Illinois
Environmental
Protection Agency

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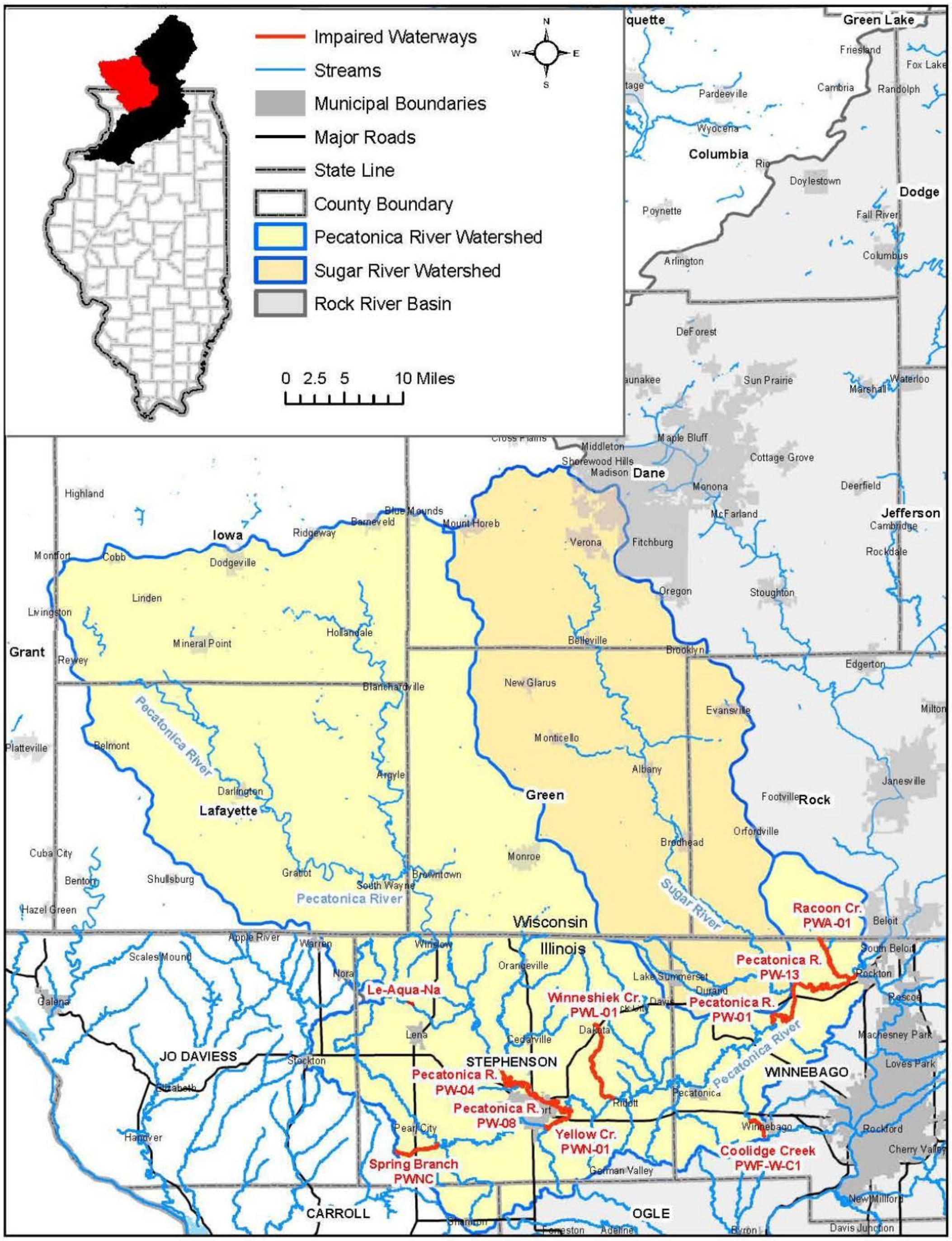
July 2018

IEPA/BOW/18-005

Pecatonica River Watershed TMDL Report



Pecatonica River Watershed

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

JUL 25 2018

REPLY TO THE ATTENTION OF:
WW-16J

Sanjay Sofat, Chief
Bureau of Water
Illinois Environmental Protection Agency
P.O. Box 19276
Springfield, Illinois 62794-9276

Dear Mr. Sofat:

The U.S. Environmental Protection Agency has conducted a complete review of the final Total Maximum Daily Loads (TMDL) for fecal coliform and phosphorus for the Pecatonica River, including supporting documentation and follow up information. The waterbody is located in northwestern Illinois. The TMDLs submitted by the Illinois Environmental Protection Agency address the impaired Primary Contact and Aquatic Life Uses for the waterbodies.

The TMDLs meet the requirements of Section 303(d) of the Clean Water Act and EPA's implementing regulations at 40 C.F.R. Part 130. Therefore, EPA hereby approves Illinois's six TMDLs for fecal coliform and phosphorus as noted in the enclosed decision document. The statutory and regulatory requirements, and EPA's review of Illinois's compliance with each requirement, are described in the enclosed decision document.

We wish to acknowledge Illinois's effort in submitting these TMDLs and look forward to future TMDL submissions by the State of Illinois. If you have any questions, please contact Mr. Peter Swenson, Chief of the Watersheds and Wetlands Branch, at 312-886-0236.

Sincerely,

Linda Holst

Linda Holst
Acting Director
Water Division

Enclosure

cc: Abel Haile, IEPA

TMDL: Pecatonica River; Jo Daviess, Stephenson, Winnebago, Ogle, and Carrol Counties, Illinois
Date:

DECISION DOCUMENT FOR THE APPROVAL OF THE PECATONICA RIVER, IL TMDL

Section 303(d) of the Clean Water Act (CWA) and EPA's implementing regulations at 40 C.F.R. Part 130 describe the statutory and regulatory requirements for approvable TMDLs. Additional information is generally necessary for EPA to determine if a submitted TMDL fulfills the legal requirements for approval under Section 303(d) and EPA regulations, and should be included in the submittal package. Use of the verb "must" below denotes information that is required to be submitted because it relates to elements of the TMDL required by the CWA and by regulation. Use of the term "should" below denotes information that is generally necessary for EPA to determine if a submitted TMDL is approvable. These TMDL review guidelines are not themselves regulations. They are an attempt to summarize and provide guidance regarding currently effective statutory and regulatory requirements relating to TMDLs. Any differences between these guidelines and EPA's TMDL regulations should be resolved in favor of the regulations themselves.

1. Identification of Waterbody, Pollutant of Concern, Pollutant Sources, and Priority Ranking

The TMDL submittal should identify the waterbody as it appears on the State's/Tribe's 303(d) list. The waterbody should be identified/georeferenced using the National Hydrography Dataset (NHD), and the TMDL should clearly identify the pollutant for which the TMDL is being established. In addition, the TMDL should identify the priority ranking of the waterbody and specify the link between the pollutant of concern and the water quality standard (see Section 2 below).

The TMDL submittal should include an identification of the point and nonpoint sources of the pollutant of concern, including location of the source(s) and the quantity of the loading, e.g., lbs/per day. The TMDL should provide the identification numbers of the NPDES permits within the waterbody. Where it is possible to separate natural background from nonpoint sources, the TMDL should include a description of the natural background. This information is necessary for EPA's review of the load and wasteload allocations, which are required by regulation.

The TMDL submittal should also contain a description of any important assumptions made in developing the TMDL, such as:

(1) the spatial extent of the watershed in which the impaired waterbody is located;
(2) the assumed distribution of land use in the watershed (e.g., urban, forested, agriculture);
(3) population characteristics, wildlife resources, and other relevant information affecting the characterization of the pollutant of concern and its allocation to sources;
(4) present and future growth trends, if taken into consideration in preparing the TMDL (e.g., the TMDL could include the design capacity of a wastewater treatment facility); and

(5) an explanation and analytical basis for expressing the TMDL through *surrogate measures*, if applicable. *Surrogate measures* are parameters such as percent fines and turbidity for sediment impairments; chlorophyll $\underline{a}$ and phosphorus loadings for excess algae; length of riparian buffer; or number of acres of best management practices.

Comment:
Location Description: The Illinois Environmental Protection Agency (IEPA) developed TMDLs for fecal coliform and phosphorus for impaired waters in the Pecatonica River watershed in northwest Illinois (Table 1 of this Decision Document). The Pecatonica River watershed begins in southwest Wisconsin, and flows south into Illinois, including Jo Daviess, Stephenson, Winnebago, Ogle, and Carrol Counties, and eventually flows into the Rock River near Rockton, Illinois (Figure 2 of the TMDL). Table 1 of this Decision Document is from Table 1 in the TMDL and lists the waterbodies addressed by this TMDL. Illinois also has Load Reduction Strategies (LRS) included in this TMDL submittal to address pollutants that do not have a numeric criterion, but EPA is not reviewing the LRSs.

Table 1: TMDLs and LRS in the Pecatonica River watershed

Segment Name	Segment ID	Designated use	Pollutant Addressed
TMDLs			
Pecatonica River	**PW-01**	**Recreation**	**Fecal coliform**
Pecatonica River	**PW-08**	**Recreation**	**Fecal coliform**
Pecatonica River	**PW-13**	**Recreation**	**Fecal coliform**
Raccoon Creek	**PWA-01**	**Recreation**	**Fecal coliform**
Yellow Creek	**PWN0-01**	**Recreation**	**Fecal coliform**
LE-AQUA-NA Lake	**RPA**	**Aesthetic Quality**	**Phosphorus**
LRS			
Pecatonica River	PW-01	Aquatic Life	Sediment
Pecatonica River	PW-04	Aquatic Life	Sediment
Pecatonica River	PW-08	Aquatic Life	Sediment
Coolidge Creek	PWF-W-C1	Aquatic Life	Sediment, Phosphorus
Winneshiek Creek	PWL-01	Aquatic Life	Sediment, Phosphorus
Spring Branch	PWNC	Aquatic Life	Phosphorus*

* - Spring Branch was initially listed as impaired for ammonia

The Pecatonica River watershed is approximately 515,000 acres in size. This TMDL report addresses the portion in Illinois, and all future discussion will focus on the Illinois portion of the watershed. Several tributaries drain into the Pecatonica River, including Raccoon Creek, Yellow Creek, Richland Creek, and Sugar River. The impaired segments are located throughout the watershed, and are noted in Figure 3 of the TMDL. Several additional waters are impaired, but IEPA has developed LRS for these waters as noted in Table 1 of this Decision Document. Spring Branch (IEPA ID# PWNC) was initially listed as impaired for ammonia, but during the

TMDL development process, IEPA determined the waterbody is no longer impaired for ammonia, but is now impaired for phosphorus. IEPA will be revising the status of Spring Branch during the next Section 303(d) listing cycle (Section 5 of the TMDL).

Distribution of land use: The land use for Pecatonica River watershed is mainly agricultural and pasture in nature, with most of the agricultural land use in row crop (corn/soybean). Urban and open space makes up a smaller portion of the watershed (Section 2.3 and Figures 5 and 6 of the TMDL). The City of Freeport is located within the watershed, with a population of approximately 25,000. Several smaller villages are located within the watershed. Table 2 of this Decision Document contains a summary of the land use for the Pecatonica River watershed.

Table 2: Land use in the Pecatonica River Watershed

Land Use	Pecatonica River	
	%	acres
Cultivated crops (corn and soybeans)	67.5	347,863
Pasture/Hay	14.9	76, 854
Developed	7.1	36,265
Forest	6.1	31,523
Other	4.4	22,837
Total	100	515,072

Table 3: Land use by TMDL segment

Watershed	Lake Le-Aqua-Na RPA	Yellow Creek PWN-01	Raccoon Creek PWA-01	Pecatonica River PW-01	Pecatonica River PW-08	Pecatonica River PW-13
Watershed Area (mi^2)	3.68	196	15.3	689	238	803
Cultivated Crop %	62	79.2	18.9	69.2	62.3	67.6
Pasture/Hay %	2.0	6.5	43.8	14.6	19.6	14.9
Developed %	6.1	7.3	4.3	7.1	8.3	7.0
Forest %	23.1	5.0	14.1	5.7	6.2	6.1
Other %	6.8	2.1	18.9	3.5	3.6	4.4
Total %	100	100	100	100	100	100

Problem Identification:

The impaired waterbodies in the Pecatonica River watershed were added to the Section 303(d) list for impairments due to high levels of fecal coliform and phosphorus. The five waterbodies impaired by fecal coliform all exceeded the bacteria standards numerous times, and to varying degrees. Lake Le-Aqua-Na exceeded the lake phosphorus standard numerous times in the last ten years, often by as much as four to five times (Section 5.7 of the TMDL).

Pollutants of Concern:

The pollutants of concern are fecal coliform and phosphorus (Table 1 of this Decision Document).

Pollutant:

Fecal coliform: Bacteria exceedances can negatively impact recreational uses (fishing, swimming, wading, boating, etc.) and public health. At elevated levels, bacteria may cause illness within humans who have contact with or ingest bacteria-laden water. Recreation-based contact can lead to ear, nose, and throat infections, and stomach illness.

Total phosphorus: While TP is an essential nutrient for aquatic life, elevated concentrations of TP can lead to nuisance algal blooms that negatively impact aquatic life and recreation (swimming, boating, fishing, etc.). Algal decomposition depletes oxygen levels which stresses benthic macroinvertebrates and fish. Excess algae can shade the water column which limits the distribution of aquatic vegetation. Aquatic vegetation stabilizes bottom sediments, and also is an important habitat for macroinvertebrates and fish. Furthermore, depletion of oxygen can cause phosphorus release from bottom sediments (i.e. internal loading).

Degradations in aquatic habitats or water quality (ex. low dissolved oxygen) can negatively impact aquatic life use. Increased algal growth, brought on by elevated levels of nutrients within the water column, can reduce dissolved oxygen in the water column, and cause large shifts in dissolved oxygen and pH throughout the day. Shifting chemical conditions within the water column may stress aquatic biota (fish and macroinvertebrate species). In some instances, degradations in aquatic habitats or water quality have reduced fish populations or altered fish communities from those communities supporting sport fish species to communities which support more tolerant rough fish species.

Priority Ranking:
The watershed was given priority for TMDL development due to the impairment impacts on the public value of the impaired water resource, and the timing as part of the Illinois basin monitoring process.

Source Identification (point and nonpoint sources):
Point Source Identification:
Fecal coliform: IEPA identified 27 individual point sources located in the Pecatonica River watershed (Table 43 of the TMDL). IEPA also identified three Municipal Separate Storm Sewer Systems (MS4) that discharge in the watershed (Table 44 of the TMDL). Two Concentrated Animal Feeding Operations (CAFOs) were identified in the watershed.

Phosphorus: One point source discharge was identified in the watershed, the Lake Le-Aqua-Na State Park. The park operates a small septic system that discharges to the lake after treatment. No MS4s or CAFOs were identified in the lake watershed.

Nonpoint Source Identification: The potential nonpoint sources for the Pecatonica River watershed TMDLs are described below.

Fecal coliform
Stormwater runoff from agricultural land use practices: Non-regulated stormwater runoff can add fecal coliform to the impaired waters. The sources of bacteria in stormwater include animal/pet wastes, and wildlife. Manure spread onto fields is a source of bacteria, and can be exacerbated by tile drainage lines, which channelize the stormwater. Tile lined fields and channelized ditches enable particles to move more efficiently into surface waters.

Animal Operations: Runoff from agricultural/animal lands may contain significant amounts of bacteria which may lead to impairments in the Pecatonica River watershed. Manure spread onto fields is often a source of bacteria, and can be exacerbated by tile drainage lines, which channelize the stormwater. Tile lined fields and channelized ditches enable bacteria to move more efficiently into surface waters. Furthermore, livestock with direct access to a waterway can directly deposit nutrients via animal wastes into a waterbody, which may result in very high localized bacteria concentrations.

Failing septic systems: IEPA noted that failing septic systems, where waste material can pond at the surface and eventually flow into surface waters or be washed in during precipitation events, are potential sources of bacteria. IEPA consulted with the county health departments and determined that while some of the watershed is served by sewer systems, portions of the watershed are not, and the potential for septic failure is possible.

Phosphorus

Stormwater runoff from agricultural land use practices: Runoff from agricultural lands may contain significant amounts of nutrients, organic material and organic-rich sediment which may lead to impairments in the lake watershed. Manure spread onto fields is often a source of phosphorus, and can be exacerbated by tile drainage lines, which channelize the stormwater. Tile lined fields and channelized ditches enable particles to move more efficiently into surface waters. Phosphorus, organic material and organic-rich sediment may be added via surface runoff from upland areas, grasslands, and agricultural lands used for growing hay or other crops. Stormwater runoff may contribute nutrients and organic-rich sediment to surface waters from livestock manure, fertilizers, vegetation and erodible soils.

Failing septic systems: IEPA noted that failing septic systems, where waste material can pond at the surface and eventually flow into the waterbodies or be washed in during precipitation events, are potential sources of phosphorus.

Internal loading: The release of phosphorus from lake sediments via physical disturbance from benthic fish (rough fish, ex. carp) and from wind mixing the water column may all contribute internal phosphorus loading to the lake. Phosphorus may build up in the bottom waters of the lake and may be resuspended or mixed into the water column when the thermocline decreases and the lake water mixes. IEPA noted that a destratifier system is installed in the lake, which mixes the water and helps to reduce or prevent anoxic conditions. Under anoxic conditions, phosphorus-rich sediments can release phosphorus into the waterbody, increasing phosphorus impacts in the lake (Section 3.3.6 of the TMDL).

Population and future growth trends

The population in the watershed is fairly small. IEPA did not account for any future growth in the watershed.

EPA finds that the TMDL document submitted by IEPA satisfies all requirements concerning this first element.

2. Description of the Applicable Water Quality Standards and Numeric Water Quality Target

The TMDL submittal must include a description of the applicable State/Tribal water quality standard, including the designated use(s) of the waterbody, the applicable numeric or narrative water quality criterion, and the antidegradation policy. (40 C.F.R. §130.7(c)(1)). EPA needs this information to review the loading capacity determination, and load and wasteload allocations, which are required by regulation.

The TMDL submittal must identify a numeric water quality target(s) - a quantitative value used to measure whether or not the applicable water quality standard is attained. Generally, the pollutant of concern and the numeric water quality target are, respectively, the chemical causing the impairment and the numeric criteria for that chemical (e.g., chromium) contained in the water quality standard. The TMDL expresses the relationship between any necessary reduction of the pollutant of concern and the attainment of the numeric water quality target. Occasionally, the pollutant of concern is different from the pollutant that is the subject of the numeric water quality target (e.g., when the pollutant of concern is phosphorus and the numeric water quality target is expressed as Dissolved Oxygen (DO) criteria). In such cases, the TMDL submittal should explain the linkage between the pollutant of concern and the chosen numeric water quality target.

Comment:
Designated Use/Standards: Section 4.1 of the TMDL states that the Pecatonica River is not meeting the General Use designation. The applicable water quality standards (WQS) for these waterbodies are established in Illinois Administrative Rules Title 35, Environmental Protection; Subtitle C, Water Pollution; Chapter I, Pollution Control Board; Part 302, Water Quality Standards, Subpart B for General Use Water Quality Standards. The portions of the WQS that apply to Pecatonica River is General Use, specifically the Aesthetic Quality Use and Primary Contact Use (Section 4.1.1 of the TMDL).

Criteria: The applicable criteria are found in Table 4 of this Decision Document.

Table 4: WQSs for the Pecatonica River TMDLs

Pollutant	Units	Criteria
Phosphorus	mg/L	0.05
Fecal coliform	Count/100 mL	May through October 200*, 400**

* - geometric mean based upon a minimum of 5 samples in a 30-day period
** - not to be exceed by more than 10% of the samples in a 30-day period

Target: The water quality targets for these TMDLs are the WQSs for the waters. For fecal coliform, IEPA used the 200 counts per 100 mL monthly geometric mean portion of the standard to calculate loads in the Pecatonica River waterbodies. IEPA stated that while the TMDL will focus on the geometric mean portion of the water quality standard, both parts of the water quality standard must be met. For phosphorus, the water quality target is the criteria of 0.05 mg/L for phosphorus (Section 7.2 of the TMDL).

Other pollutants: As noted previously, IEPA has developed LRSs to address pollutants that do not have a numeric criterion (Table 1 of this Decision Document). While these are not TMDLs, the LRSs will likely reduce other pollutants in the watershed. For these LRSs, IEPA developed water quality targets as goals to reduce TSS and TP impacts in flowing waters (Table 5 of this Decision Document). For these waters, the targets are:

Table 5: LRS Targets for the Pecatonica River watershed

Pollutant	Target
TP	0.156 mg/L
TSS	40 mg/L

EPA finds that the TMDL document submitted by IEPA satisfies all requirements concerning this second element.

3. Loading Capacity - Linking Water Quality and Pollutant Sources

A TMDL must identify the loading capacity of a waterbody for the applicable pollutant. EPA regulations define loading capacity as the greatest amount of a pollutant that a water can receive without violating water quality standards (40 C.F.R. §130.2(f)).

The pollutant loadings may be expressed as either mass-per-time, toxicity or other appropriate measure (40 C.F.R. §130.2(i)). If the TMDL is expressed in terms other than a daily load, e.g., an annual load, the submittal should explain why it is appropriate to express the TMDL in the unit of measurement chosen. The TMDL submittal should describe the method used to establish the cause-and-effect relationship between the numeric target and the identified pollutant sources. In many instances, this method will be a water quality model.

The TMDL submittal should contain documentation supporting the TMDL analysis, including the basis for any assumptions; a discussion of strengths and weaknesses in the analytical process; and results from any water quality modeling. EPA needs this information to review the loading capacity determination, and load and wasteload allocations, which are required by regulation.

TMDLs must take into account *critical conditions* for stream flow, loading, and water quality parameters as part of the analysis of loading capacity. (40 C.F.R. §130.7(c)(1)). TMDLs should define applicable *critical conditions* and describe their approach to estimating both point and nonpoint source loadings under such *critical conditions*. In particular, the TMDL should discuss the approach used to compute and allocate nonpoint source loadings, e.g., meteorological conditions and land use distribution.

Comment:
The approach utilized by the IEPA to calculate the loading capacity for the fecal coliform and phosphorus TMDLs is described in Section 6.2 of the final TMDL. The fecal coliform TMDLs are presented in Tables 6-10 at the end of this Decision Document.

For the bacteria TMDLs, a geometric mean of 200 cfu/100 ml fecal coliform for five samples equally spaced over a 30-day period was used to calculate the loading capacity of the TMDLs. IEPA determined that the geometric mean portion of the WQS provides the best overall characterization of the status of the watershed. The EPA agrees with this assertion, as stated in the preamble of *The Water Quality Standards for Coastal and Great Lakes Recreation Waters Final Rule* (69 FR 67218-67243, November 16, 2004) on page 67224, "…the geometric mean is the more relevant value for ensuring that appropriate actions are taken to protect and improve water quality because it is a more reliable measure, being less subject to random variation, and more directly linked to the underlying studies on which the 1986 bacteria criteria were based."

IEPA stated that while the bacteria TMDL will focus on the geometric mean portion of the water quality standard (i.e., the chronic WQS of 200 cfu/100mL), attainment of the WQS involves the water body meeting both the chronic (200 cfu/100 mL) and acute (400 cfu/100 mL) portions of the water quality standard. EPA finds these assumptions to be reasonable.

Typically loading capacities are expressed as a mass per time (e.g. pounds per day). However, for bacteria loading capacity calculations, mass is not always an appropriate measure because bacteria are expressed in terms of organism counts. This approach is consistent with the EPA's regulations which define "load" as "an amount of matter that is introduced into a receiving water" (40 CFR §130.2). To establish the loading capacities for the Pecatonica River bacteria TMDLs, IEPA used Illinois's water quality standards for fecal coliform (200 cfu/100 mL). A loading capacity is, "the greatest amount of loading that a water can receive without violating water quality standards." (40 CFR §130.2). Therefore, a loading capacity set at the WQS will assure that the water does not violate WQS. IEPA's fecal coliform TMDL approach is based upon the premise that all discharges (point and nonpoint) must meet the WQS when entering the water body. If all sources meet the WQS at discharge, then the water body should meet the WQS and the designated use.

Flow data from three nearby USGS gages in the watershed (Figure 8 of the TMDL) were used to develop the Load Duration Curves (LDCs). The watershed flow data were available from several decades (Section 7.2.1.1 of the TMDL). Daily stream flows are necessary to implement the LDC approach. The USGS data were supplemented by use of the Illinois Streamflow Assessment Model (ILSAM). ILSAM was developed by the Illinois State Water Survey and the Illinois Department of Natural Resources to estimate stream flow in gaged and ungaged streams (Section 6.2 of the TMDL).

The LDCs were created by multiplying individual flow values by the WQS and then multiplying that value by a conversion factor. The resulting points are plotted onto a load duration curve graph. The LDC graphs for the impaired waters in the Pecatonica River watershed have flow duration interval (percentage of time flow exceeded) on the X-axis and pollutant loads (number of bacteria or pollutant mass per unit time) on the Y-axis. The fecal coliform LDC used fecal coliform measurements in millions of bacteria per day. The curved line on an LDC graph represents the TMDL for the respective flow conditions observed at that location.

Pollutant values from the monitoring sites were converted to individual sampling loads by multiplying the sample concentration by the instantaneous flow measurement observed/estimated at the time of sample collection. The individual sampling loads were plotted on the same figure with the LDC (Figures 29, 32, 34, 35, and 39 of the TMDL).

The LDC plot was subdivided into five flow regimes; very high flows (exceeded 0–10% of the time), high conditions (exceeded 10–40% of the time), mid-range flows (exceeded 40–60% of the time), low conditions (exceeded 60–90% of the time), and very low flows (exceeded 90–100% of the time). LDC plots can be organized to display individual sampling loads and the calculated LDC. Watershed managers can interpret these plots (individual sampling points plotted with the LDC) to understand the relationship between flow conditions and water quality exceedances within the watershed. Individual sampling loads which plot above the LDC represent violations of the WQS and the allowable load under those flow conditions at those locations. The difference between individual sampling loads plotting above the LDC and the LDC, measured at the same flow, is the amount of reduction necessary to meet WQS.

The strengths of using the LDC method are that critical conditions and seasonal variation are considered in the creation of the LDC by plotting hydrologic conditions over the flows measured during the recreation season. Additionally, the LDC methodology is relatively easy to use and cost-effective. The weaknesses of the LDC method are that nonpoint source allocations cannot be assigned to specific sources, and specific source reductions are not quantified. Overall, IEPA believes, and EPA concurs, that the strengths outweigh the weaknesses for the LDC method.

Implementing the results shown by the LDC requires watershed managers to understand the sources contributing to the water quality impairment and which Best Management Practices (BMPs) may be the most effective for reducing pollutant loads based on flow magnitudes. Different sources will contribute pollutant loads under varying flow conditions. For example, if exceedances are significant during high flow events this would suggest storm events are the cause, and implementation efforts can target BMPs that will reduce stormwater runoff and consequently pollutant loading into surface waters. This allows for a more efficient implementation effort.

The TMDLs for the Pecatonica River waterbodies were calculated as appropriate. Allocations were determined for regulated permittees discharging fecal coliform (Table 6-10 of this Decision Document). The load allocations were calculated after the determination of the Margin of Safety. Other load allocations (ex. non-regulated stormwater runoff, wildlife inputs, etc.) were not divided amongst individual nonpoint contributors. Instead, load allocations were combined together into a generalized loading. The LDCs for fecal coliform show exceedences under all flow conditions, and in similar magnitudes, indicating a variety of sources are contributing to the impairment.

The flow gages used to develop the LDCs include flows from the watershed upstream of the gages, including flows from Wisconsin. To account for flows from Wisconsin (i.e., boundary condition), the LDCs were adjusted proportionally to subtract the runoff from Wisconsin. For example if 60% of the watershed was in Wisconsin, then the LDC was calculated on the 40% of the flow originating in Illinois. The pollutant concentrations at the boundary were assumed by IEPA to be meeting the Illinois WQS (Section 6.2 of the TMDL).

Tables 6-10 of this Decision Document calculates five points (the midpoints of the designated flow regimes) on the loading capacity curves. However, it should be understood that the components of the TMDL equation could be illustrated for any point on the entire loading capacity curve. The load duration curve method can be used to display collected pollutant monitoring data and allows for the estimation of load reductions necessary for attainment of the appropriate water quality standards. Using this method, daily loads were developed based upon the flow in the water body. Loading capacities were determined for the segment for multiple flow regimes. This allows the TMDLs to be represented by an allowable daily load across all flow conditions. Although there are numeric loads for each flow regime, the LDC is being approved for these TMDLs.

Total Phosphorus:
IEPA used the U.S. Army Corps of Engineers BATHTUB model to calculate the loading capacity for Lake Le-Aqua-Na (Section 4.2 of the TMDL). BATHTUB is a model for lakes and reservoirs to determine steady-state water and nutrient mass balances in a spatially segmented hydraulic network. BATHTUB uses empirical relationships to determine "eutrophication-related water quality conditions".[1] This TMDL uses the BATHTUB model to link observed phosphorus water quality conditions and modeled phosphorus loading to in-lake water quality estimates. BATHTUB can be a steady-state annual or seasonal model that predicts a lake's water quality. BATHTUB utilizes annual or seasonal time-scales, which are appropriate because watershed TP loads are normally impacted by seasonal conditions.

The model estimates in-lake phosphorus concentration by calculating net phosphorus loss (phosphorus sedimentation) from annual phosphorus loads as functions of inflows to the lake, lake depth, and hydraulic flushing rate. To estimate loading capacity, the model is rerun, reducing current loading to the lake until the modeled result shows that in-lake total phosphorus would meet the applicable WQS.[2] The BATHTUB model also allows IEPA to assess impacts of changes in nutrient loading from the various sources.

To increase the effectiveness of the BATHTUB model, IEPA used the *Spreadsheet Tool for the Estimation of Pollutant Load* (STEPL) model to generate watershed loading. STEPL provides a simplified simulation of precipitation-driven runoff and sediment and nutrient delivery. STEPL can estimate loads from land uses (such as row crops and commercial areas), as well as from other sources such as stream bank erosion and failing septic systems. STEPL simulates runoff and stream flow using summary information on precipitation and rain days for the nearest weather station (Section 6.2.2 of the TMDL).

The BATHTUB modeling effort was used to calculate the loading capacity for Lake Le-Aqua-Na. The loading capacity is the maximum phosphorus load which the waterbody can receive over an annual period and still meet the lake nutrient WQS. The loading capacity was calculated to meet the WQS during the growing season (June 1 through September 30). This time period contains the months that the general public typically uses the lake for aquatic recreation. This time of the year also corresponds to the growing season when water quality is likely to be impaired by excessive nutrient loading. Table 11 of this Decision Document shows the TMDL summary for the lake.

[1] BATHTUB Manual - http://www.wwwalker.net/bathtub/help/bathtubWebMain.html

[2] Ibid. BATHTUB Manual

Table 11: Phosphorus TMDL Summary for Lake Le-Aqua-Na

	TP Load (lbs/yr)	TP Load (lbs/day)
LA	325	0.890
WLA (Lake Le-Aqua-Na State Park (IL0054062)	38	0.104
MOS	40.3	0.110
Loading Capacity	**403**	**1.104**
Existing Load	2,322	6.362
Load Reduction	83%	83%

EPA finds that the TMDL document submitted by IEPA satisfies all requirements concerning this third element.

4. Load Allocations (LAs)

EPA regulations require that a TMDL include LAs, which identify the portion of the loading capacity attributed to existing and future nonpoint sources and to natural background. Load allocations may range from reasonably accurate estimates to gross allotments (40 C.F.R. §130.2(g)). Where possible, load allocations should be described separately for natural background and nonpoint sources.

Comment:
The LAs for the waterbodies are found Tables 6-11 of this Decision Document. The nonpoint sources of fecal coliform and phosphorus in the watershed are nonpoint source runoff from row crop agricultural fields, failing septics, unregulated suburban/urban runoff, and animal operations. As discussed in Sections 8 and 10 of this Decision Document, IEPA provided further analysis of how reductions from the various pollutant sources could be attained.

EPA finds that the TMDL document submitted by IEPA satisfies all requirements concerning this fourth element.

5. Wasteload Allocations (WLAs)

EPA regulations require that a TMDL include WLAs, which identify the portion of the loading capacity allocated to individual existing and future point source(s) (40 C.F.R. §130.2(h), 40 C.F.R. §130.2(i)). In some cases, WLAs may cover more than one discharger, e.g., if the source is contained within a general permit.

The individual WLAs may take the form of uniform percentage reductions or individual mass based limitations for dischargers where it can be shown that this solution meets WQSs and does not result in localized impairments. These individual WLAs may be adjusted during the NPDES permitting process. If the WLAs are adjusted, the individual effluent limits for each permit issued to a discharger on the impaired water must be consistent with the assumptions and requirements of the adjusted WLAs in the TMDL. If the WLAs are not adjusted, effluent limits contained in the permit must be consistent with the individual WLAs specified in the TMDL. If a draft permit provides for a higher load for a discharger than the corresponding individual WLA in the TMDL, the State/Tribe must demonstrate that the total WLA in the TMDL will be achieved through reductions in the remaining individual WLAs and that localized impairments will not result. All permittees should be notified of any deviations from the initial individual WLAs contained in the TMDL. EPA does not require the establishment of a new TMDL to reflect these revised allocations as long as the total WLA, as expressed in the TMDL, remains the same or decreases, and there is no reallocation between the total WLA and the total LA.

Comment:
Fecal coliform: IEPA determined loads for fecal coliform for the 27 dischargers in the Pecatonica watershed (Table 12 of this Decision Document). The WLAs are based upon two flow conditions; IEPA used the design average flow (DAF) of the facilities for the lower streamflow regimes (30%-100%) and the design maximum flow (DMF) of the facilities for the higher streamflow regimes (0%-30%). For those facilities without a DMF, IEPA used the DAF. The appropriate flow was multiplied by the WQS of 200 cfu/100 mL for the facilities noted in Table 12 of this Decision Document (Section 6.4 of the TMDL). Several of the facilities have been granted disinfection exemptions by IEPA; for those facilities, the WLA is applicable at the downstream point where the disinfection exemption ends.

IEPA determined individual WLAs for the MS4 permittees in the Pecatonica River watershed (Tables 13 and 14 of this Decision Document). The MS4 WLAs were based upon the land area under the jurisdiction of the MS4 permit as discussed in Section 6.4 of the TMDL.

IEPA identified two CAFOs in the watershed (Table 15 of this Decision Document). IEPA noted that these feedlots must be designed to totally contain runoff, and manure management planning requirements are more stringent than for smaller feedlots. The CAFOs were not given an allocation (WLA = 0). IEPA did not identify any other point sources for fecal coliform.

Table 12: Fecal coliform WLAs in the Pecatonica River TMDL

Permit Number	Facility Name	Design Average Flow (MGD)	Design Maximum Flow MGD	WLA – DAF (million col/day)*	WLA – DMF (million col/day)*
ILG582019	Durand Sanitary District – STP**	0.35	0.45	2.6	3.4
IL0077852	Sugar Shores Camping Resort	0.025	0.1025	0.2	0.8
IL0003204	Titan Tire Corporation of Freeport	2.88	--	22	22
IL0034908	Bay Valley Foods LLC	0.162	--	1.2	1.2
IL0030571	Village of Pecatonica WWTP**	0.6	1.65	4.5	11
ILG551070	Westlake Utilities, Inc. **	0.25	1	1.9	7.6
IL0048593	Otter Creek Lake Utility District STP**	0.4	1	3.0	7.6
ILG580267	Rock City STP**	0.04	0.1	0.3	0.8
ILG580278	Village of Davis STP**	0.075	0.19	0.6	1.4
IL0048259	Village of Winslow – WWTP**	0.055	0.137	0.4	1.0
IL0054062	Le-Aqua-Na State Park	0.0031	0.00775	0.02	0.06
IL0026735	Torkelson Cheese Company – Lena	0.1	--	0.8	0.8
ILG580248	Village of Orangeville WWTP**	0.2	0.72	1.5	5.5
ILG580136	Cedarville STP**	0.1	0.25	0.8	1.9
ILG551062	Stephenson MHP**	0.024	0.048	0.2	0.4
IL0065811	Berner Foods, Inc.	0.035	Not reported	0.3	0.3
IL0036030	Northern Hills Utility STP**	0.06	0.13	0.5	1.0
IL0023591	City of Freeport STP**	6.75	16.6	51	126

IL0024945	Village of Lena – STP**	0.6	1.5	4.5	11
IL0076210	Adkins Energy, LLC	0.062	0.15	0.5	1.1
IL0003476	Nuestro Queso, LLC	0.35	Not reported	2.6	2.6
IL0030562	Village of Pearl City STP**	0.101 proposed	0.2563 proposed	0.8	1.9
ILG580021	Shannon STP **	0.18	0.45	1.4	3.4
ILG551013	Timber Ridge MHP – Freeport**	0.012	0.03	0.1	0.2
IL0028304	Dakota STP **	0.1	0.25	0.8	1.9
ILG551061	River Road MHP **	0.0378	0.151	0.3	1.1
IL0020672	RRWD - Winnebago WWTP **	0.4	1	3.0	7.6

* - DAF applies in the lower 30-100% flows, DMF applies in the higher 0-30% flows
** - Facilities with a disinfection exemption

Table 13: WLA for MS4 systems in the Pecatonica River Segment PW-01

Permit ID	Regulated Entity	Fecal coliform WLA (billion CFU/day)				
		High	Moist	Mid-Range	Dry	Low
ILR400475	Village of Winnebago	5.1	1.80	1.20	0.76	0.44
ILR400505	Winnebago County	0.2	0.06	0.04	0.03	0.02
	Total	**5.3**	**1.9**	**1.2**	**0.79**	**0.46**

Table 14: WLA for MS4 systems in the Pecatonica River Segment PW-13

Permit ID	Regulated Entity	Fecal coliform WLA (billion CFU/day)				
		High	Moist	Mid-Range	Dry	Low
ILR400434	Village of Rockton	0.9	0.3	0.23	0.14	0.09
ILR400475	Village of Winnebago	5.3	1.9	1.30	0.83	0.50
ILR400505	Winnebago County	0.2	0.1	0.05	0.03	0.02
	Total	**6.4**	**2.3**	**1.6**	**1.0**	**0.61**

Table 15: CAFOs in the Pecatonica River Watershed

Permit ID	CAFO Name	WLA
ILA010071	Eugene Meier Farm	0
ILA010086	Rancho Cantera	0

Phosphorus: IEPA determined a load for phosphorus for the one discharger in the Lake Le-Aqua-Na watershed (Section 7.10 of the TMDL). The Lake Le-Aqua-Na State Park operates a small wastewater system. The WLA for phosphorus is **0.104 lbs/day** (38 lbs/yr) for the facility (permit number IL0054062). No other point sources were identified.

EPA finds that the TMDL document submitted by IEPA satisfies all requirements concerning this fifth element.

6. Margin of Safety (MOS)

The statute and regulations require that a TMDL include a margin of safety (MOS) to account for any lack of knowledge concerning the relationship between load and wasteload allocations and water quality (CWA §303(d)(1)(C), 40 C.F.R. §130.7(c)(1)). EPA's 1991 TMDL Guidance explains that the MOS may be implicit, i.e., incorporated into the TMDL through conservative assumptions in the analysis, or explicit, i.e., expressed in the TMDL as loadings set aside for the MOS. If the MOS is implicit, the conservative assumptions in the analysis that account for the

MOS must be described. If the MOS is explicit, the loading set aside for the MOS must be identified.

Comment:
Fecal coliform: The Pecatonica River TMDLs incorporate both an explicit and implicit MOS in the TMDL calculations (Tables 6-10 of this Decision Document). The MOS reserved 10% of the loading capacity and allocated the remaining loads to point and nonpoint sources. The TMDLs also incorporate an implicit MOS in the TMDL calculations. The WLA is based upon the 200 cfu/100 mL as a 30-day geometric mean portion of the WQS to determine the daily load. This essentially sets the monthly geometric mean portion of the WQS as a daily not-to-exceed value (i.e., no averaging), significantly overestimating the bacteria reductions needed to attain WQSs in the Pecatonica River watershed.

An additional conservative assumption is that IEPA did not use a rate of decay, or die-off rate of pathogen species, in the TMDL calculations or in the creation of the load duration curve for fecal coliform. Bacteria have a limited capability of surviving outside their hosts, and normally a rate of decay would be incorporated. IEPA determined that it was more conservative to use the WQS (200 cfu/100 mL) and not to apply a rate of decay, which could result in a discharge limit greater than the WQS.

As stated in *EPA's Protocol for Developing Pathogen TMDLs* (EPA 841-R-00-002), many different factors affect the survival of pathogens, including the physical condition of the water. These factors include, but are not limited to sunlight, temperature, salinity, and nutrient deficiencies. These factors vary depending on the environmental condition/circumstances of the water, and therefore it would be difficult to assert that the rate of decay caused by any given combination of these environmental variables was sufficient to meet the WQS of 200 cfu/100 mL. Thus, it is more conservative to apply the State's WQS as the MOS, because this standard must be met at all times under all environmental conditions.

Phosphorus: The Lake Le-Aqua-Na phosphorus TMDL incorporates an explicit MOS of 10% of the total loading capacity. The MOS reserved 10% of the loading capacity and allocated the remaining loads to point and nonpoint sources (Table 11 of this Decision Document). IEPA noted that the MOS is reasonable due to the generally good calibration of the BATHTUB model for hydrology and pollutant loading (Section 6.2.2 of the TMDL). The calibration results indicate the model adequately characterize the lake, and therefore additional MOS is not needed.

EPA finds that the TMDL document submitted by IEPA has an appropriate MOS satisfying all requirements concerning this sixth element.

7. Seasonal Variation

The statute and regulations require that a TMDL be established with consideration of seasonal variations. The TMDL must describe the method chosen for including seasonal variations. (CWA §303(d)(1)(C), 40 C.F.R. §130.7(c)(1)).

Comment:
The LDC process accounts for seasonal variation by utilizing streamflows over a wide range.

For fecal coliform, runoff carries the pollutants into the streams. The LDC graphs can be used to determine under which conditions exceedences are occurring, and any seasonal component (i.e., spring melt).

Bacterial loads vary by season, typically reaching higher values in the dry summer months when low flows and warm water contribute to bacteria abundance, and reaching relatively lower values in colder months when bacterial growth rates attenuate. Bacterial WQS need to be met between May 1st to October 31st, regardless of the flow condition. The development of the LDC utilized flow measurements from local flow gages. These flow measurements were collected over a variety of flow conditions observed during the recreation season. The LDC developed from these flow records represents a range of flow conditions within the impaired watersheds and thereby accounted for seasonal variability over the recreation season.

For phosphorus, use of the STEPL model addresses seasonal variation by accounting for run-off during the year. Precipitation data is considered in developing the loads of phosphorus from run-off events.

EPA finds that the TMDL document submitted by IEPA satisfies all requirements concerning this seventh element.

8. Reasonable Assurances

When a TMDL is developed for waters impaired by point sources only, the issuance of a National Pollutant Discharge Elimination System (NPDES) permit(s) provides the reasonable assurance that the wasteload allocations contained in the TMDL will be achieved. This is because 40 C.F.R. 122.44(d)(1)(vii)(B) requires that effluent limits in permits be consistent with "the assumptions and requirements of any available wasteload allocation" in an approved TMDL.

When a TMDL is developed for waters impaired by both point and nonpoint sources, and the WLA is based on an assumption that nonpoint source load reductions will occur, EPA's 1991 TMDL Guidance states that the TMDL should provide reasonable assurances that nonpoint source control measures will achieve expected load reductions in order for the TMDL to be approvable. This information is necessary for EPA to determine that the TMDL, including the load and wasteload allocations, has been established at a level necessary to implement water quality standards.

EPA's August 1997 TMDL Guidance also directs Regions to work with States to achieve TMDL load allocations in waters impaired only by nonpoint sources. However, EPA cannot disapprove a TMDL for nonpoint source-only impaired waters, which do not have a demonstration of reasonable assurance that LAs will be achieved, because such a showing is not required by current regulations.

Comment:
Section 8 of the TMDL discusses reasonable assurance for the Pecatonica River watershed TMDLs. IEPA provided information on controls of fecal coliform as well as phosphorus and sediment that will be targeted in the watershed.

Reasonable assurance that the WLAs will be implemented are through the NPDES program. IEPA listed 27 WWTPs that discharge fecal coliform in the Pecatonica River watershed. Section 8.2.2 of the TMDL addresses the discharges of fecal coliform from permitted facilities. At this time, point sources do not discharge a significant amount of phosphorus in the Lake Le-Aqua-Na watershed, and the current NPDES permit process will continue to control phosphorus discharges in the future.

Section 8 of the TMDL discusses various BMPs that, when implemented, will significantly reduce fecal coliform loadings to attain WQS. For most of these BMPs, IEPA provided some watershed analysis on the impacts these BMPs may have on fecal coliform loads.
IEPA utilized the STEPL model to quantify watershed loading and potential load reductions in the watershed (Section 8.2.1 of the TMDL). The modeling focused mainly on phosphorus and sediment, but IEPA noted that fecal coliform is often transported with sediment and phosphorus run-off, such as from manure spreading. Many of the best management practices (BMPs) discussed by IEPA for phosphorus and sediment reduction will also reduce fecal coliform loads, creating a more integrated approach.

IEPA also identified critical areas for fecal coliform, phosphorus, and sediment reductions, as noted in Figure 50 of the TMDL. The TMDL report also includes a watershed management plan consistent with Section 319 of the Clean Water Act. This plan discusses the nine minimum elements identified by the EPA as critical for achieving improvements in the watershed (Section 8.1.2 of the TMDL), and as necessary for implementation projects in the watershed to be eligible for Section 319 funding.

As part of the watershed management plan process, IEPA identified a schedule and milestones for implementing various control measures (section 8.5.2 and Table 61 of the TMDL). This schedule is for a 25-year time period, and focuses on high-priority efforts in the short-term, as well as long-term controls needed.

IEPA also identified several local watershed groups that will be participating in the implementation efforts in the watershed (Section 8.10 of the TMDL). The Friends of the Pecatonica River have developed a river trail to promote use of the river and surrounding land area for recreational purposes. The Lower Sugar River Watershed Association has laid out a five-year strategic plan to evaluate the water and habitat quality in the Lower Sugar River, and prioritized areas for implementation actions. The local Soil and Water Conservation Districts have also been involved in activities in the watershed to improve water quality,

EPA finds that this criterion has been adequately addressed.

9. Monitoring Plan to Track TMDL Effectiveness

EPA's 1991 document, *Guidance for Water Quality-Based Decisions: The TMDL Process* (EPA 440/4-91-001), recommends a monitoring plan to track the effectiveness of a TMDL, particularly when a TMDL involves both point and nonpoint sources, and the WLA is based on an assumption that nonpoint source load reductions will occur. Such a TMDL should provide assurances that nonpoint source controls will achieve expected load reductions and, such TMDL should include a monitoring plan that describes the additional data to be collected to determine if the load reductions provided for in the TMDL are occurring and leading to attainment of water quality standards.

Comment:
The TMDL contains discussion on future monitoring and milestones (Section 8.9.2 of the TMDL). There were several monitoring sites used to gather data for the Pecatonica River. The Pecatonica River sites are part of the Illinois Ambient Water Quality Monitoring System, and will continue to be monitored quarterly. IEPA also performs intensive basin surveys every five years using a rotating basins process. Detailed monitoring of the Pecatonica River and associated tributaries will be performed during these surveys. In order to demonstrate attainment of the milestones and benchmarks noted in the TMDL, future monitoring will be critical.

EPA finds that this criterion has been adequately addressed.

10. Implementation

EPA policy encourages Regions to work in partnership with States/Tribes to achieve nonpoint source load allocations established for 303(d)-listed waters impaired by nonpoint sources. Regions may assist States/Tribes in developing implementation plans that include reasonable assurances that nonpoint source LAs established in TMDLs for waters impaired solely or primarily by nonpoint sources will in fact be achieved. In addition, EPA policy recognizes that other relevant watershed management processes may be used in the TMDL process. EPA is not required to and does not approve TMDL implementation plans.

Comment:
Numerous implementation options are discussed in Section 8 of the TMDL. These options are directed for reductions in sediment and total phosphorus as well as fecal coliform.

The potential BMPs are:

- Cover crops
- No-till/strip till
- Water and Sediment Control Basins (WASCB)
- Grassed waterways
- Filter strip, grass conversion, and field borders
- Streambank stabilization
- Shoreline stabilization
- Detention basin/pond
- Septic Systems
- Nutrient management

For most of these BMPs, IEPA provided some watershed analysis on the impacts these BMPs may have on TP and TSS loads that are discussed under LRSs.

EPA reviews, but does not approve, implementation plans. EPA finds that this criterion has been adequately addressed.

11. Public Participation

EPA policy is that there should be full and meaningful public participation in the TMDL development process. The TMDL regulations require that each State/Tribe must subject calculations to establish TMDLs to public review consistent with its own continuing planning process (40 C.F.R. §130.7(c)(1)(ii)). In guidance, EPA has explained that final TMDLs submitted to EPA for review and approval should describe the State's/Tribe's public participation process, including a summary of significant comments and the State's/Tribe's responses to those comments. When EPA establishes a TMDL, EPA regulations require EPA to publish a notice seeking public comment (40 C.F.R. §130.7(d)(2)).

Provision of inadequate public participation may be a basis for disapproving a TMDL. If EPA determines that a State/Tribe has not provided adequate public participation, EPA may defer its approval action until adequate public participation has been provided for, either by the State/Tribe or by EPA.

Comment:
An initial public meeting was held on March 19, 2014, to describe the watershed plan and TMDL process. The public comment period for the draft TMDL opened on March 7, 2018 and closed on April 7, 2018. A public meeting was held on March 7, 2018, in Freeport, Illinois.

The public notices were published in the local newspaper and interested individuals and organizations received copies of the public notice. A hard copy of the TMDL was made available at the Stephenson County Farm Bureau and the Freeport Public Library. The draft TMDL was also made available at the website http://www.epa.illinois.gov/public-notices/index. Two public comments were received.

IEPA developed a response summary to address the comments submitted. EPA reviewed the comments and responses, and has determined that IEPA responded appropriately to the comments. A brief overview is provided below.

The Natural Land Institute submitted comments on the 303d list status of several waterbodies in the watershed, that are no longer listed as impaired, and suggested several other options for retiring land within the watershed to discontinue farming and return the acreage to a more natural state. IEPA explained that additional monitoring data has been gathered since the waters in question were originally listed as impaired. As a result of the new data, IEPA determined that the waterbodies were no longer impaired, and have been projected to be removed from the 303d list of impaired waters. IEPA added additional language to the TMDL to address other land retirement options available in the watershed, and included language on additional partners that may help implement the TMDL and watershed plan. The other comment was from Applied Ecological Services, Inc., requesting additional information on how to find geospatial data on the IEPA website. IEPA provided additional explanation and a weblink to the latest information.

EPA finds that the TMDL document submitted by IEPA satisfies all requirements concerning this eleventh element.

12. Submittal Letter

A submittal letter should be included with the TMDL submittal, and should specify whether the TMDL is being submitted for a *technical review* or *final review and approval*. Each final TMDL submitted to EPA should be accompanied by a submittal letter that explicitly states that the submittal is a final TMDL submitted under Section 303(d) of the Clean Water Act for EPA review and approval. This clearly establishes the State's/Tribe's intent to submit, and EPA's duty to review, the TMDL under the statute. The submittal letter, whether for technical review or final review and approval, should contain such identifying information as the name and location of the waterbody, and the pollutant(s) of concern.

Comment:
On June 21, 2018, EPA received the Pecatonica River watershed TMDL, and a submittal letter from Sanjay Sofat, IEPA, to Linda Holst, EPA. In the submittal letter, IEPA stated it was submitting the TMDL report for EPA's final approval. The submittal letter included the name and location of the waterbodies and the pollutants of concern.

EPA finds that the TMDL document submitted by IEPA satisfies all requirements concerning this twelfth element.

Conclusion
After a full and complete review, EPA finds that the TMDLs for the Pecatonica River watershed satisfy all of the elements of an approvable TMDL. This approval is for six TMDLs; five for fecal coliform and one for phosphorus, as noted in Table 1 of this Decision Document.

EPA's approval of this TMDL does not extend to those waters that are within Indian Country, as defined in 18 U.S.C. Section 1151. EPA is taking no action to approve or disapprove TMDLs for those waters at this time. EPA, or eligible Indian Tribes, as appropriate, will retain responsibilities under the CWA Section 303(d) for those waters.

Table 6: TMDL Summary for segment PW-01, Pecatonica River

TMDL Parameter		High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
		Fecal Coliform Load (billion cfu per day)				
Boundary Condition at WI State Line		10,931	4,200	2,639	1,758	1,111
Wasteload Allocation	NPDES Perm. Facility	219	219	103	103	103
	MS4	5.3	1.9	1.2	0.79	0.46
	CAFO	0	0	0	0	0
Load Allocation (Illinois Only)		5,880	2,124	1,370	877	518
MOS (Illinois Only)		678	261	164	109	69
Loading Capacity [a]		17,713	6,806	4,277	2,848	1,801
Existing Load		-	10,109	6,236	49,653	416
Load Reduction [b]		-	33%	31%	94%	0%

a. Loading capacity rounded to a whole number
b. TMDL reduction is based on the observed 90[th] percentile load in each flow regime and the geometric mean standard; the instantaneous standard also must be met.

Table 7: TMDL Summary for segment PW-08, Pecatonica River

TMDL Parameter		High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
		Fecal Coliform Load (billion cfu per day)				
Boundary Condition at WI State Line		10,786	4,282	2,666	1,753	1,091
Wasteload Allocation	NPDES Perm. Facility	137	137	56	56	56
	CAFO	0	0	0	0	0
Load Allocation (Illinois Only)		1,914	678	451	278	151
MOS (Illinois Only)		228	90	56	37	23
Loading Capacity		13,065	5,187	3,229	2,124	1,321
Existing Load		78,434	70,505	145,711	17,383	1,588
Load Reduction [a]		83%	93%	98%	88%	17%

a. TMDL reduction is based on the observed 90[th] percentile load in each flow regime and the geometric mean standard; the instantaneous standard also must be met.

Table 8: TMDL Summary for segment PW-13, Pecatonica River

TMDL Parameter		Flow Zones				
		High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
		Fecal Coliform Load (billion cfu per day)				
Boundary Condition at WI State Line		18,778	7,275	4,703	3,164	2,025
Wasteload Allocation	NPDES Perm. Facility	224	224	106	106	106
	MS4	6.4	2.3	1.6	1.0	0.61
	CAFO	0	0	0	0	0
Load Allocation (Illinois Only)		7,046	2,593	1,714	1,119	678
MOS (Illinois Only)		809	313	203	136	87
Loading Capacity [a]		26,863	10,408	6,728	4,526	2,897
Existing Load		36,351	32,837	101,137	19,855	-
Load Reduction [b]		26%	68%	93%	77%	-

a. Loading capacity rounded to a whole number

b. TMDL reduction is based on the observed 90th percentile load in each flow regime and the geometric mean standard; the instantaneous standard also must be met.

Table 9: TMDL Summary for segment PWA-01, Raccoon Creek

TMDL Parameter	Flow Zones				
	High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
	Fecal Coliform Load (billion cfu per day)				
Boundary Condition at WI State Line	465	168	98	63	41
Load Allocation (Illinois Only)	128	46	27	17	11
MOS (Illinois Only)	14	5	3	2	1
Loading Capacity	607	219	128	82	53
Existing Load	-	488	5,803	223	-
Load Reduction [a]	-	55%	98%	63%	-

a. TMDL reduction is based on the observed 90th percentile load in each flow regime and the geometric mean standard; the instantaneous standard also must be met.

Table 10: TMDL Summary for segment PWN-01, Yellow Creek

TMDL Parameter		Flow Zones				
		High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
		Fecal Coliform Load (billion cfu per day)				
Wasteload Allocation	NPDES Perm. Facility	20	20	10	10	10
	CAFO	0	0	0	0	0
Load Allocation		1,579	544	319	200	119
MOS		178	63	37	23	14
Loading Capacity		1,777	627	366	233	143
Existing Load		-	1,789	617	736	127
Load Reduction [a]		-	65%	41%	68%	0%

a. TMDL reduction is based on the observed 90[th] percentile load in each flow regime and the geometric mean standard; the instantaneous standard also must be met.

Pecatonica River Total Maximum Daily Load and Load Reduction Strategies

Final Report

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Contents

Figures

Tables

Acronyms and Abbreviations

AFOs	animal feeding operations
AWQMN	Ambient Water Quality Monitoring Network
CAFO	confined animal feeding operation
CFR	Code of Federal Regulation
CWA	Clean Water Act
HUC	hydrologic unit code
HSG	hydrologic soil group
Illinois EPA	Illinois Environmental Protection Agency
IPCB	Illinois Pollution Control Board
LA	load allocation
LRS	load reduction strategy
MGD	million gallons per day
MHP	mobile home park
MOS	margin of safety
MS4	municipal separate storm sewer system
N/A	not applicable
NPDES	National Pollutant Discharge Elimination System
STEPL	Spreadsheet Tool for the Estimation of Pollutant Load
STP	sewage treatment plant
TMDL	total maximum daily load
TP	total phosphorus
TSS	total suspended solids
U.S. EPA	United States Environmental Protection Agency
USDA	United States Department of Agriculture
USGS	United States Geological Survey
VW	volume weighted
WLA	wasteload allocation
WQS	water quality standards
WWTP	wastewater treatment plant

Executive Summary

The Clean Water Act and U.S. Environmental Protection Agency (EPA) regulations require that Total Maximum Daily Loads (TMDLs) be developed for waters that do not support their designated uses. In simple terms, a TMDL is a plan to attain and maintain water quality standards in waters that are not currently meeting them. In addition to TMDL development, load reduction strategies (LRS) are included to address additional pollutants in the watershed that do not have water quality standards, namely nutrients and sediment.

This TMDL and LRS study addresses the Pecatonica River watershed in northwestern Illinois. A significant portion of the Pecatonica River watershed originates in Wisconsin; however, this study only addresses the 805 square miles of the watershed in Illinois. Several waters within the Pecatonica River project area have been placed on the State of Illinois §303(d) list and require the development of a TMDL or LRS. These waters range from small headwater streams such as Spring Brook and Coolidge Creek to mainstem segments of the Pecatonica River. The sources of pollutants in the Pecatonica River watershed include NPDES permitted facilities such as wastewater treatment facilities, CAFOs, and regulated stormwater. In addition, nonpoint source pollution results from several key sources including stormwater runoff, erosion from fields and streambanks, onsite wastewater treatment systems, animal feeding operations, and livestock populations.

A TMDL or LRS identifies the total allowable load that a waterbody can assimilate (the loading capacity) and still meet water quality standards or targets. The loading capacity for each stream is determined using a load duration curve framework. An in-lake response model is used to determine the phosphorus loading capacity for Lake La-Aqua-Na. TMDLs and LRSs are presented in Section 7. A TMDL is equal to the loading capacity for a waterbody, and that loading capacity is distributed among load allocations to nonpoint and background sources and wasteload allocations to point sources. The required pollutant reductions vary between zero and 96 percent, depending on the waterbody and pollutant.

An implementation plan is provided in Section 8 which includes potential implementation activities to address sources of pollutants. This plan, when combined with the entire TMDL/LRS study, is provided to meet U.S. EPA's Nine Minimum Elements for Clean Water Act section 319 funding requirements and includes an analysis of critical areas, extent of needed implementation, schedule, milestones, partners, and estimated costs.

The State of Illinois uses a three-stage approach to develop TMDLs and LRSs for a watershed:

> **Stage 1** – Watershed characterization, historical dataset evaluation, data analysis, methodology selection, data gap identification
> **Stage 2 –** Data collection to fill in data gaps, if necessary
> **Stage 3** – Model calibration, TMDL scenarios, and implementation plan

Stage 1 for the Pecatonica River watershed was completed in 2014. As part of the Stage 1 report, additional monitoring was recommended as part of Stage 2. That work was completed in 2016. This final report represents a compilation of Stage 1, 2, and 3.

1. Introduction

The Clean Water Act and U.S. Environmental Protection Agency (U.S. EPA) regulations require that Total Maximum Daily Loads (TMDLs) be developed for waters that do not support their designated uses. In simple terms, a TMDL is a plan to attain and maintain water quality standards in waters that are not currently meeting them. In addition to TMDL development, load reduction strategies (LRS) are included to address additional pollutants in the watershed that do not have water quality standards, namely nutrients and sediment in streams. This TMDL and LRS study addresses the approximately 805 square mile Pecatonica River project area (portion included in Illinois only) located in northwestern Illinois. The headwaters for the Pecatonica River begin in Wisconsin; the Sugar River is a major tributary to the Pecatonica.

Several waters within the Pecatonica River project area have been placed on the State of Illinois 303(d) list, and require the development of a TMDL or LRS. Figure 1 shows two of these impaired waters.

Figure 1. Two impaired waters in the Pecatonica River project area left: Coolidge Creek (2012) and right: Lake La-Aqua-Na (2013).

1.1 TMDL Development Process

The TMDL process establishes the allowable loading of pollutants or other quantifiable parameters for a water body based on the relationship between pollution sources and instream conditions. This allowable loading represents the maximum quantity of the pollutant that the waterbody can receive without exceeding water quality standards. The TMDL also takes into account a margin of safety, which reflects scientific uncertainty, as well as the effects of seasonal variation. By following the TMDL process, States can establish water quality-based controls to reduce pollution from both point and nonpoint sources, and restore and maintain the quality of their water resources (U.S. EPA 1991).

The Illinois EPA will be working with stakeholders to implement the necessary controls to improve water quality in the impaired waterbodies and meet water quality standards. It should be noted that the controls for nonpoint sources (e.g., agriculture) will be strictly voluntary.

1.2 Water Quality Impairments

Several waters within the Pecatonica River watershed have been placed on the State of Illinois §303(d) list (Table 1, Figure 2 and Figure 3), and require development of TMDLs. In addition, several segments are not meeting sediment and nutrient targets. Load reduction strategies (LRS) are developed for each of these stream segments (Table 1, Figure 2 and Figure 3). This TMDL project is intended to address documented water quality problems in the Pecatonica River watershed.

Several segments of the main stem of the Pecatonica River appear on the Illinois 2012, 2014, and 2016 §303(d) lists. These segments are listed for not supporting primary contact recreation due to elevated levels of fecal coliform bacteria, and/or not supporting aquatic life due to elevated sedimentation/siltation and total suspended solids (TSS). Raccoon Creek and Yellow Creek are also listed for not supporting primary contact recreation due to elevated levels of fecal coliform bacteria. Coolidge Creek is listed for not supporting aquatic life due to elevated sedimentation/siltation and total phosphorus (TP). Winneshiek Creek is also listed for not supporting aquatic life due to elevated sedimentation/siltation, TSS, and TP. Finally, Spring Branch is listed for not supporting aquatic life due to elevated total ammonia and TP.

Lake Le-Aqua-Na is a 17.3 hectare lake, located just north of Lena within Lake Le-Aqua-Na State Park. It was created in 1955 by impounding Waddams Creek, and is used for recreation. It has a mean depth of 3.19 meters and a maximum depth of 6.71 meters (Austen et al. 1993). The watershed area is 2,352 acres. The lake's drainage area is comprised of agricultural production (67 percent) or is state-owned with no land disturbance (31 percent). Lake Le-Aqua-Na appears on the Illinois 2012, 2014, and 2016 303(d) list for not supporting an aesthetic quality designated use, due to elevated levels of TP and TSS.

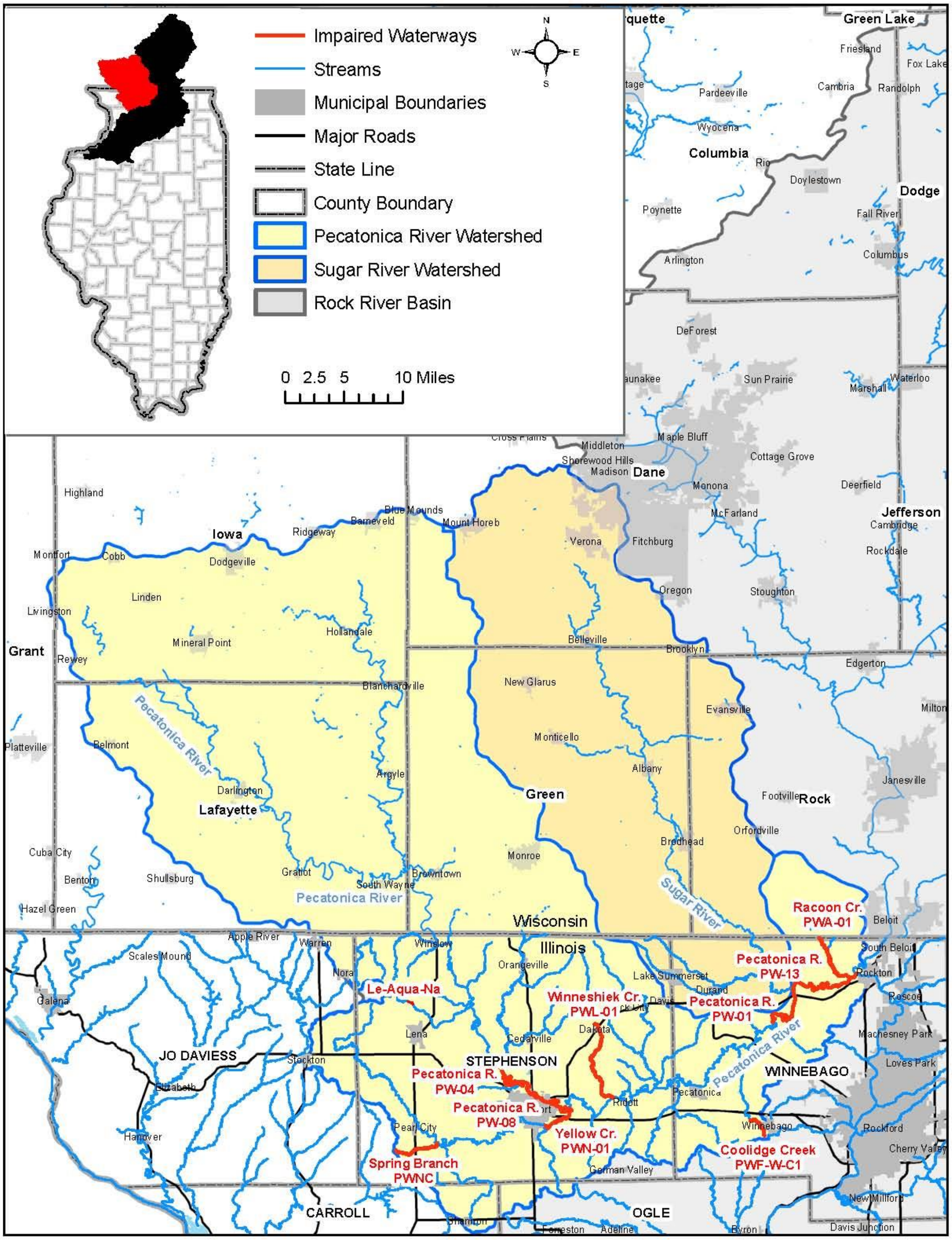


Figure 2. Pecatonica River watershed.

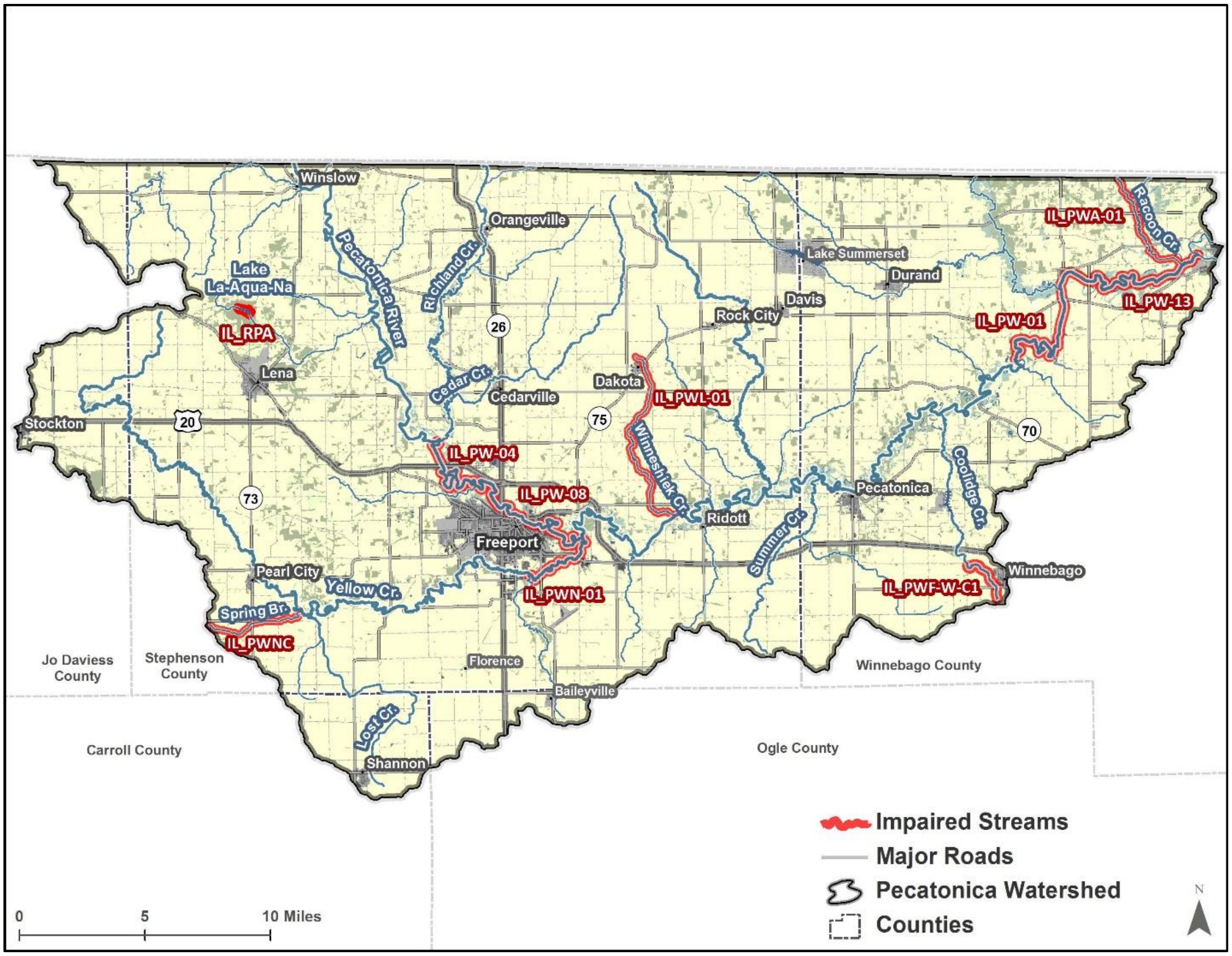


Figure 3. Pecatonica River watershed, TMDL/LRS project area.

Table 1. Pecatonica River watershed impairments and LRS pollutants (2012, 2014, and 2016 Illinois 303(d) Draft List)

Name	Segment ID	Watershed Area (Sq. Miles)	Watershed Area in Illinois (Sq. Miles)	Designated Uses	TMDL Parameters	LRS Parameters
Pecatonica River	PW-01	1,789	685	Primary contact recreation	Fecal coliform	None
				Aquatic life	None	Sedimentation/siltation, total suspended solids
	PW-04	1,321	218	Aquatic life	None	Sedimentation/siltation, total suspended solids
	PW-08	1,336	233	Primary contact recreation	Fecal coliform	None
				Aquatic life	None	Sedimentation/siltation, total suspended solids
	PW-13	2,638	794	Primary contact recreation	Fecal coliform	None
Raccoon Creek	PWA-01	60	14	Primary contact recreation	Fecal coliform	None
Coolidge Creek	PWF-W-C1	2.34	2.34	Aquatic life	Cause Unknown	Sedimentation/siltation, phosphorus (total)
Winneshiek Creek	PWL-01	14.48	14.48	Aquatic life	Cause Unknown	Sedimentation/siltation, TSS, phosphorus
Yellow Creek	PWN-01	196	196	Primary contact recreation	Fecal coliform	None
Spring Branch	PWNC	6.06	6.06	Aquatic life	Ammonia (total) [a]	Phosphorus (total)
LE-AQUA-NA	RPA	3.68	3.68	Aesthetic quality	Phosphorus (total)	Total suspended solids

a. No TMDL was developed based on water quality analysis provided in Section 5.

2. Watershed Characterization

The Pecatonica River watershed is located in northwestern Illinois and southwestern Wisconsin (Figure 2). This report will focus on the watershed in Illinois. The project area begins near Winslow, where the Pecatonica River crosses the Wisconsin/Illinois border. The project area continues downstream past Freeport, ending in Rockton just above the confluence with the Rock River. The project area covers nearly 805 square miles, and includes land within Carroll, Jo Daviess, Ogle, Stephenson, and Winnebago Counties in Illinois. Major tributaries along this stretch of the river include Cedar Creek, Coolidge Creek, Indian Creek, Lost Creek, North Branch Otter Creek, Richland Creek, Rock Run, Sugar River, Sumner Creek, and Yellow Creek.

2.1 Jurisdictions and Population

Counties with land located in the project area include Carroll, Jo Daviess, Ogle, Stephenson, and Winnebago in Illinois. U.S. Census data for each county is given in Table 2. Major government units with jurisdiction adjacent to the Pecatonica River within the project area include the Cities of Lena, Freeport, and Pecatonica in Illinois. The approximate total population for the five counties in Illinois is nearly 430,000. Populations are area weighted to the Illinois portion of the watershed in Table 3. It should be noted that much of the population of Winnebago County is in the Rockford metropolitan area, which is not all in the Pecatonica River watershed.

Table 2. Total county populations

County	State	2000	2010	2012[a]
Carroll	IL	16,674	15,387	15,011
Jo Daviess	IL	22,289	22,678	22,549
Ogle	IL	51,032	53,497	52,848
Stephenson	IL	48,979	47,711	46,959
Winnebago	IL	278,418	295,266	292,069
TOTAL		***417,392***	***434,539***	***429,436***

Source: U.S. Census Bureau
a. U.S. Census Bureau estimate as of 7/1/2012

Table 3. Area weighted county populations within project area

County	State	2000	2010	2012[a]
Carroll	IL	621	573	559
Jo Daviess	IL	9,576	9,743	9,687
Ogle	IL	47,661	49,963	49,357
Stephenson	IL	2,499	2,434	2,396
Winnebago	IL	3,847	4,080	4,035
TOTAL		**64,203**	**66,792**	**66,034**

Source: U.S. Census Bureau
a. US Census Bureau estimate as of 7/1/2012

2.2 Climate

Climate data are available from the Illinois State Water Survey Climatologist; Station 113262 is located in Freeport and was used for analysis within this report. Monthly data from 1948-2012 for precipitation and snowfall and 1974-2012 for temperature were available at the time of report development. In general, the climate of the region is continental with hot, humid summers and cold winters. Table 4 contains historical temperature data collected at the Freeport climate station. From 1974 to 2012 the average high winter temperature in Freeport was 30.6 °F and the average high summer temperature was 81.7 °F (Table 4).

Table 4. Climate summary for Freeport (1948 – 2012)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average High ºF	28	33	45	59	71	80	84	81	74	62	47	32
Average Low ºF	10	14	26	37	48	58	62	59	50	38	28	16
Average Mean ºF	19	23	35	48	59	69	73	70	62	50	38	24
Average Precipitation (in)	1.4	1.3	2.1	3.4	3.8	4.3	4.1	4.0	3.5	2.5	2.4	1.8
Average snow fall (in)	9.14	6.46	5.50	1.46	0.05	0.00	0.00	0.00	0.00	0.09	2.26	8.48

From 1948 to 2012, the annual average precipitation in Freeport was approximately 34.5 inches, including approximately 33.5 inches of snowfall. In general, larger volumes of precipitation tend to occur between the months of April and September.

2.3 Land Use and Land Cover

Land use in the watershed is heavily influenced by agriculture. There is a small amount of urban area surrounding the town of Freeport and other small towns in the watershed. Specific land use across the watershed includes agriculture – cultivated crops and pasture/hay (approximately 82 percent), forest (approximately 6 percent), and urban (approximately 7 percent). Figure 4 shows land use within the Pecatonica River watershed. Table 5 presents area percent cover by land use type.

In general, the project area watershed is dominated by agriculture. Corn is the primary crop in the Pecatonica River basin, followed closely by soybeans and forage crops (NRCS 2008). Secondary farm products include wheat, oats, vegetables, cattle, hogs, dairy products, poultry, and sheep (NRCS 2008). To increase agricultural productivity throughout the project area, a common practice includes field drainage or tiling to quickly transport excess moisture from the fields to adjacent surface waters. The most densely populated areas of the watershed surround Freeport.

Table 6 summarizes land uses that are contributing to each of the impaired segments.

Table 5. Watershed land use summary

Land Use / Land Cover Category	Acreage	Percentage
Cultivated Crops	347,863	67.5%
Pasture/Hay	76,584	14.9%
Deciduous Forest	29,820	5.8%
Developed, Open Space	20,517	4.0%
Developed, Low-Intensity	13,204	2.6%
Grassland/Herbaceous	7,049	1.4%
Woody Wetlands	6,348	1.2%
Emergent Herbaceous Wetlands	5,617	1.1%
Open Water	2,105	0.4%
Developed, Medium Intensity	1,989	0.4%
Shrub/Scrub	1,381	0.3%
Mixed Forest	1,265	0.2%
Developed, High Intensity	555	0.1%
Evergreen Forest	438	0.1%
Barren Land (Rock/Sand/Clay)	337	0.1%
Total	**515,072**	**100.0%**

Source: NLCD 2006

Table 6. Land use by impaired segment

Watershed	Segment	Watershed Area (square miles)	Cultivated Crops	Pasture /Hay	Developed	Forest	Grassland/ Herbaceous/ Shrub/Scrub	Barren Land	Wetlands and Water
			%						
Lake Le-Aqua-Na	IL-RPA	3.68	62.0	2.0	6.1	23.1	4.8	0	2.0
Spring Branch	IL-PWNC	6.06	71.3	23.8	3.8	0.5	0.4	0	0.1
Coolidge Creek	IL-PWF-W-C1	2.34	54.8	11.8	25.2	6.6	1.5	0	0
Yellow Creek	IL-PWN-01	196	79.2	6.5	7.3	5.0	1.8	0.1	0.2
Winneshiek Creek	IL-PWL-01	14.5	64.1	26.7	6.5	2.1	0.5	0	0.1
Raccoon Creek	IL-PWA-01	15.3	18.9	43.8	4.3	14.1	6.0	0.1	12.8
Pecatonica River	IL-PW-01	689	69.2	14.6	7.1	5.7	1.5	0.1	1.9
Pecatonica River	IL-PW-04	222	64.0	20.1	6.3	6.3	1.7	0	1.6
Pecatonica River	IL-PW-08	238	62.3	19.6	8.3	6.2	1.6	0.1	1.9
Pecatonica River	IL-PW-13	803	67.6	14.9	7.0	6.1	1.6	0.1	2.7

Source: NLCD Database 2006

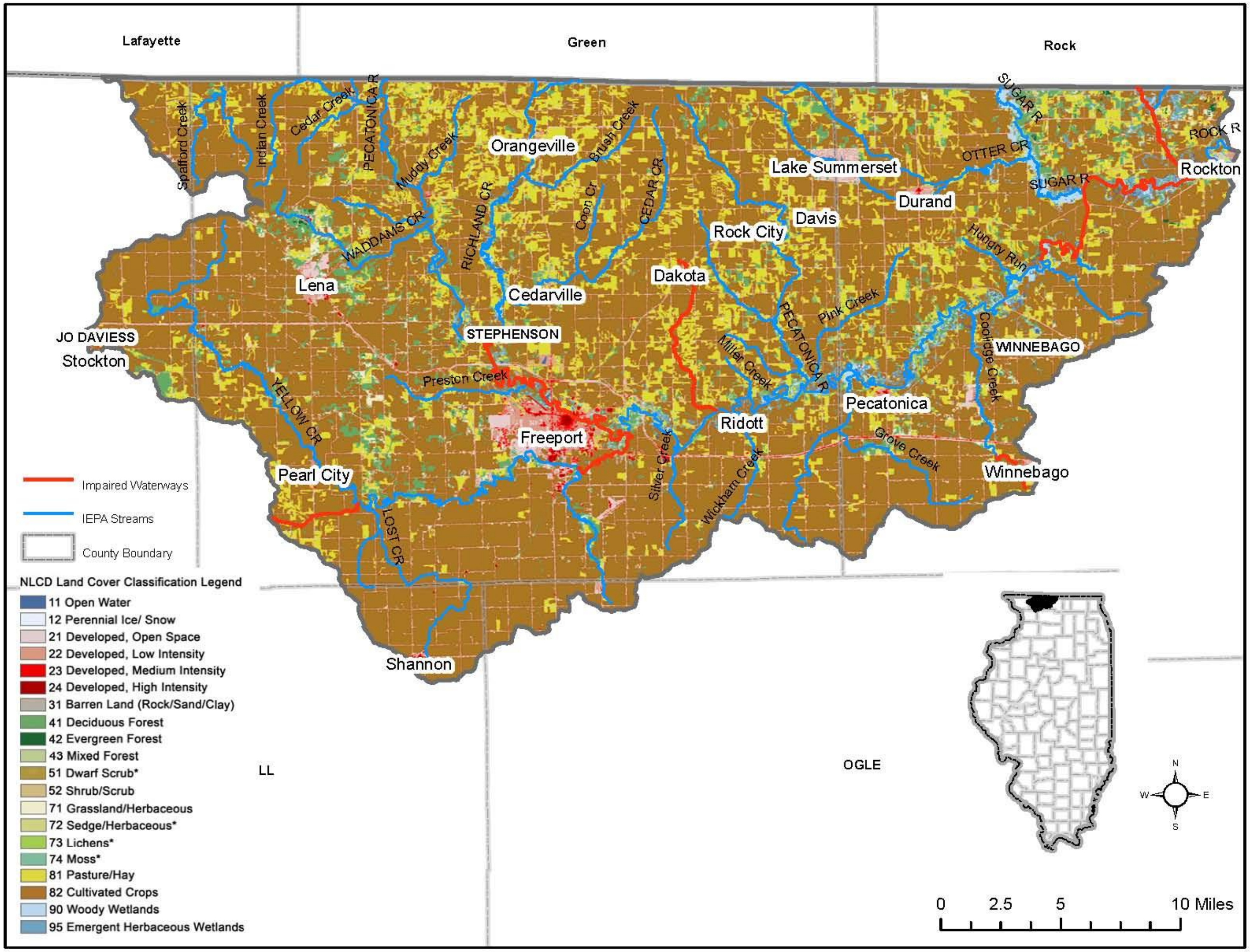


Figure 4. Pecatonica River project area land use (2006 National Land Cover Database).

2.4 Topography

Topography is an important factor in watershed management because stream types, precipitation, and soil types can vary dramatically by elevation. The Pecatonica River Watershed in Illinois varies in elevation from 719 to 1171 feet (Figure 5). Highs occur at the headwaters of the Pecatonica River, between Orangeville and Lake Summerset; at the western border of the watershed; and in the headwaters of Preston Creek, between Lena and Pearl City. Lows occur along the downstream portions of the Pecatonica River and along the downstream most tributaries, including the Sugar River, Otter Creek, and Raccoon Creek. The Pecatonica River water elevation varies from 768 feet to 729 feet and is 92.6 miles long in Illinois, resulting in an average stream gradient of 0.4 feet per mile.

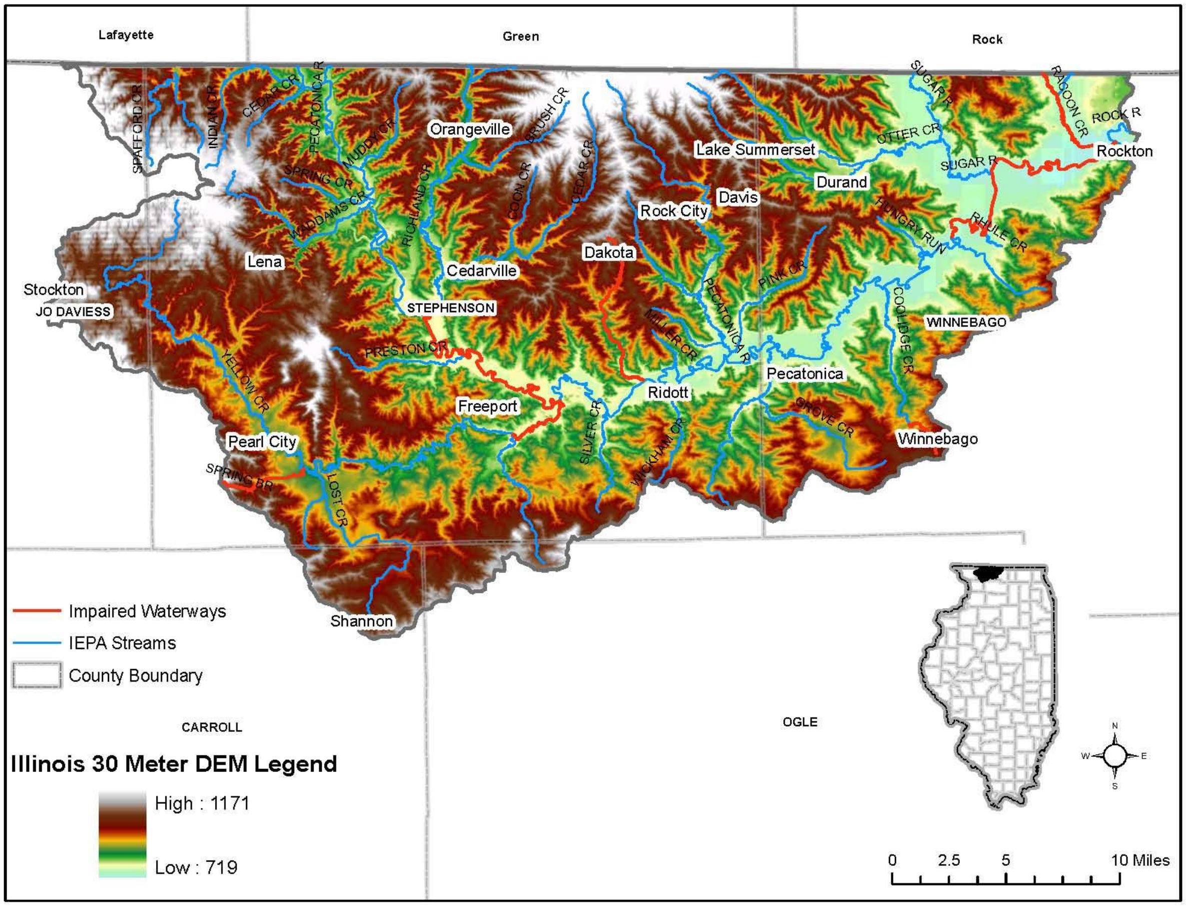


Figure 5. Pecatonica River project area land elevations (2012 National Elevation Dataset, USGS).

2.5 Soils

The National Cooperative Soil Survey publishes soil surveys for each county within the U.S. These soil surveys contain predictions of soil behavior for selected land uses. The surveys also highlight limitations and hazards inherent in the soil, general improvements needed to overcome the limitations, and the impact of selected land uses on the environment. The soil surveys are designed for many different uses, including land use planning, the identification of special practices needed to ensure proper performance, and mapping of hydrologic soil groups (HSGs) (NRCS 2007).

HSGs refer to the grouping of soils according to their runoff potential. Soil properties that influence the HSGs include depth to seasonal high water table, infiltration rate and permeability after prolonged wetting, and depth to slow permeable layer. There are four groups of HSGs: Group A, B, C, and Group D. Table 7 describes those HSGs found in the Pecatonica River project area. Figure 6 and Table 8 summarizes the composition of HSGs per watershed.

Table 7. Hydrologic soil group descriptions

HSG	Group Description
A	Sand, loamy sand or sandy loam types of soils. Low runoff potential and high infiltration rates even when thoroughly wetted. Consist chiefly of deep, well to excessively drained sands or gravels with a high rate of water transmission.
B	Silt loam or loam. Moderate infiltration rates when thoroughly wetted. Consist chiefly or moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse textures.
C	Soils are sandy clay loam. Low infiltration rates when thoroughly wetted. Consist chiefly of soils with a layer that impedes downward movement of water and soils with moderately fine to fine structure.
D	Soils are clay loam, silty clay loam, sandy clay, silty clay or clay. Group D has the highest runoff potential. Low infiltration rates when thoroughly wetted. Consist chiefly of clay soils with a high swelling potential, soils with a permanent high water table, soils with a claypan or clay layer at or near the surface and shallow soils over nearly impervious material.
A-C/D	Dual Hydrologic Soil Groups. Certain wet soils are placed in group D based solely on the presence of a water table within 24 inches of the surface even though the saturated hydraulic conductivity may be favorable for water transmission. If these soils can be adequately drained, then they are assigned to dual hydrologic soil groups (A/D, B/D, and C/D) based on their saturated hydraulic conductivity and the water table depth when drained. The first letter applies to the drained condition and the second to the undrained condition.

Table 8. Percent composition of HSGs per watershed in the project area

Watershed	Segment	A	A/D	B	B/D	C	C/D	D	No Data
		%							
Lake Le-Aqua-Na	IL-RPA	0.00	0.00	82.67	0.16	7.53	0.29	7.11	2.25
Spring Branch	IL-PWNC	0.00	0.00	92.25	6.04	1.61	0.07	0.00	0.02
Coolidge Creek	IL-PWF-W-C1	0.00	0.00	99.77	0.00	0.00	0.00	0.00	0.23
Yellow Creek	IL-PWN-01	0.00	0.03	88.61	5.70	4.59	0.54	0.27	0.27
Winneshiek Creek	IL-PWL-01	0.00	0.05	95.88	0.14	3.55	0.06	0.21	0.11
Raccoon Creek	IL-PWA-01	18.33	2.52	60.16	2.34	13.72	0.00	2.46	0.48
Pecatonica River	IL-PW-01	0.03	0.12	88.04	3.98	5.36	0.27	1.48	0.72
Pecatonica River	IL-PW-04	0.00	0.04	89.40	2.26	5.07	0.14	2.47	0.62
Pecatonica River	IL-PW-08	0.00	0.04	89.54	2.38	4.85	0.15	2.33	0.71
Pecatonica River	IL-PW-13	0.93	0.18	89.91	0.00	5.98	0.23	1.95	0.84

Source: NRCS 2007

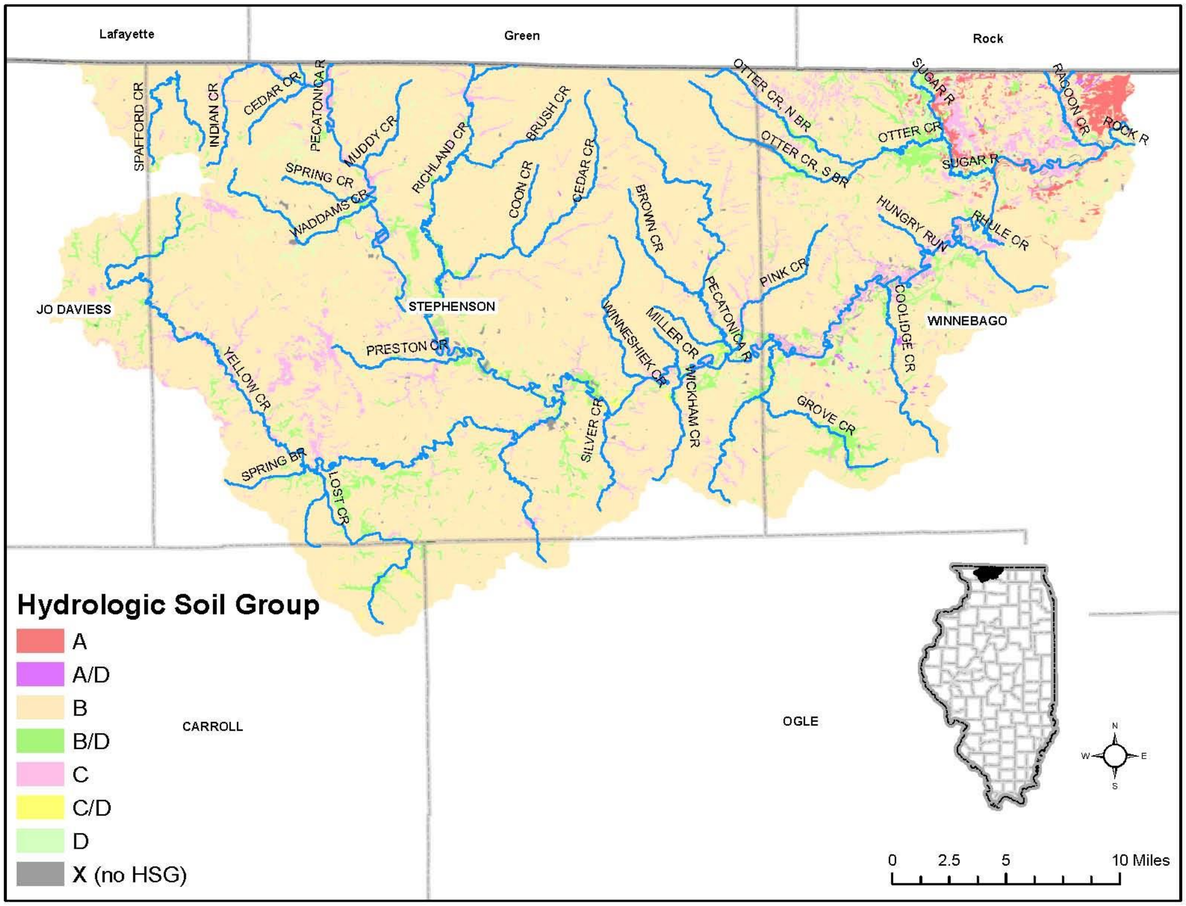


Figure 6. Pecatonica River project area hydrologic soil groups (Soil Surveys for Carroll, JoDaviess, Ogle, Stephenson, and Winnebago Counties, Illinois, USDA-NRCS).

A commonly used soil attribute is the K-factor. The K-factor:

> *indicates the susceptibility of a soil to sheet and rill erosion by water. (The K-factor) is one of six factors used in the Universal Soil Loss Equation to predict the average annual rate of soil loss by sheet and rill erosion. Losses are expressed in tons per acre per year. These estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.02 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water (NRCS 2005).*

The distribution of K-factor values in the Pecatonica River watershed range from 0.02 to 0.55 (Figure 7).

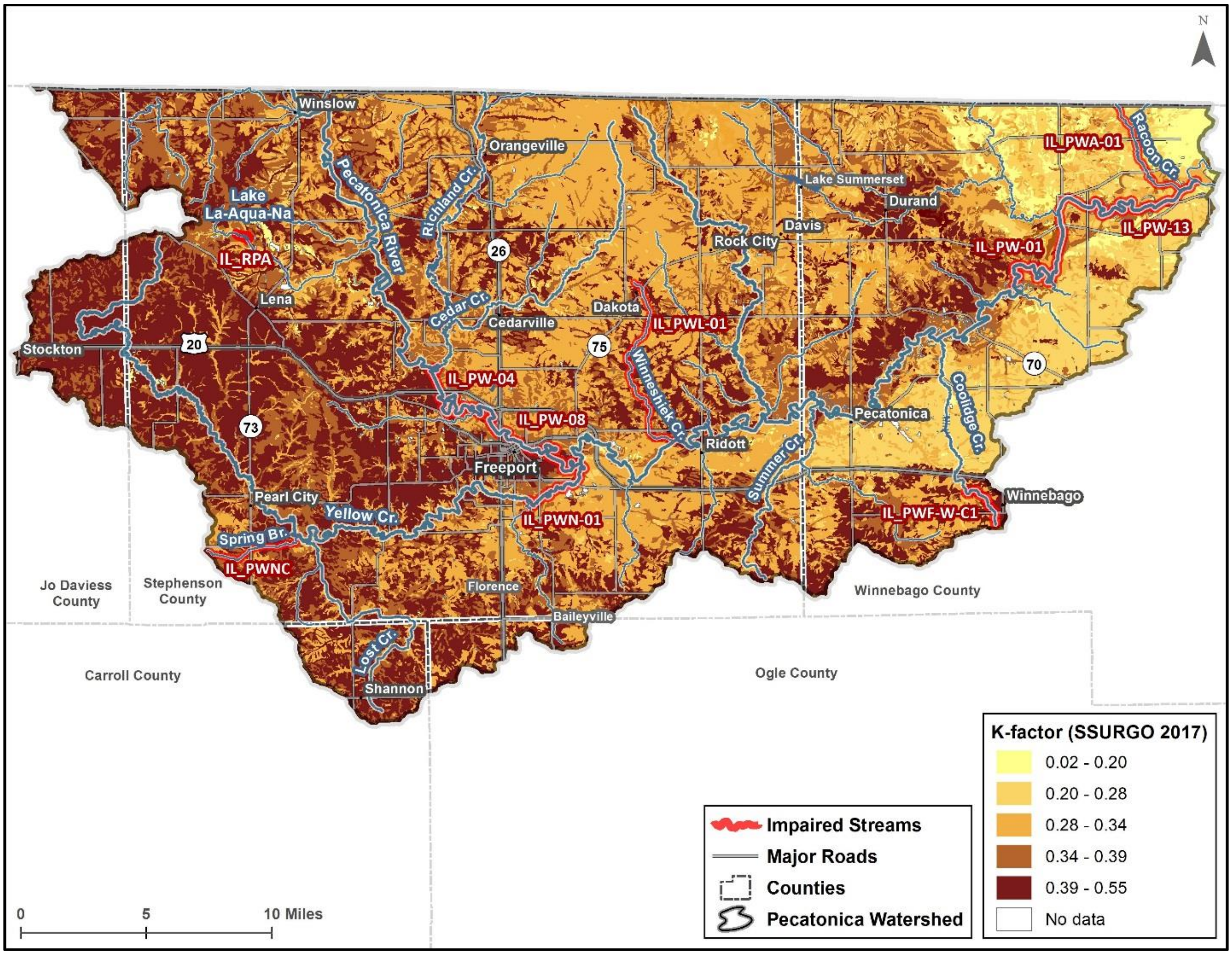


Figure 7. Distribution of soil K-factor values in the Pecatonica River watershed.

2.6 Hydrology and Water Quality

Hydrology plays an important role in evaluating water quality. The hydrology of the Pecatonica River project area is driven by local climate conditions and the landscape, consisting of rolling hills and well-developed stream valleys (IDNR 1998). The U.S. Geological Survey (USGS) have been collecting flow and water quality data in this watershed since the early 1900s, while Illinois EPA has been collecting water quality data since 1980s. In addition, water quality data has been collected in the upper portions of the watershed and are available from the Wisconsin DNR.

The Illinois State Water Survey completed a series of Clean Lakes Program studies at Lake Le-Aqua-Na in the 1980s and 1990s (Kothandaraman et al. 1983, Lin et al. 1997). These studies document an assessment of the lake's watershed and water quality and the effects of implementing water quality restoration recommendations, including soil conservation practices in the watershed and a mechanical destratifier within the lake.

2.6.1 USGS Flow Data

The USGS has monitored flow at several locations in the watershed (Table 9 and Figure 8). The daily average, peak history, and monthly flow data show the inherent variability associated with hydrology.

Flow duration curves provide a way to address that variability and flow related water quality patterns. Duration curves describe the percentage of time during which specified flows are equaled or exceeded. Flow duration analysis looks at the cumulative frequency of historic flow data over a specified period, based on measurements taken at uniform intervals (e.g., daily average or 15-minute instantaneous). Duration analysis results in a curve that relates flow values to the percent of time those values have been met or exceeded. Low flows are exceeded a majority of the time, whereas floods are exceeded infrequently. Flow duration curves for the active USGS gages are presented in Figure 9.

Table 9. USGS stream gages within project area

Gage ID	Watershed Area *(mi.^{2})*	Location	Period of Record
05434500	**1,034**	**Pecatonica River at Martintown, Wisconsin**	**1939 - 2013**
05435000	1.3	Cedar Creek near Winslow	1951 - 1971
05435450	15.5	Preston Creek near Freeport	1914 - 1961
05435500	**1,326**	**Pecatonica River at Freeport**	**1914 - 2013**
05435600 [a]	0.59	Yellow Creek Tributary near Pearl City	1981
05435650	2	Lost Creek tributary near Shannon	1961 - 1976
05435680 [a]	192	Yellow Creek near Freeport	1979 - 1997
05435750	1,710	Pecatonica River at Pecatonica	1937 - 1943
05435800	1,788	Pecatonica River at Harrison	1984 - 1990
05436900	0.6	Otter Creek tributary near Durand	1961 - 1980
05437000	2,550	Pecatonica River at Shirland	1939 - 1958
05437400 [a]	59	Raccoon Creek near Rockton	2007
05437050	**2,556**	**Pecatonica River near Shirland**	1939 – 1959 and **2001 – 2013**

BOLD – indicates active USGS gage
a. Water quality data only, no flow data available

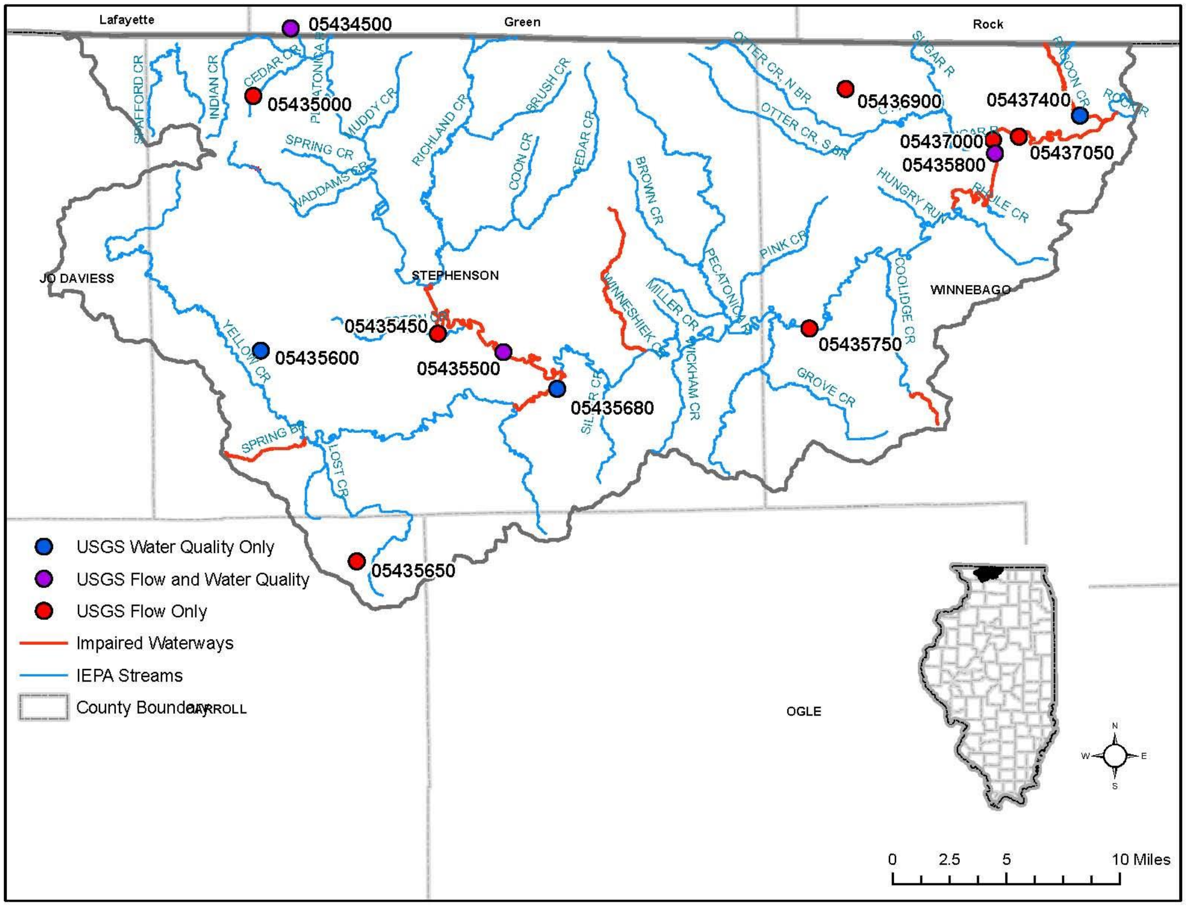


Figure 8. USGS stream gages within project area.

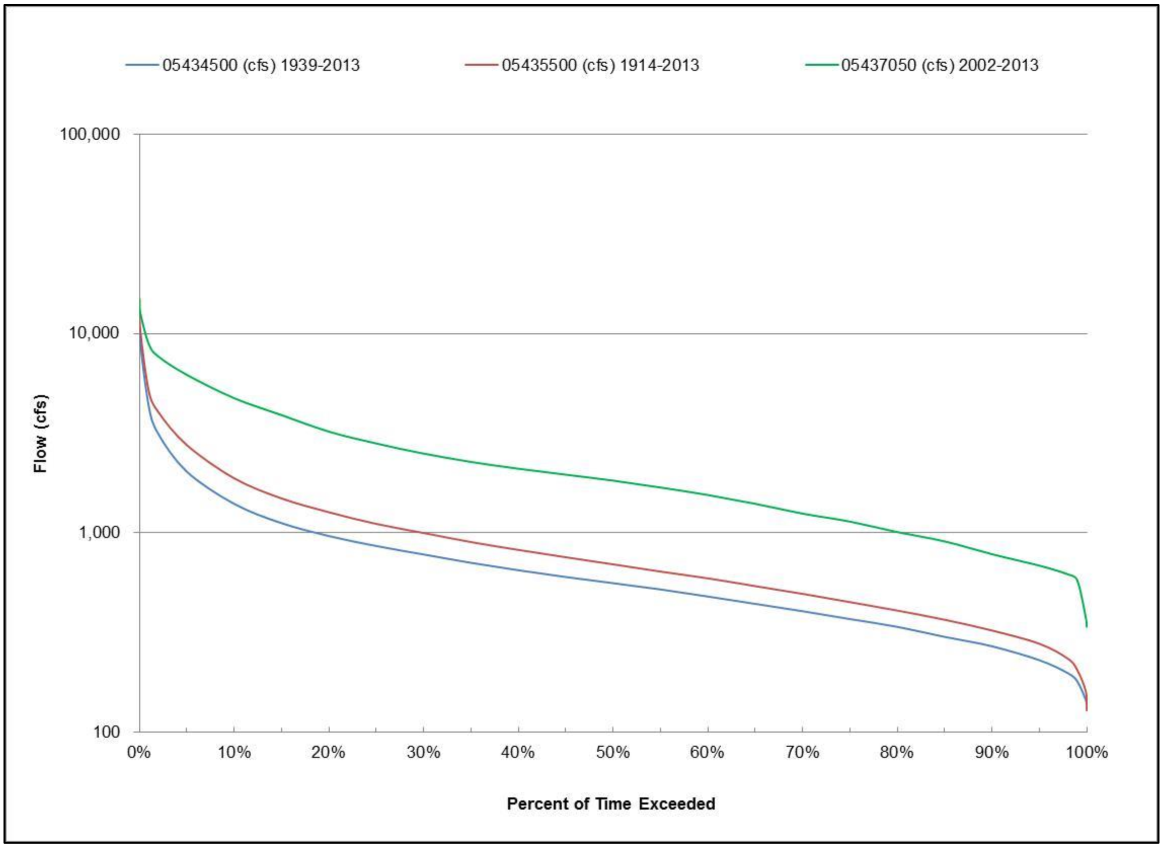


Figure 9. Flow duration curves for the active USGS gages in the Pecatonica River study area.

An evaluation of annual flow at USGS gages 05435500 and 05434500 on Pecatonica River from 1914 through 2012, and 1939 to 2013, respectively showed that annual flow in 1994 was nearly at the median; thus, it is assumed that 1994 is a typical year. Flow at USGS gages 05435500 and 05434500 are plotted with precipitation from National Climactic Data Center station113262 (Freeport) for 1994 in Figure 10.

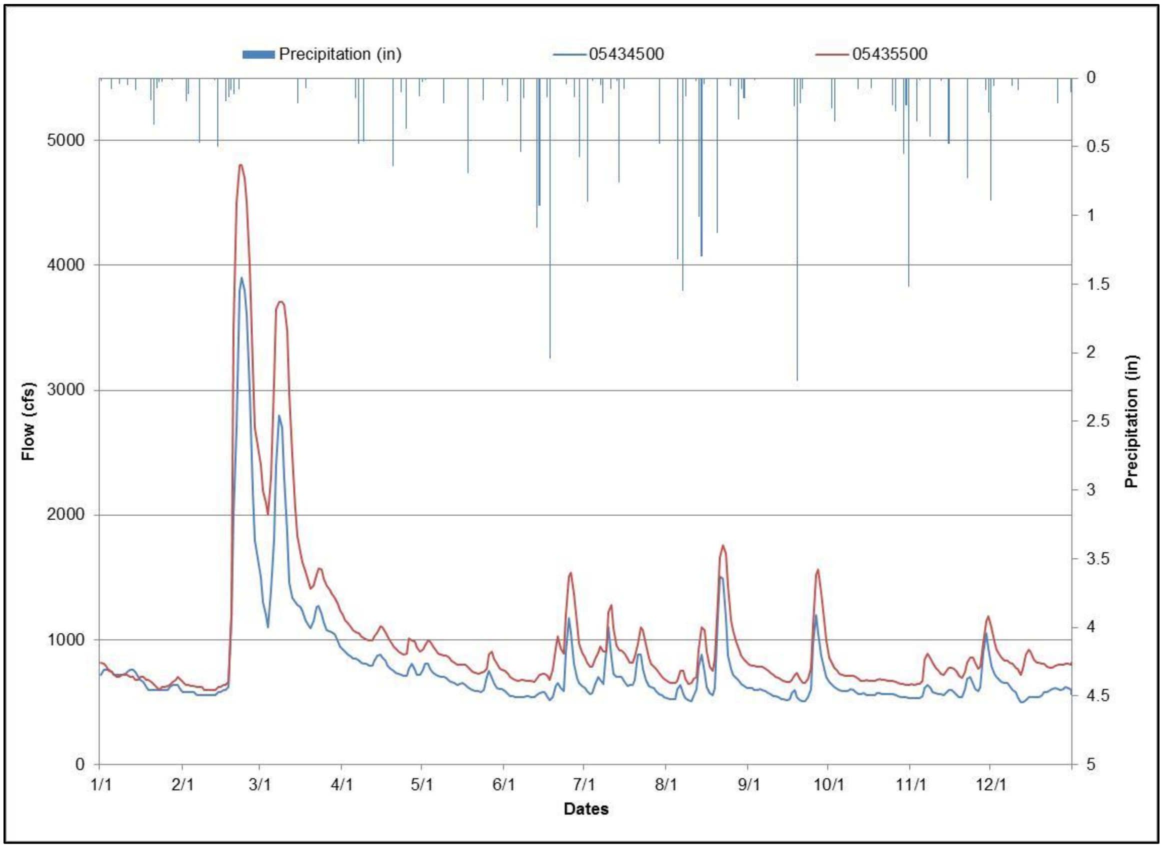


Figure 10. Daily flow in the Pecatonica River with daily precipitation at Freeport (113262), 1994.

2.6.2 Illinois EPA Water Quality Monitoring

Routine water quality monitoring is a key part of the Illinois EPA assessment program. The goals of Illinois EPA surface water monitoring programs are to determine whether designated uses are supported, identify causes of pollution (toxics, nutrients, sedimentation) and sources (point or nonpoint) of surface water impairments, determine the overall effectiveness of pollution control programs, and identify long term resource quality trends. Illinois EPA has operated a widespread, active long-term monitoring network in Illinois since 1977, known as the Ambient Water Quality Monitoring Network (AWQMN). The AWQMN is utilized by the Illinois EPA to provide baseline water quality information, to characterize and define trends in the physical, chemical and biological conditions of the state’s waters, to identify new or existing water quality problems, and to act as a triggering mechanism for special studies or other appropriate actions.

Additional uses of the data collected by the Illinois EPA through the AWQMN program include the review of existing water quality standards and establishment of water quality based effluent limits for NPDES permits. The AWQMN is integrated with other Illinois EPA chemical and biological stream monitoring programs including Intensive River Basin Surveys, Facility –Related Stream Surveys, Fish Contaminant Monitoring, Toxicity Testing Program and Pesticide Monitoring Subnetwork which are more regionally based (specific watersheds or point source receiving stream) and cover a shorter span of time (e.g. one year) to evaluate compliance with water quality standards and determine designated use support. Information from this program is compiled by Illinois EPA into a biennial report required by the Federal Clean Water Act.

Within the Pecatonica River project area, data were found for numerous stations that are part of AWQMN and Ambient Lakes Monitoring Program (Figure 11 and Table 10). Parameters sampled on the streams include field measurements (water temperature) as well as those that require lab analyses (e.g., fecal coliform, nutrients and total suspended solids). Relevant parameters sampled in the lake include nutrients, algae, solids, and turbidity in addition to field measurements including temperature and dissolved oxygen profiles and macrophytes. Many sites have historical data that are greater than 10 years old. Data were obtained directly from Illinois EPA, STORET and Legacy STORET.

Additional water quality data are also available at six USGS stations (Figure 8 and Table 10). Parameters sampled include suspended and dissolved solids, nutrients, dissolved oxygen, turbidity, fecal coliform, and metals.

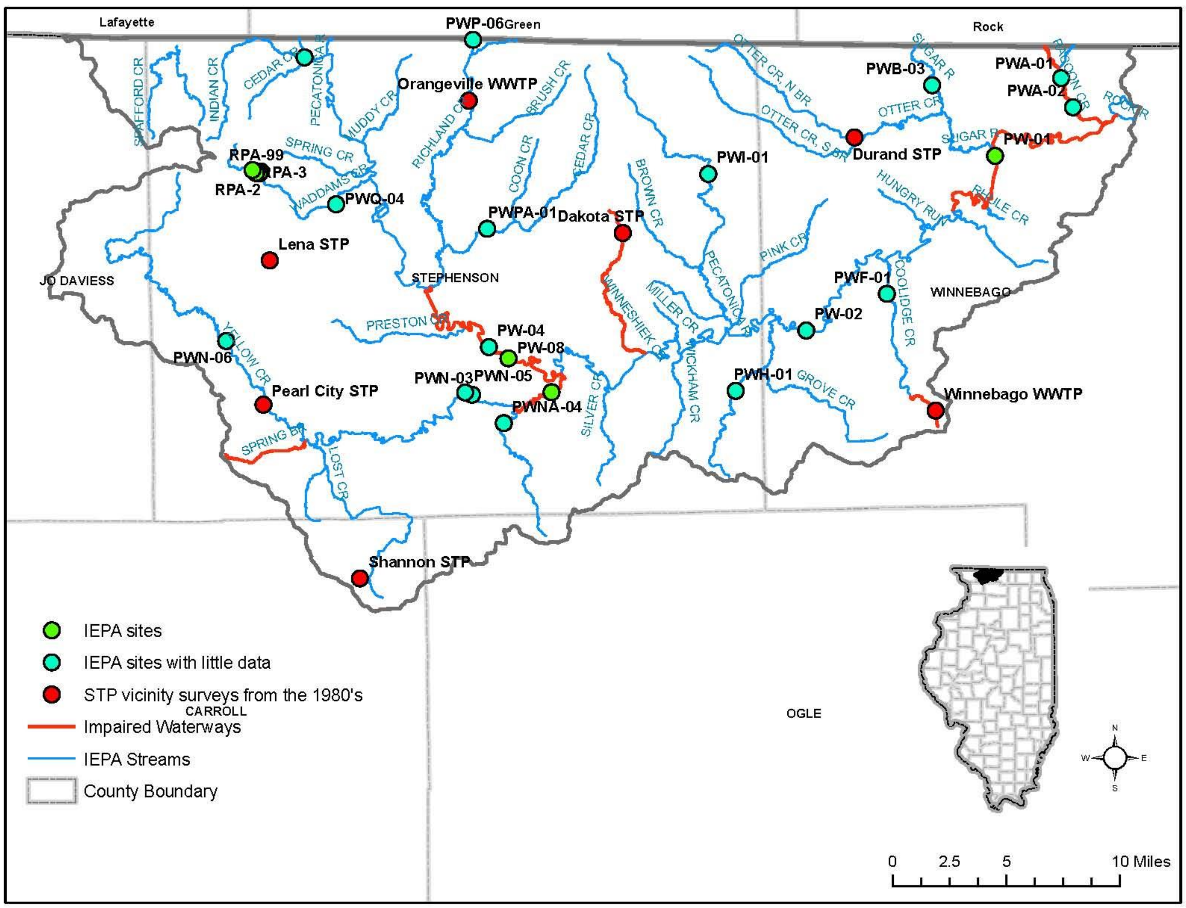


Figure 11. Illinois EPA water quality sampling sites within project area.

Table 10. Pecatonica River watershed water quality data

AWQMN Sites	USGS Gage	Water Body	Location	Period of Record
PW-01	05435800	Pecatonica River	At Harrison	*1977 – 1997, 1999-* 2007
PW-02	--		At Pecatonica	*2000, 2002,* 2007
--	05434500		At Martintown, WI	*1970* - 2003
PW-04	--		Rt 26 at Freeport	2007
PW-07	--		At Winslow	*2002,* 2007
PW-08	--		Rt 75 at Freeport	*1999*-2012
--	05435500		0.3 miles upstream from Stephenson Street at Freeport	*1970* - 2013
PW-13	--		At Meridian Road	2006-2008
PWA-01	--	Raccoon Creek	At Yale Bridge Road, 3.6 miles NE of Shirland	2007
PWA-02	--		Old railroad bridge off Rockton Road	*2002,* 2006-2007
--	05437400		Near Rockton	2007
PWB-03	--	Sugar Run	3.2 miles NW of Shirland at Yale Bridge Road	*2002,* 2007
PWF-01	--	Coolidge Creek	4 miles NE of Pecatonica at Telegraph Road	2007
PWF-W-A1, C1, C2, C3, C4, C5, E	--		Near Winnebago STP	*1989*
PWH-01	--	Sumner Creek	3 miles SE of Ridott at IL Route 20	*2002*
PWI-01	--	Rock Run	1.3 miles W of Davis at IL Route 75	*2002,* 2007
PWL-D-C1, C2, C3, C4, C5, E	--	Winneshiek Creek	Near Dakota STP	*1989*
PWN-01	--	Yellow Creek	Rt 20 at SE edge of Freeport	*1999*-2007
PWN-03	--		East side of Krape Park off Gladewood Dr., SW edge of Freeport	*2002,* 2007
PWN-05	--		Krape Park Road, SW edge of Freeport	2007
PWN-06	--		West Raders Rd, 4.8 miles SSW of Lena	2007
PWN-PC-A1, E, C1, C2, C3, C4, C5	--		Near Pearl City STP	*1988*
--	05435680		Near Freeport	*1979 – 1997*
PWP-O-A1, C1, C2, C3, C4, E	--	Richland Creek	Near Orangeville STP	*1989*
PWP-06	--		2.5 miles N of Orangeville at West State Line Rd	*2002,* 2007
PWQ-04	--	Waddams Creek	Unity Road 3 miles NE of Lena	2007

AWQMN Sites	USGS Gage	Water Body	Location	Period of Record
PWBA-D-C2, C3	--	Otter Creek	Near Durand STP	*1989*
PWBB-D-A1, C1, E	--	N. Br. Otter Creek	Near Durand STP	*1989*
PWBC-D-D1	--	S. Br. Otter Creek	Near Durand STP	*1989*
PWNA-04	--	Crane Grove Creek	4.2 miles S of Freeport at Crane Grove Rd	*2002,* 2007
PWNB-A1, C1, C2, C3, C4, D1, D2	--	Lost Creek	Near Shannon STP	*1984*
PWNB-PC-D2	--		Near Pearl City STP	*1988*
PWNC-PC-D1	--	Spring Branch Creek	Near Pearl City STP	*1988*
PWNE-L-C1, C2, C3, C4, C5, C6, C7, C8, E	--	Lena Creek	Near Lena STP	*1988*
PWNF-L-D1	--	Kempel Tributary of Lena Creek	Near Lena STP	*1988*
PWNG-L-D2	--	Huneke Tributary of Lena Creek	Near Lena STP	*1988*
PWNH-L-D3	--	E. Br. Of Lena Creek	Near Lena STP	*1988*
PWNI-L-D4	--	W. Damier Tributary of Lena Creek	Near Lena STP	*1988*
PWNJ-L-D5	--	Baumgartner Tributary of Lena Creek	Near Lena STP	*1988*
PWPA-01		Cedar Creek	0.3 miles N of Cedarville at Rt 26	*2002,* 2007
--	05435600	Yellow Creek Tributary	Near Pearl City	*1981*
PWPB-O-D1	--	Brush Creek	Near Orangeville STP	*1989*
RPA-1	--	Lake Le-Aqua-Na	Southeast end of lake	*1979, 1984, 1985, 1986, 1987, 1998, 1999, 2001,* 2004, 2007, 2012
RPA-2	--		South side of lake	*1998, 2001,* 2004, 2007, 2012
RPA-3	--		South side of lake	*1979, 1986, 1998, 2001,* 2004, 2007, 2012
RPA-98	--		Boat launch	2013
RPA-99	--		Beach	2012, 2013

Italics – Data are greater than 10 years old
STP – Sewage treatment plant

3. Watershed Source Assessment

Source assessments are an important component of water quality management plans and TMDL development. This section provides a summary of potential watershed-wide sources that contribute listed pollutants to the Pecatonica River watershed.

3.1 Pollutants of Concern

Pollutants of concern evaluated within this source assessment include fecal coliform, ammonia, phosphorus, and sediment. These pollutants can originate from an array of sources including point and nonpoint sources. Point sources typically discharge at a specific location from pipes, outfalls, and conveyance channels. Nonpoint sources are diffuse sources that have multiple routes of entry into surface waters, particularly overland runoff. This section provides a summary of potential point and nonpoint sources that contribute pollutants to the impaired waterbodies.

3.2 Point Sources

Point source pollution is defined by the Federal Clean Water Act (CWA) §502(14) as:

> *"any discernible, confined and discrete conveyance, including any ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation [CAFO], or vessel or other floating craft, from which pollutants are or may be discharged. This term does not include agriculture storm water discharges and return flow from irrigated agriculture."*

Point sources can include facilities such as municipal wastewater treatment plants (WWTPs), industrial facilities, CAFOs, or regulated storm water including municipal separate storm sewer systems (MS4s). Under the CWA, all point sources are regulated under the NPDES program. NPDES permit holders in the watershed are discussed below and are included on Figure 12.

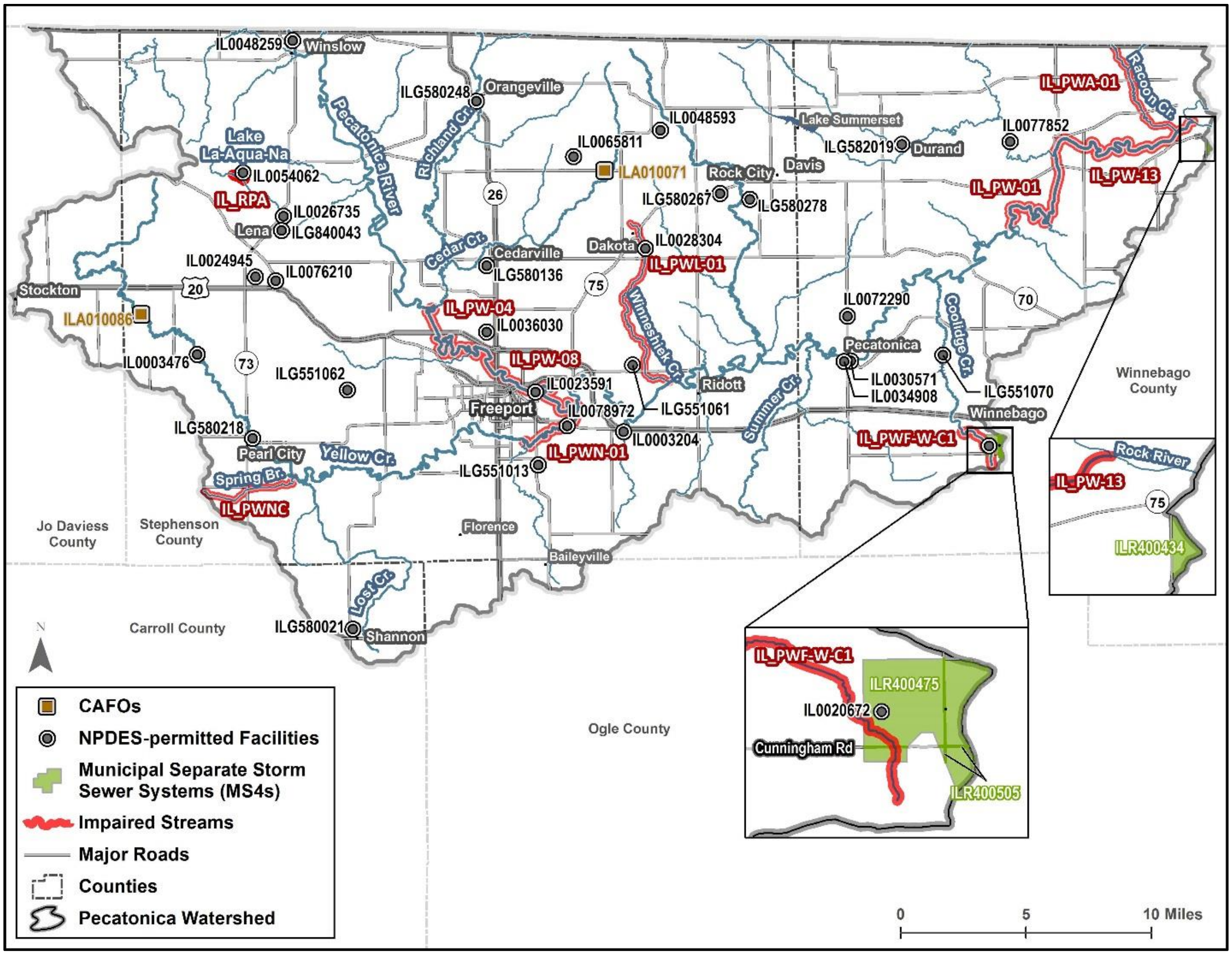


Figure 12. Point source dischargers.

3.2.1 NPDES Facilities (Non-Stormwater and Non-CAFO)

A municipality, industry, or operation must apply for an NPDES permit if an activity at that facility discharges wastewater to surface water. Examples of NPDES facilities within the study area include municipal and industrial wastewater treatment plants. Bacteria, nutrients, and ammonia can be found in these discharges.

Many WWTPs have disinfection exemptions in the watershed which allow a facility to discharge wastewater without disinfection (see Table 11). Facilities with year-round disinfection exemptions may be required to provide Illinois EPA with updated information to demonstrate compliance with these requirements and facilities directly discharging into a fecal-impaired segment may have their year-round disinfection exemption revoked through future NPDES permitting actions. Table 11 includes each NPDES permitted facility within the watershed. Exemption status, average design flows, and maximum design flows are included in the facility summaries. When design flows were not included in the permit, discharge monitoring data were used to derive flows.

Table 11. Individual NPDES permitted facilities (provided by IEPA in 2016)

IL Permit ID	Facility Name	Receiving Water	Impairment (s)	Average Design Flow (MGD)	Maximum Design Flow (MGD)	Fecal Coliform Limit	Disinfect Exempt
ILG582019	Durand Sanitary District – STP	North Branch of Otter Creek (tributary to Sugar River)	PW-13	0.35	0.45	Monitor Only	Year-round
ILG580278	Village of Davis STP	Rock Run Creek	PW-01, PW-13	0.075	0.19	Monitor Only	Year-round
ILG580267	Rock City STP	Unnamed tributary of Rock Run Creek	PW-01, PW-13	0.04	0.10	Monitor Only	Year-round
ILG580248	Village of Orangeville WWTP	Richland Creek (tributary to Pecatonica)	PW-04, PW-08, PW-01, PW-13	0.2	0.72	Monitor Only	Year-round
ILG580218 and IL0030562	Village of Pearl City STP	Yellow Creek	PWN-01, PW-01, PW-13	0.075 (0.101 proposed)	0.5 (0.2563 proposed)	Monitor Only	Year-round
ILG580136	Cedarville STP	South Branch of Cedar Creek (tributary to Pecatonica)	PW-04, PW-08, PW-01, PW-13	0.10	0.25	Monitor Only	Year-round
IL0065811	Berner Foods, Inc.	Unnamed tributary of Cedar Creek	PW-04, PW-08, PW-01, PW-13	0.035	Not reported	--	--
IL0003476	Nuestro Queso, LLC	Unnamed tributary to Yellow Creek	PWN-01, PW-01, PW-13	0.35	Not reported	–	N/A
IL0077852	Sugar Shores Camping Resort	Sugar River (tributary to Pecatonica)	PW-13	0.025	0.1025	Yes	--
IL0076210	Adkins Energy, LLC	Unnamed tributary of Yellow Creek	PWN-01, PW-01, PW-13	0.062	*0.15*	--	N/A
IL0072290	Clean Harbors Pecatonica, LLC	Unnamed ditch tributary to Pecatonica River	PW-01, PW-13	Intermittent		--	N/A
IL0054062	Le-Aqua-Na State Park	Lake Le-Aqua-Na	RPA, PW-04, PW-08, PW-01, PW-13	0.0031	0.00775	Yes	--
IL0048593	Otter Creek Lake Utility District STP	South Branch of Otter Creek (tributary to Sugar River)	PW-01, PW-13	0.40	1.00	Monitor Only	Year-round
IL0048259	Village of Winslow – WWTP	Pecatonica River	PW-04, PW-08, PW-01, PW-13	0.055	0.137	Yes	Seasonal
IL0036030	Northern Hills Utility STP	Unnamed tributary of Pecatonica River	PW-08, PW-01, PW-13	0.06	0.13	Yes	Seasonal
IL0030571	Village of Pecatonica WWTP	Pecatonica River	PW-01, PW-13	0.6	1.5	Yes	Seasonal
IL0024945	Village of Lena – STP	Unnamed tributary of Yellow Creek	PWN-01, PW-01, PW-13	0.6	1.5	Yes	Year-round
IL0023591	City of Freeport STP	Pecatonica River	PW-08, PW-01, PW-13	6.75	16.6	Yes	Seasonal
IL0078972	Conmat - Dwyer Quarry	Yellow Creek	PWN-01, PW-01, PW-13	N/A			
IL0020672	RRWRD - Winnebago WWTP	Coolidge Creek	PWF-W-C1, PW-01, PW-13	0.4	1.0	Yes	Seasonal
IL0003204	Titan Tire Corporation of Freeport	Silver Creek (tributary to Pecatonica)	PW-01, PW-13	0.06 (001) 2.82 (002)	Not Reported	--	N/A
IL0026735	Torkelson Cheese Company – Lena	Waddams Creek (tributary to Pecatonica)	PW-04, PW-08, PW-01, PW-13	0.1	--	Yes	--

IL Permit ID	Facility Name	Receiving Water	Impairment (s)	Average Design Flow (MGD)	Maximum Design Flow (MGD)	Fecal Coliform Limit	Disinfect Exempt
IL0028304	Dakota STP	Winneshiek Creek	PWL-01, PW-01, PW-13	0.1	*0.25*	Monitor Only	Year-round
IL0034908	Bay Valley Foods LLC	Pecatonica River	PW-01, PW-13	*0.162*	--	--	N/A
ILG551013	Timber Ridge MHP – Freeport	Unnamed tributary to Casey Fork	PWN-01, PW-01, PW-13	0.012	0.03	Monitor Only	Year-round
ILG551061	River Road MHP	Winneshiek Creek	PWL-01, PW-01, PW-13	0.0378	0.151	Monitor Only	Year-round
ILG551062	Stephenson MHP	Unnamed tributary to Preston Creek	PW-04, PW-08, PW-01, PW-13	0.024	0.048	Monitor Only	Year-round
ILG551070	Westlake Utilities, Inc.	Coolidge Creek	PW-01, PW-13	0.25	1	Monitor Only	Year-round
ILG580021	Shannon STP	Lost Creek (tributary to Yellow Creek)	PWN-01, PW-01, PW-13	0.18	0.45	Monitor Only	Year-round
Facilities Regulated under Mining General Permit							
ILG840043	Doc's Excavating	Waddams Creek (tributary to Pecatonica)	PW-04, PW-08, PW-01, PW-13	Not reported	Not reported	--	--

Italics – flows derived from DMR data
MGD – Million gallons per day
MHP – Mobile home park
STP – Sewage treatment plant
WWTP – Wastewater treatment plant

3.2.2 Municipal Separate Storm Sewer Systems

Regulated storm water runoff can contribute to impairments in the project area. As development increases in the watershed, additional pressure will be placed on receiving waters due to storm water. Impervious areas associated with developed land uses can result in higher peak flow rates, higher runoff volumes and larger pollutant loads. Storm water runoff often contains sediment, nutrients, and bacteria amongst other pollutants.

Under the NPDES program, municipalities serving populations over 100,000 people are considered Phase I MS4 communities. Within the project area, there are no Phase I communities. Municipalities serving populations under 100,000 people are considered Phase II communities. Within Illinois, Phase II communities are allowed to operate under the statewide General Storm Water Permit (ILR40) which requires dischargers to file a Notice of Intent, acknowledging that discharges shall not cause or contribute to a violation of water quality standards.

To assure pollution is controlled to the maximum extent practical, regulated entities operating under the General Storm Water Permit (ILR40) are required to implement six control measures. These measures include: public education, public involvement, illicit discharge and detection programs, control of construction site runoff, post construction storm water management in new development and redevelopment, and pollution prevention/good housekeeping for municipal operations. Regulated entities operating under the General Storm Water Permit within the project area are identified in Table 12 and in Figure 12.

Table 12. Permitted MS4s

Permit ID	Regulated Entity	Receiving Waters
ILR400434	Village of Rockton	Pecatonica River (PW-13)
ILR400475	Village of Winnebago	Coolidge Creek (PWF-W-C1), Pecatonica River (PW-13, PW-01)
ILR400505	Winnebago County	Coolidge Creek (PWF-W-C1), Pecatonica River (PW-13, PW-01)

3.2.3 CAFOs

The area that produces manure, litter, or processed wastewater as the result of concentrated animal feeding operations (CAFOs) is considered a point source that is regulated through the NPDES Program. In Illinois, the CAFO program is administered by the Illinois EPA through general permit number ILA01 (refer to the following Web site for more details: http://www.epa.state.il.us/water/cafo/). The federal regulations for all CAFOs can be found in 40 CFR Parts 9, 122, and 412 and U.S. EPA requires that CAFOs receive a WLA as part of the TMDL development process. The WLA is typically set at zero for all pollutants. There are 2 CAFOs in the Pecatonica River watershed (Table 13). Each of the CAFOs are located in headwater areas and do not have impaired streams directly downstream. The Eugene Meier Farm is located in the upper reaches of the Cedar Creek watershed; Cedar Creek discharges into the Pecatonica River near Freeport. Rancho Cantera is located in the headwaters of Yellow Creek.

Table 13. CAFOs

Permit ID	Regulated Entity	Receiving Waters
ILA010071	Eugene Meier Farm	Pecatonica River (PW-04, PW-08, PW-01, PW-13)
ILA010086	Rancho Cantera	Yellow Creek (PWN-01), Pecatonica River (PW-13, PW-01)

3.3 Nonpoint Sources

The term nonpoint source pollution is defined as any source of pollution that does not meet the legal definition of point sources. Nonpoint source pollution typically results from overland stormwater runoff that is diffuse in origin, as well as background conditions. It should be noted that stormwater collected and conveyed through a regulated MS4 is considered a controllable point source. With agricultural practices such as crop cultivation (68 percent) and pasture/hay (15 percent) covering an estimated 83 percent of the project area, nonpoint source pollution contributes a significant amount of the total pollutant load. In addition to runoff and erosion, significant nonpoint sources also include septic systems and animal agriculture. Illinois EPA has identified several nonpoint sources as contributing to Pecatonica River watershed impairments such as crop production, runoff from forest/grassland/parkland, and agriculture (Table 14).

Table 14. Potential sources in project area based on 2012 305b list

Segment	Causes	Sources
LE-AQUA-NA (RPA)	Mercury, TSS, TP, Macrophytes, Aquatic Algae	Atmospheric Deposition – Toxics (mercury), Source Unknown, Dam or Impoundment, Crop Production, Runoff from Forest/ Grassland/Parkland
Pecatonica River (PW-04)	Sedimentation/Siltation, TSS, PCBs [a]	Crop Production, Source Unknown
Pecatonica River (PW-08)	Sedimentation/Siltation, TSS, PCBs [a], Fecal Coliform	Crop Production, Source Unknown
Spring Branch (PWNC)	Ammonia, TP	Source Unknown, Agriculture
Winneshiek Creek (PWL-01)	Sedimentation/Siltation, TSS, TP, Cause Unknown	Municipal Point Source Discharges
Yellow Creek (PWN-01)	Fecal Coliform	Source Unknown
Pecatonica River (PW-01)	Sedimentation/Siltation, TSS, PCBs [a], Fecal Coliform	Crop Production, Source Unknown
Pecatonica River (PW-13)	PCBs [a], Fecal Coliform	Source Unknown, Agriculture
Raccoon Creek (PWA-01)	Fecal Coliform	Source Unknown
Coolidge Creek (PWF-W-C1)	Other flow regime alterations, Sedimentation/Siltation, TP	Municipal Point Source Discharges

a. PCBs and mercury are legacy pollutants with unknown sources and are not being addressed in these TMDLs.

Nonpoint sources of fecal coliform in the watershed include animal feeding operations, onsite wastewater treatment systems, wildlife, and stormwater. Nonpoint sources contributing the Lake La-Aqua-Na's phosphorus impairment include runoff and associated erosion, animal feeding operations (livestock), and internal loading. Sources of sediment in the watershed are primarily derived from watershed runoff and streambank erosion.

3.3.1 Animal Feeding Operations (AFOs)

Animal feeding operations that are not classified as CAFOs are known as animal feeding operations (AFOs) in Illinois. Non-CAFO AFOs are considered nonpoint sources by U.S. EPA. AFOs in Illinois do not have state permits. However, they are subject to state livestock waste regulations and may be inspected by the Illinois EPA, either in response to complaints or as part of the Agency's field inspection responsibilities to determine compliance by facilities subject to water pollution and livestock waste regulations.

The animals raised in AFOs produce manure that is stored in pits, lagoons, tanks and other storage devices. The manure is then applied to area fields as fertilizer. When stored and applied properly, this beneficial re-use of manure provides a natural source for crop nutrition. It also lessens the need for fuel and other natural resources that are used in the production of fertilizer. AFOs, however, can pose environmental concerns, including the following:

- Manure can leak or spill from storage pits, lagoons, tanks, etc.
- Improper application of manure can contaminate surface or ground water.
- Manure over application can adversely impact soil productivity.

Bacteria and nutrients are typically found in AFO discharges. In addition to manure management as a potential source of bacteria to waters, access of livestock to waters can introduce bacteria directly into the waterbody. In addition, pasturing near streams and lakes can also result in fecal bacteria reaching a waterbody. Livestock are potential sources of bacteria and nutrients to streams, particularly when direct access is not restricted and/or where feeding structures are located adjacent to riparian areas. Watershed specific data are not available for livestock populations. However, county wide data available from the National Agricultural Statistic Service were downloaded and area weighted to estimate animal population in the watershed (Table 15). An estimated 90,113 animal units are in the watershed.

Table 15. Estimated (area weighted) livestock animal units

Watershed	Cattle	Poultry	Horses	Sheep	Hogs
Winneshiek Creek (PWL-01)	501	0	29	57	1,558
Yellow Creek (PWN-01)	6,494	87	339	636	19,576
Spring Branch (PWNC)	210	0	12	24	652
Raccoon Creek (PWA-01)	533	0	31	61	1658
Coolidge Creek (PWF-W-C1)	15	7	9	3	41
Pecatonica River (PW-04)	7,727	22	434	852	23,235
Pecatonica River (PW-08)	8,276	22	466	914	24,944
Pecatonica River (PW-01)	20,240	449	1,512	2,229	61,344
Pecatonica River (PW-13)	21,269	735	1,905	2,394	64,376
LE-AQUA-NA (RPA)	127	0	7	14	395

Source: USDA 2007-2009

3.3.2 Onsite Wastewater Treatment Systems

Onsite wastewater treatment systems (e.g., septic systems) that are properly designed and maintained should not serve as a source of contamination to surface waters. However, onsite systems do fail for a variety of reasons, the most common of which is lack of maintenance and regular pumping. Common soil-type limitations which contribute to failure are: seasonal water tables, compact glacial till, bedrock, coarse sand and gravel outwash and fragipan. When these septic systems fail hydraulically (surface breakouts) or hydrogeologically (inadequate soil filtration) there can be adverse effects to surface waters (Horsely and Witten 1996). Septic systems contain all the water discharged from homes and business and can be significant sources of pathogens and nutrients. Watershed specific data are not available for septic systems and correspondence with the Illinois Department of Public Health did not yield any new data. However, county wide data available from the National Environmental Service Center for 1992 and 1998 are available and area weighted to estimate the number of septic systems in each watershed (Table 16). An estimated 14,810 septic systems are in the watershed and the septic system density is 18.4 per square mile.

Table 16. Estimated (area weighted) septic systems

Watershed	Number of septic systems	Septic systems per square mile
Winneshiek Creek (PWL-01)	137	9.4
Yellow Creek (PWN-01)	1,755	9.0
Spring Branch (PWNC)	57	9.4
Raccoon Creek (PWA-01)	653	42.7
Coolidge Creek (PWF-W-C1)	100	42.7
Pecatonica River (PW-04)	2,081	9.4
Pecatonica River (PW-08)	2,231	9.4
Pecatonica River (PW-01)	10,372	15.0
Pecatonica River (PW-13)	14,812	18.5
LE-AQUA-NA (RPA)	35	9.4

Source: NESC 1992 and 1998

3.3.3 Wildlife

Wildlife such as deer, raccoon, and waterfowl also contribute to fecal coliform loading in the watershed; however, these sources are not typically managed. While no specific information is available on wildlife populations in the watershed or their potential to impact fecal coliform loadings, according to the University of Illinois–Extension, the highest densities of white tail deer in the state are found in wooded areas in watersheds of major rivers. White tail deer are also known to reside in areas with intensively farmed land (University of Illinois–Extension 2017).

3.3.4 Stormwater Runoff

Whereas stormwater runoff is not an actual source of fecal coliform or phosphorus to surface waters, it acts as an important delivery mechanism of multiple fecal coliform sources including livestock, wildlife, and pets. Runoff also delivers nutrients and sediment. During wet-weather events (snowmelt and rainfall), pollutants are incorporated into runoff and can be delivered to downstream waterbodies. The resultant pollutant loads are linked to the land uses and practices in the watershed. Agricultural and developed areas can have significant effects on water quality if proper best management practices are not in place. The main pollutants of concern associated with agricultural runoff are sediment, nutrients, pesticides, and bacteria. Storm water from developed areas can be contaminated with oil, grease, chlorides, pesticides, herbicides, nutrients, viruses, bacteria, metals, and sediment. In some areas, connections to storm sewers can be illicit, which includes residences and businesses that discharge untreated wastewater to the storm sewers.

In addition to pollutants, alterations to a watershed's hydrology as a result of land use changes can detrimentally affect habitat and biological health. Imperviousness associated with developed land uses and agricultural field tiling can result in increased peak flows and runoff volumes and decreased base flow as a result of reduced ground water discharge. The increased peak flows and runoff volumes tend to increase streambank erosion. These more powerful flows have more capacity to move larger sediment particles farther, which may result in downstream sedimentation when the in-stream flow decreases and slows down. Drain tiles also transport agricultural runoff directly to ditches and streams, whereas runoff flowing over the land surface may infiltrate to the subsurface and may flow through vegetated riparian areas. Thus, runoff transported through drain tiles will contain all of the pollutants that it contained when the runoff entered the tile system; surficial runoff may lose pollutants as it is filtered during infiltration and passes through the vegetated riparian corridor.

3.3.5 Erosion

Sedimentation and siltation were identified as causes of impairment for many streams in the project area. For sedimentation (i.e., deposition of sediment) to occur, a source of sediment must be present. Various forms of erosion are a common source of sediment. Typically, erosion will increase as stream velocity and peak flow increases. Runoff over impervious surfaces and through agricultural drain tiles will have higher velocities and peak flows, and thus, increase erosion.

Sheet erosion is the detachment of soil particles by raindrop impact, and their removal by water flowing overland as a sheet instead of in channels or rills. Rill erosion refers to the development of small, ephemeral concentrated flow paths, which function as both sediment source and sediment delivery systems for erosion on hillsides. Sheet and rill erosion occur more frequently in areas that lack or have sparse vegetation. Sheet and rill erosion may contribute to phosphorus impairment because phosphorus is typically bound to sediment. Sheet or rill erosion may also transport pathogens from animal waste that was deposited by livestock, pets, or wildlife and from manure or septage that is applied to crop fields.

Bank and channel erosion refers to the wearing away of the banks and channel of a stream or river. High rates of bank and channel erosion can often be associated with water flow and sediment dynamics being out of balance. This can result from land use activities that either alter flow regimes, adversely affect the floodplain and streamside riparian areas, or a combination of both. Hydrology is a major driver for both sheet/rill and stream channel erosion.

Bank erosion is a natural process. Acceleration of this process, however, leads to a disproportionate sediment supply, channel instability, and aquatic habitat loss (Rosgen 2006). Bank erosion processes are driven by two major components: streambank characteristics (e.g., erodibility) and hydraulic forces. Many land use activities affect both these components, which can lead to increased bank erosion. Riparian vegetation and floodplain protection provide internal bank strength. Bank strength can protect banks from fluvial entrainment and subsequent collapse. For instance, when riparian vegetation is changed from woody species to annual grasses, the internal strength is weakened, thus accelerating bank erosion processes. The material from the eroded banks is later deposited via sedimentation in a segment of the stream that is flowing more slowly or where water stops flowing (e.g., a lake).

Confronted by more frequent and severe floods that increase hydraulic forces, stream channels must respond. They typically increase their cross-sectional area to accommodate the higher flows. As described previously, this is done either through widening of the stream banks, down cutting of the stream bed, or frequently both. This phase of channel instability, in turn, triggers a cycle of stream bank erosion and habitat degradation.

Discharge flow rate is a major factor that affects sediment transport in stream systems. Higher discharge volumes lead to increased flow velocities, thus raising shear stress and stream power exerted on the channel bed and banks. This effect, combined with channel stability, determines the amount of sediment that is mobilized, which in turn influences habitat and aquatic biota. In many areas of the project area, storm flows are higher than occurred under predevelopment conditions because of land use changes and increased efficiency brought about by channelization in urban and rural areas. These storm flows have greater power to erode sediment and can transport larger sediment loads downstream. When the sediment finally settles, within a slowly flowing reach or standing waterbody, it may impair aquatic life by filling in fish and benthic macroinvertebrate stream-bottom habitat.

Channelization increases peak flows as it allows flood waves to pass more quickly through the basin, increasing the volume and the erosive force of the water. Because bank erosion is often a symptom of larger, more complex problems, long-term solutions often involve much more than bank stabilization.

3.3.6 Internal Loading

Internal phosphorus loading from lake bottom sediments can be a substantial component of the phosphorus budget in lakes. The sediment phosphorus originates as an external phosphorus load that settles out of the water column to the lake bottom. There are multiple mechanisms by which phosphorus can be released back into the water column as internal loading:

- Low oxygen concentrations (also called anoxia) in the water overlying the sediment can lead to phosphorus release. In a shallow lake that undergoes intermittent mixing of the water column throughout the growing season, the released phosphorus can mix with surface waters throughout the summer and become available for algal growth. In deeper lakes with a more stable summer stratification period, the released phosphorus remains in the bottom water layer until the time of fall mixing, when it mixes with surface waters.
- Bottom-feeding fish such as carp and black bullhead forage in lake sediments. This physical disturbance can release phosphorus into the water column.
- Wind energy in shallow depths can mix the water column and disturb bottom sediments, which leads to phosphorus release.
- Other sources of physical disturbance, such as boating in shallow areas, can disturb bottom sediments and lead to phosphorus release.

In the case of Lake La-Aqua-Na, a destratifier has been present in the lake to maintain oxygen levels throughout the water column, however the operation plan for the destratifier should be reviewed to ensure that anoxic conditions are minimized. It is likely that if the lake is allowed to stratify, release of phosphorus in the anoxic portion of the lake would occur. Evaluation of dissolved oxygen data in the lake are provided in Section 5.

4. TMDL Endpoints and LRS Targets

This section presents information on the water quality impairments within the Pecatonica River watershed and the associated water quality standards (WQS) and targets.

4.1 Applicable Standards

WQS are designed to protect beneficial uses. The authority to designate beneficial uses and adopt WQS is granted through Title 35 of the Illinois Administrative Code. Designated uses to be protected in surface waters of the state are defined under Section 303, and WQS are designated under Section 302 (Water Quality Standards). Designated uses and water quality criteria are discussed below.

4.1.1 Designated Uses

Illinois EPA uses rules and regulations adopted by the Illinois Pollution Control Board (IPCB) to assess the designated use support for Illinois waterbodies. The following are the use support designations provided by the IPCB that apply to water bodies in the Pecatonica River watershed:

General Use Standards – These standards protect for aquatic life, wildlife, agricultural uses, primary contact (where physical configuration of the waterbody permits it, any recreational or other water use in which there is prolonged and intimate contact with the water involving considerable risk of ingesting water in quantities sufficient to pose a significant health hazard, such as swimming and water skiing), secondary contact (any recreational or other water use in which contact with the water is either incidental or accidental and in which the probability of ingesting appreciable quantities of water is minimal, such as fishing, commercial and recreational boating, and any limited contact incident to shoreline activity), and most industrial uses. These standards are also designed to ensure the aesthetic quality of the state's aquatic environment.

4.1.2 Water Quality Criteria

Environmental regulations for the State of Illinois are contained within the Illinois Administrative Code, Title 35. Specifically, Title 35, Part 302 contains water quality standards promulgated by the Illinois Pollution Control Board. This section presents the standards applicable to impairments within the study area. Water quality standards to be used for TMDL development in the Pecatonica River watershed are listed in Table 17. Table 18 summarizes the TMDL endpoints used for this project.

Table 17. Summary of water quality standards for the Pecatonica River watershed

Parameter	Designated Use	Units	General Use Water Quality Standard
Fecal Coliform	Primary contact recreation	#/100 ml	400 in <10% of samples collected during any 30-day period during May-October
			Geometric mean < 200 based on a minimum of 5 samples taken over not more than a 30 day period during May-October
Ammonia, Total [a]	Aquatic Life	mg/L	15 (acute standard)
Phosphorus, Total	Aesthetic quality	mg/L	0.05 [b]
Sedimentation / Siltation	Aquatic Life	N/A	No numeric standard
Total Suspended Solids	Aesthetic quality or aquatic life	N/A	No numeric standard

a. No TMDLs developed for ammonia based on analysis in Section 5, however ammonia data in Section 5 are compared to the water quality standard. The allowable concentration of total ammonia varies with water temperature and pH. In general, as both temperature and pH decrease, the allowable concentration of ammonia increases. The acute standard is never to exceed 15 mg/L regardless of pH.
b. Standard only applies in lakes/reservoirs that are greater than 20 acres in surface area and in any stream at the point where it enters such a lake / reservoir. There is no numeric standard for streams.

Table 18. TMDL endpoints

Parameter	TMDL Endpoint
Fecal Coliform (#cfu/100 mL)	400 in <10% of samples collected during any 30-day period during May-October AND Geometric mean < 200 based on a minimum of 5 samples taken over not more than a 30 day period during May-October
Ammonia, Total (mg/L) [a]	15
Phosphorus, Total (mg//L) [b]	0.05

a. No TMDLs developed for ammonia based on analysis in Section 5, however ammonia data in Section 5 are compared to the water quality standard.
b. Standard only applies in lakes/reservoirs that are greater than 20 acres in surface area and in any stream at the point where it enters such a lake / reservoir. There is no numeric standard for streams.

4.2 Load Reduction Strategy Targets

Load reduction strategy (LRS) targets are defined for sediment and phosphorus which are lacking numeric criteria. The LRS endpoints were provided by Illinois EPA and are based on the following approach (see Appendix A for more details).

Identification:

1. For each watershed, the US Geological Survey ten-digit Hydrologic Unit Codes, or HUC-10s were identified.
2. Within each HUC-10, all stream segments or lakes were identified.
3. Each stream segment or lake was checked against the Illinois EPA Assessment Data Base (or ADB) to determine those segments and lakes that are in full support for aquatic life.

4. For each HUC-10, full-support stream segments and lakes were grouped to show where each unique watershed is at its best in providing a healthy environment for aquatic plants and animals. A statewide "one size fits all" approach was purposefully avoided to allow the distinct nature of each watershed to become apparent.

Analysis:

1. For each stream segment or lake that fully supports its designated uses, the water quality data from 1999 through 2013 were compiled. This includes data from the Illinois EPA's Surface Water Section's ambient monitoring, intensive basin surveys, and special studies. The pollutants (or parameters) for which data are compiled included total phosphorus (TP) and total suspended solids (TSS).
2. This data underwent a quality control check and were carefully discriminated against any data that did not pass all the rigorous quality assurance checks. Only the data that passed all checks were used to calculate the targets.
3. Mathematical operations were kept to a minimum in order to establish targets which are as accurate and relevant as possible. For each stream segment (or lake), the raw average of all available data from 1999 through 2013 was calculated for TP and TSS, respectively.

Application:

1. For each stream segment or lake, an average concentration for TP and/or TSS over the entire time period was calculated.
2. Within each unique watershed, these long-term results for TP and TSS for all the fully supporting segments and streams in the watershed were averaged. This allows these healthy waters to most accurately represent the level of aquatic life support the watershed is capable of providing.
3. The average concentrations for the aquatic-life-supporting water bodies were then assigned as targets for all water bodies of the same type in the watershed, e.g. stream targets for streams, lake targets for lakes. The rationale for assigning this composite average is that within a given watershed, all streams for example share similar geology, soil type, land use, agricultural practices, and topography. The same holds true for lakes.

Finally, the average of these long-term concentrations are used as the target concentrations for impaired stream segments or lakes requiring an LRS be developed. Table 19 summarizes the LRS targets for total phosphorus and total suspended solids.

Table 19. Load reduction strategy targets

LRS Parameter	Stream Water Quality Targets	Lake Water Quality Targets
Phosphorus, Total (mg/L)	0.156 mg/L	--
Total Suspended Solids (mg/L)	40 mg/L	Median surface concentration of <3 mg/L nonvolatile suspended solids [b]

a. See Table 18; standard only applies in lakes/reservoirs that are greater than 20 acres in surface area and in any stream at the point where it enters such a lake / reservoir.
b. Provided in the 2010 Integrated Report Table C-25 to address aesthetic quality impairment in lakes.

LRS endpoints were updated by Illinois EPA following the initial Stage 1 report, therefore the previous LRS targets are still presented in Section 5. LRSs and associated reductions in Section 7 reflect the updated targets in Table 19.

5. Data Analysis

An important step in the TMDL and LRS development process is the review of water quality conditions, particularly data and information used to list segments. Examination of water quality monitoring data is a key part of defining the problem that the TMDL or LRS is intended to address. Data satisfy two key objectives for Illinois EPA, enabling the agency to make informed decisions about the resource. These objectives include developing information necessary to:

- Determine if the impaired areas are meeting applicable water quality standards for their respective designated use(s); and
- Support modeling and assessment activities required to allocate pollutant loadings for all impaired areas where water quality standards are not being met.

This section provides a brief review of available water quality information provided by the Illinois EPA and USGS. All relevant available data are presented below; however data that are greater than 10 years old are not used when evaluating impairment status. Each data point was reviewed to ensure the use of quality data in the analysis below.

Note that LRS targets for total phosphorous and total suspended solids were updated following the final Stage 1 report. This section was not updated to reflect these new targets; however the updated targets did not affect impairment status for any of the impaired waters. LRSs presented in Section 7 are based on the updated targets.

Stage 2 monitoring was conducted during 2015 (see Appendix B). Stage 2 monitoring included field data collection and laboratory assessment of water quality parameters in the Winneshiek Creek and Spring Branch watersheds. Stage 2 monitoring results have been added to this section since completion of the Stage 1 report. In addition to Stage 2 data, IEPA collected additional water quality data from Coolidge Creek and Winneshiek Creek. The new data associated with these sampling efforts are summarized in the appropriate section below.

5.1 Pecatonica River

The Pecatonica River is listed as being impaired along four segments – PW-01, PW-04, PW-08, and PW-13. Water quality data collected in the Pecatonica River are available at a number of stations as presented in the following sections. Segments that are adjacent and share water quality monitoring sites are presented together.

5.1.1 PW-04 and PW-08

Sites PW-04 and PW-08 are adjacent to each other and are therefore discussed together in this section. PW-04 is impaired for aquatic life with elevated levels of sediment and siltation. PW-08 is downstream of PW-04 and is listed as impaired due to fecal coliform and also has elevated sediment and siltation. Both reaches flow through Freeport.

Table 20 and Figure 13 provide a summary of TSS data for monitoring sites at or near the impaired segments. There are minimal data available at PW-04. PW-08 has an average TSS concentration of 62 mg/L, over twice the water quality target of 28.7 mg/L, and there were 37 of 58 exceedances of the water quality targets. Most data at USGS station 05435500 are older than 10 years, but its proximity to the impaired reaches warrants review. It also shows a high average concentration (96 mg/L compared with a water quality target of 28.7 mg/L) and large number of exceedances (129 of 173).

There are two monitoring stations with bacteria data along PW-08 (Table 20 and Figure 14). Both sites have numerous exceedances of the standard (400 cfu/100 mL). More extensive historical data at the USGS gage show very high fecal coliform concentrations. In addition, available data collected during the past 10 years at Wisconsin station 233002, located on the Pecatonica River upstream of the Illinois and Wisconsin border, report fecal coliform and sediment concentrations that exceed the TMDL endpoints entering Illinois.

Table 20. Data summary, Pecatonica River PW-04 and PW-08 segments

Sample Site	River Mile	No. of samples	Minimum (mg/L for sediment or cfu/100 mL for fecal coliform)	Average (mg/L for sediment or cfu/100 mL for fecal coliform)	Maximum (mg/L for sediment or cfu/100 mL for fecal coliform)	CV (standard deviation/ average)	Number of Exceedances [d]
Sediment							
PW-04	63.9	2	93	136	179	0.45	2
PW-08	62.4	58	3	62	178	0.78	37
USGS 05435500	62.7	1	<15	<15	<15	NA	0
USGS 05435500[b]	62.7	173	1	96	460	0.88	129
Fecal Coliform							
PW-08	62.4	32	10	627	4,650	1.62	12
USGS 05435500	62.7	16	67	879	4,650	1.39	9
USGS 05435500[c]	62.7	118	9	2,128	20,000	1.84	54

a. Data are from 1973-1990; greater than 10 years old.
b. Data are from 1977-1997; greater than 10 years old.
c. Data are from 1979-1996; greater than 10 years old.
d. Sediment samples also show exceedances of the updated LRS target (see Section 4.2).

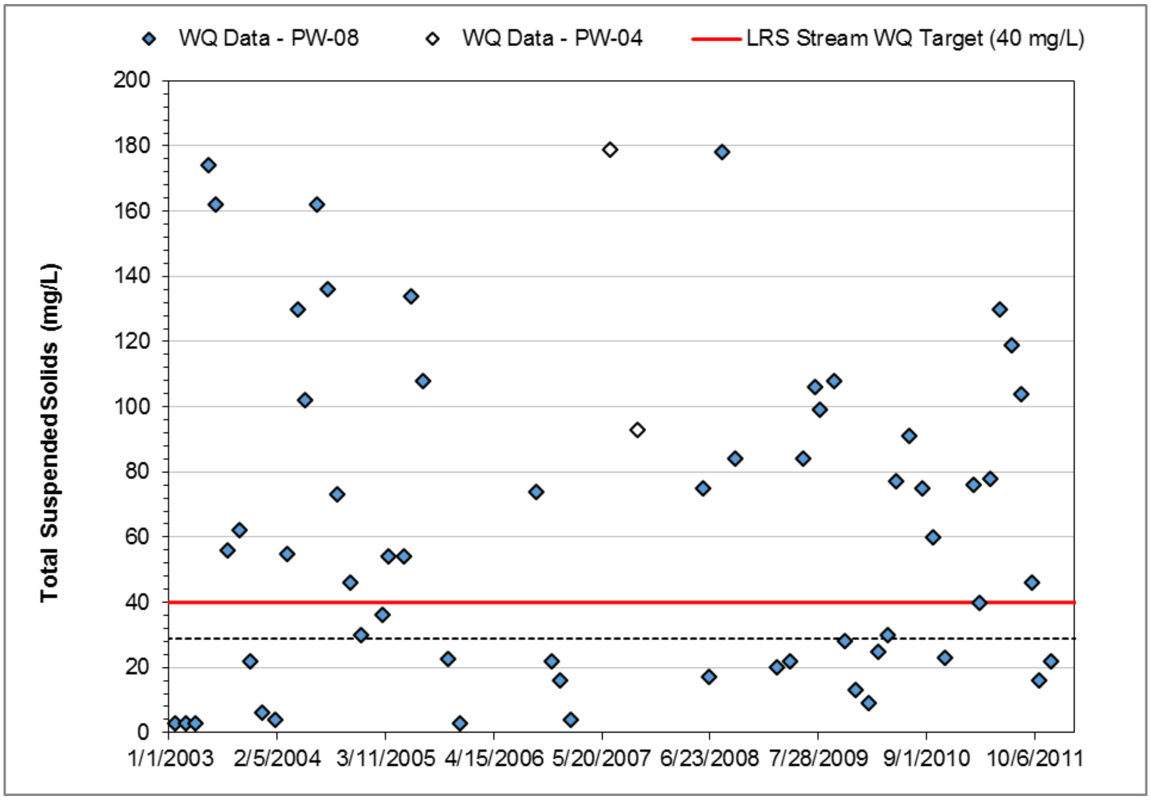


Figure 13. Total suspended solids water quality time series, Pecatonica River at PW-04 and PW-08. Dashed line indicates previous LRS target of 28.7 mg/L.

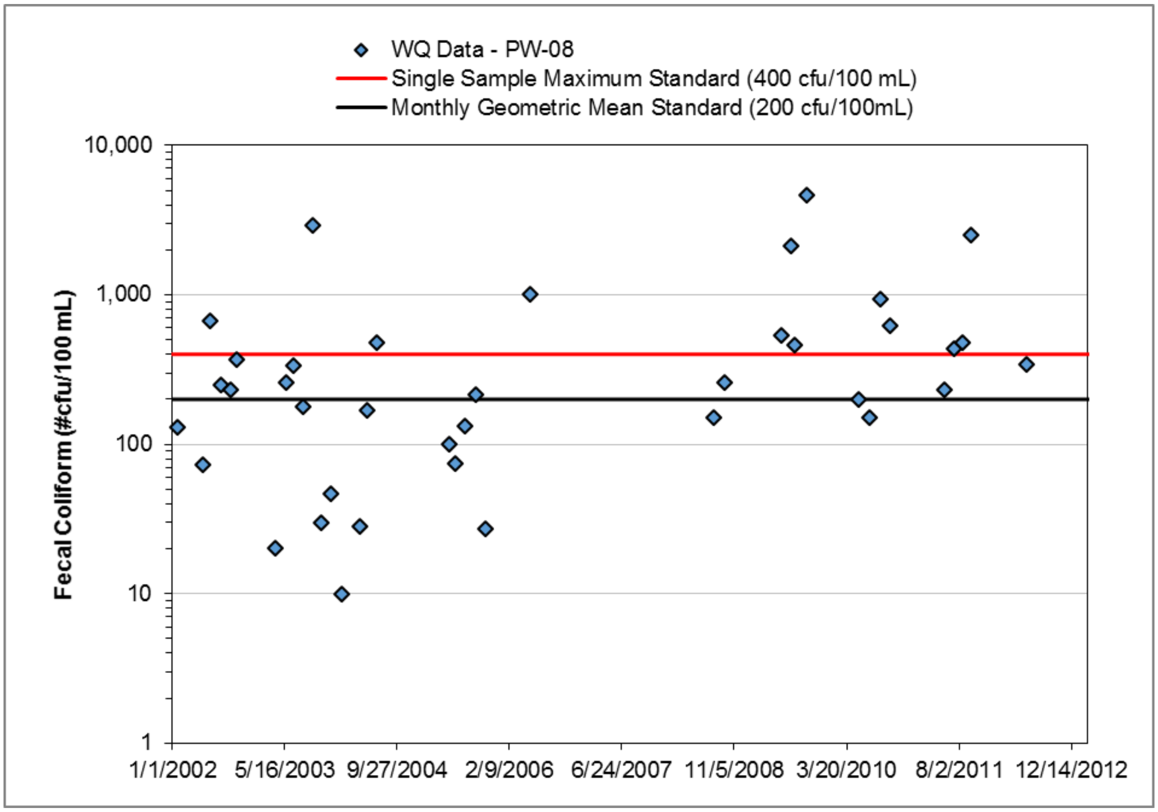


Figure 14. Fecal coliform water quality time series, Pecatonica River at PW-08.

Figure 15 presents the TSS data at PW-08 in relation to the flow conditions in the Pecatonica River. Exceedances of the water quality target are present during most flow conditions.

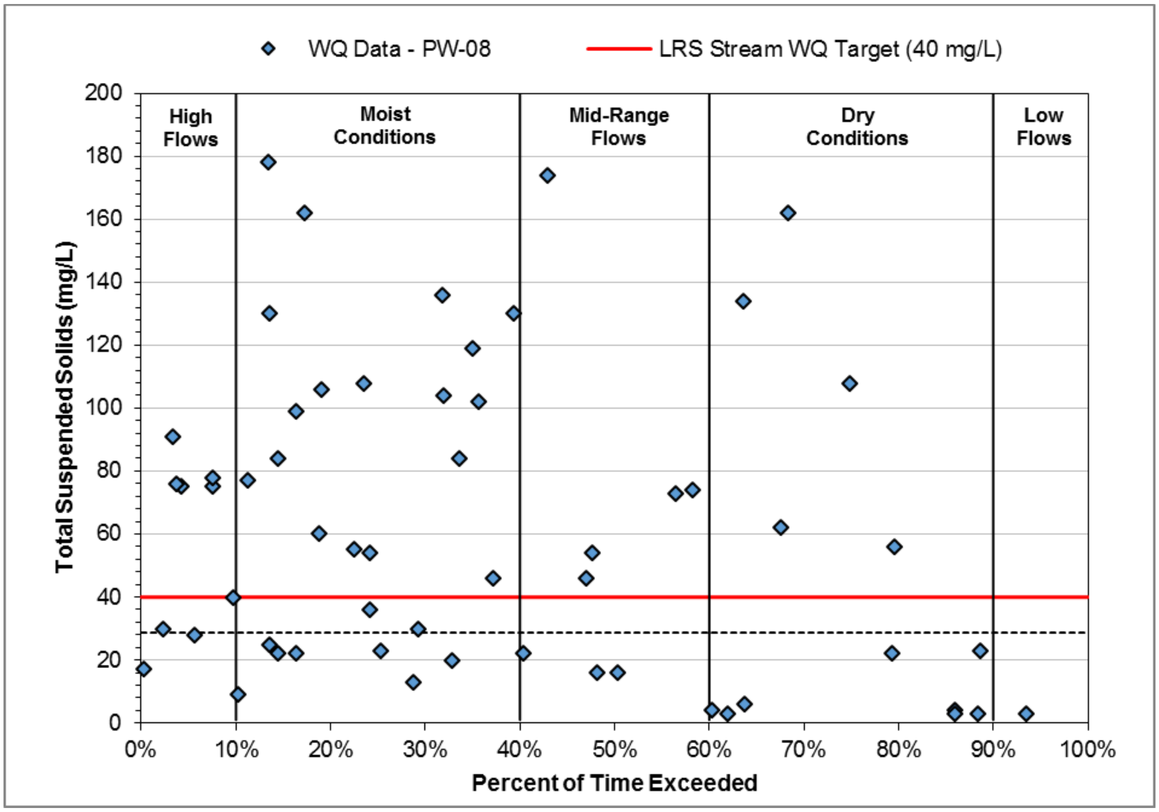


Figure 15. TSS versus flow condition, Pecatonica River at PW-08. Dashed line indicates previous LRS target of 28.7 mg/L.

Possible causes for high TSS concentrations are a high proportion of agricultural land use and streambank erosion, and NPDES permittees. Land use in the PW-08 watershed is 64 percent cultivated crops and 20 percent pasture/hay. Freeport STP is a large treatment plant (6.75 MGD ADF) located on PW-08 and has four permit exceedances for TSS between 2010 and 2013 with reported TSS effluent concentrations between 47 and 53 mg/L. Cedarville STP is located 10 miles upstream of the impaired segment and has 18 permit exceedances for TSS in the last five years.

Possible causes for high fecal coliform concentrations in this segment are high livestock concentrations and NPDES permittees. Animal feeding operations and manure management in the watershed may be contributing to high fecal coliform concentrations, especially under higher flow conditions. Freeport STP has had five fecal coliform permit exceedances within the last five years, and has a seasonal disinfection exemption.

5.1.2 PW-01 and PW-13

Sites PW-01 and PW-13 are adjacent to each other and are therefore discussed together in this section. PW-01 is impaired due to fecal coliform and aquatic life use with elevated sediment and siltation. PW-13 is downstream of PW-01 and is listed as impaired due to fecal coliform. There is one Illinois EPA sampling site in each of the impaired reaches, PW-01 and PW-13.

Twelve samples for fecal coliform have been collected within the last 10 years at PW-01 and 25 samples have been collected at PW-13 (Table 21 and Figure 16). PW-01 has two samples that exceed the standard (3,000 and 2,600 cfu/100 mL) and PW-13 has six samples that exceed the standard. Historical data from USGS station 05435800 (also located on the impaired segment) from between 1977 and 1996 shows an average fecal coliform concentration of 1,379 cfu/100 mL, over three times the standard of 400 cfu/100 mL.

The average TSS concentration at PW-01 is 71 mg/L, over twice the target of 28.7 mg/L, with the majority of samples exceeding of the target TSS concentration (Table 21 and Figure 17). Data at USGS station 05435800 are older than 10 years, and also show a high average concentration of over three times the target (89 mg/L with a target of 28.7 mg/L) and a large number of exceedances (140 of 180).

Table 21. Data summary, Pecatonica River PW-01 and PW-13 segments

Sample Site	River Mile	No. of samples	Minimum (mg/L for sediment or cfu/100 mL for fecal coliform)	Average (mg/L for sediment or cfu/100 mL for fecal coliform)	Maximum (mg/L for sediment or cfu/100 mL for fecal coliform)	CV (standard deviation/ average)	Number of Exceedances [c]
Fecal Coliform							
PW-01	9.1	12	7	540	3,000	1.96	2
PW-13	7.2	25	10	317	2,300	1.52	6
USGS 05435800[a]	9.1	133	6	1,379	22,000	2.24	58
Sediment							
PW-01	9.1	43	2	71	165	0.70	34
USGS 05435800[b]	9.1	180	1	89	444	0.94	140

a. Data are from 1977-1996; greater than 10 years old.
b. Data are from 1977-1997; greater than 10 years old.
c. Sediment samples also show exceedances of the updated LRS target (see Section 4.2).

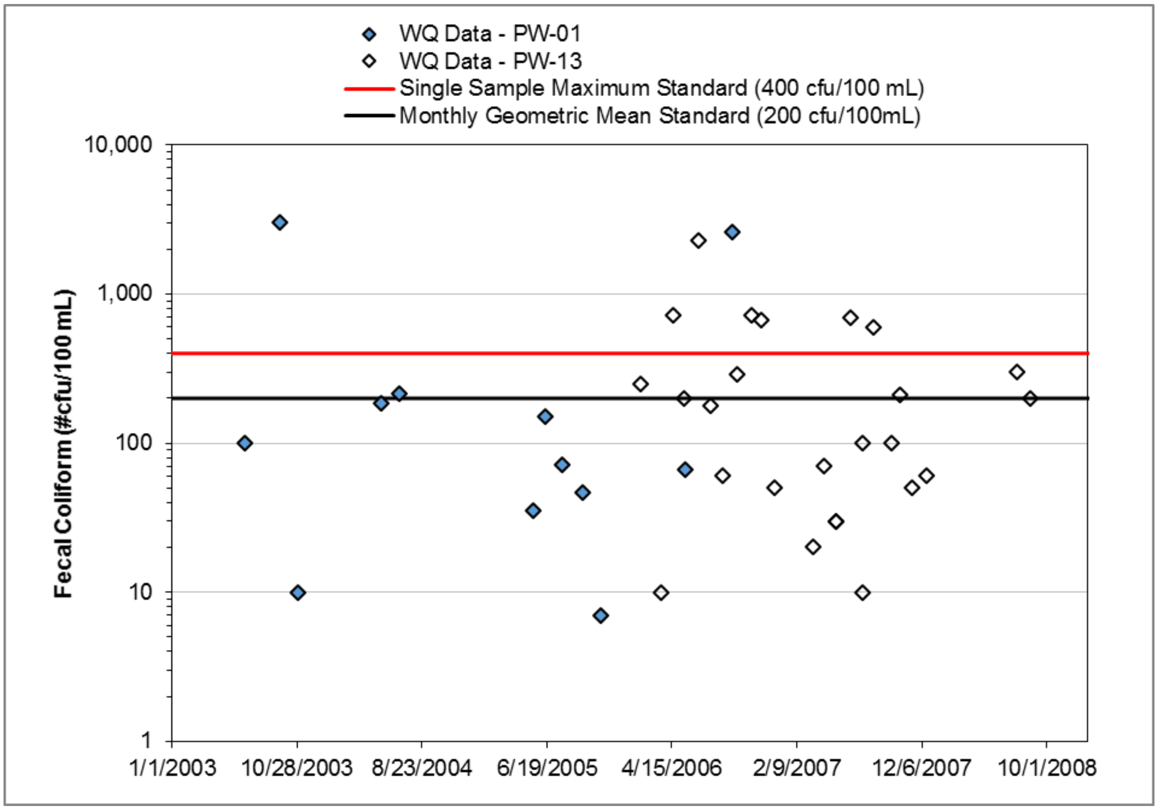


Figure 16. Fecal coliform water quality time series, Pecatonica River at PW-01 and PW-13.

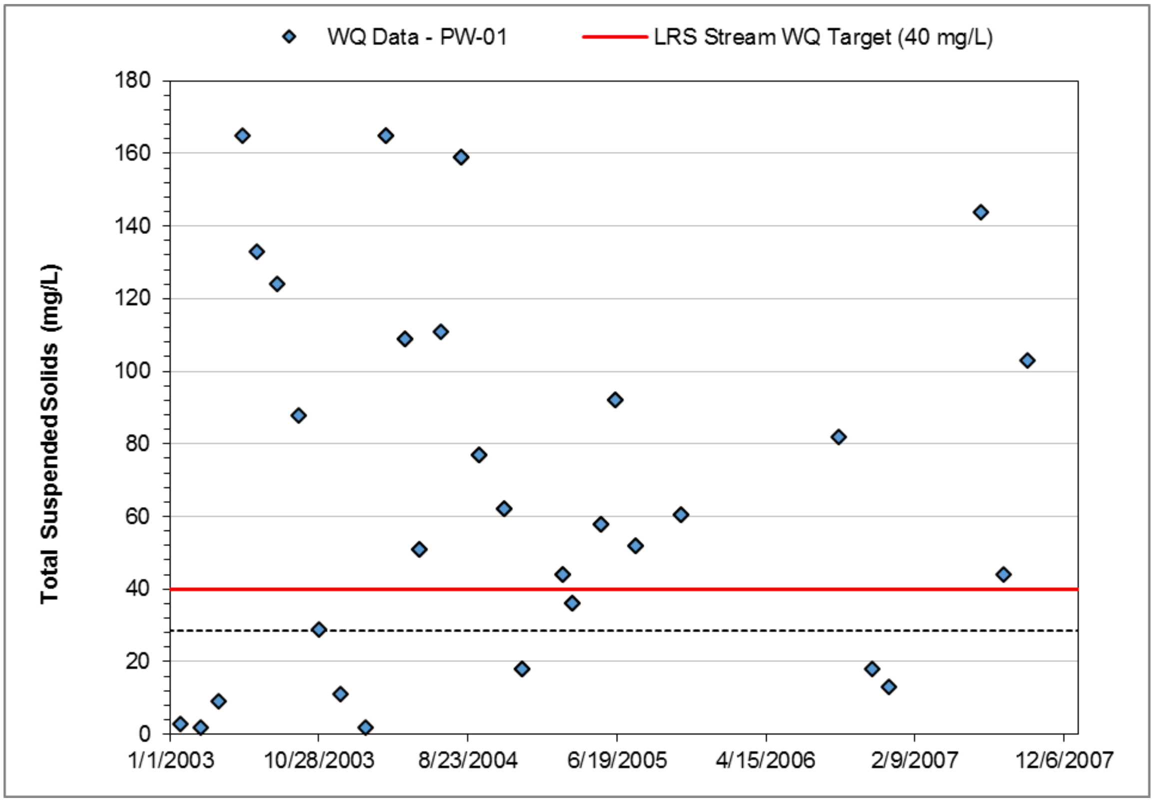


Figure 17. Total suspended solids water quality time series, Pecatonica River at PW-01. Dashed line indicates previous LRS target of 28.7 mg/L.

Possible causes for high bacteria and sediment concentrations are high livestock concentrations in the watershed, STPs, MS4 discharge, streambank erosion, and a moderate number of septic systems in the watershed. Land use in the PW-13 watershed is 69 percent cultivated crops and 15 percent pasture/hay. Seven percent of the land use is developed and there are three MS4s in the watershed, Rockton, Village of Winnebago, and Winnebago County.

There are no permitted facilities within 15 miles upstream of segment PW-01, therefore STPs and CAFOs are not likely sources of fecal coliform in PW-01. Three facilities discharge in the Sugar River watershed which drains to segment PW-13: Sugar Shores Camping Resort, Durand STP, and Otter Creek Lake Utility District STP. DMR data shows two permit exceedances at Durand STP during the last five years for TSS and three for Sugar Shores Camping Resort in the last five years for TSS and fecal coliform. Durand STP was also the subject of a 1989 report measuring the impacts of the STP on the downstream biological and chemical health of the stream (IEPA 1989a). The report found no significant biological impacts downstream of the STP, and TP and fecal coliform that were not significantly higher downstream. The impaired segment of Raccoon Creek (PWA-01) is also just upstream of PW-13 and also impaired for fecal coliform.

5.2 Raccoon Creek (PWA-01)

Raccoon Creek (PWA-01) is listed as being impaired due to fecal coliform. Two Illinois EPA monitoring stations were identified on Raccoon Creek, PWA-01 and PWA-02. Fecal coliform data are available for 2006 and 2007 at PWA-02. There are six reported exceedances of the fecal coliform standard (Table 22 and Figure 18). USGS water quality site (05437400) is also in the watershed, but has no data relevant to bacterial contamination.

Table 22. Fecal coliform data summary, Raccoon Creek PWA-01

Sample Site	River mile	No. of samples	Minimum (cfu/100 mL)	Average (cfu/100 mL)	Maximum (cfu/100 mL)	CV (standard deviation/ average)	Number of Exceedances
Fecal Coliform							
PWA-02	1.8	20	10	671	8,900	2.91	6

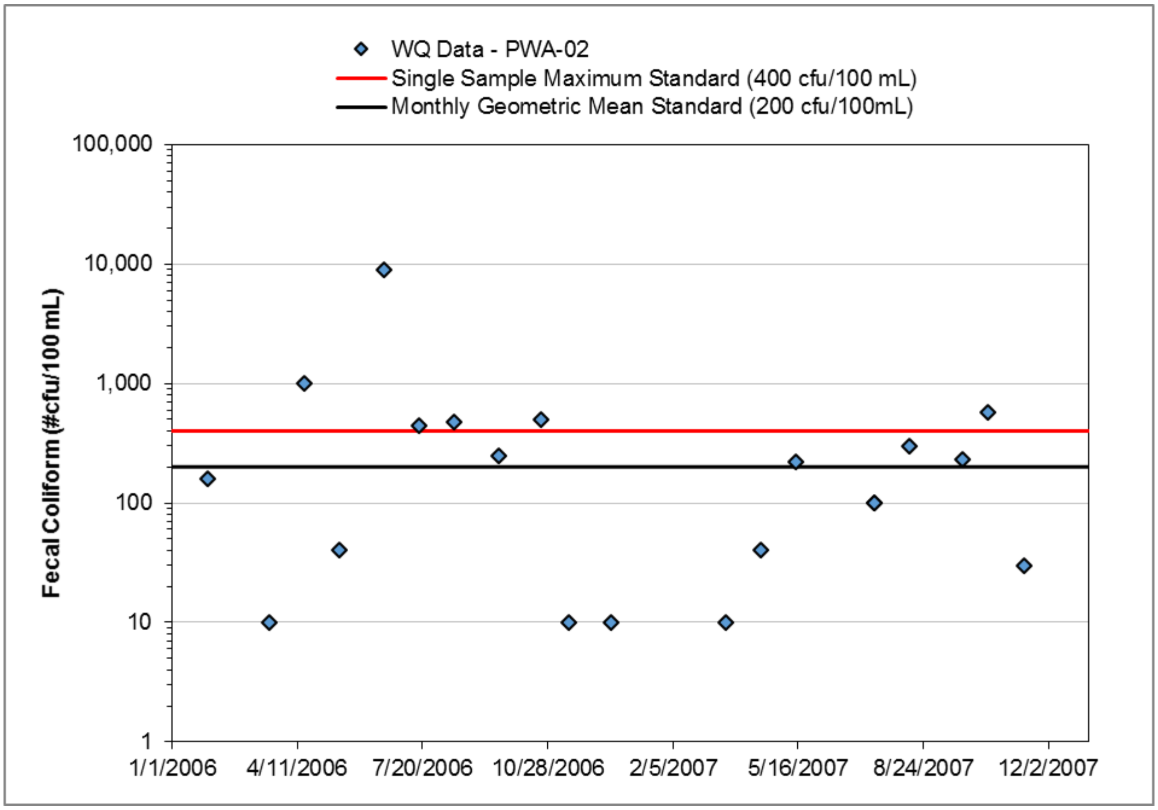


Figure 18. Fecal coliform water quality time series, Raccoon Creek at PWA-01.

Over 75 percent of the Raccoon Creek watershed is in Wisconsin. Possible bacteria sources within the watershed include agricultural activities and stormwater. Cattle and pigs make up the majority of the livestock within the Raccoon Creek watershed with a combined 149 animal units per square mile. In addition, there is a high concentration of septic systems in the watershed at 43 per square mile.

5.3 Coolidge Creek (PWF-W-C1)

Coolidge Creek (PWF-W-C1) is listed as being impaired for aquatic life with elevated sediment and TP levels. Water quality data collected in Coolidge Creek at Illinois EPA monitoring station PWF-01 (7 miles downstream from the impaired segment) are available for 2007.

Three samples were collected at PWF-01 in 2007 for sediment and TP. All of the sediment samples were below the water quality target of 50.4 mg/L and all of the TP samples were above the water quality target of 0.0725 mg/L. Additional sampling was conducted between 2014 and 2016 in Coolidge Creek by Illinois EPA and as part of Stage 2 (see Appendix B). Sampling occurred within the impaired segment. Four out of six samples exceeded the LRS target for sediment and all six samples exceeded the phosphorus LRS target (Table 23; Figure 19 and Figure 20).

The Winnebago WWTP historically discharged to the impaired stream and is identified as a potential cause of impairment. Historic DMR data were not available for the Winnebago WWTP which discharged at an average and maximum permitted flow rate of 0.4 and 1.0 MGD, respectively. A survey near the Winnebago WWTP was completed in May 1989 which reported a minor biological impact 0.1 to 0.6 mi downstream of the WWTP (IEPA 1989b). The survey also reported elevated phosphorus levels below the WWTP discharge. Downstream of this reported impact, very good conditions prevailed. IEPA understands that in the future, the Winnebago WWTP will no longer discharge into Coolidge Creek as construction of pumping and transporting facilities are underway to divert the flow from the Winnebago WWTP to Rock River Water Reclamation District.

Possible sources of sediment, phosphorus and other pollutants are cultivated land, MS4s, streambank erosion, and a high septic system density. Cultivated crops or pasture/hay make up 67 percent of the watershed. MS4s for Winnebago and Winnebago County discharge to the impaired segment, and 25 percent of the watershed is developed. There are approximately 43 septic systems per square mile (Table 16), which may also contribute to impairment.

Table 23. Coolidge Creek water quality data

Sample Site	River Mile	No. of samples	Minimum (mg/L)	Average (mg/L)	Maximum (mg/L)	CV (standard deviation/ average)	Number of Exceedances [b]
Sediment							
PWF-01[a]	2.7	3	4	17	25	0.67	0
PWF-W-C2	11.3	6	21	96	203	0.8	4
Phosphorus							
PWF-01 [a]	2.7	3	0.12	0.14	0.17	0.21	3
PWF-W-C2	11.3	6	0.364	0.542	0.744	0.2	6

a. PWF-01 is approximately 7 miles downstream of the impaired segment.
b. Sediment and phosphorus samples also show exceedances of the updated LRS targets (see Section 4.2).

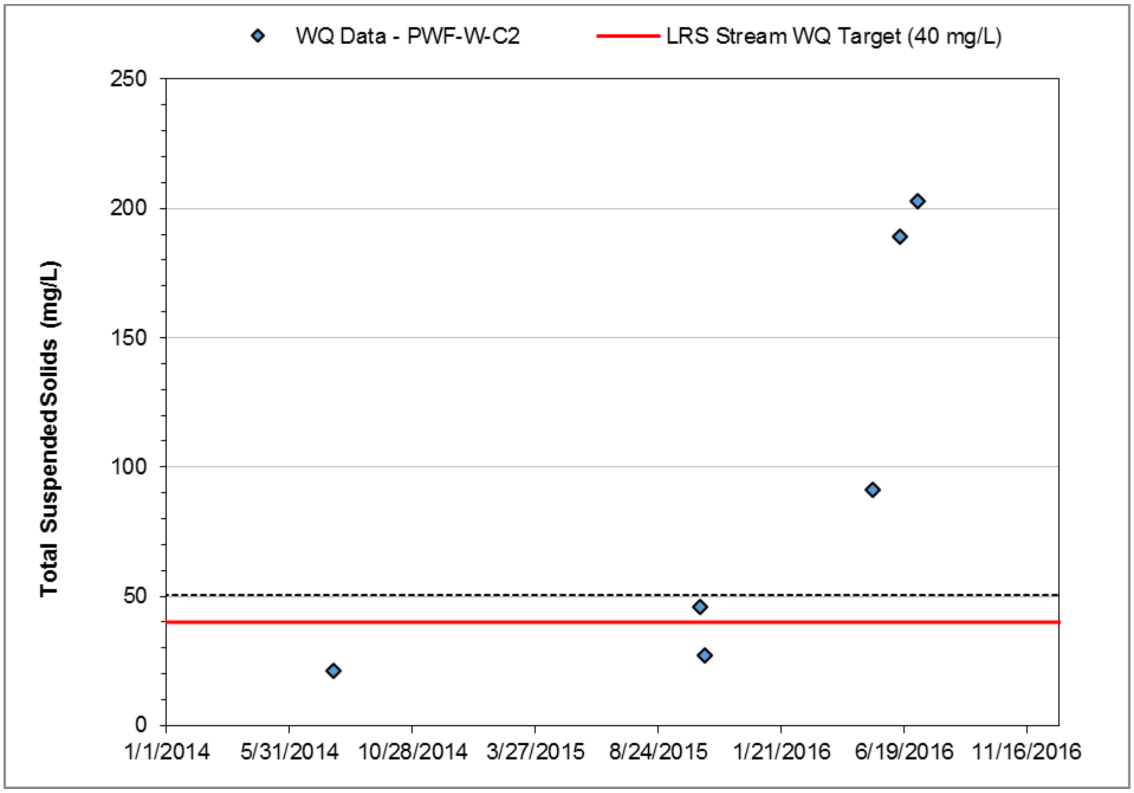


Figure 19. Total suspended solids water quality time series, Coolidge Creek at PWF-W-C1. Dashed line indicates previous LRS target of 50.4 mg/L.

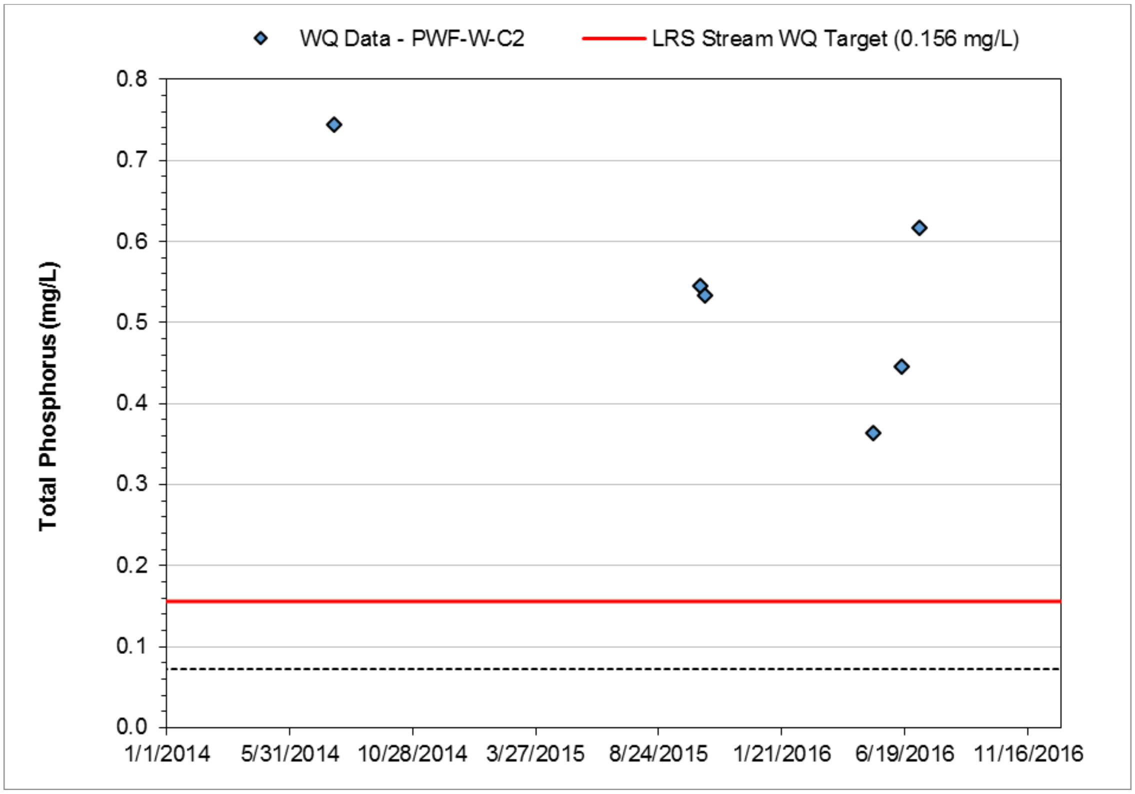


Figure 20. Total phosphorus water quality time series, Coolidge Creek at PWF-W-C1. Dashed line indicates previous LRS target of 0.0725 mg/L.

5.4 Winneshiek Creek (PWL-01)

Winneshiek Creek (PWL-01) is listed as being impaired for aquatic life having elevated sediment and phosphorus levels. Historic water quality data are only available on one date from a 1989 biological and chemical survey done near the Dakota STP (IEPA 1989c). No permanent monitoring stations are present and no recent data are available to verify impairment.

The 1989 survey reports mild biological impacts up to 0.09 miles downstream of Dakota STP. The survey also includes sampling data showing that ammonia and phosphorus decrease sharply after approximately 0.5 miles downstream of the STP. The 1989 survey also shows that TSS decreases sharply within 0.2 miles downstream from the STP.

Additional sampling was conducted as part of Stage 2 monitoring (see Appendix B). 2015 sampling did not indicate sediment impairment, however, three of four samples exceeded the phosphorus LRS target (Table 24 and Figure 21) verifying impairment. No LRS is developed for sediment.

Table 24. Winneshiek Creek water quality data

Sample Site	River Mile	No. of samples	Minimum (mg/L)	Average (mg/L)	Maximum (mg/L)	CV (standard deviation/ average)	Number of Exceedances
Phosphorus							
WC-01	1.3	3	0.10	0.23	0.41	0.72	2
PWL-D-C1 [a]	1.5	1	0.72	--	0.72	--	1

a. Flow was not estimated on the sample date, and there is no applicable existing flow site from which to estimate flow on Winneshiek Creek. The data at this sample site is not represented in Figure 38.

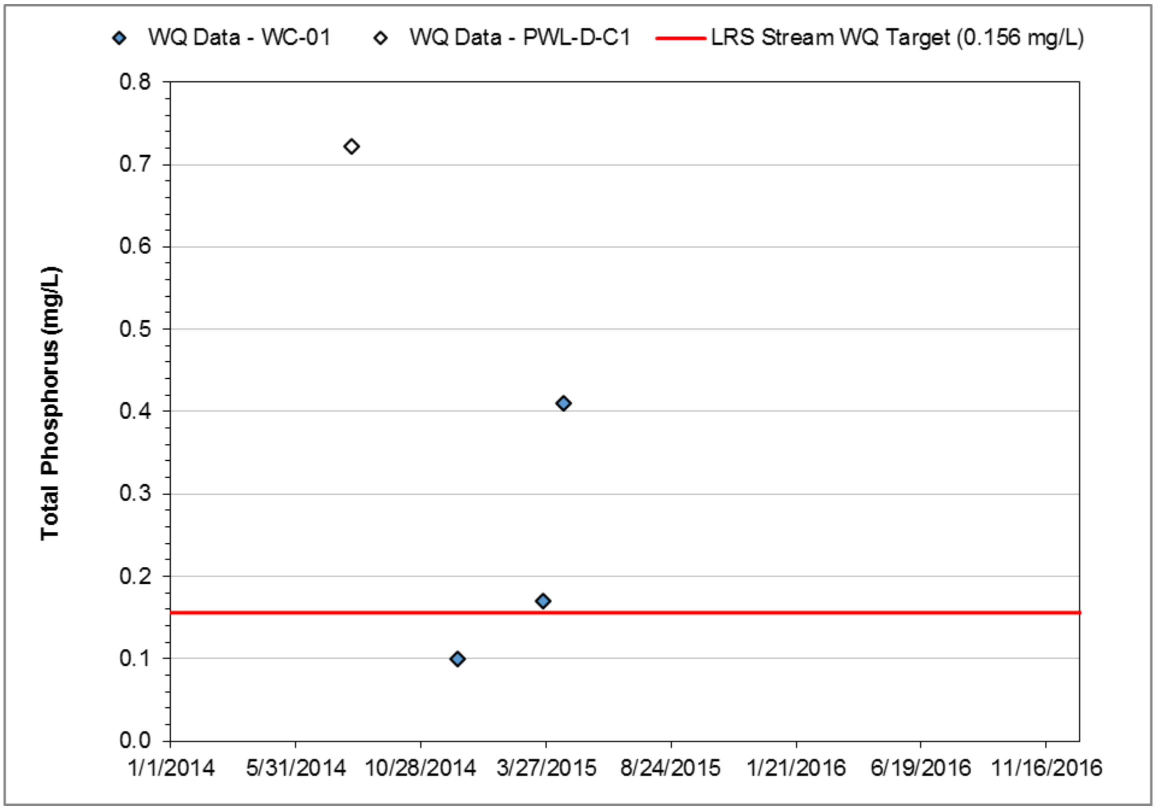


Figure 21. Total phosphorus water quality time series, Winneshiek Creek at PWL-01.

Two municipal point sources discharge to Winneshiek Creek: Dakota STP and River Road MHP. The Dakota STP discharges to the impaired segment at a permitted design average flow of 0.1 MGD, the River Road MHP discharges at a permitted design average flow of 0.0378 MGD. Neither facility has a phosphorus limit nor do they monitor phosphorus in the effluent. Dakota STP had several permit exceedances for ammonia concentrations in 2008. River Road MHP has had no permit exceedances listed on their DMRs during the last 5 years.

Possible sources of sediment and phosphorus include STPs, agricultural land uses, streambank erosion, and livestock. There are no MS4s or CAFOs in the watershed and a low density of septic systems (9 per square mile). A very high percentage of land is in cultivated crops (64 percent) and pasture/hay (27 percent). There are also a high number animal units in the watershed (148 per square mile) consisting mainly of cattle and hogs.

5.5 Yellow Creek (PWN-01)

Yellow Creek (PWN-01) is listed as being impaired due to fecal coliform. Thirteen fecal coliform samples are available from 2002 to 2006 at Illinois EPA monitoring station PWN-01 (Table 25 and Figure 22). Fecal coliform data are also available at USGS site 05435680, from 1979 to 1996. There are a number of other monitoring stations within the watershed, but none had data for bacteria and all had only a few data points.

Eleven samples collected at Illinois EPA monitoring station PWN-01 from 2003 to 2006 show four samples exceeding the standard of 400 cfu/100 ml. Two older samples from 2002 are both below the standard. Data at USGS station 05435680 are older than 10 years, but show a very high average concentration of over 7 times the limit, and 65 out of 116 samples exceed the limit.

Table 25.Yellow Creek water quality data

Sample Site	River Mile	No. of samples	Minimum (cfu/100 mL)	Average (cfu/100 mL)	Maximum (cfu/100 mL)	CV (standard deviation/ average)	Number of Exceedances
Fecal Coliform							
PWN-01	1.5	11	50	294	760	0.89	3
PWN-01[a]	1.5	2	72	--	170	--	0
USGS 05435680[a]	1.2	116	10	2,930	40,000	2.14	65

a. Samples are older than 10 years. Illinois EPA samples are from 2002, USGS samples are from 1979 – 1996.

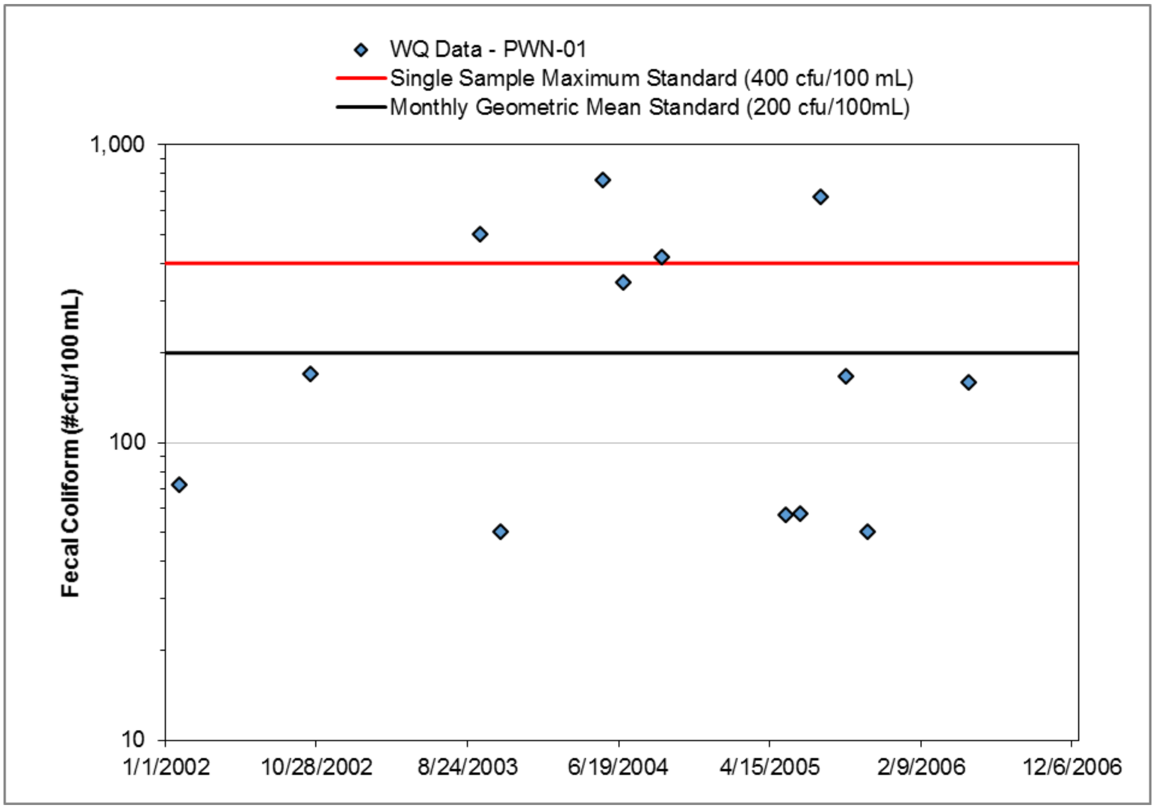


Figure 22. Fecal coliform water quality time series, Yellow Creek at PWN-01.

Possible sources of bacteria include municipal STP and livestock. The watershed has a low number of septic systems (9 per square mile). One NPDES discharger, Timber Ridge MHP – Freeport, may be contributing to fecal coliform concentrations in Yellow Creek. The facility discharges about a mile upstream of the impaired segment, but has a very small flow and no reported permit exceedances within the last 5 years. The watershed has a high concentration of animal units (138 per square mile). Animal feeding operations and manure management may be contributing to high fecal coliform levels.

5.6 Spring Branch (PWNC)

Spring Branch (PWNC) is listed as being impaired due to total ammonia and having elevated phosphorus. Historic water quality data are available on one date from a 1988 biological and chemical survey done near the Pearl City STP (IEPA 1988). One sample collected in Spring Branch did not indicate ammonia impairment but did report a high TP concentration (1.34 mg/L).

Additional data were collected during Stage 2 of the project; three of the five samples exceeded the phosphorus LRS target (Table 26 and Figure 23, see Appendix B for Stage 2 report), verifying impairment for phosphorus. Stage 2 data did not indicate ammonia impairment, therefore no TMDL is developed for ammonia.

Table 26. Spring Branch water quality data

Sample Site	River Mile	No. of samples	Minimum (mg/L)	Average (mg/L)	Maximum (mg/L)	CV (standard deviation/ average)	Number of Exceedances [a]
Phosphorus							
SB-01	0.47	5	0.078	0.24	0.63	0.95	3

a. Phosphorus samples also show exceedances of the updated LRS target (see Section 4.2).

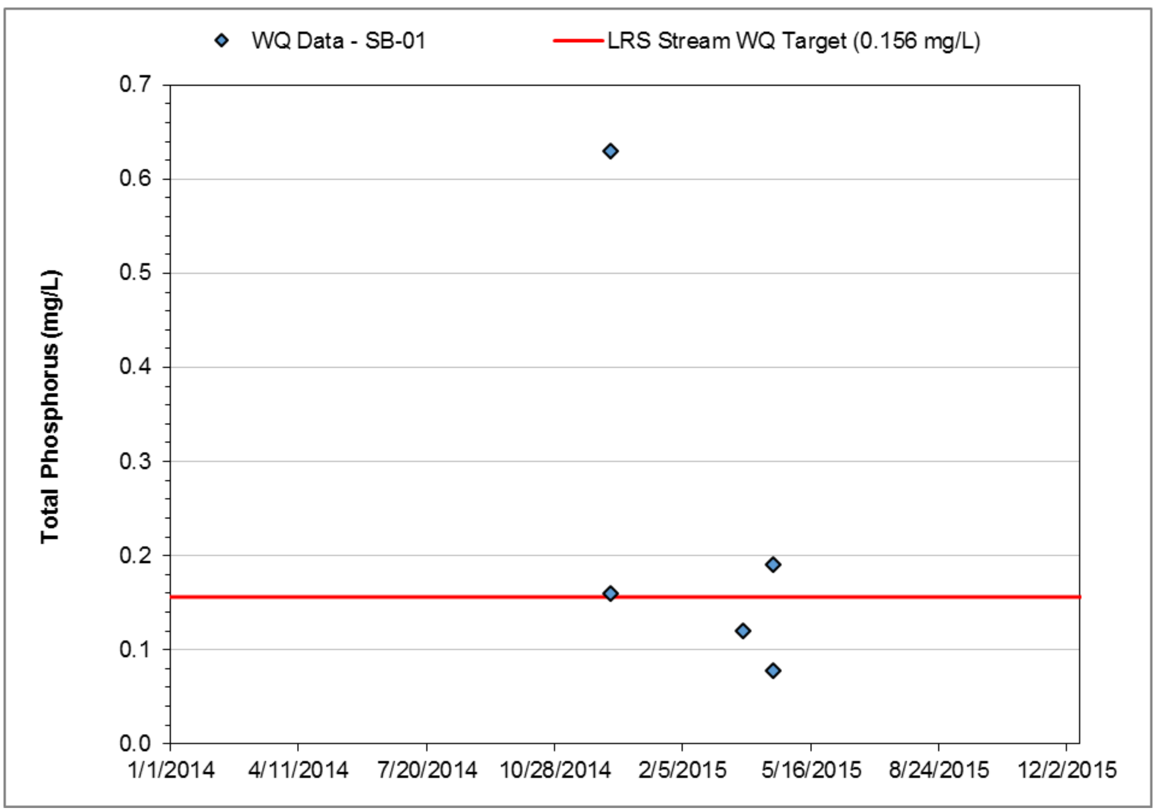


Figure 23. Total phosphorus water quality time series, Spring Branch at PWNC.

Possible causes of phosphorus are agricultural crops and livestock in the watershed. There are no MS4s or CAFOs in the watershed, and no other NPDES permittees. There are a low number of septic systems per square mile. The watershed is 95 percent agricultural, consisting of 71 percent cultivated crops and 24 percent pasture/hay.

5.7 Lake Le-Aqua-Na (RPA)

Lake Le-Aqua-Na (RPA) is listed as being impaired due to TP and having elevated TSS. Water quality data have been collected at five different sites within the lake (Table 27, Figure 24, and Figure 25). The watershed is very small, and no data are available to characterize inflows to the lake. The lake was sampled throughout the season in 2004, 2007, 2012, and 2013; older data exist as well. Samples were typically collected monthly between April and October during these years for a full suite of field and chemical parameters. A macrophyte survey was conducted in 2012 as well which identified Eurasian water milfoil present in the lake and very little macrophyte coverage.

Phosphorus concentrations averaged 3 to 4 times higher than the standard of 0.05 mg/L at the three major monitoring stations (RPA-1, -2, and -3). Also, 49 out of 58 samples exceeded the standard. At RPA-98 and RPA-99, a limited number samples were available at each, but all exceeded the TP standard. Data verify impairment due to TP.

The sediment water quality target is based on the concentration of nonvolatile suspended solids, derived from subtracting volatile suspended solids from TSS. Of the 45 samples from 2004, 2007, and 2012 taken at the surface of the lake for which nonvolatile suspended solids are calculated, 33 exceed the sediment water quality target of less than 3 mg/L at the surface.

Table 27. Lake Le-Aqua-Na water quality data

Sample Site	Location	No. of samples	Minimum (mg/L)	Average (mg/L)	Maximum (mg/L)	CV (standard deviation/ average)	Number of Exceedances
Phosphorus							
RPA-1	Southeast end of lake	27	0.04	0.14	0.26	0.46	23
RPA-2	South side of lake	13	0.02	0.13	0.28	0.59	10
RPA-3	South side of lake	13	0.03	0.13	0.28	0.57	11
RPA-98	Boat launch	2	0.09	--	0.77	--	2
RPA-99	Beach	3	0.12	0.63	1.57	1.31	3
Nonvolatile Suspended Sediment							
RPA-1	Southeast end of lake	15	0	6.9	25	1.03	11
RPA-2	South side of lake	14	0	6.1	26	1.15	10
RPA-3	South side of lake	15	0	8.3	43	1.27	11
RPA-99	Beach	1	68	--	68	--	1

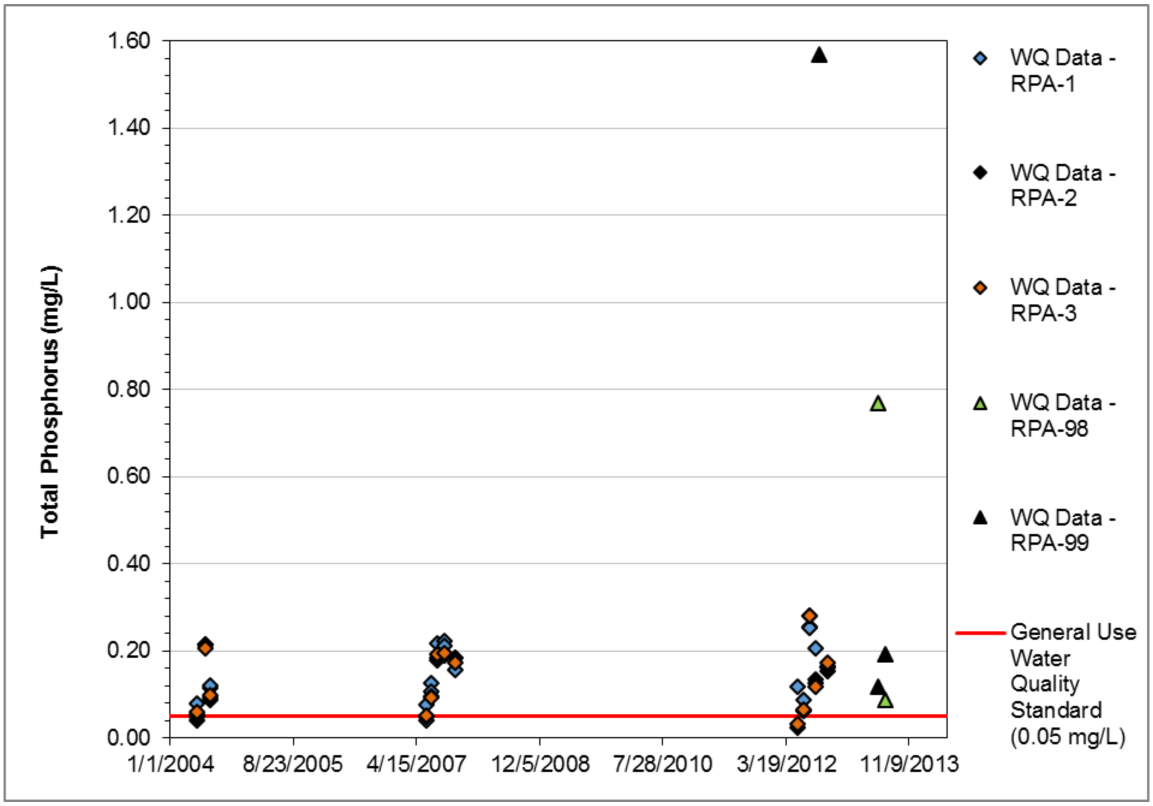


Figure 24. Total phosphorus water quality time series for Lake Le-Aqua-Na (RPA).

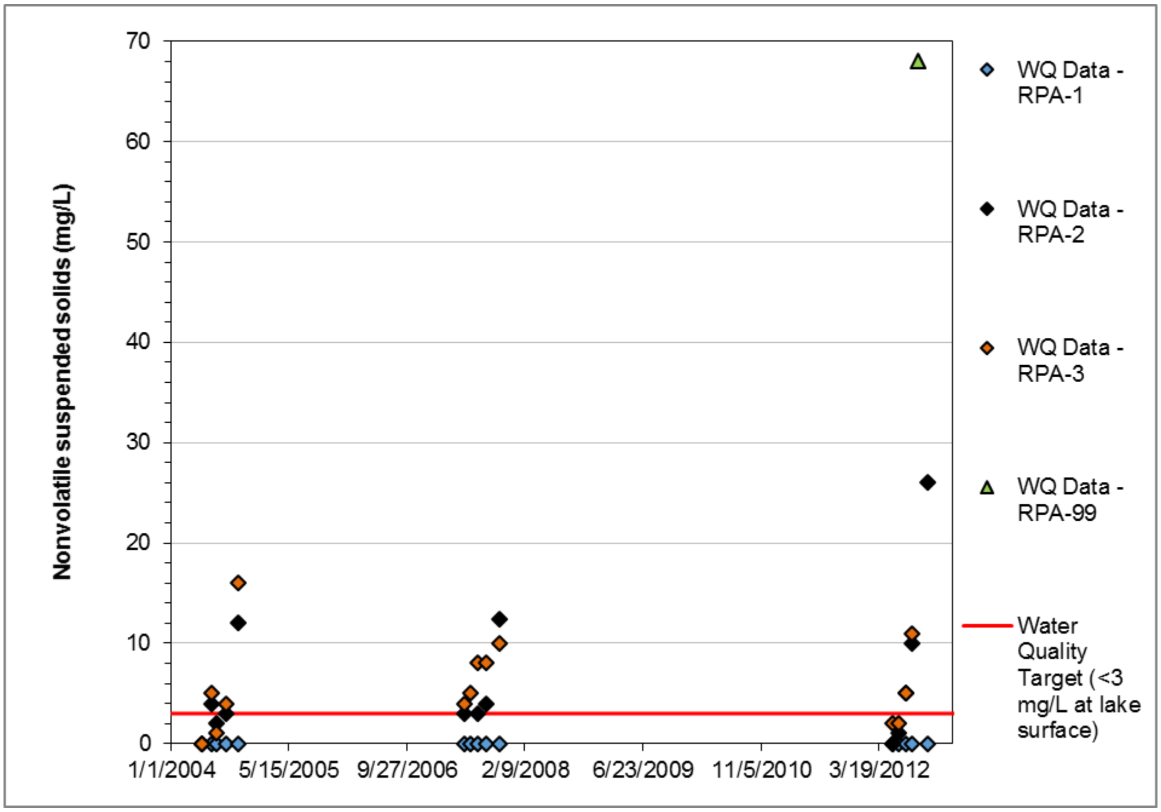


Figure 25. Nonvolatile suspended solids water quality time series for Lake Le-Aqua-Na (RPA).

Dissolved oxygen measurements reflect the operation of the destratifier in the lake. The lake has stratified in the spring as seen during May 2012 (Figure 26), however the destratifier appears to operate regularly during the summer months to mix the water column, and therefore anoxic conditions at the soil water interface are limited. Data do suggest that when the stratifier is not operating, anoxic conditions can be present within the entire water column such as occurred during July 2012 (Figure 26).

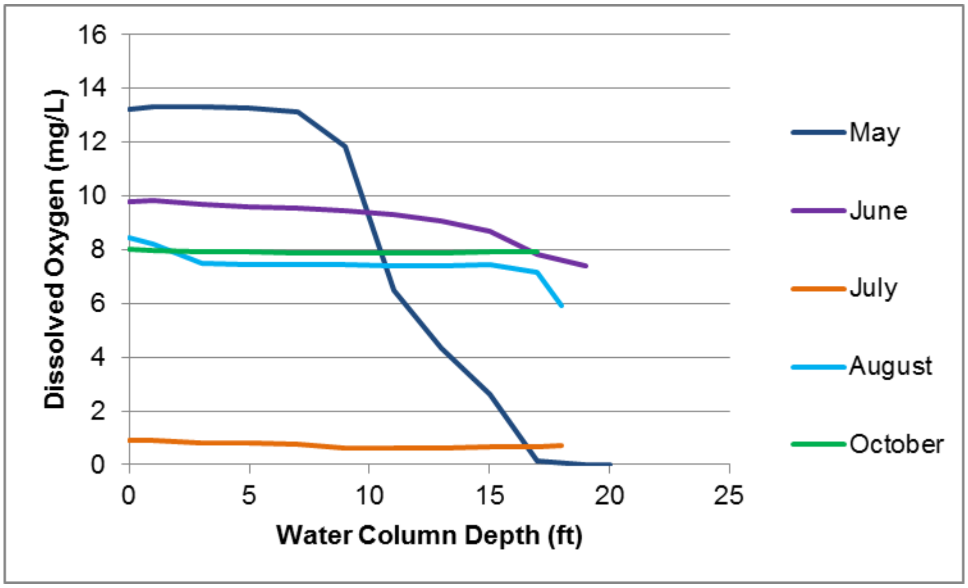


Figure 26. Dissolved oxygen profiles at RPA-1, 2012.

Chlorophyll-*a* concentrations have ranged seasonally from less than 10 to over 100 ug/L in the lake, with the highest concentrations occurring mid-summer. Blue-green algae have been monitored in this lake, and a toxic algal bloom was recorded during 2012 and 2013. Secchi disk transparency varies seasonally, with the highest clarity typically occurring in the spring (Figure 27).

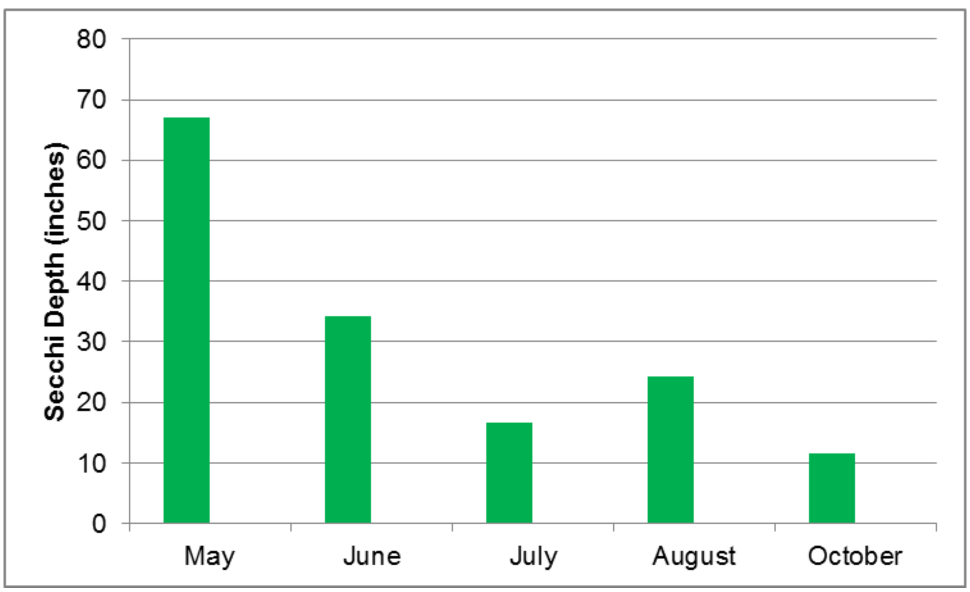


Figure 27. Secchi depth measurements at RPA-1, 2012.

Possible sources of TP to the lake are land use, an NPDES discharger, and a high number of livestock in the watershed. In addition, internal loading can contribute to phosphorus concentrations in the lake. The number of septic systems is low in the watershed (9 per square mile). Cultivated crops (62 percent) and forests (23 percent) constitute the largest land uses (Figure 28). IDNR's Le-Aqua-Na State Park STP discharges to the lake and though the flow is low (0.0031 MGD), may be contributing to elevated phosphorus levels. The STP does not have a phosphorus limit and does not monitor for phosphorus in effluent. Finally, there are many livestock in the watershed (147 per square mile). There are no monitoring data upstream of the lake to determine the concentrations or load being discharged from Waddams Creek. Additional monitoring of lake inflows would provide additional information on the sources of phosphorus to the lake.

Possible sources of sediment in the lake include crop lands which comprise 62 percent of the watershed and a high number of livestock in the watershed. Sediment can also be re-suspended in the water column due to bioturbation in the soils from bottom feeding fish such as carp and from wind.

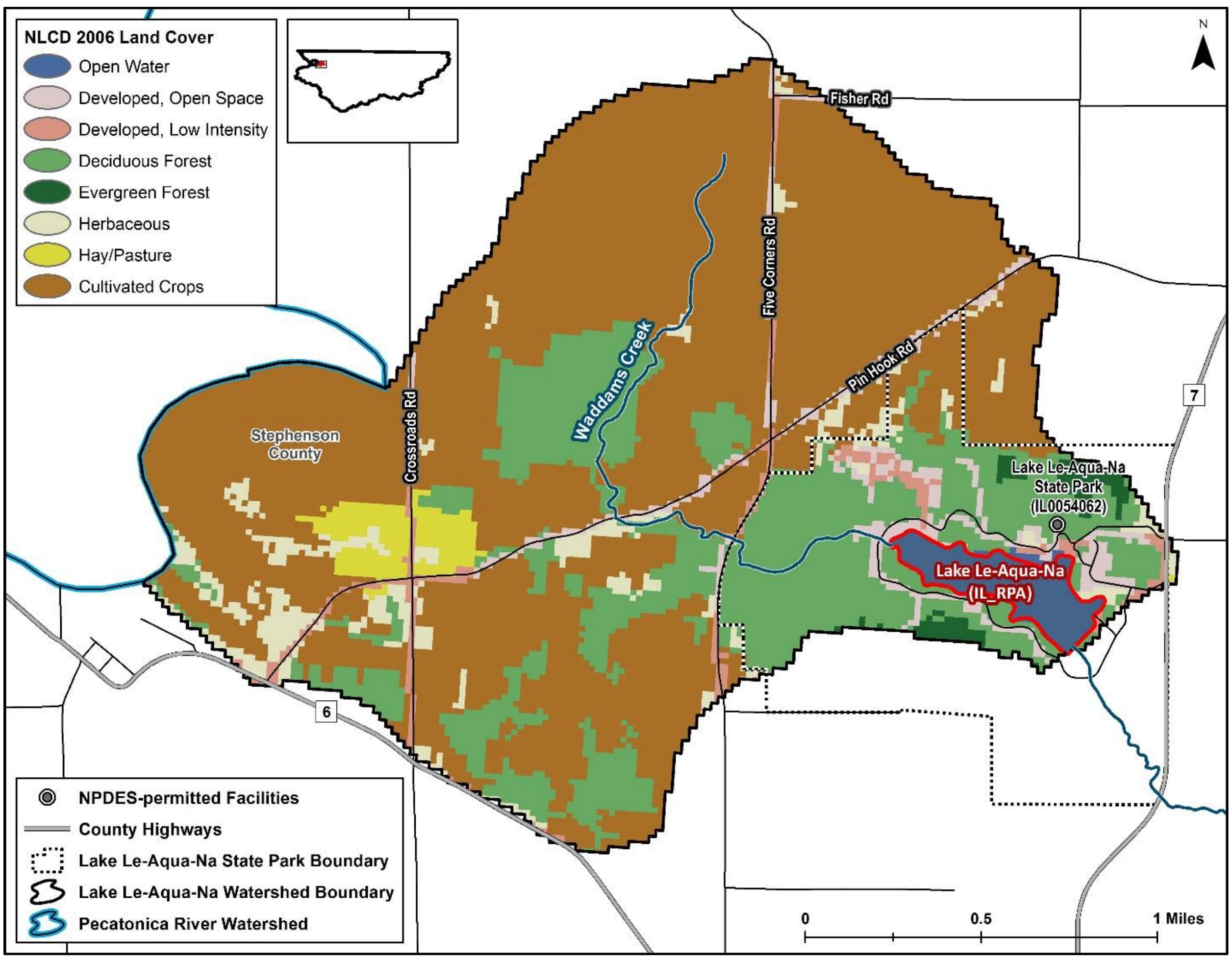


Figure 28. Lake La-Aqua-Na watershed.

6. TMDL and LRS Derivation

The first sections of this report have been an assessment of data, followed by evaluation of their credibility. The types of data available, their quantity and quality, and their spatial and temporal coverage relative to impaired segments or watersheds drive the approaches used for TMDL model selection and analysis. Credible data are those that meet specified levels of data quality, with acceptance criteria defined by measurement quality objectives, specifically their precision, accuracy, bias, representativeness, completeness, and reliability. The following sections describe the methods that will be used to derive TMDLs and LRSs.

A waterbody's loading capacity represents the maximum rate of pollutant loading that can be assimilated without violating water quality standards (40 CFR 130.2(f)). Establishing the relationship between in-stream water quality and source loading is an important component of TMDL development. It allows the determination of the relative contribution of sources to total pollutant loading and the evaluation of potential changes to water quality resulting from implementation of various management options. The following section describes the methodology used in this analysis; results are then presented by waterbody in Section 7.

A TMDL is the total amount of a pollutant that can be assimilated by the receiving water while still achieving water quality standards. TMDLs are composed of the sum of individual wasteload allocations (WLAs) for regulated sources and load allocations (LAs) for unregulated sources and natural background levels. In addition, the TMDL must include a margin of safety (MOS), either implicitly or explicitly, that accounts for the uncertainty in the relationship between pollutant loads and the quality of the receiving waterbody, and reserve capacity (RC). Conceptually, this is defined by the equation:

$$\text{TMDL} = \sum \text{WLAs} + \sum \text{LAs} + \text{MOS} + \text{RC}$$

Section 7 presents the allowable loads and associated allocations for each of the impaired waterbodies in the watershed. LRSs were developed for total phosphorus and total suspended solids. LRSs include the loading capacity of the receiving water and the reduction requirements to meet that loading capacity. A LRS does not include WLAs and is focused on nonpoint sources of pollution.

TMDLs and LRSs are developed for waterbodies that have been verified as impaired, as described in Section 5. Two impairments were not verified with available water quality data and therefore no TMDL/LRS is provided:

- Winneshiek Creek sediment-related impairments
- Spring Branch ammonia impairment

Table 28 summarizes the final set of TMDLs and LRSs.

Table 28. TMDLs and LRSs

Name	Segment ID	Designated Uses	TMDL Parameters	LRS Parameters
Pecatonica River	PW-01	Primary contact recreation	Fecal coliform	None
		Aquatic life	None	Sedimentation/siltation, total suspended solids
	PW-04	Aquatic life	None	Sedimentation/siltation, total suspended solids
	PW-08	Primary contact recreation	Fecal coliform	None
		Aquatic life	None	Sedimentation/siltation, total suspended solids
	PW-13	Primary contact recreation	Fecal coliform	None
Raccoon Creek	PWA-01	Primary contact recreation	Fecal coliform	None
Coolidge Creek	PWF-W-C1	Aquatic life	None	Total suspended solids, phosphorus (total)
Winneshiek Creek	PWL-01	Aquatic life	None	Phosphorus
Yellow Creek	PWN-01	Primary contact recreation	Fecal coliform	None
Spring Branch	PWNC	Aquatic life	None	Phosphorus (total)
Lake Le-Aqua-Na	RPA	Aesthetic quality	Phosphorus (total)	Total suspended solids

6.1 TMDL and LRS Endpoints

The TMDL and LRS endpoints are summarized in Table 29. TMDLs are completed for fecal coliform and total phosphorus (Lake Le-Aqua-Na only). LRSs are completed for total suspended solids and total phosphorus. The designated uses that these endpoints protect are primary contact recreation and aquatic life in the Pecatonica River; primary contact recreation in Raccoon Creek and Yellow Creek; aquatic life in Coolidge Creek, Winneshiek Creek, and Spring Branch; and aesthetic quality in Lake Le-Aqua-Na.

Table 29. TMDL and LRS endpoints by impairment

Segment Name	Segment ID	Parameters	Endpoints [d]
Pecatonica River	PW-01	Fecal coliform [a]	400 cfu/100 mL in <10% of samples [b] and geometric mean < 200 cfu/100 mL [c]
		Sedimentation/siltation, TSS	40 mg/L TSS
	PW-04	Sedimentation/siltation, TSS	40 mg/L TSS
	PW-08	Fecal coliform	400 cfu/100 mL in <10% of samples [b] and geometric mean < 200 cfu/100 mL [c]
		Sedimentation/siltation, total suspended solids	40 mg/L TSS
	PW-13	Fecal coliform	400 cfu/100 mL in <10% of samples [b] and geometric mean < 200 cfu/100 mL [c]
Raccoon Creek	PWA-01	Fecal coliform	400 cfu/100 mL in <10% of samples [b] and geometric mean < 200 cfu/100 mL [c]
Coolidge Creek	PWF-W-C1	Sedimentation/siltation, phosphorus (total)	40 mg/L TSS 0.156 mg/L TP
Winneshiek Creek	PWL-01	Sedimentation/siltation, TSS, phosphorus	40 mg/L TSS 0.156 mg/L TP
Yellow Creek	PWN-01	Fecal coliform	400 cfu/100 mL in <10% of samples [b] and geometric mean < 200 cfu/100 mL [c]
Spring Branch	PWNC	Phosphorus (total)	0.156 mg/L TP
Lake Le-Aqua-Na	RPA	Phosphorus (total)	0.05 mg/L
		TSS	17 mg/L TSS

a. Fecal coliform standards are applicable for the recreation season only (May through October).
b. Standard shall not be exceeded by more than 10% of the samples collected during a 30-day period.
c. Geometric mean based on minimum of 5 samples taken over not more than a 30-day period.
d. Illinois EPA provided updated water quality targets for load reduction strategies as described in Appendix A.

6.2 Loading Capacity

6.2.1 Stream Impairments

A duration curve approach was used to evaluate the relationships between hydrology and water quality and calculate the TMDLs and LRSs for all stream impairments. The primary benefit of duration curves in TMDL development is to provide insight regarding patterns associated with hydrology and water quality concerns. The duration curve approach is particularly applicable because water quality is often a function of stream flow. For instance, sediment concentrations typically increase with rising flows as a result of factors such as channel scour from higher velocities. Other parameters, such as chloride, may be more concentrated at low flows and more diluted by increased water volumes at higher flows. The use of duration curves in water quality assessment creates a framework that enables data to be characterized by flow conditions. The method provides a visual display of the relationship between stream flow and water quality.

Allowable pollutant loads have been determined through the use of load duration curves. Discussions of load duration curves are presented in *An Approach for Using Load Duration Curves in the Development of TMDLs* (U.S. EPA 2007). This approach involves calculating the allowable loadings over the range of flow conditions expected to occur in the impaired stream by taking the following steps:

1. A flow duration curve for the stream is developed by generating a flow frequency table and plotting the data points to form a curve. The data reflect a range of natural occurrences from extremely high flows to extremely low flows.

2. The flow curve is translated into a load duration (or TMDL) curve by multiplying each flow value (in cubic feet per second) by the water quality standard/target for a contaminant (mg/L or count/100 mL), then multiplying by conversion factors to yield results in the proper unit (i.e., pounds per day or count/day). The resulting points are plotted to create a load duration curve.

3. Each water quality sample is converted to a load by multiplying the water quality sample concentration by the average daily flow on the day the sample was collected. Then, the individual loads are plotted as points on the TMDL graph and can be compared to the water quality standard/target, or load duration curve.

4. Points plotting above the curve represent deviations from the water quality standard/target and the daily allowable load. Those plotting below the curve represent compliance with standards and the daily allowable load. Further, it can be determined which locations contribute loads above or below the water quality standard/target.

5. The area beneath the TMDL curve is interpreted as the loading capacity of the stream. The difference between this area and the area representing the current loading conditions is the load that must be reduced to meet water quality standards/targets.

6. The final step is to determine where reductions need to occur. Those exceedances at the right side of the graph occur during low flow conditions, and may be derived from sources such as illicit sewer connections. Exceedances on the left side of the graph occur during higher flow events, and may be derived from sources such as runoff. Using the load duration curve approach allows Illinois EPA to determine which implementation practices are most effective for reducing loads on the basis of flow regime. If loads are considerable during wet-weather events (including snowmelt), implementation efforts can target those best management practices that will most effectively reduce stormwater runoff.

Stream flow for each impaired segment was derived using the Illinois Streamflow Assessment Model (ILSAM) and used to develop load duration curves for all impaired streams. ILSAM was developed by the Illinois State Water Survey and Illinois Department of Natural Resources to estimate stream flow in both gauged and ungauged streams. The model calculates stream flow by regression equations that consider primarily the drainage area, soil properties, and long-term climate in a region. If applicable, wastewater treatment plant discharges, water supply withdrawals, and other human impacts are also included to improve flow estimates. ILSAM was developed for watersheds greater than 10 square miles in size; however, for this project the model was used to estimate flow for all ungauged stream impairments due to lack of other available data. For a more thorough explanation of the model see http://www.sws.uiuc.edu/data/ilsam/.

A boundary condition was calculated to account for flows coming from the Wisconsin portion of the watershed by area-weighting the loading capacity. Determining allocations in Wisconsin is not feasible because Illinois EPA only has jurisdiction within the boundary of the State of Illinois. The boundary condition is provided in allocation tables in Section 7 for each of the applicable waterbodies.

The stream flows displayed on water quality or load duration curves may be grouped into various flow regimes to aid with interpretation of the load duration curves. The flow regimes are typically divided into 10 groups, which can be further categorized into the following five hydrologic zones (U.S. EPA 2007):

- High flow zone: stream flows that plot in the 0 to 10-percentile range, related to flood flows.
- Moist zone: flows in the 10 to 40-percentile range, related to wet weather conditions.
- Mid-range zone: flows in the 40 to 60-percentile range, median stream flow conditions.
- Dry zone: flows in the 60 to 90-percentile range, related to dry weather flows.
- Low flow zone: flows in the 90 to 100-percentile range, related to drought conditions.

The duration curve approach helps to identify the issues surrounding the impairment and to roughly differentiate between sources. Table 30 summarizes the general relationship between the five hydrologic zones and potentially contributing source areas (the table is not specific to any individual pollutant). For example, the table indicates that impacts from point sources are usually most pronounced during dry and low flow zones because there is less water in the stream to dilute their loads. In contrast, impacts from channel bank erosion is most pronounced during high flow zones because these are the periods during which stream velocities are high enough to cause erosion to occur.

Table 30. Relationship between duration curve zones and contributing sources

Contributing source area	Duration Curve Zone				
	High	Moist	Mid-range	Dry	Low
Point source				M	H
Livestock direct access to streams				M	H
On-site wastewater systems	M	M-H	H	H	H
Riparian areas		H	H	M	
Stormwater: Impervious		H	H	H	
Combined sewer overflow	H	H	H		
Stormwater: Upland	H	H	M		
Field drainage: Natural condition	H	M			
Field drainage: Tile system	H	H	M-H	L-M	
Bank erosion	H	M			

Note: Potential relative importance of source area to contribute loads under given hydrologic condition (H: High; M: Medium; L: Low).

The load duration approach also considers critical conditions and seasonal variation in the TMDL development as required by the Clean Water Act and U.S. EPA’s implementing regulations. Because the approach establishes loads on the basis of a representative flow regime, it inherently considers seasonal variations and critical conditions attributed to flow conditions. An underlying premise of the duration curve approach is correlation of water quality impairments to flow conditions. The duration curve alone does not consider specific fate and transport mechanisms, which may vary depending on watershed or pollutant characteristics.

6.2.2 Lake Impairments

The BATHTUB model was used to support TMDL development for Lake La-Aqua-Na. BATHTUB is a steady state model that predicts eutrophication response in lakes based on empirical formulas developed for nutrient balance calculations and algal response (Walker 1987). The model was developed and is maintained by the U.S. Army Corps of Engineers. The BATHTUB model requires nutrient loading inputs from the upstream watershed and atmospheric deposition, morphometric data for the lake, and estimates of mixing depth and nonalgal turbidity.

Due to a lack of available inflow monitoring data, watershed inputs were derived from *Spreadsheet Tool for the Estimation of Pollutant Load* (STEPL). Similar to most modeling applications the BATHTUB model is first calibrated to available data and then used to determine the load reductions that are needed to meet water quality standards. STEPL provides a simplified simulation of precipitation-driven runoff and sediment and nutrient delivery. STEPL can estimate loads from land uses (such as row crops and commercial areas), as well as from other sources such as stream bank erosion and failing septic systems. STEPL simulates runoff and stream flow using summary information on precipitation and rain days for the nearest weather station. For pollutants that are not explicitly modeled in STEPL, for example metals, an evaluation of the STEPL derived sediment loading coupled with sediment quality data can provide a reasonable estimate of watershed loadings.

STEPL has been used extensively in Region 5 for watershed plan development and in support of watershed studies. STEPL is an appropriate model to evaluate the relative contribution of various sources of pollutants and allows for the identification of the priority sources of pollutants for evaluation during implementation planning. STEPL also provides the level of detail needed for external watershed loading to Lake La-Aqua-Na required for BATHTUB input.

6.3 Load Allocations

Load allocations represent the portion of the allowable load that is reserved for nonpoint sources and natural background conditions in Illinois. A boundary condition is provided for loading from Wisconsin in each allocation table as described in Section 6.2. The load allocations are based on subtracting the WLAs, the MOS and the RC from allowable Illinois loads. The load allocations are summarized in Section 7 for each of the waterbody pollutant combinations along with the baseline loads and WLAs. The load allocations are presented on a daily basis and were developed to meet TMDL targets and apply to the Illinois portion of the watershed only.

6.4 Wasteload Allocations

Numerous known National Pollutant Discharge Elimination System (NPDES) facilities are within the watershed with the potential to discharge pollutants. As required by the Clean Water Act (CWA), individual WLAs were developed for these permittees as part of the TMDL development process (see Appendix C). Each facility’s maximum design flow is used to calculate the WLA for the high flow and moist flow zones and the average design flow was used for all other flow zones. Illinois assumes that facilities will have to discharge at their maximum flow during both high and moist flows based on the following:

> *For municipal NPDES permits in Illinois, page 2 of the NPDES permit lists 2 design flows: a design average flow (DAF) and a design maximum flow (DMF). These are defined in 35 Ill. Adm. Code 370.211(a) and (b) (see http://www.ipcb.state.il.us/documents/dsweb/Get/Document-12042/). Since rain (and to a certain extent, high ground water) causes influent flows to wastewater treatment facilities to increase and precipitation also leads to higher river levels, a correlation between precipitation and treatment flows exists. The load limits in these permits gives a tiered load limit, one based on DAF for flows of DAF and below, and another load limit in the permit for flows above DAF through DMF.*

Fecal coliform WLAs are based on compliance with the geometric mean fecal coliform water quality standard of 200 cfu/100 mL; the instantaneous water quality standard requiring that no more than 10 percent of the samples shall exceed 400 cfu/100 mL is also required to be met at the closest point downstream where recreational use occurs in the receiving water or where the water flows into a fecal-impaired segment. WLAs for facilities with disinfection exemptions were based on the design flows for each facility multiplied by the water quality target and a conversion factor. The resulting WLAs apply at the end of their respective disinfection exemptions. Facilities with year-round disinfection exemptions may be required to provide Illinois EPA with updated information to demonstrate compliance with these requirements, and facilities directly discharging into a fecal-impaired segment may have their year-round disinfection exemption revoked through future NPDES permitting actions if the water quality standard is not met at the end of the exempted waterbody segment.

There is one NPDES permitted facility that discharges to Lake Le-Aqua-Na: Lake Le-Aqua-Na State Park (IL0054062). A phosphorus WLA is set to existing conditions using the estimated existing load based on the average design flow and an average concentration of phosphorus in untreated wastewater of 4 mg/L (Tetra Tech 2012). This value is based on best professional judgement and input from Illinois EPA.

Three regulated Municipal Separate Storm Sewer Systems (MS4s) are in the watershed. Individual WLAs for fecal coliform were established for each MS4 based on the area of the regulated community (Table 31). The jurisdictional areas of townships and municipalities were used as surrogates for the regulated area of each MS4. These areas were then used to calculate WLAs based on the proportion of the upstream drainage area located within the MS4 boundaries by multiplying that proportional area by the loading capacity of the assessment location. For the regulated road authority, Winnebago County, the MS4 area was determined using the length of applicable roads and estimated right-of-way width.

Table 31. Estimated area of MS4s

Permit ID	Regulated Entity	Receiving Waters	Estimated MS4 Area (acres)
ILR400434	Village of Rockton	Pecatonica River (PW-13)	66
ILR400475	Village of Winnebago	Coolidge Creek (PWF-W-C1), Pecatonica River (PW-01), Pecatonica River (PW-13)	380
ILR400505	Winnebago County	Coolidge Creek (PWF-W-C1), Pecatonica River (PW-01), Pecatonica River (PW-13)	13

Two concentrated animal feeding operations (CAFOs) are located in the watershed (Eugene Meier Farm, ILA010071 and Rancho Cantera, ILA010086). Both CAFOs receive a WLA of 0.

6.5 Margin of Safety

The CWA requires that a TMDL include a margin of safety (MOS) to account for uncertainties in the relationship between pollutants loads and receiving water quality. United States Environmental Protection Agency (U.S. EPA) guidance explains that the MOS may be implicit (i.e., incorporated into the TMDL through conservative assumptions in the analysis) or explicit (i.e., expressed in the TMDL as loadings set aside for the MOS). A 10 percent explicit MOS has been applied as part of this TMDL for fecal coliform and total phosphorus for the allowable loading capacity in Illinois. A moderate MOS was specified because the use of load duration curves is expected to provide accurate information on the loading capacity of the stream, but this estimate of the loading capacity may be subject to potential error associated with the method used to estimate flows. The MOS for fecal coliform is also implicit because the load duration analysis does not address die-off of pathogens. Implementation efforts will target the highest percent reduction needed for each impairment; this constitutes an implicit MOS for the flow regimes with lower reduction targets.

A 10 percent MOS is also added to the phosphorus TMDL for Lake La-Aqua-Na to account for uncertainty that the pollutant allocations would attain the water quality targets. The use of an explicit

MOS accounts for environmental variability in pollutant loading, variability in water quality monitoring data, calibration and validation processes of modeling efforts, uncertainty in modeling outputs, conservative assumptions made during the modeling efforts.

6.6 Reserve Capacity

Reserve capacity (RC) is provided to those watersheds that are expected to further develop. No reserve capacity is set aside at this time. For fecal coliform, any new or expanded discharges will be required to comply with permit limits. As long as the facility is meeting the single sample maximum and geomean standards, any new flow and associated load will be in compliance with the TMDL.

6.7 Critical Conditions and Seasonality

The Clean Water Act requires that TMDLs take into account critical conditions for stream flow, loading, and water quality parameters as part of the analysis of loading capacity. Through the load duration curve approach it was determined that load reductions are needed for specific flow conditions; however, the critical conditions (the periods when the greatest reductions are required) vary by location and are inherently addressed by specifying different levels of reduction according to flow.

The allocation of point source loads (i.e., the WLA) also takes into account critical conditions by assuming that the facilities will always discharge at their maximum design flows. In reality, many facilities discharge below their design flows.

The Clean Water Act also requires that TMDLs be established with consideration of seasonal variations. Seasonal variations are addressed in this TMDL by assessing conditions only during the season when the water quality standard applies (May through October) for fecal coliform. The load duration approach also accounts for seasonality by evaluating allowable loads on a daily basis over the entire range of observed flows and by presenting daily allowable loads that vary by flow. Seasonality is addressed in the Lake Le-Aqua-Na TMDL by assessing conditions during the summer growing season.

7. Allocations

7.1 Pecatonica River (PW-01)

Pecatonica River PW-01 Fecal Coliform TMDL

Figure 29 presents the load duration curve for fecal coliform at the Pecatonica River at the PW-01 assessment site, and Table 32 summarizes the TMDL and required reductions. Reductions are needed under dry to moist conditions. Data are not available for high flow conditions. Table 33 through Table 35 present the individual fecal coliform WLAs for point sources.

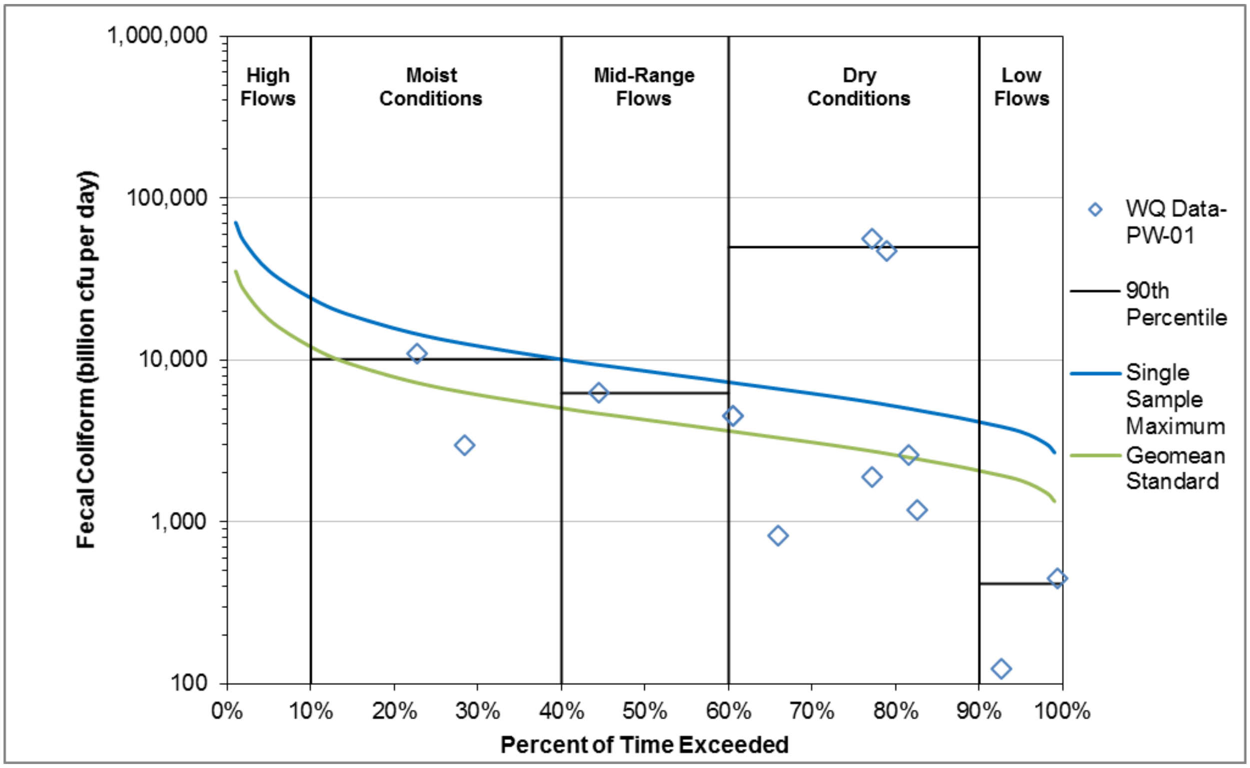


Figure 29. Fecal coliform load duration curve, Pecatonica River at PW-01.

Table 32. Fecal coliform TMDL, Pecatonica River at PW-01

TMDL Parameter		Flow Zones				
		High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
		Fecal Coliform Load (billion cfu per day)				
Boundary Condition at WI State Line		10,931	4,200	2,639	1,758	1,111
Wasteload Allocation	NPDES Perm. Facility	219	219	103	103	103
	MS4	5.3	1.9	1.2	0.79	0.46
	CAFO	0	0	0	0	0
Load Allocation (Illinois Only)		5,880	2,124	1,370	877	518
MOS (Illinois Only)		678	261	164	109	69
Loading Capacity [a]		17,713	6,806	4,277	2,848	1,801
Existing Load		-	10,109	6,236	49,653	416
Load Reduction [b]		-	33%	31%	94%	0%

a. Loading capacity rounded to a whole number
b. TMDL reduction is based on the observed 90th percentile load in each flow regime and the geometric mean standard; the instantaneous standard also must be met.

Table 33. Individual NPDES fecal coliform WLAs, Pecatonica River at PW-01

Permit ID	Facility Name	Avg. Design Flow (MGD)	Max. Design Flow (MGD)	Fecal Coliform WLA (billion cfu per day)	
				High Flows and Moist Conditions	Mid-Range to Low Flows
IL0003204	Titan Tire Corporation of Freeport	2.88	--	22	22
IL0034908	Bay Valley Foods LLC	0.162	--	1.2	1.2
IL0030571	Village of Pecatonica WWTP	0.6	1.65	11	4.5
ILG551070	Westlake Utilities, Inc.	0.25	1	7.6	1.9
IL0048593	Otter Creek Lake Utility District STP	0.4	1	7.6	3.0
ILG580267	Rock City STP	0.04	0.1	0.8	0.3
ILG580278	Village of Davis STP	0.075	0.19	1.4	0.6
IL0048259	Village of Winslow – WWTP	0.055	0.137	1.0	0.4
IL0054062	Le-Aqua-Na State Park	0.0031	0.00775	0.06	0.02
IL0026735	Torkelson Cheese Company – Lena	0.1	--	0.8	0.8
ILG580248	Village of Orangeville WWTP	0.2	0.72	5.5	1.5
ILG580136	Cedarville STP	0.1	0.25	1.9	0.8
ILG551062	Stephenson MHP	0.024	0.048	0.4	0.2
IL0065811	Berner Foods, Inc.	0.035	Not reported	0.3	0.3
IL0036030	Northern Hills Utility STP	0.06	0.13	1.0	0.5
IL0023591	City of Freeport STP	6.75	16.6	126	51
IL0024945	Village of Lena – STP	0.6	1.5	11	4.5
IL0076210	Adkins Energy, LLC	0.062	0.15	1.1	0.5
IL0003476	Nuestro Queso, LLC	0.35	Not reported	2.6	2.6

Permit ID	Facility Name	Avg. Design Flow (MGD)	Max. Design Flow (MGD)	Fecal Coliform WLA (billion cfu per day)	
				High Flows and Moist Conditions	Mid-Range to Low Flows
IL0030562	Village of Pearl City STP	0.101 proposed	0.2563 proposed	1.9	0.8
ILG580021	Shannon STP	0.18	0.45	3.4	1.4
ILG551013	Timber Ridge MHP – Freeport	0.012	0.03	0.2	0.1
IL0028304	Dakota STP	0.1	0.25	1.9	0.8
ILG551061	River Road MHP	0.0378	0.151	1.1	0.3
IL0020672	RRWD - Winnebago WWTP	0.4	1	7.6	3.0
			Total	**219**	**103**

Table 34. Individual MS4 WLAs, Pecatonica River at PW-01

Permit ID	Regulated Entity	Fecal Coliform WLA (billion cfu per day)				
		High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
ILR400475	Village of Winnebago	5.1	1.80	1.20	0.76	0.44
ILR400505	Winnebago County	0.2	0.06	0.04	0.03	0.02
	Total	**5.3**	**1.9**	**1.2**	**0.79**	**0.046**

Table 35. Individual CAFO WLAs, Pecatonica River at PW-01

Permit ID	CAFO Name	Fecal Coliform WLA (billion cfu per day)				
		High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
ILA010071	Eugene Meier Farm	0	0	0	0	0
ILA010086	Rancho Cantera	0	0	0	0	0

Pecatonica River PW-01 Sedimentation/Siltation and Total Suspended Solids LRS

Figure 30 presents the load duration curve for TSS at the Pecatonica River at the PW-01 assessment site, and Table 36 summarizes the LRS and required reductions. Reductions are needed in all flow intervals for which monitoring data are available. Data are not available for high flow conditions.

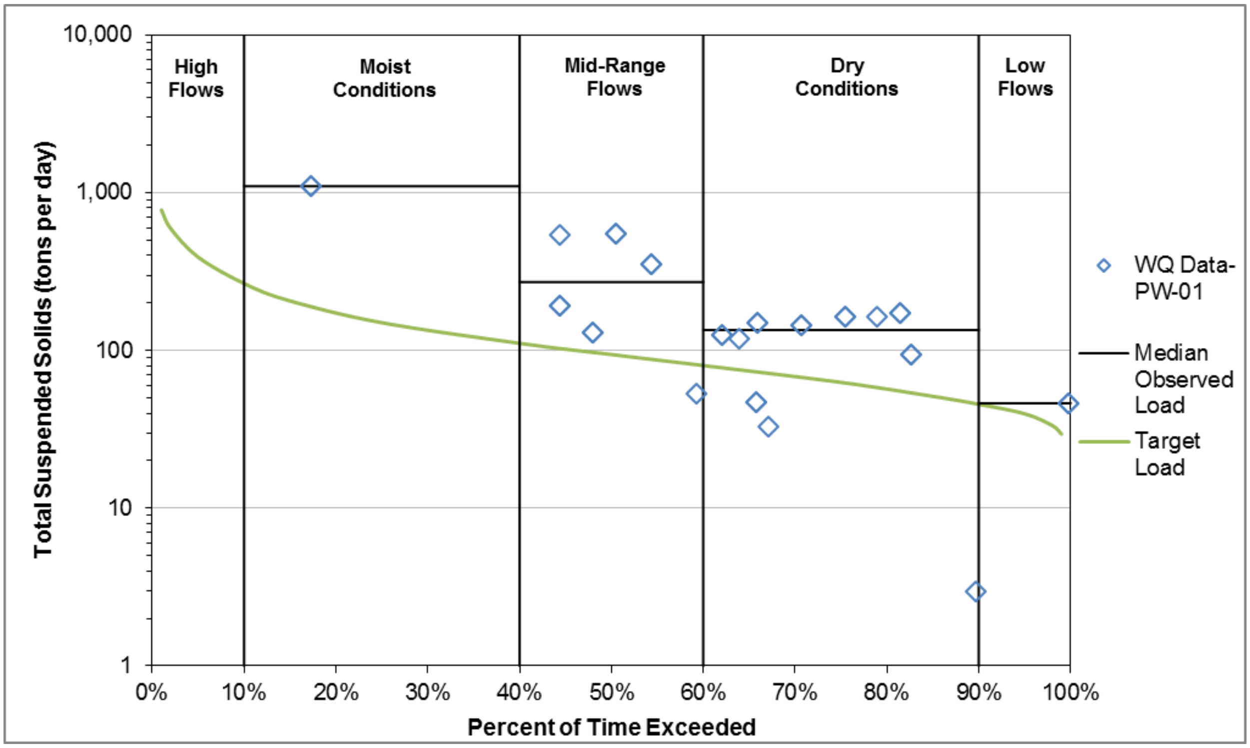


Figure 30. TSS load duration curve, Pecatonica River at PW-01.

Table 36. TSS LRS, Pecatonica River at PW-01

LRS Parameter	Flow Zones				
	High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
	TSS Load (tons per day)				
Boundary Condition at WI State Line	241	93	58	39	24
Load Allocation (Illinois Only)	135	51	33	21	14
MOS (Illinois Only)	15	5.7	3.4	2.5	1.6
Loading Capacity	391	150	94	63	40
Existing Load	-	1,102	271	135	46
Load Reduction [a]	-	86%	65%	53%	14%

a. LRS load reduction is based on the observed median load in each flow regime and the LRS target.

7.2 Pecatonica River (PW-04)

Pecatonica River PW-04 Sedimentation/Siltation and Total Suspended Solids LRS

Figure 31 presents the load duration curve for TSS at the Pecatonica River at the PW-04 and PW-08 assessment sites, and Table 37 summarizes the LRS and required reductions. Data from PW-08 are included in addition to PW-04 because only two samples are available on PW-04. Reductions are needed under mid-range to high flow conditions; data are not available for low flow conditions.

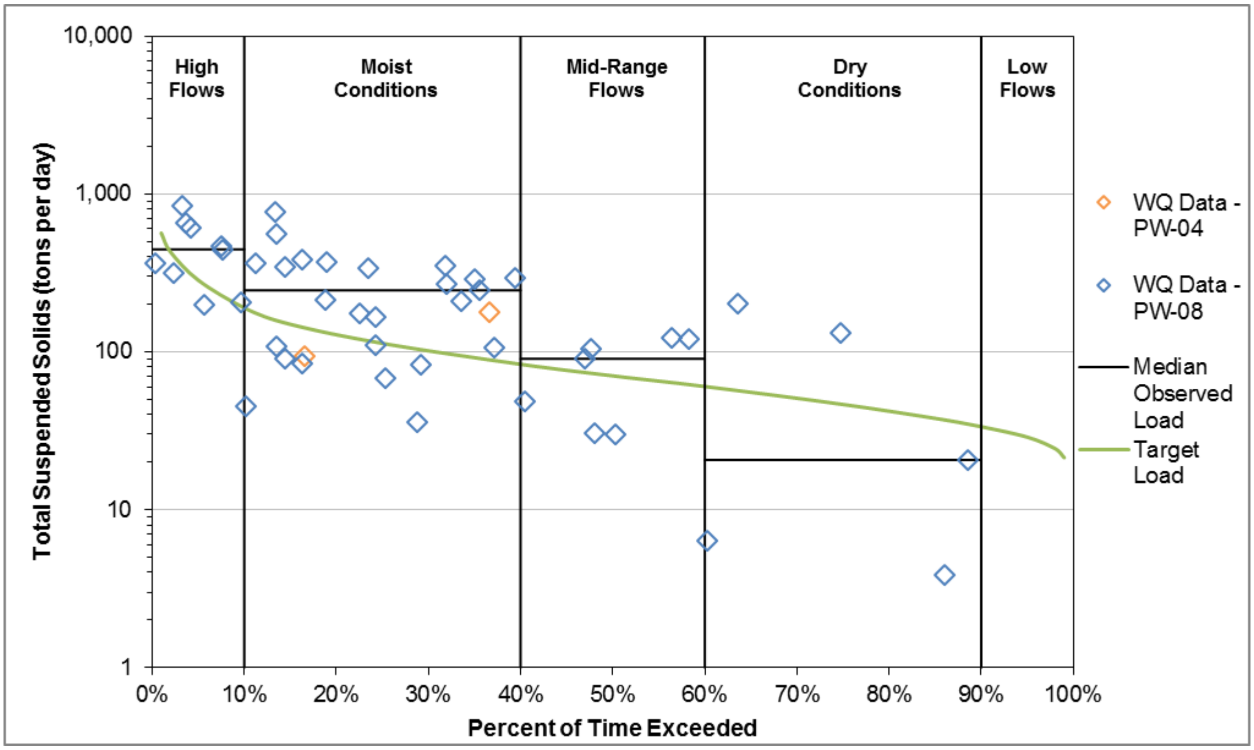


Figure 31. TSS load duration curve, Pecatonica River at PW-04.

Table 37. TSS LRS, Pecatonica River at PW-04

LRS Parameter	Flow Zones				
	High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
	TSS Load (tons per day)				
Boundary Condition at WI State Line	238	94	59	39	24
Load Allocation (Illinois Only)	42	17	10	6.6	4.3
MOS (Illinois Only)	4.7	1.9	1.1	0.74	0.48
Loading Capacity	285	113	70	46	29
Existing Load	445	245	90	21	-
Load Reduction [a]	36%	54%	22%	0%	-

a. LRS load reduction is based on the observed median load in each flow regime and the LRS target.

7.3 Pecatonica River (PW-08)

Pecatonica River PW-08 Fecal Coliform TMDL

Figure 32 presents the load duration curve for fecal coliform at the Pecatonica River at the PW-08 assessment site, and Table 38 summarizes the TMDL and required reductions. Reductions are needed under all flow conditions. Table 39 and Table 40 present the individual fecal coliform WLAs for point sources.

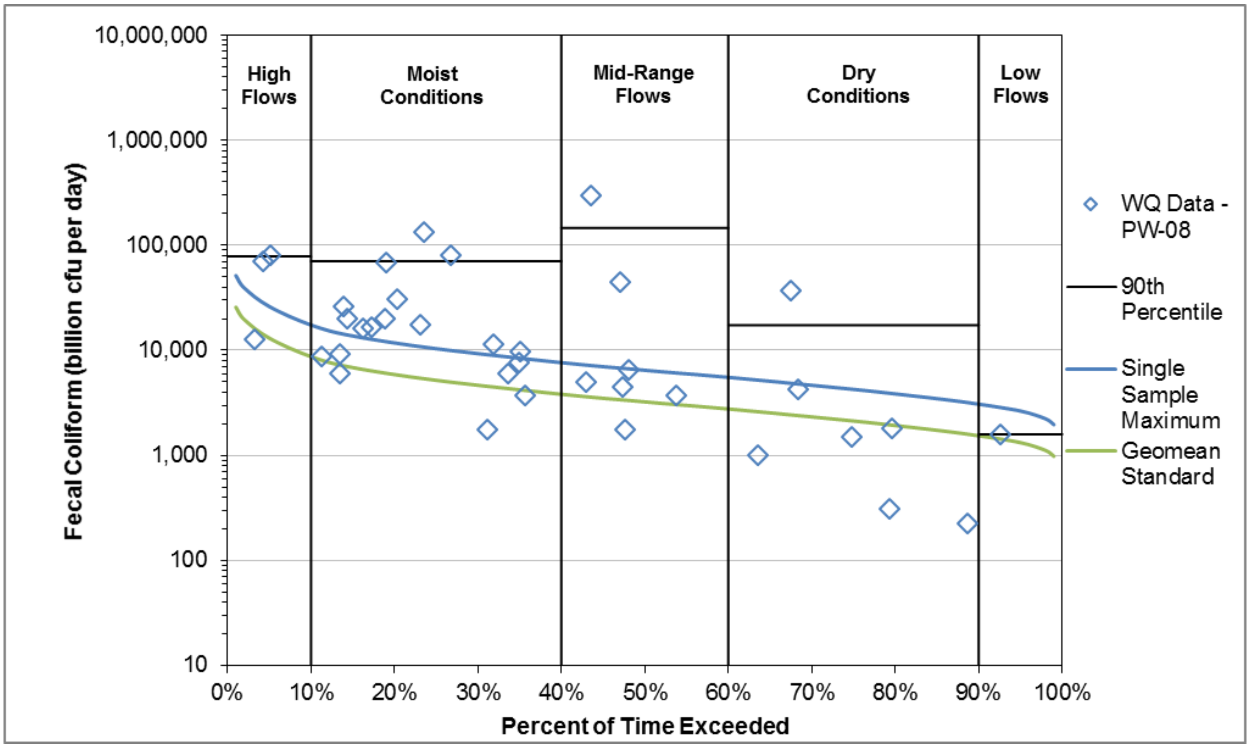


Figure 32. Fecal coliform load duration curve, Pecatonica River at PW-08.

Table 38. Fecal Coliform TMDL, Pecatonica River at PW-08

TMDL Parameter		Flow Zones				
		High Flows	**Moist Conditions**	**Mid-Range Flows**	**Dry Conditions**	**Low Flows**
		Fecal Coliform Load (billion cfu per day)				
Boundary Condition at WI State Line		10,786	4,282	2,666	1,753	1,091
Wasteload Allocation	NPDES Perm. Facility	137	137	56	56	56
	CAFO	0	0	0	0	0
Load Allocation (Illinois Only)		1,914	678	451	278	151
MOS (Illinois Only)		228	90	56	37	23
Loading Capacity		13,065	5,187	3,229	2,124	1,321
Existing Load		78,434	70,505	145,711	17,383	1,588
Load Reduction [a]		83%	93%	98%	88%	17%

a. TMDL reduction is based on the observed 90th percentile load in each flow regime and the geometric mean standard; the instantaneous standard also must be met.

Table 39. Individual NPDES fecal coliform WLAs, Pecatonica River at PW-08

Permit ID	Facility Name	Avg. Design Flow (MGD)	Max. Design Flow (MGD)	Fecal Coliform WLA (billion cfu per day)	
				High Flows and Moist Conditions	Mid-Range to Low Flows
IL0036030	Northern Hills Utility STP	0.06	0.13	1.0	0.5
IL0023591	City of Freeport STP	6.75	16.6	126	51
IL0048259	Village of Winslow – WWTP	0.055	0.137	1.0	0.4
IL0054062	Le-Aqua-Na State Park	0.0031	0.00775	0.06	0.02
IL0026735	Torkelson Cheese Company – Lena	0.1	--	0.8	0.8
ILG580248	Village of Orangeville WWTP	0.2	0.72	5.5	1.5
ILG580136	Cedarville STP	0.1	0.25	1.9	0.8
ILG551062	Stephenson MHP	0.024	0.048	0.4	0.2
IL0065811	Berner Foods, Inc.	0.035	Not reported	0.3	0.3
			Total	**137**	**56**

Table 40. Individual CAFO WLAs, Pecatonica River at PW-08

Permit ID	CAFO Name	Fecal Coliform WLA (billion cfu per day)				
		High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
ILA010071	Eugene Meier Farm	0	0	0	0	0

Pecatonica River PW-08 Sedimentation/Siltation and Total Suspended Solids LRS

Figure 33 presents the load duration curve for TSS at the Pecatonica River at the PW-08 assessment site, and Table 41 summarizes the LRS and required reductions. Reductions are needed under mid-range to high flow conditions; data are not available for low flow conditions.

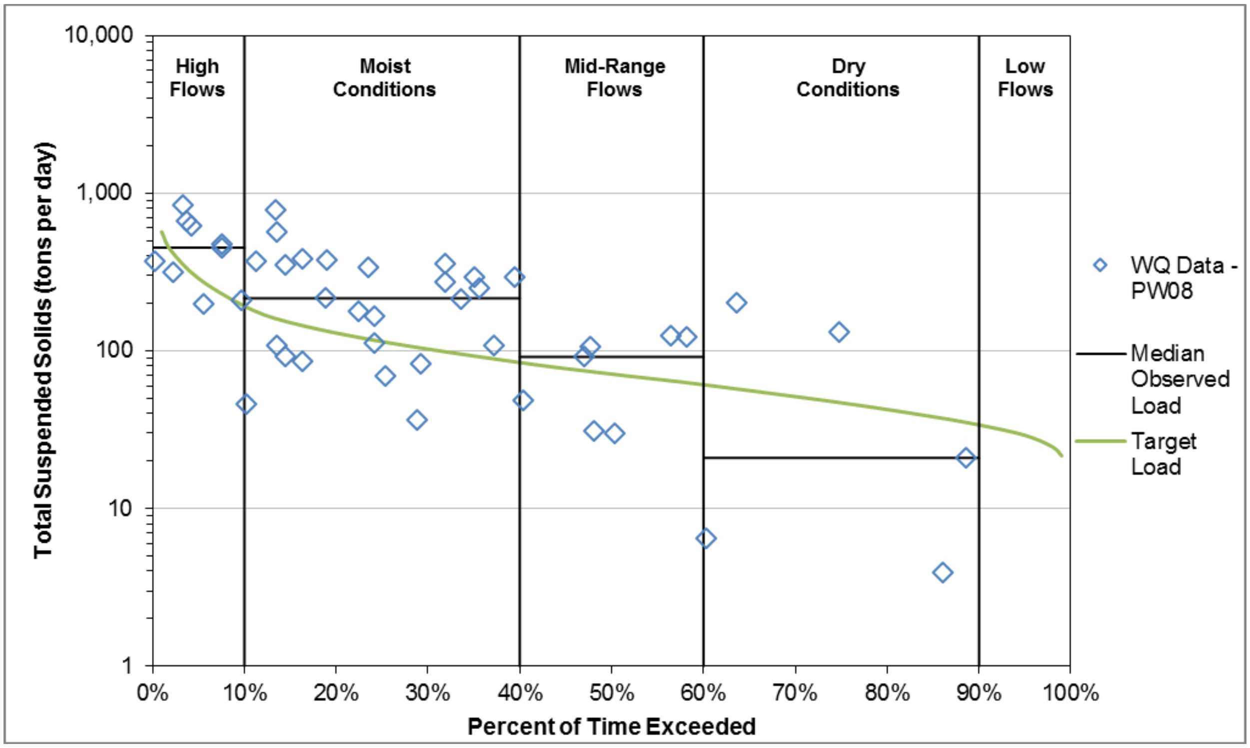


Figure 33. TSS load duration curve, Pecatonica River at PW-08.

Table 41. TSS LRS, Pecatonica River at PW-08

LRS Parameter	Flow Zones				
	High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
	TSS Load (tons per day)				
Boundary Condition at WI State Line	238	94	59	39	24
Load Allocation (Illinois Only)	45	18	11	7.0	4.6
MOS (Illinois Only)	5.0	2.0	1.2	0.78	0.51
Loading Capacity	288	114	71	47	29
Existing Load	451	215	92	21	-
Load Reduction [a]	36%	47%	22%	0%	-

a. LRS load reduction is based on the observed median load in each flow regime and the LRS target.

7.4 Pecatonica River (PW-13)

Pecatonica River PW-13 Fecal Coliform TMDL

Figure 34 presents the load duration curve for fecal coliform at the Pecatonica River at the PW-13 assessment site, and Table 42 summarizes the TMDL and required reductions. Reductions are needed under dry to high flow conditions; data are not available for low flow conditions. Table 43 through Table 45 present the individual fecal coliform WLAs for point sources.

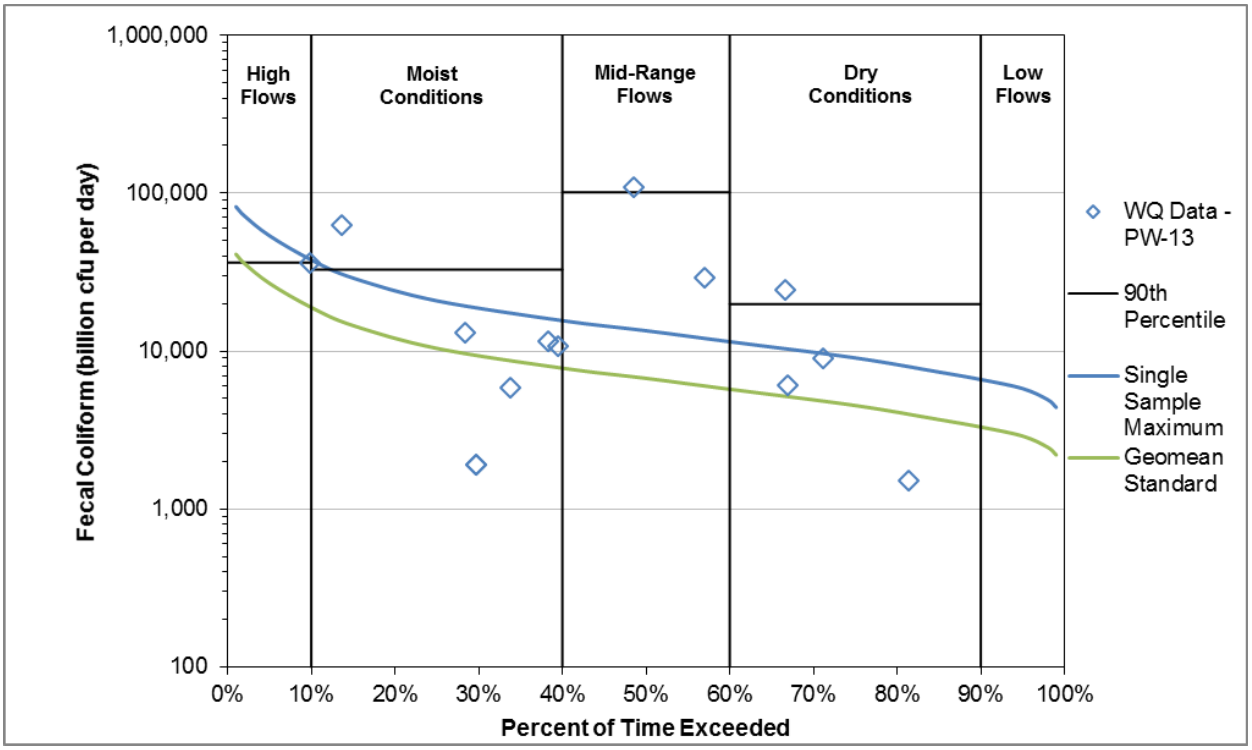


Figure 34. Fecal coliform load duration curve, Pecatonica River at PW-13.

Table 42. Fecal coliform TMDL, Pecatonica River at PW-13

TMDL Parameter		Flow Zones				
		High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
		Fecal Coliform Load (billion cfu per day)				
Boundary Condition at WI State Line		18,778	7,275	4,703	3,164	2,025
Wasteload Allocation	NPDES Perm. Facility	224	224	106	106	106
	MS4	6.4	2.3	1.6	1.0	0.61
	CAFO	0	0	0	0	0
Load Allocation (Illinois Only)		7,046	2,593	1,714	1,119	678
MOS (Illinois Only)		809	313	203	136	87
Loading Capacity [a]		26,863	10,408	6,728	4,526	2,897
Existing Load		36,351	32,837	101,137	19,855	-
Load Reduction [b]		26%	68%	93%	77%	-

a. Loading capacity rounded to a whole number
b. TMDL reduction is based on the observed 90th percentile load in each flow regime and the geometric mean standard; the instantaneous standard also must be met.

Table 43. Individual NPDES fecal coliform waste load allocations, Pecatonica River at PW-13

Permit ID	Facility Name	Avg. Design Flow (MGD)	Max. Design Flow (MGD)	Fecal Coliform WLA (billion cfu per day)	
				High Flows and Moist Conditions	Mid-Range to Low Flows
ILG582019	Durand Sanitary District – STP	0.35	0.45	3.4	2.6
IL0077852	Sugar Shores Camping Resort	0.025	0.1025	0.8	0.2
IL0003204	Titan Tire Corporation of Freeport	2.88	--	22	22
IL0034908	Bay Valley Foods LLC	0.162	--	1.2	1.2
IL0030571	Village of Pecatonica WWTP	0.6	1.65	11	4.5
ILG551070	Westlake Utilities, Inc.	0.25	1	7.6	1.9
IL0048593	Otter Creek Lake Utility District STP	0.4	1	7.6	3.0
ILG580267	Rock City STP	0.04	0.1	0.8	0.3
ILG580278	Village of Davis STP	0.075	0.19	1.4	0.6
IL0048259	Village of Winslow – WWTP	0.055	0.137	1.0	0.4
IL0054062	Le-Aqua-Na State Park	0.0031	0.00775	0.06	0.02
IL0026735	Torkelson Cheese Company – Lena	0.1	--	0.8	0.8
ILG580248	Village of Orangeville WWTP	0.2	0.72	5.5	1.5
ILG580136	Cedarville STP	0.1	0.25	1.9	0.8
ILG551062	Stephenson MHP	0.024	0.048	0.4	0.2
IL0065811	Berner Foods, Inc.	0.035	Not reported	0.3	0.3
IL0036030	Northern Hills Utility STP	0.06	0.13	1.0	0.5
IL0023591	City of Freeport STP	6.75	16.6	126	51
IL0024945	Village of Lena – STP	0.6	1.5	11	4.5
IL0076210	Adkins Energy, LLC	0.062	0.15	1.1	0.5
IL0003476	Nuestro Queso, LLC	0.35	Not reported	2.6	2.6
IL0030562	Village of Pearl City STP	0.101 proposed	0.2563 proposed	1.9	0.8
ILG580021	Shannon STP	0.18	0.45	3.4	1.4
ILG551013	Timber Ridge MHP – Freeport	0.012	0.03	0.2	0.1
IL0028304	Dakota STP	0.1	0.25	1.9	0.8
ILG551061	River Road MHP	0.0378	0.151	1.1	0.3
IL0020672	RRWD - Winnebago WWTP	0.4	1	7.6	3.0
			Total	**224**	**106**

Table 44. Individual MS4 waste load allocations, Pecatonica River at PW-13

Permit ID	Regulated Entity	Fecal Coliform WLA (billion cfu per day)				
		High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
ILR400434	Village of Rockton	0.9	0.3	0.23	0.14	0.09
ILR400475	Village of Winnebago	5.3	1.9	1.30	0.83	0.50
ILR400505	Winnebago County	0.2	0.1	0.05	0.03	0.02
Total		**6.4**	**2.3**	**1.6**	**1.0**	**0.61**

Table 45. Individual CAFO waste load allocations, Pecatonica River at PW-13

Permit ID	CAFO Name	Fecal Coliform WLA (billion cfu per day)				
		High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
ILA010071	Eugene Meier Farm	0	0	0	0	0
ILA010086	Rancho Cantera	0	0	0	0	0

7.5 Raccoon Creek (PWA-01)

Raccoon Creek PWA-01 Fecal Coliform TMDL

Figure 35 presents the load duration curve for fecal coliform at Raccoon Creek at the PWA-02 assessment site, and Table 46 summarizes the TMDL and required reductions. Reductions are needed under dry to moist conditions; data are not available for high or low flows. There are no permitted sources in the watershed.

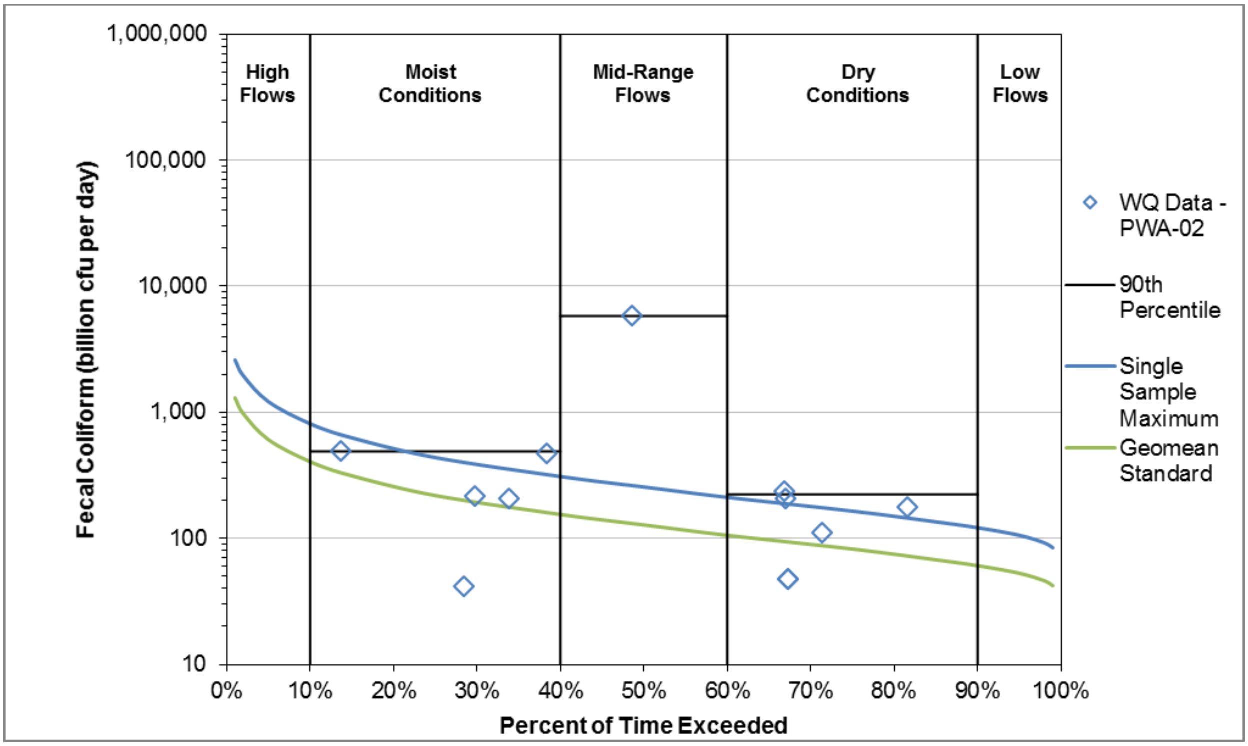


Figure 35. Fecal coliform load duration curve, Raccoon Creek at PWA-01 (flow percentile estimated from nearby USGS gauge 05437050).

Table 46. Fecal coliform TMDL, Raccoon Creek (PWA-01)

TMDL Parameter	Flow Zones				
	High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
	Fecal Coliform Load (billion cfu per day)				
Boundary Condition at WI State Line	465	168	98	63	41
Load Allocation (Illinois Only)	128	46	27	17	11
MOS (Illinois Only)	14	5	3	2	1
Loading Capacity	607	219	128	82	53
Existing Load	-	488	5,803	223	-
Load Reduction [a]	-	55%	98%	63%	-

a. TMDL reduction is based on the observed 90th percentile load in each flow regime and the geometric mean standard; the instantaneous standard also must be met.

7.6 Coolidge Creek (PWF-W-C1)

Coolidge Creek PWF-W-C1 Sedimentation/Siltation and Total Suspended Solids LRS

Figure 36 presents the load duration curve for TSS for Coolidge Creek at the PWF-W-C2 assessment site, and Table 47 summarizes the LRS and required reductions. A reduction is needed under moist conditions, mid-range flows and dry conditions; data are not available under high flows and low flows.

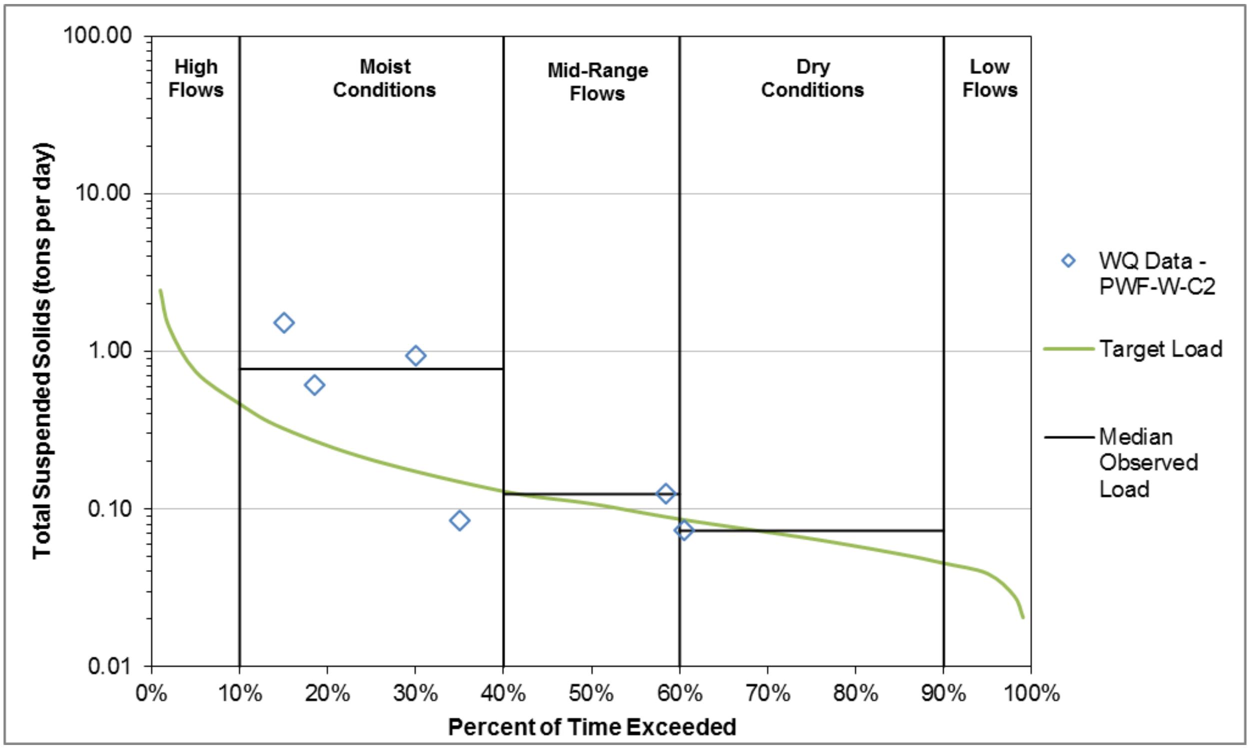


Figure 36. Total suspended solids load duration curve, Coolidge Creek (PWF-W-C1).

Table 47. Total suspended solids LRS, Coolidge Creek (PWF-W-C1)

LRS Parameter	Flow Zones				
	High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
	TSS Load (tons per day)				
Load Allocation	0.67	0.18	0.097	0.058	0.035
MOS	0.074	0.020	0.011	0.0065	0.0039
Loading Capacity	0.74	0.20	0.11	0.065	0.039
Existing Load	-	0.77	0.12	0.073	-
Load Reduction [a]	-	73%	13%	11%	-

a. LRS load reduction is based on the observed median load in each flow regime and the LRS target.

Coolidge Creek PWF-W-C1 Total Phosphorus LRS

Figure 37 presents the load duration curve for TP for Coolidge Creek at the PWF-W-C2 assessment site, and Table 48 summarizes the LRS and required reductions. A reduction is needed under moist conditions, mid-range flows and dry conditions; data are not available under high flows and low flows.

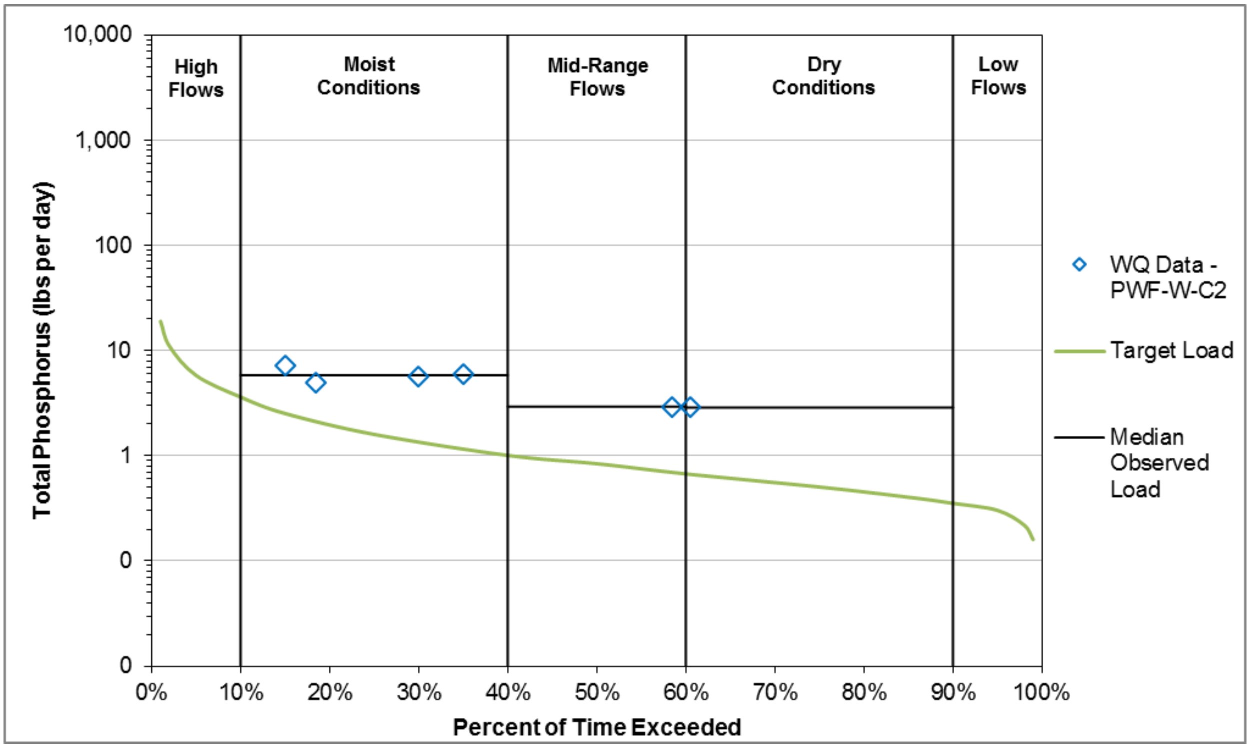


Figure 37. Total phosphorus load duration curve, Coolidge Creek (PWF-W-C1).

Table 48. Total phosphorus LRS, Coolidge Creek (PWF-W-C1)

LRS Parameter	Flow Zones				
	High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
	TP Load (lbs per day)				
Load Allocation	5.2	1.4	0.76	0.45	0.27
MOS	0.58	0.16	0.084	0.050	0.030
Loading Capacity	5.8	1.6	0.84	0.50	0.30
Existing Load	-	5.8	2.9	2.9	-
Load Reduction [a]	-	73%	71%	82%	-

a. LRS load reduction is based on the observed median load in each flow regime and the LRS target.

7.7 Winneshiek Creek (PWL-01)

Winneshiek Creek PWL-01 Total Phosphorus LRS

Figure 38 presents the load duration curve for TP at Winneshiek Creek at the WC-01 assessment site, and Table 49 summarizes the LRS and required reductions. A reduction is needed under moist conditions; data are not available under high flows, dry conditions, and low flows.

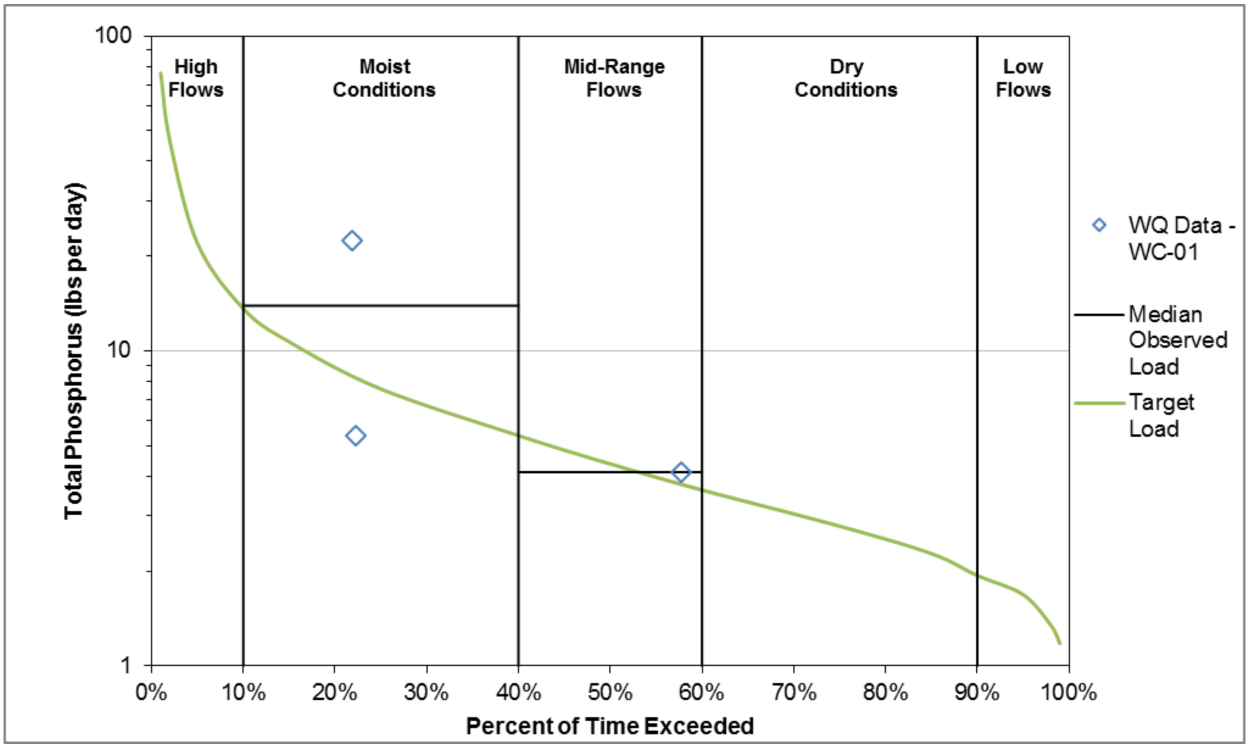


Figure 38. Total phosphorus load duration curve, Winneshiek Creek (PWL-01).

Table 49. Total phosphorus LRS, Winneshiek Creek (PWL-01)

LRS Parameter	Flow Zones				
	High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
	TP Load (lbs per day)				
Load Allocation	20	6.8	4.0	2.5	1.5
MOS	2.2	0.76	0.44	0.28	0.17
Loading Capacity	22	7.6	4.4	2.8	1.7
Existing Load	-	14	4.1	-	-
Load Reduction [a]	-	46%	0%	-	-

a. LRS load reduction is based on the observed median load in each flow regime and the LRS target.

7.8 Yellow Creek (PWN-01)

Yellow Creek PWN-01 Fecal Coliform TMDL

Figure 39 presents the load duration curve for fecal coliform at Yellow Creek at the PWN-01 assessment site, and Table 50 summarizes the TMDL and required reductions. Reductions are needed under dry and moist conditions; data are not available under high flows. Table 51 and Table 52 present the individual fecal coliform WLAs for point sources.

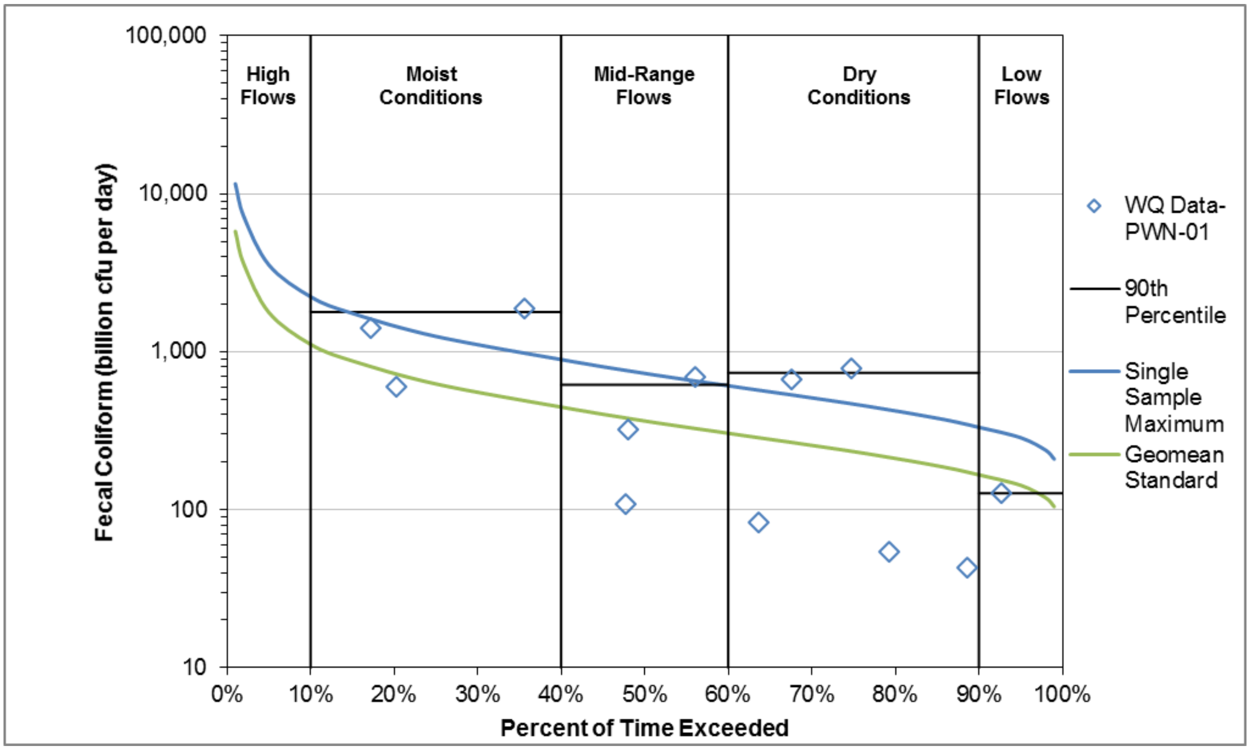


Figure 39. Fecal coliform load duration curve, Yellow Creek at PWN-01 (flow percentiles estimated from nearby USGS gauge 05435500).

Table 50. Fecal Coliform TMDL, Yellow Creek at PWN-01

TMDL Parameter		Flow Zones				
		High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
		Fecal Coliform Load (billion cfu per day)				
Wasteload Allocation	NPDES Perm. Facility	20	20	10	10	10
	CAFO	0	0	0	0	0
Load Allocation		1,579	544	319	200	119
MOS		178	63	37	23	14
Loading Capacity		1,777	627	366	233	143
Existing Load		-	1,789	617	736	127
Load Reduction [a]		-	65%	41%	68%	0%

a. TMDL reduction is based on the observed 90th percentile load in each flow regime and the geometric mean standard; the instantaneous standard also must be met.

Table 51. Individual NPDES fecal coliform waste load allocations, Yellow Creek at PWN-01

Permit ID	Facility Name	Avg. Design Flow (MGD)	Max. Design Flow (MGD)	Fecal Coliform WLA (billion cfu per day)	
				High Flows and Moist Conditions	Mid-Range to Low Flows
IL0024945	Village of Lena – STP	0.6	1.5	11	4.5
IL0076210	Adkins Energy, LLC	0.062	0.15	1.1	0.5
IL0003476	Nuestro Queso, LLC	0.35	Not reported	2.6	2.6
IL0030562	Village of Pearl City STP	0.101 proposed	0.2563 proposed	1.9	0.8
ILG580021	Shannon STP	0.18	0.45	3.4	1.4
ILG551013	Timber Ridge MHP – Freeport	0.012	0.03	0.2	0.1
			Total	**20**	**10**

Table 52. Individual CAFO waste load allocations, Yellow Creek at PWN-01

Permit ID	CAFO Name	Fecal Coliform WLA (billion cfu per day)				
		High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
ILA010086	Rancho Cantera	0	0	0	0	0

7.9 Spring Branch (PWNC)

Spring Branch PWNC Total Phosphorus LRS

Figure 40 presents the load duration curve for TP at Spring Branch at the SB-01 assessment site, and Table 53 summarizes the LRS and required reductions. A reduction is needed under mid-range flows. Data are not available for high flows, dry conditions, and low flows.

Table 53. TP LRS, Spring Branch (PWNC)

LRS Parameter	Flow Zones				
	High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
	TP Load (lbs per day)				
Load Allocation	8.4	2.9	1.6	1.0	0.58
MOS	0.94	0.32	0.18	0.11	0.064
Loading Capacity	9.3	3.2	1.8	1.1	0.64
Existing Load	-	3.0	2.2	-	-
Load Reduction [a]	-	0%	16%	-	-

a. LRS load reduction is based on the observed median load in each flow regime and the LRS target.

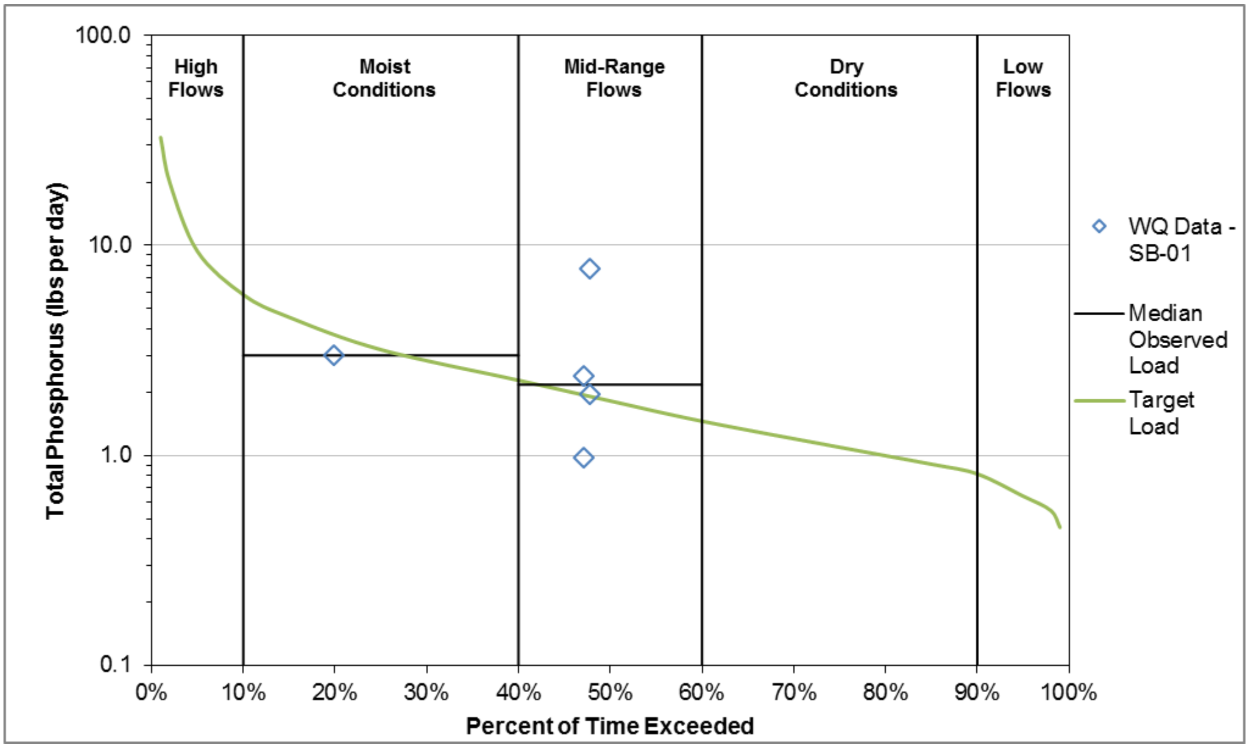


Figure 40. TP load duration curve, Spring Branch (PWNC).

7.10 Lake Le-Aqua-Na (RPA)

Lake Le-Aqua-Na (RPA) Total Phosphorus TMDL

The BATHTUB model was used to develop the total phosphorus TMDL for Lake Le-Aqua-Na. Watershed loads were first estimated with the *Spreadsheet Tool for the Estimation of Pollutant Load* (STEPL) and then calibrated based on the lake response as predicted by the BATHTUB model. The existing load and the WLA for the Le-Aqua-Na State Park point source were estimated using the average design flow (0.0031 million gallons per day [MGD]) and an estimated effluent concentration of 4 mg/L TP. The watershed load represents approximately 97 percent of the total load to the lake, the point source represents two percent, and atmospheric deposition represents less than one percent (Figure 41). An inherent internal load is accounted for in the Bathtub model; this load is not quantified. Existing conditions that include the use of a destratifier to maintain aerobic conditions in the lake appears to sufficiently control the internal load. An overall load reduction of 83 percent is needed to meet the total phosphorus TMDL. Point source load reductions are not anticipated, however monitoring should be conducted to ensure compliance with WLA.

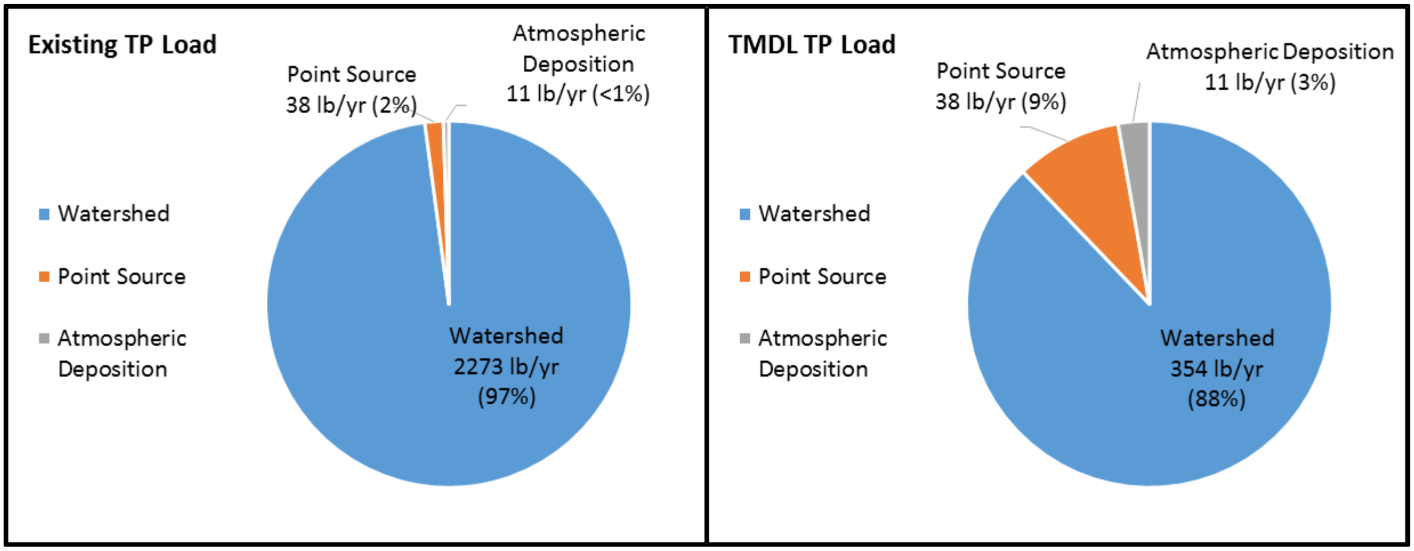


Figure 41. Existing and TMDL phosphorus budgets, Lake Le-Aqua-Na.
The TMDL phosphorus budget reflects a reduction in watershed loading to achieve the TMDL, no reductions to point sources or atmospheric deposition are proposed.

Table 54. Total phosphorus TMDL, Lake Le-Aqua-Na

TMDL Parameter	TP load (lb/yr)	TP load (lb/day)
Load Allocation	325	0.890
WLA (Le-Aqua-Na State Park, IL0054062) [a]	38	0.104
MOS	40.3	0.110
Loading Capacity	403	1.104
Existing Load	2,322	6.362
Load Reduction	83%	83%

a. The WLA for Le-Aqua-Na State Park assumes a TP effluent concentration of 4 mg/L; no reductions in TP relative to existing conditions are anticipated, however monitoring may be required to show compliance with WLA.

Lake Le-Aqua-Na RPA Total Suspended Solids LRS

The lake is currently meeting the TSS LRS target, based on average annual concentrations. The average TSS concentration in the lake is 14 mg/L, and the individual measurements range from 3 to 56 mg/L. At the TSS target of 17 mg/L, the in-lake TP concentration is approximately 0.17 mg/L (Figure 42). An LRS was not specifically developed for TSS; the TP TMDL will ensure that the TSS target will be met. In addition, best management practices that lead to reductions in phosphorus will also lead to reductions in suspended solids.

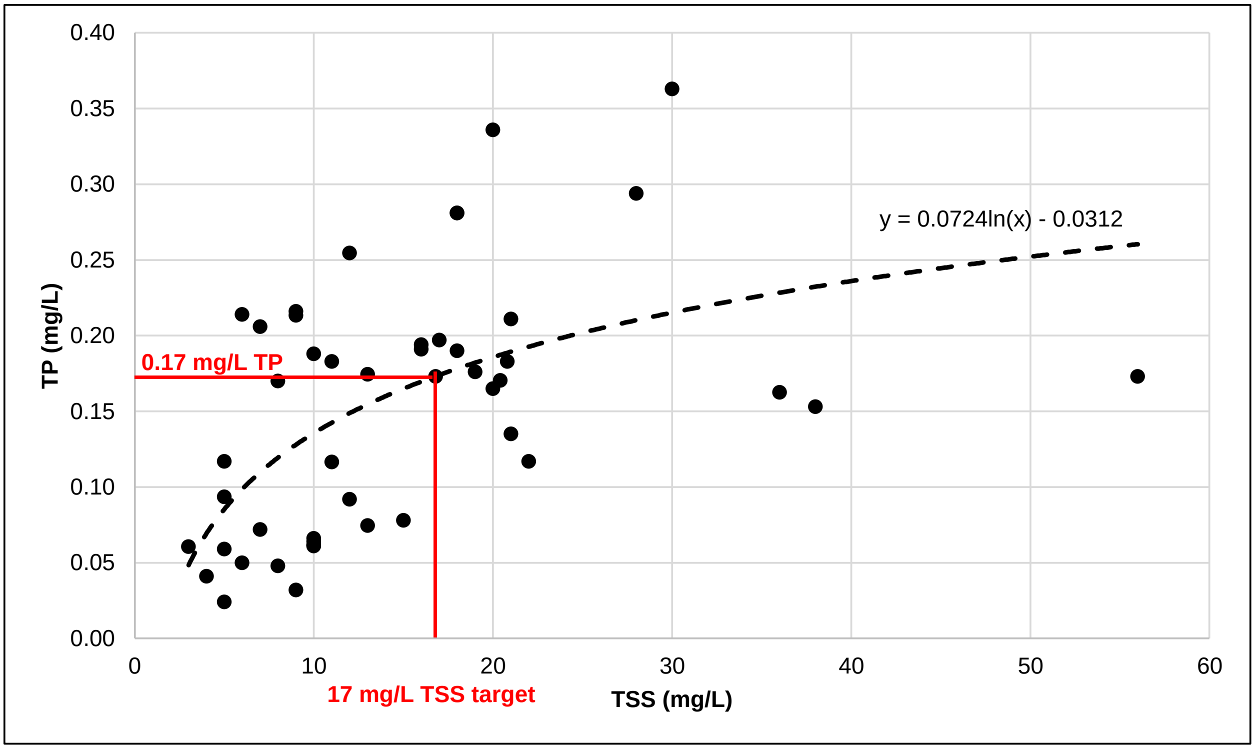


Figure 42. Relationship of total phosphorus and total suspended solids in Lake Le-Aqua-Na.

8. Implementation Plan and Reasonable Assurance

An implementation plan outlines the recommended activities that stakeholders in a watershed can use to help impaired waterbodies attain water quality standards and provides reasonable assurance that required load reductions will be achieved. The implementation plan identifies recommended activities that stakeholders can consider to reduce pollutant loads to meet the TMDL and LRS reductions. Not only will these implementation activities help to achieve the TMDL and LRS target reductions and attain water quality standards, these activities will also result in a cleaner, healthier watershed for the people who depend on the resources of the watershed for their livelihood now and in the future.

8.1 Introduction

An implementation plan is a framework that watershed stakeholders may use to guide implementation of BMPs to address TMDLs and LRSs. This framework is flexible and incorporates adaptive management to allow watershed stakeholders to adjust the implementation plan to align with their priorities and limitations. This flexibility is necessary because the implementation of nonpoint source controls is voluntary. For example, an implementation plan that specifies an exact acreage of cover crops at an exact location be of little use to watershed stakeholders if the farmers at the specified locations are unwilling to use cover crops. Adaptive management is necessary because factors unique to specific localities may yield better or worse results for a certain BMP (or suite of BMPs) and the implementation plan will need to be modified to account for such results.

This implementation plan addresses the following pollutants or response indicators for subwatersheds of the Pecatonica River in Illinois: bacteria, phosphorus, total suspended solids, and sedimentation/siltation. TMDLs and LRSs for these water quality impairments are presented in Section 7 of this report.

Recommended activities that will achieve TMDL and LRS pollutant load reductions are outlined in this implementation plan. Stakeholders can use the TMDL and implementation planning process for developing a watershed based plan to meet U.S. EPA's Nine Minimum Elements for Clean Water Act section 319 funding requirements.

8.1.1 TMDL/LRS Summary

TMDLs were developed for fecal coliform to address impairments to the primary contact recreation use of four segments and for TP to address impairment to the aesthetic quality use of Lake Le-Aqua-Na (Table 28 and Figure 43). LRSs were developed for TSS to address impairments to aquatic life use for three segments and Lake Le-Aqua-Na, and LRS were also developed for TP to address impairments to aquatic life use for three segments. Pollutant reduction goals[1] for the implementation plan include:

- Reduce fecal coliform loads in
  - Pecatonica River by 0 – 98 percent, dependent on impaired segment
  - Raccoon Creek by 55 – 98 percent
  - Yellow Creek by 0 – 68 percent
- Reduce sediment loads in
  - Pecatonica River by 0 - 86 percent, dependent on impaired segment
  - Coolidge Creek by 11 - 73 percent

[1] Pollutant load reductions for river and stream TMDLs and LRS are dependent upon flow regime. As shown in the allocation tables in Section 6, reductions are calculated for each flow duration zone.

- Reduce total phosphorus loads in
    - Coolidge Creek by 71 - 82 percent
    - Lake Le-Aqua-Na by 83 percent
    - Spring Branch 0 - 16 percent
    - Winneshiek Creek by 0 - 46 percent

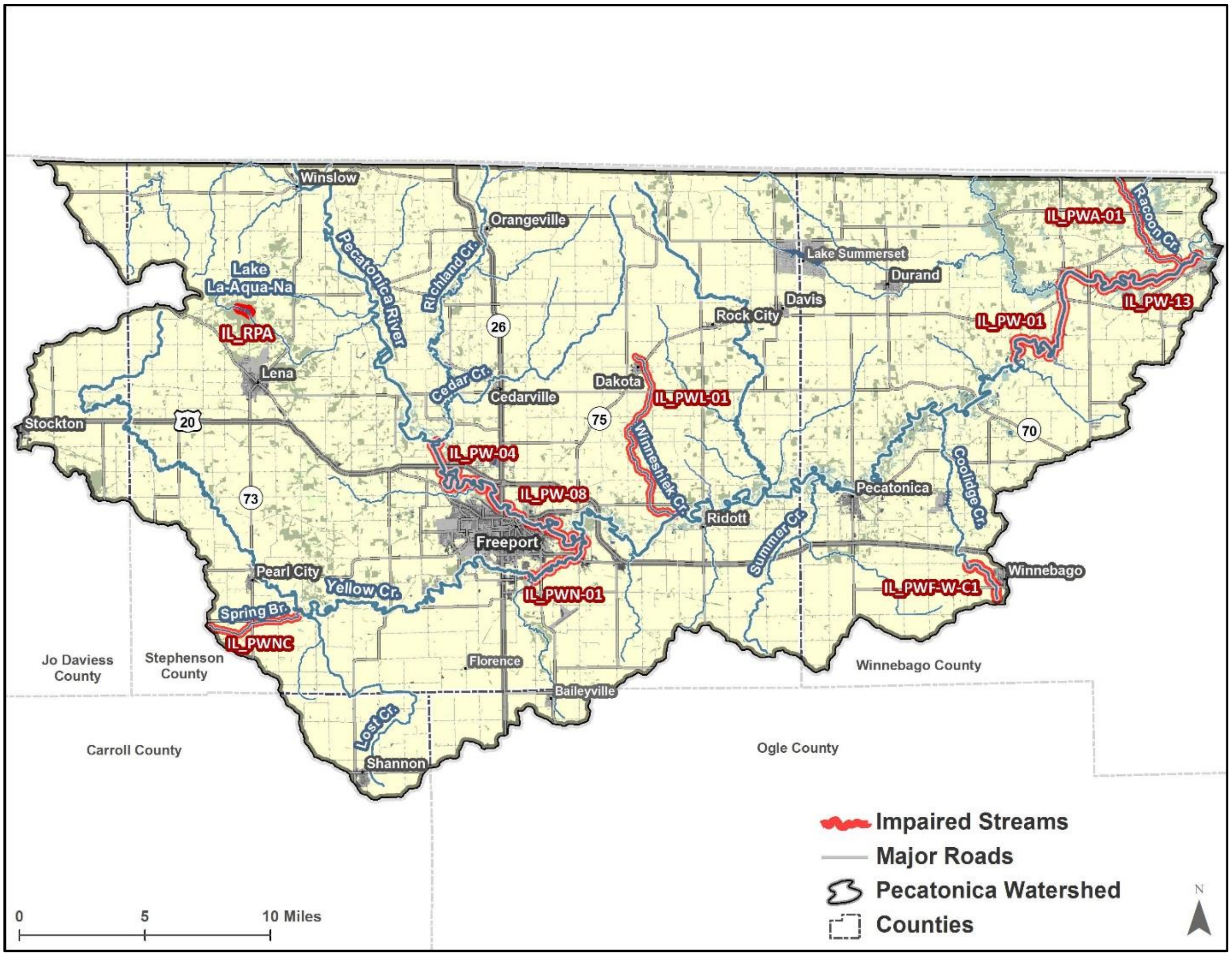


Figure 43. Pecatonica River watershed project area.

8.1.2 Watershed Plan Requirements

An important factor for implementation for the recommended BMPs is access to technical and financial resources. This implementation plan identifies what type of technical and financial resources are needed to undertake the activities recommended for achieving the water quality goals in the watershed. One potential source of funding is the Clean Water Act Section 319 Nonpoint Source Management grants. Section 319 grant funding supports implementation activities including technical and financial assistance, education, training, demonstration projects, and monitoring to assess the success of nonpoint source implementation projects. To be eligible for these funds, watershed management plans must address nine minimum elements identified by U.S. EPA (2008, 2013) as critical for achieving improvements in water quality. These nine minimum elements are listed below:

1. Identification of causes of impairment and pollutant sources or groups of similar sources that need to be controlled to achieve load reductions estimated within the plan
2. Estimate of the load reductions expected from management measures
3. Description of the nonpoint source management measures that will need to be implemented to achieve load reductions estimated in element 2; and identification of critical areas
4. Estimate of the amounts of technical and financial assistance needed, associated costs, and the sources and authorities (e.g., ordinances) that will be relied upon to implement the plan
5. An information and public education component; early and continued encouragement of public involvement in the design and implementation of the plan
6. Implementation schedule
7. A description of interim, measurable milestones for determining whether nonpoint source management measures or other control actions are being implemented
8. Criteria to measure success and reevaluate the plan
9. Monitoring component to evaluate the effectiveness of the implementation efforts over time

The Pecatonica River watershed TMDLs and LRSs, including this implementation plan, is considered a watershed plan that meets U.S. EPA's nine minimum elements. Table 55 illustrates which sections of this report contain information that fulfills U.S. EPA's nine elements.

Table 55. Comparison of Pecatonica River TMDL and LRS study to U.S. EPA's watershed plan nine elements

Section 319 Nine Elements	Applicable Section of the TMDL and LRS Report
1. Identification of **causes of impairment and pollutant sources** or groups of similar sources that need to be controlled to achieve **load reductions** estimated within the plan.	Section 3, 5, and 8.2
2. Estimate of the **load reductions expected from management measures**	Section 8.4 and 8.5
3. Description of the **nonpoint source management measures** that will need to be implemented to **achieve load reductions** estimated in element 2; and identification of **critical areas**	Section 8.3, 8.4 and 8.5
4. Estimate of the amounts of **technical and financial assistance needed**, associated **costs**, and the **sources and authorities** (e.g., ordinances) that will be relied upon to implement the plan.	Section 8.5 and 8.8
5. An **information and public education component**; early and continued encouragement of public involvement in the design and implementation of the plan.	Section 8.7

Section 319 Nine Elements	Applicable Section of the TMDL and LRS Report
6. **Implementation schedule**	Section 8.5.2
7. A description of **interim, measurable milestones** for determining whether nonpoint source management measures or other control actions are being implemented.	Section 8.5.2
8. Criteria to **measure success** and **reevaluate** the plan	Section 8.6
9. **Monitoring component** to evaluate the effectiveness of the implementation efforts over time	Section 8.9

8.2 Pollutant Sources

Achieving water quality goals in the Pecatonica River watershed will focus on addressing the primary pollutants and sources presented in Table 56 and as described in Section 3. These sources are contributing to impairments, and as such need to be managed in a way that will reduce pollutant loadings and other effects. Both nonpoint and point sources are described in this section, however only nonpoint sources are further evaluated as part of this implementation plan.

Table 56. Primary sources (by pollutant) to be addressed

Fecal coliform	Sedimentation/siltation	Phosphorus
• Livestock with access to riparian areas • Livestock feeding operations • Municipal point source dischargers • On-site wastewater treatment systems • Urban stormwater	• Crop production • Livestock with access to riparian areas • Stream channel erosion • Urban stormwater	• Crop production • Livestock with access to riparian areas • Livestock feeding operations • Municipal point source dischargers • On-site wastewater treatment systems • Urban stormwater

8.2.1 Nonpoint Sources

The *Spreadsheet Tool for the Estimation of Pollutant Load* (STEPL) model is used to quantify watershed loadings and load reductions for various BMPs in this plan. STEPL provides a simplified simulation of precipitation-driven runoff and sediment and nutrient delivery. STEPL has been used extensively in U.S. EPA Region 5 for watershed plan development and in support of watershed studies. STEPL was used to model each HUC12 in the Pecatonica River watershed (Figure 44). The model is based primarily on land cover and also incorporates livestock and septic systems. Existing BMPs and point sources are not included in the model setup.

STEPL loading results are summarized for each HUC12 watershed in Appendix D. Watershed yields (watershed load divided by watershed area) are summarized in Figure 45 and Figure 46 for total phosphorus (pounds per acre per year) and sediment (tons per acre per year), respectively. These values normalize for area, and are therefore comparable. Yields highlight those subwatersheds that are discharging a disproportionate amount of the pollutant load.

Annual loads by source category are provided in Figure 47 and Figure 48 for phosphorus and sediment, respectively. Segment PW-13, located at the outlet of the watershed, is representative of loading from the entire watershed. Based upon STEPL modeling, the dominant nonpoint source of phosphorus and sediment is cropland. Pasture is often the second largest source of TSS but yields far smaller loads than cropland. STEPL TSS results indicate that normalized loads are generally larger in the tributaries of Pecatonica River than in segments of the mainstem Pecatonica River.

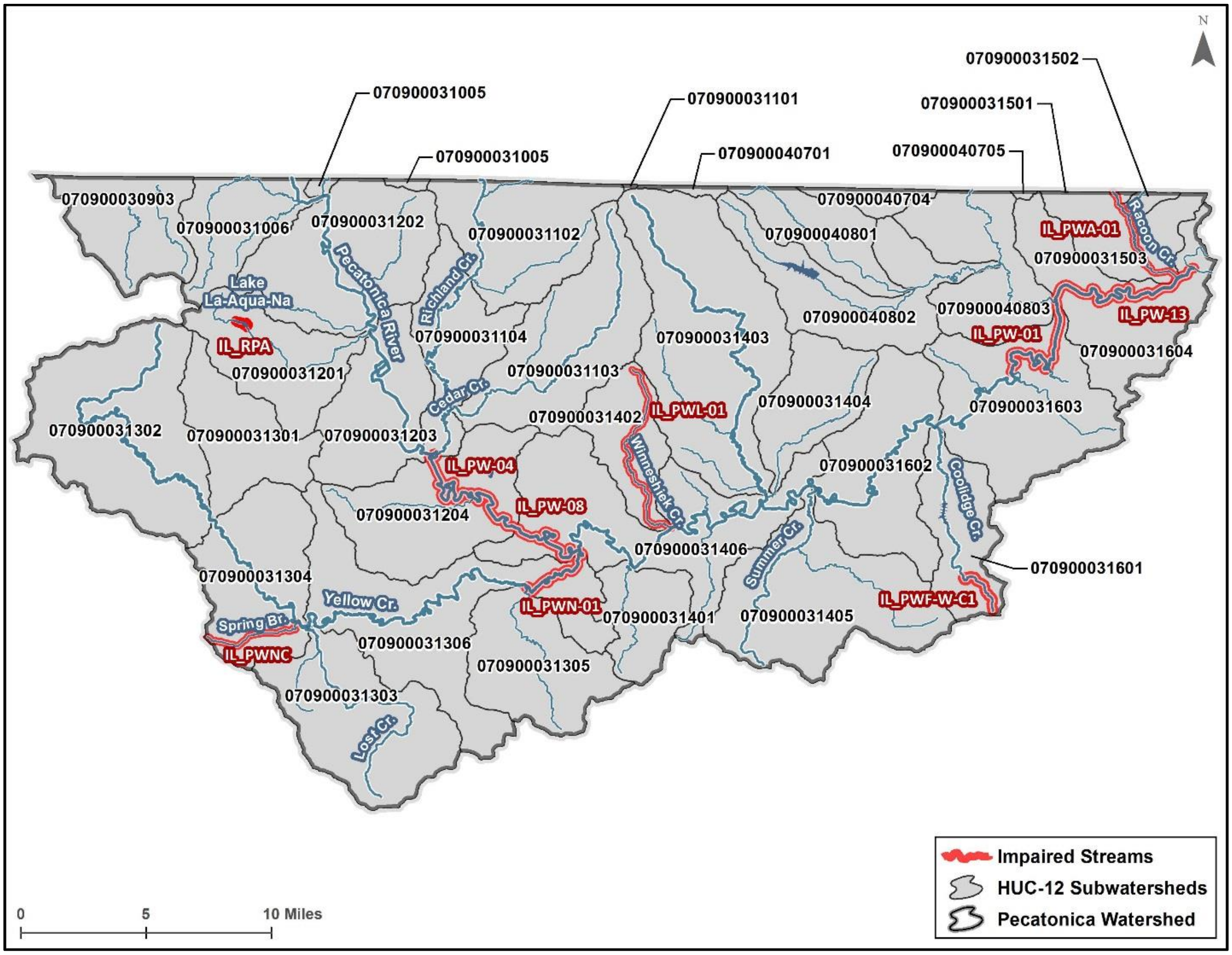


Figure 44. HUC12 subwatersheds in the Pecatonica River watershed.

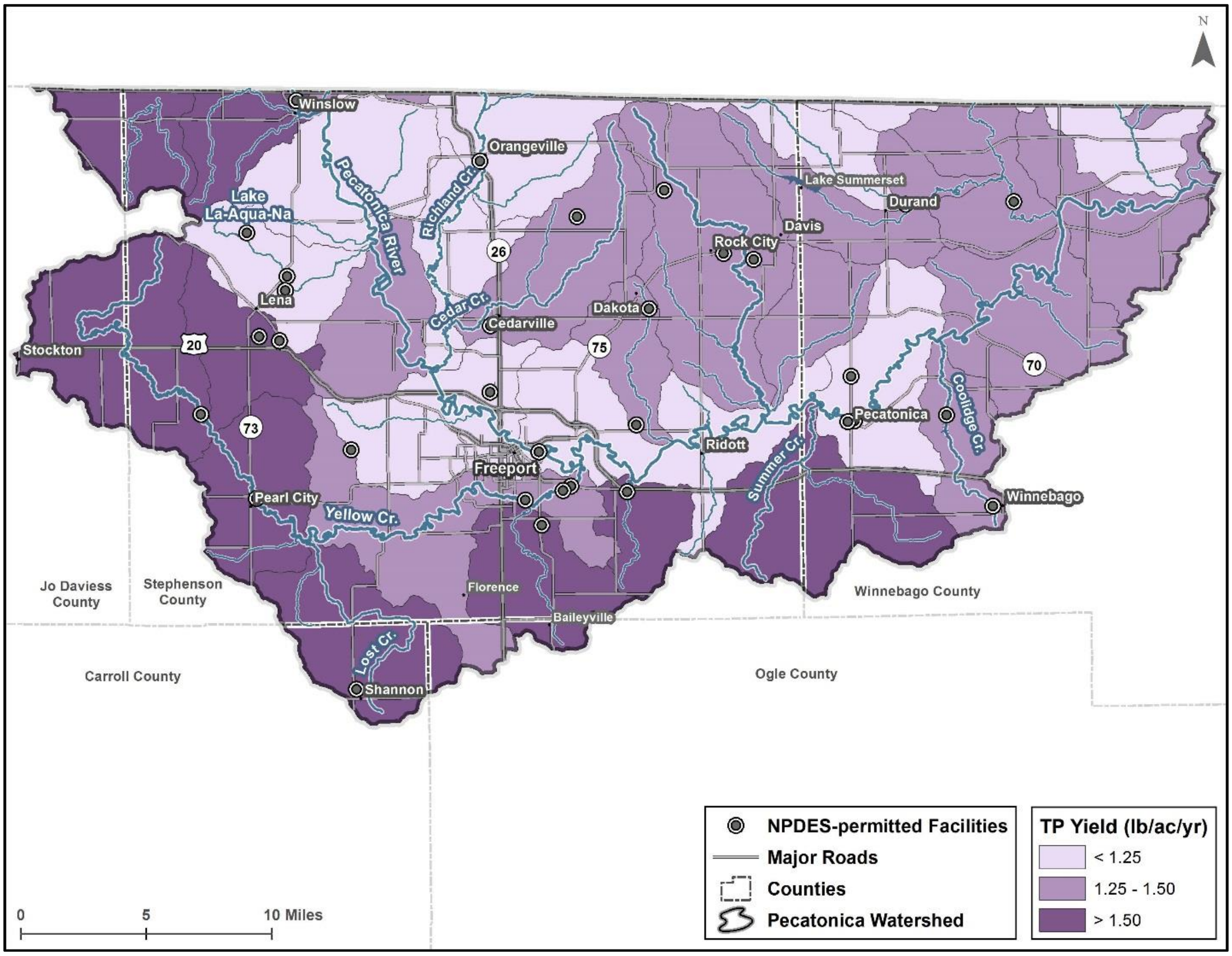


Figure 45. Phosphorus yields and municipal point sources.

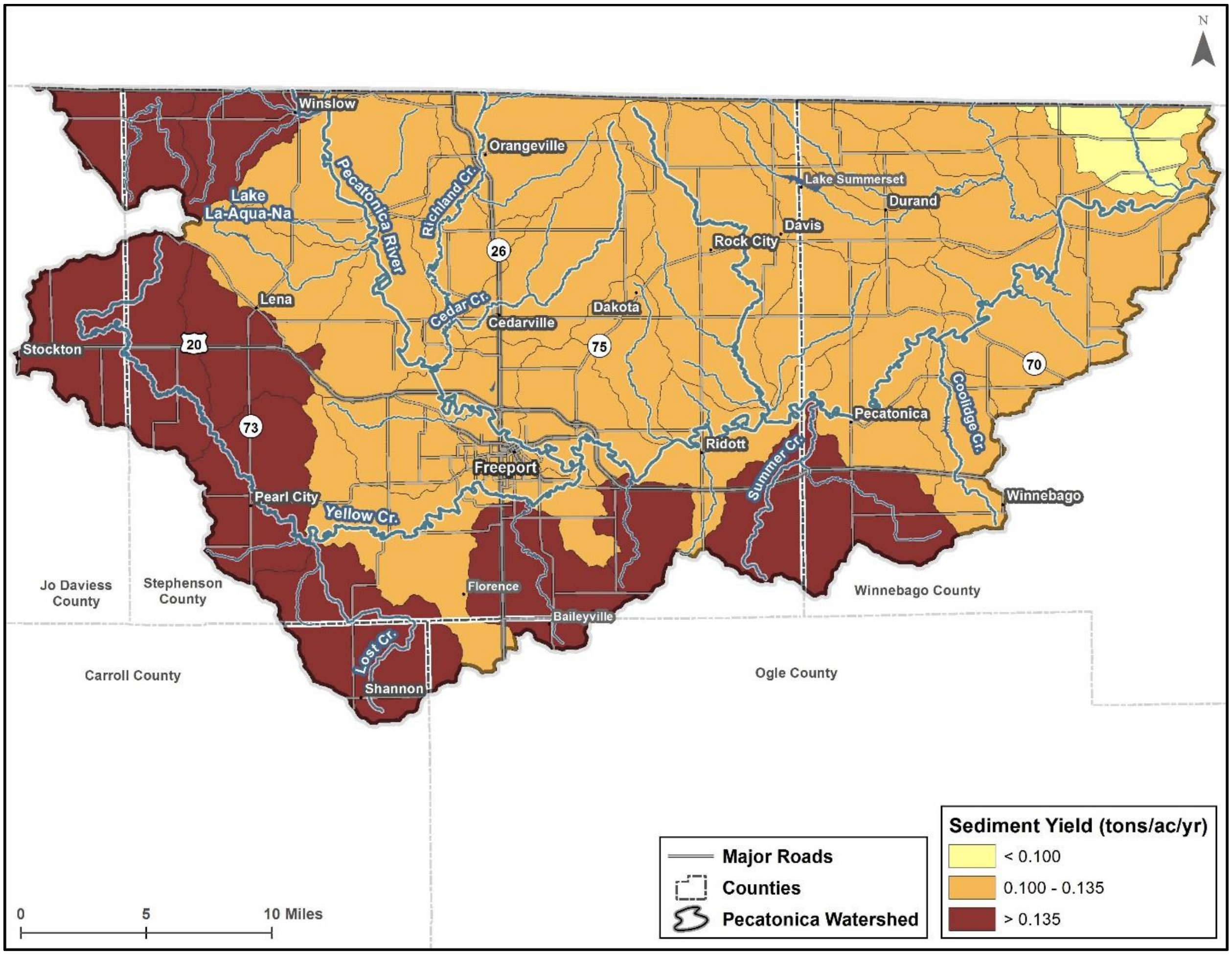


Figure 46. Sediment yields.

Figure 47. STEPL relative annual phosphorus results by nonpoint source.

Note: A zero percent (“0%”) indicates a non-zero percent less than 0.5 percent.

Figure 48. STEPL relative annual TSS results by nonpoint source.

STEPL does not estimate fecal coliform loading or reductions, therefore a qualitative approach is used to identify significant point and nonpoint sources. Point sources include municipal point sources dischargers (e.g., WWTPs) and urban stormwater. Nonpoint sources of fecal coliform are livestock (feedlots, access to streams, manure management) and on-site wastewater treatment systems. Figure 49 summarizes the locations of WWTPs and impervious areas; the location of other potential sources is unknown.

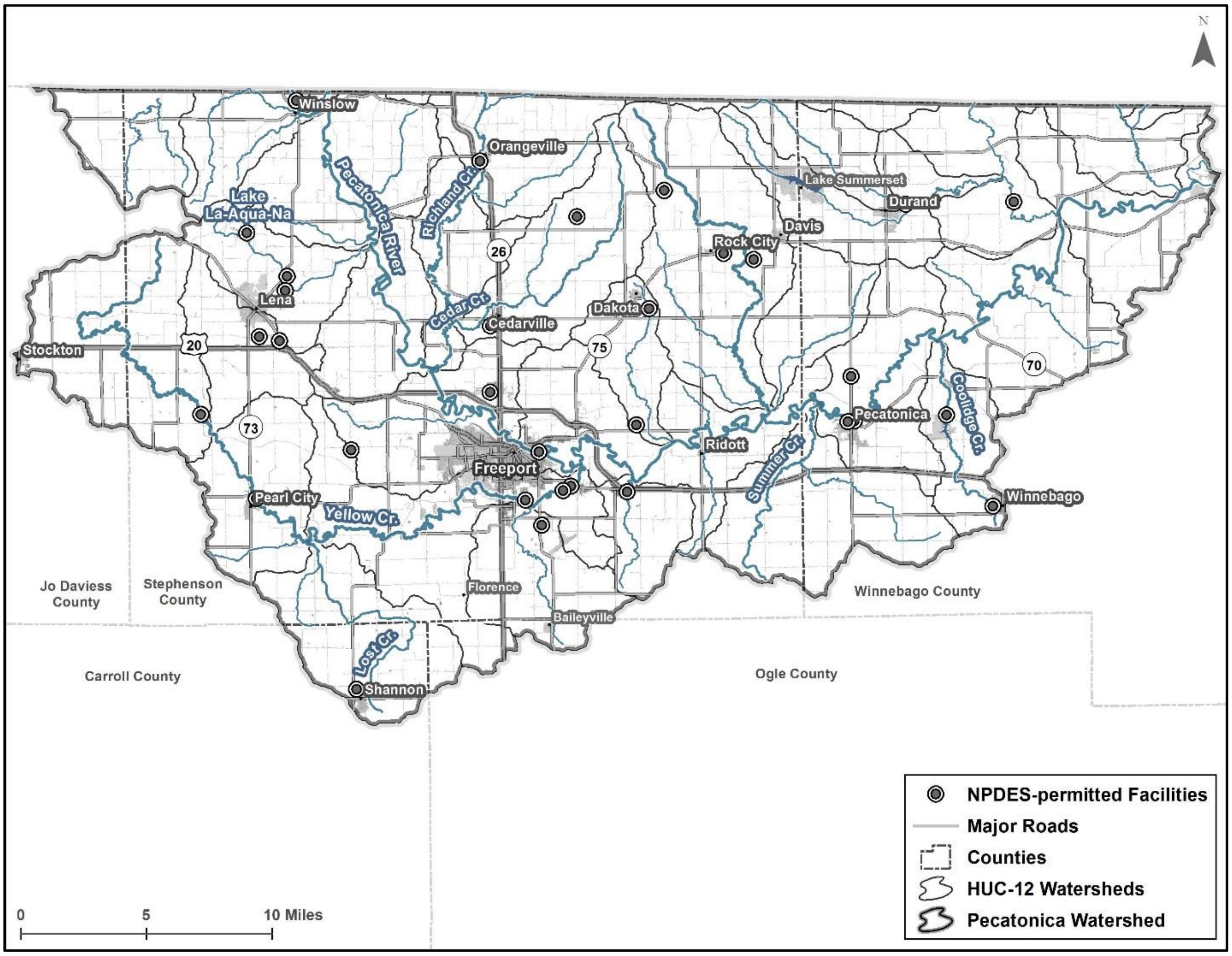


Figure 49. Fecal coliform sources with known locations.

8.2.2 Municipal Point Source Dischargers

Thirty-two facilities are covered by NPDES permits in the Pecatonica River watershed project area. Permitted discharges may be contributing to specific impairments within the watershed. Specific to implementation, disinfection exemptions will be reviewed and evaluated as well as point source discharges of phosphorus into Coolidge Creek.

Seven WWTPs have disinfection exemptions in the watershed which allow a facility to discharge wastewater without disinfection. Each facility should be meeting the geometric mean standard of 200 colony forming units per 100 milliliters at the end of their respective disinfection exempted stream reach, as identified in the permits under all flow conditions. Facilities directly discharging into an impaired segment can have their year-round disinfection exemption revoked through future NPDES permitting actions. Monitoring requirements may be included as a condition in the NPDES permit upon renewal. Following this monitoring, Illinois EPA will evaluate the need for point source controls through the NPDES permitting program. Fecal coliform permit violations have been reported within the watershed; ensuring compliance with permits is a high priority.

During 2015, discharge monitoring reports indicated that the WWTP in Winnebago (IL0020672) discharged phosphorus concentrations between 2.15 mg/L and 8.24 mg/L with an average reported value of 3.56 mg/L. The resulting phosphorus load from the facility is well above the assimilative capacity of Coolidge Creek. IEPA understands that in the future, the Winnebago WWTP will no longer discharge into Coolidge Creek as construction of pumping and transporting facilities are underway to divert the flow from the Winnebago WWTP to Rock River Water Reclamation District. At that time, monitoring of the stream should be conducted to determine if the impairment still exists, and if it does, nonpoint source reductions would then be recommended.

8.3 Critical Areas

Successful implementation begins with identifying and focusing resources in critical areas. In this case, critical areas are those areas where there is a high risk for delivery of pollutant loads to impaired streams and waters of concern. Critical areas are the focus of outcome-based plans because they represent those locations where project funding will provide the greatest environmental benefit. The critical area analysis recognizes that achieving needed bacteria, nutrient, and sediment reductions requires a mix of practices across multiple landscapes. In this case, critical areas are not provided at a site-specific scale, but rather form the initial steps in a multi-scale approach that begins with the larger watershed and eventually leads to site-specific recommendations over time. Nonpoint sources, with a particular emphasis on sediment, are contributing to impairment the entire Pecatonica River watershed upstream of the lowest segment PW-13.

Critical areas are determined on a HUC12 watershed scale based on a set of indicators (Table 57). For each indicator, a score is assigned between 1 and 3; 3 indicates the highest values, and therefore, the highest priorities. Watershed yield is weighted to allow for more influence in the overall score. Appendix E includes the indicator values and scores for each HUC12. Primary and secondary critical areas are provided in Figure 50; primary critical areas are the highest priority areas for BMP implementation. Secondary critical areas rank second highest.

Table 57. Critical area indicators

Indicator	Description
Watershed Yield	Per acre pollutant yield generated from STEPL modeling identifies HUC12 watersheds with disproportionate loading rates.
Presence of Impaired Segment	Impaired segments typically represent the highest stressed areas.
Total Stream Length	Used as indicator of watershed connectivity. Higher connectivity indicates higher potential for pollutant loading (e.g., livestock access, streambank erosion).

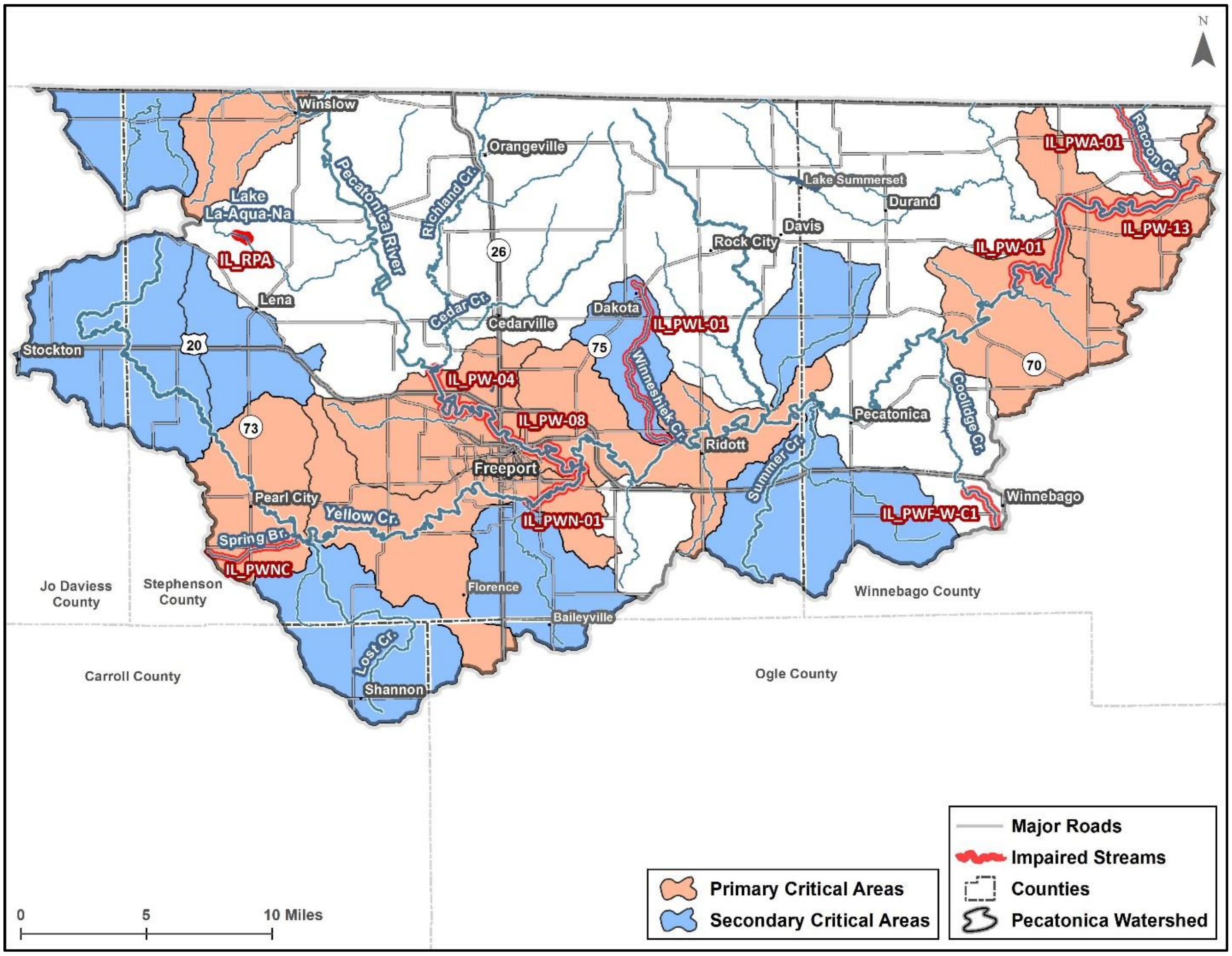


Figure 50. Critical areas.

As new information in the Pecatonica River watershed project area becomes available (e.g., existing BMPs, their location within the appropriate critical area, and their pollutant reduction effectiveness), the analysis can be refined to reflect other implementation needs. In addition, as new information becomes available as part of watershed planning projects, critical areas can be further refined to reflect local stakeholder priorities.

Critical areas present opportunities to develop smaller-scale implementation plans that can include field-based observations and landowner involvement. For example, a watershed action plan was completed recently for the Spring Brook (PWNC) watershed. This watershed action plan provides detailed information on existing BMPs and potential projects within that small watershed and was developed through landowner and stakeholder input (Olson Ecological Solutions 2016). These smaller-scale implementation plans will help to refine site-specific implementation activities and focus resources.

8.4 Best Management Practices

Within the watershed planning framework, candidate BMPs are identified and then evaluated to determine which BMPs will best address the causes and sources of pollutant loads. For watersheds with multiple causes and sources of multiple pollutants, like the Pecatonica River watershed project area, suites of BMPs must be identified and evaluated. Fecal coliform load reductions are necessary in the Pecatonica River, Raccoon Creek, and Yellow Creek watersheds, while TP load reductions are necessary in Coolidge

Creek, Lake Le-aqua-Na, Spring Branch, and Winneshiek Creek watersheds, and TSS load reductions are necessary in Coolidge Creek and the greater Pecatonica River watersheds. Because the percent load reductions needed to achieve the TMDLs are so high (i.e., up to 98 percent for fecal coliform, up to 83 percent for TP, and up to 86 percent for TSS), successful implementation will likely involve multiple BMPs targeting multiple sources in priority areas throughout the watersheds. There are many different BMPs that can be used to achieve pollutant load reductions. Common BMPs are provided below, including potential reductions, by source category. Other BMPs such as conservation easements, forestry practices, constructed wetlands and floodplain restoration, amongst others, can also be used to meet pollutant reduction requirements.

8.4.1 Crop Production

Agricultural runoff is an important source of TP and TSS loading to impaired segments in the Pecatonica River watershed. Agricultural practices such as crop cultivation (68 percent) and pasture/hay (15 percent) cover an estimated 83 percent of the project area. Much of the cropland in the Pecatonica River watershed is tiled and most stream segments have little to no riparian buffers. Drain tiles transport agricultural runoff directly to ditches and streams, whereas runoff flowing over the land surface may infiltrate to the subsurface and may flow through vegetated riparian areas. The main pollutants of concern associated with agricultural runoff are sediment, nutrients, and pesticides.

Cropland BMPs to address TP or TSS loading are presented in the following subsections and the estimated reductions are summarized in Table 58. A subset of the management practices provided in the Illinois Nutrient Loss Reduction Strategy (NLRS) are included for use in the Pecatonica River watershed. Other management practices can also be used to achieve the goals of the TMDL and this plan. The Illinois Council on Best Management Practices provides additional information on these and other BMPs (http://illinoiscbmp.org/).

Table 58. Potential reductions of loading from crop production

BMP	Phosphorus reduction	Sediment reduction
Conservation tillage	50% [a]	50% [a]
Cover crops	30% [a]	50% [a]
Riparian buffers and filter strips	25-50% [a]	25% [b]
Fertilizer management (P rate reduction)	7% [a]	--

a. Source: Illinois NLRS
b. Estimated from phosphorus reduction

Conservation Tillage

The Illinois NLRS identifies reduced or conservation tillage as a primary best management practice to control erosion and phosphorus loading. The IAH (2002) defines conservation tillage as any tillage practice that results in at least 30 percent coverage of the soil surface by crop residuals after planting. Several practices are commonly used to maintain the suggested 30 percent cover:

- **No-till** systems disturb only a small row of soil during planting, and typically use a drill or knife to plant seeds below the soil surface.
- **Strip till** operations leave the areas between rows undisturbed, but remove residual cover above the seed to allow for proper moisture and temperature conditions for seed germination.
- **Ridge till** systems leave the soil undisturbed between harvest and planting: cultivation during the growing season is used to form ridges around growing plants. During or prior to the next planting, the top half to two inches of soil, residuals, and weed seeds are removed, leaving a relatively moist seed bed.
- **Mulch till** systems are any practice that results in at least 30 percent residual surface cover, excluding no-till and ridge till systems.

Corn residues are more durable and capable of sustaining the required 30 percent cover required for conservation tillage. Soybeans generate less residue, the residue degrades more quickly, and supplemental measures or special care may be necessary to meet the 30 percent cover requirement.

Cover Crops

Winter cover crops are identified in the NLRS as an important management practice to reduce erosion and phosphorus loading. Grasses and legumes may be used as winter cover crops to reduce soil erosion and improve soil quality. These crops also contribute nitrogen to the following crop. Grasses tend to have low seed costs and establish relatively quickly, but can impede cash crop development by drying out the soil surface or releasing chemicals during decomposition that may inhibit the growth of a following cash crop. Legumes take longer to establish, but are capable of fixing nitrogen from the atmosphere, thus reducing nitrogen fertilization required for the next cash crop. Legumes, however, are more susceptible to harsh winter environments and may not have adequate survival to offer sufficient erosion protection. Planting the cash crop in wet soil that is covered by heavy surface residue from the cover crop may impede emergence by prolonging wet, cool soil conditions. Cover crops should be killed off two or three weeks prior to planting the cash crop either by application of herbicide or mowing and incorporation, depending on the tillage practices used.

Riparian Buffers and Filter Strips

Riparian buffers provide many benefits and can effectively address water quality degradation. Riparian buffers that include perennial vegetation and trees can filter runoff from adjacent cropland, provide shade and habitat for wildlife, and reinforce streambanks to minimize erosion. The root structure of the vegetation in a buffer enhances infiltration of runoff and subsequent trapping of pollutants. However, buffers are only effective in this manner when the runoff enters the buffer as a slow moving, shallow "sheet"; concentrated flow in a ditch or gully, will quickly pass through the buffer offering minimal opportunity for retention and uptake of pollutants. Similarly, tile lines can often allow water to bypass a buffer, thus reducing its effectiveness. The NLRS suggests a 35-foot wide buffer.

Fertilizer Management

Fertilizer phosphorus rate reduction on fields with soil test phosphorus above the recommended maintenance level is an important BMP for reducing phosphorus loading from excess fertilization. Fertilizer management should address application rates, methods, and timing as described in the NLRS and according to the 4Rs – Right Source, Right Rate, at the Right Time, and in the Right Place nutrient stewardship program. Additional information on the 4R program can be found at http://www.keepit4rcrop.org/. The Illinois Agronomy Handbook (IAH) lists guidelines for fertilizer application rates based on the inherent properties of the soil (typical regional soil phosphorus concentrations, root penetration, pH, etc.), the starting soil test phosphorus concentration for the field, and the crop type and expected yield (IAH 2002).

Application to frozen ground or snow cover should be strongly discouraged. Researchers studying loads from agricultural fields in east-central Illinois found that fertilizer application to frozen ground or snow followed by a rain event could transport 40 percent of the total annual phosphorus load (Gentry et al. 2007).

8.4.2 Stream Channel Erosion

In addition to sedimentation/siltation derived from crop production, erosion on the banks and beds of tributary streams has been identified as a potential source of pollutants. Stream channel erosion not only causes sedimentation but also contributes to the phosphorus loading to the watershed. Several BMPs are appropriate to stabilize stream channels impacted by erosion. Such BMPs include engineering controls, vegetative stabilization, and restoration of riparian areas.

- **Engineering controls** include armoring with materials that straighten the banks and deflection of the water course with rock or log structures.
- **Vegetative stabilization** and **restoration of riparian areas** can reduce peak flows from runoff areas and channel velocities directing runoff. Using vegetative controls also enhance infiltration, which reduces high flows that cause erosion. Installation of filter strips and grassed waterways and restoration of riparian buffers were previously discussed.

Streambank stabilization can result in 75 percent reduction in phosphorus and sediment loading based on EPA's STEPL model. Selection of BMPs and costs will depend on location-specific factors. Watershed stakeholders should work with partnering organizations to identify segments impacted by stream erosion, to select appropriate BMPs, and then to finance and implement the selected BMPs.

8.4.3 Livestock with Access to Riparian Areas

To reduce bacteria from livestock with access to streams, the implementation plan goal is to promote the use of cost-share funding to voluntarily implement BMPs for alternative watering systems and exclusion fencing. These BMPs limit or eliminate livestock access to a stream or waterbody. Fencing can be used with controlled stream crossings to allow livestock to cross a stream while minimizing disturbance to the stream channel and streambanks. Providing alternative water supplies for livestock allow animals to access drinking water away from the stream, thereby minimizing the impacts to the stream and riparian corridor. Some researchers have studied the impacts of providing alternative watering sites without structural exclusions and found that cattle spend 90 percent less time in the stream when alternative drinking water is furnished (U.S. EPA 2003). U.S. EPA (2003) estimates that fecal coliform reductions from 29-46 percent can be expected; nutrient and sediment load reductions are also achieved.

8.4.4 Livestock Feeding Operations

Animal operations are typically either pasture-based or confined, or sometimes a combination of the two. The operation type dictates the practices needed to manage manure from the facility. A pasture or open lot system with a relatively low density of animals (1 to 2 head of cattle per acre [U.S. EPA 2003]) may not produce manure in quantities that require management for the protection of water quality. If excess manure is produced, then the manure will typically be scraped with a tractor to a storage bin constructed on a concrete surface. Stored manure can then be land applied when the ground is not frozen and precipitation forecasts are low. Rainfall runoff should be diverted around the storage facility with berms or grassed waterways. Runoff from the feedlot area is considered contaminated and is typically treated.

Confined facilities (typically dairy cattle, swine, and poultry operations) often collect manure in storage pits. Wash water used to clean the floors and remove manure buildup combines with the solid manure to form a liquid or slurry in the pit. The mixture is usually land applied or transported offsite.

Final disposal of waste usually involves land application on the farm or transportation to another site. Manure is typically applied to the land once or twice per year. To maximize the amount of nutrients and organic material retained in the soil, application should not occur on frozen ground or when precipitation is forecast during the next several days.

Storage of manure for at least 30 days prior to land application may reduce fecal coliform concentrations in runoff by 97 percent (Meals and Braun 2006). Use of waste storage structures, ponds, and lagoons reduce fecal coliform loading by 90 percent (U.S. EPA 2003). Anaerobic treatment in a lagoon or digester may reduce pathogen concentrations to 100 colony forming units per 100 milliliters in less than 15 days if temperatures are maintained at 35 ºC (Roos 1999). Livestock operation BMPs generally seek to contain manure and manure wastewater; contain and treat runoff contaminated with manure or manure wastewater; divert clean water; and prevent contaminated runoff following manure land application. On average, feedlot management activities can remove up to 70% of TP based on EPA STEPL's removal efficiencies.

- **Manure management** (collection and storage; separation of solids and liquid/slurry)
    - Grading, earthen berms, and such to collect, direct, and contain manure
    - Installation of concrete pads
- **Runoff management** (runoff from production areas)
    - Grading, earthen berms, and such to collect and direct manure-laden runoff
    - Filter strips
    - Storage ponds
- **Clean water diversion**
    - Roof runoff management
    - Grading, earthen berms, and such to collect and direct uncontaminated runoff
- **Manure land application**
    - Nutrient management strategy (e.g., **R**ight Source, **R**ight Rate, **R**ight Time, **R**ight Place)
    - Filter strips and grassed waterways

As an initial step to reducing the impact of animal operations, a watershed-wide feedlot inventory is recommended.

8.4.5 Onsite Wastewater Treatment Systems

Conventional onsite wastewater treatment systems are composed of a septic tank and drainfield. Fecal coliform and phosphorus loading rates from appropriately sited and properly functioning systems are typically insignificant. However, if systems are placed on unsuitable soils, not maintained properly, or are connected to subsurface drainage systems, loading rates to receiving waterbodies may be relatively high.

In a properly functioning septic system, wastewater effluent leaves the septic tank and percolates through the system drainfield. Phosphorus is removed from the wastewater by adsorption to soil particles. Plant uptake by vegetation growing over the drainfield is assumed negligible since all of the phosphorus is removed in the soil treatment zone. Failing systems that either short circuit the soil adsorption field or cause effluent to pool at the ground surface are assumed to retain phosphorus through plant uptake only (average annual uptake rate of 0.2 grams/capita/day). Direct discharge systems intentionally bypass the drainfield by connecting the septic tank effluent directly to a waterbody or other transport line (such as an agricultural tile drain) so that no soil zone treatment or plant uptake occurs.

BMPs to reduce fecal coliform and TP loads include maintenance, inspection programs, and public education. The most effective BMP for managing loads from septic systems is regular maintenance. U.S. EPA recommends that septic tanks be pumped every 3 to 5 years depending on the tank size and number of residents in the household (U.S. EPA 2002). When not maintained properly, septic systems can cause the release of pathogens, as well as excess nutrients, into surface water. Annual inspections, in addition to regular maintenance, ensure that systems are functioning properly. An inspection program would help identify those systems that are currently connected to tile drain systems or storm sewers. Inspections would also help determine if systems discharge directly to a waterbody ("straight pipe"). The environmental divisions of county health departments in the Pecatonica River watershed in Illinois provide inspections of new and repaired on-site wastewater treatment systems for certain fees. The environmental divisions also license installation/repair contractors, pumpers, and haulers. Some communities choose to formally document their septic systems by creating a database of all the systems in the area. Education is a crucial component of reducing pollution from septic systems. Education can occur through public meetings, mass mailings, and radio and television advertisements. An inspection program can also help with public education because inspectors can educate owners about proper operation and maintenance during inspections.

The reductions in pollutant loading resulting from improved operation and maintenance of all systems in the watershed depends on the wastewater characteristics and the level of failure present in the watershed. The costs associated with education and inspection programs will vary depending on the level of effort required to communicate the importance of proper maintenance and the number of systems in the area.

8.4.6 Pet Waste Management

Pet waste management can reduce nutrient and bacteria loadings in developed areas. Successful pet waste programs are often composed of (1) codified ordinance to penalize illicit deposition of pet feces, (2) public outreach, and (3) pet waste stations in public parks and recreation areas. Some pet waste programs also include municipal pet registries that are typically created for public health concerns.

While municipalities and counties in the Pecatonica River watershed in Illinois do have codified ordinance regarding animal and pet nuisance, they do not have codified ordinance to penalize illicit deposition of pet feces. For example, the city of Freeport has codes that prohibit pet owners from allowing their pets from running at larger or committing nuisances in mobile home parks (846.17) and prohibits hotel and motel managers from allowing pets to run at large (836.02), while Stephenson County has ordinances that prohibit dogs running at large (205-3), dangerous and vicious dogs (205-6), and noisy animals (205-10). Ogle County ordinance prohibits accumulation of animal feces as a nuisance or health hazard (5-6-9) but does not address feces deposition on public property. Pets, in general, are not registered, except for dog registrations for rabies (e.g., Stephenson County 205-4, Ogle County 5-8-1).

Recommended implementation activities are intended to create a comprehensive, coordinated, and robust pet waste education and outreach program. Priority areas for domestic waste implementation practices are areas with lots of pets and with a high degree of impervious cover in Freeport and other developed areas. Recommendations for developing a pet waste program include the following:

- **City code that penalizes pet feces deposition in public areas.** New city code in Freeport and any other municipality should be developed to prohibit deposition of pet feces in public areas. Code should target public areas (e.g., municipal parks) and areas served by storm sewers. In the counties, which are rural, ordinance should focus on public recreation areas, especially those adjacent to waterways. City code or county ordinance, along with civil and monetary penalties, should be cited on signage at public recreation areas and at pet waste stations. Monetary penalties may serve as a disincentive from pet waste mismanagement.
- **Establish a network of pet waste stations in public recreation areas.** Pet waste stations should be established in parks and other recreation areas. The stations should include signs to identify the stations and how to use the stations; if code or ordinance is enacted to prohibit pet waste mismanagement, the code or ordinance should also be cited on signage.
- **Develop an education campaign.** A campaign refers to a coordinated, comprehensive outreach effort that integrates a variety of education and outreach techniques. Campaign development starts with a baseline survey to understand existing dog owner behaviors and perceptions, uses survey information to craft effective messages delivered using formats tailored to target audiences, and follows up with a post-campaign survey to determine effectiveness. This campaign can support any regional or local stormwater management programs.

Because pet waste programs are a popular component of stormwater management programs, there are a great deal of materials available for use by other communities. However, there are not a lot of data available about the effectiveness of these programs in changing behavior and improving water quality conditions. Assumptions related to the amount of dog waste diverted from the stream can be made based on bag usage from pet waste stations. Another evaluation mechanism used by these programs is changes in awareness, although a more aware target audience does not always translate into an audience that exhibits behavior changes.

8.4.7 Stormwater Management

Stormwater in developed areas rapidly transports pollutants to streams and water bodies during and after precipitation events. The typical sources of nutrients in urban runoff include fertilizer wash-off from lawns, landscaped areas, and golf courses. Bacteria sources include pet and wildlife waste that are transported via runoff from a precipitation event to storm sewers and streams; leaky infrastructure is also a potential source of bacteria since untreated domestic wastewater can leak into stormsewers. Typical sources of sediment in urban storm water include bank erosion, which increases due to faster and more powerful stream flows caused by urban development, and runoff from construction or industrial sites that is not properly contained (e.g., silt fences) or treated (e.g., settling pond).

Stormwater BMPs can be used to reduce pollutant loadings, especially in areas with higher levels of imperviousness. Stormwater management includes both retrofitting stormwater BMPs into existing untreated developed areas and enacting ordinances to require higher levels of stormwater management in new developments and re-development. The Illinois Urban Manual (http://www.aiswcd.org/illinois-urban-manual/) provides recommended design guidelines for many stormwater BMPs. Table 59 summarizes expected pollutant load reductions from various stormwater BMPs. In addition to stormwater BMPs, local water planning and ordinance adoption can also be used to enhance stormwater management activities.

Table 59. Expected removal efficiencies for urban stormwater BMPs

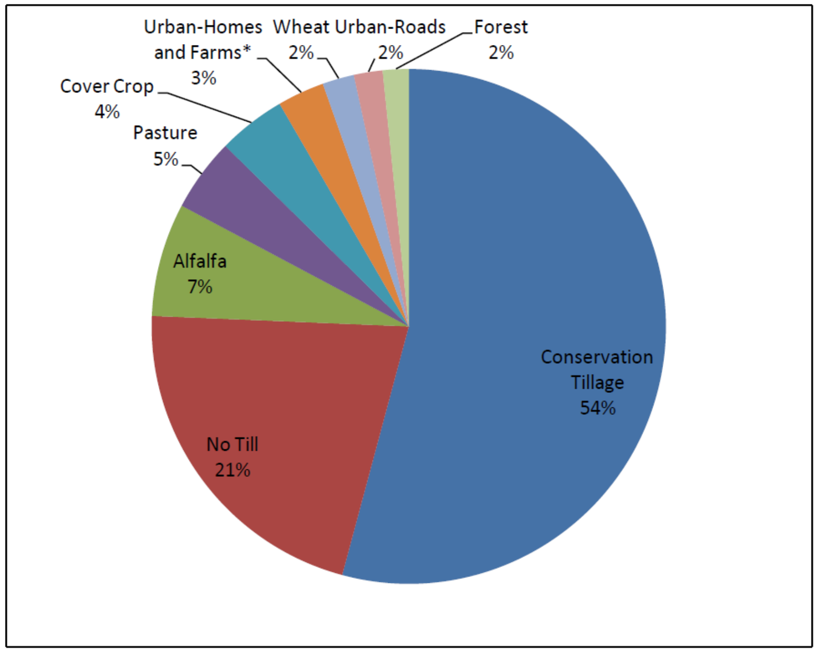
BMP	Nitrogen	Phosphorus	Sediment
Dry Detention Pond	30%	26%	58%
Extended Wet Detention Pond	55%	69%	86%
Grass Swales	10%	25%	65%
Infiltration Basin	60%	65%	75%
LID*//Bioretention	43%	81%	No data
LID/Filter/Buffer Strip	30%	30%	60%
LID/Infiltration Swale	50%	65%	90%
LID/Vegetated Swale	8%	18%	48%
LID/Wet Swale	40%	20%	80%
Porous Pavement	85%	65%	90%
Vegetated Filter Strips	40%	45%	73%
Weekly Street Sweeping	No data	6%	16%
Water Quality Inlet w/Sand Filter	35%	No data	80%
Water Quality Inlets	20%	9%	37%

Source: STEPL
*LID – Low Impact Development

8.5 Nonpoint BMP Implementation, Schedule and Milestones

An important aspect of this implementation plan is to identify and encourage activities that can be quickly implemented and produce measureable results. In many watersheds implementation faces a variety of challenges. These challenges include how to assess the benefits of a variety of water quantity and quality control strategies, how to select the optimal combination of BMPs that minimize costs, how to be consistent with community goals and characteristics, and how to meet reductions needed to achieve water quality goals.

The following implementation recommendations do not take into account existing BMPs on the landscape; existing BMPs can be counted as part of the BMPs needed to meet water quality goals. The recently completed Spring Brook Watershed Action Plan (Olson Ecological Solutions 2016) identified the land use practices in the Spring Brook watershed (PWNC) (Figure 51). This information was stakeholder-sourced as part of watershed plan development and describes a watershed that has almost 100% of the cropland using some form of conservation tillage. This local example demonstrates the potential to achieve high levels of BMP implementation watershed-wide.



Spring Branch of the Yellow Creek-Crowdsourced Land Cover

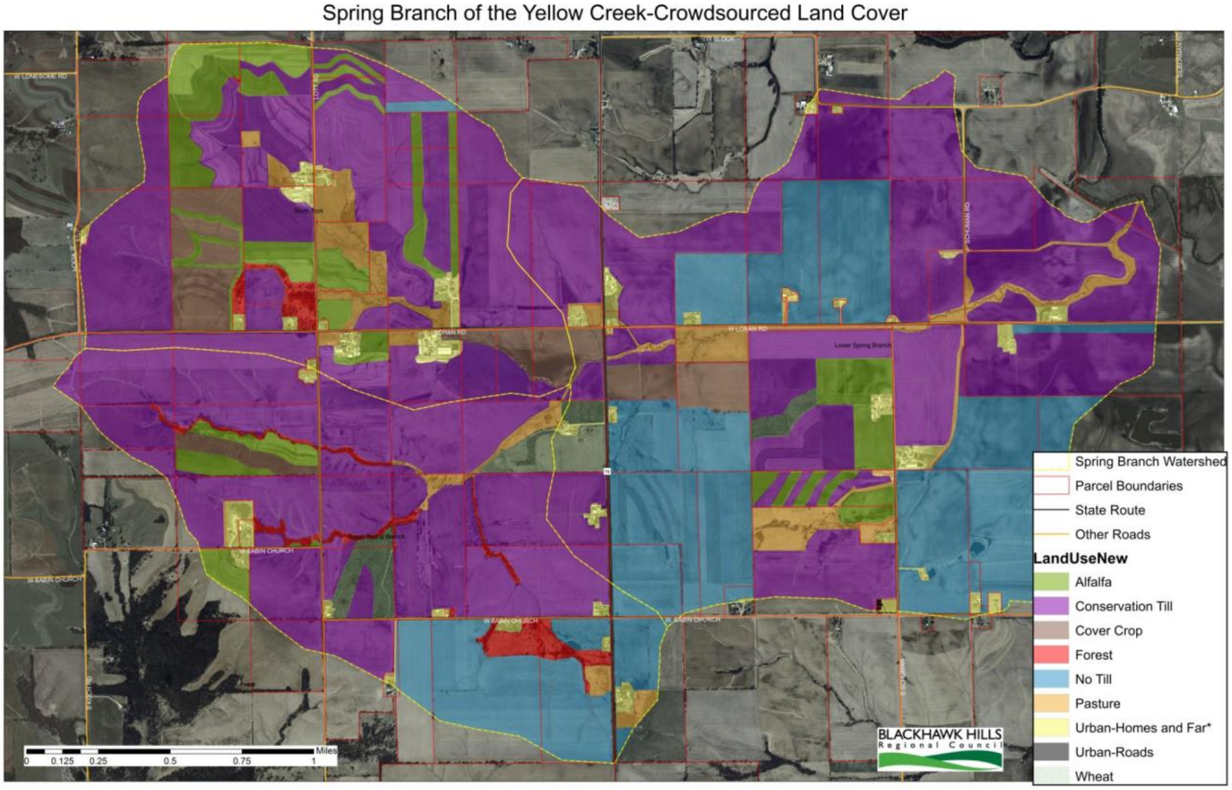


Figure 51. Stakeholder-sourced land cover and BMP information in the Spring Branch watershed (Olson Ecological Solutions 2016).

8.5.1 Level of Implementation

The majority of nutrient and sediment loading in the Pecatonica River watershed is derived from cropland. A simplified suite of implementation activities were simulated using EPA's STEPL model (updated with removal efficiencies provided in Table 58) and load reductions are provided in Table 60 that summarize the level of implementation needed and the associated costs. The watershed-wide results are based the highest and most downstream sediment reduction needed for segment PW-01 (86%). Using the set of BMPs provided in Table 60, an equivalent phosphorus reduction of 63% is achieved at PW-01. While priority should be given to first implementing sediment and nutrient control measures in upstream areas, a very large level of effort will be needed throughout the entire watershed.

Table 60. Watershed-wide BMPs

BMP	% of cropland where BMP applies	TP load reduction (lbs/year)	TSS load reduction (tons/year)	Cost per pound of phosphorus removed [a]	Cost estimate
Conservation Tillage	75%	335,653	32,174	$-(16.6)	$ -(5,571,841)
Cover Crops	50%	111,884	10,725	$24.50	$ 2,741,167
Riparian Buffer	75%	167,826	16,087	$11.97	$ 2,008,883
Total	--	615,363	58,986	--	$ -(821,791)

a. Source: Illinois Nutrient Loss Reduction Strategy, Table 3.14; negative values indicate cost savings

Additional watershed-wide implementation activities are needed to achieve watershed water quality goals as described in Section 8.4. It is anticipated that for sediment reduction needs, stream stabilization and restoration will account for approximately 25% reduction in sediment loading over time which when combined with the agricultural BMPs in Table 60 will meet the sediment reduction needs in the watershed. Costs for stream restoration are estimated between $5 and $10 million depending on selected priorities and project designs.

Additional nutrient reduction needs in Lake La-Aqua-Na will need to be met through internal load management activities once the watershed loads are controlled. Additional nutrient reduction is also needed in Coolidge Creek, however these reductions will likely need to come from point sources in the watershed.

Fecal coliform reductions by BMPs is qualitative since watershed and source loads are not quantified. Reduction in fecal coliform loading will require a combination of programmatic activities that address septic systems, stormwater, feedlots, and pet waste. In addition, review of wastewater disinfection exemptions and compliance with fecal coliform limits in existing permits is needed. The following extent of implementation is anticipated to achieve the required fecal coliform reductions:

- Riparian buffers and filter strips as described in Table 58, an estimated 34-74% reduction in fecal coliform has been estimated from the use of riparian buffers (Wenger 1999)
- Alternate water supply and exclusion fencing for all livestock with access to streams
- Livestock feeding operation management to limit or eliminate nutrient and bacteria loading associated with feedlots and manure management on all livestock feeding operations
- Eliminate all failing onsite wastewater treatment systems
- Implement pet waste management programs in developed areas
- Provide treatment using stormwater best management practices in developed areas that will reduce bacteria loading

8.5.2 Schedule and Milestones

A key part of U.S. EPA's nine-elements is interim milestones that provide meaningful evaluation points and a focus for program activities. Interim milestones are steps that demonstrate that implementation measures are being executed in a manner that will ensure progress toward water quality goals over time. Milestones are not changes in water quality. Measurable milestones are an important tool for directing limited resources towards the array and number of sources and nonpoint source pollution problems across the Pecatonica River watershed. Interim measureable milestones are presented in Table 61.

A 25-year implementation schedule is assumed and divided into three periods: 2017-2021, 2022-2031, and 2032-2041. Each phase will rely on an adaptive management approach, and will build upon previous phases. Short-term efforts (Year 1-5) include implementing practices in critical areas so that pollutant loads from high risk source areas within the watershed are significantly reduced. During this time period, additional inventory information will also be collected for different BMPs. Mid-term efforts (Year 6-15) are intended to build on the results of short-term implementation activities. This includes evaluating the success of Phase 1 projects installed (success rate, BMP performance, pollutant reductions realized, actual costs, etc.). Long-term efforts (Year 16-25) are those implementation activities that result in the watershed reaching full attainment with water quality standards.

Table 61. Implementation schedule and interim milestones for nonpoint BMPs

BMP	Partner(s)	Timeframe	Interim milestone
Crop production			
Conservation tillage	SWCDs, state agencies, NRCS	2017-2021	25% of cropland in conservation tillage in primary critical areas
		2022-2031	75% of cropland in conservation tillage in primary critical areas; 25% of cropland in conservation tillage in secondary critical areas
		2032-2041	75% of cropland in conservation tillage watershed-wide
Cover crops	SWCDs, state agencies, NRCS	2017-2021	10% of cropland with cover crops in primary critical areas
		2022-2031	50% of cropland with cover crops in primary critical areas; 20% of cropland with cover crops in secondary critical areas
		2032-2041	50% of cropland with cover crops watershed-wide
Riparian buffers and filter strips	SWCDs, state agencies, NRCS	2017-2021	Farmer/landowner survey, review of aerial imagery 30% of stream/ditch miles install buffers/filters in primary critical areas
		2022-2031	75% of stream/ditch miles install buffers/filters in primary critical areas; 30% of stream/ditch miles install buffers/filters in secondary critical areas
		2032-2041	75% of stream/ditch miles install buffers/filters watershed-wide
Fertilizer management	SWCDs, state agencies, NRCS	2017-2021	Farmer/landowner survey to determine fertilizer management practices, 20% of cropland being managed under the 4Rs watershed-wide
		2022-2031	40% of cropland being managed under the 4Rs watershed-wide
		2032-2041	90% of cropland being managed under the 4Rs watershed-wide
Stream erosion			
Engineering controls	SWCDs, state agencies, NRCS	2017-2021	Field survey to identify candidate locations for engineering controls, complete engineering controls on 2 projects
		2022-2031	Complete engineering controls on 20% of eroding streams when watershed BMPs (i.e., crop production BMPs) have been implemented

BMP	Partner(s)	Timeframe	Interim milestone
		2032-2041	Complete engineering controls on 75% of eroding streams when watershed BMPs (i.e., crop production BMPs) have been implemented
Vegetative stabilization and restoration	(see Riparian buffers and filter strips under ***Crop production***)		
Livestock with access to streams			
Alternative watering systems with exclusion fencing	SWCDs, state agencies, NRCS	2017-2021	Inventory of livestock access to streams, complete 4 fencing projects
		2022-2031	Complete fencing projects on 30% of streams
		2032-2041	Complete fencing projects on 75% of streams
Livestock feeding operations			
Livestock operation BMPs	SWCDs, state agencies, NRCS	2017-2021	Feedlot inventory Complete projects on 50% of feedlots in primary critical areas, as needed
		2022-2031	Complete projects on 50% of feedlots watershed-wide, as needed
		2032-2041	Complete projects on 75% of feedlots watershed-wide, as needed
On-site wastewater treatment			
Maintenance Inspection program Public education	County health departments IEPA	2017-2021	Landowner survey and inventory of failing systems Evaluation of inspection program effectiveness Develop and distribute watershed-specific promotional material
		2022-2031	Evaluate effectiveness of promotional material Revise and continue distribution of promotional material Complete operation and maintenance projects or replacements on 25% of failing septic systems
		2032-2041	Evaluate effectiveness of promotional material Revise and continue distribution of promotional material Complete operation and maintenance projects or replacements on 75% of failing septic systems
Pet waste management			
Pet waste management	City and county governments	2017-2021	Evaluate potential city code or county ordinance Establish pet waste stations Pet owner survey (awareness and behavior) Develop and distribute watershed-specific promotional material
		2022-2031	Enact city code or county ordinance Evaluate effectiveness of promotional material Revise and continue distribution of promotional material
		2032-2041	Evaluate effectiveness of city code or county ordinance Amend city code or county ordinance, as necessary Evaluate effectiveness of promotional material Revise and continue distribution of promotional material
Stormwater management			
Stormwater BMPs	City and county governments IEPA	2017-2021	Evaluate potential city code or county ordinance Determine potential stormwater retrofit opportunities Implement 2 water quality stormwater demonstration projects in developed areas
		2022-2031	Provide water quality treatment to 15% of developed areas
		2032-2041	Provide water quality treatment to 30% of developed areas

8.6 Progress Benchmarks and Adaptive Management

Implementation activities for the Pecatonica River watershed occur in three phases using outcome-based strategic planning and an adaptive management approach. Phase 1 (short-term), Phase 2 (mid-term) and Phase 3 (long-term) are designed to build on results from the preceding phase. To guide plan implementation through each phase using adaptive management, water quality benchmarks are identified to track progress towards attaining water quality standards. Progress benchmarks (Table 62) are intended to reflect the time it takes to implement management practices, as well as the time needed for water quality indicators to respond.

Table 62. Progress benchmarks

Indicator	Target	Segments	Timeframe	Progress benchmark
Fecal coliform	400 cfu/100 mL in <10% of samples and geometric mean <200 cfu/100 mL [a]	Pecatonica River (PW-01) Pecatonica River (PW-08) Pecatonica River (PW-13) Raccoon Creek (PWA-01) Yellow Creek (PWN-01)	2017-2021	20% of load reductions specified in Section 3.
			2022-2031	40% of load reductions specified in Section 3.
			2032-2041	Load reductions specified in Section 3. Full attainment of water quality standards.
TP	0.156 mg/L	Coolidge Creek (PWF-W-C1) Winneshiek Creek (PWL-01) Lake Le-Aqua-Na (RPA)	2017-2021	20% of load reductions specified in Section 3.
			2022-2031	40% of load reductions specified in Section 3.
			2032-2041	Load reductions specified in Section 3. Compliance with LRS target.
TSS	40 mg/L	Pecatonica River (PW-01) Pecatonica River (PW-04) Pecatonica River (PW-08) Coolidge Creek (PWF-W-C1) Winneshiek Creek (PWL-01) Lake Le-Aqua-Na (RPA)	2017-2021	20% of load reductions specified in Section 3.
			2022-2031	40% of load reductions specified in Section 3.
			2032-2041	Load reductions specified in Section 3. Compliance with LRS target.

Notes
cfu/100 mL = colony forming units per 100 milliliters; mg/L = milligrams pwer liter; TMDL = total maximum daily load; TP = total phosphorus; TSS = total suspended solids.
a. Fecal coliform targets are only applicable during the Illinois recreation season (May through October). Ten percent or less of samples collected in a 30-day period must be less than or equal to 400 cfu/100 mL. Geometric mean based on minimum of 5 samples taken over not more than a 30-day period must be less than or equal to 200 cfu/100 mL.

To ensure management decisions are based on the most recent knowledge, the implementation plan follows the form of an adaptive and integrated management strategy and establishes milestones and benchmarks for evaluation of the implementation program. U.S. EPA (2008) recognizes that the processes involved in watershed assessment, planning, and management are iterative and that actions might not result in complete success during the first or second cycle. For this reason, it is important to remember that implementation will be an iterative process, relying upon adaptive management.

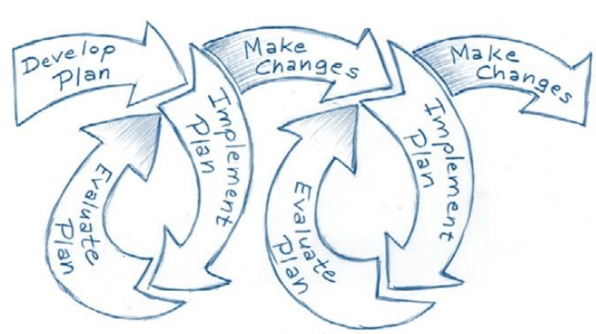


Figure 52. Adaptive management iterative process (U.S. EPA 2008).

Adaptive management is a commonly used strategy to address natural resource management that involves a temporal sequence of decisions (or implementation actions), in which the best action at each decision point depends on the state of the managed system. As a structured iterative implementation process, adaptive management offers the flexibility for responsible parties to monitor implementation actions, determine the success of such actions and ultimately, base management decisions upon the measured results of completed implementation actions and the current state of the system. This process, depicted in Figure 52, enhances the understanding and estimation of predicted outcomes and ensures refinement of necessary activities to better guarantee desirable results. In this way, understanding of the resource can be enhanced over time, and management can be improved.

In addition to focusing future management decisions, with established assessment milestones and benchmarks, adaptive management can include a re-assessment of the TMDL/LRS. Re-assessment of the TMDL is particularly relevant when completion of key studies, projects or programs result in data showing load reductions or the identification/quantification of alternative sources. Reopening/ reconsidering the TMDL/LRS may include refinement or recalculation of load reductions and allocations. For instance, if special studies can quantify wildlife loading, the load allocations can be refined and wasteload adjusted accordingly.

The implementation phases, milestones, and benchmarks will guide the adaptive management process, helping to determine the type of monitoring and implementation tracking that will be necessary to gauge progress over time. Evaluation for adaptive management can include a variety of evaluation components to gain a comprehensive understanding of implementation progress. An implementation evaluation determines if non-structural and structural activities are put in place and maintained by implementation partners according to schedule; this is often referred to as an output evaluation. An outcome evaluation focuses on changes to behaviors and water quality as a result of implementation actions. This type of evaluation looks at changes in stakeholder behavior and awareness (i.e., non-structural BMP effectiveness), structural BMP performance, and changes to ambient water quality.

8.7 Public Education and Participation

Successful implementation in the Pecatonica River watershed will rely heavily on effective public education and outreach activities that will encourage participation and produce changes in behavior. Although Section 319 grant funds and cost-share dollars are available, if watershed stakeholders eligible to participate in activities such as feedlot improvements are not aware of these programs or willing to get involved, water quality improvements will not occur in the watershed. This section presents recommendations related to developing and implementing a coordinated watershed-wide public education and outreach program.

It is imperative to raise stakeholders' awareness about issues in the watershed and develop strategies to change stakeholders' behavior in a manner that will promote voluntary participation. Changes in awareness and behavior are surrogate indicators for longer-term changes in water quality. For example, if more feedlot operators are aware of cost-share programs and participation in these programs go up, local partners can report on the implementation of more feedlot improvement projects that have an associated fecal coliform removal efficiency. These estimated fecal coliform removal efficiencies can be used to estimate fecal coliform load reductions, which will likely result in lower bacteria concentrations in water quality monitoring over time.

Ideally, a public education and outreach program for the Pecatonica River watershed would be spearheaded by a single entity serving as an outreach campaign organizer. This outreach campaign organizer would be responsible for coordinating all outreach efforts conducted by multiple partners to ensure an efficient use of resources, avoid duplicative activities, and promote targeted messaging to specific audiences. A Pecatonica River watershed public outreach campaign should involve representatives from all agencies and organizations that play a role in conducting outreach.

A stakeholder survey could be one of the first activities related to a watershed-wide public education and outreach campaign. This type of survey (e.g., a pre-campaign survey) will help to establish a baseline of stakeholder awareness and behaviors that will help watershed outreach campaign organizers to develop tailored outreach messages. Successful outreach and education campaigns address the knowledge and behaviors of specific target audiences as they relate to specific pollutants. A stakeholder survey (described above) or input from local partners can be used to tailor activities and messages. Key topics for education and outreach could include:

- General watershed management principles
- Watershed friendly riparian uses and activities
- Agricultural BMP demonstrations (e.g., cover crops, conservation tillage)
- Municipal operations
- Septic system maintenance and compliance
- Feedlot and livestock management
- Pet waste management in developed areas
- Funding and technical assistance opportunities

Public outreach and education can include a variety of activities including newspaper articles, newsletters, radio spots, website content, workshops, demonstration projects and tours. A variety of activities can be undertaken in order to reach the various stakeholders.

8.8 Technical and Financial Assistance

A significant portion of this TMDL implementation plan focuses on voluntary efforts as opposed to permit requirements. As a result, technical and financial assistance are essential to successful implementation over time. This section identifies sources of funding and technical assistance for the recommended implementation practices in the watershed. Selected BMPs will depend on numerous factors including cost, public support, and landowner interest. This section also identifies the watershed partners who will likely play a role in implementation.

8.8.1 Partners

There are several key implementation partners that can provide technical and financial assistance to promote successful TMDL implementation and watershed management. In addition, watershed groups within the Pecatonica River watershed have local knowledge of the resources and the residents. These federal, state, and local partners will have a more specific understanding of what technical and financial needs exist in the Pecatonica River watershed to undertake the recommended implementation activities:

- Lower Sugar River Watershed Association
- Friends of the Pecatonica River Foundation
- Yellow Creek Watershed Partnership
- Sugar Pecatonica Rivers Ecosystem Partnership
- Soil and Water Conservation Districts
- Illinois Farm Bureau
- University of Illinois Extension
- County Health Departments
- County Commissioners, City Councils, and Township Boards
- Illinois EPA
- Illinois Department of Agriculture

- Illinois Department of Natural Resources
- Illinois State Water Survey
- NRCS
- Farm Service Agency
- U.S. EPA Region 5

Staff at local NRCS offices and county SWCDs can meet with farmers and landowners and help them identify, finance, and install or implement agricultural BMPs. Similarly, staff at county health departments can meet with septic system owners and help determine if and when upgrades are needed.

In addition to local and government organizations, the Illinois Council on Best Management Practices, a coalition of agricultural organizations and agribusinesses, provide education, guidance, and incentives to assist and encourage voluntary BMP adoption by agricultural producers. This coalition also supports an interactive map that describes many successful conservation activities throughout Illinois (http://conservationstorymap.com/). This information can be used to demonstrate the different BMPs being proposed as part of this implementation plan.

Public and private land conservation organizations and agencies including the Natural Land Institute, Trout Unlimited, Illinois Audubon Society, The Nature Conservancy, Forest Preserves of Winnebago County, James Addamsland Park Foundation, Northwest Illinois Audubon Societies, and others are also important implementation partners.

8.8.2 Financial Assistance Programs

There are many existing financial assistance programs which may assist with funding implementation activities. Many involve cost sharing, and some may allow the local contribution of materials, land, and in-kind services (such as construction and staff assistance) to cover a portion or the entire local share of the project. Several of these programs are presented below. In addition to these programs, partnerships between local governments can help to leverage funds. State and federal grant programs may also be available, depending on the nature of the implementation activity. A stormwater utility may also be used to generate local funds for stormwater programs and are becoming more common. The nearby cities of Rock Island and Bloomington operate successful stormwater utilities.

State Revolving Fund

The State Revolving Fund programs, including the Water Pollution Control Loan Program for wastewater and stormwater projects and the Public Water Supply Loan Program for drinking water projects, are annually the recipients of federal capitalization funding, which is combined with state matching funds and program repayments to form a perpetual source of low interest financing for environmental infrastructure projects. Eligible projects include traditional pipe, storage, and treatment systems, green infrastructure projects, erosion and sediment control projects, and right-of-way acquisition needed for such projects. The loans are for a maximum of 20 years, and can be used to cover the entire project cost. More information about this fund can be found at http://www.epa.illinois.gov/topics/grants-loans/state-revolving-fund/index.

Environmental Quality Incentives Program (EQIP)

Several cost-share programs are available to landowners who voluntarily implement resource conservation practices. The most comprehensive is the NRCS EQIP which offers cost-sharing and incentives to farmers (in livestock, agricultural, or forest production) who utilize approved conservation practices to reduce pollutant loading from agricultural lands. In recent years, EQIP has paid for:

- Acreage of farmland that is managed under a nutrient management plan
- Use of vegetated filter strips

- Portions of the cost to construct grassed waterways, riparian buffers, and windbreaks
- Use of residue management
- Installation of drainage control structures on tile outlets, as well as portions of the cost of each structure
- Portions of the construction cost for a composting facility
- Portions of the fencing, controlled access points, spring and well development, pipeline, and watering facility costs
- Cost-share for waste storage facilities
- Prescribed grazing practices

To participate in the EQIP cost-share program, all BMPs must be constructed according to the specifications listed for each conservation practice. Payments are made after practices have been installed, and are capped per practice, but may cover up to 75 percent of project costs. Most contracts are for one to three years. More information about this program in Illinois is available at https://www.nrcs.usda.gov/wps/portal/nrcs/main/il/programs/financial/eqip/.

Conservation Reserve Program (CRP)

The Farm Service Agency of the USDA supports the CRP which provides a yearly rental payment in exchange for farmers removing environmentally sensitive land from agricultural production. Payments are based on the number of acres removed, and are capped at $50,000 per year. The land is converted to grass or forestland for the purposes of reducing erosion and protecting sensitive waters. This program is available to farmers who establish wetland or riparian buffers, vegetated filter strips, grassed waterways, or similar practices. The program also provides up to 50 percent of the upfront cost to establish vegetative cover, and contracts in the program are for 10 to 15 years. More information about this program can be found at https://www.fsa.usda.gov/programs-and-services/conservation-programs/conservation-reserve-program/index.

Conservation Stewardship Program (CSP)

The NRCS CSP is for agricultural producers who want to enhance existing conservation practices on their land. NRCS consults one-on-one with the producer to develop enhancements that will improve conservation. CSP contracts are for 5 years and are renewable. Payments are based on the type and number of conservation practices implemented, as well as the number of acres under conservation practices, with a minimum annual payment of $1,500. Recent CSP conservation practices include:

- Riparian buffers
- Cover crops
- End-of-pipe or ditch treatment for phosphorus
- Livestock access management to streams

More information about the CSP can be found at https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/programs/financial/csp/.

Agricultural Conservation Easement Program

NRCS's Agricultural Conservation Easement Program (ACEP) offers landowners the opportunity to protect, restore, and enhance agricultural lands and wetlands on their property. Land can be placed into an agricultural land easement or wetland reserve easement. Under the Agricultural Land component, NRCS may contribute up to 50 percent of the fair market value of the agricultural land easement. Under the Wetlands component, NRCS may contribute up to 100 percent of easement value for the purchase of the easement and up to 100 percent for the cost of restoration, and NRCS offers technical support for restoration. Easements can be 30 years in length or permanent. This program offers landowners an opportunity to establish long-term conservation and wildlife practices and protection. More information is available at http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/programs/easements/acep/.

Partners for Conservation (formerly Conservation 2000)

In 1995 the Illinois General Assembly passed the Conservation 2000 bill providing $100 million in funding over a 6-year period for the promotion of conservation efforts. In 1999, legislation was passed to extend the program through 2009. In 2008, House Bill 1780 was signed into law as Public Act 95-0139, extending the program to 2021 as Partners for Conservation. The Partners for Conservation Program funds programs at Illinois Department of Natural Resources, Illinois Department of Agriculture, and IEPA. Its programs include:

- **Conservation Practices Program:** This program provides monetary incentives for conservation practices implemented on land eroding at a rate of one and one-half times or more the tolerable soil loss rate. Payments of up to 60% of initial costs are paid through the local conservation districts, which also prioritize and select the projects to be funded in their district. The program provides cost share assistance for BMPs such as cover crops, filter strips, grassed waterways, no-till systems, pasture planting, contour farming, and installation of stormwater ponds. Practices funded through this program must be maintained for at least 10 years. More information can be found at https://www.agr.state.il.us/conservation/.
- **Streambank Stabilization Restoration Program**: Partners for Conservation also funds a streambank stabilization and restoration program aimed at restoring highly eroding streambanks. Research efforts are also funded to assess the effectiveness of vegetative and bioengineering techniques for bank stabilization. Streambank stabilization projects funded through this program must be maintained for at least 10 years. Further information is available at https://www.agr.state.il.us/conservation/.
- **Sustainable Agriculture Grant Program:** This program funds on-farm and university research, education, and outreach efforts for sustainable agricultural practices. Private landowners, organizations, and educational and governmental institutions are all eligible for participation in this program. Maximum per-project, per-year grant amounts are $10,000 for individuals and $20,000 for units of government, non-profits, institutions or organizations, and a source of matching funds is required. More information can be found at https://www.agr.state.il.us/conservation-2000.

Nonpoint Source Management Program

IEPA receives federal funds through section 319(h) of the Clean Water Act to help implement Illinois' Nonpoint Source Pollution Management Program. The purpose of the program is to work cooperatively with local units of government and other organizations toward the mutual goal of protecting the quality of water in Illinois by controlling nonpoint source pollution. The program emphasizes funding for implementing cost-effective corrective and preventative BMPs on a watershed scale; funding is also available for BMPs on a non-watershed scale and the development of information/education nonpoint source pollution control programs.

The maximum federal funding available is 60 percent, with the remaining 40 percent coming from local match. The program period is two years unless otherwise approved. Funding is directed toward activities that result in the implementation of appropriate BMPs for the control of nonpoint source pollution or to enhance the public's awareness of nonpoint source pollution. Approximately $3,000,000 is available in this program per year, awarded amongst approximately 15 projects.

Projects or activities carried out to comply with the MS4 six minimum control measures are not eligible for section 319 funding. However, there may be some activities that promote opportunities to implement the watershed approach that are eligible for section 319 funding that could indirectly address the six minimum measures as well as nonpoint source projects. For more information: http://www.epa.state.il.us/water/watershed/nonpoint-source.html.

Ag Invest Agricultural Loan Program – Annual or Long Term

The Ag Invest Agricultural Loan Program offered through the Illinois State Treasury office provides low-interest loans to assist farmers. Loan funds can be used to implement soil and water conservation practices, for construction related expenses, to purchase farm equipment, or to pay for costs related to traditional crop production and alternative activities. Loan limits are between $300,000 and $400,000 per year. More information is available at http://illinoistreasurer.gov/Individuals/Ag_Invest.

Illinois Green Infrastructure Grants

Grants have been made available in the past by IEPA to local units of government and other organizations to implement green infrastructure BMPs to control stormwater runoff for water quality protection in Illinois. Previous projects were required to be located within an MS4 combined sewer overflow (CSO) area. Competitive grants are available in three categories: CSO rehabilitation ($300,000 - $3,000,000); stormwater retention and infiltration ($100,000 - $750,000); and green infrastructure small projects ($15,000 - $75,000). Minimum required local match is 15 to 25 percent depending on the project category. Currently, the program is in a state of change and no new applications are being accepted. For more information, see http://www.epa.state.il.us/water/financial-assistance/igig.html.

Illinois Buffer Partnership

The Illinois Buffer Partnership is administered by Trees Forever, an Iowa non-profit organization. It offers cost sharing for installation of streamside buffer plantings at selected sites. Ten to twenty participants in Illinois are selected for the program annually. They receive cost-share assistance, on-site assistance from Trees Forever field staff, project signs and the opportunity to host a field day to highlight their project. Participants are reimbursed up to $2,000 for 50 percent of the expenses remaining after other grant programs are applied. Types of conservation projects eligible for the Illinois Buffer Partnership program include: riparian buffers, livestock buffers, streambank stabilization projects, wetland development, pollinator habitat, rain gardens and agroforestry projects. More information can be found at http://www.treesforever.org/Illinois_Buffer_Partnership.

Sustainable Agricultural Grand Program (SARE)

SARE is a USDA program that funds research, education, and outreach efforts for sustainable agricultural practices. Farmer Rancher Grants are for farmers and ranchers who want to explore sustainable solutions to problems through on-farm research, demonstration, and education projects. These grants have funded a variety of topics including pest/disease management, crop and livestock production, education/outreach, networking, quality of life issues, marketing, soil quality, energy, and more. Awards are for a maximum of $7,500 for an individual project to a maximum of $22,500 for a group project, and may last up to 24 months. No matching funds are required for this program. About 40 Farmer Rancher grant projects are funded nationwide each year. More information is at http://www.sare.org/Grants.

Tax Incentive Filter Strip Program

The is an NRCS program that protects water quality by providing a property tax reduction incentive to landowners who install vegetative filter strips between farm fields and a water body to be protected. As an incentive for installing protective vegetative filter strips on land adjacent to surface or ground water sources, landowners may receive a reduced property tax assessment of 1/6th of its value as cropland. Landowners can expect to save about $1 to $25 per acres in taxes depending on soils and local tax rates. Vegetative filter strip design and certification assistance is available from local Soil and Water Conservation District offices. For more information, see local SWCD websites.

8.9 Follow-Up Monitoring

The ultimate measure of success will be documented changes in water quality, showing improvement over time (see Table 62 for progress benchmarks). The top priority for this plan is to identify and reduce sources of fecal coliform, phosphorus, and sediment that contribute to water quality impairments in the Pecatonica River watershed. In addition, long-term monitoring of the overall health and quality of the watershed is important. Monitoring will help determine whether the implementation actions have improved water quality. In addition, monitoring will help determine the effectiveness of various BMPs and indicate when adaptive management should be initiated. The primary goal of the monitoring plan is to assess the effectiveness of source reduction strategies for attaining water quality standards and designated uses.

8.9.1 Water Quality Monitoring

Progress towards achieving water quality standards will be determined through ambient monitoring by Illinois EPA. The state conducts studies of ambient conditions across the state by evaluating watersheds on a rotating basis, collecting measurements of physical, chemical, and biological parameters. This ambient monitoring program will continue as the Pecatonica River watershed plan is implemented with a particular focus on impaired sites and increasing the understanding of pollutant sources.

8.9.2 BMP Effectiveness Monitoring

Multiple BMPs will be needed to address the water quality impairments in the Pecatonica River watershed. There are limited local data on the effectiveness of many BMPs; therefore, monitoring the results of programs and representative practices are critical. BMP monitoring can include quantitative monitoring of physical components (e.g., water quality and flow) qualitative (i.e., visual) monitoring of physical components (e.g., vegetation), and monitoring of behaviors. A monitoring program should be put in place as both structural and nonstructural BMPs are implemented to 1) measure success and 2) identify changes that could be made to increase effectiveness. U.S. EPA (1999) describes water quality monitoring and reporting data that are useful for assessing the effectiveness of stormwater BMPs.

8.10 Reasonable Assurance

U.S. EPA requires that a TMDL provide reasonable assurance that the required load reductions will be achieved and water quality will be restored. For municipal point source dischargers (including MS4s) in the Pecatonica River watershed, Illinois EPA will assure implementation of TMDLs through its NPDES and stormwater programs. For nonpoint source control, the implementation plan (Section 8) provides reasonable assurance that management activities will be implemented. The implementation plan contains several key aspects of reasonable assurance including previous, current, and planned water quality improvement actions and the technical and financial resources required to conduct them.

Previous and current water quality improvement activities are provided throughout the implementation plan. Several active partners, organizations and programs exist in the watershed that have taken action to improve water quality (see Section 8.8.1). For example, Friends of the Pecatonica River Foundation is a local non-profit in Stephenson County that promotes the responsible and recreational use of the Pecatonica River. In 2011, they completed a water trail plan that promoted environmental and physical health and wellness and recreational, historical, and environmental education, among others. Obtaining recreation use water quality standards is important to the overall goal of this plan. The Yellow Creek Watershed Partnership, whose mission is to improve the health and diversity of Yellow Creek and its watershed, is another active nonprofit in the watershed. The Lower Sugar River Watershed Association is also active in watershed protection and management. This organization has laid out a 5 year strategic plan to evaluate water and habitat quality throughout the watershed and prioritize areas for implementation, develop programming to address invasive species throughout the watershed, and conduct citizen outreach.

Local soil and water conservation districts are also active in the watershed and provide technical and financial assistance on topics such as conservation farming, nutrient management, streambank stabilization, and many others. Examples of past and current SWCD involvement include a cover crop tour in 2015 and 2017 through Stephenson County, workshops such as Carrol County SWCD's forest edge habitat workshop in 2015, and various educational activities for K-12 students and teachers such as the Illinois State Envirothon. Additionally, SWCDs have annual trees sales and supply rain barrels and compost systems to promote water quality improvement actions at a residential level.
Lastly, the University of Illinois Extension is active in education and outreach on water quality improvement practices throughout the state. Extension units within the Pecatonica River watershed include:

- University of Illinois Extension serving Boone, DeKalb and Ogle counties (http://web.extension.illinois.edu/bdo/)
- University of Illinois Extension serving Jo Daviess, Stephenson and Winnebago counties (http://web.extension.illinois.edu/jsw/)
- University of Illinois Extension serving Carroll, Lee, and Whiteside counties (http://web.extension.illinois.edu/clw/)

The extension offices are currently involved in many activities including the Northern Illinois Agricultural blog through the Northern Illinois Agronomy Research Center where the latest research is shared, numerous educational webinars and workshops such as a soil health management workshop planned for February 2018, and many more.

The Spring Branch Watershed Action Plan (summarized in Section 8.6) was funded through an EPA 319 grant and outlines current and planned BMPs in the Spring Branch watershed. The Plan, and the level of agricultural practice implementation reported by the farming community, provides an excellent example of the expected greater Pecatonica River watershed potential for agricultural producers to implement management practices. Planned activities include four large scale projects that address livestock, stormwater, streambank stabilization, and runoff retention. All of these projects will contribute to reductions in fecal coliform loading.

Additionally, the state of Illinois developed the Illinois Nutrient Loss Reduction Strategy (INLRS) which promotes agricultural BMPs that have co-benefits of reducing sediment loading in addition to nutrients. Implementation activities recommended in the INLRS will also have the benefit of reducing bacteria loading associated with livestock operations. The following activities are being promoted:

- Using clean water diversions whenever possible to keep uncontaminated water from coming into contact with manure.
- Scrapping lot areas daily and removing and storing the resulting manure in an area protected from precipitation.
- Collecting runoff from animal feeding and loafing and appropriately disposing of it via land application, treatment wetlands, filter strips, or other practices intended to keep runoff at the treatment site.
- Treating silage leachate, milkhouse waste, or other liquids that have come into contact with manure as manure and storing it until conditions are appropriate for land application.
- Protecting feeding areas whenever possible from precipitation to minimize the amount of feedlot runoff that must be managed.

The INLRS also promotes eliminating uncontrolled livestock access to streams and drainage ways, providing alternative water supplies, and riparian buffers.

The results of a 2017 tillage transect survey conducted in Stephenson County indicated that only 28 of the surveyed cropland was using conventional tillage. The remaining 72 percent of cropland was using some form of conservation tillage (e.g., no till, mulch till, and reduced till). These results also indicate the high level of commitment by producers to conservation in the watershed.

Participation of farmers and landowners is essential to implementing nonpoint source BMPs and improving water quality in the Pecatonica River watershed. Educational efforts as mentioned above and cost-share programs will likely increase participation to levels needed to protect water quality. Technical and financial assistance, as summarized in Section 8.8, provides the resources needed to improve water quality and meet watershed goals. Additional assurance can be achieved during implementation of the TMDLs through contracts, memorandums of understanding, and other similar agreements, especially for BMPs that receive outside funds and cost share.

9. Public Participation

Two public meetings were held on March 19, 2014 in Freeport at the Stephenson County Farm Bureau to present the Stage 1 report and findings. A public notice was sent out and the public comment period closed on April 18, 2014. Over 90 stakeholders attended the meetings in Freeport. Stakeholders provided input on the watershed characterization report and offered comments related to existing water quality efforts in the watershed (refer to Appendix F for public comments). Updates were made to the Stage 1 report to correct inaccurate information.

The Stage 3 public meeting was held on March 7, 2018, at 1:00 pm, at the Stephenson County Farm Bureau in Freeport, Illinois. Approximately 45 people participated in the public meeting and the public comment period ended at midnight on April 7th, 2018.

Illinois EPA provided public notice for all meetings by placing a display-ad in Freeport Journal-Standard (the local newspaper). In addition, a direct mailing was sent to several stakeholders/permittees in the watershed. The notice gave the date, time, location, and purpose of the meeting. The notice also provided references on how to obtain additional information about this specific site, the TMDL program, and other related information. The draft TMDL report was available for review in hard copy at the Stephenson County Farm Bureau, the City of Freeport Public Library, and electronically on the Agency's webpage: www.epa.illinois.gov/public-notices/index.

Appendix F includes public comments provided on the Stage 3 and an accompanying responsiveness summary.

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Appendix A. LRS Water Quality Targets

The following documentation was provided by IEPA to stakeholders on 5/1/2015.

Load Reduction Strategy

As part of the TMDL development process the Agency started to include Load Reduction Strategies (LRS) in TMDL watershed projects in 2012 for those pollutants that do not currently have a numeric water quality standards. Developing an LRS involves determining the loading capacity and load reduction necessary that is needed in order for the water body to meet "**Full Use Support"** for its designated uses. The load capacity is not divided into WLA, LA, or MOS, these are represented by one number as a target concentration for load reduction within each unique watershed. This LRS here is only for two parameters (Total Phosphorus and Total Suspended Solids); all other parameters such as Sedimentation/Siltation and Turbidity will be addressed separately. The Load Reduction Strategy provides guidance (with no regulatory requirements) for voluntary nonpoint source reduction efforts by implementing agricultural and urban stormwater best management practices (BMPs).

To arrive at these results, three tasks were performed: **Identification**, **Analysis**, and **Application**.

Identification:

1. For each TMDL watershed, the US Geological Survey ten-digit Hydrologic Unit Code, or HUC-10 was identified.
2. Within each HUC-10, each and every stream segment or lake was identified.
3. Each stream segment or lake was checked against the Illinois EPA Assessment Data Base (or ADB) to determine those segments and lakes that are in full support for aquatic life.
4. For each HUC-10 basin, full-support stream segments and lakes were grouped to show where each unique watershed is at its best in providing a healthy environment for aquatic plants and animals. A statewide "one size fits all" approach was purposefully avoided to allow the distinct nature of each watershed to become apparent.

Analysis:

1. For each stream segment or lake that fully supports designated uses, the water quality data from 1999 through 2013 was compiled. This includes data from the Illinois EPA's Surface Water Section's ambient monitoring, intensive basin surveys, and special studies. The pollutants (or parameters) for which data compiled data are Total Phosphorus (TP) and Total Suspended Solids (TSS), those pollutants requiring an LRS be developed.
2. This data underwent a last quality control check and carefully discriminated against any data that did not pass all the rigorous quality assurance checks. Only the data that passed all checks was used to calculate the targets in this strategy.
3. Mathematical operations were kept to a minimum in order to establish targets which are as accurate and relevant as possible. For each stream segment (or lake), the raw average of all available data from 1999 through 2013 was calculated for TP and TSS, respectively.

Application:

1. For each stream segment or lake, an average concentration for TP and/or TSS over the entire time period was calculated.
2. Within each unique watershed, these long-term results for TP and TSS for all the fully supporting segments and streams in the watershed were averaged together. This allows these healthy waters to most accurately represent the level of aquatic life support the watershed is capable of providing.
3. The average concentrations for the aquatic-life-supporting water bodies were then assigned as targets for all water bodies of the same type in the watershed, e.g. stream targets for streams,

lake targets for lakes. The rationale for assigning this composite average is that within a given watershed, all streams for example share similar geology, soil type, land use, agricultural practices, and topography. The same holds true for lakes.

Finally, the average of these long-term concentrations can be the target concentrations for impaired stream segments or lakes requiring an LRS be developed.

The targets for each watershed are presented below:

Pecatonica Watershed-Wide Load Reduction Targets

USGS HUC-10 Basins Addressed: 0709000311, 0709000312, 0709000313, 0709000314, 0709000315, 0709000316, 0709000408, and 0709000215.

The following stream segments are full use support in the Pecatonica watershed:

- Pecatonica River PW-07
- Pecatonica River PW-02
- Waddams Creek PWQ-04
- Raccoon Creek PWA-01
- Sugar Creek PWB-03
- Sumner Creek PWH-02
- Rock Run PWI-01
- Richland Creek PWP-06
- Cedar Creek PWPA-01
- Otter Creek PWBA-02

The averages of data for each fully supporting stream segment are as follows:

Stream Name	Total Phosphorus	Total Suspended Solids
Pecatonica River PW-07	0.19 mg/l	93 mg/l
Pecatonica River PW-02	0.206 mg/l	66 mg/l
Waddams Creek PWQ-04	0.4 mg/l	14 mg/l
Raccoon Creek PWA-01	0.091 mg/l	20 mg/l
Sugar Creek PWB-03	0.16 mg/l	63 mg/l
Sumner Creek PWH-02	0.036 mg/l	13.5 mg/l
Rock Run PWI-01	0.074 mg/l	18 mg/l
Richland Creek PWP-06	0.17 mg/l	53 mg/l
Cedar Creek PWPA-01	0.062 mg/l	22 mg/l
Otter Creek PWBA-02	0.165 mg/l	35 mg/l
Raw Average	0.156 mg/l	40 mg/l

Based on an average of validated, real-world data for these streams over a period from 1999 to 2013, the load reduction targets for all streams in this watershed are as follows:

Total Phosphorus: 0.156 milligrams/liter
Total Suspended Solids: 40 milligrams/liter

Lake Le-Aqua-Na (RPA) (Cause of TSS listed) has this target:
The Total Suspended Solids: 17 milligrams/liter {analysis of 1999 – 2013 data}

Appendix B. Stage 2 Monitoring Report

Please visit http://www.epa.state.il.us/water/tmdl/report/pecatonica/stage-2.pdf for the full Stage 2 report.

Appendix C. Wasteload Allocations

Individual WLAs

Permit ID	Facility Name	Avg. Design Flow (MGD)	Max. Design Flow (MGD)	Fecal Coliform WLA (billion cfu per day)	
				High Flows and Moist Conditions	Mid-Range to Low Flows
IL0003204	Titan Tire Corporation of Freeport	2.88	--	22	22
IL0003476	Nuestro Queso, LLC	0.35	Not reported	2.6	2.6
IL0020672	RRWD - Winnebago WWTP	0.4	1	7.6	3
IL0023591	City of Freeport STP	6.75	16.6	126	51
IL0024945	Village of Lena – STP	0.6	1.5	11	4.5
IL0026735	Torkelson Cheese Company – Lena	0.1	--	0.8	0.8
IL0028304	Dakota STP	0.1	0.25	1.9	0.8
IL0030562	Village of Pearl City STP	0.101 proposed	0.2563 proposed	1.9	0.8
IL0030571	Village of Pecatonica WWTP	0.6	1.65	11	4.5
IL0034908	Bay Valley Foods LLC	0.162	--	1.2	1.2
IL0036030	Northern Hills Utility STP	0.06	0.13	1	0.5
IL0048259	Village of Winslow – WWTP	0.055	0.137	1	0.4
IL0048593	Otter Creek Lake Utility District STP	0.4	1	7.6	3
IL0054062	Le-Aqua-Na State Park	0.0031	0.00775	0.06	0.02
IL0076210	Adkins Energy, LLC	0.062	0.15	1.1	0.5
IL0077852	Sugar Shores Camping Resort	0.025	0.1025	0.8	0.2
ILG551013	Timber Ridge MHP – Freeport	0.012	0.03	0.2	0.1
ILG551061	River Road MHP	0.0378	0.151	1.1	0.3
ILG551062	Stephenson MHP	0.024	0.048	0.4	0.2
ILG551070	Westlake Utilities, Inc.	0.25	1	7.6	1.9
ILG580021	Shannon STP	0.18	0.45	3.4	1.4
ILG580136	Cedarville STP	0.1	0.25	1.9	0.8
ILG580248	Village of Orangeville WWTP	0.2	0.72	5.5	1.5
ILG580267	Rock City STP	0.04	0.1	0.8	0.3
ILG580278	Village of Davis STP	0.075	0.19	1.4	0.6
ILG582019	Durand Sanitary District – STP	0.35	0.45	3.4	2.6
				TP WLA (lb/day)	
IL0054062	Le-Aqua-Na State Park	0.0031	0.00775	38	

MS4 WLAs

Permit ID	Regulated Entity	Applicable Impairment	Fecal Coliform WLA (billion cfu per day)				
			High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
ILR400434	Village of Rockton	Applicable to PW-13 Impairment	0.9	0.3	0.23	0.14	0.09
ILR400475	Village of Winnebago	Applicable to PW-13 Impairment	5.3	1.9	1.30	0.83	0.50
		Applicable to PW-01 Impairment	5.1	1.80	1.20	0.76	0.44
ILR400505	Winnebago County	Applicable to PW-13 Impairment	0.2	0.1	0.05	0.03	0.02
		Applicable to PW-01 Impairment	0.2	0.06	0.04	0.03	0.02

CAFO WLAs

Permit ID	CAFO Name	Fecal Coliform WLA (billion cfu per day)				
		High Flows	Moist Conditions	Mid-Range Flows	Dry Conditions	Low Flows
ILA010071	Eugene Meier Farm	0	0	0	0	0
ILA010086	Rancho Cantera	0	0	0	0	0

Appendix D. Land Cover-Based Estimates of Annual TN, TP and Sediment Loading

HUC12	Annual TN Load (lbs/day)					
	STEPL Land Use					Watershed
	Cropland	Pastureland	Urban	Forest	Septic	
70900030903	79,166	1,465	241	5	21	80,898
70900031005	4,987	218	14	0	2	5,221
70900031006	61,880	1,491	239	3	17	63,631
70900031101	194	43	-	0	0	237
70900031102	80,176	4,501	465	7	28	85,177
70900031103	125,094	3,625	446	11	36	129,212
70900031104	52,584	2,899	269	13	19	55,784
70900031201	61,534	1,011	637	55	23	63,261
70900031202	108,428	4,862	528	27	37	113,883
70900031203	81,184	1,280	431	25	24	82,943
70900031204	88,497	1,654	1,755	29	31	91,966
70900031301	77,144	320	527	15	20	78,026
70900031302	189,103	2,415	836	28	50	192,433
70900031303	159,822	390	533	3	36	160,785
70900031304	106,215	1,732	410	21	29	108,407
70900031305	104,800	326	589	15	26	105,756
70900031306	166,595	1,313	1,401	46	47	169,402
70900031401	58,772	198	307	4	14	59,294
70900031402	48,296	1,981	270	4	15	50,566
70900031403	181,383	6,815	782	29	57	189,066
70900031404	63,235	1,496	204	8	18	64,961
70900031405	174,151	1,039	661	16	42	175,908
70900031406	129,773	3,483	1,639	40	44	134,979
70900031502	2,991	36	8	2	1	3,038
70900031503	34,927	1,529	208	29	14	36,708
70900031601	61,328	790	541	17	18	62,694
70900031602	84,354	2,622	682	38	29	87,726
70900031603	124,792	2,796	474	27	36	128,124
70900031604	95,873	1,887	600	31	29	98,421
70900040701	3,342	149	35	0	1	3,528
70900040704	10,469	439	67	5	4	10,984
70900040801	39,077	1,921	271	16	15	41,300
70900040802	88,513	2,261	1,030	10	28	91,841
70900040803	68,786	1,513	247	31	22	70,598

HUC12	Annual TP Load (lbs/day)					
	STEPL Land Use					Watershed
	Cropland	**Pastureland**	**Urban**	**Forest**	**Septic**	
70900030903	19,638	127	37	3	14	19,819
70900031005	1,237	19	2	0	1	1,259
70900031006	15,351	129	37	2	11	15,529
70900031101	48	4	-	0	0	52
70900031102	19,889	389	72	4	19	20,372
70900031103	31,032	313	69	5	24	31,443
70900031104	13,044	250	41	6	13	13,355
70900031201	15,265	87	98	27	15	15,493
70900031202	26,898	420	81	13	25	27,437
70900031203	20,139	111	66	12	16	20,344
70900031204	21,953	143	270	14	21	22,402
70900031301	19,137	28	81	7	13	19,266
70900031302	46,910	209	129	14	33	47,295
70900031303	39,647	34	82	1	24	39,788
70900031304	26,348	150	63	10	20	26,591
70900031305	25,998	28	91	8	17	26,141
70900031306	41,327	113	216	23	32	41,710
70900031401	14,579	17	47	2	9	14,655
70900031402	11,981	171	42	2	10	12,206
70900031403	44,995	589	120	14	38	45,757
70900031404	15,687	129	31	4	12	15,863
70900031405	43,201	90	102	8	28	43,429
70900031406	32,193	301	252	20	30	32,795
70900031502	742	3	1	1	1	748
70900031503	8,664	132	32	14	10	8,852
70900031601	15,213	68	83	8	12	15,385
70900031602	20,925	226	105	19	20	21,295
70900031603	30,957	241	73	13	24	31,309
70900031604	23,783	163	92	15	20	24,073
70900040701	829	13	5	0	1	848
70900040704	2,597	38	10	2	3	2,650
70900040801	9,694	166	42	8	10	9,919
70900040802	21,957	195	159	5	19	22,335
70900040803	17,064	131	38	15	14	17,262

HUC12	Annual Sediment Load (tons/day)					
	STEPL Land Use					Watershed
	Cropland	Pastureland	Urban	Forest	Septic	
70900030903	1,762	17	6	0	-	1,784
70900031005	111	2	0	0	-	114
70900031006	1,377	17	5	0	-	1,400
70900031102	1,784	52	11	0	-	1,847
70900031103	2,784	41	10	0	-	2,836
70900031104	1,170	33	6	0	-	1,210
70900031201	1,369	12	15	1	-	1,397
70900031202	2,413	56	12	1	-	2,481
70900031203	1,807	15	10	1	-	1,832
70900031204	1,969	19	40	1	-	2,029
70900031301	1,717	4	12	0	-	1,733
70900031302	4,208	28	19	1	-	4,256
70900031303	3,557	4	12	0	-	3,573
70900031304	2,364	20	9	0	-	2,393
70900031305	2,332	4	14	0	-	2,350
70900031306	3,707	15	32	1	-	3,756
70900031401	1,308	2	7	0	-	1,317
70900031402	1,075	23	6	0	-	1,104
70900031403	4,036	78	18	1	-	4,133
70900031404	1,407	17	5	0	-	1,429
70900031405	3,875	12	15	0	-	3,903
70900031406	2,888	40	38	1	-	2,966
70900031502	67	0	0	0	-	67
70900031503	777	17	5	1	-	800
70900031601	1,365	9	12	0	-	1,387
70900031602	1,877	30	16	1	-	1,924
70900031603	2,777	32	11	1	-	2,821
70900031604	2,134	22	14	1	-	2,170
70900040701	74	2	1	0	-	77
70900040704	233	5	2	0	-	240
70900040801	870	22	6	0	-	898
70900040802	1,970	26	24	0	-	2,019
70900040803	1,531	17	6	1	-	1,554

Appendix E. Critical Area Indicators

HUC12 measured indicators

HUC12 Subwatershed 0709000-	Sediment Yield (tons/acre/yr)	Phosphorus Yield (lbs/acre/yr)	Length of sediment impaired stream (ft)	Length of phosphorus impaired stream (ft)	Length of fecal coliform impaired stream (ft)	Total stream length in HUC12 (ft)
70900030903	0.143	1.59	0	0	0	203,162
70900031005	0.122	1.35	0	0	0	41,004
70900031006	0.136	1.51	0	0	0	655,176
70900031102	0.108	1.19	0	0	0	373,416
70900031103	0.131	1.45	0	0	0	339,405
70900031104	0.098	1.08	0	0	0	374,582
70900031201	0.100	1.11	0	0	0	216,175
70900031202	0.110	1.22	0	0	0	824,802
70900031203	0.124	1.38	0	0	0	724,219
70900031204	0.103	1.14	51,760	0	13,274	866,598
70900031301	0.144	1.60	0	0	0	211,312
70900031302	0.142	1.57	0	0	0	603,263
70900031303	0.166	1.85	0	0	0	362,481
70900031304	0.136	1.51	0	24,802	0	570,385
70900031305	0.150	1.67	0	0	0	264,285
70900031306	0.132	1.47	0	0	22,053	666,161
70900031401	0.156	1.73	0	0	0	133,381
70900031402	0.119	1.32	0	53,517	0	163,161
70900031403	0.119	1.32	0	0	0	621,485
70900031404	0.134	1.49	0	0	0	167,412
70900031405	0.153	1.71	0	0	0	346,648
70900031406	0.103	1.14	26,788	0	26,847	1,404,324
70900031502	0.081	0.90	0	0	0	72,491
70900031503	0.083	0.92	0	0	42,933	129,269
70900031601	0.125	1.39	13,528	13,528	0	142,127
70900031602	0.101	1.12	0	0	0	726,558
70900031603	0.121	1.35	36,900	0	36,900	751,642
70900031604	0.112	1.24	0	0	46,625	777,646
70900040701	0.109	1.20	0	0	0	7,355
70900040704	0.103	1.14	0	0	0	19,965
70900040801	0.101	1.11	0	0	0	155,195
70900040802	0.118	1.30	0	0	0	339,079
70900040803	0.105	1.17	0	0	0	283,540

HUC12 critical area scores

HUC12 Subwatershed	HUC12 Name	Impaired Stream Segment(s)	Watershed Pollutant Yield SCORE (weighted 2x)	Length of impaired stream SCORE	Total stream length in HUC12 SCORE	Overall SCORE
70900030903	**Spafford Creek**	**-**	**6**	**1**	**2**	**3.0**
70900031005	Honey Creek	-	4	1	1	2.0
70900031006	**Indian Creek-Pecatonica River**	**-**	**6**	**1**	**3**	**3.3**
70900031102	Brush Creek-Richland Creek	-	4	1	2	2.3
70900031103	Cedar Creek	-	4	1	2	2.3
70900031104	Richland Creek	-	2	1	2	1.7
70900031201	Waddams Creek	-	2	1	2	1.7
70900031202	Muddy Creek-Pecatonica River	-	4	1	3	2.7
70900031203	Town of Damascus-Pecatonica River	-	4	1	3	2.7
70900031204	**Preston Creek-Pecatonica River**	**Pecatonica River (PW-04 and PW-08)**	**4**	**3**	**3**	**3.3**
70900031301	**City of Lena**	**-**	**6**	**1**	**2**	**3.0**
70900031302	**Upper Yellow Creek**	**-**	**6**	**1**	**2**	**3.0**
70900031303	**Lost Creek**	**-**	**6**	**1**	**2**	**3.0**
70900031304	**Middle Yellow Creek**	**Spring Branch (PWNC)**	**6**	**3**	**2**	**3.7**
70900031305	**Grove Creek**	**-**	**6**	**1**	**2**	**3.0**
70900031306	**Lower Yellow Creek**	**Yellow Creek (PWN-01)**	**4**	**3**	**3**	**3.3**
70900031401	Silver Creek	-	6	1	1	2.7
70900031402	**Winneshiek Creek**	**Winneshiek Creek (PWL-01)**	**4**	**3**	**2**	**3.0**
70900031403	Rock Run	-	4	1	2	2.3
70900031404	**Pink Creek**	**-**	**6**	**1**	**2**	**3.0**
70900031405	**Sumner Creek**	**-**	**6**	**1**	**2**	**3.0**
70900031406	**Wickham Creek-Pecatonica River**	**Pecatonica River (PW-08)**	**4**	**3**	**3**	**3.3**
70900031502	East Fork Raccoon Creek	-	2	1	1	1.3
70900031503	Raccoon Creek	-	2	3	1	2.0
70900031601	Coolidge Creek	-	4	3	1	2.7
70900031602	City of Pecatonica-	-	2	1	3	2.0

HUC12 Subwatershed	HUC12 Name	Impaired Stream Segment(s)	Watershed Pollutant Yield SCORE (weighted 2x)	Length of impaired stream SCORE	Total stream length in HUC12 SCORE	Overall SCORE
	Pecatonica River					
70900031603	**Tunnison Creek-Pecatonica River**	**Pecatonica River (PW-01)**	**4**	**3**	**3**	**3.3**
70900031604	**Pecatonica River**	**Pecatonica River (PW-13)**	**4**	**3**	**3**	**3.3**
70900040701	Spring Creek	-	4	1	1	2.0
70900040704	Mt Hope Cemetary	-	4	1	1	2.0
70900040801	North Branch Otter Creek	-	2	1	1	1.3
70900040802	Otter Creek	-	4	1	2	2.3
70900040803	Sugar River	-	4	1	2	2.3

Primary critical area   Secondary critical area

Appendix F. Public Comments and Responsiveness Summary

Stage 1 Comments

April 17, 2014

Abel Haile
Manager
Planning (TMDL) Unit
Watershed Management Section
Bureau of Water
Illinois Environmental Protection Agency
1021 North Grand Avenue East
P.O. Box 19276
Springfield, Illinois 62794-9276
Abel.Haile@illinois.gov

Re: Pecatonica River Watershed TMDL

Dear Mr. Haile:

Please accept these comments from Illinois Farm Bureau (IFB), Jo Daviess County Farm Bureau, Carroll County Farm Bureau, Ogle County Farm Bureau, Stephenson County Farm Bureau, and Winnebago-Boone Farm Bureau (CFBs) regarding the Illinois Environmental Protection Agency's (Illinois EPA) draft Stage 1 Total Maximum Daily Load (TMDL) Report (Draft Stage 1 Report) for the Pecatonica River watershed in Jo Daviess, Carroll, Ogle, Stephenson and Winnebago counties.

IFB is a member of the American Farm Bureau Federation®, a national organization of farmers and ranchers. Founded in 1916, IFB is a non-profit, membership organization directed by farmers who join through their county Farm Bureau. IFB has a voting membership of more than 82,000. IFB represents three out of four Illinois farmers. IFB and the CFBs share the same set of individual members. Representatives of IFB, as well as several members and staff of the CFBs, were present at the March 19, 2014 public meetings regarding the draft TMDL.

IFB has the following comments and/or questions regarding the Draft Stage 1 Report:

One of the many aspects of the Draft Stage 1 Report that immediately caught our attention and raised serious concerns is the use of the United States Environmental Protection Agency's (USEPA) ecoregional numeric nutrient criteria (NNC). An NNC is offered for phosphorous to set the TMDL's load reduction targets for in-stream conditions in the impaired segments of the river and its tributaries.

Table 4-3 on page 31 lists the “load reduction strategies (sic) targets” for streams and lakes.

In the case of streams, the target is either .0725 micrograms of P per liter for one of the ecoregions and .080 micrograms of P per liter for the other.

We have concerns with the attempt to use any NNC for streams or rivers in this or any other TMDL in Illinois. We especially have concerns when those numeric criteria are derived from EPA’s default ecoregional approach that is based on nutrient concentrations in least disturbed or pristine waters. The reasons for our concerns are as follows.

First, we are very worried that there is no solid, scientific or even discernible relationship between this ecoregional NNC and the required goals of a TMDL under the Clean Water Act. The Draft Stage 1 Report discusses directly the context for our concern:

> The TMDL process establishes the allowable loading of pollutants or other quantifiable parameters for a water body based on the relationship between pollution sources and in-stream conditions. This allowable loading represents the maximum quantity of the pollutant that the water body can receive without exceeding water quality standards.

In other words, the TMDL’s load reduction goals are supposed to relate directly to the desired in-stream conditions, which means they would meet the water quality standards.

Our concern with the use of a P NNC in the Pecatonica TMDL is that there is no “relationship” that can be established between these NNC for P in these streams and the streams’ designated uses as aquatic habitat. Illinois EPA does not have a way, nor does anyone else, of knowing whether meeting this standard of .0725 mg/L - .080 mg/L will result in meeting the aquatic habitat designated uses of the Pecatonica. It is entirely possible that the desired aquatic habitat uses could be fully restored well before these “pristine” levels of P are reached. It is also very possible that these pristine levels could be attained and the streams would still not meet their designated uses. Illinois EPA’s own research has made clear just how little data there are to establish those links.

Not only that, but Illinois EPA says that factors other than nutrients are more limiting to algae growth. See the Nutrient Reduction Strategy PowerPoint on Illinois EPA’s website, which says:

> Nutrients alone do not cause impacts in most Illinois streams because physical factors such as depth, shading, turbidity, substrate and gradient are usually more limiting to algae growth.
>
> - No strong cause-effect threshold values for P or chlorophyll were determined— (and this is) needed for scientifically defensible standards.
> - On two occasions, USEPA has conducted Stressor Response Correlation Studies on Illinois stream data
>   - No strong correlation obtained.

Our primary questions on this issue include the following:

1. Why are these ecoregional NNC for P being used, given that Illinois EPA has rejected them in its own draft Nutrient Reduction Strategy?
2. Is the use of NNC for P in this TMDL even lawful when, according to Illinois EPA, such a criteria cannot be related to the Clean Water Act's water quality standards for the Pecatonica?
3. Does use of this NNC for P set up everyone in the watershed, including farmers, for failure?
4. The Draft Stage 1 Report lists a range of 0.0725 mg/L to 0.080 mgl/L for USEPA ecoregional criteria for stream phosphorus levels, as well as a range of 28.7 to 50.4 mg/L for sediment in streams using USGS Reference Streams. How does Illinois EPA determine what figure in the ranges will be the target?

Setting as a goal that these waters have to be as pristine as the most pristine waters in the region is simply not attainable. We are told that when USEPA tried to establish such NNC for the jurisdictional waters in the state of Florida that the Florida Department of Agriculture estimated that meeting the criteria would cost the farmers of the state about $1 billion in initial costs, and several hundred million dollars a year in ongoing operations and maintenance costs. We most definitely do not want Illinois EPA to create a similar situation here in Illinois. Fortunately, USEPA backed away from those criteria and let the state come up with better standards.

The alternative in the case of the Pecatonica is to develop site specific load reduction goals that are directly associated and correlated with the aquatic habitat designated uses in the Pecatonica. We encourage Illinois EPA to do this instead of using these default and deeply flawed ecoregional criteria.

Table 1-1 – Why are the designated uses of fish consumption and impairments of PCBs not addressed here since those are listed in the 2012 Section 303(d) list too?

p. 7 – Land use and land cover. Is there any newer information from NRCS available since 2008? And, the language cites NRCS 2008, but then Tables 2-4 and 2-5 and Figure 2-1 cite to National Land Cover Database 2006. What is the source of that information?

p. 10 – Soils. There is a cite to NRCS 2007 data. Is there any newer information available than that?

Table 2-8 – Only 3 of the referenced USGS gauges are currently active. Are those continuous monitors? 05435500 is the only currently active gauge that looks at water quality and flow. What parameters are assessed for water quality? How much emphasis was put on the currently inactive gauge information? Why were they taken out of activity? And, not all of the gauges shown on Figure 2-4 are included in Table 2-8. Why is that the case?

p. 18 – This part of the Draft Stage 1 Report discusses additional water quality data at 6 USGS stations, but only one of the currently active gauges looks at water quality. This statement is misleading and implies that all those USGS gauges help to show current water quality, when in fact they do not. None of the USGS water quality only gauges are currently active. Only 2 of the 3 USGS flow and water quality gauges are currently active.

Table 2-9 – This part of the Draft Stage 1 Report lists watershed water quality data and just covers a period of years. How many data points are available for each time period? What methodology/rationale was used to list these segments on the 2012 Section 303(d) List?

Table 3-3 – CAFOs in Project Area - How did Illinois EPA determine the livestock operations to be included in this table? Only two of the facilities are listed on Illinois EPA's website as having a General CAFO NPDES Permit, others are listed on USEPA's Envirofacts website, but there is no indication that they actually have permits. The language in the Draft Stage 1 Report implies that all operations listed in the Table are permitted, which is incorrect. This table and the surrounding language should be corrected.

p. 21 – With regard to NPDES permits, the Draft Stage 1 Report notes that any operation, industry, etc. that discharges to surface water must apply for a permit. That is not the case for CAFOs as the ongoing discharge must be to a "water of the United States." The Draft Stage 1 Report should be updated to include an accurate statement of the requirement.

p. 23 – The Draft Stage 1 Report classifies disposal of manure as a point source, and that is incorrect. The production area is a point source, not the disposal area. The Draft Stage 1 Report should be updated to reflect an accurate statement of this requirement.

p. 28-29 – Livestock, AFOs. This part of the Draft Stage 1 Report should include information regarding the best management practices in place on many livestock farms in the watershed that reduce nutrient losses.

For manure application, those include:

- Application of manure at agronomic rates based on USDA-NRCS and University of Illinois guidelines;
- Injection or immediate incorporation of applied manure into the soil to minimize the potential for manure off-site movement;
- Avoidance of manure applications when precipitation is anticipated within the next 24 hours;
- Maintenance of appropriate no application setbacks (as are currently statutorily defined) from critical areas that can contribute to losses to surface waters when making manure applications; and
- Avoiding and or minimizing the application of manure to snow covered and/or frozen application areas, except where manure is immediately incorporated or injected.

For managing runoff, those include:

- Clean water diversions are used whenever possible to keep uncontaminated water from coming into contact with manure;
- Lot areas are daily scrapped and the resulting manure is removed and stored in an area protected from precipitation;
- Runoff from animal feeding and loafing areas is collected and appropriately disposed of via land application, wetlands, filter strips, or other practices intended to keep the runoff volume on the treatment site;

- Silage leachate, milkhouse waste, or other liquids which have come into contact with manure is treated like manure and stored until they can be land applied when conditions are appropriate to avoid land application area runoff;
- Feeding areas are, whenever possible, protected from precipitation to minimize the amount of feed lot runoff that must be managed.
- Appropriate management of pasture or grazing-based livestock production minimizes the potential for nutrient losses from production areas by eliminating uncontrolled livestock access to streams and drainage ways, maintaining areas that receive heavy use and high traffic, and providing shade and watering sources away from streams and waterways.
- Livestock producers can impact the potential for phosphorus nutrient losses by reducing the phosphorus content in their animal feeds thus reducing the amount of phosphorus ending up in the manure. Formulating diet rations consistent with University of Illinois recommendations can, in some cases, reduce the phosphorus content of the resulting manures.

p. 34-43 – Why do some sample points only have a few data points while others have several?

p. 48 – Why is additional data not recommended for all of the stream segments?

During the public meeting, it was stated that, for purposes of the Draft Stage 1 Report, the water bodies in question are assumed to meet Illinois Water Quality Standards at the border between Wisconsin and Illinois. What are the assumptions made regarding Wisconsin Water Quality Standards? More should be done by Illinois EPA to actually determine the water quality at that point, and then factor that into the TMDL. Without doing that, the TMDL will not present a clear and accurate picture of the current water quality in the watershed. The Wisconsin portion of the Pecatonica River watershed has significantly more animal agriculture than the Illinois portion, a very large portion of which is comprised of small animal feeding operations. Further, it is common practice in Wisconsin's portion of the Pecatonica River watershed for manure to be hauled daily in the winter, often closely along the river, which is then subject to flooding in the spring.

What SWCD or Section 319 projects have been done in the area in the past 10 years?

How many exceedances of the various standards are needed to determine certain segments as impaired? How is it possible that there is enough data to determine a water body as impaired, but not enough to create the TMDL? For example, please see the situation with Winneshiek Creek.

If Illinois EPA does move forward in gathering additional data in the watershed and some segments are shown to no longer be impaired, what is the process of delisting the segment from the Section 303(d) list?

If Illinois EPA does move forward in gathering additional data, what will be the methodology for sampling location and timing? Multiple samples should be taken at the same location in different flow scenarios to gather the most accurate picture of the water quality in that particular area.

Thank you for the opportunity to comment on the draft TMDL for the Pecatonica River watershed.

Sincerely,

Lauren Lurkins
Director of Natural and Environmental Resources
Illinois Farm Bureau®
1701 Towanda Avenue
Bloomington, IL 61701-2050

Carroll County Farm Bureau

Jo Daviess County Farm Bureau

Ogle County Farm Bureau

Stephenson County Farm Bureau

Winnebago-Boone Farm Bureau

Pecatonica River Watershed TMDL Comments

My name is Bruce Johnson and I serve as the manager of the Stephenson County Farm Bureau in Freeport IL. I am submitting these comments on behalf of the 4500 members of our organization, many of whom are actively involved in production agriculture and /or own land in Stephenson County and northwest Illinois. Those involved in production agriculture are genuinely concerned with the business of resource conservation and management, and they work diligently to ensure that their practices and management systems serve the purpose of maintaining the quality of our environment.

As Illinois EPA gathers data and prepares to begin additional sampling procedures, it is imperative that adequate consideration is given to the current management practices and technologies being utilized by our farmers to remediate contaminants, sediment, etc. entering the waters of the region. Some of the data being used as a basis for determining impaired waters is quite outdated and in some cases may have been collected under extreme, non-typical situations (such as the drought year of 1988 when a number of extreme circumstances could have yielded elevated readings). We strongly encourage IEPA to seek out all relevant information relating to these issues to gain a clear and comprehensive understanding of the dynamics of today's rural landscape. Farm Bureau, NRCS, and other organizations are ready and willing to help fill these information gaps to give an accurate assessment. Most farmers can provide an extensive list of improved practices implemented in recent decades that have positively affected outcomes.

I also want to stress the need for the highest degree of integrity possible in selecting those who will do the sampling process in the affected waters. It is critical that only qualified individuals who have an unbiased perspective and no personal agendas are secured for this task, as there are individuals and groups out there who have established themselves as anti-agriculture and who have an interest in undermining animal agriculture operations in particular. If civilian contractors are used, they need to be fully investigated to ensure proper protocol is followed.

A final concern is the lack of accurate measures of water quality entering the region from Wisconsin. It is unfair to base assessments of waters in our region on assumptions of clean water entering at the border, when by most accounts of people living in that area the waters are anything but clean. The agricultural footprint of southwest Wisconsin is quite similar to northwest Illinois with large livestock numbers, and to not have an adequate baseline reading from which to start seems counterproductive. I understand that collaboration and cooperation in these efforts may be difficult, but in fairness to those in the affected areas there needs to be a realistic benchmark of waters entering the Pecatonica watershed.

I hope that we can have continued open dialogue as this process moves forward, as our stakeholders want to be aware of what's happening and any potential outcomes. Thank you for your consideration of these and other comments relating to this project.

Bruce A. Johnson, Manager
Stephenson County Farm Bureau
210 W. Spring Street
Freeport IL 61032-4346
(815) 232-3186

Comments Received:

Comment Letter #1:

Good morning,

We are farmers in the Pecatonica River watershed and wanted to share some information about current farming practices we use. We are considered a medium sized CAFO and were listed in the report under the Spring Branch. I am very concerned about the data being used in the models as it is listed as a test from 1988. That is 26 years ago! My how farming practices have improved since then!

Here are some things that were issues looking back to 1988.

1) The summer of 1988 was a major drought year. Water levels in our creek were extremely low, so anything being tested for would naturally be very concentrated compared to a normal year and creek level.

2) At that time we were feeding beef cattle and hogs. Our cattle were allowed to graze the pastures that the creek ran thru and there were extremely high stocking rates (up to 100 head) and little grass cover left because they were fed in the yard and left to go out on the pasture. This in turn caused creek banks to be eroded away as well.

3) The yards they were fed in all were designed many years before to have the water run off in a rain storm, along with manure, and end up in the creek.

4) Our hog pens were the same way along with many other farms at that time.

5) Our crop land was often plowed and had very little residue remaining to hold the soil in place in a heavy rain event.

6) Manure was applied where it was convenient, usually near the farmstead.

7) Commercial fertilizer was broadcast spread on fields at the same rate across the entire field.

8) Insecticide was applied to all corn acres as a preventative measure against insects.

Now, for the changes that have happened since the last water tests back in 1988.

1) We are no longer feeding beef cattle or hogs, but now are feeding dairy replacement heifers.

2) We have all pastures seeded to grass and maintain that grass by only putting enough animals there that they are no longer fed any other feed. Where there used to be 100 head, today only has 5 head. Grass is maintained and cutting of creek banks by cattle has been eliminated.

3) We no longer use any of the outside yards that were previously used and had runoff issues. We spent over $600,000. dollars to build a new confinement freestall barn with an attached concrete manure storage pit. All manure is channeled directly to the pit and has no chance of pollution.

4) We also purchased the farm across the road, quit using some yards the previous owner had cattle in, and spent another $100,000. to build a manure pit there to collect all runoff from the yards we still use there. We also implemented the same pasture practices where supplemental feeding is no longer done, and significantly less animals are maintained on the pasture during the summer months.

5) Now, all of our land is covered by a nutrient management plan that spells out exactly where and how much manure can be applied to a field based on soil test results and manure test results. We no longer haul manure where its convenient, now we apply it where it is needed for the crops. There is also a setback from any stream, well, or residence where applications can't be placed.

6) All crop land is soil tested on 2.5 acre grids and commercial fertilizer is applied only in needed amounts, varying rates on those same 2.5 acre grids through the use of GPS technology on application equipment. The needed amounts are determined by the test and the nutrient management plan.

7) GMO crops have allowed us to discontinue using insecticide because the target pests such as rootworm in corn can be controlled by the plant, rather that the use of insecticides which could be washed away and also killed beneficial insects.

8) We also have implemented the use of cover crops. We seed annual ryegrass on the acres which we harvest corn silage or remove the stalks for bedding. This is seeded in the fall and begins growing to hold the soil in place thru the winter and spring when it is harvested for feed and then another crop is no-tilled into those fields. We also use wheat on some land and take it to harvest in the summer and use a sorghum/sudan grass cover after that. No land is left bare!

9) We also use contour rows, which run around hills rather than straight up and down. These contours help to hold the soil in place when it rains as the plants hold the water from running between the rows. No-till has also become a common practice to eliminate soil and nutrient loss as well.

10) Precision farming has been a great benefit to us and the environment as well. We now have automatic shutoffs for our nitrogen application equipment, sprayer, and planter. These shutoffs use GPS to automatically shut off sections of the implement as they reach a point in a field that has already been applied. This greatly reduces over application of nutrients, chemicals, and seed. The contours mentioned above often cause a field to have rows that come out on an angle. When we previously had to have all of the machine running to apply on the end rows until the last row was covered, now each section shuts off when it gets to those areas.

These are not unique practices to our operation. This has become commonplace in agriculture today. Hopefully you can understand that many positive changes have been implemented and will continue to be used and adapted as new practices are developed. Please use CURRENT data when comparing our water quality, as we have made huge investments to improve our methods. Please test the water as it comes across the state line from Wisconsin and not assume that water to be pristine. Also, be sure the standards being used are attainable. We can't control wildlife, household overuse of chemicals and fertilizers, or municipalities whose sewer systems overflow every time it floods like our small town does. Farmers are the ultimate environmentalists, because we want to leave our land better for our children and grandchildren.

Thank you.

Comment Letter #2:

Abel,

I am a dairy farmer that lives near Kent, Illinois. I have attended two of your meetings that were held in Freeport concerning the Pec watershed. I have farmed on the same farm that my father farmed over thirty years. Agriculture has changed significantly over the years.
On our dairy operation we are able to use all the nutrients produced from the dairy animals for our crops. The only nutrient that we purchase is nitrogen because the corn crop uses more nitrogen than what we can supply with manure without having an over application of phosphorous. We use urea as a nitrogen source and it is applied at the same time we plant with an attachment on the planter. We apply 200# of urea per acre. That is about 92 units of nitrogen. The rest of the needs for the corn crop come from the residual nitrogen from the previous crop and the cow manure. We use alfalfa in our crop rotation. It is an excellent feed source for our dairy cows. It produces its own nitrogen and protects our soils from erosion. The main source of potential contamination of our streams is from erosion. Farmers know the importance of keeping the soil in place and the economical benefit of applying the proper nutrients at the proper time. We are constantly improving our methods with the use of newer technology and equipment.

Some questions I have are:

The watersheds in this area are already on a five year rotation with water testing. How does this project compare to the current testing procedure? Your data presented showed water samples that were taken over 30 years ago. If there is a rotating testing procedure why is there such a gap in data collected?

The map shows areas of the impaired watershed. These areas are the same parts of the stream that are slow moving. When we have potential flooding conditions, these areas are the areas that are flood prone. Do you take into account the flow of the stream when collecting data and does the water test reflect this?

You indicated that part of this watershed study will be to identify any point and non-point contamination. How intensive will this investigation be?

Reducing the TMDL of the streams is part of the goal of this project. You are attempting to do this on a voluntary basis. When does the voluntary become involuntary?

If the agriculture sector continues to make strides in improving the efficiencies of using the nutrients they apply, how will this study acknowledge the advancements made?

The Illinois Fertilizer and Chemical Association is doing research on reducing nutrients going into the streams. Will you be able to utilize any of their results in your study?

Once a stream is on the impaired waters list. What does it take to get the stream off the list?

In the investigation of source of pollution, will there be any testing done to indicate the source is natural, livestock or human (any DNA testing)?

You indicated that Lake Le-Aqua-Na will be studied using a model. Wouldn't it be more accurate if an actual testing program was done on the lake?

I know that this is a large project. Your results from this testing will have a significant impact on all the residents in the area. We want to be reassured that the testing procedure is done in such a way as to fairly access the conditions of the streams. If improvements must be made we want them recommended in a way that is cost effective and measurable. If a farmer makes an improvement in their operation that affects the streams, we want to know if it was effective.

Thank you,

Comment Letter #3:

Mr. Haile

Following are some of the concerns I feel need to be addressed before, after reviewing the stage 1 report and attending the informational meetings in Freeport, Illinois.

1. The report is seriously lacking in current documentation. table 2-8,page 14 shows only 3 USGS test sites.

Only 2 sites in the entire watershed have current data.

2. Section 33.1 states that field tile runoff contains all of the original pollutants. This is not true. The majority of nutrients are taken up by plants,bound by soil particles,or evaporated before entering tile lines.

3.Table 3-6,estimated livestock animal units.Who estimated these numbers? This data needs to be updated and current best management practices , in place, need to be included.

4. Page 36 discusses high TSS concentrations:

Freeport STP had 4 permit exceedances for TSS 2010-2013

Cedarville STP had 18 permit exceedances for TSS 2010-2013

Is fecal bacteria part of the TSS discharge?

Reference is made to high livestock concentrations in the same section.

What is the definition of "high livestock concentration"?

Who determines if concentrations are high?

What is the criteria used to make these determinations?

5. If the goal is to accurately test the affected areas, why is all of the additional testing being done between now and the Fall of 2014?

6. Why are only some portions being tested, and not all stream segments?

7. It was stated that volunteers would collect water samples. This is unacceptable. There is too much at stake to not have properly trained professionals testing and documenting the testing methodologies, locations and times of the test procedures.

8. Based on the current information, in the report and presented at the meetings, the timetable needs to be extended to allow accurate gathering and assessment of data. All data should be readily available for review by all parties in the watershed.

Thank you,

Comment Letter #4:

Comments on Pecatonica River TMDL and load reduction strategies stage 1 report:

Section 3.3.2, beginning on page 22

One thing that struck me as out of place in this section is the channel evolution model of Simon and Hupp diagramed on p 26. This model describes the response of a stream to channelization and resultant downcutting. There has been very little channelization in the Pecatonica basin, and therefore this model is not really relevant. A much more relevant model to the Pecatonica basin is the work of Stanly Trimble in the Coon Creek watershed of SW Wisconsin. Trimble describes the rapid aggradation of river channels and floodplains in response to the vastly increased sediment loading resulting from the clearing of prairie and woodland ground cover by the first settlers. Francis J. Magilligan describes similar aggradation in the Galena River basin a short distance west of the Pecatonica. Though no detailed study of floodplain aggradation in the Pecatonica River has been done (to my knowledge,) there is abundant evidence of this process in the river valley. The Pecatonica has one of the lowest gradients of any stream in the state, and has an extremely well developed meandering pattern. This low gradient leads to extensive flooding in the river valley, with associated deposition on the floodplain.

The reduction in sediment load due to better soil conservation practices from the mid 20th century to the present has allowed the river to become slightly entrenched within this floodplain sediment, resulting in a stream channel bounded in most places by nearly vertical mud banks. These steep banks provide ideal nesting habitat for bank swallows and kingfishers.

The references for the Magilligan and Trimble works are as follows:

Magilligan,Francis J. (1985) Historical floodplain sedimentation in the Galena River Basin, Wisconsin and Illinois, Annals of the Association of American Geographers, 75: 583-594

Trimble, S.W., and Lund, S.W. 1982, Soil conservation and the reduction of erosion and sedimentation in the Coon Creek Basin, Wisconsin. U.S. Geological Survey Professional Paper 1234, Washington, D.C.: Government Printing Office

Table 2-9, Page 20, I had some questions about the data for site PWNC-PC-D1. The table lists the site as "Near Pearl City STP," and I think that is misleading since the STP discharges into Yellow Creek, not Spring Branch. Any impairments to this stream come from hog and cattle feeding operations, not the STP. Also, I was surprised to see there has been no testing in the creek since 1988. The Ronald Bremmer CAFO is located along this creek, and Bremmer was recently designated "Farmer of the Year" by Prairie Farmer Magazine. In the article it mentions extensive testing by the EPA, and I'm wondering why the results of this testing did not make it into the report.

Notes on Recreational potential in the basin:

I have canoed and kayaked extensively in the Midwest, West, and Canada over the last 45 years, and feel qualified to comment on the recreational potential of streams in the Pec Basin. I consider the Pecatonica to be a good stream for recreation, especially since access points have been developed in recent years. Scenery is not spectacular, but it is a great stream for riparian wildlife, and has been known to yield some good fishing. Water quality is the biggest limitation in that area.

I consider Yellow Creek to be an excellent river for recreation, with some truly spectacular scenery. The creek alternates between slow, meandering segments and shallow, steep, rocky segments bounded by dolostone bedrock walls. These rocky segments are places where the stream channel was displaced from its ancient, pre-glacial valley by the Illinoisian glacial advance. Krape Park includes one of the nicest of these segments, and the bluffs extend another mile or two upstream from the park. Another bluff lined segment extends from Sec. 13 of Loran township into sec 18 of Florence. These very scenic segments are what set the stream into the category of an exceptional recreational stream. With an improvement of water quality and the lowering of the dam at Krape Park (which the Park District hopes to do if they can find the money,) fishing would be greatly enhanced.

Sampling needs:

The listing of impaired waterways in the draft report seems very arbitrary, with many impaired sections not making the list because they have not been sampled, and some impaired sections that have not had followup checks in decades. Consistent, regular sampling and evaluation of water quality would seem to be crucial if any progress is going to be made in identifying pollution sources and developing remediation strategies.

Stage 3 Comments and Responsiveness Summary

60 YEARS 1958 2018
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April 4, 2018

Mr. Abel Haile
Illinois EPA, Watershed Management Section
1021 North Grand Avenue East
P.O. Box 19276
Springfield, Illinois 62794-9276

Sent via e-mail: Abel.Haile@illinois.gov

Re: Pecatonica River TMDL and LRS, Draft Phase 3 Report

Dear Mr. Haile:

The Natural Land Institute (NLI) is a private non-profit land trust that has been working for sixty years to protect natural land and water in northern Illinois, including within the Pecatonica River watershed. NLI owns 720 acres of land at the mouth of the Pecatonica River known as the Nygren Wetland Preserve; Raccoon Creek flows through the preserve to its confluence with the Pecatonica. We also own preserves along the Pecatonica River and near the Stateline along Raccoon Creek.

NLI is currently working with several other organizations and agencies to develop a Regional Strategic Land and Water Conservation Plan for northwestern Illinois. One of the goals of this planning process is to define the role that land trusts and other land conservation groups and agencies can play to reduce nutrients and improve water quality in the rivers and streams in the region. The Pecatonica River watershed encompasses a large part of the region, so we are very interested in exploring the potential for cooperating with the IEPA to implement watershed management strategies in critical areas identified in the Pecatonica River TMDL/LRS plan.

First, I have some questions about the draft TMDL/LRS report for the Pecatonica River. Specifically I would like to know the following:

1. Segments of the Pecatonica River between Freeport and Winslow, and Freeport and Harrison are no longer designated as "Impaired Stream" although they appeared on earlier 303d lists. The same is true for Cedar Creek and the Sugar River. Can you explain why these river segments are no longer on the list of impaired streams? This is not clear from the Phase 2 or Phase 3 reports.

2. When was Winneshiek Creek added to the list of "impaired streams"? (Section 5.4) It appears that it was added based on the results of additional water quality monitoring done after the Phase 2 report.

3. Raccoon Creek is designated as an "Impaired Stream" due to high levels of fecal coliform bacteria, but the watershed is not designated as either a 'Primary Critical Area" or "Secondary Critical Area" (Figure 50. Critical areas map, page 90-91). Why isn't the Raccoon Creek watershed designated a critical area?

We recommend that other land retirement strategies be added to the list of potential Best Management Practices in Section 8.4, in addition to "Riparian Buffers and Filter Strips". These should include the use of Agricultural Conservation Easements, CRP Forestry Practices, bio-reactors, constructed wetlands, and floodplain restoration. NLI and other land trusts and conservation agencies are adept at using these strategies to reduce nutrients and sediments and improve water quality in rivers and streams in the Pecatonica River watershed. A good example is the restoration of the floodplain forests and wetlands in the Nygren Wetland Preserve at the mouth of the Pecatonica River.

We also recommend that the Natural Land Institute, Trout Unlimited, Illinois Audubon Society, The Nature Conservancy, Forest Preserves of Winnebago County, Jane Addamsland Park Foundation, Northwest Illinois Audubon Society, and other public and private land conservation organizations and agencies be added to the list of potential partners to implement the plan in Section 8.8.1. NLI has entered into an agreement with Trout Unlimited and other partners to implement a US Dept. of Agriculture Regional Conservation Partnership Program (RCPP) award to implement permanent conservation practices to reduce pollution and sediment runoff into streams. We are eager to explore potential partnerships to implement the recommendations in the Pecatonica River TMDL/LRS plan.

Thank you for the opportunity to comment on the Draft Stage 3 Report for the Pecatonica River Total Maximum Daily Load and Load Reduction Strategies.

Sincerely yours,

Kerry Leigh

Kerry Leigh
Executive Director

From: Sheila J. McCabe
Sent: Friday, April 13, 2018 6:56 PM
To: Haile, Abel <Abel.Haile@Illinois.gov>
Subject: [External] Pecatonica River TMDL and LRS Draft Stage 3 Report GIS Data Request

Hello Abel,

I work for Applied Ecological Services (AES) and we are working with the Natural Land Institute and other regional partners (including Scott Tomkins also from IEPA) on a nutrient reduction strategy for several counties in northwestern Illinois, which also encompasses the Pecatonica River Watershed. AES' role in the project is to develop the GIS mapping and a prioritization strategy for targeting on-the-ground projects. We believe information provided in your Pecatonica River Total Maximum Daily Load and Load Reduction Strategies Draft Stage 3 Report will be very useful for prioritization purposes, particularly the critical areas, impaired streams, and the NPDES mapped layers.

I have downloaded the 303(d) Impaired Waters geodatabase from the EPA's website https://goo.gl/JhyzXN. However, based on maps showing impaired streams in the Draft January 2018 report, the dataset available on the website is outdated. Would you be able to point me to where I can get the updated GIS data (shapefile or geodatabase) used in the maps for the impaired streams, please? Additionally, it would be very appreciative if I could get the GIS data layers for the Critical Areas and NPDES as well.

Feel free to give me a call to discuss the possibility of acquiring these data layers if you'd like.

Many thanks in advance,

Sheila

Sheila McCabe
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Responsiveness Summary

Pecatonica River Watershed

Total Maximum Daily Load

The responsiveness summary responds to questions and comments received during the public comment period from March 7, 2018, through April 7, 2018.

What is a TMDL?

A Total Maximum Daily Load (TMDL) is the sum of the allowable amount of a pollutant that a water body can receive from all contributing sources and still meet water quality standards or designated uses. **The Pecatonica River Watershed** TMDL report contains a plan detailing the actions necessary to reduce pollutant loads to the impaired water bodies and ensure compliance with applicable water quality standards. The Illinois EPA implements the TMDL program in accordance with Section 303(d) of the federal Clean Water Act and regulations thereunder.

Background

The watershed targeted for TMDL development is the **Pecatonica River Watershed** located in in northwestern Illinois and southwestern Wisconsin. The portion of the watershed in Illinois, which this TMDL addresses, covers nearly 805 square miles and includes lands within Carroll, Jo Daviess, Ogle, Stephenson, and Winnebago Counties in Illinois.

The Clean Water Act and USEPA regulations require that states develop TMDLs for waters on the Section 303(d) List. Illinois EPA is currently developing TMDLs for pollutants that have numeric water quality standards. Therefore, fecal coliform TMDLs were developed for the Pecatonica River (waterbody segments PW-01, PW-08, and PW-13), Racoon Creek (Waterbody Segment PWA-01), and Yellow Creek (PWN-01). A total phosphorus (TP) TMDL was also develop for Lake Le-Aqua-Na (waterbody segment RPA). These waterbodies are listed as impaired per the *Draft Illinois Integrated Water Quality Report and Section 303(d) List-2016.*

In addition, a Load Reduction Strategy (LRS) was developed for pollutant(s) that do not have numeric water quality standard. These include sedimentation/siltation and total suspended solids (TSS) LRSs for Pecatonica River (waterbody segments PW-01, PW-04, and PW-08) and Winneshiek Creek (waterbody segment PWL-01). Total phosphorus LRSs were developed for Coolidge Creek (waterbody segment PWF-W-C1), Winneshiek Creek (waterbody segment PWL-01), Spring Branch (waterbody segment PWNC), and LRS for TSS was developed for Lake Le-Aqua-Na (waterbody segment RPA).

Illinois EPA contracted with TetraTech (a TMDL Consultant) to prepare the TMDL report for the Pecatonica River Watershed project.

Public Meetings

Two draft Stage 1 public meetings were held on March 19, 2014 (at 3:00 pm and 5:00 pm) at the Stephenson County Farm Bureau at 210 West Spring Street in Freeport, Illinois. Over 90 stakeholders attended the meetings, and the public comment period for the Stage 1 meeting closed on April 18, 2014.

The draft Stage 3 public meeting was held on March 7, 2018, at 1:00 pm, at the Stephenson County Farm Bureau in Freeport, Illinois. Approximately 45 people participated in the public meeting and the public comment period ended at midnight on April 7th, 2018.

Illinois EPA provided public notice for all meetings by placing a display-ad in Freeport Journal-Standard (the local newspaper). In addition, a direct mailing was sent to several stakeholders/Permittees in the watershed. The notice gave the date, time, location, and purpose of the meeting. The notice also provided references on how to obtain additional information about this specific site, the TMDL program, and other related information. The draft TMDL report was available for review in hard copy at the Stephenson County Farm Bureau, the City of Freeport Public Library, and electronically on the Agency's webpage: www.epa.illinois.gov/public-notices/index.

Questions & Comments

1. Segments of the Pecatonica River between Freeport and Winslow, and Freeport and Harrison are no longer designated as “Impaired Stream” although they appeared on earlier 303(d) lists. The same is true for Cedar Creek and Sugar River. Can you explain why these river segments are no longer on the list of impaired streams? It is not clear from the phase 2 or phase 3 reports.

   Response: At the time the TMDL Contract for Pecatonica River Watershed was developed the Pecatonica River segments (IL_PW-07, PW-02, IL_PW-01), Cedar Creek segment IL_PWPA-01 and Sugar River segment IL_PWB-01 were listed as impaired in the Draft 2012 Illinois Integrated Water Quality Report 303(d) list. As part of the TMDL development process (Stage 2 - Monitoring) and IEPA/BOW-Surface Water Monitoring Program, additional monitoring and assessment was conducted to confirm the impairments. As discussed below for the segments that are no longer impaired a TMDL was not developed. Illinois EPA has also reached out to USEPA for assistance to develop Statewide TMDL for mercury and PCBs.

   <u>Pecatonica River between Freeport and Winslow:</u>

   Segment IL_PW-07, Pecatonica River from the Illinois – Wisconsin State Line downstream to Scioto Mills, was assessed as Fully Supporting for Aquatic Life Use and Not Supporting for Fish Consumption due to PCBs impairments in 2016 using the 2012 Intensive Basin Survey data.

   Segment IL_PW-07 is currently listed for Not Supporting Fish Consumption in the 2016 Draft Illinois Integrated Water Quality Report (IR) - 303 (d) list.

   <u>Pecatonica River between Freeport and Harrison:</u>

   The Pecatonica River between Freeport and Harrison is currently assessed as Not Supporting for Aquatic Life Use and Fish Consumption.

   In 2010, Segment IL_PW-02, from Pecatonica downstream to Oliver Road, was assessed as Fully Supporting for Aquatic Life Use using the 2007 Intensive Basin Survey data, and in 2016, the segment was re-assessed as Not Supporting for Aquatic Life Use using 2012 Intensive Basin Survey data. Segment IL_PW-02 is currently listed as Not Supporting Fish Consumption because of mercury and PCBs impairments in the Draft 2016 IR.

   Segment IL_PW-01, from Oliver Road downstream to Harrison, was assessed as Not Supporting for Aquatic Life Use, Fish Consumption, and Primary Contact Recreation in 2016, using the 2012 Intensive Basin Survey data and the segment is listed in the Draft 2016 IR - 303(d) list. The cause of impairments are sedimentation/siltation, total suspended solids, fecal coliform, and PCBs.

Cedar Creek

Segment IL_PWPA-01, Cedar Creek, was assessed as Fully Supporting for Aquatic Life Use in 2010 using 2007 Intensive Basin Survey data.

Sugar River

Segment IL_PWB-01, Sugar River, has been listed as Fully Supporting for Aquatic Life Use in the Draft 2008, 2010, 2012, 2014, and 2016 IR. Fish Consumption in this segment remains impaired and is currently listed as Not Supporting.

Segment IL_PWB-03, Sugar River has been listed as Fully Supporting for Aquatic Life Use in the Draft 2008, 2010, 2012, 2014, and 2016 IR, while Fish Consumption in this segment remains impaired and is currently listed as Not Supporting in the Draft 2016 IR.

2. When was Winneshiek creek added to the list of "impaired Streams" (Section 5.4)? It appears that it was added based on the results of additional water quality monitoring done after the phase 2 report.

   Response: Winneshiek Creek was placed on 303(d) list of impaired waters in the Draft Illinois Integrated Water Quality Cycles - 2008, 2010, 2012, 2014, and 2016. As part of the TMDL development process, the Stage 2- Monitoring results verified the impairment.

3. Raccoon Creek is designated as "Impaired stream" due to high levels of fecal coliform bacteria, but the watershed is not designated as either a 'Primary critical area" or "Secondary critical area" (Figure 50. Critical areas map, pg. 90-91.) Why isn't the Raccoon Creek watershed designated a critical area?

   Response: Three indicators were used watershed-wide to select critical areas, while Raccoon Creek scored high for being impaired, the other two indicators were low (Watershed Yield and Total Stream Length), resulting in Raccoon Creek not being ranked very high overall. Appendix D provides the critical area scoring. Please note that even though Raccoon Creek is not identified as a critical area, implementation activities are still potentially fundable under the 319 program.

4. We recommend that other land retirement strategies be added to the list of potential Best Management Practices in Section 8.4, in addition to "Riparian Buffers and Filter Strips." These should include Agricultural Conservation Easements, CRP Forestry Practices, bio-reactors, constructed wetlands, and floodplain restoration.

Response: We have added the following text to the 1st paragraph under Section 8.4: Other BMPs such as conservation easements, forestry practices, constructed wetlands and floodplain restoration, amongst others, can also be used to meet pollutant reduction requirements.

5. We recommend that the Natural Land Institute, Trout Unlimited, Illinois Audubon Society, The Nature Conservancy, Forest Preserves of Winnebago County, James Addamsland Park Foundation, Northwest Illinois Audubon Societies, and other public and private land conservation organizations and agencies be added to the list of potential partners to implement the plan in Section 8.8.1.

   Response: Thank you, these entities have been added as potential partners.

6. The 303(d) Impaired Waters geodatabase is available for download from the EPA's website; https://goo.gl/JhyzXN. However, based on maps showing impaired streams in the Draft January 2018 report, the dataset available on the website is outdated. Would you tell us where to find the updated GIS data (shapefile or geodatabase) used in the maps for the impaired streams, please? Additionally, it would be very appreciative if we could get the GIS data layers for the Critical Areas and NPDES as well.

   Response: The current NDPES layer and the 2016 Integrated Report 303(d) - streams layers are available for download on the Resource Management Mapping Service (RMMS) at the Agency's website: (http://www.rmms.illinois.edu/RMMS-JSAPI/). The NPDES layer will be updated in the near future. Once the final report has been completed, and submitted to USEPA for approval, the GIS maps and data will be available for stakeholders (a FOIA request may be necessary).