Understanding Water Quality Standards

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US EPA Region 6
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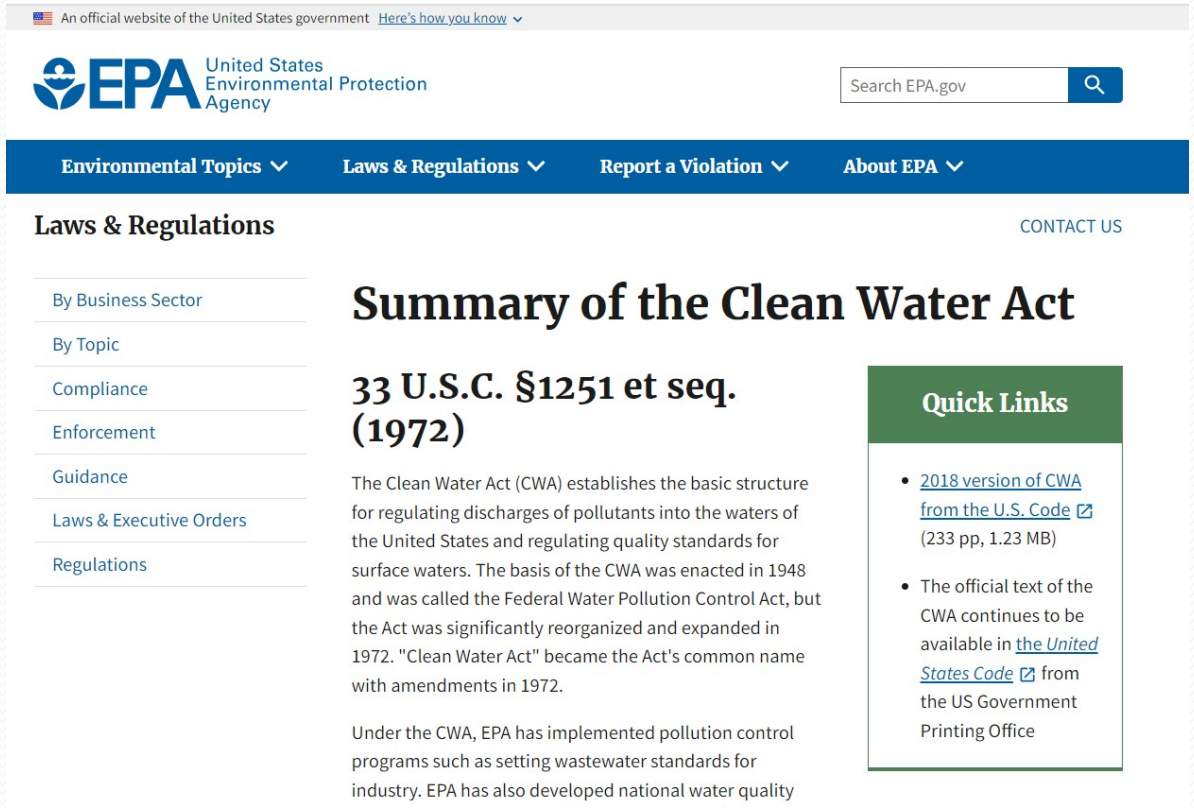
Learning objectives

- Brief history of the Clean Water Act
- Understanding Water Quality Standards
  - Core components of WQS:
    - Designated Uses
    - Water Quality Criteria
    - Antidegradation

History of the Clean Water Act

Clean Water Act (1972)

- Monitor waters
- Assess waters
  - Every two years
    - Find and analyze available information
    - Decide which waters do not meet water quality standards because they are too polluted (impaired)
- Impaired waters are placed on a list for future actions to reduce pollution



https://www.epa.gov/laws-regulations/summary-clean-water-act

CWA Section 518

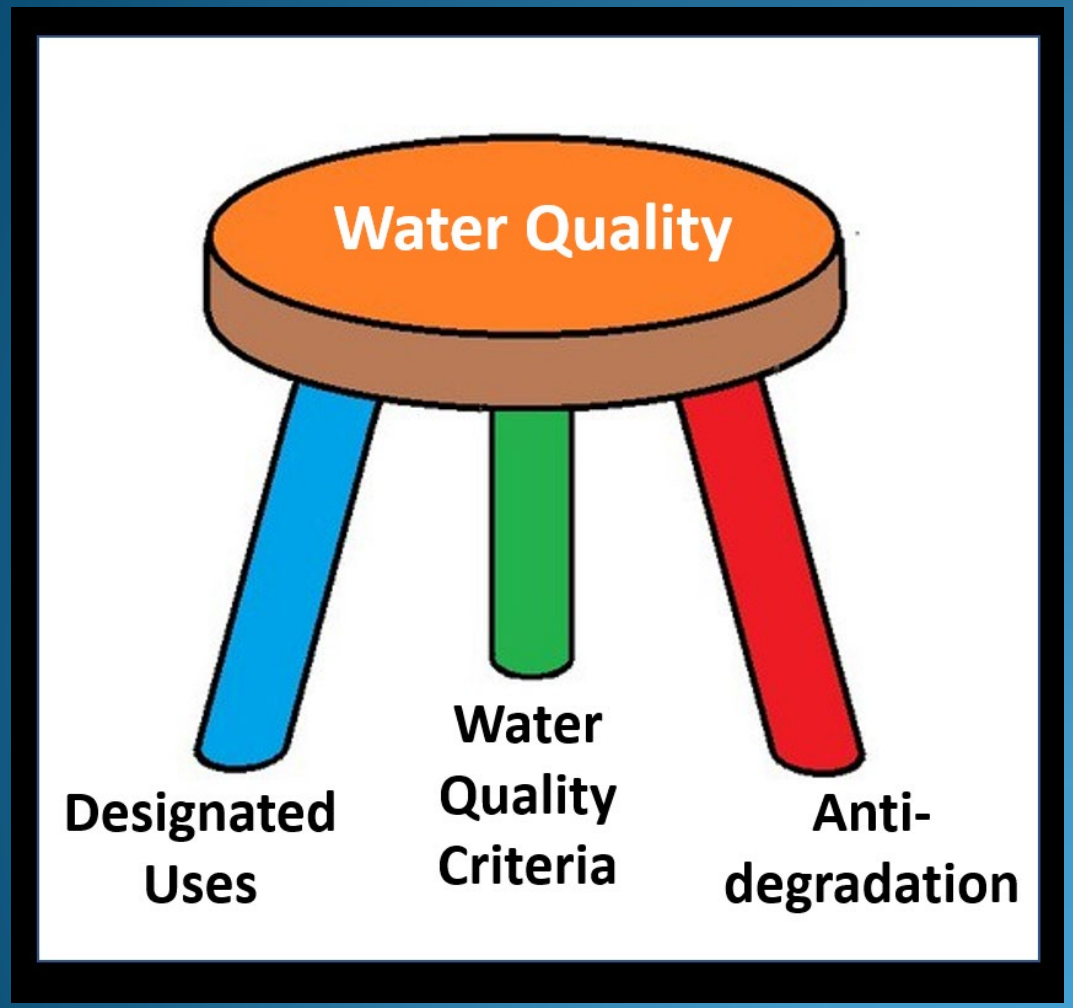
In 1987, Congress amended the Clean Water Act in part by adding Section 518 authorizing the EPA Administrator to treat tribes in a similar manner as states (TAS) for purposes of administering certain Clean Water Act programs including:

- 106 and 319 grants
- 303(c) WQS and 401 water quality certification
- 303(d) listings and TMDLs
- 402 NPDES permits
- 404 dredge and fill permits

Why Does the Clean Water Act Matter?

Ca. 1960s present day

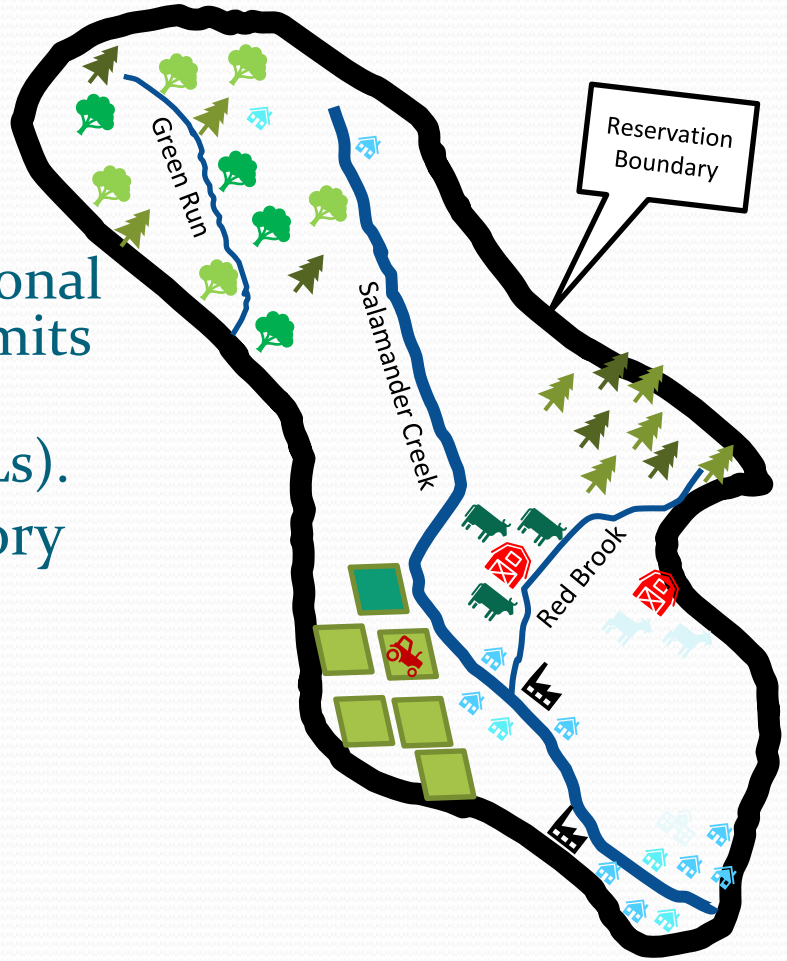
Cuyahoga River water quality improvements in recent years reflect the effects of requirements of the CWA 1972 amendments.



CWA Water Quality Standards

CWA 303(c):Water Quality Standards

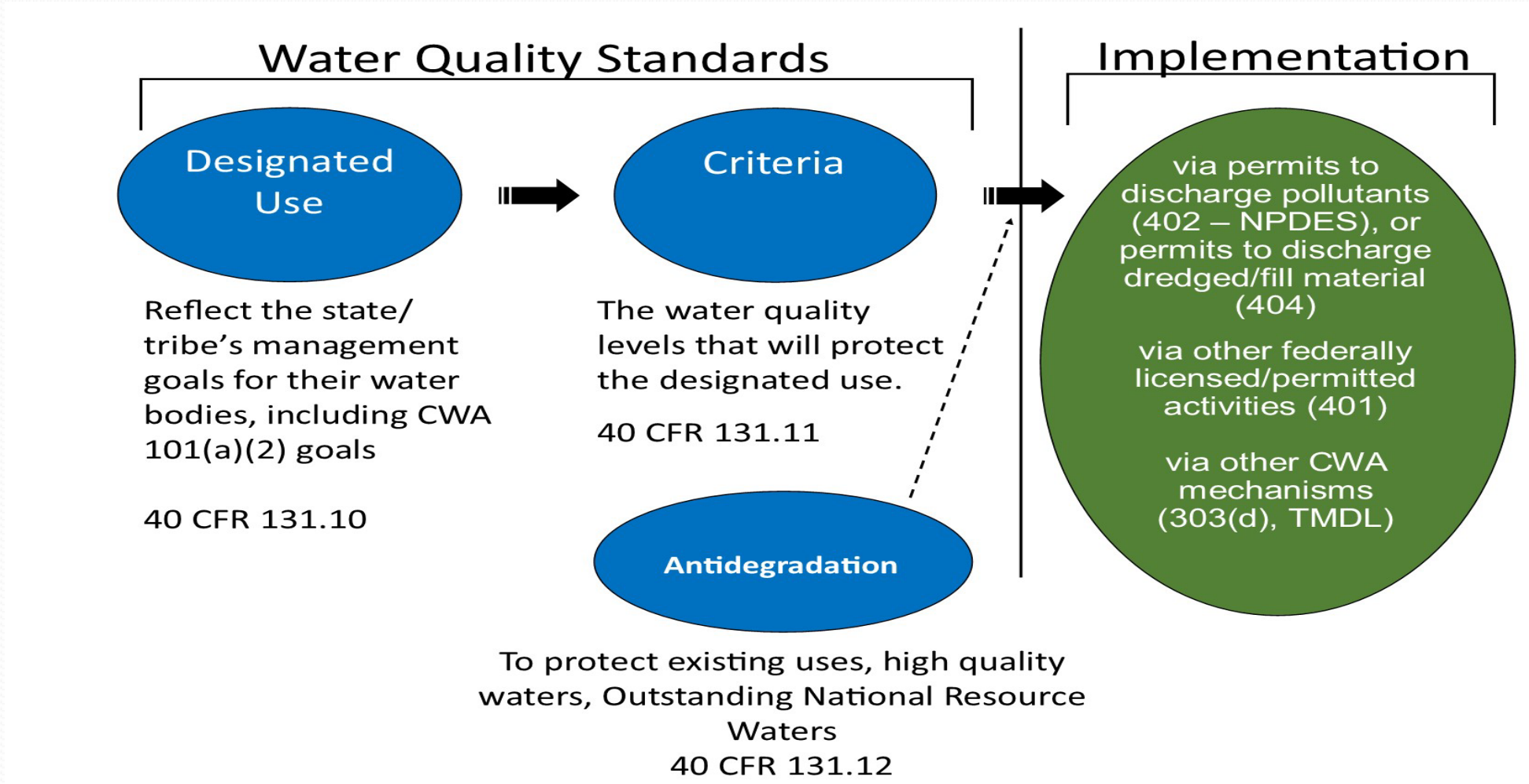
- WQS define the water quality goals for a waterbody.
- WQS provide a regulatory basis for many actions, e.g.,
  - Reporting on water quality conditions and status.
  - Developing water quality-based effluent limits in National Pollutant Discharge Elimination System (NPDES) permits for point sources.
  - Setting targets for Total Maximum Daily Loads (TMDLs).
- An important function of WQS is to provide a regulatory basis for the water quality management activities authorized under the CWA.



Components of Water Quality Standards

- Core components of WQS:
  - Designated uses (sometimes known as "beneficial uses")
  - Criteria to protect those uses
  - Antidegradation requirements
- Additional components:
  - General policies (e.g., low flow provisions, mixing zone policies) (40 CFR 131.13)
  - WQS variances (40 CFR 131.14)
  - Compliance schedule authorizing provisions (40 CFR 131.15)

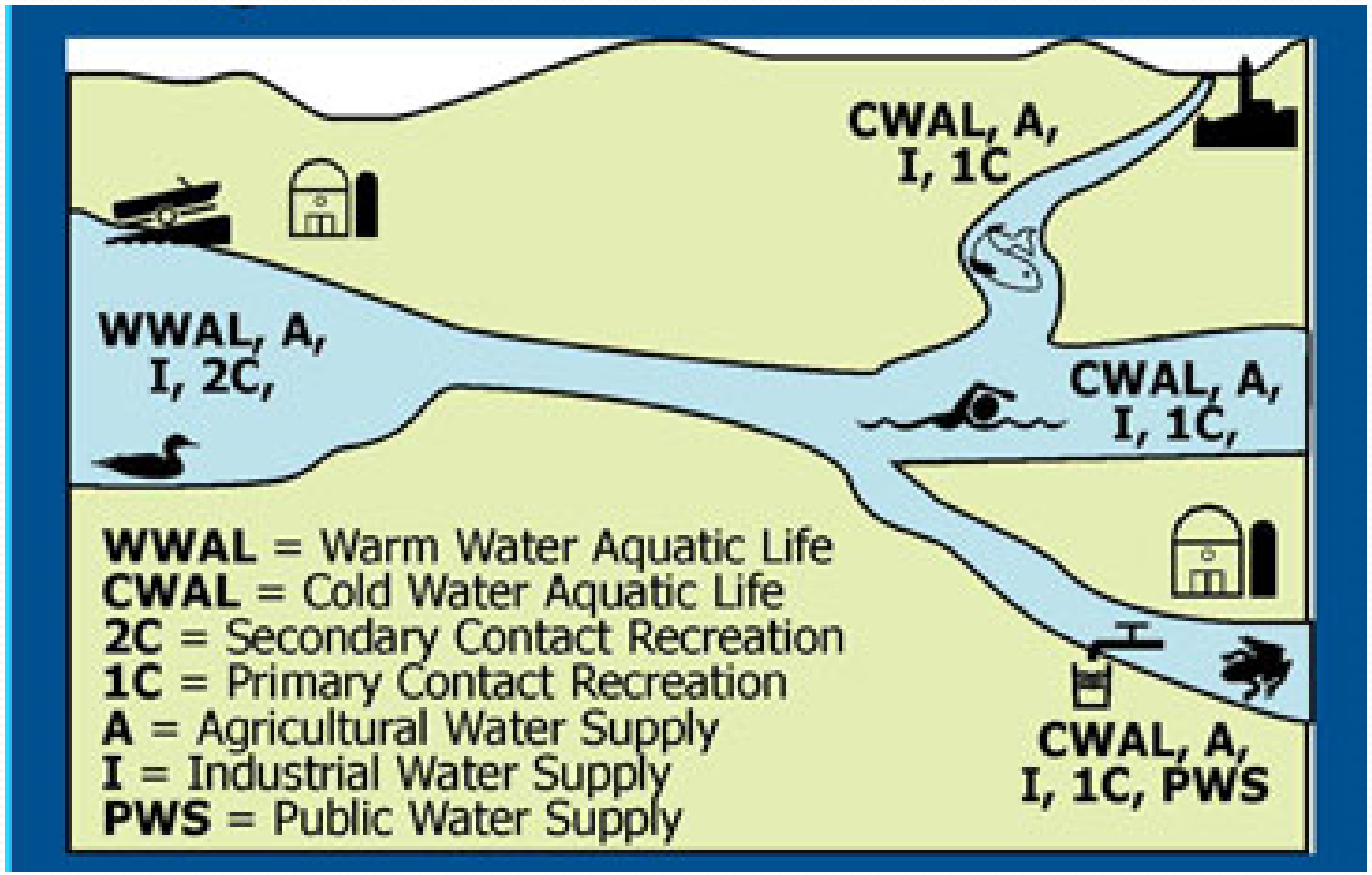
Water Quality Standards Schematic



Designated Uses

Designated Uses (40 CFR 131.10)

- Designated uses are uses specified in an authorized tribes' water quality standards regulations for each water body or segment, whether they are being attained
- Uses describe the water quality goals or desired condition for a specific water body, and the functions and/or activities that are supported by a level of water quality
- Uses serve as tools to communicate water quality goals to the public.



Clean Water Act Uses

- CWA 303(c)(2)(a): Such revised or new water quality standard shall consist of the designated uses of the navigable waters involved and the water quality criteria for such waters based upon such uses.
- CWA 101(a)(2) Uses:
  - Protection and propagation of fish, shellfish and wildlife
  - Recreation in and on the water
- Non-101(a)(2) Uses: Any uses not unrelated to the protection and propagation of fish, shellfish, wildlife or recreation in and on the water (40 CFR 131.3(q)).
- 40 CFR 131.10(a): Each State must specify appropriate water uses to be achieved and protected.
  - States and tribes are not required to designate non-101(a)(2) uses but their use and value must be considered (40 CFR 131.10(a))
  - If a state or tribe disagrees that uses are attainable, they may demonstrate through a Use Attainability Analysis (UAA) that such uses are not attainable (40 CFR 131.10(g))

Designated Uses (40 CFR 131.10)

- Authorized tribes have discretion in designating uses and how to articulate them if the system established allows protection of waters consistent with the CWA and regulations.
- Authorized tribes can designate multiple uses for each water body.
- Authorized tribes must account for downstream protection when designating uses.

Designated Use Example Approaches

Example A	Example B
Specifically designates multiple uses to each water.	Designates a "class" that contains multiple different uses.
For example, one water body designated for: Warm water aquatic life use, Public water supply use, Agricultural use, and Primary contact recreation use Cultural and traditional use	For example, designations may be: Class A(1): • Aquatic biota, wildlife and aquatic habitat use • Cultural and Traditional use • Swimming and other primary contact recreation use • Boating, fishing and other recreation use Class A(2) • Includes Class A(1) + Public Water Supply Class B • Includes Class A(1), Class A(2), + irrigation of crops and other agricultural uses

Revising Designated Uses (40 CFR 131.10)

- Except in certain circumstances, designated uses can be revised to reflect:
  - **More specific** desired condition (e.g., aquatic life use to cold or water-aquatic life use).
  - Enhanced articulation of the **attainable** use (e.g. primary vs secondary contact recreation use).
- Revising designated uses can lead to more effective criteria, permits, TMDLs.
- For all designated use revisions, the CWA and regulations require the evaluation of the use and value for that use. Congress established more prescriptive requirements for uses related to CWA 101(a)(2) uses.
  - For CWA 101(a)(2) uses, revisions must be accompanied by a UAA (a "structured scientific assessment of the physical, chemical, biological and economic factors affecting attainment of the use.")

Criteria

Water Quality Criteria (40 CFR 131.11)

Definition (40 CFR 131.3(b)): Criteria are elements of State water quality standards, expressed as constituent concentrations, levels, or narrative statements, representing a quality of water that supports a particular use. When criteria are met, water quality will generally protect the designated use.

CWA Requirements for Criteria

- CWA 303(c)(2)(A)/40 CFR 131.11(a)(1): States/Tribes shall adopt criteria to protect designated uses into their WQS.

- CWA 303(c)(2)(B)/40 CFR 131.11(a)(2): States/Tribes shall adopt criteria for toxic pollutants listed pursuant to section 307(a)(1)
  - Toxic Pollutants List: 40 CFR 401.15
  - Priority Pollutants List: 40 CFR 423, Appendix A

https://www.epa.gov/eg/toxic-and-priority-pollutants-under-clean-water-act

Regulatory Requirements for Criteria

- Criteria must be based on sound scientific rationale.
  - Water quality criteria *recommendations* (not Federal Rules) under CWA 304(a)
  - Factors such as technological feasibility, social and economic costs, and the benefits of achieving criteria levels are not considered in criteria development
  - Criteria may be revised as new scientific data or methodologies are developed
- Criteria must contain sufficient parameters to protect the designated use
- For waters with multiple uses, the criteria shall support the most sensitive use
  - EPA encourages states and tribes to reach out to the local communities to learn how they use particular water bodies. This information will help make more informed decisions on how to support the most sensitive use.

https://www.epa.gov/wqc/national-recommended-water-quality-criteria-tables

Criteria in Two Forms (40 CFR 131.11(b))

Numeric values should be based on:

- 304(a) national recommended water quality criteria
- 304(a) guidance modified to reflect site-specific conditions
- Other scientifically defensible methods

Narrative criteria should be established:

- When numeric criteria cannot be established
- To supplement numeric criteria

Both numeric and narrative forms of criteria provide a regulatory basis for implementation and management actions like NPDES permit limits, water quality assessments, and TMDL development.

Numeric Water Quality Criteria

- EPA develops recommended water quality criteria as guidance for use in developing criteria.
- Numeric criteria are often expressed as:
  - Less than, such as nitrate is *not to exceed* 10 mg/L
  - Greater than, such as the 7-day average of the daily mean dissolved oxygen should be *at least* 8.5 mg/L
  - A range, such as pH shall be *within the range* of 6.5 to 8.5 S.U.
  - No more than one exceedance of the calculated criteria in three years: WQC = $(e^{(x[\ln(hardness)]+y)})*z$

Parts of a Numeric Water Quality Criterion

Explicit Value = actual number/magnitude

Duration = period of time

Example: Should not exceed 10 mg/L as an annual average,

and cannot be exceeded more than 10% of the time.

Frequency = recurrence interval

Narrative Criteria Example

Surface waters *shall be free from* substances attributable to wastewater discharges or other pollutant sources that cause injury to, or are toxic to, or produce adverse physiological responses in humans, animals, or plants.

Note: For CWA 307(a) toxics, a state/tribe must provide a method of translating a narrative criterion into something numeric from which a permit writer can derive effluent limits (40 CFR 131.11(a)(2)).

Aquatic Life Criteria

- Aquatic life criteria protect aquatic life from specific pollutants in the water column.
- Acute and Chronic

Dissolved Oxygen

Temperature

Color

pH

Turbidity

Phosphorus

Ammonia

https://www.epa.gov/wqc/national-recommended-water-quality-criteria-aquatic-life-criteria-table

Biological Criteria (or 'biocriteria')

- Biological criteria protect aquatic life uses by describing the desired biological condition of surface waters for a specific aquatic life designated use.
- Examples:
  - Narrative: "Waters shall be free from substances in concentrations or combinations that would adversely alter the structure and function of aquatic communities, as defined by the reference condition."
  - Numeric: Class I: Cool Water Aquatic Life,
    - Taxa Richness: 5
    - EPT Index: 3

https://www.epa.gov/wqc/biological-water-quality-criteria

Human Health Criteria

- Human health criteria protect humans from specific pollutants in both water and fish tissue that humans might ingest.
- Calculated to protect from effects of pollutants from ingestion of aquatic organisms ("org only") and for ingestion of water and organisms ("water + org").
- Expressed as a pollutant concentration based on:
  - Toxicological Assessment
  - Exposure Scenario

Nickel

Nutrients

pH

Zinc

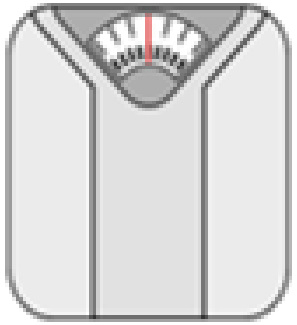
Nitrate

Methylmercury

Fluorene

https://www.epa.gov/wqc/national-recommended-water-quality-criteria-human-health-criteria-table

Human Health Criteria Calculation

$$= \frac{\text{Toxicity factors} \times \text{  }}{\text{  } + \left(\text{  } \times \text{Bioaccumulation factors} \right)}$$

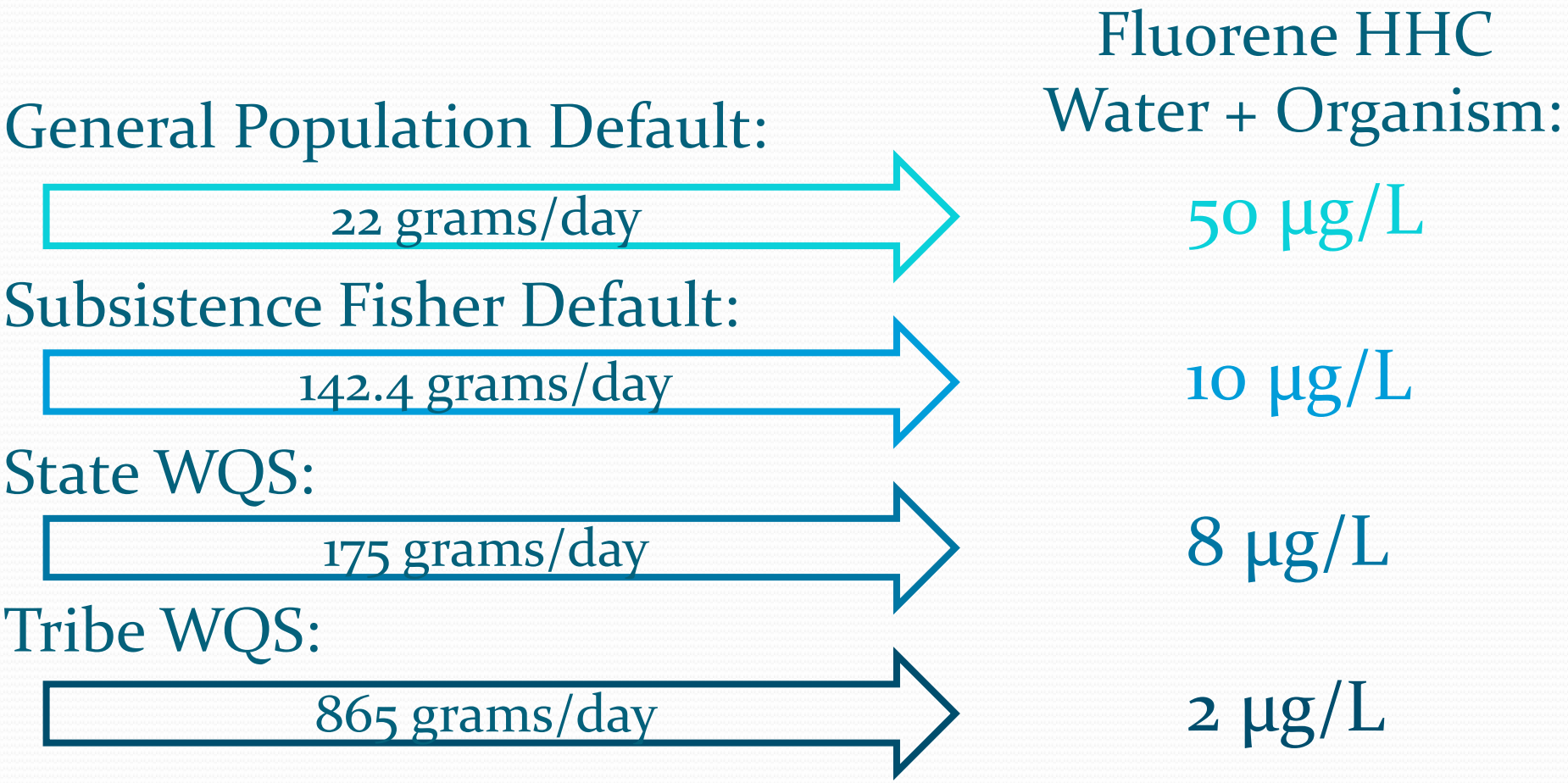
Human Health Criteria: Fish Consumption

Fish Consumption Rate

- National default for general population: 22 grams per day
- Default for subsistence fishers: 142.4 grams per day
- State WQS: 175 grams per day
- Tribe WQS: 865 grams per day

Photo: Lac du Flambeau Band of Lake Superior Chippewa Indians of the Lac du Flambeau Reservation of Wisconsin

Human Health Criteria Example

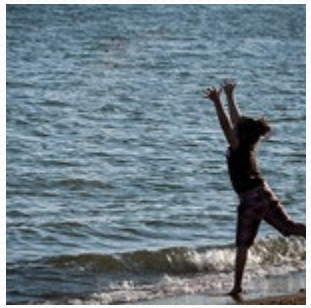


https://www.epa.gov/wqs-tech/water-quality-standards-tools-tribes#tab4

Recreational Criteria

- Protect recreational designated uses (activities including swimming, bathing, surfing
- Designed to protect people from illnesses (including gastrointestinal, skin, eye, ear) due to exposure to fecal contamination in water, and kidney and liver damage due to exposure to certain cyanotoxins.
- For fecal contamination, EPA has published criteria recommendations based on epidemiological studies involving swimmers, looking at an association between water quality and illness.



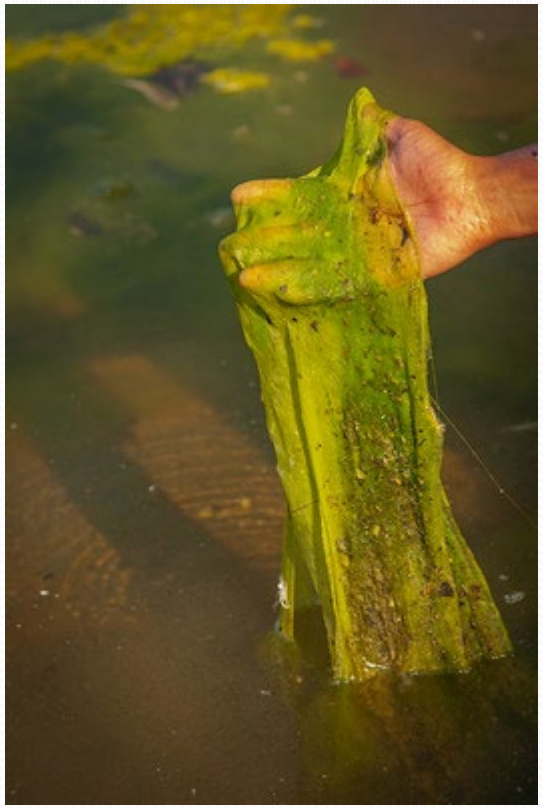

https://www.epa.gov/wqc/recreational-water-quality-criteria-and-methods

Recreational Criteria Example

- Fecal contamination:
  - Criteria expressed in terms of fecal indicator bacteria, for example: A 30-day *geometric mean* of 30 colony forming units (cfu) enterococci /100 mL water, not to be exceeded, and a *statistical threshold value* of 110 cfu/100 mL for marine waters may not be exceeded in more than 10% of samples in a 30-day interval.
- Microcystin Toxin:
  - Criteria expressed in terms of specific toxins, for example: The concentration of total microcystins shall not exceed 8 µg/L in more than three ten-day periods per recreational season, for more than one recreational season, over a 5-year period.

Nutrient Criteria

- Numeric or narrative limits that protect from the effects of eutrophication.
- Nutrient criteria are developed for different water body types using field data of nutrient concentrations (*stressors*) and different ecological effects symptomatic of eutrophication (*responses*).



https://www.epa.gov/nutrientpollution/technical-support-numeric-nutrient-water-quality-criteria-development

Water Quality Criteria Basics

- Each criterion has a specific focus and designated use application
- There are usually multiple criteria for each designated use
- Criteria work together to ensure that uses are protected
- The most protective criterion is the that needs to be met

https://www.epa.gov/wqs-tech/state-specific-water-quality-standards-effective-under-clean-water-act-cwa

Antidegradation

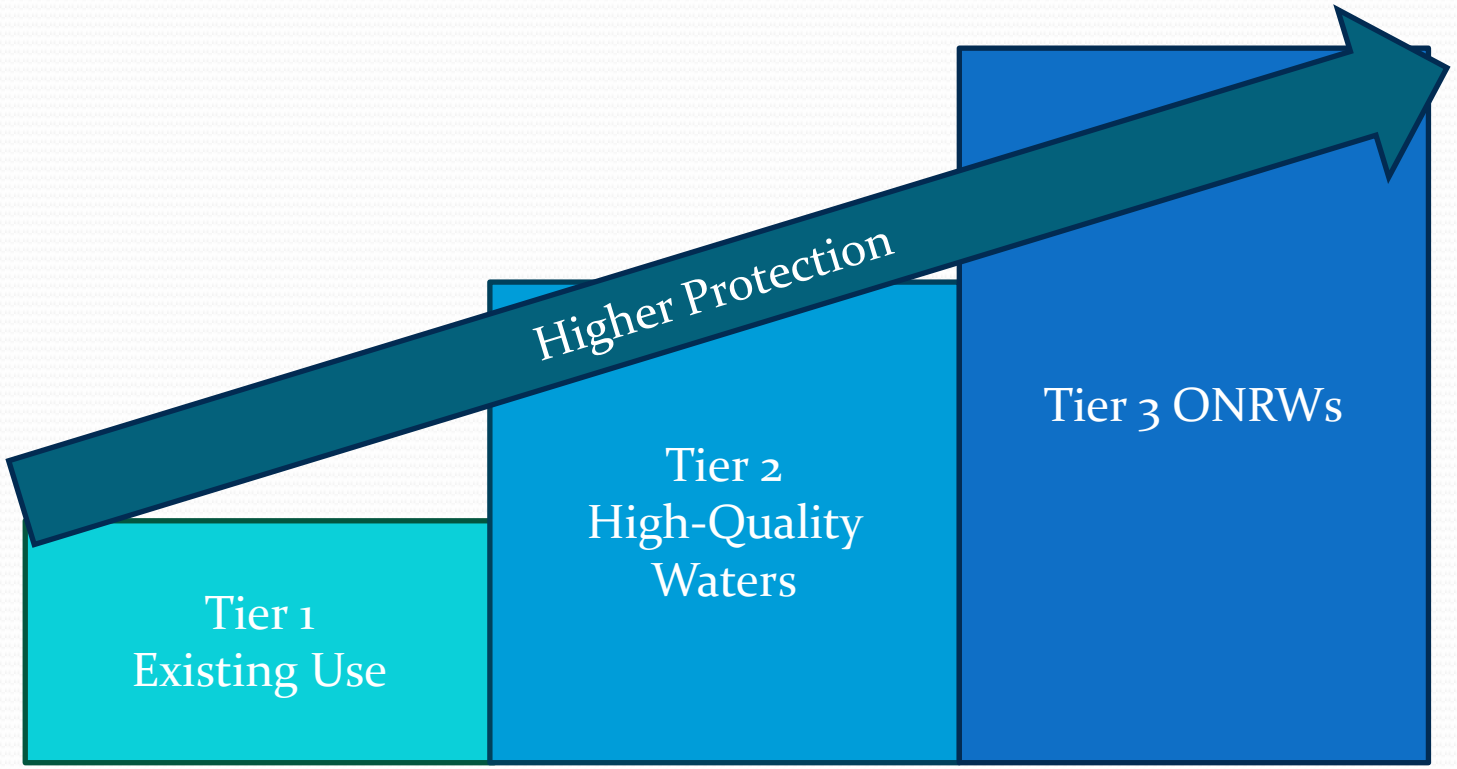
Antidegradation (40 CFR 131.12)

- **Policy:**
  - 40 CFR 131.12(a): *The State shall develop and adopt a statewide antidegradation policy*.
  - Antidegradation adds additional protections for waters above and beyond designated uses and criteria. The antidegradation policy provides the goals and framework of protection.
- **Implementation Methods:**
  - 40 CFR 131.12(b): *The State shall develop methods for implementing the antidegradation policy that are, at a minimum, consistent with the State's policy and with paragraph (a) of this section. The State shall provide an opportunity for public involvement during the development and any subsequent revisions of the implementation methods, and shall make the methods available to the public.*
  - The antidegradation implementation method describes how the state/tribe will implement the policy.

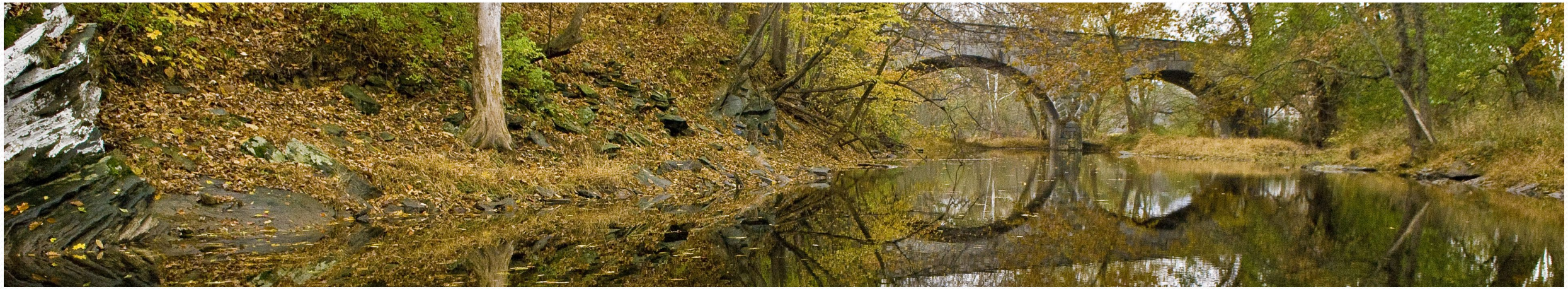
Antidegradation: Policy (40 CFR 131.12(a))

- Protection for **existing uses** for all waters of the U.S.;
- Protection for **high-quality waters** (water quality that exceeds the levels necessary to support protection and propagation of fish, shellfish and wildlife and recreation in and on the waters);
  - Identification of High-Quality Waters
  - Analysis of Alternatives
- Protection for identified **Outstanding National Resource Waters** (ONRWs)
- Compliance with CWA 316 regarding thermal discharges.

Three Tiers of Protection



Tier 1: Existing Uses



40 CFR 131.12(a)(1): *Existing instream water uses and the level of water quality necessary to protect the existing uses shall be maintained and protected.*

- This protection applies to all waters of the U.S.

Tier 2: High Quality Waters

40 CFR 131.12(a)(2): *Where the quality of the waters exceeds levels necessary to support the protection and propagation of fish, shellfish, and wildlife and recreation in and on the water, that quality shall be maintained and protected…*

- UNLESS after full review, intergovernmental coordination, and public review it is found that using some of that extra buffer is necessary to accommodate important economic or social development in the area in which the waters are located.
- Before allowing the degradation of water quality, there must be a Tier 2 Review, including analysis of alternatives, a socio-economic analysis, and public participation, to demonstrate these circumstances are met.
- Still must assure the highest statutory and regulatory requirements for all new and existing point sources and reasonable BMPs for nonpoint sources

Tier 3: Outstanding National Resource Waters

40 CFR 131.12(a)(3) *Where high quality waters constitute an outstanding National resource, such as waters of National and State parks and wildlife refuges and waters of exceptional recreational or ecological significance, that water quality shall be maintained and protected.*

- An authorized tribe can identify any water body as an ONRW.
- Waters that are viewed as pristine, highly valued waters (important to recreation or tourism), and/or waters of exceptional ecological significance (important, unique or sensitive ecologically).
- This is the most stringent protection. No degradation is allowed, except on a short term or temporary basis (weeks or months, not years).
- Some states have created a "Tier 2.5" category as a slightly less restrictive protection.

https://www.epa.gov/sites/default/files/2014-10/documents/handbook-chapter4.pdf

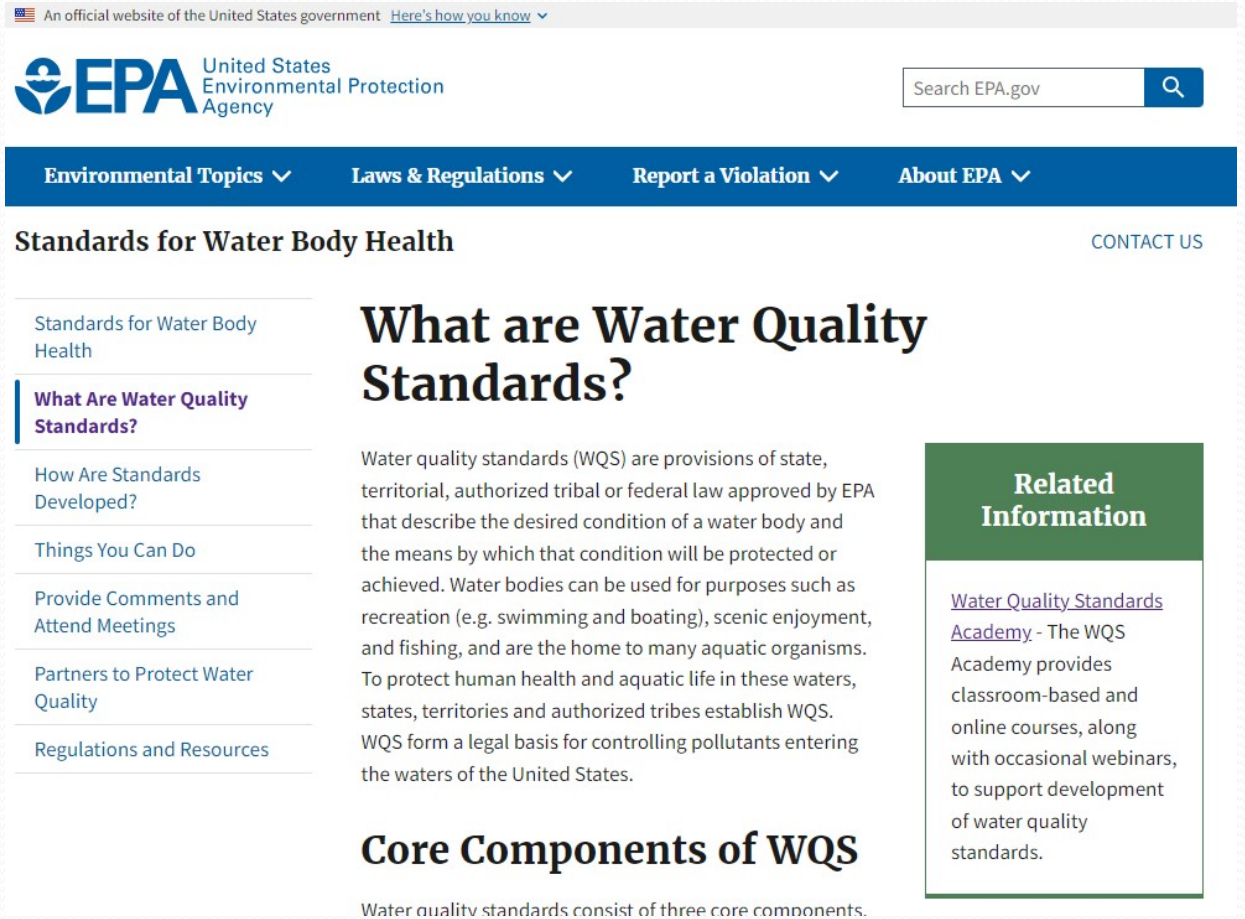
Antideg: Implementation (40 CFR 131.12(b))

- Implementation methods must describe how the policy will be applied
  - Must be consistent with and address all components of the state's/tribe's policy and EPA's regulation
    - 3 Tiers of Protection, Components of Tier 2 review, CWA 316 Compliance
  - State/tribe must provide an opportunity for public involvement during development and revisions of implementation methods
  - Must be publicly available
- In addition:
  - May provide additional details that explain how the state's/tribe's policy will be implemented.
  - Can be adopted as WQS provisions (binding), incorporated by reference (binding), or written as guidance documents (non-binding).

https://www.epa.gov/wqs-tech/water-quality-standards-tools-tribes

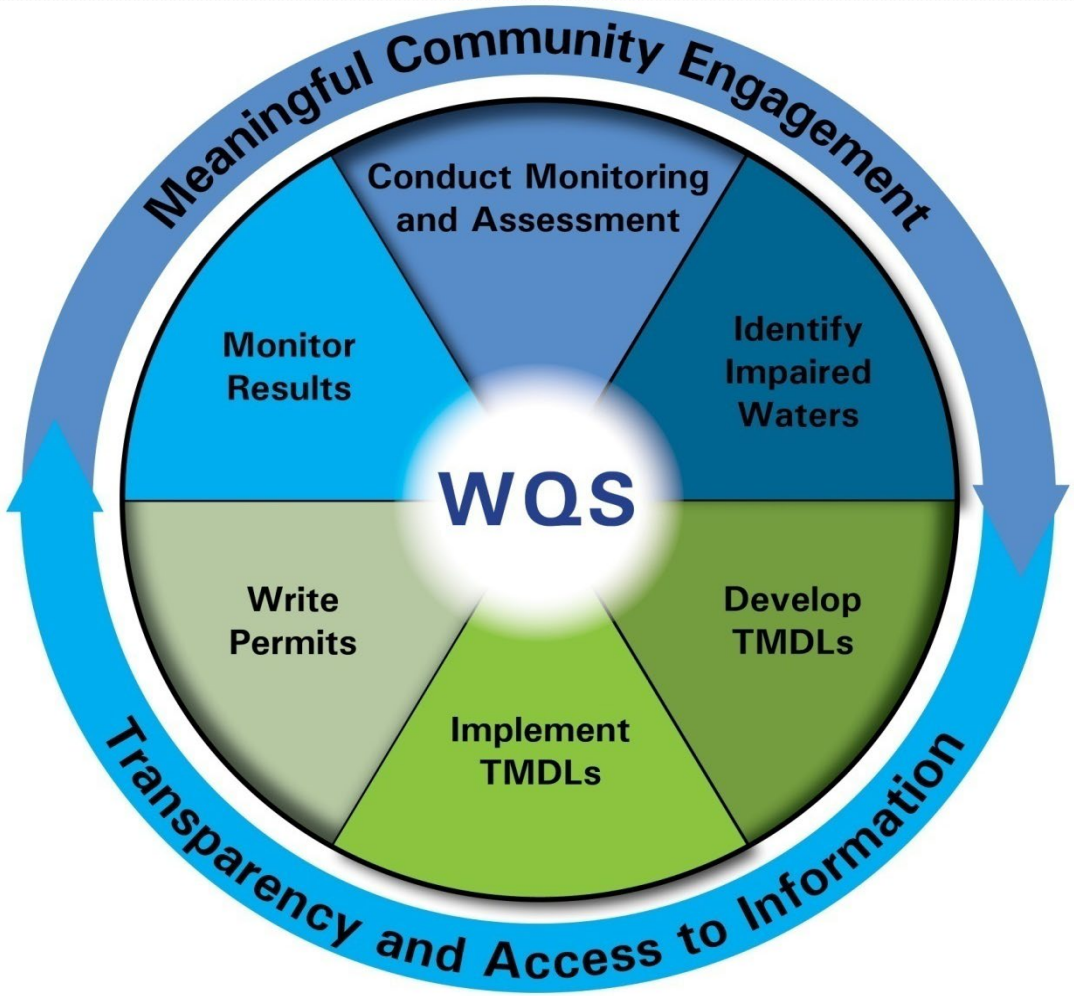
Summary: Components of WQS

- Designated uses
- Criteria
  - Magnitude
  - Duration
  - Frequency
- Antidegradation requirements

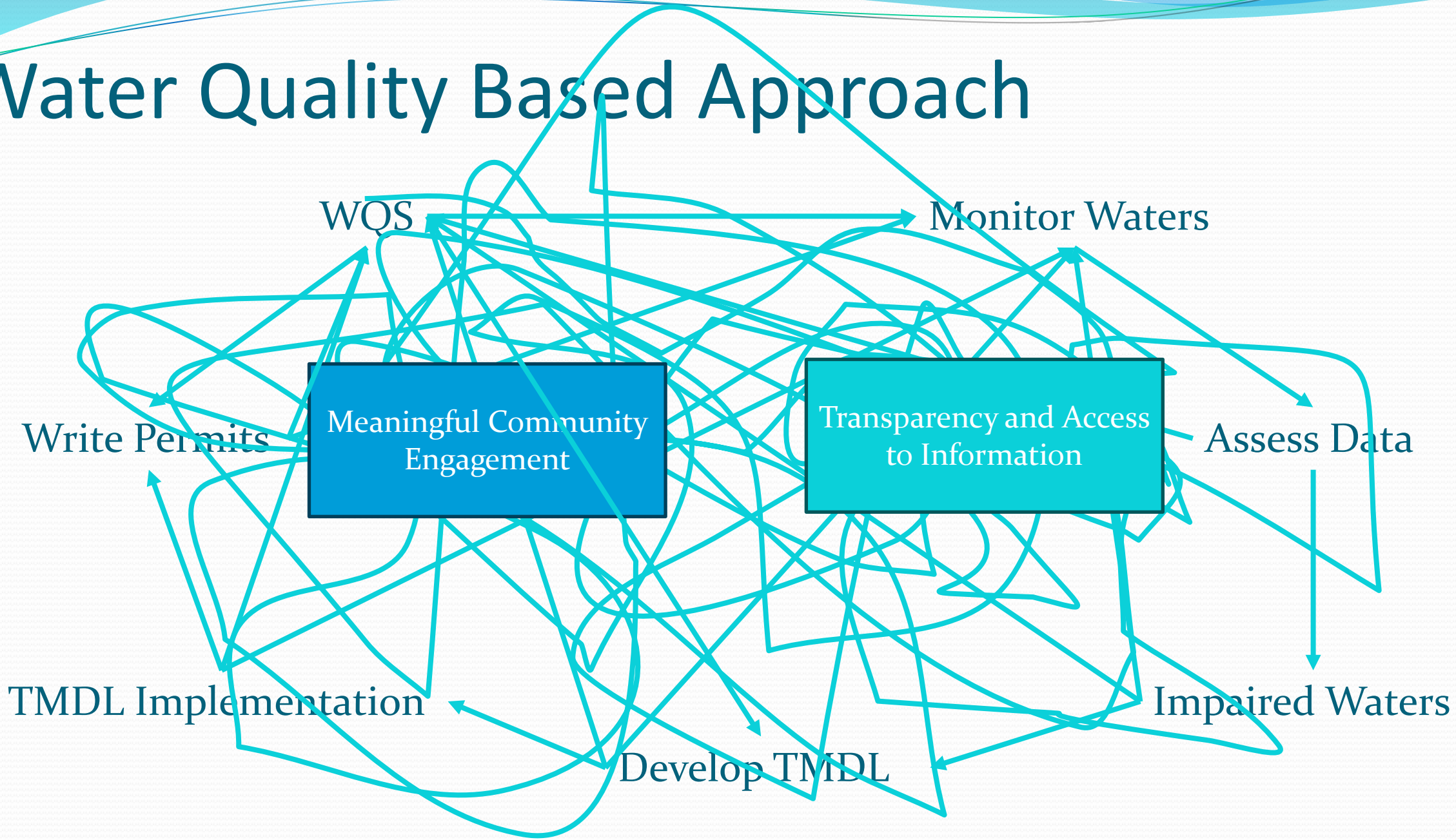


https://www.epa.gov/wqs-tech/what-are-water-quality-standards

Water Quality Based Approach



Water Quality Based Approach



Questions

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