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Water Quality Trading on a Watershed Scale

Executive Summary

The Environmental Protection Agency's (EPA's) 2019 memorandum *Updating the Environmental Protection Agency's Water Quality Trading Policy to Promote Market-Based Mechanisms for Improving Water Quality* identifies six broad market-based principles that, if implemented, will help modernize and promote the development of environmental markets. The first of those principles is that "states, tribes, and stakeholders should consider implementing water quality trading and other market-based programs on a watershed scale." This principle is consistent with the Clean Water Act Section 319 directive to states to develop nonpoint source pollution management programs on a watershed-by-watershed basis.

Establishing an appropriately defined trading area is necessary to provide a viable trading market and to ensure that targeted water quality concerns are addressed throughout the trading area. EPA recommends that the scale of a market-based water quality improvement program, including water quality trading, be informed by the hydrology and ecology of the watershed in conjunction with the effects and the extent of the pollutants of concern. As with any market-based program, in order to ensure market viability, the existence of sufficient supply and demand for credits should be considered when determining the trading area. Working within a larger geographic area may facilitate greater market opportunities and participation, resulting in larger scale resource improvements over time.

This paper describes three factors that trading program managers may want to consider when evaluating the appropriate scale for a trading area:

1. **Water quality goals, connectivity and pollutant processing.** Factors including pollutant source locations and types, pollutant fate and transport, and ecological and hydrologic characteristics of the watershed all influence the extent of downstream pollution. Connectivity between pollutant sources and areas of impact coupled with the magnitude and rate at which pollutants are processed along such flow paths (that is, a pollutant's ability to flow from a source into a waterbody of concern and to downstream waters and how it might change along that path) are important in determining the scale of a trading area.
2. **Relevant statutory, regulatory, and policy information.** Regulations, policy, or guidance established by states, tribes, or local jurisdictions might affect the scale of a trading area. Consistent or complementary policies across jurisdictions can promote larger scale market opportunities.
3. **Availability of data and modeling.** The amount, type, representativeness, and quality of data available to support analyses and modeling are other factors to consider in establishing a trading area. Overall, the existence of data across a larger watershed, including modeling and analysis of pollutant sources and fate and transport, may support water quality trading at a larger scale.

Establishing boundaries for market-based programs, including water quality trading, should be based on careful consideration of all available geographic, water quality, hydrologic, and other data as well as analyses that demonstrate source impacts and predicted improvements through trading. Adjustments to the watershed scale may be appropriate over time if a trading programs grows, additional data are

collected, relevant regulations or policies are aligned, additional factors are considered, or if states, tribes or stakeholders refine water quality goals.

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Introduction

On February 6, 2019, EPA issued *Updating the Environmental Protection Agency's (EPA) Water Quality Trading Policy to Promote Market-Based Mechanisms for Improving Water Quality* (the 2019 Memorandum) to modernize the Agency's approach to market-based programs. The 2019 Memorandum: i) reiterates EPA's strong support for water quality trading; ii) promotes the adoption of market-based programs to incentivize the implementation of technologies and practices to reduce nonpoint source pollution; iii) provides additional guidance and policy options to stakeholders for developing and implementing market-based programs; and, iv) promotes increased investment in conservation actions. To achieve these goals, the 2019 Memorandum identifies six market-based principles, the first of which is that "states, tribes, and stakeholders should consider implementing water quality trading and other market-based programs on a watershed scale." Elaborating on this principle, the 2019 Memorandum states:

- Focusing on a watershed boundary for planning and achieving water quality improvements is often more appropriate than using a municipal or jurisdictional boundary.
- Working within a larger geographic area may facilitate greater market opportunities and participation, resulting in larger scale resource improvements over time.
- EPA encourages states and tribes to work together to achieve resource improvements through interstate market-based programs and other collaborative approaches.

EPA recommends that boundaries for market-based programs, including water quality trading, be based on careful consideration of available and applicable geographic, water quality, hydrologic, and other data, as well as analyses to predict the water quality improvements that can be achieved within the target watershed.

Factors Affecting Trading Area Scale

Establishing an appropriately defined trading area is necessary to provide a viable trading market and to ensure that targeted water quality concerns are addressed throughout the trading area. This paper identifies three factors that EPA recommends trading program managers consider when evaluating the appropriate watershed scale for a trading area: i) water quality goals, connectivity and pollutant processing; ii) relevant regulations and policy; and, iii) availability of data and modeling. These factors need not be considered in the order presented and are not the only factors that influence the scale of trading programs.

Water Quality Goals, Connectivity and Pollutant Processing

- ✓ Identify water quality goals, including pollutants of concern and their sources, and waters targeted for improvement.
- ✓ Determine how upstream and downstream waters are connected using the best available maps and tools for the watershed of interest.
- ✓ Determine the upstream and downstream extent of impact for the pollutant of concern.
- ✓ Identify watershed features that may inform the trading area.

The size of a trading area should primarily be based on the water quality goals for the program. For example, what is the pollutant of concern; what water(s) are targeted for improvement; and what are the sources of the pollutant in the watershed of the targeted water(s)? Answering these questions can help identify the appropriate area or scale for a market-based program.

The connectivity of waters within a watershed can help answer those questions as well as provide context and support for evaluating pollutant reductions across the trading area. Connectivity has been described by EPA as "The degree to which components of a river system are joined, or connected, by various transport mechanisms; connectivity is determined by the characteristics of both the physical landscape and the biota of the specific system."[1] Within a watershed, at the downstream pour point, all upstream waters are connected and this connection can be used to establish a trading area. EPA has also acknowledged that ''Variation in the degree of connectivity is critical to the integrity and sustainability of downstream waters, and can be described in terms of the frequency, duration, magnitude, timing, and rate of change of fluxes to and biological exchanges with downstream waters. These descriptors characterize the range over which streams and wetlands vary and shift along connectivity gradients and the probable effects of different types (hydrologic, chemical, biological) and degrees of connectivity over time. . . . Ultimately, differences in the frequency, duration, magnitude, timing, and rate of change of physical, chemical, and biological connections describe different positions along the connectivity gradient and produce different types of downstream effects.''[2] The degree of connectivity within a potential trading area may also be considered in evaluating the goals for water quality improvements in the targeted waterbodies and how upstream and downstream actions to improve water quality, including the purchase and sale of credits or offsets upstream and downstream of particular discharges, can help achieve those goals.

The basic concept of water quality trading is that where disparities exist between and amongst dischargers in ease or cost of reducing pollutant loads, trading may create cost efficiencies for pollutant reductions that achieve the same or greater water quality benefit. Generally, pollutant discharges from credit buyers and pollutant reductions from credit sellers in a water quality trading program should address the same water quality problem in the same watershed or hydrologic system. For example, point and non-point source discharges of nutrients throughout the Mississippi River/Atchafalaya River Basin affect nutrient loading, and therefore the water quality, within the river and tributary system and downstream in the Gulf of Mexico. In choosing the trading area, EPA recommends considering the connectivity of the waterbody of interest with upstream waterbodies that contribute to a larger watershed as well as downstream waterbodies to which the pollutant travels.

Evaluating topography and other watershed characteristics can help identify conditions that influence the selection of the trading area. Hydrologic conditions, including stream flow and climatological conditions, can influence the persistence of a pollutant of concern and loading to a stream, and

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[1] U.S. EPA. *Connectivity of Streams and Wetlands to Downstream Waters: A Review and Synthesis of the Scientific Evidence* (Jan. 2015) (EPA/600/R–14/475F)

[2] *Id*.

therefore, can be evaluated in conjunction with pollutant source information, hydrologic features, and ambient water quality data to understand the potential extent of the downstream impact of pollutant sources.

Relevant Clean Water Act Provisions, Regulations, and Policies

- ✓ Identify relevant regulations or policies within a potential trading area.
- ✓ Evaluate potential differences in requirements across jurisdictions.

The regulatory environment plays an important role in trading program implementation. Trading activities within a watershed, no matter how large the watershed, should be consistent with applicable water quality standards, including a state's or tribe's antidegradation provisions. Establishing water quality trading programs at the watershed scale is consistent with the Clean Water Act directive to states to develop nonpoint source pollution management programs under section 319(b)(4) "on a watershed-by-watershed basis." In doing so, as permitted by state law, see Clean Water Act section 319(b)(2)(D), states should consider developing watershed based water quality trading programs as a best management practice or measure to reduce nonpoint source pollutant loadings to downstream waters in accordance with section 319(b)(2)(A). EPA recommends that states and authorized tribes consider using Clean Water Act section 319(h) grant funds to support water quality trading programs[3] and EPA may consider prioritizing nonpoint source grant funds to support state water quality trading programs as "innovative methods or practices for controlling nonpoint sources of pollution." See Clean Water Act section 319(h)(5)(B).

Evaluating applicable trading-related rules, policies, or guidance across the potential trading program area is important to ensure program-wide compatibility and workability. Existing regulations or policy statements need not dictate the appropriate trading boundaries for watershed-based trading, but they may inform the extent to which policy changes may be necessary before a cross-boundary trading program could be successfully implemented.

Political boundaries that divide a watershed might result in inconsistent regulations or different permitting authorities within the potential trading area. Consistent with the 2019 Memorandum, EPA encourages collaboration across jurisdictional boundaries and coordination of policies that facilitate development of interstate trading programs. In watersheds divided by political boundaries, EPA recommends that trading program managers consider regulatory or policy modifications where necessary to enhance compatibility within a larger trading area.[4]

Similarly, trading program managers and permitting authorities should consider whether a watershed-based permitting approach might be appropriate to synchronize permit issuance or effluent limitations across the watershed to facilitate trading program implementation on a larger scale. Developing a watershed-based permit across jurisdictions may be a more efficient approach to facilitate cross-boundary trading than coordinating trading policies or regulations across jurisdictions.

Availability of Data and Modeling

A clear understanding of the level of data and modeling tools available for a particular watershed can help inform the potential trading area. Useful information can include data used to develop Total

[3] U.S. EPA. *EPA Financing Available to Support Market-Based Water Quality Improvement*, September 30, 2020.
[4] This is consistent with Clean Water Act section 103, which directs EPA to encourage cooperative activities by the states, including the development of compacts between states, for the prevention, reduction and elimination of pollution.

Maximum Daily Loads (TMDLs), reasonable potential analyses for discharge permits, watershed plans, or other management or restoration analyses developed for a watershed.

The amount, type, representativeness, and quality of data available to characterize watershed conditions and support analyses and modeling can be helpful factors in establishing a trading area. However, the lack of certainty in a data set or modeling tool should not determine the size of a trading area. As noted in the 2019 memorandum *Updating the Environmental Protection Agency's Water Quality Trading Policy to Promote Market-Based Mechanisms for Improving Water Quality,* "Demanding too much precision in measuring or predicting pollutant reductions . . . can be an impediment to market-based programs."

Evaluating the geographic and temporal range of data will help to identify potential gaps in the understanding of water quality conditions. The level of detail in a model, both spatial and temporal, affects its utility in predicting watershed conditions and evaluating relationships among sources. An understanding of the spatial relationships and temporal dynamics of pollutant loadings, the relative impacts of contributions from different sources in the watershed, and the overall watershed conditions may help trading program managers select appropriate trading boundaries.

Gathering Data and Analyses

Water quality trading program managers should collect available data and results of relevant analyses when identifying trading area boundaries. Watershed and conservation organizations, local colleges and universities, and state and local natural resource agencies are potential sources for useful data. Watershed management plans or TMDLs developed in the relevant watershed may also provide or reference useful data and analyses. Table 1 provides a summary of potential data types and sources.

Table 1 – Potential Data Types, Uses and Sources

Data type	Typical uses	Sources
Watershed data		
Watershed boundaries	▪ Delineating geographic boundaries for evaluation and coordinating activities ▪ Defining scale for additional data collection	U.S. Geological Survey Elevation Derivatives for National Application (EDNA) database and interactive map: https://www.usgs.gov/land-resources/eros/edna
Hydrology	▪ Defining locations of waterbodies and tributaries ▪ Providing an understanding of how water flows through the watershed ▪ Defining flows at critical conditions (low and high flows) and variations in flow for water quality modeling	U.S. Geological Survey's National Water Information System web site (NWISWeb): https://waterdata.usgs.gov/nwis/
Topography	▪ Deriving slopes of stream segments and watershed areas for estimating fate and transport of pollutants and water quality modeling ▪ Evaluating altitude changes and the effect on projected precipitation for runoff characterization	U.S. Department of Agriculture's Natural Resources Conservation Service: https://www.nrcs.usda.gov/wps/portal/nrcs/main/national/ngce/elevation/
Soils	▪ Identifying areas with potentially high erosion rates and poor drainage for estimating fate and transport of pollutants	Natural Resources Conservation Service's State Soil Geographic Database (STATSGO2) and Soil Survey Geographic Database (SSURGO): https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/geo/?cid=nrcs142p2_053629 https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/geo/?cid=nrcs142p2_053627
Climate	▪ Correlating loading conditions and in-stream data (e.g., elevated in-stream concentrations during storm events) ▪ Providing data for wet-weather watershed modeling	National Center for Environmental Information (NCEI), maintained by the National Oceanic and Atmospheric Administration (NOAA): https://www.ncdc.noaa.gov/

Data type	Typical uses	Sources
Aquatic life and habitat	▪ Identifying areas that support aquatic life and areas that are impaired or are at risk of impairment ▪ Defining stressors that might contribute to impairment ▪ Identifying lack of shade or riparian cover ▪ Assessing the general health of the watershed through biological criteria and biological assessments ▪ Identifying potential habitat protection areas	U.S. Geological Survey National Water-Quality Assessment (NAWQA) Program's ecological studies: https://www.usgs.gov/mission-areas/water-resources/science/national-water-quality-assessment-nawqa?qt-science_center_objects=0#qt-science_center_objects https://www.usgs.gov/mission-areas/water-resources/science/stream-ecology?qt-science_center_objects=0#qt-science_center_objects/ State water quality agency information: https://www.epa.gov/npdes/npdes-state-program-authority https://www.epa.gov/npdes/contact-us-general-information-about-npdes https://www.epa.gov/wqs-tech/state-specific-water-quality-standards-effective-under-clean-water-act-cwa#tb1https://ofmpub.epa.gov/waters10/attains_index.home https://catalog.data.gov/dataset/epa-office-of-water-ow-305b-waters-as-assessed-by-assessed-uses https://www.epa.gov/tmdl Watershed organizations
Wildlife	▪ Identifying wildlife species for special protection ▪ Identifying potential sources of bacteria and nutrients	State or local wildlife agencies: https://www.fws.gov/offices/statelinks.html
Land use and land cover	▪ Identifying potential point and nonpoint sources (e.g., land use, impervious surfaces) ▪ Simulating loadings in watershed water quality models	Multi-Resolution Land Characteristics (MRLC) Consortium: https://www.mrlc.gov/
Demographics	▪ Current development characterization and projected growth ▪ Identifying potential environmental justice concerns	U.S. Census Bureau: https://www.census.gov/ Local planning agencies
Water quality standards	▪ Identifying water quality standards that apply to waterbodies and waterbody segments in the watershed ▪ Identifying state implementation policies (e.g., mixing zones)	State water quality agency information: https://www.epa.gov/wqs-tech/state-specific-water-quality-standards-effective-under-clean-water-act-cwa

Data type	Typical uses	Sources
Water quality assessments and impaired waters	▪ Determining the condition and the water quality status of water bodies (e.g., impaired, threatened, attaining standards) ▪ Identifying potential causes and sources of impairment	Water Quality Portal: https://www.waterqualitydata.us/portal/ State water quality agency information: https://ofmpub.epa.gov/waters10/attains_index.home https://catalog.data.gov/dataset/epa-office-of-water-ow-305b-waters-as-assessed-by-assessed-uses https://www.epa.gov/tmdl
TMDLs	▪ Identifying waterbody impairments, sources, pollutant loads, and reductions needed for attainment	State water quality agency information: https://ofmpub.epa.gov/waters10/attains_index.home https://catalog.data.gov/dataset/epa-office-of-water-ow-305b-waters-as-assessed-by-assessed-uses https://www.epa.gov/tmdl EPA Regional offices: https://www.epa.gov/tmdl/forms/contact-us-about-impaired-waters-and-tmdls
Source Water Protection Plans	▪ Identifying source waters areas for special protection	State water quality agency information: https://www.epa.gov/sourcewaterprotection/source-water-assessments State departments of health State source water protection contacts: https://www.epa.gov/sourcewaterprotection https://www.asdwa.org/sourcewatercontacts/

Data type	Typical uses	Sources
Source Data		
Point sources	▪ Locating point sources within the watershed ▪ Identifying existing permit conditions for point sources ▪ Characterizing point sources and point source pollutant loadings ▪ Establishing the relationships (e.g., geographic, water quality impact) between point sources and among point and nonpoint sources in the watershed (e.g., for trading)	EPA's Permit Compliance System (PCS) and Integrated Compliance Information System: https://www.epa.gov/enviro/pcs-icis-search State water quality agency information: https://www.epa.gov/npdes-permits https://www.epa.gov/enviro/pcs-icis-search https://www.epa.gov/npdes/contact-us-general-information-about-npdes/ eNOI registrations (for states where EPA is the NPDES authority): https://19january2017snapshot.epa.gov/npdes/electronic-notice-intent-enoi_.html
Nonpoint sources	▪ Identifying types or categories of nonpoint sources ▪ Identifying locations of specific nonpoint sources ▪ Identifying existing nonpoint source management measures ▪ Characterizing nonpoint sources and nonpoint source pollutant loadings ▪ Establishing the relationships (e.g., geographic, water quality impact) among nonpoint sources and between nonpoint and point sources in the watershed (e.g., for trading)	U.S. Department of Agriculture's Census of Agriculture (livestock and cropland) MRLC (land use categories) Natural Resources Conservation Service Local conservation districts Watershed organizations U.S. Census Bureau (septic tank use): https://www.census.gov/data/tables/time-series/dec/coh-sewage.html National Small Flows Clearinghouse (failing septic systems in the nation by county): https://www.nesc.wvu.edu/about-actat/national-small-flows-clearinghouse Bureau of Land Management (silviculture services)