

May 1, 2001

Canute Dalmasse  
Vermont Department of Environmental Conservation  
103 South Main St. 1 S  
Waterbury VT 05671-0401

**SUBJECT: Notification of Approval of Black River at Ludlow TMDL**

Dear Mr. Dalmasse:

Thank you for your submittal of the Total Maximum Daily Load (TMDL) for the Black River at Ludlow (for phosphorus). This waterbody is included on Vermont's 1998 303(d) list as a high priority for TMDL development to protect aquatic life.

The U.S. Environmental Protection Agency (EPA) hereby approves Vermont's February 2001 Black River at Ludlow TMDL. EPA has determined that this TMDL meets the requirements of §303(d) of the Clean Water Act (CWA), and of EPA's implementing regulations (40 CFR Part 130). Attached is a copy of our approval documentation.

We are pleased with the quality of your TMDL submittal. My staff and I look forward to continued cooperation with the VT DEC in exercising our shared responsibility of implementing the requirements under Section 303(d) of the CWA.

Sincerely,

Ronald Manfredonia  
Surface Water Branch Chief  
Office of Ecosystem Protection

cc: Wally McLean, VT DEC  
Tim Clear, VT DEC

In-house distribution:

Alison Simcox  
Ann Williams  
Jerry Potamis  
Eric Perkins

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## EPA NEW ENGLAND'S TMDL REVIEW

**TMDL:**       **Black River at Ludlow**  
Waterbody ID VT10-11

**STATUS:**     Final

**IMPAIRMENT/POLLUTANT:** An approximately 0.5-mile segment of the Black River located below the municipal wastewater treatment facility (WWTF) in Ludlow, VT, has the potential to be impaired by excessive phosphorus loadings. Currently the principal source of phosphorus is the Ludlow WWTF.

The TMDL addresses potential violations in Vermont's Water Quality Standards (WQSs) for total phosphorus (TP) during the summer season.

**REVIEWERS:**       Alison Simcox, Ph.D. (617-918-1684) E-mail: [simcox.alison@epa.gov](mailto:simcox.alison@epa.gov)  
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**BACKGROUND:** The Vermont Department of Environmental Conservation (VT DEC) submitted to EPA New England the final Total Maximum Daily Load (TMDL) for the Black River at Ludlow, dated February 2001, with a transmittal letter dated March 12, 2001 (received by EPA March 19, 2001). The purpose of the TMDL is (1) to establish the pollutant loading that the Black River can assimilate without violating WQSs for total phosphorus, and (2) to develop the basis for discharge limits for the Ludlow WWTF when the permit is renewed. The Ludlow WWTF currently operates under a National Pollution Discharge Elimination System (NPDES) permit issued by VT DEC. Also included in the administrative record file are the following documents:

- Draft Total Maximum Daily Load (TMDL) for Phosphorus: Black River at Ludlow (VT DEC, October 2000)
- EPA New England's Review of Vermont's TMDL for the Black River at Ludlow (EPA, December 8, 2000)

## REVIEW ELEMENTS OF TMDLs

*Section 303(d) of the Clean Water Act (CWA) and EPA's implementing regulations at 40 C.F.R. § 130 describe the statutory and regulatory requirements for approvable TMDLs. The following information is generally necessary for EPA to determine if a submitted TMDL fulfills the legal requirements for approval under Section 303(d) and EPA regulations, and should be included in the submittal package. Use of the verb "must" below denotes information that is required to be submitted because it relates to elements of the TMDL required by the CWA and by regulation.*

### 1. Description of Waterbody, Pollutant of Concern, Pollutant Sources and Priority

## Ranking

*The TMDL analytical document must identify the waterbody as it appears on the State/Tribe's 303(d) list, the pollutant of concern and the priority ranking of the waterbody. The TMDL submittal must include a description of the point and nonpoint sources of the pollutant of concern, including the magnitude and location of the sources. Where it is possible to separate natural background from nonpoint sources, a description of the natural background must be provided, including the magnitude and location of the source(s). Such information is necessary for EPA's review of the load and wasteload allocations which are required by regulation. The TMDL submittal should also contain a description of any important assumptions made in developing the TMDL, such as: (1) the assumed distribution of land use in the watershed; (2) population characteristics, wildlife resources, and other relevant information affecting the characterization of the pollutant of concern and its allocation to sources; (3) present and future growth trends, if taken into consideration in preparing the TMDL; and, (4) explanation and analytical basis for expressing the TMDL through surrogate measures, if applicable. Surrogate measures are parameters such as percent fines and turbidity for sediment impairments, or chlorophyll a and phosphorus loadings for excess algae.*

The main stem of the Black River begins in Plymouth in Windsor County in southeastern Vermont and flows south to the town of Ludlow, then east through Proctorsville and Cavendish and discharges into the Connecticut River, which forms the border between New Hampshire and Vermont. This TMDL is developed for approximately 0.5 miles of the Black River downstream of the Ludlow WWTF.

The segment is on the 1998 and 2000 303(d) lists of threatened and impaired waters for nutrients and was scheduled for TMDL development in 2001, which classifies it as a high-priority TMDL. The segment was listed based on assessments by VT DEC of macroinvertebrates conducted above and below the Ludlow WWTF in 1987 and 1991. VT DEC concluded that nutrient enrichment due to phosphorus loadings from the Ludlow WWTF was harming the aquatic community.

In 1999, the Town of Ludlow asked VT DEC about expanding the permitted flow of its WWTF. In considering this request, VT DEC conducted further study of the potential nutrient-enrichment problem, which resulted in development of this TMDL. The 1999 study was done during the summer, low-flow season and included chemical sampling of the WWTF effluent and of the Black River upgradient of the WWTF. Biomonitoring, which included both fish and macroinvertebrate sampling, was done above and below the WWTF. In addition, a mixing study was done to estimate the location of complete mixing of effluent with river water. Biomonitoring stations were located downgradient of this location, which was determined to be 2500 feet from the effluent discharge. VT DEC notes that the downstream macroinvertebrate sampling site in 1987 and 1991 was located about 700 feet from the outfall and may not have been in a completely mixed location. To determine if this had an effect on sampling results, in 1999, VT DEC sampled both the former and the completely mixed sites.

The results of 1999 biomonitoring showed that all downstream sites met biological criteria for Class B waters. However, VT DEC needs several years of data showing that biological criteria are being met before a waterbody can be delisted.

For the TMDL analysis of the Black River, VT DEC chose to establish a cause-and-effect relationship between the numeric biocriteria targets and pollutant sources (primarily the Ludlow WWTF) by correlating the condition of the aquatic biota in the river to current TP loading (see TMDL Review Element #3 below). The TMDL contains a description of assumptions used (see TMDL Review Element #3).

NPS loadings include both background sources of TP and existing and future nonpoint sources. These were aggregated because NPS loadings appear to be minor relative to point-source loadings to this river segment.

**Assessment:** EPA New England concludes that the TMDL document adequately characterizes the Black River, the pollutant of concern, the priority ranking of the waterbody, and the sources of the pollutant. VT DEC has used the best available information, including data from bioassessments done in 1987, 1991, and 1999. EPA New England agrees with VT DEC that the analytical approach chosen is adequate.

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

*The TMDL submittal must include a description of the applicable State/Tribe water quality standard, including the designated use(s) of the waterbody, the applicable numeric or narrative water quality criterion, and the antidegradation policy. Such information is necessary for EPA's review of the load and wasteload allocations which are required by regulation. A numeric water quality target for the TMDL (a quantitative value used to measure whether or not the applicable water quality standard is attained) must be identified. If the TMDL is based on a target other than a numeric water quality criterion, then a numeric expression, usually site specific, must be developed from a narrative criterion and a description of the process used to derive the target must be included in the submittal.*

The TMDL for the Black River describes the applicable water-quality standards, which include narrative criteria, which specify that "In all waters, total phosphorus loadings shall be limited so that they will not contribute to the acceleration of eutrophication or the stimulation of the growth of aquatic biota in a manner that prevents the full support of uses". The TMDL also identifies designated uses for a Class B water, including support of aquatic biota, wildlife, and aquatic habitat; aesthetics; and boating, fishing, and other recreational uses. In addition, the TMDL states Vermont's antidegradation policy.

VT DEC proposes to use macroinvertebrate biocriteria, including organism density, species richness, EPT/richness and the Biotic Index (see TMDL, Table 2), to determine whether water-quality standards are being met in the Black River during the low-flow summer season. VT DEC states that the biometric of primary importance for this TMDL is the Biotic Index because it measures an organism's tolerance to organic enrichment.

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The advantage to using biological indicators for assessing nutrient enrichment is that they are not as variable over time as pollutant loads or concentrations and give an integrated measure of overall ecological health. Once it is shown that the macroinvertebrate biocriteria targets are achieved, VT DEC predicts the Black River will fully support an aquatic community consistent with Vermont's Class B Water Quality Standards.

*Assessment:* EPA New England concludes that VT DEC has adequately described Vermont's WQSs, and has established a TMDL for TP at a level that will assure that current WQSs in the Black River will be met.

### **3. Loading Capacity - Linking Water Quality and Pollutant Sources**

*As described in EPA guidance, a TMDL identifies the loading capacity of a waterbody for a particular pollutant. EPA regulations define loading capacity as the greatest amount of loading that a water can receive without violating water quality standards (40 C.F.R. § 130.2(f)). The loadings are required to be expressed as either mass-per-time, toxicity or other appropriate measure (40 C.F.R. § 130.2(i)). The TMDL submittal must identify the waterbody's loading capacity for the applicable pollutant and describe the rationale for the method used to establish the cause-and-effect relationship between the numeric target and the identified pollutant sources. In most instances, this method will be a water quality model. Supporting documentation for the TMDL analysis must also be contained in the submittal, including the basis for assumptions, strengths and weaknesses in the analytical process, results from water quality modeling, etc. Such information is necessary for EPA's review of the load and wasteload allocations which are required by regulation.*

*In many circumstances, a critical condition must be described and related to physical conditions in the waterbody as part of the analysis of loading capacity (40 C.F.R. § 130.7(c)(1)). The critical condition can be thought of as the "worst case" scenario of environmental conditions in the waterbody in which the loading expressed in the TMDL for the pollutant of concern will continue to meet water quality standards. Critical conditions are the combination of environmental factors (e.g., flow, temperature, etc.) that results in attaining and maintaining the water quality criterion and has an acceptably low frequency of occurrence. Critical conditions are important because they describe the factors that combine to cause a violation of water quality standards and will help in identifying the actions that may have to be undertaken to meet water quality standards.*

Even though 1999 sampling indicated attainment of water-quality standards, VT DEC has determined that there is a potential for aquatic-life impairment due to nutrient enrichment. Numeric water-quality targets for the TMDL for the Black River consist of macroinvertebrate biocriteria targets. However, the primary numeric water-quality target in the TMDL used to link nutrient enrichment to attainment of water-quality standards is the Biotic Index.

VT DEC established a cause-and-effect relationship between the numeric targets (i.e., macroinvertebrate biocriteria) and the identified pollutant sources (primarily the Ludlow WWTF) by correlating the condition of the aquatic biota in the river to current TP loading. Data collected by VT DEC from May to July in 1999 downstream from the Ludlow WWTF resulted in a Biotic Index close to the impairment threshold. During the 1999 sampling period, average flows in the Black River (estimated from a USGS gaging station on the nearby Williams River) were close to (about 20 percent higher than) the estimated 7Q10 flow,

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presenting nearly ideal conditions for assessing impacts of the WWTF on biologic communities. Therefore, VT DEC set the loading capacity of the Black River equal to 1999 measured TP loading in this downstream segment.

With an average TP concentration in effluent (C) from the WWTF equal to 2.4 milligrams per liter (mg/l) and an average effluent flow (Q) of 0.35 million gallons per day (MGD), TP loading ( $L=CQ$ ) from the WWTF equals 7.0 pounds per day (lbs/day) [(2.4 mg/l x 8.34 pounds per million gallons (lb/MG)) x 0.35 MGD]. Similarly, with an average TP concentration in the river (C) upstream from the WWTF equal to 0.013 mg/l and an estimated average river flow (Q) of 10.9 cfs (7.04 MGD), TP loading from background sources equals about 0.8 lbs/day. Therefore, the total loading capacity of the potentially impaired river segment equals 7.8 lbs/day.

The analysis includes the assumption that intermittent TP loading from wet-weather runoff (i.e., runoff-producing precipitation events) has a less critical impact on the aquatic environment than consistent daily TP loading from the Ludlow WWTF. The analysis also assumes a direct relationship between TP loading to the river and the condition of aquatic biota.

Because TP loadings are mainly derived from a WWTF, critical conditions occur during the low-flow, summer season when (1) available dilution of effluent by river water is low and (2) environmental conditions (e.g., higher temperatures, increased light intensity, etc.) stimulate algal productivity (both periphyton and phytoplankton). Consequently, the TMDL is proposed for the summer season.

*Assessment:* EPA New England concludes that VT DEC has used a reasonable approach to establish a relationship between pollutant loading and water quality. We also concur that it is reasonable to set the TMDL for the summer season.

#### **4. Load Allocations (LAs)**

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

*If the TMDL concludes that there are no nonpoint sources and/or natural background, or the TMDL recommends a zero load allocation, the LA must be expressed as zero. If the TMDL recommends a zero LA after considering all pollutant sources, there must be a discussion of the reasoning behind this decision, since a zero LA implies an allocation only to point sources will result in attainment of the applicable water quality standard, and all nonpoint and background sources will be removed.*

For the potentially impaired segment of the Black River, the portion of the TP loading capacity attributed to background sources (undifferentiated from existing and future nonpoint sources) equals about 0.8 lbs/day (see previous review element - Loading Capacity). This is minor

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compared to the estimated TP loading capacity allocated to the Ludlow WWTF (7.0 lbs/day).

Because the TMDL analysis shows that 90 percent of the TP loadings to the Black River below the WWTF is caused by this point source, no NPS load reductions are recommended in the TMDL to meet water-quality standards.

*Assessment:* EPA New England believes the approach used by VT DEC to estimate background pollutant loads is reasonable. We agree that NPS loadings appear to be minor relative to point-source loadings to this river segment, and it is reasonable to assign an allocation to point sources only. EPA also agrees that for the minor background loadings that may exist, it is not possible to separate natural background from nonpoint sources and that attempting to do so would add little value to the analysis.

## **5. Wasteload Allocations (WLAs)**

*EPA regulations require that a TMDL include WLAs, which identify the portion of the loading capacity allocated to existing and future point sources (40 C.F.R. § 130.2(h)). If no point sources are present or if the TMDL recommends a zero WLA for point sources, the WLA must be expressed as zero. If the TMDL recommends a zero WLA after considering all pollutant sources, there must be a discussion of the reasoning behind this decision, since a zero WLA implies an allocation only to nonpoint sources and background will result in attainment of the applicable water quality standard, and all point sources will be removed.*

*In preparing the wasteload allocations, it is not necessary that each individual point source be assigned a portion of the allocation of pollutant loading capacity. When the source is a minor discharger of the pollutant of concern or if the source is contained within an aggregated general permit, an aggregated WLA can be assigned to the group of facilities. But it is necessary to allocate the loading capacity among individual point sources as necessary to meet the water quality standard.*

*The TMDL submittal should also discuss whether a point source is given a less stringent wasteload allocation based on an assumption that nonpoint source load reductions will occur. In such cases, the State/Tribe will need to demonstrate reasonable assurance that the nonpoint source reductions will occur within a reasonable time.*

VT DEC determined that the portion of the TP loading capacity attributed to existing and future point sources of pollution equals 7.0 lbs/day during the critical summer low-flow season (see previous review element - Loading Capacity). Therefore, VT DEC proposes to set a WLA applicable to low-flow conditions at this amount.

VT DEC has determined that the Ludlow WWTF is currently the major source of TP loadings to the Black River, and that it is appropriate to assign the entire WLA to this WWTF to meet the goal of maintaining State water-quality standards. It is anticipated that the allocation could be expressed in pounds/day as a monthly average in an NPDES permit, provided that the average daily total phosphorus load does not exceed 7.0 pounds/day.

*Assessment:* EPA New England agrees that it is appropriate to assign the entire WLA to the

Ludlow WWTF, and that this allocation procedure (expressed as a monthly average) is appropriate in this case because the expected response time of the algal community is less dependent on short term (daily) total phosphorus fluctuations than it is on longer time scales (weeks or months).

## **6. Margin of Safety (MOS)**

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

A MOS accounts for any lack of knowledge concerning the relationship between effluent limitations and water quality. VT DEC provides a margin of safety (MOS) in the Black River TMDL by determining the river's loading capacity and setting a WLA for an unimpaired environmental condition (as measured by the Biotic Index). As no impairment is identified at this loading level, there remains an additional unallocated TP load that provides an MOS.

Follow-up monitoring will be conducted to assess the adequacy of the TMDL. If monitoring indicates that violations of water-quality standards are likely to occur, the TMDL will be revised accordingly.

*Assessment:* Adequately addressed.

## **7. Seasonal Variation**

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

The TMDL for TP is established for summer, which is the season when impairment is most likely to occur.

*Assessment:* Adequately addressed.

## **8. Monitoring Plan for TMDLs Developed Under the Phased Approach**

*EPA's 1991 document, Guidance for Water Quality-Based Decisions: The TMDL Process (EPA 440/4-91-001), recommends a monitoring plan when a TMDL is developed under the phased approach. The guidance recommends that a TMDL developed under the phased approach also should provide assurances that nonpoint source controls*



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*will achieve expected load reductions. The phased approach is appropriate when a TMDL involves both point and nonpoint sources and the point source is given a less stringent wasteload allocation based on an assumption that nonpoint source load reductions will occur. EPA's guidance provides that a TMDL developed under the phased approach should include a monitoring plan that describes the additional data to be collected to determine if the load reductions required by the TMDL lead to attainment of water quality standards.*

Monitoring will be performed by the Ludlow WWTF as required by its NPDES permit. The monitoring plan specifies sample station locations, parameters, timing, frequency for both ambient and effluent monitoring. VT DEC also anticipates doing periodic biomonitoring in this portion of the Black River.

*Assessment:* Adequately addressed.

## **9. Implementation Plans**

*On August 8, 1997, Bob Perciasepe (EPA Assistant Administrator for the Office of Water) issued a memorandum, "New Policies for Establishing and Implementing Total Maximum Daily Loads (TMDLs)," that directs Regions to work in partnership with States/Tribes to achieve nonpoint source load allocations established for 303(d)-listed waters impaired solely or primarily by nonpoint sources. To this end, the memorandum asks that Regions assist States/Tribes in developing implementation plans that include reasonable assurances that the nonpoint source load allocations established in TMDLs for waters impaired solely or primarily by nonpoint sources will in fact be achieved. The memorandum also includes a discussion of renewed focus on the public participation process and recognition of other relevant watershed management processes used in the TMDL process. Although implementation plans are not approved by EPA, they help establish the basis for EPA's approval of TMDLs.*

Prediction that the TMDLs will meet water-quality standards is based on point-source control to improve water quality in the approximately 0.5-mile segment of the Black River below the Ludlow WWTF. The TMDL report identifies the Ludlow WWTF as the primary source of total phosphorus in this river segment. TP loadings to the river segment are controlled through a NPDES permit issued by VT DEC.

Nonpoint sources currently contribute relatively minor amounts of phosphorus; therefore, the TMDL does not rely on NPS controls to meet water quality standards in the potentially non-attaining segment.

As mentioned under TMDL Review Element #8 above, follow-up monitoring will be conducted to assess the adequacy of the TMDL. If monitoring indicates that violations of water-quality standards are likely to occur, the TMDL will be revised accordingly. This may result in a need to modify the NPDES permit under 40 CFR 122.62 (a)(2), as a revised TMDL would constitute new information not available at the time of permit reissuance.

*Assessment:* Adequately addressed.

## **10. Reasonable Assurances**

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*EPA guidance calls for reasonable assurances when TMDLs are developed for waters impaired by both point and nonpoint sources. In a water impaired by both point and nonpoint sources, where a point source is given a less stringent wasteload allocation based on an assumption that nonpoint source load reductions will occur, reasonable assurance that the nonpoint source reductions will happen must be explained in order for the TMDL to be approvable. This information is necessary for EPA to determine that the load and wasteload allocations will achieve water quality standards.*

*In a water impaired solely by nonpoint sources, reasonable assurances that load reductions will be achieved are not required in order for a TMDL to be approvable. However, for such nonpoint source-only waters, States/Tribes are strongly encouraged to provide reasonable assurances regarding achievement of load allocations in the implementation plans described in section 9, above. As described in the August 8, 1997 Perciasepe memorandum, such reasonable assurances should be included in State/Tribe implementation plans and "may be non-regulatory, regulatory, or incentive-based, consistent with applicable laws and programs."*

The WLA in the TMDL will be implemented through issuance of a new NPDES permit. The Ludlow WWTF is responsible for performing monthly water-quality monitoring as a requirement of its NPDES permit. Water-quality limits in the permit assure that State water-quality standards will be met. If needed, monthly monitoring data may be used to refine the TMDLs if water quality standards in the Black River are not being attained.

*Assessment:* Adequately addressed.

## **11. Public Participation**

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

*Inadequate public participation could be a basis for disapproving a TMDL; however, where EPA determines that a State/Tribe has not provided adequate public participation, EPA may defer its approval action until adequate public participation has been provided for, either by the State/Tribe or by EPA.*

A final draft version of the TMDL was made available for public comment in accordance with VT DEC's public participation process. A copy of the notice is appended to the final TMDL. VT DEC received several requests for the document, but no comments.

*Assessment:* Adequately addressed.

## **12. Submittal Letter**

*A submittal letter should be included with the TMDL analytical document, and should specify whether the TMDL is being submitted for a technical review or is a final submittal. Each final TMDL submitted to EPA must be*

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

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