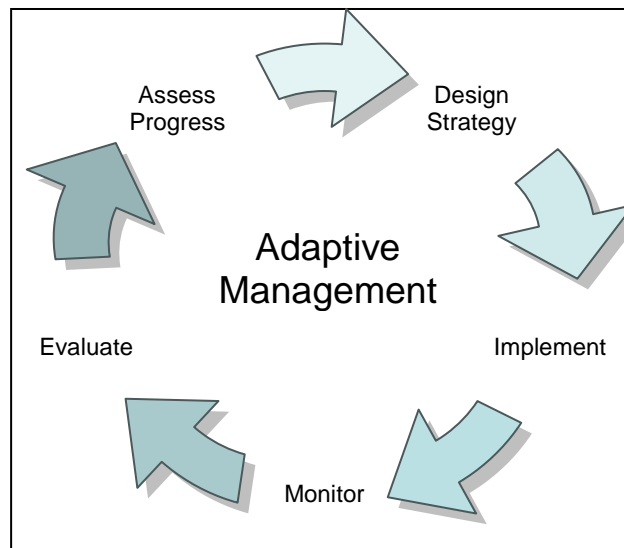
### West Central Technical Service Area II (WCTSA II)

The WCTSA will provide staff and equipment to design BMP implementation project and conduct inspections during construction to ensure proper installation. Staff will also participate in the technical advisory committee.

## Adaptive Management

The implementation activities listed above will be ongoing for 20+ years. As the sediment dynamics within the watershed are better understood, management activities will be changed or refined to efficiently meet the TMDL and lay the groundwork for de-listing Unnamed Creek. Because there are no known point sources in the project area watershed, the implementation elements will focus exclusively on non-point source controls.

Figure 3. Adaptive management.



The sediment reduction needs in Unnamed Creek watershed identified in the TMDL require aggressive goals. Implementation activities will be conducted using an adaptive management approach. Adaptive management is based on assessment, planning, action, monitoring, evaluation and adjustment based on knowledge gained. Changes in water quality standards, technology, research, and weather may alter the course of actions listed in this plan. Continued monitoring and adjustments responding to monitoring results are the most appropriate strategy for attaining the water quality goals established in the Unnamed Creek TMDL.

Implementation activities will occur over a 20+ year period. Adjustments to the implementation plan will occur as organizations undertake various facets of the plan. Implementation activities can be completed using existing conservation programs or rules established by state, county, or local ordinances.