United States
Environmental Protection Agency
Region 10
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TOTAL MAXIMUM DAILY LOAD (TMDL) FOR BIOCHEMICAL OXYGEN DEMAND (BOD_5) IN THE SURFACE WATERS OF WARD COVE, ALASKA

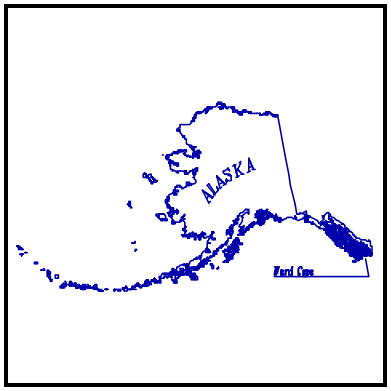
In compliance with the provisions of the Clean Water Act, 33 U.S.C. § 1251 et seq., as amended by the Water Quality Act of 1987, P.L. 100-4, the Environmental Protection Agency is hereby establishing a TMDL to limit discharges of biochemical oxygen demand to the surface waters of Ward Cove, Alaska.

This TMDL shall become effective immediately, and is incorporated into the water quality management plans for the state of Alaska under Clean Water Act § 303(e). Subsequent actions must be consistent with this TMDL.

Signed this _____ day of _____, 1994.

_____
Charles E. Findley, Director
Water Division

Total Maximum Daily Load for Biochemical Oxygen Demand in the Surface Waters of Ward Cove, Alaska



Background

Section 303(d)(1)(C) of the Clean Water Act and EPA's implementing regulations (40 CFR Part 130) require the establishment of Total Maximum Daily Loads (TMDL) for the achievement of state water quality standards. A TMDL is an implementation plan which identifies the degree of pollution control needed to maintain compliance with standards using an appropriate margin of safety. The focus of the implementation plan is the reduction of pollutant inputs to a level (or "daily load") that fully supports the beneficial uses of a given waterbody; however, other considerations are needed to complete the TMDL process. The components used to address water quality problems through the TMDL process include effluent limits and monitoring requirements.

The state of Alaska has identified Ward Cove as being water quality-limited for dissolved oxygen. Based on an assessment of the problem of low dissolved oxygen (DO) in Ward Cove, a draft TMDL for this waterbody was noticed to the public on August 4, 1993, in conjunction with the draft permit for Ketchikan Pulp Company. This final TMDL is established for Five Day Biochemical Oxygen Demand (BOD_5), a parameter directly related to the impact of a discharge on DO levels in a receiving water.

There have been no substantive changes to the draft TMDL resulting from public comment. EPA's responses to comments received on the draft TMDL are included at the end of this document.

Loading Capacity and Wasteload Allocation

Loading Capacity

As indicated in the problem assessment, the cove's capacity to assimilate a surface BOD_5 loading is dependent not only on BOD_5 loading but also on dissolved oxygen. Therefore, the loading capacity is defined in terms of both BOD and DO. Based on the modeling results from the Problem Assessment (EPA, August 1993), a

loading capacity of 20,000 lbs/day BOD_5 is established for the surface layer of Ward Cove. Based on the same analysis, a minimum dissolved oxygen requirement of 5 mg/l is established for discharges from the Ketchikan Pulp Company (KPC) facility.

Wasteload Allocation

The BOD_5 loading capacity of the surface layer of Ward Cove must be allocated to the sources identified as contributing pollutant loads to that portion of the waterbody. In this case, a single significant source, wastewater discharges from KPC, was identified.

In accordance with the regulations, a margin of safety was established to account for uncertainty in the data analyses. A margin of safety may be provided (1) by using conservative assumptions in the calculation of the loading capacity of the waterbody and (2) by establishing allocations that in total are lower than the defined loading capacity. In the case of the Ward Cove analysis, the latter approach was used to establish a safety margin. The following uncertainties were considered in establishing the margin of safety:

- Potential contributions of BOD_5 to the surface layer from the seafood processing facility discharge and bottom sediments

- Potential contributions of BOD_5 to the surface layer from non-point source pollution in the watershed.

- Uncertainty about assumptions used in modelling the dissolved oxygen budget

Based on the information available at this time, EPA establishes the following allocations among these sources:

Source	BOD_5 Allocation (% of Total)	Minimum DO
Ketchikan Pulp Co.	16,000 lbs/day (80%)	5 mg/l
Non-Point Source	2,000 lbs/day (10%)	-
Margin of Safety	2,000 lbs/day (10%)	-

The allocation for the KPC facility forms the basis of the BOD_5 limitations in the permit (reissuance). The allocation and limitations are established for the summer months (June through October), when dissolved oxygen violations in Ward Cove have been documented.

Monitoring Requirements

The ambient DO monitoring program conducted by KPC under its NPDES permit will continue under the reissued permit, as will monitoring of process wastewater discharges for BOD. The permit will also contain a stormwater monitoring program. This program will focus monitoring efforts on significant stormwater discharges, including those that may contribute significant BOD_5 loadings to Ward Cove. For compliance purposes, stormwater BOD_5 loadings will be added to process waste discharges to determine compliance with total BOD_5 limitations.

Endangered Species Consultation

EPA consulted the National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS) regarding potential effects of the proposed KPC permit on threatened and endangered species. A Biological Evaluation supplied by EPA to the Services discussed the elements of this TMDL and the wasteload allocation proposed for the KPC facility. USFWS concurred with EPA in a letter dated February 2, 1994, that the proposed discharges are not likely to adversely affect the listed species. NMFS similarly concurred in a letter dated February 4, 1994.

Public Involvement and Response to Comments

In conjunction with the Public Notice for the draft NPDES permit for Ketchikan Pulp Company, EPA requested comment on the Problem Assessment and proposed TMDL from all interested parties between August 4, 1993, and February 4, 1994. All comments submitted to EPA before the expiration date of the Public Notice are summarized below. After reviewing these comments, EPA has made final determinations and is issuing this final TMDL.

Response to Comments

Comment: Several parties commented that it is not clear if KPC's wasteload allocation for BOD has taken into account the BOD demands of the log storage facilities that now exist in the cove or are planned for the future operations of the mill. If not, the allowable loading from the pulp mill would have to be reduced.

Response: The WLA is tied to conditions occurring in 1986, and BOD contributions from sources other than the KPC mill discharges at that time would have been captured in the data used to calibrate the model parameters. The effect of log storage on surface DO is believed minor, whereas longer term effects of bark deposits on the bottom DO may be significant. This TMDL addresses the surface DO problem.

Comment: Several parties commented that the TMDL problem assessment does not adequately address the sediment problems in Ward Cove.

Response: EPA agrees that continued effort is needed to characterize and address sediment impairment. EPA plans to update the problem assessment with regard to this issue. Effluent and sediment monitoring under this permit should provide helpful information about the sources and extent of the problems. This information will be needed to support any TMDLs for sediments.

Comment: KPC commented that EPA considers 1986 summer conditions to be representative of the worst conditions that could occur in Ward Cove. This is because the highest number of DO measurements below 6 mg/l were observed in Ward Cove during the months of August and September of 1986. It is also for this reason that the DO-BOD_5 model was calibrated to 1986 conditions. However, there have been several changes in the mill operation, processes, and treatment systems since 1986 which considerably impact the model inputs and assumptions. These changes include increased chemical recovery, pH control, and biological treatment. These changes affect the BOD exertion rate and inputs of chemical oxygen demand (COD) and exerted rates.

KPC commented on the following limitations of using a model calibrated to 1986 effluent and Ward Cove data to derive KPC's WLA and therefore the 1994 permit limits:

- Effluent DO: The predicted minimum DO in Ward Cove is highly sensitive to effluent DO concentrations. An effluent DO of 5 mg/l was assumed by EPA in performing model calibration. However, new effluent DO data collected by KPC since the new effluent mixing chamber with the associated neutralization equipment became operational indicates that effluent DO levels now are typically well above 5 mg/l.

- BOD decay rate: Effluent TSS loading to Ward Cove has shown a steady decline. Also, the effluent solids from the biological treatment unit are less oxidized than in 1986 due a change in the operating characteristics of the treatment unit. This reduction directly impacts overall BOD decay rate, which is an important component of the DO-BOD5 balance. The overall decay rate, K_R, is defined as

$$K_R = K_d + K_s$$

where K_d is the BOD decay rate in natural waters and K_s is BOD settling rate. In the modeling performed by EPA, the overall BOD decay rate used was assumed to be equal to K_d, which was calculated using Ward Cove plume samples collected in 1989, and K_s was neglected. This assumes that the overall BOD decay rate has remained a constant over the years 1986 through 1994, although it is very likely that the overall decay rate has undergone a change with the change in the K_s component due to changes in the quantity and character of the total solids loading to the cove.

- BOD to BOD Conversion: The DO-BOD_5 model requires ultimate BOD (BOD_u) as an input as opposed to the typically measured BOD_5. In calibrating the model to 1986 data, effluent BOD_u was computed from BOD_5 data using a relation based on the 1989 instream decay rate K_d. For the reasons discussed above, this in inappropriate. Likewise the decay rate calculated for 1989 probably does not reflect the current rate. BOD_u is an effluent property that is best determined through laboratory tests or using laboratory derived decay constant K based on the effluent samples from the combined outfall and 1994 effluent data.

- BOD_5 input loading: The modeling performed used a 5-day running average value of BOD_5 loading to calibrate against a DO data set collected at the Ward Cove monitoring stations. In view of the fact that Ward Cove DO levels are only measured once in 14 days, the use of 5-day average for effluent BOD5 needs to be reevaluated.

ENSR Consulting and Engineering independently performed a DO-BOD_5 analysis of Ward Cove using the model DOPRMT. The three-dimensional VAX-based model was adjusted to run on a PC using MS-FORTRAN Power Station. EPA results were reproduced for the summer of 1986. ENSR then conducted a model sensitivity analysis and an outfall siting analysis within Ward Cove to determine the effect of the extended outfall on dissolved oxygen. They found that an extended outfall with a diffuser that allows the plume to trap underwater will considerably alter the computed TMDL. As an example, moving the outfall about 440 m downstream and about 150 m from the shore results in an increase in BOD_5 WLA from 20,000 lb/day to 38,583 lb/day for the same 1986 summer conditions.

Design of an extended outfall and the associated outfall siting analysis is currently underway. Several sites within Ward Cove and in Tongass Narrows are under study. If a site is selected within Ward Cove, ENSR will present its analysis of the DO-BOD5 kinetics using the EPA model DOPRMT as part of the mixing zone request to the State of Alaska, and in that document request a new WLA for BOD_5'.

Response: In general, EPA agrees that the analysis of BOD and DO in Ward Cove, like any predictive water quality analysis, has a number of assumptions that affect the certainty of its conclusions. However, while highlighting some of these assumptions, KPC has not proposed any specific improvements to the analysis that are feasible given the available data. EPA maintains that the analysis is reasonable given the limitations of the data; therefore, the

results of the analysis remain unchanged. Specific points in this comment are addressed below:

Effluent DO: KPC indicates that effluent DO levels are now typically well above 5 mg/l. The company has not requested a higher minimum DO limit (and corresponding higher BOD allocation), and EPA is encouraged that compliance with the proposed minimum limit of 5 mg/l will be expected without process modification.

Decay rate: While the company's assertion that the effluent BOD decay rate has changed since 1986 may be accurate, there is no data to support this claim. In the absence of supporting monitoring data, EPA must use available data and conservative assumptions. In this case, the available data were generated in 1989.

BOD Conversion: In order to estimate the model parameters for the 1986 data set, EPA fixed the decay rate using the available data (obtained in 1989). Because any change to this rate would be compensated by changes in best fit parameter values, use of 1994 data to generate a new parameter set would not necessarily increase the certainty or significantly change the final results. EPA reiterates that more recent data have not been provided to support this comment.

BOD loading: The comment about the need to reevaluate the averaging of BOD_5 levels is somewhat vague, because no alternative to the chosen averaging period is suggested. EPA believes that averaging is appropriate. The choice of 5 days is based on the approximate response time of cove waters to a BOD discharge, as indicated by the estimated time scale for reaeration. The fact that DO samples in the cove were obtained every 14 days has no bearing on effluent BOD averaging.

Outfall Location: EPA agrees that the outfall location is a key factor in affecting the magnitude of DO problems in Ward Cove. Because impacts to the surface layer are sensitive to outfall location, relocation of the outfall to deeper and/or more open water may result in a significantly higher wasteload allocation for KPC, as indicated in this comment.