PUBLIC REVIEW DRAFT – FOR PUBLIC COMMENT

A Watershed Report created by the Bureau of Water Quality in support of the Clean Water Act

Yellowstone River Targeted Watershed Assessment: A Water Quality Report to Restore Wisconsin Watersheds

Yellowstone River Watershed (SP04)
HUC12: 070600050203
Monitored 2016

Yellowstone River – Lafayette County
Photo by James Amrhein, South District Water Quality Biologist
Wisconsin Department of Natural Resources

To learn more about this area, see this plan on *Wisconsin's TWA Projects Online!*

Or search for Sinsinawa River at Explore Wisconsin's Waters Online! for more detail

EGAD # 3200-2020-TBD
Water Quality Bureau,
Wisconsin DNR

An Assessment of

Water Quality

in the

Yellowstone River Watershed

HUC 10 = 0709000307,

Iowa and Lafayette Counties, Wisconsin

By James Amrhein

Water Quality Biologist – Water District South

May 2017

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Water Quality Monitoring and Planning

This Water Quality Management Plan was created under the state's Water Resources Planning and Monitoring Programs. The plan reflects water quality program priorities and Water Resources Monitoring Strategy 2015-2020 and fulfills Wisconsin's Areawide Water Quality Management Plan requirements under Section 208 of the Clean Water Act. Condition information and resource management recommendations support and guide program priorities for the planning area.

This WQM Plan is approved by the Wisconsin DNR and is a formal update to the Sugar Pecatonica River Basin Plan and Wisconsin's statewide Areawide Water Quality Management Plan (AWQM Plan). This plan will be forwarded to USEPA for certification as a formal update to Wisconsin's AWQM Plan.

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- Lafayette County Land and Water Conservation Department

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WISCONSIN DEPT. OF NATURAL RESOURCES

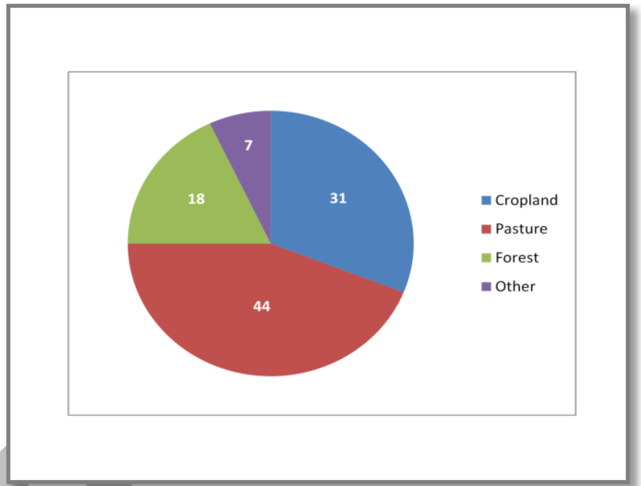
EGAD# 3200-2020-TBD

About the Watershed

The Yellowstone River Watershed is a HUC 10 (0709000307) comprising approximately 57 square miles (36,842 acres). It is believed that the name "Yellowstone" is derived from the yellowish color of the lead ore that was mined in the region during the mid-1800's. The watershed begins in southeastern Iowa County and extends into the northeastern corner of Lafayette County where the Yellowstone River joins the East Branch of the Pecatonica River. The Lafayette County portion of the watershed comprises 63% of the total area and the remaining 37% of the watershed lies in Iowa County (WDNR, 2003).

The watershed lies in the Driftless area of the state. The topography of the watershed generally consists of rolling ridges with steep sided valleys. The majority of land in the watershed is used for agricultural purposes with 44% of the watershed in pasture and 31% in cropland. Eighteen percent of the watershed is in forest, the majority of which lies in the boundaries of Yellowstone State Park. The remaining forests are generally limited to steep hillsides and scattered throughout the watershed.

Figure 1. Land use in the Yellowstone River Watershed



Water Condition

The streams, river and lake in the Yellowstone River Watershed all experience some problems as a result of nonpoint pollution, primarily nutrient and sediment input, as well as loss of riparian vegetation due to over grazing. Despite these problems, a 1998 survey and watershed appraisal determined the overall water quality in the watershed to be fair to good (Marshall and Fix, 1998). With improved land use management on the uplands and riparian corridors, the potential for reduction in bed sediments in the watershed is good because of high stream gradients and relatively good habitat characteristics. In addition, an increase in riparian vegetation could not only have a positive impact on in-stream conditions, but could also increase the habitat available for wildlife in the watershed (Ibid).

Yellowstone Lake is one of the most prominent surface water features in the watershed and in southwestern Wisconsin as a result of its value as a fishery and for recreation. The lake, located in the northeastern corner of Lafayette County, was created in the summer of 1954 by damming the Yellowstone River. The lake covers approximately 455 acres, and is relatively shallow with a maximum depth of 21 feet. The lake's fishery was developed through the stocking of a variety of gamefish and panfish.

Yellowstone Lake State Park became one of Wisconsin's state parks in August of 1970. The park is the fourth most visited park in the state, covers approximately 890 acres and offers a variety of recreational opportunities. The Wisconsin DNR also owns an additional 4,047 acres that makes up the Yellowstone Lake State Wildlife Area. The wildlife area adjoins the Yellowstone Lake State Park and extends up a portion of Steiner Branch and Cannon Creek.

Monitoring Study

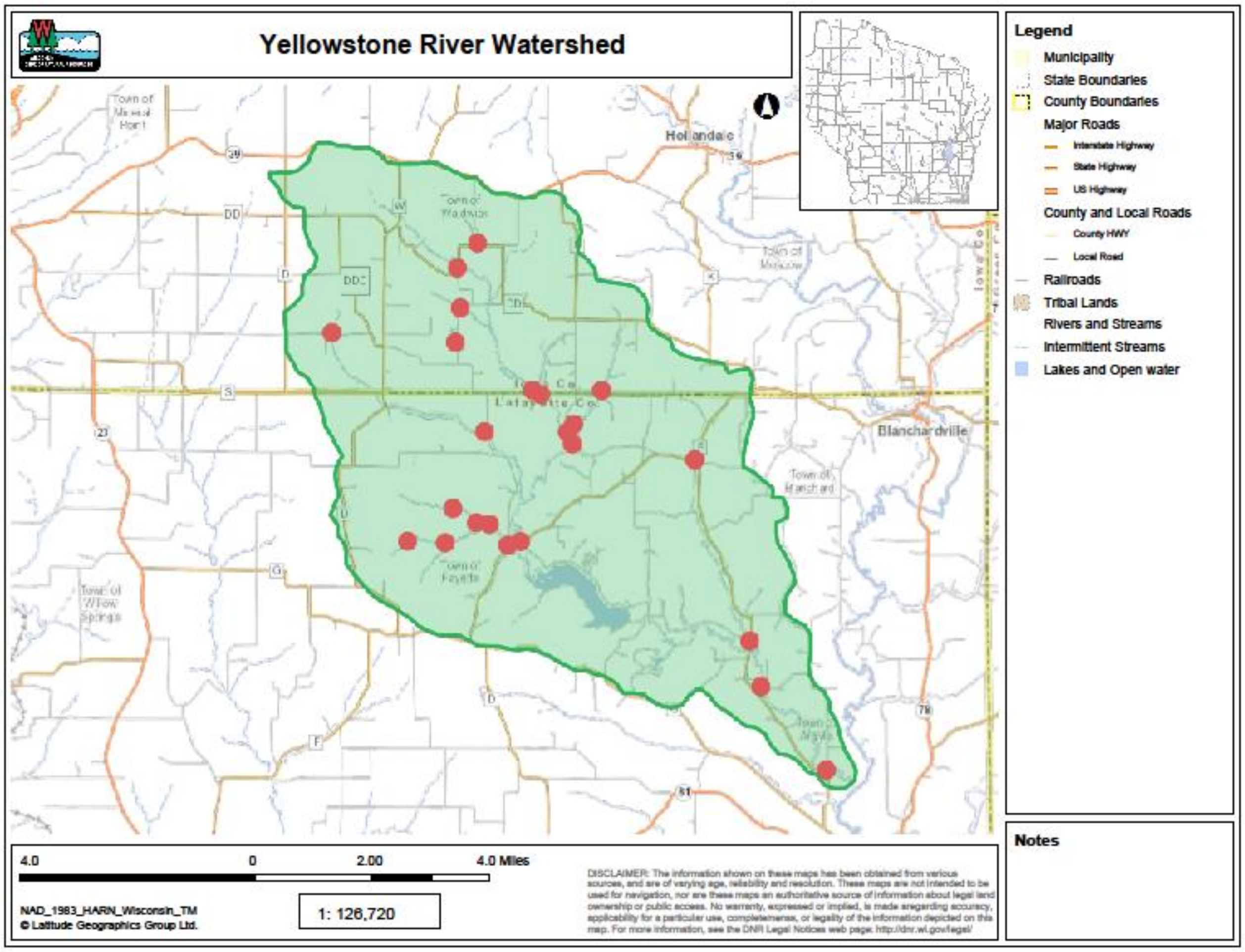
Purpose

The purpose of this study was to assess the overall conditions of the streams in the Yellowstone River watershed as a whole and potentially identify areas of management to help the gamefish and other non-game species to thrive in this agriculturally dominated watershed.

Methods

The 2016 watershed survey was conducted by water resources biologists on 23 sites in the HUC 10 (Figure 1). Sites were selected to cover a variety of stream reaches as predicted by the Targeted Watershed Site Selection Tool (TWSST) model (WDNR, 2015). With this model, stream network homogeneity or heterogeneity are estimated based on stream channel and landscape level physical characteristics. By this method, one can assess differing stream types within a watershed and predict the status of other, similar streams in the watershed where very little known information exists and without sampling each stream individually.

Figure 2: Yellowstone River Watershed and Sample Sites



Fish Monitoring

The fisheries assemblage was determined by electroshocking a section of stream with a minimum station length of 35 times the mean stream width (Lyons, 1992). A stream tow barge with a generator and two probes was used at most sites. A backpack shocker with a single probe was used at sites generally less than 2 meters wide. All fish were collected, identified, and counted. All gamefish were measured for length.

Habitat Monitoring

At each site, qualitative notes on average stream width and depth, riparian buffers and land use, evidence of sedimentation, fish cover and potential management options were also recorded. A qualitative habitat survey (Simonson, et. al., 1994) was also performed at each site.

Macroinvertebrate Monitoring

Macroinvertebrate samples were obtained at 15 sites by kick sampling and collecting using a D-frame net in fall, 2016 and sent to the University of Wisconsin-Stevens Point for analysis.

Water Temperature

Continuous water temperature loggers were placed on streams throughout the watershed and at two sites on the Yellowstone River - at CTH DD near the headwaters and at (lower) Gant Rd which is also one of the department's wadable trend sites. These loggers were programmed to take hourly water temperatures throughout the "summer" (June – August) period.

Results

The results of the fisheries surveys are summarized in Table 1. Because the natural communities model (Lyons, 2008) predicted most of the waters in the watershed to be cool transitional waters, the coolwater index of biotic integrity (IBI) developed by Lyons (2012) was applied to all streams. Where appropriate and based on natural community verification (Lyons, 2015), additional IBIs were applied.

Fish Condition

A total of 31 fish species were collected in the 2016 surveys. Bluntnose minnows, brook stickleback, common shiners, creek chubs, fantail darters, and white suckers were the most widely distributed species. Most species found in the watershed represent cool transitional or warm thermal regimes (Lyons, 2012). Mottled sculpin, a stenothermal coldwater indicator species was only found in McClintock Creek. Three streams - Canon Creek, McClintock Creek, and Steiner Branch - contained brown trout. Steiner Branch also had significant populations of brook trout. Smallmouth bass were found in the Yellowstone River. Some populations of largemouth bass were also found in the Yellowstone River as well as in the lower reaches of McClintock Creek and Steiner Branch. Most largemouth collected in the surveys were young-of-the-year fish. Northern pike were the only other game species collected and were found in the lower section of the Yellowstone River.

Habitat Condition

Qualitative habitat surveys (Table 2) showed the overall habitat scores to be “fair” to “good” at all sites with scores generally from 40 to 65. Riparian buffer scores were either poor or excellent depending upon whether the stream flowed through pastureland or not. The sites were evenly split between those with pasturing and those without. Bank erosion was “fair” to “excellent” and not necessarily correlated with buffer width, but fine sediment scores generally varied inversely to buffer scores. Pool areas were scarce throughout the watershed, but riffles common. Habitat scores varied from site to site, with smaller headwater streams and pastured sections of streams having lower scores.

Macroinvertebrate Condition

Macroinvertebrates collected in fall were analyzed and the macroinvertebrate IBI (MIBI) developed by Weigel (2003) and the Hilsenhoff Biotic Index (HBI) (Hilsenhoff, 1987).

Cows in Yellowstone River. Photo by James Amrhein, DNR Water Quality Biologist.

Table 1. Fisheries Assemblage, IBI, and Natural Community Analysis for sites in the Yellowstone River Watershed - 2016

	Canon Creek		McClintock Creek		Steiner Branch			Unnamed Trib (904200)		Unnamed (904400)	Yellowstone River							Unnamed (905600)	Unnamed (905400)	Unnamed (905300)	Unnamed (905000)	Unnamed (904700)	
Species	Rock Branch Rd	Gilbertson Rd	CTH F	CTH N	Upstream Horsetrail Bridge	Yellowstone SNA	Upstream CTH F	Upstream of Unnamed Trib (5039135)	Upstream Yellowstone SNA Road	Horse Trail Gate	CTH DD	County Line Rd	Gant Rd (upper)	Gant Rd (Lower)	CTH F	Gunderson Rd	Old Q	CTH DD	Rocky Knoll Rd	Rocky Knoll Rd	County Line Rd	County Line Rd	Off Gant Rd
Banded Darter																3							
Black Bullhead		1																					
Blackside Darter																	1						
Bluegill															6	9	2						
Bluntnose Minnow		49				1	32		1			21	70	53	6	3	4		1		5		15
Brook Stickleback		6	18	13			2	3	4		14	8	3	4					28	1	74	2	16
Brook Trout* [size range (in)]					29 (2.3-7.0)	53 (2.7-10.7)	12 (7.9-10.5)	1 (8)															
Brown Trout [size range (in)]		2 (9.5-10.3)		3 (7.6-19.5)		18 (6.0-11.4)	6 (8.2-12.5)																
Central Stoneroller	No Fish Captured	18								No Fish Captured	43	36	105	40	15				75		4	10	13
Common Carp																	1						
Common Shiner		25		6		116	80	3	20		14	49	339	479		1	13	4	15		136	80	154
Creek Chub		34	16	12		6	2	3	6		71	64	42	56				29	185	1	123	60	67
Fantail Darter		37	2			8	3	17	19		164	55	41	15					191		29	5	21
Fathead Minnow		1					1										3						
Golden Redhorse																1	11						
Golden Shiner							3								1	26	30						
Green Sunfish			1	6			4							4	5	2	2						
Hornyhead Chub		2										19	28	59	4	5					4		3
Johnny Darter		21					16				10	17	19	16					15		28		15
Largemouth Bass *[size range (in)]*				2 (3.3-3.5)			5 (3.1-3.7)						12 (3.0-4.0)	5 (3.1-3.9)	8 (3.1-17.5)	3 (2.8-7.5)	4 (2.3-7.2)						
Mottled Sculpin*			126	7																			
Northern Pike																	2 (18.0-18.6)						
Rock Bass																	1						
Shorthead Redhorse																11	10						
Silver Redhorse																3	15						
Smallmouth Bass *[size range (in)]*													11 (7.7-12.9)	19 (5.3-17.8)	4 (13.0-17.7)		1 (15.5)						
Southern Redbelly Dace		91	2								10	29	1	1					15		14		4
Spotfin Shiner				6												26	121						
White Sucker		145		63		70	90	2	3		32	48	371	244	32	2	1		23		47	81	56
Yellow Bullhead																10	1						
Common Shiner x Creek Chub												1											
Modeled Natural Community[1]	CCHW	CCHW	CCHW	CCHW	Cold	Cold	Cold	Cold	Cold	Cold	CCHW	CCHW	CCMS	CCMS	CCMS	CWMS	CWMS	CCHW	CCHW	CCHW	CCHW	CCHW	CWHW
Verified?	No	No	No	No	Yes	No	No	No	No	No	No	No	No	No	No	No	No	No	No	N/A	No	No	No
Verified Natural Community[2]	Macro-invertebrate	CWMS	Cold	CCMS		CCMS	CCMS	CWHW	CWHW	Macro-invertebrate	CWHW	CWHW	CWMS	CWMS	CWMS	WMS	WMS	CWHW	CWHW	CCHW	CWHW	CWMS	CWMS
Cool-cold/Cool-warm IBI[3]	-	60 (Good)	80 (Excellent)	60 (Good)	-	80 (Excellent)	80 (Excellent)	50 (Good)	50 (Good)	-	60 (Good)	70 (Excellent)	60 (Good)	70 (Excellent)	40 (Fair)	80 (Excellent)	100 (Excellent)	20 (Poor)	70 (Excellent)	Too few fish	70 (Excellent)	40 (Fair)	70 (Excellent)
Other IBI as appropriate[4]			40 (Fair)[c]		90 (Excellent)[c]			70 (Good)[a]	70 (Good)[a]		100 (Excellent)[a]	90 (Excellent)[a]				42 (Fair)[b]	50 (Good)[b]	10 (Poor)[a]	100 (Excellent)[a]		100 (Excellent)[a]		

Stenothermal Coldwater Species   * also intolerant

Tolerant Species

Intolerant Species

Species names in italics indicate warmwater species

1) Lyons, John. 2015. DRAFT Methodology for Using Field Data to Identify and Correct Wisconsin Stream "Natural Community" Misclassifications. Version 5. May 2, 2015.

2) Natural Community suggested by the methodology cited above.

3) Lyons, John. 2012 Development and Validation of Two Fish-based Indices of Biotic Integrity for Assessing Perennial Coolwater Streams in Wisconsin, USA. Ecological Indicators. 23(2012)402-412.

4) (a) Lyons, John. 2006. A Fish-Based Index of Biotic Integrity to Assess Intermittent Headwater Stream in Wisconsin

(b)Lyons, John. 1992. Using the Index of Biotic Integrity (IBI) to Measure Environmental Quality in Warmwater Streams of Wisconsin. U.S. Department of Agriculture. Forest Service General Technical Report NC-149.

(c)Lyons, John, L. Wang, and T. Simonson. 1996. Development and Validation of an Index of Biotic Integrity for Coldwater Streams in Wisconsin. North American Journal of Fisheries Management. 16: 241-256.

Table 2. Qualitative Habitat Surveys of sites in the Yellowstone River Watershed - 2016

Station Name	Swims Station Id	Date	Flow CMS	Width (m)	Depth (m)	Riparian Buffer Score	Bank Erosion Score	Pool Area Score	Width Depth Score	Riffle Bend Score	Fine Sediments Score	Fish Cover Score	Habitat Score	Habitat Rating	Comments
Canon Creek, Gilberston Road	10012841	09-Aug-16	-	5	0.5	0	15	3	10	10	10	5	53	Good	-
Canon Creek at Rock Branch Rd	10044969	02-Jun-16	-	2	0.1	15	15	0	5	10	10	10	65	Good	PRETTY SMALL STREAM. MAYBE 0.5 CFS FLOW. NEAR THE UPPER END OF THIS STREAM. COLD!
															-
McClintock Creek at CTH F	10044970	02-Jun-16	-	2	-	0	10	0	10	5	5	5	35	Fair	CURRENTLY NOT HEAVILY PASTURED. SOME FILAMENTOUS AGLAE.
McClintock Creek at CTH N	10046971	11-Aug-16	-	2	0.6	0	15	0	15	5	0	10	45	Fair	POSSIBLE TROUT STREAM?
															-
Steiner Branch Upstream of Horsetrail Bridge	10022553	14-Jun-16	-	1.5	0.2	15	10	0	10	10	10	5	60	Good	AMOUNT OF SEDIMENT AND TURBIDITY SURPRISING GIVEN THE RIPARIAN CORRIDOR (STATE WILDLIFE AREA).
Steiner Branch - Yellowstone SNA (2007 Habitat Work Area)	10033742	13-Jun-16	-	2.75	0.4	15	10	3	10	10	10	10	68	Good	MAJOR HABITAT PROJECT CONDUCTED IN 2007. SOME WILLOW AND BOX ELDER MGMT NEEDED. SOME NATRL REPRODUCTION OF BROOK TROUT.
Steiner Branch, Snowmobile Bridge upstream CTH F	10022554	09-Aug-16	-	2.6	0.6	15	15	0	15	5	0	10	60	Good	-
															-
Unnamed Trib (905600) to Yellowstone River at CTH DD	10044962	31-May-16	-	3	0.3	0	15	0	10	5	5	5	40	Fair	HEAVY WATER CRESS. 80% SILT/SAND; 20% GRAVEL.
															-
Unnamed Trib (905400) to Yellowstone River at Rocky Knoll Rd	10044968	02-Jun-16	-	3	0.3	0	10	0	10	10	5	5	40	Fair	PRETTY GOOD AMOUNT OF SEDIMENT.
															-
Unnamed Trib (905300) to Yellowstone River at Rocky Knoll Rd	10033665	31-May-16	-	1	-	15	15	0	10	5	15	5	65	Good	PRAIRIE/MEADOW. LOOKS LIKE IT HAD BEEN MANAGED AS A PRAIRIE IN THE PAST, NOW A LOT OF PARSNIP. SMALL WATERSHED AREA.
Unnamed Trib (905000) to Yellowstone R at County Line Rd	10046931	01-Aug-16	-	2	0.2	0	5	0	10	10	10	5	40	Fair	-
Unnamed Trib (904700) to Yellowstone R at County Line Rd	10046798	07-Jul-16	-	2	0.2	0	10	0	10	10	5	5	40	Fair	GOOD FLOW.
Unnamed Trib (904700) to Yellowstone R off Gant Rd	10010044	01-Aug-16	0.142	2	0.3	0	5	3	15	10	5	10	48	Fair	DEFINITELY AN IMPACTED SECTION WITH HEAVY GRAZING. LOTS OF SEDIMENT.
															-
Unnamed Trib (904400) to Steiner Br at Horse Trail gate	10045001	13-Jun-16	-	1.25	0.1	15	5	3	10	10	10	5	58	Good	SMALL STREAM, HIGH GRADIENT. IN YELLOWSTONE STATE WILDLIFE AREA.
Unnamed Trib (904200) to Steiner Br - Upstrm of State Wildlife Area Rd	10044998	14-Jun-16	-	2.5	0.2	15	10	3	10	10	10	10	68	Good	POSSIBLE EFFCTS OF PERCHED CULVERT ON THIS STREAM? SURPRISED NOT TO SEE SOME BROOK TROUT.
Unnamed Trib (904200) to Steiner Br - Upstrm of Unnamed (5039135) Trib	10045000	13-Jun-16	-	1.5	0.2	15	10	3	10	10	10	10	68	Good	-
															-
Yellowstone River at CTH DD	10044845	14-Jun-16	0.094	3	0.4	0	15	0	10	10	10	10	55	Good	WIDER (3M) THAN IT LOOKS BECAUSE REED CANARY IN STREAM MADE UP ABOUT 1M OF THE FOOTPRINT ALONG EDGES (WATER LEVEL NOT ABNORMAL).
Yellowstone River at County Line Rd	10029857	01-Aug-16	0.441	5.5	0.25	15	15	0	5	10	15	5	65	Good	WELL PROTECTED CORRIDOR COMPARED TO OTHER SITES ON THIS RIVER WHICH ARE OFTEN PASTURED. LACKS DEEP RUNS/POOLS TO HOLD NUMBERS OF GAME SPP.
Yellowstone RIver - Gant Road (Upper Crossing)	10044847	02-Aug-16	-	6	0.4	0	5	0	10	5	10	10	40	Fair	MANAGE GRAZING
Yellowstone RIver - Gant Road (Lower Crossing)*	333235	02-Aug-16	0.598	7.3	0.4	0	10	0	10	15	10	0	45	Fair	MANAGE GRAZING
Yellowstone River - CTH F	333091	11-Aug-16	-	9	1.2	15	5	0	15	5	0	15	55	Good	GOOD W/D RATIO, DEEP BENDS, LOTS OF WOOD.
Yellowstone River at Gunderson Rd	10046967	10-Aug-16	-	8	1.2	15	10	0	15	10	0	10	60	Good	U-SHAPED CHANNEL; DEEP OUTSIDE BENDS, CLAY AND SILT BOTTOM; LOTS OF WOOD COVER
Yellowstone River at Old Q Rd	10021416	10-Aug-16	-	9.9	1	10	5	0	10	0	0	15	40	Fair	LOTS OF COARSE WOODY DEBRIS.

*Based on quantitative habitat done at this wadable long-term trend site were applied to the data. The MIBI ranged from “poor” to “good”, with most sites being in the “fair” category based on WisCALM (WDNR, 2013) thresholds. The HBI, which is an indicator of organic loading, varied from “fair” to “very good”, with most sites showing only slight or some organic pollution indicated.

Table 3. Macroinvertebrate Data for the Yellowstone River Watershed

Station Name	Station ID	MIBI Score/Ranking	HBI Score/Ranking
Canon Creek Gilberston Road	10012841	1.95 (Poor)	5.58 (Fair)
McClintock Creek at CTH F	10044970	3.85 (Fair)	4.26 (V. Good)
McClintock Creek at CTH N	10046971	3.73 (Fair)	5.71 (Fair)
Steiner Branch - Yellowstone State Wildlife Area	10022553	4.99 (Fair)	4.60 (Good)
Unnamed Trib (904200) to Steiner Br - Upstrm of State Wildlife Area Rd	10044998	3.34 (Fair)	4.08 (V. Good)
Yellowstone River at CTH DD	10044845	4.65 (Fair)	4.50 (V. Good)
Yellowstone River at County Line Rd	10029857	2.21 (Poor)	5.35 (Good)
Yellowstone RIver - Gant Road (Upper Crossing)	10044847	4.96 (Fair)	4.67 (Good)
Yellowstone River - Gant Road (Lower Crossing)	333235	3.03 (Fair)	5.10 (Good)
Unnamed Trib (904700) to Yellowstone R at County Line Rd	10046798	4.55 (Fair)	3.59 (V. Good)
Unnamed Creek (904700) - off Gant Rd	10010044	4.99 (Fair)	4.82 (Good)
Unnamed Trib (905000) to Yellowstone R at County Line Rd	10046931	3.86 (Fair)	4.60 (Good)
Unnamed Trib (905300) to Yellowstone River at Rocky Knoll Road	10033665	6.33 (Good)	5.53 (Fair)
Unnamed Trib (905400) to Yellowstone River at Rocky Knoll Rd	10044968	5.53 (Good)	4.40 (V. Good)
Unnamed Trib (905600) to Yellowstone River at CTH DD	10044962	5.87 (Good)	3.52 (V. Good)

Temperature data, collected hourly from May to October at 8 sites showed temperature varied by stream and position in the watershed (Table 4 and Appendix B). Most temperature data suggested the streams fall into the cold or cool-cold thermal regime (Lyons, et. al., 2009). This is similar to the natural community model prediction. On the other hand, the verified natural community as defined by the fish community (Lyons, 2015) showed most of these systems to be cool-warm.

Table 4. Comparison of Temperature Data, Modeled Community and Verified Community

Site	June-Aug Mean	July Mean	Maximum Daily Mean	Thermal Regime (Based on Water Temp Data)	Modeled Natural Community	Verified Community (Fish Assemblage Based)
Canon Branch at Gilbertson Rd	17.75	18.23	20.34	Cool-Cold	Cool-Cold	Cool-Warm
McClintock Creek at CTH N	17.64	17.91	21.09	Cool-Cold	Cool-Cold	Cool-Cold
Steiner Branch at CTH F	15.64	15.81	17.97	Cold	Cold	Cool-Cold
Yellowstone River at CTH DD	15.99	16.29	19.29	Cold	Cool-Cold	Cool-Warm
Yellowstone River at Gant Road (lower crossing)	18.8	19.33	21.9	Cool-Cold	Cool-Cold	Cool-Warm
Unnamed Trib (904700) to Yellowstone R off Gant Rd	17.24	17.66	20.57	Cool-Cold	Cool-Cold	Cool-Warm
Unnamed Trib (905400) to Yellowstone R at Rocky Knoll Rd	17.55	17.93	20.59	Cool-Cold	Cool-Cold	Cool-Warm
Unnamed Trib (905600) to Yellowstone R at CTH DD	15.08	15.61	18.03	Cold	Cool-Cold	Cool-Warm

Class and/or Subclass	June-Aug Mean	July Mean	Maximum Daily Mean
Coldwater	< 17.0	< 17.5	< 20.7
(Coolwater) Cold transition	17.0 - 18.7	17.5 - 19.5	20.7 - 22.6
(Coolwater) Warm transition	18.7 - 20.5	19.5 - 21.0	22.6 - 24.6
Warmwater	> 20.5	> 21.0	> 24.6

Temperature Ranges from Lyons, et. al., 2009

Discussion

Most of the streams in the HUC 10 are modeled to be cold or cool-cold transitional headwaters or mainstems (Lyons, 2008). The exception was the section of the Yellowstone River below Yellowstone Lake which was modeled to be cool-warm. Using a methodology developed by Lyons (2015), the department can use the fishery assemblage to validate the modeled community or propose an alternative classification. With the exception of McClintock Creek and Steiner Branch, the rest of the modeled cold or cool-cold systems lack any native coldwater indicator species such as mottled sculpin and brook trout. As such, most cannot be defined as cool-cold except for those that contain (introduced) brown trout. Most of the sites surveyed in 2016 were verified as either cool-warm or warm systems. The exceptions for this were McClintock Creek and Steiner Branch. As reflected in Table 4, actual water temperature data more closely resemble the modeled natural community than did the fishery community. This has to do with the lack of coldwater indicator species, as well as the presence of eurythermal warmwater species (Lyons, et. al., 1996) in most of these systems. It should be noted that even though a species is labelled as “warmwater” that does not preclude its presence in streams that have lower water temperatures as these species are able to tolerate a broad range of temperatures. There is also a fair amount of diversity of species in most streams, which is in contrast to true cold or cool-cold systems which have more limited species diversity (Ibid).

Even Steiner Branch, which contained a healthy population of brook trout, also contained a good number of common shiners and some darters, and lacked other coldwater indicator species. By contrast, McClintock Creek, which is not classified as trout water, contained the only native non-game coldwater indicator species (mottled sculpin) in the watershed. Most of the streams contained a subset of the species found in the Yellowstone River itself. The species assemblage varied by stream size and place in the watershed and not surprisingly headwater species give way to higher populations of mainstem species as one progressed downstream.

Besides brook trout and brown trout, the only other prominent game species found was the smallmouth bass. Their presence was limited to the mainstem sections of the Yellowstone River itself and were more prevalent upstream of Yellowstone Lake than downstream. This may be in part to more appropriate habitat provided by the higher gradient in this portion of the river. Smallmouth bass were not found in any of the tributary streams. This was interesting because it was hypothesized that some of these tributaries, particularly those with adequate flow in close proximity to the river, could serve as nursery streams for smallmouths. It is unclear if this absence is due to stream size, temperature, a combination of both, or some other factors. It should be noted that conditions in 2016 did not appear to be favorable for smallmouth bass reproduction based on the lack of young-of the year smallmouth bass found at most trend sites for streams in southwest Wisconsin (Lyons and Kanehl, 2016).

Smallmouth bass from Yellowstone River

Several species which tend to occupy larger river systems such redhorse were found in the Yellowstone River below Yellowstone Lake and most likely due to the fact they can access the East Branch Pecatonica River. Biologists also noted the presence of young-of-the-year largemouth bass, mostly in sections upstream and downstream of Yellowstone Lake. Because largemouth are generally noted as a lentic species, biologists attributed their presence in the river to an abundance of largemouth bass found in Yellowstone Lake.

When the appropriate fishery IBI, based on verification, is applied to sites in the watershed, most are “good” to “excellent” according to WisCALM (WDNR, 2013) guidelines. According to WisCALM (Ibid), streams that are considered headwaters (90th percentile flow < 3 cubic feet per second) should be evaluated using the “Small and Intermittent Stream IBI” (Lyons, 2006). When this is applied to the streams where the verified community is confirmed as a headwater, most sites are between 70 (good) and 100 (excellent). Canon Creek at Rock Branch Road and unnamed tributaries (WBICs = 905300 and 904400) and had either no fish captured or too few fish to calculate an IBI. Biologists noted that these were very small systems, in high gradient areas, and therefore the lack of fish was more likely the result of stream morphology and limited flow than environmental perturbation. It may be more appropriate to label these streams sites as macroinvertebrate systems. Unnamed tributary (WBIC = 905600) had a “poor” IBI because it was dominated by creek chubs – a tolerant species. While most headwater pioneer species are tolerant, biologists did note excessive sedimentation and macrophyte (water cress) growth. This may be due in part to improper culvert placement at the road crossing.

Agriculture, particularly grazing, is quite prevalent in the watershed. About half of the sites surveyed in 2016 had no buffer. This influences the habitat scores to some extent, and appeared to be more correlated with the amount of fine sediment, but not necessarily with bank erosion. As Table 2 shows, the overall qualitative habitat scores ranged from "fair" to "good" and were buoyed by the other the other metrics of bank erosion score, width/depth ratio, riffle-to-riffle ratio, and fine sediments scores. Fish cover tended to vary with steam size with larger streams having more cover.

The high gradient of streams in the watershed tends to keep accumulation of fines to margins and more quiescent areas such as runs upstream of riffles and culverts or in lower gradient areas near stream mouths. Gravel and rubble cobble bottoms are quite common despite the prevalence of sediment sources and the species associated with coarse substrate (common shiners, hornyhead chubs, southern redbelly dace, and fantail darter) are common throughout the watershed.

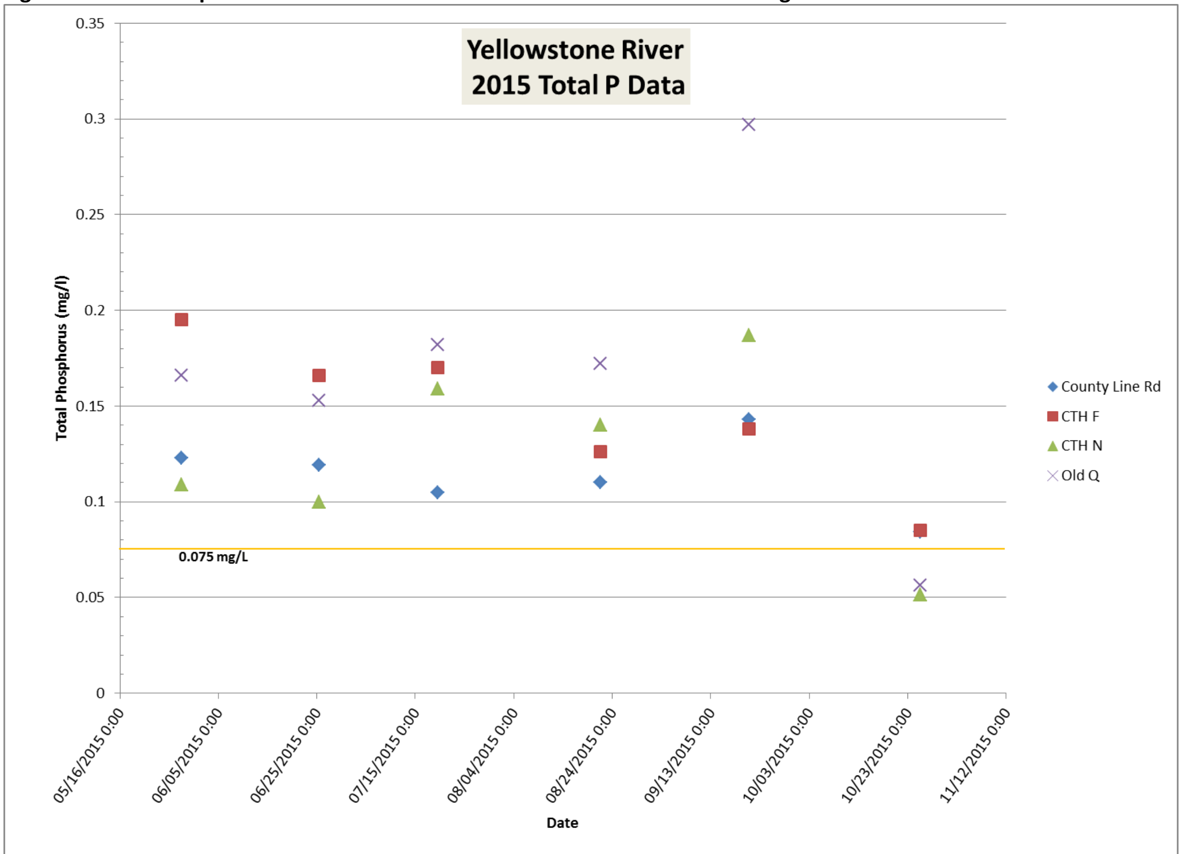
The fishery health, as measured by the IBI, showed most streams to be in good condition. This does not mean, however, that there are not indicators of environmental degradation. This is evidenced by enhanced overall numbers of fish. The nutrient loads enhance algal and periphyton growth which then enhances available food for grazers and this pattern is repeated up the food chain. Contrary to the conventional thinking that more fish equates to a healthier system, the enhanced abundance of fish is actually a sign of nonpoint source pollution impact, and while these streams may not necessarily be considered as impaired, it does indicate excessive eutrophication of these systems. Despite this, it is reasonable to assume that the gradient and habitat of the streams in these watersheds mask problems caused by sediment and nutrient loading. High gradient and an abundance of riffles mitigate dissolved oxygen sags. The lack of soft sediment and low residence time of nutrients precludes the excessive growth of macrophytes, thus limiting dissolved oxygen swings and allowing for a fishery community that is impacted, but not impaired. This may explain the relative health of the fishery, which is more responsive to habitat, compared to the health of the macroinvertebrate community, which is more responsive to water quality (Lyons, personal communication).

Evidence of this is reflected in the depressed macroinvertebrate IBI scores for streams in the watershed. The mIBI would seem to indicate there is a fair amount of localized stress on these systems. The larger, named systems tended to have lower MIBI scores than some of the unnamed tributaries. Although there did not appear to be a correlation with riparian buffer in this study, in general the macroinvertebrate IBI has shown the combination of watershed land cover and local riparian and instream conditions strongly influence one another (Weigel, 2003). While watershed and local variables explain a significant portion of variance among sites, Weigel found that in the driftless region, localize stressors were of greater importance to explain the IBI than in other parts of the state. The HBI scores seemed to indicate there was only slight to some organic loading at most sites, with a few localized samples showing moderate organic pollution. This is interesting in that most sites were similar in nature with regards to pasturing and potential sources of inputs from animals.

The department had been collecting total phosphorus data for Yellowstone River over the past 10 years for various reasons. In 2014, the department listed the upper portion of Yellowstone River (upstream of CTH F) on the state's 303(d) list of impaired waters due to phosphorus concentrations that exceed the 0.075 mg/L criteria*. The department, using volunteer monitors, then collected further total phosphorus data on 4 sites in 2015 during the growing season both upstream and downstream of Yellowstone Lake and according to the WisCALM (WDNR, 2013) protocol. The phosphorus criteria was exceeded in all samples save for 2 sites in late November (Figure 2). In 2016, the department recommended listing the remainder of Yellowstone River from Yellowstone Lake on down to its confluence with the East Branch Pecatonica because of this additional data showing the total phosphorus exceeding the criteria for that section of river.

*Although it is named the Yellowstone River, by definition, it is considered as a stream as the 90th percentile exceedance flow is less than 110 ft/second (Lyons, 2008). Thus it is subject to the 0.075 mg/L phosphorus criterion that is applied to streams (WDNR, 2013).

Figure 3. Total Phosphorus at Various Sites on the Yellowstone River – Growing Season 2015



Conclusion

Consistent with what was reported by Marshall and Fix (1998), streams in the Yellowstone River watershed are heavily pastured, leading to sediment deposition in pools and quiescent areas. However, sedimentation is variable and temporary, due to frequent scouring of these high gradient streams during storm events.

High stream gradients and good riffle-run-pool ratios indicate good potential for stream recovery with improved land use, especially upstream of Yellowstone Lake. The intensely grazed watershed offers opportunities for either rotational grazing or streambank fencing projects with cattle crossings. Some more severely eroded banks may require rip-rap (Ibid). This would also reduce nutrient loading to the system and have a positive impact on the lake.

Recommendations

The department should seek opportunities to work collaboratively on projects which would benefit the overall ecosystem health. Specifically, the department should work with the Iowa and Lafayette county land conservation departments to identify landowners willing to work with managed grazing, pursue farmer lead projects and/or demonstration areas.

The natural community designation of unnamed tributaries (WBICs = 905300 and 904400) should be changed to "macroinvertebrate" water. The natural community of other waterbodies in the watershed should be changed to reflect their contemporary fishery assemblage.

The county land conservation departments should promote the use of cover crops on fields to reduce soil loss and promote soil health.

Fisheries management should explore whether McClintock Creek may be a viable trout fishery.

Fisheries management should explore opportunities on Canon Branch to expand upon the stream habitat work that has already taken place and cooperation with landowners to secure easements.

Appendix A: Yellowstone Lake

Although not a part of the 2016 watershed survey, Yellowstone Lake is one of the most prominent surface water features in the watershed and in southwestern Wisconsin as a result of its value as a fishery and for recreation. The lake, located in the northeastern corner of Lafayette County, was created in the summer of 1954 for recreational purposes. The original surface area of Yellowstone Lake was approximately 455 acres and a maximum depth of 21 feet. Over the years, sedimentation and building of 2 levees has decreased the surface area to approximately 400 acres and a maximum depth of 14 feet.

The lake experiences heavy sedimentation due to intensive agriculture and streambank erosion from the watershed above. It was once estimated that this runoff from croplands and barnyards contributes approximately 13,200 pounds of phosphorus to the lake each year (WDNR, 2006). During the summer months, algae blooms combined with re-suspension of sediment from precipitation, rough fish, wind, and recreational boating lead to low water clarity. Secchi depths less than 0.5 meters have been recorded during these high turbidity periods. Turbidity restricts the ability of light to penetrate through the water column and can ultimately reduce the growth of aquatic macrophytes, which provide oxygen, habitat and food for a variety of aquatic animals. Yellowstone Lake has experienced fish kills as a result of this reduction in dissolved oxygen in the water column. This lack of habitat affects the health of the fishery of Yellowstone Lake. Overall, in conditions such as these, the lake becomes a breeding ground for undesirable fish species such as carp and suckers. These undesirable fish often make the problem worse by uprooting established macrophyte beds in the lake, further increasing turbidity and decreasing plant numbers. Partners in the watershed have pursued a variety of strategies over the years to improve and maintain the health of this very important lake. They have worked to plant native macrophytes along the shore to protect from wave erosion. The Lafayette County Land Conservation Department and Natural Resources Conservation Service had helped landowners identify ways to reduce runoff and erosion from agricultural fields. It is estimated the implementation of best management practices in the watershed reduced the amount of phosphorus entering the lake by over 4,000 pounds per year (Ibid).

In addition to commercial removal of carp, the department has also used management of the fishery to combat water quality and carp issues, by emphasizing using predator fish to feed on young carp. Today, walleye and muskies are still stocked regularly in the lake and special size regulations have been put in place to maintain good predator/prey relationships.

Overall, carp numbers have been reduced and sediment induced turbidity has decreased. However, the lake still suffers from (summer) season long algae blooms (Bradd Sims, personal communication). Water chemistry data is taken on an annual basis and shows the lake clearly exceeds the fish and aquatic life (FAL) standards and recreational thresholds for total phosphorus and chlorophyll a (See table below). Because of this, the lake has been on the state's 303(d) list of impaired waters since 2014.

Table 5. Yellowstone Lake Water Chemistry (2012 – 2016 data)

Parameter	Mean (ug/L)	Min (ug/L)	Max (ug/L)	Confidence Interval 90% (lower)	Confidence Interval 90% (upper)	Chl a % Days Exceed	Confidence Interval (% days) 90% (lower)	Confidence Interval (% days) 90% (upper)
Total Phosphorus[1]	152	52.6	289	118.28	162.83	n/a	n/a	n/a
Chlorophyll a[2]	124.5	61	226	97	151.9	94.6	79.2	99.3
	1) TP standard = 40 ug/L (recreational); 100 ug/L (FAL)							
	2) Chl-a = 30% exceeds (recreational); 27 ug/L (FAL)							

Yellowstone Lake is bordered by Wisconsin State Park and State Wildlife Area. Public access is allowed along the entire shoreline. Much of the access is located on the north side of the lake within Yellowstone Lake State Park. There are two paved boat launches, a gravel carry in launch, five disabled angler fishing pads, and just over 1.5 miles of accessible shore fishing. In addition to fishing during the open water months, it continues to be a popular recreational area for swimming, water skiing, and paddle sports. It is also a popular destination for ice anglers. Current fisheries management efforts have resulted in a fishery that is popular not only for Wisconsin residents, but also for anglers from Illinois, Iowa, and other surrounding areas. The lake continues to produce muskies, walleye, and largemouth bass that meet or exceed statewide averages for growth and weight.

Yellowstone Lake

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Appendix B: Stream Narratives

Canon Creek

Canon Creek is a 7-mile-long stream that begins in southern Iowa County and flows southeastward into Lafayette County where it joins the Yellowstone River about 1 ½ miles upstream of Yellowstone Lake. The stream is managed as a Class II trout water for its entire length. Private landowners have done some habitat rehabilitation and the department owns several miles of easements upstream of English Hollow Road, CTH W and CTH S. Surveys of the creek over the past several years show a variety of warm and transitional species are found in the creek, but dominated by white suckers, with only modest returns on brown trout, although multiple year classes are present. It is stocked annually with small fingerling brown trout. The 2016 surveys were conducted at Rock Branch Road and Gilbertson Road. No fish were found at Gilbertson Road owing to its small size. The stream should be considered as a macroinvertebrate water upstream from this point. The survey at Gilbertson Road revealed an assemblage of minnow species and a couple of brown trout. No other coldwater indicator species were found. Temperature data for the summer of 2016 showed the stream to fall in the “cold-cool” regime. The stream corridor is largely in pasture and grassland except for the woodlands encompassing the lower 1 mile of stream. Much of the stream downstream of Gilbertson Road has not been surveyed recently. The department should look into other opportunities for easements and habitat work downstream from English Hollow Road since temperature data shows it is favorable to trout. The stream is purported to be a cool-cold headwater and while the temperature data supports the thermal classification, like most streams in the area, the fishery assemblage at Gilbertson Road and English Hollow Road more closely resemble a cool-warm mainstem. The stream’s classification should be updated to reflect the current biota using a contemporary classification system.

McClintock Creek

This spring fed stream originates in southern Iowa County and flows southward 7 miles into Lafayette County and parallels CTH F, then CTH N. It joins the Yellowstone River 4 miles downstream of Yellowstone Lake. The natural communities model (Lyons, 20??) shows the stream alternating between a cool-cold headwater and a coldwater stream. Indeed, the 2016 monitoring at CTH F showed the fishery to more closely resemble a coldwater system. The other site surveyed resembled a cool-cold mainstem. McClintock Creek is the only stream in the watershed that contains mottled sculpin, a native coldwater indicator species. The non-game dominated system is mostly made up of white suckers, creek chubs or brook stickleback, although mottled sculpin were by far the most prevalent species at CTH F. Several large brown trout were found at CTH N and their origin is unknown since the stream has not been stocked. It is thought with proper management, the stream could support a coldwater (trout) fishery (WDNR, 2003). Temperature monitoring conducted at the lower end (CTH N) showed the thermal regime to be cool-cold. The stream flows through pasturelands and scattered woodlots. There are many trampled or raw banks along the length of the stream. Fisheries management should explore whether streambank and habitat restoration would result in a system that could support numbers of trout. Since there are few brown trout in the system, it may be a good system to introduce brook trout. Because the stream parallels 2 county highways with few public road crossings, access would have to be a consideration.

Mottled Sculpin

Photo credit: John Lyons

Steiner Branch

Steiner Branch is a 4-mile spring fed tributary to Yellowstone River. The stream suffered from extreme sedimentation due to poor agricultural land practices in the early 1980’s (Fix, 1995). Today, much of the stream flows through the Yellowstone State Wildlife Area. As a result of this change in land use and habitat improvement work conducted in the early 2000’s, the habitat and water quality of Steiner Branch has improved significantly (WDNR, 2003). The stream is now considered a Class II trout fishery. Since 2004, the department has been stocking small fingerling brook trout in order to establish a native brook trout fishery on the creek. Trend monitoring conducted over the past 5 years has shown that the creek supports a fishable population of brook trout and brown trout in the mid to upper areas where habitat improvement has taken place (Sims, 2014). In addition to the annual stocking of brook trout, natural reproduction also supplements the populations. Adult habitat, however, is limited in the lower areas of Steiner Branch (Ibid). The 2016 sampling looked at 3 different sites on Steiner Branch and the results mirrored that found in the trend report. Despite the habitat work, there is still a good amount of silt and sand in the stream. However, the habitat work offers plenty of fish cover for both game and non-game species to thrive.

The stream is modeled to be a coldwater stream for its entire length, and the fishery shows it to be a coldwater system nearer the headwaters, but the fishery more closely resembles a cool-cold mainstem as one moves further downstream. In addition to the brown and brook trout, common shiners and white suckers are also prevalent. There are no native non-game coldwater species such as mottled sculpin present.

The fish manager recommends continued stocking of small fingerling brook trout; changing the regulations to catch and release only for brook trout and no size limit with a daily bag limit of 5 fish for brown trout; improve habitat in the lower reaches of Steiner Branch where habitat is degraded or limited and continue to monitor Steiner Branch as a trend station for wadable coldwater streams (Ibid).

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Yellowstone River

The river from which this watershed gets its name is a 25-mile-long waterbody that starts in southern Iowa County in the township of Waldwick. It flows 25 miles southeastward until it meets the East Branch Pecatonica River about a mile northwest of Argyle in Lafayette County. Approximately halfway along the river, it is impounded by a dam forming Yellowstone Lake, a 455 acre waterbody formed in 1954. The upper portions of the river are spring and groundwater fed, thus have cold water temperatures. However, the natural community based on the fishery assemblage is cool-warm. As one proceeds further downstream, the river receives input from other cold or cool-cold tributaries. Steiner Branch and Canon Branch flow into Yellowstone River just upstream of the lake and McClintock joins the river about 4 miles downstream of the lake. Despite all these inputs of cool water, the fishery remains a diverse cool-warm to even warm assemblage for all of its length. Upstream of the lake, the stream has higher gradient and contains a nice complex of riffle, run and some pool areas. Smallmouth bass are common in these stretches of stream. Fish more common in Yellowstone Lake such as walleye, largemouth bass, northern pike, crappie and bluegill can be found in the section of Yellowstone River upstream of the lake at CTH F. Downstream of the lake, the river has lower gradient, is lacking riffles, and tends to have a more clay/silt bottom. Because fish have access to this portion of the Yellowstone River from the East Branch Pecatonica, fish diversity increases and there are some larger river species such as redhorse found in this lower section.

The health of the fishery as defined by the IBI shows most sections of Yellowstone River to be “good” to “excellent”. The section upstream from Yellowstone Lake at CTH F had fewer numbers of species and fish than had been reported in the past (WDNR, unpublished data). This may have been because of the high water conditions encountered during sampling in the 2016 survey. Similar water depth (average = 1.2 m) conditions also made sampling difficult at Gunderson Road. Consistent with what was reported by Marshall and Fix (1998), the Yellowstone River is heavily pastured, leading to sediment deposition in pools and quiescent areas. However, sedimentation is variable and temporary, due to frequent scouring of the high gradient upper sections (upstream of the lake) during storm events.

Like many streams in the watershed, the temperatures in the upper half of Yellowstone River more closely resemble a “cool-cold” system, even though the fishery contains a good diversity of cool and warmwater species.

Macroinvertebrate samples taken from various sites on the stream and over time show the community to be low quality based on the IBIs which generally range from “poor” to low “fair” (see table below). This is likely a reflection of conditions in the watershed as well as riparian land use as found in Weigel, 2003.

A wadable trend site has been monitored annually at the lower Gant Road crossing. Macroinvertebrate IBIs range from 0.78 (poor) to 3.42 (fair). A special study was conducted in spring of 2016 to look at intra and inter riffle variability. It showed a several things: 1) Inter and intra riffle variability was not significant, showing no distinctive differences between sites within a specific riffle, nor nearby riffles, 2) samples were consistently “poor” over the length of river from which the samples were taken and, 3) it appears to show differences between samples taken in spring of the year vs. samples taken in fall from the same sites as the fall samples are consistently higher in score, albeit not of good quality.

Phosphorus monitoring conducted along the river showed the 0.075 mg/L* criteria to be exceeded at all sites, thus the entire length of the river has been placed on the state’s 303(d) list of impaired waters.

*Although it is named the Yellowstone River, by definition, it is considered a stream as the 90th percentile exceedance flow is less than 110 ft/second (Lyons, 2008). Thus it is subject to the 0.075 mg/L phosphorus criterion that is applied to streams (WDNR, 2013).

Table 6. Macroinvertebrate IBI for Yellowstone River

<------Downstream Upstream------>

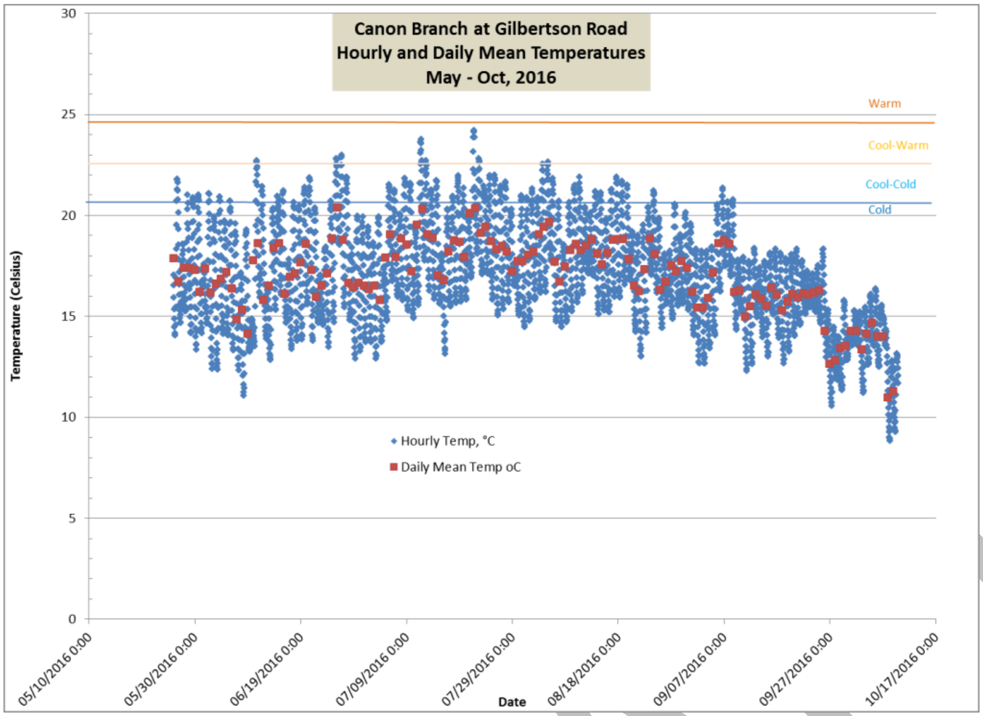
Station ID	Station Name	Date	MIBI
10044843	Yellowstone River at CTH W	04/18/16	2.84 (Fair)
		04/18/16	2.58 (Fair)
10044844	Yellowstone River - Farm Driveway off CTH DD	04/18/16	1.91 (Poor)
10044845	Yellowstone River at CTH DD	04/18/16	1.04 (Poor)
		10/10/16	4.65 (Fair)
10044846	Yellowstone River at Woodlawn Road	04/18/16	2.34 (Poor)
		04/19/16	2.21 (Poor)
10029857	Yellowstone River at County Line Rd	10/03/13	-1.65 (Poor)
		04/18/16	2.33 (Poor)
		04/18/16	0.84 (Poor)
		04/19/16	0.88 (Poor)
		10/10/16	2.21 (Poor)
10016093	Yellowstone River - County Line Rd - Downstream	11/15/02	1.39 (Poor)
10044847	Yellowstone RIver - Gant Road (Upper Crossing)	04/18/16	2.63 (Fair)
		10/10/16	4.96 (Fair)
333235	Yellowstone River - Gant Rd (Lower Crossing)	10/23/07	3.42 (Fair)
		10/14/10	3.2 (Fair)
		10/13/11	2.39 (Poor)
		10/04/12	0.78 (Poor)
		10/03/13	2.87 (Fair)
		09/26/14	2.40 (Poor)
		09/30/15	3.15 (Fair)
		04/19/16	1.22 (Poor)
		04/19/16	2.27 (Poor)
		10/10/16	3.03 (Fair)
10044848	Yellowstone River - Farm drive off English Hollow Rd	04/19/16	1.1 (Poor)
		04/19/16	2.26 (Poor)
		04/19/16	2.70 (Fair)
10021416	Yellowstone River - Old Q Road	10/03/13	-0.54 (Poor)
	Historic data		
	Special 2016 Spring Survey		
	Fall 2016 TWA Survey		

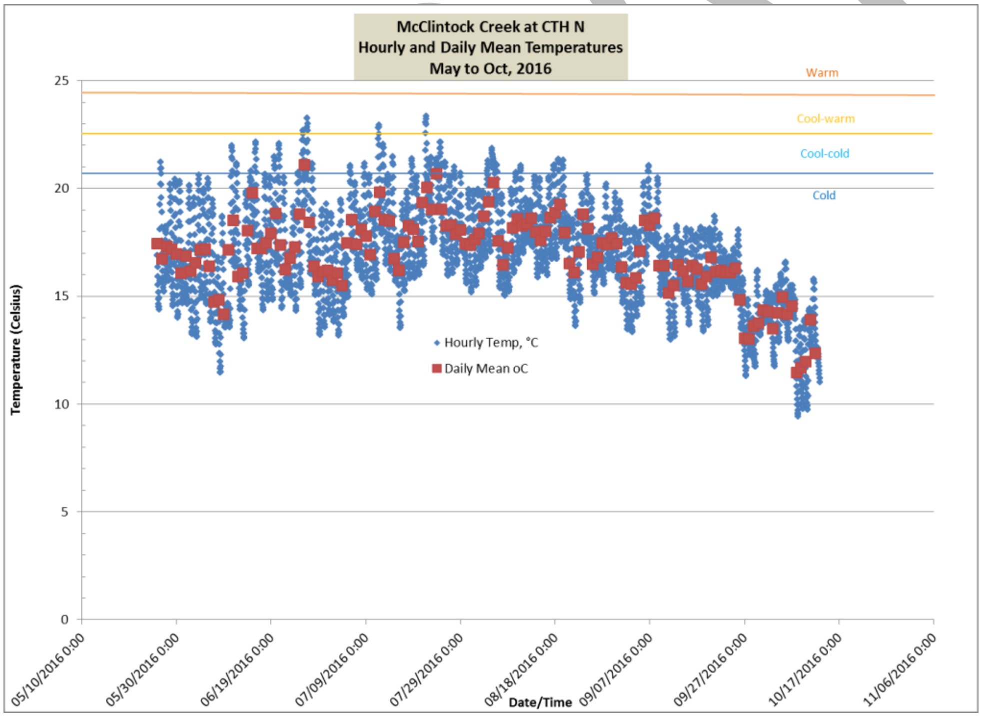
Multiple tributaries to Yellowstone River were also sampled for the 2016 study. These streams were found to have a subset of the species found in the mainstem of the river itself. As was the case with most tributaries in the watershed, their temperatures more closely resembled a cool-cold thermal regime, while their fishery assemblage more closely resembled a cool-warm one. One interesting item was the lack of smallmouth bass in these tributaries. It was hypothesized that some of these tributaries, particularly those with adequate flow nearer to the river, could serve as nursery streams for the river. It is unclear if this absence is due to streams size, temperature, a combination of both or some other factors. It should be noted that 2016 was a “down” year for smallmouth bass reproduction (Lyons and Kanehl, 2016).

High stream gradients and good riffle-run-pool ratios indicate good potential for stream recovery with improved land use, especially upstream of Yellowstone Lake. The intensely grazed watershed offers opportunities for either rotational grazing or streambank fencing projects with cattle crossings.

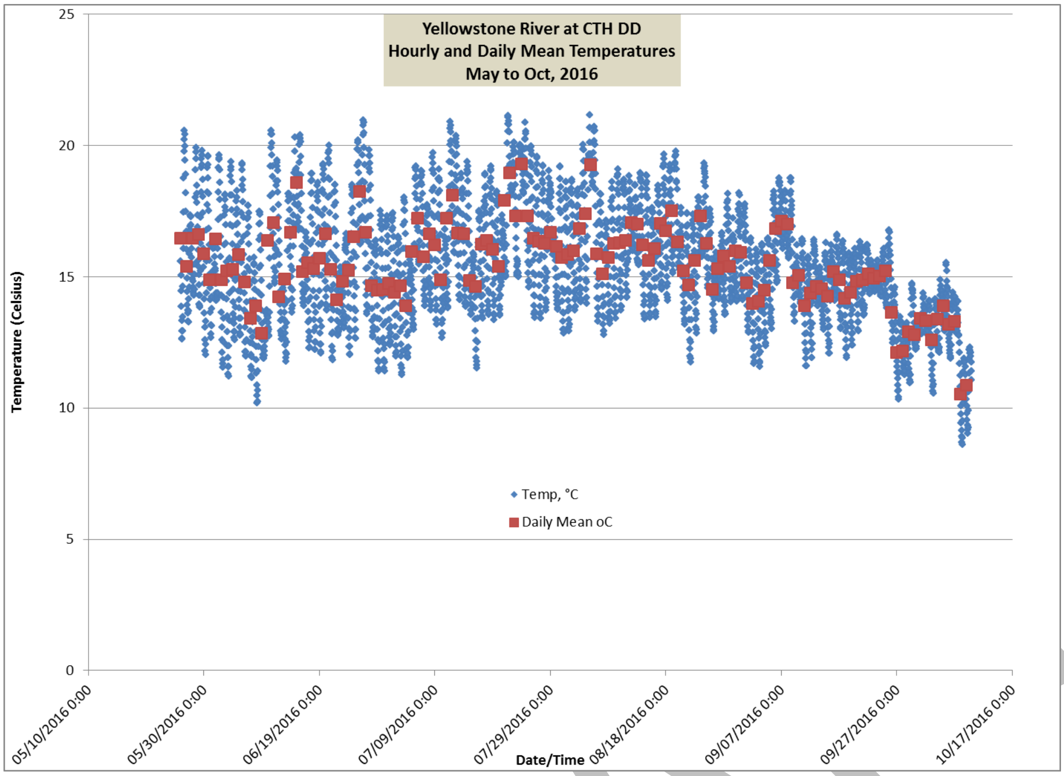
The department should seek opportunities to work collaboratively on projects which would benefit the overall ecosystem health. Specifically, the department should work with the Iowa and Lafayette county land conservation departments to identify landowners willing to work with managed grazing, pursue farmer lead projects and/or demonstration areas. This would also reduce nutrient loading to the system and have a positive impact on the lake.

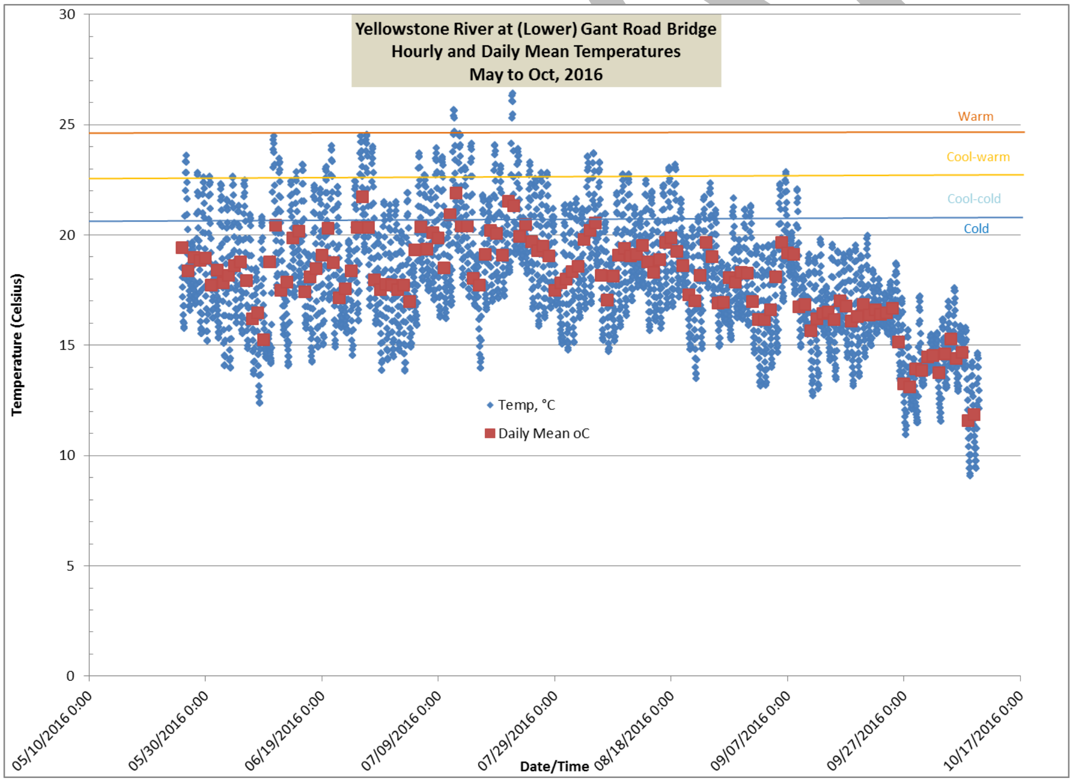
Appendix C: Stream Temperature Data



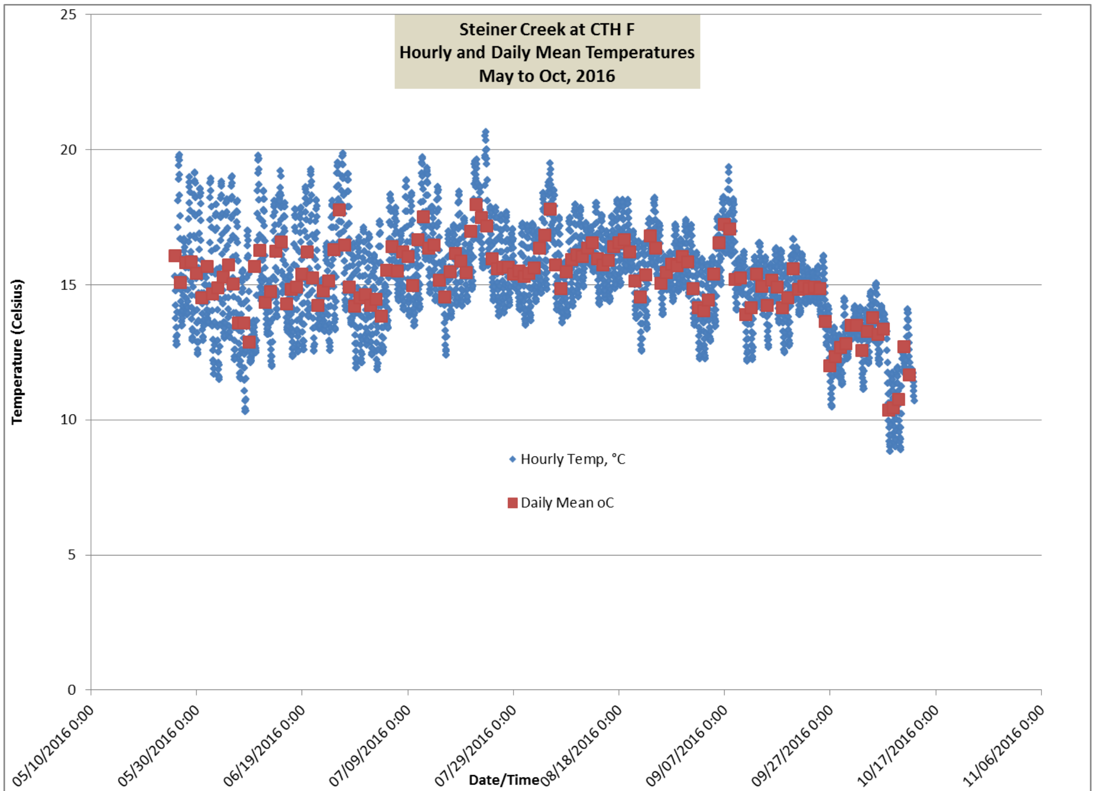


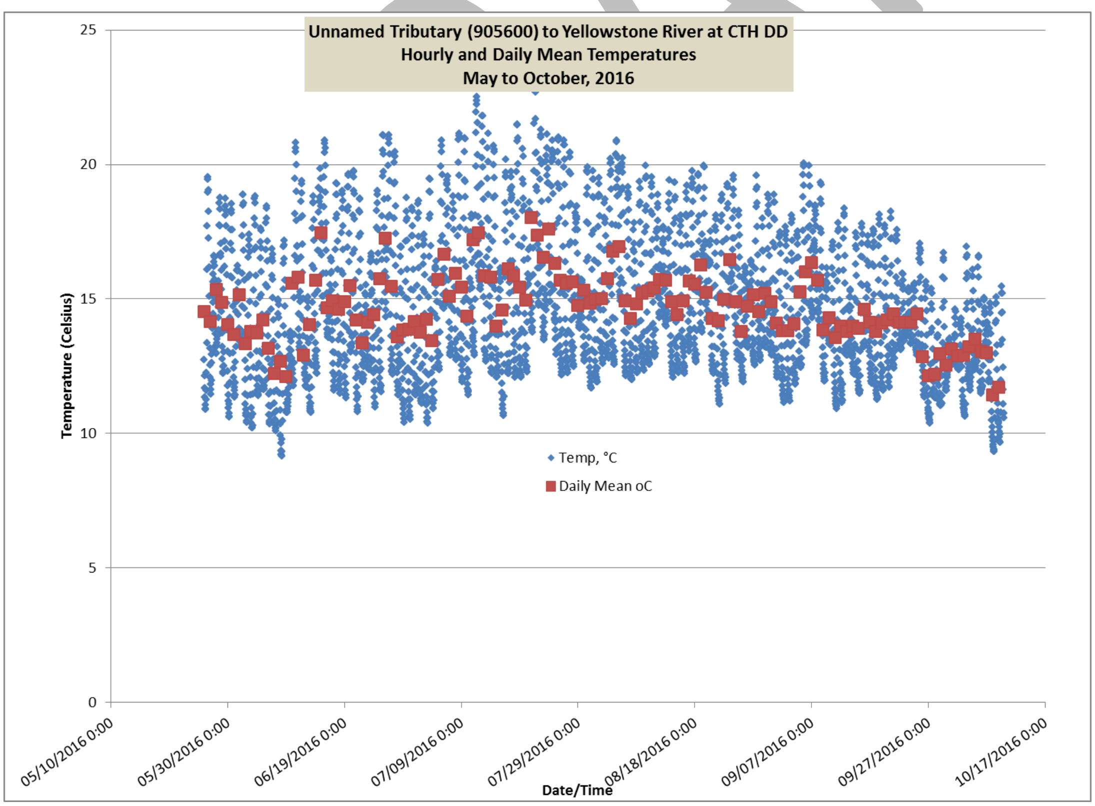
Appendix C: Temperature Data (continued)





Appendix C: Temperature Data (continued)





Appendix C: Temperature Data (continued)