Circular DEQ-15

Translation of Narrative Nutrient Standards and Implementation of the Adaptive Management Program

March 2024 Edition

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Document Number

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ACRONYMS

AMP	Adaptive Management Plan
ARM	Administrative Rules of Montana
ARP	Advance Restoration Plan
DO	Dissolved Oxygen
DSS	Decision Support System
EPA	United States Environmental Protection Agency
HUC	Hydrological Unit Code
LA	Load Allocation
MCA	Montana Code Annotated
MPDES	Montana Pollutant Discharge Elimination System
TDG	Total Dissolved Gas
TMDL	Total Maximum Daily Load
TN	Total Nitrogen
TP	Total Phosphorus
USGS	United States Geological Survey
WLA	Wasteload Allocation

GENERAL INTRODUCTION TO CIRCULAR DEQ-15

In 2021 the 67th Montana Legislature adopted Senate Bill 358, which described a new process for implementing narrative standards for nutrients in permits. The Montana Legislature also directed the Department of Environmental Quality (department) to eliminate the numeric nutrient criteria that had been adopted for total phosphorus (TP) and total nitrogen (TN) in Circular DEQ-12A. The numeric criteria in Circular DEQ-12A applied to wadeable streams and medium-sized rivers across Montana as well as portions of the Yellowstone River. Circular DEQ-12A criteria were not applicable to Montana's remaining large rivers, lakes, reservoirs, or other state surface waters, all of which remained subject to Montana's narrative nutrient standards.

The narrative standards at Administrative Rules of Montana (ARM) 17.30.637(1)(e) — "State surface waters must be free from substances attributable to municipal, industrial, agricultural practices or other discharges that will: (e) create conditions which produce undesirable aquatic life" — are the primary narrative standards the department uses to regulate the impacts of excess phosphorus and nitrogen in state waters. Narrative nutrient standards apply to all state surface waters, including those previously covered under Circular DEQ-12A. This circular provides methods to interpret the narrative nutrient standards and provides additional requirements related to the implementation of an adaptive management program.

While the narrative nutrient standards remain unchanged, Section 75-5-321, Montana Code Annotated (MCA), now requires the department to adopt rules allowing for the use of an adaptive management program as one option for achieving the narrative nutrient standards. The adaptive management program is an incremental, watershed-based approach for protecting and maintaining water quality affected by excess nutrients. An important element of the adaptive management program is that it allows different nutrients (phosphorus vs. nitrogen) and nutrient sources to be addressed separately and incrementally over time by incorporating flexible decision-making which can be adjusted as management actions, their effects, and other factors become better understood in each watershed.

Circular DEQ-15 has two parts. **Part I** contains details associated with translating the narrative nutrient standards, in accordance with NEW RULE I, to determine if a waterbody is achieving the standards or not. **Part II** addresses the implementation of the adaptive management program per NEW RULE II.

DEFINITIONS

Adaptive Management Plan (AMP) means a watershed-specific plan developed under the adaptive management program to achieve the narrative nutrient standards and address nutrients in a specific watershed.

Adaptive Management Program means a watershed-scale program that protects water quality from the impacts of nutrient sources by: (a) prioritizing phosphorus reduction, as appropriate, while accounting for site specific conditions; (b) allowing for nutrient sources to be addressed incrementally over time by incorporating flexible decision-making which can be adjusted as management actions and other factors become better understood; (c) reasonably balancing all factors impacting a waterbody while considering the relative cost of treatment options, their feasibility, and their expected water quality improvement; (d) identifying specific nutrient reduction requirements, and (e) setting as its goal the protection and achievement of beneficial uses of the waterbody.

Ecoregion means a mapped region of relative homogeneity in ecological systems derived from perceived patterns of a combination of causal and integrative factors including land use, land surface form, potential natural vegetation, soils, and geology.

Far Field Sites means, for purposes of an adaptive management plan, instream sampling locations placed throughout the adaptive management plan watershed for the primary purpose of characterizing nutrient loads entering and exiting the watershed.

Large River means a perennial waterbody which has, during summer and fall baseflow (August 1 to October 31 each year), a wadeability index (product of river depth [in feet] and mean velocity [in ft/sec]) of 7.24 ft^2 /sec or greater, a depth of 3.15 ft or greater, or a baseflow annual discharge of 1,500 ft^3 /sec or greater. See also, **Table 1-1**.

Medium River means a perennial waterbody in which much of the wetted channel is unwadeable by a person during baseflow conditions.

Near Field Sites means, for purposes of an adaptive management plan, instream sampling locations near a point source discharge that (a) downstream of the point source represent segments of the stream directly under the influence of the point source's effluent and (b) upstream of the point source represent segments of the stream uninfluenced by the point source and having similar physical characteristic to the downstream location(s) in terms of gradient, flow, baseflow water depth, substrate, and stream shading.

Total Nitrogen means the sum of all nitrate, nitrite, ammonia, and organic nitrogen, as N, in an unfiltered water sample. Total nitrogen in a sample may also be determined via persulfate digestion or as the sum of total Kjeldahl nitrogen plus nitrate plus nitrite.

Total Phosphorus means the sum of orthophosphates, polyphosphates, and organically bound phosphates, as P, in an unfiltered water sample. Total phosphorus may also be determined directly by persulfate digestion.

Wadeable Stream means a perennial or intermittent stream in which most of the wetted channel is safely wadeable by a person during baseflow conditions.

PART I: TRANSLATION OF THE NARRATIVE NUTRIENT STANDARDS

Part I of **Circular DEQ-15** provides translations of the narrative nutrient standards, descriptions of causal and response variables and associated thresholds, and tables to interpret the various combinations of causal and response results. Collectively, this is a weight-of-evidence framework in which each data type (total nitrogen/total phosphorus, and response variables) provides key information; however, it is the response variables—which are direct measures of the biological community or its effects—which have the greatest weight. Achievement (or non-achievement) of the narrative nutrient standards requires that all the specified causal and response variables associated with a beneficial use have been collected and are available for evaluation. If they are not all available, the department will provide a reasonable amount of time for their collection prior to making a decision regarding achievement of the narrative nutrient standards.

The daily curve of dissolved oxygen (DO) change in flowing waters is the response variable with the widest geographic application in this process. Daily DO change, referred to as DO delta, is the daily maximum DO concentration minus the daily DO minimum concentration, expressed in mg DO/L.

Biological assemblages (floral and faunal) and DO patterns are affected by environmental factors besides total nitrogen and total phosphorus concentrations and **Part I** includes options—based on demonstrated effects and within reasonable limits—for addressing such circumstances. These options may result in modified thresholds and site-specific criteria being applied to specific waterbodies or waterbody segments. Site specific modifications must be approved by the department, reviewed and approved by the U.S. Environmental Protection Agency (EPA), and then be made easily accessible to the public via the department's website.

Translators found in **Part I** do not apply to ephemeral waterbodies, but they do apply to intermittent and perennial waterbodies.

1.0 Identify Waterbody Size

To translate the narrative nutrient standards per NEW RULE I, each waterbody must first be identified as a wadeable stream, medium river, or large river (for permittees discharging to or affecting a lake or reservoir, see **Section 3.0** in **Part II**). **Figure 1-1** is a guide to sections in **Part I** depending upon waterbody size; each section provides details on the indicated subjects.

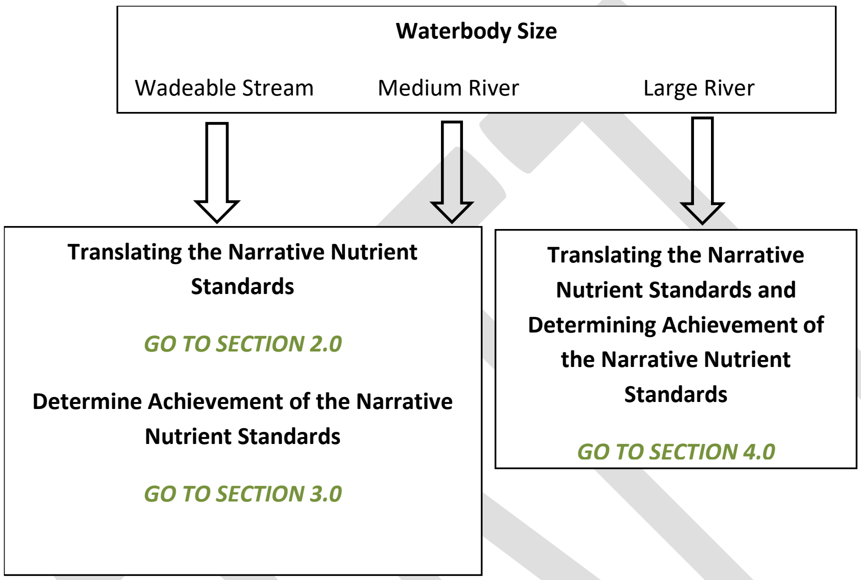

Figure 1-1. Guide to Sections in Part I Depending on Waterbody Size.

Readers should refer to definitions in the **General Introduction to Circular DEQ-15** (above), the list of large rivers in **Table 1-1** below, and any other current department guidance when determining the size of a receiving water body.

Table 1-1. Large River Segments within the State of Montana

River Name	Segment Description
Big Horn River	Yellowtail Dam to mouth
Clark Fork River	Bitterroot River to state-line
Flathead River	Origin to mouth
Kootenai River	Libby Dam to state-line
Madison River	Ennis Lake to mouth
Missouri River	Origin to state-line
South Fork Flathead River	Hungry Horse Dam to mouth
Yellowstone River	State-line to state-line

2.0 WADEABLE STREAMS AND MEDIUM RIVERS: THE NARRATIVE NUTRIENT STANDARDS TRANSLATOR

Table 2-1 shows instream nutrient causal and instream response variable parameters, applicable to different beneficial uses and regions of the state, that must be measured to translate the narrative nutrient standards for wadeable streams and medium rivers. Department programs (e.g., Montana Pollutant Discharge Elimination System (MPDES) Permitting, Monitoring and Assessment, Total Maximum Daily Load (TMDL)) must use these parameters to translate the narrative nutrient standards but may have program-specific data compilation and analysis methods appropriate for their purposes and documented in their respective work units.

Table 2-1. The Narrative Nutrient Standards Translator. An "X" indicates the parameter applies and is required to be measured at monitoring sites to translate the narrative nutrient standards per NEW RULE I.

Benefical Use and Applicable Zone			Causal Variable	Response Variable (threshold)			
Beneficial Use	**Stream Slope Zone***	**Macroinvertebrate Zone***	**TP, TN (*see* ecoregional nutrient concentrations in Table 2-3)**	**DO Delta†**	**Benthic Chl*a* ; AFDW**	**% filamentous algae bottom cover**	**Macroinvertebrates**
Recreation	Western and transitional ecoregions, all stream/medium river water surface slopes	n/a	**X**		**X** (150 mg Chla/m^2; 35 g AFDM/m^2)	**X** (30% cover)	
Aquatic Life	Western and transitional ecoregions, streams/medium rivers with >1% water surface slope	Mountains	**X**				**X** Beck's Biotic Index v3 (35.1)
Aquatic Life	Western and transitional ecoregions, streams/medium rivers with ≤1% water surface slope	Low Valleys and Transitional[a]	**X**	**X** (3.0 mg DO/L)			**X** Beck's Biotic Index v3 (18.7)
Aquatic Life	Eastern ecoregions, all streams/medium rivers	Plains	**X**	**X** (6.0 mg DO/L)[b]			

*Ecoregions comprising these zones are provided in **Table 2-2**.

† The allowable exceedance rate of a dataset of weekly average DO delta values is 10% in the Low Valleys and Transitional and 15% in the Plains.

[a] With the exception of Big Spring Creek, spring creeks are exempt from this narrative translation. Stream and medium river reaches below dams may be given special consideration. See **Section 2.3** for details and applicable criteria.

[b] Data collected during drought periods may be excluded from analysis. See department guidance for definition of drought.

Ecoregions associated with the stream slope and macroinvertebrate zones are shown in **Table 2-2**. A map of the three macroinvertebrate zones is shown in **Figure 2-1**. Stream slope and macroinvertebrate zones in **Table 2-1** largely correspond; for example, western and transitional ecoregions with water surface slope >1% are largely restricted to the ecoregions in the Mountains macroinvertebrate zone, and conversely, western and transitional ecoregions with water surface slope <1% are largely restricted to ecoregions which form the Low Valleys and Transitional macroinvertebrate zone. However, cases will arise—usually near western ecoregion borders—where, for example, a stream may have ≤1% water surface slope but is located in the Mountains macroinvertebrate zone. **Case-by-case evaluations may be appropriate in such situations, using stream slope as the primary criterion to determine which parameters should apply**. Causal and response variables (and their thresholds) should be kept together; in other words, for the example just given, if the stream is to be evaluated as a waterbody with ≤1% slope it should be evaluated using DO delta (and its corresponding threshold of 3.0 mg/L) and the Beck's Biotic Index (v3) and its corresponding threshold of 18.7. Translator parameters modified from what is shown in **Table 2-1** and applied to a waterbody must be approved by the department and submitted to EPA for review and approval as site specific criteria.

Table 2-2. Ecoregions associated with the Stream Slope Zone and Macroinvertebrates Zone from the Narrative Nutrient Standards Translator in Table 2-1. Level IV (small-scale) ecoregions are those shown as a number-letter combination.

Beneficial Use	Stream Slope Zone	Stream Slope Zone Ecoregions	Macroinvertebrate Zone	Macroinvertebrate Zone Ecoregions
Recreation	Western and transitional ecoregions, <u>all</u> streams/medium rivers regardless of water surface slope	15. Northern Rockies	n/a	n/a
		16. Idaho Batholith		
		17. Middle Rockies		
		41. Canadian Rockies		
		42l. Sweetgrass Uplands		
		42n. Milk River Pothole Upland		
		42q. Rocky Mountain Front Foothill Potholes		
		42r. Foothill Grassland		
		43s. Non-calcareous Foothill Grassland		
		43t. Shield-Smith Valleys		
		43u. Limy Foothill Grassland		
		43v. Pryor-Bighorn Foothills		
		43o. Unglaciated Montana High Plains		
Aquatic Life	Western and transitional ecoregions, streams/medium rivers with >1% water surface slope **OR** with ≤1% water surface slope	15. Northern Rockies	Mountains	15. Northern Rockies (excl. 15c Flathead Valley)
		16. Idaho Batholith		16. Idaho Batholith
		17. Middle Rockies		17. Middle Rockies (excl. Level IV Ecoregions in Low Valleys and Transitional)
		41. Canadian Rockies		41. Canadian Rockies
			Low Valleys and Trasitional	15c. Flathead Valley
				17s. Bitterroot-Frenchtown Valley
				17u. Paradise Valley
				17w. Townsend Basin
				17aa. Dry Intermontane Sagebrush Valleys
				17ac. Big Hole
				17ak. Deer Lodge-Philipsburg-Avon Grassy Intermontane Hills and Valleys
		42l. Sweetgrass Uplands		42l. Sweetgrass Uplands
		42n. Milk River Pothole Upland		42n. Milk River Pothole Upland
		42q. Rocky Mountain Front Foothill Potholes		42q. Rocky Mountain Front Foothill Potholes
		42r. Foothill Grassland		42r. Foothill Grassland
		43s. Non-calcareous Foothill Grassland		43s. Non-calcareous Foothill Grassland
		43t. Shield-Smith Valleys		43t. Shield-Smith Valleys
		43u. Limy Foothill Grassland		43u. Limy Foothill Grassland
		43v. Pryor-Bighorn Foothills		43v. Pryor-Bighorn Foothills
		43o. Unglaciated Montana High Plains		43o. Unglaciated Montana High Plains
	Eastern ecoregions, <u>all</u> streams/medium rivers	18. Wyoming Basin	Plains	18. Wyoming Basin
		42. Northwestern Glaciated Plains (excl. Level IV Ecoregions listed above)		42. Northwestern Glaciated Plains (excl. Level IV Ecoregions in Low Valleys and Transitional)
		43. Northwestern Great Plains (excl. Level IV Ecoregions listed above)		43. Northwestern Great Plains (excl. Level IV Ecoregions in Low Valleys and Transitional)

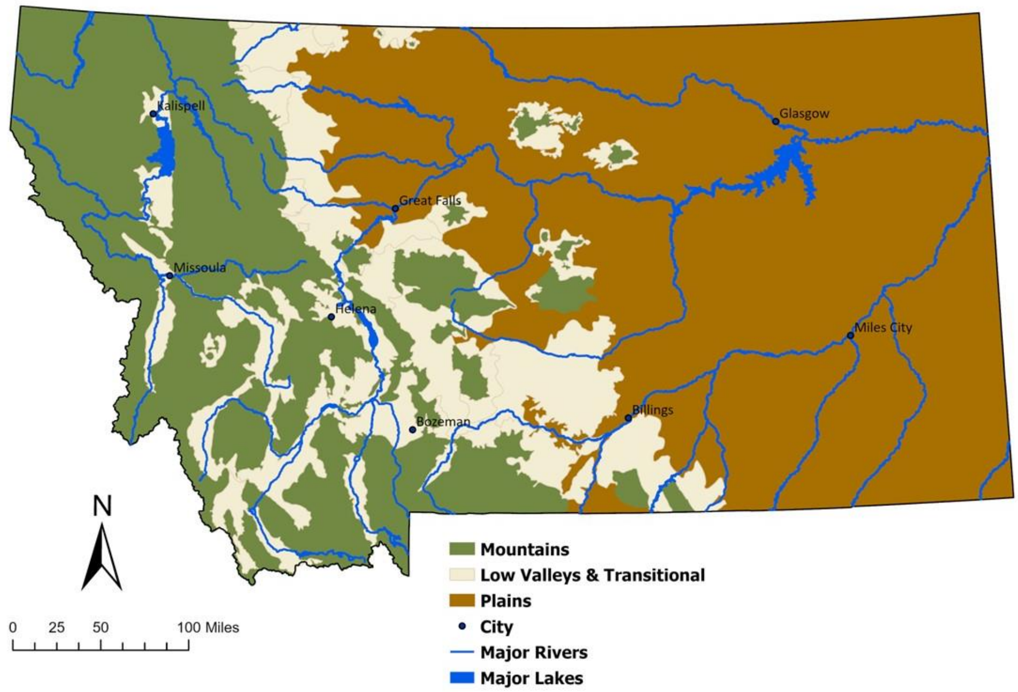

Figure 2-1. Map of Montana showing the Geographic Extent of the Mountains, Low Valleys and Transitional, and Plains Macroinvertebrate Zones.

2.1 Total Phosphorus (TP) and Total Nitrogen (TN): The Causal Variables

Table 2-3 provides TP and TN concentrations—the causal variables that must be measured as part of the narrative nutrient standards translation—organized by ecoregion. The department compiled and reviewed scientific literature and carried out its own studies[1,2,3,4,5] which demonstrate that TP and TN concentrations protective of aquatic life and recreation beneficial uses vary across the state (ecoregion by ecoregion). The highest TP and TN concentrations which protect the most sensitive beneficial use in each ecoregion or ecoregion group are shown in **Table 2-3**; harm to beneficial uses (e.g., aquatic life) at lower TN and TP concentrations are documented in the scientific literature. Simultaneous realization of paired TN and TP concentrations in **Table 2-3** could also affect beneficial uses, i.e., either the TN or the TP value may need to be at a lower concentration than shown in the table to ensure full protection. The department also uses stream hydrograph and biological patterns to identify appropriate index periods (i.e., time periods during which variables should be measured/data collected) applicable to wadeable streams and medium rivers for each ecoregion[3,4]. Montana streams and rivers are generally most vulnerable to excess nutrient impacts during the summer and early fall baseflow months, therefore values in **Table 2-3** shall be applied seasonally, at a minimum, per the time periods in the table. To identify the ecoregion applicable to a point source or monitoring location, start at the smallest geographic scale (column three from the left) and determine if the point source/monitoring location is situated in one of the listed level IV ecoregions. If it is not, then the nutrient concentration applicable to the larger-scale level III ecoregion (column two) applies.

Table 2-3. Ecoregional TP and TN Concentrations Protective of Aquatic Life and Recreation Beneficial Uses. The most sensitive beneficial use associated with the ecoregional concentrations is shown. Also shown are the minimum time periods when the concentrations should be applied.

Region	Ecoregion (Level III)	Ecoregion (Level IV)	Upper Threshold		Most Sensitive Beneficial Use Threshold is Associated With	Applicable Time Period	
			Total Phosphorus (µg/L)	Total Nitrogen (µg/L)		Start of Growing Season	End of Growing Season
Western	Northern Rockies (15)	all	40[a]	640[a]	Aquatic Life	July 1	September 30
Western	Canadian Rockies (41)	all	60[b]				
Western	Idaho Batholith (16)	all					
Western	Middle Rockies (17)	all except 17i					
Western	Middle Rockies (17)	Absaroka-Gallatin Volcanic Mountains (17i)	117[c]	Apply concentrations less than Middle Rockies (17) ecoregion threshold above	Aquatic Life	July 1	September 30
Transitional	Northwestern Glaciated Plains (42)	Sweetgrass Upland (42l), Milk River Pothole Upland (42n), Rocky Mountain Front Foothill Potholes (42q), and Foothill Grassland (42r)	226[d]	640[a]	Aquatic Life	July 1	September 30
Transitional	Northwestern Great Plains (43)	Non-calcareous Foothill Grassland (43s), Shields-Smith Valleys (43t), Limy Foothill Grassland (43u), Pryor-Bighorn Foothills (43v), and Unglaciated Montana High Plains (43o)[a]	41[e]	640[a]	Aquatic Life	July 1	September 30
Eastern	Northwestern Glaciated Plains (42)	all except those listed above as transitional for 42	150[f]	1300[g]	Aquatic Life	June 16	September 30
Eastern	Northwestern Great Plains (43) and Wyoming Basin (18)	all except for those listed above as transitional for 43, and 43c below				July 1	September 30
Eastern	Northwestern Great Plains (43)	River Breaks (43c)	Narrative Nutrient Standards Apply	Narrative Nutrient Standards Apply		June 16	September 30

[a]See endnote 6.
[b] Based on maintaining TP concentration below saturation (per Dodds et al. (2006) which is cited in the document in endnote 3). Concentration is <90[th] percentile of Middle Rockies reference streams.
[c]Based on the 90[th] percentile of the reference stream concentrations for this level IV ecoregion. Aquatic life are adapted to naturally higher TP concentrations in this ecoregion.
[d] Based on these streams' origins in the Canadian Rockies; equal to the 90[th] percentile of natural background for these ecoregions.
[e]Based on upper concentrations observed in the Elk Creek reference site.
[f]Per Heiskary et al. (2010) cited in the document in endnote 3. Concentration is below the 90[th] percentile of these ecoegions' reference streams.
[g]Based on protection of regional DO standards for aquatic life (see page 3-18 of the document in endnote 3).

2.2 Response Variables

See Table 2-1. Response variables in **Table 2-1** (e.g., benthic algae density, DO delta, Beck's Biotic Index (v3)) were selected because they respond to eutrophication (i.e., excess nutrient concentrations)[4,5,7], are readily measured, and have been linked by the department to the specified beneficial uses indicated.

2.3 The Narrative Nutrient Standards Translator: Site Specific Considerations

Some waterbodies have characteristics which may be given special consideration when applying the narrative nutrient standards translator. These cases are detailed in this section.

2.3.1 Wadeable Streams and Medium Rivers in Western and Transitional Ecoregions: Influence of Dams

In Montana, conditions resulting from the reasonable operation of dams on July 1, 1971, are natural (§ 75-5-306(2), MCA). Dense macrophyte beds are sometimes found downstream of dams; this is often due to the hydrologic modifications caused by the dam that result in more favorable conditions for macrophyte growth. Reaches immediately downstream of dams having dense macrophyte beds may have DO delta and Beck's Biotic Index (v3) values that do not meet the thresholds in **Table 2-1**. Adjustment to **Table 2-1** thresholds may be appropriate in these situations if the department is satisfied that dam operations are done in the best practicable manner to minimize harmful effects (ARM 17.30.636(1)), to be evaluated by the department on a case-by-case basis. The extent of the reach downstream of a dam affected in such a manner needs to be identified, and updated translator thresholds applied to the reach must be approved by the department and submitted to EPA for review and approval under factor 4 of 40 CFR 131(10)(g).

2.3.2 Western and Transitional Ecoregions: Spring Creeks

Spring creeks commonly have dense, naturally occurring macrophyte beds resulting in DO delta and Beck's Biotic Index (v3) values that may not meet the thresholds in **Table 2-1**; therefore, they are exempt from the narrative nutrient translator. Montana's spring creeks are inventoried[8] and this inventory must be used to identify these waterbodies. Unlisted but verified spring creeks may be evaluated and assessed on a case-by-case basis; these waterbodies must be approved as spring creeks by the department. The narrative nutrient standards (NEW RULE I) apply to spring creeks but will require development of site-specific causal and response variable criteria on a case-by-case basis. Such criteria must be approved by the department and submitted to EPA for review and approval.

Big Spring Creek (from its headwaters at 46.999211, -109.33704, to its mouth at the Judith River) is not included among the spring creeks described in this section (Big Spring Creek is influenced by 23 non-spring tributaries). **Instead, use the translator in Table 2-1 for Big Spring Creek.**

2.3.3 Wadeable Streams and Medium Rivers in the Low Valleys and Transitional Macroinvertebrate Zone: Effects of Specific Conductance

Department analysis[5] shows that streams and rivers whose specific conductivity (a measure of the dissolved salts in water) is below 200 µS/cm will likely have higher-than-expected Beck's Biotic Index (v3) scores and, conversely, those whose specific conductivity is above 200 µS/cm will likely have lower-than-expected Beck's Biotic Index (v3) scores. If the natural background specific conductance of a waterbody is less than or greater than 200 µS/cm, consideration may be given to the applicable Beck's Biotic Index (v3) threshold, subject to department review and approval. The department will require data and analysis indicating the specific conductivity is natural and the extent of the affected reach in question. Permittees and others are advised to consider any current guidance developed by the department. Site-specific Becks Biotic Index (v3) thresholds developed for a waterbody reach must be approved by the department and submitted to EPA for review and approval.

2.3.4 Waterbodies which are Atypical for the Ecoregion

It is possible that permittees and others may find that although they discharge to or are assessing a waterbody in the geographic areas described in **Table 2-2**, the waterbody does not appear to fit the general stream characteristics outlined here:

Western and Transitional Ecoregion streams are those that are usually perennial and generally clear during summer/fall base flow, have high-to-low gradient, are mostly gravel-to cobble-bottomed but whose substrate becomes finer in their lower extents, comprise a pool-riffle-run series longitudinally, have limited macrophyte populations (with exceptions, e.g., below dams and spring creeks), and generally support a salmonid fish population. This zone has a high degree of geographic overlap with Montana's A-1 and B-1 waterbody classifications (see ARM 17.30.607 through 614).

Eastern Ecoregion streams are those that are low-gradient and which may become intermittent during summer/fall baseflow, often have deep pools even when intermittent, commonly have a mud bottom, may be quite turbid, are often very sinuous, frequently have substantial macrophyte populations including near-bank emergent macrophytes, often have filamentous algae but sometimes only phytoplankton algae (i.e., as evidenced by a green color to the stream water), and generally support warm-water fish species (e.g., green sunfish, black bullheads, silvery minnows, etc.). This zone has a high degree of geographic overlap with Montana's B-3 and C-3 waterbody classifications (see ARM 17.30.607 through 613).

When a waterbody in one of these geographic areas does not appear to fit these general ecoregional patterns, permittees and others are advised to contact the department early in the process of establishing their monitoring sites and before collecting causal and response variable data. Permittees and others are advised to consider any current guidance developed by the department. A Use Attainability Analysis (ARM 17.30.602(39)) may be in order; these use classification changes must be approved by the department and submitted to EPA for review and approval under one or more of the six factors at 40 CFR 131(10)(g).

2.4 Data Collection Index Period, Minimum Data Collection

This section covers the index period during which nutrient and response variable data should be collected and provides minimum data collection requirements. If appropriate for a waterbody, the index period may be adjusted to include earlier or later dates on a case-by-case basis, subject to department review and approval. Permittees and others are advised to consider any current department guidance on this subject.

2.4.1 Nutrient, Response Variable, and Other Monitoring Data for Western and Transitional Ecoregions

Table 2-4 provides details on minimum data collection requirements for wadeable streams and medium rivers in western and transitional ecoregions. When implementing sampling methods for purposes of meeting the requirements in **Table 2-4**, permittees and others are advised to consider any current department guidance.

Table 2-4. Minimum Data Collection Requirements for Monitoring Sites in the Western and Transitional Ecoregions

Parameter	Associated Beneficial Use	Site Type	Annual Index Period	Minimum Annual Sampling Requirements	Threshold
1. Physical Variables					
Water Surface Slope (%)	Recreation, Aquatic Life	Near-field, far-field, and other monitoring sites	n/a	Determined once, generally at the time the sampling reach is established	1%
2. Response Variables					
Reach average benthic algal chlorophyll *a* (Chl*a*)	Recreation	Near-field, far-field, and other monitoring sites	July 1 to September 30	Twice during the index period, with a minimum of 4 weeks between sampling events	150 mg Chla/m^2
Reach average benthic algal ash free dry weight (AFDW)	Recreation	Near-field, far-field, and other monitoring sites	July 1 to September 30	Twice during the index period, with a minimum of 4 weeks between sampling events	35 g AFDW/m^2
% Bottom cover by filamentous algae, reach average	Recreation	Near-field, far-field, and other monitoring sites	July 1 to September 30	Monthly during the index period; two of the events must pair with the Chl*a* /AFDW sampling	30% bottom coverage
Dissolved Oxygen* Delta (daily maximum minus daily minimum)	Aquatic Life	Near-field, far-field, and other monitoring sites	July 1 to September 30	Instruments deployed annually for at least 14 continuous days which must be in August; longer datasets may include July and September. Logging must occur at least every 15 minutes. Deployment sites must correspond to reaches used to collect other response variable data.	Western and transitional ecoregions, streams/medium rivers with ≤1% water surface slope: 3.0 mg/L
Macroinvertebrates (reach-wide composite)	Aquatic Life	Near-field, far-field, and other monitoring sites	July 1 to September 30	Once per annual index period, corresponding to one of the other sampling events	Beck's Biotic Index (v3): Mountains = 35.1 Low Valleys and Transitional = 18.7
3. Nutrient Concentrations					
Total P, Total N	Recreation, Aquatic Life	Near-field, far-field, and other monitoring sites	July 1 to September 30	Twice during the index period, with a minimum of 4 weeks between sampling events	Concentration are greater than applicable ecoregional values in **Table 2-3**
Total P, Total N	Recreation, Aquatic Life	Tributaries	July 1 to September 30	At a sufficient frequency to characterize tributary loads as established in an AMP	Concentration are greater than applicable ecoregional values in **Table 2-3**

*Dissolved oxygen concentration standards in Circular DEQ-7 also apply, and must be examined using the instrument datasets.

For data collection bracketing point source discharges, data collection may not exceed 24 hours between upstream and downstream site sample collections.

Water surface slope is required for waterbodies in western and transitional ecoregions and should be determined using a laser level over the longitudinal extent of each monitored sampling reach. Permittees and others are advised to consider any current guidance developed by the department. Alternatively, a GIS may be used to determine slope subject to department review and approval.

Extraction of Chl*a* from samples, and the subsequent determination of Chl*a* concentration, must be performed in an analytical laboratory by a qualified laboratory technician or chemist. Benthic Chl*a* must be reported as milligrams chlorophyll *a* per square meter of stream bottom (mg Chl*a*/m^2). Chlorophyll *a* may be analyzed spectrophotometrically or by high-performance liquid chromatography (HPLC). If using spectrophotometric methods, use of the monochromatic equation for phaeopigment-corrected Chl*a* is required. **For both spectrophotometric and HPLC methods, Chl*a* extraction must be undertaken using warmed ethanol.** Analysis of benthic algae ash free dry weight (AFDW) must be undertaken using standard methods. Benthic algal AFDW must be reported as grams ash free dry weight per square meter of stream bottom (g AFDW/m^2). Percent bottom cover of the stream bottom may be assessed visually by trained personnel or via the use of aerial drone technology (subject to review and approval by the department). Permittees and others are advised to consider any current guidance developed by the department.

Dissolved oxygen must be measured using logging instruments deployed instream that have been properly calibrated in accordance with the manufacturer's instructions. When selecting instruments and evaluating different instrument deployment options, permittees and others are advised to consider any current guidance developed by the department. DO delta values must be expressed as a 7-day moving average however, for datasets ≥30 days long, DO delta values may—alternatively—be expressed as a calendar weekly average (n=4 weekly averages, minimum).

Macroinvertebrates must be collected using a reach-wide composite method using a D-frame kick net, sampling from downstream to upstream along the reach and collecting a sample at each of 11 transects; the 11 kick samples are composited to obtain a single sample which is representative of the entire reach. Permittees and others are advised to consider any current guidance developed by the department.

2.4.2 Nutrient, Response Variable, and Other Monitoring Data for Eastern Montana Ecoregions

Table 2-5 provides details on minimum data collection requirements for wadeable streams and medium rivers in eastern Montana ecoregions. When developing and implementing sampling methods to meet the requirements in **Table 2-5**, permittees and others are advised to consider any current department guidance.

Table 2-5. Data Collection Requirements for Different Types of AMP Monitoring Sites in Eastern Montana Ecoregions

Parameter	Associated Beneficial Use	Site Type	Annual Index Period	Minimum Annual Sampling Requirements	Threshold
1. Response Variables					
Dissolved Oxygen* Delta (daily maximum minus daily minimum)	Aquatic Life	Near-field, far-field, and other monitoring sites	Northwestern Glaciated Plains(42): 6/16-9/30 Northwestern Great Plains(43): 7/1-9/30	Instruments deployed annually for at least 14 continuous days which must be in August; longer datasets may include June, July, and September. Logging must occur at least every 15 minutes. Deployment sites must correspond to reaches used to collect causal variable data.	6.0 mg DO/L†
2. Nutrient Concentrations					
Total P, Total N	Aquatic Life	Near-field, far-field, and other monitoring sites	Northwestern Glaciated Plains(42): 6/16-9/30 Northwestern Great Plains(43): 7/1-9/30	Twice during the index period, with a minimum of 4 weeks between sampling events	Concentration are greater than applicable ecoregional values in **Table 2-3**
Total P, Total N		Tributaries		At a sufficient frequency to characterize tributary loads as established in the AMP	

*Dissolved oxygen concentration standards in Circular DEQ-7 also apply, and must be examined using the instrument datasets.
† Data collected during drought periods may be excluded from analysis. See department guidance for definition of drought.

For data collection bracketing point source discharges, data collection may not exceed 24 hours between upstream and downstream sample collection.

Dissolved oxygen must be measured using logging instruments deployed instream that have been properly calibrated according to the manufacturer's instructions. When selecting instruments and evaluating different instrument deployment options, permittees and others are advised to consider any current guidance developed by the department. DO delta values must be expressed as a 7-day moving average however, for datasets ≥30 days long, DO delta values may—alternatively—be expressed as a calendar weekly average (n=4 weekly averages, minimum).

3.0 Wadeable Streams and Medium Rivers: Use of Data for Determining if Beneficial Uses are Protected and Narrative Nutrient Standards are Achieved

This section provides decision tables pertaining to causal and response data collected per the Narrative Nutrient Standards Translator (**Table 2-1**). The department shall use such data, along with other relevant, credible data, to determine if beneficial uses are protected and narrative nutrient standards are achieved. These data may also inform if a phosphorus control focused strategy has resulted in the protection of beneficial uses in the waterbody.

If it is concluded that narrative nutrient standards are not achieved or depending on other circumstances, it may be necessary for the department to use a TP and/or TN concentration from **Table 2-3** for use in MPDES permits and for other department water quality work. See **Section 4.0**, **Part II** of this circular for additional information.

3.1 Expression of Nutrient Concentration and Response Variable Data

Data collected for purposes of determining if the narrative nutrient standards are achieved must be reduced and expressed as described in **Table 3-1**. The table provides information on how to express the data for individual sampling events/months and for larger datasets which have been collected over multiple years. The department has concluded that datasets 3-5 years in length will be necessary to accurately evaluate achievement/non-achievement of the narrative nutrient standards for waterbodies receiving discharge from an MPDES permit.

Table 3-1. Expression of Nutrient Concentration and Response Variables, and Associated Thresholds, for Purposes of Determining Achievement of the Narrative Nutrient Standards in Wadeable Streams and Medium Rivers

Applicable Ecoregions	Parameter	How the Parameter is Expressed	How the Parameter is Assessed across Time (2-5 years or longer)	Threshold
Western and Transitional, Eastern	Instream nutrient concentrations	Monthly arithmetic average	Long-term arithmetic average	Applicable ecoregional concentrations in **Table 2-3**
Western and Transitional	Benthic algal chlorophyll *a* (Chl*a*)	Weighted average of replicates (normally 11) collected across a reach	One sampling event exceedence is allowed every three years	150 mg Chla/m^2
Western and Transitional	Benthic algal ash free dry weight (AFDW)	Weighted average of replicates (normally 11) collected across a reach	One sampling event exceedence is allowed every three years	35 g AFDW/m^2
Western and Transitional	% Bottom cover by filamentous algae	Arithmetic average of replicates (normally 11) visually assessed across a reach	One sampling event exceedence is allowed every three years	30% bottom coverage
Western and Transitional	Macroinvertebrates	A single metric score generated from a reachwide composite sample	Arithmetic average of sampling-event metric scores	Beck's Biotic Index (v3) Mountains: 35.1 Low Valleys and Transitional: 18.7
Western and Transitional, Eastern	Dissolved Oxygen Delta (daily maximum minus daily minimum)	7-day average of daily DO deltas	All available 7-day average DO deltas compared to the applicable exceedence rates in **Table 2-1**.	Western and TransitionaL: 3.0 mg DO/L. Eastern: 6.0 mg DO/L during non-drought periods

3.2. Determining if Narrative Nutrient Standards are Achieved in Wadeable Streams and Medium Rivers

Tables 3-2 through **3-5** below provide all result combinations for the **Table 3-1** parameters and their associated thresholds. The tables apply to the specific beneficial uses and the geographic region(s) indicated. **For a site, "Meets" means the parameter value is less than or equal to the threshold in Table 3-1, "Exceeds" means the parameter is greater than the threshold—however the reverse applies to Beck's Biotic Index (v3). Higher Beck's Biotic Index (v3) scores are better, therefore "Exceeds" for this parameter means a site score is lower than (less than) the threshold.** Different result combinations inform achievement or non-achievement of the narrative nutrient standards. This construct is a weight-of-evidence approach in which each data type (nutrients and response variables) provides key information, however it is the response variables which provide the most important information.

Some data combination outcomes may warrant further investigation (e.g., scenario two in **Table 3-3**). If additional scientific investigation reveals an underlaying cause for the outcome that is not related to nutrient concentrations, the department may consider alternatives for determining more appropriate response variable threshold(s) for the waterbody or waterbody reach.

Table 3-2. Evaluation of Narrative Nutrient Standards for the Recreational Use in the Western and Transitional Ecoregions—All Wadeable Streams and Medium Rivers

Parameter			
Nutrient Causal Variables	**Benthic Chlorophyll *a*, Ash Free Dry Weight***	**% Filamentous Algae Cover**	**Are Narrative Nutrient Standards Achieved?**
Meets	Meets	Meets	Yes
Meets	Meets	Exceeds	No
Meets	Exceeds	Meets	No
Meets	Exceeds	Exceeds	No
Exceeds	Meets	Meets	Yes
Exceeds	Meets	Exceeds	No
Exceeds	Exceeds	Meets	No
Exceeds	Exceeds	Exceeds	No

*If either benthic chlorophyll *a* or ash free dry weight exceed their respective thresholds on more than one sampling event every three years, the conclusion is "Exceeds."

Table 3-3. Evaluation of Narrative Nutrient Standards for the Aquatic Life Use in the Western and Transitional Ecoregions for Wadeable Streams and Medium Rivers with Water Surface Slope ≤1%

Parameter			
Nutrient Causal Variables	**Dissolved Oxygen Delta**	**Macroinvertebrate Metric (Beck's Biotic Index v3)**	**Are Narrative Nutrient Standards Achieved?**
Meets	Meets	Meets	Yes
Meets	Meets	Exceeds	No*
Meets	Exceeds	Meets	No
Meets	Exceeds	Exceeds	No
Exceeds	Meets	Meets	Yes
Exceeds	Meets	Exceeds	No
Exceeds	Exceeds	Meets	No
Exceeds	Exceeds	Exceeds	No

*Investigation of other factors that may be depressing the macroinvertebrate metric may be warranted. Coordinate investigations with the department's Adaptive Management Program Scientist.

Table 3-4. Evaluation of Narrative Nutrient Standards for the Aquatic Life Use in the Western and Transitional Ecoregions for Wadeable Streams and Medium Rivers with Water Surface Slope >1%

Parameter		
Nutrient Causal Variables	**Macroinvertebrate Metric (Beck's Biotic Index v3)**	**Are Narrative Nutrient Standards Achieved?**
Meets	Meets	Yes
Meets	Exceeds	No
Exceeds	Meets	Yes
Exceeds	Exceeds	No

Table 3-5. Evaluation of Narrative Nutrient Standards for the Aquatic Life Use in the Eastern Ecoregions—All Wadeable Streams and Medium Rivers. ***See text for important caveat*****.**

Parameter		
Nutrient Causal Variables	**Dissolved Oxygen Delta**	**Are Narrative Nutrient Standards Achieved?**
Meets	Meets	Yes
Meets	Exceeds	No
Exceeds	Meets	Yes
Exceeds	Exceeds	No

Important Caveat for Table 3-5. Based on patterns observed in eastern ecoregion reference sites, average weekly dissolved oxygen delta values during drought periods will increase above the threshold in **Table 3-1** (6.0 mg/L) strictly as a result of drought. Therefore, data compared to the threshold and used for **Table 3-5** should be collected during non-drought periods only. For a definition of drought and a website where drought data can be derived, permittees and others are advised to consider any current guidance developed by the department.

3.3 Dataset Reset

Nutrient reduction activities undertaken in a watershed, including a watershed in an AMP, may justify a reset of the nutrient and response variable dataset used to evaluate nutrient control effectiveness and achievement of the narrative nutrient standards. Datasets must properly represent current conditions. A dataset reset means establishing a new period of record for evaluating instream nutrient and response variable data which begins after nutrient reduction activities have been implemented and these changes have had the potential to affect response variables at the monitoring sites. Changes could come from improvement in the facility discharge, nonpoint source controls, or both. Permittees may request that a dataset be reset. The department will determine if and when a dataset reset is appropriate, in accordance with an AMP and the conditions of the MPDES permit.

4.0. Large Rivers: The Narrative Nutrient Standards Translator *and* Data Evaluation to Determine if Beneficial Uses are Protected and Narrative Nutrient Standards are Achieved

Protection of beneficial uses and achievement of narrative nutrient standards in large rivers must be evaluated using the translator in **Table 4-1**. The department has completed its most detailed data collection and mechanistic modeling work on the lower Yellowstone River[9] and therefore the translator is more specific for it than for other large river segments where modeling work is unfinished or has not commenced.

Table 4-1. The Narrative Nutrient Standards Translator for Large Rivers. An "X" indicates the parameter applies and is required to be measured at monitoring sites to translate the narrative nutrient standards per NEW RULE I.

Benefical Use, Applicable River, Reach				Causal Variable and Threshold	Response Variable (threshold)		
Beneficial Use	**River**	**Reach**	**Applicable Time Period**	**TP, TN Concentration***	**DO Delta**	**Benthic algal Chl*a* †; AFDW†**	**% filamentous algae bottom cover†**
Recreation	Yellowstone River mainstem	From the Bighorn River confluence to the Power River confluence	August 1 to October 31	**X** TP: 55 µg/L **X** TN: 655 µg/L	n/a	**X** (150 mg Chla/m^2; 35 g AFDM/m^2)	**X** (30% cover)
Aquatic Life	Yellowstone River mainstem				**X** (4.1 mg/L)	n/a	n/a
Recreation	Yellowstone River mainstem	From the Powder River confluence to the Stateline		**X** TP: 95 µg/L **X** TN: 815 µg/L	n/a	**X** (150 mg Chla/m^2; 35 g AFDM/m^2)	**X** (30% cover)
Recreation	Other Large River Reaches (see **Table 1-1**)	Variable		**X** TP‡ **X** TN‡	n/a	**X** (150 mg Chla/m^2; 35 g AFDM/m^2)	**X** (30% cover)

*Allowable exceedance rate is 20% of reach-specific TP or TN criteria. For causal variables shown as ranges, an allowable 20% exceedance rate will apply to any site-specific TP or TN concentration identified.

†Along shore areas at river transects where approximatly 10% or more of the river transect is wadeable.

‡ No specific concentrations are provided; site specific criteria will need to be determined case-by-case, generally using mechanistic modeling methods.

Mechanistic modeling work may be underway for other large river segments; check with the department's Water Quality Standards & Modeling Section for status. Field data collected to support model development may be used to assess if the narrative nutrient standards are achieved and a use-support assessment may be completed even before a model is completed.

For large river reaches where thresholds have not been provided in **Table 4-1**, mechanistic modeling and field data collected to support model development may be used to identify causal variable concentration thresholds, as well as DO delta thresholds for aquatic life use protection. Site-specific thresholds are subject to department review and approval and must be submitted to EPA for review and approval.

Dissolved oxygen must be measured using in-river deployed logging instruments that have been properly calibrated in accordance with the manufacturer's instructions. When selecting instruments and evaluating different instrument deployment options, permittees and others are advised to consider any current guidance developed by the department. Instruments are to be deployed for at least 14 continuous days which must be in August; longer datasets may include September. Logging must occur at least every 15 minutes. DO delta values must be expressed as a 7-day moving average however, for datasets ≥30 days long, DO delta values may—alternatively—be expressed as a calendar weekly average (n=4 weekly averages, minimum).

4.1. Evaluation of Data to Determine if Large River Beneficial Uses are Protected and Narrative Nutrient Standards are Achieved

Data collected for purposes of determining if the narrative nutrient standards are achieved in large rivers must be reduced and expressed as described in **Table 3-1** of the previous section.

Tables 4-2 and **4-3** below provide all result combinations for the parameters in the large river narrative nutrient standards translator (**Table 4-1)**. **Tables 4-2** and **4-3** apply to the specific beneficial uses indicated. **For a monitoring location, "Meets" means the parameter is less than or equal to the threshold provided in Table 2-1, "Exceeds" means the parameter is greater than the threshold.** Different result combinations inform achievement or non-achievement of the narrative nutrient standards.

Table 4-2. Evaluation of Narrative Nutrient Standards for the Recreational Use in Large Rivers

Parameter			
Nutrient Causal Variables	**Benthic Chlorophyll *a*, Ash Free Dry Weight***	**% Filamentous Algae Cover**	**Are Narrative Nutrient Standards Achieved?**
Meets	Meets	Meets	Yes
Meets	Meets	Exceeds	No
Meets	Exceeds	Meets	No
Meets	Exceeds	Exceeds	No
Exceeds	Meets	Meets	Yes
Exceeds	Meets	Exceeds	No
Exceeds	Exceeds	Meets	No
Exceeds	Exceeds	Exceeds	No

*If either benthic chlorophyll *a* or ash free dry weight exceed their respective thresholds on more than one sampling event every three years, the conclusion is "Exceeds."

Table 4-3. Evaluation of Narrative Nutrient Standards for the Aquatic Life Use in Large Rivers

Parameter		
Nutrient Causal Variables	**Dissolved Oxygen Delta**	**Are Narrative Nutrient Standards Achieved?**
Meets	Meets	Yes
Meets	Exceeds	No
Exceeds	Meets	Yes
Exceeds	Exceeds	No

The dataset reset principles outlined in **Section 3.3** above also apply to large rivers.

4.1.1 Large Rivers: Influence of Dams

In Montana, conditions resulting from the reasonable operation of dams on July 1, 1971, are natural (§ 75-5-306(2), MCA). Dense macrophyte beds are sometimes found downstream of dams; this is often due to the hydrologic modifications caused by the dam that result in more favorable conditions for macrophyte growth. Reaches immediately downstream of dams having dense macrophyte beds may have DO delta values that do not meet the thresholds in **Table 4-1**. Adjustment to **Table 4-1** DO delta thresholds are allowed in these situations if the department is satisfied that dam operations are done in the best practicable manner to minimize harmful effects (ARM 17.30.636(1)), to be evaluated by the department on a case-by-case basis. The extent of the reach downstream of a dam affected in such a manner needs to be identified, and updated translator parameters for the reach must be approved by the department and submitted to EPA for review and approval under factor 4 of 40 CFR 131(10)(g).

5.0 OTHER WATER QUALITY STANDARDS LINKED TO NUTRIENTS

In addition to the narrative nutrient standards, there are several water quality standards closely linked to nutrient-induced effects; these include the following response variables: (1) dissolved oxygen concentrations, (2) pH, (3) turbidity (as a function of increased phytoplankton biomass), and (4) total dissolved gas (TDG). Water quality standards and thresholds associated with these response variables are found in: (1) for dissolved oxygen, Circular DEQ-7; (2) for pH, within specific water-use classifications found in ARM Title 17, chapter 30, subchapter 6; (3) for turbidity, within specific water-use classifications found in ARM Title 17, chapter 30, subchapter 6; and (5) for TDG, in Department Circular DEQ-7, but accounting for the fact the dissolved oxygen is only a fraction of TDG. Achievement/non-achievement of these water quality standards are evaluated independently in accordance with other department procedures and guidance.

6.0 NONDEGRADATION

When determining whether activities will result in nonsignificant changes in existing water quality for TN and TP in surface waters, the criteria applicable for parameters for which there are only narrative water quality standards at ARM 17.30.715(1)(h) will apply. ARM 17.30.715(1)(h) indicates that changes in the quality of water for any parameter for which there are only narrative water quality standards are nonsignificant, and are not required to undergo review under 75-5-303, MCA, if the changes will not have a measurable effect on any existing or anticipated use or cause measurable changes in aquatic life or ecological integrity. When implementing the nondegradation policy at 17.30.715(1)(h), an evaluation of response variables through the use of a model or models must be undertaken to evaluate whether measurable changes in aquatic life or ecological integrity will be likely to result from a proposed activity.

PART II: IMPLEMENTATION OF THE ADAPTIVE MANAGEMENT PROGRAM

1.0 INTRODUCTION TO THE ADAPTIVE MANAGEMENT PROGRAM

Implementation of narrative nutrient standards via the adaptive management program and other regulatory pathways is shown in **Figure 1-1**. The adaptive management program is a long-term compliance schedule with interim performance milestones to be evaluated annually and at each permit renewal cycle. These performance milestones will be based on the principles of improving facility operations, understanding waterbody response variable characteristics, and reducing nonpoint source nutrient loading as soon as possible given each permittee's unique circumstances. Performance milestones must be based on the considerations listed in **Section 1.1, Part II**, specific to individual permittees and waterbodies, and must be consistent with the requirements in ARM 17.30.1350.

The department will evaluate each point source with nutrients as a pollutant of concern for reasonable potential to cause or contribute to an exceedance of the narrative nutrient standards. For point sources with reasonable potential, adaptive management can be used by the department to prioritize phosphorus reduction, where appropriate. Reduction of phosphorus is an initial requirement of adaptive management and will be implemented if appropriate (see decision point in the upper left part of **Figure 1-1**). At a minimum, nitrogen limits will be implemented per state and federal regulations for anti-backsliding (e.g., ARM 17.30.1344(2)(b)). If phosphorus control is successful in protecting receiving water body beneficial uses and downstream uses, additional controls will not be necessary. However, regardless of the success of phosphorus control, ongoing monitoring will continue to be required. If phosphorus-focused control is not successful in protecting water quality and beneficial uses, then phosphorus *and* nitrogen controls are implemented. Nitrogen sources in watersheds are often dispersed among different sources and adaptive management at this stage allows permittees to examine the potential for effective reduction of nutrients in their watershed in an iterative manner (see circular component in lower right area of **Figure 1-1**). The entire process is adaptive in that it allows for an incremental approach (phosphorus focus first, then nitrogen) and incorporates flexible decision-making which can be adjusted as management actions and other factors become better understood in each watershed. Note that adaptive management is a complex, iterative process with the potential for feedbacks which may not all be presented in **Figure 1-1**.

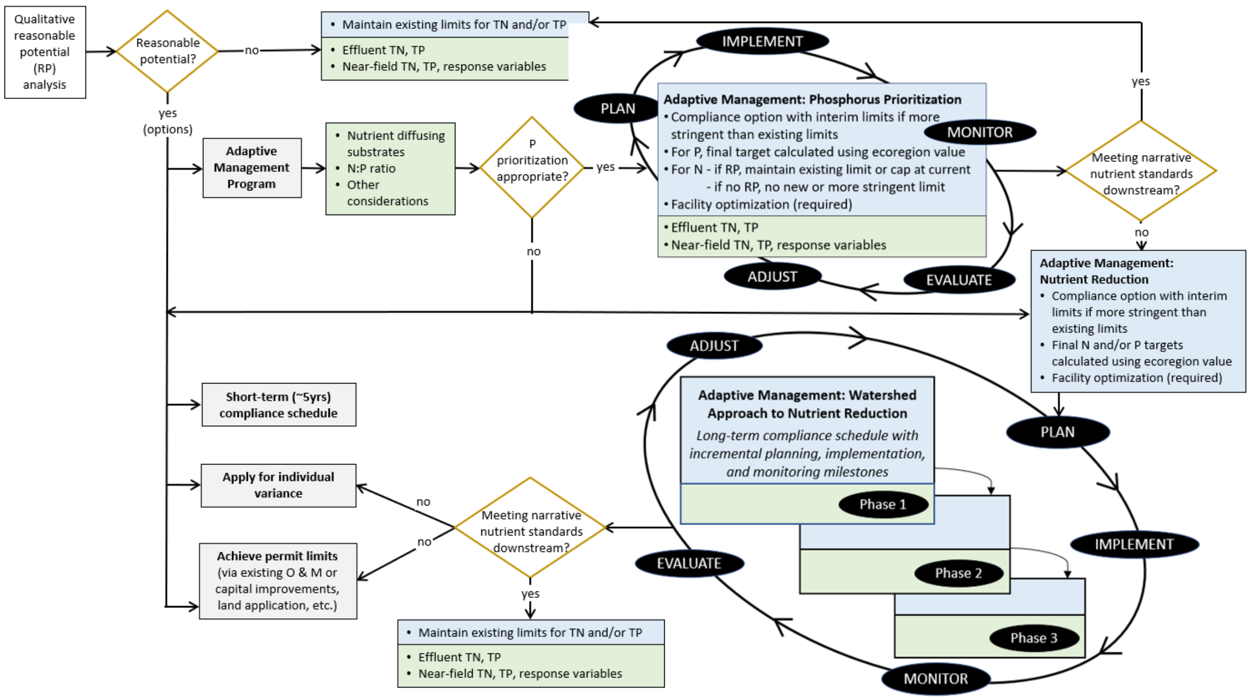

Figure 1-1. Flowchart Outlining Implementation of Narrative Nutrient Standards and Steps in the Adaptive Management Program and Other MPDES Permit Compliance Options. In the colored boxes blue areas describe permit limits and conditions, green areas indicate monitoring requirements. Key decision points in the figure are diamond shaped.

Figure 1-1 also addresses permittees who need or choose to select other regulatory pathways instead of adaptive management to achieve the narrative nutrient standards. Additional pathways include, for example, water quality standard variances and more traditional compliance schedules that do not include an AMP. *These options have separate and distinct rules and requirements that are not included in this circular.*

The department adopted this circular in conformance with the statutory requirements found in Section 75-5-321, MCA. This circular contains adaptive management implementation requirements for Montana's narrative nutrient standards found at ARM 17.30.637(1)(e) for point sources whose discharges contains total phosphorus and/or total nitrogen that has the reasonable potential to cause or contribute to an exceedance of the narrative nutrient standards. This circular is applicable only to the implementation of these narrative nutrient standards. The methods, implementation process, and department approach described in this circular are not applicable to any other department circular water quality standards including but not limited to nitrate + nitrite and ammonia.

1.1 Program Eligibility Requirements

Point source permittees choosing to enter the adaptive management program must satisfy the following program eligibility requirements:

- It must be demonstrated that the point source has a reasonable potential to cause or contribute to an exceedance of the narrative nutrient standards due to discharges of total nitrogen (TN) and/or total phosphorus (TP);

- The point source permittee(s) must submit an adaptive management plan (AMP) with monitoring and implementation elements, to be approved by the department; and
- Applicable program fees must be submitted to the department.

In developing an AMP, each permittee will consult with the department's adaptive management program scientist to determine initial milestones while taking into consideration the following:

- Status of the treatment facility's performance and optimization;
- Appropriateness of phosphorus prioritization (see **Section 2.0**);
- Characterization of nutrient causal and response variables in the receiving waterbody;
- Existence of prior nutrient source assessment studies in the watershed;
- Attaining water quality goals as soon as possible; and
- Opportunities for watershed-scale nonpoint source project implementation.

An AMP may continue for multiple permit cycles if the department considers interim milestones to be achieved and that the permittee continues to be eligible. Requirements for AMPs are the same for wadeable streams, medium rivers, and large rivers, and are covered in **Section 6.0** here in **Part II**. Other considerations for entering the adaptive management program are provided in department guidance.

1.2 Identify Waterbody Size

For purposes of entering the adaptive management program and applying the correct narrative nutrient standards translator, each receiving waterbody must be identified as a wadeable stream, medium river, or large river. Please see **Section 1.0** of **Part I** of this circular for instructions on this.

1.3 Organization of the Rest of Part II

For the purpose of implementing the adaptive management program, NEW RULE II contains requirements specific to the department and requirements for AMPs which are the responsibility of permittees (to be later reviewed and approved by the department). As such, the remainder of **Part II** of this Circular is organized as follows:

- **Sections 2.0, 3.0, 4.0, and 5.0 address requirements specific to the department regarding AMPs it may receive (permittees are advised to review these sections).**
- **Section 6.0 addresses requirements for AMPs; this section should be reviewed by permittees and others developing AMPs for submittal to the department.**
- **Section 7.0 addresses large rivers and water quality modeling; this section should be reviewed by permittees discharging to large rivers or those planning on developing a mechanistic or conceptual water quality model for inclusion in an AMP.**
- **Section 8.0 addresses integration of the Adaptive Management Program and Total Maximum Daily Load (TMDL) Program.**

2.0. Determining if Phosphorus Prioritization is Appropriate for the Point Source and the Waterbody

Section 75-5-321, MCA, requires that the department prioritize the minimization of phosphorus where appropriate, accounting for site-specific conditions. NEW RULE II provides factors the department may consider when evaluating if phosphorus prioritization is appropriate for a discharge facility. This section provides additional details to support requirements in the rule.

2.1 Techniques for Identifying the Limiting Nutrient in a Waterbody

Nutrient diffusing substrates (NDS) provide a mechanism to determine if phosphorus, nitrogen, or both control algae growth and primary productivity in a location of a stream or river. Nutrient diffusing substrates may be deployed in flowing waterbodies for the purpose of determining the limiting nutrient(s). A limiting nutrient is the one present in the least quantity; this is an important factor in controlling algae growth in a waterbody. The ratio of TN to TP (i.e., the Redfield Ratio) of ambient water samples from the waterbody may also be used to inform this analysis, but water TN:TP ratios should be used in conjunction with (not as an alternative to) NDS.

Nutrient diffusing substrates may be deployed upstream and downstream of a facility in the same sites where other instream data are collected (more on these sites in **Section 6.0**). Results from NDS deployed downstream of a point source should be considered together with the status of phosphorus and nitrogen treatment and effluent concentrations from the facility. Downstream of a discharge, a receiving waterbody (via NDS data) could show nitrogen limitation but, rather than reducing nitrogen concentrations in the effluent, it might be effective (from a cost and engineering perspective) for a permittee to first lower facility effluent phosphorus concentrations and—as a result—move the waterbody towards P limitation and achievement of the narrative nutrient standards. Readers are advised to consider any current department guidance on this subject.

In areas where nitrogen is the primary limiting nutrient (e.g., in the Absaroka-Gallatin Volcanic Mountains level IV ecoregion in **Table 2-3** in **Part I**, where natural background phosphorus is already at saturating concentrations), nitrogen control will likely be required in addition to phosphorus control. Some MPDES permits regulate activities where total nitrogen is present in the effluent while total phosphorus is absent. For these circumstances, the department shall limit total nitrogen rather than total phosphorus.

The department may find that phosphorus-focused control at a point source is not protecting beneficial uses nor achieving the narrative nutrient standards based on sufficient credible data, including response variable data collected from downstream near field sites. For such cases, if a permittee would like to continue under the adaptive management program, the department will require the permittee to develop a watershed-scale plan for inclusion in their AMP that will include actions for addressing nitrogen (see **Section 6.6**).

3.0 MPDES Discharges that May Affect a Lake, Reservoir, or a Downstream waterbody

Loading of nutrients to lakes and reservoirs occurs year-round and, in northern temperate regions like Montana, spring runoff normally constitutes the bulk of the annual loading. Although the bulk of nutrient loading to lakes and reservoirs occurs in spring, undesirable aquatic life (e.g., phytoplankton algae blooms) can occur in lakes and reservoirs later, during summer and fall, if annual nutrient load is excessive or elevated nutrient concentrations persist through those seasons. The department must consider elements in this section when developing MPDES permit limits for nutrients, if nutrients will affect a lake, reservoir, or downstream waterbody.

3.1 Discharges Directly to a Lake or Reservoir

Permittees discharging nutrients directly to a lake or reservoir will be required to have year-round monitoring for TP and/or TN. Where MPDES effluent limits are required for direct discharges of nutrients to a lake or reservoir, the department may apply these effluent limits year-round. In addition, and in consultation with the department and under their AMP (if applicable), permittees must determine the proportion of their TP and/or TN load relative to the total annual load to the lentic waterbody. This data must be collected over at least two calendar years. Depending upon the permittee's proportion of the annual load, the department may require the permittee to undertake in-lake response variable monitoring (e.g., phytoplankton chlorophyll *a*), to be determined in consultation with the department. AMP actions to protect, maintain, and potentially improve the lake condition shall be determined on a case-by-case basis. In determining their contribution to the annual load, permittees and others are advised to consider any current department guidance.

3.2 Discharges to a Flowing Waterbody that May Affect a Downstream Lake or Reservoir

Permittees whose discharge is likely to affect a downstream lake or reservoir will be informed of this situation by the department. The department may determine year-round TP and/or TN permit limits are necessary, to be determined on a case-by-case basis.

3.3 Discharges to a Flowing Waterbody that May Affect Beneficial Uses in a Downstream Reach

Beneficial uses downstream of point source discharges must be protected. A reach of a wadeable stream, medium river, or large river downstream from an MPDES discharge may have beneficial uses sensitive to phosphorus and/or nitrogen concentrations from the upstream point source. In these cases, the department may carry out case-by-case evaluations for each applicable MPDES permit. These evaluations may lead to MPDES nutrient limits adjusted to protect a downstream waterbody.

4.0. NUTRIENT CONCENTRATIONS FOR USE IN MPDES PERMITS AND OTHER DEPARTMENT PROGRAMS

The translators in **Sections 2.0** and **4.0** of **Part I**, together with the decision tables in **Sections 3.0** and **4.0** of **Part I** provide the means to determine if narrative nutrient standards are achieved. When it is concluded that narrative nutrient standards are not achieved, or depending on other circumstances, it may be necessary for the department to identify a TP and/or TN concentration protective of recreation and aquatic life beneficial uses for application in MPDES permits and other department programs. TP and/or TN concentrations must be selected from **Tables 2-3** and **4-1** of **Part I** unless compelling waterbody-specific scientific information indicates a concentration or concentrations greater than the table values is protective of the most sensitive beneficial use. If waterbody-specific information indicates TP and/or TN concentrations greater than those in **Tables 2-3** and **4-1** of **Part I** are more appropriate for protection of beneficial uses**,** the department may initiate a formal rulemaking process, including submission to EPA for review and approval. Permittees and others are advised to consider any current guidance developed by the department.

Different department work units may have program-specific guidance on how they collate TP and/or TN concentration data, and how they evaluate and apply these data in relation to **Tables 2-3** and **4-1** of **Part I**. Methods used by a department work unit for evaluating and applying **Tables 2-3** and **4-1** nutrient concentration data must be communicated to other department work units working in the same subject area. This communication must occur prior to any program-specific application of the nutrient concentrations.

5.0 DEPARTMENT FIELD AUDITS OF MONITORING LOCATIONS

This circular requires the implementation of complex field data-collection methods. To ensure high quality data are collected, the department shall carry out field audits to ensure all data collection protocols are being properly adhered to. The department shall audit a minimum of 10% of permittees under the adaptive management program per year. Audits will be performed in the field by department staff having expertise in the applicable data collection methods and who will accompany the data-collection entity (permittee, their consultant, or other responsible agent) to observe the data collection event as it proceeds. The department shall prepare an annual report summarizing audit findings and permittees not properly adhering to protocols established in their AMP will be informed in writing and required to correct the issue prior to the next field sampling event.

6.0 REQUIREMENTS FOR ADAPTIVE MANAGEMENT PLANS: WADEABLE STREAMS, MEDIUM RIVERS, AND LARGE RIVERS

Per NEW RULE II, permittees entering the adaptive management program are required, at a minimum, to (1) collect monthly effluent data for TP and TN, (2) submit an AMP which includes causal and response variable monitoring, (3) examine pollutant minimization activities which may reduce nutrient concentrations in their facility’s effluent and the watershed, and (4) report annually on progress. This section provides details related to these activities. Applicable, credible data collected prior to the adoption of this circular may be used to inform an AMP including watershed activities whose goal is to reduce nutrient loadings.

6.1 Identify Waterbody Beneficial Use Classification, Watershed, and Applicable Translator

Permittees should refer to ARM 17.30.607 through 613 and identify their receiving waterbody's beneficial use classification, then review the associated beneficial uses described in ARM 17.30.621 through 631.

AMPs are based on United States Geological Survey (USGS) hydrologic unit code (HUC) watershed boundaries. Different ecoregions may exist within a single watershed because ecoregion boundaries are not watershed-based. This could result in a permittee identifying, for example, both transitional and eastern ecoregion nutrient concentrations and response variables as being applicable to their watershed.

An AMP submitted to the department must describe the applicable use class of the waterbody, which translator best applies to them (**Sections 2.0** and **4.0**, **Part I**), and which response variables will be measured, along with a justification; this is subject to department review and approval. Permittees are advised to consider any current department guidance to address such situations, and to select parameters most appropriate for their near field sites.

The department acknowledges that there may be streams that do not fit the typical ecoregional patterns; if a permittee or other entity believes this situation applies, see **Section 2.3.4** in **Part I.**

6.2 Types of Sites in an Adaptive Management Plan (AMP)

Sampling site locations in a submitted AMP are subject to department review and approval. **At a minimum, an AMP must comprise one near field site upstream and one near field site downstream of each point source discharge** (**Figure 6-1**). The department expects a permittee to establish the sampling sites in an approved AMP as long-term monitoring locations. A permittee may request modifying the monitoring locations. The downstream near field site (or sites) is the point of compliance for determining if the narrative nutrient standards are achieved. Permittees are advised to consider any current guidance on locating these sites that has been developed by the department.

Data collected at the near field sites under the AMP, as well as other credible data (if available), will be used by the department to determine if phosphorus prioritization has been successful in protecting beneficial uses and achieving the narrative nutrient standards. Other credible data include chemical and biological information from locations in the watershed that are useful for evaluating point source P-control effectiveness and beneficial use support. Sources for such data might be, for example, a conservation district, a water quality protection district, or similar entity.

For permittees in the early phase of the adaptive management program, two near field sites may be all that is necessary (see example, **Figure 6-1**) to determine achievement of standards for purposes of permit compliance. However, downstream far field sites may be required by the department to ensure attainment of water quality standards of the entire receiving waterbody or downstream waterbodies (far field sites are further discussed in **Section 6.6**).

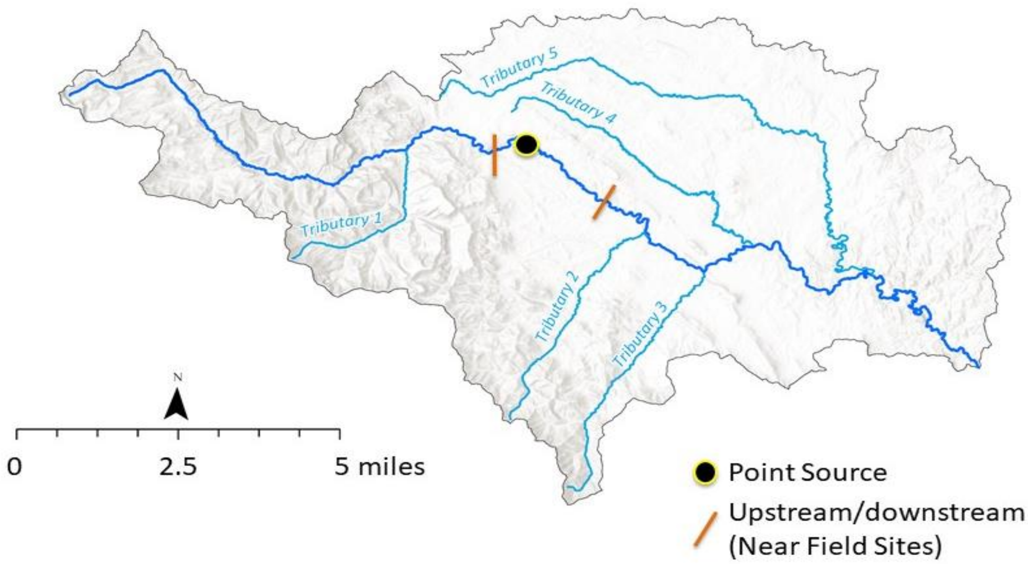

Figure 6-1. Example of an AMP Watershed with Near Field Sites Bracketing a Single Point Source.

6.3 Nutrient Concentration Data Requirements

A permittee must monitor TP and TN in the effluent, and at all near field and far field department-approved sites. Instream TN and TP data must be collected at least at the same frequency and during the same monitoring events as the instream response variables. Nutrient data will be used to characterize nutrient concentrations and loads in the near field area upstream and downstream of the point-source discharge point. At a minimum, TP and TN must be measured, however soluble forms (e.g., nitrate, and soluble reactive phosphorus (SRP)) can provide important information about sources and the department encourages their collection during monitoring events for TN and TP.

Table 6-2 provides the required reporting values (RRVs) for TP and TN, the RRVs for nitrogen that can be used to compute total nitrogen from its constituents, and the RRV for SRP. Permittees are also advised to consider any current department guidance on collecting instream nutrient samples.

Table 6-2. Required Reporting Values[a,b] for Phosphorus and Nitrogen Measurements

Nutrient		Method of Measurement	Required Reporting Value
Total phosphorus		Persulfate digestion	3 µg/L
Total nitrogen		Persulfate digestion	70 µg/L
Total nitrogen	Sum of:	(a) total kjeldahl nitrogen	225 µg/L
		(b) nitrate + nitrite	See RRVs below
Nitrate- as N			20 µg/L
Nitrite- as N			10 µg/L
Nitrate + Nitrite-as N			20 µg/L
Soluble reactive phosphorus (SRP)		Sampled filtered, 0.45 µm	1 µg/L

[a] See definition for required reporting values found in footnote 19 of Department Circular DEQ-7.

[b] The total nitrogen persulfate method is used for instream measurements only and cannot be used for effluent. Persulfate digestion is not a 40 CFR Part 136 approved method.

6.4 Pollutant Minimization Activities for Point Sources, including Optimization

Permittees are required to examine pollutant minimization activities which may reduce nutrient concentrations in the effluent. Nutrient reductions may be achieved by optimization, conventional capital improvements, or both. The department offers technical support and training to municipal wastewater treatment plant operators to achieve nutrient reductions through operational optimization. This section provides requirements, recommendations, and resources for undertaking this work. Permittees are advised to consider any current department guidance on these topics.

A strong optimization effort should begin with monitoring of the influent, effluent, and internal points within the system such as between cells, tanks, or zones. The permittee should monitor ammonia, nitrate, nitrite, dissolved oxygen, alkalinity, pH, and oxidation-reduction potential at each location to assess the wastewater chemistry in each treatment phase. This chemistry can inform decision making regarding nitrification or denitrification (modify anaerobic and aerobic zones) in the system. The department recommends consultation with its technical assistance staff through the department's optimization program or with qualified third-party wastewater optimization experts.

For lagoons, the department recommends regular sludge depth recording and sludge removal when needed to ensure proper health and function of the lagoon. Proper sludge maintenance increases retention time and thus treatment effectiveness.

6.5 Information Provided by Changes Upstream and Downstream of a Point Source

Near field site datasets collected upstream and downstream of a point source provide important information about relative changes in nutrient concentrations and response variables and the effectiveness of phosphorus-focused point source control (as well as other watershed nutrient-control work). Data from near field sites, along with other relevant information, shall be used to inform next steps in adaptive management. Based on the outcomes of the upstream- and downstream-near field sites, different scenarios will be encountered; these are outlined in **Table 6-3**. The implications/actions in the table's right column should be used to guide next steps.

Table 6-3. Scenarios Resulting from the Outcome of Analyses Undertaken in Part I Section 3.2. Achieving/not achieving refers to whether beneficial uses are protected/the narrative nutrient standards are achieved at the near field monitoring locations indicated.

Scenario	Upstream Site(s)	Downstream Site(s)	Implications/Actions
A	Achieving	Achieving	Uses are supported/the narrative nutrient standards are achieved. Continue to monitor.
B	Achieving	Not Achieving	Uses are not supported/the narrative nutrient standards are not achieved. Evaluate further phosphorus control and potentially nitrogen control for the point source, and/or implement an AMP watershed plan to address phosphorus and nitrogen control at the watershed scale
C	Not Achieving	Achieving	Uses are supported/the narrative nutrient standards are achieved below the point source; continue to monitor. Upstream of the point source, the department should encourage/coordinate nutrient reduction work in the upstream watershed.
D	Not Achieving	Not Achieving	Uses are not supported/the narrative nutrient standards are not achieved. Evaluate further phosphorus control and potentially nitrogen control for the point source, and/or implement an AMP watershed plan to address phosphorus and nitrogen control upstream of the point source, downstream of the point source, or both.

6.6 Developing a Watershed-scale Plan for Inclusion in an Adaptive Management Plan

If the department concludes that prioritization/limitation of phosphorus alone is insufficient to achieve the narrative nutrient standards, a permittee's continued participation in the adaptive management program will require the inclusion, in the AMP, of a watershed-scale plan for the reduction of nutrients ("watershed plan"). All elements in this section must be incorporated into an AMP watershed plan. For large rivers, outputs from a mechanistic model may also be used to inform the AMP watershed plan (large rivers and modeling are described in **Section 7.0** here in **Part II**). A watershed plan may be developed and included in an AMP prior to a department finding that P prioritization has not been successful in supporting beneficial uses and achieving the narrative nutrient standards.

6.6.1 Identification, Quantification, and Characterization of Sources of Nutrient Contributions in the AMP Watershed

To the extent feasible, the permittee(s) must identify, quantify, and characterize major nutrient sources in their watershed and provide them and their locations in the AMP. Established watershed restoration plans and total maximum daily load documents (**Section 8.0**) should be consulted to synchronize sampling and reduce redundant efforts.

Robust monitoring within the watershed will be necessary for a successful AMP. Existing scientific information concerning algal growth dynamics, applicable scientific data specific to the region, locally collected data from the waterbody, and characterization of the point source effluent(s) and the nonpoint sources may all be used by the permittee to quantify and describe nutrient sources and loads in the watershed. Consideration should be given to the magnitude and extent of nonpoint source nutrients already in the receiving waterbody and the degree to which the point source(s) alone can reduce nutrient concentrations below algal growth saturation concentrations. Nutrient control projects downstream of a point source can be undertaken and may be credited to the point source's permitted load so long as no hot spots (localized areas of water quality exceedances) remain downstream of the facility after the projects have been completed.

For small watersheds with a single point source (**Figure 6-2**), the two near field sites, a downstream far field site, and strategically selected tributary sites may be all that are necessary to adequately characterize nutrient loads in the watershed. A downstream far field site should normally be placed near the terminus of the AMP watershed (i.e., the point where the waterbody flows into the next watershed) but may be placed further upstream subject to department review and approval. Tributary sites are used to track tributary nutrient loading and, as illustrated in **Figure 6-2**, may be used to monitor the effect of nonpoint source nutrient reduction projects (see Tributary 4 in **Figure 6-2**).

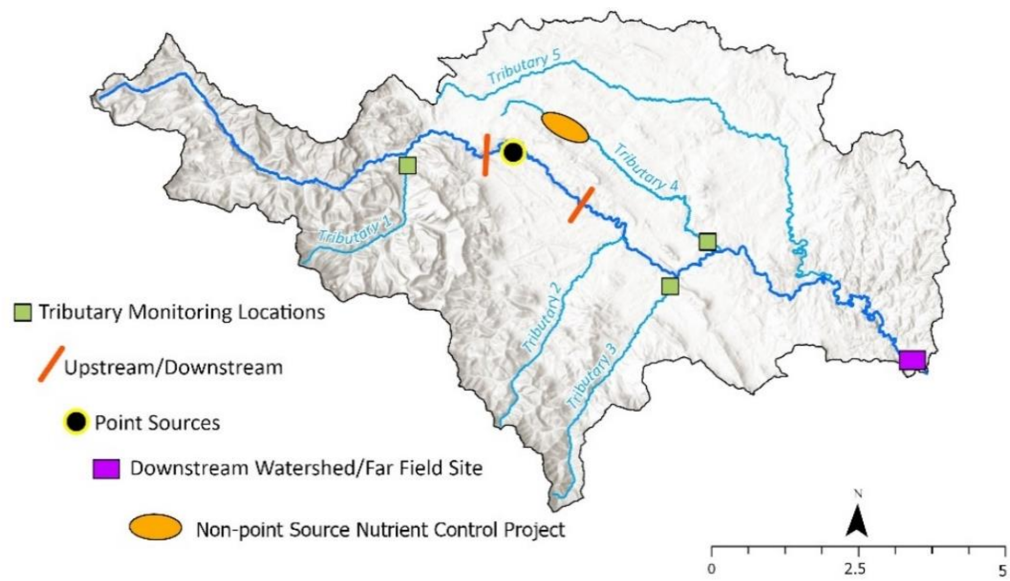

Figure 6-2. Example of a Simple AMP Watershed. Monitoring sites include near field sites, a downstream far field site, and tributary sites. In this example a tributary site is placed on Tributary 4 so effects of an upstream nonpoint source nutrient control project on that tributary can be tracked.

In complex watersheds, such as those with multiple dischargers and various types of non-point sources of nutrients, multiple sampling sites will be needed. These include near field sites bracketing the point sources, far field sites, tributary sites, and mainstem monitoring sites (**Figure 6-3**). Tributary sites may be used to characterize nutrient concentrations and loads from principal tributaries, while far field sites characterize nutrient concentrations and loads at the far upstream and downstream extent of an AMP watershed (**Figure 6-3**), and response variables where applicable. One downstream far field site is required, at a minimum. When locating sites for an AMP watershed, permittees are advised to consider any current department guidance.

A downstream far field site should normally be placed at the terminus of the AMP watershed (i.e., at the point where the waterbody flows into the next watershed; see the downstream far field site in **Figure 6-3**), although there may be exceptions subject to department review and approval. Far field sites may be used to assess achievement of the narrative nutrient standards at a larger waterbody or watershed (multiple waterbody) scale, provided the permittee identifies this as an objective in the AMP and coordinates with the department to select sites for this objective. Upstream far field sites provide data on nutrient concentrations and loads entering the AMP watershed, and inform AMP loading calculations, TMDLs, and other water quality planning work. Upstream sites do not necessarily have to be placed at the very upper-most boundary of the HUC; they may be placed further downstream within the HUC if appropriate.

Site locations should be strategically located to monitor the effect of any nonpoint source control activities. For illustration, there are two nonpoint source nutrient control projects in the watershed in **Figure 6-3**. The effects of the nonpoint source project on Tributary 2 are tracked at the monitoring site at the mouth of that tributary. Similarly, changes resulting from the nonpoint source project on the mainstem are tracked using a mainstem site (red square, **Figure 6-3**).

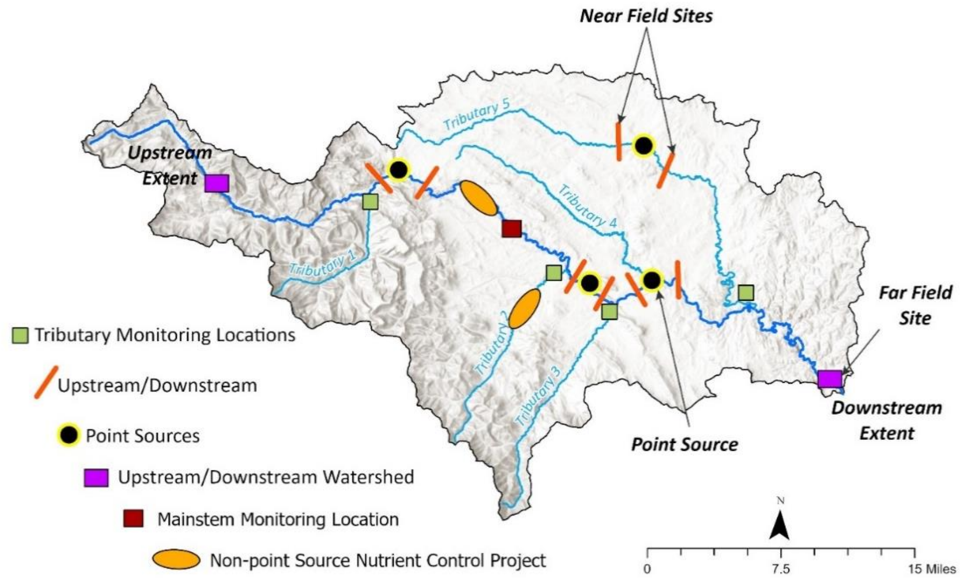

Figure 6-3. Example of a Complex AMP Watershed, Showing Different Types of Monitoring Sites.

6.6.2 Identifying All Partners that will Assist in Implementing Nutrient Reductions

Permittees must identify partners, including landowners, conservation districts, watershed groups, water quality districts, municipalities, counties, and others. Permittees and partners must work to target point and nonpoint sources of nutrients to minimize their overall fiscal outlays while achieving compliance with narrative nutrient water quality standards and improving water quality.

6.6.3 Develop and Document Action Items for the Reduction of Nutrients in the Watershed

As part of the watershed plan to achieve nutrient reductions, permittees must develop action items and milestones in accordance with the compliance schedule required in their permit. Evaluation of information from the near field upstream and downstream monitoring sites (**Section 6.5**, **Part II**, above) should be used to inform these decisions. A permittee may choose to improve their facility and/or proceed with a broader nitrogen (or nitrogen and phosphorus) focused watershed approach to address nonpoint sources and meet necessary nutrient reductions and achieve compliance.

6.6.3.1 Implementing Nonpoint Source Projects

A permittee may achieve nutrient reductions in the watershed through nonpoint source project implementation. A TMDL wasteload allocation, or WLA (more on TMDLs in **Section 10**), requires reasonable assurance that the load reduction expected will in fact be achieved. Permittees are advised to consider any current department best management practice guidance on this subject. All significant pollutant sources—including natural background, permitted point sources, and nonpoint sources—need to be quantified at the watershed scale so that the relative pollutant contributions and reductions can be determined. Because the effects of pollutants on water quality can vary throughout the year, assessing pollutant sources must include an evaluation of the seasonal variability of the pollutant loading in relation to the period that nutrient controls are in place (most commonly, the summer/fall index period). This loading and reduction analysis may be done using a department approved watershed-loading model and, in all cases, must be based on sound scientific and engineering practices.

Once necessary reductions have been calculated and allocated to nutrient sources, a permittee must select nonpoint source projects that will reduce nutrients to a level which will achieve the narrative nutrient standards in the waterbody point of compliance. Established watershed restoration plans and total maximum daily load documents (**Section 8.0**) should be consulted to synchronize sampling and reduce redundant efforts.

6.6.3.2 Nutrient Trading

A permittee may achieve nutrient reductions through nutrient trading. *See* **Department Circular DEQ-13**. Trading is an approach to achieving water quality standards in which a point source acquires pollutant reduction credits from another point source or a nonpoint source in the applicable trading region; these credits are then used to meet the source's pollutant discharge obligations.

6.6.4. Demonstrate the Ability to Fund and Implement Nutrient Reductions via a Watershed Plan

A permittee must demonstrate reasonable assurance through secured funding and landowner/partner agreements to implement nonpoint source projects in the watershed. Permittees who choose to invest in nonpoint source projects in the watershed to reduce nutrient loading must provide funding documentation in the AMP. This documentation must include enforceable written agreements—enforceable by the permittee—that document a commitment to fund, implement, and complete projects with stakeholders. The documentation must identify all stakeholders participating, include cost estimates, assign specific contribution amounts to each stakeholder, and identify timelines for project completion that include responsibilities for each project implementation step. The agreement must also specify the period nonpoint source controls will be maintained. If partners implement nutrient reduction actions in lieu of permittees, AMPs must include or reference enforceable written agreements reflecting commitments by partners to implement actions. Enforceable written agreements are the responsibility of permittees and will not be enforced by the department; however, permittees are responsible for the load reductions or other permit-limit adjustments made as a result of these agreements. Failure to implement agreed-upon projects according to AMP timelines must be reported in annual reports, may be considered a permit violation under Section 75-5-605, MCA, and may result in the department re-evaluating continued permittee eligibility in the program.

6.6.5 Continued Data Collection for Response Variables as Performance Indicators

Ongoing and potentially expanded collection and monitoring of response variables and thresholds, as well as nutrient concentrations, are the principal means by which the department will conclude if a waterbody is achieving the narrative nutrient standards. Data collection locations, frequency, and types must be linked to the action items and on-the-ground activities planned for a permittee's AMP; these actions in turn must inform any updates to the AMP watershed monitoring objectives, subject to department review and approval.

Data collection at the near field sites must be on-going and remain relatively consistent. However, data collection that best supports an AMP needs to be adaptive. For example, potential nutrient sources identified during a watershed inventory may prompt the selection of new or additional monitoring sites to quantify nutrient loads or isolate potential nutrient reduction projects. Initial characterization at tributary sites may clarify which tributaries contribute greater or lesser nutrient loads to the receiving waterbody and therefore may lead to tributary sites being added or discontinued. Additional or different monitoring sites—particularly far field sites—may be required to demonstrate effectiveness of nonpoint source reduction projects or to affirm achievement of the narrative nutrient standards. Far field sites may be required to demonstrate protection of downstream beneficial uses and to monitor changes over time.

6.6.6 Timeframes for Completing and Submitting Items in Sections 6.6.1 through 6.6.5; Annual Reports

Subject to department approval, a permittee, or multiple permittees collaborating on a single AMP, must identify the timeframe for completing and submitting to the department each of the components in **Sections 6.6.1** through **6.6.5** as part of their AMP (or updated AMP). Annual progress reports must be submitted to the department by March 31st and must address all relevant actions taken under the AMP implementation plan in the year prior to the report. Annual reports are required to maintain communication and accountability between the permittee(s) and the department. Additionally, annual reports provide the permittee(s) with the opportunity to modify their adaptive management strategy. Adjusted plans and accompanying justifications should be submitted with the annual report. Annual reporting must include electronic data submittal of collected biological, chemical, and physical measurements in a format provided by the department.

7.0 Large Rivers and Water Quality Models: Data Collection, Model Calibration and Validation, Simulating the Effect of Potential Management Activities

Permittees discharging to a large river should consult with the department as to the status of mechanistic modeling on the river segment where they discharge. Where models are developed or are nearing completion, modeling shall be used to examine the effects simulated point- and nonpoint source pollution management activities will have on a waterbody's beneficial uses and water quality.

Permittees on wadeable streams and medium rivers are not precluded from developing and using a mechanistic water quality model as part of their AMP. However, please note that developing water quality models is resource intensive.

For large rivers where a mechanistic model has not been developed and a model is not currently under development, NEW RULE II(4)(b) provides for a process similar to that for wadeable streams and medium rivers (phosphorus control first); however, there are applicable water quality causal variables and response variables specific to large rivers (see **Section 4.0** in **Part I**). Also, considerations about where to place monitoring sites will be different from smaller waterbodies. The department encourages permittees on large rivers where models are not developed nor are currently under development to undertake modeling work, but they should first consult the department and consider any current department guidance on the topic. Permittees pursuing a mechanistic model must conform with the requirements in this section.

The department may develop mechanistic water quality models for the state's large rivers (listed in **Table 1-1** in Part I), where feasible. Once calibrated and validated, the models must be used to derive phosphorus limits for MPDES permits that protect beneficial uses and achieve water quality standards along the modeled reach.

Field data to support model development serves multiple purposes. The data inform and constrain the range of model parameters. The data must be collected at a sufficient number of strategically selected sites to ensure that the built model can properly simulate the effect of different management options and their resulting effects on water quality. The data may also be used to determine if the narrative nutrient standards (and other water quality standards) have been achieved, per **Section 4.0** in **Part I**.

Figure 7-1 (reproduced from Chapra 2003)[10] shows the overall methodology for developing and using a mechanistic model in an AMP watershed. Once developed, the model becomes a decision support system (DSS) which involves the integration of science and data for waterbody and water quality management. AMPs for nutrient management that are model-based must follow the water-quality modeling process identified in **Figure 7-1**. The process starts with problem specification (i.e., nutrient management), and includes the water-quality modeling process (model selection, data collection for modeling, calibration and confirmation procedures, uncertainty analysis, and decision support, as detailed in the right side of the figure), and finally, use of the model-based DSS to evaluate beneficial use support and achievement of water quality standards. Since the DSS can directly simulate (1) management activity impacts on surface water and (2) hypothetical load reduction(s) necessary to achieve the narrative nutrient standards and other applicable water quality standards (dissolved oxygen and pH), the department will use the modeling results to inform MPDES permit limits. Simulation of potential management activities within the DSS must reasonably balance all factors impacting a waterbody while considering the feasibility of treatment options and the expected water quality improvements.

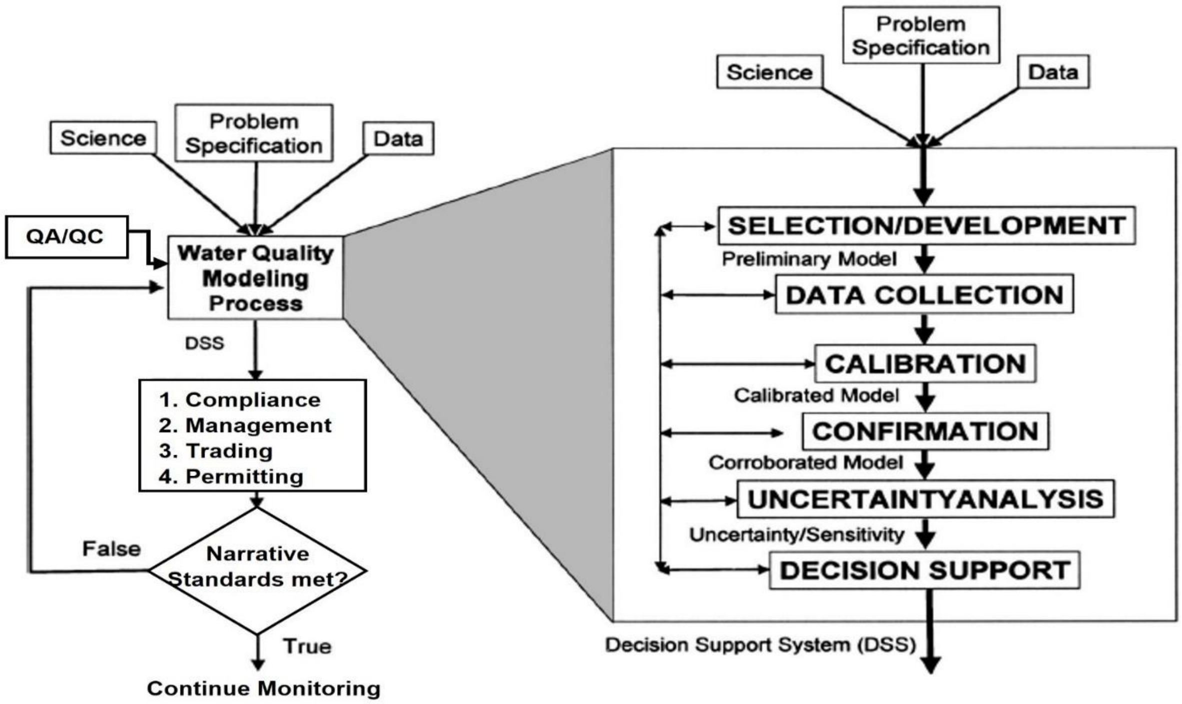

Figure 7-1. Process for Applying Water Quality Modeling in an AMP Watershed. The principal components for developing, calibrating, and confirming a model are contained in the break-out box shown on the right-hand side of the figure. The developed model then becomes a decision support system (DSS) for evaluating the effect of different management options, determining potential compliance pathways, and establishing permit limits.

7.1. Types of Models and Modeling Report Requirements

The department and permittees shall use non-proprietary modeling tools for AMPs. This means using only standardized modeling applications that are readily available to the public, are widely supported by federal agencies, and are also well known through both professional and academic literature. In selecting a non-propriety modeling tool, permittees are advised to consider any current department guidance.

Once modeling activities are completed, the modeling process and application of its results must be documented in a report and referenced in the AMP. Reporting requirements will be project-specific but must include the following: (1) an executive summary; (2) numeric table of contents; (3) project information and background; (4) model overview; (5) model construction overview; (6) model parameterization section; (7) model calibration; (8) model confirmation; and (9) the final modeling results. The report must have sufficient detail to document all phases of the modeling project so that the process could be completed by an experienced user to generate similar modeling results. In developing models and the associated report, permittees are advised to consider any current department guidance.

7.2. Conceptual Water Quality Models

An alternative modeling approach to the mechanistic modeling methods described above is the development of a conceptual water quality model. Conceptual water quality models are a formal and rigorous process to identify stressors causing biological impairments in aquatic ecosystems (i.e., impacts to aquatic life beneficial uses), and a structure for organizing the scientific evidence supporting the conclusions. However, they do not provide for carrying out “what if” scenarios (e.g., “what will be the effect on diel pH fluctuations if the phosphorus load from source X is reduced by 25%?”), which is a distinct advantage of mechanistic models. The department must review and approve the use of a conceptual water quality model prior to inclusion in an AMP.

Permittees may develop conceptual water quality models to assess the array of factors which may be affecting their receiving waterbody and AMP watershed. This can include analysis of physicochemical factors which enhance or mute the effects of nutrients, analysis of conditions that may impact the macroinvertebrate community, etc. In developing conceptual models and the associated report, permittees are advised to consider any current department guidance.

8.0 Integration of the Adaptive Management Program with the Total Maximum Daily Load Program

When a waterbody or waterbody segment is not achieving the narrative nutrient standards and it is considered impaired by a pollutant, a total maximum daily load (TMDL) must be developed. To calculate the TMDL load allocations and wasteload allocations, the department will translate the narrative nutrient standards to TP and/or TN target values from the TN and TP concentrations derived from relevant studies (see translators in **Part I)** and nutrient concentrations in **Tables 2-3**and **4-1** in **Part I**. Once the TMDL is determined, reductions will be allocated to the significant source(s) of the pollutant to meet the TMDL.

Pollutant sources are characterized as either point sources, which receive a wasteload allocation (WLA), or as nonpoint sources, which receive a load allocation (LA). For purposes of assigning WLAs, point sources include all sources subject to regulation under the MPDES program. To the extent possible, the department shall coordinate TMDL development or revision in conjunction with active AMPs to promote robust data collection and analysis, detailed source assessment, and implementation efficiency and consistency. The department must then ensure that any effluent limits developed in MPDES permits are consistent with the requirements and assumptions of any available TMDL wasteload allocation.

8.1. TMDL Revisions

In situations where a permittee opts into the adaptive management program and a nutrient TMDL already exists, any TMDL revision must be based on 3-5 years of data collected through a department-approved AMP (this may include applicable, credible data collected after the TMDL was completed but before adoption of this circular). If response variable data indicate a different nutrient target concentration than used in the approved TMDL is more appropriate for achieving the narrative nutrient standards, the TMDL may be revised using the new target concentration. In this situation, any WLA will also be revised and the MPDES permit limit would subsequently be modified to reflect the new WLA, as appropriate. Revised TMDLs would be periodically evaluated based on AMP data collection efforts and subsequent reassessments.

Any changes or re-allocation between the WLA and LA or changes in the TMDL's loading capacity will be released for public comment and submitted to EPA for review and approval as a revised TMDL according to the same procedures as for a new TMDL. TMDL revisions shall be prioritized by the department in accordance with Section 75-5-702, MCA, through consultation with the Statewide TMDL Advisory Group, and based on data collected via an approved AMP.

Previously approved nutrient TMDLs with WLAs will remain in place until new data is acquired that could inform a new target value or values. For permittees opting into the adaptive management program in these areas, information may be added to the existing TMDL to outline options for implementation of the WLA. These document edits will take place in the form of an erratum that does not require public comment or resubmittal to EPA for approval.

Previously approved nutrient TMDLs without WLAs would not be prioritized for revision as part of the adaptive management program process, but they could be addressed if prompted by subsequent monitoring and assessment activities.

8.2. The Adaptive Management Program and Advance Restoration Plans

Under the EPA's Long-Term Vision for Assessment, Restoration and Protection under the Clean Water Act (CWA) Section 303(d) Program, EPA recognizes that there are cases in which pursuing advance restoration plans (ARPs) before developing a TMDL may provide a more immediate and practicable path to restore water quality. An ARP is a near-term plan for water quality improvement with a schedule and milestones that is accepted by EPA. Impaired waters for which the department pursues an ARP would remain on the CWA 303(d) list and still require a TMDL until all beneficial uses are attained. If beneficial uses are attained, the relevant waterbody-pollutant pairing would be removed from the CWA 303(d) list and a TMDL would no longer be required.

The department may submit AMPs to EPA for acceptance (but not under a formal approval process) as ARPs in watersheds impaired for nutrients with no existing TMDL. Acceptance of an AMP as an ARP may prompt the department to lower the priority ranking of TMDL development for the waterbody-pollutant pairing in question, in accordance with Section 75-5-702, MCA. Accepted ARPs would be evaluated on the same schedule as their accompanying AMPs to ensure they are still the most practicable path toward achieving water quality standards. If the ARP is determined not to be the most immediate and practicable approach to attain all beneficial uses, the department would require updates to the AMP and/or increase the priority ranking of TMDL development for the waterbody-pollutant pairing.

9.0 ENDNOTES

(1) Suplee, M.W., A. Varghese, and J. Cleland. 2007. Developing Nutrient Criteria for Streams: An Evaluation of the Frequency Distribution Method. *Journal of the American Water Resources Association* 43: 453-472.

(2) Suplee, M.W., V. Watson, A. Varghese, and J. Cleland. 2008. Scientific and Technical Basis of the Numeric Nutrient Criteria for Montana's Wadeable Streams and Rivers. Helena, MT: Montana Dept. of Environmental Quality. *For more specificity, refer to scientific citations within the document*.

(3) Suplee, M.W., and V. Watson. 2013. Scientific and Technical Basis of the Numeric Nutrient Criteria for Montana's Wadeable Streams and Rivers—Update 1. Helena, MT: Montana Dept. of Environmental Quality. *For more specificity, refer to scientific citations within the document*.

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