

Listing Methodology for Determining Water Quality Impairments from Pathogens

GUIDANCE

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[Please note: this pathogens listing methodology was originally made public in Alaska's 2010 Integrated Report, in 2016 there were formatting enhancements such as headings and table of contents.]

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1. Purpose and Background

This listing methodology is intended to be used by Alaska Department of Environmental Conservation (DEC) staff as guidance for listing or delisting a waterbody on the Clean Water Act §303(d) list as impaired from pathogens. The methodology includes information on the quantity and characteristics of data needed to be deemed sufficient and credible for these decisions. The methodology presents the applicable regulations as adopted in the Alaska Water Quality Standards (WQS) in 18 AAC 70, and discusses challenges to making listing and delisting determinations based on sampling data for pathogens. These guidelines are designed to assure that sufficient data are gathered to determine if a waterbody is impaired or attaining WQS, and to characterize the areal extent of the impairment (if necessary).

This guidance was originally made public in Appendix I in Alaska's 2010 Integrated Report. The guidance was reformatted into a standalone document in 2016.

2. Requirements for all criteria

It should be established that the pathogen concentrations are caused by human activities (such as septic systems or domestic animal waste) prior to any consideration of Section 303(d) listing as impaired. A waterbody is not Section 303(d) listed if it can be established that the exceedance is due to natural conditions (e.g., wildlife). A determination about natural conditions requires well-reasoned best professional judgment combined with information or data to validate the condition. A decision to not list a waterbody due to exceedances caused by natural conditions requires, at a minimum, identification of a natural source that is likely responsible for producing the exceedances and information to support the absence of human impacts or no human impacts, which exceed the allowable limits. Wilderness areas or other areas with no significant human impact are assumed to represent natural conditions.

Test methods for pathogens are specified in 18 AAC 70. The fecal coliform bacteria and enterococci enumeration must be determined by the membrane filter technique or MPN procedure, according to the approved editions of *Standard Methods for the Examination of Water and Wastewater*, adopted by reference in 18 AAC 70.020(c), or in accordance with other standards approved by the DEC and the EPA. The standard method (EPA Method 1600) for *enterococci* analysis must utilize the mouse erythro leukemia medium or other method approved by the EPA for CWA purposes.

Section 303(d) listing determinations must be based on a laboratory analysis with an approved QAPP for any FC bacteria or enterococci samples. For non-detect samples, the laboratory minimum detection limits are used to determine the value for a geometric mean calculation.

3. Parameter-Specific Criteria for Pathogens

3.1 Criteria for fecal coliform bacteria for fresh water uses

Alaska water quality criteria for fecal coliform bacteria are specified in 18 AAC 70.020(b)(2) for fresh water uses and in 18 AAC 70.020(b)(14) for marine water uses. Fecal coliform bacteria criteria are established for seven fresh water and seven marine water designated uses. The designated uses and criteria applicable to the waterbody of interest need to be identified before applying the criteria. Generally, a waterbody is designated either for fresh water designated uses or marine water designated uses, including the corresponding criteria with the exception of a waterbody that has been reclassified (18 AAC 70.230) or a waterbody subject to site-specific criteria (18 AAC 70.236). The designated uses for fresh water and marine water may differ (e.g., water supply for drinking, culinary, and food processing for fresh waters versus harvesting for consumption of raw mollusks or other raw aquatic life for marine waters).

(2) FECAL COLIFORM BACTERIA (FC), FOR FRESH WATER USES (See note 1)	
(A) Water Supply (i) drinking, culinary, and food processing	In a 30-day period, the geometric mean may not exceed 20 FC/100 ml, and not more than 10% of the samples may exceed 40 FC/100 ml. For groundwater, the FC concentration must be less than 1 FC/100 ml, using the fecal coliform Membrane Filter Technique, or less than 3 FC/100 ml, using the fecal coliform most probable number (MPN) technique.
(A) Water Supply (ii) agriculture, including irrigation and stock watering	The geometric mean of samples taken in a 30-day period may not exceed 200 FC/100 ml, and not more than 10% of the samples may exceed 400 FC/100 ml. For products not normally cooked and for dairy sanitation of unpasteurized products, the criteria for drinking water supply, (2)(A)(i), apply.
(A) Water Supply (iii) aquaculture	For products normally cooked, the geometric mean of samples taken in a 30-day period may not exceed 200 FC/100 ml, and not more than 10% of the samples may exceed 400 FC/100 ml. For products not normally cooked, the criteria for drinking water supply, (2)(A)(i), apply.
(A) Water Supply (iv) industrial	Where worker contact is present, the geometric mean of samples taken in a 30-day period may not exceed 200 FC/100 ml, and not more than 10% of the samples may exceed 400 FC/100 ml.
(B) Water Recreation (i) contact recreation	In a 30-day period, the geometric mean of samples may not exceed 100 FC/100 ml, and not more than one sample, or more than 10% of the samples if there are more than 10 samples, may exceed 200 FC/100 ml.

(B) Water Recreation (ii) secondary recreation	In a 30-day period, the geometric mean of samples may not exceed 200 FC/100 ml, and not more than 10% of the total samples may exceed 400 FC/100 ml.
(C) Growth and Propagation of Fish, Shellfish, Other Aquatic Life, and Wildlife	Not applicable.

The numeric criteria for six fresh water uses specified in Alaska's WQS for FC bacteria (18 AAC 70.020) have an "in a 30-day period" geometric mean provision and a "not more than 10% of the samples may exceed" provision. Both provisions in the criteria must be met to attain the FC bacteria standard. A numeric criterion is not specified for the "Growth and Propagation of Fish, Shellfish, Other Aquatic Life, and Wildlife" fresh water use.

3.2 Criteria for fecal coliform bacteria for marine water uses

FC bacteria criteria are specified for six of the seven marine water uses. The numeric criteria for five uses specified in 18 AAC 70.020(b) for FC bacteria have provisions for "in a 30-day period" and a "not more than 10% of the samples may exceed." Both provisions must be met to attain the FC bacteria standard. No criterion is specified for the marine water use for "Growth and Propagation of Fish, Shellfish, Other Aquatic Life, and Wildlife" marine water use.

FC bacteria criterion specified for the "Harvesting for Consumption Raw Mollusks or Other Aquatic Life" marine water use is different from the other five marine water uses. In addition, the EPA has established additional criteria for *enterococci* for Alaska for the primary contact recreation use in marine waters. These criteria are discussed below.

(14) FECAL COLIFORM BACTERIA (FC), FOR MARINE WATER USES, (see note 1)	
(A) Water Supply (i) aquaculture	For products normally cooked, the geometric mean of samples taken in a 30-day period may not exceed 200 FC/100 ml, and not more than 10% of the samples may exceed 400 FC/100 ml. For products not normally cooked, the geometric mean of samples taken in a 30-day period may not exceed 20 FC/100 ml, and not more than 10% of the samples may exceed 40 FC/100 ml.
(A) Water Supply (ii) seafood processing	In a 30-day period, the geometric mean of samples may not exceed 20 FC/100 ml, and not more than 10% of the samples may exceed 40 FC/100 ml.
(A) Water Supply	Where worker contact is present, the geometric mean of samples taken in a 30-day period may not exceed 200

(iii) industrial	FC/100 ml, and not more than 10% of the samples may exceed 400 FC/100 ml.
(B) Water Recreation (i) contact recreation	In a 30-day period, the geometric mean of samples may not exceed 100 FC/100 ml, and not more than one sample, or more than 10% of the samples if there are more than 10 samples, may exceed 200 FC/100 ml.
(B) Water Recreation (ii) secondary recreation	In a 30-day period, the geometric mean of samples may not exceed 200 FC/100 ml, and not more than 10% of the samples may exceed 400 FC/100 ml.
(C) Growth and Propagation of Fish, Shellfish, Other Aquatic Life, and Wildlife	Not applicable.
(D) Harvesting for Consumption of Raw Mollusks or Other Raw Aquatic Life	The geometric mean of samples may not exceed 14FC/100ml; and not more than 10% of the samples may exceed; - 43 MPN per 100ml for a five-tube decimal dilution test; - 49 MPN per 100ml for a three-tube decimal dilution test; - 28 MPN per 100ml for a twelve-tube single dilution test; - 31 CFU per 100ml for a membrane filtration test (see note 14).

Note 1. Wherever criteria for fecal coliform bacteria are provided in this section, fecal coliform bacteria enumeration must be determined by the membrane filter technique or most probable number procedure according to any edition of *Standard Methods for the Examination of Water and Wastewater*, adopted by reference in (c)(1) of this section, and adopted by reference, or in accordance with other standards approved by the department and the United States Environmental Protection Agency (EPA). Fecal coliform results reported as “too numerous to count” (TNTC) is considered an exceedance for comparison to water quality standards. Analysis and reporting of the method recommended dilution of the sample is required.

3.3 Criteria for fecal coliform bacteria for the “Harvesting for Consumption of Raw Mollusks or Other Aquatic Life” Marine Water Use

The Alaska water quality criterion for the “Harvesting for Consumption Raw Mollusks or Other Aquatic Life” marine water use is worded as follows:

Based on a 5-tube decimal dilution test, the fecal coliform median MPN may not exceed 14 FC/100 ml, and not more than 10% of the samples may exceed a fecal coliform median MPN of 43 FC/100 ml. Or based on a 12-tube single dilution test, the fecal coliform median MPN may not exceed 14 FC/100ml, and not more than 10% of the samples may exceed a fecal coliform median MPN of 28 FC/100 ml.

3.4 Criteria for pathogens for pathogens for marine water use for coastal recreation areas (primary contact) use

The federal BEACH Act of 2000 specifies the following water quality criteria for coastal recreation (primary contact) in marine waters: Geometric mean of 35 *enterococci* per 100 ml shall not be exceeded or a single sample maximum (per 100 ml) of 158 *enterococci* shall not be exceeded.

This standard was promulgated by the EPA for Alaska in 2004 and published in the Federal Register in 69 FR 67217-67243.

4.0 Guidance for Determining Water Quality Impairments from Pathogens for Fresh Water Uses

4.1 Minimum Number of Samples

For either the 30-day “geometric mean” or the “10% of samples” provisions of the fecal coliform bacteria criteria, a minimum of five samples are required to determine attainment or impairment; however, ten samples are preferred. Data sets for 30 days with fewer than ten samples are less desirable for the purposes of making a determination of standard attainment.

4.2 Assessment and Sampling Period

At least two 30-day sampling periods during a 2-year period are desired to make attainment or impairment decisions. Ten samples in each 30-day sampling period are considered to be an adequate assessment and sampling period. In each 30-day sampling period, the grouping or overlapping of samples should be avoided, and preferably, sampling should be spread over the 30-day period. Data sets that do not have two distinct 30-day sampling periods within a 2-year period are considered insufficient for listing and delisting purposes.

Two or more samples may be taken on the same day, but should not be taken at the same sampling point. A period of sampling may be established for an impairment when exceedances are dependent on seasonal temperature conditions, heavy water use periods, or both.

Sampling during a range of stream flows, if applicable, is a better representation of all conditions and can identify seasonal conditions that are problematic for FC bacteria, such as ice break-up in the spring. Sampling during peak flow events, such as spring break-up or large rain events, is not desirable as it may not represent a persistent human-caused impact. If it is deemed necessary to sample during peak flow events or spring break-up, the sample data set must contain samples collected during a range of stream flow conditions and results should be compared to other flows for comparison.

4.3 Guidance for Impairment Determination for Fecal Coliform Bacteria for Fresh Water Uses

The waterbody is considered impaired (e.g., persistent exceedances) when at least two 30-day sampling periods demonstrate an exceedance of either provision of the criterion over a 2-year period. Samples collected in two or more 30-day sampling periods are not combined; they are examined separately for comparison with the standard.

The recommended approach is that exceedances found in only one 30-day sampling period be followed with an additional 30-day sampling period during the same season of the next year to validate the persistence of the water quality impairment over a 2-year period.

5.0 Guidance for Determining Water Quality Impairments from Pathogens for Marine Water Uses

5.1 Minimum Number of Samples

For either the 30-day “geometric mean” or the “10% of samples” provisions of the criteria, a minimum of five samples are required to determine attainment or impairment; however, ten samples are preferred in a recommended 30-day period. Data sets for 30 days with fewer than ten samples are less desirable for the purposes of making a determination of WQS attainment or impairment.

5.2 Assessment and Sampling Period

At least two 30-day sampling periods during a 2-year period are desired. As noted earlier, ten samples in each 30-day sampling period are considered to be an adequate assessment and sampling period. In each 30-day sampling period, the grouping or overlapping of samples should be avoided, and preferably, sampling should be spread over the 30-day period. Data sets that do not have two distinct 30-day sampling periods within a 2-year period are considered insufficient for listing and delisting purposes.

Two or more samples may be taken on the same day, but should not be taken at the same sampling point. A period of sampling may be established for an impairment when exceedances are dependent on seasonal temperature conditions, heavy water use periods, or both.

5.3 Impairment determination for fecal coliform bacteria for marine water uses

The waterbody is considered impaired (e.g., persistent exceedances) when at least two 30-day sampling periods demonstrate an exceedance of either provision of the criteria over a 2-year period. Samples collected in two or more 30-day sampling periods are not combined; they are examined separately for comparison with the standard.

6.0 Guidance for Determining Water Quality Impairments from FC Bacteria for the “Harvesting for Consumption of Raw Mollusks or Other Aquatic Life” Marine Water Use

6.1 Minimum Number of Samples

A minimum of 15 samples should be collected for assessing attainment of the “Harvesting for Consumption Raw Mollusks or Other Aquatic Life” use in remote areas where there is no actual or potential pollution. The collection of the water samples generally should be planned or scheduled to capture the rainy months and the dry months, as well as high- and low-tide variables. Ideally the samples should capture various hydrological and meteorological conditions that might have an impact on the water quality. In addition to the water sampling, a shoreline survey is required to determine potential pollution sources on shore. A typical water classification survey for the categorization of commercial shellfish growing and harvest areas takes at least 12 months. A minimum of 30 samples should be collected under various environmental conditions in growing areas where pollution sources (human habitation or known pollution potential) may have an impact on the water quality.

6.2 Impairment determination for FC bacteria for the “Harvesting for Consumption of Raw Mollusks or Other Aquatic Life” marine water use

A waterbody is considered to not be attaining the FC bacteria standard when either provision of the criteria is exceeded for the “Harvesting for Consumption Raw Mollusks or Other Aquatic Life” marine water use.

7.0 Guidance for Determining Water Quality Impairments from Pathogens for Marine Water Use for Coastal Recreation Areas (Primary Contact) Use

7.1 Minimum Number of Samples

At least two 30-day sampling periods during a 2-year period, with a minimum of five samples in each 30-day sampling period, are necessary to provide an adequate assessment and sampling period for coastal recreation (primary contact) areas in marine waters. In the 30-day period, samples should not be grouped; instead, they should be reasonably spread over the 30-day sampling period. However, two samples in 1 day are acceptable, but should not be taken at the same sampling point. When exceedances are dependent on seasonal temperature conditions, heavy water use periods, or both, a seasonal period may be established for the impairment.

7.2 Impairment determination from FC Bacteria for the marine water coastal recreation areas (primary contact) uses

The waterbody is considered impaired (e.g., persistent exceedances) when at least two 30-day sampling periods demonstrate an exceedance of either provision of the criterion. Samples collected in two or more 30-day sampling periods are not combined; instead, they are examined separately for comparison with the standard.

The recommended approach is that exceedances found in only one 30-day sampling period be followed with an additional 30-day sampling period during the same season of the next year to validate the persistence of the water quality impairment over a 2-year period.

8.0 Removal of a Waterbody from the Section 303(d) List for Pathogens

The current listing methodology used by Alaska and outlined in the 2014 Integrated Report dictates that removing a waterbody from the Section 303(d) list requires a level of data equivalent to what was used in the initial Section 303(d) listing determination. Sampling plans for removing a waterbody should be designed to capture whether or not changes have occurred that have resulted in the waterbody meeting WQS. Sampling should be specifically designed to determine if the documented impairment still exists.

The minimum number of samples depends on the number needed to document that the criteria are not exceeded during periods of highest risk (e.g., greatest number of sources, low flow, etc.). Data from at least 2 years must show that criteria have not been exceeded in order to demonstrate consistent attainment of the WQS.