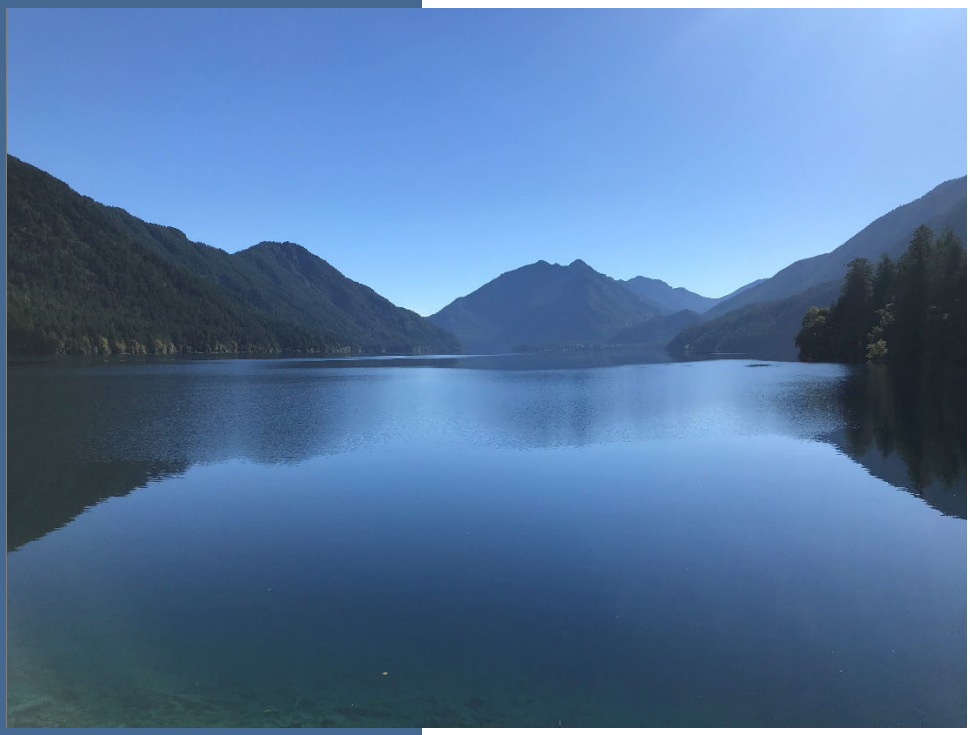


Water Quality Program Policy 1-11

Chapter 1

Washington's Water Quality Assessment Listing Methodology to Meet Clean Water Act Requirements

Water Quality Program
Washington State Department of Ecology
Olympia, Washington

Final: March 2023
Revisions: July 2020 and February 2023
Original: July 2018

Publication 18-10-035

Publication Information

This document is available on the Department of Ecology's website at:
https://apps.ecology.wa.gov/publications/summarypages/1810035.html

Contact Information

Water Quality Program

Justin Donahue
P.O. Box 47600
Olympia, WA 98504-7600
Phone: 360-628-3630
Email: 303d@ecy.wa.gov

Website: Washington State Department of Ecology[1]

ADA Accessibility

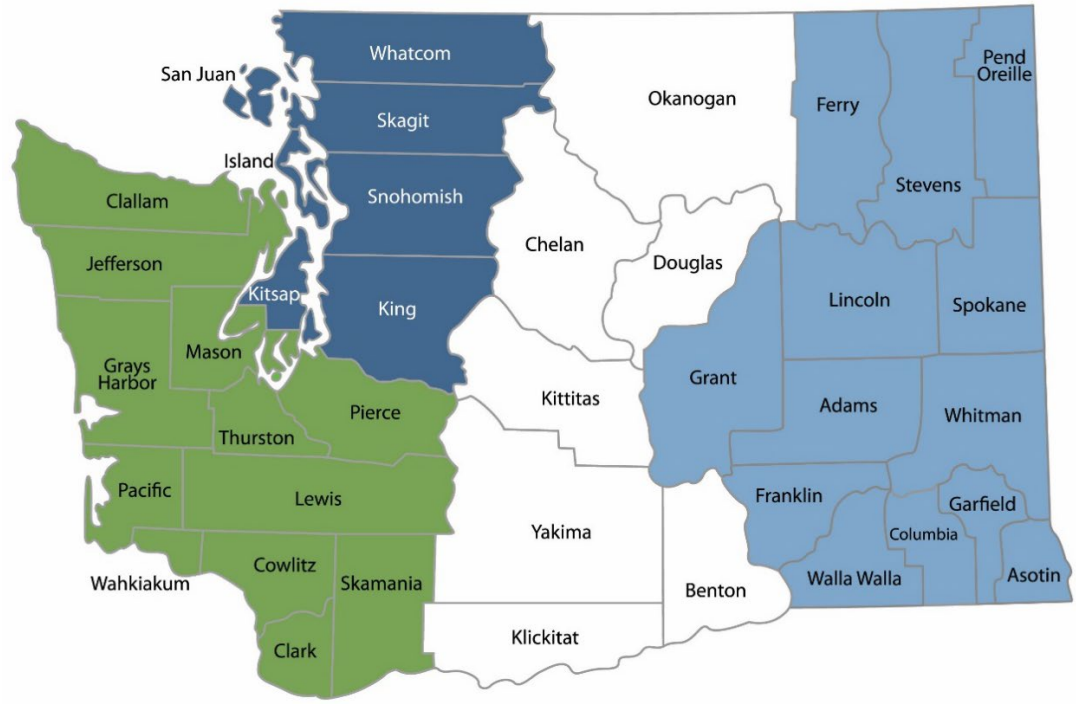
The Department of Ecology is committed to providing people with disabilities access to information and services by meeting or exceeding the requirements of the Americans with Disabilities Act (ADA), Section 504 and 508 of the Rehabilitation Act, and Washington State Policy #188.

To request an ADA accommodation, contact Ecology by phone at 360-407-6600 or email at 303d@ecy.wa.gov. For Washington Relay Service or TTY call 711 or 877-833-6341. Visit Ecology's website[2] for more information.

[1] www.ecology.wa.gov/contact
[2] www.ecology.wa.gov/accessibility

Department of Ecology's Regional Offices

Map of Counties Served



Southwest Region 360-407-6300	Northwest Region 206-594-0000	Central Region 509-575-2490	Eastern Region 509-329-3400

Region	Counties served	Mailing Address	Phone
Southwest	Clallam, Clark, Cowlitz, Grays Harbor, Jefferson, Mason, Lewis, Pacific, Pierce, Skamania, Thurston, Wahkiakum	PO Box 47775 Olympia, WA 98504	360-407-6300
Northwest	Island, King, Kitsap, San Juan, Skagit, Snohomish, Whatcom	PO Box 330316 Shoreline, WA 98133	206-594-0000
Central	Benton, Chelan, Douglas, Kittitas, Klickitat, Okanogan, Yakima	1250 W Alder St Union Gap, WA 98903	509-575-2490
Eastern	Adams, Asotin, Columbia, Ferry, Franklin, Garfield, Grant, Lincoln, Pend Oreille, Spokane, Stevens, Walla Walla, Whitman	4601 N Monroe Spokane, WA 99205	509-329-3400
Headquarters	Across Washington	PO Box 46700 Olympia, WA 98504	360-407-6000

Water Quality Program Policy 1-11
Chapter 1

Washington's Water Quality Assessment Listing Methodology to Meet Clean Water Act Requirements

Water Quality Program

Environmental Assessment Program

Toxics Cleanup Program

Washington State Department of Ecology

Olympia, WA

March 2023 (revised from July 2020) | Publication 18-10-035

Approval

Approved: _____ March 15, 2023
Vincent McGowan, P.E. Date
Program Manager
Water Quality Program

Approved: _____ 03/22/2023
Annette Hoffmann Date
Program Manager
Environmental Assessment Program

Approved: _____ March 20, 2023
Barry Rogowski Date
Program Manager
Toxics Cleanup Program

Table of Contents

List of Figures and Tables

Figures

Tables

Abbreviations, Acronyms, and Definitions

Abbreviations and acronyms

Term	Meaning
303(d)	Clean Water Act Section 303(d)
305(b)	Clean Water Action Section 305(b)
AU	Assessment Unit (defines the waterbody segment)
B-IBI	Benthic Index of Biological Integrity
CAP	Cleanup Action Plan
CERCLA	Comprehensive Environmental Response Compensation and Liability Act (also known as Superfund)
CFR	Code of Federal Regulations
CM	Corrective Measure
CWA	Clean Water Act
DWEC	Drinking Water Exposure Concentration
$DWEC_N$	Drinking Water Exposure Concentration for non-carcinogenic effects
$DWEC_C$	Drinking Water Exposure Concentration for carcinogenic effects
DOH	Washington State Department of Health
Ecology	Washington State Department of Ecology
EAP	Environmental Assessment Program
EIM	Environmental Information Management (Ecology database)
EPA	U.S. Environmental Protection Agency
ISIS	Integrated Site Information System
LLOQ	Lower Limit of Quantitation
LRAU	Large River Assessment Unit
MTCA	Model Toxic Control Act
MCL	Maximum Contaminant Levels
MDL	Method Detection Limit
mg/L; mg/kg	Milligrams per Liter; Milligrams per kilogram
mL	Milliliters
MRL	Method Reporting Limit
ng/L; ng/kg	Nanograms per Liter; Nanograms per kilogram
NTR	National Toxics Rule

Term	Meaning
NHD	National Hydrography Dataset
NTU	Nephelometric Turbidity Unit
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
pg/L; pg/kg	Picograms per Liter; Picograms per kilogram
ppm	Parts per Million (same as mg/kg or mg/L)
ppb	Parts per Billion (same as µg/kg or µg/L)
ppt	Parts per Trillion (same as ng/kg or ng/L)
ppq	Parts per Quadrillion (same as pg/kg or pg/L)
PQL	Practical Quantitation Limit
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RCW	Revised Code of Washington
RIVPACS	River Invertebrate Prediction and Classification System
ROD	Record of Decision
SCUM	Sediment Cleanup User's Manual
SDWA	Safe Drinking Water Act
SIZmax	Sediment Impact Zone maximum
SMS	Sediment Management Standards
SOP	Standard Operating Procedure
SQS	Sediment Quality Standards
State	Washington State
TCDD	Tetrachlorodibenzoparadioxin (dioxin)
TCP	Toxics Cleanup Program
TEC	Tissue Exposure Concentration
TEC_N	Tissue Exposure Concentration for non-carcinogenic effects
TEC_C	Tissue Exposure Concentration for carcinogenic effects
TEF	Toxicity Equivalent Factor
TEQ	Toxic Equivalents
TMDL	Total Maximum Daily Load

Term	Meaning
µg/L; µg/kg	Micrograms per Liter; Micrograms per Kilogram
USGS	United States Geological Survey
WAC	Washington Administrative Code
WQA	Water Quality Assessment

Definitions

The following terms are defined to aid in the interpretation of the text in this policy. Terms listed below may have a different meaning outside of the WQA.

Table 1. List of terms and definitions used throughout Policy 1-11.

Term	Definition
303(d) List	Clean Water Act Section 303(d) List, which requires that States provide a list of impaired waters that are not meeting water quality standards.
305(b) Report	Clean Water Act Section 305(b) Report, which requires that States provide a biennial report to Congress on the water quality status of state waterbodies.
7-DADMax	Mean value of the maximum daily temperatures in a consecutive 7-day period.
7Q10 High Flow	Seven-day, consecutive high flow with a ten-year return frequency; the highest stream flow for seven consecutive days that would be expected to occur once in ten years.
7Q10 Low Flow	Seven-day, consecutive low flow with a ten-year return frequency; the lowest stream flow for seven consecutive days that would be expected to occur once in ten years.
Ambient conditions/Ambient water quality	Chemical, physical, or biological characteristics representative of a waterbody. Water quality data are considered “ambient” when data accurately reflect the characteristic of a waterbody at the time data are being collected.
Assessment Unit (AU)	A waterbody segment or portion of a waterbody segment from which data are evaluated to determine compliance with water quality standards. Assessment units are typically delineated using the NHD reaches for fresh waters and grids for open waterbodies. AUs are the basis for identifying waterbody listings.
BioPoints	The number of points assigned to an individual BioStation based on the number of bioassay exceedances (maximum 3 bioassays per station) and the severity of the bioassay exceedance (SQS/SIZmax).
BioScore	The total number of points assigned to a quarter grid resulting from the summation of the BioPoints.
BioStation	A location (i.e. station) within a quarter grid where a sediment sample was obtained and tested for biological effects using Ecology designated biological tests.

Term	Definition
Call-for-data	A solicitation notice for parties to submit water quality data and information collected within ten years of the published end date that will be addressed in the forthcoming water quality assessment. Note that a party may submit data and information to Ecology at any time, but to ensure consideration in a specific assessment cycle, it must be received by Ecology by the published end date.
ChemPoints	The number of points assigned to an individual ChemStation based on the number of chemical exceedances and the severity of the chemical exceedance (SQS/SIZmax) at that station.
ChemScore	The total number of points assigned to a quarter grid resulting from the summation of the ChemPoints.
ChemStation	A location (i.e. station) within a quarter grid where a sediment sample was obtained and tested for chemical constituents using Ecology designated procedures.
Continuous monitoring	Sampling regime that records a series of parameter values at a defined frequency.
Critical period	A reoccurring timeframe (e.g. a specific season or time of day) during which designated uses are more susceptible to impairment. When considered in the WQA, a critical period may be defined through a TMDL study or may be assumed based on knowledge of waterbody characteristics. For example, the critical period for protecting the aquatic life use of a stream from impairment caused by high temperatures may be designated as the summer months in which high air temperatures cause water to heat up.
Data validation	An analyte-specific and sample-specific process used for certain complex chemicals that extends the evaluation of data beyond data verification to determine the usability of a specific data set. It involves a detailed examination of the data package, using both professional judgment, and objective criteria, to determine whether the method quality objectives for precision, bias, and sensitivity have been met. It may also include an assessment of completeness, representativeness, comparability and integrity, as these criteria relate to the usability of the dataset.
Data verification	Examination of a dataset for errors or omissions, and assessment of the data quality indicators related to that dataset for compliance with acceptance method quality objectives.
Data window	The period of time from which data and information are evaluated during an individual WQA cycle; typically a 10-year period immediately preceding the issuance of a call-for-data for an assessment cycle.

Term	Definition
Designated use	Designated uses are those uses specified in Chapter 173-201A WAC for waterbodies in the State, regardless of whether or not the uses are currently attained.
Epilimnion	The uppermost layer of water in a thermally stratified body of water.
Exceedance	A water quality parameter result value that is greater than, or outside of the acceptable range of, a numeric water quality standard criteria.
Excursion	A water quality parameter result value that is above or below a water quality criterion expressed as an acceptable range.
Grid cell	Defines an assessment unit in marine waters, lakes of more than 1,500 acres, and estuarine areas (the tidally influenced portion of some large rivers). When assessing water quality parameters, a rectangular grid sized at 45 seconds latitude by 45 seconds longitude (approximately 2,460 feet by 3,660 feet) is used. Grid cells are divided into quarters for the purpose of evaluating toxics in sediments.
Impairment	Non-support of a designated use of a waterbody in accordance with Policy 1-11. A use is considered impaired when data and/or information indicate that water quality standards intended to protect the use are not persistently attained.
Integrated Report	A status of waterbodies, including a list of impaired waters, that states report to EPA to meet requirements of the Section 303(d) list and 305(b) report as required by the federal Clean Water Act (CWA).
Large River Assessment Unit (LRAU)	Defines assessment units that apply to the Columbia and Snake Rivers only. LRAUs are river reaches with endpoints generally delineated by the location of dams and adjacent watershed boundaries.
Listing	An evaluation of data and information compared to the water quality standards, in accordance with this policy, to determine the appropriate category for an individual waterbody segment, which is comprised of an AU/medium/parameter combination.
Listing cycle	The timeframe and process of issuing the call-for-data and then assessing the data in preparation of the Washington Water Quality Assessment to meet CWA requirements in sections 303(d) and 305(b).
National Hydrography Dataset (NHD)	The National Hydrography Dataset (NHD) is a database of surface water features used to make maps. It contains features such as lakes, ponds, streams, rivers, canals, dams and stream gages for the United States at the 1:24,000 scale or better.

Term	Definition
NHD reach	Sections of rivers and streams that serve as assessment units. In general, the endpoints of an NHD reach are located at tributary confluences, and channel intersections where a river has a braided channel morphology.
Non-detect	In general, a sample value for an analyte is designated as a non-detect when it is below the laboratory detection limit for the sample analysis. A detection limit is the concentration that is statistically greater than the concentration of a method blank with a high level of confidence (typically, 99%), or the lowest level of a given chemical that can be positively identified when using a particular analytical method. Refer to the EIM Help Center for further information about laboratory analytical reporting: https://fortress.wa.gov/ecy/eimhelp/[3]
Numeric Water Quality Criteria	Portions of the water quality standards in WAC 173-201A-200 and 210 that address numeric water quality requirements for specific designated uses. The numeric criteria for a parameter represent a goal for the measured magnitude (level or amount) and may specify the acceptable frequency (how often) and duration (for how long) to meet the magnitude goal.
Parameter	A measurable chemical, physical, or biological attribute of a waterbody, such as bacteria or dissolved oxygen.
QA Assessment Level	The level of quality assurance performed on data that is being submittal into EIM. Refer to Section 1E of this policy for further information.
QA Planning Level	The level of quality assurance planning of a study for data being submitted into EIM. Refer to Section 1E of this policy for further information.
Surface Waters of the State	Defined in in WAC 173-201A-020 to include lakes, rivers, ponds, streams, inland waters, saltwaters, wetlands, and all other surface waters and water courses within the jurisdiction of the State of Washington.
TMDL boundary	The watershed area wherein a specific TMDL study applies and wherein implementation actions must occur to meet the goals and objectives of the TMDL study.
Water Quality Assessment	A statewide report on the status of water quality of State waterbodies based on readily available data. Used to satisfy CWA sections 303(d) and 305(b) reporting requirements.

[3] https://fortress.wa.gov/ecy/eimhelp/

Term	Definition
Water Quality Standards	Water quality rules that consist of water quality criteria, designated uses, and antidegradation components. The water quality standards represent the chemical, physical, and biological conditions necessary to support the state designated uses of a waterbody.

Executive Summary

Purpose

The Washington State Department of Ecology (Ecology) periodically assesses the status of water quality in state waterbodies to develop the Washington Water Quality Assessment (WQA). The purpose of the WQA is to determine the status of water quality in Washington State (State) using the methodologies described in Water Quality Policy 1-11, Chapter 1. The foundation of this policy is based on the use of credible water quality data and information described in the Water Quality Data Act[4] (RCW 90.48.570-590), the surface water quality standards[5] (Chapter 173-201A WAC), and the sediment management standards[6] (Chapter 173-204 WAC). This policy, in combination with the guidance documents referenced herein, constitutes the methodologies applied to fulfill the federal Clean Water Act (CWA) Section 303(d) List and Section 305(b) state water quality status report, collectively referred to by the United States Environmental Protection Agency (EPA) as the 'Integrated Report.'

This policy describes the methodologies for how assessment units (AUs) will generally be assessed for each water quality standard parameter (for example, bacteria or dissolved oxygen) and then placed in one of five categories, ranging from waters that meet tested standards (Category 1) to impaired waters (Category 5). The different listing categories described in this WQA policy identify the status of the AU for each parameter and may signify future actions needed to improve or protect water quality.

Only one category, Category 5, represents the 303(d) list of impaired waters, required by section 303(d) of the CWA. The methodologies for the 303(d) list are developed to identify those waters for which there is credible evidence of impairment to a designated use.

The Water Quality Data Act requires Ecology to ensure the credibility of data used in the implementation of Clean Water Act programs through the application of quality assurance (QA) protocols. This policy provides additional guidance on ensuring the use of credible data in the WQA to meet state requirements.

Application

Ecology applies this policy when evaluating data and information for the WQA to meet the federal CWA reporting requirements. The policy is also intended as guidance for all parties that submit data for the WQA process or are planning data collection efforts for use in future WQAs.

[4] https://apps.leg.wa.gov/RCW/default.aspx?cite=90.48.570
[5] https://apps.leg.wa.gov/WAC/default.aspx?cite=173-201a
[6] https://app.leg.wa.gov/WAC/default.aspx?cite=173-204

Part 1: General Assessment Considerations

A. Introduction and Background

B. Process to Develop the Water Quality Assessment

C. Waterbody Segments and GIS Layers

D. Ensuring Credible Data in the Assessment

E. Data and Information Submittals

F. Categories

G. Other Assessment Considerations

H. Prioritization of TMDLs

1A. Introduction and Background

The federal Clean Water Act (CWA) at sections 303(d) and 305(b) require Washington State to assess the water quality status of WA state waters and periodically report on the status to the Environmental Protection Agency (EPA). The Washington State Department of Ecology (Ecology) develops the Water Quality Assessment (WQA) to fulfill this requirement. The purpose of the WQA is to determine if readily available data demonstrates that the water quality supports the designated uses described in 173-201A WAC. Ecology accomplishes this by applying methodologies to compare available data and information to water quality standards for surface waters and sediments. The surface water quality standards used for the WQA process are in Chapter 173-201A WAC, Water Quality Standards for Surface Waters of the State of Washington and federally promulgated criteria[7] at 40 CFR 131.45. For sediments, the standards are in Chapter 173-204 WAC, Sediment Management Standards, parts I – IV.

Ecology has developed Policy 1-11, Chapter 1, to guide the evaluation of data and information to develop the WQA. EPA's Integrated Reporting Guidance[8] is highly influential in determining the usage of data and information to assess if waterbodies are persistently attaining designated uses. Additionally, the State's Water Quality Data Act (WQDA), codified in RCW 90.48.570 through 90.48.590, outlines criteria that must be met for data and information used in the WQA. See Part 1D of this policy for more information on meeting credible data requirements for the use of data in the WQA.

Ecology identifies a designated use of an assessment unit (AU) as impaired when the applicable water quality standards for a given AU are not persistently attained. For each water quality parameter, Ecology analyzes the magnitude, frequency, and duration of observed numeric or narrative criteria exceedances. The parameter-specific methodologies in Parts 2 and 3 of this policy describe the evaluation of numeric criteria attainment, while Section 1E describes the requirements to assess waters based on narrative water quality criteria.

Ecology will place an AU in one of five categories for each parameter and medium (e.g. water, tissue or sediment) assessed, ranging from Category 1 (meets tested standards) to Category 5 (impaired). Only one category, Category 5, represents the 303(d) list of impaired waters required by the CWA. The remaining categories (Categories 1 through 4, including three subcategories of Category 4) meet the intent of section 305(b) of the CWA and inform the public about the known condition of the State's waters. Part 1F describes the five Categories in more detail. After the assessment is complete, Ecology prioritizes and schedules AUs placed in Category 5 for TMDL studies or other cleanup plans to address the impairment. This prioritization process is outlined in Part 1H.

[7] https://www.epa.gov/wqs-tech/water-quality-standards-regulations-washington#fed
[8] https://www.epa.gov/tmdl/integrated-reporting-guidance-under-cwa-sections-303d-305b-and-314

1B. Process to Develop the Water Quality Assessment

The CWA requires states to submit a report pursuant to sections 303(d) and 305(b) every two years. Federal regulations at 40 CFR section 130.7(b)(5) requires that "[e]ach State shall assemble and evaluate all existing and readily available water quality related data and information to develop the list." EPA 2006 guidance[9] describes the types of data and information appropriate to consider and encourages states to solicit data and information from a wide variety of public, private, and academic organizations and individuals. EPA also advises that if the state has specifications for data and information, these specifications should be included in any requests for information.

Each WQA listing cycle goes through key steps to develop and submit a final WQA to EPA for approval.

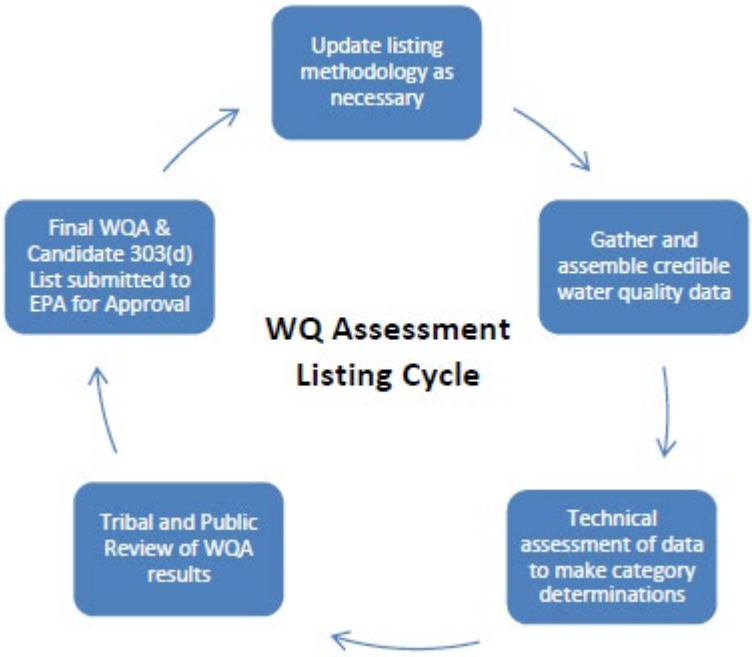


Figure 1. WQA Listing Cycle

For each WQA, Ecology will assess and categorize water quality parameters into one of the five categories. Ecology will make the draft results available for public review and comment, followed by submittal to EPA. Only Category 5, submitted as the candidate 303(d) list, is subject to EPA approval. EPA has authority to disapprove the Category 5 list and to propose the addition of AUs to Category 5. These subsequent actions by EPA are also subject to public review. EPA approves TMDLs through a separate action. Ecology will move Category 5 listings that are associated with an EPA-approved

[9] https://www.epa.gov/tmdl/integrated-reporting-guidance-under-cwa-sections-303d-305b-and-314

TMDL to Category 4A. The WQA, including the EPA approved 303(d) list, is accessible through the WQA Search Tool.[10]

Public participation

Each WQA will have a public call-for-data to solicit readily available data and information collected within the WQA data window; the data window is typically the ten-year period preceding the call-for-data. Ecology will announce the call-for-data for each listing cycle through the WQA website[11] and Water Quality email list.[12] Data submitters do not need to resubmit data considered in a prior assessment. Ecology will then present the results of the WQA for public review and comment prior to submitting the WQA and candidate 303(d) list to EPA for review and approval.

Individuals and organizations can participate in developing the WQA in any of the following ways:

- Review and comment on the listing policy and methodology during public comment periods.
- Submit data at any time to Ecology's Environmental Information Management (EIM) database for use in a subsequent assessment cycle. Water quality data and information can also be submitted during the public "call-for-data" period for a specific WQA cycle.
- Review and comment on Ecology's draft WQA.
- Review and comment on the annual TMDL prioritization process (see Part 1H).
- After Ecology submits the updated WQA and candidate 303(d) list to EPA for approval, interested parties may submit any further comments to EPA for consideration in their approval process.
- If EPA disapproves or partially disapproves the candidate 303(d) list, then interested parties may review and comment on EPA's actions.

Coordination with tribes and other states

In accordance with the Centennial Accord established between the State and adjacent federally recognized tribes, this policy supports intergovernmental cooperation during development of the State's WQA. The policy relies on the agreement described in the 1997 *Cooperative Management of the Clean Water Act 303(d) Program for the Tribes in Washington State, the Washington State Department of Ecology, and the U.S. Environmental Protection Agency Region 10*.

Washington does not have CWA authority within tribal reservation boundaries. The EPA or the governing tribe implements clean water act programs on tribal lands. However, Ecology occasionally receives water quality data from waters within reservation boundaries. Ecology's 303(d) list will not address waters within reservation boundaries. This policy does not, nor is it intended to, enlarge,

[10] https://apps.ecology.wa.gov/ApprovedWQA/ApprovedPages/ApprovedSearch.aspx
[11] https://ecology.wa.gov/Water-Shorelines/Water-quality/Water-improvement/Assessment-of-state-waters-303d
[12] https://public.govdelivery.com/accounts/WAECY/subscriber/new?topic_id=WAECY_61

diminish, or define the jurisdiction of the State or the tribes, nor does this policy limit the right of the State or any tribe to act in other forums to protect their rights.

The States of Oregon and Idaho also share jurisdiction over water quality in waters that flow across state lines or along state boundaries. Although water quality standards and criteria may differ, coordination of listing decisions for shared waters may occur during the WQA public process.

Ecology staff will offer to confer with each interested tribe and also with neighboring states during the development of the WQA and 303(d) list, including policy development and revisions, and preparation of draft and final WQAs.

Flow chart for developing the WQA

The process for developing the WQA involves a series of phases and steps, described in the flow chart in Figure 2 on the next page.

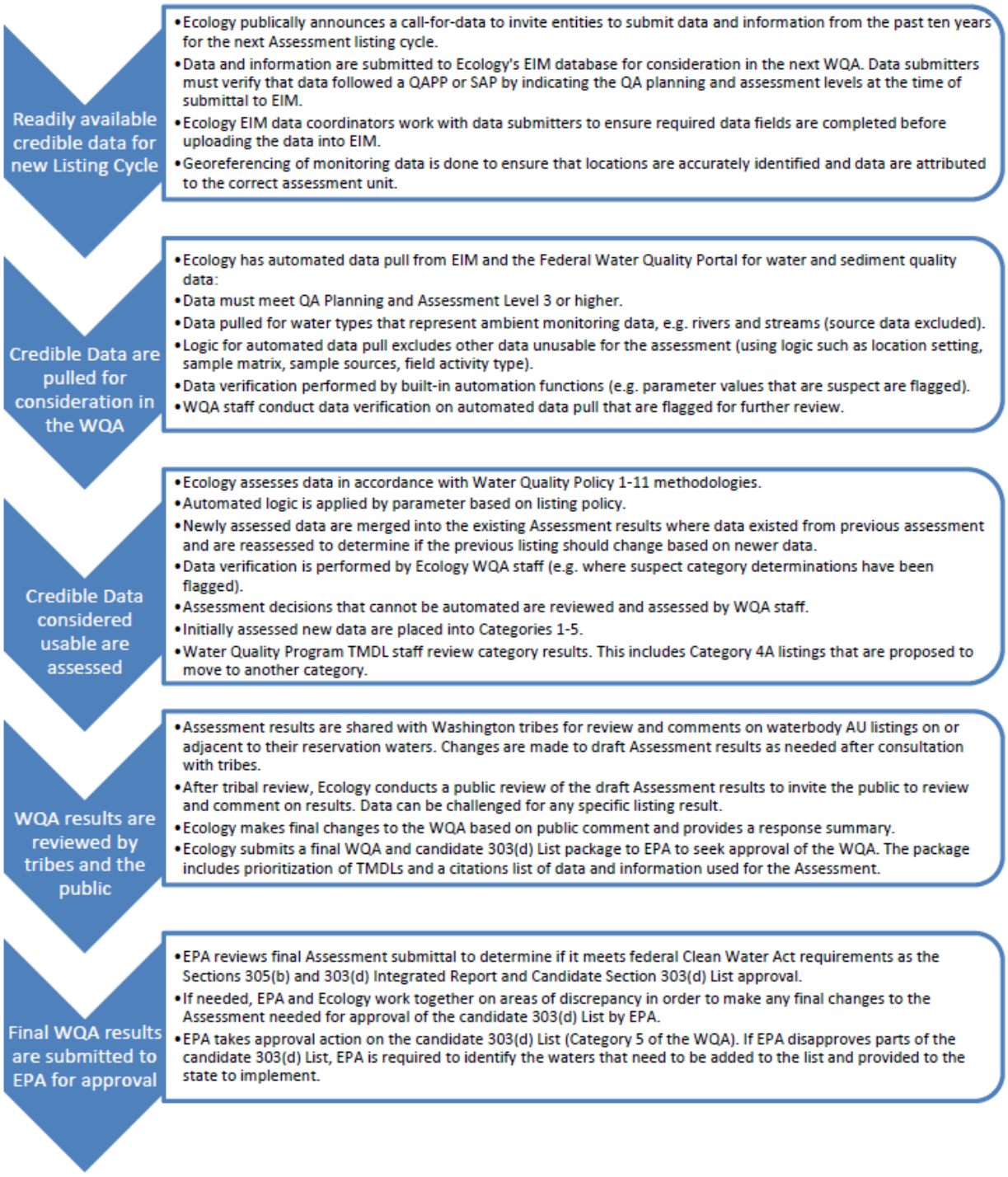


Figure 2. Process for developing WQA to meet Clean Water Act requirements.

1C. Waterbody Segments and GIS Layers

Waterbodies covered by this policy include all surface waters of the state. The water quality standards at WAC 173-201A-101(2) define waters of the state to include lakes, rivers, ponds, streams, inland waters, salt waters, wetlands, and all other surface waters and water courses within the jurisdiction of the state of Washington.

As part of the WQA process, Ecology delineates waterbody segments by assessment units (AU) as follows.

In fresh waters: Ecology uses the 1:24,000 scale National Hydrography Dataset (NHD) to delineate AUs for fresh water rivers, streams and lakes less than 1500 acres. This establishes AUs based on a confluence-to-confluence type hydrologic system. The Columbia and Snake Rivers are delineated into Large River Assessment Units (LRAUs) based on 12 digit USGS Hydrologic Unit Codes (12 digit HUCs), whose boundaries on the Snake and Columbia generally correspond to the location of dams and watershed boundaries.

In open waters: Ecology uses a gridded system to delineate AUs for marine waters, lakes of more than 1,500 acres, and estuarine areas (the tidally influenced portion of some large rivers). When assessing water quality parameters, Ecology uses a rectangular grid sized at 45 seconds latitude by 45 seconds longitude (approximately 2,460 feet by 3,660 feet) delineates AUs for open waters. Ecology assigns AUs for sediment evaluations in marine waters to corresponding quarter grid sections of a full size rectangular grid (dividing the 2,460 feet by 3,660 feet grid into quarter sections).

Water Quality Atlas

Ecology maintains an interactive mapping system called the Water Quality Atlas.[13] This Atlas contains GIS layers for both marine and fresh surface waters, including:

- Surface water quality standards (note that the mapped depiction of the standards may contain errors and the information displayed does not replace the official rules available in Chapter 173-201A WAC;
- The 5 categories of assessed waters based on water, tissue, and sediment data;
- Permits and outfall information; and
- Watershed areas addressed by TMDLs

The Water Quality Atlas can also be accessed through specific listing results in the WQA Search Tool by selecting the WQ Atlas Map Link for a given listing.

[13] https://apps.ecology.wa.gov/waterqualityatlas/wqa/startpage

1D. Ensuring Data Credibility in the Assessment

In 2004, the Washington State Legislature enacted the Water Quality Data Act[14] (RCW 90.48.570-590). This legislation requires Ecology to ensure the credibility of data used in the implementation of Clean Water Act programs through the application of quality assurance (QA) protocols. This includes the development of the State's WQA.

Ecology established Policy 1-11, Chapter 2,[15] *Ensuring Credible Data for Water Quality Management"* (Data Credibility Policy) to fulfill the intent of the Water Quality Data Act (RCW 90.48.585(3)(b)). This policy describes how Ecology evaluates the credibility of data and information using quality assurance procedures, water quality regulations, policies, and guidance. It also contains data credibility guidance for stakeholders whose data are potentially usable in the WQA.

EPA requires states to document all sources of data and information in the development of their 303(d) lists as well as provide the reason for any sources of data and information not used.

Similarly, Washington State law (RCW 34.05.272[16]) requires Ecology's water quality program to identify, categorize, and make publicly-available the sources of information reviewed and relied upon when preparing to take a significant agency action.

In fulfilling these state and federal requirements, Ecology compiles a list of data and information considered in the development of the WQA and makes it publicly available when Ecology submits the assessment to EPA. The sources of information used to develop this policy, in order to meet RCW 34.05.272, are included in Appendix 3.

Data evaluation for use in the assessment

Data used in the WQA must be credible. Based on RCW 90.48.585 and the Data Credibility Policy (Policy 1-11, Chapter 2), data are considered credible if:

- Appropriate quality assurance and quality control procedures were followed and documented in collecting and analyzing water quality samples.
- The samples or measurements are representative of water quality conditions at the time the data was collected.
- The data consists of an adequate number of samples based on the objectives of the sampling, the nature of the water in question, and the parameters being analyzed.
- Sampling and laboratory analysis conform to methods and protocols generally acceptable in the scientific community as appropriate for use in assessment the condition of the water.

[14] https://apps.leg.wa.gov/RCW/default.aspx?cite=90.48.570
[15] https://apps.ecology.wa.gov/publications/SummaryPages/2110032.html
[16] https://apps.leg.wa.gov/RCW/default.aspx?cite=34.05.272

The Data Credibility Policy describes objectives to ensure the credibility of data used, including:

- Section 5: Components of an Approvable Quality Assurance (QA) Project Plan
- Section 6: Monitoring Procedures
- Section 7: Minimum Documentation for Data Submission and Recordkeeping

A key component of the data credibility requirement is that persons conducting sampling and analyses must do so under a formal Quality Assurance Project Plan (QAPP) or an equivalent plan such as a sampling and analysis plan (SAP) that documents quality assurance processes.

Quality management planning at Ecology

Ecology relies on quality assurance to monitor, assess, and improve its scientific practices, especially those involving the generation and assessment of environmental data. Ecology bases its agency QA/QC system on requirements established by EPA and incorporates guidance and methodology from many standards-setting organizations worldwide. In terms of the WQA, Ecology performs data quality management at multiple scales that collectively serve to meet the credible data objectives outlined in the Data Credibility Policy.

At the broadest scale, Ecology operates under an agency Quality Management Plan.[17] The goal of the Quality Management Plan is to ensure that data collected by Ecology (as well as by Ecology funded contractors, grantees, loan recipients, and permittees) are of known quality and usable for intended purposes. To this end, the Ecology quality management system involves many aspects of agency operations, including:

- Project Planning for quality assurance
- Document development (operating procedures and reports), document control, and document standardization
- Internal laboratory operations
- Laboratory accreditation
- Data management
- Field sampling and analytical procedures, field auditing, and field proficiency

Quality assurance project plans

Each environmental study conducted by or for Ecology must have an approved QAPP. The QAPP describes the objectives of the study and the procedures to achieve those objectives. Ecology has developed numerous QA documents to assist entities in collecting credible data, including the following templates, guidelines, checklists, and sample plans; some of these are outlined below.

[17] https://apps.ecology.wa.gov/publications/SummaryPages/1503030.html

- Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies[18] is a downloadable Ecology publication on preparing a QAPP. This document presents detailed guidance on preparing a QAPP. It describes the elements that entities should address in the plan and provides supporting information relevant to the content of each element.
- A QA project plan template[19] is available for the development of a QA project plan. The template includes information and instructions needed for the preparation of a QA project plan (QAPP).
- Examples of Quality Assurance Project Plans[20] links to well-written QAPPs for completed projects.
- Entities or persons can use the QAPP Review Checklist as they prepare the QA Project Plan; it provides a list of all the required elements for the plan.

Standard operating procedures

Ecology has also developed a suite of standard operating procedures (SOPs) for field sampling and field analytical activities. For example, SOPs for the collection, processing, and analysis of stream samples[21] (EAP034 Publication #17-03-207) provides information useful to data submitters for the WQA. Ecology is in the process of publishing all SOPs and making them available on Ecology's website.[22] If you cannot find a specific SOP on the website, please contact Ecology at 303d@ecy.wa.gov to request a copy.

SOPs specific to a pollutant parameter are listed in this policy at the end of each section in Parts 2 and 3; the entire list of SOPs is provided in Appendix 1. Entities performing monitoring can use these SOPs to help ensure data credibility, however, Ecology does not limit the usage of data for the WQA to only data collected using Ecology SOPs.

Data verification

Ecology performs data verification to determine the credibility of data for use in the WQA. Ecology defines data verification as the examination of a dataset for errors or omissions, and assessment of data quality indicators related to that dataset for compliance with accepted method quality objectives. Data validation is a much more detailed chemical analyte-specific and sample-specific

[18] https://apps.ecology.wa.gov/publications/summarypages/0403030.html
[19] https://ecology.wa.gov/Issues-and-local-projects/Investing-in-communities/Scientific-services/Quality-assurance/Quality-assurance-for-NEP-grantees
[20] https://ecology.wa.gov/Issues-and-local-projects/Investing-in-communities/Scientific-services/Quality-assurance/Quality-assurance-for-NEP-grantees/Project-plan-examples
[21] https://apps.ecology.wa.gov/publications/SummaryPages/1703207.html
[22] https://apps.ecology.wa.gov/publications/UIPages/PublicationList.aspx?IndexTypeName=Topic&NameValue=Standard+Operating+Procedure+(SOP)&DocumentTypeName=Publication

process that is not typically necessary for the purpose of the WQA. Data validation extends the evaluation of data beyond data verification to determine the usability of a specific data set.

Ecology programs perform data verification at multiple points to ensure the credibility of data used in developing the WQA. For example:

- The QAPP provides the foundation for data verification by the data submitter. Prior to submitting data into EIM, the data submitter must indicate the planned level of quality assurance at the outset of a project as well as indicate the level of quality achieved in data collection and analysis.
- Ecology staff perform quality control checks before data are loaded to the EIM database.
- The EIM database relies on a multitude of business rules intended to filter out poor quality and duplicative data.
- Ecology's WQA automation software, which downloads and analyzes data from EIM and the federal Water Quality Portal, has numerous business rules focused on data usability, such as identification of appropriate lab/field methods and units of measure for parameters.
- When stakeholders report any errors or questionable results to Ecology, staff will investigate and address the issue. Ecology staff will remove any data of insufficient or unknown quality from the WQA.

Lab accreditation program

Ecology maintains a Lab Accreditation Database[23] to track accreditation status of the labs in the accreditation program. This database tracks accredited parameters and status and also issues renewals and accreditation certificates.

Ecology's Environmental Laboratory Accreditation Program Procedure Manual[24] explains procedures for implementing the Environmental Laboratory Accreditation Program, administered by Ecology. The manual provides guidance to laboratories participating in the program and to users of data produced in these laboratories.

Any data collection funded by Ecology must use an accredited lab in accordance with Executive Policy 22-01. The reader can find more information on choosing an analytical laboratory[25] on Ecology's website.

[23] https://apps.ecology.wa.gov/laboratorysearch/Default.aspx

[24] https://apps.ecology.wa.gov/publications/SummaryPages/1003048.html

[25] https://ecology.wa.gov/Regulations-Permits/Permits-certifications/Laboratory-Accreditation/How-to-choose-an-analytical-laboratory

Data unusable for the assessment

Ecology will not use data or information to evaluate the status of water quality in the WQA when it does not meet data credibility requirements. Ecology reserves the right to request further quality assurance documentation from any entity that has submitted data for use in the WQA. Ecology will not remove data from EIM that does not meet QA requirements for the WQA; such data will reside in EIM with the appropriate QA designation since EIM has a broader purpose and scope beyond the WQA.

The following are examples of unusable data (this includes data provided during earlier WQA cycles):

- There are problems regarding quality assurance, sampling, laboratory procedure, or similar issues that do not meet the minimum requirements for a QAPP.
- The data submitter did not adequately document quality assurance and control efforts.
- Data quality control documentation is available, but Ecology has significant concerns about the sufficiency of the quality control measures.
- The data submitter did not provide sufficient sample location information needed to associate the data with an AU.
- The data do not contain the required elements necessary for assessing compliance with water quality standards as described in Policy 1-11, Chapter 2.
- Ecology determines that the monitoring design was intentionally manipulated or the data submittal was incomplete in order to obscure or avoid periods of non-compliance. Although this is unlikely to occur for studies that are operating under a QAPP, if it were to happen, then all data for all parameters in the study may become ineligible for use for the assessment.

1E. Data and Information Submittals

The purpose of the WQA is to determine the status of the State's water quality based on water quality standards and readily available data. Ecology develops the WQA using available data and information that meets the requirements of this policy. Ecology will use numeric and narrative data and information for WQA purposes, depending on the parameter. Ecology will use modeled outputs that meet credible data requirements when the status of water quality is being determined relative to natural or reference conditions, such as with bioassessment (see section 2B. Benthic Biological Indicators).

Ecology bases the decision to place an AU in a given category on data that are representative of the AU at the time of sampling. Entities conducting water quality monitoring projects typically base the project on objectives to determine ambient water quality conditions. Some projects may collect data to characterize a localized condition, such as the mixing zone for a permitted discharge into a receiving waterbody, or within a lake swimming beach during times of peak recreation use. Ecology will not use data to assess the status of waters for the WQA when it is not representative of ambient water quality.

Ecology will accept data that are discrete measurements or samples (also called instantaneous, single, or grab samples) as well as time series monitoring datasets (i.e. using probes that continuously measure a parameter at a set time interval). Part 2 of this policy describes the use of continuous monitoring data in the specific parameter sections for dissolved oxygen, pH, temperature, and total dissolved gas. Data sets must be complete, that is, not censored to include only part of the valid ambient water quality data from the project.

For water column data it is important to note that Ecology will use only one parameter value per day per AU in the WQA for each water column. The value used will vary as follows:

- Bacteria: the average value (arithmetic mean) will be used for a station when multiple samples are available for a given day, with the highest averaged value used when there are multiple stations. (Note that a series of these average daily values may then be included to calculate a geometric mean for comparison to the water quality criteria)
- Dissolved oxygen: the lowest measurement in the AU during a day will be used.
- pH: the extreme value (relative to the criteria range) will be used, which may be the highest or lowest value measured during the day.
- Temperature: the highest value measured in the AU on a given day will be used.
- Total phosphorus and Toxics (aquatic life and human health): the average value (arithmetic mean) will be used for a station when multiple samples are available for a given day; then, if applicable, the arithmetic average of multiple stations in a given AU will be used.
- Turbidity: the average value (arithmetic mean) will be used for a station when multiple samples are available for a given day, then, if applicable, the highest average will be used when there are multiple stations.

Numeric data submittals

Ecology obtains data and information in one of three ways:

1. Numeric data are submitted to Ecology's Environmental Information Management (EIM) system.
2. Numeric data are retrieved from the federal Water Quality Portal (includes data from federal, tribal and other sources that meet the same level of quality required by Ecology).
3. Information other than numeric data, such as a study used to make a determination based on narrative standards, is submitted to Ecology for consideration.

Ecology will make exceptions to receiving data and information as described above if the data submitter has made alternate arrangements with Ecology, or when Ecology retrieves data from other databases that meet credible data requirements.

Numeric data submitted to EIM

Ecology's EIM database is the agency repository for the vast majority of environmental information generated by Ecology as well as outside data submittals. This online database allows the public to access a wide variety of environmental data and includes mapping tools to view where the data were gathered.

In general, organizations and individuals who submit numeric data for use in the WQA must do so through Ecology's EIM database. Ecology will make exceptions to this requirement if the data submitter has made alternate arrangements with Ecology, or data are retrieved from other databases that meet the same level of quality required for EIM. Information on electronic data submittals to EIM is available on Ecology's EIM website.[26]

Data entry standardization is an important concern for EIM managers and staff. Ecology maintains an online EIM Help Center[27] that provides guidance, user manuals, training, and other relevant information to assist entities that want to submit data into EIM. Ecology also has several EIM Data Coordinators associated with each program that assist individual data submitters.

Upon request, Ecology will also offer training on the EIM system.

EIM data used in the WQA to make listing decisions are accessible for independent review by the public. See the EIM Search[28] website for more information on accessing data in EIM.

It is the responsibility of the data submitter to provide sufficient information on the name of the waterbody and location of the data sample stations, as well as the quality assurance level of the data when submitting data to EIM. The EIM Study Help document describes minimum information

[26] https://ecology.wa.gov/Research-Data/Data-resources/Environmental-Information-Management-database
[27] https://apps.ecology.wa.gov/eim/help/
[28] https://apps.ecology.wa.gov/eim/search/default.aspx

required by the data submitter in order to upload data into EIM. The data submitter must include all field names marked 'required' before the data can be uploaded into EIM. These include:

- An EIM account established to identify the person and organization submitting the data.
- The location of each sample station, including: longitude and latitude and associated reference datum coordinates; waterbody name; location description; National Hydrography Dataset (NHD) reach code for all lakes and streams; NHD Reach Measure for all streams, and other necessary metadata.
- The date and time of sample collection.
- The parameter measured, including the measured value and the unit of measurement.
- For non-detect or non-quantifiable data, the appropriate result data qualifier along with the detection limits and/or reporting limits provided by the laboratory.
- The method used to measure the parameter.
- The quality assurance level of the data (see further details below).

Datasets undergo data verification checks by Ecology's Data Coordinators during the submittal input process to EIM. When Ecology considers data submittals for use in the WQA, it performs data verification at multiple points on the data. See Section 1D. Ensuring Data Credibility in the Assessment for more details. It is the responsibility of data submitter to document the Study QA Planning level, and document the Study QA Assessment Level at the time that data are submitted to Ecology for loading into EIM.

Quality assurance levels for data submittals to EIM

Data submitted for uploading into EIM must have QA Planning and Assessment Levels assigned to the data. Both the Study QA Planning Level and Study QA Assessment Level are required fields and the data submitter must assign the levels before the data can be uploaded into EIM.

The data submitter must assign a Study QA Planning Level to the data to indicate that the study plans are to collect the data according to: 1) informal or no QA documentation; 2) generic or incomplete document; 3) a QAPP, SAP or equivalent; or 4) an approved QAPP or SAP. A Study QA Planning Level of 3 or above means that a study plans to operate under a QAPP or equivalent plan, such as an SAP.

Table 1 below describes the different Study QA Assessment levels that the data were actually collected at, indicated by the data submitter. The QA Assessment levels are cumulative, moving from the lower level to higher levels. Thus, descriptions of QA Assessment Levels 3 through 5 represent requirements *in addition to* the ones described in the previous QA Assessment Level. For example, QA Assessment Level 4 means that the data submitter indicates that data generated by the study also meet levels 2 and 3 (the data were verified, assessed for usability, and discussed in a formal study report).

Ecology only uses EIM data in the WQA that data submitters have assigned as Level 3 or above for both Study QA Planning and QA Assessment Levels. The WQA's exclusion of data having a Study QA

Planning or QA Assessment below Level 3 aligns with the requirements in Policy 1- 11, Chapter 2, to have appropriate quality assurance and quality control procedures documented and followed.

Table 2. EIM QA Assessment Level Descriptions

Study QA Assessment Level	Short Description found in EIM Study Help Guide	Description for WQA purposes
Level 1	Data neither Verified nor Assessed for Usability	No assessment information is available
Level 2	Data Verified	**Data Verified:** Data submitter has examined study quality control (QC) results for compliance with acceptance criteria specified in the QAPP, SAP or field/analytical method. **Additional Explanation:** **For lab data –** Determine conformance with Method Quality Objectives (MQO) as stated in applicable QAPP, SAP, SOP or analytical method. Evaluate information such as sample duplicates, matrix spikes, surrogate standards, and Lab Control Standards. Data submitter follows EIM data entry protocols to ensure maximize accuracy in data entry. **For field measurements** – Data submitter verifies that all field operations were controlled by the use of current and approved SOPs. SOPs contain method-specific calibration and verification protocols for all field analytical operations.
Level 3	Data Verified and Assessed for Usability	**Data Assessed for Usability:** Data submitter has evaluated study data package for precision, bias, sensitivity, representativeness, comparability, and completeness as specified in the QAPP or SAP, and assessed for usability specified in the project data quality objective.
Level 4	Data Verified and Assessed for Usability in a Formal Study Report	**Formal Study Report:** Document describing Study objectives, procedures, results, conclusions and assessment of the quality of the data. Data submitter should provide bibliographic citations.

Study QA Assessment Level	Short Description found in EIM Study Help Guide	Description for WQA purposes
Level 5	Data Verified and Assessed for Usability in a Peer-Reviewed Study Report	**Peer Reviewed Study Report:** Data submitter acknowledges that the report was checked or reviewed for accuracy and completeness by a supervisor or colleague with appropriate experience (does not require independent, outside scientific review, as for juried publications).

Numeric data submitted to the federal Water Quality Portal

Ecology will retrieve numeric data from the federal Water Quality Portal database[29] that meet data credibility requirements and will use the data in the WQA.

Information submittals based on narrative standards

In addition to numeric criteria, Washington's water quality standards include narrative criteria at WAC 173-201A-260(2) that are designed to protect fresh and marine water designated uses from adverse effects to aquatic life or public health. Ecology will consider the assessment of data and information relevant to narrative standards that demonstrates degradation of a designated use.

Assessment of studies to determine impairment based on narrative standards

Parts 2 and 3 of this policy describe the methodology for assessing specific water and sediment quality parameters. Most of the parameter sections focus on evaluations based on numeric criteria. However, Ecology also evaluates the attainment of designated uses based on narrative criteria. For example, narrative criteria are applied for the bioassessment parameter (to protect aquatic life uses), and for human health toxics parameters (to protect fish and shellfish harvesting and domestic water supply uses). Other examples of submitted data and information that we will evaluate under the narrative criteria include, but are not limited to, environmental data for chemical, biological, or physical parameters for which numeric standards have not been adopted, field surveys, or site-specific water quality studies providing information on designated use support. Ecology may use narrative criteria in conjunction with numeric criteria as described in the parameter sections to make an impairment determination.

To determine a designated use impairment based on narrative criteria in the WQA, data and information packages must demonstrate a direct link between the environmental alteration in the

[29] https://www.waterqualitydata.us/

waterbody and the degradation of a designated use. Submittals should include the following information:

1. documentation of persistent deleterious, chemical, or physical alterations of an AU, **and**
2. documentation of degradation of a designated use in the same AU, **and**
3. documentation or supporting scientific evidence that directly links the deleterious, chemical, or physical alterations as the cause of the designated use degradation in the same AU.

The information provided must clearly document the connection between a persisting environmental alteration occurring within an AU and the effects to the designated use in the same AU in order to meet credible data requirements. The connection between these two lines of evidence is necessary to make a reasonable impairment determination. When sufficient information is available, an AU upstream of an impaired AU may be placed in Category 5, given there is credible data and documentation that directly links the upstream condition to the degradation of the designated use in the downstream AU.

Below are examples demonstrating data and information that would be sufficient to determine impairment of a designated use.

Wildlife Habitat

1. Information documenting persistent environmental alteration or levels of a contaminant likely of human causes within an AU.
2. Documentation that the AU habitat has degraded in that it can no longer persistently support a resident wildlife species within the same AU.
3. A rationale as to how the documented levels of that contaminant are causing the documented habitat degradation within that AU.

Aesthetics

1. Information documenting persistent environmental alteration or presence of a deleterious material likely of human causes in an AU.
2. Quantifiable documentation that the general public has indicated the waterbody as visually displeasing or producing nuisance odors.
3. A rationale as to how the documented levels of alteration or contaminant are producing a visually displeasing waterbody or nuisance odor within that AU.

Aquatic Life

1. Information documenting persistent environmental alteration or levels of a contaminant within an AU.
2. Documentation that a resident species is not developing, reproducing, or surviving at the levels which are natural within that AU.
3. A rationale as to how the documented levels of that environmental alteration or contaminant are causing the documented impacts to resident species within the same AU.

Based on submittal requirements detailed above, field collection data alone are generally not sufficient to determine impairment of narrative standards. Rather, submittals should include a detailed rationale as to how the results from field collection data within an AU directly affects a specific designated use in that AU. All data and information in the submittal must either be collected within Surface Waters of the State or have supporting information to demonstrate the data are representative of Surface Waters of the State. Analyses should account for natural processes and variability within systems. Ecology will not place a waterbody in Category 5 based on naturally occurring environmental processes (See Section 1G. Other Assessment Considerations: Natural Conditions, for more information).

Ecology will assess narrative information regarding impairments by non-pollutant (such as habitat or flow alterations) in the same manner and may lead to a Category 4C listing (Impairment by a Non-Pollutant).

Pursuant to the CWA 40 CFR § 130.7(b)(6), Ecology will evaluate all information packages submitted under the narrative criteria for use in the WQA. Ecology will provide EPA a summary of all submissions, how each submission was evaluated, a response to each submission that includes a decision on whether the data is included in the WQA, and a rationale for making that decision.

Entities should submit any data and information packages documenting potential impacts based on narrative standards directly to the Water Quality Program, through postal mail or by email at 303d@ecy.wa.gov.

Additional information on data submittals

Age of data considered in the WQA

Each WQA cycle generally begins with a published call-for-data. For each cycle, Ecology will consolidate readily available data and information collected within the period (aka data window) specified by a published call-for-data (typically ten years), and assess it along with other data and information of the same type and AU. An additional call for data may be necessary for a given WQA cycle in order to acquire the most recent data. Generally, Ecology will not assess data older than ten years for a given cycle unless noted in the parameter-specific WQA considerations described in Part 2. However, Ecology may consider data and information older than ten years when necessary to determine historic conditions.

Ecology will evaluate newly submitted data and information along with previously assessed data and information collected within the WQA data window. Ecology will not automatically use the latest assessment policy to re-evaluate listings based on data and information collected prior to the current WQA data window. A re-evaluation of a listing category determination requires data and information from the current data window. The exception is that Ecology may re-evaluate an old listing if it is determined that the data and/or information on which the old listing was based did not meet quality assurance requirements in place at the time of its collection. In this manner, listings carried over from a previous WQA will remain in the category previously assigned if more recent data and information is either unavailable or does not justify a category change.

Determining appropriate standards in brackish waters

Application of fresh and marine water criteria vary depending on salinity concentrations in brackish waters of estuaries. In these cases, the method to determine what standards apply can be found in the water quality standards at WAC 173-201A-260(3) (e). If information is not available to determine the delineation between marine and freshwater criteria for brackish waters, then the more stringent of the two criteria will apply as described in WAC 173-201A- 260(3)(c).

Use of non-detect samples

Ecology will use sample values that are below laboratory detection limits in the assessment when the detection limit is less than the numeric criteria or threshold. These non-detect values can be used to show that a sample met the numeric water quality criteria (e.g. evidence for a possible Category 1 determination). In addition, Ecology can use non-detect samples to determine a median value for a parameter (e.g. in the fish tissue evaluation method). Non-detect values that have a detection limit greater than the numeric criteria or threshold will not be used in the assessment, as it is unknown if the non-detect value shows compliance with the criteria or threshold. For calculating a geometric mean using non-detect samples (i.e. bacteria), in which a zero cannot be used, a value will be assigned so as not to bias the geometric mean high or low. For parameters that are summed to generate a 'total' value (i.e. some toxics), only the detected values for the individual addends are used for summing. Part 2 provides more information about how non-detect values are addressed for a specific parameter.

Determination and use of field replicate samples

Ecology will average field replicate sample values in EIM together if they are identified as field replicates. Additionally, for some parameters, samples collected at the same location within a specified time frame may be averaged. Ecology will average bacteria samples if the samples were collected in the same location, less than 15 minutes apart; this reduces bias in situations where additional sample(s) were collected at a different time of the same day. Dissolved oxygen, pH, and temperature samples will be averaged if they are collected at the same location, less than five minutes apart; Ecology will treat the resulting calculated value as a single sample in the WQA. This does not necessarily apply to depth profiles where repeat measurements are made less than five minutes apart, but at different depths.

Comparison of data to a water quality criteria expressed as an average

For the purposes of the WQA, Ecology allows instantaneous measurements or discrete samples to represent the averaging periods specified in the State's surface water quality standards for both acute and chronic criteria (e.g., 24-hour average for the chronic criteria for many toxic substances). In other words, where only one grab sample is available to represent the specified averaging period, then Ecology will use that sample to represent the average concentration over the averaging period. In cases where water quality criteria for toxic substances are expressed as an average over a number of days (e.g., 4-day average for the chronic criteria for some toxic substances) and there are multiple

samples collected from a representative site within the time period, Ecology will average the samples to assess compliance with the criteria during the specified averaging time.

Assessment of data and information for specific pollutant parameters

Parts 2 and 3 of the policy describe requirements for the assessment of specific pollutant parameters. Part 2 addresses assessment methodology for the following parameters: bacteria, bioassessment, dissolved oxygen, pH, total phosphorus (in lakes), temperature, total dissolved gas, toxic aquatic life and human health criteria, and turbidity. Part 3 addresses the assessment methodology for sediment quality standards decisions.

Third party data submittals

Data and information submitted by third parties for use in the WQA must include documentation addressing the accuracy and completeness of the information submitted to Ecology, including documentation from the original data submitter indicating that the required QA objectives were met. For the purpose of the WQA, a "third party" is defined as an entity outside of the organization responsible for collecting the data, and thus is not directly responsible for the collection and quality control assurances that are part of a QAPP. The decision to include data submitted by a third party will be at the sole discretion of Ecology and will only be included in the WQA if there is adequate information provided to determine that the data are of sufficient quality to meet credible data requirements and are representative of water quality conditions at the monitoring location.

Ecology contacts for submittal

For more information on how to submit data, see the Ecology 303(d) website.[30]

Or contact Ecology staff at: 303d@ecy.wa.gov, (360) 407-6400.

To submit data, see the EIM website.[31]

[30] https://ecology.wa.gov/Water-Shorelines/Water-quality/Water-improvement/Assessment-of-state-waters-303d
[31] https://ecology.wa.gov/Research-Data/Data-resources/Environmental-Information-Management-database

1F. Category Descriptions

Ecology will assign waters in the State (except on tribal reservation lands) to one of five categories in the following descriptions. These five categories are based on, though not identical to, the categories recommended in EPA's "Guidance for 2006 Assessment, Listing, and Reporting Requirements Pursuant to Sections 303(d), 305(b) and 314 of the Clean Water Act."

All the categories together represent the statewide status of water quality to meet section 303(d) and 305(b) requirements, and is referred to as the "Integrated Report" in EPA guidance. Only one category, Category 5, constitutes the 303(d) list of impaired waters.

When data are available for more than one water quality parameter in the same AU, Ecology will do a separate evaluation for each parameter. For example, Ecology may place an AU in a category due to one parameter and may also place the same AU in a different category for another parameter.

Category 1. Meets tested criteria

Category 1 is not part of the 303(d) list. When recent data are of sufficient quality and quantity to show attainment of the water quality criteria for a parameter within an AU, Ecology will place the AU in the "Meets Tested Criteria" category for that parameter. To qualify for this category, some data must be available for an AU that shows attainment of the applicable water quality standard as described in the listing methodologies in Part 2 of this document. It is not sufficient merely to have a lack of evidence of impairment. Parts 2 and 3 of this document describe specific assessment considerations for moving AUs to Category 1.

An AU placed in Category 1 for a given parameter does not necessarily mean that the AU is attaining all designated uses. Ecology may place an AU in Category 1 for certain parameters while also listing the AU in another category for a different pollutant or condition.

When a TMDL has been approved by EPA and is being implemented, data results for a monitoring location within the TMDL boundary may indicate that the listing should be placed in Category 1 based on data alone. However, in certain cases the listing for a waterbody may remain in Category 4A (Has a TMDL). See Part 1F. Category 4A, Assessment of Data within a TMDL Boundary for more details.

Placement of an AU in Category 1 does not constitute a determination of compliance or non-compliance with water quality standards for any other purpose (such as for permitting).

Category 2. Water of concern

Category 2 is not part of the 303(d) list. Category 2 applies when credible data indicate concerns of possible impact to designated uses, but falls short of demonstrating the non-attainment of standards. The placement of an AU in this category first requires a decision that the water should not be in Category 5. Once Ecology determines that the AU does not meet Category 5 criteria, then the AU will be placed in the "Water of Concern" category when data indicate there are remaining

concerns that reduce confidence that the tested water quality standards are in fact being persistently met. Examples of this include:

1. Data show exceedances of applicable water quality criteria, but there are fewer exceedances than are necessary to place in in Category 5.
2. Narrative information raises concerns about designated use attainment, but it is not sufficient for listing in Category 5.

In these and similar cases, the AU will be placed in the "Water of Concern" category. Parts 2 and 3 of this policy describe specific situations when AUs should be included in Category 2. Ecology will assess other situations, which are not specifically described, on a case-specific basis.

Ecology and the public can use the "Water of Concern" category to help identify, track, and investigate these water quality concerns. Ecology and others should pursue additional monitoring, incorporate the waterbody into existing studies, or find other means to confirm or refute the suspected problem.

Category 3. Insufficient data to make determination

Category 3 is not part of the 303(d) list. When there are insufficient data available to evaluate the attainment of a water quality parameter, Ecology will place the AU in the "Insufficient Data" category. AUs without any data are considered to be in Category 3 for the given parameter. Category 3 listing information will be maintained in Ecology's WQA database for potential future use.

Ecology may place AUs with incomplete or inconclusive datasets (i.e. newly assessed AUs) in Category 3 while a TMDL is under development for a watershed. After EPA approves TMDLs for the associated parameters, Ecology will reassess such listings.

Category 4. Impaired but does not require a TMDL

Category 4 is not part of the 303(d) list, but these waters are still impaired. This category acknowledges impaired AUs that are not appropriate for Category 5 because:

A. EPA has approved the respective TMDL for a given pollutant (Category 4A).
B. A pollution control program other than a TMDL designed to meet water quality standards is being implemented (Category 4B).
C. A non-pollutant is causing an impairment to a designated use, and a TMDL is not the appropriate tool for addressing the identified cause of impairment (Category 4C).

Category 4A: Has a TMDL approved by EPA

Ecology places AUs in Category 5 when a pollutant causes an impairment to a designated use. When EPA approves a TMDL for a parameter in an AU, Ecology will move the AU/ parameter combination from Category 5 to Category 4A: Has a TMDL. A Category 5 listing is no longer required because the primary purpose of the 303(d) listing has been fulfilled, which is to develop actions that will bring

the water back into compliance with water quality standards. If Ecology determines that successful TMDL implementation is not occurring, Ecology will place the AUs addressed by the TMDL back in Category 5.

The following sections describe how Ecology will assess data that are within a TMDL boundary that is in place or being developed, and how data will move in or out of Category 4A.

Assessment of data within a TMDL boundary

Ecology may initiate a TMDL study when one or more Category 5 listings indicate impairment of designated uses. A TMDL study is an in-depth analysis that addresses which waters are not meeting standards, which waters are contributing to downstream impairments, and what needs to be done for all waters within the TMDL boundary to bring them back to persistently attaining designated uses, natural conditions, or other objectives.

Once the TMDL is completed and approved by EPA, all impaired waters monitored for the pollutant(s) in the TMDL that have a load or wasteload allocation associated with them are placed in Category 4A. During implementation of the approved TMDL, monitoring data may continue to be collected to help determine if the TMDL implementation is effectively bringing the waterbodies back into compliance with the water quality standards or TMDL objectives. Monitoring data submitted independent of the TMDL study that are within a TMDL boundary need to also be considered within the context of the TMDL.

The completion of a TMDL provides additional information on contributions of pollutants from AUs within the watershed and information on what is needed to bring a waterbody or watershed back into compliance with the standards. When Ecology assesses monitoring data within a TMDL boundary, the following guidelines apply to move AUs in or out of Category 4A during implementation of an approved TMDL.

Moving a proposed Category 1, 2, 3, or 5 listing to Category 4A

When Ecology assesses new data for an AU within an approved TMDL boundary, WQA staff will consult with appropriate TMDL staff to determine if the existing TMDL adequately addresses the AU. If the existing TMDL adequately addresses the AU, it will be placed in Category 4A (Has a TMDL*)*. If not, the AU will be placed in the appropriate category based on data results alone.

Moving an existing Category 4A listing to a Category 1

If Ecology assesses new data for an AU within an approved TMDL boundary and the data indicate that the waterbody qualifies for Category 1 (meets tested criteria) in accordance with the specific parameter determinations described in this policy, the following will occur:

- WQA staff will consult with the appropriate regional TMDL Ecology staff to share initial data WQA results.
- TMDL Ecology staff will determine if there are special circumstances in the TMDL study that need to be considered in the assessment of the new data or that would require the AU to remain in Category 4A in order to ensure that the TMDL is being adequately implemented. Ecology TMDL staff may decide to keep the AU in Category 4A when it is determined to be

necessary to appropriately protect water quality and the support of designated uses (for example, to protect marine shellfish beds downstream of a stream reach in Category 4A). Other examples include:

- Load allocations within the monitored AU result in more stringent expectations than the numeric criteria and require the AU to remain in Category 4A to continue implementation of the load allocation.
- The TMDL identifies a critical period that was not addressed as part of the original data assessment.

If Ecology makes a decision that the AU should remain in Category 4A due to special circumstances, a remark describing this decision will be documented in the AU listing record.

Moving AUs within a TMDL boundary from Category 4A to Category 1 does not end the implementation of the TMDL. The terms of the TMDL need to continue in order to maintain compliance with water quality standards.

If Ecology previously moved an AU from Category 4A to Category 1, but future monitoring data indicate renewed impairment, then Ecology will return the AU to Category 4A if it is determined that the applicable TMDL is appropriate for prescribing and scheduling the needed corrective actions. If not, Ecology will move the AU back to Category 5.

Category 4B. Has a pollution control program that is being actively implemented

When Ecology determines that a local, state, or federal program or strategy is implementing a pollution control program expected to result in the impaired waterbody meeting water quality standards, Ecology will place a Category 5 listing into Category 4B for consideration by EPA. The waterbody does not require a TMDL because stakeholders are actively implementing a pollution control program designed to attain compliance with water quality standards in a reasonable amount of time.

How Category 4B decisions will be made

In order for Ecology to place a waterbody AU into category 4B, an active pollution control program must meet specific requirements as described below. For contaminated sediment listings, Ecology will place into Category 4B based on the process described in Part 3 of this document.

Ecology must submit a written determination to EPA explaining how the program meets the 4B requirements at the time that the draft WQA is submitted to EPA for review. Ecology will work directly with the program implementers to gather all the necessary information and data needed to make the justification to EPA. This determination and gathering of updated information must be done each time Ecology submits a WQA. If for any reason the program is no longer meeting the Category 4B requirements, then Ecology will move the waterbody AU back into Category 5.

Requirements for an eligible Category 4B program[32]

Ecology will determine if the following elements are met in order to place an impaired AU in Category 4B.

1. Identification of AU and statement of problem causing impairment

The written determination that Ecology develops must identify the impaired AU(s), including name, location information, and must provide information on the known and likely point, nonpoint, and background (upstream inputs) sources causing the impairment, including the magnitude and locations of the sources.

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

- Identification of the water quality target: the water quality target is the protection of beneficial uses and the attainment of the numeric criteria that are set to protect that use.
- A description of the point and nonpoint source loadings that will attain the water quality standards when implemented.
    - A description of the cause-and-effect relationship between the water quality standard and the identified pollutant sources. Based on this linkage, an identification of loading reductions needed to achieve the water quality standard and protect the beneficial use.
    - The determination Ecology submits will also need to contain or reference documentation supporting the analysis, including the basis for any assumptions; a discussion of strengths and weaknesses in the analytical process; and results from any water quality modeling or data analysis.
- Enforceable pollution controls or actions stringent enough to meet water quality standards.
    - A description of all controls (already in place and scheduled for implementation), which will result in reductions of pollutant loadings to a level that achieves the water quality standards. When combined, all loading from point sources and nonpoint sources need to meet water quality standards.
- A description of requirements under which pollution controls will be implemented.
    - Information explaining how each identified pollution control activity is a requirement. An explanation of how those requirements are enforced and how the controls will address the pollutant.

[32] This section applies to waterbodies listed for not meeting applicable water quality criteria. Category 4B requirements for sediment quality are described in Part 3 under "Specific Assessment Considerations for Sediment Quality Standards."

The following is the type of information needed to determine if these controls are 'requirements':

- Authority (local, state, federal) under which the controls are required and will be implemented (for example enforceable state or local regulations, permits, contracts, and grant/funding agreements that require implementation of necessary controls);
- Existing commitments made by the sources to implement controls; or
- Availability of dedicated funding for the implementation of the controls.

3. Estimate or projection of time when water quality standards will be met

The program seeking to place AUs in category 4B must forecast a time estimate by which the controls will result in water quality standards attainment; including an explanation of the basis for the conclusion. The determination that Ecology develops for EPA will need to justify a reasonable time estimate for the controls to achieve WQS. What constitutes a "reasonable time" will vary depending on factors, such as:

- The initial severity of the impairment;
- The cause of the impairment (e.g., point source discharges, in place sediment fluxes, atmospheric deposition, nonpoint source runoff);
- The riparian condition;
- The channel condition;
- The nature and behavior of the specific pollutant (e.g., conservative, reactive);
- The size and complexity of the AU (e.g., a simple first-order stream, a large thermally stratified lake, a density-stratified estuary, and tidally influenced coastal AU); and
- The nature of the control action, cost, and public interest.

Ecology will consider the timeframe for correcting the impairment to be reasonable if it is as expeditious as practical, given full cooperation of all parties involved, and if it is similar to the timeframe that would likely be developed under a TMDL.

4. Schedule for implementing pollution controls.

The determination Ecology develops will describe the implementation schedule for the pollution controls actions.

5. Monitoring plan to track effectiveness of pollution controls.

The determination must include a description of, and schedule for, monitoring milestones to track effectiveness of the pollution controls. The program, for which Ecology is writing the determination for, needs to make the monitoring information available to Ecology for each subsequent eligibility determination in order for a waterbody AU to maintain 4B status.

6. Commitment to revise pollution controls.

Entities implementing the pollution control program must commit to revising the pollution controls, as necessary, if progress towards meeting water quality standards is not being shown. Also, the determination Ecology submits should identify how any changes to the pollution controls, and any other element of the original determination, will be reported to the public and EPA.

Ecology will review progress made every listing cycle, and if the pollution control program is not progressing, the water will be placed back into Category 5 until a revised program is developed and implementation has begun.

Any program may qualify if Ecology determines that it meets all of these listed requirements. Examples that may qualify for this category include:

- Local program developed to improve water quality that adequately addresses the pollutant(s) causing the impairment.
- Wastewater discharge permits or 401 Certifications with conditions or limitations that show they will meet water quality standards.

Ecology's WQA website identifies existing programs that have waterbodies placed in 4B.

All category 4B listings must be reassessed by Ecology during each WQA cycle to determine progress:

- If sufficient data within a Category 4B listing indicates that the specific AU is now meeting standards, Ecology will place the AU in Category 1.
- If Ecology determines that the pollution control program is making sufficient progress towards meeting tested standards, the AU will remain in Category 4B.
- If a pollution control program is not making sufficient progress, or Ecology does not get updated information, then the listing will be returned to Category 5. Likewise, if a pollution control program has been declared completed and implementation has ended, but at that time or later the AU is again shown to be impaired, then the AU will be returned to Category 5.

Category 4C. Impaired by a non-pollutant

Ecology will place AUs in Category 4C when the failure to meet the applicable water quality standards is caused by a type of pollution that is not appropriately addressed through the TMDL process.

Some designated uses of an AU may be impaired due to degradation that does not cause an exceedance of a pollutant criterion. When data show that an AU is impaired for such reasons, it will be placed in the "Impaired by a Non-Pollutant" category. A Category 5 listing is not required because a TMDL would be ineffective in addressing this type of water quality problem.

Under federal statute, pollution is defined as the man-made or man-induced alteration of the chemical, physical, biological, and radiological integrity of water (CWA sec. 502(19)). Most pollution

is caused by pollutants such as toxic chemicals, waste material, nutrients, sediments, and heat. However, impairment can also be caused by factors that are not pollutants. Some examples of non-pollutants that nonetheless cause impairment are:

- Physical habitat alterations
- Physical barriers to fish migration, such as culverts
- Invasive exotic species
- Flow alterations, including anthropogenic dewatering or other hydrological alterations
- Degraded biological integrity, when a pollutant does not contribute to the impairment

TMDLs are designed to allocate the input of pollutants among sources. In the case of non-pollutants, the cause of the impairment cannot be allocated, so the TMDL process is not appropriate. Other programs are more appropriate to resolve pollution impairments (for example, culvert replacement programs or invasive species eradication programs).

A determination of impairment can be based on either numeric or narrative information. In cases where Ecology uses narrative information to demonstrate impairment, it must be submitted in accordance with this policy (see Part 1E, "Assessment of Information using Narrative Standards"). Ecology will remove waters from Category 4C when information is submitted that demonstrates the impairment has been corrected, or that the listing was made in error.

Category 5. The 303(d) list

Ecology will place an AU listing in Category 5 when data indicates that water quality criteria are not persistently attained, or when well-documented narrative evidence indicates impairment of a designated use by a pollutant. Placement of a listing in Category 5 means that the designated use associated with that waterbody segment is impaired. Ecology may also place an AU that is currently meeting standards in Category 5 when trend analysis indicates that the AU is not expected to meet applicable water quality standards by the next WQA cycle. A valid statistical design and analysis methodology is required to justify a Category 5 listing based on trend analysis (see USGS publication, Statistical Methods in Water Resources, September 2002[33]).

Category 5 constitutes the 303(d) list that EPA will review and approve or disapprove pursuant to federal regulations. In accordance with EPA 2006 Integrated Report Guidance, "[AUs] must be placed in Category 5 when, based on existing and readily available data and/or information, technology-based effluent limitations required by the [Clean Water] Act, more stringent effluent limitations, and other pollution control requirements are not sufficient to implement an applicable water quality standard and a TMDL is needed. 40 CFR 130.7(b)(1)."

AUs in Category 5 will need a TMDL, pollution control program, or other action(s) to bring the water into compliance with the water quality standards.

[33] https://pubs.er.usgs.gov/publication/tm4A3

Delisting from Category 5

In general, once an AU qualifies for Category 5, it can only move out of Category 5 to Category 4A or 4B if a TMDL or alternative active cleanup program is in place. A Category 5 listing can also move to Category 1 (meets tested criteria) directly if new data indicates that it qualifies for Category 1 in accordance with this policy. Exceptions to these general rules are described for specific pollutant parameters found in Parts 2 and 3 of this document. It is also possible that a new assessment of data determines that a Category 5 from a previous listing cycle should move to Category 2 based on new data and on reconsideration of the appropriateness of the prior Category 5 listing.

1G. Other Assessment Considerations

Natural conditions

Note: On November 19, 2021, EPA disapproved Ecology's natural condition provisions in our Surface Water Quality Standards. As a result, Ecology will not utilize the following Natural Conditions methodology for waterbodies relevant to the disapproved provisions until a new natural condition provision has been adopted into our Surface Water Quality Standards and approved by EPA.

In accordance with EPA's 2006 Integrated Reporting Guidance, states are not required to place waterbody segments into impaired categories when the non-attainment of a water quality standard is due solely to non-anthropogenic sources. AUs with data indicating impairment will be placed in Category 5 unless Ecology determines that human activities do not cause or contribute to exceedances of the standards.

A natural condition determination requires data and information to substantiate that human sources do not cause or contribute to the non-attainment of water quality standards. The evaluation involves the examination of all available data from the site in question (including historic data when available), comparison to an appropriate reference site where applicable, and professional judgment based on experience in the field of freshwater and marine science. It also requires identification of a likely natural source or processes sufficient to produce the condition, and information to support that there are no human impacts or none in excess of the allowable limits. In general, Ecology assumes that water quality conditions in wilderness areas represent natural conditions due to minimal impacts from anthropogenic pollutant sources. If there is insufficient information to determine the level of human influence, then Ecology will assume that human influences have contributed to criteria exceedances and that the contribution is measurable over natural conditions.

If information or data are available to determine human activities do not cause or contribute to an AU not meeting a water quality standard, then the AU will not be considered out of compliance with the standard. Ecology must document that the non-attainment of a water quality standard is due to natural conditions, and will then place the listing in Category 1, subject to approval by EPA. Placement of AUs in Category 1 due to natural conditions do not need to meet Category 1 requirements described in the specific parameter sub-sections under Parts 2 and 3. In the absence of conclusive information about the natural condition of a waterbody, or whether a criterion exceedance is above or below the allowable threshold specified in the standards, Ecology will place the AU in Category 5 until further information or data are available to justify a change in the category determination. In this case, follow-up investigation (such as a TMDL study) will be needed to more fully characterize the extent of human influence.

Examples of natural conditions that may occur in marine waters include the presence of large- scale physical processes, such as upwelling, circulation, and heating patterns. These may result in conditions in which human influences are not discernable from natural conditions. Ecology will place marine AUs with exceedances of criteria that are likely due to natural conditions in Category 1 if information demonstrates that the waterbody historically did not meet standards. For fresh waters,

exceedances from naturally occurring metals or natural site conditions could lead to exceedances of criteria that are not caused by human influences. In any case, the determination must include conclusive documentation that human activities are not causing or contributing to the exceedance.

Listing challenges and other situations

Ecology reserves the right to make WQA decisions on matters not addressed by this policy, or in a manner not in accordance with this policy, as needed to address unusual or unforeseen situations. Ecology will base the WQA decisions on available information used in accordance with the water quality standards, credible data policies, and other relevant state and federal laws and regulations. Any listing decisions made by Ecology that deviate from methodologies described in this policy will be clearly explained in the remarks section of the waterbody AU listing record.

Requests for reconsideration of listing decisions

At any time, interested parties may contact Ecology in writing to request that Ecology reassess an existing AU listing in any of the five categories under the listing factors of this policy. The request must include the following:

- The reason(s) the listing category is inappropriate and how the policy would lead to a different outcome (for example moved to another category)
- The credible data and information necessary to enable Ecology to conduct the review

The results of WQA reviews that occur between scheduled WQA cycles will not be considered final until they are submitted as part of the next scheduled draft WQA submittal to EPA, and EPA has taken an approval action.

Ecology will, in consultation with EPA, correct any errors identified in the 303(d) list or the overall WQA as soon as Ecology is aware of the error, without waiting for the next WQA cycle. Errors may include things such as incorrect monitoring stations, the presence of erroneous data in a listing, mistaken application of a non-applicable numeric criterion, etc. This does not apply to requests to change a WQA decision based on new data prior to the next WQA cycle nor to disagreements with Ecology's judgment in making a WQA decision. Changes made between listing cycles due to errors may not be visually available until the next WQA is updated.

1H. Prioritizing TMDLs

Ecology will prioritize Category 5 AUs for TMDL development and submit this prioritization plan to EPA as part of the WQA package to meet approval requirements for section 303(d) of the CWA. Ecology typically develops TMDLs using a watershed-based approach that addresses impairments from multiple pollutants concurrently.

Ecology recognizes that partnerships at the local level are essential for ensuring successful TMDL implementation. To that end, Ecology is committed to engaging stakeholders, tribes, local organizations, and other members of the public in establishing TMDL priorities that take into account local perspectives and priorities.

To ensure consistency statewide and enhance public participation in the TMDL prioritization process, Ecology will hold an annual statewide public meeting to present its proposed list of TMDLs to start in the following two years. Ecology will seek feedback from the public and take comments on the proposed list. Ecology will then revise the list as appropriate and respond to stakeholder comments. It is important to note that there may be some years when Ecology does not propose new TMDLs because of resource constraints, such as limited staffing to start new projects or limited resources to conduct the technical studies.

Criteria to prioritize TMDLs

Criteria to prioritize TMDLs as higher priority include the following:

- Severity of the pollution problem
- Risks to public health
- Risks to threatened and endangered species
- Vulnerability of water bodies to degradation
- Waterbodies where a new or more stringent permit limit is needed for point sources
- Local support and interest in a watershed

Additionally, Ecology will include environmental justice (EJ) considerations when prioritizing TMDLs, including the utilization of EJ screening tools to better understand and address potential impacts of the TMDL prioritization process on low-income, minority, and tribal populations.

Priorities for contaminated sediment listings in Category 5 will be set by Ecology's Toxics Cleanup Program in accordance with the sediment management standards at Chapter 173-204 WAC.

Forest practices activities

Under state law, landowners must conduct forest practices activities in a manner that supports the attainment of water quality standards. In 2000, Washington adopted revised forest practices rules that identify stream buffers and other management prescriptions expected to meet water quality standards. The state Forest Practices Board tests the forestry rules through a formal adaptive

management program, which has the goal of identifying and expediently revising any forestry rules that do not support the attainment of water quality standards. Washington established the Clean Water Act Assurances as a formal agreement in the 1999 Forests and Fish Report[34] in recognition of the improvements to the rules and commitments made. Ecology views the forest practices rules, with its adaptive management program, as providing protection equal to what would occur under a TMDL in watersheds where the rules apply. For this reason, TMDL development is a low priority in watersheds where forestry is the primary land use. Ecology may assign a higher TMDL development priority to forested watersheds with a broader mixture of land uses, but Ecology would still rely upon the forest practices rules to address any portion of the pollution contributed by forestry activities. The agreement to rely on the forest practices rules in lieu of developing separate TMDL load allocations or implementation requirements remains conditioned on maintaining an effective adaptive management program.

[34] https://www.dnr.wa.gov/publications/fp_rules_forestsandfish.pdf

Part 2: Assessment Considerations for Specific Water Quality Criteria

Part 2 describes the requirements and methodologies by which Ecology will assess data and information for specific water quality parameters relative to surface water quality standards (Chapter 173-201A WAC). Part 3 describes requirements for sediment quality standards.

A. Bacteria
    a. Shellfish Harvesting
    b. Water Contact Recreation
B. Benthic Biological Indicators
C. Dissolved Oxygen
D. Harmful Algae Blooms
E. pH
F. Phosphorus (Total) in Lakes
G. Temperature
H. Total Dissolved Gas
I. Toxics-Aquatic Life Criteria
J. Toxics-Human Health Criteria
K. Turbidity

2A.1. Bacteria – Shellfish Harvesting

Designated Use:	Shellfish harvesting
Numeric Criteria:	WAC 173-201A-210 (2)(b)
Narrative Standards:	WAC 173-201A-260 & -300
Unit of Measure:	Number of colony forming units (CFU) or most probable number (MPN) per 100mL

Assessment information and data requirements

The state water quality standards for bacteria rely on fecal coliform data to protect shellfish harvesting in marine waters.

The bacterial indicators for shellfish harvesting uses include provisions for determining compliance based on two-part criteria. The criteria are not met if either component is exceeded:

1. A "geometric mean component" with a specified magnitude value that is not to be exceeded.
2. A "ten-percent exceedance component" which is a magnitude value that is not to be exceeded by more than 10 percent of all samples within a given time period (or any single sample when less than ten sample values exist).

Ecology will apply the appropriate indicator criteria to datasets resulting from a monitoring design that represents general ambient conditions. The criteria are expressed in a manner to be compared to a distributed sample dataset. Sampling that solely targets known periods of elevated bacteria levels is not representative of the general condition of an AU, as it may result in an artificially inflated proportion of samples that exceed the criteria. Therefore, Ecology will remove monitoring data from the evaluation when the intention of the monitoring is to target high bacteria levels.

For all bacteria data evaluated in the WQA, Ecology will use only one value per AU per day. For all waterbody types, an arithmetic mean value will be calculated from multiple samples collected on the same day from a single station within an AU to represent the daily value. This averaging helps reduce the effects of sample variability inherent in determining ambient bacteria concentrations at the time of sampling. When sample values are available from multiple stations within an AU on the same day, the station with the highest (average) value will be used as the daily value. This will help ensure the influence of bacteria sources upon a portion of an AU (e.g. a downstream portion of a stream reach) is not obscured by averaging values from a station on a different portion of the AU (e.g. an upstream portion of an stream reach) that is not influenced by the same sources. Samples with non-detect values will be assigned the method detection limit. When the detection limit is not available, a value of 2 CFU/100mL will be assigned.

Ecology will group the data for each AU by individual water year, which extends from October 1 through September 30 of the following calendar year. Ecology will calculate a single geometric mean

for the entire water year (and critical period if applicable) and determine the percentage of samples exceeding the ten-percent exceedance component for the entire water year. A minimum of five data collection events is required to calculate a geometric mean value for marine shellfish harvesting bacteria criteria. No minimum sample size is required to evaluate the ten-percent exceedance component of the criterion.

Where sufficient information is available, Ecology may also define a specified critical period or season in which the criteria need to be met for shellfish harvesting, based on WAC173-201A, sections 200(2)(b)(i)&(210)(3)(b)(i). This time period may be defined through a TMDL study or a seasonal analysis that brackets specific months or seasons in which bacteria levels are more prone to exceed criteria. Where a critical period has been identified, Ecology will assess bacteria for the critical period and the entire water year.

Ecology may also use agency advisories to assess the support of designated uses. Specific details on category determinations for shellfish classification standards are included at the end of the Category Determinations section below.

Analysis of fecal coliform data in fresh water for shellfish harvesting use

Fecal coliform data is considered an alternative indicator for water contact recreation uses until Dec. 31, 2020.. Fecal coliform data and information collected after 2020 in fresh waters that flow into marine waters protected for shellfish harvesting can be assessed using the methodologies described in Part 1E under “Information Submittals based on Narrative Standards”. Types of water quality studies that could be assessed under the narrative standards to protect downstream uses include Pollution Identification Control (PIC) programs that monitor fecal coliform in fresh waters in order to identify bacterial contamination that could be contributing impairment to marine waters.

Where a TMDL is being implemented, Ecology will continue to assess fecal coliform data collected after 2020 in fresh water in order to determine compliance with load allocations under a TMDL that is developed for the protection of downstream shellfish harvesting use.

For purposes of delisting waters, freshwater AUs that drain directly to marine waters within a TMDL boundary may require monitoring of both fecal coliform and *E. coli* bacterial indicators to determine attainment of both recreation and shellfish harvesting uses. Consult with a regional TMDL lead for information regarding the re-evaluation of AUs that have a fecal coliform TMDL.

Category determinations

More recent data outweighs older data in qualifying an AU for a given category. For example, if the AU qualifies for Category 5 based on earlier years but are followed by subsequent years that qualify for Category 1, then Ecology will place the AU in Category 1. The exception is years showing no exceedances but have insufficient number of sample values to meet the Category 1 requirements; these insufficient datasets will not outweigh prior years that qualify for another category.

Category determinations based on agency advisories are described at the end of this section.

Category 5

Ecology will place an AU in Category 5 when:

- The geometric mean component of the criterion is exceeded in any water year.

OR

- The ten-percent exceedance component of the criterion is exceeded within a single water year and at least two samples exceed the associated criterion magnitude during that water year.

Category 4

Ecology will place an AU in Category 4A when EPA has approved a TMDL for bacterial indicators associated with shellfish harvesting.

Ecology will place an AU in Category 4B when an alternative pollution control program (meeting the requirements in Section 1F) is actively addressing the associated problem affecting the designated use.

Category 3

Ecology will place an AU in Category 3 when the available data are insufficient for any other category determination. This information will be maintained in Ecology's WQA database for future use. As additional data and information become available in future listing cycles, Ecology will again assess all available data to update the category determination according to this policy.

Category 2

Ecology will place an AU in Category 2 when a water year does not meet the ten-percent exceedance component of the applicable criterion but only one sample in the water year exceeds the magnitude of this criterion component.

Category 1

Ecology will place an AU in Category 1 in one of two ways:

The geometric mean and the ten percent exceedance components of the criteria are met in each of two water years, based on ten or more samples from each of those years.

- If any critical period has been identified by Ecology, the criteria must also be met during this period.
- The two years qualifying for Category 1 do not need to be consecutive as long as there is no year between them in which the criterion is not met. The two years do not need to be the two most recent as long as there is no subsequent year in which the criteria are not met.

OR

Ecology will place an AU in Category 1 based on data from a single water year when the following circumstances are met:

- The AU has an approved TMDL (Category 4A) or alternative pollution control program (Category 4B) that is being actively implemented.
- Ecology has defined a critical period for the AU during which:
  - There are at least five sample values from the critical period.
  - The data meet the geometric mean and the ten-percent exceedance components of the criteria, and/or the applicable TMDL targets, whichever is more stringent.
- The qualifying year does not have to be the most recent year provided that there are no more recent data for which the criteria are not met.

In some cases, Ecology will retain an AU in Category 4A when the criteria are attained if further work is needed to achieve associated water quality goals. For example, an AU may be meeting criteria, but may not yet be meeting TMDL load allocations necessary to support downstream uses. See Part 1, Section 1F. Category 4A: Has a TMDL Approved by EPA, for more information on assessment of data within a TMDL boundary.

Category determinations based on agency health advisories

Category determinations using Department of Health Shellfish Program Data

The Washington Department of Health (DOH) classifies shellfish[35] growing areas based on their sanitary conditions under the direction of the U.S. Food and Drug Administration (FDA). The DOH classification methods are derived from the National Shellfish Sanitation Program (NSSP) Guide for the Control of Molluscan Shellfish.[36] The bacteriological quality of marine water samples collected from an approved growing area must satisfy both parts of the following NSSP standard. The concentration of fecal coliform bacteria, the indicator organisms, is not to exceed:

- A geometric mean of 14 organisms per 100mL; and
- The estimated 90th percentile cannot exceed 43 organisms per 100 mL if sampling under the systematic random sampling plan. If sampling where point sources of pollution may impact the growing area, not more than 10 percent of the samples can exceed 43 organisms per 100 mL.

Generally, DOH uses a minimum of 30 samples for determining compliance with the geometric mean criterion and may include several years of data. However, in accordance with the surface water quality standards, Ecology assesses the ambient bacteriologic conditions of commercial and

[35] https://doh.wa.gov/about-us/programs-and-services/environmental-public-health/environmental-health-and-safety/shellfish-program
[36] https://www.fda.gov/food/federalstate-food-programs/national-shellfish-sanitation-program-nssp

recreational shellfish harvesting area based on a maximum 12 months duration for calculating a geometric mean [WAC 173-201A-210(2)(b)(ii)].

This differing temporal range (several years vs. one year) for determining compliance with the geometric mean criterion, may in some cases, create a disparity between DOH and Ecology impairment decisions. Furthermore, when assessing data for Conditionally Approved growing areas, DOH removes data collected under specific conditions such as storm events. Ecology includes these data when collected in the course of a random sampling plan. Sampling designed to target high bacteria levels are not used to assess ambient conditions.

As allowed by the surface water quality standards, shellfish growing areas approved for unconditional shellfish harvest using the DOH assessment methods, may be considered fully supporting the shellfish harvesting use. In accordance with this provision, Ecology will consult with DOH on WQA determinations that use DOH shellfish program sampling data. In the event of a discrepancy between the WQA impairment status and DOH shellfish sanitation classification for an AU, Ecology will defer to DOH and administratively modify the WQA as necessary to align with DOH classifications.

Helpful documents

- EAP030 – Collection of Fecal Coliform Bacteria Samples in Surface Water
- EAP034 – Collection, Processing, and Analysis of Stream Samples
- EAP092 – BEACH Program Bacteria Sampling

2A.2. Bacteria – Water Contact Recreation

Designated Use:	Water contact recreation
Numeric Criteria:	WAC 173-201A-200 (2)(b) WAC 173-201A-210 (3)(b)
Narrative Standards:	WAC 173-201A-260 & -300
Unit of Measure:	Number of colony forming units (CFU) or most probable number (MPN) per 100mL

Assessment information and data requirements

The state water quality standards for bacteria to protect for water contact recreation were updated in January 2019 to align with nationally recommended criteria. The newly adopted bacteria criteria rely on the following indicators to protect water contact recreation:

- Fresh water: Escherichia coli (E. coli) and fecal coliform[37]
- Marine water: Enterococci and fecal coliform[36]

The bacterial indicators for water contact recreation include provisions for determining compliance based on a two-part criteria. The criteria are not met if either component is exceeded:

- A "geometric mean component" with a specified magnitude value that is not to be exceeded.
- A "ten-percent exceedance component" which is a magnitude value that is not to be exceeded by more than 10 percent of all samples within a given time period (or any single sample when less than ten sample values exist).

Ecology will apply the appropriate indicator criteria to datasets resulting from a monitoring design that represents general ambient conditions. The criteria are expressed in a manner to be compared to a distributed sample dataset. Sampling that solely targets known periods of elevated bacteria levels is not representative of the general condition of an AU, as it may result in an artificially inflated proportion of samples that exceed the criteria. Therefore, Ecology will remove monitoring data from the evaluation when the intention of the monitoring is to target high bacteria levels.

For all bacteria data evaluated in the WQA, Ecology will use only one value per AU per day. For all waterbody types, an arithmetic mean value will be calculated from multiple samples collected on the same day from a single station within an AU to represent the daily value. This averaging helps reduce the effects of sample variability inherent in determining ambient bacteria concentrations at

[37] Water quality standards for fresh water and marine contact recreation allow use of fecal coliform as an alternate bacterial indicator through 12/31/2020, in order to allow laboratories adequate time to transition to methods that analyze for *E. coli* and enterococci.

the time of sampling. When sample values are available from multiple stations within an AU on the same day, the station with the highest (average) value will be used as the daily value. This will help ensure the influence of bacteria sources upon a portion of an AU (e.g. a downstream portion of a stream reach) is not obscured by averaging values from a station on a different portion of the AU (e.g. an upstream portion of an stream reach) that is not influenced by the same sources. Samples with non-detect values will be assigned the method detection limit. When the detection limit is not available, a value of 2 CFU/100mL will be assigned.

Ecology will group data for each AU by individual water year (October 1 through September 30 of the following calendar year). Within each water year, data will be compared to the criteria in three-consecutive-month periods (i.e. Jan./Feb/March, Feb/March/April, etc.), as well as separately for any applicable critical period. The three-consecutive-month period is a simplified method for interpreting the ninety days or less averaging period required under WAC 173-201A section 200 (2)(b)(i)(B). In accordance with the numeric criteria, a minimum of three data collection events within a three-consecutive-month period are required to calculate a geometric mean value for fresh and marine water contact recreation bacteria criteria. No minimum sample size is required to evaluate the ten-percent exceedance component of the criterion for any of the designated uses.

Where sufficient information is available, Ecology may also define a specified critical period or season in which the criteria need to be met for water contact recreation, based on WAC173- 201A, sections 200(2)(b)(i)&(210)(3)(b)(i). This time period may be defined through a TMDL study or a seasonal analysis that brackets specific months or seasons in which bacteria levels are more prone to exceed criteria. Where a critical period has been identified, Ecology will assess bacteria for the critical period and the entire water year.

Analysis of fecal coliform data

Fecal coliform data is considered an alternative indicator for water contact recreation and will be assessed in accordance with this policy until 12/31/2020. If both fecal coliform and primary indicator data are available for a waterbody, the data will be assessed separately and independent category determinations will be made for each parameter. Ecology will not assess fecal coliform data for water contact recreation collected after 2020, unless fecal coliform data is needed to determine compliance with load allocations under a TMDL. Any fecal coliform data collected after 2020 for the purpose of determining the protection of shellfish harvesting uses will be assessed in accordance with the shellfish harvesting use outlined in Section 2A.1. of this policy.

Category determinations

More recent data outweighs older data in qualifying an AU for a given category. For example, if the AU qualifies for Category 5 based on earlier years but are followed by subsequent years that qualify for Category 1, then Ecology will place the AU in Category 1. The exception is years showing no exceedances but have insufficient number of sample values to meet the Category 1 requirements. These insufficient datasets will not outweigh prior years that qualify for another category.

Category 5

Ecology will place an AU in Category 5 when:

- The geometric mean component of the criterion is exceeded within a single water year (i.e. for any three-consecutive-month period).

OR

- The ten-percent exceedance component of the criterion is exceeded within any three-consecutive-month period in a single water year and at least two samples exceed the associated criterion magnitude during that water year.

Category 4

Ecology will place an AU in Category 4A when EPA has approved a TMDL for bacterial indicators associated with water contact recreation.

Ecology will place an AU in Category 4B when an alternative pollution control program (meeting the requirements in Section 1F) is actively addressing the associated problem affecting the designated use.

Category 3

Ecology will place an AU in Category 3 when the available data are insufficient for any other category determination. This information will be maintained in Ecology's WQA database for future use. As additional data and information become available in future listing cycles, Ecology will again assess all available data to update the category determination according to this policy.

Category 2

Ecology will place an AU in Category 2 when the data exceed the ten-percent exceedance component of the criteria, but the AU does not qualify for Category 5.

Category 1

Ecology will place an AU in Category 1 in one of two ways:

The data meet both the geometric mean and ten-percent exceedance components of the criteria in each of two water years, under the following conditions:

- In each of the two water years, there must be enough samples to calculate at least one geometric mean for October through March and one for April through September. The ten percent exceedance component must be met for all three-consecutive-month periods with data available, regardless of sample size.
- For AUs where Ecology has identified one or more critical periods, the data must also meet the criteria or approved TMDL load allocation in that period.

- The two years qualifying for Category 1 do not need to be consecutive as long as there is no year between them in which the criterion is not met. The two years do not need to be the two most recent as long as there is no subsequent year in which the criteria are not met.

OR

Ecology may place an AU in Category 1 based on data from a single water year where the AU has an approved TMDL (Category 4A) or an actively implemented alternative pollution control program (Category 4B) under the following conditions:

- Ecology has defined a critical period for the AU for which:
  - There are at least three sample values from the critical period(s).
  - The data meet the geometric mean and the ten percent exceedance components of the criteria, and/or meet the applicable TMDL targets, whichever is more stringent.
- If data is available from outside the critical period, such data must also meet the geometric mean and ten percent exceedance components of the criteria.
- There are no more recent data for which the criteria are not met.

In some cases, Ecology will retain an AU in Category 4A when the criteria are attained if further work is needed to achieve associated water quality goals. For example, an AU may be meeting criteria, but may not yet be meeting TMDL load allocations necessary to support downstream uses. See Part 1, Section 1F. Category 4A: Has a TMDL Approved by EPA, for more information on assessment of data within a TMDL boundary.

Helpful documents

- EAP030 – Collection of Fecal Coliform Bacteria Samples in Surface Water
- EAP034 – Collection, Processing, and Analysis of Stream Samples
- EAP092 – BEACH Program Bacteria Sampling

2B. Benthic Biological Indicators

Designated Uses:	Aquatic life
Narrative Standards:	WAC 173-201A-260 & -300

Assessment information and data requirements

Assessments based on multi-metric, community-level biological indicators provide direct measures of the cumulative response of biological communities to multiple types of stressors. EPA Integrated Report guidance advises states to include bioassessment methodologies in the data and information they evaluate in developing their 303(d) lists and 305(b) reports. The EPA guidance stipulates that states should identify AUs in Category 5 using bioassessment data even if the specific pollutant causing the impairment has not been identified.

Ecology primarily relies upon a multi-metric benthic index of biotic integrity (B-IBI) methodology to identify impairments of the aquatic life use in freshwaters. The B-IBI model is based on the response of community attributes relative to gradients in environmental attributes. For more information on the B-IBI model, refer to the helpful documents listed at the end of this section. Past assessments also used the River Invertebrate Prediction and Classification System (RIVPACS) multivariate model. Ecology has not recently employed this model, however, as with any credible data and information on aquatic life use conditions, the results of this model remain usable for WQA purposes. Ecology may also use other types of biological data and information for fresh or marine waters to evaluate aquatic life use support provided that the data meets data credibility requirements and guidelines for listing based on Section 1E. 'Information Submittals Based on Narrative Standards'.

Ecology relies upon a numeric B-IBI threshold to indicate whether or not the biological integrity of an aquatic life community is degraded. The accepted scientific practice is to compare the similarity between standardized community metrics observed at an assessment site to the community metrics expected to occur at the site. The expected attributes are based on data from reference sites that are minimally or least affected by human activities.

Since aquatic benthic communities are significantly influenced by both water quality and habitat conditions, bioassessment scores that are depressed, relative to a set of reference sites, are indicative of water quality and/or habitat degradation. However, in some cases a depressed score may indicate natural environmental constraints upon the biological community. A stressor identification analysis is typically required to identify the most probable causes of low bioassessment scores.

Ecology will use bioassessment data based on the B-IBI model to determine if the bioassessment scores are indicative of water quality and/or habitat degradation, and if so AUs will be placed in Category 5 as 'Benthic Macroinvertebrates Bioassessments'. B-IBI scores below the 10th percentile of reference site scores most often indicate that benthic community diversity is constrained by one or more pollutants and/or habitat degradation. If an AU is in Category 5 based only on B-IBI data, a stressor identification analysis will first need to occur in order to identify pollutants or habitat

impairments that are causing the community to be degraded. Category 5 listings based on B-IBI data will not result in permit limitations or wasteload allocations unless an associated pollutant has been identified.

Evaluating bioassessment data based on B-IBI

The following procedures will apply to assessing bioassessment data for use in the WQA:

- Benthic macroinvertebrate community data must be collected and reported in accordance with the Standard Operating Procedure for the Minimum Requirements for the Collection of Freshwater Benthic Macroinvertebrate Data in Streams and Rivers (Ecology SOP EAP073),[38] or, using protocols that are at least as rigorous as the Ecology SOPs and that produce data to which the B-IBI model can be applied. Data collected prior to 2012, before the Ecology SOP was formalized as the regional standard, must have met data usability requirements in place at the time the data were collected. Ecology will only use B-IBI data from monitoring studies conducted since 2012 if the following are met:
    - Data must be collected within the index period that matches Ecology's reference sites, from July through October 15.
    - The sampling area must be a minimum of 8 square feet.
    - Data must be analyzed by labs with certified taxonomists in accordance with industry standard QA/QC protocols.
    - The labs must identify organisms to a fine taxonomic resolution, referred to specifically as the 'Lowest Practical Level', or 'Level 2' as defined by the Northwest Standard Taxonomic Effort. More information can be found: Pacific Northwest Aquatic Monitoring Partnership (PNAMP);[39] Northwest Standard Taxonomic Effort (NWSTE), January 2013.
- Ecology's goal for sample counts is to evaluate a benthic macroinvertebrate assemblage based on a sample containing at least 500 individual organisms. In general, samples sizes below approximately 300 organisms will provide cause for evaluating the potential reasons that the organism count goal is not attained. A low organism count may be associated with stressful environmental conditions or due to sub-optimal sampling effort. Whether or not Ecology rejects a sample based on the organism count will depend on the known or inferred condition of the waterbody being evaluated. A sample with less than 300 organisms will be rejected if the sub-optimal count is attributable to a deficiency in sampling effort.
- Ecology will use B-IBI data from sites with an NHD reach scale channel gradient between 0.1% (the cut-off for low gradient channels (Olivero and Anderson, 2008)) and 30%; this approximates range of NHD reach-scale gradients in which Ecology reference sites are

[38] https://apps.ecology.wa.gov/publications/SummaryPages/2203212.html
[39] https://www.pnamp.org/document/5210

located. Ecology will determine the reach gradients when the sample sites are georeferenced to individual NHD reaches for the WQA.

- Ecology will use B-IBI data available throughout the entire state.
- The B-IBI model will be calibrated to a 0 - 100 scoring scale.
- Ecology has established B-IBI WQA thresholds for determining impairment by EPA Level 3 ecoregion (i.e. based on the distribution of reference site scores in a given ecoregion), found in Table 2.
- Ecology will average multiple bioassessment scores in a single year together, unless there is clear justification not to do so for an individual AU. For example, the scores will be averaged if a station was sampled multiple times, or, if multiple stations on an AU were sampled in a single year.
- B-IBI score assumptions: Ecology has designated scores below the 10th percentile of the reference site score distribution by EPA Level III Ecoregion[40] as being indicative of degraded biological integrity.

Table 3 identifies B-IBI thresholds for indicating degraded biological integrity and diagnostic metric thresholds for the Fine Sediment Biotic Index by ecoregion. Ecology derived the B-IBI thresholds from 10,000 bootstrap replications for reference site scores within the various ecoregions of Washington using data through 2016.

Table 3. B-IBI and the Fine Sediment Biotic Index diagnostic metric thresholds

EPA Level III Ecoregion	B-IBI (0-100 scale) 10th Percentile	Fine Sediment Biotic Index[2]
North Cascades	63	89
Cascades	72	89
Coast Range	62	89
Puget Lowland	65	89
Willamette Valley[1]	65	89
Eastern Cascades Slopes & Foothills	54	79
Northern Rockies	60	79
Blue Mountains	68	79

[40] https://www.epa.gov/eco-research/ecoregion-download-files-state-region-10#pane-45

EPA Level III Ecoregion	B-IBI (0-100 scale) 10th Percentile	Fine Sediment Biotic Index[2]
Columbia Plateau	39	8

Table notes:

[1] The threshold for the Puget Lowland ecoregion also applies to the small portion of the Willamette Valley Ecoregion in Washington for WQA purposes.

[2] Scores less than these values indicate sediment pollution. These numbers are based on the 10th percentile of Fine Sediment Biotic Index (FSBI) values at reference sites in western Washington, eastern Washington, and the Columbia Plateau.

The Hilsenhoff Biotic Index diagnostic metric threshold for all ecoregions is >5.50. Scores greater than this value indicate nutrient pollution (Hilsenhoff, 1987).

The Metals Tolerance Index diagnostic metric threshold for all ecoregions is ≥4.0. Scores greater than this value indicate metals pollution (McGuire, 2007).

Category determinations

The following describes how Ecology will use B-IBI data to place listings into an appropriate category within the WQA. Figures 3 and 4 at the end of this section summarize the category determination process.

Category 5

Ecology will place an AU in Category 5 when:

- From the two most recent years that data is available within the listing cycle, the average B-IBI score is below the 10th percentile of reference site scores for the associated EPA Level III Ecoregion (See Table 2 of B-IBI thresholds).

AND

- One or more diagnostic metrics indicates that the composition of the benthic assemblage is influenced by a pollutant or habitat condition. Ecology will base the evaluation on an average score of a diagnostic metric; the procedure noted above for averaging the B-IBI scores will be followed.

Ecology will not use the diagnostic metrics at this stage to identify a probable pollutant, but to provide higher confidence that an impairment is caused by one or more pollutants or habitat condition. Ecology will use a stressor identification process, which will occur subsequent to a Category 5 listing, to identify the probable causes of impairment. Ecology will use the Hilsenhoff

biotic index,[41] a fine sediment index, and a metals tolerance index as the diagnostic metrics. Ecology may use other benthic assemblage indices once they are developed (for example, a thermal indicator index is currently under development and will be used when available). Although these indices do not cover all possible pollutants that may be present, impairment by additional pollutants is likely to be captured in the scores of one or more of the above indices. This assumption is based on the rationale that taxa sensitive to sediment, metals, temperature, and/or organic enrichment are often sensitive to other pollutants as well.

A Category 5 listing based on bioassessment data alone (i.e., a stressor identification analysis has not been completed), does not have a known cause of the degraded biological integrity. Therefore, Ecology will initially assign bioassessment listings in Category 5 under the parameter name "Benthic Macroinvertebrates Bioassessments". The listing will remain in Category 5 until a stressor identification analysis has been completed to determine if one or more pollutants are contributing to impairment. If the analysis identifies specific pollutants as likely causes of impairment, then the Category 5 listing for "Benthic Macroinvertebrates Bioassessments" will be modified to indicate the Category 5 listing(s) based on each identified pollutant parameter.

A Category 5 listing based on bioassessment data in a previous listing cycle may be removed from Category 5 to Category 1, 2, or 3 in a subsequent WQA cycle if the most recent data does not meet the requirements described above for listing in Category 5. Category 5 listings based on bioassessment data can be moved to Category 4A (has an approved TMDL) after the completion of a TMDL for the pollutant(s) identified, or to 4C (impairment by a non-pollutant) after identification of non-pollutants as the likely cause of impairment. Ecology has guidance for stressor identification of biologically impaired aquatic resources[42] available on the Ecology publications website.

Category 4

Category 4 is only indirectly applicable to bioassessment since Category 5 listings based on bioassessment data will transition to pollutant or habitat impairment listings after a stressor identification analysis is completed. In other words, there will be no Category 4 listings with the parameter name "Benthic Macroinvertebrates Bioassessments."

Categories 4A and 4B

A Category 5 listing for "Benthic Macroinvertebrates Bioassessments" will be modified to a Category 5 listing for each pollutant parameter identified in a stressor identification analysis. When EPA approves a subsequent TMDL or an alternative pollution control program is implemented for a pollutant identified from the stressor analysis, Ecology will move the listing for that pollutant from Category 5 to 4A or 4B, as appropriate.

This listing policy provides guidance on determining category listings for the WQA and is not intended to provide guidance or direction on subsequent TMDL development and implementation.

[41] http://cfb.unh.edu/StreamKey/html/biotic_indicators/indices/Hilsenhoff.html
[42] https://apps.ecology.wa.gov/publications/SummaryPages/1003036.html

Nonetheless, it is important to note that a TMDL based on pollutants identified from a stressor identification analysis due to degraded B-IBI threshold scores may need to also address other stressors that are identified as non-pollutants. Pollutant stressors are often highly correlated with stressors from habitat impairment. For example, fine sediment may be identified as the pollutant, while flow alterations are identified as the stressor on aquatic habitat. These stressors are interrelated, as flashy flows transport more sediment from the watershed into the stream and can likewise result in in-stream erosion. Thus, an integrated approach may be needed in the TMDL to address all stressors and bring the waterbody back into compliance with meeting water quality standards and protecting designated uses of the waterbody.

A TMDL based on pollutants identified as a stressor on the biologic macroinvertebrate community will likely need to evaluate the effects of potential combinations of anthropogenic pollutants, anthropogenic habitat alterations, natural habitat limitations, and/or natural water quality limitations. It is possible that a site may naturally have sub-optimal habitat that limits biological diversity and will continue to have B-IBI scores below the 10th percentile of reference site scores even if the pollutant-caused impairment has been eliminated. In this case, the B-IBI approach described in this policy would be insufficient for determining if the pollutant-caused impairment had been remedied. The TMDL effectiveness monitoring will likely need to take into consideration the natural environmental potential in determining the benthic habitat condition and establishing expectations for the biological community.

Category 4C

If the stressor identification analysis for a Category 5 "Benthic Macroinvertebrates Bioassessments" listing indicates that a non-pollutant (such as physical habitat alteration) is likely to be a stressor on the biologic community, Ecology will modify the listing to a Category 4C and the stressor identified (eg. habitat alteration).

Category 3

Ecology will place an AU in Category 3 when the available data are insufficient for another category determination (such as only one year of data are available). This information will be maintained in Ecology's WQA database for future use. As additional data and information become available in future listing cycles, Ecology will again assess all available data to update the category determination according to this policy.

Category 2

An AU qualifies for Category 2 when:

- From the two most recent years that data is available within the listing cycle, the average B-IBI score is below the 10th percentile of reference site scores but all diagnostic metric scores attain the thresholds specified in Table 2.

OR

- The average B-IBI score from the most recent two years is above the 10th percentile of reference site scores but one or more diagnostic metric scores does not attain the thresholds.

Category 1

An AU qualifies for Category 1 when the average B-IBI score from the most recent two years is above the 10th percentile of reference site scores and all diagnostic metric scores attain the thresholds.

Helpful documents

- EAP073 – Minimum Requirements for the Collection of Freshwater Benthic Macroinvertebrates in Streams and Rivers

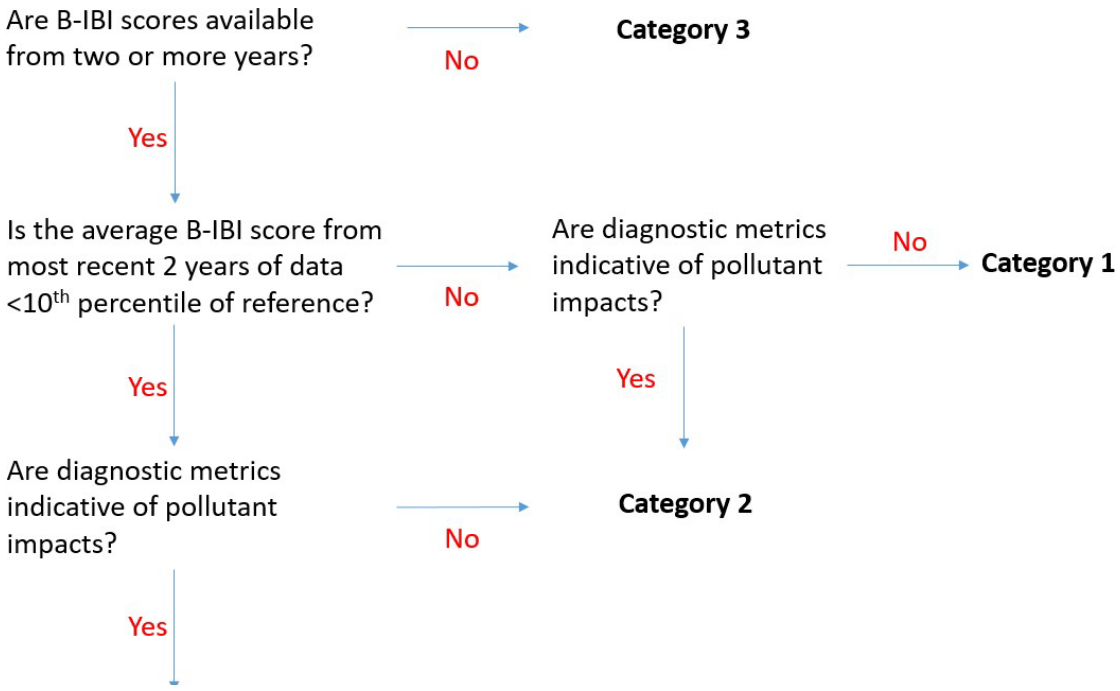


Figure 3. Decision Tree for Benthic Biodiversity Category Determinations

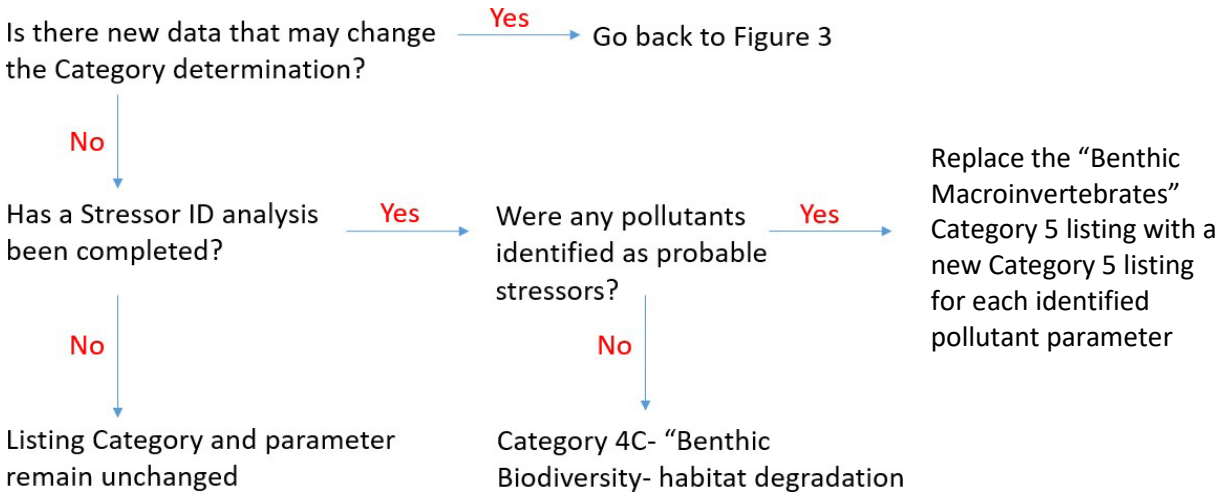


Figure 4. Decision Tree for Existing Category 5 Benthic Biodiversity Listings

2C. Dissolved Oxygen

Designated Uses:	Aquatic life
Numeric Criteria:	WAC 173-201A-200(1)(d); WAC 173-201A-210(1)(d)
Narrative Standards:	WAC 173-201A-260 & -300
Unit of Measure:	mg/L or parts per million (ppm)

Assessment information and data requirements

The water quality standards for dissolved oxygen (DO) include minimum criteria limits designed to protect the most sensitive aquatic life uses (e.g. freshwater salmonid spawning and rearing). The State's numeric water quality standards for DO are expressed as a one-day minimum; there is no averaging period in the DO criteria.

In some cases the DO criteria cannot be met due to natural conditions. See the Natural Conditions section under "1G. Other Assessment Considerations" for more information on what would be needed to make a natural conditions determination.

This WQA methodology applies to water column DO concentrations. The assessment of compliance with the DO criteria are evaluated using time series monitoring datasets (i.e. using probes that continuously measure DO at a set time interval) or discrete measurements (also called instantaneous, single, or grab sample) datasets. For purposes of the WQA, Ecology will consider data sets as time series when measurements are recorded at least once per hour for at least 80% of each day (i.e. ≥19 hours per day). Time series data provides a better representation of the waterbody AU condition throughout the day in comparison to discrete sample data since ambient DO concentrations typically exhibit a diurnal cycle. Unlike discrete measurements, Ecology can use time series data to determine the lowest daily DO concentration in a waterbody AU. For either type of data, the single lowest value recorded on any given day is the value used to represent that day in determining whether or not the AU meets water quality criteria.

In general, DO levels impacted by pollution are much more likely to be at their highest point in the afternoon when photosynthetic rates in aquatic plants and algae are at their peak, and at their lowest point in the early morning. DO levels may also vary seasonally in response to changes in water temperature and rates of photosynthesis & respiration by aquatic plants and algae. Discrete sample DO data tends not to capture the lowest DO concentration occurring during a day because relatively few samples are collected during early morning hours.

For marine waters, large river AUs, lakes, and reservoirs with DO profile data, Ecology will consider vertical variability in the DO profile when comparing the data to the applicable criterion. For example, if a water column meets the criterion except at depths close to the sediment interface, it may be appropriate not to attribute a criterion exceedance to the data since DO levels near the

sediment interface are naturally depleted in certain waters. Where a DO depth profile is collected, Ecology will average the data values by vertical increments that are consistent with accepted scientific practices (e.g. values from separate thermally stratified layers will not be averaged together). For purposes of the WQA, Ecology will determine that there is a criterion exceedance in profile data when more than 10% of the water column is below the criterion magnitude on a given day. However, when profile data are unavailable, only a single value is available for a location, and the value is below the criterion, Ecology will count the value as a daily exceedance. When available, Ecology will consider information on naturally occurring conditions, (such as natural eutrophication in pristine lakes or marine currents and tides) when determining whether the waterbody AU has an aquatic life use impairment due to depressed DO.

The estimated instrument accuracy in measuring ambient DO is ±0.2mg/L. DO values that exceed a criterion magnitude by more than 0.2 mg/L are therefore more likely to indicate a true criterion exceedance. Ecology will not count a DO value from a time series dataset as an exceedance when it exceeds the criterion by 0.2mg/L or less. However, Ecology will not apply the 0.2 mg/L margin of error to discrete DO data. This is because discrete data are unlikely to capture the daily extreme values, and thus an observed exceedance in discrete values was likely to be greater than what was recorded.

Evaluating data using the hypergeometric test

Ecology will use the hypergeometric statistical test[43] to assess whether an AU should be placed in Category 5 due to exceedances of the lowest measured DO concentration for each day from available time series and/or discrete data. This test uses the annual observed count of measurements in an AU that meet or do not meet the applicable DO criterion to estimate the probability that the DO criterion is persistently attained in a given year.

Ecology will apply the hypergeometric test as follows:

- The data from each year is assessed separately to determine if each year passes or fails.
- The test is performed separately on discrete and time series datasets.
- The test is performed with the "allowable" criterion exceedance rate set at 5%. In other words, Ecology assumes that exceedances of the criteria on more than 5% of the days in a year indicates that the criteria are not persistently met and therefore the aquatic life use is impaired. The actual number of allowed exceedances varies according to the statistical probability associated with the number of exceedances observed out of the number of samples collected; when fewer samples are available, fewer exceedances are "allowed." See Table 3 under the Category 5 description.

[43] https://stattrek.com/probability-distributions/hypergeometric

Category determinations

More recent data of sufficient quantity supersedes older data to qualify an AU for a given category. For example, if the AU qualifies for Category 5 based on earlier years but are followed by subsequent years that qualify for Category 1, then the AU will be placed in Category 1. The exception is that years with insufficient data to evaluate compliance do not supersede prior years that qualify for another category.

Category 5

Ecology has established two pathways for placing an AU in Category 5 for DO. The first pathway involves applying the hypergeometric test to time series and discrete data. The second pathway involves evaluating if there are any observations of large deviations from the criterion magnitude. Important exceptions to these two general pathways are also described below. Category 5 listing determinations for the two pathways are:

1. Ecology will place an AU in Category 5 when the hypergeometric test is failed in one or more calendar years based on time series data or two or more calendar years based on discrete data (see Table 3 below). One year of time series data that fails the test provides sufficient confidence that criteria are not persistently attained. Two years are necessary when using discrete data in order to establish that DO criteria are not persistently attained.

Table 4 below shows the number of days with DO values below the criteria will fail the hypergeometric test.

Table 4. DO data and associated exceedances that fail the hypergeometric test

Total Number of Days with Measurements	Number of Exceedances that Fail the Hypergeometric Test	Total Number of Days with Measurements	Number of Exceedances that Fail the Hypergeometric Test
1	N/A*	135 - 154	≥11
2 - 8	≥ 2	155 - 173	≥12
9 - 19	≥ 3	174 - 194	≥13
20 - 32	≥ 4	195 - 214	≥14
33 - 47	≥ 5	215 - 236	≥15
48 - 63	≥ 6	237 - 258	≥16
64 - 80	≥ 7	259 - 283	≥17
81 - 98	≥ 8	284 - 310	≥18

Total Number of Days with Measurements	Number of Exceedances that Fail the Hypergeometric Test	Total Number of Days with Measurements	Number of Exceedances that Fail the Hypergeometric Test
99 - 116	≥ 9	311- 365	≥19
117 - 134	≥ 10		

* A statistically significant p-value is obtained when only a single measurement is available and the value exceeds the criterion; however, a minimum of two exceedances is required in order to help ensure confidence in Category 5 determinations.

OR

2. Ecology will place an AU in Category 5 when the above requirements are not met, but large deviations from the criterion magnitude are observed, providing high confidence that the applicable DO criteria are not persistently met:
    - For fresh water, when two or more days have a verifiable DO value below 6.5 mg/L (i.e. using the Salmonid Spawning, Rearing, and Migration only DO criterion, which is the least stringent criterion for fresh water).
    - For marine water, when two or more days have a verifiable DO value below 4.0 mg/L (i.e. using the Fair Quality marine DO criterion, which is the least stringent criterion for marine water).

Exceptions to the two pathways:

- Some waterbodies have site specific DO criteria listed in Table 602 (WAC 173-201A-602). For these waterbodies, Ecology will assess compliance using the hypergeometric test as described previously along with the criterion magnitude and any time period specified in Table 602. For example, the special criterion for the lower Columbia River requires DO levels to be above 90% saturation at all times. The hypergeometric test for the lower Columbia River will be based on the number of days in which DO falls below 90% saturation in a given year and the total number of days measured in that year.
- The solubility of DO in a waterbody is influenced by barometric pressure, water temperature, and specific conductivity. Some waters at higher elevations will not attain the assigned DO criterion even at 100% DO saturation. Ecology will not place a DO listing in Category 5 where Ecology has information to conclude that the AU is not meeting the applicable criterion at 100% DO saturation.

Category 4

Ecology will place an AU in Category 4A when EPA has approved a TMDL for DO.

Ecology will place an AU in Category 4B when an alternative pollution control program (meeting the requirements in Section 1F) is actively addressing the DO problem.

Category 3

Ecology will place an AU in Category 3 when the available data are insufficient for any other category determination. This information will be maintained in Ecology's assessment database for future use. As additional data and information become available in future listing cycles, Ecology will again assess all available data to update the category determination according to this policy.

Category 2

Ecology will place an AU in Category 2 when exceedances of the criteria have been observed, but the listing does not qualify for Category 5.

Category 1

Ecology will place an AU in Category 1 when the available data show no exceedances of the DO criteria during the summer season (June 15 - September 15th) in two or more years.

- If a season other than the summer is expected to have the lowest DO levels during the year, then Ecology will consider that season to show compliance instead of the summer season. The requirements listed below would also apply to the alternative season.
- Both years used to qualify for Category 1 must have a minimum of 21 days with measurements collected within the focal period of 12am and 9am during the summer season or designated critical period. The days do not need to be consecutive. Discrete or time series datasets may be used. If data are available outside of the summer season/critical period or outside of the daily focal period, then the entire datasets for each of the two years must have no exceedances.
- The years used to qualify for Category 1 do not need to be the two most recent nor do they need to be adjacent years as long as there are no intermediate or subsequent years that qualify for Category 2 or 5.
- To move from Category 4A or 4B to Category 1, there must be no days with exceedances of the criteria during the Ecology designated critical period(s) in two or more years. In some cases, Ecology may retain an AU in Category 4A when the criteria are attained if further work is needed to achieve associated water quality goals. For example, an AU may be meeting criteria, but may not yet be meeting TMDL load allocations necessary to support downstream uses.

Helpful documents

- EAP023 – Collection and Analysis of Dissolved Oxygen (Winkler Method)
- EAP027 – Seawater Dissolved Oxygen Analysis

- EAP034 – Collection, Processing, and Analysis of Stream Samples

2D. Harmful Algae Blooms – Freshwater

Designated Uses:	Water contact recreation
Narrative Standards:	WAC 173-201A-260 & -300

Assessment information and data requirements

Freshwater harmful algae blooms (HABs) are events during which excessive growth of algae in lakes and rivers produces toxins or other environmental conditions harmful to humans and animals. While algae blooms can be natural events in aquatic environments, they can be worsened by nutrient inputs from human activities. The Washington State Department of Health (DOH) has developed freshwater contact recreation guidance values for four toxins produced by cyanobacteria (blue-green algae), as well as a framework for local health jurisdictions to issue public health advisories for waterbodies with active HABs (DOH, 2021).

Under this framework, local health jurisdictions are encouraged to use a combination of algae bloom spatial extent and physical characteristics, cyanobacteria toxin (cyanotoxin) data, and historical information of bloom toxicity when deciding to issue advisories. The guidance also provides a framework for removing advisories when blooms have dissipated and no longer pose a threat to human or animal health.

Under Washington's Freshwater Algae Control Program, Ecology, DOH, local health jurisdictions, and stakeholders routinely collaborate to monitor algae blooms during the summer growing season. Monitoring for HABs generally includes visual surveys and collecting surface water samples from active blooms. Water samples collected under this program are sent to King County Environmental Laboratory who analyze for cyanotoxins and qualitatively identify algae species. Toxin results are reported to local health jurisdictions within 48 hours. Data are stored in the Washington State Toxic Algae database.[44]

Ecology will utilize a combination of public health advisory information, cyanotoxin data from the Northwest Toxics Algae Database, public health assessment information, and the DOH recreational guidance as the basis for evaluating the health of contact recreation in the Water Quality Assessment (WQA).

For cyanotoxin data evaluated in the WQA, Ecology will use only one value per assessment unit (AU) per day. For all waterbody types, the highest value collected within an AU will be used to represent the daily value.

Ecology will review local health jurisdiction webpages for public health advisory information. In the event an advisory is issued for a waterbody, Ecology will review data and information used to support the advisory and coordinate with the local health jurisdiction to retrieve all relevant data

[44] https://www.nwtoxicalgae.org/

and information on the advisory. Any advisory issued solely for the preemptive purposes of protecting human health and without reasonable information to support bloom toxicity will not be used to support an impairment determination.

Category determinations

Category 5

Ecology will place an AU in Category 5 when:

1. Two cyanotoxin sampling events meet DOH recommendations for a WARNING or DANGER public health advisory[45] in each of two or more years. Samples should be collected a minimum of one week apart. The years do not need to be consecutive.

OR

2. A WARNING or DANGER public health advisory for potentially toxin-producing cyanobacteria or algae has been issued by a local or state health jurisdiction in two or more years. Each advisory must be in place for a minimum of three weeks and supported by cyanotoxin or other toxicity data. The years do not need to be consecutive.

OR

3. DOH public health assessment has identified one or more probable or confirmed human[46] or animal[47] HABs exposure events resulting in illness or death.

Category 4

Ecology will place an AU in Category 4A when EPA has approved a TMDL that addresses HABs.

Ecology will place an AU in Category 4B when an alternative pollution control program (meeting the requirements in Section 1F) is actively addressing the HABs problem.

Category 3

Ecology will place an AU in Category 3 when the available data are insufficient for another category determination. This information will be maintained in Ecology's WQA database for future use. As additional data and information become available in future listing cycles, Ecology will again assess all available data to update the category determination according to this policy.

---

[45] 'WARNING' and 'DANGER' defined by DOH's two-tiered approach to managing Washington waterbodies with cyanobacterial blooms, https://doh.wa.gov/sites/default/files/legacy/Documents/4300//333-279-GuidanceFreshwaterToxins.pdf

[46] 'Confirmed' defined by the CDC's One Health Harmful Algal Bloom System (OHHABs) Tool, https://www.cdc.gov/habs/pdf/OHHABS-Human-Case-Public-Health-Assessment-Tool-4.3.19-p.pdf

[47] https://www.cdc.gov/habs/pdf/ohhabs-public-health-assessment-tool-animal-case-508.pdf

Category 2

Ecology will place an AU in Category 2 when:

1. At least one cyanobacteria sampling event meets DOH recommendations for a WARNING or DANGER public health advisory, but the listing does not qualify for Category 5.

OR

2. A WARNING or DANGER public health advisory for potentially toxin-producing cyanobacteria or algae is issued by a local or state health jurisdiction, but the listing does not qualify for Category 5.

Category 1

Ecology will place an AU in Category 1 when:

- The waterbody is free of public health advisories for three consecutive years and has supplemental data (photos, algae cell counts, cyanotoxin or other toxin levels) in each year consistent with DOH advisory removal procedures.

AND

- There have been no suspected, probable, or confirmed human or animal HABs exposure events resulting in illness or death in the waterbody within the assessment data collection period.

Ecology will only use Category 1 to move a waterbody out of Category 5, 4A, or 4B when the waterbodies meets the above requirements.

Helpful documents

- Washington Department of Health. 2021. Washington State Recreational Guidance for Microcystins, Anatoxin-a, Cylindrospermopsin and Saxitoxin. Publication Number 333-279.

2E. pH

Designated Uses:	Aquatic life
Numeric Criteria:	WAC 173-201A-200(1)(g); WAC 173-201A-210(1)(f)
Narrative Standards:	WAC 173-201A-260 & -300
Unit of Measure:	pH standard units

Assessment information and data requirements

The pH criteria are expressed in the water quality standards as a range of acceptable values which vary according to the designated use classification of a waterbody. The criteria also specify an allowable limit of human-caused variation within the acceptable range of values, although data and information to evaluate this criteria component is typically unavailable for ambient waters.

Ecology assesses pH data using either time series (also called "continuous") monitoring data or discrete (also called "single", "grab", or "instantaneous") sample event data. In general, Ecology will omit lab derived pH measurements from consideration in the WQA. For purposes of the WQA, Ecology will consider pH data sets as time series when measurements are recorded at least once per hour for at least 80% of each day (i.e. ≥19 hours per day). Time series monitoring data are preferable as it shows how the pH of a waterbody changes throughout the day. Discrete measurements typically miss the lowest and highest pH values of the day, which tend to occur in the early morning and late afternoon, respectively.

The estimated instrument accuracy in measuring ambient pH is ±0.2 pH standard units. pH values that depart from the criteria range by more than 0.2 units are more likely to indicate a true exceedance of the criteria. Ecology will not include a pH value from a time series dataset in the count of exceedances when it exceeds the applicable criteria range by 0.2 units or less. However, Ecology will not apply the 0.2 unit margin of error to discrete pH data. This is because discrete data are unlikely to capture the daily extreme values, and thus an exceedance in a discrete dataset was likely to be greater than what was recorded.

Evaluating data using the hypergeometric test

Ecology will use the hypergeometric statistical test[48] to assess whether an AU should be placed in Category 5 due to exceedances of the pH criteria (higher or lower than criteria limits) from available time series and/or discrete data. This test uses the annual observed count of measurements in an

[48] https://stattrek.com/probability-distributions/hypergeometric

AU that meet or do not meet the applicable pH criterion to estimate the probability that pH in a given year persistently meets the pH criterion. Ecology will apply the hypergeometric test as follows:

- The data from each year is assessed separately to determine if each year passes or fails.
- The test is performed separately on discrete and time series datasets.
- The test is performed with the "allowable" criterion exceedance rate is set at 5%. In other words, Ecology assumes that exceedance of the criteria on more than 5% of the days in a year indicates that the pH criteria are not persistently met and therefore the aquatic life use is impaired. The actual number of allowed exceedances varies according to the statistical probability associated with the number of exceedances observed out of the number of samples collected; when fewer samples are available, fewer exceedances are allowed. See Table 4 under the Category 5 description.

Category determinations

More recent data of sufficient quantity supersedes older data in to qualify an AU for a given category. For example, if an AU qualifies for Category 5 based on earlier years but later years qualify for Category 1, then Ecology will place the AU in Category 1. The exception is that years with insufficient data to evaluate compliance do not supersede prior years that qualify for another category.

Category 5

Ecology uses two pathways to place an AU in Category 5 for pH. The first pathway involves applying the hypergeometric test to time series and discrete data. The second pathway involves evaluating if large deviations from the criterion magnitude have been observed. Important exceptions to these two general pathways are also described below. The two pathways are:

1. Ecology will place an AU in Category 5 when the hypergeometric test is failed in one or more calendar years based on time series data or two or more calendar years based on discrete data (see Table 5 below). One year of time series data that fails the test provides sufficient confidence that criteria are not persistently attained. Two years are necessary when using discrete data in order to establish that pH criteria are not persistently attained.

Table 5. pH data and associated exceedances that fail the hypergeometric test.

Total Number of Days with Measurements	Number of Observed Exceedances that Fail the Hypergeometric Test	Total Number of Days with Measurements	Number of Observed Exceedances that Fail the Hypergeometric Test
1	N/A*	135 - 154	≥11
2 - 8	≥ 2	155 - 173	≥12

Total Number of Days with Measurements	Number of Observed Exceedances that Fail the Hypergeometric Test	Total Number of Days with Measurements	Number of Observed Exceedances that Fail the Hypergeometric Test
9 - 19	≥ 3	174 - 194	≥13
20 - 32	≥ 4	195 - 214	≥14
33 - 47	≥ 5	215 - 236	≥15
48 - 63	≥ 6	237 - 258	≥16
64 - 80	≥ 7	259 - 283	≥17
81 - 98	≥ 8	284 - 310	≥18
99 - 116	≥ 9	311- 365	≥19
117 - 134	≥ 10		

*A statistically significant p-value is obtained when only a single measurement is available and the value exceeds the criterion; however, a minimum of two exceedances is required in order to help ensure confidence in Category 5 determinations.

OR

2. Ecology will place an AU in Category 5 when the above requirements are not met, but large deviations from the criterion magnitude are observed, providing high confidence that the applicable pH criteria are not persistently met. An AU will be placed in Category 5 when two or more days have a verifiable pH value below 5.5 in freshwater, below 6.5 in marine waters, or above 9.0 in fresh or marine waters.

Category 4

Ecology will place an AU in Category 4A when EPA has approved a TMDL that addresses pH.

Ecology will place an AU in Category 4B when an alternative pollution control program (meeting the requirements in Section 1F) is actively addressing the pH problem.

Category 3

Ecology will place an AU in Category 3 when the available data are insufficient for any other category determination. This information will be maintained in Ecology's WQA database for future use. As additional data and information become available in future listing cycles, Ecology will again assess all available data to update the category determination according to this policy.

Category 2

Ecology will place an AU in Category 2 when exceedances of the criteria have been observed, but the listing does not qualify for Category 1 or Category 5.

Category 1

Ecology will place an AU in Category 1 when:

- The available data show that pH criteria are exceeded on 5% or less of monitored days in two or more years AND no pH value exceeds the criteria by more than 1.0 pH unit.
- Both years used to qualify for Category 1 must have a minimum of 3 weeks (21 days) with measurements. The days do not need to be consecutive. Discrete or time series datasets may be used.
    - The measurements should occur during the season(s) and time of day in which exceedances are more likely to be observed, which may vary by waterbody.
- The years used to qualify for Category 1 do not need to be the two most recent nor do they need to be adjacent years as long as there are no intermediate or subsequent years that qualify for Category 2 or 5.
- To move from Category 4A or 4B to Category 1, the criteria must be met on 95% or more of the monitored days during the Ecology designated critical period(s) in two or more years. If data are available outside of the critical period, then the exceedance rate in each of the two annual data sets must also be 5% or less. In some cases, Ecology may retain an AU in Category 4A when the criteria are attained if further work is needed to achieve associated water quality goals. For example, an AU may be meeting criteria, but may not yet be meeting TMDL load allocations necessary to support downstream uses.

Helpful documents

- EAP031 – Collection and Analysis of pH Samples
- EAP034 – Collection, Processing, and Analysis of Stream Samples

2F. Phosphorus (Total) in Lakes

Designated Uses:	Recreational Aquatic life
Numeric Criteria:	WAC 173-201A-230
Narrative Standards:	WAC 173-201A-260 & -300
Unit of Measure:	µg/L

Assessment information and data requirements

Ecology will use phosphorus criteria established by a lake-specific study as described in WAC 201A-230 when available. If a phosphorus criterion has not been established by a lake-specific study, Ecology will determine impairment by applying the action values designated by ecoregion in WAC 173-201A-230 Table (1). For ecoregions that are not assigned action values, Ecology will apply 20 µg/L. In the absence of available numeric criteria based on a lake-specific study or ecoregion action value, narrative standards will be assessed as described in Part 1E of this policy. If a phosphorus assessment for an AU includes both numeric and narrative information, the WQA will be based on the narrative standards unless more recent total phosphorus data based on an action value indicate that the quality of the waterbody has changed.

Ecology will not use a phosphorus dataset that has been grouped or spread out over time in a manner that may mask periods of noncompliance. For example, if there is evidence of problems with phosphorus concentrations during a season or critical period, data collection should not be limited to or primarily conducted during other times. The WQA period for total phosphorus in lakes is June 1 through September 30 as noted in WAC 173-201A-230. Ecology may define a different assessment period for certain lakes where available lake-specific data show the critical period to be other than June 1 through September 30.

Ecology will evaluate phosphorus data based on the calculated arithmetic mean of four or more daily total phosphorus values collected from the epilimnion during the critical period or season. Samples collected from multiple epilimnion depths at a single location on a single day will be averaged together to represent that location. When temperature profile data are available, Ecology will determine the depth of the epilimnion by the depth of the seasonal thermocline. When temperature profile data are not available, Ecology will define the epilimnion as the upper three meters of the water column. Samples collected from multiple locations within an AU in a single day will be averaged together to derive the total phosphorus value representative of that day.

Category determinations

Category 5

Ecology will place a lake or lake grid AU in Category 5 when the calculated mean phosphorus concentration of a single season or critical period exceeds the criterion or action value for that lake or lake grid AU. A Category 5 determination may also result from narrative standards as described in Part 1E of this policy.

Category 4

Ecology will place in Category 4A when EPA has approved a TMDL for total phosphorus.

Ecology will place a lake or lake grid AU in Category 4B when an alternative pollution control program (meeting the requirements in Section 1F) is actively addressing the phosphorus problem.

Category 3

Ecology will place a lake or lake grid AU in Category 3 when the available data are insufficient for any other category determination. This information will be maintained in Ecology's WQA database for future use. As additional data and information become available in future listing cycles, Ecology will again assess all available data to make a new category determination according to this policy.

Category 2

Ecology will place a lake or lake grid segment in Category 2 when fewer than four sample values are available from a single season or critical period, and at least one value is greater than the criterion or action value for that waterbody segment.

Category 1

Ecology will place a lake or lake grid AU in Category 1 under the following conditions:

- Values from four or more days are available between June 1 through September 30 or during the critical period in each of two or more consecutive years; and
- The arithmetic mean of the sample values collected between June 1 through September 30 or during the critical period from each year is equal to or less than the numeric criterion or action value for that waterbody AU.

Helpful documents

- EAP034 – Collection, Processing, and Analysis of Stream Samples

2G. Temperature

Designated Uses:	Aquatic life
Numeric Criteria:	WAC 173-201A-200(1)(c); Including spawning and incubation protection in Ecology publication 06-10-038 WAC 173-201A-210(1)(c)
Narrative Standards:	WAC 173-201A-260 & -300
Unit of Measure:	Degrees Celsius (C) or Fahrenheit (F) 1-day maximum (1-DMax) Continuous: 7-Day Average of the Daily Maximum (7-DADMax)

Assessment information and data requirements

The water quality standards set numeric criteria for maximum water temperatures that are designed to protect the most sensitive aquatic life uses (typically cold-water species). The two types of water temperature criteria are a seven-day average daily maximum (7-DADMax) or a one-day maximum (1-DMax). Compliance with either type of criteria is evaluated using time series (also called continuous) monitoring datasets or discrete measurement (also called instantaneous, single, or grab sample) datasets.

In some cases, the temperature criteria cannot be met due to natural conditions. See the Natural Conditions section under "1G. Other Assessment Considerations" for more information on making a natural conditions determination.

Definitions of duration:

- **7-DADMax** is the arithmetic average of seven consecutive measures of daily maximum temperatures. The 7-DADMax for any individual day is calculated by averaging that day's maximum temperature with the maximum temperatures for each of the three days prior and the three days after that date.
- **1-DMax** is the highest water temperature reached on any given day. This measure can be obtained using calibrated maximum/minimum thermometers or continuous monitoring probes having sampling intervals of thirty minutes or less.

Accounting for error

The estimated instrument accuracy for measuring ambient temperature is ±0.2°C. Temperature values that exceed a criterion magnitude by more than 0.2°C are more likely to indicate a true

criterion exceedance. When using time series data to evaluate compliance with 7-DADMax and 1-DMax criteria, Ecology will include a value in the count of exceedances when it exceeds the applicable criterion by more than 0.2°C. However, Ecology will not apply the 0.2°C margin of error to discrete temperature data. This is because discrete data are unlikely to capture the daily extreme values, and thus the exceedance was likely to be greater than what was recorded.

Evaluation of discrete or time series data where a 7-DADMax or 1-DMax criterion applies.

The warmest temperatures of the year and therefore the highest probabilities of criteria exceedances typically occur between late spring and early fall. Ecology's assessment will focus on available temperature measurements collected between June 15 and September 15th, which corresponds to the definition of the summer season in WAC 173-201A-600 for all aquatic life uses in Table 200(1)(c) of the water quality standards.

- Ecology will use exceedances from outside of the summer season and outside of the daily focal period to support a Category 5 determination when data from the summer is lacking. Values outside of the summer season that meet criteria will not be used to determine compliance with the criteria, except for supplemental spawning criteria as described below.
- Seasonal supplemental spawning and incubation criteria in WAC 173-201A-200(1)(c)(iv) apply in some waterbodies. The seasonal numeric temperature criteria for each of these waterbodies that will be used to evaluate compliance with the temperature criteria can be found in Ecology publication 06-10-038.[49]

Evaluating time series data where a 7-DADMax or 1-DMax criterion applies

- Ecology will assess the data from each year separately.
- Ecology will assess the 7-DADMax temperature when time series monitoring data (sampling intervals of 30 minutes or less) are available.
- Ecology will use one temperature value per day (the highest recorded temperature) to determine a 1-DMax or to calculate a 7-DADMax.
- Ecology will directly compare time series data to the applicable criteria, whereas discrete data will be compared to a 7-DADMax criterion using a hypergeometric statistical test.

Evaluating discrete data using the hypergeometric test

Ecology will use the hypergeometric statistical test[50] to assess whether an AU should be placed in Category 5 based on discrete data. This test uses the annual observed count of measurements in an

[49] https://apps.ecology.wa.gov/publications/summarypages/0610038.html

[50] https://stattrek.com/probability-distributions/hypergeometric

AU that meet or do not meet the applicable temperature criterion to estimate the probability that a given year persistently attains the temperature criterion. Discrete measurements of temperature consistently underestimate daily maximum temperatures because they are unlikely to capture the highest temperatures of the day. Although discrete data typically cannot be used to calculate a 7-DADMax, they can be compared to the criterion which is expressed as a 7-DADMax. This is because a discrete measurement on a single day that exceeds the criterion magnitude tends to correspond to an exceedance of the actual 7-DADMax criterion. However, because discrete temperature values underestimate daily maximums, Ecology will not use discrete data to place a waterbody AU in Category 1.

Ecology considers the following when evaluating data using the hypergeometric test:

- The data from each year is assessed separately to determine if each year passes or fails.
- One temperature value per day (the highest recorded temperature) will be used in the evaluation.
- The test is performed with the "allowable" criterion exceedance rate set at 5% for the summer season (June 15 – September 15). In other words, Ecology assumes that exceedances of the criteria on more than 5% of the days in the summer season indicates that the criteria are not persistently met and therefore the aquatic life use is impaired. The actual number of allowed exceedances varies according to the statistical probability associated with the number of exceedances observed out of the number of measurements taken. Table 5 below under the Category 5 description shows the number of daily exceedances that fail the test relative to the total number of days with measurements. For AUs with supplemental spawning period criteria, Ecology will adjust the hypergeometric test to the number of days associated with the length of a supplemental spawning period that applies to a given AU.

Category determinations

More recent data of sufficient quantity supersedes older data in to qualify an AU for a given category. For example, if an AU qualifies for Category 5 based on earlier years but later years qualify for Category 1, then Ecology will place the AU in Category 1. The exception is that years with insufficient data to evaluate compliance do not supersede prior years that qualify for another category.

Category 5

Ecology will use three pathways to place an AU in Category 5. The first pathway involves direct comparison of applicable 7-DADMax or 1-DMax criteria to time series data. The second pathway involves applying the hypergeometric test to discrete data. The third pathway involves evaluating if there are any observations of large deviations from the criterion magnitude.

Category 5 listing determinations for the three pathways are:

1. **Time series data:** Ecology will place an AU in Category 5 when there are two or more exceedances of an applicable 7-DADMax criterion or 1-DMax criterion (per WAC 173-201A-602 Table 602) in a single year.
    - The two 7-DADMax exceedances must be derived from non-overlapping seven-day periods in order to avoid Category 5 determinations based solely on daily maximum values that have been used in multiple 7-DADMax calculations (i.e. since each 7-DADMax shares 3 days with the 7-DADMax before or after it).

OR

2. **Discrete data**: Ecology will place an AU in Category 5 when the hypergeometric test is failed in two or more years. The years do not have to be adjacent.

Table 6 below shows the number of days with measurements versus the number of days with exceedances of a criterion magnitude (in a single summer season) result in failure of the hypergeometric test. For the sake of brevity additional tables that would be used for evaluating supplemental spawning periods (which range from a length of 108 to 350 days) are not presented here but can be obtained by Ecology upon request.

Table 6. Temperature data and associated exceedances that fail the hypergeometric test.

Discrete Data: Total Number of Days with Measurements	Discrete data: Number of Observed Exceedances Resulting in Hypergeometric Test Failure
1	N/A
2 - 7	≥2
8 - 18	≥3
19 - 33	≥4
34 - 51	≥5
52 - 93	≥6

OR

3. Ecology will place an AU in Category 5 when the above requirements are not met, but temperatures exceed the criterion for protecting against acute lethality of fish are observed, providing high confidence of aquatic life use impairment. An assessment unit will be placed in Category 5 when: in freshwater or marine waters, there is a

verifiable value exceeding 23°C[51,52]on two or more days; or there is a verifiable value exceeding 17.5°C[353] on two or more days where freshwater supplemental spawning uses apply (per Ecology publication 06-10- 038).

Category 4

Ecology will place an AU in Category 4A when EPA has approved a TMDL for temperature.

Ecology will place an AU in Category 4B when an alternative pollution control program (meeting the requirements in Section 1F) is actively addressing the temperature problem.

Category 3

Ecology will place an AU in Category 3 when the available data are insufficient for any other category determination. This will typically occur when there are no exceedances in the available dataset, but the amount of data are insufficient for meeting Category 1 requirements. For example, this may occur when data do not show exceedances of the criteria but are collected outside of the summer or outside of the daily focal period.

Category 2

Ecology will place an AU in Category 2 when the monitoring data do not meet the requirements for a Category 5 or Category 1 determination but show at least one exceedance of a numeric criterion. A minimum number of samples is not required for a Category 2 determination.

Category 1

Ecology will place an AU in Category 1 only where continuous monitoring data are available.

Where 7-DADMax criterion is applicable

Ecology will place an AU in Category 1 when:

- At a minimum, 7-DADMax values are available for every day during the period of July 15 through August 15 in both years used to show compliance with the criteria. If data beyond this period is available, it must also meet the provisions below.
- No 7-DADMax values exceed the applicable criterion in two or more years. The years satisfying this requirement do not need to be the two most recent nor do they need to be adjacent years as long as there are no intermediate or subsequent years that qualify for Category 2 or 5.
- For supplemental spawning periods, no 7-DADMax values exceed the applicable criterion in two or more years. If compliance with supplemental spawning criteria must be evaluated due

[51] 1-DMax protecting salmonids against acute lethality WAC 173-201A-200 (1)(c)(vii)(A)
[52] 1-DMax protecting salmonids against acute lethality (WAC 173-201A-210 (1)(c)(v)(A))
[53] 1-DMax protecting fish embryo survival WAC 173-201A-200 (1)(c)(vii))(B)

to previously documented exceedances of those criteria, then both summer and supplemental spawning periods in the two years must be evaluated. For the supplemental spawning period it is sufficient to have 7-DADMax values for only the first and last 14 days of the period, except that periods beginning or ending in winter months need only be monitored for the two weeks that shoulder the summer season.

Where a 1-DMax criterion is applicable

Ecology will place an AU in Category 1 under the following conditions:

- No 1-DMax values exceed the applicable criterion in two or more years. The two years satisfying this requirement do not need to be the two most recent nor do they need to be adjacent years as long as there are no intermediate or subsequent years that qualify for Category 2 or 5.
- At a minimum, 1-DMax values are available for every day during the period of July 15 through August 15 in the years used to show compliance with the criteria. If data beyond this period is available, it must also meet the criteria.

To move from Category 4A or 4B to Category 1

- There must be no exceedances of the criteria during the Ecology designated critical period(s) in two or more years. In some cases, Ecology will retain an AU in Category 4A/4B when the criteria are being met if further work is needed to achieve associated water quality goals. For example, an AU may be meeting criteria, but may not yet be meeting TMDL load allocations necessary to support downstream uses.

Helpful documents

- EAP011 – Instantaneous Measurements of Temperature in Water
- EAP072 – Basic Use and Maintenance of WaterLOG ® Data Loggers and Peripheral Equipment
- EAP080 – Continuous Temperature Monitoring of Freshwater Rivers and Streams
- EAP034 – Collection, Processing, and Analysis of Stream Samples

2H. Total Dissolved Gas

Designated Uses:	Aquatic life
Numeric Criteria:	WAC 173-201A-200(1)(f)
Narrative Standards:	WAC 173-201A-260 & -300
Unit of Measure:	Percent (%) Saturation

Assessment information and data requirements

Ecology will assess total dissolved gas data (TDG) using continuous monitoring data. Continuous monitoring provides a better representation of the waterbody condition. In general, total dissolved gas single sample measurements are rarely collected. Therefore this WQA will not assess single sample datasets.

Ecology will consider datasets that include at least one sample value per hour to be continuous monitoring, whereas measurements performed less frequently than once per hour to be single sample data. Where a detailed vertical profile of total dissolved gas data are collected, Ecology will use the data value from the deepest location. Natural conditions will be considered in cases where stream structure (such as below natural waterfalls) contributes to high total dissolved gas levels.

Exceedances of the criteria generally occur during the highest flow rates of the year during the critical season, which is the spring and early summer (March through July). Criteria exceedances may also occur below dams during critical operational conditions, such as powerhouse shut down or start up. The TDG criteria do not apply when flow rates exceed the 7Q10 high flow rates.

The TDG criterion limit is 110% saturation statewide, except in the Snake and Columbia rivers when special fish passage exemptions apply.

Category determinations

Category 5

Ecology will apply the percent saturation criteria for continuous monitoring data as an average based on the 12 highest consecutive hourly readings in a 24-hour period. Ecology will place an AU in Category 5 for TDG when two or more 12-hour average values in the same year are above the criterion. The 12 highest consecutive hourly readings are not to be overlapping.

Category 4

Ecology will place an AU in Category 4A when EPA has approved a TMDL for total dissolved gas.

Ecology will place an AU in Category 4B when an alternative pollution control program (meeting the requirements in Section 1F) is actively addressing the TDG problem.

Category 3

Ecology will place an AU in Category 3 when the available data are insufficient for any other category determination. This information will be maintained in Ecology's WQA database for future use. As additional data and information become available in future listing cycles, Ecology will again assess all available data to update the category determination according to this policy.

Category 2

Ecology will place an AU in Category 2 if the threshold for placement in Category 5 or 1 is not achieved but there are events demonstrating exceedances in the latest ten years. Placement into Category 2 may also occur if evidence shows that natural conditions are the cause of exceedances but data are insufficient to make a conclusive determination.

Category 1

Ecology requires the following to make a Category 1 determination for TDG:

- Continuous monitoring datasets (with measurements at least once per hour) to permit calculation of 12-hour averages.
- Availability of a minimum of three years of continuous monitoring data during the peak runoff season, in years with peak flows reaching 7Q10 levels.
- Below a hydropower facility, seven days of continuous monitoring below the powerhouse while it shuts down and restarts (once each day) are necessary.
- No 12-hour average exceeds the criterion.

2I. Toxics-Aquatic Life Criteria

Designated Uses:	Aquatic life
Numeric Criteria:	WAC 173-201A-240
Narrative Standards:	WAC 173-201A-240(1); -260; -300
Unit of Measure:	µg/L except for ammonia and chloride which are typically reported as mg/L

Assessment information and data requirements

The aquatic life criteria are designed to protect freshwater and marine organisms from short-term (acute) and long-term (chronic) exposure to toxic parameters. To meet this intended purpose, one or more of the following durations for pollutant concentrations are built into the chemical criteria for specific parameters:

- An instantaneous concentration not to be exceeded at any time (acute)
- A 24-hour average not to be exceeded (chronic[54])
- A 1-hour average concentration not to be exceeded more than once every three years (acute)
- A 4-day average concentration not to be exceeded more than once every three years (chronic)

Averaging periods

For the purposes of the WQA, Ecology allows instantaneous measurements or single discrete samples to represent the averaging periods for the acute and chronic criteria. If multiple samples are available for the 4-day averaging period, Ecology requires samples from at least 2 days within the 4-day period in order to calculate an average to compare to the chronic criterion.

Constant and calculated criteria

The criterion for a specific toxic substance is either a constant value or a calculated value that varies according to an equation in the water quality standards. Toxic substances with constant criteria have explicit numeric values in Table 240(3) in WAC 173-201A-240. The toxicity of some substances are dependent on ambient conditions of the waterbody such as hardness, temperature, or pH. Results from these ancillary parameters are used to calculate the numeric criterion for a given sampling location and time. Numeric criterion calculations are provided in Table 240 footnotes of the water quality standards (WAC 173-201A). An important note for these criteria based on varying

[54] A 24-hour average duration is also used for the acute criteria for PCBs.

ambient conditions is that a calculated criterion is not a fixed value; the criterion value may vary throughout the course of a day or season due to fluctuations in water hardness, temperature, and/or pH depending upon the toxic parameter.

Assessment of the acute and chronic criteria

Ecology will reduce water quality data to a 'daily value' before category determinations are made. Samples with non-detect qualifiers will be assigned the laboratory detection limit value and will be used only when that value is below the numeric criterion. In cases where multiple samples are collected in one calendar day within an AU, Ecology will average the samples to generate a daily value. For evaluating compliance with the acute and chronic criteria, the daily value will be directly compared to the criteria (see exception below).

It is preferable to evaluate compliance with a 4-day chronic aquatic life criterion using an average sample value derived from multiple samples collected over a period of 4 days, however, it is recognized that this type of sampling is seldom conducted. In cases when multiple samples are collected in a 4-day period, Ecology will obtain a 4-day average value as follows:

- For parameters that have constant criteria, an average will be calculated using at least 2 daily values within a 4-day period.
- For parameters that have calculated criteria (which prevents a direct comparison of a sample average to a single criterion value), a 4-day average will be determined by using an exceedance factor method as follows:
    - The specific criterion for a daily value is calculated using the required ancillary data.
    - The daily value is divided by the calculated criterion to yield an exceedance factor.
    - Within a 4-day period, an average exceedance factor is determined. An average greater than 1 indicates an exceedance of the 4-day chronic criterion. An average less than or equal to 1 indicates a non-exceedance.

Notes on parameter-specific data requirements and information are located at the end of this section.

Category determinations

More recent data outweighs older data in qualifying an AU for a given category. For example, if the AU qualifies for Category 5 based on earlier years but are followed by subsequent years that qualify for Category 1, then Ecology will place the AU in Category 1. The exception is that years with insufficient data to evaluate compliance do not outweigh prior years that qualify for another category.

Category 5

An AU will be placed in Category 5 for a toxic pollutant in the water column when:

- Two or more daily values within a three-year period exceed an acute aquatic life criterion.

OR

- Two or more daily values within a three-year period exceed a chronic aquatic life criterion.

OR

- Two or more 4-day averages exceed a 4-day chronic aquatic life criterion in a three-year period. The 4-day averaging periods cannot overlap.

OR

- One daily value and one 4-day average exceeds a 4-day chronic criterion within a three-year period. The daily value and 4-day averaging period cannot overlap.

OR

- One daily value exceeds an acute criterion and one 4-day average exceeds a 4-day chronic criterion within a three-year period. The acute and chronic criteria evaluation periods may temporally overlap.

In addition to the state and federal numeric criteria, an AU may be placed in Category 5 if bioassay tests show adverse effects as measured by a statistically significant response relative to a reference or control (WAC 173-201A-240(2)), and the source of impairment is known to be a pollutant. These tests will be evaluated by Ecology staff and documented on a case-specific basis consistent with WAC 173-201A-240.

Category 4

Ecology will place an AU in Category 4A when EPA has approved a TMDL for a given toxic substance.

Ecology will place an AU in Category 4B when an alternative pollution control program (meeting the requirements in Section 1F) is actively addressing an aquatic life toxic substance. Aquatic life toxic substances need to qualify for this category on an individual basis.

Category 3

Ecology will place an AU in Category 3 when the available data are insufficient for any other category determination. This information will be maintained in Ecology's WQA database for future use. As additional data and information become available in future listing cycles, Ecology will again assess all available data to update the category determination according to this policy.

Category 2

Ecology will place an AU in Category 2 for a toxic substance in the water column when there are exceedances of criteria, but the data does not qualify for placement in Category 5.

Category 1

Requirements for Category 1 placement depend on the prior category assignment.

New listing or prior Category 2, Category 3, or Category 5 listing

Ecology will place an AU into Category 1 when:

- At least 20 daily values within a three-year period are available and there are no exceedances of an acute or chronic criterion. Demonstrating compliance with a 4-day chronic criterion requires at least 20 daily values that are more than 4 days apart, with no exceedances of the criteria magnitude value. If multiple daily values are within a 4-day period, they will be averaged together for comparison to a criterion. A 4-day average is a single comparison to a chronic criterion regardless of the number of daily values averaged together. A Category 1 determination for a 4-day chronic criterion can be achieved with a combination of 4-day average values and daily values that are more than 4 days apart.
    - If an AU is currently in Category 5 or Category 2, at least 10 daily values must be collected during any critical period that can be inferred from previous exceedances for that toxic substance in the waterbody AU.

Prior Category 4A or Category 4B listing

Ecology will place an AU that is currently in Category 4A or 4B into Category 1 when the following conditions are met:

- At least 10 daily values within a three-year period are available and there are no exceedances of an acute or chronic criterion. Demonstrating compliance with a 4-day chronic criterion requires at least 10 daily values that are more than 4 days apart, with no exceedances. If multiple daily values are within a 4-day period, they will be averaged together for comparison to a criterion. A 4-day average is a single comparison to a chronic criterion regardless of the number of daily values averaged together. A Category 1 determination for a 4-day chronic criterion can be achieved with a combination of 4-day average values and daily values that are more than 4 days apart.
- Sample data represent the critical period that has been identified in the TMDL or pollution control program for the toxic substance in the waterbody AU.
- The TMDL or pollution control program is being actively implemented.

In certain cases, projects specifically designed to determine compliance with criteria may be appropriate or necessary to qualify an AU for Category 1. The findings of such studies may result in an AU being placed in Category 1 using different (i.e. greater or lesser) data requirements than the requirements listed above. Entities interested in conducting an assessment project to verify compliance with water quality standards are advised to contact Ecology.

Parameter-specific data requirements and information

The following information provides Ecology's approach to assessing certain chemicals. For further information about the following parameters see WAC 173-201A, Table 240.

Metals

The water quality criteria for metals may be dependent on hardness and/or the laboratory method used (e.g. dissolved or total). Hardness values from the same sampling event are preferred for the assessment of metals criteria which are dependent on these conditions. Modeled or otherwise estimated hardness values are not acceptable for the purpose of the WQA. Metals must be sampled using clean sampling and analytical techniques, or appropriate alternate sampling procedures or techniques. For guidance, see EPA, Method 1669: Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels, 1996.[55]

Arsenic

Total dissolved arsenic is used for water data when assessing compliance with aquatic life toxic criteria.

Ammonia

The water quality criteria calculation for freshwater ammonia concentration requires sample values for temperature and pH collected during the same sampling event. Modeled or otherwise estimated temperature and pH values are not acceptable for the purpose of the WQA.

Aldrin/Dieldrin

The sum of aldrin and dieldrin are evaluated in comparison to the aquatic life criteria.

Chlordane

The sum of one or more of the following compounds may be compared to the criteria: cis- and trans-chlordane, cis- and trans-nonachlor, and oxychlordane. A Category 1 determination for aquatic life uses requires sample values for all compounds. Assessment of chlordane can also be based on technical chlordane results.

Dichlorodiphenyltrichloroethane (DDT)

Criteria exist for Total DDT. The sum of one or more isomers may result in an exceedance of the Total DDT criteria. For an aquatic life Category 1 determination, a value must be calculated from the sum of 4,4’ and 2,4’ isomers of DDT, DDD, and DDE sample values.

Endosulfans

The sum of endosulfan I (alpha) and endosulfan II (beta) is compared to the aquatic life criteria. A Category 1 determination requires sample values for both compounds.

[55] https://www.epa.gov/sites/default/files/2015-10/documents/method_1669_1996.pdf

Polychlorinated biphenyls (PCBs)

Total PCBs (i.e. the sum of all congeners, isomers, homologs or Arochlor results) will be compared to the criteria.

Helpful documents

- EAP029 – Collection and Field Processing of Metals Samples
- EAP001 – Conducting Studies Using Semi-Permeable Membrane Devices (SPMDs)
- EAP003 – Sampling of Pesticides and Semivolatile Organics in Surface Waters
- EAP079 – Semi-Permeable Membrane Devices (SPMDs) Data Management and Data Reduction
- EAP090 – Decontaminating Field Equipment for Sampling Toxics in the Environment
- EAP034 – Collection, Processing, and Analysis of Stream Samples

2J. Toxics-Human Health Criteria

Designated Uses:	Fish and shellfish harvesting Domestic water supply
Numeric Criteria:	WAC 173-201A-240 Federally promulgated criteria at 40 CFR 131.45
Narrative Standards:	WAC 173-201A-240(1); -260; -300
Unit of Measure:	Water column data: µg/L. Tissue data: µg/kg, wet weight, or dry weight converted to wet weight.

Assessment information and data requirements

The human health criteria (HHC) are designed to protect designated uses associated with human consumption of fish and domestic water supply. There are challenges with using numeric HHC alone as a basis for determining impairment. One key challenge is that many of the HHC pollutants are not quantifiable at low enough levels because the HHC concentrations are below detection and quantification limits. Given the challenges with using numeric HHC alone to determine impairment, listing methodologies are also included that are based on a direct evaluation of impairment to the designated uses that the HHC were designed to protect.

Ecology will use three approaches for assessing toxics data for human health protection, depending on available data and information.

1. Directly assessing human health criteria (HHC) by conducting a statistically valid study to evaluate if HHC are being met.
2. Evaluating the support of fish and shellfish harvest uses, primarily based upon tissue exposure concentrations (TEC).
3. Evaluating the support of domestic water supply uses, primarily based on drinking water exposure concentrations (DWEC).

Appendix 2 provides TECs and DWECs for chemicals that will be used for the assessment of tissue and water data for human health protection from toxics.

The following three sub-sections provide category determination information for the protection of human health uses based on the above approaches:

- 2J(1). Directly assessing human health criteria attainment
- 2J(2). Fish and shellfish harvest use assessment

- 2J(3). Domestic water supply use assessment

The primary lines of evidence Ecology will use to evaluate toxic chemical levels for protection of the designated uses associated with human health criteria are tissue data to determine that the harvest use is being met (i.e. from fish/shellfish) and water column data to determine that the HHC or domestic drinking water supply use is being met. Fresh water data will be evaluated for both the harvest use and drinking water use, while marine water data will only be evaluated for the harvest use (since marine waters are not assigned drinking water uses).

Ecology will determine that a fresh water AU is impaired for the domestic water supply use using either the methodology described under 2J(1) using HHC or the methodology described under 2J(3) using the DWEC for a given chemical. However, if Ecology determines that a fresh water AU is impaired using the methodology described in 2J(2) using the TEC for a given chemical, then the methodology described under 2J(1) using HHC must consider data and information for both the harvest use and the drinking water supply use in order to determine that both uses are being met. Otherwise, the harvest use will continue to be considered impaired based on the TEC.

Ecology will consider other lines of evidence intended to assess the status of the designated uses in addition to the above lines of evidence:

- *WA Department of Health (DOH) Fish Advisories (also Oregon Health Authority advisories on the lower Columbia River and Idaho Dept. of Health and Welfare advisories on the lower Snake River):* Fish Consumption Advisories are directly related to harvest use impairment. In Washington and Oregon, Fish Consumption Advisories typically focus on mercury and PCBs. It is anticipated that most waterbodies with data that are covered by fish consumption advisories will already be in Category 5 based on the pathway associated with the tissue exposure concentration (TEC) evaluation. Fish consumption advisories are sometimes spatially extrapolated to portions of a waterbody from which data have not been actually collected (e.g. stream reaches adjacent to one from which data was collected). Ecology will consider a fish consumption advisory in the WQA process as an additional line of evidence in AUs from which data have actually been collected and the evaluation methodology is at least as rigorous as those described in this section. Ecology may also consider impairment determinations based on fish advisories for chemicals that are not priority pollutants adopted in the water quality standards if data collected from specific AUs meet data requirements. Ecology will evaluate advisories on a case by case basis in order to determine how to appropriately identify an impaired harvest use in Category 5.
- *Safe Drinking Water Act (SDWA) Maximum Contaminant Levels (MCL):* MCLs are intended to protect drinking water sources and are applied as a limit at water treatment facilities after the water has undergone conventional treatment. MCLs also incorporate other considerations that do not easily fit within the framework of the WQA (e.g. economic feasibility of treatment technology). Nonetheless, there may be examples of where Ecology could use MCL compliance data and information for a waterbody in the WQA process as an additional line of evidence if they aren't already captured in the pathway using the drinking water exposure concentration (DWEC).

When appropriate, staff from Ecology's Water Quality and the Environmental Assessment Programs will confer to make a category assignment decision based on multiple lines of evidence available. Exceptions to the general WQA methodology might occur in instances where if Ecology verifies that a toxic substance found in fish tissue does not have sources within the watershed in which the affected waterbody is located. These site specific determinations will be documented in the WQA listing record.

Notes on parameter-specific data requirements and information are located at the end of this section.

2J(1) Directly assessing human health criteria attainment

The completion of a statistically rigorous study is the only pathway for Ecology to directly evaluate whether or not the human health criteria are being met in a waterbody AU. A direct evaluation of human health criteria attainment takes priority over the water supply use assessment methodology described in this policy. Attainment of the human health criteria in the water column may not result in a determination that the harvest use is supported unless the study includes adequate consideration of the harvest use being protected. Interested parties can work with Ecology to design and implement a study to directly evaluate the attainment of human health criteria for the harvest use, as it is not practical to describe the study requirements in this policy for each toxic substance.

2J(2) Fish and shellfish harvest use assessment

Assessment of harvest use support will rely upon tissue exposure concentrations (TEC) for pollutants. The TECs are rooted in the human health criteria equations, but expressed as a tissue consumption exposure threshold. They do not represent a water quality criteria because they have not been adopted into Chapter 173-201A WAC, except for methylmercury. TEC thresholds for carcinogenic and non-carcinogenic effects differ because the underlying assumptions associated with the two types of health effects are different.

- **For chemicals that have non-carcinogenic effects (TEC_N):**

  (Reference dose) x (Body weight) ÷ Fish consumption rate = **TEC_N**

- **For chemicals that have a carcinogenic effect level (TEC_C):**

  (Risk level) x (Body weight) ÷ (Cancer slope factor) x (Fish consumption rate) = **TEC_C**

See Appendix 2 for a list of TECs that apply to specific chemicals.

Many carcinogens can also have non-cancer health effects above certain concentrations. Chemicals that have non-carcinogenic effects in addition to carcinogenic health endpoints will be evaluated using the carcinogen threshold (TEC_C) as well as the non-carcinogen threshold (TEC_N). A listing for such a carcinogen may therefore qualify for Category 5 through the TEC_C Category 5 pathway and/or the TEC_N Category 5 pathway.

Data evaluation for tissue samples

Ecology will use the following factors to determine what tissue data will be used for WQA purposes:

Species used and tissue characteristics

The edible portions (defined below) of any fish and shellfish species will be used. Edible portions are defined for the WQA as tissue that is typically consumed by humans, as noted below:

- Fin fish: fillet (with or without the skin intact)
- Crabs: muscle (hepatopancreas tissue will not be evaluated)
- Shellfish (clams, oysters, mussels, scallops, shrimp, crayfish): whole-body, shell removed (either depurated or non-depurated)

Resident species used for Category 5

For Category 5 listing purposes, fish/shellfish tissue data must be representative of chemical contamination in the waterbody from which the fish was collected. Therefore, Category 5 listings must be based on tissue data from resident fish/shellfish species. For purposes of the WQA, a fish/shellfish species is considered to be a resident species when it is collected from a waterbody in which it spends the majority of its lifespan. In freshwaters and marine waters, anadromous fish species are generally considered to be non-resident unless information exists that the species is resident to the area.

When the residency of a species is in question, Ecology will not use data from that species as the justification for a Category 5 determination. Tissue data from a nonresident species will be assessed similar to resident species, but will be placed in Category 2 as a 'water of concern" instead of Category 5.

Age of fish

Ecology may consider information on the age of fish in the evaluation of harvest use impairment when determining if the samples in the dataset are representative of the site.

Composite samples

Ecology will consider a composite sample to be a sample composed of at least three individual fish. Only individuals of a single species can constitute an individual composite sample. The fish used in each composite sample should be of similar size (i.e. total length of smallest being no less than 75% the total length of the largest). All composite samples are treated independently regardless of whether they were collected in the same day, season, or year.

- **Combining individual fish collected within a single AU into a quasi-composite sample value***:* Ecology will apply this when separate sampling events in a year each collected a fish from a certain species, but no one event collected enough individuals to make a

composite sample for that event. Three or more individual fish from the same year will be combined to make one quasi-composite sample. Ecology will assign the average value of the chemical among the individual fish used as the quasi-composite sample value.

Trophic level

Trophic level is not considered when listing in Category 5, but upper trophic levels of edible species are necessary for moving from Category 5 and 4A/4B to Category 1 (Exception: shellfish can be used to list and delist for polycyclic aromatic hydrocarbons (PAHs) because they are a better indicator of these pollutants).

AUs represented by tissue data

Often it is necessary to collect fish from multiple locations in order to obtain a sufficient number of fish to create composite samples. This means that a single composite sample may include fish collected from two or more AUs. If fish in a composite sample are collected from more than one stream/river AU, then Ecology will typically apply the resulting listing to the AU containing the assigned monitoring station location. The current convention in Ecology's EIM database is to assign the station location of composite samples to the midpoint (centroid) of the total length of stream/river sampled. If fish are collected from more than one grid cell AU in marine waters or large lakes to constitute a composite sample, then the grid cell AU containing the centroid of the sample collection stations will be associated with the listing. It should not be interpreted that the displayed stream reach or grid cell AU represents the true spatial extent of a harvest use impairment. This would require additional study, such as through a TMDL.

Data analysis

In general, Ecology will aggregate composite samples for each species for the entire period of time that the assessment cycle is addressing (e.g. estimating the median value for all composite samples collected from a given species within a 10 year period). In some cases however, more weight will be given to the most recent years when Ecology can determine that an increasing or decreasing trend in a pollutant concentration is occurring. The remarks section of a listing will note when a category determination took into account a trend in the data.

For each species, Ecology will separately compare the median composite sample value to the applicable TEC threshold(s). If only one single composite sample value is available for a species, then that sample value will be designated as the median. This method will use sample values that are qualified as estimates at the reported numeric value. Composite sample values that are qualified as below a laboratory method detection limit will not be used in the assessment when the detection limit is greater than a TEC threshold. For these composite samples, it is not possible to determine if the sample value exceeds the TEC threshold.

Category determinations for fish and shellfish harvest use

The category determinations described below assess for the fish and shellfish harvest use using the TEC. A direct evaluation of the numeric human health criteria using the methodology

described in 2J(1) takes priority over the harvest use assessment described below in 2J(2) if the study includes adequate consideration of the harvest use being protected.

Category 5

Carcinogens

Ecology will place an AU in Category 5 when:

- The median composite sample value(s) from one or more resident species exceeds the TEC_C by a factor of 10 or more. A minimum of 3 composite samples is required.

  How this works: All of the species with a median composite sample value exceeding 10 times the TEC_C are identified. If the total number of composite samples among the species is three or more, then the AU qualifies for Category 5.

Non-carcinogens (and carcinogens that also have a TEC_N threshold)

Ecology will place an AU in Category 5 when:

- The median composite sample value(s) from one or more resident species exceeds the TEC_N. A minimum of 3 composite samples is required.

  How this works: All of the species with a median composite sample value exceeding the TEC_N are identified. If the total number of composite samples among the species is three or more, then the AU qualifies for Category 5.

- De-listing from Category 5 to Category 1 or 2 can occur if additional data in a subsequent assessment cycle results in a shift in the median composite sample value(s) below the applicable TEC threshold. For chemicals with both carcinogenic and non-carcinogenic effects, de-listing can only occur if the data from both the TEC_C pathway and the TEC_N pathway do not qualify for Category 5.

Category 4

Ecology will place an AU in Category 4A when EPA approves a TMDL for a given listed toxic substance in an AU.

Ecology will place an AU in Category 4B when an alternative pollution control program (meeting the requirements in Section 1F) is actively addressing a human health toxic substance. Human health toxic substances need to qualify for this category on an individual basis.

Category 3

For all carcinogens and non-carcinogens, Ecology will place an AU in Category 3 if there are no exceedances of a TEC, but the data does not qualify for any other category.

Category 2

For Carcinogens and Non-carcinogens

Ecology will place an AU in Category 2 for a given toxic substance when there are exceedances of a TEC, but the data do not qualify for Category 5 or Category 1. No minimum composite sample size is required unless otherwise stated. The following also apply to Category 2 determinations:

- AUs with data from nonresident species will be assessed similar to tissue data from resident species, but will be placed in Category 2 instead of Category 5 in accordance with the methodology outlined for Category 5.
- A listing can potentially move from Category 5 to Category 2 in a subsequent WQA cycle when the addition of new data results in a calculated median value that does not qualify for Category 5. This would require an individual review of the listing by the assessor prior to the final category designation.

Category 1

Requirements for a Category 1 determination depend on whether an AU is either:

- a new listing or was in Category 2, 3, or 5 in the previous WQA cycle, or
- was in Category 4A or 4B in the previous WQA cycle.

Ecology will place an AU into Category 1 for a new listing or previous Category 2, 3, or 5 listing when the following are met:

Carcinogens

The median composite sample values for two or more upper trophic level species are equal to or below the TEC_C.

- Only resident species are used in the evaluation.
- There must be a total of at least 10 composite samples among all species sampled.
- All species sampled (if more than 2) must have a median composite sample value equal to below the TEC_C.
- No single composite sample is greater than 100 x TEC_C.
- Exception for polycyclic aromatic hydrocarbons (PAHs): only bivalve species are used.

Non-carcinogens

The median composite sample values for two or more upper trophic level species are equal to or below the TEC_N.

- Only resident species are used in the evaluation.
- There must be least 10 composite samples for all species combined.

- All species sampled (if more than 2) must have a median composite sample value equal to below the TEC_N.
- Exception for PAHs: only bivalve species are used.
- No single composite sample is more than 10 x TEC_N.

When a listing was in Category 4A or 4B in a prior assessment cycle

For both carcinogens and non-carcinogens, Ecology will place an AU into Category 1 for a previous Category 4A or 4B listing when a TMDL effectiveness study or similar study findings conclude that the harvest use is no longer impaired. These projects may result in a listing being placed in Category 1 using different data requirements than those listed above. For example, a specific study design may prescribe different sampling or data distribution requirements for concluding that the harvest use of a particular waterbody is not impaired by a given parameter.

2J(3). Domestic water supply use assessment

This methodology only applies to freshwaters. Assessment of the drinking water use support relies on drinking water exposure concentrations (DWEC) that are rooted in the human health criteria equations, but are expressed as water ingestion exposure thresholds. The derivations of the DWEC for carcinogenic and non-carcinogenic effects differ because the underlying assumptions associated with the two types of health effects are different.

1. **For chemicals that have a non-carcinogenic effects level ($DWEC_N$):**
   (Reference dose) x (Body weight) ÷ Drinking water rate = $DWEC_N$
2. **For chemicals that have a carcinogenic effect levels ($DWEC_C$):**
   (Risk level) x (Body weight) ÷ (Cancer slope factor) x (Drinking water rate) = $DWEC_C$

See Appendix 2 for a list of DWECs that apply to specific chemicals.

Many carcinogens also have non-cancer health effects above certain concentrations. Chemicals that have non-carcinogenic effects in addition to carcinogenic health endpoints will be evaluated using both the carcinogen threshold ($DWEC_C$) and non-carcinogen threshold ($DWEC_N$). A listing for such a carcinogen may therefore qualify for Category 5 through the $DWEC_C$ Category 5 pathway and/or the $DWEC_N$ Category 5 pathway.

Data evaluation for water column samples

Ecology uses the following factors to determine what water column data will be used for WQA purposes:

Sampling methods

Data from “grab samples” will be the primary means for assessing the domestic water supply use. Data from standardized “pre-concentration” sampling methods (e.g. high-volume water samplers) may also be considered in the evaluation.

Sampling independence

Samples collected on different days are independent values. Samples values collected on the same day are averaged together.

Data analysis

Data from the most recent 10 years are used. The category determination is based on the proportion (i.e. a percentile or percentage) of sample values exceeding or not exceeding the applicable DWEC threshold(s). This method will use sample values that are qualified as estimates at the reported numeric value. Sample values that are qualified as below the method detection limit will not be used in the assessment when the detection limit is greater than a DWEC threshold. For these samples, it is not possible to determine if the sample value exceeds the DWEC threshold.

Category determinations for domestic water supply

The category determinations described below assess for the domestic water supply use using the DWEC. A direct evaluation of the numeric human health criteria using the methodology described in 2J(1) takes priority over the water supply use assessment methodology described in 2J(3).

Category 5

- Both Category 5 pathways apply to carcinogens that also have non-carcinogenic effects.
- De-listing from Category 5 to Category 1 or 2 can occur if additional data in a subsequent assessment cycle results in the requirements listed above not being met (e.g. if additional samples shift the median concentration below the $DWEC_C$ or result in less than 10% of samples exceeding the $DWEC_N$)
- Exceeding the $DWEC_C$ or $DWEC_N$ does not automatically mean that an AU has an impaired domestic water supply use. Ecology may conduct a final quality control review when water data qualifies a listing for Category 5. The purpose for such a review would be for Ecology to evaluate ancillary and corroborative data and information in order to ascertain whether there is sufficient confidence that the domestic water supply use is impaired. In such a review, Ecology will present the rationale for the final listing decision in the remarks of the listing record.
    - The review may consider associated blank[56] sample values in relation to the ambient sample values that exceed the DWEC threshold. Since the $DWEC_C$ and $DWEC_N$ thresholds represent very low concentrations, the likelihood for sample blank values to exceed these thresholds is amplified, and therefore the possibility

[56] A laboratory blank is a solution containing little to no analyte of interest that is used to calibrate instruments and to perform quality control evaluations.

of false positives in ambient samples is also amplified. If a "blank" sample value is greater than an associated ambient sample value, then the sample value will be culled from the evaluation. Likewise, sample values exceeding the associated "blank" value by an insignificant amount (e.g. by a factor of 3 - 10) may also be culled from the evaluation; a specific factor is not specified here because for each sample value it is important to take into account lab specific analytical method considerations.

- Additional lines of evidence may also be considered. The review may include tissue data and information on potential sources of the chemical in order to better understand the reason(s) for the observed levels of the chemical in the water and ascertain the likelihood of its persistence in the waterbody. These review considerations may include data and information from the same AU as well as from an adjacent or nearby AUs (e.g. upstream or downstream stream reaches).

Carcinogens

Ecology will place an AU in Category 5 when the median sample concentration exceeds the $DWEC_C$.

- A minimum of two exceedances is required.
- Exceedances of the $DWEC_C$ must be present in two or more years.

Non-Carcinogens (and carcinogens that also have a $DWEC_N$)

Ecology will place an AU in Category 5 for a parameter when more than 10% of samples exceed the $DWEC_N$.

- A minimum of two exceedances is required.
- Exceedances of the $DWEC_N$ must occur in two or more years.

Category 4

Ecology will place an AU in Category 4A when EPA approves a TMDL for a given listed toxic substance in an AU.

Ecology will place an AU in Category 4B when an alternative pollution control program (meeting the requirements in Section 1F) is actively addressing a human health toxic substance. Human health toxic substances need to qualify for this category on an individual basis.

Category 3

For all carcinogens and non-carcinogens, Ecology will place an AU in Category 3 if the data does not qualify for any other category.

Category 2

For all carcinogens and non-carcinogens, Ecology will place an AU in Category 2 for a given toxic substance when there are exceedances of a DWEC, but the data does not qualify for Category 5 or Category 1.

Category 1

Requirements for Category 1 placement depend on whether an AU is a new listing or was in Category 2, 3, or 5 in the previous WQA cycle, or was in Category 4A or 4B in the previous WQA cycle.

Ecology will place an AU into Category 1 for a new listing or previous Category 2, 3, or 5 listing when the following are met:

Carcinogens and Non-carcinogens

At least 90% of sample values are below the applicable $DWEC_C$ and/or $DWEC_N$.

There must be a total of 25 or more samples collected in 3 or more years.

No sample is greater than 100 x $DWEC_C$ or greater than 10 x $DWEC_N$.

AUs previously in Category 4A or 4B

For both carcinogens and non-carcinogens, Ecology will place an AU into Category 1 for a previous Category 4A or 4B listing when a TMDL effectiveness study or similar study concludes that the water supply use is no longer impaired. These projects may result in a listing being placed in Category 1 using different data requirements than those listed above. For example, a specific study design may prescribe different sampling or data distribution requirements for concluding that the water supply use of a particular waterbody is not impaired by a given parameter.

Parameter-specific data requirements and information

The following additional information provides Ecology's approach to assessing certain chemicals. For further information about the following parameters see WAC 173-201A, Table 240 and federally promulgated criteria at 40 CFR 131.45.

2, 3, 7, 8-TCDD (Dioxin)

Ecology did not calculate a TEC_C or $DWEC_C$ threshold for 2,3,7,8-TCDD because the validity of the existing cancer slope factor developed by EPA is uncertain and currently under review. The final rule[57] that set HHC applicable to Washington State waters at 40 CFR 131.45 EPA notes that for 2,3,7,8-TCDD, the Integrated Risk Information System IRIS does not currently contain a measure of dioxin's cancer-causing ability (i.e., a CSF). Without such values, EPA concluded that

[57] https://www.govinfo.gov/content/pkg/FR-2016-11-28/pdf/2016-28424.pdf

further analysis is necessary in order to promulgate scientifically sound revised criteria for 2,3,7,8-TCDD. In the Technical Support Document[58] issued in November 2016 as part of EPA's partial approval/disapproval of Washington's human health criteria, EPA noted its intent to reevaluate the existing federal 2,3,7,8-TCDD human health criteria in IRIS by 2018. EPA noted that it was withdrawing its federal proposal of proposed criteria for 2,3,7,8-TCDD, given the uncertainty regarding aspects of the science, and was taking no action on Washington's 2,3,7,8-TCDD criteria. As a default EPA left the existing criteria from the NTR in effect for Washington. Therefore, Ecology will not evaluate 2,3,7,8-TCDD at the carcinogenic effects level by applying $DWEC_C$ or TEC_C thresholds to evaluate compliance with the narrative toxics criteria. Evaluating 2,3,7,8-TCDD at the carcinogenic effect level must occur using the methodology described in 2J(1) for HHC.

Ecology will evaluate 2,3,7,8-TCDD at the non-carcinogenic effects by using the $DWEC_N$ and TEC_N to evaluate compliance with the toxics narrative criteria. Since the $DWEC_N$ and TEC_N are below method detection limits, any detection of 2,3,7,8-TCDD in freshwater or in fish tissue will result in a Category 2 or Category 5. For the same reason, there will be no pathway to Category 1 based on TEC or DWEC thresholds. Existing Category 5 listings for 2,3,7,8-TCDD (established using the NTR criteria) will remain in Category 5 pending an appropriate methodology to assess concentrations based on cancer effect levels.

2,3,7,8-TCDD Toxic Equivalency Quotient: The 17 PCDD/F congeners have different levels of toxicity compared to 2,3,7,8-TCDD, the most toxic form. To assess the cumulative risks to human and environmental health, the congener concentrations are expressed as toxic equivalents (TEQs). The TEQ is calculated by multiplying each congener result by its congener-specific toxicity equivalent factor (TEF) and then summing to obtain the overall TEQ. Washington State does not have a human health criterion for 2,3,7,8-TCDD TEQ. However, calculated TEQ values will be assessed using the 2,3,7,8 TCDD TEC_N and $DWEC_N$ thresholds in order to identify areas of concern. An exceedance of the TEC_N and $DWEC_N$ threshold will result in a Category 2 determination.

Aldrin/Dieldrin

For harvest and water supply uses, aldrin and dieldrin are separately compared to the criteria, tissue exposure concentrations and drinking water exposure concentrations.

Arsenic

Ecology did not calculate a TEC_C or $DWEC_C$ for arsenic because the validity of the existing cancer slope factor developed by EPA is uncertain and currently under review. In a Technical Support Document[59] issued in November 2016 as part of EPA's partial approval/disapproval of

[58] https://www.epa.gov/sites/default/files/2016-11/documents/epas_partial_approvalpartial_disapproval_wa_hh_wqc_impl_tools_bellon_ltr_enclosures_508c.pdf
[59] https://www.epa.gov/sites/default/files/2016-11/documents/epas_partial_approvalpartial_disapproval_wa_hh_wqc_impl_tools_bellon_ltr_enclosures_508c.pdf

Washington's human health criteria, EPA noted its intent to reevaluate the existing federal arsenic human health criteria through the IRIS Toxicological Review of inorganic arsenic (total dissolved) by 2018. Given the scientific uncertainty of the cancer toxicity factors, EPA withdrew its proposal for revising criteria for arsenic in Washington and as a default left the existing criteria from the National Toxics Rule (NTR) in effect for Washington. Therefore, Ecology will not evaluate arsenic at the carcinogenic effects level by applying $DWEC_C$ or TEC_C thresholds to evaluate compliance with the narrative toxics criteria. Evaluating arsenic at carcinogenic effect levels must occur using the methodology described in 2J(1) for HHC.

Ecology will evaluate domestic water supply use support by comparing the $DWEC_N$ to total dissolved (filtered) arsenic data, with the assumption that all dissolved arsenic is of the inorganic fraction. The value of the $DWEC_N$ is equal to the MCL (10µg/L) set by the Safe Drinking Water Act for protecting drinking water supplies. Ecology will evaluate harvest use support by comparing total inorganic arsenic levels in tissue using to the TEC_N threshold. Since the TEC_N is below method detection limits, any detection of arsenic in fish tissue will result in a Category 2 or Category 5 listing. For the same reason, there will be no pathway to Category 1 based on TEC or DWEC thresholds. Existing Category 5 listings for inorganic arsenic (established using the NTR numbers) will remain in Category 5 pending an appropriate methodology to assess concentrations based on the cancer effect level.

Chlordane

The sum of one or more of the following compounds may be compared to the criteria, tissue exposure concentrations, or drinking water exposure concentrations: cis- and trans-chlordane, cis- and trans-nonachlor, and oxychlordane. A Category 1 determination for water supply or harvest uses requires sample values for all compounds. Assessment of chlordane can also be based on technical chlordane results.

Dichlorodiphenyltrichloroethane (DDT)

Criteria exist for individual isomers of DDT. For harvest and water supply uses, tissue and water data for DDT and its isomers will be compared to the criteria, tissue exposure concentrations, and drinking water exposure concentrations.

Endosulfans

For human health, alpha-endosulfan, beta-endosulfan, and endosulfan-sulfate (either separate or summed) in tissue and water can be used in a Category 5 determination. Sample values for all compounds must be available for harvest and water supply use for Category 1 determinations.

Polychlorinated biphenyls (PCBs)

For PCBs in tissue or water, total PCBs (i.e. the sum of all congeners, isomers, homologs or Arochlor results) will be compared to the water and tissue thresholds.

Methylmercury

The numeric human health criterion for methylmercury (0.03mg/kg) is expressed as a fish tissue concentration. Category determinations for this parameter will employ the tissue criterion and follow the evaluation pathways described for non-carcinogens in the Fish and Shellfish Harvest Use Assessment section. Methylmercury and mercury tissue data will be used to assess the criterion. Mercury and methylmercury in water will not be evaluated.

Helpful documents

- EAP029 – Collection and Field Processing of Metals
- EAP001 – Conducting Studies Using Semi-Permeable Membrane Devices (SPMDs)
- EAP003 – Sampling of Pesticides and Semivolatile Organics in Surface Waters
- EAP007 – Resecting Finfish Whole Body, Body Parts or Tissue Samples
- EAP008 – Resecting DNA Samples and Aging for Finfish
- EAP009 – Field Collection, Processing and Preservation of Finfish Samples at the Time of Collection in the Field
- EAP079 – Semi-Permeable Membrane Devices (SPMDs) Data Management and Data Reduction
- EAP090 – Decontaminating Field Equipment for Sampling Toxics in the Environment
- EAP034 – Collection, Processing, and Analysis of Stream Samples

2K. Turbidity

Designated Uses:	Aquatic life
Numeric Criteria:	WAC 173-201A-200(1)(e); WAC 173-201A-210(1)(e)
Narrative Standards:	WAC 173-201A-260 & -300
Unit of Measure:	Nephelometric Turbidity Units (NTUs)

Assessment information and data requirements

Turbidity criteria in the water quality standards are expressed as the difference between an upstream or background value and the increased value derived at a location downstream of a source of turbidity. For rivers, the background value for turbidity is gathered at a location up-gradient from the activity that is being investigated. In lakes and marine waters, the background value is the ambient conditions outside of the impacted area. Depending on the designated aquatic life use of the waterbody, the acceptable difference is either 5 or 10 NTUs over background when the background is 50 NTUs or less. When background is greater than 50 NTUs, the acceptable maximum increase is either 10 or 20 percent. If more than one sample value is available for the same location and day, the average sample value will be used in the WQA.

Temporal variability will be considered in the evaluation. For example, if elevated turbidity only occurs during high flows, then high flow conditions will be evaluated separately from low flows.

Category determinations

Category 5

Ecology will place an AU in Category 5 if ten percent or more sample values in the latest ten years exceed the applicable criterion. A minimum of three exceedances is required for an impairment determination.

Category 4

Ecology will place an AU in Category 4A when EPA has approved a TMDL for turbidity.

Ecology will place an AU in Category 4B when an alternative pollution control program (meeting the requirements in Section 1F) is actively addressing a turbidity problem.

Category 3

Ecology will place an AU in Category 3 when the available data are insufficient for any other category determination. This information will be maintained in Ecology's WQA database for future use. As additional data and information become available in future listing cycles, Ecology will again assess all available data to make a new category determination according to this policy.

Category 2

Ecology will place an AU in Category 2 if the threshold for placement in Category 5 is not achieved but there are events demonstrating exceedance in the latest ten years. A minimum number of samples is not required for a Category 2 determination.

Category 1

Ecology will place an AU in Category 1 when a minimum of ten sample sets have been collected (e.g. during separate storm runoff events, or during irrigation season), and no more than 5 percent of the available data exceeds the criterion.

Helpful Documents

- EAP034 – Collection, Processing, and Analysis of Stream Samples

PART 3: Assessment Considerations for Sediment Quality Standards

Designated Uses:	Aquatic life
Numeric Criteria:	WAC 173-204 - Sediment Management Standards
Narrative Standards:	WAC 173-204-100(3)
Unit of Measure:	Depending on chemical constituent: mg/kg dry weight (ppm dry) OR µg/kg dry weight (ppb dry) OR mg/kg organic carbon (ppm carbon) OR Biological data

Assessment information and data requirements

Regulatory authorities

The Sediment Management Standards[60] (SMS), WAC 173-204 (), are administered by Ecology's Toxics Cleanup Program (TCP) and include:

- Part I, General Information (WAC 173-204-100 through 173-204-130).
- Part II, Definitions (WAC 173-204-200).
- Part III, Sediment Quality Standards (WAC 173-204-300 through 173-204-350).
- Part IV, Sediment Source Control (WAC 173-204-400 through 173-204-420).
- Part V, Sediment Cleanup Standards (WAC 173-204-500 through 173-204-590).
- Part VI, Sampling and Testing Plans/Recordkeeping (WAC 173-204-600 through 620).

Parts I - IV were promulgated under the authority of Chapter 90.48 RCW, *Water Pollution Control Act*, and Chapter 70.105D RCW, *Model Toxics Control Act* (MTCA), to establish marine, low salinity, and freshwater surface sediment management standards for the state of Washington. They are EPA approved water quality standards consistent with CWA Section 303. EPA did not take action on Part V of the sediment management standards, therefore Part V is not used as water quality standards in this policy.

[60] https://apps.ecology.wa.gov/publications/documents/1309055.pdf

Data requirements

Ecology will use sediment data in this WQA that are based on either chemical or biological data. The following requirements must be met for data to be acceptable for this WQA.

- The samples must be taken from surface sediments 0 – 16 centimeters in depth (the acceptable default for the biologically active zone under the WQA). Any depth interval from 0 – 16 centimeters can be used to determine compliance with the SMS criteria.
- The following preliminary assessment criteria must be met for sampling stations for this WQA:
    - Similar water depth
    - Similar grain size
    - Similar TOC
    - Spatially distinct and overall chemically similar samples/stations
- Sediment data must be verified as error free in EIM. For information on the sediment data submission requirements refer to the TCP program's data requirements webpage[61].
- Data submitted must be for the specific isomer or chemical fraction addressed in the SMS criteria.
- Marine biological sediment tests must conform to WAC 173-204-315.
- Freshwater biological sediment tests must conform to WAC 173-204-340. Freshwater sediments are evaluated on a case-by-case basis as established in Part III. Bioassays are the definitive tool to determine impact to freshwater sediments.
- The SMS [WAC 173-204-320(2)(a)] requires that, when laboratory results indicate an undetected chemical, the detection limit (e.g., practical quantitation limit or PQL and method detection limit or MDL) shall be reported to be at or below the Marine Sediment Quality Standards (SQS) chemical criteria. However, Ecology also recognizes that the PQL, method reporting limit (MRL), and lower limit of quantitation (LLOQ) are generally the same concept (i.e., PQL ≈ MRL ≈ LLOQ). Ecology will accept reporting of the LLOQ (EPA SW-846 method) and recognizes that EPA SW-846 no longer includes the MDL. However, since this is a requirement in MTCA, reporting of the MDL is also required. Refer to SCUM Chapter 11 Section 11.2.2 and Appendix D Section D2 for further discussion.

[61] https://ecology.wa.gov/Regulations-Permits/Reporting-requirements/Data-submittal-requirements-for-cleanup-sites

Assessment information

The Sediment Quality Standards (SQS, WAC 173-204-320) and the Sediment Impact Zone Maximum chemical (SIZmax, WAC 173-204-420) criteria are used in this WQA. Sediment is defined in WAC 173-204-200 as follows:

- Marine sediments have pore water salinity ≥ 25 ppt.
- Low salinity sediments have pore water salinity is > 0.5 ppt and < 25 ppt salinity.
- Freshwater sediments have pore water ≤ 0.5 ppt salinity.

Numeric and biological criteria are established for saline and freshwater environments. Low salinity conditions are generally assessed using marine criteria.

Ecology will use the most recent chemical and biological data and can override older data on a station-by-station basis if it is in compliance with the SMS and Ecology requirements.

Only sediment data with appropriate detection limits are used in this WQA.

Contaminated sediment listings are assigned to the appropriate quarter grid section of a full size rectangular grid (dividing the 2,460 feet by 3,660 feet grid into quarter sections).

Chemistry data for chemical quarter grid listings is evaluated using the following process:

- Within each quarter grid, up to 3 ChemStations (if available) with the highest chemical concentrations within the quarter grid are compared with the benthic SQS and SIZmax chemical values for each contaminant.
- For each ChemStation, chemistry points (ChemPoints) are assigned for each of the 47 SMS chemicals based upon the level of SMS chemical criteria exceedance as follows:
    - No exceedance of SMS chemical criteria = 0 ChemPoint,
    - SQS exceedance = 1 ChemPoint, and
    - SIZmax exceedance = 2 ChemPoints.

Therefore, up to 47 individual chemical assessments may be performed on each ChemStation.

- The total ChemPoints for each quarter grid containing the 3 highest chemistry values (ChemPoints) are summed. This sum per quarter grid = *ChemScore*.
- The quarter grid is placed in the appropriate listing category as follows:
    - 0 ChemScore = Category 1
    - 1 and 2 ChemScore = Category 2
    - 3 ChemScore = Category 2
    - 4 or greater ChemScore = Category 5 with the following exceptions: If an administrative override exists detailing that a Cleanup Action Plan (CAP) or its federal equivalent (Record of Decision [ROD] or Corrective Measure [CM]) is in

place for that quarter grid or a sediment TMDL is in place for that quarter grid, then either a Category 4B or a Category 4A (TMDL) is designated. If both a sediment TMDL and a CAP, ROD or CM are in place, then the quarter grid is listed as Category 4B and the comments will indicate that a 4A (TMDL) is also in place for that quarter grid as well.

- If less than 3 ChemStations exist in a quarter grid, final listings are dependent upon the ChemPoint results of these limited number of ChemStations. In the case of less than 3 stations, for a ChemScore of less than 4 refer to Figure 5 below for detailed listing criteria using chemical data. It can result in a Category 3 or a Category 2 dependent upon the final ChemScore value.
- It should be noted that when a ChemScore results in a Category 2 designation, then Ecology will prioritize conducting confirmatory bioassay testing for these grids based upon funding and staffing availability as well as other critical criteria such as proximity to Category 4A and 4B listed areas, etc.

Confirmatory biological testing, in compliance with the SMS and Ecology requirements, may override chemical data. The biological point system (BioScore) used in this WQA is in compliance with the SMS WAC 173-204-315, where:

- For each BioStation, bioassay points (BioPoints) are assigned based upon the number and level (SQS and SIZmax) of SMS bioassay exceedances as follows:
  - No exceedance of SMS bioassay criteria = 0 BioPoints,
  - SQS exceedance = 1 BioPoint, and
  - SIZmax exceedance = 2 BioPoints.
- The total BioPoints for a quarter grid containing 3 BioStations with the highest number of bioassay exceedances (BioPoints) are summed. This sum per quarter grid = BioScore.
- The quarter grid is placed in the appropriate listing category as follows:
  - 0 BioScore = Category 1
  - 1 or 2 BioScore = Category 2
  - ≥ 3 BioScore = Category 5
- If fewer than 3 BioStations exist within a quarter grid, then based upon the BioScore, the quarter grid will be placed in the following Categories:
  - 1 or 2 BioScore = Category 2
  - ≥ 3 BioScore = Category 5
  - 0 BioScore = Category 3

Category determinations

Category 5

Ecology will place a quarter grid AU in Category 5 when it exceeds the below-listed ChemScore and BioScore criteria (WAC 173-204-420). See the sediment listing flowcharts below (Figure 5 and 6, *Category Determination for Contaminated Sediments*) for further details on category determinations. This generally includes quarter grids where:

- The ChemScore $\geq$ 4 and/or
- The BioScore $\geq$ 3.

Category 5 Administrative Override

Sediment quarter grids or other sediment areas that would have been designated as meeting Category 1, 2, or 3 listing requirements using the standardized EIM data evaluation procedure, but have instead been evaluated by EPA or Ecology technical staff using all available historical hard copy data not available in EIM, will be placed in Category 5 (Figure 7). In other words, there may be quarter grids that would normally have been designated as meeting Category 1, 2 or 3 listing requirements if using only EIM electronic data and following the standard designation procedure. But, because they have been administratively determined by technical staff using historical, hard-copy data, they are placed in Category 5. This is done to accurately and transparently represent quarter grids using non-electronic non-EIM historical data.

For freshwater or low salinity sediments, assessment for potential listing of grids in Category 5 will be based on biological tests and the process outlined above in accordance with WAC 173-204-330 and 173-204-340. Based upon the site-specific flexibility allowed by these sections within the WAC, this evaluation will be performed on a case-by-case basis.

Category 4

Ecology will place a quarter grid AU in Category 4A when EPA has approved a TMDL for contaminated sediments.

Ecology will place a quarter grid AU in Category 4B when contaminated sites identified in Ecology's Integrated Site Information System (ISIS) database have an active cleanup in process documented through a legal administrative mechanism (i.e., Pollution Control Program) such as a CAP, ROD, CM, or other approved legally enforceable cleanup plan. AUs in Category 4B will be eligible to move to Category 1 when they meet sediment quality standards described in Part 3 of the SMS.

There is a two-step process in a Category 4B listing. The first step involves identifying quarter grids that are part of known cleanup sites. Information is obtained from Site Managers to identify specific quarter grids and the chemicals and biological exceedances being addressed by the cleanup work. This process is known as an Administrative Override (Figure 7). All of the quarter grids identified by the Site Managers are then categorized as 4B. All chemicals related

to these quarter grids in the cleanup site exceeding SQS and SIZmax are listed in the basis statement for each quarter grid being addressed by the cleanup. All contaminants exceeding SQS must meet the EPA-approved sediment quality standards prior to being eligible to be moved into Category 1. The second step involves reviewing appropriate EIM data. These data are linked to the appropriate quarter grid and the assessment is based upon the EIM bioassay and chemistry data. Listings, therefore, can be based upon step one or step two or both in combination.

Category 5 listed quarter grids or other sediment areas that are, wholly or in part, within the boundaries of a cleanup site will be placed in Category 4B. In other words, there may also be quarter grids that are not in Category 5, but are within the boundaries of a cleanup site that will be placed in Category 4B. This is done to transparently represent grids included in the boundaries of the site defined by the Pollution Control Program documents (e.g., CAP, ROD, or CM). Refer to the flowchart (Figure 5). Various authorities are used to accomplish cleanup of contaminated sediment sites. Which authority is applied depends on the site, sources of contaminants, and sometimes even the liable persons and/or parties. Cleanup of sediment sites is primarily conducted using either CERCLA authority under the EPA Superfund program or under the SMS. Other supporting authorities are not exempted from cleanup consideration.

Category 3

Ecology will place a quarter grid AU in Category 3 when the available data are insufficient for any other category determination. For example, this could include sites where the ChemScore = 1 or 2 or where the preliminary assessment criteria are not met. This information will be maintained in Ecology's WQA database for future use. As additional data and information become available, during the next WQA Ecology will review all available data to make a new category determination according to this policy.

Category 3 Administrative Override

Any quarter grids or other sediment areas that would have been designated as meeting Category 3 listing requirements (Figure 7) but are, wholly or in part, within the boundaries of a cleanup site, will be placed in Category 4B. In other words, there may be quarter grids that would be placed in Category 3, but because they have been administratively determined to be within the boundaries of a cleanup site they will be placed in Category 4B. This is done to transparently represent grids included in the boundaries of the site defined by the legally enforceable Pollution Control Program documents (e.g., CAP, ROD, or CM).

Category 2

Ecology will place a quarter grid AU in Category 2 when there are exceedances of the SQS and/or the SIZmax, as identified in the SMS (WAC 173-204-320 and 173-204-420). This generally includes grids where:

- The ChemScore = 3

- The BioScore = 1 or 2

These quarter grids will require further monitoring, investigation, or observation to determine if there is a persistent sediment quality problem and if there is an ongoing source, historic source, or a combination of both. If the sediment quality issue is determined to be partially or completely caused by an ongoing source, then further source control efforts, pollution control actions, or other regulatory actions will be required and specified on a case-by-case basis by Ecology. If the sediment quality issue is determined to be caused solely by an historic source, then further monitoring may be required to determine if action is needed.

There are no numeric standards in the SMS for freshwater or low salinity sediments that are EPA approved water quality standards. Therefore, quarter grids will be assessed using Ecology approved bioassays on a case–by-case basis. The existence of chemistry data will be noted in the comment section of any biologically based listing.

Category 2 Administrative Override

Any quarter grids or other sediment areas that would have been designated as meeting Category 2 listing requirements but are, wholly or in part, within the boundaries of a cleanup site, will be placed in Category 4B. In other words, there may be quarter grids that would be placed in Category 2, but because they have been administratively determined to be within the boundaries of a cleanup site they will be placed in Category 4B. This is done to transparently represent grids included in the boundaries of the site defined by the legally enforceable Pollution Control Program documents (e.g., CAP, ROD, or CM).

Category 1

Ecology will place a quarter grid AU in Category 1 if it has been determined by Ecology to meet the SQS benthic criteria (WAC 173-204-320 through 173-204-340), which includes marine, low salinity, and freshwater sediment.

Category 1 Administrative Override

Any quarter grids or other sediment areas that would have been designated as meeting Category 1 listing requirements but are, wholly or in part, within the boundaries of a cleanup site, will be placed in Category 4B (Figure 7). In other words, there may be quarter grids that would be placed in Category 1, but because they have been administratively determined to be within the boundaries of a cleanup site they will be placed in Category 4B. This is done to transparently represent grids included in the boundaries of the site defined by the legally enforceable Pollution Control Program documents (e.g., CAP, ROD, or CM).

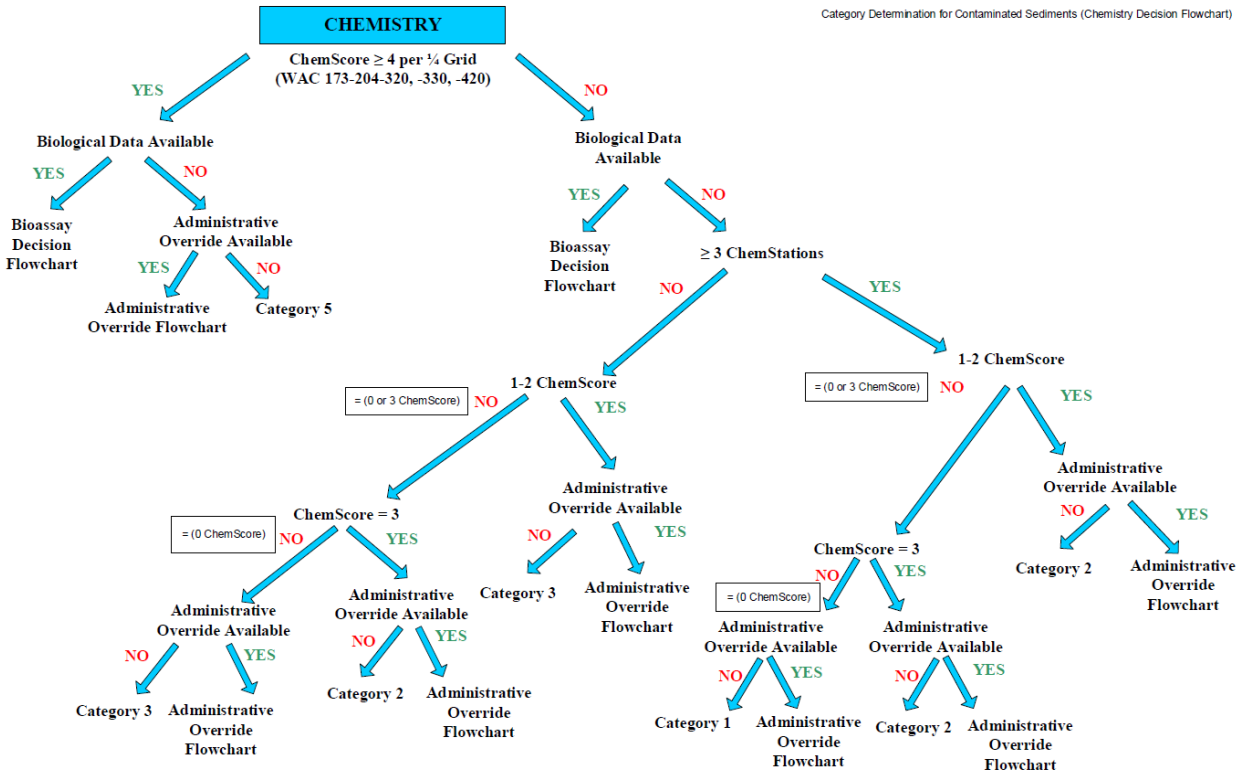


Figure 5. Chemistry Decision Flowchart

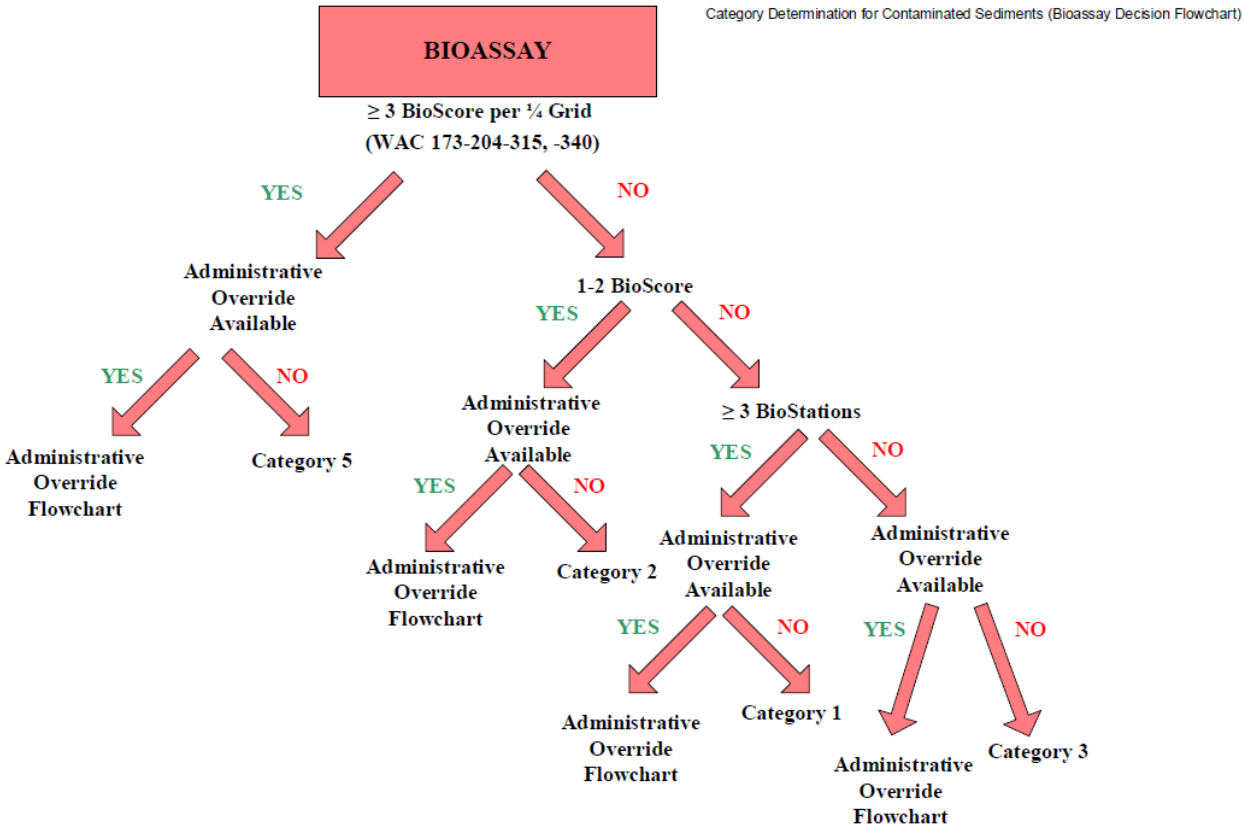
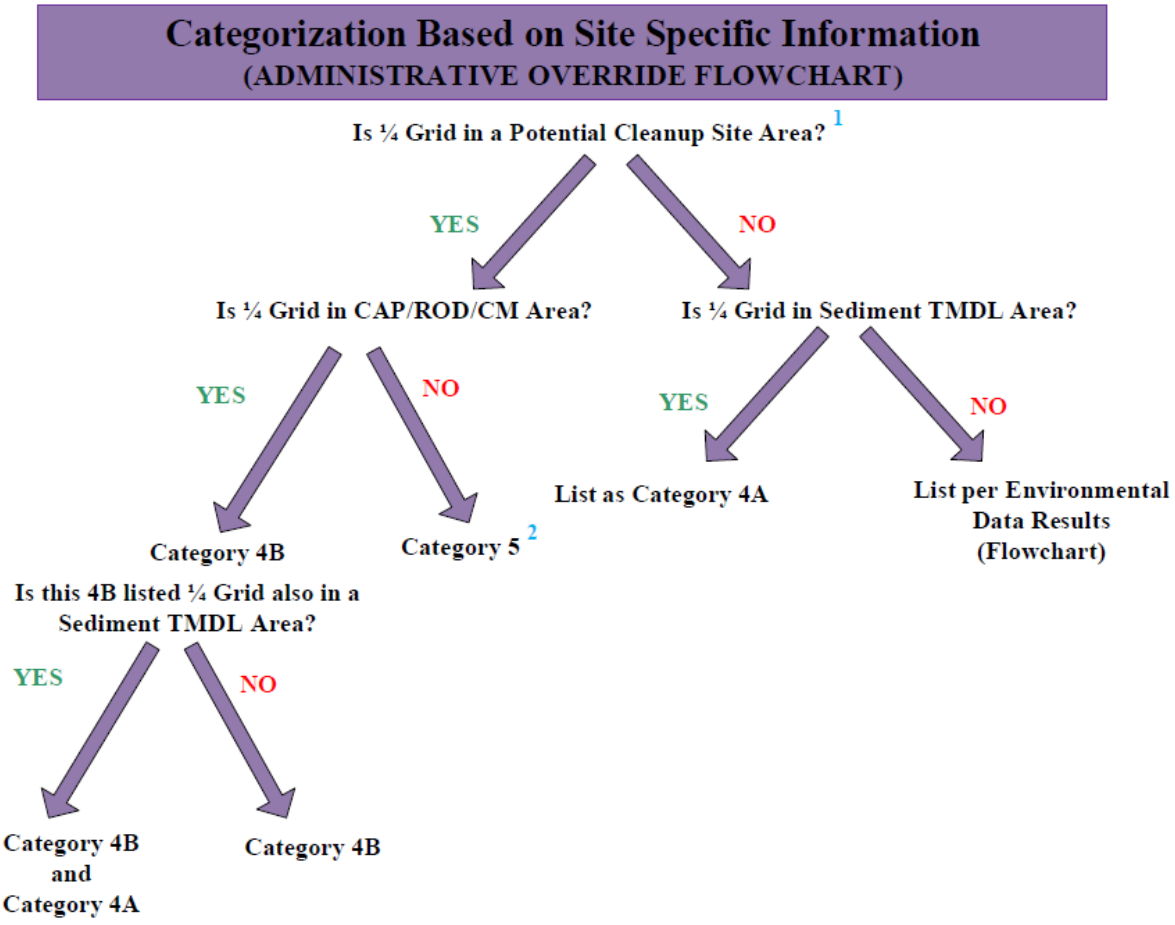


Figure 6. Bioassay Decision Flowchart



1. Administrative override data source is Ecology's Integrated Site Information System (ISIS) which includes information from MTCA, CERCLA, or RCRA Site Managers.

2. Administrative override data source is based upon historic data that may not be in the Environmental Information Management (EIM) System. Additionally, technical evaluations performed by technical staff.

Figure 7. Administrative Override Flowchart

APPENDIX 1. Ecology's Standard Operating Procedures (SOPs)

Ecology has also developed a full suite of standard operating procedures (SOPs) for field sampling, auditing, and methodologies for field analytical activities undertaken. Ecology is in the process of publishing all SOPs. A published SOP can be found by searching Ecology's publications[62] using the short identifier (for example, EAP023) in the "Title" field in the search form. If you cannot find a specific SOP on the website, please contact Ecology at 303d@ecy.wa.gov to request a copy.

Ambient freshwater biological and water quality monitoring SOPs

- EAP011 – Instantaneous Measurements of Temperature in Water
- EAP023 – Collection and Analysis of Dissolved Oxygen (Winkler Method)
- EAP029 – Collection and Field Processing of Metals Samples
- EAP030 – Collection of Fecal Coliform Bacteria Samples in Surface Water
- EAP031 – Collection and Analysis of pH Samples
- EAP032 – Collection and Analysis of Conductivity Samples
- EAP034 – Collection, Processing, and Analysis of Stream Samples
- EAP072 – Basic Use and Maintenance of WaterLOG® Data Loggers and Peripheral Equipment
- EAP073 – Minimum Requirements for the Collection of Freshwater Benthic Macroinvertebrates in Streams and Rivers
- EAP080 – Continuous Temperature Monitoring of Freshwater Rivers and Streams

Ambient river and stream flow monitoring SOPs

- EAP042 – Measuring Gage Height of Streams
- EAP055 – Operation of the Teledyne RD Instruments Stream-Pro Acoustic Doppler Current Profiler
- EAP056 – Measuring and Calculating Stream Discharge
- EAP057 – Conducting Stream Hydrology Site Visits

[62] https://apps.ecology.wa.gov/publications/UIPages/SearchPublications.aspx

- EAP058 – Operation of the SonTek® FlowTracker® Handheld ADV®
- EAP059 – Operation of Mechanical Velocity Indicators
- EAP060 – Measuring Stream Discharge from a Bridge
- EAP072 – Basic Use and Maintenance of WaterLOG® Data Loggers and Peripheral Equipment
- EAP082 – Correction of Continuous Stage Records Subject to Instrument Drift

Marine monitoring SOPs

- EAP025 – Seawater Sampling
- EAP026 – Chlorophyll a Analysis
- EAP027 – Seawater Dissolved Oxygen Analysis
- EAP028 – Reagent Preparation
- EAP039 – Obtaining Marine Sediment Samples
- EAP043 – Marine Macrobenthic Sample Analysis
- EAP050 – Calibration, Preparation, and Deployment of Teledyne RD Instruments Acoustic Doppler Current Profilers (ADCPs) © (RDI)
- EAP086 – Marine Waters Oxygen and Supporting Sensor Performance Assessment – Lab Procedures
- EAP088 – Marine Waters Data Quality Assurance and Quality Control
- EAP092 – BEACH Program Bacteria Sampling

Total maximum daily load (TMDL) studies SOPs

- EAP015 – Manually Obtaining Surface Water Samples
- EAP023 – Collection and Analysis of Dissolved Oxygen (Winkler Method)
- EAP024 – Measuring Streamflow for Water Quality Studies
- EAP030 – Collection of Fecal Coliform Bacteria Samples in Surface Water
- EAP032 – Collection and Analysis of Conductivity Samples
- EAP033 – Hydrolab®, DataSonde®, MiniSonde®, and HL4 Multiprobes
- EAP037 – Time-of-Travel Studies in Freshwater Using a Dye Tracer
- EAP044 – Collecting Data to Support a Temperature Total Maximum Daily Load (TMDL) Study

- EAP045 – Hemispherical Digital Photography Field Surveys
- EAP046 – Computer Analysis of Hemispherical Digital Images Collected as part of a TMDL or Forests and Fish Unit Technical Study
- EAP075 – Measuring Vertically Averaged Salinity in Brackish Waters
- EAP084 – Conducting Riparian Vegetation and Stream Channel Surveys in Wadeable Streams for Temperature TMDL Studies
- EAP085 – Collecting Periphyton Samples for TMDL Studies
- EAP091 – Turner Designs Cyclops-7 Submersible Optical Brightener Sensors and Precision Measurement Engineering, Inc. Cyclops-7 Loggers
- EAP097 – Collection of Longitudinal Stream Depth Profiles

Toxics monitoring SOPs

- EAP001 – Conducting Studies Using Semi-Permeable Membrane Devices (SPMDs)
- EAP003 – Sampling of Pesticides and Semivolatile Organics in Surface Waters
- EAP007 – Resecting Finfish Whole Body, Body Parts or Tissue Samples
- EAP008 – Resecting DNA Samples and Aging for Finfish
- EAP009 – Field Collection, Processing and Preservation of Finfish Samples at the Time of Collection in the Field
- EAP038 – Collection of Freshwater Sediment Core Samples Using a Box or KB Corer
- EAP040 – Freshwater Sediment Sampling
- EAP079 – Semi-Permeable Membrane Devices (SPMDs) Data Management and Data Reduction
- EAP090 – Decontaminating Field Equipment for Sampling Toxics in the Environment

Watershed health monitoring SOPs

- EAP095 – Collecting Water Samples for Watershed Health Monitoring

APPENDIX 2. TECs and DWECs for Assessment of Tissue and Water Data

The following table shows Tissue Exposure Concentrations (TECs) and Drinking Water Exposure Concentrations (DWECs) expressed in parts per million (mg/L for water, mg/kg for tissue) for specific chemicals. The TECs and DWECs are used for the assessment of tissue and water data for human health protection from toxics.

To determine human health criteria that apply to specific chemicals, go to Ecology's website on the water quality standards[63] for the latest update on human health criteria applicable to Washington.

Table 7. TECs and DWECs for the assessment of tissue and water data.

Chemical Name	CAS #	TEC- tissue (Cancer) (ppm) (mg/kg)	TEC- tissue (Non-cancer) (ppm) (mg/kg))	DWEC- water (Cancer) (ppm) (mg/L)	DWEC- water (Non-cancer) (ppm) (mg/L)
1,1,1-Trichloroethane	71556	-	910	-	67.000
1,1,2,2-Tetrachloroethane	79345	0.0023	9.1	0.00017	0.670
1,1,2-Trichloroethane	79005	0.0080	1.8	0.00058	0.130
1,1-Dichloroethylene	75354	-	23	-	1.700
1,2,4-Trichlorobenzene	120821	0.016	4.6	0.0011	0.330
1,2-Dichlorobenzene	95501	-	140	-	10.000
1,2-Dichloroethane	107062	0.14	36	0.010	2.600
1,2-Dichloropropane	78875	0.013	41	0.00093	3.000
1,2-Diphenylhydrazine	122667	0.00057	-	0.000042	-
1,2-Trans-Dichloroethylene	156605	-	9.1	-	0.670

[63] https://ecology.wa.gov/Water-Shorelines/Water-quality/Water-quality-standards/Updates-to-the-standards

Chemical Name	CAS #	TEC- tissue (Cancer) (ppm) (mg/kg)	TEC- tissue (Non-cancer) (ppm) (mg/kg))	DWEC- water (Cancer) (ppm) (mg/L)	DWEC- water (Non-cancer) (ppm) (mg/L)
1,3-Dichlorobenzene	541731	-	0.91	-	0.067
1,3-Dichloropropene	542756	0.0037	11	0.00027	0.830
1,4-Dichlorobenzene	106467	-	32	-	2.300
2,3,7,8-TCDD (Dioxin)	1746016	(1)	0.00000032	(1)	0.000000023
2,4,6-Trichlorophenol	88062	0.042	0.46	0.00303	0.033
2,4-Dichlorophenol	120832	-	1.4	-	0.100
2,4-Dimethylphenol	105679	-	9.1	-	0.670
2,4-Dinitrophenol	51285	-	0.91	-	0.067
2,4-Dinitrotoluene	121142	0.00069	0.91	0.000050	0.067
2-Chloronaphthalene	91587	-	37	-	2.700
2-Chlorophenol	95578	-	2.3	-	0.170
2-Methyl-4,6-Dinitrophenol	534521	-	0.14	-	0.010
3,3'-Dichlorobenzidine	91941	0.0010	-	0.000074	-
3-Methyl-4- Chlorophenol	59507	-	46	-	3.300
4,4'-DDD	72548	0.0019	0.23	0.00014	0.017
4,4'-DDE	72559	0.0027	0.23	0.00020	0.017
4,4'-DDT	50293	0.0013	0.23	0.000098	0.017
Acenaphthene	83329	-	27	-	2.000
Acrolein	107028	-	0.23	-	0.017
Acrylonitrile	107131	0.00085	-	0.000062	-

Chemical Name	CAS #	TEC- tissue (Cancer) (ppm) (mg/kg)	TEC- tissue (Non-cancer) (ppm) (mg/kg))	DWEC- water (Cancer) (ppm) (mg/L)	DWEC- water (Non-cancer) (ppm) (mg/L)
Aldrin	309002	0.000027	0.014	0.0000020	0.0010
alpha-BHC	319846	0.000073	3.7	0.0000053	0.270
alpha-Endosulfan	959988	-	2.7	-	0.200
Anthracene	120127	-	140	-	10.000
Antimony	7440360	-	0.18	-	0.013
Arsenic, Inorganic	7440382	(2)	0.14	(2)	0.010
Asbestos	1332214	-	-	-	-
Benzene	71432	0.0083	0.23	0.00061	0.017
Benzidine	92875	0.0000020	1.4	0.00000014	0.100
Benzo(a)Anthracene	56553	0.00063	-	0.000046	-
Benzo(a)Pyrene	50328	0.000063	-	0.0000046	-
Benzo(b)Fluoranthene	205992	0.00063	-	0.000046	-
Benzo(k)Fluoranthene	207089	0.0063	-	0.00046	-
beta-BHC	319857	0.00025	-	0.000019	-
beta-Endosulfan	33213659	-	2.7	-	0.200
Bis(2-Chloroethyl)Ether	111444	0.00042	-	0.000030	-
Bis(2-Chloroisopropyl) Ether	108601	-	18	-	1.300
Bis(2-Ethylhexyl) Phthalate	117817	0.033	27	0.0024	2.000
Bromoform	75252	0.10	14	0.0074	1.000
Butylbenzyl Phthalate	85687	0.24	590	0.018	43.000

Chemical Name	CAS #	TEC- tissue (Cancer) (ppm) (mg/kg)	TEC- tissue (Non-cancer) (ppm) (mg/kg))	DWEC- water (Cancer) (ppm) (mg/L)	DWEC- water (Non-cancer) (ppm) (mg/L)
Carbon Tetrachloride	56235	0.0065	1.8	0.00048	0.130
Chlordane	57749	0.0013	0.23	0.000095	0.017
Chlorobenzene	108907	-	9.1	-	0.670
Chlorodibromomethane	124481	0.011	9.1	0.00083	0.670
Chloroform	67663	-	4.6	-	0.330
Chrysene	218019	0.063	-	0.0046	-
Copper	7440508	-	-	-	-
Cyanide	57125	-	0.27		0.020
Dibenzo (a,h) Anthracene	53703	0.000063	-	0.0000046	-
Dichlorobromomethane	75274	0.013	1.4	0.00098	0.100
Dieldrin	60571	0.000029	0.023	0.0000021	0.0017
Diethyl Phthalate	84662	-	360	-	27.000
Dimethyl Phthalate	131113	-	4600	-	330.000
Di-n-Butyl Phthalate	84742	-	46	-	3.300
Endosulfan Sulfate	1031078	-	2.7	-	0.200
Endrin	72208	-	0.14	-	0.010
Endrin Aldehyde	7421934	-	0.14	-	0.010
Ethylbenzene	100414	-	10	-	0.730
Fluoranthene	206440	-	18	-	1.300
Fluorene	86737	-	18	-	1.300

Chemical Name	CAS #	TEC- tissue (Cancer) (ppm) (mg/kg)	TEC- tissue (Non-cancer) (ppm) (mg/kg))	DWEC- water (Cancer) (ppm) (mg/L)	DWEC- water (Non-cancer) (ppm) (mg/L)
gamma-BHC (Lindane)	58899	-	2.1	-	0.160
Heptachlor	76448	0.00011	0.046	0.0000081	0.0033
Heptachlor Epoxide	1024573	0.000083	0.0059	0.0000061	0.00043
Hexachlorobenzene	118741	0.00045	0.37	0.000033	0.027
Hexachlorobutadiene	87683	0.011	0.14	0.00083	0.010
Hexachloro-cyclopentadiene	77474	-	2.7	-	0.200
Hexachloroethane	67721	0.011	0.32	0.00083	0.023
Indeno (1,2,3-cd) Pyrene	193395	0.00063	-	0.000046	-
Isophorone	78591	0.48	91	0.035	6.700
Methyl Bromide	74839	-	9.1	-	0.670
Methylene Chloride	75092	0.23	2.7	0.017	0.200
Methylmercury	22967926	-	-	-	-
Nickel	7440020	-	9.1	-	0.670
Nitrobenzene	98953	-	0.91	-	0.067
N-Nitrosodimethylamine	62759	0.0000090	-	0.00000065	-
N-Nitrosodi-n-Propylamine	621647	0.000065	-	0.0000048	-
N-Nitrosodiphenylamine	86306	0.093	-	0.0068	-
Pentachlorophenol	87865	0.0011	2.3	0.000083	0.170
Phenol	108952	-	270	-	20.000

Chemical Name	CAS #	TEC- tissue (Cancer) (ppm) (mg/kg)	TEC- tissue (Non-cancer) (ppm) (mg/kg))	DWEC- water (Cancer) (ppm) (mg/L)	DWEC- water (Non-cancer) (ppm) (mg/L)
Polychlorinated Biphenyls (PCBs)	n	0.00023	0.0091	0.000017	0.00067
Pyrene	129000	-	14		1.000
Selenium	7782492	-	2.3	-	0.170
Tetrachloroethylene	127184	0.22	2.7	0.016	0.200
Thallium	7440280	-	0.031	-	0.0023
Toluene	108883	-	4.4	-	0.320
Toxaphene	8001352	0.00042	0.16	0.000030	0.012
Trichloroethylene	79016	0.0091	2.3	0.00067	0.170
Vinyl Chloride	75014	0.00030	1.4	0.000022	0.100
Zinc	7440666	-	140	-	10.000

(1) There is not a TEC$_C$ nor a DWEC$_C$ threshold for 2,3,7,8-TCDD because the validity of the existing cancer slope factor developed by EPA is uncertain and currently under review. In the final rule at 40 CFR 131.45 EPA notes that for 2,3,7,8-TCDD, IRIS does not currently contain a measure of dioxin's cancer-causing ability (i.e., a CSF). Without such values, EPA concluded that further analysis is necessary in order to promulgate scientifically sound revised criteria for 2,3,7,8-TCDD. In the Technical Support Document issued in November 2016 as part of EPA's partial approval/disapproval of Washington's human health criteria, EPA noted its intent to reevaluate the existing federal 2,3,7,8-TCDD human health criteria in IRIS by 2018.

(2) There is no TEC$_C$ or DWEC$_C$ for arsenic because the validity of the existing cancer slope factor developed by EPA is uncertain and currently under review. In a Technical Support Document issued in November 2016 as part of EPA's partial approval/disapproval of Washington's human health criteria, EPA noted its intent to reevaluate the existing federal arsenic human health criteria through the Integrated Risk Information System (IRIS) Toxicological Review of inorganic arsenic (total dissolved) by 2018.

APPENDIX 3. Sources of Information

This publication is part of a significant agency action under RCW1 34.05.272. To meet the law, the sources of information used to support revisions to Water Quality Policy 1-11 are identified, followed by the source type number in [brackets]. The required 11 types of sources are listed below by number.

1. Peer review overseen by an independent third party.
2. Review by staff internal to Ecology.
3. Review by persons that are external to and selected by Ecology.
4. Documented open public review process that is not limited to invited organizations or individuals.
5. Federal and state statutes.
6. Court and hearings board decisions.
7. Federal and state administrative rules and regulations.
8. Policy and regulatory documents adopted by local governments.
9. Data from primary research, monitoring activities, or other sources, but that has not been incorporated as part of documents reviewed under other processes.
10. Records of best professional judgment of Ecology employees or other individuals.
11. Sources of information that do not fit into one of the other categories listed.

Federal and state statutes and rules

33 U.S.C. 1251 et seq. Federal Water Pollution Control Act (the "Clean Water Act"). Public Law 92-500. [5]

40 CFR 131. Water Quality Standards. 33 U.S.C. 1251 *et seq*. [5]

40 CFR 131.45. Revision of certain Federal water quality criteria applicable to Washington. 81 FR 85435, November 28, 2016. [5]

42 U.S.C 82 6901 *et seq.* Resource Conservation and Recovery Act (RCRA). Public Law 94-

580. [5]

42 U.S.C. 300f. Federal Safe Drinking Water Act. Public Law 93-523. [5]

42 U.S.C. 9601 *et seq.* Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund). Public Law 96-510. [5]

Revised Code of Washington. Chapter 70.105D RCW. Model Toxics Control Act. [5] Revised Code of Washington. Chapter 90.48 RCW. Water Pollution Control. [5] Revised Code of Washington. Chapter 90.48.570-590 RCW. Water Quality Data Act. [5]

Revised Code of Washington. Chapter 76.09.370 RCW. Findings-Forests and Fish Report-Adoption of rules. [5]

United States Environmental Protection Agency. 2016. Federal Register: Revision of Certain Federal Water Quality Criteria Applicable to Washington. EPA-HQ-OW-2015-0174. (https://www.gpo.gov/fdsys/pkg/FR-2016-11-28/pdf/2016-28424.pdf) [5]

United States Environmental Protection Agency. Integrated Risk Information System. (https://www.epa.gov/iris) [11]

Washington Administrative Code. Chapter 173-201A WAC. Water Quality Standards for Surface Waters of the State of Washington. [7]

Washington Administrative Code. Chapter 173-204 WAC. Sediment Management Standards. [7]

Washington Administrative Code. Chapter 173-340 WAC. Model Toxics Control Act (MTCA) Cleanup. [7]

Washington State Department of Ecology. Waters Requiring Supplemental Spawning and Incubation Protection for Salmonid Species. Publication No. 06-10-038. Revised January 2011. [2, 3, 4, 7]

Washington State Department of Ecology. Water Quality Standards for Surface Waters of the State of Washington Chapter 173-201A WAC (easy to read version). Washington State Department of Ecology. Publication No. 06-10-091. Revised August 1, 2016. [2, 3, 4, 7]

Guidance & supporting information

Adams, K. 2010. Guidance for Stressor Identification of Biologically Impaired Aquatic Resources in Washington State. Washington State Department of Ecology. Publication No. 10- 03-036. [3]

California Environmental Protection Agency. State Water Resources Control Board. 2004. Functional Equivalent Document. Water Quality Control Policy for Developing California's Clean Water Act Section 303(d) List. Amended February 3, 2015. [11]

Hilsenhoff, William L. (1987) "An Improved Biotic Index of Organic Stream Pollution," The Great Lakes Entomologist: Vol. 20 : No. 1 , Article 7. [11]

Helsel, D. 2010. Much Ado About Next to Nothing: Incorporating Nondetects in Science. The Annals of Occupational Hygiene, Volume 54, Issue 3, Pgs. 257-262. [11]

Marshalonis, D. and C.A. Larson. 2018. Flow pulses and fine sediments degrade stream macroinvertebrate communities in King County, Washington, USA. Ecological Indicators 93: 365-378. (https://doi.org/10.1016/j.ecolind.2018.04.060) [11]

McGuire, D. L. 2007. Clark Fork River macroinvertebrate biomonitoring. Macroinvertebrate Community Assessments, 2006. Technical report prepared for United States Environmental Protection Agency Region 8. (http://cfb.unh.edu/StreamKey/html/biotic_indicators/indices/Hilsenhoff.html) [11]

National Water Quality Monitoring Council. Water Quality Portal. 2018. (https://www.waterqualitydata.us/) [9]

Olivero and Anderson, 2008. Northeast Aquatic Habitat Classification System. The Nature Conservancy. Eastern Regional Office. Boston, MA [11]

Opalski, D. Office of Wetlands and Watersheds. United States Environmental Protection Agency. 2016. Letter to Director Maia Bellon, Department of Ecology on November 15, 2016.

Pacific Northwest Aquatic Monitoring Partnership (PNAMP); Northwest Standard Taxonomic Effort (NWSTE), https://www.pnamp.org/document/5210, January 2013. [11]

Regas, Diane. Office of Wetlands, Oceans and Watersheds. United States Environmental Protection Agency. 2005. Memorandum on "Guidance for 2006 Assessment, Listing and Reporting Requirements Pursuant to Sections 303(d), 305(b) and 314 of the Clean Water Act." July 29, 2005. [11]

Stat Trek. Hypergeometric Distribution. (https://stattrek.com/probability-distributions/hypergeometric.aspx) [11]

United States Environmental Protection Agency. 1996 Method 1669: Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels. (https://www.epa.gov/sites/production/files/2015-10/documents/method_1669_1996.pdf) [11]

United States Environmental Protection Agency. 2000. National Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories. Volumes 1: Fish Sampling and Analysis. EPA 823-B-00-007. [11]

United States Environmental Protection Agency. Office of Wetlands, Oceans and Watersheds. 2002. Consolidated Assessment and Listing Methodology. July 2002.

United States Environmental Protection Agency. 2005. Guidance for 2006 Assessment, Listing and Reporting Requirements Pursuant to Sections 303(d), 305(b) and 314 of the Clean Water Act. (https://www.epa.gov/sites/production/files/2015-10/documents/2006irg-report.pdf) [11]

United States Environmental Protection Agency. 2006. Data Quality Assessment: Statistical Methods for Practitioners. EPA QA/G92. EPA/240/B-06/003. February 2006.

United States Food and Drug Administration. 2017. National Shellfish Sanitation Program (NSSP) Guide for the Control of Molluscan Shellfish. 2017 Revision. (https://www.fda.gov/downloads/Food/GuidanceRegulation/FederalStateFoodPrograms/UCM623551.pdf) [11]

United States Geologic Survey. 2002. *Statistical Methods in Water Resources.* *(*https://pubs.usgs.gov/twri/twri4a3/) [11]

Washington State Department of Ecology, U.S. Environmental Protection Agency, and Washington Tribes. 1997. *Cooperative Management of the Clean Water Act 303(d) Program for*

the Tribes in Washington State, the Washington State Department of Ecology, and the U.S. Environmental Protection Agency Region 10. [11]

Washington State Department of Ecology. 2006. Water Quality Program Policy, WQP Policy 1-11 Chapter 2. Ensuring Credible Data for Water Quality Management. Washington State Department of Ecology. (https://ecology.wa.gov/DOE/files/3b/3bf2eaab-090b-49d1-8ff4-fd8c82960f7a.pdf) [2, 3, 4]

Washington State Department of Ecology. 2015. Quality Management Plan, 2015: Washington State Department of Ecology. Publication number 15-03-030. [2]

Washington State Department of Ecology. 2016a. Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies. Publication number 04-03-030." [2]

Washington State Department of Ecology. 2016b. Error Analysis for Water Quality Policy 1-11: Pertaining to the Water Quality Assessment. (https://ecology.wa.gov/DOE/files/44/441bf7ac-7f34-499f-8b14-5e21c39eb1b9.pdf) [2]

Washington State Department of Ecology. Environmental Information Management. 2018. (https://fortress.wa.gov/ecy/eimhelp/) [11]

Washington State Department of Ecology. Integrated Site Information System. (https://fortress.wa.gov/ecy/tcpwebreporting/) [2]

Washington State Department of Ecology. 2019. Sediment Cleanup User's Manual (SCUM). Publication number 12-09-057. [2]

Washington State Department of Health. Shellfish Program. (https://www.doh.wa.gov/AboutUs/ProgramsandServices/EnvironmentalPublicHealth/EnvironmentalHealthandSafety/ShellfishProgram)

Wayland, Robert H. Office of Wetlands, Oceans and Watersheds. United States Environmental Protection Agency. 2001. Memorandum on "2002 Integrated Water Quality Monitoring and Assessment Report Guidance". Nov. 19, 2001. https://www.epa.gov/sites/production/files/2015-10/documents/2002_02_13_tmdl_2002wqma.pdf) [11]