



# WHITE PAPER

SEPTEMBER 7, 2018

## CLARIFICATION OF PHASED TMDL AND ADAPTIVE MANAGEMENT

### Summary of Issue/Background

The Barr-Milton Watershed total maximum daily loads (TMDLs) for pH and dissolved oxygen are constructed as **Phased TMDLs** with an **Adaptive Management** approach for implementation. There is a need for a common understanding of these terms as they relate to a variety of TMDL requirements. The specifics of the TMDL and implementation requirements are currently spread throughout multiple documents, and it can be confusing, especially for new member representatives to interpret the TMDL requirements. The issue is further confused because there are several identified steps or “stages” that comprise the Phase I Implementation Plan.

There are several guidance documents that have been developed over the years by EPA and other organizations that help to clarify the definitions and appropriate use of a phased TMDL and adaptive management approach. The Barr Lake and Milton Reservoir (BMW) Association membership determined that it would be useful to prepare this white paper to document information from the TMDL and other reference and supporting documents on this subject. Additionally, there are some sources of ambiguity in the current TMDL documents, and there is a need to capture key findings and decisions from past meetings so that BMW members have a common framework for discussions about TMDL implementation.

### Recommended Outcome

**Establish a common understanding of phased TMDL requirements and adaptive management implementation approach among BMW members.** This will be accomplished by addressing specific areas of ambiguity in the TMDLs and Implementation Plan to develop a common understanding among BMW members, the Water Quality Control Division, and other external stakeholders regarding the interpretation of a phased TMDL approach and adaptive management structure. This document also serves as a central repository for key guidance from EPA and examples of other phased TMDLs and adaptive management approaches in Colorado.

### Phased TMDL /Staged TMDL/Adaptive Management Reference Information

The Barr-Milton Watershed TMDLs are written as “Phased TMDLs,” however, they also have elements of both phased and staged TMDLs. Use of the terms “Phased TMDL” and “Staged TMDL” can be confusing. Phasing allows for adjusting final water quality targets, if appropriate, once underlying uncertainties are resolved, while staging involves a stepwise process for implementation measures for different types of sources or classes of dischargers, but keeps the underlying targets in place unless new information is uncovered through the implementation process. In short, “phased TMDLs are a matter of TMDL development while staged implementation and adaptive implementation are post development implementation concepts” (EPA Clarification Memo, pg. 1). A summary of key reference information on this topic is provided below.

EPA's 1991 "Guidance for Water Quality-based Decisions: The TMDL Process" identifies two specific types of "phasing", specifically:

Type 1: Water impaired by both point and nonpoint sources and point source wasteload allocations are contingent on nonpoint source reductions.

*Where nonpoint source controls are involved, the phased approach is also necessary. Under the CWA, the only federally enforceable controls are those for point sources through the NPDES permitting process. In order to allocate loads among both nonpoint and point sources, there must be reasonable assurances that nonpoint source reduction will in fact be achieved. Where there are not reasonable assurances, under the CWA, the entire load reduction must be assigned to point sources. With the phased approach, the TMDL includes a description of the implementation mechanisms and the schedule for the implementation of nonpoint source control measures. (1991 Guidance, pg. 15)*

Type 2: Available data only allow for estimates of necessary load reductions for "non-traditional problems" where predictive tools may not be adequate to characterize the problem with a sufficient level of certainty.

*A phased approach to developing TMDLs may be appropriate where estimates are based on limited information. The phased approach is a TMDL that includes monitoring requirements and a schedule for re-assessing TMDL allocations to ensure attainment of water quality standards. Uncertainties that cannot be quantified may also exist for certain pollutants discharged primarily by point sources. In such situations a large margin of safety and follow-up monitoring is appropriate. (1991 Guidance, pg. 15)*

EPA now prefers the term "staged TMDL" for Type 1 as described in its 2006 clarification letter

*We recommend the use of the term "phased TMDLs" be limited to TMDLs that for scheduling reasons need to be established despite significant data uncertainty and where the State expects that the loading capacity and allocation scheme will be revised in the near future as additional information is collected. In other words, phased TMDLs would be reserved for the second scenario described in the 1991 Guidance. (EPA Clarification Letter, pg. 3)*

EPA's August 2, 2006 letter provides further direction that the phased TMDLs must be written to meet water quality standards:

*In both of these situations, the phased approach has sometimes been misinterpreted to mean that a phased TMDL may be calculated to improve water quality, but not to meet water quality standards. However, the Guidance clearly indicates that TMDLs must be set at levels that meet water quality standards. (EPA Clarification Letter, pg. 2)*

AND

*All phased TMDLs must include all elements of a regular TMDL, including load allocations, wasteload allocations and a margin of safety. As with any TMDL, each phase must be established to attain and maintain the applicable water quality standard. In addition, EPA recommends that a phased TMDL document or its implementation plan include a monitoring plan and a scheduled timeframe for revision of the TMDL. (EPA Clarification Letter, pg. 3, emphasis added)*

The 2006 Clarification letter further provides a specific example of a Phased TMDL that is very similar to the situation in Barr Lake and Milton Reservoir:

*An example of a phased TMDL could be a TMDL for phosphorus in a lake watershed where there are uncertain loadings from the major land uses and/or limited knowledge of in-lake processes. In such a case, the loading capacity of the water body may be difficult to establish and the State may decide to include a schedule for establishing a revised TMDL based on follow-up monitoring. (EPA Clarification Letter, pg. 3)*

To summarize, phased TMDLs must be written to meet water quality targets, but do allow for future changes as sources of uncertainty are resolved over time. Staged TMDLs allow for multiple implementation steps, potentially including adaptive management in order to achieve the final targets, and information gained during the stages of implementation may be used to inform future phases of a TMDL.

## Phasing and Staging within Barr-Milton TMDL Documents

### Phased TMDL

With the above framework in mind, the BMW TMDL clearly fits the definition of a Phased TMDL due to significant uncertainty remaining regarding the water quality targets. From the Implementation Plan:

*The pH TMDL is structured as a phased TMDL per the EPA publication Guidance for Water Quality-Based Decisions: The TMDL Process (April 1991) and an EPA memorandum Clarification Regarding “Phased” Total Maximum Daily Loads (August 2, 2006). Selection of a phased TMDL necessitates use of an Adaptive Implementation Plan that allows for the development of new information used to re-evaluate the original TMDL. Per U.S. EPA’s August 2006 Guidance Memorandum (Guidance), a phased TMDL approach is “...used in situations where limited existing data are used to develop a TMDL and the State believes that the use of additional data or data based on better analytical techniques would likely increase the accuracy of the load calculation and merit development of a second phase TMDL.” The pH TMDL is currently written as a phased TMDL with the possibility of multiple phases. The first phase includes load allocations, wasteload allocations, and an implicit margin of safety (MOS) that are established to attain and maintain the existing underlying pH standard, using the best available data and modeling results to date. (Implementation Plan, pg. 3-1)*

AND

*It is understood that the pH TMDL will require re-approval by EPA if it is necessary to embark upon a second phase of the pH TMDL that results in a revision in loading capacity, wasteload, or load allocations. (pg. 3-1)*

## Water Quality Targets

The BMW TMDL contains clear water quality targets intended to meet applicable pH and dissolved oxygen water quality standards, and identifies multiple sources of uncertainty related to those targets that justify the phased approach. The applicable water quality targets include

- pH = 9.0 upper limit as 85<sup>th</sup> percentile value, assessed as an average of all measurements taken within the upper portion of the water column (0.5 m to 2.0 m depth) for each profile collected.
- 0.1 mg/L as a maximum (summer season July - September), with an average concentration ranging from 0.04 mg/L to 0.06 mg/L (Barr) and 0.046 mg/L to 0.069 mg/L (Milton).
- The dissolved oxygen TMDL identifies a chlorophyll-a target of 20 µg/L as the 80<sup>th</sup> percentile of summer averages and as a maximum of 25 µg/L.

## Uncertainty

A phased TMDL is an option to address remaining uncertainty. It is convenient to think of uncertainty in two bins; first, uncertainty that can be resolved via scientific studies and second, uncertainty that can be resolved by monitoring and observing on-the-ground responses to management actions. The first scientific studies “bin” may be conducted and refined throughout the TMDL implementation process, but significant work has already been completed for the BMW TMDLs, with some follow-on work identified. Key sources of uncertainty were identified in the TMDL:

*(1) although it is widely accepted, scientifically, that there are qualitative linkages between pH, chlorophyll a (chl), and total phosphorus (TP), a quantitative linkage hasn't been defined between the surrogate causal variable (phosphorus) and the in-reservoir response variables (pH and chlorophyll a), probably because the TP levels are too high to see the relationships; (2) limited available information regarding the complex watershed system, e.g., determining the appropriate watershed boundaries for calculating phosphorus loading; (3) internal reservoir loading contributions of phosphorus; and (4) the water budget for both reservoirs, e.g., the lawful exercise of water rights results in varying amounts of water being diverted to the reservoirs from year to year. (TMDL, pg. 1-2)*

Regardless of which bin, uncertainty will be reduced with monitoring of reservoir responses to various studies and changes in overall watershed management. Uncertainty around parameter relationships and nutrient loading will be reduced with studies, modeling, and improved calculations. Uncertainty around how the reservoirs respond to management actions will be reduced with long-term, routine monitoring and evaluation. As implementation proceeds, it is important to document the water quality changes and draw conclusions based on scientific analysis.

## Staged TMDL

While clearly a phased TMDL, the BMW TMDL also contains elements of a staged TMDL, with wasteload allocation concentrations and temporal implementation varying by facility. In simple terms, the stages that have occurred so far or will occur in the near future include an initial period of scientific studies and minimal nutrient reductions (hereafter referred to as Phase 1.1), and implementation of Regulation No. 85 requirements (hereafter referred to as Phase 1.2). The final stage would be implementation of final TMDL requirements (hereafter referred to as Phase 1.X; however, there could be other stages of implementation in between Phase 1.2 and Phase 1.X. A summary of these three distinct stages (Phase 1.1, Phase 1.2, and Phase 1.X) is provided below.

### Phase 1.1 (TMDL Adoption in 2013 – 2017)

From the time of TMDL development until about 2017, several major scientific studies were conducted by BMW to address uncertainty. These studies are addressed in the following reports:

- In-canal Treatment Report (December 2014)
- In-reservoir Treatment Report (July 2016)
- Limnocorral Study Summary (2011-2014) (September 2016)
- Modeling Efforts – Second Revision of Final Modeling Report (August 2009)

More information on studies completed to date can be found in the White Paper: Addressing Scientific Uncertainty in Barr Lake and Milton Reservoir (2018) and the Watershed Plan (2008) and Watershed Plan Update (2017).

During this time period, some reductions were made to point sources, and there was a temporary cessation of the pumpback of metro effluent through the Burlington Pump Works.

### Phase 1.2 Implementation of Regulation No. 85 Interim Limits (2018 – 2023)

#### Point Sources

The TMDL recognized that implementation of Regulation No. 85 at the larger facilities clearly delineates a second stage of the BMW TMDL.

*Significant water quality improvements will occur once phosphorus reduction facilities are in place at the larger POTWs (Centennial, Littleton-Englewood, and Robert W. Hite (including the Burlington Pump Works discharge location) wastewater treatment facilities) and in MS4 regulated areas identified in the TMDL. It is therefore appropriate that these improvements be implemented as expeditiously as feasible. Accordingly, reductions at other POTWs with wasteload allocations will not be required until evaluations of water quality improvements based on the reductions from the larger POTWs and identified non-point sources have been completed and additional phosphorus reductions are deemed necessary to achieve the in-reservoir water quality goals. However, interim improvements at these POTWs may be required in order to comply with other state regulatory requirements, including Regulation 85 (WQCC 2012). (TMDL, pg. 4-5)*

AND

*Notwithstanding the discussion contained in the preceding paragraph, interim effluent limitations for the Centennial, Littleton-Englewood, and Robert W. Hite (including the Burlington Pump Works discharge location) wastewater treatment facilities shall be set at 1000 µg/L. This value is selected for the interim effluent limitations because this level of treatment is consistent with that identified in the Water Quality Control Commission Nutrients Management Control Regulation No. 85 (WQCC 2012) (promulgated June, 2012). The Division has chosen to retain the 100 ug/L treatment as the long-term effluent wasteload allocations for the referenced facilities as modeled projections for both reservoirs were predicated upon achieving that more stringent level of treatment. However, if additional data developed during the Phase I implementation activities described in the TMDL Implementation Plan support alternative WLAs, the Phase II TMDL will include documentation for such revised wasteload allocations. (TMDL, pg. 4-4)*

When the TMDL was developed, Regulation No. 85 had only recently been adopted and the specific timeframe for implementation in point source discharge permits in the watershed was unclear. However, it is now clear that all but one facility with a wasteload allocation in the BMW TMDL is subject to Regulation No. 85. The only facility excluded from Regulation No. 85 (based on having a design flow rate below 2 MGD) is the Town of Hudson, which represents just 0.08% of initial estimated loading to Milton Reservoir. That facility no longer discharges in the watershed. Some WWTP permits have not yet been renewed with Regulation No. 85 limits, but Regulation No. 85 limits are being implemented as permits are renewed.

Incorporation of Regulation No. 85 limits as a separate stage of the TMDL was also clearly delineated in the Implementation Plan through the adoption of “initial effluent limits” or “interim effluent limits”

*In June, 2012, the Water Quality Control Commission (Commission) adopted Regulation No. 85, the Nutrient Management Control Regulation (5 CCR 1002-85). For this TMDL, the Division has proposed an adaptive discharge permit implementation approach for the RWHTF, L/E, and Centennial that is consistent with Regulation No. 85 requirements. Such adaptive implementation is compatible with the phased implementation approach of this TMDL and also is consistent with TMDLs approved by EPA in other parts of the country. (Implementation Plan, pg. 2-2)*

AND

*The initial effluent limitations for total phosphorus at the RWHTF, L/E, and Centennial will be set at 1.0 mg/L phosphorus as a running annual median (most recent 12 calendar months) and 2.5 mg/L phosphorus as the 95th percentile of all samples taken in the most recent 12 calendar months. The Division will incorporate this initial effluent limit into permits upon the first permit renewal after approval of this TMDL, with compliance schedules if appropriate. The limits are the same as required for “existing” facilities in Regulation No. 85 that are not subject to exclusions or delayed implementation. These controls will be considered interim effluent limitations. (Implementation Plan, pg. 2-3)*

It is noted that once Regulation No. 85 is implemented for some of the smaller facilities (South Adams WWTP, Fort Lupton WWTP, Brighton WWTP, Aurora WWTP, Lochbuie WWTP), the TMDL includes no expectations within any part of Phase 1 of any further reductions (below 1000 µg/L), so those facilities may be considered to have completed Phase 1 after this Phase 1.2 is completed.

### **Additional Studies**

Concurrent with Phase 1.2, the following scientific studies are planned prior to or shortly after final implementation of Regulation No. 85 limits.

- Reservoir model validation (during and after (?) final implementation of Reg. 85)
- Reservoir model re-calibration if needed (during and after (?) final implementation of Reg 85)

**[RESERVED: We need to discuss whether there are additional phases that should come between Phase 1.2 and 1.X (Such as monitoring results of Phase 1.2, new scientific studies, etc). ]**

## **Phase 1.X Implementation of Full TMDL Tables**

### **Point Sources**

At some point in time after full implementation of Regulation No. 85, the larger facilities (Burlington Pump Works, L/E WWTP, Centennial WWTP, and MWRD Hite and NTP) will need to either

- Plan to meet the TMDL wasteload allocation of 0.1 mg/L either directly or through pollutant trading or other controls;
- Identify another regulatory solution, such as a use attainability analysis to modify the uses; or
- Determine alternative standards/water quality targets that are protective of the uses, based on reduced uncertainty and improved understanding of water quality drivers in the reservoirs (TMDL Phase 2).

*As indicated in the TMDL allocation tables, in subsequent permit renewals<sup>1</sup>, the most restrictive final permit effluent limitations at the largest facilities for total phosphorus would be 100 µg/L implemented as an annual average plus a 30-day average not to exceed 3 times the annual average at any hydraulic capacity (rated or existing) for the identified wastewater treatment facilities with wasteload allocations. When combined with other management strategies identified in this Plan this effluent concentration level will allow Barr and Milton to meet the pH standard. In addition to the three largest POTWs identified in the TMDL as having wasteload allocations, other facilities located within the*

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<sup>1</sup> It is noted that the term “subsequent permit renewals” is ambiguous and has led to a question of how many permit renewals using Regulation No. 85 limits or other interim limits can occur before final TMDL WLAs are implemented. Potential options are discussed in Attachment 1, FAQ.

*Barr-Milton datsashed will be subject to the Regulation No. 85 effluent limitations. (Implementation Plan pg. 2-3)*

The EPA discusses the variable nature of timing of phased implementation in its Great Lakes Water Quality Guidance:

*In some cases, for example, water quality standards may reasonably be expected to be met within one NPDES five-year permit cycle. In other cases the reasonable expectation of meeting water quality standards could be twenty years, following the implementation of controls on nonpoint sources such as sediment. (EPA, 1995, Section VIII.C)*

The tables of wasteload allocations in the TMDL reflect the levels identified to meet the water quality targets.

The TMDL states:

*Under this regime, the phosphorus effluent limitation at POTWs receiving wasteload allocations under the TMDL would be set at 100 ug/L end-of-pipe at any hydraulic capacity (rated or existing) for the identified facilities (Tables 4.1 and 4.2), and for any new dischargers, and 1000 ug/L end-of-pipe at any hydraulic capacity for the identified facilities, at the appropriate time during implementation. In effect, the approach to implementing the POTWs wasteload allocations is volume-independent.*

AND

*under the allocation strategy, the most stringent POTW effluent limits are set at the targeted in-reservoir TP level needed to achieve compliance with the pH standard. As with any numeric effluent limitation, actual effluent concentrations will include a significant MOS that ensures permit compliance with that limitation, meaning that overall concentrations of phosphorus discharged from POTWs will be less than 100 ug/L.*

TMDL Tables 4.1 and 4.2 reflect the allocation strategy that was determined necessary to meet the Phase I water quality targets.

**Table 4.1 Barr Lake Allocation Strategy.**

Source of Phosphorus to Barr Lake	Current Load (kg/yr)	% of Total Current Load	Load Reduction Rationale	Target Load Reduction (%)	Target Load (kg/yr)	Target In-Lake Concentration (ug/L)
<b>Wasteloads</b>						
Burlington Pump Works	26,075	37.1%	Treatment upgrade: 2,800 ug/L to 100 ug/L	96.5%	913	100
Littleton-Englewood WWTP	33,893	48.2%	Treatment upgrade: 2,900 ug/L to 100 ug/L	96.5%	1,186	100
Centennial WWTP	1,194	1.7%	Treatment upgrade: 700 ug/L to 100 ug/L	85.5%	173	100
MS4 Regulated Areas	2,189	3.1%	Some activity over last decade, plus more BMPs	20.0%	1,751	100
<b>Wasteload Total</b>	<b>63,351</b>	<b>90.0%</b>		<b>93.6%</b>	<b>4,023</b>	<b>100</b>
<b>Loads</b>						
Upstream Background Loads	3025	4.3%	Targeted for a 75% reduction through in-canal treatment in the Burlington Ditch	75.0%	756	100
Benthic P Load from Barr	4,000	5.7%	In-lake treatment to inactivate P in upper 10 cm of sediment	75.0%	1,000	100
<b>Load Total</b>	<b>7,025</b>	<b>10.0%</b>		<b>75.0%</b>	<b>1,756</b>	<b>100</b>
<b>Total Load (all sources)</b>	<b>70,376</b>	<b>100.0%</b>	Calculated loading limit to achieve maximum target load of 5,900 kg/yr and target in-lake maximum concentration of 100 ug/L	<b>91.8%</b>	<b>5,779</b>	<b>100</b>

Note: For wasteload allocations, the long-term permit effluent limitations for total phosphorus of 100 ug/L as indicated in the table above will be implemented as an annual average plus a 30-day average not to exceed 3 times the annual average at any hydraulic capacity (rated or existing) for the identified wastewater treatment facilities. Interim effluent limitations of 1000 ug/L for the Burlington Pump Works, Littleton-Englewood WWTP, and Centennial WWTP will be implemented as described in Regulation No. 85.

**Table 4.2 Milton Reservoir Allocation Strategy.**

Source of Phosphorus to Milton Reservoir	Current Load (kg/yr)	% of Total Current Load	Load Reduction Rationale	Target Load Reduction (%)	Target Load (kg/yr)	Target In-Lake Concentration (ug/L)
<b>Wasteloads</b>						
Burlington Pump Works	54	0.1%	Treatment upgrade: 2,800 ug/L to 100 ug/L	96.3%	2	100
RWHTF	28,529	73.2%	Treatment upgrade: 2,800 ug/L to 100 ug/L	96.4%	1,027	100
Littleton-Englewood WWTP	1,840	4.7%	Treatment upgrade: 2,900 ug/L to 100 ug/L	96.6%	63	100
Centennial WWTP	65	0.2%	Treatment upgrade: 700 ug/L to 100 ug/L	85.7%	9	100
South Adams WWTP	1,102	2.8%	Treatment upgrade: 4,500 ug/L to 1000 ug/L	78.0%	242	100
Fort Lupton WWTP	494	1.3%	Treatment upgrade: 3,000 ug/L (approximate) to 1000 ug/L	67.0%	163	100
Brighton WWTP	491	1.3%	Treatment upgrade: 3,000 ug/L (approximate) to 1000 ug/L	67.0%	162	100
Aurora WWTP	28	0.1%	Effluent TP currently at 200 ug/L; no action	0.0%	28	100
Hudson WWTP	29	0.1%	Treatment upgrade: 3,000 ug/L (approximate) to 1000 ug/L	67.0%	10	100
Lochbuie WWTP	22	0.1%	Treatment upgrade: 3,000 ug/L (approximate) to 1000 ug/L	67.0%	7	100
MS4 Regulated Areas	452	1.2%	Some activity over last decade, plus more BMPs	20.0%	362	100
<b>Wasteload Total</b>	<b>33,106</b>	<b>84.9%</b>		<b>93.7%</b>	<b>2,075</b>	<b>100</b>
<b>Loads</b>						
Upstream Background Loads	254	0.6%	Targeted for a 75% reduction through in-canal treatment in the Platte Valley Canal	75.0%	64	100
Benthic P from Barr	419	1.1%	Reduced 75% by internal loading controls associated with Barr treatment	75.0%	105	100
Benthic P from Milton	2,000	5.1%	Treatment to inactivate P in upper 10 cm of sediment	75.0%	500	100
Clear Creek	919	2.4%	Target 20% reduction	20.0%	735	100
Big Dry Creek	2,301	5.9%	Target 20% reduction	20.0%	1,840	100
<b>Load Total</b>	<b>5,893</b>	<b>15.1%</b>		<b>45.0%</b>	<b>3,244</b>	<b>100</b>
<b>Total Load (all sources)</b>	<b>38,998</b>	<b>100.0%</b>	Calculated loading limit to achieve maximum target load of 5,300 kg/yr and target in-lake maximum concentration of 100 ug/L	<b>86.4%</b>	<b>5,319</b>	<b>100</b>

Note: For wasteload allocations, the long-term permit effluent limitations for total phosphorus of 100 ug/L, as indicated in the table above, will be implemented as an annual average plus a 30-day average not to exceed 3 times the annual average at any hydraulic capacity (rated or existing) for the identified wastewater treatment facilities. Interim effluent limitations of 1000 ug/L for the Burlington Pump Works, RWHTF, Littleton-Englewood WWTP, and Centennial WWTP, as well as for other identified facilities subject to Regulation No. 85 and/or required to achieve long-term effluent limitations of 1000 ug/L, will be implemented as described in Regulation No. 85.

Point sources outside the dashed are to be addressed in future Phases – there are no expectations in Phase I of the TMDL.

*These sub-watersheds were treated as a single input for modeling activities to evaluate conditions and possible remediation scenarios. As such, more distant point sources included in the Clear Creek and Big Dry Creek loads may need to be accounted for separately during refinement of the Phased TMDL. Some of these WWTPs already have reduced TP effluent limitations, but these could potentially need to be reduced in the future. It is expected that such evaluations will take place following completion of the first TMDL phase. (TMDL, pg. 4-5)*

At this time, the BMW Board has acknowledged that more discussion is needed regarding several key issues. More discussion is needed on each of these issues.

- 1) What specific monitoring will be conducted, on what schedule, and what indicators will be evaluated to determine whether there is remaining uncertainty that warrants the phased TMDL approach?
- 2) When and how will we know when nutrient reductions other than Phase I.X are necessary? These could potentially be more or less stringent requirements.
- 3) How soon must Phase I.X be implemented?
- 4) How are the TMDL requirements linked to Regulation No. 31 requirements?
  - a) What is the relationship of the timing of reductions required under Regulation No. 85 and voluntary reductions under the Incentive Program (Water Quality Control Commission Policy 17-1: Voluntary Incentive Program for Early Nutrient Reductions) on TMDL implementation?
  - b) Members that anticipate making early nutrient reductions will want to understand the impact or lack thereof on TMDL implementation timing. It is expected that by the end of 2019, which is the enrollment deadline for the voluntary incentive program, we will have a more complete understanding of predicted point source reductions through 2027. This will be valuable information as we plan for future water quality monitoring and regulatory efforts.

## Other Considerations

### Stormwater

Per the TMDL, MS4 Regulated Areas comprised 3.1% of total TP load to Barr Lake and 1.2% of total TP load to Milton Reservoir. A 20% reduction of MS4 TP loads was targeted in the TMDLs. MS4 reductions are mentioned in conjunction with larger POTWs for which *“It is therefore appropriate that these improvements be implemented as expeditiously as feasible; however, Regulation No. 85 does not contain any interim numeric targets for MS4s as it does for POTWs.”* Regulation No. 85 does, however, include non-numeric requirements for stormwater entities subject to MS4 permits. These requirements have been incorporated into the new statewide stormwater general permit, COR090000, and have also been incorporated into general permit certifications. Regulation No. 85 requirements are included at Regulation No. 85 § 85.5(4), and include:

- Public education and outreach on stormwater impacts associated with nutrients for stormwater runoff and illicit discharges; and
- Pollution Prevention/ Good Housekeeping for Municipal Operations associated with nutrients.

It appears that these requirements are currently being incorporated into the new stormwater permit certifications with compliance schedules generally coinciding with the timing of Regulation No. 85 point source implementation.

### Nonpoint Sources

Nonpoint sources are included in the Other Sources category of the load allocations in the TMDL.

It appears that some non-point source reductions were anticipated to occur prior to further reductions at smaller POTWs.

*Accordingly, reductions at other POTWs with wasteload allocations will not be required until evaluations of water quality improvements based on the reductions from the larger POTWs **and identified non-point sources** have been completed and additional phosphorus reductions are deemed necessary to achieve the in-reservoir water quality goals. However, interim improvements at these POTWs may be required in order to comply with other state regulatory requirements, including Regulation 85 (WQCC 2012, emphasis added).*

## External Influences

The watershed is facing several potential new loading sources. These sources were not anticipated in the TMDL, and were not mentioned as types of discharges that might be included in the TMDL safety factors. Some TMDLs intentionally include growth allocations to assign assimilative capacity for future development, but this TMDL appeared to rely on trading mechanisms for new permits.

### New Discharge Permits

The Water Quality Control Division has issued multiple new discharge permits within Segment COSPUS14. Many of these are dewatering permits or remediation permits that were previously operating under general discharge permits, but needed to convert to individual permits. Permit requirements for phosphorus have varied from no limits to reporting only requirements to actual discharge limits.

### Denver Water ortho-P Addition

In March of 2018, the Water Quality Control Division made a determination that Denver Water must add ortho-phosphorus to its drinking water in order to minimize corrosion and protect its customers from lead. This decision is currently being appealed by multiple entities, including Denver Water and BMW, because we believe there may be other alternatives that protect human health without the significant environmental consequences expected to result from this decision.

Wasteload allocations for new discharge sources were not discussed in the TMDL, and were not mentioned as types of discharges that might be included in the TMDL safety factors. Some TMDLs intentionally include growth allocations to assign assimilative capacity for future development. In a response to BMW's comments regarding new dischargers to the watershed, the Division has drawn a distinction between new POTWs and new industrial facilities, stating:

*"Industrial sources were determined to not be significant and are not further addressed in the TMDL after Table 1.2. The division has determined that during this phase of the TMDL, implementing 100 ug/l for a non-POTW is not the intent of this TMDL; nor is it the intent for non-POTWs to have stricter limits than POTWs." (WQ Fact Sheet for Permit No. CO0049003, Comment Response No. 48, April 2017)*

As such, it will be important to track new industrial contributions over time to determine the effect on the TMDL assumptions. BMW may wish to consider clarifying the TMDL via the Implementation Plan to address new industrial loads that have potential to contribute phosphorus loads to the watershed.

The Denver Water load would be a major new load that was not contemplated in the TMDL. If ortho-P addition moves forward as required, BMW will need to coordinate closely with the Division, Denver Water, and EPA to assess the impacts and determine how the TMDL and individual wasteload and load allocations will be impacted. This project has the potential to invalidate previous modeling assumptions.

## REFERENCES

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## Attachment 1

### List of Frequently Asked Questions for the BMW Phased TMDL and Adaptive Implementation Plan

[Keep this list updated as questions are identified or resolved through ongoing discussions and research]

	Question	Answer	Citation(s)
1.	Was the 1 <sup>st</sup> Phase of the TMDL intended to meet water quality standards?	Yes, the phased TMDL is intended to meet water quality standards. This is a requirement of EPA.	EPA 2006 Letter
2.	Are the Regulation No. 85 reductions intended to meet water quality standards?	No, the Regulation No. 85 values are interim targets, but the adaptive nature of the TMDL allows us to reevaluate the appropriateness of the final WLAs after reductions to Reg. 85 levels are made. <i>“The Division has chosen to retain the 100 µg/L treatment as the long-term effluent wasteload allocations...”</i>	pH TMDL, pg. 4-5
3.	What is the difference between phased TMDLs and staged TMDLs?	Phased TMDLs are a matter of TMDL development. They allow water quality targets, wasteload allocations, and load allocations to be adjusted as new information becomes available. Staging of water quality improvements and adaptive management are a matter of TMDL implementation.	EPA 2006 Letter
4.	What type of TMDL is the BMW TMDL?	As detailed in this paper, the Board has determined that the BMW TMDL has elements of both a phased and staged TMDL. It is described as phased due to multiple sources of uncertainty, but it is also staged, with several intermediate steps toward final implementation identified.	
5.	When must Regulation No. 85 limits be implemented per TMDL requirements?	Regulation No. 85 is being implemented in current discharge permit renewals for facilities with >= 2 MGD design flow. This includes all TMDL facilities that were given wasteload allocations, except Hudson, which no longer discharges to the watershed. Current status of Reg. 85 Implementation is shown in Attachment 2. The implementation of Regulation No. 85 limits is incorporated into the TMDL as “interim limits” as described in the Implementation Plan. For smaller facilities (Ft. Lupton, Brighton, Lochbuie), Regulation No. 85 is the only required target through the end of Phase I of the TMDLs.	
6.	When must final WLAs be implemented into permits for the	This answer to this question has not been resolved and requires more discussion. The schedule attached to the Implementation Plan identifies that Regulation No. 85-based interim effluent limits for the largest facilities would be included in permit renewals beginning in 2016, however that	

	larger wastewater facilities?	schedule does not specifically address the timing of implementation of final wasteload allocations at the 100 µg/L concentrations for large facilities.	
6.	How do the TMDLs interface with Regulation No. 31 and 10-Year WQ Roadmap?	The 10-Year Roadmap contains multiple nutrient criteria revisions between 2018 and 2027. In 2022, the Division intends to adopt revised lake criteria for chlorophyll-a, total nitrogen, and total phosphorus. For chlorophyll-a, the pH TMDL has targets of 21 µg/L and 25 µg/L. The DO TMDL has targets of 20 µg/L as a summertime 80 <sup>th</sup> percentile and a maximum chl-a target of 25 µg/L. The Division’s proposed summertime chl-a standard for Regulation No. 31 is 20 µg/L with a 1 in 5-year exceedance frequency (equivalent to 80 <sup>th</sup> percentile). Therefore, the BMW TMDL target is already as stringent as the Regulation No. 31 chl-a value. For TP, the pH TMDL indicates a maximum target concentration of 100 µg/L. This equates to a summertime average of 40-60 µg/L in Barr Lake and 46-69 µg/L in Milton Reservoir. These values are more stringent than the Regulation No. 31 Interim Phosphorus value for warm lakes of 83 µg/L summer average with a 1 in 5-year allowable exceedance frequency. For TN, the Regulation No. 31 Interim Total Nitrogen value is 910 µg/L. There is no equivalent nitrogen control target within the BMW TMDLs. Both the TP and TN values may change during the 2022 Rulemaking Hearing for nutrients, but per the roadmap, these values will not be adopted until 2027. The chlorophyll-a criteria could also be revised, and per the roadmap, will be adopted in 2022.	Regulation No. 31
8.	Have we done enough scientific work to confirm that the water quality targets/goals are appropriate, i.e., that the uncertainty associated with the water quality linkages has been resolved?	To be discussed	
9.	How does monitoring of incremental reductions intend to further the phased approach? And/or, to support	To be discussed	

	staged implementation?		
10.	How does the TMDL interface with the Regulation No. 85 Incentive Program?	It is expected that some facilities will achieve concentrations below Regulation No. 85 via the Regulation No. 85 Incentive program. This program was actually tailored to the Barr-Milton Watershed in order to focus efforts on phosphorus reductions by allowing additional credits for reductions of phosphorus below 0.7 mg/L. The Board has not discussed in detail the interactions between the Regulation No. 31 standards and final wasteload allocation targets – this will require more discussion because the Incentive Program provides for delay to Regulation No. 31 limits, but does not explicitly address delays to TMDL WLAs.	WQCC Policy 17-1

## NPDES Permitted Facilities' Nutrient Reductions Status

Facility Name	NPDES Permit ID	Rated Capacity (MGD)	Effluent Data	Effective Date of Last Renewal	Reg. 85 TP Effective Date	Reg. 85 TIN Effective Date	Reg. 85 Incentive Program?
Metro WRD Hite Facility	CO0026638	220	<a href="https://echo.epa.gov/effluent-charts#CO0026638">https://echo.epa.gov/effluent-charts#CO0026638</a>	7/1/2018	1/1/2023	7/1/2018	
SPWRP	CO0032999	50	<a href="https://echo.epa.gov/effluent-charts#CO0032999">https://echo.epa.gov/effluent-charts#CO0032999</a>	12/1/2017	7/1/2023	7/1/2023	Yes, not filed yet
Metro WRD NTP	CO0048959	28.8	<a href="https://echo.epa.gov/effluent-charts#CO0048959">https://echo.epa.gov/effluent-charts#CO0048959</a>	5/1/2016	5/1/2016	5/1/2016	
Centennial WSD	CO0037966	8.48	<a href="https://echo.epa.gov/effluent-charts#CO0037966">https://echo.epa.gov/effluent-charts#CO0037966</a>	1/1/2016	7/1/2022	7/1/2022	

S. Adams County WSD	CO0026662	8	<a href="https://echo.epa.gov/effluent-charts#CO0026662">https://echo.epa.gov/effluent-charts#CO0026662</a>	8/1/2010			
City of Ft. Lupton	CO0021440	2.75	<a href="https://echo.epa.gov/effluent-charts#CO0021440">https://echo.epa.gov/effluent-charts#CO0021440</a>	7/1/2018	2/1/2023	2/1/2023	
City of Brighton	CO0021547	3	<a href="https://echo.epa.gov/effluent-charts#CO0021547">https://echo.epa.gov/effluent-charts#CO0021547</a>	3/1/2016	1/1/2021	3/1/2016	
Town of Lochbuie	CO0047198	2	<a href="https://echo.epa.gov/effluent-charts#CO0047198">https://echo.epa.gov/effluent-charts#CO0047198</a>	9/1/2012			

Town of Hudson	COG589104	0.5	<a href="https://echo.epa.gov/effluent-charts#COG589104">https://echo.epa.gov/effluent-charts#COG589104</a>	10/1/2013	N/A	N/A	
Sand Creek Reuse (Aurora)	??	??					
Burlington Pumpback	??	??					
<b>Facility Name (No WLAs)</b>							
Suncor							
Arapahoe Station		No discharge					
Cherokee Station							
Zuni Station		No discharge					

### Attachment 3

#### History of Discussion/Actions [Maintains the document history]

Date	Action	Editor	Other
1/18/2018	Outline developed	Dan DeLaughter	
2/14/2018	Rough Draft completed circulated to co- authors	Dan DeLaughter	Support from Emily Jackson, Sarah Reeves, Laurie Rink
8/3/2018	BMW Board review and subsequent revisions incorporated	Dan DeLaughter	
8/28/18	BMW Board discussion and acceptance of “working” document to share with BMW stakeholders and WQCD	Lead by Dan DeLaughter	
9/7/18	Finalization of “working document”	Laurie Rink	
Next Steps	Continue to flesh out answers to questions posed in Attachment 1		