

## **Sediment TMDL for Carpenter Creek**

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This Total Maximum Daily Load (TMDL) for sediment addresses sedimentation and degraded habitat impairment conditions in Carpenter Creek, a tributary to the Pine River. The TMDL identifies load allocations and management actions that will restore the biological integrity of this stream. Carpenter Creek is identified as high priority water in the 2002 and 2004 303(d) list.

### **Background**

Carpenter Creek is 6.0 miles in length. This stream flows in a southerly direction before emptying into the Pine River. The creek and its watershed are entirely in Waushara County. Carpenter Creek is located within the Carpenter Creek subwatershed, one of 12 subwatersheds that make up the Pine River Willow Creek Watershed of the Wolf River Basin. The 12.7 square mile drainage area to Carpenter Creek is 42% of the area of Carpenter Creek subwatershed as described in the Pine River/ Willow Creek Priority Watershed Project.

The lack of exposed gravel substrate greatly limits the spawning in Carpenter Creek. The filling-in of riffle areas (measured as embeddedness) reduces reproductive success of trout by reducing inter-gravel flow which is necessary to maintain suitable temperature and oxygen conditions for eggs and fry. Sedimentation of riffle areas also reduces suitable habitat for macroinvertebrates and other fish food organisms. Filling-in of pools reduces the amount of available cover for juvenile and adult fish. The sand substrate reduces the amount of suitable habitat for fish, and fish food organisms. Macroinvertebrate biomass is generally lower in areas with a predominantly sand substrate with a mix of gravel, rubble and sand. There is extensive drainage of riparian wetlands adjacent to Carpenter Creek. Several lateral ditches appear to contribute both sediment and warmer water to the stream.

A description of the population, soils, topography, geology and other physical characteristics of the Pine River/ Willow Creek Priority Watershed is contained in Chapter 2 of *A Nonpoint Source Control Plan for the Pine River/ Willow Creek Priority Watershed Project*. For a map of Carpenter Creek Subwatershed, please see Map 2-3 in Chapter 2 of the Plan.

### **Critical Condition**

The extensive sedimentation is a year-round situation. As such, there is no "critical condition". This is not to say that there is not variation on the sediment carried in runoff to a stream. (See section on Seasonal Variation below).

## Water Quality Standards

Carpenter Creek for its entire length is not currently meeting applicable narrative *water quality criterion* as defined in NR 102.04 (1); Wis. Adm. Code:

“To preserve and enhance the quality of waters, standards are established to govern water management decisions. Practices attributable to municipal, industrial, commercial, domestic, agricultural, land development or other activities shall be controlled so that all waters including the mixing zone and effluent channel meet the following conditions at all times and under all flow conditions: (a) *Substances that will cause objectionable deposits on the shore or in the bed of a water, shall not be present in such amounts as to interfere with public rights in waters of the state.*”

Excessive sedimentation is considered as an objectionable deposit.

The designated uses applicable to Carpenter Creek are as follows:

S. NR 102.04(3) intro, (a) and (b), Wis. Adm. Code:

"FISH AND OTHER AQUATIC LIFE USES. The department shall classify all surface waters into one of the fish and other aquatic life subcategories described in this subsection. Only those use subcategories identified in pars. (a) to (c) shall be considered suitable for the protection and propagation of a balanced fish and other aquatic life community as provided in the federal water pollution control act amendments of 1972, P.L. 92-500; 33 USC 1251 et.seq.

"(a) *Cold water communities.* This subcategory includes surface waters capable of supporting a community of cold water fish and aquatic life, or serving as a spawning area for cold water fish species. This subcategory includes, but is not restricted to, surface waters identified as trout water by the department of natural resources (Wisconsin Trout Streams, publication 6-3600 (80)).

"(b) *Warm water sport fish communities.* This subcategory includes surface waters capable of supporting a community of warm water sport fish or serving as a spawning area for warm water sport fish.

"(c) *Warm water forage fish communities.* This subcategory includes surface waters capable of supporting an abundant diverse community of forage fish and other aquatic life.”

Presently, Carpenter Creek is classified as Class II cold water. It received fair aquatic life habitat ratings both in the upper and lower reaches. Carpenter Creek has the potential to improve with the reduction in sediment and phosphorus loading and the enhancement of wetlands. A reduction would stabilize dissolved oxygen levels,

decrease sediment accumulation in the streambed, and decrease overall loading to the Pine River. Stream channelization, the shifting sand substrate, beaver activity and increased water temperature, and the dam on the Pine River also have a negative impact on the coldwater fish communities and water quality of this subwatershed. Sediment inhibits the spawning and limits the habitat for aquatic insects, reducing the food source.<sup>1</sup>

**Existing Sediment Loads**

Glacial features largely dictate the relief in the region. Much of the Pine River/ Willow Creek watershed, including the Carpenter Creek subwatershed, is located within the Central Plains Geographic Province of Wisconsin. The land to the east of the villages of Wild Rose and Wautoma gradually flatten into a gently rolling lake plain.

As shown in Tables 3-4 and 3-6 of the Nonpoint Source Control Plan for the Pine River/ Willow Creek Priority Watershed Project, most of the sediment entering Carpenter Creek is as follows:

**Table 1. Sediment loading for Carpenter Creek.** All values are in average annual tons of sediment reaching the stream. The drainage area to Carpenter Creek is 42% of the area of Carpenter Creek subwatershed as described in the Pine River/ Willow Creek Priority Watershed Project.

	Average Annual Tons of Sediment to Stream	%
Croplands	1300	75
Pasture, grassland and other uplands	0	
Stream banks	346	20
Developed	97	6
<b>Total</b>	<b>1743</b>	<b>101</b>

The total above exceeds 100% due to rounding. All estimates of sediment load are made using the WINHUSLE Model (information on model previously submitted to EPA Region 5). This model uses results from the Universal Soil Loss Equation with runoff based on NRCS TR-55 routed from the field to the stream.

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<sup>1</sup> We also reviewed the dissolved oxygen information for Carpenter Creek. September 2004 data shows that the stream’s headwaters are naturally low in dissolved oxygen due to the headwater wetlands. The stream’s dissolved oxygen levels increase with distance from the wetlands. Thus, we do not view the older dissolved oxygen information as indicating an anthropogenic-induced impairment.

## **Total Load Capacity, Wasteload Allocation and Load Allocation**

The objective of this TMDL is to produce habitat conditions in Carpenter Creek that meet narrative water quality standards and support a cold water trout fishery, as described in NR 1.02(7)(b), Wis. Adm. Code, as follows:

“A class III trout stream is a stream or portion thereof that:

- a. Requires the annual stocking of trout to provide a significant harvest, and
- b. Does not provide habitat suitable for the survival of trout throughout the year, or for natural reproduction of trout.”

“A class II trout stream is a stream or portion thereof that:

- a. Contains a population of trout made up of one or more age groups, above the age [of] one year, in sufficient numbers to indicate substantial survival from one year to the next, and
- b. May or may not have natural reproduction of trout occurring; however, stocking is necessary to fully utilize the available trout habitat or to sustain the fishery.”

### **Total Load Capacity**

Based on a review of the data for Carpenter Creek, in the best professional judgment of Department water quality staff, the total load capacity assigned to Carpenter Creek is an average annual amount of sediment of 1272 tons<sup>2</sup>. However, the Department will monitor the stream to track the anticipated response. If the load reduction is sufficient to achieve the load capacity and the stream has not adequately responded, the load capacity will be reviewed and lowered appropriately. In the event that the stream adequately responds with a load reduction that is still above the load capacity, the Department will either pursue “de-listing” of the stream (possibly making this TMDL irrelevant) or will revise (upward) the load capacity.

### **Wasteload Allocation**

Since there are no point sources in the watershed the wasteload allocation is zero. If a point source discharge were proposed, one of the following would need to occur:

- An effluent limit of zero sediment load would be included in the WPDES permit.

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<sup>2</sup> As measured (calculated) for the mouth of Carpenter Creek.

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- An offset would need to be created through some means, such as pollutant trading.
- A re-allocation of sediment load would need to be developed and approved by EPA.

### Load Allocation

The load allocation corresponds to the total load capacity since the wasteload allocation is zero and the margin of safety is implicit. To achieve the load capacity, a 27% reduction in average annual sediment load based on mid-1990s conditions is needed. The sediment load allocation for mid-1990s conditions in the Carpenter Creek subwatershed is summarized in Table 2.

**Table 2. Sediment load allocation for Carpenter Creek.** All values are expressed in average annual tons of sediment reaching the stream.

Category	Load Allocation (Tons)	Annual Load (Tons)	Percent Reduction	Reduction in Load (Tons)	Reduced Annual Load (Tons)
Cropland and other Agricultural Lands and Uplands	X	1300	23%	298	1002
Developed	X	97	0	0	97
Stream banks (primarily agricultural)	X	346	50%	173	173
Totals:	1272	1743	27%	471	1272

*From Table 4-11 of the Nonpoint Source Control Plan for the Pine River/ Willow Creek Priority Watershed Project.*

The total annual loading capacity for sediment is the sum of the wasteload allocation and the load allocation, as expressed in the following equation:

$$\begin{array}{rcl}
 \text{Loading Capacity} & = & \text{WLA} \\
 1272 \text{ Tons/Yr} & & 0 \text{ Tons/Yr}
 \end{array}
 +
 \begin{array}{rcl}
 & & \text{LA} \\
 & & 1272 \text{ Tons/Yr}
 \end{array}$$

## **Margin of Safety**

An implicit margin of safety is used for this TMDL. Additional load reduction should be achieved through implementation of additional best management practices (BMPs) in the watershed. A primary example is the establishment of vegetative buffers along streams through programs such as the Continuous Sign-up Conservation Reserve Program and the Conservation Reserve Enhancement Program (CREP). Vegetative buffers along streams were not included in estimating the load allocations due to the fact that they could not be modeled. Presently, Waushara County and USDA agencies are implementing The Conservation Reserve Continuous Sign-up Program. Wisconsin is applying to have CREP eligible area expanded to incorporate the drainage area to Carpenter Creek.

## **Seasonal Variation**

There is no seasonal variation in the sedimentation of this stream. Sediment is a “conservative” pollutant and does not degrade over time or during different critical periods of the year. The extensive sedimentation occurs year-round. Under some stream flow regimes, sediment is deposited, and at other times, sediment is scoured and transported downstream. Much of the sediment in this stream remains within the confines of the stream until major floods scour some of the accumulated sediment. However, over time the net result has been an accumulation of sediments in and along the stream under the current amounts of sediment reaching the stream.

Undoubtedly, the amount of sediment reaching Carpenter Creek through major rainfall and snowmelt runoff events varies throughout the year.<sup>3</sup> However, most of the sediment enters during spring runoff and intense summer rainstorms. Considerable sediment also enters the stream from eroding stream banks during runoff events. The best management practices to achieve the load allocation are selected and designed to function for 10-year or 25-year, 24-hour design storms, providing substantial control for the major rainfall events.

## **Public Participation**

Consistent with the Wisconsin DNR Continuing Planning Process and as required by Sections NR 120.08 (Watershed Plans), and NR 121.07(1), (Water Quality Management Plans), Wis. Adm. Code, there was public participation on Pine River/Willow Creek Priority Watershed Project Plan. There were public meetings in the developmental stage of the plan, and a public hearing was held on the Pine River/Willow Creek Priority Watershed Project Plan on August 6, 1997. The Waushara and Winnebago Counties Land Conservation Committees, Wisconsin DNR and the Wisconsin Department of Agriculture, Trade and Consumer Protection (DATCP)

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<sup>3</sup> The reader should clearly differentiate between sedimentation – the deposition of sediment – and the sediment as a pollutant reaching the stream. The first is a year-round situation where the depth of the sediment deposition may vary in response to flood flows in the stream. The second is the pollutant itself, which reaches the stream during storm events.

approved the plan. Since the load allocation in this TMDL is consistent with the Pine River/ Willow Creek Priority Watershed Plan, the Department believes the public participation process used for the priority watershed project meets the intent of public participation requirements for a TMDL.

### **Reasonable Assurance**

There are no point sources in the watershed. So, the reasonable assurance provisions apply only to nonpoint sources. Implementation of this TMDL is provided through Wisconsin's section 319 Management Plan. The 319 Plan (approved by EPA in 2000) describes the variety of financial, technical and educational programs available in the state. In addition, the plan describes "back-up" enforcement authorities for nonpoint source management in Wisconsin. The primary state program described in the 319 Management Plan is the Wisconsin Nonpoint Source Water Pollution Abatement Program (Section 281.65 of the Wisconsin Statutes and Chapter NR 120 of the Wisconsin Administrative Code).

Specific to this TMDL, Carpenter Creek is part of a larger watershed project, the Pine River/ Willow Creek Priority Watershed Project. As part of a financing plan for priority watershed projects, long-term state cost-sharing and local staff funding was committed to the Pine River/ Willow Creek Priority Watershed Plan. A copy of the watershed plan is attached to this TMDL.

No new or additional enforcement authorities are proposed under this TMDL. However, future enforcement of nonpoint source performance standards and prohibitions will likely take place in the watershed. It is also anticipated that regulatory agricultural and non-agricultural performance standards and performance standards called for in Wisconsin Statutes will be implemented in the Pine River/ Willow Creek Watershed. Administrative rules passed by the Natural Resources Board indicate that watersheds with impaired waters will have the highest priority for enforcement.

Farmers may also enroll in the Conservation Reserve Enhancement Program or similar programs to establish vegetated buffers on cropland and marginal pastures as well as the Conservation Reserve Program, which takes highly erodible lands out of agricultural use.

Another option available to landowners in the watershed is the Targeted Runoff Management (TRM) grant program through the WDNR. The TRM program is a competitive grant program that provides financial assistance to control polluted runoff from both rural and urban sites. The grant period is two years, and the maximum cost-share rate is 70% of eligible costs.

### **Monitoring**

The WDNR intends to monitor Carpenter Creek in the summer of 2010, after implementation of the Pine River/ Willow Creek Priority Watershed Plan is complete. The monitoring will consist of metrics contained in the WDNR's baseline protocol for

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wadeable streams, such as the Index of Biological Integrity (IBI) and the current habitat assessment tool repeating the methods outlined in the Pine/ Willow/Poygan South Priority Watershed Surface Water Resource Appraisal Report. Based on the 2010 monitoring, the need for further monitoring will be determined.



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## **References**

Baun, Ken and Sarah Snowden. 1988. The Wisconsin Nonpoint (WIN) Model, Version 2.2. Pub. No. WR-207-88.

Wis. Dept. of Natural Resources. 1995. Nonpoint Source Control Plan for the Pine River / Willow Creek Priority Watershed Project. Pub. No. WR-535-01.

Fassbender, Ronald L., et al. Surface Water Resources of Waushara County, 1970. Dept. of Natural Resources.

## **Attachment**

Wis. Dept. of Natural Resources. 1995. Nonpoint Source Control Plan for the Pine River/ Willow Creek Priority Watershed Project. Pub. No. WR-535-01.

Wis. Dept. of Natural Resources. 1997. Pine/Willow/Poygan South Priority Watershed Surface Water Resource Appraisal Report.