Total Maximum Daily Load:
Otter Creek
Iowa County, WI

Otter Creek at Hwy C, Iowa Co., WI
Report prepared by Mike Gilbertson & Nicole Richmond
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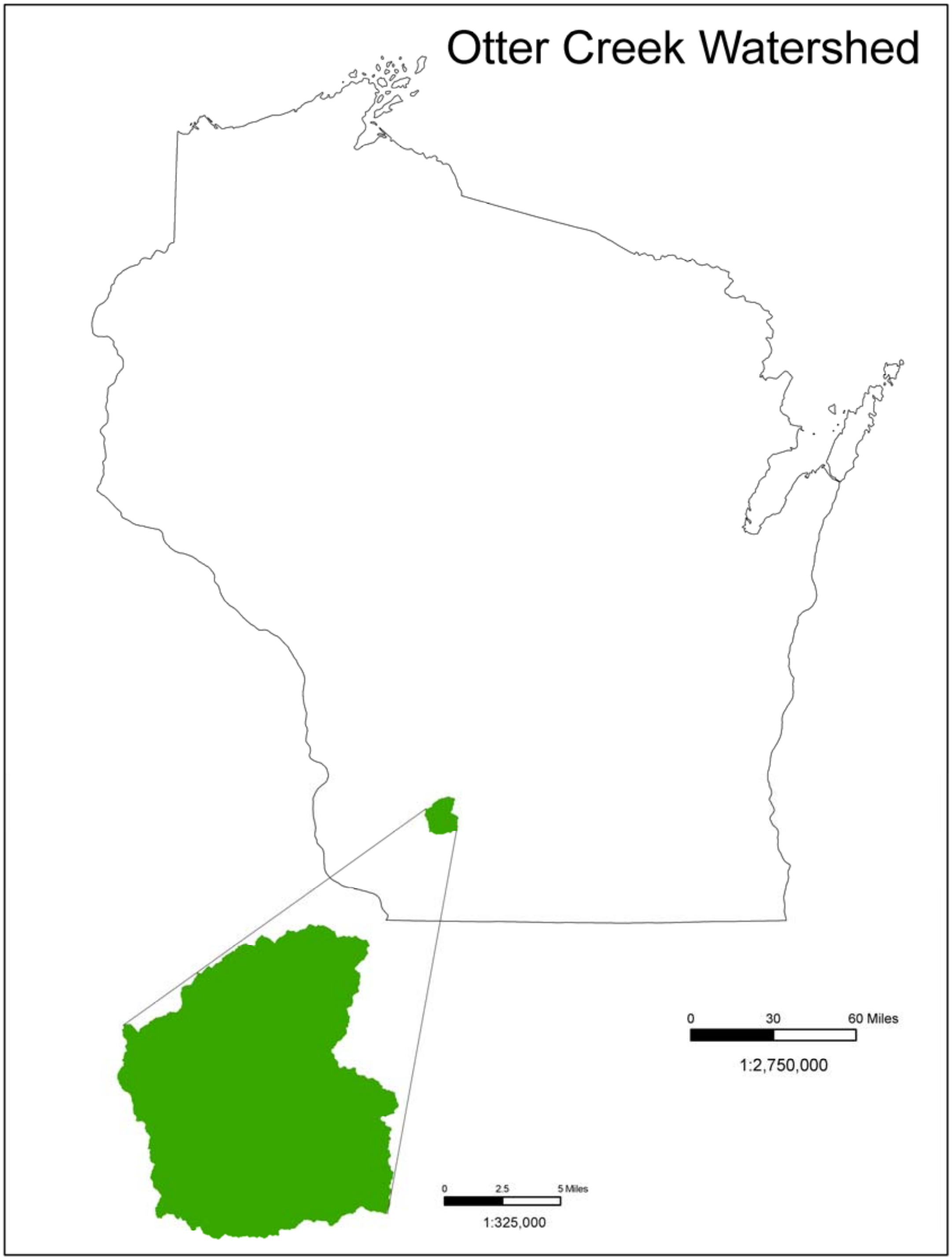
Figure 1. Otter Creek Watershed location in Wisconsin.



Wisconsin Department of Natural Resources
Bureau of Watershed Management

Sediment Total Maximum Daily Load for Otter Creek

INTRODUCTION

Otter Creek is approximately 25 miles long and located in north central Iowa County (Figure 1). The Wisconsin Department of Natural Resources (WDNR) placed Otter Creek on the Section 303(d) Impaired Waters List in 1996 as high priority due to degraded habitat caused by excessive sedimentation (Table 1). The Clean Water Act and US EPA regulations require that each state develop TMDLs for waters on the Impaired Waters List. This TMDL will identify the necessary sediment load reductions and management actions that will help restore the biological integrity of Otter Creek.

Table 1. Designated Uses of Otter Creek and Impaired Waters Listing.

Waterbody Name	WBIC	Impaired Stream Miles	Existing Use	Codified Use	Pollutant	Impairment
Otter Creek	1237100	0-14.89	WWFF	WWSF	Sediment	Degraded Habitat
Otter Creek	1237100	14.89-19.86	Cold III	Cold II	Sediment	Degraded Habitat
Otter Creek	1237100	21.37-23.3	Cold III	Cold II	Sediment	Degraded Habitat

PROBLEM STATEMENT

Otter Creek is impaired due to degraded habitat because of excessive sediment loading from surround agricultural lands to the stream. Otter Creek is not currently meeting applicable narrative water quality criterion as defined in NR 102.04 (1); Wisconsin Administrative 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 mixing zone and effluent channels 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.
(c) Materials producing color, odor, taste or unsightliness shall not be present in such amounts as to interfere with public rights in waters of the state."

Sediment is considered an objectional deposit in Otter Creek. In addition, Otter Creek is not meeting its codified fish uses. The designated uses applicable to these streams are as follows:

S. NR 102.04 (3) intro, (a), (b), (c), (4) (a), and (e2) Wisconsin Administrative 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 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 it not restricted to, surface waters identified as trout waters by the department of natural resources (Wisconsin Trout Streams, publication 6-6300(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."

Currently, Wisconsin does not have numeric water quality criteria for total suspended solids (TSS) so a numeric target for TSS was designated for the Otter Creek TMDL. The majority of the sediment loading to Otter Creek occurs during rain events, particularly in spring when less ground cover is available to shield the soil from erosive actions. A numeric target of 100 mg/L TSS (concentration) during *high flow periods* was chosen as a feasible, achievable target for this TMDL. Installing best management practices (BMPs) to control and reduce the majority of sediment entering the stream during high flow conditions to meet the TMDL, will also protect the stream during all other flow conditions, leading to less sedimentation in the stream. Over time, the stream will scour out existing sediment and expose substrate for improved habitat conditions.

OTTER CREEK BACKGROUND

Otter Creek is a 25 mile stream in Iowa County that flows north until it reaches the Wisconsin River near Lone Rock, Wisconsin (Appendix A). Otter Creek is designated as a warm water sport fish (WWSF) from stream miles 0-14.9 (Factory Road) and Cold-class II Trout from mile 14.9 to the headwaters. The stream was impounded back in the late 1960s about 19.86 miles upstream from the mouth to create the Blackhawk Lake Recreation Area. The headwaters of Otter Creek is a 3.5 mile segment above Blackhawk Lake that flows through state owned land as part of Blackhawk Lake Recreation Area.

Table 2. Otter Creek Land Use, NASS 2001 (Ag 2006).

Land Use in Otter Creek Watershed	Percent Cover
Pasture, Non-Ag.	51
Woodland	27
Ag.	17
Urban	4
Wetland	<1
Water	<1
Shrubland	<1
Barren	<1

Monitoring data was collected over the last few years to assess the stream and support TMDL development. Agricultural land use makes up 17% of the watershed and is concentrated in the middle and lower stream reaches. WDNR staff conducted a habitat survey in June 2006 about eight miles upstream from the mouth, where Spring Valley Road crosses Otter Creek. The current WDNR quantitative habitat assessment tool for wadeable streams (WDNR, 2002) scored this section of stream as having "fair" habitat. Almost 90% of the substrate is sand and fine particles. The stream section from 1 mile upstream from Spring Valley Road to the mouth are areas of excessive grazing and destabilized/eroding banks causing significant sedimentation of the stream. Above Factory Road to the headwaters of Otter Creek the stream corridor is well protected by non-agricultural pasture which also makes up the majority of the land use in the watershed (Table 2).

Water chemistry data were collected by WDNR at Hwy C (see map Appendix A) during 2006 and 2007 to assess the extent of sedimentation to Otter Creek. Water samples were analyzed for Total Suspended Solids (TSS), and the results will be applied to the continuous flow data gathered during this monitoring period in a load duration curve (LDC). The purpose of the LDC is to show when excessive sedimentation occurs under different flow conditions. The TSS concentrations throughout the range of flow conditions are indications of changes in the amount of sediment loading to the stream. During high flow conditions, higher TSS concentrations are expected as sediment loading occurs by way of erosion from stream banks and unprotected riparian sections of the watershed. An amount of sediment load to the stream that exceeds the sediment carrying capacity of the stream causes sediment deposition on the stream bed, filling in the spaces in the substrate and causing undesirable stream habitat conditions for fish and macroinvertebrates.

The result of fish assessments conducted in the lower segment of Otter Creek in 2006 scored these areas as having a "fair" warm water fish assemblage (WDNR, 2001). The majority of the fish species collected were warm water forage fish and no sport fish were captured. Based on this survey, the existing use of Otter Creek supports a warm water forage fish community rather than the WDNR designated uses of a warm water sport fish community or cold water class II trout stream. In the upstream sections of Otter Creek, fish assessments conducted in 2004 indicate "poor" coldwater fish assemblage (Lyons, et. al., 1996) . In the upstream sections, mostly warm water forage species were collected. In 2004 there were several brown trout collected, however it was discovered that the assessment done coincided with a recent trout stocking event. Fish assessments conducted in 2002, 2000, and 1999 indicate very few brown trout collected and no other cold water species were found.

Surface water temperature was monitored above Blackhawk Lake at Union Valley Road, below the lake at Plank Road, Spring Valley Road, and at Hwy C during 2006. Even though fish assemblages show that the three segments of Otter Creek are not meeting their full fish and aquatic use designations, surface water temperature monitoring data measured are consistent with the temperature characteristics for their designated use at each site. Otter Creek is not impaired for temperature, therefore, if sediment is addressed through this TMDL, and habitat approves, the fisheries could be restored to full potential.

Macroinvertebrate samples were collected at Plank Road and at Factory Road in 2006 using WDNR macroinvertebrate sampling guidance for wadeable streams (WDNR, 2000). The results of the Plank Road survey scored the water quality of this site as being "fairly poor" (HBI = 6.97)[1]. Further downstream at Factory Road the macroinvertebrate sample collected indicates "very good" water quality at this site (HBI = 4.4). Dowstream of Factory Rd. where the stream was accessible and wadeable, no cobble substrate riffle sections were found to collect a macroinvertebrate sample. The majority of the substrate below Factory Rd. has heavy sand and silt deposition.

In conclusion, the monitoring data collected support that a sediment TMDL is needed for Otter Creek. The biological parameters measured in Otter Creek (poor to fair fish assemblages, macroinvertebrate populations, habitat assessments) are directly correlated to the high TSS values measured during high flow events. With this TMDL, it is expected that as sediment loadings to Otter Creek decrease, banks stabilize, and in-stream habitat improves, the narrative water quality standard will be met and the fish and aquatic life uses will be restored.

SOURCE ASSESSMENT

Point Sources

There are no point sources, Concentrated Animal Feeding Operations (CAFOs), or permitted stormwater (MS4) communities located on or discharging to Otter Creek.

Nonpoint Sources

Agricultural runoff and bank erosion during rain events and snowmelt is the suspected cause of excessive sedimentation in Otter Creek. Due to high agricultural land use and excessive grazing in the watershed, there are several areas of exposed and eroding stream banks adjacent to Otter Creek throughout the lower impaired segment and in the lower end of the upper impaired stream segment. To investigate potential sources of the pollutant for the TMDL, a TSS load duration curve was developed based on methods

[1] The macroinvertebrate indicator of water quality at Plank Road could be misleading because of the close proximity to the Blackhawk Lake Dam. There is not enough "stream" above Plank Road to allow downstream drifting and corresponding macroinvertebrate assemblage.

outlined by Cleland (2002) and the Nevada Division of Environmental Protection (2003). To calculate the flow duration curves, continuous daily stream flow from a USGS gage station located at the furthest downstream crossing of the impaired segment on Otter Creek. Monthly TSS data were collected at the gauge site on Hwy C site by WDNR staff between 2006 and 2007 to provide the data necessary to build the load duration analysis (Appendix C). The load duration curve for Otter Creek indicates high TSS loading during high flow periods in the watershed.

LINKAGE ANALYSIS

Establishing the link between watershed characteristics and resulting water quality is a crucial step in TMDL development. By striving to return watershed characteristics closer to natural conditions, improvements in overall stream health can be achieved. However, determining natural conditions of the stream is challenging due to lack of historical information to represent conditions prior to human disturbance.

Sedimentation from stream bank erosion and runoff from agricultural practices within the watersheds are the suspected cause of habitat degradation in Otter Creek. Fine sediments covering the stream substrate reduce suitable habitat for fish and other biological communities by filling in pools and reducing available cover for juvenile and adult fish. Sedimentation of riffle areas compromises reproductive success of fish communities by covering gravel substrate necessary for spawning conditions. The filling in of riffle areas also affects the fish communities' food source, macroinvertebrates, which have difficulty thriving in areas with predominately sand and silt substrate as opposed to a substrate composed of gravel, cobble/rubble, and sand mixture. In addition, sedimentation can increase turbidity in the water column, causing reduced light penetration necessary for photosynthesis in aquatic plants, reduced feeding capacity of aquatic macroinvertebrates due to clogged gilled surfaces, and reduce the visibility of predator fish species to find prey.

The TSS sampling data that WDNR biologists conducted during 2005 and 2006 are used as an indicator of increased sediment loading to Otter Creek. As expected in a waterbody with exposed stream banks and agricultural runoff, TSS concentrations rise considerably during high flow periods compared to the TSS concentrations during normal flow, indicating increased sediment loading during high flows. As the energy of the flowing water decreases to a point where it is unable to keep the amount of existing suspended solids in suspension, the sediment loaded into the stream during the high flows will fall out of suspension and deposit onto the stream bottom. This sediment loading cycle results in a substrate dominated by silt and sand and reduces the quality of the stream habitat. In 2005-2006, we measured TSS concentrations during high flow periods at around 350 mg/L, and on average 35 mg/L during normal flow.

After best management activities have been installed in the watershed to reduce the amount of sediment loading, we will compare the post-BMP data to the TSS data collected from 2005-2006. If the proper management practices have been installed to protect the stream during high flow conditions (when the stream is most vulnerable), there will be less TSS in the stream under all flow conditions. Less sediment loading to the stream will occur, and therefore, more stream flow energy will be available to remove the existing silt and sand dominating substrate and expose more suitable habitat for fish and macroinvertebrates. To conclude, biotic integrity scores for fish and macroinvertebrate communities are expected to increase in Otter Creek as measures are taken to reduce sedimentation and embeddedness of the substrate, and practices are installed to increase stability of exposed banks.

TMDL DEVELOPMENT

A TMDL is a quantitative analysis of the amount of specific pollutants reaching an impaired lake or stream to the extent that water quality standards will be met. As part of a TMDL, the amount of pollutant that the water can tolerate and still meet water quality standards must be identified. Otter Creek habitat has been impaired by a combination of flashy flow conditions during runoff events, severe bank erosion, and excessive sedimentation covering the stream substrate. The goal of this TMDL is to reduce sediment loads to Otter Creek to a level that narrative water quality standards will be met and the biological communities in the stream will be restored to their potential.

In addition to identification of pollutant loading, a TMDL also identifies critical environmental conditions used when defining allowable pollutant levels. However, in this circumstance there is no critical condition 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. EPA acknowledges this in its 1999 Protocol for Developing Sediment TMDLs, “the critical flow approach might be less useful for the sediment TMDLs because sediment impacts can occur long after the time of discharge and sediment delivery and transport can occur under many flow conditions.” The excessive sedimentation is a year-round situation. This is not to say that there is no variation in the sediment carried via runoff to a stream (refer to Seasonality Section below).

For the Otter Creek TMDL, a load duration curve was developed using two years of continuous flow monitoring data measured by a USGS flow gage and two years of monthly water quality grab samples analyzed for TSS collected at HWY C (more data would be ideal however, resources for this project were limited). Two years of continuous flow monitoring and monthly grab samples provide an efficient data set capable of producing a load duration curve (Cleland, personal communication). TSS samples were collected at the furthest access point downstream (Hwy.C). These samples capture help describe the “total” sediment load to Otter Creek from the majority of the watershed upstream of Hwy. C. A water quality duration curve was created using TSS samples collected over the 2 years of monitoring and the flow data that was organized to show a percentage of days that flow exceeded to indicate the type of flow conditions over this monitoring period (Appendix C). For example, the high flow period indicates the highest 10% of flow recorded over the 2 year monitoring period. It is important to show the difference in TSS at different flow periods to be able to see where the majority of sediment loading is occurring.

Otter Creek, consistent with most nonpoint source agriculture dominated watersheds, receives excessive sediment loading during high flow periods. This critical time of event-driven loads is targeted by our numeric TSS target of 100 mg/L for this TMDL. Sediment management activities installed to achieve the 100 mg/L TSS target in high flow conditions will also reduce the sediment load during other flow conditions. The 100 mg/L TSS target was then used to develop a load duration curve based on the 2 years of flow data. The daily load was calculated using the following equation:

Discharge (cfs) x TSS (mg/L) x 5.396 (conversion factor[2]) = TSS load (lbs/day)

The daily TSS loads were then plotted to establish the load duration curve. The curve represents the loading capacity for the water body. However for purposes of establishing a discrete TMDL value (the loading capacity is the TMDL) we chose to divide the curve into five flow regimes (high flows, moist conditions, normal flows, dry conditions, and low flows). The five flow regimes (or some say five flow zones) represent general categories of stream conditions that are useful to understanding where the majority of loading occurs. The median TSS loading concentration within each flow zone was selected as the loading capacity to account for the natural variation within each sample of each flow zone, and to allow for easier comparisons between flow zones. The margin of safety (MOS) was determined after the loading capacities were established (see MOS section below). Since the WLA is zero, after MOS is incorporated into the TMDL, the remainder of the load is assigned to the load allocation (i.e. agricultural nonpoint sources).

ALLOCATIONS

The total daily loading capacity for TSS is the sum of the wasteload allocations for permitted sources, the load allocations for nonpoint sources, and the margin of safety, as generally expressed in the following equation:

TMDL Load Capacity = WLA + LA+ MOS

WLA = Wasteload Allocation
LA = Load Allocation
MOS = Margin of Safety

WLA

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

- An effluent limit of zero TSS would be included in the WPDES permit.
- An offset would need to be created through some means, such as pollutant trading.

[2] 5.396 is a conversion factor derived from the equation 1 lb / 454,000 mg x 28.32 liters / cubic foot x 86,400 seconds / day.

- A re-allocation of TSS load would need to be developed and approved by EPA.

LA

The load allocation (LA) component defines the load capacity for a pollutant that is related to nonpoint source pollution. The LA was calculated by subtracting the margin of safety (MOS) from the TMDL for each flow zone. To achieve the TSS LA, sediment load reductions are necessary in the agriculture land use areas of these watersheds. The LA is based on a reduction of wet-weather runoff event sediment loads with a goal of a median stream concentration of 100 mg/L for Otter Creek. It is important to note that these values target high flow periods that occur during 10% of the flow regime. For 90% of the time, TSS concentrations are typically less than 100 mg/L in Otter Creek. See Table 3 below for the load allocations for Otter Creek as determined by the load duration curve in Appendix C.

MOS

The margin of safety (MOS) accounts for the uncertainty about the relationship between the pollutant of concern and the response in the waterbody. For the Otter Creek TMDL, an explicit MOS is provided for each of the flow periods of the TSS load duration curve. In this TMDL, the MOS was calculated based on the difference between the loading capacity as calculated at the mid-point of each flow zone and the loading capacity calculated at the minimum flow of each zone. The midrange flows and loading were used for each flow zone to account for the uncertainty in the range of values associated for each flow zone. The MOS assures that load allocations will not exceed the load associated with the minimum flow in each zone and recognizes that water quality varies over different flow conditions (See Table 3 for the MOS for Otter Creek, reference: EPA 841-B-07-006, 2007).

TOTAL LOAD CAPACITY

The total loading capacity was captured for this TMDL using a water quality duration curve (see Appendix C for Load Duration Curve). For Otter Creek, it is evident that TSS concentrations are highest during event flows as a result of runoff from agriculture fields, stream bank erosion, and factors such as re-suspension of sediment from channel scour.

Based on the understanding that the majority of sediment loading to this stream is occurring during rain and snowmelt events, the sediment loading capacity for Otter Creek was based on (1) the amount of sediment reduction needed to be less than the estimated median observed sediment load during high flow periods (2) the condition that the median values for other flow regimes will not be exceeded. For this waterbody, it was decided that the target TSS concentration during all flow conditions in Otter Creek is 100 mg/L. WDNR recognizes that 100 mg/L TSS during high flow conditions is a reasonable and feasible water quality target based on the land use in this watershed. Meeting this target under high flow conditions and *not increasing current loading under other flow regimes* will prevent excessive sedimentation of this stream. Over time as stream scouring occurs during high flows, habitat such as gravel and cobble substrate will be exposed and available for fish and macroinvertebrate communities. Management practices installed to lower TSS concentrations during high flow conditions will also work effectively to reduce TSS concentrations during the remaining flow conditions. TSS loading throughout all of the flow conditions was estimated using the continuous flow data and the 100 mg/L target concentration. The TMDL for TSS is the allowable load calculated at the median flow for the respective flow zone for each stream. The TMDL and associated allocations for Otter Creek are listed in Table 3.

Table 3. TMDL Summary for TSS in Otter Creek[3].

TMDL Component	High	Moist	Mid	Dry	Low
Current Load (tons/day)	**174.2**	**11.2**	**12.8**	**2.5**	**No Data**
TMDL = LA + WLA + MOS (tons/day)	**47.2**	**25.1**	**14.8**	**11.6**	**10.0**
LA (tons/day)	**36.1**	**17.0**	**13.0**	**10.5**	**8.1**
WLA (tons/day)	**0**	**0**	**0**	**0**	**0**
MOS (tons/day)	**11.1**	**8.1**	**1.8**	**1.1**	**1.9**

SEASONALITY

Although sediment as a pollutant reaches Otter Creek under high flow events such as storms and runoff, there is no seasonal variation in the sedimentation of these streams. The impairment that excessive sediment causes in streams exists in all seasons. Under some flow regimes, sediment is deposited, and at other times, sediment is scoured and transported downstream. Sediment is considered a “conservative” pollutant and does not degrade over time. Sedimentation is a year round situation in which the depth of sediment on the stream bed varies under response of flood flows in the stream. Much of the sediment in these systems remains within the confines of the stream until major floods scour some of the accumulated sediment. 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.

REASONABLE ASSURANCE

To ensure the reduction goals of this TMDL are attained, best management practices (BMPs), such as streambank protection and riparian buffers, must be implemented and maintained to control sediment loadings from nonpoint source pollution (there are currently no point sources discharging sediment to Otter Creek). Many of these restoration and management measures require local participation to properly implement. Without local participation, it is likely that the reduction goals of the TMDL will not be attained.

The WDNR and Iowa County Land Conservation Department (LCD) will implement the state agricultural and non-agricultural performance standards and manure management

[3] This TMDL addresses the entire stream of Otter Creek (all 3 segments). Water quality and flow monitoring data is representative of the entire watershed since samples were collected at the most downstream, accessible site.

prohibitions listed in Chapter NR 151, Wisconsin Administrative Code, to address sediment in the Otter Creek watershed. Many landowners voluntarily install BMPs to help improve water quality and comply with the performance standards. Cost sharing is available for many of these BMPs. In most cases, farmers cannot be required to comply with the agricultural performance standards and prohibitions, unless they are offered at least 70% cost sharing.

The *Iowa County Land & Water Resource Management (LWRM) Plan* workplan for 2008-2013 includes goals that address reductions for sediment loadings. The county's LWRM Plan also includes a strategy to implement the state performance standards and prohibitions.

The Iowa County LCD and other local units of government may apply for Targeted Runoff Management (TRM) Grants through the WDNR. The TRM Grant Program provides competitive cost-sharing grants to support small-scale, 2-year projects to reduce nonpoint source pollution. TRM Grants fund up to 70% of eligible project costs, with the grant amount capped at $150,000.

In addition to the implementation of state performance standards and WDNR cost-sharing programs, there are several federal and local programs that may assist in implementing this TMDL:

Conservation Reserve Program
The Conservation Reserve Program (CRP) is a federal, USDA program that provides annual rental payments for taking environmentally sensitive cropland out of production for 10 to 15 years. This land is usually highly erodible. The land must be planted and maintained in vegetative cover consisting of certain mixtures of trees, shrubs, forbs and/or grass species. Cost-sharing incentives and technical assistance are provided for planting and maintenance.

Conservation Reserve Enhancement Program
The Conservation Reserve Enhancement Program (CREP) is a joint federal, state, and local program that provides annual rental payments up to 15 years for taking cropland and marginal pasture adjacent to surface water out of production. A strip of land adjacent to the stream must be planted and maintained in vegetative cover consisting of certain mixture of trees, forbs and/or grass species. This land is highly sensitive and, by putting land into this program, there is less sediment and nutrients getting into streams. Cost-sharing incentives and technical assistance are provided for planting and maintenance of the vegetative strips. Landowners also receive an upfront, lump-sum payment for enrolling in the program, with the amount of payment dependant on whether they enroll in the program for 15 years or permanently.

Environmental Quality Incentives Program
The Environmental Quality Incentives Program (EQIP) is a federal, NRCS program that provides technical assistance and cost sharing to farm operators to install conservation

practices to reduce soil erosion and polluted runoff delivery to ground and surface waters. Farmers compete annually for the limited funds.

Farmland Preservation Program

The Farmland Preservation Program is a state program that provides tax relief to farmland owners for maintaining their land in an agricultural use. To remain eligible for tax relief, program participants must comply with “Soil and Water Conservation Standards” that include the state agricultural performance standards and prohibitions.

LWRM Plan Implementation Cost-sharing Program

This cost-sharing program is administered by the Iowa County LCD and Wisconsin Department of Agriculture, Trade, and Consumer Protection (DATCP). DATCP annually provides funds for landowners to cost share the installation of conservation practices that are needed to accomplish the goals and objectives of the County’s LWRM Plan. The cost-share funds can be used throughout the county but are often targeted to certain areas or resource concerns.

Managed Forest Law Program

This WDNR program provides a reduction in property taxes to woodland owners if they enroll their woodland in it for 25 to 30 years and develop and follow a forestry management plan. Technical assistance to develop the plans is provided by private consulting foresters and reviewed by WDNR foresters. Woodlands cover must cover at least 10 contiguous acres to be eligible. Any sites with erosion problems are noted in the plan.

Wildlife Habitat Incentive Program

The Wildlife Habitat Incentive Program (WHIP) is a federal, USDA program that provides cost-sharing payment to landowners for developing or improving fish and wildlife habitat on almost all types of land including cropland, woodlands, pastures, and streams. Practices used for development and improvement of habitat include: native plant community establishments, fencing of livestock out of sensitive areas, and in-stream structures for fish.

MONITORING

The WDNR will monitor Otter Creek based on the rate of implementation of the TMDL. Monitoring will continue until it is deemed that the stream has responded to the point where it is meeting its codified use or until funding for these studies are discontinued. In addition, the stream will be monitored on a 5 to 6 year interval as part of a special project strategy to assess temporary conditions and trends in overall stream quality. The monitoring will consist of metrics contained in WDNR’s baseline protocol for wadeable streams, such as the Index of Biotic Integrity (IBI), the Hilsenhoff Biotic Index (HBI), the current habitat assessment tool, and sampling of water quality parameters at a subset of sites.

PUBLIC PARTICIPATION

The Otter Creek TMDL was subject to public review from June 11, 2008 to July 14, 2008. A press release was sent to: newspapers, television stations, radio stations, interest groups, and interested individuals in the south-central region of the state. The news release indicated the 30-day public comment period and how to obtain copies of the public notice and the draft TMDL. The news release, public notice, and draft TMDL were also placed on the DNR's website:
http://dnr.wi.gov/org/water/wm/wqs/303d/Draft_TMDLs.html
No public comments were received on this TMDL. EPA comments are addressed below in Appendix E.

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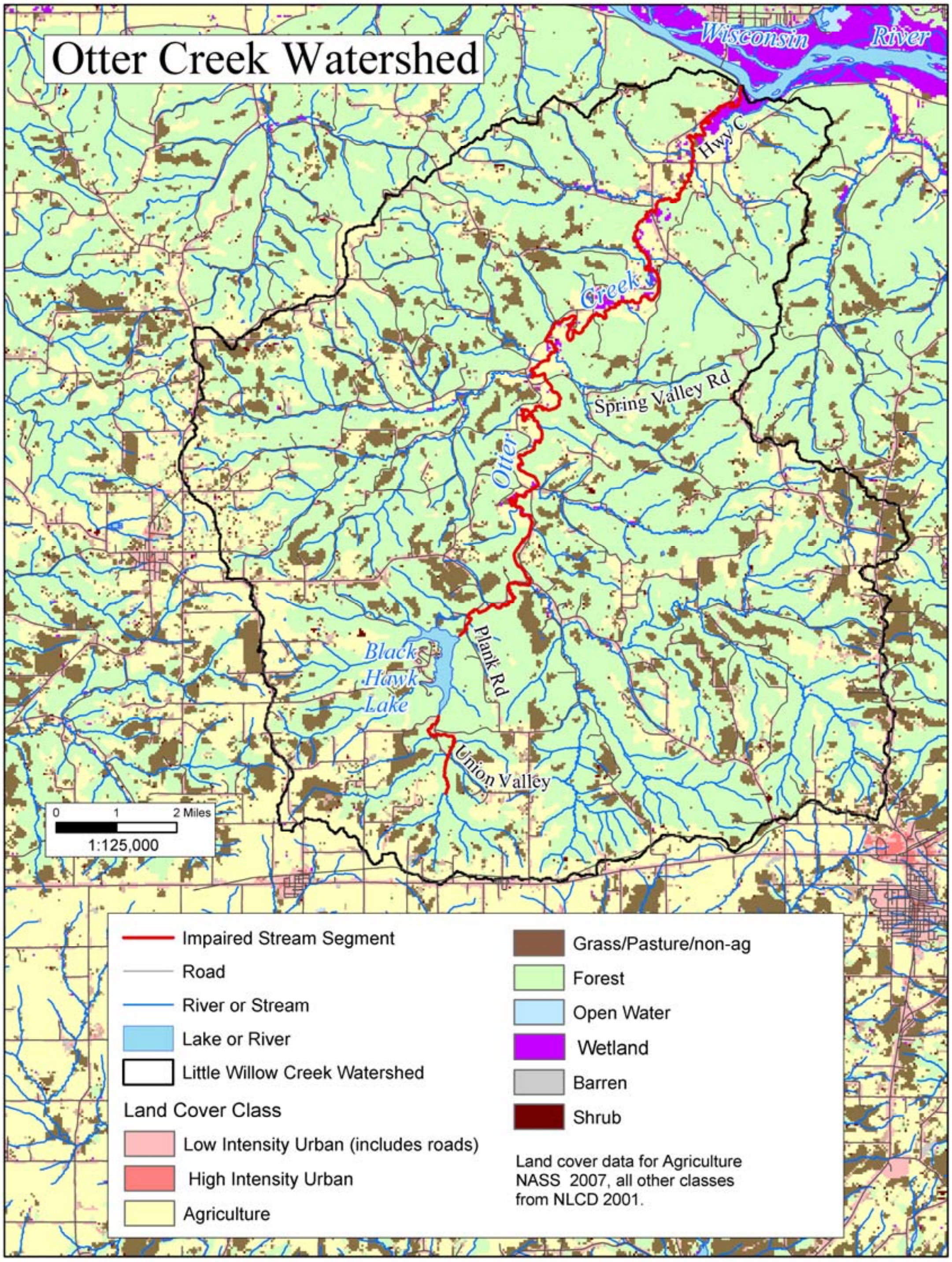
APPENDIX A: OTTER CREEK WATERSHED LAND USE



APPENDIX B: STREAM CLASSIFICATION AND DESCRIPTION

Wisconsin Stream Use Classifications

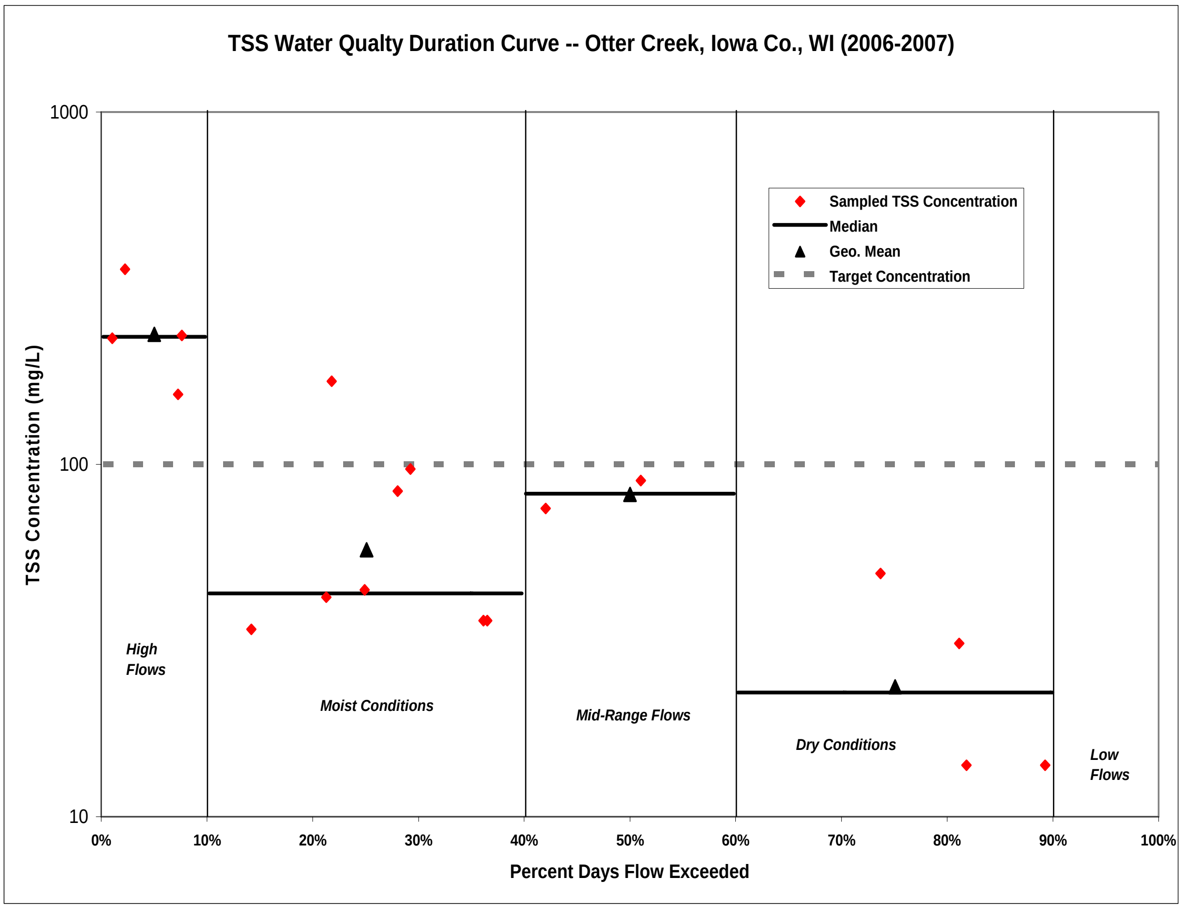
Stream Use Classification	Description
Cold	Cold water community; includes surface waters that are capable of supporting a cold water fishery and other aquatic life and serving as a spawning area for cold water species. This includes three levels of cold water classification (Class I, II, or III).
WWSF	Warm water sport fish communities; includes surface waters capable of supporting a community of warm water sport fish or serving as a spawning or nursery for warm water sport fish.
WWFF	Warm water forage fish communities; includes surface waters capable of supporting an abundant and diverse community of forage fish and other aquatic life.
LFF	Limited forage fishery; (intermediate surface waters (INT-D) includes surface water of limited capacity because of low stream flow, naturally poor water quality or poor habitat. These surface waters are capable of supporting only a limited community of tolerant forage fish and aquatic life.
Default	Water bodies with no reference are considered to be “default” waters and are assumed to support either a coldwater community, warmwater sportfish community, or a warmwater forage fish community depending on water body-specific temperature and habitat limitations.

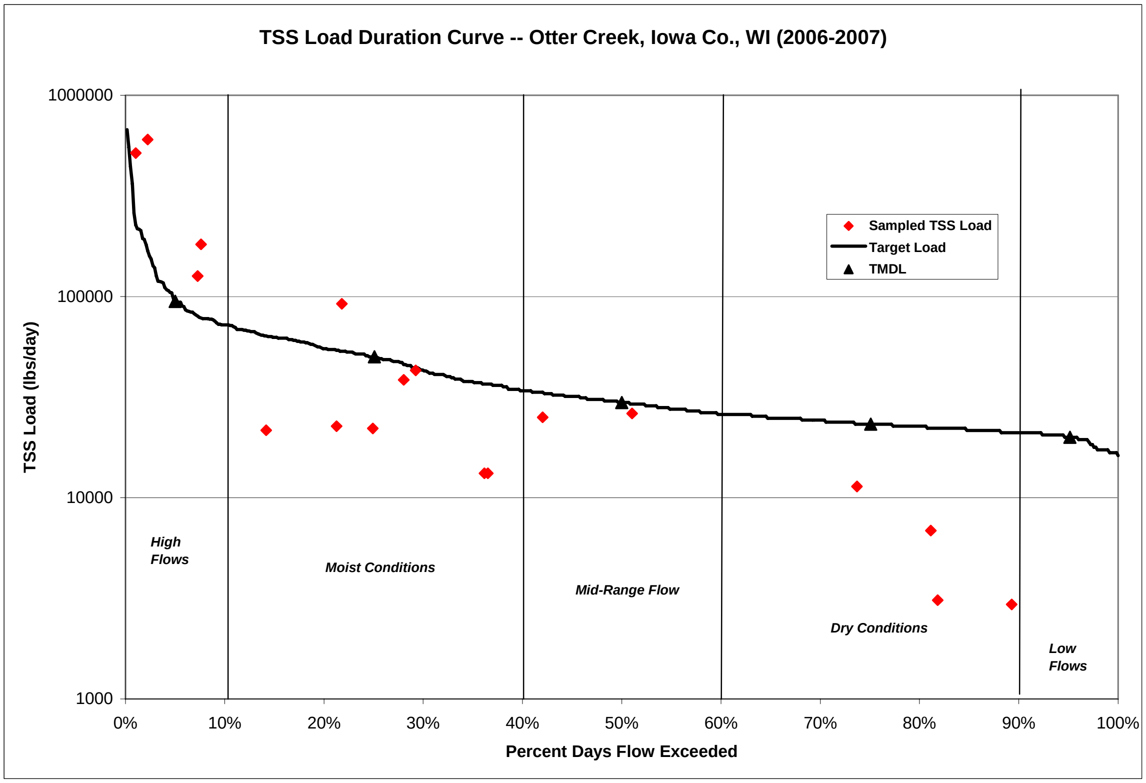
Wisconsin Trout Stream Classifications

Trout Stream Classification	Description
Class I	These are high quality trout waters, having sufficient natural reproduction to sustain populations of wild trout at or near carrying capacity. Consequently, streams in this category require no stocking of hatchery trout. These streams or stream sections are often small and may contain small or slow-growing trout, especially in the headwaters.
Class II	Streams having this classification may have some natural reproduction but not enough to utilize available food and space. Therefore, stocking is sometimes required to maintain a desirable sport fishery. These streams show good survival and carryover of adult trout often producing some fish of better than average size.
Class III	These waters are marginal trout habitat with no natural reproduction occurring. They require annual stocking of legal-size fish to provide trout fishing. Generally, there is no carryover of trout from one year to the next.

APPENDIX C: LOAD DURATION CURVE

Flow duration curves display the cumulative frequency of the distribution of the daily flow for the period of record. Flow duration curves are transformed into load duration curves by multiplying the flow values along the curve by the respective pollutant water quality target and appropriate conversion factors. The x-axis represents the flow recurrence interval and the y-axis represents the allowable load for the water quality parameter. The measured pollutant loading points that are plotted above the target line on the load duration curve exceed the pollutant water quality target level; those that fall below the line meet the pollutant water quality target. The flow duration interval (%) is derived from a set of average daily flow data, and indicates the percent of days where flow was exceeded (0% indicates the highest flow periods or “flood conditions”, and 100% indicates the lowest flow periods or “dry conditions”).




TSS Load Duration Curve -- Otter Creek, Iowa Co., WI (2006-2007)
Sampled TSS Load
Target Load
TMDL
1000000
100000
10000
1000
TSS Load (lbs/day)
High Flows
Moist Conditions
Mid-Range Flow
Dry Conditions
Low Flows
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent Days Flow Exceeded

APPENDIX D:
PHOTOGRAPHIC DOCUMENTATION OF SEDIMENTATION DURING HIGH FLOWS

Figure D-1. Otter Creek upstream of Hwy C during normal flow conditions.

Figure D-2. Upstream of Hwy C, turbid water during high flow periods on Otter Creek.

Figure D-3. Upstream at Hwy C, turbid water during high flow periods on Otter Creek.

Figure D-4. Downstream at Hwy C., turbid water during high flow periods on Otter Creek.

Figure D-5. Downstream at Hwy C., turbid water during high flow periods on Otter Creek.

Figure D-6. Turbid water discharge from Otter Creek to the Wisconsin River at the confluence.

Appendix E - EPA Comments and WDNR Responses
Otter Creek TMDL

Compiled by Mike Gilbertson & Nicole Richmond, August 14, 2008

1. Table 1:

a. Do the impaired water bodies, as identified in Table 1, match Wisconsin's 2006 list? Match Wisconsin's 2008 list?

WDNR: The listing of Otter Creek was updated for Wisconsin's 2008 Impaired Waters List. The segments of Otter Creek listed in this report our consistent with the most recent list submittal (August 1, 2008).

2. Problem Statement section:

a. Sentences just below the narrative standard quotes in Problem Statement section: WDNR states that Otter Creek is not meeting its codified fisheries uses. How do we know that the uses are not being met? The State's discussions in Otter Creek Background section should be used to support the impairments being addressed by these TMDLs.

WDNR: Results of fish assessments conducted in the lower segments show this waterbody supporting warm water forage species, not sport fishery or cold water species as described in the codified uses column in Table 1. Text was added to the document.

b. Is the Wisconsin Trout Streams, publication 6-6300(80) the commonly referred to "1980 Trout Book"?

WDNR: Yes, this reference was added to the report.

c. Since you talk about the water quality standards in this section you should include the TMDL numeric target and how that target will achieve the applicable water quality standards. This discussion could also be included in the linkage analysis section or even in the TMDL development section.

WDNR: Text was added to include the numeric target for this TMDL and how this will achieve water quality standards.

3. Otter Creek Background section:

a. Clearly connect the data discussions in this section to the degraded habitat impairment, the narrative water quality standard for sediment and the TSS loads being established as the TMDL.

WDNR: Text was added to address this comment.

b. Where is Hwy C? Hwy C is mentioned in the discussion of the water chemistry data.

WDNR: A new map was created to include road names, see Appendix A.

c. Explain how water chemistry data mentioned in third paragraph supports impairments. Since the water chemistry data is TSS a linkage between TSS and sediment and the degraded habitat impairment is necessary.

WDNR: Text was added to describe TSS loads and habitat impairment.

d. The fourth paragraph indicates that uses are being met or at least that temperature characteristics are consistent with designated uses. Are you referring to the designated uses for each of the three impaired water body segments or just at the monitoring locations? The report should go on to say even though the temperatures are consistent with uses for these reasons, and then list the reasons or explain why, WDNR does not consider the designated uses as being met.
WDNR: This was stated more clearly in the text.
e. Explain how the macroinvertebrate samples of 2006 support the impairments.
WDNR: Text was added to address this comment.
f. When was the fish assessment conducted? This fish assessment provides support for the designated uses not being met but in which of the three impaired segments or in all three?
WDNR: Text was added to address this comment.

4. Point Sources section: Please confirm that there are no CAFOs of MS4 communities that need to be considered when establishing these TMDLs.
WDNR: This was confirmed and text was added to address this comment.

5. Linkage Analysis section: As stated earlier in these comments, a linkage analysis needs to be made between the impairments and pollutants identified on the 303d list, i.e., degraded habitat and sediment, respectively, and the applicable water quality standards and the pollutant that the State is establishing the TMDL, i.e., TSS. The discussion already does a good job discussing the problems associated with increase sedimentation but there is no clear discussion of a linkage to TSS. The selection of 100 mg/L TSS as the target could also be included in this discussion.
WDNR: Text was added to describe how TSS will be used as an indicator of sediment loading. TSS will not be used to describe sedimentation because other factors influence the rate of sedimentation. Once best management practices have been installed in the watershed to reduce sediment loading, TSS concentration will be measured again to see the improvement.

6. TMDL Development section:
a. This section should clearly explain how the TMDL was developed.
WDNR: The text was improved to clearly explain how the TMDL was developed for Otter Creek.
b. As mentioned above, a rationale for the period of flow record needs to be included. Why X number of years were used. In this TMDL it appears that two years of record were used. Why 2 and not 10 or 30 years? Also, if you are using only one gage does that gage account for flow other than Otter Creek flow? If yes, how did WDNR account for the additional flow? Were any drainage area ratios calculated and applied to the overall flow at the gage?
WDNR: Text was added to address this comment.

7. Allocations section:
a. This section explains how total annual loading capacities for sediment and phosphorus are calculated. The only TMDLs provided are for TSS, not sediment and phosphorus.

Therefore, the introduction should be consistent with the actual loads being established (see table 3 of TMDL report for TSS loads, not sediment or phosphorus).
WDNR: This TMDL is only addressing sediment. Any references to phosphorus were removed.
b. The TMDL is establishing daily loads not total annual loads so the first sentence should be changed to state daily loading capacities not total annual loading capacities.
WDNR: Text was changed to address this comment.
c. The third bullet of the WLA section should change sediment to TSS since only TSS loads are established and it is these TSS loads that would need to be re-allocated if new point sources were established.
WDNR: Text was changed to address this comment.
d. LA allocation section should clearly explain how the LA was established.
WDNR: Text was added to address this comment.

8. MOS section: Add a few sentences identifying what uncertainty exists in the TMDL and how accounting for flow at the low end of each zone accounts for this uncertainty.
WDNR: Text was added to explain the use of midrange values for each zone to account for the uncertainty in the range of data for each flow zone.

9. Total Load Capacity section:
a. Last sentence should read "The loading capacity and allocations" or the "The TMDL and associated allocations". The terms TMDL and loading capacity mean the same, both mean the maximum amount of a pollutant that a water body can assimilate and still attain water quality standards.
WDNR: Change was made, thanks.
b. Second paragraph, first sentence, (1): what amount less than the estimated median and why is that amount less reasonable?
WDNR: This section was re-worded to be easier to understand by the reader. The "amount" is meant to mean the load capacity. We want the loading capacity to be less than the median so that there is an overall reduction of sediment loading/TSS reduction in Otter Creek during high flow conditions.
c. Third sentence from the end of the second paragraph states that continuous flow data was used to estimate the TSS loading. Is this continuous flow data for two years or a longer period of record?
WDNR: Continuous data for 2 years.
d. Table 3: The mid-flow zone column does not add correctly. Either 14.8 should be 14.9 or 1.9 should be 1.8.
WDNR: Correction made.
e. The loading capacities and allocations in Table 3 are applicable to each of the three impaired segments identified on Table 1 or to the entire 23.3 miles of Otter Creek?
WDNR: The load capacity was estimated based on the TSS samples collected at HWY C (the furthest downstream monitoring point), so this load capacity applies to what is measured at HWY C, and therefore applies to the entire stream as a whole. Footnote added to Table 3.

10. References: Do you know if the June 2002 Guidelines for Evaluating Habitat of Wadable Streams is a guidance that EPA reviewed, concurred with, approved?
WDNR: EPA has approved Wisconsin's monitoring strategy which includes Wisconsin's guidance for field work (collection methods for fish, habitat, macroinvertebrates,etc.)
Is this the guidance used to direct your fish assessment, habitat survey and macroinvertebrate sampling discussed in the Otter Creek Background section of the report?
WDNR: No, fish assessments and macroinvertebrate sampling have their own guidance documents. References for these have been added.

11. Appendix A: Is Black Hawk Lake included in any of the impaired segments? If not, has Black Hawk Lake been assessed, if yes, is it impaired? If yes, what are the identified impairments?
WDNR: Blackhawk Lake is not currently on the 303(d) list nor included in this TMDL assessment and report.

12. First sentence of Total Load Capacity section should state, "load duration curve" instead of "water quality duration curve". --
WDNR: The water quality duration curve is different than the load duration curve and is used to quantify the median loads for each flow zone and therefore the load capacity. The load capacity is then plotted in the load duration curve.