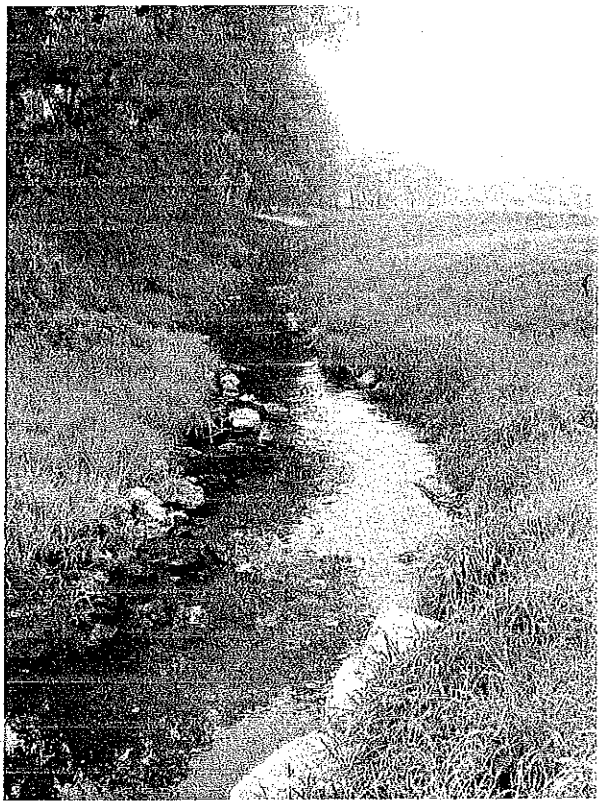
Rehabilitation of the West Branch Sugar River

Dane County, Wisconsin
Waterbody Index Code: 886100

A Documentation for Removal from the State of Wisconsin's List of Impaired Waters



Wisconsin Department of Natural Resources
South Central Region
April, 2004

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A Documentation for Removal
from the
State of Wisconsin's List
of Impaired [303(d)] Waters

Prepared by

Wisconsin Department of Natural Resources
South Central Region

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A special thanks to all the partners who helped make this project possible:

USDA Natural Resources Conservation Service
Upper Sugar River Watershed Association
Deer Creek Sports and Conservation Club
Southern Chapter Trout Unlimited
Badger Fly Fishers
Dane County Conservation League
Madison Fishing Expo
Participating Landowners

Introduction

Based on monitoring by department staff, three formerly impaired segments of the West Branch Sugar River are now meeting attainable use. Therefore we recommend these three segments be removed from the state's list of impaired waters. The following documentation provides supporting information for this decision.

The primary staff responsible for this project were Michael Sorge, a professional hydrologist and water resources biologist in the department's South Central Region for over 10 years, and Patrick Sutter, a conservation technician with the Dane County Land Conservation Department. Pat is certified in conservation planning and has engineering approval for streambank protection and restoration. He has worked on projects such as these for over 15 years.

Stream Classification

The West Branch of the Sugar River rises near the southwest limits of the Village of Mount Horeb and proceeds southeast for 21 miles where it flows into the Sugar River just upstream from Lake Belleview (Figure 1). It drains 66.6 miles of southwest Dane County and has a gradient of 7.5 feet per mile (WDNR, 1985). The Mount Horeb wastewater treatment plant is the only permitted facility discharging effluent to the headwaters of the West Branch Sugar River. While the upper watershed is receiving development pressure, most of the stream flows through agricultural lands.

The stream is currently classified as a limited forage fishery from it's headwaters downstream 2 miles (Table 1). The next 11 miles, from Barton Road to State Highway 92, are a default warm water forage fishery. The next 5.5 miles from Mount Vernon Creek to County Highway PB are classified as a cold water Class II trout fishery. The final 2.5 miles from Highway PB to the mouth is considered a default warm water sport fishery. With the exception of the lower 2.5 miles, the rest of the stream has the potential to be a cold water, trout fishery (WDNR, 2004). In 1998, three segments of the river were put on the state's list of impaired waters due to severe nonpoint source pollution causing a failure to meet its potential. The stream was impacted by streambank erosion, overgrazed pastures, unrestricted cattle access, barnyard runoff, gully erosion, and sediment deposition from uplands, all of which resulted in the destruction of in-stream habitat.

Table 1: West Branch Sugar River Designations

Stream Mile (from mouth)	Previous Use	Current Use	Codified Use	Proposed Codified Use	Use Impair-ment - Source	Use Impair-ment – Impact
19-21	WWFF	COLD II	LFF	COLD II	NPS	Habitat
8-19	WWFF	COLD II	DEF	COLD II	NPS	Habitat
2.5-8	COLD	COLD II	COLD	Same	NPS, HM	Habitat
0-2.5	WWSF	WWSF	DEF	Same	NPS	Habitat

Shaded areas indicate the segments which were on the 303(d) list
See Appendix A for description of abbreviations

indicator species such as brook lamprey and mottled sculpin were found. This is likely due to the inputs of cold water from spings and Mount Vernon Creek at or about State Highway 92 (WDNR, 1985). Above mile 10.3 (County Highway U), only forage fish were found and most of those were eurythermal, tolerant species such as white sucker, creek chubs and fathead minnows (See Appendix C).

In 1997, Sorge conducted a watershed assessment that included fish surveys at 5 different locations on the West Branch Sugar River (Table 3). The survey showed that the numbers of intolerant coolwater species had increased over the past 20 years. This is likely an indication that the BMPs placed on surrounding lands improved groundwater flows to the river and further indicated the its potential as a cold water fishery. The Coldwater Index of Biotic Integrity (IBI) ratings developed by Lyons, et. al. (1996) were poor at all the sites as eurythermal tolerant species were still predominant at most segments and habitat was lacking to sustain a number of top level carnivores such as brown trout.

Table 3: Species List and Coldwater IBI – West Branch of the Sugar River, 1997

Species	Fritz Road	STH 92	CTY U	Primrose Ctr	CTY G
Brown Trout	17	35	23	7	11
Mottled Sculpin	21	11	135	186	988
White Sucker	51	64	100	53	405
Creek Chub	21			6	11
Rainbow Trout			1		
Bluntnose Minnow	6				
Central Mudminnow	2				6
Common Carp	23	11			
Northern Hogsucker	1				
Shorthead Redhorse	1				
Green Sunfish	2		1		
Bluegill				1	
Brook Stickleback					2
Coldwater IBI	10 (Poor)	20 (Poor)	20 (Poor)	20 (Poor)	20 (Poor)

Macroinvertebrates

Water quality surveys using macroinvertebrates as an indicator have been conducted on the river since 1979. The biotic index for macroinvertebrates was developed by Hilsenhoff (1977, 1982, and 1987) and has widely been used in Wisconsin to evaluate water quality of streams. The index is calculated by assigning tolerance values to aquatic macroinvertebrate species ranging from 0-10 based on their tolerance to organic and nutrient pollution. The macroinvertebrate richness has ranged from fair to very good for most sites over that time (Table 4), indicating that the river is receiving some, but not significant, organic pollution.

Table 5: Continued

Year	River Segment	BMPs and other installations	Funding (Dollars)
2001	Britt Valley Region Upstream from County Highway G	6,285 feet of riprap and edging 15,902 feet of shaping and seeding 3,000 feet of permanent fencing 20 acres of critical seeding 302 fish habitat structures	DNR TRM = 150,000 *In-kind labor and funds*: DNR Trout Stamp = 20,000 Deer Creek SC = 23, 168.50 USRWA = 19,419 Madison Fishing Expo = 2,500 Badger Fly Fishers = 2,500 USRI = 3,733 Dane Co. Cons. League = 1,500
2002	County Highway U upstream to Primrose Center Road	3,000 feet of riprap and edging 11,205 feet of shaping and seeding 13 acres of critical seeding 240 fish habitat structures	DNR TRM = 119,330.50 *In-kind labor and funds*: USDA WHIP = 24,758 USRWA & Deer Creek SC = 48,000
2003	Primrose Center upstream County Highway G	1,700 feet of riprap and edging 12,000 feet of shaping and seeding 12 acres of critical seeding 186 fish habitat structures	DNR TRM = 100,617 *In-kind labor and funds*: USRWA = 22,771 Deer Creek SC = 20,478

Post-rehabilitation Monitoring

Habitat

The DNR conducted pre- and post-rehabilitation monitoring on the sections of river to gage the effectiveness of the project. In 2000, Sorge (unpublished data) monitored the habitat at 3 sites on the West Branch Sugar River using a protocol developed by Simonson et. al. (1994). Habitat scores prior to the project ranged from poor to good. Post-rehabilitation scores ranged from good to excellent (Table 6 and Appendix D).

Table 6: Pre and Post Rehabilitation Habitat Evaluation – West Branch Sugar River

Site	Pre-rehabilitation	Post-Rehabilitation
State Highway 92	58 (Good)	78 (Excellent)
Upstream State Highway 92 (upstream of cattle crossing)	38 (Fair)	60 (Good)
Downstream from County Highway U	20 (Poor)	65 (Good)

Qualitative Ratings: Excellent ≥75; Good 50-74; Fair 25-49; Poor < 25

Fisheries

The DNR conducted pre- and post-rehabilitation monitoring on 12 sites along the West Branch Sugar River between 2000 and 2003. Monitoring on some sections took place while work on other sections had already occurred. Table 7 shows cool and cold water indicators and most frequently caught species during these surveys. For a full list of all species sampled, see Appendix E. In some surveys, only a gamefish were captured, for others a full IBI run was conducted.

Table 7 (continued):

	2000	2001	2002	2003
7) Upstream Primrose Center Road				
Brown Trout	N/A	N/A	10	9
Rainbow Trout	N/A	N/A	2	0
Mottled Sculpin	N/A	N/A	87	346
White Sucker	N/A	N/A	85	127
Coldwater IBI	N/A	N/A	10 (Poor)	20 (Poor)
8) Upstream County Highway G				
Brown Trout	N/A	15	23	14
Mottled Sculpin	N/A	256	253	199
White Sucker	N/A	265	173	138
Bluntnose Minnow	N/A	27	0	213
Coldwater IBI	N/A	20 (Poor)	20 (Poor)	10 (Poor)
9) Rhiner Property to Tributary				
Brown Trout	N/A	45	34	33
Mottled Sculpin	N/A	N/A	N/A	197
White Sucker	N/A	N/A	N/A	147
Bluntnose Minnow	N/A	N/A	N/A	51
Coldwater IBI	N/A	N/A	N/A	20 (Poor)
10) Upstream L. Haag Bridge				
Brown Trout	N/A	4	27	13
Mottled Sculpin	N/A	126	N/A	92
White Sucker	N/A	98	N/A	131
Coldwater IBI	N/A	20	N/A	20 (Poor)
11) Downstream L. Haag Bridge				
Brown Trout	N/A	5	16	5
Mottled Sculpin	N/A	646	559	31
White Sucker	N/A	193	182	137
Creek Chub	N/A	22	8	0
Bluntnose Minnow	N/A	5	0	42
Coldwater IBI	N/A	30 (Fair)	30 (Fair)	10 (Poor)
12) Haag Tributary				
Brown Trout	N/A	10	9	7
Mottled Sculpin	N/A	N/A	N/A	78
White Sucker	N/A	N/A	N/A	88
Bluntnose Minnow	N/A	N/A	N/A	20
Coldwater IBI	N/A	N/A	N/A	20 (Poor)

Shaded areas indicate pre-rehabilitation monitoring

Table 8: Catch Per Unit Effort for Brown Trout in the West Branch Sugar River

Location	1997	2002	Percent Change
State Highway 92	206	180	-12
County Highway U	147	179	+22
Primrose Center	56	68	+21
County Highway G	77	202	+162

Cool and coldwater species now inhabit the sections of river above the project area. Brown trout and mottled sculpin are now showing up in more numbers as far up as County Highway JG and Barton Road (WDNR, 2002 and 2003). Another positive indicator of project success is the evidence of multiple year classes of trout, including 3-4 inch young-of-the-year (YOY) that are evidence of natural reproduction, in the project area. Evaluation of length frequency data is conducted to determine recruitment, carryover, and year class strength. Surveys conducted in 1997 showed no YOY present at any of the sampling sites (Sorge, 1997). Surveys conducted in 2002 and 2003 show the presence of YOY at ten of the thirteen post-evaluation stations (Figure 8). The presence of YOY at all of these locations indicates that natural reproduction is taking place in the West Branch Sugar River. This was one of the major limiting factors impacting year class strength and overall population densities. Prior to the habitat restoration, brown trout did not have suitable spawning habitat. Now brown trout have access to spawning habitat and desirable substrate that is necessary to complete their life cycle (Sorge, 2004).

Also important is the carryover of one year class to the next. The length-frequency analysis shows the presence of multiple year classes of trout at all 13 locations with most having at least 4 consecutive year classes present. Two sites contained 6 year classes. Densities of brown trout are recovering and populations starting to build toward management goals. The overall growth rates and condition factors of brown trout seem to be similar to neighboring waterbodies in western Dane County (Sorge 2004).

Conclusion

The West Branch Sugar River has responded to the implementation of best management practices which have helped increase baseflow and reduce erosion. The repair of the riparian corridor and addition of stream habitat has enabled the river to meet its potential as a coldwater Class II trout water. For these reasons, the department is proposing to remove the West Branch Sugar River from the state's list of impaired waters.

References (continued):

WDNR. 1985. Surface Water Resources of Dane County. Elizabeth Day, Gayle Grzebieniak, Kurt Osterby, Clifford Brynildson. Wisconsin Department of Natural Resources Lake and Stream Classification Project. Madison, WI.

WDNR. 2002 and 2003. Wisconsin Department of Natural Resources. South Central Region Fisheries Program. Unpublished data.

WDNR. 2004. Draft of the State of the Basin Report: Sugar and Pecatonica Rivers Basin. March, 2004 Draft. James Amrhein. Wisconsin Department of Natural Resources. South Central Region Headquarters.

Welke, Kurt. 2004. Wisconsin Department of Natural Resources. South Central Region. Personal communication.

Figure 1: West Branch Sugar River Watershed

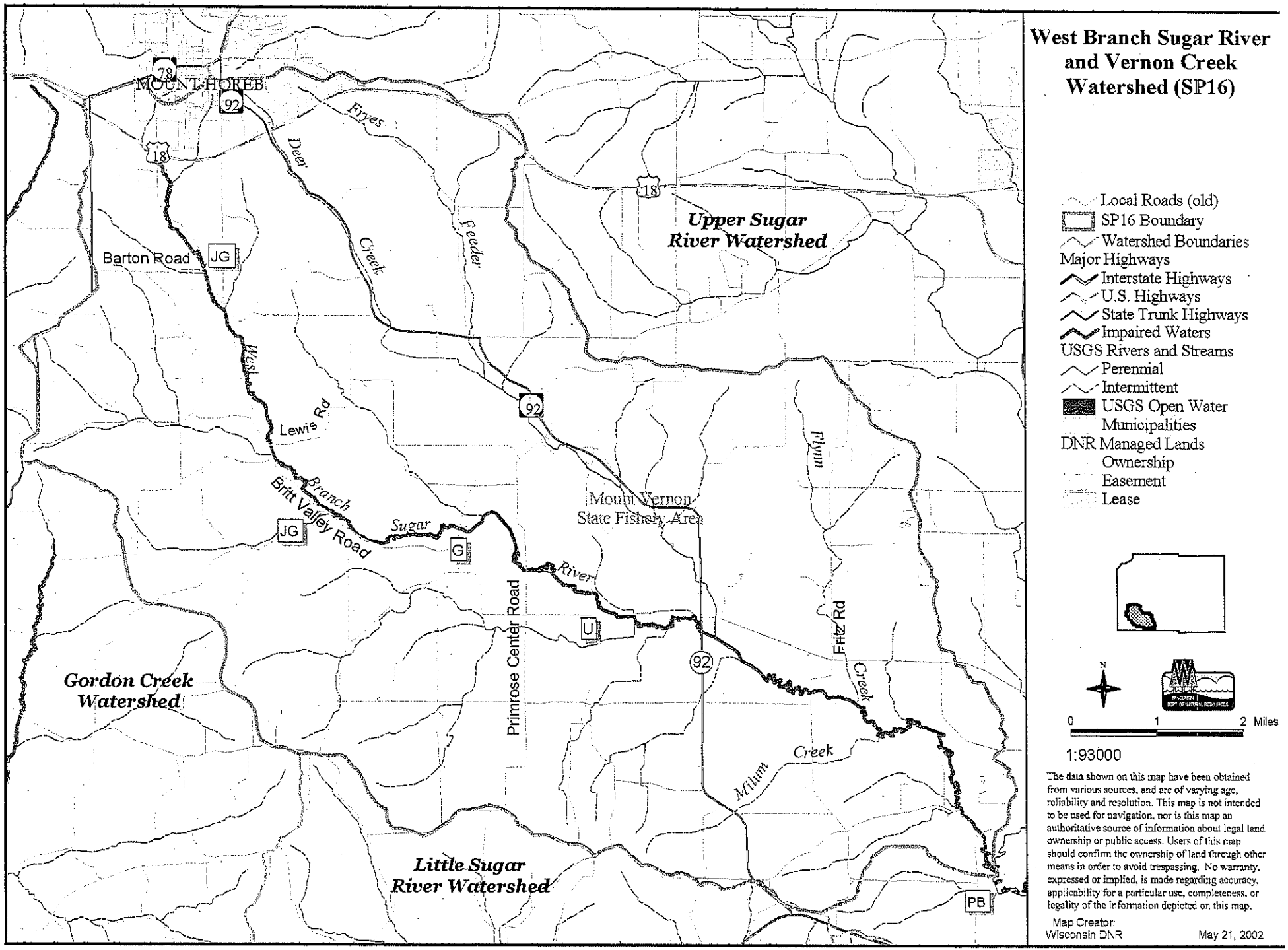
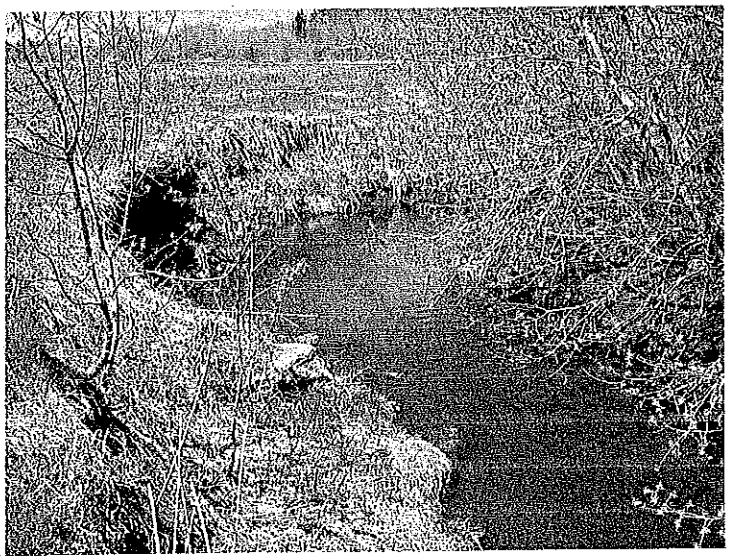


Figure 2: West Branch Sugar River – Prerehabilitation Conditions

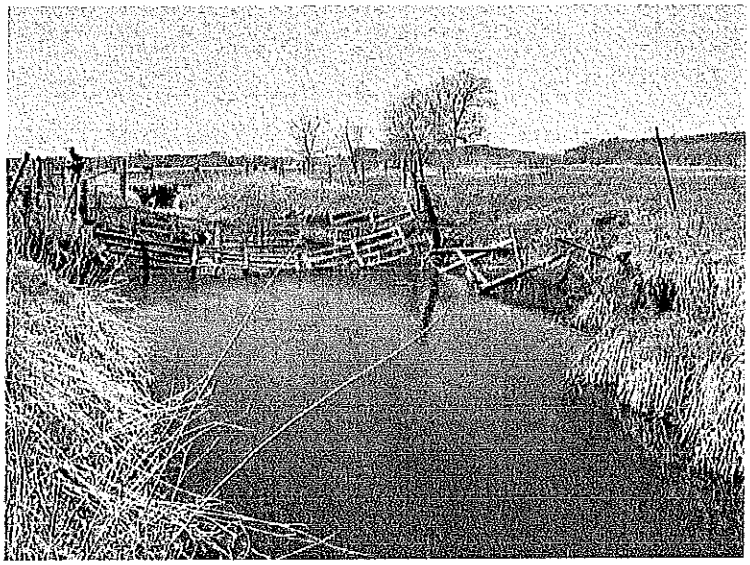
Typical outside bend on the river. Steep eroding bank. Trees inadequate to hold soil in place.



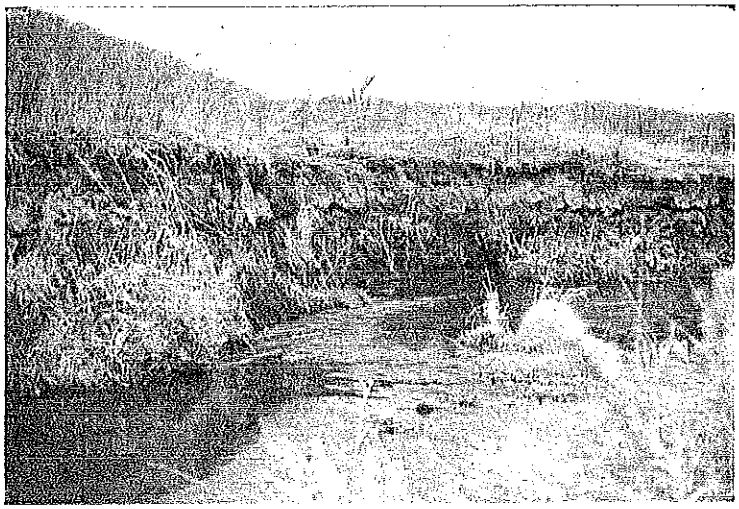
Steep, slumping bank next to agricultural field. Very little buffer between the field and the river.

As the bank erodes, the river becomes wider and shallower.

Figure 2 (continued):



Cattle crossings in need of repair. River is wide, shallow, and suffers from heavy siltation of the stream bottom.



The river flows through pastured areas where bank erosion is typical. Bank slope is 1:1.

Typical corridor of box elders. Trees canopy shades out vegetation and tree roots themselves are unable to hold soil in place. Eventually the trees fall into the stream, furthering the erosion process.

Figure 3: West Branch Sugar River Rehabilitation Segments and Pre-Post Fish Sampling Stations

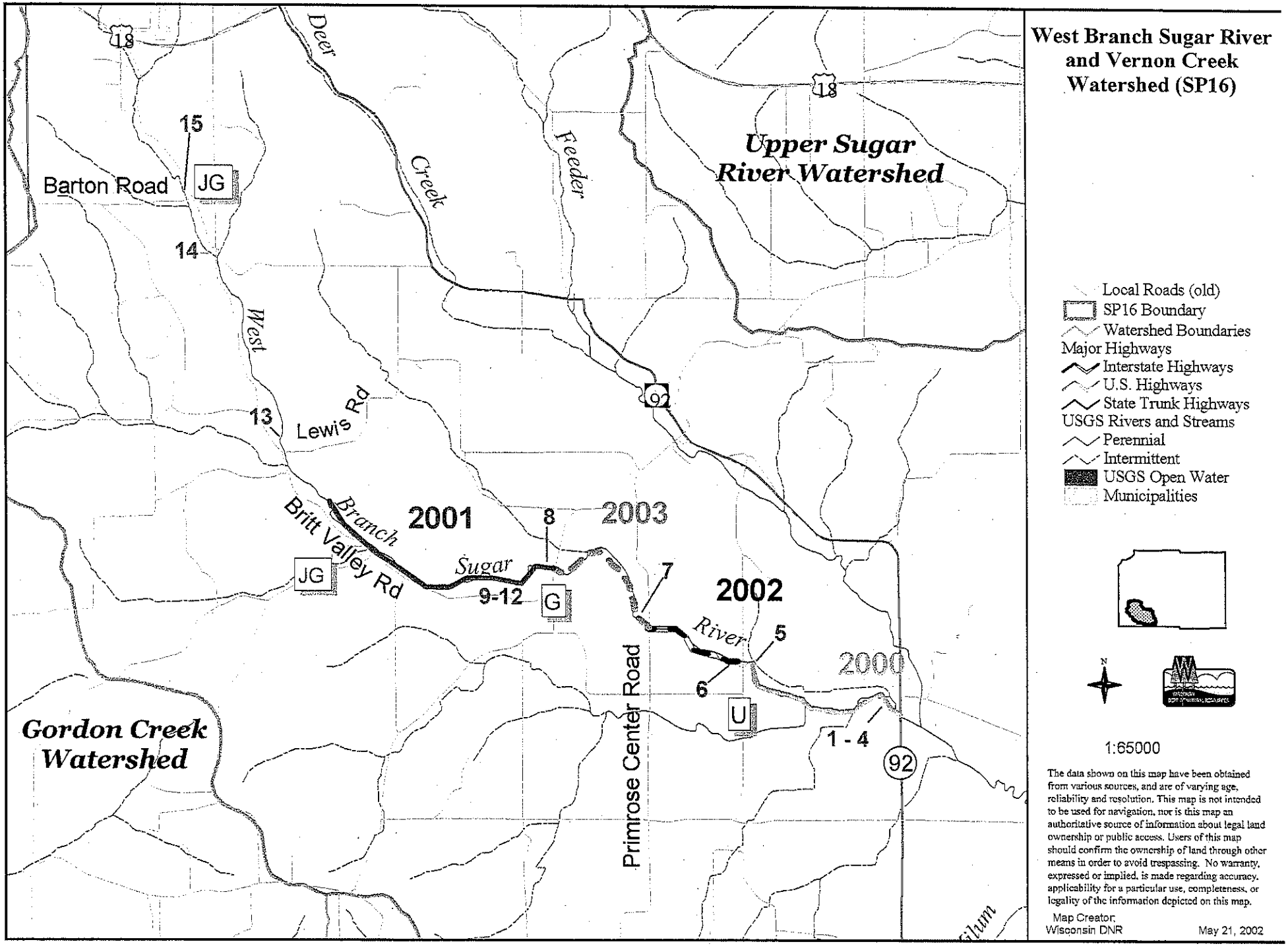
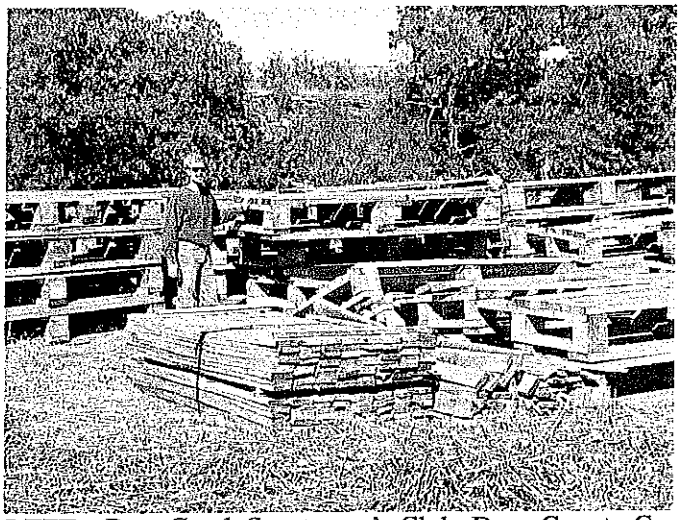
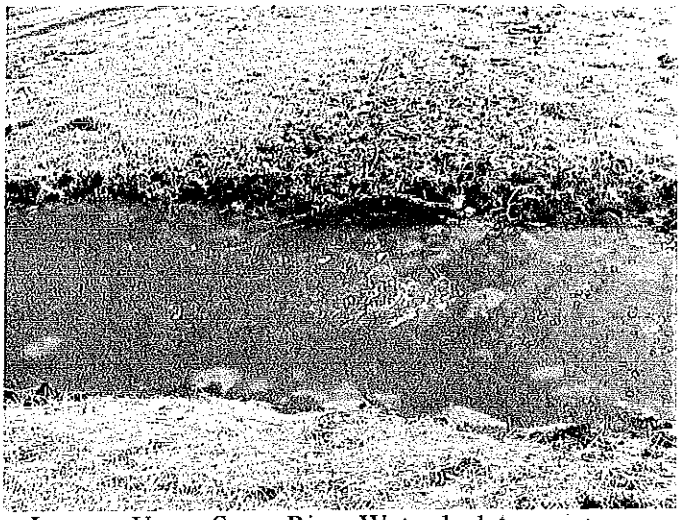
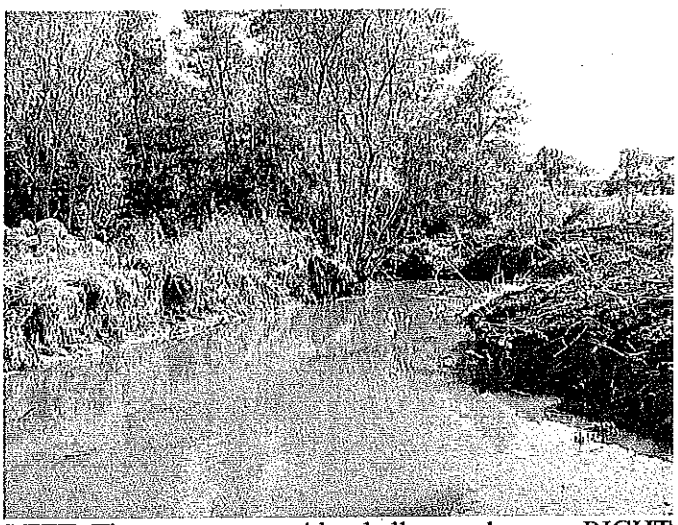


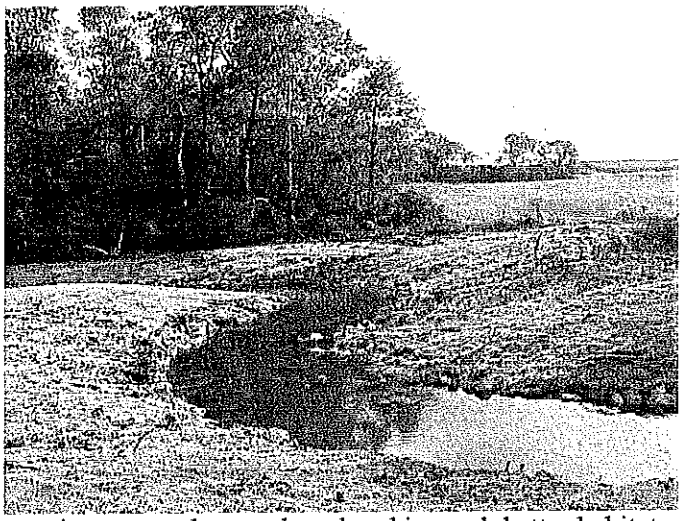
Figure 4: LUNKERS Installation and Streambank Stabilization



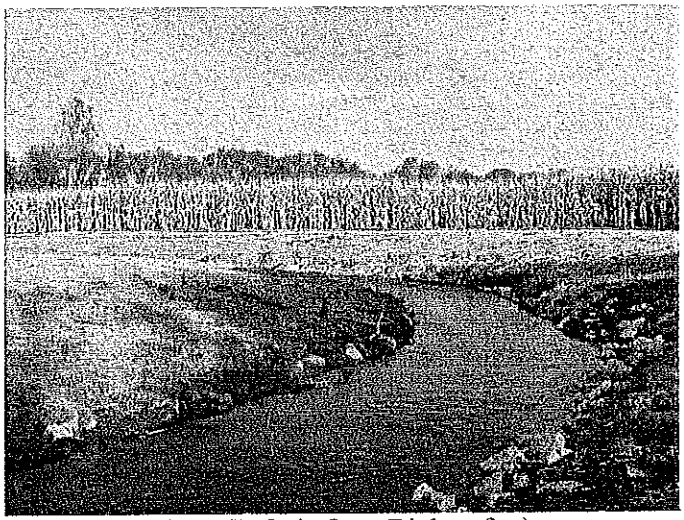


LEFT—Deer Creek Sportsman's Club, Dane County Conservation League, Upper Sugar River Watershed Association and others worked together to build the LUNKERS (Little Underwater Neighborhood Keepers Encompassing Rheotactic Salmonids). RIGHT—The stream has been narrowed, the banks reshaped, and riprap placed on the edges.



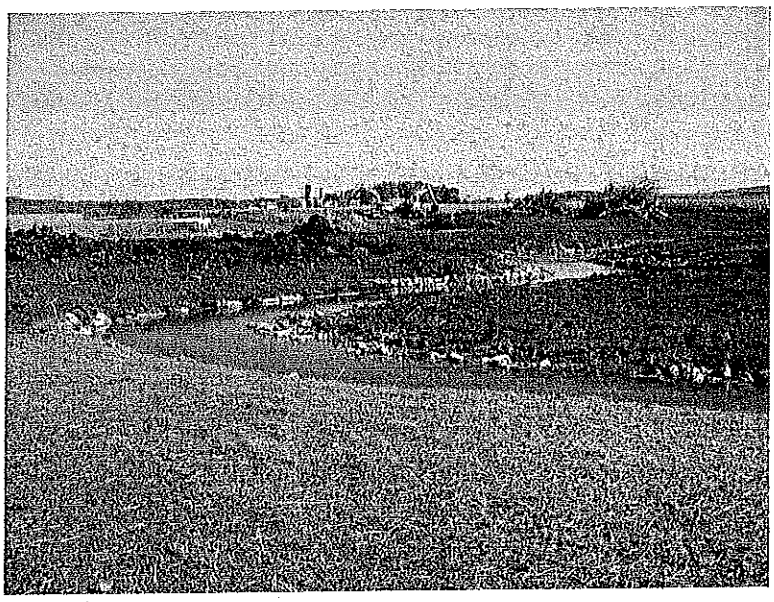


LEFT: The stream was wide, shallow and warm. RIGHT: The stream is narrow, deep and cool and is much better habitat for trout and other fishes.

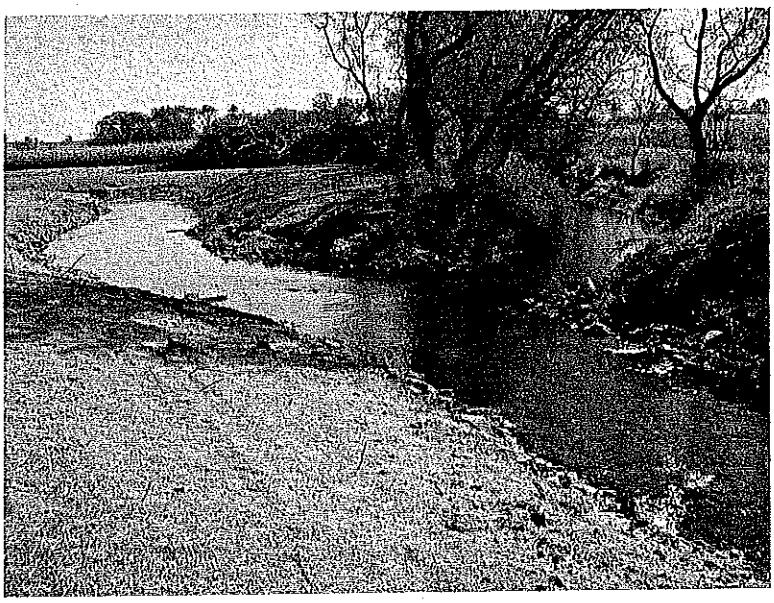


By the end of 2003, over 1,000 LUNKERS were installed on this four-year project. (Left: before; Right: after)

Figure 5: West Branch Sugar River – Rehabilitation Stages



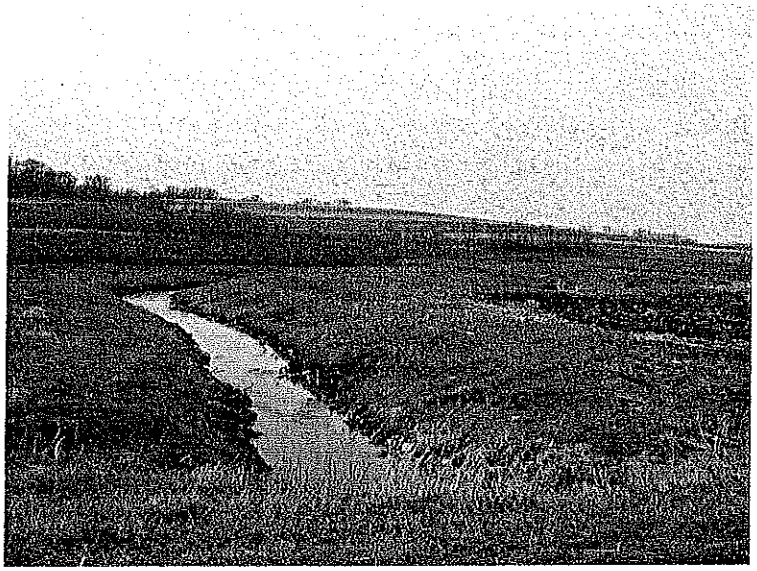
Streambanks are shaped and sloped to allow the stream to reach its floodplain during high flow events
Fish habitat structures are placed at the same time.
The shoreline in the foreground is mulched and seeded.



Banks sloped, mulched and seeded. Note difference in banks and buffer compared to Primrose Branch coming in from the right

Fish habitat structures have been placed, banks sloped, mulched and seeded. Toe of streambank stabilized with rip-rap

Figure 6: West Branch Sugar River – Post Rehabilitation, the First Year



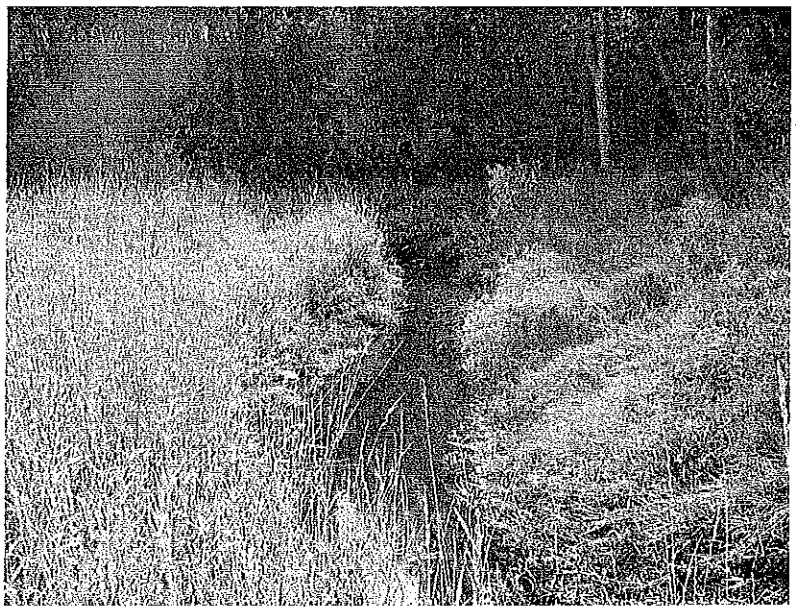
This buffer was seeded in late September with cool season grasses. This cover crop will stabilize the shoreline through the winter.

The newly established vegetation not only stabilizes the banks, but acts as a buffer and filter for runoff from surrounding agricultural fields

While habitat structures were placed in bends of the river, rock weirs were used on straight sections (foreground) to create plunge pools for creating deeper water areas.

Figure 7: West Branch Sugar River – Post Rehabilitation, the Second Year

Two years after the project, grasses have become well established, stabilizing the shoreline, acting as a buffer for runoff, and providing cover and shade during the summer months over the narrowed river.



The well established grasses hide any evidence of the "work" that was perfomed on the river.

Figure 8: Length Frequencies for Brown Trout in the West Branch Sugar River – 2002