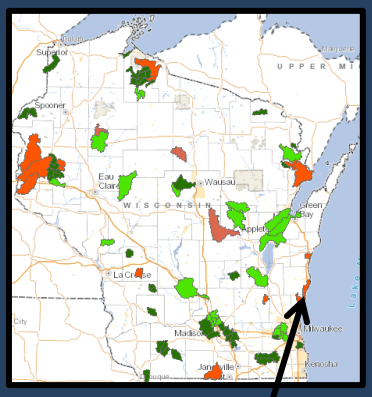
Plum - Kankapot Creek Targeted Watershed Assessment: A Water Quality Plan to Restore Wisconsin Watersheds

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

Lower Fox (LF03) Basin, Outagamie County
HUC12s 40302040204, 40302040203
Monitored 2015



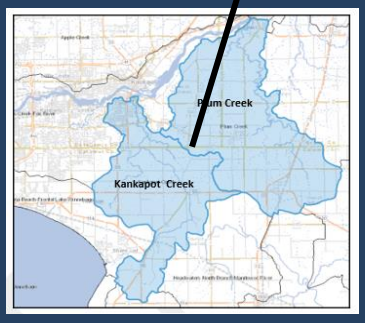


Photo by Andy Hudak, East District Water Quality Biologist
Wisconsin Department of Natural Resources

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

WISCONSIN DEPT. OF NATURAL RESOURCES

EGAD # 3200-2020-23
Water Quality Bureau,
Wisconsin DNR

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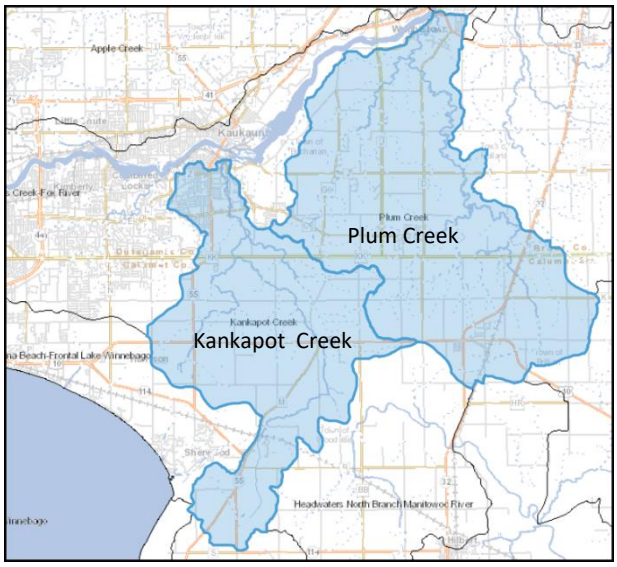
Targeted Watershed Assessment Summary

About the Watershed

The Plum- Kankapot Creek TWA Project is located in two HUC12 watersheds within the extensively developed Lower Fox River Basin and the heart of the Fox Valley Community (see map at right(. The watershed is comprised of two HUC 12 scale watersheds, Plum Creek drains roughly 28.15 square miles and Kankapot Creek drain roughly 18.7 square miles. The headwaters for both watersheds originate in Calumet County. Plum has equal portions in the lower reaches of the watershed split between Brown and Outagamie while Kankapot only has a small portion of the lower reaches within Outagamie County. Both are tributaries to the Fox River and their confluences are approximately 7 miles apart.



Plum-Kankapot Creek Subwatersheds

Water Quality

Overall water quality and stream habitat in this area is rated poor to fair with documented problems of suspended solids and phosphorous from non-point sources of pollution.

Study Summary

This monitoring study was conducted to support the Plum and Kankapot Watershed Implementation Plan, which is a nine-key element plan created by Outagamie County to restore and protect the water resources of the area. The Plum and Kankapot Watershed is a sub-watershed of the Lower Fox River Watershed and is in east central Wisconsin in Brown, Outagamie, and Calumet Counties. The Plum and Kankapot Creeks empty into the Lower Fox River draining approximately 38,712 acres.

This monitoring study is designed to provide a baseline of information regarding resource condition prior to the implementation of the Nine key plan, which has the following goals:

Goal #1: Improve surface water quality to meet the TMDL limits for total phosphorus and sediment.
Goal #2: Increase citizens' awareness of water quality issues and active participation in stewardship of the watershed.
Goal #3: Reduce flood levels during peak storm events.
Goal #4: Improve stream bank stability and reduce amount of streambank degradation.

Recommendations

- Advance the understanding and use of Soil Health principles throughout the watershed.
- Develop a riparian corridor management strategy. The management strategy should promote the establishment of diverse, healthy forest cover types to improve infiltration, nutrient and sediment sequestration, and provide for stabile bank conditions.
- Vegetative buffer widths should be increased in the headwaters and concentrated flow paths should be established into grassed waterways where possible.
- Focused efforts on strategic bank stabilization should be taken to address watershed wide bank erosion and failures.
- Continue monitoring monthly growing season total phosphorus, orthophosphate and total suspended solids at CTH Z on Kankapot Creek and upstream of CTH ZZ at the VandeHey Crossing on Plum Creek to track progress of BMP installation throughout the watersheds on water quality.
- Within 5 years following the BMP implementation through the Plum-Kankapot 9KE plan repeat monitoring at the 20 locations to evaluate contemporary conditions within the watershed.

Wisconsin Water Quality Monitoring and Planning

This Water Quality Management Plan was created under the state's Water Quality Management Planning and Water Resources Monitoring Programs. The plan reflects Water Quality Bureau and Water Resources Monitoring Strategy 2015-2020 goals and priorities and fulfills Areawide Water Quality Management Planning milestones under the Clean Water Act, Section 208. Condition information and resource management recommendations support and guide program priorities for the plan area.
This plan is hereby approved by the Wisconsin DNR Water Quality Program and is a formal update to the Lower Fox Areawide Water Quality Management Plan and Wisconsin's Statewide Areawide Water Quality Management Plan. This plan will be forwarded to USEPA for certification as a formal plan update.

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Adrian Stocks, Water Quality Bureau Director

Basin/Watershed Partners

- Outagamie County Land Conservation Department
- Calumet County Land Conservation Department
- Fox-Wolf Watershed Alliance
- UW-Green Bay
- Fox Valley Technical College
- United States Geological Survey
- Natural Resources Conservation Service
-

Report Acknowledgements

- Andrew Hudak, Primary Author and Investigator, Eastern District, Wisconsin DNR
- Victoria Ziegler, Program Support, Water Quality Bureau, Wisconsin DNR
- Lisa Helmuth, Program Coordinator, Water Quality Bureau, Wisconsin DNR

EGAD # 3200-2020-23

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Abbreviations

AEL: Aquatic Entomology Laboratory at UW – Stevens Point: the primary laboratory for analysis of macroinvertebrate taxonomy in the State of Wisconsin.

BMP: **Best Management Practice**. A land management practice used to prevent or reduce nonpoint source pollution such as runoff, total suspended solids, or excess nutrients.

DATCP: Wisconsin Department of Agriculture, Trade and Consumer Protection – the state agency in partnership with DNR responsible for a variety of land and water related programs.

DNR: **Department of Natural Resources.** Wisconsin Department of Natural Resources is an agency of the State of Wisconsin created to preserve, protect, manage, and support natural resources.

END: Endangered Species - Wisconsin species designated as rare or unique due to proximity to the farthest extent of their natural range or due to anthropogenic deleterious impacts on the landscape or both.

ERW: Exceptional Resource Water- Wisconsin's designation under state water quality standards to waters with exceptional quality and which may be provided a higher level of protection through various programs and processes.

FMDB: Fisheries Management Database – or **Fish Database** – the state's repository for fish taxonomy and auto-calculated metrics involving fish assemblage condition and related.

FIBI: **Fish Index of biological integrity (Fish IBI).** An Index of Biological Integrity (IBI) is a scientific tool used to gauge water condition based on biological data. Results indicate condition and provide insight into potential degradation sources. In Wisconsin, specific fish IBI tools are developed for specific natural communities. Therefore, biologists must review and confirm the natural community to use the correct fish IBI tool.

HUC: **Hydrologic Unit Code.** A sequence of numbers that represent one of a series of nested hydrologic catchments delineated by a consortium of agencies including USGS, USFS, and Wisconsin DNR.

MIBI: **Macroinvertebrate Index of biological integrity.** The mIBI is the primary tool used to assess stream macroinvertebrate community condition.

NC: Natural Community. A system of categorizing water based on inherent physical, hydrologic, and biological components. Streams and Lakes have uniquely derived systems that result in specific natural community designations for each lake and river segment in the state. These designations dictate the appropriate assessment tools which improves the condition result, reflecting detailed nuances reflecting the modeling and analysis work foundational to the assessment systems.

Monitoring Seq. No. Monitoring sequence number refers to a unique identification code generated by the Surface Water Integrated Monitoring System (SWIMS), which holds much of the state's water quality monitoring data except for fisheries taxonomy and habitat data.

MDM: Maximum Daily Averages – maximum daily average is a calculated metric that may be used for temperature, dissolved oxygen and related chemistry parameters to characterize water condition.

NC: Natural Community. A system of categorizing water based on inherent physical, hydrologic, and biological components. Streams and Lakes have uniquely derived systems that result in specific natural community designations for each lake and river segment in the state. These designations dictate the appropriate assessment tools which improves the condition result, reflecting detailed nuances reflecting the modeling and analysis work foundational to the assessment systems.
mg/L: milligrams per liter - a volumetric measure typically used in chemistry analysis characterizations.

NOAA: National Oceanic and Atmospheric Administration – a federal agency responsible for water / aquatic related activities involve the open waters, seas, and Great Lakes.

ND: No detection – a term used typically in analytical settings to identify when a parameter or chemical constituent was not present at levels higher than the limit of detection.

NRCS: USDA Natural Resources Conservation Service - the federal agency providing local support and land management outreach work with landowners and partners such as state agencies.

ORW: Outstanding Resource Water- Wisconsin's designation under state water quality standards to waters with outstanding quality and which may be provided a higher level of protection through various programs and processes.

SC: Species of Special Concern- species designated as special concern due to proximity to the farthest extent of their natural range or due to anthropogenic deleterious impacts on the landscape, or both.

SWIMS ID. Surface Water Integrated Monitoring System (SWIMS) identification number is the unique monitoring station identification number for the location of monitoring data.

TDP: Total Dissolved Phosphorus – an analyzed chemistry parameter collected in aquatic systems positively correlated with excess productivity and eutrophication in Wisconsin waters.

TMDL: Total Maximum Daily Load – a technical report required for impaired waters Clean Water Act. TMDLs identify sources, sinks and impairments associated with the pollutant causing documented impairments.

TP: Total Phosphorus - an analyzed chemical parameter collected in aquatic systems frequently positively correlated with excess productivity and eutrophication in many of Wisconsin's waters.

TWA: **Targeted Watershed Assessment.** A monitoring study design centered on catchments or watersheds that uses a blend of geometric study design and targeted site selection to gather baseline data and additional collection work for unique and site-specific concerns for complex environmental questions including effectiveness monitoring of management actions, evaluation surveys for site specific criteria or permits, protection projects, and generalized watershed planning studies.

TSS: Total suspended solids – an analyzed physical parameter collected in aquatic systems that is frequently positively correlated with excess productivity, reduced water clarity, reduced dissolved oxygen and degraded biological communities.

WATERS ID. The Waterbody Assessment, Tracking, and Electronic Reporting System Identification Cod**e**. The WATERS ID is a unique numerical sequence number assigned by the WATERS system, also known as "Assessment Unit ID code." This code is used to identify unique stream segments or lakes assessed and stored in the WATERS system.

WBIC: Water Body Identification Code. WDNR's unique identification codes assigned to water features in the state. The lines and information allow the user to execute spatial and tabular queries about the data, make maps, and perform flow analysis and network traces.

WSLH: Wisconsin State Laboratory of Hygiene– the state's certified laboratory that provides a wide range of analytical services including toxicology, chemistry, and data sharing.

WQC: Water quality criteria – a component of Wisconsin's water quality standards that provide numerical endpoints for specific chemical, physical, and biological constituents.

Targeted Watershed Assessment Summary

About the Watershed

The Plum- Kankapot Creek TWA is comprised of two HUC 12 scale watersheds, Plum Creek drains roughly 28.15 square miles and Kankapot Creek drain roughly 18.7 square miles. The headwaters for both watersheds originate in Calumet County. Plum has equal portions in the lower reaches of the watershed split between Brown and Outagamie while Kankapot only has a small portion of the lower reaches within Outagamie County. Both are tributaries to the Fox River and their confluences are approximately 7 miles apart. Overall water quality and stream habitat is rated poor to fair with documented problems of suspended solids and phosphorous from non-point sources of pollution.

There are two municipal permitted wastewater treatment facilities located on Plum Creek and one industrial permitted discharge. There is one municipal permitted wastewater discharge and one industrial permitted discharge in the Kankapot Creek watershed. There are currently no concentrated animal feeding operations located in either watershed proper but with the proximity to dozens of permitted operations in the surrounding watershed, much of the agricultural lands in the either watersheds are under nutrient management plans of those operations.

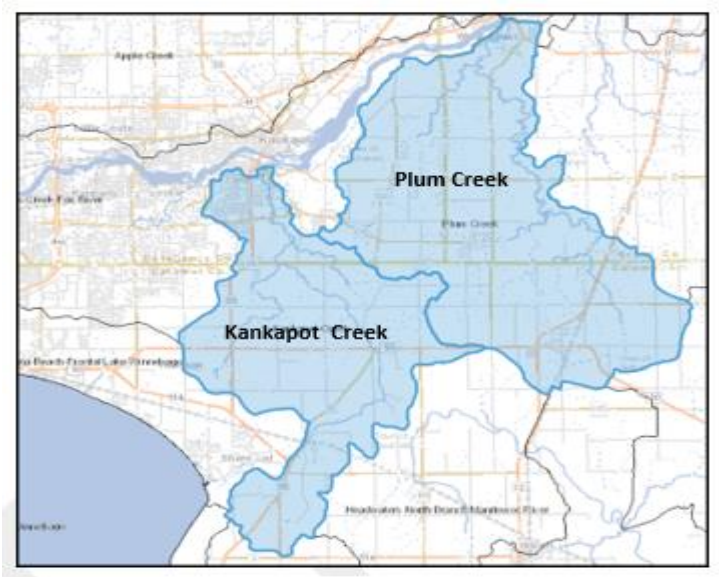


Figure 1: Plum – Kankapot Creeks Watersheds

Land Use

The Plum and Kankapot Creek watersheds are dominated by agricultural crop lands. There are still intermixed forested areas interspersed throughout the dominant agricultural settings. These are often limited to the steep slopes along the mid to lower portion of the river corridors. As one travels downstream, the streams become highly entrenched within the valley floors. Historically these steep slopes served as pastures for the numerous small farms in the area. Currently the number of small farms has decreased but the average size has sharply increased. There are currently 72 known livestock operations in the two watersheds of which 4 are CAFO's. (Outagamie County, LCD) Most dairy cows within these watersheds are housed in barns reducing the need for open pastures which has allowed them to revert to woodlots. Small portions of the communities of Kaukauna, Wrightstown, Holland, and Sherwood comprise the urban land uses within the watershed.

Figure 2. Land Use Plum Creek Watershed

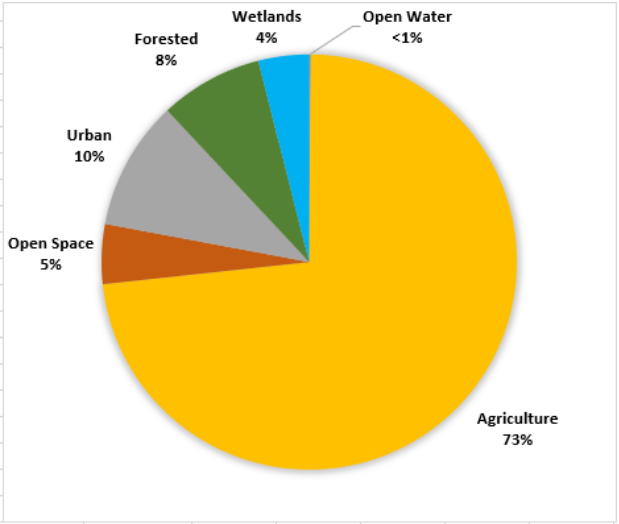
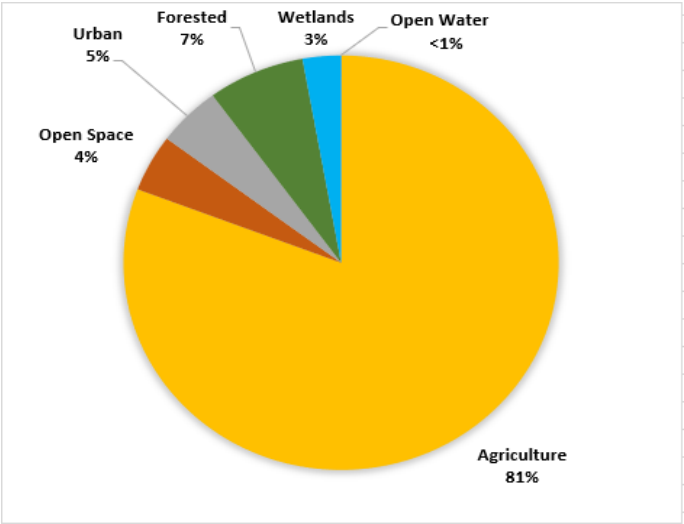


Figure 3. Land Use in the Kankapot Creek



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Goal #1: Improve surface water quality to meet the TMDL limits for total phosphorus and sediment.
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Goal #4: Improve stream bank stability and reduce amount of streambank degradation.

Recommendations

- Advance the understanding and use of Soil Health principles throughout the watershed.
- Develop a riparian corridor management strategy. The management strategy should promote the establishment of diverse, healthy forest cover types to improve infiltration, nutrient and sediment sequestration, and provide for stabile bank conditions.
- Vegetative buffer widths should be increased in the headwaters and concentrated flow paths should be established into grassed waterways where possible.
- Focused efforts on strategic bank stabilization should be taken to address watershed wide bank erosion and failures.
- Continue monitoring monthly growing season total phosphorus, orthophosphate and total suspended solids at CTH Z on Kankapot Creek and upstream of CTH ZZ at the VandeHey Crossing on Plum Creek to track progress of BMP installation throughout the watersheds on water quality.
- Within 5 years following the BMP implementation through the Plum-Kankapot 9KE plan repeat monitoring at the 20 locations to evaluate contemporary conditions within the watershed.

Water Quality Plan Goals

The overall goal of this plan is to improve and protect water quality in the basin. This Targeted Watershed Assessment monitoring project provided substantial data to analyze current conditions and to make recommendations for future management actions in the area. This plan is designed to present monitoring study results, identify consistent with Clean Water Act guidelines and state water quality standards. issues or concerns in the area found during the project and to make recommendations to improve or protect water quality

Resource Outstanding and Exceptional Resource Waters

Wisconsin has designated many of the state's highest quality waters as Outstanding Resource Waters (ORWs) or Exceptional Resource Waters (ERWs). Waters designated as ORW or ERW are surface waters which provide outstanding recreational opportunities, support valuable fisheries and wildlife habitat, have good water quality, and are not significantly impacted by human activities. ORW and ERW status identifies waters that the State of Wisconsin has determined warrant additional protection from the effects of pollution. There are no listed ORW or ERW in the Plum and Kankapot Creek Watersheds.

Trout Waters

DNR uses three categories to classify the several types of trout streams throughout Wisconsin. There are no listed trout waters in the Plum and Kankapot Creek Watersheds.

Impaired Waters

Every two years, Section 303(d) of the Clean Water Act requires states to publish a list of all waters that do not meet water quality standards. The list, also known as the Impaired Waters List, is updated to reflect waters that are newly added or removed based on current information. Impaired waters in this watershed are impaired from non-point sources of discharges associated from rural or urban sources. Impaired waters in the Plum-Kankapot Creek watershed include Kankapot Creek and Plum Creek (Table 1).

Table 1: Impaired Waters in the Plum and Kankapot Creek Watershed

Watershed	Local Name	WBIC	Start Mile	End Mile (acres)	Pollutant	Impairment	Sources
LF03	Kankapot Creek	126800	0	2.66	Total Phosphorus	Degraded Biological Community, Degraded Habitat	Non-Point Source (Rural or Urban), Discharges from Municipal Separate Storm Sewer Systems (MS4), Streambank Modifications/destabilization
LF03	Kankapot Creek	126800	0	2.66	Sediment/Total Suspended Solids	Degraded Habitat	Non-Point Source (Rural or Urban), Discharges from Municipal Separate Storm Sewer Systems (MS4), Streambank Modifications/destabilization
LF03	Kankapot Creek	126800	2.66	9.57	Sediment/Total Suspended Solids	Degraded Habitat	Non-Point Source, Streambank Modifications/destabilization
LF03	Kankapot Creek	126800	2.66	9.57	Total Phosphorus	Degraded Habitat	Non-Point Source Streambank Modifications/destabilization
LF03	Plum Creek	125100	0	13.86	Total Phosphorus	Degraded Biological Community, Degraded Habitat	Non-Point Source, Municipal Separate Storm Sewer Systems (MS4), Streambank Modifications/destabilization
LF03	Plum Creek	125100	0	13.86	Sediment/Total Suspended Solids	Elevated Water Temperature, Degraded Habitat	Non-Point Source Municipal Separate Storm Sewer Systems (MS4), Streambank Modifications/destabilization
LF03	Plum Creek	125100	13.87	16.42	Sediment/Total Suspended Solids	Elevated Water Temperature, Degraded Habitat	Non-Point Source Municipal Separate Storm Sewer Systems (MS4), Streambank Modifications/destabilization
LF03	Plum Creek	125100	16.42	19.5	Sediment/Total Suspended Solids	Elevated Water Temperature, Degraded Habitat	Non-Point Source Streambank Modifications/destabilization

Aquatic Invasive Species

Round Gobies, Rusty Crawfish, Curly-leaf Pondweed, Eurasian Water Milfoil, Phragmites, and Purple Loosestrife, were all identified and vouchered within the watershed in 2015.

Monitoring Project Discussion

Purpose of Project

Plum and Kankapot Creek are listed on the State's 303(d) list if impaired waterways. These two streams contribute a significant source of sediment and phosphorous that continue to cause impairment to the Lower Fox River and degradation in the Lower Bay of Green Bay. In efforts to reduce this pollutant load to the Lower Fox River, Outagamie County in cooperation with Brown and Calumet County have developed Nine-Key Element plans with the goals below to improve conditions within these streams and the downstream waters. This monitoring project was designed to provide contemporary biological, physical and chemical conditions prior to the implementation of conservation practices through the Nine key element plan. Additionally, in 2011 and 2014 the West Branch of Plum Creek was awarded a GLRI grant to install buffers and address bank erosion. The effectiveness of these installed BMP's on instream conditions within this stream will be evaluated.

Plum and Kankapot Creek 9KE plan Goals:

Goal #1: Improve surface water quality to meet the TMDL limits for total phosphorus and sediment.
Goal #2: Increase citizens' awareness of water quality issues and active participation in stewardship of the watershed.
Goal #3: Reduce flood levels during peak storm events.
Goal #4: Improve stream bank stability and reduce amount of streambank degradation.

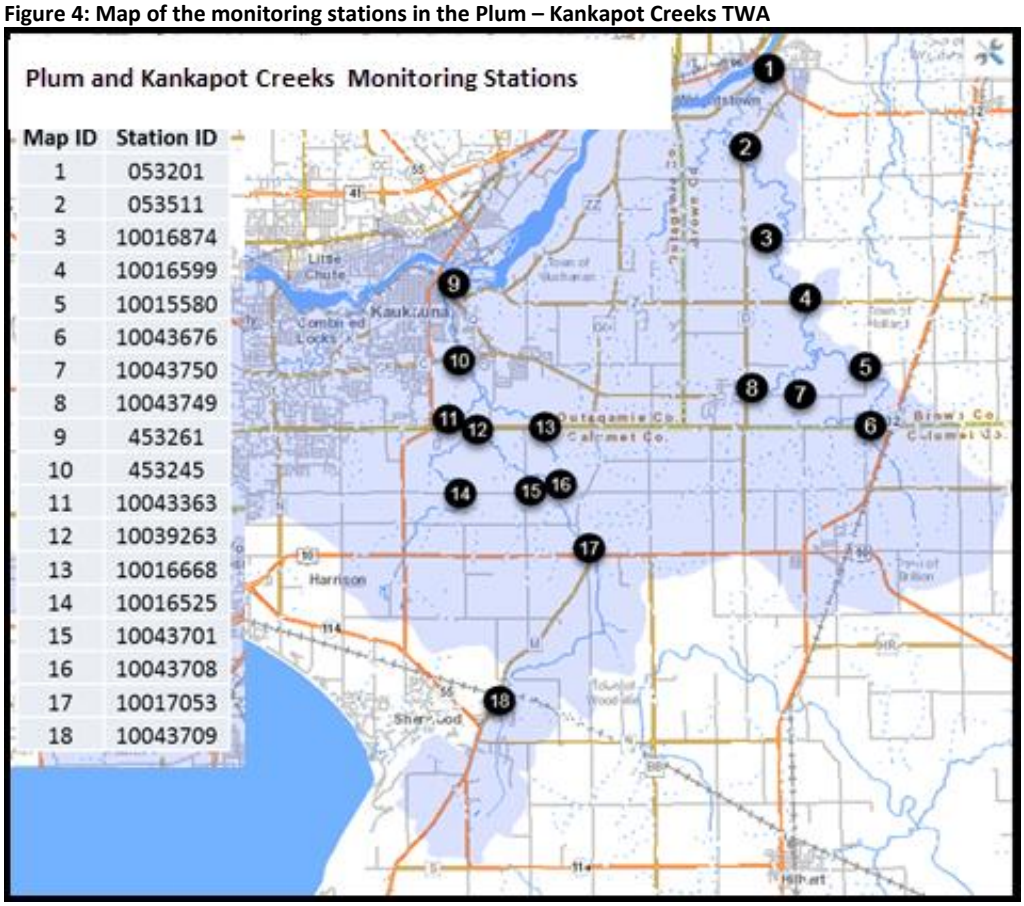
Site Selection and Study Design

This study involved collection of data on fish assemblage, quantitative habitat, and macroinvertebrates on 10 streams at 21 sites in these targeted HUC 12's. Phosphorus data was collected 6 times during the growing season from 5 sites in the watersheds including the furthest downstream crossings on both Plum and Kankapot Creeks. The samples were collected by citizen volunteers through the Lower Fox River Citizen Monitoring Program. Sample stations were established to limit outside influences and set-up using DNR field procedures manuals of 35 times the mean stream width (Modified from Simonson, et al. 1994). Stations were no less than the minimum of 100 meters and no more than the maximum of 400 meters.

Table 2: Monitoring Stations in the Plum – Kankapot Creeks TWA

Map ID	Station ID	Station Name	WBIC	Water Body Name
1	53201	Plum Creek - CTH ZZ Bridge	125100	Plum Creek
2	53511	Plum Creek - CTH D	125100	Plum Creek
3	10016874	Plum Creek - Lamers and Clancy Road	125000	Unnamed
4	10016599	Plum Creek - Hills Road	125100	Plum Creek
5	10015580	Plum Creek- Holland Road	125100	Plum Creek
6	10043676	Plum Creek - ManCal Road	125100	Plum Creek
7	10043750	UNT to Plum Creek - Holland Road	5022241	Unnamed
8	10043749	UNT to Plum Creek - CTH D	125500	Unnamed
9	453261	Kankapot Creek - Dodge Street	126800	Kankapot Creek
10	453245	Kankapot Creek - CTH CE	126800	Kankapot Creek
11	10043363	UNT to Kankapot Creek - DS CTH KK	126900	Unnamed
12	10039263	UNT to Kankapot Creek - CTH KK	126900	Unnamed
13	10016668	Kankapot Creek - CTH KK Bridge	126800	Kankapot Creek
14	10016525	UNT to Kankapot Creek - Schmidt Road #7	127000	Unnamed
15	10043701	UNT to Kankapot Creek - Schmitt Road #5	5022391	Unnamed
16	10043708	UNT to Kankapot Creek - Schmidt Road #6	126900	Unnamed
17	10017053	UNT to Kankapot Creek - Military Road	126900	Unnamed
18	10043709	UNT to Kankapot Creek -Robinhood Drive	126900	Unnamed
19	10043742	West Plum Creek - New Road	125200	West Plum Creek
20	10043731	UNT to West Plum Creek - County Line Road	125300	West Plum Creek
21	10043720	UNT to West Plum Creek – CTH Z	125200	Unnamed

Figure 4: Map of the monitoring stations in the Plum – Kankapot Creeks TWA



Methods, Equipment and Quality Assurance

Collection of total phosphorus (TP), Orthophosphate (ORP) and Total Suspended Solids (TSS), continuous water temperatures, quantitative habitat, fish, and aquatic macroinvertebrates used standard DNR data collection methods and samples were sent to certified laboratories in the state for specific analysis. No specific in-field duplicates, replicates or blanks were collected for the study; however quality assurance sampling procedures were used in the collection and preservation of samples for all parameters.

Water Chemistry (TP, ORP, TSS)

Water Chemistry samples were collected through citizen volunteers under a grant awarded to the Fox Valley Technical College to support and implement a citizen volunteer network in the Lower Fox River watershed. Standard DNR grab sampling methods were used to collect a total of 30 samples (Tables 3 & 4). All samples were shipped to Wisconsin State Laboratory of Hygiene (WISLOH) for analysis. The WISLOH entered all sample analysis data into the Surface Water Integrated Monitoring System (SWIMS) database.

Continuous Temperature

Onset continuous temperature loggers were placed in 7 sites in 2015 and collected water temperature readings at 1-hour intervals to ascertain daily maximum average temperatures throughout the summer, approximately May through October.

Fish Assemblage

The fisheries assemblage was determined by a quantitative survey involving electroshocking a section of stream with a minimum station length of 35 times the mean stream width (Lyons, 1992). All fish were collected, identified, and counted. All gamefish were measured for length. All other DNR sampling protocols were used to assess the fish community for purposes of calculating the index of biotic integrity. DNR staff entered the fish data into the DNR Fisheries Database.

Habitat Surveys

Habitat was evaluated throughout each fish survey station. Quantitative habitat survey station lengths were 35 times the mean stream width of the survey station. Following the determination of station length, the station was divided into 12 transects. At each transect, substrate, sedimentation, erosion, water depth, and riparian land use data were collected. DNR staff entered the quantitative habitat data into the DNR Fisheries and Habitat Management Database (FHMD).

Macroinvertebrates

All sites were sampled using the DNR Guidelines for Collecting Macroinvertebrate Samples from Wadable Streams (2000). A D-shaped kicknet with 600-micron mesh was used at all sites by standing upstream from the net and placing it firmly on the stream bed while digging into the substrate with the heel or toe to free the macroinvertebrates from the substrate. Riffles were targeted at each of the sites, but if none were present then overhanging vegetation, woody debris, or other vegetation would be sampled. For a representative sample of the aquatic macroinvertebrate community, a minimum of 100 aquatic macroinvertebrates collected in each sample was targeted. The aquatic macroinvertebrates were preserved in a 70-80% ethanol solution inside quart "Mason" jars. If necessary, multiple "Mason" jars were used per sample depending upon how much sediment and organic material was collected with the aquatic macroinvertebrates. Within the next 24 hours, the samples were re-preserved with another 70-80% ethanol solution. Samples were taken to the University of Wisconsin-Stevens Point Aquatic Entomology Laboratory (UWSP AEL) for lowest possible taxonomic identification. Staff at the UWSP AEL entered the data into the SWIMS database upon final taxonomic identification.

Results

Total Phosphorus

All inorganic chemistry samples were sent to the WISLOH in Madison for analysis. All sample sites for this project had a median TP concentration (mg/L) exceeding the NR 102 water quality criteria (WQC) for creeks and rivers of 0.075 mg/L (Tables 3 & 4). Wisconsin Consolidated Assessment and Listing Methodology (WisCALM 2018) requires a parametric statistical approach to assess stream TP data against the applicable water quality criterion found in NR 102. This approach involves the calculation of a 90% confidence limit around the median of a TP sample dataset. If the lower 90% confidence limit (LCL) exceeds the criterion for TP, then that creek segment (assessment unit) is considered to exceed the criterion. The LCLs were calculated for each streams' s TP samples (Table 4). All 5 locations within the Plum and Kankapot Creek watersheds had calculated LCLs that exceeded the water quality criterion for TP (Figure 5 and Figure 6.

Unnamed Tributary to Kankapot Creek at County Highway KK

Table 3: Total Phosphorus Concentrations in the Plum/Kankapot Creek Watershed in 2015

SWIMS Station ID	Waterbody Name	May	June	July	August	September	October	Median	Lower 90% Median	Upper 90% Median
10043363	UNT to Kankapot Creek - CTH KK	0.523	0.53	0.666	1.65	0.504	--	0.53	0.44	1.11
10016494	West Plum Creek - County Line Road	0.409	0.696	1.33	0.549	0.593	2.6	0.645	0.53	1.53
10016599	Plum Creek - Hills Road	0.431	0.652	0.964	2.07	1.11	1.13	1.037	0.72	1.4
453261	Kankapot Creek - Dodge Street	0.379	0.321	0.351	0.315	0.38	0.812	0.365	0.31	0.54
53201	Plum Creek - CTH ZZ Bridge	0.16	0.125	0.105	0.204	0.16	0.141	0.151	0.13	0.17

Table 4: Total Phosphorus Concentrations in the Plum/Kankapot Creek Watershed in 2016 and 2017

SWIMS Station ID	Waterbody Name	May	June	July	August	September	October	Median	Lower 90% Median	Upper 90% Median
453261	Kankapot Creek - Dodge Street (2016)	0.169	0.392	0.292	0.257	--	0.353	0.292	0.23	0.35
10046999	Plum Creek - VendeHey Farm (2016)	--	--	--	1.34	0.839	0.661	0.839	0.56	1.33
53201	Plum Creek - CTH ZZ Bridge (2016)	0.3	0.188	0.191	--	--	--	0.191	0.16	0.3
453261	Kankapot Creek - Dodge Street (2017)	0.313	0.412	0.488	0.663	0.747	0.507	0.498	0.43	0.62
10046999	Plum Creek - VendeHey Farm (2017)	0.462	0.395	0.46	0.6.2	0.878	1.59	0.541	0.46	1.01

Figure 5: Lower 90% confidence limit of Total Phosphorus concentrations in 2015

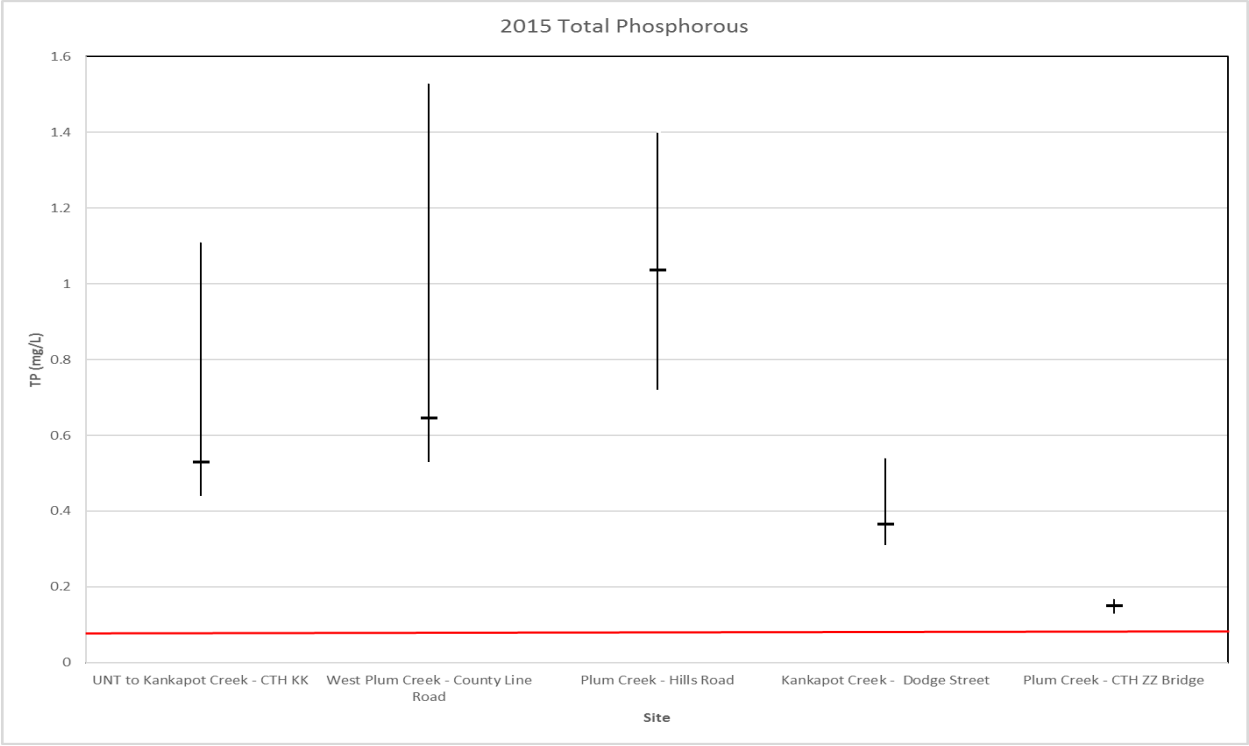


Figure 6: Lower 90% confidence limit of Total Phosphorus concentrations 2017 at pour-point stations

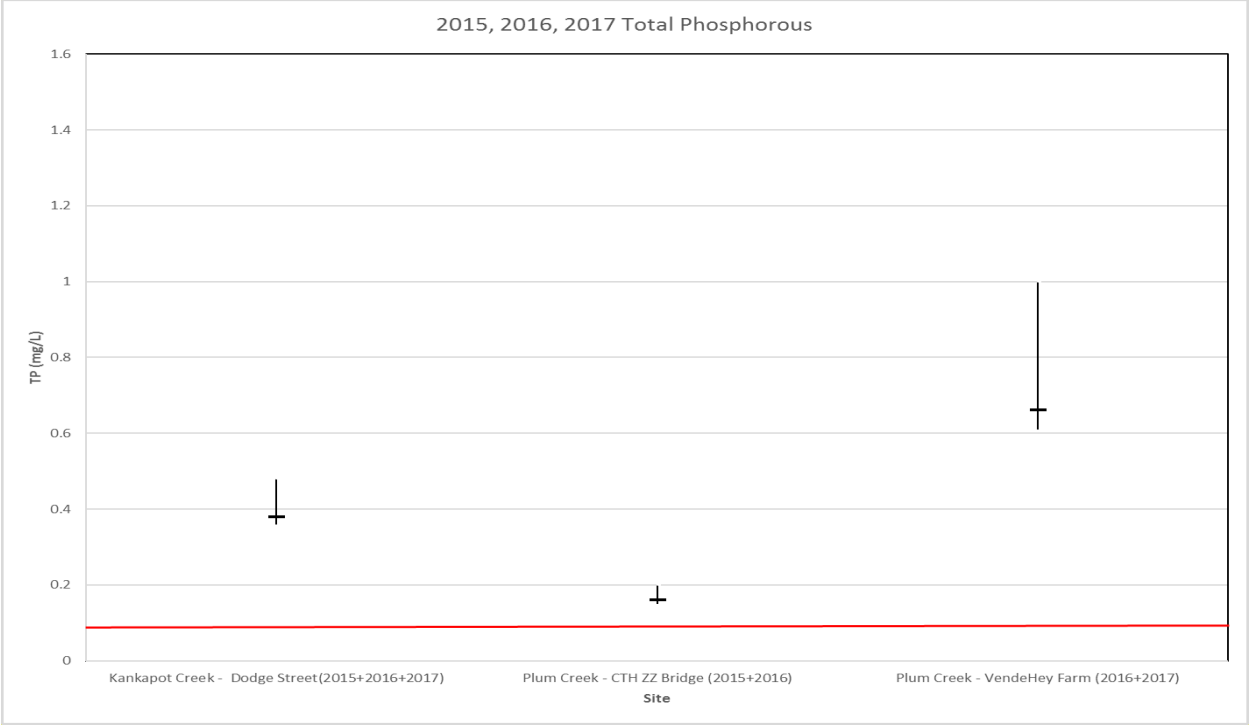


Figure 7: Plum Creek at CTH ZZ Water Chemistry Results

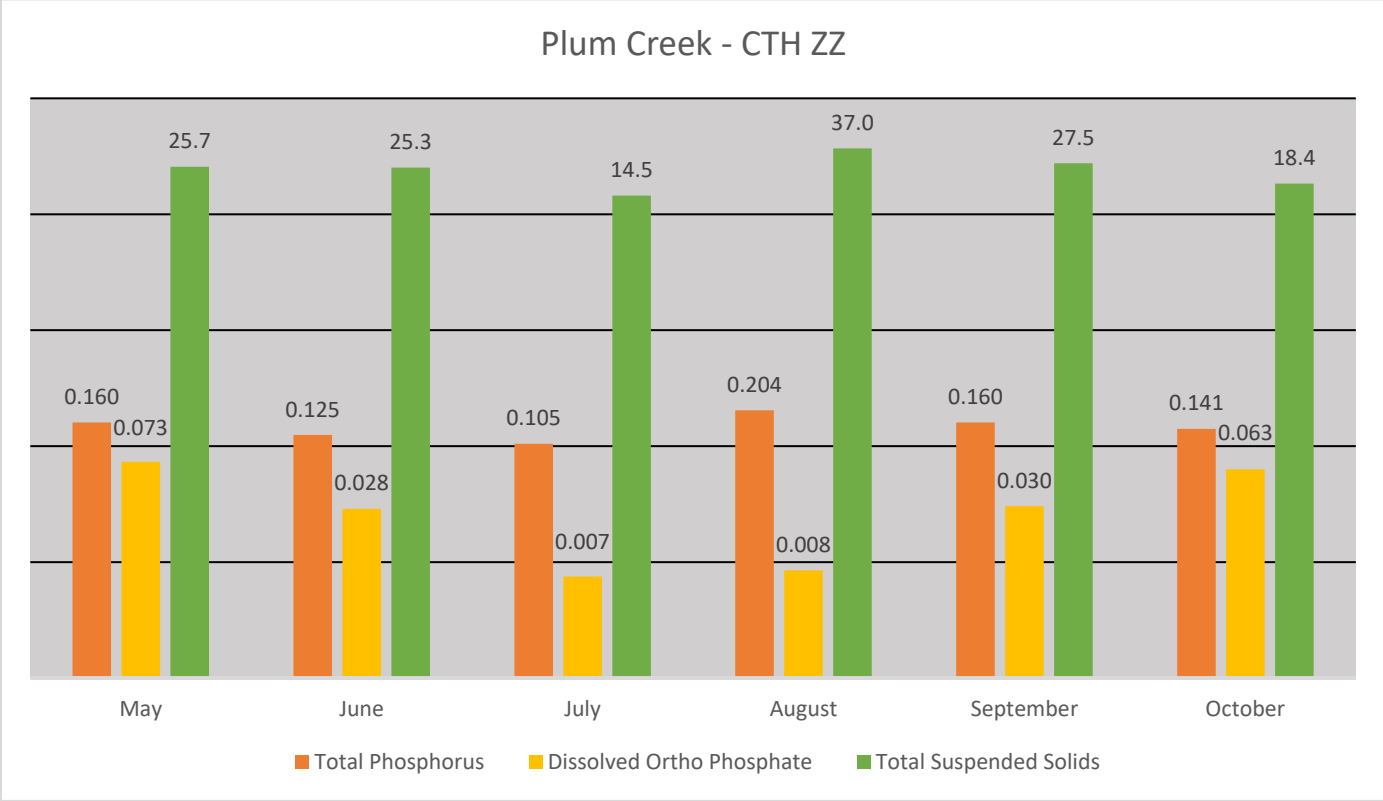
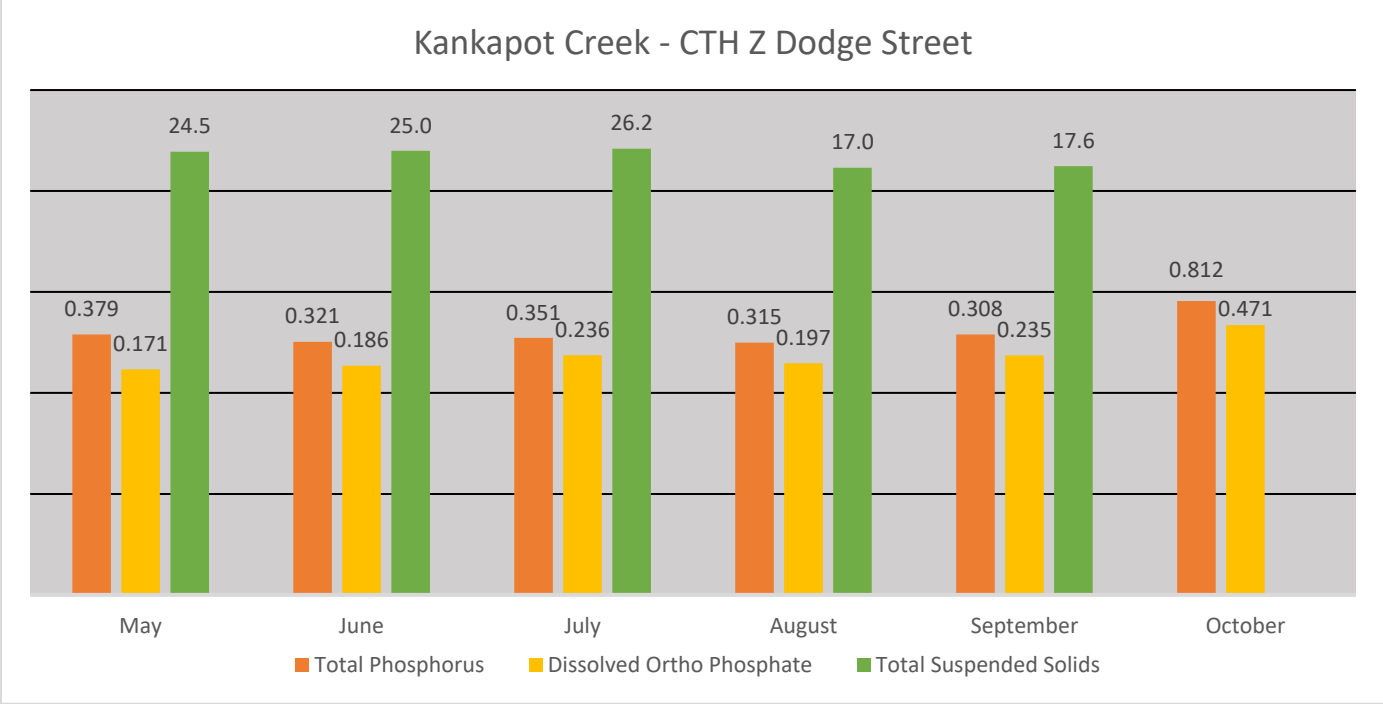


Figure 8: Kankapot Creek at CTH Z Dodge Creek Water Chemistry



Continuous Water Temperature

Continuous water temperature loggers were placed at 7 sites in the Plum-Kankapot Creek Watershed in 2015 (Table 5 and Appendix C). Continuous water temperatures were recorded on 1-hour intervals to assess water temperatures compared to their modeled natural community thermal regime.

Table 5. Continuous Water Temperature monitoring sites in the Plum/Kankapot Watershed

WBIC	Waterbody Name	Station ID	Station Name
126900	Unnamed	10039263	UNT to Kankapot Creek - CTH KK
126800	Kankapot Creek	10016668	Kankapot Creek - CTH KK Bridge
126900	Unnamed	10017053	UNT to Kankapot Creek - Military Road
126900	Unnamed	10043709	UNT to Kankapot Creek - Robinhood Drive
125100	Plum Creek	53201	Plum Creek - CTH ZZ Bridge
125100	Plum Creek	53511	Plum Creek - CTH D
125200	West Plum Creek	10043742	West Plum Creek - New Road

Fish Assessments

Fish surveys were completed on 20 stream sites between May and September in 2015. Some fish species are tolerant of environmental degradation, some species are moderately tolerant, and some others are intolerant. Based upon the representative fish collected during the survey and their associated tolerance to environmental degradation, a Fish Index of Biotic Integrity (FIBI) was calculated to indicate the water quality of the streams in the Plum and Kankapot Creek Watersheds. The FIBI scores range from 20 to 70 based on the applicable IBI applied. Of the 20 fish surveys completed, 5 had a condition of poor, 13 had a condition of Fair, and 1 had a condition of excellent. 1 site did not have a minimum number of fish captured to calculate an IBI score.

Table 6: Fish Index of Biodiversity (FIBI) scores and ratings, Plum/Kankapot Watershed 2015.

WBIC	Waterbody Name		Station	Station Name	Score	Rating	Verified Natural Community
126800	Kankapot Creek		453245	Kankapot Creek - CTH CE	50	Fair	CWHW
126800	Kankapot Creek		453261	Kankapot Creek - Dodge Street	30	Poor	CWHW
126800	Kankapot Creek		10016668	Kankapot Creek - CTH KK Bridge	40	Fair	CCHW
126900	Unnamed		10017053	UNT to Kankapot Creek - Military Road	30	Poor	CCHW
127000	Unnamed		10016525	UNT to Kankapot Creek - Schmidt Road #7	NA	N/A	CWHW
126900	Unnamed		10043709	UNT to Kankapot Creek - Robinhood Drive	40	Fair	CCHW
5022391	Unnamed		10043701	UNT to Kankapot Creek - Schmitt Road #5	40	Fair	CCHW
126900	Unnamed		10043708	UNT to Kankapot Creek - Schmidt Road #6	20	Poor	CWHW
126900	Unnamed		10039263	UNT to Kankapot Creek - CTH KK	50	Fair	CWHW
125100	Plum Creek	1	53201	Plum Creek - CTH ZZ Bridge	70	Excellent	CWMS
125100	Plum Creek	2	53511	Plum Creek - CTH D	60	Fair	CCHW
125100	Plum Creek	4	10016599	Plum Creek - Hills Road	50	Fair	CWHW
125100	Plum Creel	6	10043676	Plum Creek - ManCal Road	30	Poor	MAC
125100	Plum Creel	5	10015580	Plum Creek- Upstream of Holland Road	30	Poor	CWHW
125100	Plum Creek	3	10016874	Plum Creek - Lamers and Clancy Road	50	Fair	CWHW
5022241	Unnamed	7	10043750	UNT to Plum Creek - Holland Road	60	Fair	CCHW
125500	Unnamed		10043749	UNT to Plum Creek - CTH D	40	Fair	CCHW
125300	Unnamed		10043731	UNT to West Plum Creek - County Line Road	60	Fair	CWHW
125200	Unnamed		10043720	UNT to West Plum Creek - CTH Z	40	Fair	CCHW
125200	Unnamed		10043742	West Plum Creek - New Road	50	Fair	CCHW

Figure 9: FIBI Condition Values for Streams in the Plum Kankapot Watershed

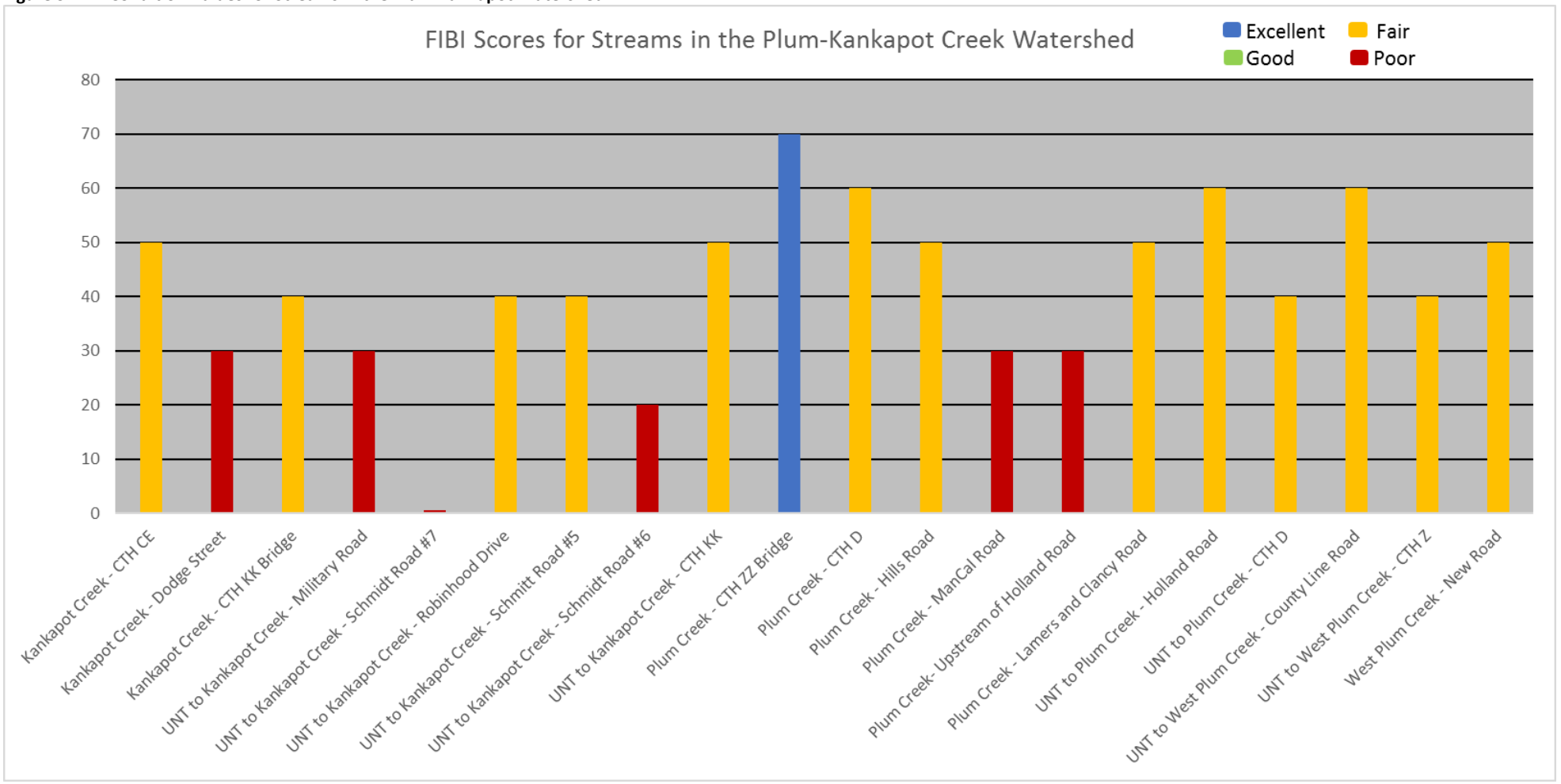
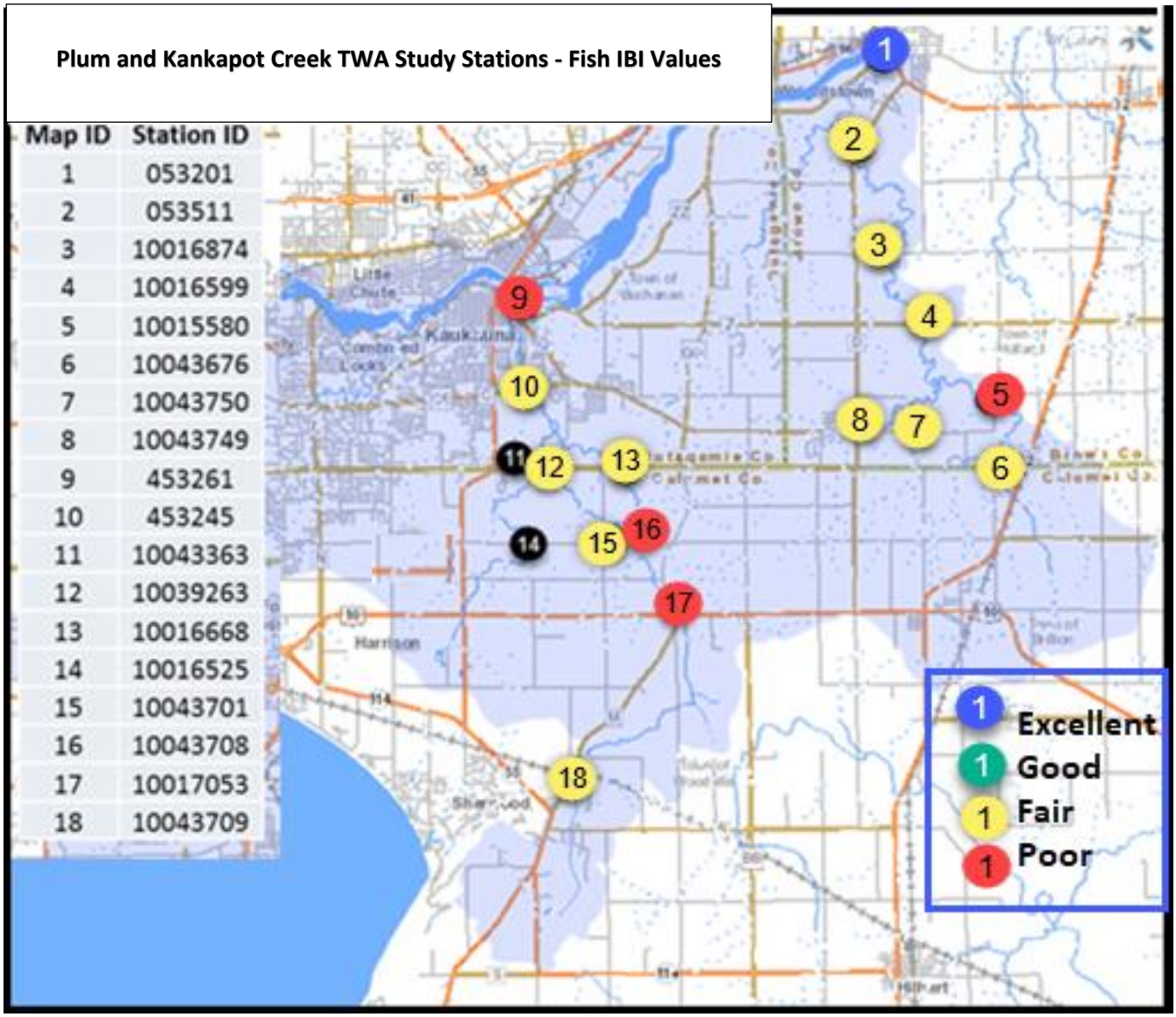


Figure 10: Fish IBI Condition Map



Macroinvertebrates

In the fall of 2015, macroinvertebrate samples were collected from 13 streams for calculating the macroinvertebrate Index of Biotic integrity (MIBI). Some aquatic macroinvertebrate species are tolerant of environmental degradation, some species are moderately tolerant, and some others are intolerant. Based upon the representative macroinvertebrate samples collected and their associated tolerance to environmental degradation, the MIBI was calculated to indicate the water quality condition of the stream (Table 7, Figure 9). The MIBI scores ranged from 0.647 to 4.394 which demonstrated these sites are likely impacted from environmental degradation.

Table 7: Macroinvertebrate Index of Biotic Integrity scores and rating in the Plum/Kankapot Watershed in 2015.

WBIC	Waterbody Name	Station	Station Name	Score	Rating
126800	Kankapot Creek	10016668	Kankapot Creek - CTH KK Bridge	3.42	Fair
126900	Unnamed	10043709	UNT to Kankapot Creek - Robinhood Drive	4.028	Fair
5022391	Unnamed	10043701	UNT to Kankapot Creek - Schmitt Road #5	4.042	Fair
126900	Unnamed	10043708	UNT to Kankapot Creek - Schmidt Road #6	3.014	Fair
126900	Unnamed	10039263	UNT to Kankapot Creek - CTH KK	2.91	Fair
125100	Plum Creek	53201	Plum Creek - CTH ZZ Bridge	3.85	Fair
125100	Plum Creek	53511	Plum Creek - CTH D	0.912	Poor
125100	Plum Creek	10043676	Plum Creek - ManCal Road	4.394	Fair
125100	Plum Creek	10015580	Plum Creek - Holland Road	3.169	Fair
125100	Plum Creek	10016874	Plum Creek - Lamers and Clancy Road	2.94	Fair
125500	Unnamed	10043749	UNT to Plum Creek - CTH D	3.882	Fair
125300	Unnamed	10043731	UNT to West Plum Creek - County Line Rd	4.306	Fair
125200	Unnamed	10043742	West Plum Creek - New Road	0.647	Poor

Unnamed Trib to Kankapot Creek- Robinhood Lane

Figure 11: Macroinvertebrate IBI Condition Values for Streams in the Plum Kankapot Watershed

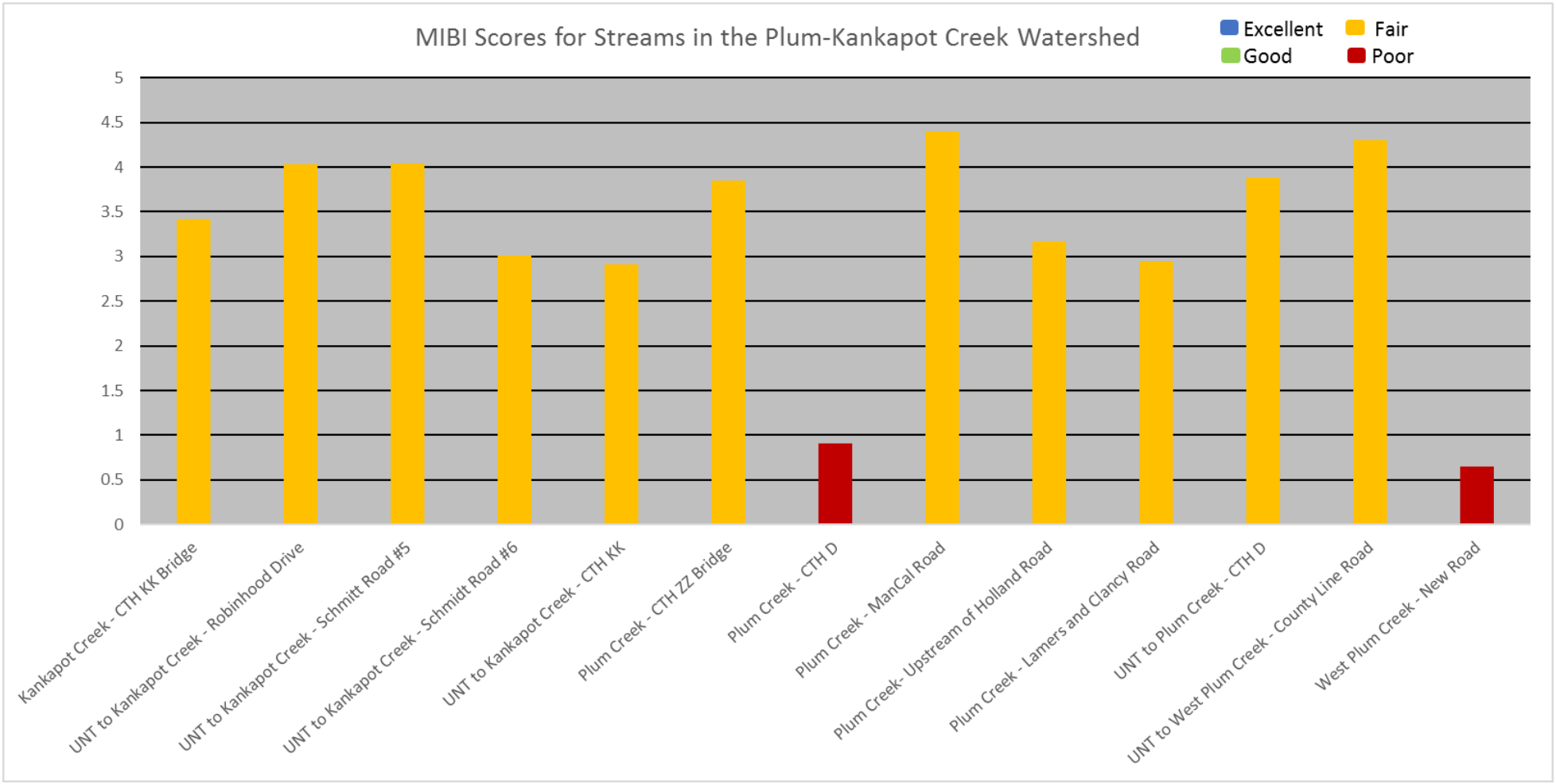
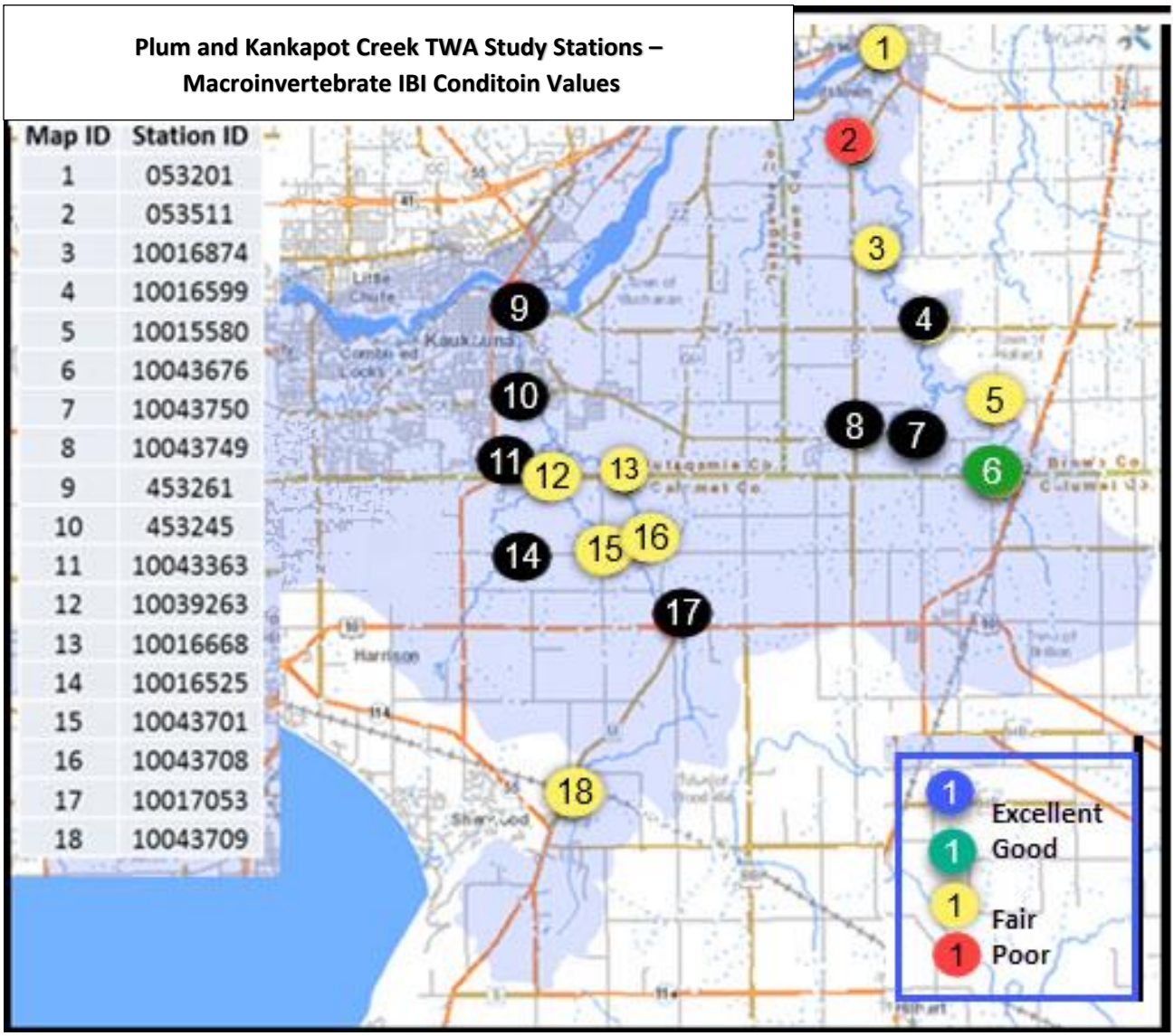


Figure 12: Macroinvertebrate IBI Condition Value Map in the Plum Kankapot Watershed



Habitat Assessments

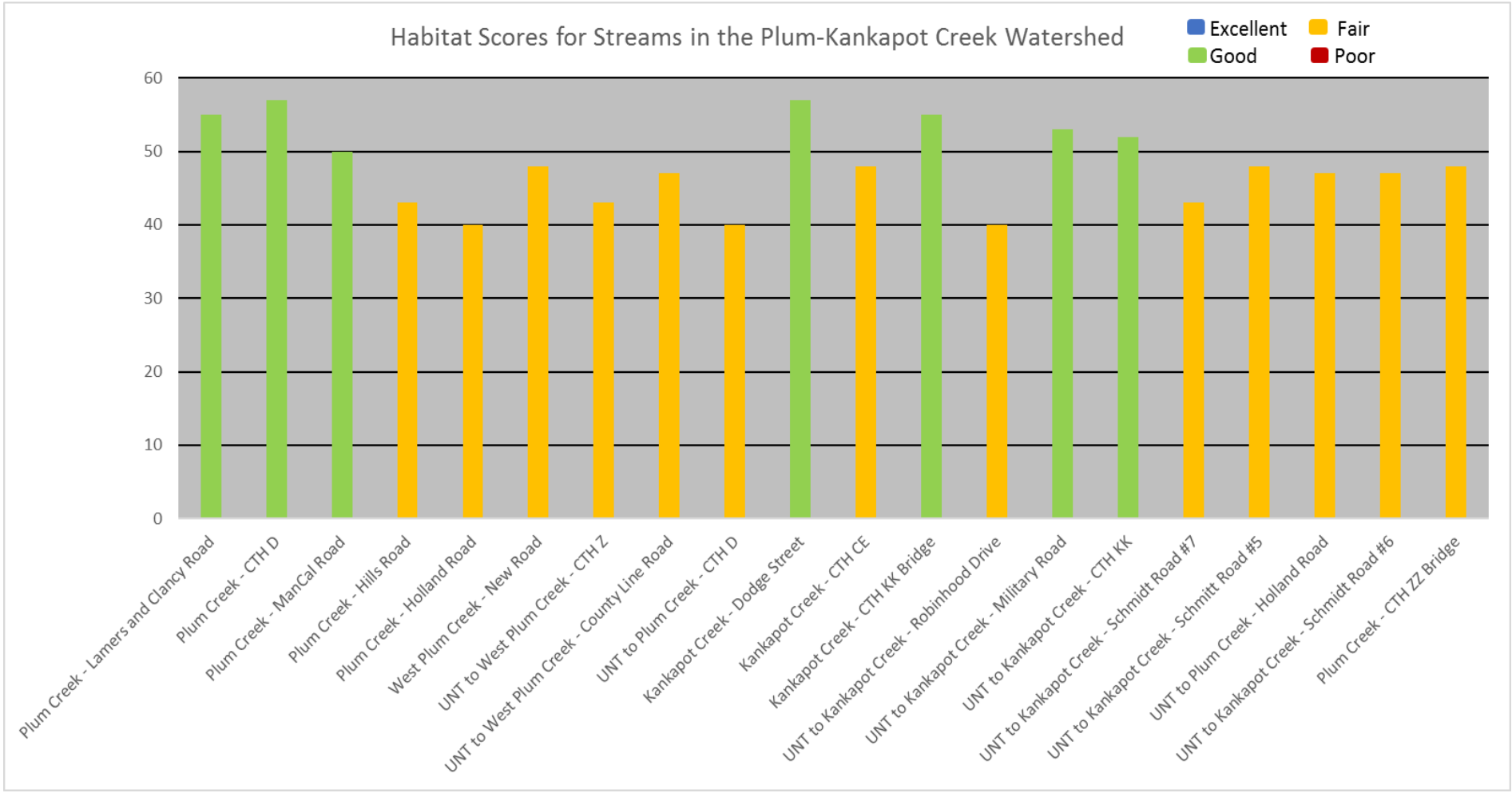
Quantitative habitat assessments evaluate a representative stream reach (35 X Mean Stream Width) for the quantity and quality of habitat for fish and compare the habitat to reference streams in Wisconsin. Based upon the assessment data collected during the 2015 surveys, a habitat rating was calculated for the 19 small streams less than 10m wide and one large streams greater than 10 m wide. (Table 8, Figure 11). The habitat rating scores were relatively similar for all streams and 13 scored in the Fair range and 7 scored in the Good range.

West Plum Creek at New Road

Table 8: Habitat scores and rating in the Plum/Kankapot Watershed in 2015

Waterbody Name	WBIC	SWIMS ID	Station Name	AU	MSW (m)	Buffer	Erosion	Pool	W:D	Riff:Riff	Bend:Bend	Fine Sed.	Fish Cover	Score Small	Rating Small
Plum Creek	125100	10016874	Plum Creek - Lamers and Clancy Road	10841	9	15	5	10	10	10	5	0	5	55	Good
Plum Creek	125100	53511	Plum Creek - CTH D	10840	7	15	5	7	10	15	0	5	0	57	Good
Plum Creek	125100	10043676	Plum Creek - ManCal Road	357670	2.5	10	10	0	10	15	5	0	5	50	Good
Plum Creek	125100	10016599	Plum Creek - Hills Road	10841	8	15	5	3	0	15	15	5	0	43	Fair
Plum Creek	125100	10015580	Plum Creek - Holland Road	10841	4	10	5	0	10	15	15	0	0	40	Fair
Plum Creek	125200	10043742	West Plum Creek - New Road	5690388	4.5	15	5	3	10	15	15	0	0	48	Fair
Unnamed	125200	10043720	UNT to West Plum Creek - CTH Z	5690388	2.5	10	5	3	10	0	15	0	0	43	Fair
Unnamed	125300	10043731	UNT to West Plum Creek - County Line Road	5690442	3	10	5	7	10	15	15	0	0	47	Fair
Unnamed	125500	10043749	UNT to Plum Creek - CTH D	6896785	4	10	10	0	5	5	10	5	0	40	Fair
Unnamed	126800	453261	Kankapot Creek - Dodge Street	10844	6	10	10	7	5	10	0	15	0	57	Good
Kankapot Creek	126800	453245	Kankapot Creek - CTH CE	10844	6	15	5	3	5	15	0	5	0	48	Fair
Kankapot Creek	126800	10016668	Kankapot Creek - CTH KK Bridge	357763	3	10	5	10	10	15	10	0	5	55	Good
Kankapot Creek	126900	10043709	UNT to Kankapot Creek - Robinhood Drive	5690476	2.5	10	15	0	10	0	0	0	5	40	Fair
Kankapot Creek	126900	10017053	UNT to Kankapot Creek - Military Road	5690476	3	15	5	3	10	15	5	5	0	53	Good
Unnamed	126900	10039263	UNT to Kankapot Creek - CTH KK	5690476	4	10	5	7	10	15	0	5	0	52	Good
Unnamed	126900	10016525	UNT to Kankapot Creek - Schmidt Road #7	5690522	2.5	10	5	3	10	10	15	0	0	43	Fair
Unnamed	127000	10043701	UNT to Kankapot Creek - Schmitt Road #5	6776356	2	15	5	3	10	15	15	0	0	48	Fair
Unnamed	5022241	10043750	UNT to Plum Creek - Holland Road	6776292	4	15	0	7	10	15	15	0	0	47	Fair
Unnamed	5022391	10043708	UNT to Kankapot Creek - Schmidt Road #6	5690476	4	10	5	7	10	15	15	0	0	47	Fair
Plum Creek	125100	53201	Plum Creek - CTH ZZ Bridge	10841	12	12	0	12	0	16	8	0	0	48	Fair

Figure 13: Habitat Condition of Streams in the Plum-Kankapot Creek Watershed



Discussion

Overall River and Stream Health

All streams monitored in these watersheds were cool-warm to cool-cold transitional headwaters except for Plum Creek at CTH ZZ which was consistent with a mainstem stream. (Lyons, 2008). The classification for these streams as small headwaters streams is consistent with observed conditions and fish communities captured in stream surveys. The proximity of the Fox River and its influence on the fish community in the Lower segments of Plum Creek is present to the approximate confluence of West Plum Creek downstream of CTH D and allows for resident fish which are consistent with large rivers to be encountered such as Channel Catfish, Walleye, Trout-Perch, and Freshwater Drum. When the correct IBI's were applied, impact to the fish community from environmental degradation is highly evident. This is further supported by the overwhelmingly dominance of tolerant species vs absence of intolerant species captured during surveys.

There were 25 total species observed in the watersheds with only a small diversity observed outside of the influence of the Fox River site with only 10 species captured in 19 of the 20 surveys. Most surveys contained 2-7 species. The most dominant species as far as percent of the total catch and number of surveys (n=20) was the Creek Chub (39%). The other dominant species included the White Sucker (15%), Brook Stickleback (11%), Central Mudminnow (11%) and Fathead Minnow (6%). All other species comprised 5% or less of the total catch.

The Department has recently developed a draft method to determine whether the modeled natural community is accurate based on the fishery assemblage and climate conditions (Lyons, 2013). In most cases, the thermal composition of species (cold, warm, or transitional) indicated these streams resemble cool-warm systems. Of the 20 sites sampled only one stream segments had a natural community that did not fit the model. Plum Creek at County Hwy ZZ was modeled to be a cool-warm transitional headwater however with the proximity of the Fox River and instream conditions, this segment was more appropriately verified as a cool-warm mainstem. The temperature monitoring conducted in 2015 would indicate the natural communities are within range of the cool-warm to cool-cold communities observed.

The fishery is only one environmental indicator and for this reason, the quality of the resources should be looked at in the context of overall conditions including habitat and macroinvertebrates. Overall habitat conditions were mostly in the fair to good category and these scores showed little variance between those sites in the Plum Creek watershed and those within Kankapot Creek watersheds. Scores in both watersheds were likely bolstered by several metrics that were favorable as observed by the biologist. The undisturbed buffer width was maintained at many locations as was the riffle to riffle and/or bend to bend score. Coincidently the streams are highly entrenched set within the steep valley floors. This limits the ability of traditional agricultural practices to farm immediately adjacent to the stream banks except for the extreme headwater areas. The change in farm dynamics and the conversion to housing barns has greatly reduced grazing pressure along the banks however a few traditional grazing pastures exist.

There is limited urban development however impervious surfaces and a degradation of the infiltration capacity of the soils in both watersheds has led to an increase in peak flow velocity and timing. These hydrologic modification and land use have led to significant bank erosion and the deposition of fine sediment. There is an overall absence of fish cover in both streams. While the riparian corridor is largely undeveloped, and pastures have been allowed to revert to woodlots, the condition of these corridors is less than desirable. The prevalence of invasive species and undesirable forest cover types do little to prevent bank failures and manage sediment transport downstream.

The macroinvertebrate data also showed a consistent trend with all mIBI scores in the poor to fair range. The HBI indicates that organic loading continues to be a significant impact to the streams in both watersheds. The macroinvertebrate IBI has shown the combination of watershed land cover and local riparian and instream conditions strongly influence one another (Weigel, 2003). This is relationship was reaffirmed through Biologists' observations and comparison of the F-IBII, M-IBI, and the habitat scores within the watershed. It is evident that significant impacts from nutrient and sediment loading, altered hydrology, and banks de-stabilization continue to limit the aquatic life in these systems.

Growing season total phosphorous concentrations were very consistent between the 5 stream sights monitored in 2015. Additionally, the most downstream stations on Plum and Kankapot were also consist in 2016 and 2017. The department's listing methodology for impaired waters (WDNR, 2013) recommends listing sites where the median phosphorus concentration exceeds 0.075 mg/l on wadeable streams and 0.1 mg/l on rivers. The impairment listing protocol uses a 90% confidence interval about the median for listing streams and rivers. Plum and Kankapot Creek continue to be impaired by TP concentrations. The s ample results indicate that the median concentration on all sites was 3-10 times the standard. Total Suspended Solids and Orthophosphate concentrations were also collected at CTH ZZ on Plum Creek and CTH Z on Kankapot Creek. The Lower Fox River TMDL sets a target for TSS in the Lower Fox at 18 mg/l. The average concentration of TSS observed in Plum Creek and Kankapot Creek for Total Suspended solids between 2015 and 2017 is 32.7 mg/l, 29.8 mg/land the median is 27.5 mg/l, 24.5mg/l respectively. This would indicate that TSS continue to be a significant concern in both Plum and Kankapot Creeks.

When comparing the TP, TSS, and ORP results during that same time, it is evident that ORP is a significant contribution to the overall source for TP within both watershed.

Management Actions

Management Priorities and Goals

It is evident that signifincat impacts from non-point sources of pollution to the streams in Plum and Kankapot Creek continue to limit the aquatic life. Starategies should continue to improve knowledge of soil helth principles in the watershed to reduce nutirient and sediment loads, increase infiltration and overall improve water quality conditions. Riparian corridors should be managed to promote native cover types with limited invasive species and dense herbaceous understories to stabilize eroding banks. Comprehensive bank stabilization projects should utilize strategies to establish natural stream morphology, contain a significant fish cover component, establish a sustainable rate of sediment transport, and re-develop a floodplain connectivity. Headwater areas should be protecting increasing buffer widths, installing grassed waterways, or otherwise protecting concentrated flow paths to the streams.

Management Goals

Management of woody vegetation to prevent overgrowth along banks, to control regrowth and use management practices that avoid destabilization of banks are optimal goals for resource improvement.

Recommendations

- Advance the understanding and use of Soil Health principles throughout the watershed.
- Develop a riparian corridor management strategy. The management strategy should promote the establishment of diverse, healthy forest cover types to improve infiltration, nutrient and sediment sequestration, and provide for stabile bank conditions.
- Vegetative buffer widths should be increased in the headwaters and concentrated flow paths should be established into grassed waterways where possible.
- Focused efforts on strategic bank stabilization should be taken to address watershed wide bank erosion and failures.
- Continue monitoring monthly growing season total phosphorus, orthophosphate and total suspended solids at CTH Z on Kankapot Creek and upstream of CTH ZZ at the VandeHey Crossing on Plum Creek to track progress of BMP installation throughout the watersheds on water quality.
- Within 5 years following the BMP implementation through the Plum-Kankapot 9KE plan repeat monitoring at the 20 locations to evaluate contemporary conditions within the watershed.

Plum Creek at ManCal

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Appendix B: Stream Narratives

Plum Creek

Plum Creek, is a 19.5-mile long tributary to the Fox River. Land use in the watershed is predominantly agriculture. The fish community is dominated by species tolerant to environmental degradation and the FIBI rated from poor to fair. The lower reaches below the confluence of the West Plum Creek are highly influenced by the Fox River and this bolsters the fish community and IBI score. The lower segment however experiences significant deposition of sediment and prone to frequent blue-green algae blooms. Due to the flashy nature of this stream, fish often congregate in pools isolated between shallow to sometimes dry riffles during flow times of the year. The upper reaches have limited habitat, narrow buffers, and are often farmed through the channels. The habitat scores rated fair to good. The Macroinvertebrate IBI rated from poor to fair and the HBI indicated significant organic loading is impacting the water quality conditions. The stream is highly entrenched in areas and severe bank erosion exists due to the flashy flow regime of this stream. Total Phosphorous concentrations exceed the State's water quality criteria for phosphorous and high suspended solids load continue to impair this stream.

West Plum Creek

West Plum Creek, is a 9.39-mile long tributary to Plum Creek. Land use along the stream is predominantly agriculture. The fish community is dominated by species tolerant to environmental degradation and the FIBI rated fair. The habitat scores rated fair and the habitat is impacted by bank erosion, deposition of fines and largely an absence of fish habitat. The stream is highly entrenched in areas and severe bank erosion exists due to the flashy flow regime of this stream. Total Phosphorous concentrations exceed the State's water quality criteria for phosphorous and high suspended solids load continue to impair this stream.

UNT to West Plum Creek (125300)

The Unnamed Tributary is a 4.57-mile long Tributary to West Plum Creek, Land use along the stream is predominantly agriculture. The fish community is dominated by species tolerant to environmental degradation and the FIBI rated fair. The habitat scores rated fair and the habitat is impacted by bank erosion, buffer width, deposition of fines and largely an absence of fish habitat. The stream is highly entrenched in areas and severe bank erosion exists due to the flashy flow regime of this stream. Increased buffer widths and the protection of concentrated flow paths are needed.

UNT to Plum Creek (125500)

The Unnamed Tributary is a 5.5-mile long Tributary to Plum Creek, Land use along the stream is predominantly agriculture however the Town of Holland contribute urban inputs to this stream. The Holland WWTF discharges to this stream and serves the Town along with a cheese factory. The fish community is dominated by species tolerant to environmental degradation and the FIBI rated fair as did the MIBI. The habitat scores rated fair and the habitat is impacted by bank erosion, buffer width, deposition of fines and largely an absence of fish habitat. The stream is highly entrenched in areas and severe bank erosion exists due to the flashy flow regime of this stream. Historical compliance issues of the WWTF may continue to have lasting impacts on this stream reach.

UNT to Plum Creek (5022241)

The Unnamed Tributary is a 1.6-mile long Tributary to Plum Creek. The land use along this stream is dominated by agriculture. The stream is limited by flow and habitat. The fish community is dominated by species tolerant to environmental degradation and the FIBI rated fair.

Kankapot Creek

Kankapot Creek is a Tributary to the Fox River is a 9.57-mile-long tributary to the Fox River. Land use in the watershed is predominantly agriculture. The fish community is dominated by species tolerant to environmental degradation and the FIBI rated from poor to fair. The lower segment is highly entrenched, and experiences severe bank erosion during flashy peak flow events. Stream features are intact and good sequences of riffle, runs, and pools are present in the lower reaches. The upper reaches have limited habitat, narrow buffers, and are often farmed through the channels. Due to the flashy nature of this stream, fish often congregate in pools isolated between shallow to sometimes dry riffles. The habitat scores rated fair to good and were bolstered by undisturbed buffers and the riffle to riffle scores. The Macroinvertebrate IBI scores rated fair and the HBI indicated significant organic loading is impacting the water quality conditions. The stream is highly entrenched in areas and severe bank erosion exists due to the flashy flow regime of this stream. Total Phosphorous concentrations exceed the State's water quality criteria for phosphorous and high suspended solids load continue to impair this stream.

UNT to Kankapot Creek (UNT to Kankapot Creek (126900)

The Unnamed Tributary is a 10.68-mile long Tributary to Kankapot Creek. Although this stream is identified as a separate waterway, this is likely the headwaters of Kankapot Creek. Land use in the watershed is predominantly agriculture, however the Town of Sherwood is located one this stream and the Sherwood WWTF discharges to it. Downstream of the Town of Sherwood, the stream flows through a relatively large wetland complex with some hydrologic modifications of ditching and straightening. The fish community is dominated by species tolerant to environmental degradation and the FIBI rated from poor to fair. This stream is relatively flat and begins to increase in gradient as it flows north to the confluence of Kankapot. The habitat scores rated fair to good and were bolstered by undisturbed buffers

and the width to depth ratio. The Macroinvertebrate IBI scores rated fair and the HBI indicated moderate organic loading impacting water quality conditions. Total Phosphorous concentrations exceed the State's water quality criteria for phosphorous.

UNT to Kankapot Creek (UNT to Kankapot Creek (127000)

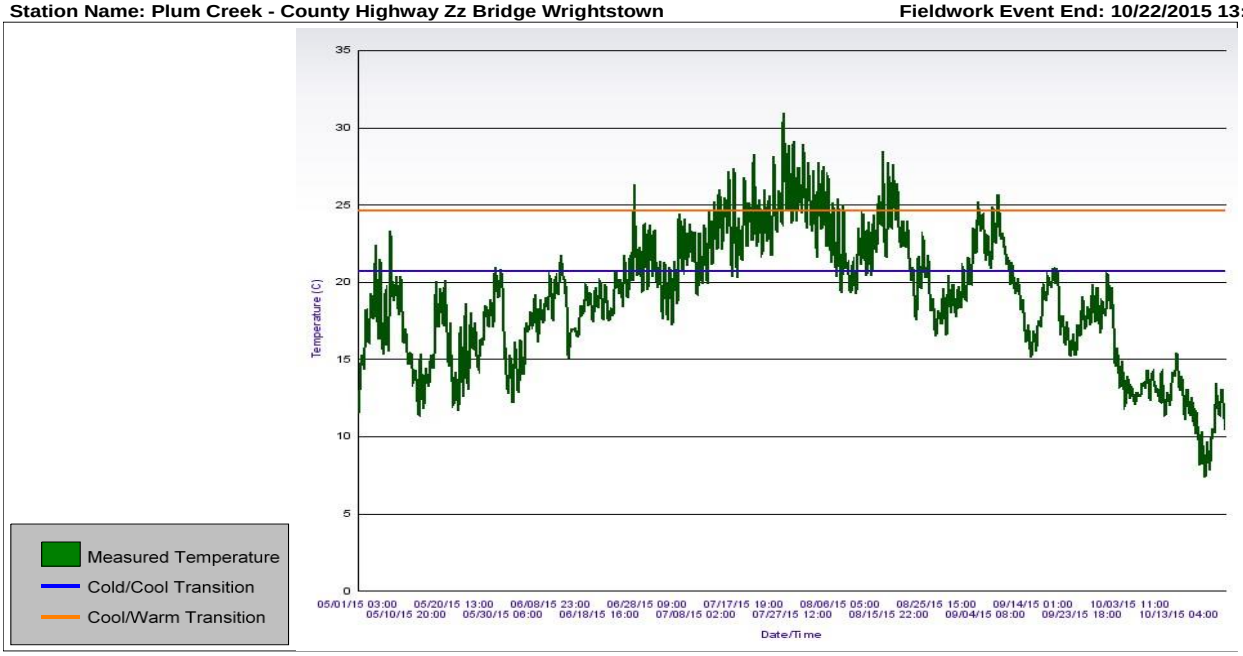
The Unnamed Tributary is a 5.06-mile long Tributary to Kankapot Creek. The land use along this stream is dominated by agriculture. The stream is limited by flow and habitat. There is a lack of a developed fish community at this site and to few fish were sampled to calculate an IBI.

UNT to Kankapot Creek (UNT to Kankapot Creek (5022391)

The Unnamed Tributary is a 1.92-mile long Tributary to Kankapot Creek. The land use along this stream is dominated by agriculture. The stream is limited by flow and habitat. The fish community is dominated by species tolerant to environmental degradation and the FIBI rated fair.

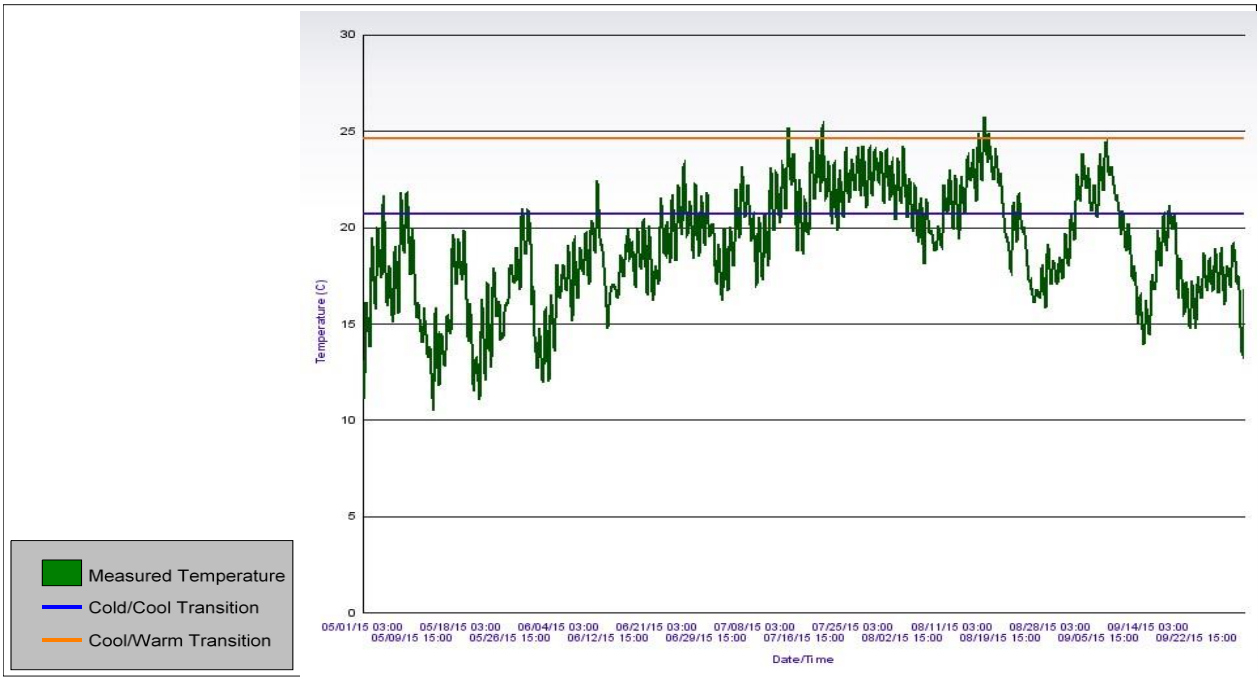
Appendix C: Stream Temperature Graphs

Designated Use: Default FAL **Natural Community: Cool-Cold Headwater, Cool-Warm Headwater, Macroinvertebrate,**
Station ID: 053201 **Fieldwork Event Start: 05/01/2015 12:00**
Station Name: Plum Creek - County Highway Zz Bridge Wrightstown **Fieldwork Event End: 10/22/2015 13:00**



SWIMS: Temperature for a Selected Fieldwork Event

Designated Use: Default FAL **Natural Community: Cool-Cold Headwater, Cool-Warm Headwater, Macroinverte**
Station ID: 053511 **Fieldwork Event Start: 05/01/2015 00:0**
Station Name: Plum Creek - Cth D **Fieldwork Event End: 09/30/2015 23:5**

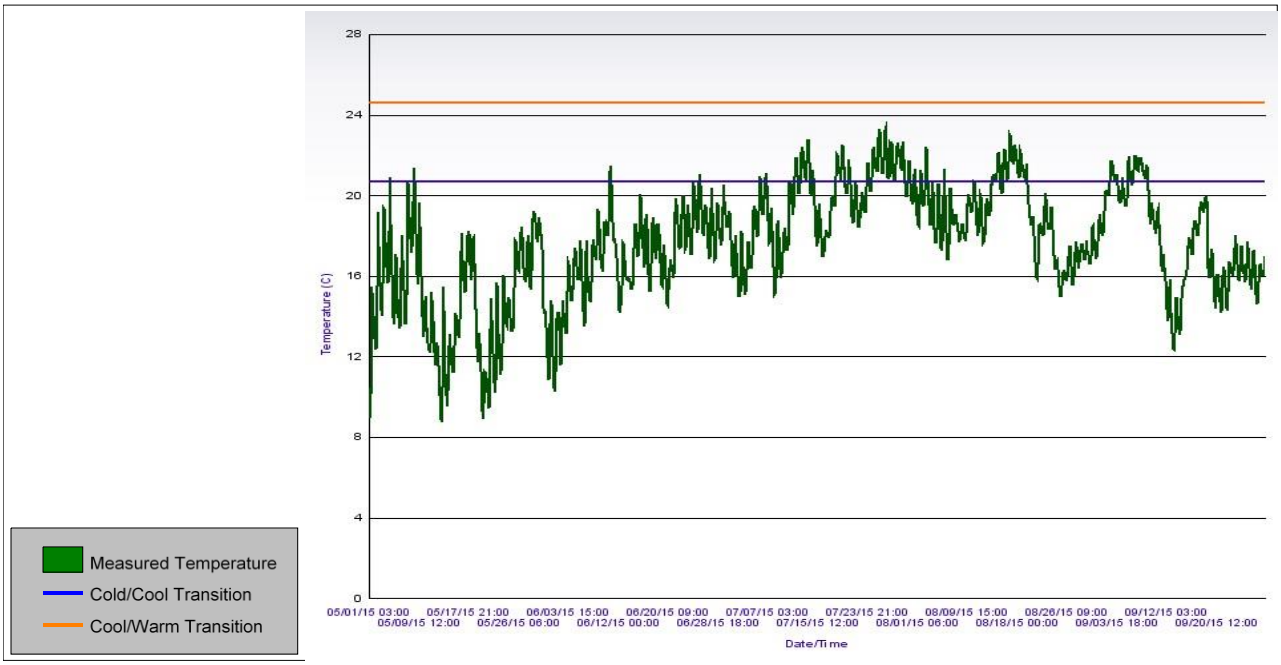


SWIMS: Temperature for a Selected Fieldwork Event

Designated Use: LFF **Natural Community: Cool-Cold Headwater, Cool-Warm Headwater, Macroinvertebrate**

Station ID: 10016668 **Fieldwork Event Start: 05/01/2015 00:00**

Station Name: Kankapot Creek - Upstream Of Cth Kk Bridge **Fieldwork Event End: 09/28/2015 23:59**

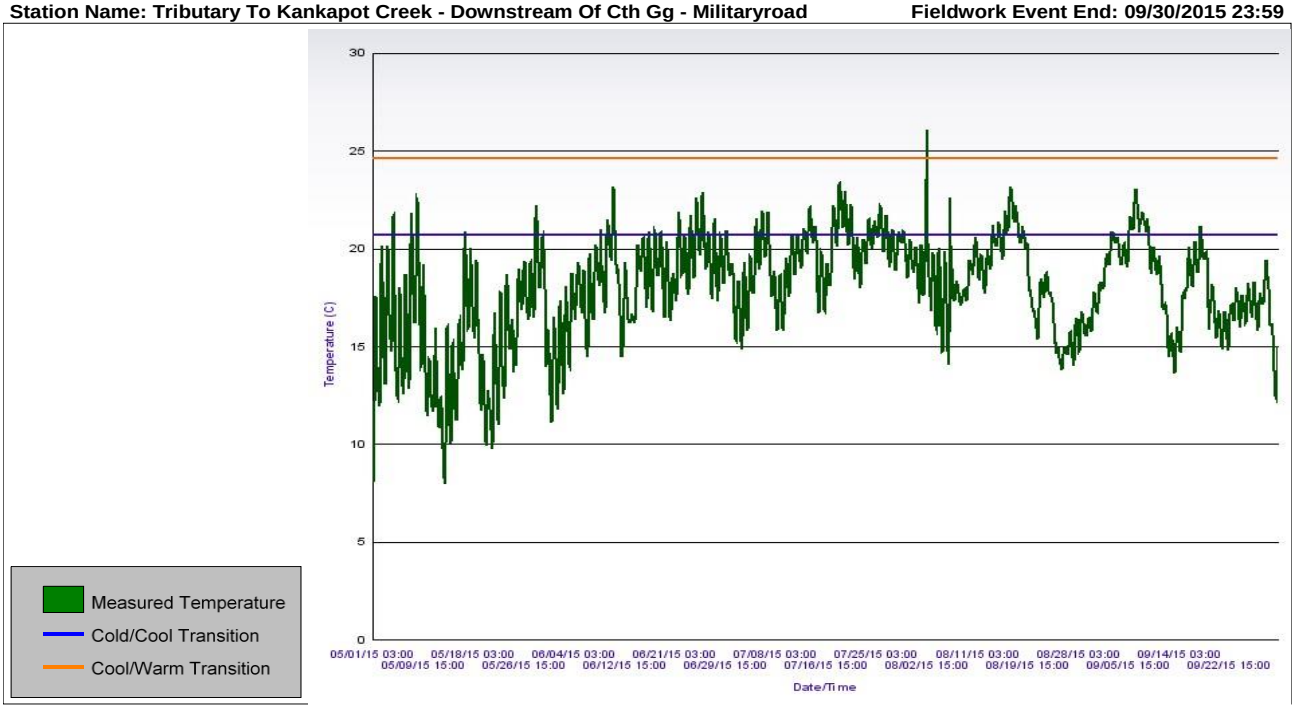


SWIMS: Temperature for a Selected Fieldwork Event

Designated Use: Default FAL **Natural Community: Cool-Cold Headwater, Cool-Warm Headwater**

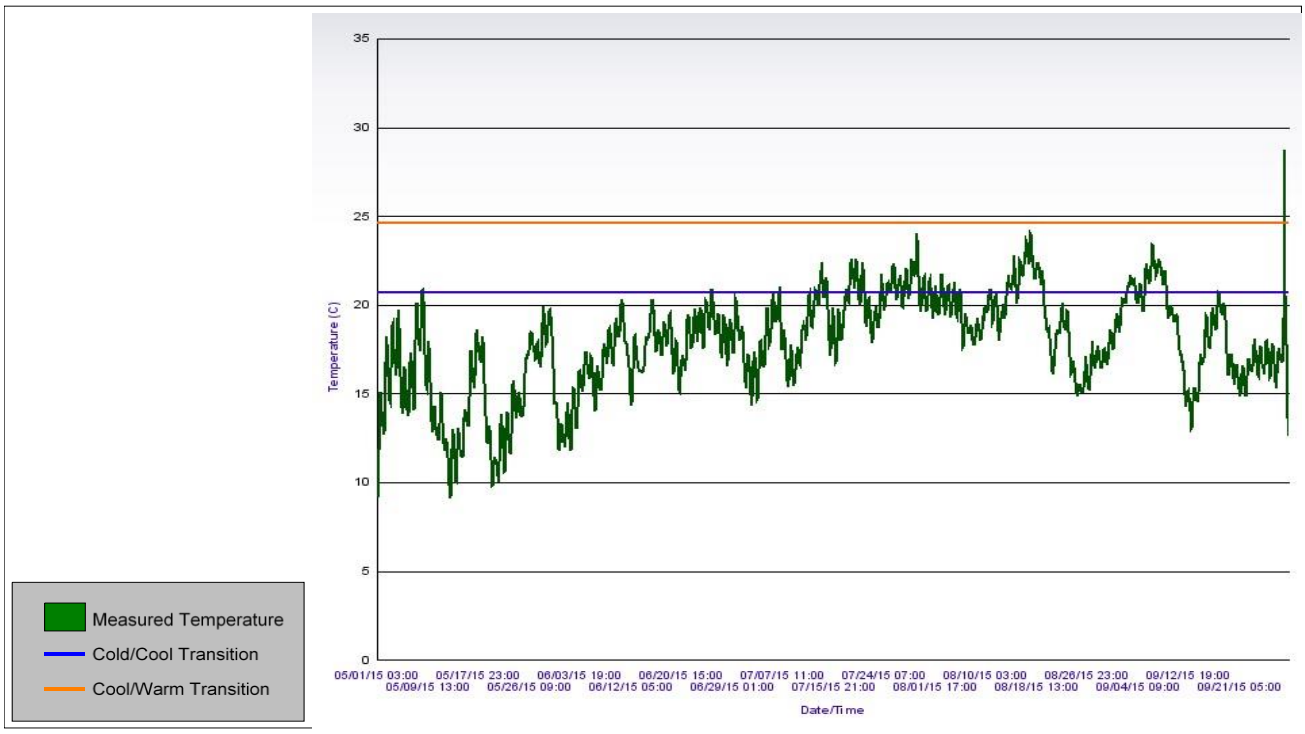
Station ID: 10017053 **Fieldwork Event Start: 05/01/2015 00:00**

Station Name: Tributary To Kankapot Creek - Downstream Of Cth Gg - Militaryroad **Fieldwork Event End: 09/30/2015 23:59**



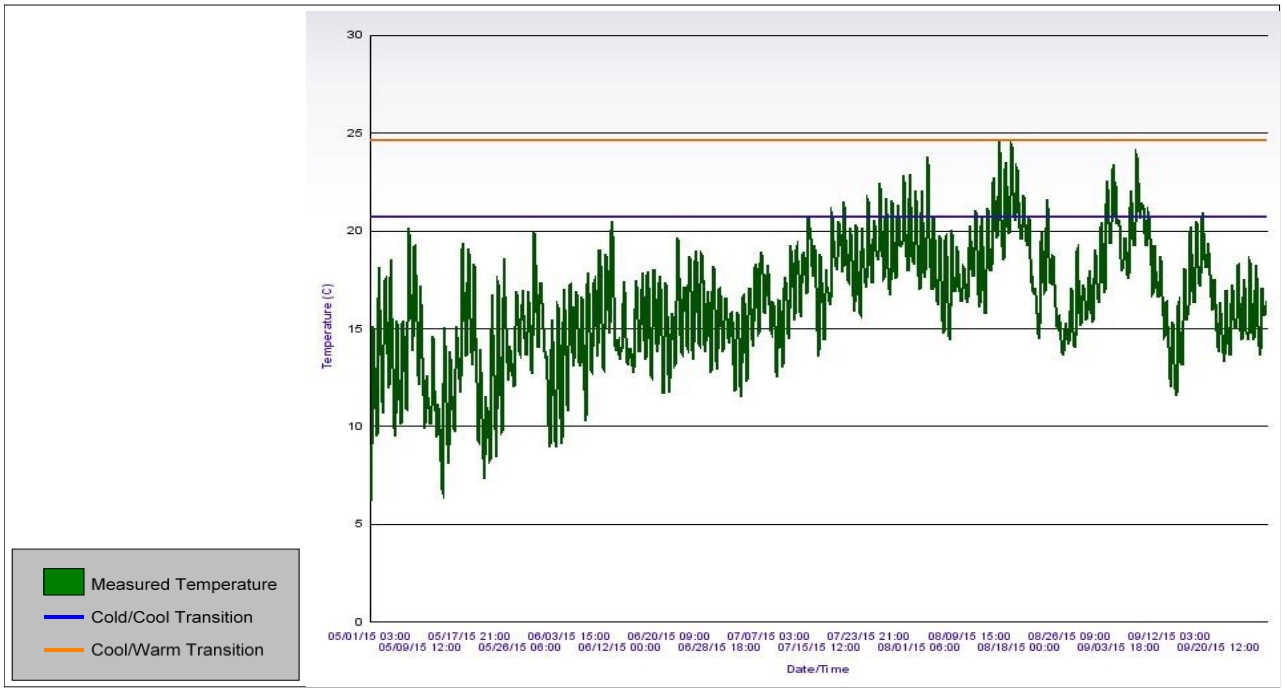
SWIMS: Temperature for a Selected Fieldwork Event

Designated Use: Default FAL
Natural Community: Cool-Cold Headwater, Cool-Warm Headwater
Station ID: 10039263
Fieldwork Event Start: 05/01/2015 00:00
Station Name: Unnamed Tributatry just upstream of KK
Fieldwork Event End: 09/29/2015 23:59



SWIMS: Temperature for a Selected Fieldwork Event

Designated Use: Default FAL
Natural Community: Cool-Cold Headwater, Cool-Warm Headwater
Station ID: 10043709
Fieldwork Event Start: 05/01/2015 00:00
Station Name: UNT to Kankapot creek 10 meters upstream Robinhood drive
Fieldwork Event End: 09/28/2015 23:59

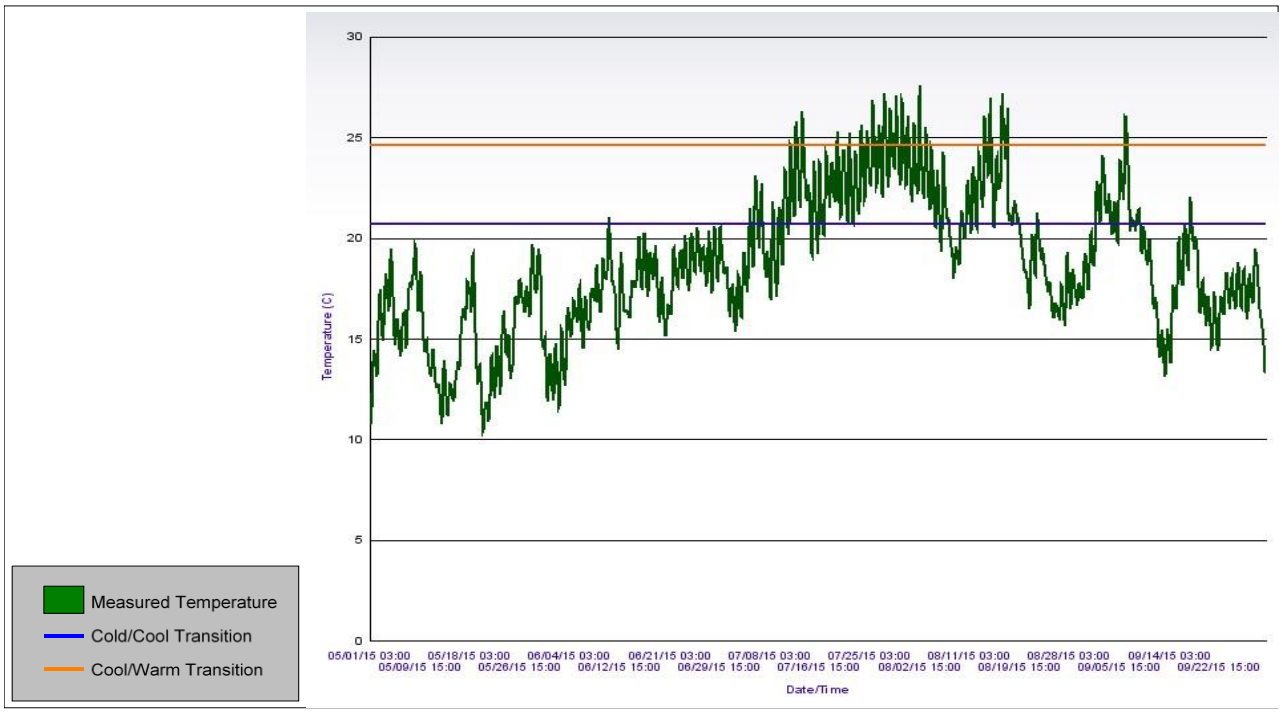


SWIMS: Temperature for a Selected Fieldwork Event

Designated Use: Default FAL **Natural Community: Cool-Cold Headwater, Cool-Warm Headwater, Macroinvertebrate**

Station ID: 10043742 **Fieldwork Event Start: 05/01/2015 00:00**

Station Name: West Plum Creek 20 meters upstream New Road **Fieldwork Event End: 09/30/2015 23:59**



SWIMS: Temperature for a Selected Fieldwork Event

Appendix D: Fisheries, Habitat, Macroinvertebrate Table 2015

Stream - Site	UNT to Plum Creek CTH D	UNT to Plum Creek Holland Road	Plum Creek Lamers Clancy Road	UNT West Plum Creek County Line Road	Plum Creek CTH D	West Plum Creek New Road	West Plum Creek CTH Z	Plum Creek ManCal Road	Plum Creek CTH Z	Plum Creek Vanderwetting Road/Holland	Plum Creek CTH ZZ	Kankapot Creek Dodge Street	Kankapot Creek CTH CE	Kankapot Creek Robinhood Drive	UNT to Kankapot HWY 10	Kankapot Creek CTH KK	UNT to Kankapot Creek CTH KK	UNT to Kankapot Creek #5 Schmidt Road	UNT to Kankapot Creek #6 Schmidt Road	UNT to Kankapot Creek #7 Schmidt Road	
Stream Order	3	3	4	2	4	3	3	2	4	3	4	4	4	1	2	3	3	1	3	3	
Mean Stream Width	4	4.0	9	3	8	4.5	2.5	2.50	8	4.00	12	6	6	2.5	3	3	4	2	4	2.50	
Station Length	140	140	315	105	245	140	105	105	280	140	400	210	210	105	105	105	140	105	140	105	
Nat. Comm. Classification	CCHW	CCHW	CWHW	CWHW	CCHW	CCHW	CCHW	MAC	CWHW	CWHW	CCHW	CWHW	CWHW	CCHW	CCHW	CCHW	CWHW	CCHW	CWHW	CWHW	
Ver. Nat. Comm. Classification	CCHW	CCHW	CWHW	CWHW	CCHW	CCHW	CCHW	MAC	CWHW	CWHW	CWMS	CWHW	CWHW	CCHW	CCHW	CCHW	CWHW	CCHW	CWHW	CWHW	
Fish Species																					**Total**
Black Bullhead			1		6	1			4		2										14
Black Crappie											8										8
Bluegill											1										1
Bluntnose Minnow			5		14				1		22										42
Brook Stickleback	138	37		8		93	61	10		1			4	31	4	56	7	25	1		476
Central Mudminnow										1		22	34	127	16	4	53	104	136		497
Channel Catfish											2										2
Common Shiner		1	30	2	60				24		23	1	4				2				147
Common Carp											2										2
Creek Chub	1	30	163	30	455	12	3	3	82	53	58	282	205	8	67	123	57	26	50	2	1710
Fathead Minnow	1	11	1	111		5	10	5		2	17	3	31	3	3	38	10	3	6		260
Freshwater Drum											4										4
Gizzard Shad					8						217										225
Golden Shiner											2										2
Green Sunfish		5	1	12	20	1			6	3	66										114
Johnny Darter		12	2	12	36	6			9	1	26										104
Largemouth Bass											11										11
Logperch											5										5
Round Goby											64										64
Shorthead Redhorse			1						1												2
Spotfin Shiner											2										2
Trout-Perch											2										2
Walleye											1										1
White Sucker		9	96	6	103	3			80	6	101	125	73		2	5	13		9		631
Yellow Perch											4										4
Totals	140	105	300	181	702	121	74	18	207	67	640	433	351	169	92	226	142	158	202	2	4330
# species	3	7	9	7	8	7	3	3	8	7	22	5	6	4	5	5	6	4	5	1	
25 species																					
IBI Score																					
Coldwater	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Coolwater (CC)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Coolwater (CW)	-	-	-	-	-	-	-	-	-	-	E 70	-	-	-	-	-	-	-	-	-	
Warmwater	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Small Stream	F 40	F 60	F 50	F 60	F 60	F 50	F 40	P 30	F 50	P 30	-	P 30	F 50	F 40	P 30	F 40	F 50	F 40	P 20	P 0	

E= Excelent
G= Good
F= Fair
P= Poor

Stream - Site	UNT to Plum Creek CTH D	UNT to Plum Creek Holland Road	Plum Creek Lamers Clancy Road	West Plum Creek County Line Road	Plum Creek CTH D	West Plum Creek New Road	Plum Creek ManCal Road	Plum Creek CTH ZZ	Kankapot Creek Dodge Street	Kankapot Creek Robinhood Drive	Kankapot Creek CTH KK	UNT to Kankapot Creek CTH KK	UNT to Kankapot Creek #6 Schmidt Road	UNT to Kankapot Creek #7 Schmidt Road
Stream Order	3	3	4	2	4	3	2	4	4	1	3	3	3	3
Mean Stream Width	4	4	9	3	8	4.5	2.5	12	6	2.5	3	4	4	2.5
Station Length	140	140	315	105	245	140	105	400	210	105	105	140	140	105
Nat. Comm. Classification	CCHW	CCHW	CWHW	CWHW	CCHW	CCHW	MAC	CCHW	CWHW	CCHW	CCHW	CWHW	CWHW	CWHW
HBI Rating [1]	Poor	Poor	Good	Poor	Fair	Poor	Fairly Poor	Very Poor	Fairly Poor	Fair	Poor	Fairly Poor	Fairly Poor	Fairly Poor
HBI Score [1]	8	8.24	5.362	8.325	5.544	7.87	7.306	8.8	6.97	5.75	7.911	6.648	6.894	6.73
MIBI Rating [2]	Fair	Fair	Fair	Fair	Poor	Poor	Fair	3.85	Fair	Fair	Fair	Fair	Fair	Fair
MIBI Score [2]	3.882	3.169	2.94	4.306	0.912	0.6471	4.394	Fair	4.45	4.028	3.42	2.91	4.042	3.014

1) E= Excellent (0-3.5)
VG= Very Good (3.51-4.50)
G= Good (4.51-5.50)
F= Fair (5.51-6.50)
FP= Fairly Poor (6.51-7.50)
P= Poor (7.51-8.50)
VP= Very Poor (8.51-10)

2) E= Excellent (7.5-10)
G= Good (5.0- 7.49)
F= Fair (2.51- 4.99)
P= Poor (0- 2.5)

Stream - Site	UNT to Plum Creek CTH D	UNT to Plum Creek Holland Road	Plum Creek Lamers Clancy Road	West Plum Creek County Line Road	Plum Creek CTH D	West Plum Creek New Road	West Plum Creek CTH Z	Plum Creek ManCal Road	Plum Creek CTH Z	Plum Creek Vanderwetting Road	Plum Creek CTH ZZ	Kankapot Creek Dodge Street	Kankapot Creek CTH CE	Kankapot Creek Robinhood Drive	UNT to Kankapot HWY 10	Kankapot Creek CTH KK	UNT to Kankapot Creek CTH KK	UNT to Kankapot Creek #5 Schmidt Road	UNT to Kankapot Creek #6 Schmidt Road	UNT to Kankapot Creek #7 Schmidt Road
Stream Order	3	3	4	2	4	3	3	2	4	3	4	4	4	1	2	3	3	1	3	3
Mean Stream Width	4	4	9	3	8	4.5	2.5	2.5	8	4	12	6	6	2.5	3	3	4	2	4	2.5
Station Length	140	140	315	105	245	140	105	105	280	140	400	210	210	105	105	105	140	105	140	105
V. Nat. Comm. Classification	CCHW	CCHW	CWHW	CWHW	CCHW	CCHW	CCHW	MAC	CWHW	CWHW	CWMS	CWHW	CWHW	CCHW	CCHW	CCHW	CWHW	CCHW	CWHW	CWHW
Habitat Rating	F 40	F 47	G 55	F 47	G 57	F 48	F 43	G 50	F 43	F 40	F 48	G 57	F 48	F 40	G 53	G 55	G 52	F 48	F 47	F 43

E= Excellent
G= Good
F= Fair
P= Poor

Appendix E: Water Quality Standards Attainment Plum Kankapot Watershed

Name	Start Mile	End Mile	WATER_SIZE	WBIC	COUNTY	MONITORED	FAL Condition
Lower Fox River (DePere Dam to Middle Appleton Dam)	7.39	32.18	24.8 Miles	117900	Brown, Columbia, Green Lake, Marquette, Outagamie, Waushara, Winnebago	2020	Poor
Lower Fox River (Appleton Dam to L. Winnebago Outlet)	32.18	40.09	7.9 Miles	117900	Brown, Columbia, Green Lake, Marquette, Outagamie, Waushara, Winnebago	2019	Poor
Fox Lock Channel-Appleton			100.9	128400	Outagamie	2017	Unknown
Fox River Lock Channel			7.1 Acres	128800	Outagamie	2017	Unknown
Fox River Lock Channel-Cedars			157.5	128100	Outagamie	2017	Unknown
Unnamed			100.2	125700	Outagamie	1989	Unknown
Garners Creek	0	6.99	7.0 Miles	127700	Calumet, Outagamie	2020	Poor
Kankapot Creek	0	2.66	2.7 Miles	126800	Calumet, Outagamie	2020	Poor
Kankapot Creek	2.66	9.57	6.9 Miles	126800	Calumet, Outagamie	2015	Poor
Plum Creek	0	13.86	13.9 Miles	125100	Brown, Calumet	2020	Poor
Plum Creek	13.87	16.42	2.6 Miles	125100	Brown, Calumet	2015	Poor
Plum Creek	16.42	19.5	3.1 Miles	125100	Brown, Calumet		Poor
Unnamed Stream	0	0.45	0.5 Miles	5022562	Calumet		Unknown
Wetland Tributary	0	0.62	0.6 Miles	3000135	Calumet	2017	Good
Unnamed Stream	0	0.73	0.7 Miles	5022696	Calumet		Unknown
Unnamed Trib to Fox River	0	0.8	0.8 Miles	5021600	Outagamie	2016	Good
Unnamed Trib to Garners	0	0.87	0.9 Miles	5022198	Calumet, Outagamie	2016	Fair
Unnamed	0	1.6	1.6 Miles	5022241	Brown, Calumet	2017	Fair
Unnamed Stream	0	1.61	1.6 Miles	128600	Outagamie		Unknown
Garners Creek	0	1.83	1.8 Miles	5021676	Outagamie	2016	Good
Unnamed Tributary to Garners Creek	0	1.85	1.9 Miles	5022136	Calumet, Outagamie	2016	Fair
Unnamed	0	1.92	1.9 Miles	5022391	Calumet	2015	Fair
Unnamed Creek(T21n,R19e,S36)	0	2	2.0 Miles	125600	Brown, Calumet		Suspected Poor
Tributary to Plum Creek	0	2.8	2.8 Miles	125500	Brown, Calumet	2015	Unknown
Local Water	0	4.57	4.6 Miles	125300	Brown, Outagamie	2018	Fair
Unnamed Trib to Garners Creek	0	4.71	4.7 Miles	5022162	Calumet, Outagamie	2020	Poor
Local Water	0	5.06	5.1 Miles	127000	Calumet	2020	Fair
Local Water	0	9.39	9.4 Miles	125200	Brown, Outagamie	2020	Poor
Local Water	0	10.68	10.7 Miles	126900	Calumet, Outagamie	2020	Fair
Unnamed Trib to Garners	0.87	2.78	1.9 Miles	5022198	Calumet, Outagamie	2016	Unknown
Unnamed Trib to Plum Cr	2.8	5.5	2.7 Miles	125500	Brown, Calumet	1978	Fair
Local Water			2.6 Acres	5554199	Calumet		Unknown
Local Water			3.0 Acres	5555265	Calumet		Unknown