Adaptive Management Technical Handbook

A Guidance Document for Stakeholders

Wisconsin Department of Natural Resources
6/1/2020

Guidance Number: 3400-2020-11

Edition: 2

This document is intended solely as guidance and does not contain any mandatory requirements except where requirements found in statute or administrative rule are referenced. Any regulatory decisions made by the Department of Natural Resources in any matter addressed by this guidance will be made by applying the governing statutes and administrative rules to the relevant facts.

Approved:

Adrian Stocks *6/18/2020*

Adrian Stocks, Director **Date**
Bureau of Water Quality
Wisconsin Department of Natural Resources

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Abbreviations/Acronyms

This list contains the most common abbreviations used in this document.

AM	Adaptive Management
BMP	Best Management Practice
CSA	Critical Source Area
DATCP	Department of Agriculture, Trade and Consumer Protection
DMR	Discharge Monitoring Report
EPA	United States Environmental Protection Agency
HUC	Hydrologic Unit Code
LCD	Land and Water Conservation Department
mg/L	Milligrams Per Liter
MOU	Memorandum of Understanding
MS4	Municipal Separate Storm Sewer System
NPS	Nonpoint Source
NRCS	Natural Resources Conservation Service
POTW	Publicly Owned Treatment Works
PS	Point Source
TMDL	Total Maximum Daily Load
TSS	Total Suspended Solids
µg/L	Micrograms Per Liter
USGS	United States Geological Survey
WDNR	Wisconsin Department of Natural Resources
WPDES	Wisconsin Pollutant Discharge Elimination System
WQBEL	Water Quality-Based Effluent Limit
WQC	Water Quality Criteria
WQT	Water Quality Trading
WWTF	Wastewater Treatment Facility

Executive Summary

Adaptive management is a phosphorus compliance option available to many wastewater dischargers throughout Wisconsin pursuant to s. NR 217.18 Wis. Adm. Code. The purpose of this document is to advise point sources as well as other interested entities about adaptive management, when to consider adaptive management, and how to develop a successful adaptive management plan. The adaptive management handbook is designed to be a comprehensive document to provide guidance to multiple user groups and audiences. It is recommended that permittees contact their local WDNR wastewater engineer, specialist, or adaptive management coordinator prior to adaptive management plan development for additional guidance (see Section 6, pg. 81 for contact information). Adaptive management questions not addressed in this guidance can also be submitted to DNRphosphorus@wisconsin.gov.

This handbook is broken up into six sections, with additional information provided in appendices. The following hyperlinks are also available to take you directly to the section(s) you are most interested in:

Information you may be seeking	*Hyperlink to direct you*
Background Information about Adaptive Management	Section 1. Introduction
Benefits of Adaptive Management	Section 2. Adaptive Management Commitment
Determining Eligibility	Section 3. Adaptive Management Eligibility
Deciding if Adaptive Management is Right for You	Section 3. Making a Decision
Comparing Water Quality Trading to Adaptive Management	Section 3. Trading vs. Adaptive Management
Permit Requirements	Section 4. Permit Requirements
Adaptive Management Limits	Section 4. Interim Limits
Adaptive Management & Small Discharges	Section 4. Lagoons and Other Small Discharges
Parts of the Adaptive Management Plan	Section 5. Components of the Plan
Developing an Adaptive Management Plan	Section 5. Developing the Plan
Contact Information to Seek Additional Help	Section 6. Contact Information
Adaptive Management Request Form	Appendix G. The Request Form
Adaptive Management and MS4 discharges	Appendix C. Permitted Urban Discharges
Finding Phosphorus Data in your Watershed	Appendix E. Finding Phosphorus Data

Section 1. Introduction

Wisconsin's phosphorus water quality standards were adopted in December of 2010, setting numeric phosphorus targets for Wisconsin's waters. These phosphorus targets (also called "phosphorus criteria") are designed to protect water quality and to ensure that Wisconsin's surface waters are fishable and swimmable for current and future generations. Point sources, including municipal and industrial Wisconsin Pollutant Discharge Elimination System (WPDES) permit holders, generally receive phosphorus limits in their permits to achieve these targets.

Because water quality-based phosphorus limits are often more stringent than the applicable technology-based phosphorus limits, the Wisconsin Department of Natural Resources (WDNR) and stakeholders have developed alternative options for complying with WPDES limits to ease the financial burden on communities and industry. The "watershed adaptive management option", or "adaptive management", is an innovative approach to reach water quality goals more efficiently, and for point sources to achieve compliance with phosphorus limits in their WPDES permits in the most cost-effective manner possible. Adaptive management allows facilities facing higher phosphorus control costs to meet their regulatory obligations by reducing phosphorus pollution within their watershed to achieve compliance and water quality improvement at a lower overall cost. The purpose of adaptive management is to improve water quality within the watershed and for the receiving surface water bodies to eventually meet the applicable in-stream phosphorus criteria in s. NR 102.06, Wis. Adm. Code.

The Reason for an Adaptive Management Option

As part of its responsibility to protect Wisconsin's surface water quality, WDNR continues to implement phosphorus water quality standards in WPDES permits. Water quality based effluent limits (WQBELs) for phosphorus may be included in municipal or industrial WPDES permits upon permit issuance or reissuance to comply with these standards. These limits mark a shift from technology-based phosphorus limits, which are based on treatment technology and best practicable methods rather than surface water quality. WDNR recognizes that technology to remove phosphorus from wastewater effluents to the level required to meet phosphorus WQBELs can be expensive. However, installing expensive treatment systems, such as filters, may not be the only option for a WPDES permit holder. In some cases, it might be less expensive to reduce phosphorus from nonpoint sources in the watershed to improve water quality.

What are "point sources"?

Pursuant to s. 283.01(12), Wis. Stats., point sources are discernible, confined, and discrete conveyances from which pollutants may be discharged into waters of the state and are regulated by Wisconsin Pollutant Discharge Elimination System permits.

What are "nonpoint sources"?

Pursuant to s. 281.65(2)(b), Wis. Stats., nonpoint sources are land management activities which contribute runoff, seepage, or percolation which adversely affects water quality and are not a "point source" under s. 283.01(12), Wis. Stats.

As mentioned, adaptive management is a *phosphorus* compliance option that allows WPDES permittees to work with point and nonpoint sources in a watershed to improve water quality in waters not meeting

phosphorus standards. The legal requirements for adaptive management are specified in s. NR 217.18, Wis. Adm. Code[1].

This option recognizes that the excess phosphorus entering our lakes and rivers comes from a variety of sources, and that reductions in both point and nonpoint sources are frequently needed to achieve water quality goals. Adaptive management was developed through a collaborative effort which included WDNR, WPDES permittees, environmental organizations, and other stakeholders. This option allows creativity and flexibility for dischargers to meet water quality goals. By working in their watershed with landowners, municipalities, and counties to target sources of phosphorus runoff, point sources can minimize their overall investment while helping achieve compliance with water quality-based criteria and improve water quality.

[1] Section NR 217.18, Wis. Adm. Code is available for download at http://docs.legis.wisconsin.gov/code/admin_code/nr/200/217.

Adaptive Management vs. Water Quality Trading

Adaptive management is often confused with water quality trading, as both options allow permittees to work with nonpoint or other point sources of phosphorus in a watershed to reduce the overall phosphorus load to a given water body. However, these options are not the same. Trading requires a facility to acquire environmentally equivalent (or superior) pollutant reduction credits to offset enough of a facility's phosphorus load to demonstrate compliance with a phosphorus water quality-based effluent limit. Adaptive management is solely focused on improving water quality so that the applicable phosphorus criterion is met. In other words, water quality trading focuses on compliance with a discharge permit *limit* (offsetting the amount of phosphorus in the effluent); while adaptive management focuses on compliance with phosphorus *criteria* (meeting an acceptable in-stream phosphorus concentration). This difference creates many nuances between adaptive management and water quality trading such as implementation area, offset requirements, timing, and monitoring requirements. These distinctions will be highlighted throughout this document, particularly in Section 3 on page 15.

For more information on water quality trading visit: http://dnr.wi.gov/topic/wastewater/phosphorus.html.

Adaptive Management	Water Quality Trading
• Permittee improves water quality in a watershed by reducing in-stream phosphorus concentrations • Permit compliance is demonstrated by reducing in-stream phosphorus concentrations and eventually acheiving the phosphorus water quality criterion	• Permittee purchases "credits" in the watershed to acheive permit compliance • Permit compliance is demonstrated by comparing permittee discharge data and "credits" available to the applicable WQBEL

Section 2. The Adaptive Management Commitment

Why Select Adaptive Management

Adaptive management allows point source dischargers to work with nonpoint sources and other facilities in the same watershed to achieve the water quality goals of the receiving water. There are many benefits to adaptive management:

1. Permit compliance through adaptive management may be economically preferable to other compliance options.
2. Point sources, and the nonpoint sources that work cooperatively with them, can demonstrate their commitment to the community and to the environment by protecting and restoring local water resources.
3. Dischargers are given less restrictive interim phosphorus limits while they work to improve water quality under adaptive management; these less restrictive phosphorus limits can continue in future permit terms, if adaptive management is successful (water quality criteria is met).
4. Adaptive management provides flexibility for permittees and their partners to learn from each other and adapt as experience is gained. The adaptive management option can extend over a 20-year timeframe (up to four five-year permit terms). This time is given so the permittee can install phosphorus reduction practices, create new partnerships, and measure success.

Requirements for Point Sources Participating in Adaptive Management

By selecting adaptive management as their compliance option, permit holders agree to implement practices that will improve water quality whether these practices occur within their facility, township, or watershed. By committing to adaptive management, point sources also agree to meet specific permitting requirements. The purpose of these permit requirements is to demonstrate progress towards water quality improvement and maintain accountability. Examples of specific permit requirements include: conducting in-stream monitoring, complying with interim adaptive management limits, and providing annual reports to WDNR. See Section 4 for details about these permit requirements (pg. 18). An adaptive management plan is required to be prepared at the beginning of the process to outline the strategy the applicant intends to use to achieve compliance.

Section 3. Evaluating Adaptive Management

Adaptive management is a voluntary compliance option that should be considered and compared to other available compliance options. Other compliance options include treatment optimization, treatment upgrades, and water quality trading. The adaptive management option should also be thoughtfully considered prior to pursuing a water quality standards variance.

Determining Eligibility

Not all facilities are eligible for adaptive management. If you represent a point source facility considering adaptive management, follow these steps to determine the facility's eligibility. These steps are designed to be simple to follow, and to ensure that the eligibility requirements are met. See Appendix A for more detailed information about the eligibility requirements for adaptive management (pg. 83).

Step 1. Answering Initial Eligibility Questions

A. The first step to determining adaptive management eligibility is to calculate the applicable phosphorus WQBEL for the facility in question. Typically, WDNR will provide the phosphorus WQBEL to permittees with their permit application or draft permit, and they will specify how the limit was derived. Guidance is also available for permittees to calculate draft phosphorus limits prior to permit application. See Section 2.01 of the Phosphorus Implementation Guidance document for details at http://dnr.wi.gov/topic/wastewater/phosphorus.html or contact the local WDNR wastewater engineer, specialist, or adaptive management coordinator.

> The technical eligibility requirements for adaptive management are found in s. NR 217.18(2), Wis. Adm. Code and include:
>
> 1. The receiving water is exceeding the applicable phosphorus criterion
> 2. Filtration or equivalent technology would be required to meet the proposed/new phosphorus limit
> 3. Nonpoint sources contribute at least 50% of the total phosphorus entering the receiving water

B. Once the phosphorus WQBEL for the facility is known, answer the following questions:
   - Does the WQBEL equal the applicable phosphorus criterion for the receiving water OR is the facility subject to a total maximum daily load (TMDL)-derived limit?
   - Does the facility need major upgrades, such as adding filtration, to achieve compliance with the phosphorus limit?
   - Are you willing to work with partners in the watershed to target other phosphorus sources and improve water quality?
   - Is the facility capable of meeting an interim phosphorus limit of 0.6 mg/L, expressed as a six-month average, within the next permit term?

   If you answered 'yes' to all of the above questions, continue to evaluate adaptive management as a potential compliance option. If you answered 'no' to any of the above questions, you have not met the eligibility requirements of adaptive management pursuant to s. NR 217.18(2)(a) and (c), Wis. Adm. Code, and alternative options should be considered.

Step 2. Evaluating Phosphorus Contributions in Your Watershed

The next step to evaluate adaptive management is to determine the contributions of phosphorus from point and nonpoint sources in the watershed. WDNR has already done this calculation for most permitted municipal and industrial facilities with phosphorus monitoring using a GIS-based model called "Pollutant load Ratio EStimation TOol (PRESTO)". To look up the point to nonpoint source ratio at a facility, or to find more information about the PRESTO model, visit http://dnr.wi.gov/topic/surfacewater/presto.html. In addition to PRESTO, WDNR now offers PRESTO Lite, a web-based tool that can be accessed via the surface water data viewer platform. PRESTO Lite reports are obtained quickly and easily. See the PRESTO Lite user guide at: https://dnr.wi.gov/topic/SurfaceWater/documents/PRESTO/PRESTOLiteUserGuide.pdf

To be eligible for adaptive management, a permittee should be in a nonpoint source dominated watershed, in a watershed with an approved TMDL, or in a watershed where nonpoint sources must be controlled to meet water quality goals. See Appendix A for details regarding exceptions to the nonpoint source dominated watershed requirement (pg. 83).

If PRESTO indicates that the facility is in a nonpoint source dominated watershed, and the questions in Step 1 were answered affirmatively, that facility is eligible for adaptive management. If the facility is in a point source dominated watershed, adaptive management may not be an appropriate compliance option, but water quality trading may be an option. If you are in a point source dominated watershed but would like to consider adaptive management as a compliance option, contact the local WDNR wastewater engineer, specialist, or adaptive management coordinator to determine eligibility options for adaptive management pursuant to s. NR 217.18(2)(b), Wis. Adm. Code.

Deciding if Adaptive Management is Right for You

The following questions are provided to help determine if adaptive management is the best compliance option available for your facility. These questions are optional and do not need to be answered affirmatively to consider adaptive management. However, the more questions that are answered favorably, the more likely adaptive management is a practical compliance option for you. These questions may be easy to answer or may require preliminary meetings to be set up with WDNR or the local county land and water conservation department (LCD):

- **Can the facility achieve a limit of 0.6 mg/L through optimization, slight operational changes, or limited facility upgrades**? *Adaptive management requires an interim limit be included in the WPDES permit. This interim limit will be set equal to 0.6 mg/L in the first permit term after adaptive management takes effect. See Section 4 on page 20 for details.*
- **Is there in-stream phosphorus data available in the watershed?** *Having existing in-stream phosphorus data is essential for AM plan development. A robust dataset will significantly improve the accuracy of the adaptive management plan (discussed in Section 4 and 5), reducing the need for plan modifications throughout the permit term. To review WDNR's water quality database, visit http://dnr.wi.gov/topic/surfacewater/swdv/. See Appendix D and E for details (pgs. 95 and 100, respectively).*

- **Is the facility in a TMDL watershed?** *A Total Maximum Daily Load (TMDL) is a pollutant "budget" for a waterbody or watershed that establishes the pollutant reduction needed from each pollutant source to meet water quality goals. The advantage of having a phosphorus TMDL in your watershed is that extensive monitoring and modeling has already been conducted to quantify phosphorus load reductions needed to attain the applicable phosphorus standards. Additionally, nonpoint and point source reductions have been quantified for the watershed, making it easier to select and target management measures. This information is directly applicable to adaptive management plan development. To review Wisconsin's TMDL watersheds, visit http://dnr.wi.gov/topic/tmdls/.*
- **Is the county LCD willing to participate in the adaptive management project such as providing guidance in selecting areas to target for nonpoint source reductions?** *The county LCDs are great resources for identifying and developing nonpoint source pollution control projects. Many LCD staff have extensive experience implementing watershed projects and working with landowners, and it is anticipated that these local agencies will play a critical role to help facilitate adaptive management efforts, connecting permit holders with nonpoint sources in their watershed. LCDs are not required to assist in an adaptive management project and may have program needs and/or limited staff resources that could prevent them from participating. WDNR recommends that you meet with your local LCD early in the planning process to determine their level of interest and resource availability for adaptive management.*
- **Is the Qs:Qe (stream flow to effluent flow) ratio at least 5 to 1**? *The greater the ratio of stream flow to effluent flow, the less impact your point source discharge has on the concentration of phosphorus in the water body. The ratio of 5:1 in most cases indicates good dilution, suggesting that the stream is more likely to respond to best management practices upstream and is less reliant on point source load reductions.*
- **Are there active or historic watershed projects in your watershed?** *Current or historic watershed projects may have developed reports or studies that describe management measures installed in the watershed and the success of those practices that could provide guidance on adaptive management planning and implementation decisions. Additionally, these projects illustrate areas that have already had active participation from organizations and landowners to improve water quality. The watershed project database is available at http://nonpoint.cals.wisc.edu/?page_id=14.* 9 key element watershed plans may also provide important information, help identify partners, and set goals. Visit the following page for more information: (https://dnr.wi.gov/topic/nonpoint/9keyelement/).
- **Are there multiple point sources interested in adaptive management in your watershed?** *Pooling together resources with other point sources in a watershed may make the task of achieving water quality criteria more feasible.*
- **Is your receiving water close to achieving the applicable phosphorus criterion?** *Typically, the smaller the difference between the in-stream phosphorus concentration and the applicable criterion, the fewer management measures that will need to be installed in the watershed. This will help keep adaptive management costs down and is also indicative that water quality goals can be reached in a reasonable timeframe.*

- **Are the estimated costs of adaptive management economically feasible?** *If the costs of adaptive management are too great and would cause economic hardship to the discharger, an alternative compliance option should be considered. In some cases, a water quality standards variance may be appropriate. More information on variances may be found at: https://dnr.wi.gov/topic/wasteWater/phosphorus/variance/.*
- **Are there other benefits to adaptive management?** *Adaptive management allows the flexibility for communities, dischargers, and landowners to work together collaboratively to improve water quality. This type of cooperation can help improve public relations, allow companies or municipalities to work towards "green" solutions, and can lead to water quality improvement for everyone, including future generations, to enjoy.*
- **Can implementable management measures affect enough change?** *During the feasibility stages of considering adaptive management, it is important to be realistic about what management measures will be put in place, and how far these will go towards meeting water quality standards. The adaptive management plan will need to propose specific practice types that have potential to restore water quality, based on an assessment of the watershed.*

Additional Guidance Comparing Adaptive Management and Water Quality Trading

Adaptive management and water quality trading each have advantages and disadvantages (see Table 1, pg. 17). Understanding these differences can help you determine which of these options is most appropriate for your facility. WDNR recommends that the following factors be considered when comparing adaptive management to water quality trading:

1. **Flexibility**: Adaptive management is a flexible compliance option because the details of individual management practices do not need to be specified in a WPDES permit. This allows management measures and strategies to be adjusted throughout the permit term as more experience is gained. Water quality trading is less flexible because site specific parameters of any management practices must be specified in the WPDES permit (s. 283.84(4), Wis. Stats.). Therefore, management measures cannot be adjusted throughout the permit term without a permit modification. Given this, adaptive management may be the preferred compliance option for permittees that have not had experience working with nonpoint sources or best management practices, and/or wish to have implementation flexibility over time. Trading may be the preferred compliance option for dischargers which prefer immediate compliance with the phosphorus standard.
2. **Timing**: Water quality trading requires that "credits" be generated before they can be used to offset a phosphorus discharge. This offset must be in place by the effective date of the WQBEL in order to demonstrate compliance. It will take time to establish these practices and begin generating trading credits with them. In contrast to trading, adaptive management allows management practices to be installed throughout the permit term. If preparation and planning time is needed, adaptive management may be the preferred compliance option. For example, if agricultural nutrient management planning is a key practice to reduce nonpoint sources, adaptive management may be the preferred compliance option given that these practices can take time to begin producing phosphorus reductions. If best management practices are easily

installed and can begin generating credits in a short timeframe, water quality trading may be the preferred compliance option.

3. **Calculating offsets**: Calculation of pollutant reduction credits for trading requires trade ratios to account for modeling assumptions used to estimate phosphorus reductions from nonpoint sources. Adaptive management does not require these margins of safety to be considered. However, in-stream monitoring must be completed to demonstrate water quality improvements over time (s. NR 217.18(3)(a), Wis. Adm. Code). If in-stream monitoring is not feasible, water quality trading may be the preferred compliance option, since compliance is shown through modeling. Adaptive management may be the preferred compliance option if more flexibility in calculating offsets is desired and in-stream monitoring is feasible.
4. **Reductions needed**: The phosphorus reductions needed for adaptive management and water quality trading should be compared. If the in-stream phosphorus concentration is approaching the applicable phosphorus criterion and stream flow is relatively low, adaptive management is likely the preferred compliance option. However, if a facility only needs to offset a small amount of phosphorus loading to achieve compliance, water quality trading (or a combination of trading and optimization) is likely the preferred compliance option.
5. **Credits for practices**: With trading, the credit duration and magnitude generated from a given practice depends on the duration and type of practice. For example, a one-year cropping practice typically only provides credit for one year. With adaptive management, the length of a specific practice does not matter as much as the result. As long as in-stream water quality goals are being achieved, the management measures and location of these practices can change.

If a permittee selects adaptive management as the preferred compliance option, that permittee can choose a different compliance option upon permit reissuance. For example, if a facility enters into adaptive management and doesn't observe the anticipated water quality improvements in the receiving water, that facility can choose to achieve compliance with phosphorus limits through water quality trading at the next permit reissuance. Practices installed under adaptive management can be used in a water quality trading framework so long as those practices meet the water quality trading requirements. Table 1 provides a side-by-side comparison of the two compliance options.

Table 1. Comparing adaptive management and water quality trading.

	Adaptive Management	Water Quality Trading
Goal	To improve water quality and achieve P water quality criteria in receiving water	To offset pollutant that is discharged in excess of an effluent limit
Implementation timing	Install practices identified in the plan prior to or during the term of the permit	Install practices and generate pollutant load reductions prior to credit use
Duration	A maximum duration of twenty years can be granted to achieve compliance with P criteria; PS compliance with permit requirements based on criteria being attained	May be used to demonstrate compliance indefinitely, as long as credits are generated
Applicable limit	Interim limits applicable throughout the AM project, and may continue if criteria are attained; if unsuccessful, WQBEL applies	WQBEL only
Trade ratios	Not required	Required
Effluent monitoring	Required	Required
In-stream monitoring	Required	Not required
Method of compliance	In-stream and effluent monitoring; P concentration meets WQC	Effluent monitoring, modeling of practices, and trade ratios
Required reductions	Difference between in-stream P concentration and P criterion	Difference between effluent P concentration and effluent P limit
Flexibility to adjust strategy over time	More flexible	Less flexible
Can reductions from other point sources count towards compliance?	Yes	Yes
Can traditional BMPs such as contour strips count towards compliance?	Yes	Yes
Can wetland restoration, bank stabilization and other similar practices count towards compliance?	Yes	Only if reductions are quantifiable
Is inspection of the BMP required?	Some periodic inspections required	Yes, every BMP should be periodically inspected
Does modeling need to be performed to quantify expected load reductions?	Yes, some modeling is required	Yes, field-by-field modeling is required

Section 4. Permit Requirements Overview

From Considering Options to Permit Reissuance

If you represent a municipality, sewer district, or an industry, WDNR recommends that you review your phosphorus compliance options now, before your permit is due for renewal so that you have enough time to make informed compliance decisions. Time to consider options may also be granted during the alternative evaluation step in a phosphorus compliance schedule. While time to consider options may also be granted during the permit term through a phosphorus compliance schedule, this should not be assumed.

Once a facility chooses adaptive management as their preferred compliance option, the facility should submit the adaptive management eligibility form (located in Appendix G on pg. 106) to their local WDNR wastewater engineer, specialist, or adaptive management coordinator and then begin developing an adaptive management plan pursuant to s. NR 217.18(2)(d), Wis. Adm. Code. See Section 5 (pg. 23) for more details on developing an adaptive management (AM) plan. Once an eligibility form is received and reviewed, WDNR will confirm adaptive management eligibility in writing to the applicant.

The adaptive management plan must be submitted no later than the deadline for permit application when an extended compliance schedule was granted. A permit modification request must also be submitted with the plan if a facility was granted a traditional compliance schedule (less than 5 years). Permit modification is required in this scenario to allow public comment opportunities on the adaptive management plan and to incorporate the adaptive management plan requirements into the permit.

Typically, facilities with extended compliance schedules (5 years or more) are not required to submit a permit modification request. Rather, WDNR will use the permit reissuance process to allow public comment on the adaptive management plan and incorporate adaptive management requirements into the reissued permit (permit term 2).

Figure 1 shows the typical process a point source would follow to select adaptive management as their compliance option.

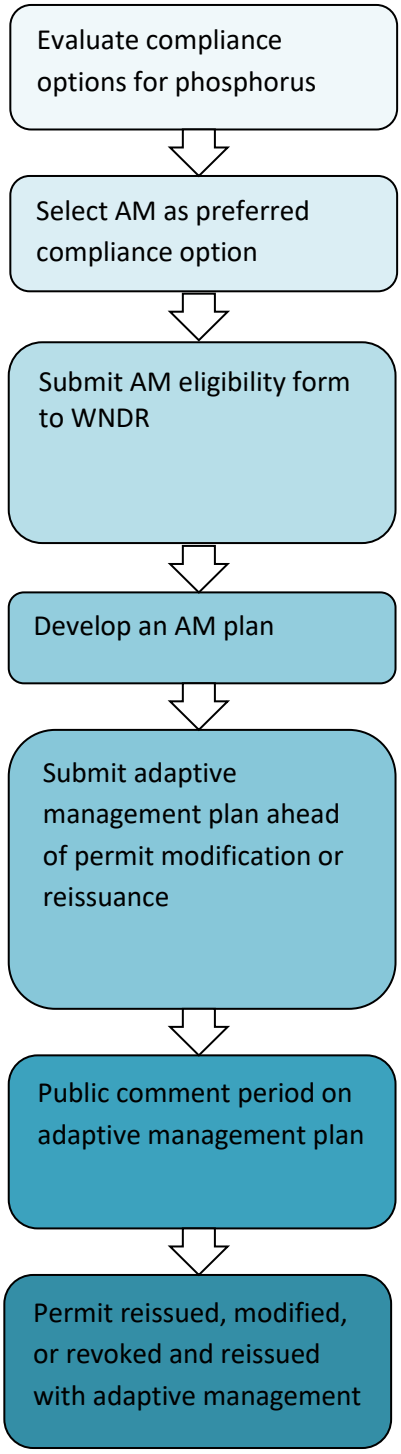


Figure 1. Point source process to request adaptive management.

Components of Adaptive Management in a WPDES permit

Annual reporting

Once the permit is modified or reissued with adaptive management requirements, the facility will have up to 20 years[2] to demonstrate compliance through adaptive management. WPDES permit requirements for adaptive management include: implementing the adaptive management plan, in-stream monitoring, effluent monitoring, compliance with adaptive management interim limits, and submitting annual progress reports to WDNR (see Figure 2 for facilities with extended compliance schedules and Figure 3 for facilities with traditional compliance schedules). Annual reports are required pursuant to s. NR 217.18(3)(d), Wis. Adm. Code, and are important to maintain communication between the point source and WDNR as well as reinforce accountability. Additionally, progress reports provide the permittee with the flexibility to adjust the adaptive management strategy throughout the permit term. If the adaptive management plan needs to be adjusted, the adjusted plan and accompanying justification should be submitted with the annual report. See Section 6 for details (pg. 81).

Interim limits

The facility is also required to comply with adaptive management interim limits pursuant to s. NR 217.18(3)(e), Wis. Adm. Code (see Table 2, pg. 20). The adaptive management interim limits are intended to be achievable through facility optimization or modest upgrades to the existing treatment technology. A compliance schedule of up to five years will be included in the permit, as necessary, for point sources to comply with adaptive management interim limits. If a facility is unable to achieve compliance with the adaptive management interim limits, a different compliance option may be required.

Demonstrating compliance with an adaptive management interim limit is no different than demonstrating compliance with any other limit in a WPDES permit. Effluent monitoring data must be collected consistent with the frequencies and protocols specified in the permit and these data are submitted on the facility discharge monitoring report (DMR). The effluent monitoring frequency (typically 3 to 5 times per week for phosphorus) will be specified in the WPDES permit.

If the applicable phosphorus criterion is achieved in the receiving water prior to the expiration of the fourth permit term under adaptive management, subsequently reissued permits will maintain the effective adaptive management interim limit, as long as the receiving water continues to achieve the criterion. In-stream monitoring and best management practice (BMP) maintenance will be required to ensure water quality is maintained. If water quality declines after the criterion was achieved, s. NR 217.13, Wis. Adm. Code, water quality-based effluent limits may be included in the next WPDES permit. See Section 2.01 of the Phosphorus Implementation Guidance for details: https://dnr.wi.gov/topic/wastewater/phosphorus/.

[2] Compliance with water quality standards may be obtained in fewer than 20 years. If water quality standards are attained in the fourth permit term, permit modification will be required to allow compliance with the phosphorus WQC and final AM interim limit rather than the final calculated WQBEL.

Table 2. Interim P limits and WQBELs expressed in each of the four permit terms under adaptive management. Compliance schedules of up to five years can be included in the permit as appropriate to comply with these limits. Note: If the goals of adaptive management are met before the end of the fourth permit term, the permit may need to be modified to reflect adaptive management success.

Permit term following AM approval	1	2	3	4
	AM Limits: • 0.6 mg/L as a 6-month avg. • 1.0 mg/L as a monthly avg.	AM Limits: • 0.5 mg/L as a 6-month avg. • 1.0 mg/L as a monthly avg.	AM Limits: • 0.5 mg/L as a 6-month avg. • 1.0 mg/L as a monthly avg.	Final WQBEL, which can be recalculated if water quality improves or a TMDL is approved, OR the final limit can equal the AM Limit in permit term 3 if the WQC is achieved [3]

Permit reissuance

At each permit reissuance, WDNR will re-evaluate the adaptive management option to ensure the facility has complied with the permit requirements, including: annual report submittal, compliance with adaptive management interim limits, minimum pollutant reduction, and in-stream and effluent monitoring. If the permittee has demonstrated that these components have been met, adaptive management will be extended into the next permit term for up to four permit terms total (as illustrated in Figure 2 and Figure 3, pg. 21). If one or more of these components has not been met, the applicant may be required to choose a different compliance approach; such as facility upgrades or water quality trading. The permittee can choose to abandon adaptive management and select a new compliance option at the time of permit reissuance if progress is not being observed towards achieving the water quality criteria (WQC) or if adaptive management proves to be too onerous. Public comments on these decisions will be solicited during the public comment period of the reissued WPDES permit.

[3] If water quality standards are attained in the fourth permit term, permit modification is possible to allow compliance with the phosphorus WQC and final AM interim limit rather than the final calculated WQBEL.

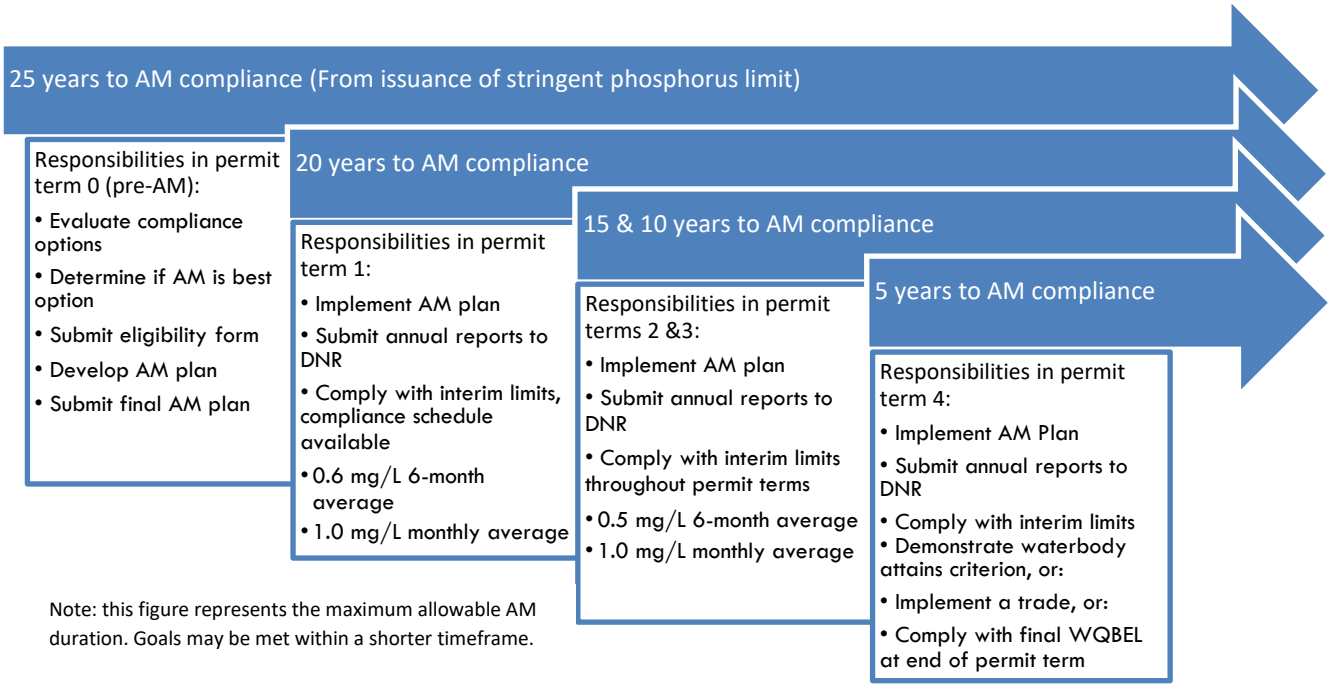


Figure 2. Point source responsibilities during each permit term of adaptive management (AM) assuming extended compliance schedule (>5 years) is given for phosphorus in the first permit term after a WQBEL is issued.

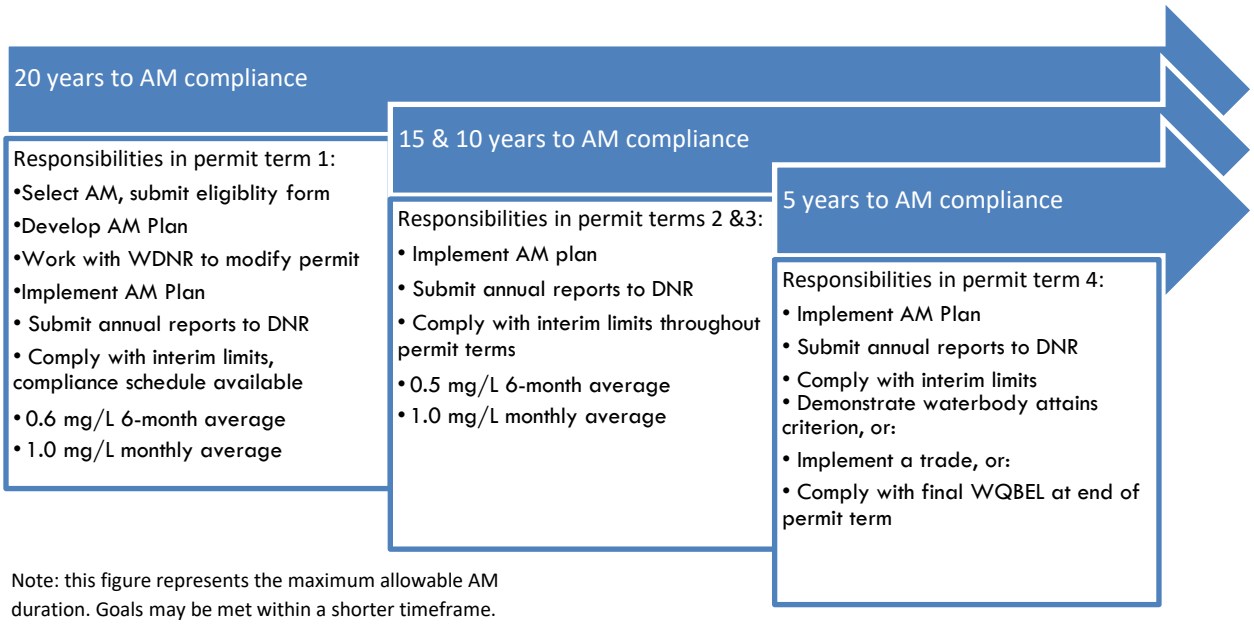


Figure 3. Point source responsibilities during each permit term of adaptive management (AM) assuming traditional compliance schedule (<5 years) is given for phosphorus in the first permit term after rule promulgation.

Adaptive Management for Lagoons and Other Small Discharges

WDNR recommends that municipal and industrial permittees, no matter their size, should review all applicable phosphorus compliance options, including adaptive management to determine which compliance option is best for them. There are no special eligibility requirements for small discharges. These permittees must meet the same requirements and expectations as other permittees (see Section 3, pg. 12 for details). Given this, adaptive management may or may not be a viable compliance option for all small discharges. For some, the costs associated with adaptive management may not be economically feasible. For others, achieving compliance with interim limits may be technologically infeasible.

There are some ways to improve the feasibility of adaptive management for small point source discharges. For example, strong partnerships can be built to utilize staff resources from other entities to help promote adaptive management. Additionally, small entities may be able to work within a smaller subwatershed to manage adaptive management costs and more accurately reflect phosphorus contribution of the small volume discharge to the overall watershed (see Section 4, pg. 29 for details).

Despite these flexibilities, water quality trading or other compliance options may be preferable over the adaptive management compliance option. Because lagoon and other small discharges generally add a smaller mass of phosphorus to the receiving water, offsetting this amount through a trade may be cost-effective and preferable. If the available compliance options including water quality trading and adaptive management are not attainable, the permittee may request a water quality standards variance. Requests for water quality standards variances for phosphorus are generally addressed in s. 283.16 Wis. Stats. as Wisconsin's Multiple Discharger Variance (MDV) for phosphorus. If MDV coverage is not possible, a permittee may pursue an individual variance pursuant to s. 283.15 Wis. Stats., and Subchapter III in ch. NR 200, Wis. Adm. Code. See the Phosphorus Implementation Guidance and Multiple Discharger Variance Guidance for details, available at the following web pages:

https://dnr.wi.gov/topic/wastewater/phosphorus/statewidevariance.html
https://dnr.wi.gov/topic/wastewater/phosphorus/index.html

Additional Opportunities for Facilities with Total Suspended Solids Wasteload Allocations

The 2013 adoption of s. 283.13 (7) Wis. Stats. authorized the use of adaptive management to comply with total suspended solids (TSS) wasteload allocations issued in WPDES permits. In recognition that TSS and phosphorus have similar nonpoint and point source origins, many watershed efforts geared towards phosphorus reductions will also result in TSS reductions. Furthermore, TMDL development in many watersheds addresses both phosphorus and TSS, resulting in wasteload allocations being assigned for both pollutants.

Goals and measures for an adaptive management plan designed to achieve compliance with a TMDL TSS allocation will be based on the TSS load reductions required in the federally approved TMDL. Plans should include the 9 key components, discussed below in Section 5. Eligibility and timing aspects, as discussed above, should be evaluated individually for TSS. Interim limits for TSS during adaptive

management terms should reflect a level of control achievable at the facility without a major upgrade, generally in correlation with phosphorus interim limits described in s. NR 217.18(3)(e), Wis. Adm. Code.

Section 5. Developing an Adaptive Management Plan

The purpose of the adaptive management plan is to identify actions to be implemented that will achieve compliance with the applicable in-stream phosphorus criterion through verifiable reductions of phosphorus from point and nonpoint sources. One or multiple WPDES permitted facilities can be covered under the same adaptive management plan. Adaptive management plan components will not change if multiple facilities choose to enter into adaptive management collaboratively. However, the level of detail required in an adaptive management plan will vary based on the complexity of the watershed, the in-stream phosphorus concentration of the receiving water, and the strategies employed to reduce phosphorus contributions to surface water.

Some expertise is required to develop a successful adaptive management plan. It is recommended that point sources collaborate with the county LCD, Natural Resources Conservation Service (NRCS), and WDNR's local adaptive management coordinators and nonpoint source coordinators as much as possible to develop these plans[4]. The counties have expertise in agricultural performance standards compliance, cost-share agreements, and working with rural landowners and municipalities, among other things, making them ideal partners to assist you in selecting and targeting nonpoint source management measures. Environmental consultants may also be needed to develop effective adaptive management plans. Prior to plan development, it is recommended that point sources and the adaptive management plan developers identify and agree on deliverables, milestones, and necessary compensation. WDNR staff may be available to review and provide feedback on draft adaptive management plans, as appropriate.

There are nine key components to develop a successful adaptive management plan:

1. Identify partners
2. Describe the watershed and set load reduction goals
3. Conduct a watershed inventory
4. Identify where reductions will occur
5. Describe management measures
6. Estimate load reductions expected by permit term
7. Measuring success
8. Financial security
9. Implementation schedule with milestones

Each of these components of the plan, explained in greater detail on the following pages, can be modified as experience and knowledge are gained. Also provided in Section 5 are supporting tables and documents to help foster the development of each of the nine key components in the plan. These tools

[4] Visit https://wisconsinlandwater.org/ and http://dnr.wi.gov/topic/nonpoint/npscontacts.html to find County and WDNR nonpoint source staff in your area, respectively.

are meant to be resources to consider when developing an adaptive management plan and are not required documentation for adaptive management plan submittal.

Table 3. Adaptive management plan development steps and a brief description of the step and administrative code that guides plan development and submittal.

Step of the Adaptive Management Plan	Tasks in the Step	Supporting Administrative Code Reference
1. Identify partners	Identify potential partners and their role in adaptive management. Gather letters of support and create a memorandum of understanding (MOU) between partners, if desirable.	• s. NR 217.18(2)(d)3. Wis. Adm. Code
2. Describe the watershed and set load reduction goals	Describe the adaptive management action area including the counties in the watershed, available water quality data, number of reaches, hydraulic retention time and/or stream order data.	• s. NR 217.18(2)(d)2. Wis. Adm. Code
3. Conduct a watershed inventory	Gather current and historic land use data, and describe the physical features of the action area, typical agricultural practices in the watershed, and potential land uses in the future.	• s. NR 217.18(2)(d)1. Wis. Adm. Code
4. Identify where reductions will occur	Evaluate all data gathered in step 3 for decision-making purposes and identify critical areas within the action area to target management practices.	• s. NR 217.18(2)(d) Wis. Adm. Code
5. Describe management measures	Complete a facility plan to comply with interim limits, if necessary, and identify management measures that will be installed throughout adaptive management implementation to control nonpoint sources of excess phosphorus.	• s. NR 217.18(2)(d) Wis. Adm. Code
6. Estimate load reductions expected by permit term	Quantify the phosphorus reductions needed from point sources, and approximate the phosphorus reductions expected from nonpoint source management measures.	• s. NR 217.18(2)(d)2. Wis. Adm. Code
7. Measuring success	Develop a monitoring strategy that will identify who will collect data, who will analyze these data, when and where samples will be collected, and the quality assurance protocols that will be followed.	• s. NR 217.18(3)(a) Wis. Adm. Code
8. Financial security	Estimate the cost and outline the sources of funding to implement the adaptive management plan, either individually by the permittee or in conjunction with other permittees as partnering on the adaptive management effort.	• s. NR 217.18(2)(d)4. Wis. Adm. Code
9. Implementation schedule with milestones	Prioritize implementation measures and develop a schedule by setting compliance dates for adaptive management interim limits and water quality milestones.	• s. NR 217.18(3)(b) Wis. Adm. Code

1. Identify partners

In this step you will:

- Identify potential partners
- Determine the role of adaptive management partners
- Develop a communication strategy for partners
- Create Memorandum of Understanding (MOU) between partners, if desirable

The expertise and involvement of key individuals and groups will likely be needed to develop and implement the adaptive management plan once it is approved by WDNR. The goal of this step is to identify the key partners that will assist in adaptive management plan development, implementation, and outreach and education. Pursuant to s. NR 217.18(2)(d)3. Wis. Adm. Code, adaptive management plans must identify the partner(s) and their level of support for the project. A letter of support should be included with the AM plan for key partners (those relied upon for AM plan success). If a Memorandum of Understanding (MOU) is signed between the various parties, it may be submitted to WDNR to document partner support. Developing MOUs with partners is one way to specify deliverables, milestones, and necessary compensation. These agreements can help protect both the point source and the partner throughout the adaptive management process.

MOUs do not have to be submitted to WDNR, nor are they required. If an applicant submits an MOU to WDNR staff it will be for informational purposes only. WDNR will not validate or comment on these agreements, but it may consider them when evaluating the adequacy of the submitted plan. The following are examples of different categories of potential adaptive management partners:

Counties: The county land and water conservation department (LCD) may be one partner that can effectively facilitate communication between point and nonpoint sources, develop an adaptive management plan, and oversee adaptive management progress. The counties have expertise in agricultural performance standards compliance, cost-share agreements, and working with farmers and municipalities, among other things. Partnerships between adaptive management applicants and county LCDs can be mutually beneficial given the overlap in water quality goals. However, county staff are not required to assist with adaptive management activities and may have program needs and/or limited staff resources that would prevent them from participating. Point sources should meet with their local LCD to determine their level of interest and resource needs in order to participate in adaptive management.

Agricultural nonpoint sources: Nonpoint source reductions from agricultural producers will be included in most adaptive management plans. If the adaptive management plan involves agricultural nonpoint source phosphorus reductions from individual agricultural producers and specific fields are not identified in the adaptive management plan , the adaptive management plan should provide a communication strategy that describes who will reach out to landowners, who will validate best management practice installation and/or maintenance, and who will be responsible for record keeping. The adaptive management plan should, at a minimum, specify the general areas and management measures that will be used to control nonpoint source pollution; see Steps 4 and 5 of the adaptive management plan for details (pgs. 49 and 54, respectively).

Concentrated animal feeding operations (CAFOs): Agricultural operations with 1,000 animal units or more are required to obtain a WPDES permit and are identified as CAFOs. Although the production area of the CAFO is assumed to have no discharge under typical precipitation conditions, land applications of manure and process wastewater associated with a CAFO are considered nonpoint source discharges when the operation is in compliance with its nutrient management plan and WPDES permit. These discharges are considered agricultural stormwater and, therefore, are treated the same as other agricultural nonpoint sources, as described above. In many Wisconsin agricultural areas, CAFO facilities will have access to a large number of fields and may be able to manage these fields to reduce phosphorus runoff.

Urban nonpoint sources: If adaptive management practices work to control non-permitted urban sources of phosphorus, the adaptive management plan should identify the township or municipality where those reductions will be occurring. The adaptive management plan should provide a communication strategy for non-permitted urban sources, if different from the agricultural communication strategy.

Other WPDES Permitted discharges: To meet the goals of this step, the adaptive management plan must identify all traditional WPDES permitted discharges (municipal and industrial wastewater treatment facilities) or permitted MS4s within the adaptive management action area as well as identify their level of involvement in the adaptive management project. The adaptive management "action area" includes the watershed(s) or subwatershed(s) that adaptive management activities will occur in, or can occur in if needed. Facilities covered under general permits, rather than specific permits, do not need to be identified unless they are an active partner in the action area. Again, permitted discharges are not required to enter into the adaptive management option. However, they can choose to participate in adaptive management to achieve compliance with their permit requirements. See Appendix C for details on MS4s and adaptive management, if applicable (pg. 93).

Other partners: Other partnerships may be beneficial to provide technical expertise, assist with project outreach and education, or provide alternative funding sources. When determining the potential for other partners it is important to identify regional groups already active in land use/water quality issues. For example, local agricultural groups and/or environmental groups can help install BMPs or collect in-stream phosphorus data.

Citizen Science: Some citizens may already be collecting these data in your region through a citizen monitoring program. Visit http://watermonitoring.uwex.edu/wav/monitoring/local/programs.html for details. Beyond gathering existing data, engaging with citizen science groups can help to establish your effort in the community and provide additional outreach contacts. Citizen science efforts may be used for secondary metrics, such as biological monitoring, to help demonstrate progress towards plan goals.

There may be groups or agencies willing to assist in adaptive management projects such as Wisconsin Rural Watershed Association, Clean Wisconsin, Sand County Foundation, Department of Agriculture, Trade, and Consumer Protection (DATCP), and UW Extension. WDNR staff including district adaptive

management coordinators can introduce point sources to county staff or other potential partners, as appropriate.

2. Describe the watershed and set load reduction goals

The goal of this step is to provide a detailed account of the receiving water and to set a load reduction goal for the watershed so that water quality criteria can be attained. There are three required actions to fulfill this step of the plan: identify the action area, describe the receiving water, and set a load reduction target.

In this step you will gather:

- Watershed boundaries and watershed area
- Area of watershed in each county, if more than one county
- All applicable water quality data available for the receiving water
- Number of reaches in the AM action area
- Hydraulic retention time or stream order data, if applicable

Identify the action area

The adaptive management "action area" should include the watershed(s) or subwatershed(s) that adaptive management activities will occur in, or can occur in, if needed. The size of the action area will be a case-by-case determination and must be of sufficient size to reduce phosphorus by the percent commensurate with the permittee's pollutant load[5] or by the percent required to achieve water quality criteria, whichever is smallest. The action area for the adaptive management plan must, at minimum, cover all areas where phosphorus controls are being actively pursued, and also any area where "back-up" strategies may be implemented, if necessary. "Back-up" strategies are additional strategies that can be installed to account for situations where best management practices are not properly implemented, extreme weather events inhibit or destroy certain reduction strategies, or water quality improvements may not be measured in a reasonable timeline.

The action area will generally conform to the 12-digit Hydrologic Unit Code sub-basins, or HUC 12s, where the point source(s) are located. Also, the action area should be upstream of the point source(s) involved with the adaptive management plan, if possible. In other words, it is recommended that management measures for adaptive management occur upstream of the point source discharge(s) whenever possible. Using this recommended approach, the outfall location should be the furthest downstream point of the adaptive management action area and used as the final point of compliance to demonstrate water quality improvements for adaptive management (Figure 4). If multiple point sources are involved in the same adaptive management project, the furthest downstream outfall location can serve as the ultimate point of compliance for the overall project.

For demonstrating final compliance, pursuant to s. NR 217.18(3)(e)4. Wis. Adm. Code, monitoring data collected for the receiving water must indicate that the applicable phosphorus criterion under s. NR 102.06 has been met.

If you are unsure which HUC 12 your discharge is located in, see Appendix D on page 95 for detailed instructions on how to identify your HUC 12 watershed.

[5] If multiple point sources are working together to implement one adaptive management plan, the action area must be based on the sum of these loads. See "Permit Term 1" in Step 6 for further details.

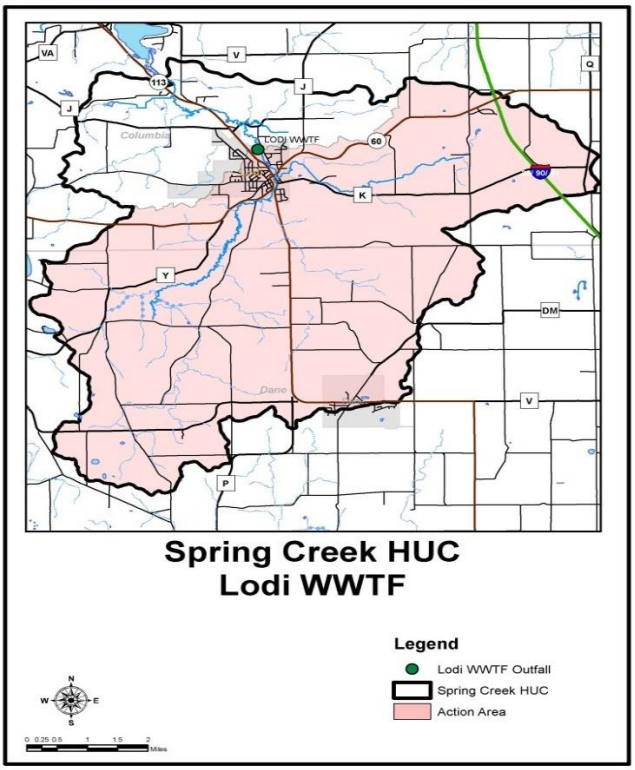


Figure 4. Example action area where ultimate point of compliance is at outfall location.

WDNR may approve an alternative adjacent HUC 12, a larger HUC (such as a HUC 10), or a downstream action area on a case-by-case basis. Scenarios where alternative action areas may be approved include point sources discharging to waters designated as "limited aquatic life", waters dominated by residual phosphorus loads, or waters with a United States Environmental Protection Agency (EPA) approved TMDL. The ultimate point of compliance for adaptive management will be the furthest downstream point of the action area, and should be defined as a discharger's receiving water pursuant to s. NR 217.18(3)(e)4. Wis. Adm. Code. When selecting an action area and final point of compliance, contact your local WDNR wastewater engineer, specialist, or adaptive management coordinator.

Flexibility in TMDL Watersheds

A "TMDL reach" is a water body segment used to calculate pollutant reductions from point and nonpoint sources in a TMDL. Typically, TMDL reaches are either impaired or upstream of an impaired water. TMDL reaches serve as the basis for calculating TMDL-derived limits for point sources, and for setting goals and targeting nonpoint source reductions. Because TMDL reaches focus on improving the water quality of impaired waters, TMDL reaches do not often times align with HUC 12 watershed boundaries. They can either be larger or smaller in scale. If a permit holder chooses to do adaptive management within a TMDL watershed, that permittee may be able to consider their TMDL reach as their action area. Visit http://dnr.wi.gov/topic/tmdls/tmdlreports.html to search for approved TMDLs in Wisconsin.

Overlapping action areas should be avoided if at all possible. If multiple point sources in the same HUC 12 watershed choose to pursue adaptive management, it is recommended that they work collaboratively under one adaptive management plan. Alternatively, the HUC 12 watershed can be divided into smaller subwatersheds so that each facility is responsible for their specific portion of the subwatershed; each subwatershed must meet the definition of an "action area" as described above.

Table 4 is a tool available to help submit these data to WDNR. A map of the action area should also be submitted to WDNR.

Table 4. Blank adaptive management action area description for plan development.

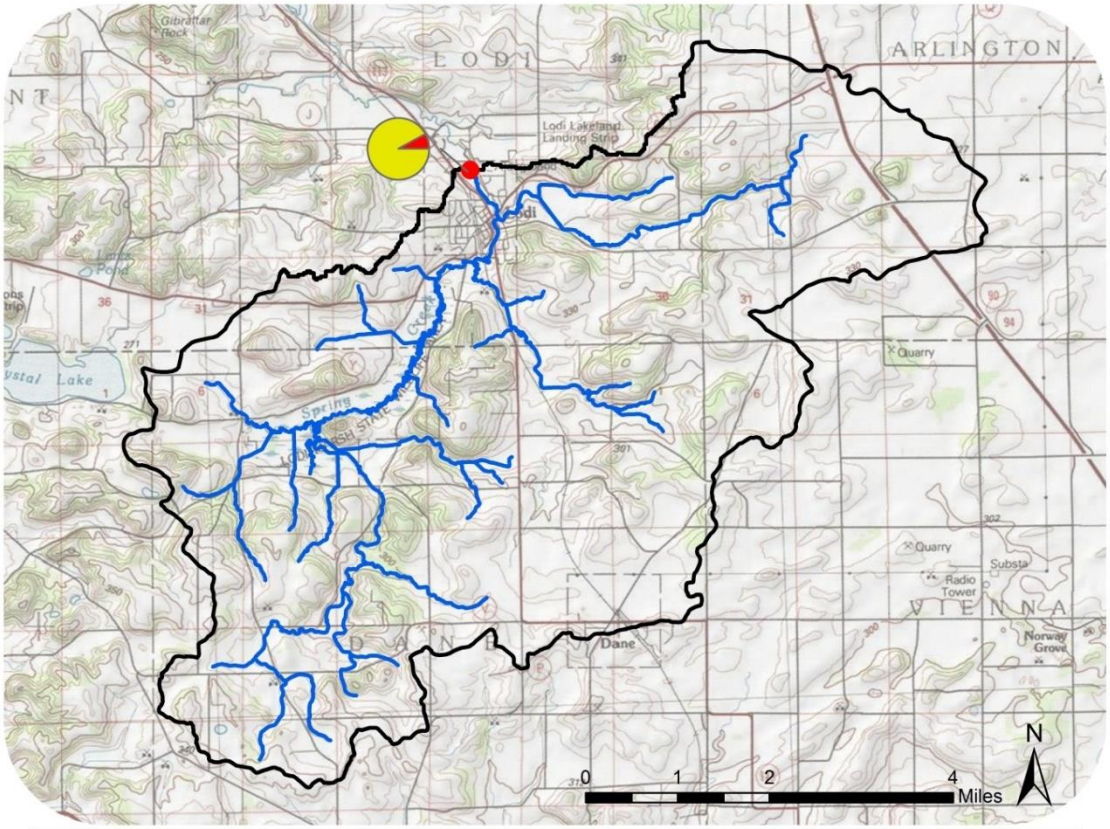
HUC and Watershed Name		**Total Area of Watershed**	
		Acres	Sq. Miles
County	**Area of watershed in the county**	**Percentage of watershed within the county**	
What watershed scale was used to develop the action area? *Note: If action area is full HUC 12 STOP.*		☐- Full HUC 12 ☐- Portion of the HUC 12 ☐- Based on TMDL reach ☐- Other	
Size of the Action Area			
Acres		Sq. Miles	
County	**Size of action area per county**	**Percentage of action area within the county**	

Describe the characteristics of the receiving water.

"Receiving waters" in adaptive management are those waters targeted for water quality improvements. A facility can choose one receiving water, or multiple, depending on the size of the facility and the characteristics of the receiving water and action area. Ideally, the adaptive management "receiving water" is the water body where the outfall(s) are located for those discharges involved with adaptive management (Figure 5, pg. 33). If you have questions about which waters to target under adaptive management, contact your local WDNR wastewater engineer, specialist, or adaptive management coordinator.

Evaluating the current condition of the receiving water is critical for adaptive management. At minimum, the adaptive management plan must identify the receiving or target waters, the attainment status of those waters, and any monitoring data available. There are several databases available to help with this data need such as WDNR's watershed search tool and PRESTO: http://dnr.wi.gov/water/watershedSearch.aspx, http://dnr.wi.gov/topic/surfacewater/presto.html . Of the aforementioned tools, the watershed search tool provides an easy-to-use option for identifying receiving waters, while PRESTO provides more detailed information. For a detailed description of the PRESTO model visit http://dnr.wi.gov/topic/surfacewater/presto.html. To use WDNR's watershed search tool simply enter the name of your facility's receiving water in the "Enter Water Name or Water Body Identification Code (WBIC)" search field and the county your facility is located in from the "County" dropdown menu. If there are multiple search results, click the link in the Watershed Code column (for example, LW17) to view a map of the watershed. Once you have located your watershed, click the watershed name to explore watershed information such as natural features, water bodies in the watershed and their impaired status, existing grants and monitoring projects in the watershed, and future recommendations for management.

Both tools are acceptable, as are other tools and databases available. Data may also be available through county LCDs or the U.S. Geological Survey (USGS).



Station ID	Basin Area (mi^2)	Average Annual Nonpoint P Load (lbs)	Average Annual Point P Load (2007-2009) (lbs)	Point to Nonpoint P Load Ratio (%)
Lodi WWTF	37.7	11498	990	8 : 92

Nonpoint P load and Load Ratio are based on PRESTO Model MR#1 "high" estimate.

Point to Nonpoint Phosphorus Ratio (%)
Point Source
Nonpoint Source
Watershed Boundary
Stream Network

Figure 5. Example adaptive management action area and receiving water. In this case the stream network above the Lodi discharge represents the "receiving water" for that adaptive management project.

Gathering Phosphorus Data

Monitoring data that must be submitted in this portion of the adaptive management plan include the growing season median in-stream phosphorus concentration and average flow of the receiving water at the point of compliance, or furthest downstream point of the adaptive management action area. If other relevant data are available for the receiving water/watershed, these data should also be submitted. Table 5 on page 34 is provided as a tool to submit these data to WDNR. Maps may also be appropriate for submittal.

Phosphorus data may be available on WDNR's surface water data viewer (http://dnr.wi.gov/topic/surfacewater/), on WDNR's surface water integrated monitoring system

(http://dnr.wi.gov/topic/surfacewater/swims/), at your local county LCD office, or through USGS. See Appendix E on page 100 for details on using WDNR's available databases. If applicable, monitoring and modeling data will also be available in TMDL development documents for watersheds within a TMDL (visit http://dnr.wi.gov/topic/tmdls/ for details). If data are available through a source other than WDNR, the applicant(s) must identify the data source, when these data were collected, and the method(s) used for evaluation. It is recommended that only data collected in the past ten years be considered for adaptive management planning purposes.

If phosphorus data are not available, phosphorus monitoring should begin immediately. See step 7 of the adaptive management plan on page 70 for details on phosphorus monitoring. In the interim, an assumed value will be generated by WDNR from a comparable stream based on size, drainage basin, topography and land use, preferably within the same HUC 8. This assumed value will be included in the final WQBEL recommendations memo for the facility or can be requested by the permittee ahead of time, and can be used for adaptive management planning purposes. This assumed value must be substantiated or replaced by actual in-stream phosphorus data once the minimum data required are available, as specified in Step 7 (pg. 70). The adaptive management plan should then be updated to reflect this new information.

Gathering Flow Data

If an applicant needs to obtain flow data, they may wish to contact USGS directly. USGS will provide these types of estimates to the applicant for a fee. See Section 6, page 81, for USGS contact information. If flow data is available from other sources than USGS, these data may be used in the adaptive management plan, but they should be validated for accuracy by the adaptive management applicant. USGS currently maintains a network of gauging stations throughout Wisconsin. Flow data generated at these gauging stations may be used to inform plan development and track flows during plan implementation. Data may be accessed online at the following link:
https://waterdata.usgs.gov/wi/nwis/rt
WDNR will consider alternative means of providing flow data (i.e. gauged, modeled) if the method is scientifically defensible and provides a time- and site-specific value for streamflow.

Other Data

Other data that should be gathered, if applicable and useful, include reservoir or impoundment residence time, stream order, and number of reaches within the watershed. If available, data by stream reach should also be evaluated and submitted with the adaptive management plan. These data are required for action areas within a TMDL watershed, but they are also useful to help target high contributing areas for action areas outside of a TMDL watershed.

Table 5. Blank table for adaptive management plan describing receiving water characteristics and monitoring data.

Receiving Water Characteristics			
Receiving Water Name(s)	Downstream Water(s)	Name(s) of Reservoirs/Impoundments on receiving water	Stream Order (if applicable)

Impaired Segments		
Streams on the 303(d) List of Impaired Waters	Contaminants of concern	Is a TMDL scheduled or completed?

Monitoring History				
Who Monitored	What Parameters	Dates Collected	Where did you get the data?	Results

Set a load reduction target

The next step is to set the load reduction target for the adaptive management plan. This value represents the reduction needed for the receiving water to attain its applicable criterion. At a minimum, the adaptive management plan must determine the phosphorus loading at the point of compliance, typically the furthest downstream point of the adaptive management action area. If possible, loadings should also be quantified by reach. If the watershed is within a TMDL, loads by reach are already available in the TMDL document (http://dnr.wi.gov/topic/tmdls/).

There are two basic methods for estimating the load reduction target for adaptive management action areas outside of a TMDL. Both of these methods compare the current phosphorus load to the receiving water and the allowable load. The first method uses the in-stream phosphorus concentration to determine the current phosphorus load entering the receiving water. The second method sums the phosphorus loading from point and nonpoint sources to quantify this load entering the receiving water. Both methods are valid and can be completed using the following steps to calculate the load reductions needed. Alternatively, the adaptive management plan could require watershed-specific modeling to quantify the load reduction target. Although modeling might provide the most precise load reduction targets, many watersheds may not have sufficient data to run these models.

Method 1: Calculate the Current P Load Based on the In-Stream Phosphorus Concentration

Step 1: Calculate the current phosphorus load from point source discharges within the adaptive management action area. For each facility apply the following equation:

Current Point Source Phosphorus Load = Qe*Ce*8.34*365 days/year

Where: Qe= Effluent flow (MGD) as defined in s. NR 217.13 (2)(c), Wis. Adm. Code.
Ce = Effluent P concentration (mg/L)

8.34 = Conversion factor for converting MGD and mg/L into pounds per day

*Example: Current Phosphorus Load for Facility A =1 MGD *0.83 mg/L *8.34 *365 days/yr = 2,527 lbs/yr*

Note: If multiple point sources exist in the watershed, sum the total facility load (Σ{facility$_a$, facility$_b$,…, facility$_n$}). Facility phosphorus loads are also available using the PRESTO model (see page 13).

Step 2: Calculate the current load in the receiving water.

Current Load in Receiving Water = Qs*Cs*8.34*365days/year)

Where: Qs=Annual average flow of receiving water; *to convert cfs to MGD, multiply Qs in MGD by 0.6463*
Cs = Receiving water P concentration at point of compliance or "pour point" (mg/L)

*Example: Current Load in Receiving Water =56 MGD *0.23 mg/L *8.34 *365 days/yr = 39,208 lbs/yr*

Step 3: Calculate the allowable load in the receiving water.

Allowable Load = (Qs+Qe)*WQC*8.34*365 days/yr

Where: WQC = Water quality criterion (mg/L)

*Example: Allowable load for Facility A's watershed =(56 MGD + 1 MGD) *0.1 mg/L *8.34 *365 days/yr = 17,351 lbs/yr*

Note: Use 0.075 mg/L for stream discharges, rather than 0.1 mg/L which represents the river criteria. If the facility discharges to a lake or reservoir, an alternative calculation may be necessary. See Table 22 in Appendix A (pg. 84) for all applicable phosphorus criteria.

Step 4: Calculate needed reductions in the receiving water.

Needed Reductions =Current PS Load (step 1) + Current RW Load (step 2) - Allowable Load (step 3)

Example: Needed reduction for Facility A's watershed =2,527 lbs/yr + 39,208 lbs/yr – 17,351 lbs/yr= ***24,384 lbs/yr***

Method 2: Calculating the Current P load by Adding Point and Nonpoint Source Loadings
Method 2 is available for watersheds without accurate water quality data. If water quality data is available, method 1 is likely a more reliable approach to set a load reduction target.

Step 1: Use Step 1 in Method 1 to calculate the current phosphorus load from point source discharges within the adaptive management action area.

Step 2: Determine the approximate load of the receiving water from nonpoint sources.

This step approximates the phosphorus load from mixed land use watersheds. There are many ways to approximate this load through models etc.

One option is to use the estimated NPS load value from PRESTO. Although this model provides a long-term average annual nonpoint phosphorus load, this value is likely sufficient for planning purposes. It is preferable to conduct watershed-specific modeling if data is available, however. To access the information in PRESTO visit http://dnr.wi.gov/topic/surfacewater/presto.html.

PRESTO Lite reports provide modeled flow data that can inform loading analyses. These reports can be obtained by working through the steps provided in the above link. Using the flow graph on the PRESTO Lite report, a 50% flow exceedance value is a suitable approximation of average flow volume at the catchment's outlet.

Example: The NPS load according to PRESTO for Facility A's watershed equals 45,113 lbs/yr

Step 3: Calculate the needed reductions in the receiving water.

Needed reductions= Current PSLoad (step1) + NPS Load (step 2) - Allowable Load (step 3)

Example: Need reductions for Facility A's watershed =

2,527lbs/yr + 45,113lbs/yr - 17,351 lbs/yr= **30,289lbs/yr**

Note: WDNR understands that this approach may not take all factors into consideration such as background and residual phosphorus loads. However, this value should be sufficient for adaptive management planning purposes. This value should be modified as the adaptive management plan is implemented and additional site-specific information becomes available.

Demonstrating Compliance with TMDL Allocations

Adaptive management efforts are designed to achieve compliance with the phosphorus water quality criterion found in ch. NR 102, pursuant to s. NR 217.18(1) Wis. Adm. Code. Permittees using adaptive management to address a TMDL-based WQBEL have an additional option for demonstrating compliance beyond the approach outlined in s. NR 217.18 Wis. Adm. Code. Adaptive Management efforts oriented towards achieving compliance with a TMDL pursuant to s. 283.13(7)(a) Wis. Stats. may employ water quality monitoring or modeling to demonstrate that compliance with the loading capacity, as defined in s. NR 212.72(5) Wis. Adm. Code has been achieved. To demonstrate compliance with a TMDL's loading capacity, both the load allocations and wasteload allocations for the project pollutant(s) must be met in the TMDL subbasin that the facility discharges as well as all upstream contributory subbasins.

Modeling may be employed to demonstrate that nonpoint source contributions have been reduced to (or below) the load and wasteload allocations identified in the TMDL. Modeling will need to employ similar methods as the federally-approved TMDL and should be supported by a robust field-scale dataset from the adaptive management action area that represents current conditions. Effluent monitoring data will be available to quantify contributions from point sources. Other combinations of point and nonpoint source reductions may be considered, provided the waterbodies included in the approved adaptive management plan action area achieve the TMDL loading capacity. Please contact your local WDNR adaptive management coordinator to discuss modeling methods to be used for demonstrating compliance with TMDL load allocations.

In-stream monitoring may also be used to demonstrate compliance with TMDL loading capacity. Translating the mass-based TMDL load and wasteload allocations into an in-stream target may require additional analysis based on TMDL modeling methods. Certain TMDLs have translated the loading capacity to in-stream targets for this purpose, which can be found in Appendix O of the Wisconsin River Basin TMDL Report and Appendix K of the Upper Fox and Wolf River Basin TMDL Report. In cases with a downstream lake or reservoir, the TMDL loading capacity for the facility's subbasin is set to meet both local and downstream lake/reservoir water quality criteria and is reflected in the "Adaptive Management Target".

Table 6 provides a straight-forward spreadsheet to submit the load reduction information to WDNR with the adaptive management plan.

Table 6. Blank phosphorus loading table for adaptive management plan.

Phosphorus Contributions in Watershed			
Point Source Load Information			
Number of Municipal and Industrial Point Sources in Watershed			
Facility Name:	WPDES Permit No.:	Point Source Loading:	Source:
Nonpoint Source Load Information			
Approximate land cover:			
Approximate load from NPS:			
Source:			
Receiving Water Load Information			
Other phosphorus loadings:		Facility Name(s):	
		Load(s):	
Current phosphorus load into the receiving water:			
Allowable phosphorus load:			
NEEDED P REDUCTION:			

3. Conduct a watershed inventory

To complete an effective watershed inventory, collaboration with local governments, county LCD staff, and local NPS coordinators will likely be necessary. You may also need to make direct observations in the watershed.

Why do a watershed inventory?

- Helps identify activities in the watershed that could be negatively affecting water quality
- Provides an understanding of how land use and landscape features affect water resources in your watershed
- Helps develop a monitoring strategy to collect baseline data or monitor the progress of your adaptive management efforts.
- Organizes materials that can be used at public meetings, to educate others about your project
- Provides a detailed record of current conditions and characteristics of your unique watershed, serving as a benchmark to measure future changes against.

Gather and organize data

Gathering existing data is the first step in conducting a watershed inventory. Many sources of information are available to help complete a watershed inventory such as:

- Data from local watershed groups, associations, current or past projects or studies within the watershed or nearby soil surveys
- Topographic maps and aerial photos of the watershed
- Any reports, studies, monitoring data, or plans developed in the watershed by others
- County road maps and plat books, if available

It is strongly advised that you work with your local county LCD and WDNR NPS coordinator to determine what information is needed for your project, and what sources of information are already available within your watershed. A summary of the types of information you will likely need throughout the adaptive management project is summarized in Table 7. Sources of information that may be available are summarized in Table 8. Once information is gathered, determine how to organize these data. ArcGIS and Excel© or Access© tables are the most common tools used for data storage and organization.

Table 7. Types of information that you will need throughout the watershed inventory.

	Physical Features of the Land	Land Use	Streams, Lakes, Wetlands	Residential and Urban	Agriculture	Forests
Topographic Map	x		X	x		x
Soil Survey	x				x	
Aerial Photos	x		X	x	x	x
National Wetlands Inventory			X			
Current Land Use		x		x	x	x
Zoning Maps		x				
Floodplain Maps	x					

Table 8. Potential sources of information available by agency.

Title of Publication or Government Agency	Information Available	How to Obtain/Contact
Wisconsin DATCP	Land and water conservation directory	https://datcp.wi.gov/Pages/About_Us/LandWaterConservationBoard.aspx
U.S. Department of Agriculture (USDA)	Web soil survey	http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm
DATCP	Manure management advisory system and WI 590 Nutrient Management Planning	http://www.manureadvisorysystem.wi.gov/
WDNR	GIS layers for land cover, NPS grants, surface water monitoring locations, wetlands, etc.	http://dnr.wi.gov/topic/surfacewater/swdv/
UW Stevens Point/UW Extension	Data, mapping and survey resources	http://www.uwsp.edu/cnr-ap/clue/Pages/publications-resources/DataMappingGIS.aspx
UW-Madison Department of Soil Science	Wisconsin watershed project clearinghouse	http://nonpoint.cals.wisc.edu/?page_id=14
U.S. Geological Survey (USGS)	Wisconsin Water Quality Center housing monitoring information, numerous reports, and stream flow data	http://wi.water.usgs.gov/
USDA	Wisconsin agricultural statistics	https://www.nass.usda.gov/Statistics_by_State/Wisconsin/
USGS	Land cover data layers	http://landcover.usgs.gov/
Natural Resource Conservation Service (NRCS)	Soil Survey Geographic (SSURGO) Database	https://www.nrcs.usda.gov/wps/portal/nrcs/site/national/home/
USDA	National Agricultural Statistics Service	http://www.nass.usda.gov/
NASS – CropScape	Yearly cropping data at field-level resolution	https://nassgeodata.gmu.edu/CropScape/

Describe the physical features of the action area

This portion of the adaptive management plan should examine the natural physical features of the land in your watershed such as soil type, soil type abundance, floodplains, and topography. This information will help identify those areas where soil loss and phosphorus loading to the receiving water is most likely to occur.

Soil surveys have been conducted for every county in Wisconsin, and can be obtained through your local county LCD or online through the USDA's web soil survey: http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm (Table 8). Soil surveys contain a description of each soil and suggest their aptitudes for flooding, slope stability, septic systems, building suitability, range production, and erosion hazards based on various soil properties. One soil parameter of particular interest is the soil erodibility (K) factor. The adaptive management plan should identify the soil types in the watershed, their approximate acreage covered, and other basic soil properties as specified in Table 9 (pg. 42).

Typically, watersheds are made up of a number of soils with similar soil properties. If there are a large number of aggregated soils within the watershed and action area it is possible to combine these similar soil types to make planning and decision-making easier. Quantifying exact acreage covered for a given soil type is not necessary, an approximation is usually sufficient. The adaptive management plan should also provide a soils map of the watershed, and a map of the highly erodible soils in the adaptive management action area (Figure 6).

The Erosion Vulnerability Assessment for Agricultural Lands (EVAAL) is a spatial model developed by WDNR, designed to quickly identify areas vulnerable to erosion using readily available data and a user-friendly interface. This tool estimates vulnerability by separately assessing the risk for sheet and rill erosion (using the Universal Soil Loss Equation, USLE), and gully erosion (using the Stream Power Index), while de-prioritizing those areas that are not hydrologically connected to surface waters (also known as internally drained areas). These three pieces are combined to produce an erosion vulnerability index value that can be assessed at the grid scale or aggregated to areas, such as field boundaries. Areas identified as high-risk are more likely to export nutrients to surface waters.

To access EVAAL tutorials, model files, and other information, visit: https://dnr.wi.gov/topic/Nonpoint/EVAAL.html

Table 9. Blank soil information table for adaptive management plan.

Soil Symbol	Soil Name	Area (ac)	% Cover	Frequency of flooding	Erodibility (K)	K factor	Hydrologic soil group	Other key characteristics	Comments
EXAMPLE: ***DgC2***	*Dodgeville silt loam, 6 to 12 percent slopes*	*91.3*	*3.5*	*None*	*Moderately eroded*	*.43*		*Slow water movement*	*Potential site for future development*

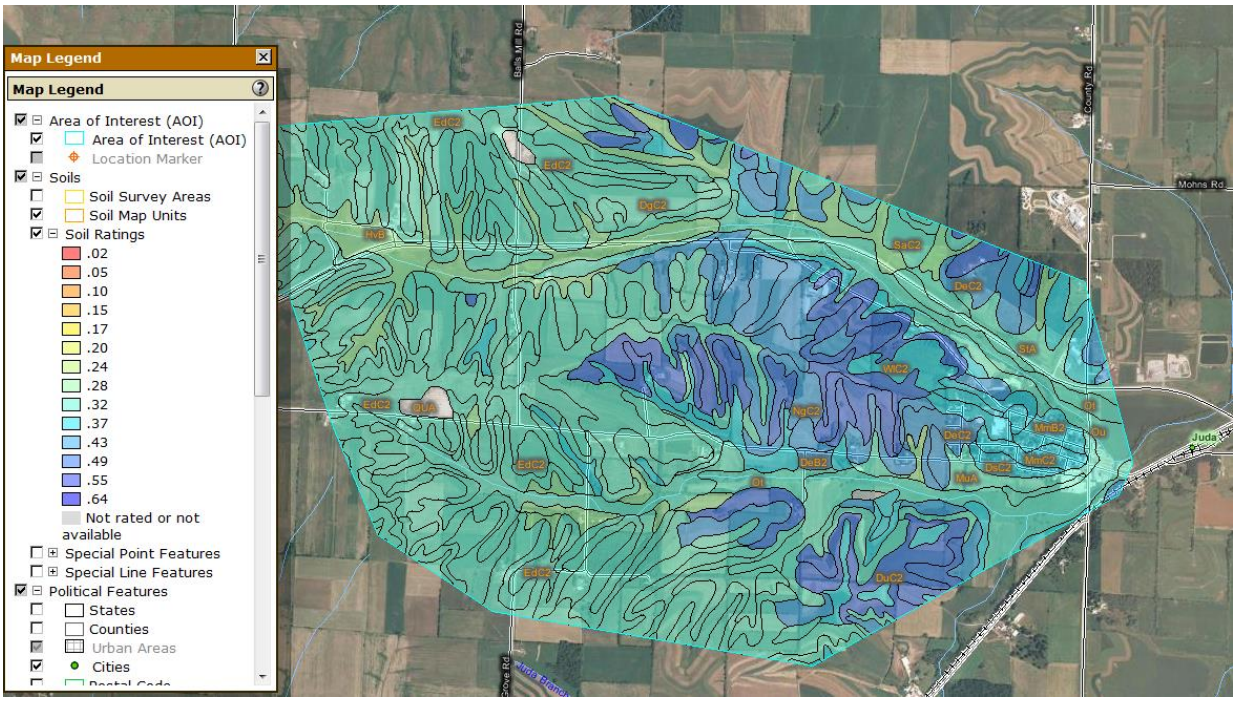


Figure 6. Example map of soil erodibility (K) factor within a given watershed. This map was generated from the Web Soil Survey (USDA).

Current Land Use Overview

This portion of the watershed description examines the current land uses in the watershed, and how land uses may change in the future. Recent aerial photographs, topographic maps, Wisconsin agriculture statistics publications, Geographical Information System (GIS) data layers, and field visits, sometimes referred to as "windshield surveys", are appropriate ways to determine current land use within the watershed. GIS is the most frequently used software to store and analyze land use data.

> **What is a windshield survey?**
> A windshield survey relies on direct observations to gather land use data. Windshield surveys can be useful to validate existing data, identify opportunities for conservation practices, determine typical cropping rotations in the watershed, and approximating the animal density in a watershed, among other things.

Urban, agricultural, and natural land use features should be identified in the adaptive management plan. Urban land uses of interest may include urban open spaces, low density residential areas, high density residential areas, and commercial and industrial areas. Agricultural land use features that should be identified include cropland, pastures/hay land, and animal feedlots. Natural land use features can include forests, prairie, wetlands, conservation land, and open water areas. The adaptive management plan should identify other important land uses that occur in the watershed that are not covered in the above categories as well. Once the land use features for the action area have been obtained, approximate the acreage and percent total for those land uses. This information should be submitted with the adaptive management plan visually and in tabular form (Figure 7 pg. 45, Table 10 pg. 46, and Table 11 pg. 47).

Additional detail is needed to describe the approximate density of livestock, common cropping rotations, and management practices in the watershed. These values can be estimated through a variety of methods and are important when assessing the current conditions within the watershed. In some cases, windshield surveys may be the best approximation tool available. For example, estimating the number of livestock in a watershed can be very difficult given that livestock numbers change seasonally; information may be considered proprietary (not available to the public); and operations fluctuate due to economic impacts, changes in ownership, and changes in management. Table 11 on page 47 is provided as an example worksheet to submit these data to WDNR.

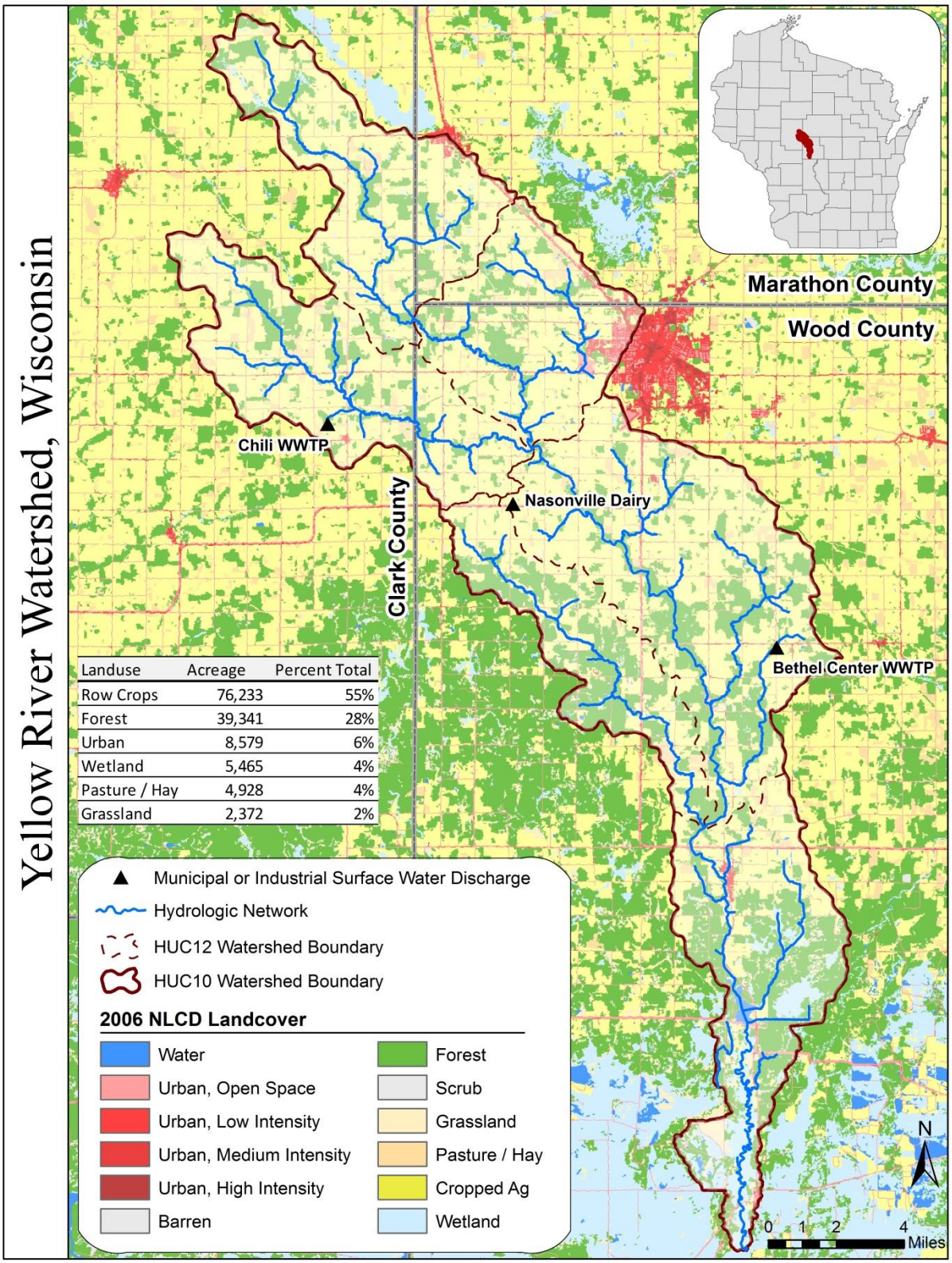


Figure 7. Example land use map of the Yellow River Watershed, Wisconsin.

Table 10. Example land use overview table.

Current Land Use				
Land Use	**Approximate Land Cover (ac)**	**Approximate Land Cover (%)**	**Typical Impervious Fraction/Runoff Coefficient**	**Approximate Impervious Area in Watershed (%)** (Column B*Column C)
Low density residential	5000	3.65	0.3	1.09
Medium density residential	2032	1.48	0.5	0.74
High density residential	450	0.33	0.7	0.23
Industrial and commercial areas	238	0.17	0.85	0.15
Urban open areas	360	0.26	0.2	0.05
Wetland	5465	3.99	0.08	0.32
Forest	39431	28.78	0.1	2.88
Grassland	2372	1.73	0.1	0.17
Cropland	76233	55.64	0.1	5.56
Animal Feedlots	499	0.36	0.75	0.27
Pasture/hay	4928	3.60	0.12	0.43
TOTAL:	137008 ac.	100%		11.91%

Description of Cropping Practices		
Common Rotations	**Approximate Land Cover (ac)**	**Approximate Land Cover (%)**
Continuous Corn	15240	20
Corn-Soybean	19050	25
Corn-soybean-wheat/clover	15240	20
Three-year alfalfa, one-year corn	11430	15
Oats/alfalfa-alfalfa-corn	12954	17
Other	2286	3
TOTAL:	76200	100% (55% of total watershed)

Tillage Practices	
No-till (ac)	12450
Conservation tillage (30% or more) (ac)	31000
Conventional tillage (less than 30%) (ac)	26250
Unknown (ac)	6500

Livestock Density	
	Approximate number of animals in watershed
Beef	2000
Dairy	6000
Pork	900
Poultry	600
Other	
Comments:	

Table 11. Blank land use overview table.

Current Land Use				
Land Use	**Approximate Land Cover (ac)**	**Approximate Land Cover (%)**	**Typical Impervious Fraction/Runoff Coefficient[6]**	**Approximate Impervious Area in Watershed**
Low density residential			0.3	
Medium density residential			0.5	
High density residential			0.7	
Industrial and commercial areas			0.85	
Urban open areas			0.2	
Wetland			0.08	
Forest			0.1	
Grassland			0.1	
Cropland			0.1	
Animal Feedlots			0.75	
Pasture/hay			0.12	

Description of Cropping Practices		
Common Rotations	**Approximate Land Cover (ac)**	**Approximate Land Cover (%)**

Tillage Practices	
No-till (ac)	
Conservation tillage (30% or more) (ac)	
Conventional tillage (less than 30%) (ac)	
Unknown (ac)	

Livestock Density	
	Approximate number of animals in watershed
Beef	
Dairy	
Pork	
Poultry	
Other	
Comments:	

[6] Runoff coefficients are used in the *rational equation*, which is one of the simplest methods to determine peak discharge from drainage basin runoff. These values are provided as a general approximation for decision-making purposes and should be modified as appropriate.

Zoned/Proposed Land Uses

Most counties have planning departments or commissions that create maps to show how land parcels are zoned within the county. Although zoning maps are not usually representative of current land uses, they do show what the potential or future land uses could be. You should be aware of the zoning within the adaptive management action area to plan for future impacts on your watershed. Contact your local planning department to access these maps. Once you have obtained the maps, compare the current land uses to the zoning boundaries to identify areas of future land uses changes such as development.

Other Key Watershed Features

This portion of the adaptive management plan should discuss other watershed features not addressed previously. Other key watershed features may include wellhead protection sites, construction sites, areas of stream bank erosion, landfills, etc.

This component of the adaptive management plan also provides an opportunity for the applicant to discuss secondary watershed projects they may engage in, if applicable. Adaptive management is a compliance option that helps address watershed-scale issues. Although the primary focus of adaptive management needs to be phosphorus reductions to the receiving water, it is also possible to work with other watershed projects to help achieve their goals while achieving the goals of adaptive management. There are many opportunities for these secondary projects and benefits; one example is wellhead protection, as discussed below.

Nitrogen in drinking water can be a potential human health concern and is, therefore, regulated by WDNR and EPA. Portions of Wisconsin are exceeding or close to exceeding the nitrogen drinking water standards of 10 mg/L. Kaspar et.al. (2012) documented[7] that best management practices, like cover crops, can be used to control both nitrogen and phosphorus. If the applicant chooses to engage with other projects in their watershed to maximize the benefits of the adaptive management plan, they should describe these projects in this step of the plan.

[7] Kaspar et. al (2012). Effectiveness of oat and rye cover crops in reducing nitrate losses in drainage areas. Agricultural Water Management (110). Pg 25-33.; Schmidt et al. (1989). Nutrient and pesticide best management practices for Wisconsin farms. DATCP Technical Bulletin ARM-1.

4. Identify where reductions will occur

In this step you will:

- Evaluate all data gathered in step 3 for decision-making purposes
- Identify critical areas within the action area to target management practices
- Approximate critical area acreage in the action area

Reductions can occur anywhere within the adaptive management action area. To optimize the impact of implementation funding, it is recommended that phosphorus reductions target "critical source areas" or CSAs, those areas contributing a disproportionate amount of phosphorus to receiving waters relative to other areas within a watershed. A CSA not only stores (or is a source of) phosphorus, but also transports (or delivers) phosphorus to a receiving water. Both factors must be in play for a particular area to be defined as critical (Figure 8).

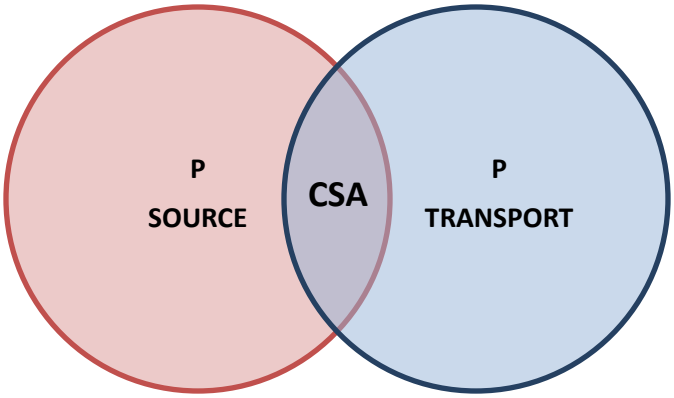


Figure 8. Critical source area concept.

With respect to agricultural lands, the first step in this process is to consult with the county LCD, NRCS, DATCP, WDNR local nonpoint source coordinator, and/or others familiar with the nonpoint source conditions within the watershed. They are likely to have first-hand knowledge of the watershed and may already know where the critical source areas are located.

The approach outlined below can help identify critical areas for targeting. This is not a "modeled" approach as the data required to apply a detailed model at this scale are not always readily available. Instead, this approach identifies some publicly available data that can be used to help identify potential critical areas without going through an extensive modeling effort.

Use readily available data to identify potential critical source areas, and then use a windshield survey and/or local knowledge to gather evidence of uncontrolled critical source areas.

The process of identifying CSAs involves overlaying spatial GIS data layers to locate potential critical areas and then using the windshield survey and/or local knowledge gathered in Step 3 of the plan as evidence of uncontrolled (i.e., no BMPs in place) critical source areas (pg. 39). This process of targeting critical areas relies on data that is readily available (e.g., slope, soil characteristics, etc.) and if it is available, management information

(e.g., tillage practices, manure spreading, barnyard runoff control systems, cropping practices, etc.).

Phosphorus movement from the agricultural landscape to receiving waters involves a combination of both source factors and transport factors[8] (Table 12). Source factors represent the amount of phosphorus available on the land, while transport factors represent the mechanisms by which phosphorus is moved across the landscape and delivered to receiving waters. These factors, among others, are used to calculate the Wisconsin Phosphorus Index (P Index), an estimate of the average annual phosphorus delivered from a field to a nearby waterbody (http://wpindex.soils.wisc.edu/). Without going to the extent of actually calculating a P Index value, the following outlines the types of data that may be available to identify potential CSAs.

Table 12. Phosphorus source and transport factors.

Source Factors	Transport Factors
• Soil Test P • Application rate of P fertilizer & manure • Application method of P fertilizer & manure	• Erosion potential • Runoff • Connectivity to receiving water

Source Factors

Phosphorus source factors include the amount of phosphorus present in the soil (soil test P), the application rate of phosphorus inputs (manure, fertilizer, etc.), as well as the application timing and method. Soil test P values can increase over time when the amount of manure or fertilizer applied is greater than the amount removed through crop harvesting. Fields with high soil test P values have the potential to be a large source of phosphorus in a watershed. The application method can determine the potential for an area to be a source of phosphorus. For example, manure or fertilizer that is injected into the soil has less chance of being moved off the field than manure or fertilizer that is surface applied. Along the same line, poor barnyard practices including inadequate manure storage, unprotected manure piles, cattle in streams, etc. can also contribute phosphorus. Timing of manure application can also be a factor. Manure or fertilizer that is not quickly incorporated into the soil has greater potential for delivery to nearby receiving waters particularly if it has not been incorporated before fall or winter.

Transport Factors

Because a large portion of soil phosphorus is "bound" to soil particles, areas where the soil is easily detached or eroded are potential CSAs if there is a high concentration of phosphorus in or on the soil. Data that can help identify areas prone to erosion include, soil erosion factor or "K Factor" and slope. The K Factor indicates the susceptibility of a soil to sheet and rill erosion by water, and other factors being equal, higher values correspond to greater erosion potential. Steeper slopes correspond with

[8] Sharpley, A.N., T.C. Daniel, and D.R. Edwards. 1993. Phosphorus movement in the landscape. J. Prod. Agric. 6:492-500.

faster runoff, and therefore more force to move soil and soil-bound phosphorus. As mentioned in Step 3 on page 39, both the K Factor and slope for a particular area can be determined using the USDA-NRCS Web Soil Survey (http://websoilsurvey.nrcs.usda.gov). The Web Soil Survey allows a user to select a custom area of interest, then view available soil properties by map unit (soil type). Table 13 shows the path to find K Factor and slope on the web soil survey. Areas with higher K factor and higher slope will likely have higher erosion rates. Some counties have maps of Highly Erodible Lands (HEL). If this is available in the area of interest, it can be used as a substitute for the K Factor and Slope analysis since HEL analyses include those factors. Additional information that can help determine the erosion potential of an area includes tillage frequency and type. Conservation tillage and no-till practices can reduce erosion over traditional tillage practices.

Runoff from a particular area is affected by the amount and intensity of precipitation, land cover, management practices, and soil properties. The variability of precipitation over a small subbasin is likely to be minimal, therefore this factor need not be considered here. A straightforward way of addressing both land cover/management and soil factors is by using the methodology in TR-55[9] for determining curve numbers. TR-55 contains tables that relate land cover/management and hydrologic soil group to curve number values. Higher curve numbers indicate greater runoff potential. Sources of land cover information include the National Land Cover Dataset (NLCD) and the National Agricultural Statistics Service (NASS). The NLCD and NASS data can be downloaded from the USDA NRCS Geospatial Data Gateway (http://datagateway.nrcs.usda.gov/). Hydrologic soil group, which is necessary for determining curve number, is available from the Web Soil Survey and should have been identified in Step 3 of the plan on page 39, as well as Table 13, below.

What is "TR-55"?

Technical Release 55 (TR-55) refers to a USDA technical document that provides a number of techniques used to model hydrology. TR-55 presents procedures to calculate storm runoff volume, peak rate of discharge, hydrographs, storage volumes required for floodwater reservoirs, and curve numbers. Curve numbers are empirical parameters used for predicting direct runoff or infiltration from rainfall excess.

Table 13. Web Soil Survey headings for K factor, slope, and hydrologic soil group.

Soil Properties and Qualities
--Soil Erosion Factors
----K Factor, Whole Soil
--Soil Qualities and Features
----Hydrologic Soil Group
----Representative Slope

Another factor in the transport of phosphorus to receiving waters is connectivity. Connectivity can occur when an area is within close proximity to a receiving water or when an area is connected through artificial underground (tile) drainage or a surface drainage ditch. Connectivity can be broken if the flow

[9] United States Department of Agriculture. 1986. Urban hydrology for small watersheds. Technical Release 55 (TR-55) (Second Edition ed.). Natural Resources Conservation Service, Conservation Engineering Division.

path of the source area contains land cover or landforms that capture runoff (e.g., wetlands or internally drained areas). Studies have shown that fields within 100-300 feet of a waterbody have an increased potential of transporting phosphorus to that water body[10]. To evaluate this potential, it is recommended that the distance to the nearest surface water is calculated using the 1:24,000 hydrography layer from the WDNR (https://data-wi-dnr.opendata.arcgis.com/datasets/24k-hydro-flowlines-rivers-streams). Drain tile can be an important transport pathway for soluble phosphorus as well; however, artificial drainage location information is not readily available. Local experts may know specific or general locations of artificial drainage.

Windshield Survey

As mentioned in Step 3 on page 39, performing a windshield survey (i.e., observing the watershed while driving along the road) can help to identify additional source and transport factors. Conducting a windshield survey in the spring offers the advantages of greater land visibility due to lack of vegetation and greater chance of observing runoff patterns. If observations of cropping practices are important, then a follow-up survey during the growing season would be appropriate.

The following are some source and transport factors that may be identified during a windshield survey:

Factors related to source potential:

- Cattle access to streams
- Poor barnyard manure handling
- Inadequate manure storage
- Unprotected manure piles

Factors related to transport potential:

- Tillage practices
- Cropping practices (strip cropping, terraces, crop type, etc.)
- Grazing practices
- Stream channel erosion
- Riparian buffers

Summary

Overlaying source and transport factors may identify potential critical source areas. Lack of local field-scale data may inhibit the analysis of all the factors mentioned above; however, with available statewide data, local knowledge from county, WDNR, and other staff, and information gathered during a windshield survey, many of the critical source areas within a watershed can be identified (Figure 9, pg.

[10] Lemunyon, J.L. and R.G. Gilbert. 1993. The concept and need for a phosphorus assessment tool. Journal of Production Agriculture 6(4):483-496.
Sharpley, A. N., Weld, J. L., Beegle, D. B., Kleinman, P. J. A., Gburek, W. J., Moore, P. A., & Mullins, G. 2003. Development of phosphorus indices for nutrient management planning strategies in the United States. Journal of Soil and Water Conservation 58(3):137-151.

53). Table 14 on page 53 is provided as an example worksheet to submit critical source areas to WDNR. A map of critical source areas should also be submitted.

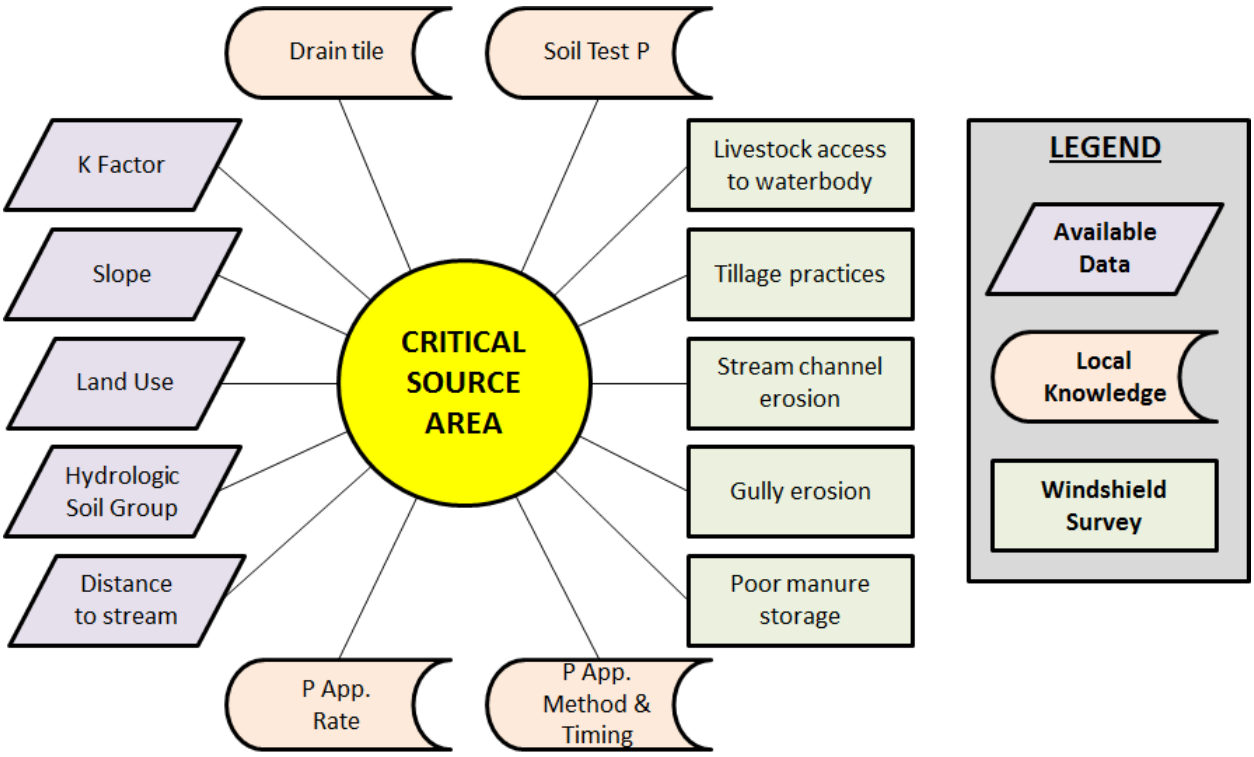


Figure 9. Critical source area identification inputs.

Table 14. Blank critical source overview table. A map of critical source areas should also be submitted.

Critical Source Area				
Critical Source Area	**Critical Source Description**	**General Land Use Category**	**Approximate Land Cover (ac)**	**Approximate Land Cover (%)**
Area 1				
Area 2				
Area 3				
Area 4				
Area 5				

5. Describe management measures

In this step you will:

- Complete a facility plan to comply with interim limits, if necessary
- Identify management measures that will be installed throughout adaptive management implementation to control nonpoint sources of excess phosphorus

Management measures, or practices, are those activities that will be used to reduce phosphorus loads to the watershed in order to improve water quality. There are a wide variety of management practices that can be used to reduce phosphorus. WDNR does not require specific management measures be utilized under adaptive management. Point sources and their partners have discretion to select management measures that can control runoff in the watershed and will meet the intent of adaptive management. Communication between the adaptive management plan developers and partners is critical to ensure that management measures identified in this step are reasonable, acceptable, and effective. Management measures will vary depending on the source of phosphorus and the partner(s) you are collaborating with to control the source. This portion of the guidance is therefore broken up by source reduction type: traditional point source, urban stormwater, agricultural nonpoint source, CAFOs, and other.

Traditional point source reductions

"Traditional" point source reductions are those reductions made by municipal or industrial wastewater discharges. Phosphorus reductions from these sources are required for those dischargers covered under the adaptive management plan and not already meeting the adaptive management interim limits (Section 4, pg. 18). Typically, treatment technology optimization will be sufficient to meet these interim limits. Point source(s) can also voluntarily choose to reduce effluent phosphorus beyond the reductions required to comply with the adaptive management interim limits. These reductions are not required, but they can be used to contribute to progress towards meeting the water quality criteria of the receiving water. If point source reductions will occur under adaptive management, the adaptive management plan should describe the treatment that will be enhanced or added, and when these modifications will occur. Completing the Phosphorus Operational Evaluation & Optimization Report Worksheet may aid point sources in this effort.

Pursuant to s. NR 217.18(3) Wis. Adm. Code, the permittee is ultimately responsible for implementing the adaptive management plan. The actions identified in the plan must be sufficient to attain the applicable water quality criterion in the receiving water (s. NR 217.18(2)(d) Wis. Adm. Code). Effluent phosphorus reductions occurring on behalf of other point sources not formally partnering on the adaptive management plan are not appropriate actions to include as core AM plan content that will

achieve the phosphorus criterion. These reductions may work as a safety factor and help achieve plan goals but should not be considered as formal AM actions.

Urban storm water pollutant load reductions

Storm water runoff can be targeted in adaptive management projects to reduce phosphorus and improve water quality. Urban storm water discharges are generated by runoff from exposed and/or disturbed land area, including construction sites and industrial sites, and impervious areas like paved streets, parking lots, and building rooftops during rainfall and snow events. The adaptive management plan should identify the array of storm water management practices that will be used to reach water quality goals. See Figure 11 on page 56 for examples of practices that could be utilized in adaptive management projects. The plan should also ensure that management practices will be designed, implemented, and maintained according to any applicable technical standards (Figure 10). WDNR provides technical standards for storm water management practices on its web site at: http://dnr.wi.gov/topic/stormwater/standards/index.html.

Figure 10. Process to successfully implement a management practice.

Most storm water discharges from municipal separate storm sewer systems (MS4s) require authorization to discharge under a WPDES permit. Operators of regulated MS4s must obtain coverage under a WPDES storm water permit and must implement storm water pollution prevention programs, which specify how management practices will be used to control pollutants in runoff and prevent their discharge to receiving waters. If the adaptive management plan includes working with an MS4 partner, that MS4 may be able to achieve compliance with its own TMDL-based phosphorus limits through adaptive management. If the MS4 chooses to take credit for activities in the adaptive management plan to meet its own permit requirements, additional documentation and restrictions may apply. See Appendix C for additional details on adaptive management and MS4s (pg. 93).

Examples of Urban Best Management Practices

- Filter Strips
- Sediment Traps
- Wind Erosion Controls
- Check Dams - Silt Fence
- Steep Slope Terraces
- Streambank Stabilization - Structural and Vegetative
- Miscellaneous BMPs for Urban Construction
- Direct Runoff Away From Natural Channels
- Proper Disposal of Accumulated Sediment
- Herbicide/pesticide/fertilizer Management
- Protect Natural Vegetation and Riparian Vegetation
- Managing lawn waste such as leaves and grass clippings
- Exposure Reduction
- Infiltration basins
- Porous pavement
- Bioretention facilities

Figure 11. Examples of best management practices to reduce excess P loading from urban sources.

Agricultural nonpoint source reductions

Agricultural nonpoint source pollution can be targeted in adaptive management projects to reduce phosphorus and improve water quality. The adaptive management plan should identify the types of management practices that will be used to reduce phosphorus loads from agricultural areas. Figure 12 (pg. 57) lists examples of cropland and manure management practices that can be used to reduce phosphorus loading to the receiving water. County LCD staff, WDNR nonpoint source (NPS) coordinators, and other partners familiar with the nonpoint source condition of the watershed can be consulted to assist with identifying appropriate agricultural management practices. They may have experience identifying which practices are most cost-effective and which practices may not be feasible in the watershed.

The adaptive management plan should ensure that agricultural practices are constructed and maintained according to all applicable performance standards and technical standards. Technical standards used in Wisconsin are maintained by the USDA-Natural Resource Conservation Service (NRCS) in the Electronic Field Office Technical Guide (eFOTG) at: https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/technical/fotg/. Performance standards are found in ch. NR 151, Wis. Adm. Code, available at http://docs.legis.wisconsin.gov/code/admin_code/nr/100/151.pdf.

Data collected in Steps 3 and 4 of the planning process should be used to strategically focus management practices in critical source areas (see pages 39 and 49, respectively). Tools or models are

available to help determine which management practices would be most effective at controlling phosphorus loadings from agricultural sources. See Step 6 on page 59 (Estimate load reductions expected by permit term) for details on available models.

CAFOs

Concentrated animal feeding operations (CAFOs) are required to meet applicable livestock performance standards to fulfill their own WPDES permit requirements. The only opportunity to work collaboratively with CAFOs for adaptive management is to ensure that a) croplands utilized by CAFOs are complying with applicable agricultural performance standards, and b) partner with CAFOs to go above and beyond these performance standards. The content in the "agricultural nonpoint source" discussion above applies to all cropland regardless of the size of the agricultural producer.

Other

Adaptive management provides the flexibility to consider other innovative water quality improvement activities such as wetland restoration, lake management activities, dredging, etc. Any management measure that will reduce phosphorus loadings and/or improve water quality can be considered under adaptive management. If these innovative activities have separate WDNR or other approval requirements, however, these approvals must be gained before the activity can be considered under adaptive management.

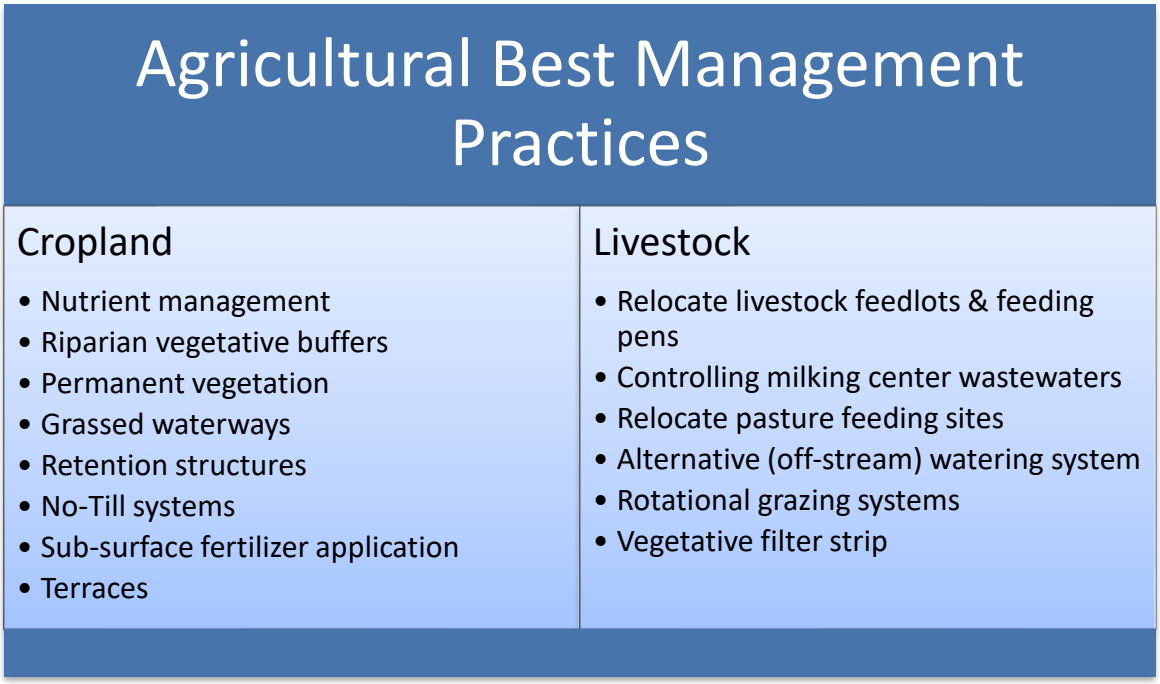


Figure 12. Examples of best management practices to reduce excess P loading from agricultural sources.

Table 15 is provided as an example worksheet to submit selected management measures to WDNR.

Table 15. Example worksheet to help outline necessary management measures in action area as part of the adaptive management plan. *Critical Area number should match those identified in Column A on Table 14, pg. 53.

Critical Area*	Control Objective(s)	Management Practice(s)
Area 1	Objective 1. Objective 2.	BMP 1
		BMP 2
		BMP 3
		BMP 4
Area 2	Objective 3. Objective 4.	BMP 5
		BMP 6
		BMP 7
		BMP 8
Area 3	Objective 5. Objective 6.	BMP 9
		BMP 10
		BMP 11
		BMP 12
Area 4	Objective 7. Objective 8.	BMP 13
		BMP 14
		BMP 15
		BMP 16
Area 5	Objective 9. Objective 10.	BMP 17
		BMP 18
		BMP 19
		BMP 20

Section NR 217.18(2)(d) Wis. Adm. Code formally addresses the adaptive management plan as part of the requirements for requesting adaptive management as a phosphorus compliance mechanism. The section states, as a condition of authorization of the adaptive management option: "The permittee has submitted an adaptive management plan that identifies **specific actions** to be implemented that **will achieve compliance** with the applicable phosphorus criterion in s. NR 102.06 through verifiable reductions of phosphorus from point and nonpoint sources in the watershed." (emphasis added)

The previously discussed components of an adaptive management plan (watershed inventory, where reductions will occur, and management measures to be implemented) work together to satisfy the above requirement. By defining the type of management measures that will occur, with prioritized locations based on an assessment of CSAs, the plan will contain sufficient specificity. By demonstrating, through a watershed inventory, the degree to which point and nonpoint sources of phosphorus are present, and that they will be addressed by the planned management measures, a case is made that the actions will lead to in-stream compliance with the applicable criterion.

6. Estimate load reductions expected by permit term

In this step you will:

- Quantify the phosphorus reductions needed from point and nonpoint sources to meet water quality goals
- Approximate the phosphorus reductions expected from nonpoint source management measures by permit term

As previously stated in Section 4, the adaptive management plan can extend over a 20-year timeframe, up to four permit terms. In each permit term, the point source phosphorus load must be reduced through compliance with the adaptive management interim limits (Section 4, Table 2 pg. 20). As a reminder these interim limits are set equal to 0.6 mg/L by the end of the first permit term, 0.5 mg/L for the second and third permit terms, and the final WQBEL at the conclusion of the fourth permit term, unless water quality standards are met.

The load from nonpoint or other point sources must be reduced in each permit term so that water quality improvements can be observed and, eventually, water quality criteria can be attained. The load reduction target calculated in Step 2 of the adaptive management plan on page 29 should provide the final reduction goal for adaptive management.

WDNR understands that time is needed to develop partnerships and for best management practices to become established and show improvements. However, progress from both point and nonpoint sources must be demonstrated to continue to implement the adaptive management option for the full timeframe available. The following provides the minimum reduction requirements for each permit term. Again, the goal of adaptive management is to achieve compliance with phosphorus water quality standards. Load reductions estimated in this portion of the adaptive management plan must be sufficient to reasonably conclude that this goal can be achieved. The WPDES permit reissued with adaptive management provisions will reflect load reduction goals calculated in this step.

Estimating load reductions from point sources

Permit term 1:

In the first permit term, the adaptive management applicant must, at minimum, demonstrate that its contributing phosphorus load[11] to the watershed will be offset through nonpoint or other point source reductions. Nonpoint source BMPs must be installed and functioning. If modeling estimates indicate that water quality criteria can be met through smaller load reductions, an alternative load reduction can be requested by the applicant.

[11] If multiple facilities are working collaboratively under one adaptive management plan, the sum of the loads must be offset to demonstrate compliance with adaptive management in the first permit term.

Example Calculation of the Amount of Offset Required from Nonpoint or Other Point Sources in Permit Term 1:

A municipal wastewater treatment system with a 1-MGD design capacity and a long-term phosphorus effluent concentration of 0.83 mg/L[12] (i.e., the average of three years of weekly monitoring results) discharges to a receiving water with an annual average flow of 19 cfs (12 MGD). The receiving water is phosphorus impaired and has a background concentration of 0.23 mg/L upstream of the discharge. The proposed WQBEL equals the water quality criterion of 0.1 mg/L.

Step 1: Calculate the applicant's current discharge as an annual load.

1 MGD x 0.83 mg/L x 8.34 x 365 days/yr = **2,527 lbs/yr**

Note: 8.34 is a conversion factor for converting MGD and mg/L into pounds per day

Step 2: Calculate the current load in the receiving water just downstream from the applicant's discharge.

2,527 lbs/yr + (12 MGD x 0.23 mg/L x 8.34 x 365 days/yr) = 10,929 lbs/yr

Step 3: Calculate the applicant's percent contribution of load.

2,527 lbs/yr ÷ 10,929 lbs/yr x 100 = 23.1 %

Step 4: Calculate the allowable load in the receiving water.

(12 MGD + 1 MGD) x 0.1 mg/L x 8.34 x 365 lbs/yr = 3,957 lbs/yr

Note: Substitute 0.075 mg/L for stream discharges for 0.1 mg/L, which represents the river criteria.

Step 5: Calculate the needed reduction in the receiving water.

10,929 lbs/yr - 3,957 lbs/yr = 6,972 lbs/yr

Step 6: Calculate the applicant's proportional share of the needed reduction.

6,972 lbs/yr x 23.1% /100 = **1,604 lbs/yr**

[12] To improve the statistical validity of this calculation, consider using the facility's flow weighted mean concentration rather than the long-term mean effluent concentration.

In this example, the municipality is responsible for, at minimum, offsetting 1,604 pounds of phosphorus per year as part of its AM plan in the first permit term. Although this value represents the minimum reduction required for adaptive management, it may be advantageous to offset more than the minimum requirement in permit term 1 to improve the likelihood of adaptive management success. WDNR may also require a higher level of reduction if water quality goals will clearly not be met through this minimum. Adaptive management applicants should consider offsetting more than the required amount when the overall water quality load reduction goal is far greater than the minimum reduction requirement or when the receiving water is likely to respond slowly to changes in land use in the watershed. In these scenarios, it is recommended to target 50% of the load reduction needed to meet water quality criteria, rather than the minimum offset required:

6,972 lbs/yr*50%/100= **3,486 lbs/yr**

In cases where large-scale reductions are warranted, the adaptive management applicant should consider expanding partnerships to increase the amount of phosphorus that can be cost-effectively reduced in permit term 1. These partnerships can help reduce phosphorus loading in the receiving water and/or provide alternative funding sources to help pay for these additional reductions.

Permit Terms 2 and 3:
If the offset in permit term 1 is not sufficient to show water quality improvement, the adaptive management plan should be modified in the second permit term to either: a) add point sources to the AM plan to offset more phosphorus, b) offset more of the phosphorus load than required in the first permit term, or c) continue to implement the AM plan while developing a TMDL in order to account for additional P sources and achieve the applicable water quality criteria. Either the WDNR or a third party may develop a TMDL. Visit http://dnr.wi.gov/topic/tmdls/ for details on TMDL projects and contact information.

In most cases the point source will need to reduce additional phosphorus in permit term 2 and permit term 3. The reduction target for permit terms 2 and 3 should be based on the difference between phosphorus load in the receiving water after permit term 1 and the final phosphorus target (Figure 13).

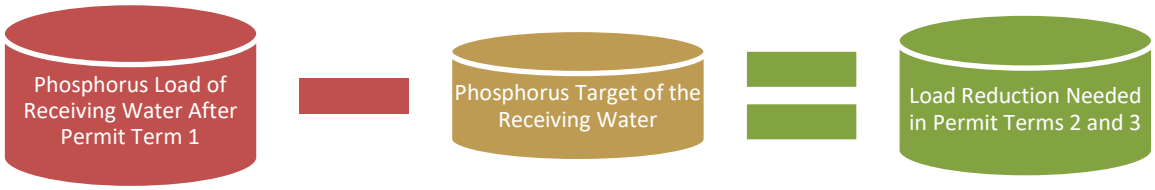


Figure 13. Equation for calculating P reduction needed in permit term 2.

In some waterbodies, large residual phosphorus concentrations in the receiving water sediments will impede a facility's ability to demonstrate water quality improvement. In this scenario a point source may adjust the load reduction needed in permit terms 2 and 3 by accounting for the residual phosphorus in the receiving water (Figure 14). Additional data will need to be collected in permit term 1

to adequately account for residual phosphorus in the receiving water. Contact the regional adaptive management coordinator before collecting these additional data.

Figure 14. Alternative equation for calculating P reduction needed in permit terms 2 and 3 by accounting for residual P in the receiving water.

Alternatively, a point source may request a different load reduction in permit term 2 or 3 based on the amount of phosphorus they discharge. This load reduction will be based on the annual load of the point source delivered to the receiving water in the previous permit term. This adjusted reduction may be appropriate in TMDL watersheds, or in cases where a TMDL or site-specific phosphorus criteria is being developed.

Alternative Example Calculation for Permit Term 2 Based on Point Source Contribution:

> A municipal wastewater treatment system with a 1-MGD design capacity and is in compliance with the 0.6 mg/L adaptive management interim limit. Given this, the point source must, at minimum, offset 1,827 lbs/yr in the second permit term.
>
> 1 MGD x 0.6 mg/L x 8.34 x 365 days/yr = **1,827 lbs/yr**
>
> *Note: 8.34 is a conversion factor for converting mgd and mg/L into pounds per day*

Permit Term 4:

Option A, Adaptive Management is Successful: The goal of adaptive management is to improve water quality so that the applicable phosphorus criterion is attained in the fourth permit term or sooner, if feasible. If this goal is met, a final limit will be included in the permit upon permit reissuance. This WQBEL can be recalculated based on in-stream phosphorus concentration, or it can be set as an interim limit equal to 0.5 mg/L[13]. If a limit of 0.5 mg/L is selected, the applicant will be required to continue in-stream phosphorus monitoring. The point source will maintain the permit limit of 0.5 mg/L as long as the in-stream phosphorus concentration continues to meet the applicable phosphorus criterion. If the in-stream phosphorus concentration increases over time, a more stringent WQBEL may be required.

[13] This limit reflects the adaptive management interim limit required in the second permit term pursuant to s. NR 217.18(e)(3), Wis. Adm. Code: http://docs.legis.wisconsin.gov/code/admin_code/nr/200/217.

Option B, Adaptive Management is Not Successful: If the goals of adaptive management are not met prior to permit term four, a phosphorus WQBEL equal to the criterion will be included in the permit upon reissuance. The point source can consider water quality trading or upgrading treatment technology to comply with this final WQBEL. If these options are economically infeasible, the facility may request a water quality standards variance, which must be submitted at along with the permit application. A compliance schedule of up to five years can be given to achieve compliance with a final limitation.

Note: If the applicable water quality criterion is attained within the fourth permit term the permit may be modified to reflect option A, as previously described.

Other Options for Flexibility

In some situations, it may not be feasible to meet the phosphorus criterion in a twenty-year timeframe. Changing land uses, extreme weather events, and residual phosphorus concentrations can inhibit adaptive management success. In these cases, the point source(s) may want to consider options such as site-specific phosphorus water quality criteria to adjust the final target of adaptive management. For more information about site-specific phosphorus criteria or variance waters, contact WDNR's Water Quality Standards Specialist (see Section 6, pg. 82, for contact information).

Note: Site-specific phosphorus criteria designations can also be considered in the first permit term if sufficient data is available. WDNR is pursuing rulemaking to allow these options to be more easily implemented.

Employing Water Quality Trading Following Adaptive Management

In addition to the challenges described above, other factors may lead a permittee to desire a change in compliance strategy. Adaptive management partners may change priorities, municipal attitudes and budgets may shift, or staff changes at a facility may bring different skill sets to the table. It is recognized that long-term efforts often have limitations, and therefore, flexibility exists for permittees engaged in adaptive management. Practices installed as part of an adaptive management effort may be considered viable offsets to generate credits as part of a future water quality trade. If this flexibility is desired, the permittee should ensure that practices installed under adaptive management meet the following guidelines:

- Practices, when installed, are registered with WDNR using the water quality trading practice registration form, found at: https://dnr.wi.gov/files/PDF/forms/3400/3400-207.pdf
- At the time of practice installation, a binding, written agreement is executed that fulfills the requirements s. 283.84(1) Wis. Stats.

- The practice(s), associated annual pollutant reduction, and agreement(s) must continue to occur and be valid for the duration of future proposed trade.
- Documentation of baseline pollutant load, modeling, and all other components of a water quality trade, as outlined in *Guidance for Implementing Water Quality Trading in WPDES Permits*, must be satisfied via a water quality trading plan.

Before the term of adaptive management ends, the permittee should submit a water quality trading plan to WDNR for review and approval. Once conditionally approved by WDNR, the permit reissuance process may incorporate provisions for compliance via water quality trading.

Estimating load reductions from nonpoint sources

The phosphorus reductions calculated above set the minimum reductions needed from adaptive management partners such as agricultural producers and MS4s for each permit term. The adaptive management plan should include modeling to ensure that the needed reductions will be achieved from the management measures selected in Step 5 of the adaptive management plan (see page 54). Agricultural information is sometimes considered proprietary (not available to the public). Given this, and the constantly changing dynamic of land use practices within a watershed, it can be very difficult to gather sufficient data to model the land use for your entire action area.

During adaptive management plan development, WDNR does **not** expect field-by-field modeling for the entire action area. Rather, WDNR recommends that models be run using approximate land use conditions to estimate the reductions received from various management practices. Modeling activities should focus on quantifying management measures within the critical source areas. As the adaptive management plan is implemented and more reliable land use data becomes available, models should be re-run to ensure that the needed reductions are being accomplished in the watershed.

Models can also be used to demonstrate interim compliance with adaptive management in cases where residual phosphorus loading in the receiving water prohibits measured reductions from monitoring data. In these cases, modeling should be conducted at the field scale for all practices installed. The resulting modeled annual pollutant reduction should be related to in-stream water quality concentrations.

What models are available for use?

Facilities using nonpoint source phosphorus reductions in conjunction with the adaptive management option will be required to evaluate where phosphorus will be reduced and what type of reduction is achieved using certain best management practices (BMPs). Following the identification of critical phosphorus areas within the watershed (Step 4 of the Adaptive Management Plan, page 49), the subsequent step is to evaluate what the implementation of management practices within the targeted zones means for phosphorus load reductions. There are many models available to help determine this.

The following models have been applied throughout Wisconsin to help estimate the phosphorus reduction through improved landscape practices:

- Agricultural Policy/Environmental eXtender (APEX)
- Program for Predicting Polluting Particle Passage thru Pits, Puddles, & Ponds (P-8)
- SNAP-Plus (Wisconsin Phosphorus Index)
- Spreadsheet Tool for Estimating Pollutant Load (STEPL)
- Soil and Water Assessment Tool (SWAT)
- Source Loading and Management Model for Windows (WinSLAMM)
- NRCS Erosion Estimator
- Annual Phosphorus Loss Estimator – Wisconsin (APLE LOTS- WI)

Table 16 summarizes each of the above models, reviewing their functional scale, if model calibration is required, and the types of BMPs assessed with respect to evaluating phosphorus reductions. It should be noted that the one land type not able to be explicitly assessed using the models listed is barnyards. Barnyard models such as the USDA Barnyard Evaluation Tool (BERT) and BARNY, a Wisconsin adapted version of the ARS feedlot runoff model, are qualitative ranking tools and are less effective at quantifying load reduction. APLE LOTS may provide a better estimate of baseline phosphorus loss from a barnyard. If barnyard practices are utilized as an adaptive management practice, the adaptive management applicant may want to consider offsetting more than the minimum requirement in permit terms 1 and 2 to account for the potential inaccuracy associated with barnyard models.

The landscape models discussed in this portion of the guidance vary in their complexity and have known strengths and weaknesses. The selection of a model includes factors such as the question being answered, the complexity of the landscape and the level of detail required from the model output. Simple landscape models such as STEPL require generalized data such as estimated landcover composition. A simplistic model approach typically relies on land use-based export coefficients, yielding an event-based or average annual phosphorus load. Robust, process-based models such as APEX or SWAT require detailed data inputs; however, the benefit of such a model is that the output can be tied to in-stream water quality at a sub-annual time step. All models, regardless of their ease of use, require proper model conceptualization. In addition, all the models discussed in this step model some type of BMP. It is recommended that the simulation of BMPs include design and efficiency based on technical standards from agencies such as WDNR, NRCS, and DATCP.

While the models listed have traditionally been used to simulate phosphorus reductions from the landscape with typical BMPs, permittees are not limited to those models cited. If permittees have questions about another model's applicability, they can contact the WDNR water quality modeling group (dnrwaterqualitymodeling@wisconsin.gov) for input.

Table 16. Summary of Tools for Estimating Phosphorus Load Reductions.

Model	Functional Scale	Calibration Recommended?	Types of BMPs	
APEX	Field to Watershed	Yes	• buffer strips • channel protection • cover crops • crop change • infiltration trench	• stream restoration • terraces • tillage • wetland creation
P-8	Urban Watersheds	Yes	• buffer strips • detention ponds • flow splitters	• infiltration basins • pipes • swale
SNAP-Plus	Field to Farm	No	• contour cropping • cover crop • crop change	• fertilizer • filter strips
NRCS Erosion Estimator	Field	No	• Streambank Stabilization • Gully Stabilization	
STEPL	Field to Watershed	No	• alum treatment • bioretention • contour cropping • diversion • dry retention • fencing • filter strips • gully stabilization	• infiltration basin • swale • strip cropping • streambank stabilization • separation basin • terraces • waste storage facility
SWAT	Watershed	Yes	• contour cropping • cover crop • crop change • fertilizer	• filter strip • infiltration basin • land use conversion • tillage
WinSLAMM	Urban Watersheds	No	• catch basin cleaning • filter • impervious disconnection • swale	• pond • street sweeping
APLE-Lots WI	Field	No	• Barnyard Practices	• Barnyard Relocation

APEX (Available at http://epicapex.brc.tamus.edu/ or http://apex.tamu.edu/) Maintained by the Texas A&M AgriLife Research & Extension Center	
Background	The Agricultural Policy/Environmental eXtender (APEX) model provides a continuous-time daily simulation to predict the impact of management practices on soil and water quality at the edge-of-field and watershed. The model can be linked with the Soil and Water Assessment Tool (SWAT) to evaluate small-scale impacts within a larger watershed.
Interface	Windows (WinAPEX)or ESRI ArcMap Add-in (ArcAPEX)
Scale	Field / Watershed
Time Step	Daily
Input	• Topography (DEM) • Soils (STATSGO / SSURGO) • Time series metrological data (User defined or from model database) • Land use • Land management (tillage, crop, fertilizer, herd size)
Output	• Daily stream flow • Daily sediment load and concentration • Daily phosphorus load and concentration
BMPs	• Structural practices: infiltration trench, terraces, wetland creation, stream restoration • Nonstructural practices: no till, cover crops, buffer strips, channel protection Complete list available at: https://epicapex.tamu.edu/apex/

P-8 (Available for download at http://wwwalker.net/p8/) Maintained by Dr. William Walker	
Background	The Program for Predicting Polluting Particle Passage through Pits, Puddles, and Ponds – Urban Catchment Model predicts the generation and transport of stormwater pollutants in urban watersheds.
Scale	Watershed (Urban)
Time Step	Hourly
Input	• Time series metrological data • Land area and use (and associated curve number) • Pervious and impervious surface percentages • Existing BMPs (and parameters for pond, basin, buffer, pipe, splitter) • Depressional storage
Output	• Water and mass balances • Mean inflow and outflow concentrations • BMP removal efficiencies • Sediment accumulation rates
BMPs	• Structural practices: swales, detention ponds, flow splitters, infiltration basins, and pipes. • Nonstructural practices: buffer strips

SNAP-Plus (Available at https://snapplus.wisc.edu/) Maintained by the University of Wisconsin - Madison Department of Soil Science	
Background	SNAP-Plus is the interface for the Wisconsin Phosphorus Index and is designed to produce a nutrient management plan. In accordance with Wisconsin's nutrient management standard code 590 the tool also simulates annual sediment and phosphorus losses from cropland.
Interface	Windows
Scale	Field / Farm
Time Step	Annual
Input	• Field Acreage • Crop per year • Tillage per year • Field characteristics (*size, slope, slope length, below field slope to water, distance to water*) • Soil test information (*pH, percent organic matter, phosphorus, potassium, and buffer pH*) • Fertilizer or manure amount, method, season, and composition (N, P, K, percent dry matter)
Output	• Phosphorus export • Soil loss
BMPs	• Nonstructural practices: contour or strip cropping, filter strips, cover crops, changes in management (crop rotation, fertilizer or manure, tillage)

NRCS Erosion Estimator Spreadsheet Available at: https://dnr.wi.gov/topic/surfacewater/documents/ModelingTools/gully-ephemeral_-streambank_-irrig_ditch_erosion.xlsm/	
Background	NRCS developed this spreadsheet to help quantify seasonal erosion caused by concentrated flow, not predicted by RUSLE2. The spreadsheet relies on simple dimensions for the eroding area, recession rate, and predefined bulk mass of soil types to yield an annual soil erosion weight (tons/year). Phosphorus soil testing values maybe be applied to determine lbs/year phosphorus yield.
Interface	Windows
Scale	Field / Farm
Time Step	Annual
Input	• Gully dimensions (average width, length, average depth) • Gully formation time period • Streambank Dimensions (height, length) • Streambank lateral recession rate • Soil Texture
Output	• Soil loss
BMPs	• Streambank and Gully Stabilization

STEPL (Available for download at (**http://it.tetratech-ffx.com/steplweb/**) Maintained by the US EPA	
Background	The Spreadsheet Tool for Estimating Pollutant Load (STEPL) is a regression-based model with simple algorithms that calculates sediment and nutrient loads from different land uses and the load reductions that would result from the implementation of various best management practices (BMPs).
Interface	Microsoft Excel Workbook
Scale	Field to Watershed
Time Step	Annual
Input	• Drainage area and Land use • Hydrologic soil group • Metrological data (pre-loaded precipitation stations) • Animal units and manure application • Septic systems and point sources • Universal soil loss equation parameters per land use
Output	• Annual phosphorus and sediment load • BMP Efficiencies
BMPs	• Structural practices: terraces, bioretention, dry retention, streambank stabilization and fencing, infiltration basins, swales, diversion, separation basin, waste storage facility • Nonstructural practices: contour or strip cropping, buffer strips, alum treatment • Custom BMPs with known pollutant load reduction efficiency rates

SWAT (Available for download at http://swatmodel.tamu.edu/) Maintained by the Texas A&M AgriLife Research & Extension Center	
Background	The Soil and Water Assessment Tool (SWAT) model is a continuous-time, physically-based model that can predict the impact of land management practices on water, sediment, and nutrients within complex, mixed land use watersheds. The model is relatively complex; calibration to measured flow and water quality is recommended.
Interface	Fortran executable, EPA BASINS, or ESRI ArcMap Add-in (ArcSWAT)
Scale	Watershed
Time Step	Daily
Input	• Time series metrological data • Soils • Land use • Topography • Land Management • Hydrology • Point Sources
Output	• Discharge at various scales • Sediment and nutrient concentrations and loads at various scales • Crop yields • Water and mass balances
BMPs	• Nonstructural practices: contour and strip cropping, changes in management (crop rotation, cover crop, fertilizer, tillage), changes in landuse (cropped to grassland), buffer strips

	• Structural practices: infiltration or detention basins, wetlands

WinSLAMM (Available for download at http://www.winslamm.com) Maintained by the PV & Associates	
Background	Source Loading and Management Model for Windows (WinSLAMM) is a proprietary model used as an urban watershed decision support system. Computations are based on extensive field data collected in Wisconsin.
Scale	Watershed (Urban)
Time Step	Hourly
Input	• Drainage area • Soils • Time series metrological data • Pervious and impervious surface percentages • Land use (types of urban such as parking lots, roofs) • Existing BMPs
Output	• Phosphorus concentration and yield at outfall • BMP removal efficiencies
BMPs	• Structural practices: ponds, swales, and filters • Nonstructural practices: street sweeping, catch basin cleaning, and impervious area disconnection

Minimum offset per federal requirements

To conform to 40 C.F.R. s. 122.44(d), WDNR will review adaptive management plans and the reissued or modified permit for each involved point source to verify that a minimum subset of adaptive management actions will offset the mass of phosphorus which corresponds to the difference between the interim effluent limitation under s. NR 217.18(3)(e) 2. or 3. Wis. Adm. Code, and the water quality based effluent limitation.

7. Monitor water quality

Adaptive management requires in-stream monitoring in addition to effluent monitoring as part of the implementation process. This portion of the adaptive management plan is meant to address in-stream monitoring. (Effluent monitoring should be conducted consistently with the permit frequencies and protocols specified in the permit and submitted to WDNR using the normal discharge monitoring report (DMR) process).

This step must determine:

• Who will collect TP data

• Who will analyze these data

• When and where will samples be collected

• The quality assurance protocols that will be followed

The adaptive management plan should describe the location, frequency, and sampling protocols that will be used for in-stream monitoring throughout the adaptive management project. The following guidance is provided to help develop this monitoring strategy.

Why collect in-stream data: In-stream data is **critical** to set load reduction goals, to assess trends and improvements in water quality over time, and to verify compliance with phosphorus criteria. It is also required pursuant to s. NR 217.18(3)(a), Wis. Adm. Code.

What to collect: In-stream phosphorus and flow measurements are the only required monitoring parameters for adaptive management. Typically, these measurements will be grab samples; however, composite sampling or continuous monitoring may also be used if the applicant chooses. Dischargers or their partners may choose to collect additional parameters such as total suspended solids (TSS), temperature, or nitrogen for other permitting or watershed management projects. Again, this additional monitoring would be voluntary, and not required under adaptive management.

Where to collect samples: In-stream phosphorus data must be collected at the furthest downstream point of the adaptive management action area (the point of compliance for adaptive management), and other sample locations necessary to demonstrate compliance under adaptive management. Phosphorus monitoring by TMDL reach is required if the adaptive management action area is within a TMDL, or an MS4 permit holder chooses to comply with their permit requirements through adaptive management (see Appendix C page 93 for details). These monitoring locations will serve as the basis for determining compliance under adaptive management.

It is strongly advised to collect phosphorus and flow data in tributaries/subwatersheds upstream of the point of compliance or furthest downstream point. These additional sampling locations are essential to prioritize management activities, determine the effectiveness of management activities, and quantify interim water quality improvements made in the watershed. Additional sampling points can also improve the accuracy of watershed modeling. Again, watershed modeling is often times needed to predict anticipated load reductions gained from various management activities, and to demonstrate interim success under adaptive management. Additional locations can also include up and downstream monitoring of management areas, storm water monitoring, edge-of-field monitoring, and sampling location(s) to reference watersheds where no management activities are targeted.

Monitoring frequency: Minimum data requirements for adaptive management phosphorus monitoring should be the same as those used by WDNR for waterbody assessments and impairment listing, unless otherwise specified by WDNR. At the time this guidance was written, this methodology was available in Wisconsin's Consolidated Assessment and Listing Methodology ("WisCALM") guidance at http://dnr.wi.gov/topic/surfacewater/assessments.html. The WisCALM guidance for streams and rivers specifies that samples should be collected, during pre-selected days or dates (e.g., second Tuesday of the month), once per month (about 30 days apart) each month from May through October[14] at a minimum. In other words, monthly grab samples collected from May to October is the minimum monitoring frequency for adaptive management. Flow data should be collected at the same time as phosphorus samples are collected.

[14] Dischargers with variable effluent flow in the winter months may be required to monitor in-stream during that time.

Sampling at a frequency greater than the minimal requirement is advantageous for adaptive management projects, however. Additional sampling can minimize data variability, mitigate outliers in the dataset, and allow trends in water quality to be detected. Given these benefits, it is strongly encouraged to collect biweekly grab samples from May to October rather than monthly grab samples[15].

Collecting Samples: The adaptive management plan should specify the person(s) responsible for collecting in-stream samples and identify a primary point of contact for adaptive management monitoring activities. There may be opportunities in your watershed to work with partners such as consultants, county LCDs, or citizen groups to collect these data. Partnerships can be beneficial to help reduce overhead monitoring costs, and to maximize the public's involvement and connection to the watershed project.

Phosphorus samples must meet preservation requirements in ch. NR 219, Wis. Adm. Code, Table F: http://dnr.wi.gov/regulations/labcert/. The current preservation requirements specify that the sample be acidified to a pH of less than 2 with sulfuric acid and the sample be cooled to less than or equal to 6°C (but not frozen). This means having acidified sample bottles and a cooler with ice available for sample collection. Certified laboratories can supply correct bottles and preservative.

Quality assurance protocols should be created to ensure that samples are collected and handled using proper sampling techniques. The adaptive management plan can specify its own quality assurances or can take advantage of WDNR's citizen-based monitoring assurance protocols already established. To successfully engage citizen-based monitoring volunteers and/or the citizen monitoring quality assurance protocols, monitoring participants will need to attend the Adaptive Management Water Action Volunteer (WAV) Training Program. For details on the WAV program, and training opportunities in your area, visit http://watermonitoring.uwex.edu/level3/adaptivemgt.html. A marginal training fee may apply for this course.

At the stream location, the samples should be collected as follows (Note: the following guidance is subject to change as new monitoring protocols become available):

- ***Sample in portion of stream/river with greatest or strongest flow***
  This may or may not be in the middle of the stream. In general, relatively straight reaches of the stream are preferred. However, if a meandering section of the stream is selected for sampling, the sample should be collected in the portion with greatest flow at the outside of the meander. Slow flow areas along the banks, in eddies or immediately downstream of islands should be avoided. These areas tend to not be representative of the overall stream condition and may have debris and other floating material that can skew results.

[15] Robertson, Dale (2003). Influence of Difference Temporal Sampling Strategies on Estimating Total Phosphorus and Suspended Sediment Concentrations and Transport in Small Streams. Jrnl. Of Am. Water Resrc. Assoc. 1281-1308.

- ***Sample at a depth of 3 to 6 inches below surface using triple rinsed sample bottles, completely filling the sample bottle***
  Surface samples tend to have debris and other things floating on them and should be avoided. Whether a sample is collected by hand directly in a sample bottle or with a sampling device, such as a Van Dorn sampling bottle, the collection vessel needs to be rinsed three times with water from the same location as the sample. Care should be made to avoid touching the inside cap of sample bottles.

- ***Avoid disturbing the sample site***
  If the sample is collected by wading in the stream, walk upstream to the sample location and take the sample facing upstream.

- ***Don't trespass on private lands to collect sample***
  Use a public access point, such as a road right of way, or seek permission from the landowner or operator to cross land for the purpose of collecting the samples.

Analyzing samples: Adaptive management participants are financially responsible for the costs of collecting and analyzing samples. Samples must be analyzed by an accredited laboratory per ch. NR 149, Wis. Adm. Code, using proper sample preservation and analysis protocols (Table 17 displays currently approved methods). Those requirements can also be found in ch. NR 219, Wis. Adm. Code, Table B and F: http://dnr.wi.gov/regulations/labcert/. If a facility has their own laboratory that is registered or certified to analyze phosphorus on-site, then they can analyze their own samples as long as other requirements are met (i.e., LOD is low enough).

WDNR requires analysis that will achieve a level of detection (LOD) and a level of quantitation (LOQ) at sufficiently low levels to ensure that meaningful results are gathered. For a list of certified laboratories in your area visit http://dnr.wi.gov/regulations/labcert/lablists.html.

Adaptive management partners should work with the certified lab of their choosing to establish a budget code, create lab forms, and ensure that the lab has proper LODs and LOQs to meet the project needs. See Appendix F for an example of a lab slip used by WDNR (pg. 103).

Table 20 is also available to help submit an overall monitoring strategy to WDNR as part of the adaptive management plan. A map of sampling locations and the quality assurance protocols should also be submitted to WDNR with the plan. It is also strongly recommended that the laboratory work with WDNR to submit adaptive management results to WDNR directly via the Surface Water Integrated Monitoring System (SWIMS) database. This will simplify adaptive management annual reports and ensure that the LOD, LOQ and Lab ID are accurately reported to WDNR in a timely and efficient fashion.

Table 17. Currently approved Methods for Analysis of Total Phosphorus in Wastewater

Analytical Technology	U.S. EPA Method	Standard Methods	ASTM Method	USGS Method	Other[16]
Persulfate digestion		4500 - P B.5 18, 19, 20 or 21 edition			973.55
Followed by one of the following:					
Manual Ascorbic acid reduction	365.3 (1978)	4500 - P E[17] 18, 19, 20 or 21 edition	D515-88 (A)	I-4600-85	973.56
Automated Ascorbic acid reduction	365.1 rev 2.0 (1993)	4500 - P F[17] 18, 19, 20 or 21 edition			
Semi-automated block digester	365.4 (1974)		D515-88 (B)	I-4610-91	

[16] "Official Methods of Analysis of the Association of Official Analytical Chemists" 16th Edition 1998

Table 18. Blank monitoring overview table. A map of samples points should also be submitted.

Monitoring Location					
Sample Point	**Sample Point Description**	**Latitude**	**Longitude**	**Parameters to be collected**	**Sampling Frequency**
Example: Point 1	*Point of Compliance*	*43.324946 (43° 19' 30" N)*	*-89.533045 (89° 31' 59" W)*	*Phosphorus, Total Suspended Solids*	*Biweekly, May-Oct.*

Sampling Methodology			
Who will collect samples?			
Lab Information	Name:		
	Lab ID:		
	Address:		
Phosphorus Analysis	Methodology used:		
	LOD:		
	LOQ:		
Other Lab Analyses for Adaptive Management	Pollutant 1 Name:	Pollutant 2 Name:	Pollutant 3 Name:
	Methodology used:	Methodology used:	Methodology used:
	LOD:	LOD:	LOD:
	LOQ:	LOQ:	LOQ:

8. Financial security

Costs associated with adaptive management include outreach efforts, BMP implementation, facility modifications to comply with adaptive management interim limits, modeling, in-stream and effluent monitoring, technical support, and compliance checking, among other things. These costs should be evaluated over a twenty-year timeframe, the maximum duration of an adaptive management project. Table 19 provides some factors to consider when quantifying costs associated with adaptive management.

This step requires:

- An evaluation of adaptive management implementation costs
- A written statement from adaptive management participants that these financial needs are achievable

Table 19. Options to consider when evaluating adaptive management implementation costs.

	Factors to Consider	Sources of Information
BMP Implementation Costs	• Potential for voluntary compliance through education • Types of BMPs needed • Cost share rates for various BMPs	• Chapter NR 154, Wis. Adm. Code: http://docs.legis.wisconsin.gov/code/admin_code/nr/100/154 • http://water.epa.gov/scitech/wastetech/guide/stormwater/upload/2006_10_31_guide_stormwater_usw_d.pdf • http://datcp.wi.gov/farms/nutrient_management/index.aspx
Interim Limit Compliance	• Source reduction, optimization, or treatment technology needed to comply with interim limits	https://dnr.wi.gov/topic/wastewater/phosphorus/tools.html
Outreach and Education	• Cost of meetings • Cost of outreach materials such as brochures • Staff time needed to communicate AM in watershed	
Modeling	• Staff time needed to run and re-run models • Technology needs to use models	Varies based on selected model and staff familiarity. See Step 6 for a list of potential models that can be used for adaptive management planning and implementation (pg. 59).
In-Stream and Effluent Monitoring	• Cost to collect the samples • Number of sampling points • Cost to analyze the samples	• http://dnr.wi.gov/regulations/labcert/lablists.html • http://dnr.wi.gov/topic/surfacewater/assessments.html
Technical Support	• Cost of hiring an environmental consultant • Financial needs of the county land conservation department • Other individuals or orgs	To be discussed with the adaptive management participants and their partners.
Compliance Checking	• Travel costs • Reporting costs • Cost of sending compliance notifications	Varies based on watershed.

With the selection of AM as their phosphorus compliance option, the primary responsibility lies with the point source to fund the associated watershed projects. As a party to implementation of an AM plan, project partners may be asked to assist the point source with locating or providing supplemental funding options. Point sources and AM partners should consult with funding programs to determine if funding may be used for AM. Some nonpoint source-related grant programs have restrictions on the use of funding for WPDES permit compliance. For example, federal funding under s. 319 of the Clean Water Act has the following restrictions that would make a project or practice ineligible for s. 319 funding or state match of s. 319 funding:

1. If a project is specifically listed in an AM plan consistent with s. NR 217.18.
2. If a practice will be credited toward the achievement of a WPDES permit performance goal.
3. If a practice is not consistent with the goals of the State's *Nonpoint Source Program Management Plan*.

To address each of these restrictions, it is critical that the AM plan under s. NR 217.18 clearly identify what the point source is responsible for and which practices they are interested in pursuing. Practices identified as core AM plan actions will not be eligible for s. 319 funding or state funding used as match for s. 319 funding. Practices not used in the s. NR 217.18(2)(d) Wis. Adm. Code demonstration (projected offsets to attain the criterion) in the AM plan may be eligible for s. 319 funding and state NPS funding. All such practices if recognized as a BMP in ch. NR 154 are consistent with the goals of the State's Nonpoint Source Program Management Plan.

In AM project areas, multiple funding sources may contribute to the implementation of BMPs, resulting in water quality improvement in the applicable stream, river, or lake. Regardless of the funding sources or who is bringing the funding into the AM project area, the point source will benefit from any positive response in water quality, as it will help them comply with their WPDES permit requirements for AM.

9. Implementation Schedule with Milestones

Setting milestones and goals is an important step in any watershed project. Adaptive management milestones that must be identified in the adaptive management plan include:

> **In this step you will**:
> • Prioritize management measures
> • Set compliance dates for adaptive management interim limits
> • Set water quality milestones

1. Prioritizing the installation of management measures (Step 5, page 54);
2. Installing sufficient management measures to offset the minimum adaptive management reduction requirement on an annual basis (Step 6, page 59);
3. Setting a compliance date for adaptive management interim limits; and
4. Water quality milestones (Step 7, page 70);

Each of these elements may be revised in the annual reports submitted to WDNR (see Section 4 for details, page 18).

Prioritizing Management Measures:

It is strongly recommended that adaptive management plans prioritize management measures so that the highest priority practices can be implemented in the watershed first. "Highest" priority actions are those actions that address significant land use problems on critical areas within the watershed, and actions that are most likely to improve water quality in the watershed and at the point of compliance for adaptive management. Management practices that take time to establish, such as nutrient management plans, should receive a "high priority" to ensure that sufficient time is available to receive benefits from these practices. The resultant adaptive management implementation sequence for management measures may look something like the following table.

Table 20. Example worksheet to determine when various management practices will be installed. This approach is designed to ensure that the highest priority activities are implemented first.

Priority (Step 4, pg. 49)	*Action (Step 5, pg. 54)*	*Approximate Phosphorus Reduction from Action (Step 6, pg. 59)*
High target timeframe: 1-3 years	*BMP 1*	*P Reduction 1*
	BMP 2	*P Reduction 2*
	BMP 3	*P Reduction 3*
	BMP 4	*P Reduction 4*
Medium target timeframe: 3-6 years	*BMP 5*	*P Reduction 5*
	BMP 6	*P Reduction 6*
	BMP 7	*P Reduction 7*
	BMP 8	*P Reduction 8*

Low target timeframe: 5-8 years	*BMP 9*	*P Reduction 9*
	BMP 10	*P Reduction 10*
	BMP 11	*P Reduction 11*
	BMP 12	*P Reduction 12*
	BMP 13	*P Reduction 13*
Summation of Reductions:		

Installing Sufficient Management Measures:

There are minimum reduction targets set for adaptive management, as described in Step 6 on page 59. Adaptive management participants are responsible for ensuring that these minimum reductions are being met on an **annual** basis. A combination of tracking, surveying, compliance checking, and modeling may be needed to quantify the annual load reductions generated over a given year. The adaptive management plan should specify who is responsible for this demonstration, when this evaluation will be made, and the types of data used for this evaluation. This information must be submitted to WDNR with each annual report submittal during the implementation process.

Compliance with Interim Limits

For those point source discharges not currently achieving compliance with adaptive management interim limits (Table 2), a compliance schedule may be granted during the first permit term of adaptive management. The adaptive management plan should demonstrate the need for this compliance schedule and provide an approximate timeline for interim limit compliance. This timeline must ensure that compliance with these limits is achieved as soon as reasonably possible.

If the applicant is already complying with the applicable interim limit for the given adaptive management permit term, this portion of the plan is not required.

Water Quality Milestones:

The adaptive management plan should specify goals for water quality improvements. These water quality goals should be based on load reduction targets, outreach and education efforts, and the overall responsiveness of the receiving water to management practices. If water quality improvement goals are met, or exceeded, implementation of the adaptive management plan can continue. If, however, water quality improvement goals are not met, additional reductions may be warranted. These additional reduction goals should be submitted to WDNR with the annual reports required during implementation, or with the revised adaptive management plan with permit reissuance. For water bodies with high residual phosphorus concentrations, modeling in addition to in-stream monitoring can be used to demonstrate progress towards final compliance with adaptive management.

Water quality milestones can be based on phosphorus loading reductions to the receiving water and/or in-stream phosphorus concentrations (Figure 15).

AM Permit Term 1	Year 1: 0% P reduction
	Year 2: 0% P reduction
	Year 3: 5 % P reduction
	Year 4: 10% P reduction
	Year 5: 12% P reduction
AM Permit Term 2	Year 6: 14% P reduction
	Year 7: 18% P reduction
	Year 8: 20% P reduction
	Year 9: WQC acheived
	Year 10: WQC acheived

Figure 15. Example of P reductions on based on P loading to the receiving water.

Annual phosphorus reduction goals, as shown above, are the preferred time step for providing goals in an adaptive management plan. Other timing approaches may be considered, but the temporal resolution should, at a minimum, reflect load reduction goals on a permit-term basis (5-year increments). The WPDES permit will need to specify reduction milestones on a permit-term basis via an adaptive management reporting schedule.

Section 6. Implementation and Additional Information

Required Document to Request Adaptive Management

As stated in Section 4 (pg. 18), there are two required documents that must be submitted to WDNR no later than the date of the permit application submittal. These documents are the final adaptive management request form (Appendix G, pg. 106) and the adaptive management plan. These documents should be submitted to the applicable WDNR wastewater engineer, specialist, or adaptive management coordinator. Upon approval, the WPDES permit will be reissued with adaptive management requirements included. All WPDES permits and supporting documents, such as adaptive management plans and the documents mentioned here, are public noticed at http://dnr.wi.gov/topic/wastewater/publicnotices.html prior to issuance or reissuance.

A facility should also submit an adaptive management eligibility form (Appendix G, pg. 106) to their local WDNR wastewater engineer, specialist, or adaptive management coordinator prior to developing an adaptive management plan. The preliminary request form should be submitted no later than the preliminary alternatives evaluation due date. This preliminary request form ensures that applicants are eligible for adaptive management before they spend the time and resources to develop an adaptive management plan. Once an eligibility form is received and reviewed, WDNR will confirm adaptive management eligibility in writing to the applicant.

WPDES Permit Requirements

Adaptive management is an option for point sources to achieve compliance with phosphorus reduction requirements in WPDES permits. The language of the WPDES permit will reflect the requirements of this option. Given this, permittees can expect to see the following items built into their permits upon adaptive management approval:

- In-stream and effluent monitoring requirements
- Requirements to implement the actions identified in the adaptive management plan
- Annual reporting of monitoring data and actions completed over the previous calendar year
- Adaptive management interim limits (see Table 2 in Section 4 of this guidance, page 20).

In-Stream and Effluent Monitoring Requirements

The WPDES permit will set the minimum data needs for adaptive management implementation. This will include the minimum frequency of in-stream and effluent data that must be collected, and will also specify the locations where samples and measurements need to be collected. WDNR will likely use the monitoring locations and sample frequencies recommended in the adaptive management plan, but reserves the right to choose alternative procedures to meet WDNR's needs. As mentioned in Section 5, effluent monitoring data should be submitted to WDNR through their DMR while in-stream monitoring should be submitted in SWIMS, Laboratory Data Entry System (LDES), and the annual adaptive management report.

Implementing Actions

The WPDES permit will have a general statement ensuring that point sources implement the actions they specify in the adaptive management plan. If necessary, WDNR may require additional actions be included in the adaptive management project. These additional actions will be specifically identified in the WPDES permit.

Annual Reporting

As mentioned in Section 4, annual reports are required pursuant to s. NR 217.18(3)(d), Wis. Adm. Code, and are important to maintain communication between the point source and WDNR as well as reinforce accountability. Annual reports should evaluate monitoring data collected, briefly describe the adaptive management actions that have been installed and describe the outreach and education efforts that have occurred over the past year.

Annual reporting can be used to adjust the adaptive management actions used to improve water quality within the action area. For example, if a point source chooses to modify management measures specified in the adaptive management plan, the annual report should explain the change to the management measures and provide justification for this change. Changes that will require permit modification will include adjustments to the minimum monitoring requirements, changes to the action area size, and significant changes to the amount of phosphorus being offset in the current permit term. Pursuant to s. NR 203.015 Wis. Adm. Code, minor changes to timelines or adaptive management actions will not be public noticed as these changes will not require permit modification.

Contact Information

WDNR is committed to making adaptive management implementation as flexible and accurate as possible. As you work towards the adaptive management option, WDNR staff are available to answer questions and provide technical feedback). Local wastewater engineers, specialists, NPS coordinators are available to help you through the adaptive management process. Additional questions can also be directed to your local adaptive management and trading coordinator. WDNR is excited for the opportunity to work towards water quality improvements together.

A list of local and statewide adaptive management coordinators is available at the following link:

https://dnr.wi.gov/topic/SurfaceWater/documents/phosphorus/coordinatorList.pdf

Appendix A: Additional Information to Determine Adaptive Management Eligibility

This appendix provides a technical discussion of the adaptive management eligibility requirements specified in s. NR 217.18(2), Wis. Adm. Code[18], and why the four simplified questions posed in Section 3 address them (Table 21).

Table 21. Comparison of the adaptive management eligibility requirements identified in s. NR 217.18, Wis. Adm. Code, and the simplified questions in Section 3 meant to address these requirements.

Eligibility requirement pursuant to s. NR 217.18(2), Wis. Adm. Code	Simplified questions posed in Section 3
The receiving water is exceeding the applicable P criteria.	Does the WQBEL equal the applicable phosphorus criterion for your receiving water OR is the facility subject to a total maximum daily load (TMDL)-derived limit?
Filtration or equivalent technology is required to meet the phosphorus limit	Does your facility need major upgrades such as adding filtration to achieve compliance with phosphorus limits?
Nonpoint and point sources contribute to the exceedance of the applicable P criteria.	Are you willing to work with partners in your watershed to target other phosphorus sources and improve water quality? Does PRESTO indicate you are in a point source dominated watershed?

Requirement 1: Phosphorus Criterion Is Not Being Met

For discharges of phosphorus to flowing streams and rivers, water quality-based effluent limitations are calculated using the formula from s. NR 217.13(2), Wis. Adm. Code.

Limitation = [(WQC)*(Qs+(1−f)*Qe)−(Qs−f*Qe)*(Cs)]/ Qe

Where:

Limitation = Water quality-based effluent limitation (in units of mass per unit of volume),
WQC = The water quality criterion concentration (in units of mass per unit volume) from s. NR 102.06,
Qs = Receiving water design flow (in units of volume per unit time)
Qe = Effluent flow (in units of volume per unit time)
f = Fraction of the effluent flow that is withdrawn from the receiving water, and
Cs = Upstream concentration (in units of mass per unit volume)

[18] NR 217 is available for download at http://docs.legis.wisconsin.gov/document/administrativecode/ch.%20NR%20217.

Upon permit reissuance, WDNR reviews the phosphorus criterion, in-stream phosphorus concentration, and effluent characteristics. If the upstream concentration is greater than the phosphorus criterion specified in s. NR 102.06, Wis. Adm. Code, as seen in Table 22, the calculated water quality-based effluent limitation will be set equal to the criterion per s. NR 217.13(7), Wis. Adm. Code. Therefore, permittees with phosphorus limitations equal to the criterion automatically meet this first eligibility requirement for adaptive management; the phosphorus criterion is exceeded.

Monitoring data may be available, if you would like to determine whether your receiving water is exceeding the criterion prior to permit reissuance. You may be able to find monitoring data on the DNR's Surface Water Data Viewer (visit http://dnr.wi.gov/topic/surfacewater/swdv/). If no existing data are readily available, you may need to monitor phosphorus as well other water quality parameters to establish a baseline of background data.

Making the determination that a receiving water is exceeding the criterion should employ WisCALM methods discussed in Section 7, page 71 (utilize the median growing-season phosphorus concentration). If insufficient data is available to make the determination, or if data is considered out of date, in-stream monitoring may need to be carried out before beginning adaptive management.

Table 22. Phosphorus water quality criterion specified in s. NR 102.06, Wis. Adm. Code.

Total Phosphorus Criteria NR 102.06				
Rivers: 100 ug/L	Streams: 75 ug/L	Reservoirs: 30-40 ug/L	Lakes: 15-40 ug/L	Great Lakes: 5-7 ug/L

Requirement 2: Filtration or equivalent technology is required

Pursuant to s. NR 217.18(2)(c), Wis. Adm. Code, the proposed phosphorus WQBEL in the applicant's permit must require filtration or other equivalent treatment technology to achieve compliance. Under current available technology and available data, it was concluded that if the calculated WQBEL is 0.30 mg/L or less as a monthly average, that limit cannot be achieved without addition of filtration or other equivalent technology. If the limit is greater than 0.30 mg/L, the permittee will need to demonstrate that their current system cannot achieve the limit without adding technology beyond secondary chemical or biological treatment.

Requirement 3: Nonpoint and point sources contribute to the exceedance of the applicable P criteria.

The last requirement for adaptive management eligibility is that the nonpoint source phosphorus contributions must make up a substantial portion of the total phosphorus loading in the watershed, or nonpoint sources must be controlled in order to meet water quality goals. To evaluate the contributions of phosphorus from point and nonpoint sources in the watershed, WDNR has developed a GIS-based

tool called "Pollutant load Ratio EStimation TOol (PRESTO)"[19]. PRESTO estimates the phosphorus loading from non-point sources based on land use practices, soil types, and topography. The model then compares the phosphorus loading from runoff with point sources of phosphorus and provides a ratio of point and nonpoint sources in the watershed. WDNR has already done this calculation for most permitted municipal and industrial facilities with phosphorus effluent monitoring. For details about the model, and model results, visit http://dnr.wi.gov/topic/surfacewater/presto.html.

If PRESTO indicates that you are eligible for adaptive management, continue to evaluate adaptive management as a potential compliance option. If PRESTO suggests that you are in a point source dominated watershed (greater than 50% point source phosphorus contributions), an alternative evaluation process may be required. These alternative evaluations should demonstrate that the point source is in a non-point source dominated watershed, or that non-point sources must be controlled to meet water quality standards. Three simple methods are available for making such a calculation:

1. Determine if water quality goals could be met without NPS reductions.
2. Applying unit area loads appropriate to the watershed.
3. Applying phosphorus export coefficients appropriate to the watershed.

In these methods, the entire drainage area of the outfall should be used in the calculation.[20]

Determining Need for NPS Reductions

Some watersheds are point source dominated, but must receive phosphorus reductions from both point and nonpoint sources in order to meet water quality goals. Adaptive management is still a compliance option in these watersheds pursuant to s. NR 217.18(2)(b), Wis. Adm. Code. If you are in a phosphorus impaired watershed with a U.S. EPA approved TMDL, it has been pre-determined that pollutant reductions from both point and nonpoint sources must occur in order to meet water quality goals. Therefore, all point sources in TMDL watersheds meet this adaptive management eligibility requirement.

For point sources outside a TMDL watershed there are several options to demonstrate that nonpoint sources must be controlled in order to meet water quality goals; however, the simplest is to compare water quality targets to point and nonpoint source loads in the watershed.

Example:

Watershed A has a P reduction target of 26,000 lbs/year.

[19] PRESTO is one tool available to determine the point to nonpoint source ratio in your watershed. Other tools can also be used to make this determination.

[20] The reference to the entire drainage area is not meant to infer that implementation of the watershed adaptive management option must occur throughout the entire drainage area. See the watershed adaptive management option section of this guidance.

The current P load is 45,000 lbs/year (23,000lbs/yr is coming from PS and 22,000lbs/yr is coming from NPS)

There is no way to meet water quality goals without reducing nonpoint pollution. If the point source load was 0, water quality goals would still not be met.

Unit Area Loads:

Unit area loads have been used since at least the early 1980s for determining phosphorus loads carried to a downstream location, whether it is a location on a stream, a lake or the Great Lakes. The unit area load is derived by calculating phosphorus loads from stream monitoring data over some number of years. After the influence of major point source contributions are subtracted from the calculated load, the remaining load is divided by the drainage area to the monitoring station. The unit area load thus represents the contribution of phosphorus from the combination of sources within the monitored watershed, such as agricultural nonpoint sources, tile drainage, septic systems, wetlands, woodlands, etc. They also take into account transport of phosphorus through the stream system. Use of a unit area load approach may be appropriate where the conditions in the evaluated watershed are similar to those in the monitored watershed.

USGS fact sheet FS-195-97 entitled "Unit-Area Loads of Suspended Sediment, Suspended Solids, and Total Phosphorus From Small Watersheds in Wisconsin" (Corsi et. al.) lists the unit area loads for nearly 50 Wisconsin Streams: http://wi.water.usgs.gov/pubs/FS-195-97/. The fact sheet also suggests unit area loads for U.S. EPA aggregate ecoregions.

The user should use the fact sheet information with care. The information is not particularly good for some of the ecoregions, especially the North Central Hardwoods Forests where the land use and soils vary greatly. Also, there are only a few sites within this eco-region. Where land cover varies greatly, such as in the driftless area where the percentage of agricultural use varies from about 50 percent to about 90 percent, the eco-region value may not be the best representative value either.

Method:

1. Select the unit area load from the USGS fact sheet for an individual stream, a similar nearby stream, or an eco-region.
2. Multiply the unit area load by the drainage area to arrive at a watershed average annual phosphorus load. For many situations, the low flow information tables used to obtain 7Q10 and 7Q2 flows will have a corresponding drainage area. If this information is not available, it may be possible to use 12-digit HUC areas to estimate a drainage area or to use the Purdue drainage area calculation website http://lthia.agriculture.purdue.edu/
3. Determine the annual average phosphorus load from the facility and point sources upstream of the facility. The information by year is available in PRESTO, or can be provided to you by contacting your local adaptive management coordinator. If the operating

conditions of the point source have been consistent over the last few years, a mean value of three years should be used. If the operation has changed, such as an increase or decrease in volume, the year or years consistent with expected operation for the next permit term should be use.

4. Add the watershed annual phosphorus load and the average annual point source phosphorus load to determine the total average annual phosphorus load.
5. Determine the relative percent contribution for the watershed and point source. If the point source contribution is less than 50%, the situation should be considered as nonpoint source dominated.

Phosphorus Export Coefficient Method (also available on the Wisconsin Lake Modeling Suite):

Information about the Wisconsin Lake Modeling Suite (WiLMS) is available at http://dnr.wi.gov/lakes/Model/WiLMSDocumentation.pdf. This method applies a phosphorus export or loss coefficient to each major land use categories within the watershed to calculate an annual load. Generally, the phosphorus export coefficients are derived from monitoring or modeling individual land uses. They present contribution to the receiving water, but do not take into account transport within a stream system.

Step 1. Determine the watershed area to the outfall

For many situations, the low flow information used to obtain 7Q10 and 7Q2 flows will have a corresponding drainage area. If this information is not available, it may be possible to approximate the watershed area by summing the area of 12-digit HUC areas within the watershed or by using the Purdue drainage area calculation website at https://engineering.purdue.edu/~lthia/MSDSS/index.html

Step 2. Determine the land use of the watershed

For most situations, the WISCLand Anderson Level 1 for Wisconsin watersheds is sufficient. Anderson 1 land use is the broadest category with the land use broken into agricultural, urban, forested, wetland, etc. Although WISCLand is based on 1993 land cover, it is likely representative for most rural areas. For many areas with TMDLs, a more detailed land cover and load analysis may be available.

Step 3. Apply phosphorus export coefficients (unit area loads)

For general use, use the following information:

- For cropland use:

  Driftless area – 2.0 to 3.0 pounds per acre per year

The phosphorus loads tend to be higher per unit of agriculture in the western part of the driftless area with the lowest values in the Sugar River Basin, the Black Earth Creek watershed, the eastern end of the Baraboo River subbasin, and nearby watersheds.

Southeast and East Central areas – 0.4 to 0.5 pounds per acre per year

Phosphorus loads tend to be relatively low in the Kettle Moraine area but may be relatively high in the clay soil areas. Good information is not available throughout much of the Rock River Basin

Sandy areas – 0.2 pounds per acre per year

This is an estimate since little information is available.

Other areas should use one of the three unit area loads above. Much of the Lower Chippewa River Basin seems to be similar to the Sugar River Basin. Western Marathon County may be similar to the eastern clays, but could be slightly higher.

- Woodlands 0.05 to 0.18 pounds per acre per year

  The lower end of the range is appropriate for lower slope, sandy soil areas, such as those in northeastern Wisconsin, while the higher end of the range is more appropriate for the driftless area.

- Urban – 0.3 to 0.8 pounds per acre per year

  The lower end of the range is for low density residential and the high end for mixes of residential and commercial. If the urban area is small, use 0.5 pounds per acre per year.

- Wetlands – 0.1 pounds per acre per year

Step 4. Determine the point source contribution

The information can be found in the PRESTO model. If actual data by year is preferred, that data can be obtained from WDNR.

Step 5. Add the loads from each land cover category and the average annual point source phosphorus load to determine the total average annual phosphorus load.

Step 6. Determine percent of contribution from agriculture and urban land uses. If agricultural land uses are 50 percent or greater, consider the situation as nonpoint source dominated. This will

automatically meet the adaptive management eligibility requirement in s. NR 217.18(2)(b), Wis. Adm. Code.

References:

Panuska, John C., and Lillie, Richard A., "Phosphorus Loadings from Wisconsin Watersheds: Recommended Phosphorus Export Coefficients for Agricultural and Forested Watersheds", Wisconsin Department of Natural Resources, Research Management Findings. April 1995.

Corsi, Steven R., Graczyk, David J., Owens, David W., and Bannermann, Roger T., "Unit-Area Loads of Suspended Sediment, Suspended Solids, and Total Phosphorus From Small Watersheds in Wisconsin", U. S. Geological Survey, Fact Sheet FS-195-97. http://wi.water.usgs.gov/pubs/FS-195-97/. Undated.

Appendix B: Example Communication Strategy Template

This template is an aid to assist in communicating adaptive management workforce and succession plans, and may also be helpful for other communication strategies. This guide covers the elements necessary for pulling together a successful communication strategy such as: setting objectives, developing messages and branding, prioritizing audiences, choosing channels, planning activities, and evaluating success. This template is meant as a reference and can be modified to fit the specific need. This template is not a required document for submittal, but may be helpful in the planning process.

Adaptive Management Communication Strategy	
Lead WPDES permitted discharge(s):	
Contact information for person(s) responsible for completing communication strategy:	Name: Phone: Email: Address:
HUC 12 watershed(s) involved:	
Communications objectives, principles and key messages: *A clear statement of the objectives in communicating, the principles underpinning this strategy and the key messages for adaptive management.*	
Key Audiences: *Who are you communicating with (including user groups)? What are your priorities? What do your audiences already know, and what needs to be communicated to them?*	

Target audience ranked by importance	**AM partner responsible for communication**	**Preferred/appropriate channel(s) of communication**
How are you going to communicate with target audiences and who is responsible for facilitating this communication? What is the most appropriate channel – newsletters, conferences, workshops, press releases, website, etc.? Note: Several channels may be appropriate.		

Tracking adaptive management objectives: *Who will track adaptive management projects and milestones? Generally, how will these be tracked?*		
Objective to be tracked	AM partner responsible for tracking	How tracking will occur
Example: *BMP installation in agricultural production areas*	*County LCD*	*GIS data layer & website*
Example: *BMP maintenance in permitted urban areas*	*Permitted MS4 & Environmental Consultant*	*GIS data layer & Microsoft access table*

Evaluating Success: *Who will be responsible for evaluating success overall, submitting annual reports to WDNR, and updating that AM plan as needed?*

Appendix C: Permitted Urban Discharges and Adaptive Management

More than two hundred municipalities in Wisconsin that include cities, villages, towns and counties are required to have Municipal Separate Storm Sewer System (MS4) permits under ch. NR 216, Wis. Adm. Code. When a permitted MS4 is assigned a TMDL wasteload allocation (WLA), by federal law the WLA is required to be implemented through their MS4 permit. MS4s will be assigned a waste load allocation target for the pollutant(s) of concern in that TMDL. For details on MS4 permit requirements and the permitting process visit http://dnr.wi.gov/topic/stormwater/municipal/.

Any urban discharge, whether covered under an MS4 permit or not, can be considered an adaptive management partner if their phosphorus contribution can be reduced. The expense of this reduction can be borne by the MS4, or through funding opportunities from the industrial or municipal wastewater discharger leading the adaptive management project. There are several potential advantages to partnering with municipal and/or industrial point sources under adaptive management:

- Increases in storm water and sanitary sewer rates may be reduced or avoided for rate payers
- Additional funding sources may be available for storm water management
- Water quality may be improved for the community and future generations

For an MS4 to formally participate in an adaptive management project the following requirements must be met:

1. The MS4 must have an assigned phosphorus waste load allocation,
2. The MS4 must work with a wastewater WPDES permit holder that is subject to a phosphorus limitation, and
3. Only reductions that occur in the same reach as the MS4 or potentially upstream of the MS4's reach will be given credit towards compliance with the MS4's waste load allocation.

MS4s with Phosphorus Waste Load Allocations

Although MS4s are required to meet a TSS reduction performance standard pursuant to s. NR 151.13(2), Wis. Adm. Code, there is no similar statewide performance standard for phosphorus reduction. Under TMDL scenarios, however, MS4s may be given a phosphorus waste load allocation requiring them to reduce their contribution of phosphorus in addition to TSS. To determine if you are in a TMDL watershed visit http://dnr.wi.gov/topic/tmdls/. Because these TMDL waste load allocation requirements may go beyond s. NR 151.13, Wis. Adm. Code, MS4s are allowed to utilize adaptive management to comply with phosphorus waste load allocations.

Working with Industrial and/or Municipal Point Sources

For purposes of adaptive management eligibility for a wastewater or industrial treatment plant, the phosphorus contribution coming from MS4s is considered part of the "nonpoint source" phosphorus

load to the receiving water (s. NR 217.18(2)(b), Wis. Adm. Code). Combining MS4 contributions with those from traditional nonpoint sources aids in the ability for some municipal or industrial discharges to meet the adaptive management eligibility requirement that reductions in total phosphorus loading to the receiving water must come from nonpoint sources (s. NR 217.18(2)(b), Wis. Adm. Code). Regulatory requirement found in ss. NR 217.18(2)(c) and (3)(e) prohibits MS4s from using adaptive management as a compliance option absent a municipal or industrial wastewater WPDES permit holder partner. Through partnership with a wastewater permittee, however, MS4s may then be part of an adaptive management project.

Compliance by Reach

Adaptive management success for MS4s means that the water quality within **their** TMDL reach improves so that the applicable in-stream phosphorus standard is met. To demonstrate this compliance through adaptive management, in-stream phosphorus monitoring must, at minimum, be conducted at the point of compliance, or the furthest downstream point, of the MS4's TMDL reach. If the MS4 is located within multiple TMDL reaches, monitoring at the furthest downstream point of each reach may be necessary (see the monitoring step of the adaptive management for details of phosphorus monitoring, pg. 70). If adaptive management is successful and the applicable phosphorus target in their reach is met, the MS4 will be considered in compliance with their phosphorus waste load allocation.

Many urban best management practices capture phosphorus and TSS. If an urban management practice is installed within the MS4 boundary, and captures both phosphorus and TSS, that management practice can be counted towards compliance for both pollutants. Careful tracking will be required to ensure that MS4s and other point sources are not taking credit for the same TSS reductions.

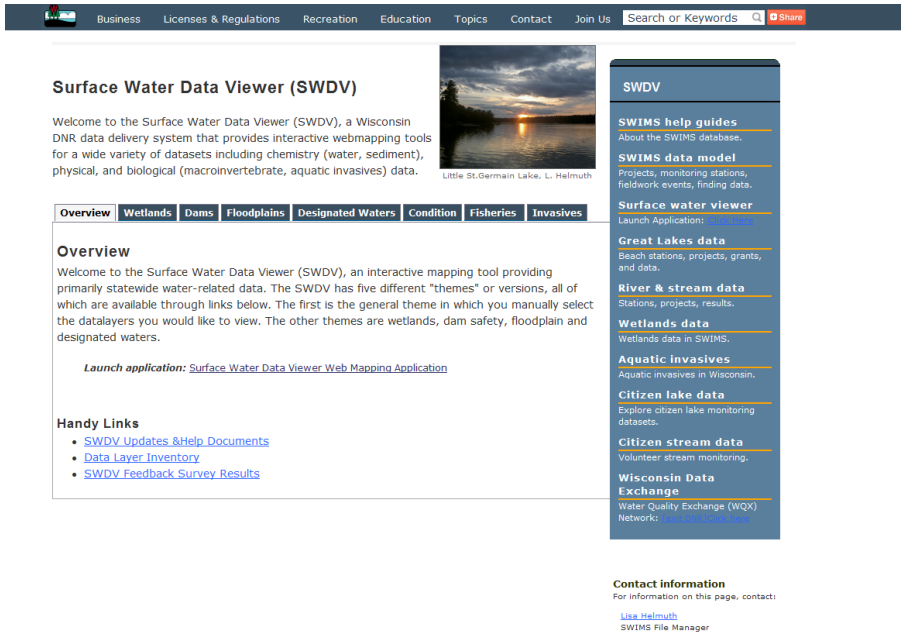
After Adaptive Management

Adaptive management has a 10-20 year timeframe to demonstrate compliance with the water quality criteria or TMDL. Again, MS4s will be in compliance with their phosphorus waste load allocations if the MS4's TMDL reach is meeting the applicable phosphorus target . If adaptive management is not successful, the MS4 will need to achieve compliance with their phosphorus waste load allocations through reductions within their municipality, or through water quality trading. For more information about trading visit: https://dnr.wi.gov/topic/wastewater/phosphorus/tools.html.

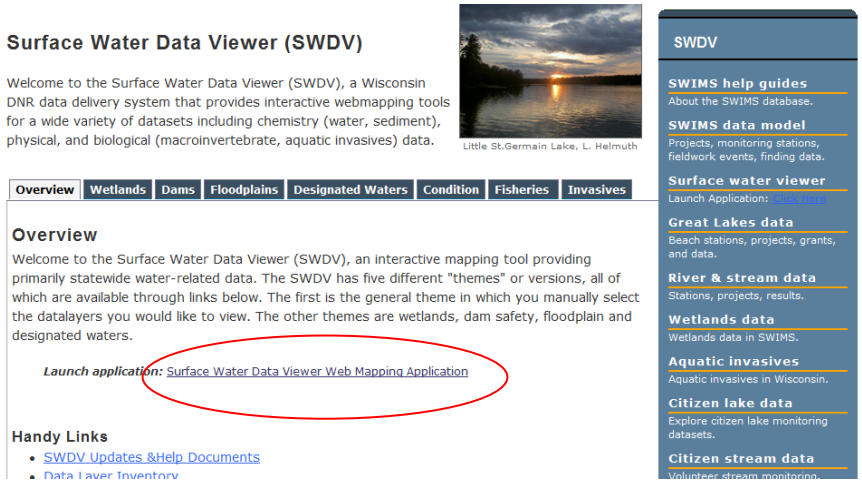
Appendix D: Eight Easy Steps to Finding Your 12-digit Hydrologic Unit Code (HUC)

The adaptive management "action area" will generally be contained within the 12-digit Hydrologic Unit Code (HUC) where the discharger(s) are located. Permittees should work with their local WDNR wastewater engineer, specialist, or adaptive management coordinator, if an adjacent HUC 12 or larger scale HUC is desired.

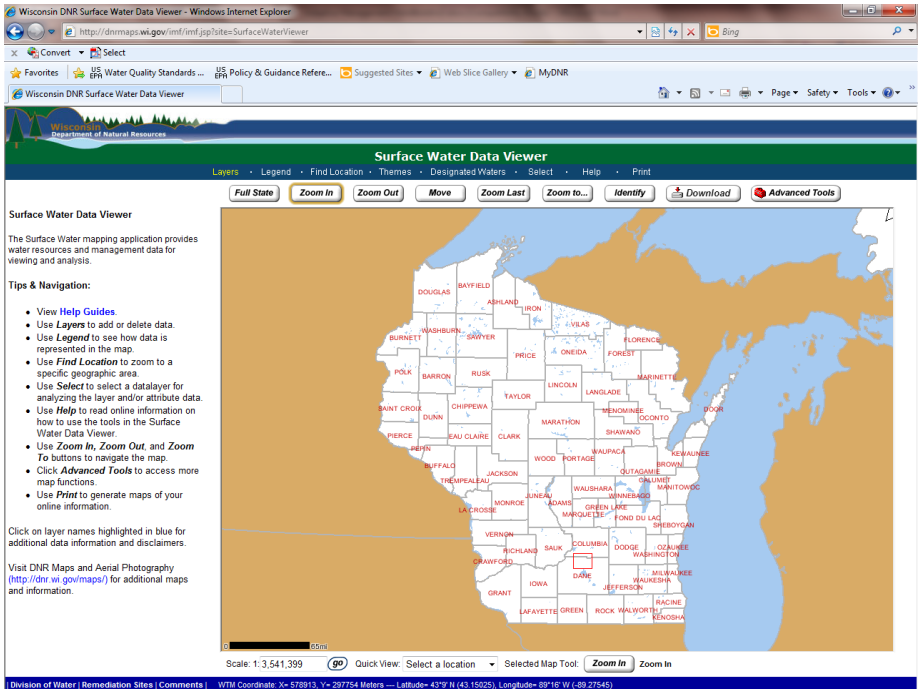
Step 1: To locate your HUC 12 click on the link below, which will take you to WDNR's Surface Water Data Viewer Home Page: http://dnr.wi.gov/topic/surfacewater/swdv/.



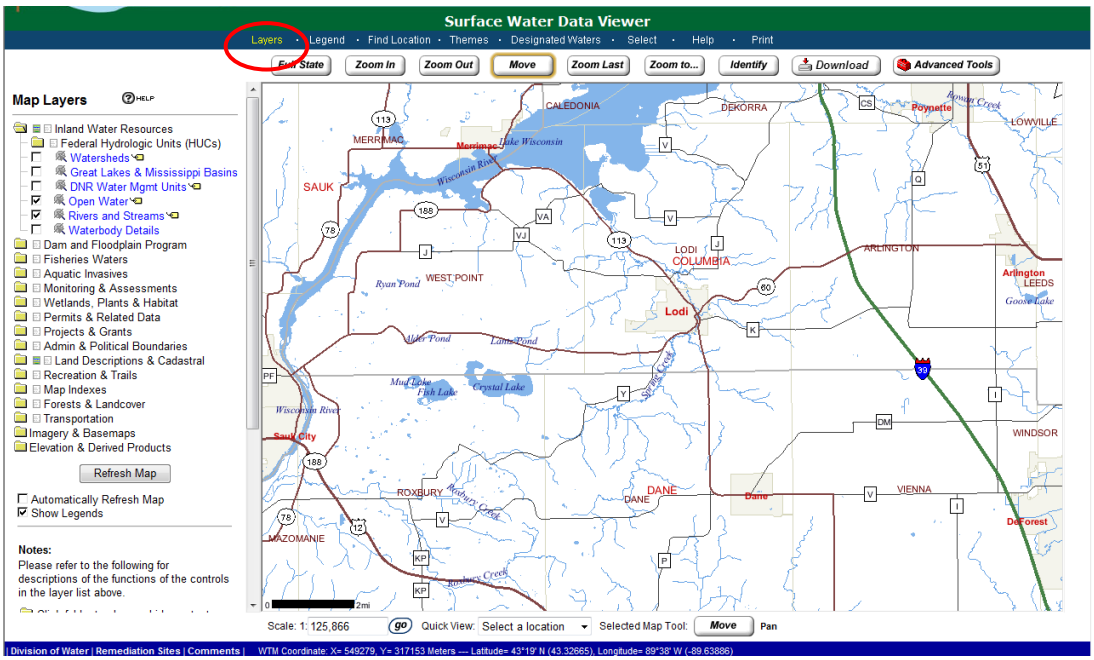
Step 2: Launch the Surface Water Data Viewer Mapping Application.

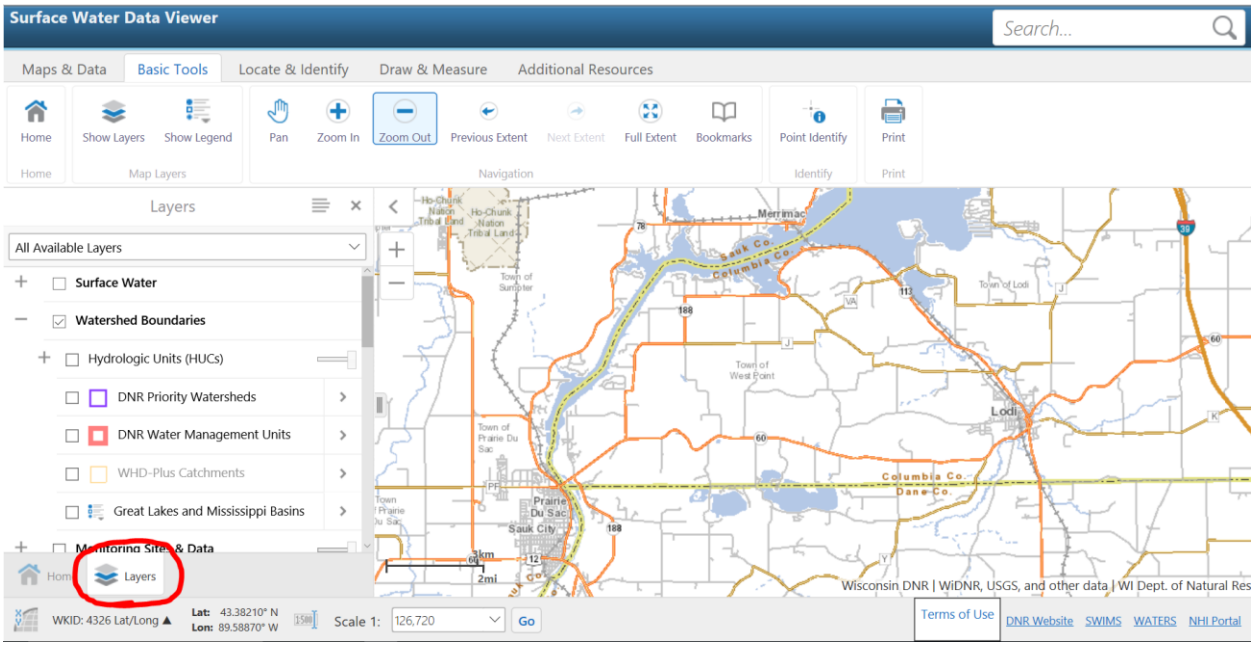


Step 3: Zoom to your area of interest by double-clicking on an area of the map and dragging your mouse over the area you wish to zoom to.

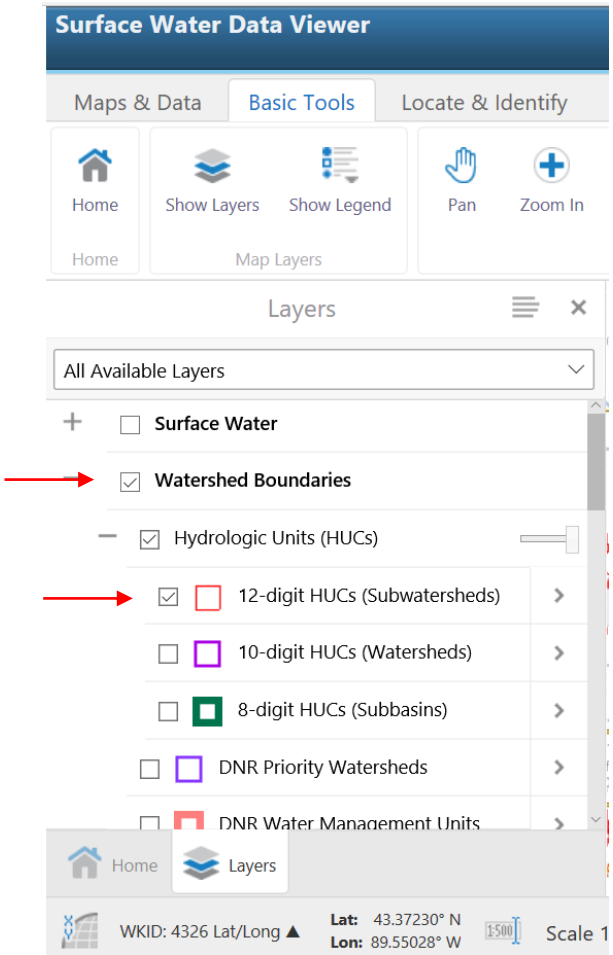


Step 4: Click on the "layers" icon at the bottom left hand side of the page.





Step 5: Click on the "Watershed Boundaries)" folder and select the "Hydrologic Units (HUCs)" subfolder. *Note: you may also be interested in the "Surface Water Outfalls" layer in the "Permits and Relate Data" Folder. This layer shows you all of the point source discharges in your HUC 12 watershed.*



Step 6: Activate the 12-digit HUCs layer by clicking on the mouse icon next to the layer name. This will make the layer turn blue.

Once you have completed the above steps you should have enough information to complete Table 4 in Step 1. A map of the HUC 12(s) and action area should also be included in the adaptive management plan submittal.

Table 23. Example of complete action area table.

HUC and Watershed Name		**Total Area of Watershed**	
HUC 070700050204; Spring Creek		Acres	Sq. Miles
		30000	46.88
County	**Area of watershed in the county**	**Percentage of watershed within the county**	
Columbia	25.32 mi^2	54%	
Dane	21.56 mi^2	46%	
What watershed scale was used to develop the action area? *Note: If action area is full HUC 12 STOP.*		☐ - Full HUC 12 ☑ - Portion of the HUC 12 ☐ - Based on a TMDL reach	
Size of the Action Area			
Acres		Sq. Miles	
24102		37.66	
County	**Size of action area per county**	**Percentage of action area within the county**	
Columbia	16.1 mi^2	43%	
Dane	21.56 mi^2	57%	

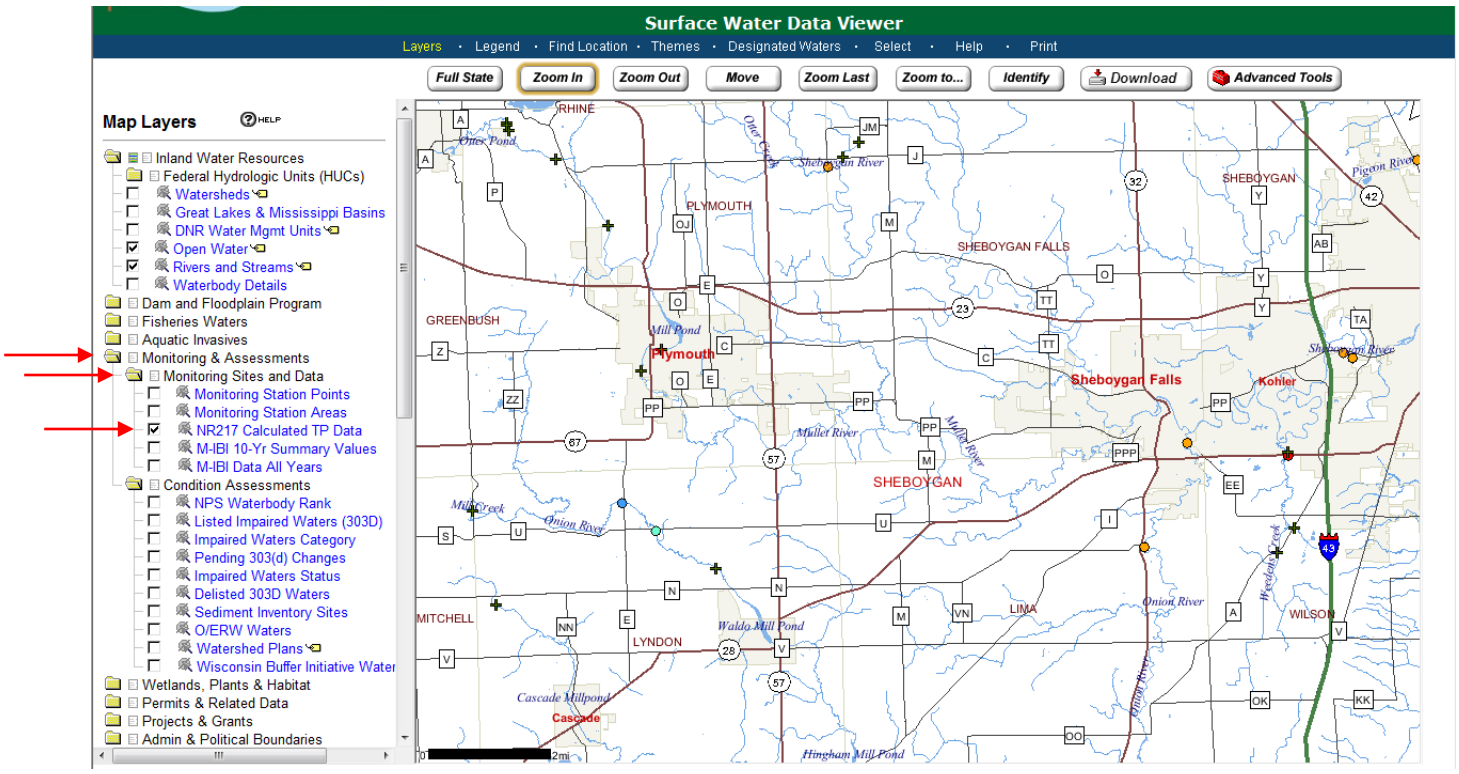
Appendix E: Steps to Finding Available Phosphorus Data in Your Watershed

All WDNR phosphorus data is publicly available. There are two ways to access these data: via the Surface Water Data Viewer and directly through the Surface Water Integrated Monitoring System (SWIMS). The Surface Water Data Viewer is an online tool that is a straight forward and easy to use option for accessing data in the SWIMS database. To access these data directly from the SWIMS database may be preferable, particularly to mine and download data, but requires some level of expertise. Either tool is available to external partners; however, partners will need to work with WDNR staff to create a user name and password before they can access the SWIMS database. For more information about the SWIMS database and how to create a user name and password visit http://dnr.wi.gov/topic/surfacewater/swims/.

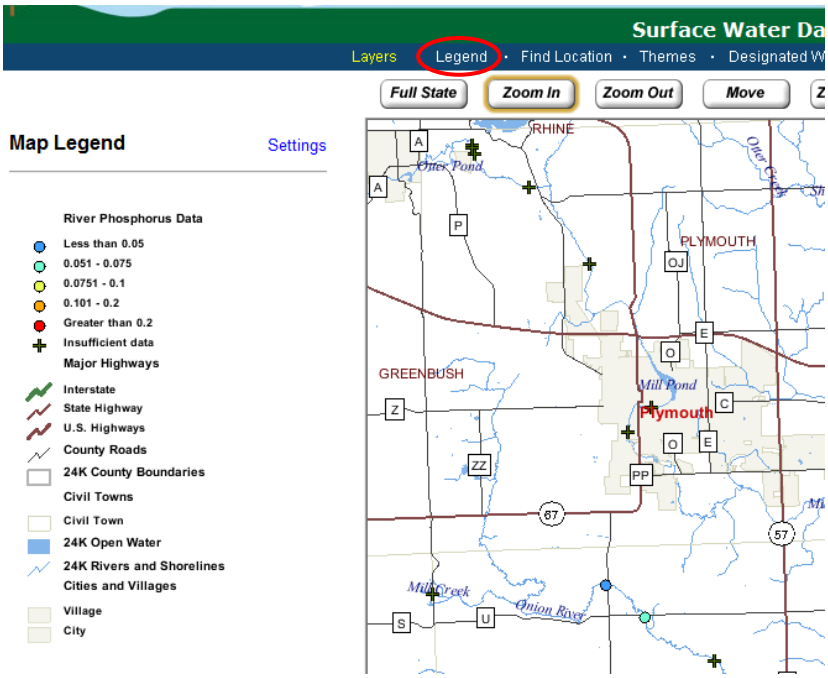
To access total phosphorus data on the Surface Water Data Viewer follow the first four steps in Appendix D (pg. 95):

- Go to WDNR's Surface Water Data Viewer website: http://dnr.wi.gov/topic/surfacewater/swdv/.
- Launch the Surface Water Data Viewer Mapping Application.
- Zoom to your area of interest by clicking on an area of the map and dragging your mouse over the area you wish to zoom to.
- Click on the "show layers" icon at the top of page.

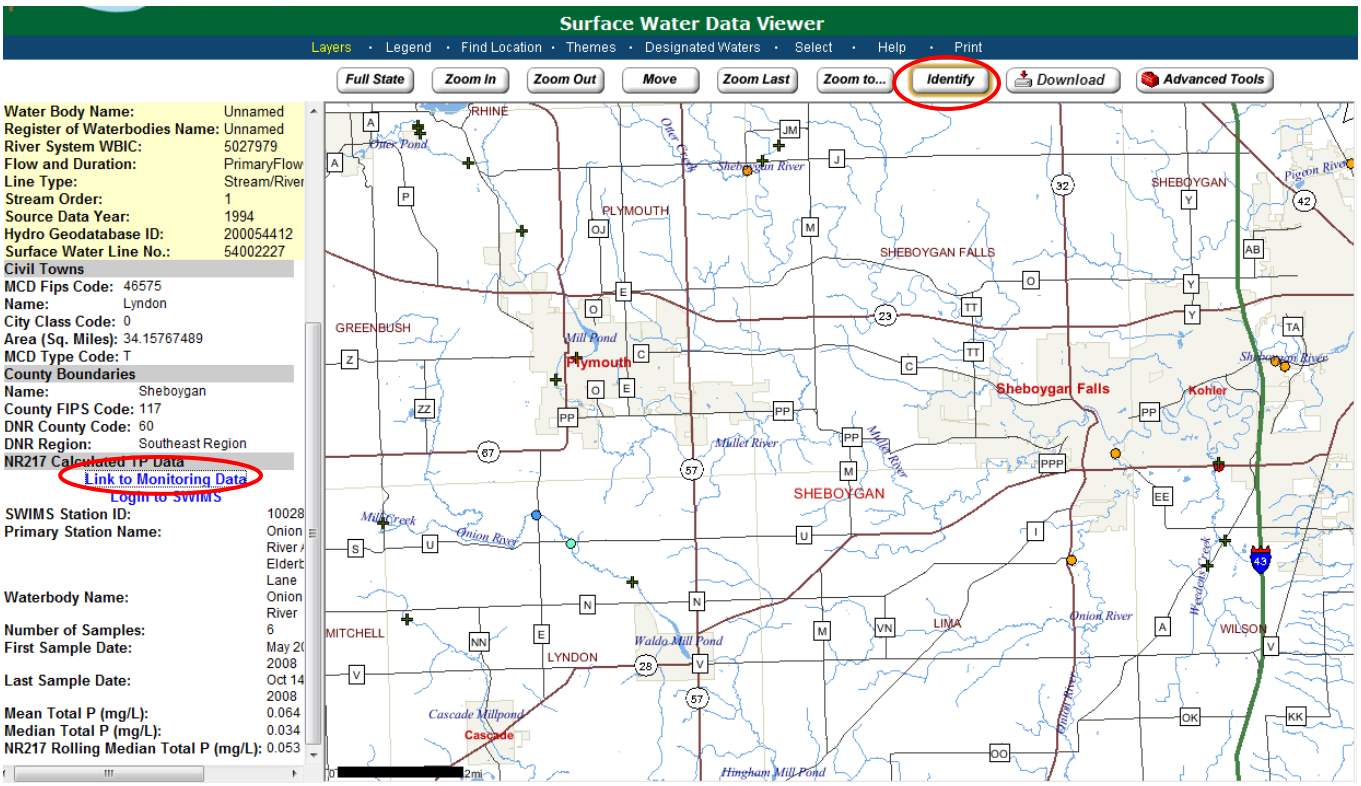
Next, expand the "Monitoring Sites and Data" folder. Select the "monitoring sites with data" layer. This layer provides all surface water phosphorus data currently available. *Note: you may also be interested in the "Surface Water Outfalls" layer in the "Permits and Related Data" Folder. This layer shows you all of the point source discharges in your HUC 12 watershed.*



By activating this layer, a series of colored circles and crosses will appear on your area of interest. These represent the sampling location where phosphorus data is available, and the approximate concentration of phosphorus at this location. To view the map legend for these symbols click “Legend” at the top of the page.



If you would like to see the data that was used to derive these points use the identify tool at the top of the page and click on the sample point of interest. This will bring up information on the sample point including mean total phosphorus concentration. You can also click on “link to monitoring data” to view and download the raw data.



Appendix F: Example Form to Submit Samples to Certified Lab

Most certified labs have forms/slips available for use. If a laboratory does not have slips available, it is recommended that adaptive management partners work with their lab to create one. It is also recommended that a budget code be established with the lab to streamline sampling submittals as much as possible.

Below is an example lab slip used by WDNR to accompany monitoring samples submitted for analyses to the Wisconsin State Laboratory of Hygiene. This pre-printed slip identifies the project name, collectors, lab account code, monitoring station ID, and other important information.

If you choose to use the State Lab of Hygiene to analyze your samples, you can choose to use WDNR's lab slips for your adaptive management project. For details on how to use the "lab slip generator" in the SWIMS database visit http://dnr.wi.gov/topic/surfacewater/swims/documents/basic_user_guide-4_07.pdf. Features of the Lab Slip Generator include:

- Links sample data to monitoring stations with GIS location identifiers
- Automatic charge back of laboratory services to lab account codes
- Automatic entry of data results from the State Laboratory of Hygiene into WDNR's SWIMS data system
- Tracks fieldwork events at project monitoring stations

State of Wisconsin
Department of Natural Resources
and Laboratory of Hygiene

Inorganic Test Request

Form 4800-015 (R 2/09) Page 1 of 2

ID, License, Permit or STORET Number	Point or Outfall Number	Field Number	County No.	Program Code	Region
10000000	111000		9	WTA	WCR

Waterbody Number	Sample Address or Location
2156800	1 - OTTER CREEK - CTHS G AND S- EXAMPLE

Sample Point Description / Sampling Device

Send Report To

DNR User ID MINKSA
Date Results Needed (mm/dd/yyyy)

Name (Last, First) MINKS, AMANDA

Address 101 S WEBSTER

City MADISON | State WI | Zip 53703

Account Number
Collected By AMANDA BOYCE

Lakes Grant or Project Number AM Monitoring- EXAMPLE
Telephone Number

Begin or Grab Date (mm/dd/yyyy) 10/16/2012
Begin Time (24-hr clock) 07:00

End Date - For Composite Samples Only (mm/dd/yyyy) 10/16/2012
End Time (24-hr clock) - For Composite Samples Only 08:00

Enforcement? ☐ Yes ☒ No If yes, include chain of custody form.

If Field QC Sample (select one): ☐ Duplicate ☐ Blank ☐ _____

Sample Type (select one)

- ☒ SU Surface Water
- ☐ NP Storm Water
- ☐ E Public Drinking Entry Point
- ☐ W Public Drinking Well/Source
- ☐ D Public Drinking Distribution
- ☐ PO Private Well
- ☐ X Non-Potable Well
- ☐ _____
- ☐ EF Effluent (Treated Wastewater)
- ☐ IF Influent (Untreated Wastewater)
- ☐ MW Monitoring Well
- ☐ SE Sediment
- ☐ SL Sludge
- ☐ SO Soil
- ☐ TI Tissue
- ☐ OW Waste

For Lab Use: Priority

Sample Reason (Drinking Water - select one)

- ☐ N New Well
- ☐ I Investigation
- ☐ W Raw Water
- ☐ C Confirmation
- ☐ D Compliance

Depth of Sample (feet or meters) _____ F or M

Is Sample Disinfected? ☐ Yes ☐ No If Yes, how? _____

If field filtered, indicate by checking the box on this sheet and noting on the lid of the sample bottle.

Plastic Quart (946 ml) Bottles (No Chemical Preservation)

☐ Sample field filtered? (Check box if yes)

- ☐ Total Solids
- ☐ Volatile Total Solids
- ☐ Suspended Solids (500 ml needed)
- ☐ Vol. Susp. Solids
- ☐ Total Dissolved Solids
- ☐ $CBOD_5$ Total (carbonaceous)
- ☐ BOD_5 Total (900 ml needed)

BOD Estimate Required: _____ mg/l

- ☐ BOD_5 Dissolved
- ☐ Alkalinity, pH, & Conductivity
- ☐ pH only **(non-Waste or non-Compliance)**
- ☐ Chloride
- ☐ Color
- ☐ Fluoride
- ☐ Sulfate
- ☐ Turbidity
- ☐ MBAs Screening
- ☐ _____
- ☐ _____
- ☐ Chlorophyl A (if Field Filtered, give ml _____ filtered)

250 ml Bottle (add NaOH to pH > 12)

- ☐ Cyanide, Total
- ☐ Cyanide, Amenable to Chlorination

60 ml Bottle (No Chemical Preservation)

☐ Sample field filtered? (Check box if yes)

- ☐ $NO_2 + NO_3$ as Nitrogen (Drinking Water)
- ☐ Nitrite (NO_2) as Nitrogen
- ☐ Diss.-Orthophosphate
- ☐ Diss. Silica

Quart Mason Jar (Also TCLP Metals)

- ☐ Oil & Grease (3 qts) (Acidify w/ Sulfuric Acid)
- ☐ pH (Waste Samples Only)

250 ml Bottle for Nutrients or Metals - Check each of the boxes that apply

Metals Bottle 250 ml **(Acidify W/Nitric Acid)**

☐ Sample field filtered? (Check box if yes)

- ☐ Low Level Metals (e.g., clean sampling)
- ☐ TCLP (Toxicity Characteristic Leaching Procedure) (*TC Regulated Metals)(Use Mason Jar)

Note: Special Bottles & Acid Needed +

For non-drinking waters, total recoverable metals will be run unless otherwise instructed.

- ☐ Antimony +
- ☐ Arsenic* +
- ☐ Barium* +
- ☐ Beryllium +
- ☐ Cadmium* +
- ☐ Calcium
- ☐ Chromium, Total*
- ☐ Chromium, Hexavalent
- ☐ Copper +
- ☐ Hardness-as $CaCO_3$
- ☐ Iron
- ☐ Lead* +
- ☐ Magnesium
- ☐ Manganese +
- ☐ Mercury* +
- ☐ Nickel +
- ☐ Selenium* +
- ☐ Silver* +
- ☐ Sodium
- ☐ Thallium +
- ☐ Zinc +
- ☐ _____
- ☐ _____
- ☐ _____

Nutrients Bottle 250 ml **(Acidify W/Sulfuric Acid)**

☒ Sample field filtered? (Check box if yes)

- ☒ Tot.-Phosphorus
- ☐ Ammonia-N
- ☒ Tot. Dis. Phosphorus **(filter, then acid preserve in 60 ml bottle)**
- ☐ $NO_2 + NO_3$ as Nitrogen
- ☐ Chemical Oxygen Demand (COD)
- ☐ Total Kjeldahl-N

Where required, has sample been chemically preserved and has pH been checked?

☐ Yes ☐ No

Initials _____ Date _____

Additional parameters or instructions to laboratory

Field Parameters - Optional

Sample Temperature - field (°C)		Gage Height (ft)	
Ambient Air Temperature - field (°C)		Flow cfs	
DO field (mg/l)		Flow MGD	
pH (su) field		Depth to Groundw ater (ft)	
Secchi Depth (feet or meters)	For M	Top of Sampling Interval	For M
Secchi Depth Hit Bottom?	☐ Yes ☐ No	Bottom of Sampling Interval	For M
Cloud Cover %	%	Turbidity (NTU)	
Cond-fld (µS/CM@25°C)		Turbidity Tube (cm)	
		% Saturation	

Partial Instructions

See Chapter 4 "Lab Slips" of the Field Procedures Manual (see http://intranet/int/es/science/ls/fpm/IV.htm) for further instructions and definitions.

The **ID, License, Permit or STORET Number** and **Point or Outfall Number fields** should contain the appropriate IDs, left justified, for the program system the sample is for:

Program	ID Number	Example	Pt. or Outfall	Example
Water Supply - Privates	Unique Well No.	AA999	Blank	
Water Supply - Publics RAW	PWS ID No.	24100567	Well No.	002
Water Supply - Publics DIST	PWS ID No.	24100567	Blank	
Waste Management	License No.	00130	Point ID	101
Watershed Management	Permit No.	0000030	Outfall No.	001
Fish Management and Habitat Protection	Storet No.	265013	Blank	
Remediation and Redevelopment	CERCLIS No.	006094197	Point ID	001
Remediation and Redevelopment	FID	268181770	Point ID	001
Remediation and Redevelopment	Brow nfields No.	000000003	Point ID	001

The **Sample Address or Location field** should be the "entity" name, and depends on the program the sample is for. For example, Facility, Site, Licensee, River/Lake, Ow ner, etc. Follow ing this information, include the address of the facility or site (if appropriate).

The **Sample Point Description field** should include a description of the point w ithin the property that the sample w as collected. For example, secondary setting tank effluent or faucet prior to pressure tank.

The **Program Code** is a tw o-digit DNR program abbreviation such as WT for Watershed, DG for Drinking and Groundw ater, WA for Waste Management, and etc.

The **Region Code** is a single numeric code for the appropriate DNR region (1 is SCR, 2 is SER, 4 is NER, 6 is WCR, & 7 is NOR). The computer w ill assign a region based on the county.

The **Account Number** must be completed in order for the samples to be billed to the correct funding source. If you are unsure w hat the proper account number is refer to http://intranet/int/es/science/ls/Account.htm or contact the DNR Laboratory Coordinator or the State Laboratory of Hygiene.

The **Lake Grant or Project Number field** should include the Lake Planning Grant Number or the Project Number.

County Code

Adams	01	Florence	19	Marathon	37	Rusk	55
Ashland	02	Fond du Lac	20	Marinette	38	Saint Croix	56
Barron	03	Forest	21	Marquette	39	Sauk	57
Bayfield	04	Grant	22	Menominee	40	Saw yer	58
Brow n	05	Green	23	Milw aukee	41	Shaw ano	59
Buffalo	06	Green Lake	24	Monroe	42	Sheboygan	60
Burnett	07	Iow a	25	Oconto	43	Taylor	61
Calumet	08	Iron	26	Oneida	44	Trempealeau	62
Chippew a	09	Jackson	27	Outagamie	45	Vernon	63
Clark	10	Jefferson	28	Ozaukee	46	Vilas	64
Columbia	11	Juneau	29	Pepin	47	Walw orth	65
Craw ford	12	Kenosha	30	Pierce	48	Washburn	66
Dane	13	Kew aunee	31	Polk	49	Washington	67
Dodge	14	La Crosse	32	Portage	50	Waukesha	68
Door	15	Lafayette	33	Price	51	Waupaca	69
Douglas	16	Langlade	34	Racine	52	Waushara	70
Dunn	17	Lincoln	35	Richland	53	Winnebago	71
Eau Claire	18	Manitow oc	36	Rock	54	Wood	72

Appendix G: Adaptive Management Request Form

The adaptive management request form must be submitted no later than the permit application submittal date, and is meant to be a cover document for the more detailed adaptive management plan. This form should be completed by the facility entering into adaptive management, or an authorized representative of the facility. If the adaptive management plan covers multiple facilities, each facility should submit an adaptive management request form to WDNR. Only one adaptive management plan needs to be submitted, however.

The “preliminary request form” feature can be used for facilities interested in verifying their adaptive management eligibility. Although the preliminary request form is not required, it is recommended to ensure the facility is eligible for adaptive management prior to plan development.

The adaptive management request form or preliminary request form should be submitted to your local basin engineer or specialist, or adaptive management coordinator.

State of Wisconsin
Department of Natural Resources
Bureau of Watershed Management
PO Box 7921, Madison WI 53707-7921
dnr.wi.gov

Watershed Adaptive Management Request

Form 3200-139 (1/12)

Notice: Pursuant to s. NR 217.18, Wis. Adm. Code, this form must be completed and submitted to the Department at the time of the reissuance of an existing WPDES (Wisconsin pollutant discharge elimination system) permit to request adaptive management for phosphorus water quality based effluent limits (WQBEL).Failure to provide all requested information may result in denial of your request. Personal information collected will be used for administrative purposes and may be provided to requestors to the extent required by Wisconsin Open Records law [ss. 19.31-19.39, Wis. Stats.].

Type of Request:

- ☐ This is the formal adaptive management request as required in s. NR 217.18(2)
- ☐ This is a preliminary adaptive management request (to be submitted as part of facility planning.)

Facility and Permit Information

Facility Name			WPDES Permit No. **WI -**
Facility Address	City	State	ZIP Code
Receiving Water			

Owner Contact Information

Last Name	First Name	MI	Phone No. (incl. area code)
Street Address			FAX Number
City	State	ZIP Code	Email address

Facility Information

Provide listed information for each lagoon or pond basin

Required for AM Request	Wis. Administrative Code Reference	Conclusion	Evidence/Source of information (attach as needed)
1. NPS contribute at least 50% of total P contribution	s. NR 217.18(2)(b)	☐ NPS contributes at least 50% ☐ NPS DOES NOT contribute at least 50%	
2. WQBEL Requires Filtration	s. NR 217.18(2)(c)	☐ Filtration required ☐ Filtration NOT required	
3. AM Plan	s. NR 217.18(2)(d)	☐ Plan is Included – Page 3 ☐ Plan is NOT Included *For a preliminary adaptive management request, AM plan not required*	

Facility Operation and Performance

1. **Current P removal capability** – If the facility is currently required by a WPDES permit to monitor effluent phosphorus (P) provide a summary of the influent and effluent annual average P concentrations for each of the past three (3) years. If permit required P data is not available, the applicant should provide any other P data that may be applicable and available. If no data is available, the Department may estimate the P effluent concentration based on data from other similar facilities.

2. **Facility Operation** – Provide a summary description of overall facility operation. If not a continuously discharging facility, describe storage procedures and the time periods when effluent discharge occurs.

3. **Previous Studies** – Reference or attach any facility planning or evaluation study that evaluated facility performance capabilities (Note – Only include studies that are recent, within 5 years, or otherwise applicable for the evaluation of the existing facility and current conditions).

Adaptive Management Plan (s. NR 217.18(d))

This section should summarize the Adaptive Management Plan for internal and external review. A complete Adaptive Management Plan should be attached. Note: If this is a preliminary adaptive management request, this section is not required.

Watershed	Percent Contribution of Applicant Discharge

Action Area (include map)

Watershed Characteristics and Timeline Justification

Key Proposed Actions

Key Goals and Measures for Determining Effectiveness

Partner(s)

Funding Sources

Adaptive Management Request and Certification

Based on the information provided, I am requesting the Watershed Adaptive Management option to achieve compliance with phosphorus water quality standards in accordance with s. NR 217.19, Wis. Adm. Code.

I certify that the information provided with this request is true, accurate and complete to the best of my knowledge.

Print or type name of person submitting request*	Title
Signature of Official	Date Signed

*Must be an Authorized Representative for the treatment facility

WISCONSIN DEPARTMENT OF NATURAL RESOURCES
NOTICE OF FINAL GUIDANCE & CERTIFICATION

Pursuant to ch. 227, Wis. Stats., the Wisconsin Department of Natural Resources has finalized and hereby certifies the following guidance document.

DOCUMENT ID

WY-20-0009

DOCUMENT TITLE

Adaptive Management Technical Handbook

PROGRAM/BUREAU

Water Quality

STATUTORY AUTHORITY OR LEGAL CITATION

Section 283.13 (7), Wis. Stats. and chapter NR 217, Wis. Adm. Code.

DATE SENT TO LEGISLATIVE REFERENCE BUREAU (FOR PUBLIC COMMENTS)

01/20/2020

DATE FINALIZED

06/01/2020

DNR CERTIFICATION

I have reviewed this guidance document or proposed guidance document and I certify that it complies with sections 227.10 and 227.11 of the Wisconsin Statutes. I further certify that the guidance document or proposed guidance document contains no standard, requirement, or threshold that is not explicitly required or explicitly permitted by a statute or a rule that has been lawfully promulgated. I further certify that the guidance document or proposed guidance document contains no standard, requirement, or threshold that is more restrictive than a standard, requirement, or threshold contained in the Wisconsin Statutes.

Adrian Stocks *6/18/2020*

Signature Date