An Assessment

of

German Valley Creek

WBIC = 909200

Dane County, WI

A proposal for delisting from the state's 303(d) list of impaired waters

In fulfillment of SP12 projects SCR02_09 and SCR04_10

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Introduction

German Valley Creek is a 7 mile long stream on the south slope of Military Ridge. The spring-fed stream has its headwaters southwest of Mount Horeb and joins Big Spring Creek (also known as Blue Mounds Branch) to form Gordon Creek. German Valley Creek is currently classified as a default warm water fishery. While the upper half of the stream can generally be regarded as a "cool" water system, the lower half, augmented by higher spring flow, generally has colder water temperatures than the upper half. It is on the state's 303(d) list of impaired waters because of habitat degradation caused by sedimentation due to cropland and bank erosion, stream bank grazing, and barnyard runoff.

History and Land Use

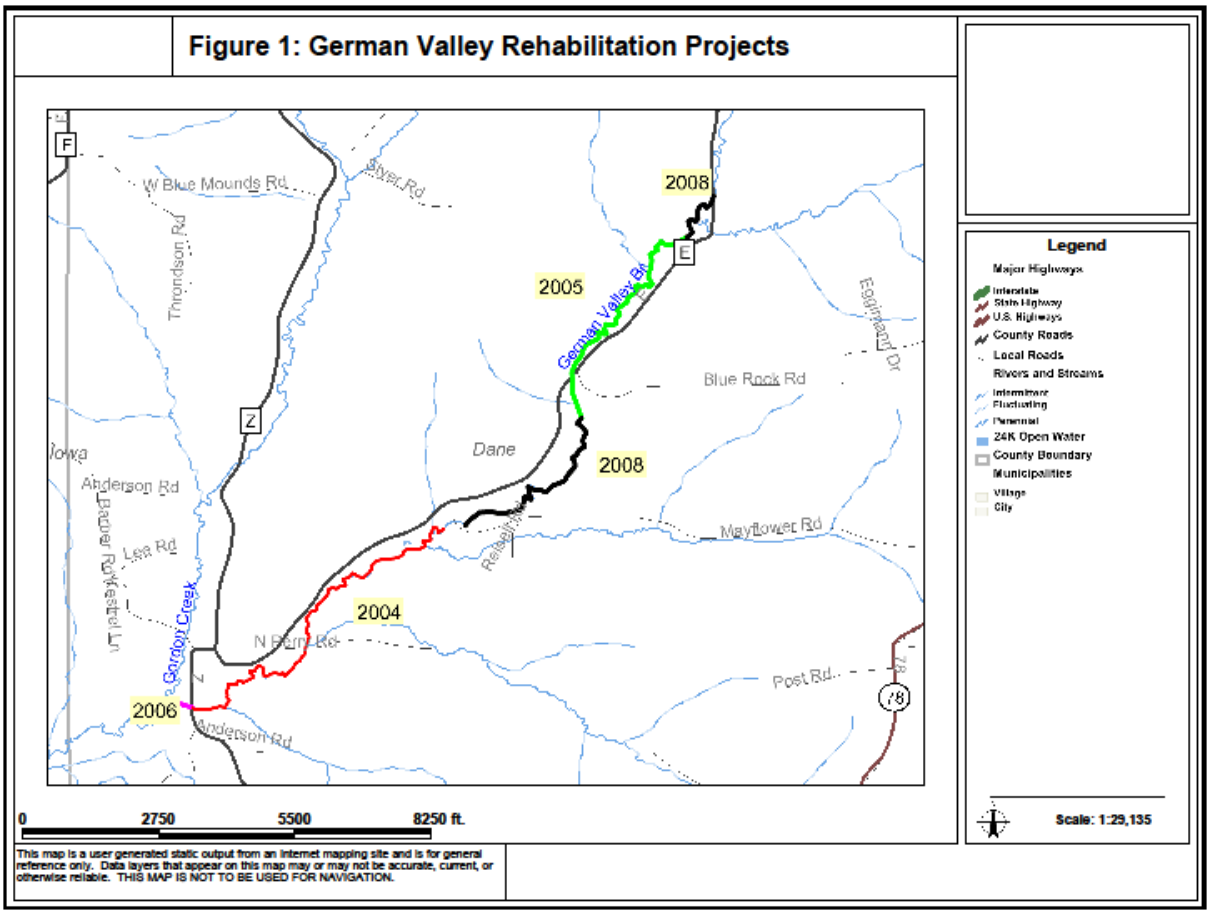
Almost half of the land cover in the Gordon Creek watershed is used for agriculture. However, more intensive agricultural uses declined as more land was set aside to conservation and due to increased "hobby farming" and rural home development (WDNR, 2004). Wet meadows that were formerly pastured are now in set aside including 140 acres of wet meadow near the mouth. Additionally, the watershed is encompassed by the Conservation Reserve Enhancement Program's Grassland Project which looks to restore 10,000 acres of grassland in south central Wisconsin. Additionally, The Nature Conservancy is actively involved in a grassland restoration project in the upper portion of the watershed. Each of these projects have likely improved habitat for grassland birds and have the additional benefit of increasing infiltration of rainfall and subsequently increase the base flow of area streams (Ibid).

During the late 1990s and early 2000's, landowners in the watershed enrolled 525 acres in conservation programs such as the Conservation Reserve Program (CRP). Data collected in 2001 and 2002 showed temperature and dissolved oxygen levels that were consistent with those supporting a coldwater resource. Indeed, subsequent fish monitoring conducted during that same period showed the presence of cold and cool water indicator species such as brown trout, mottled sculpin, and American brook lamprey. These survey results indicated that the lower reaches had the potential to support a productive trout fishery if steps were taken to improve habitat. Because German Valley Creek is an important tributary to Gordon Creek, resource managers felt that habitat restoration would likely expand trout fisheries in the watershed and lead to the removal of German Valley Creek from the state's impaired waters list.

In the mid-1970's to mid-1990's, surveys showed German Valley Branch contained several species of cool-warm transitional species (Lyons, et. al., 2009) and was dominated by habitat tolerant species such as white sucker and creek chub (Table 1). The stream corridor was shrouded with box elder trees leading to substantial bank erosion. The stream was wide, shallow and the bottom mostly made up of soft sediment. Even in surveys conducted shortly after the millennium, while cold and cool water species were becoming present, the fishery assemblage was still dominated by these same species tolerant to disturbed habitat.

Stream Rehabilitation

Landowners along German Valley Creek expressed their support for improving the stream and the fishery. In 2003, the Dane County Land and Water Conservation Department (LWCD) received the first of four Targeted Runoff Management (TRM) grants from the state to improve a 1.5 mile long section of stream from CTH Z to Mayflower Road (Figure 1). Cost share money was received from a county conservation



fund, Wildlife Habitat Improvement Program (WHIP), U.S. Fish and Wildlife (USFWS) funds as well as volunteer labor from non-profit organizations such as Trout Unlimited (TU) and the Upper Sugar River Watershed Association (USRWA). The LWCD subsequently received 3 additional TRM grants for rehabilitating a total of over 4 miles of stream (Table 2).

The water quality objective of the project was to reduce stream bank erosion by 90% resulting in an overall reduction of sediment load of over 7300 tons/year over the whole area of the project. In all, almost 50,000 feet of stream bank was shaped and stabilized, and over 600 fish habitat structures (LUNKERS and weirs) were added to the stream.

Table 1: Historic Fish Data for German Valley

	Stream Site (Year)	Species	Number
↑ Downstream	CTH Z	Creek Chub	44
	(1976)	White Sucker	36
		Johnny Darter	9
		Western Blacknose Dace	2
		Central Stoneroller	1
		American Brook Lamprey	1
	Private Drive	Brook Stickleback	100
	SW ¼ SE ¼ Sec. 21 T6N R6E	Johnny Darter	3
	(1994)	White Sucker	29
		Fantail Darter	70
Upstream		Creek Chub	260
	CTH E – upper	Stonerollers	54
	(1976)	White sucker	39
		Brook Stickleback	25
		Creek Chub	22
		Central Stoneroller	3
↓		Johnny Darter	2
	CTH E -upper	Fantail Darter	20
	(1994)	Brook Stickleback	20
		Johnny Darter	1

Table 2: German Valley Creek Stream Improvement Projects

Year	Stream Segment	BMPs and other installations	Funding (Dollars)
2004	CTH Z to Mayflower Road	20,000 feet of shaping and seeding w/ habitat 26 acres of critical area seeding 394 fish habitat structures (291 LUNKERS and 103 weirs)	DNR TRM = 132,661 *In-kind labor and funds:* WHIP = 50,000 TU (labor) = 58,200
2005	Downstream Blue Rock Road to CTH E	14,000 feet of shaping and seeding w/ habitat 11 acres of critical area seeding 181 fish habitat structures (127 LUNKERS and 54 weirs) 1 acre wastewater treatment strip 1 acre grassed waterway 1500 ft of fencing 300 feet livestock crossing	DNR TRM = 136,271 *In-kind labor and funds:* Dane Co. = 25,000 TU (labor) = 10,700 USRWA (labor) = 10,700
2006	Confluence with Blue Mounds Branch to CTH Z	900 feet of shaping and seeding w/ habitat 0.5 acre critical area seeding 13 fish habitat structures (10 LUNKERS and 3 weirs)	DNR TRM = 4,900 *In-kind labor and funds*: Labor = 2,100
2008	Mayflower Road to downstream Blue Rock Road	14,600 feet of shaping and seeding w/habitat 11 acres of critical seeding 100 fish habitat structures (44 LUNKERS and 56 weirs)	DNR TRM = 92,620 *In-kind labor and funds*: Dane Co = 17,380 USFWS = 15,000 Labor = 44,115

Macroinvertebrate samples were generally taken prior to the start of the project (Table 3). In general, the Hilsenhoff (1987) Biotic Index (HBI) showed values from 4.5 to 5.5 or "good" on the index scale. The macroinvertebrate index of biotic integrity (MIBI) developed by Weigel (2003) was more varied with values from 2.4 to 8.2 or "poor" to "excellent". Most values ranged from 2.5 to 5.8 or "fair" to "good". These data indicated that the water quality and status of the watershed was such that a rehabilitation project would likely be successful.

Table 3: Macroinvertebrate Data for German Valley Creek

Site	Date	HBI	MIBI
Upstream of North Perry Road	11/01/2001	2.9 (Excellent)	8.2 (Excellent)
Upstream Mayflower Road	05/11/1994	4.4 (V. Good)	5.2 (Good)
	05/17/1995	4.5 (V. Good)	3.5 (Fair)
	04/22/2001	5.2 (Good)	3.7 (Fair)
	04/17/2002	5.2 (Good)	3.2 (Fair)
	04/22/2005	4.8 (Good)	2.4 (Poor)
Upstream of CTH E (downstream crossing)	11/01/2001	3.0 (Excellent)	5.2 (Good)
Upstream of CTH E (second crossing)	10/09/1987	5.0 (Good)	2.9 (Fair)
Upstream of CTH E (3rd crossing)	11/01/2001	3.6 (V. Good)	5.8 (Good)

More recent surveys were conducted on various stream segments prior to, and after, stream rehabilitation had taken place. In some cases, the station length varied, so the calculation of trout/mile and the coldwater Index of Biotic Integrity (IBI) developed by Lyons, et. al.(1996) were used as metrics to normalize the data (Tables 4a – e). A full compilation of fish surveys can be found in the Appendix.

Table 4a: Fish Assemblage at CTH Z

	Pre-rehabilitation			Post-rehabilitation		
Year	2001	2002	2003	2005	2006	2009
Mottled Sculpin	228	311	145	538		194
Creek Chub	81	55	3			
Brown Trout	78	78	59	68	96*	18
Brook Trout						1
White Sucker	57	51	8	2		5
American Brook Lamprey	10	19	1	6		
Brook Stickleback	1					3
Trout/mile	87	87	66	78	107	115
Coldwater IBI	40 (Fair)	50 (Fair)	70 (Good)	60 (Good)	N/A	70 (Good)

* Gamefish run only

Table 4b: Between North Perry Road and Mayflower Road

	Pre-rehabilitation	Post-rehabilitation			
Year	2001	2005	2006	2008	2009
Mottled Sculpin	301	2082		400	120
Creek Chub	196	20		1	
White Sucker	151	47			
Brown Trout	22	109	66*	14	17
American Brook Lamprey	0	3			
Fathead Minnow				1	
Trout/mile	21	124	296	136	141
Coldwater IBI	20 (Poor)	60 (Good)	N/A	50 (Fair)	50 (Fair)

* Gamefish survey only

Table 4c: Upstream of Mayflower Road

	Pre-rehabilitation	Post-rehabilitation
Year	2008	2009
Mottled Sculpin	2	165
Brown Trout	7	14
White Sucker	3	
Creek Chub	2	1
Trout/mile	92	184
Coldwater IBI	40 (Fair)	50 (Fair)

Table 4d: Upstream CTH E (furthest downstream CTH E crossing)

	Pre-rehabilitation	Post-rehabilitation	
Year	2001	2008	2009
Brook Stickleback	103		
White Sucker	27		1
Creek Chub	13		7
Fantail Darter	111		
Johnny Darter	5		
Bluegill	1		
Brown Trout		10	11
Brook Trout			3
Mottled Sculpin		815	800
Trout/mile	0	70	98
Coldwater IBI	0 (Very Poor)	50 (Fair)	70 (Good)

Table 4e: 0.3 mile Upstream CTH E (machine crossing in field)

	Pre-rehabilitation	Post-rehabilitation	
Year	2001	2008	2009
Brown Trout	3	9	17
White Sucker	53		
Creek Chub	27	8	4
Brook stickleback	75		
Fantail Darter	14	10	
Johnny Darter	24		
Central Stoneroller	8		
Mottled Sculpin		288	200
Brook Stickleback		2	
Trout/mile	51	76	145
Coldwater IBI	0 (Very Poor)	50 (Fair)	50 (Fair)

Quantitative habitat surveys (Simonson et. al., 1994) were also conducted prior to and after rehabilitation. Measurements of stream width, bank erosion, width-to-depth ratio, riffle and/or pool ratio, percent soft sediment, and fish cover are incorporated into this metric. The habitat surveys are summarized in Table 5.

Table 5: Habitat Surveys for German Valley Creek – value (score)

Station Name	Buffer	Erosion	Pools	W/D Ratio	Riffle or Bends*	% Fines	Fish Cover	Score/ Rank
CTH Z	10.0 (15)	0.59 (5)	0 (0)	11.5 (10)	(5)	88.1 (0)	8.9 (5)	40 Fair
	10.0 (15)	0.46 (10)	0 (0)	5.64 (10)	(15)	83.8 (0)	54.8 (15)	65 Good
Perry Rd	8.3 (10)	0.21 (10)	21.8 (3)	7.33 (10)	(15)	93.9 (0)	32.9 (15)	63 Good
	10.0 (15)	0.06 (15)	14.1 (3)	3.21 (10)	(15)	38.3 (5)	32.5 (15)	78 Excellent
Mayflower Road	5.8 (10)	0.43 (10)	3.3 (0)	9.82 (10)	(15)	91.1 (0)	6.7 (5)	50 Good
	9.8 (10)	0.65 (5)	0 (0)	14.7 (10)	(0)	83.8 (0)	3.5 (0)	25 Fair
	10.0 (15)	0.48 (10)	0 (0)	6.76 (10)	(15)	88.8 (0)	3.9 (0)	50 Good
	10.0 (15)	0.05 (15)	12.1 (3)	4.77 (10)	(15)	67.9 (0)	31.9 (15)	73 Good
CTH E	5.7 (10)	0.25 (10)	6.83 (0)	5.73 (10)	(5)	61.9 (0)	20.9 (15)	50 Good
	10.0 (15)	0 (15)	4.57 (0)	3.50 (10)	(15)	26.7 (5)	38.0 (15)	75 Excellent

Before rehabilitation
After rehabilitation

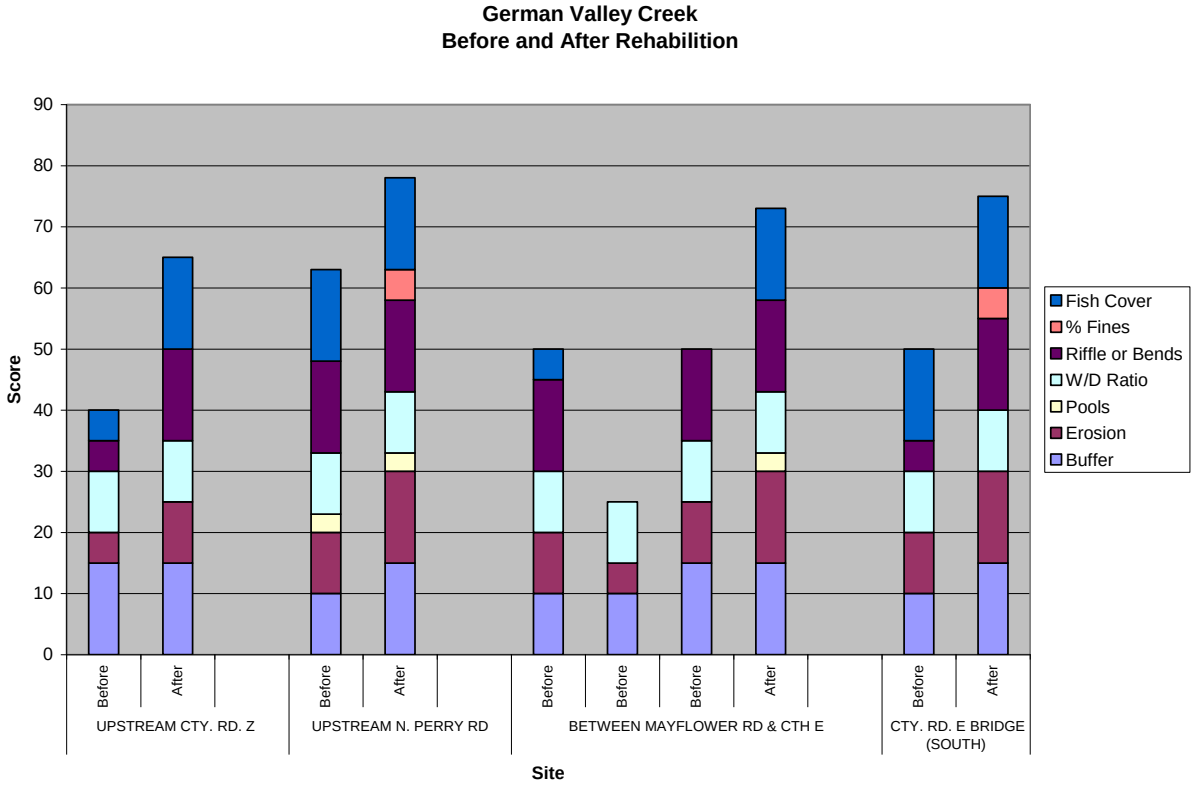
* Only the Score is reported as the higher of the two measures is included in the final score

Discussion

Fisheries surveys were conducted on various segments of German Valley before and after rehabilitation. Historically, there were no cold water or cool water species present in the surveys conducted prior to the turn of the century. The stream contained cool water transitional species and was dominated by species tolerant to disturbed habitat. During the mid-1990's, a large amount of land was enrolled in the CRP program. The result was more infiltration and higher base flows. This subsequently led to cooler water temperatures. Marshall (2005) documented summer water temperatures from 2001 through 2003 that fell within the coldwater thermal regime as defined by Lyons (2008) with maximum daily mean summer temperatures that do not exceed 69.3^{o}F (20.7^{o}C). Resource managers felt the main agricultural sources of pollution were being addressed, and that habitat limitation due to high sedimentation from bank and bed load sources was the greatest impediment to the stream reaching its attainable use as a cold water stream.

The improved habitat is immediately noticeable in the improved metrics that make up the habitat scores (Figure 2). The mean buffer width was already good and was one of the reasons managers felt the chances of success with the project were reasonably good. Banks were stabilized and erosion reduced as evidenced by the improved erosion scores. This was an important aspect in meeting the goals of the project. While the score for the width to depth ratios was unchanged, the actual ratio decreased from an average of 9.3 to 4.3, indicating a narrower, deeper channel which is generally more favorable to fish habitation. The score for percent fines did not increase appreciably; however, the percentage of fines decreased from an average of 84.6% before the projects to 54.2% after. The placing of rock and log weirs as well as LUNKER structures led to improved fish habitat. Overall habitat scores improved from "fair" and "good" to "good" and "excellent".

Figure 2: Habitat Surveys on German Valley Creek Before and After Rehabilitation



Fishery assemblages that were already showing improvement because of improved water quality and lower temperatures likewise responded almost immediately to the improved habitat. Coldwater IBIs and trout densities increased at all sites. Some coldwater IBIs were suppressed by the fact that mottled sculpin, an intolerant cool water indicator species, became so prevalent that their numbers dwarfed the trout populations, and thus caused the coldwater IBI to be about 10 points lower because the top level carnivore species metric was suppressed by the high numbers of sculpin. Another indication of the transition to cold water is the decrease in the number of species found in the stream. Prior to the environmental and stream improvements, there were from 6 to 7 species present, most of which represented warm-cool transitional species and most tolerant of habitat disturbance. Surveys conducted over the past 3 years showed a dramatic drop in the number of such species, especially white sucker. The stream now contains almost exclusively brown trout and mottled sculpin with an occasional white sucker or creek chub. Brown trout have been stocked since 2004 and annually since 2007. Multiple year classes of trout indicate adequate survival from one year to the next. In 2009 brook trout were stocked into the stream. However, even before this stocking, brook trout were showing up in the surveys, likely migrating up from Gordon Creek.

I should be noted that in fall, 2004, a fish kill occurred on a portion of the stream that had already been improved. This partial kill led to the identification of a source of runoff that was eventually addressed in the 2005 improvement project.

Macroinvertebrates

The HBI values showed that there was low organic loading to the system which could lead to excessive macrophyte growth and potential low dissolved oxygen levels. The macroinvertebrate IBIs ranged from poor to excellent, with most values reflecting a "fair" rating. This probably reflects the aggregation of the local watershed stressors on the stream including some nutrient loading and poorer habitat caused by sedimentation. While there is still intense agricultural land use in this sub-watershed, there is also been a great deal of land placed in set aside. Additionally, the stream already had good buffers in certain sections of the stream either from natural features (wetlands or wooded hillsides) or through the benevolence of riparian landowners. The most recent macroinvertebrate sample, taken upstream from Mayflower Road in 2009, showed an HBI of 2.5 or "excellent" water quality. The macroinvertebrate IBI has not yet been calculated.

Conclusions

The streams classification model (Lyons, 2008) predicts that, based on watershed size (flow) and temperature, German Valley Creek would likely be a cool-cold transitional stream for its entire length. Based on actual temperature data and fish assemblage, the stream is more likely a cold water resource. In 2010, fisheries management designated the entire German Valley Branch as a "Class II" trout stream, meaning that the stream may have some natural reproduction, but not enough to utilize available food and space. Therefore stocking is required to maintain a desirable sport fishery. These streams have good survival and carryover of adult trout.

Therefore, it is recommended that German Valley Creek be removed from the state's list of impaired waters.

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