

Category 4b Demonstration for Petroleum Hydrocarbon Impaired Waters in the Kenai River, Alaska

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ABSTRACT

Section 303(d) of the Clean Water Act (CWA) and the US Environmental Protection Agency's (USEPA's) supporting regulations in 40 CFR Part 130.7 require states to develop lists of waterbodies impaired by a pollutant and needing a Total Maximum Daily Load (TMDL) (i.e., the Section 303(d) list) and to prepare a TMDL for each waterbody/pollutant combination. USEPA's regulations also recognize that other pollution control requirements may obviate the need for a TMDL. These alternatives to TMDLs are commonly referred to as Category 4b waters as described in USEPA's Integrated Reporting Guidance for Sections 303(d), 305(b), and 314 of the CWA.

One of the most visible waterways in Category 4b is the Kenai River. The Kenai River is known worldwide for its prized King Salmon. The initial 20 miles of the lower river attracts over 700 boats per day during the peak fishing season. Water quality data for the Kenai River showed elevated petroleum hydrocarbon levels during the month of July in the lower portion of the river. A water quality assessment conducted by the Alaska Department of Environmental Conservation (ADEC) in 2003 confirmed the source of the petroleum hydrocarbon pollution was from motorboats and subsequent studies identified older, 2-stroke motors as the primary source. The waterbody was subsequently listed as impaired on ADEC's Section 303(d) list (Category 5).

As a result of the 2003 study, ADEC began meeting with Kenai River stakeholders to strategize and develop a waterbody recovery plan and take the necessary actions. By 2007, the Kenaitze Indian Tribe using USEPA Targeted Watershed Initiative Grant monies initiated a buy-back program for older, more polluting, carbureted 2-stroke motors. In 2008, Alaska adopted regulations requiring all outboard engines used in the Kenai River Special Management Area and the personal use fishery to be cleaner motors - either 4-stroke or direct fuel injection 2-stroke motors. For the 2008 reporting cycle, the ADEC assigned petroleum hydrocarbon impaired waters of the Kenai River to Category 4b. Based on water quality modeling results for the river, ADEC expects the implementation strategy will result in attainment of the petroleum hydrocarbon water quality standard by 2010.

This paper presents ADEC's demonstration for assigning these waters to Category 4b according to USEPA's Category 4b guidance, lessons learned in developing the restoration strategy, and potential challenges for maintaining these waters in Category 4b for future 303(d) reporting cycles.

KEYWORDS

TMDL, alternative, Category 4b, impairment, petroleum hydrocarbon, motorboats, nonpoint source

INTRODUCTION

Section 303(d) of the Clean Water Act (CWA) and the U.S. Environmental Protection Agency's (USEPA) 1992 supporting regulations (see 40 CFR 130.7) require states, territories, and authorized tribes (herein referred to as states) to develop lists of waters impaired or threatened by pollutants (i.e., Section 303(d) list) and to develop Total Maximum Daily Loads (TMDLs) for these waters. Since the 1990s, States and USEPA have produced more than 39,000 TMDLs. And, based on the current status of States' Section 303(d) lists, more than 70,000 TMDLs remain to be completed (USEPA, 2009).

USEPA's supporting regulations also recognize that alternative pollution control requirements may obviate the need for a TMDL. Specifically, impaired waters are not required to be included on a State's Section 303(d) list if technology-based effluent limitations required by the CWA, more stringent effluent limitations required by state, local, or federal authority, or "[o]ther pollution control requirements (e.g., best management practices) required by local, [s]tate or [f]ederal authority" are stringent enough to implement applicable water quality standards (see 40 CFR 130.7(b)(1)). These alternatives to TMDLs are commonly referred to as "Category 4b" waters, as described in USEPA's Integrated Reporting Guidance (IRG) for Sections 303(d), 305(b), and 314 of the CWA (USEPA, 2005 and 2006).

Beginning with the 2002 reporting cycle, USEPA's IRG recommends that States use the following five reporting "categories" to report on the water quality status of all waters in their State:

- Category 1: All designated uses (DU) are supported, no use is threatened;
- Category 2: Available data and/or information indicate that some, but not all of the DUs are supported;
- Category 3: There is insufficient available data and/or information to make a DU support determination;
- Category 4: Available data and/or information indicate that at least one DU is not being supported or is threatened, but a TMDL is not needed;
- Category 5: Available data and/or information indicate that at least one DU is not being supported or is threatened, and a TMDL is needed.

As the above categories show, waters assigned to Category 4 and 5 are impaired or threatened; however, waters assigned to Category 5 represent waters on a State's Section 303(d) list. Similar to Category 5, waters in Category 4 are also impaired or threatened; however, other conditions exist that no longer require them to be included on a State's Section 303(d) list. These conditions, which are referred to as subcategories of Category 4 in USEPA's IRG are described below:

- Category 4a: TMDL has been completed;
- Category 4b: TMDL is not needed because other pollution control requirements are expected to result in the attainment of an applicable WQSs in a reasonable period of time;
- Category 4c: The non-attainment of any applicable WQS for the waterbody is the result of pollution and is not caused by a pollutant. Examples of circumstances where an impaired segment may be placed in Category 4c include waterbodies impaired solely due to lack of adequate flow or to stream channelization.

According to USEPA's IR guidance, EPA will evaluate on a case-by-case basis a State's decisions to exclude certain segment/pollutant combinations from Category 5 (the Section 303(d) list) based on the Category 4b alternative. The IRG indicates that States should provide in their Section 303(d) list submission a rationale that supports their conclusion that there are "other pollution control requirements" stringent enough to achieve applicable water quality standards within a reasonable period of time.

Although USEPA's Category 4b guidance was initiated over eight years ago for the 2002 reporting cycle, Category 4b is not a widely used alternative to developing TMDLs for impaired and threatened waters. A 2006 survey (based primarily on States' USEPA-approved 2006 303(d) lists) showed that 267 impaired waters had been successfully assigned to Category 4b in 15 States (Monschein and Mann, 2007). A more recent survey (based primarily on States' USEPA-approved 2008 303(d) list) showed that more than 400 impaired waters have been successfully assigned to Category 4b (Monschein and Reems, 2009). Despite this increase in use of Category 4b, TMDLs (over 39,000 nationally) continue to be the primary means to address impaired and threatened waters in States' Section 303(d) programs.

Several options to advance the appropriate use of Category 4b have been suggested. In a March 2008 letter to USEPA's Assistant Administrator for Water, the Association of State and Interstate Water Pollution Control Administrators (ASIWPCA) highlighted State-developed options for reducing the workload burden for States associated with their biennial development and submission of Section 303(d) lists/Integrated Reports (IR). Among ASIWPCA's options was a suggestion to identify Category 4b demonstrations that have been successfully vetted through the Section 303(d) list development and review process, including those that involve more than National Pollutant Discharge Elimination System (NPDES) permits. Sharing of model Category 4b demonstrations was also identified as a means to advance the appropriate use of Category 4b in Monschein and Mann (2007).

As an example of the appropriate use of Category 4b for nonpoint source pollution, this paper describes a Category 4b demonstration in Alaska that has been successfully vetted through the Section 303(d) list/IR development and review process according to USEPA's Category 4b guidance for the 2008 reporting cycle. Specifically, this paper summarizes Alaska's Department of Environmental Conservation (ADEC), Water Quality Standards, Assessment and Restoration Category 4b demonstration for the a petroleum hydrocarbon impaired water (Lower Kenai River) located on the Kenai Peninsula in south central Alaska. This paper also presents the methods used to evaluate the appropriateness of assigning these impaired waters to Category 4b, as well

as lessons learned in developing the Category 4b demonstration and potential challenges for maintaining these waters in Category 4b for future Section 303(d) list/IR reporting cycles.

METHODS

The State and USEPA evaluated the appropriateness of assigning these impaired waters to Category 4b based on USEPA's IRG for the 2008 reporting cycle (USEPA, 2006). USEPA's IRG indicates that States should provide in their Section 303(d) list submission a rationale that supports their conclusion that there are "other pollution control requirements" stringent enough to achieve applicable water quality standards within a reasonable period of time. Specifically, USEPA requests that States address the following six elements in their Category 4b demonstrations:

1. Identification of segment and statement of problem causing the impairment
2. Description of the pollution controls and how they will achieve WQS, including a description of the "requirements" under which the controls will be implemented
3. An estimate or projection of the time when WQS will be met
4. Schedule for implementing pollution controls
5. Monitoring plan to track effectiveness of pollution controls
6. Commitment to revise pollution controls, as necessary

RESULTS

A summary of the Category 4b rationale for the petroleum hydrocarbon impaired Lower Kenai River is provided below. Additional details are available in the Kenai River Petroleum Hydrocarbon Waterbody Recovery Plan (Stevens, 2008).

1. Identification of segment and statement of problem causing the impairment

In 2006, the State of Alaska Department of Environmental Conservation (ADEC) listed the lower 19 miles of the Kenai River as impaired under the Clean Water Act Section 303(d) for not meeting the state's 10 parts per billion (ppb) petroleum hydrocarbon water quality standard during the month of July (see Figure). The major source of the petroleum hydrocarbons found in the river during the 2003 petroleum hydrocarbon assessment was the incomplete combustion of gasoline used to fuel 2-stroke and 4-stroke motors operating on the Kenai River. A disproportionate amount of pollution was coming from conventional, carbureted 2-stroke motors.

2. Description of pollution controls and how they will achieve water quality standards

In response to the Kenai River impairment, new state regulations were enacted in 2008 that required the use of cleaner, more fuel efficient motors while operating on the Kenai River. The regulations, described below, came in two parts. An incentive program had also been place to reduce the financial burden of the new requirements.

Figure – Lower Kenai River Map

Source: (Stevens, 2008)

On January 31, 2008, the Lt. Governor approved updated Department of Natural Resources regulation (11AAC.20.860) requiring the use of motorboats within the Kenai River Special Management Area (river mile 5-19). The regulation, effective March 1, 2008, required all motors used during July in the Kenai River Special Management Area to be either 4-stroke or 2-stroke direct fuel injected (DFI) motors. The regulation also allowed larger motors to operate on the river than previously allowed but required all motors greater than 35 horsepower, the former horsepower limit, to be either 4-stroke or DFI 2-stroke motors. DNR also proposed a year-round ban on older 2-stroke motors beginning in 2013. This delay allowed owners of conventional 2-stroke motors time to upgrade their motors while still using the river during non-peak season. A violation of this DNR State Parks regulation is considered an unspecified misdemeanor criminal offense. Violators are required to make a mandatory court appearance and are punishable up to 90-days in prison and a fine of up to \$1000.

In February 2008, the Alaska Department of Fish & Game, Board of Fisheries, adopted a publicly submitted proposal that prohibited the use of conventional 2-stroke motors while fishing for salmon in the personal use fishery located in the lower 5-miles of the Kenai River (river mile 0-5). The adopted language was signed by the Lt. Governor on May 15, 2008 and became effective on June 14, 2008. A violation of this ADF&G regulation is a Class-A Misdemeanor criminal offense. Violators are required to make a mandatory court appearance and are punishable up to one year in prison and a fine of up to \$10,000.

A onetime component of the water restoration triad was a motor buyback program initiated by the Kenaitze Indian Tribe and operated by the Kenai Watershed Forum (KWF). Through

funding received from a USEPA Targeted Watershed Initiative Grant, the Kenaitze Indian Tribe and the KWF developed an incentive program to purchase older, carbureted 2-stroke motors. Boat owners that could prove, by signing an affidavit, that they operated their 2-stroke motors on the Kenai River in the past were eligible. Owners that turned in their motors to the KWF received a \$500 voucher towards the purchase of a 4-stroke or 2-stroke DFI motor. Many local outboard motor dealerships also participated in this effort by offering an additional \$500 discount on new motors. Over the life of the program, over 200 older 2-stroke motors were removed from operation. Motors that were turned in were destroyed so that they could not be operated on any other waters.

3. Estimate or projection of the time when WQS will be met

By July 2008, state water quality standards were met. ADEC credits the actions taken by the Departments of Natural Resources and Fish and Game, eliminating the use of conventional 2-stroke motors. The success of the Kenaitze Indian Tribe's buyback program helped with the economic hardship imposed on owners of 2-stroke motors by the new regulations and created public acceptance of the recovery plan.

ADEC was confident that the program would work because of modeling work. The model predicted an average peak petroleum hydrocarbon concentration of 5.6 µg/l in the impaired river segment during July when older conventional 2-stroke motors were prohibited and powerboat usage didn't increase. The mass-balance model was initially developed to back calculate the amount of gasoline entering the river from unburned fuel from motorboats. The model was later refined to determine the amount of total aromatic hydrocarbons (TAH - the major components in gasoline) entering the river during July based on the number and types of motors operating on the lower Kenai River. TAH is composed of Benzene, Toluene, Ethyl benzene and Xylenes (BTEX). These compounds are major constituents of gasoline and are soluble in water. Because it is difficult to determine all makes, models and fuel efficiencies of motors operating on the river at any one time, ADEC took a conservative approach when evaluating the model results against the water quality standards by assuming all motorboats were equipped with 50 horsepower, 4-stroke motors.

4. Schedule for implementing pollution controls

The Alaska Department of Natural Resources regulation, 11AAC.20.860, which regulates the use of motorboats within the Kenai River Special Management Area, became effective on March 1, 2008. The regulation required all motors used during July within the Kenai River Special Management Area of the Kenai River to be either 4-stroke or 2-stroke Direct Fuel Injected (DFI) motors. The regulation also requires all motors greater than 35 horsepower to be either 4-stroke or DFI 2-stroke motors and includes a year round ban on conventional 2-stroke motors in 2013.

The Alaska Department of Fish & Game, Board of Fisheries regulation, 5 AAC 77.540, which regulates methods and means for the Kenai River Personal Use Fishery was signed by the Lt. Governor on May 15, 2008 and had an effective date of June 14, 2008. The newly updated regulation prohibits the use of conventional 2-stroke motors while fishing for salmon in the Kenai River personal use fishery beginning in July 2008.

5. Monitoring plan to track effectiveness of pollution controls

ADEC will continue to monitor water quality and boat usage to determine if water quality milestones are being met and to recalibrate the model as necessary. Monitoring was conducted in July 2008; results were as predicted with water quality standards being met. Monitoring is scheduled for July 2009.

6. Commitment to revise pollution controls, as necessary

If monitoring conducted after implementing the new regulations shows the actions taken to date are insufficient to attain state water quality standards the ADEC will consider additional measures to reduce the hydrocarbon input to the river. Any new actions taken would include additional monitoring to show water quality standards are being met.

DISCUSSION

Lessons learned in developing the Category 4b demonstration and potential challenges for maintaining these waters in Category 4b for future 303(d) reporting cycles are described below.

Lessons learned in developing the Category 4b demonstration

The keys to the success of the Kenai River petroleum hydrocarbon 4b plan were: (1) stakeholders wanted to resolve the pollution problem rather than develop a TMDL; (2) education is a critical factor - ADEC and the Kenai Watershed Forum educated a key stakeholder, the Kenai River Special Management Area Advisory Board (KRSMA-AB), in an effort to develop a workable solution; and (3) early and continuous stakeholders' involvement throughout the 4b planning process.

Resolving the pollution problem

The Kenai River is a world renown fishing attraction and is a large economic engine for the communities of Soldotna and Kenai. Stakeholders expressed concern that being labeled "impaired" could have economic impacts on the sport and commercial fishing industries and the local communities. Stakeholders chose to focus on resolving the impairment rather than waiting for a TMDL because there were no guarantees the pollution would be addressed in a time efficient manner under a TMDL scenario.

Education involvement

The key education factor was the technical information provided. ADEC and its partners invested a considerable amount of time educating stakeholders (including the KRSMA-AB) about; the source of the pollution, the amount of pollution being discharged, and the state petroleum hydrocarbon water quality standard being violated. The KRSMA-AB was created by the Governor in 1985 to serve as an advisor to the Department of Natural Resources, which

manages the Kenai River Special Management Area. The KRSMA-AB is made up of 17 members including river user groups, local governments, and state and federal resource agencies.

Key pieces of information that proved to be influential to the stakeholders were information derived from the mass-balance model that showed motors were exhausting up to 400-gallons/day of raw fuel into the river each day, and data gathered from the EPA Marine Spark-Ignition Engine database that showed conventional 2-stroke motors exhaust as much as 10 times more unburned fuel than the cleaner, more fuel efficient, 4-stroke and direct fuel injected 2-stroke motors.

Early and continuous stakeholder involvement

ADEC involved the KRSMA-AB as early as 2004 when it presented the results of the 2003 Kenai River Hydrocarbon Assessment report that showed petroleum hydrocarbon levels exceeded state water quality standards during the month of July. However, little action was taken by the KRSMA-AB. Simultaneously the KRSMA-AB was considering increasing the allowable motor size. The possibility of an impaired waterbody and larger motors peaked general public concern. This pressured the KRSMA-AB to consider other actions. After the lower 19 miles of river were listed as impaired in the State's 2006 Integrated Report and a TMDL date scheduled, the KRSMA-AB took on the pollution problem in earnest. ADEC met monthly with the KRSMA-AB for more than a year to discuss the petroleum hydrocarbon issue and possible solutions.

Originally, stakeholders wanted any actions taken to reduce petroleum hydrocarbons to be equally applied among all users groups. Although noble, this led to heated discussions and finger pointing as to how much one group or fishing style was contributing to the petroleum problem versus another. Consensus building started once stakeholders were presented information that showed conventional 2-stroke motors contribute as much as 10 times more unburned fuel to the river than cleaner, more fuel efficient, 4-stroke and direct fuel injected 2-stroke motors. Regulators and technical experts spent significant time convincing stakeholders that banning conventional 2-stroke motors was a fair and equitable solution; the solution would allow the river to meet state water quality standards in the near future, and would fully resolve the petroleum hydrocarbon pollution problem. Stakeholders favored the prohibition on conventional 2-stroke motors over other options because; the number of motors allowed to operate on the river was not limited, both 2-stroke and 4-stroke motor technologies were allowed, an individual could operate his or her motor on the river unrestricted, and it had the potential to greatly reduce the amount of gasoline being exhausted into the water. The one user group targeted for petroleum reductions (owners of conventional 2-stroke motors) was reluctant to accept the proposal, mostly for economic reasons. The economic issues were addressed with the initiation of a motor buy-back program by The Kenaitze Indian Tribe and a delay in the year round ban on conventional 2-stroke motors until 2013.

Also important were the numerous public forums where the problem and potential solutions were discussed. The monthly KRSMA-AB meetings included the topic for over a year, the local assembly discussed the problem/solutions and DNR/F&G sought public input as a normal

component of their regulation process. During these meetings ADEC noted the need for enforceable requirements to support a Category 4b assignment for the Lower Kenai River.

Potential challenges for maintaining these waters in Category 4b for future 303(d) reporting cycles

Base on modeling done by ADEC and its partners there was consensus the river would meet state water quality standards as soon as the state regulations (reduction measures) were in place. ADEC was also convinced the river would continue to meet state water quality standards as long regulations were enforced. In July 2008, monitoring was done in the lower river at River Miles (RM) 10.1, 5.0 and 1.5. The highest petroleum hydrocarbon (BTEX) value reported was 7.0 ppb at RM 1.5 and the majority of values were 3 ppb or less. ADEC expects to be able to state the river is meeting state water quality standards and plans to list the Lower Kenai River as Category 2 water in the 2010 Integrated Report.

CONCLUSIONS

The combination of an incentive program, cooperation among state agencies, acceptance of a technology fix and a willing public made this 4b plan an easy success.

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Opinions expressed in this paper are those of the authors. Publication does not signify that the contents necessarily reflect the views and policies of State of Alaska Department of Environmental Conservation, Environmental Protection Agency, or any other organization represented in this document.

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