



Water Quality Standards Regulation: Numeric Turbidity Criteria

Jutta Schneider
Virginia State Water Control Board Meeting
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Presentation Outline

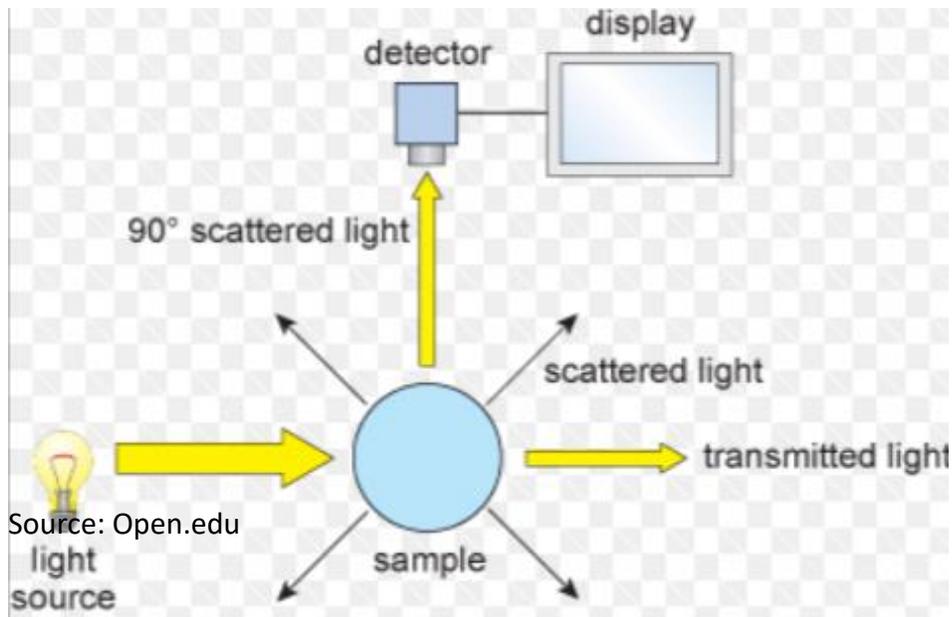
- Turbidity background and state of the science
- Water quality standards overview
- Numeric criteria development
- Overview of other states' turbidity criteria
- Virginia-specific information
- Summary

Presentation Outline

➤ Turbidity background and state of the science

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Turbidity Background and State of the Science



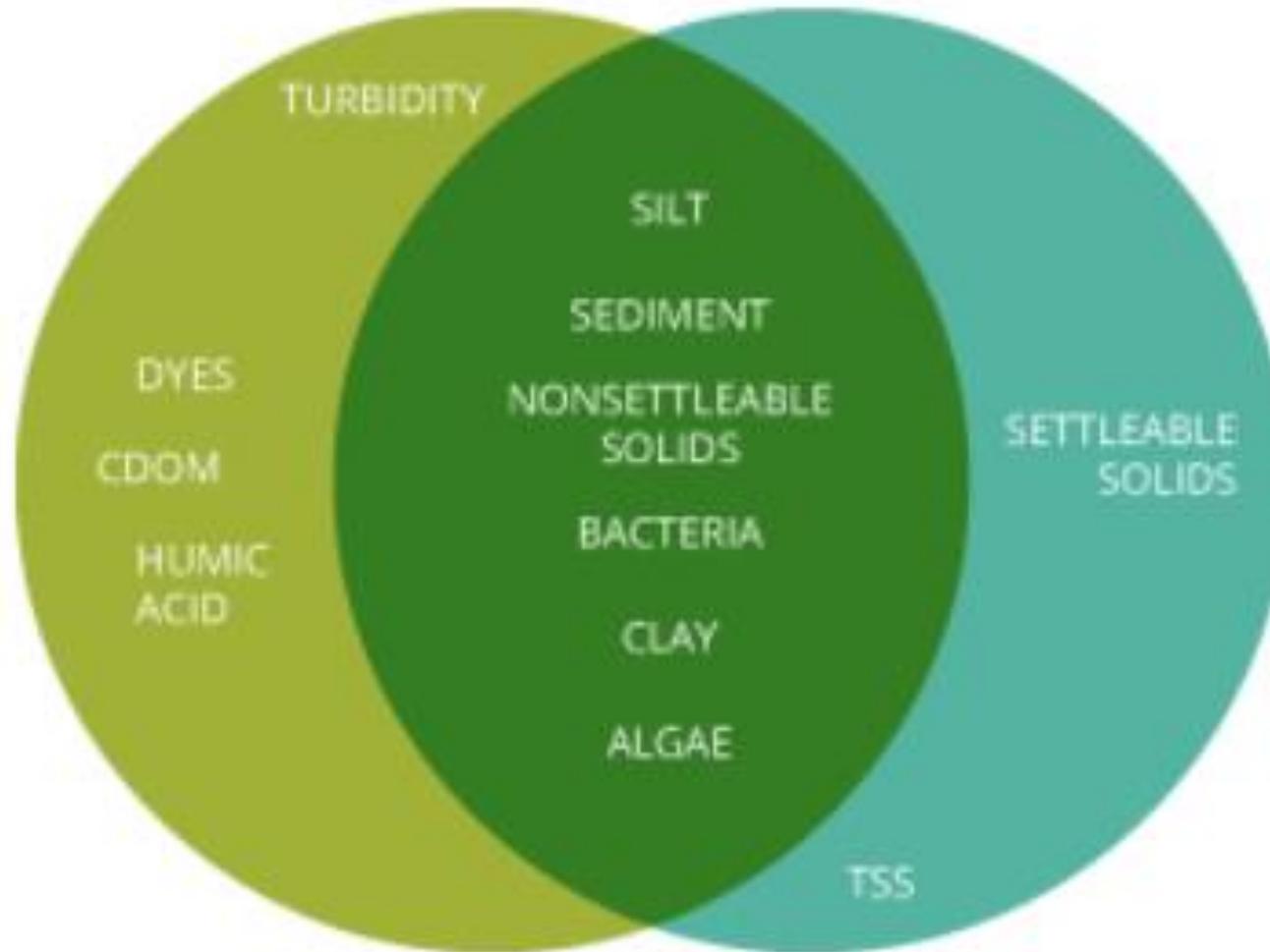
Turbidity (NTU)

Water Samples:



Source: Learn NC

Turbidity Background and State of the Science (cont.)



Source: Fondriest.com

Contact DEQ at 804-698-4470 or Kevin.Vaughan@DEQ.Virginia.gov if you have technical difficulties

Turbidity Background and State of the Science (cont.)

50 controlled field and laboratory studies were reviewed

- Most of the scientific literature is focused on how turbidity affects fish feeding and predator avoidance behavior, particularly of salmonids.
- Very few studies have been conducted on the effects of turbidity on invertebrates.
- Studies focused on lethal levels of turbidity are rare. The ones that have been performed have found lethal effects only at very high turbidity levels (greater than 3,000 NTU)
- Non-lethal effects of turbidity have been detected at a broad range of turbidity levels, from 1.5 NTU (reduced reactive distance to prey in salmonids) to 898 NTU (increased ventilation rate in a species of sunfish).

Turbidity Background and State of the Science (cont.)

Challenges to interpreting existing studies

- In the vast majority of studies, control subjects are those exposed to 0 NTU. “Significant effects” are based on responses in test subjects that are statistically different from controls. But the vast majority of Virginia’s surface waters always have some detectable turbidity.
- Most studies documenting behavioral responses do so without paired growth, reproduction, or survival data.
- Turbidity studies are highly variable in their design, complicating generalization.

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Water Quality Standards Overview

- Water Quality Standards (WQS) are provisions of state, territorial, authorized tribal or federal law that describe the designated uses of a water body and the means by which those uses will be protected or achieved.
- WQS must be based on sound scientific rationale and approved by EPA.
- WQS form the legal basis for controlling pollutants entering the waters of the US through two primary pathways: permit limits and controls aimed at protecting in-stream water quality, and biennial ambient water quality assessments.

Water Quality Standards Overview (cont.)

WQS have three components:

1. Designated uses

- Virginia's designated uses: aquatic life, wildlife, recreation, public water supply, shellfish consumption, fish consumption

2. Water Quality Criteria

- Narrative or numeric
- Protect specific designated uses

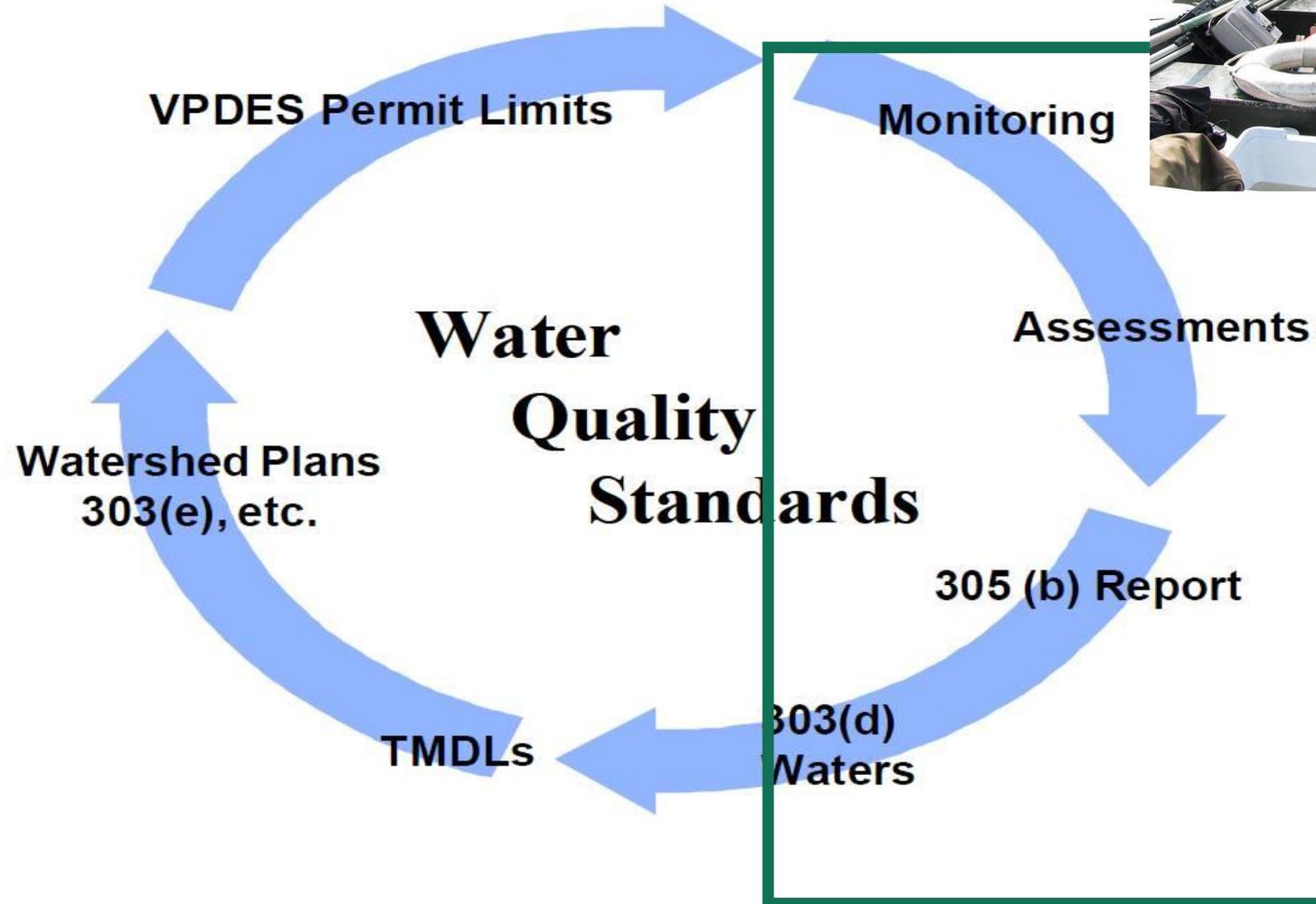
3. Anti-degradation policy

- Maintains current level of water quality, primarily through permit limits

Water Quality Standards Overview (cont.)

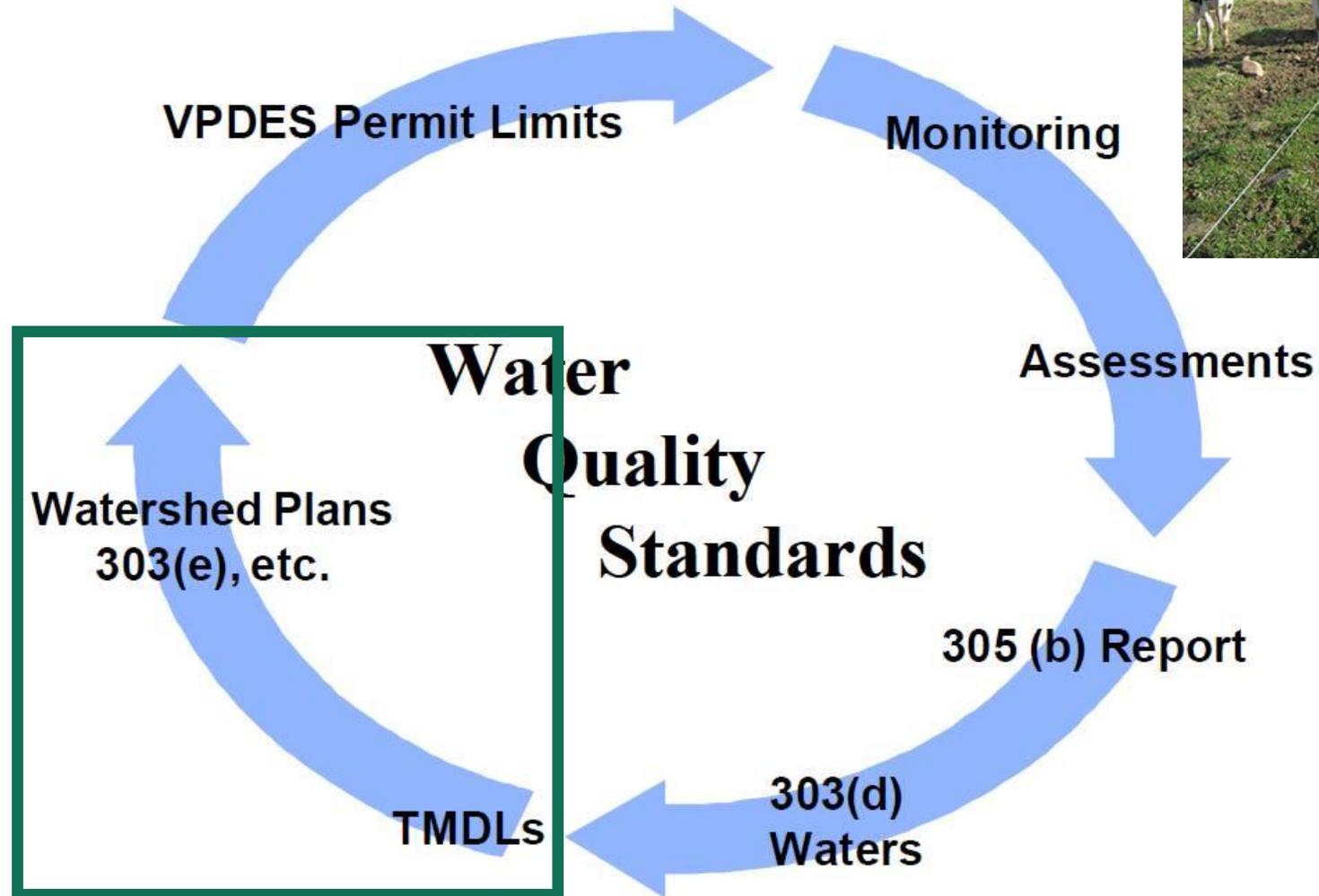


Water Quality Standards Overview (cont.)



WQS are the basis for biennial assessments of water bodies.

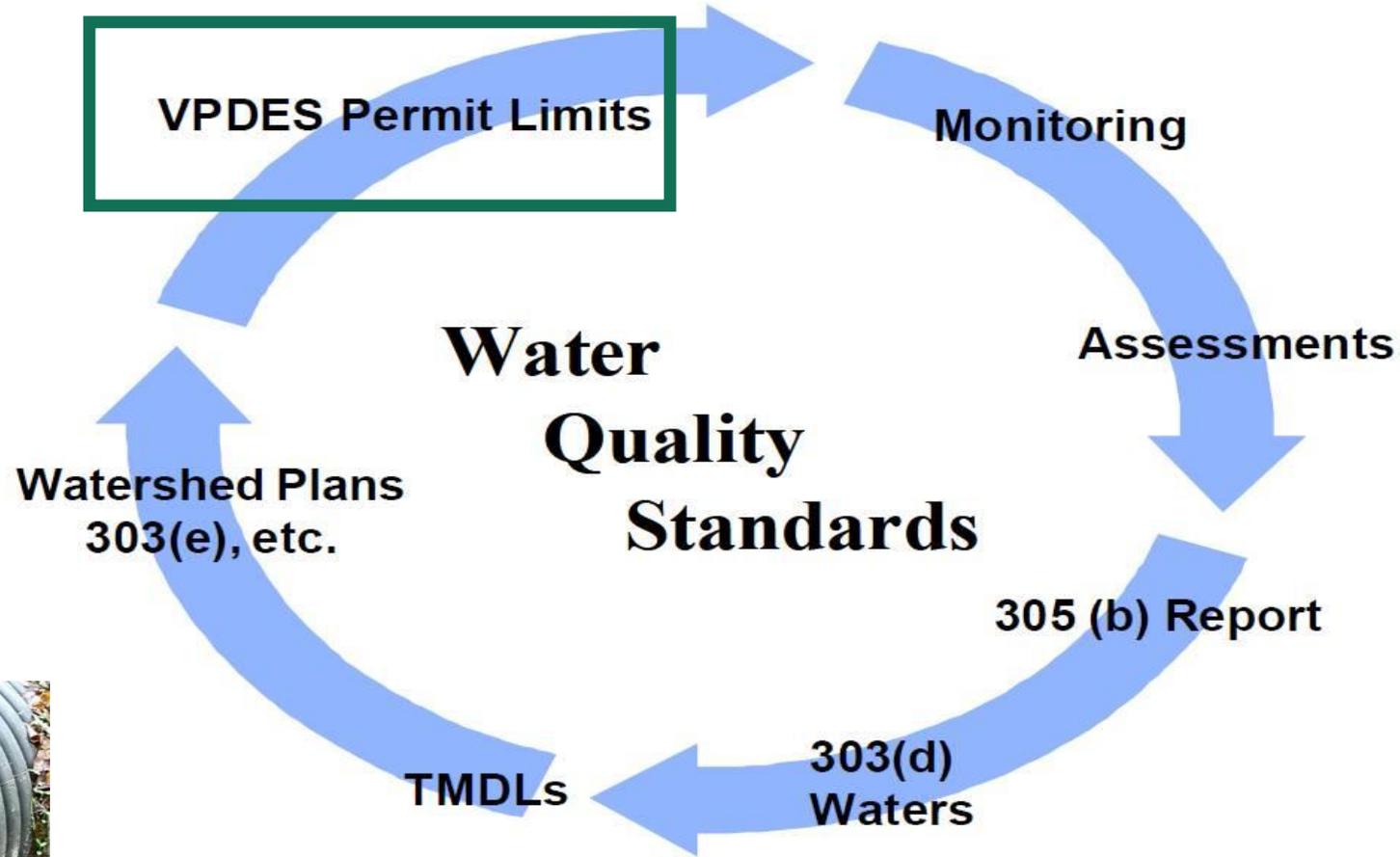
Water Quality Standards Overview (cont.)



WQS are used as targets for restoring impaired water bodies.

Water Quality Standards Overview (cont.)

WQS are used to set effluent permit limits.



Compliance and Enforcement

Compliance with WQS is supported in three ways:

1. Biennial evaluation of ambient water quality in accordance with the water quality assessment guidance manual
2. Compliance monitoring of water-quality based effluent limits or control requirements in permits
3. Through enforcement actions e.g. against 1) permitted dischargers in violation of their permits, or 2) unpermitted discharges or impacts based on measurable impacts on designated uses (aquatic life, human health) attributable to a specific discharger.

Narrative Water Quality Criteria

9VAC25-260-20. General Criteria.

- A. State waters, including wetlands, shall be free from substances attributable to sewage, industrial waste, or other waste in concentrations, amounts, or combinations which contravene established standards or interfere directly or indirectly with designated uses of such water or which are inimical or harmful to human, animal, plant, or aquatic life.

Specific substances to be controlled include, but are not limited to: floating debris, oil, scum, and other floating materials; toxic substances (including those which bioaccumulate); substances that produce color, tastes, turbidity, odors, or settle to form sludge deposits; and substances which nourish undesirable or nuisance aquatic plant life. Effluents which tend to raise the temperature of the receiving water will also be controlled. Conditions within mixing zones established according to 9VAC25-260-20 B do not violate the provisions of this subsection.

Narrative Water Quality Criteria (cont.)

Can be used to assess water quality impacts by developing translators that assess direct impacts on designated uses, for example:

- Biological indices (Virginia Stream Condition Index, Coastal Plain Macroinvertebrate Index)
- Fish consumption advisories
- Shellfish harvesting closures
- Beach closures
- Sediment deposits on stream bottoms or in wetlands
- Whole effluent toxicity testing



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Numeric Water Quality Criteria Development

- Represent limits or ranges of physical, chemical, or radiological concentrations that are permitted in a water body based on certain risk levels to protect designated uses.
- Developed using well-established scientific methodologies such as:
 - laboratory testing,
 - risk assessments,
 - literature surveys, and
 - peer review.
- Any water quality criteria submitted to EPA for approval must be based on sound science.

Numeric Water Quality Criteria Development (cont.)

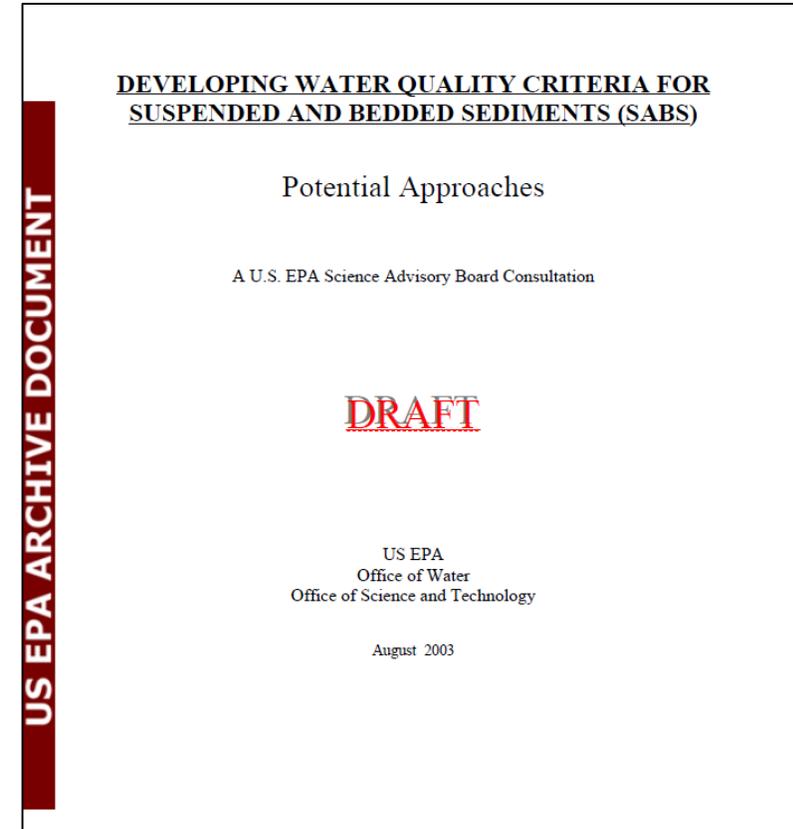
- Harmful effects are predicted to occur when criteria are exceeded.
 - Mortality or reduced growth/reproduction (aquatic life and wildlife)
 - Illness in humans
- Acute criteria protect against the rapidly occurring effects of elevated pollutant concentrations (mortality).
- Chronic criteria protect against effects that occur over a longer period of time (non-lethal effects).
- For aquatic life, these established methods describe an objective way to estimate the highest concentration of a substance in water that will not present a significant risk to the aquatic organisms in the water.

Numeric Water Quality Criteria Development (cont.)

- EPA has developed national recommendations for numeric criteria to protect designated uses, main focus has been on protecting human health and aquatic life.
- Typically, Virginia adopts EPA's numeric criteria, relying on EPA's scientific process and analyses to support its rulemaking.

EPA Effort to Develop National Recommendations for Turbidity and Related Criteria

- No specific national recommendation for turbidity or other sediment-related parameters published, except for an 1986 EPA recommendation for solids and turbidity based on 10% light reduction with depth.



<https://archive.epa.gov/epa/sites/production/files/2015-10/documents/sediment-report.pdf>

EPA Effort to Develop National Recommendations for Turbidity and Related Criteria (cont.)

Challenges identified for developing national recommendations:

- Need for site-specificity due to climate, geology, water body size and type, and aquatic assemblages present.
- No clear methodology for non-toxic parameters.
- Background/natural levels should be accounted for.
- Lack of stressor-response data.
- Consistent implementation across different water quality programs.

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Overview of Other States' Turbidity Criteria

- Almost all states have narrative criteria that stipulate the control of substances causing turbidity which interfere with designated uses.
- About 60% of jurisdictions have numeric turbidity criteria.
- The majority of numeric turbidity criteria are expressed as a value or percentage above background turbidity.
- A few states use TSS in place of turbidity (AZ, MN).

Overview of Other States' Turbidity Criteria (cont.)

- For numeric turbidity criteria expressed as an instantaneous maximum, values range from 10 to 150 NTUs.
- Most jurisdictions have general numeric turbidity criteria. Some have varying criteria for different designated uses, waterbody types, or river basins. Some have seasonal criteria.
- Some jurisdictions have either replaced numeric turbidity criteria with total suspended solids criteria or use TSS as a surrogate for permit limits.

Overview of Other States' Turbidity Criteria (cont.)

- Construction Permit Performance Requirements
 - Few states have numeric turbidity limitations that are imposed in construction stormwater permits and instead rely on narrative statements regarding numeric action levels/targets, BMPs, stormwater pollution prevention plans, compliance inspections, and, when necessary, enforcement actions.
 - Frequently seen is language in construction general permits: *“prohibit any discharge not in compliance with water quality standards”*.

Example: Maryland

- Criteria –
- “(5) *Turbidity.*
- (a) *Turbidity may not exceed levels detrimental to aquatic life.*
- (b) *Turbidity in the surface water resulting from any discharge may not exceed 150 units at any time or 50 units as a monthly average. Units shall be measured in Nephelometer Turbidity Units.”*
- No numeric turbidity limits in construction stormwater permits
- Water quality assessments based on biological assessments, not turbidity

Example: Delaware

- Criteria –
- *“4.5.5 Turbidity Measured as Nephelometric or Formazin Turbidity Units, in all waters of the State shall not exceed natural levels by more than 10 units.”*
- No numeric turbidity limits in construction stormwater permits
- Not used in water quality assessments

Example: West Virginia

- Criteria –
- *“8.33 Turbidity No point or non-point source to West Virginia's waters shall contribute a net load of suspended matter such that the turbidity exceeds 10 NTU's over background turbidity when the background is 50 NTU or less, or have more than a 10% increase in turbidity (plus 10 NTU minimum) when the background turbidity is more than 50 NTUs. This limitation shall apply to all earth disturbance activities and shall be determined by measuring stream quality directly above and below the area where drainage from such activity enters the affected stream. Any earth disturbing activity continuously or intermittently carried on by the same or associated persons on the same stream or tributary segment shall be allowed a single net loading increase.*
- *Applicability*
- *8.33.1 This rule shall not apply to those activities at which Best Management Practices in accordance with the State's adopted 208 Water Quality Management Plan are being utilized, maintained and completed on a site-specific basis as determined by the appropriate 208 cooperative or an approved Federal or State Surface Mining Permit is in effect. This exemption shall not apply to Trout Waters.”*
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Virginia-Specific Information - Water Quality Controls

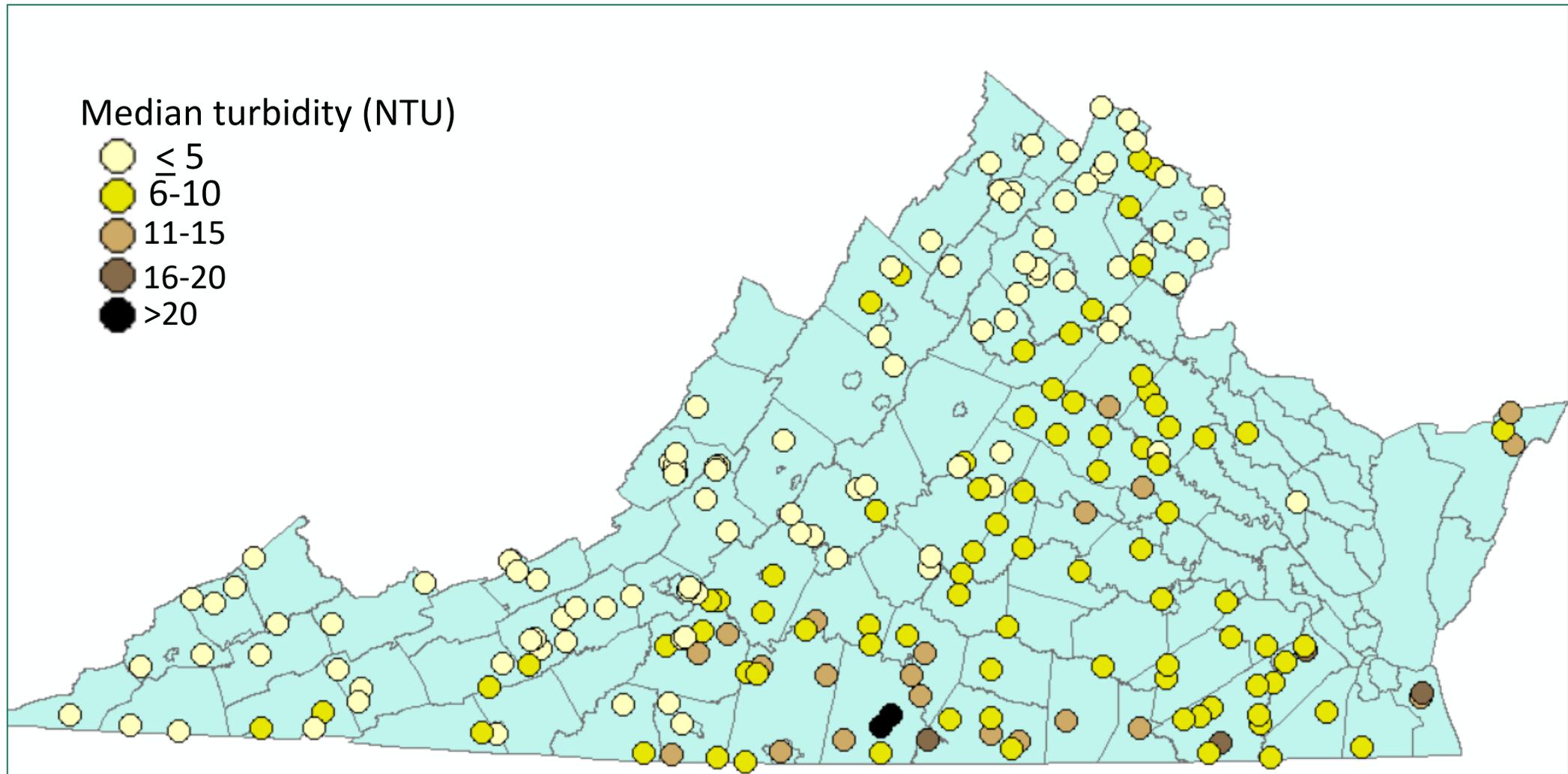
Permitting

- VA Pollution Discharge Elimination System Permit Program
- VA Water Protection Permit Program
- VA Erosion and Sediment (E&S) Control Program
- VA Stormwater Management Program (VSMP)

Monitoring, Assessment & Total Maximum Daily Load (TMDL)

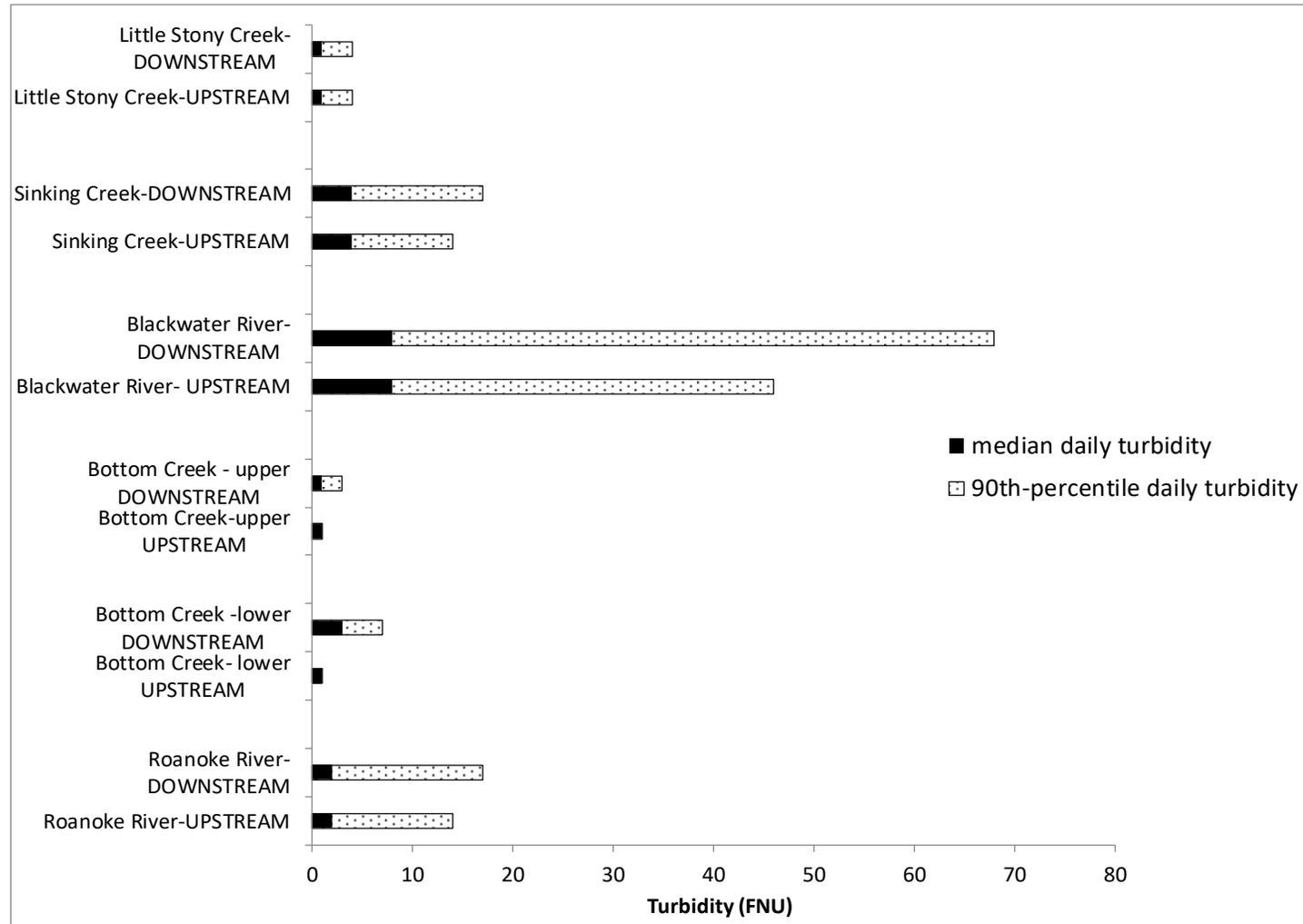
- VA Water Quality Monitoring and Assessment Program
- VA TMDL and Implementation Program

Virginia-Specific Information - Turbidity Data (Riverine Long-Term Monitoring Stations 2000 – 2018)



Virginia-Specific Information – Turbidity Data (cont.)

Provisional turbidity estimates from USGS continuous monitoring stations downstream and upstream of the Mountain Valley Pipeline stream crossings during the period fall 2017 to September 2020



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