6560-50-P

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 131

[EPA-HQ-OW-2023-0222; FRL 10760-02-OW]

RIN 2040-AG30

Water Quality Standards to Protect Aquatic Life in the Delaware River

AGENCY: Environmental Protection Agency (EPA).

ACTION: Final rule.

SUMMARY: The U.S. Environmental Protection Agency (EPA) is finalizing revised water quality standards (WQS) largely as proposed for certain water quality management zones of the mainstem Delaware River under the Clean Water Act (CWA). Specifically, the EPA is promulgating a designated use of protection and propagation of resident and migratory aquatic

life and corresponding dissolved oxygen water quality criteria for the mainstem Delaware River in Zone 3, Zone 4, and the upper portion of Zone 5 (in total, river miles 108.4 to 70.0).

DATES: This final rule is effective on **[INSERT DATE 60 DAYS AFTER DATE OF PUBLICATION IN THE FEDERAL REGISTER]**.

ADDRESSES: The EPA has established a docket for this action under Docket ID No. EPA-HQ-OW-2023-0222. All documents in the docket are listed on the *https://www.regulations.gov* website. Although listed in the index, some information is not publicly available, e.g., Confidential Business Information or other information whose disclosure is restricted by statute. Certain other material, such as copyrighted material, is not placed on the internet and will be publicly available only in hard copy form. Publicly available docket materials are available electronically through *https://www.regulations.gov*.

FOR FURTHER INFORMATION CONTACT: Hannah Lesch, Office of Water, Standards and Health Protection Division (4305T), Environmental Protection Agency, 1200 Pennsylvania Avenue NW, Washington, DC 20460; telephone number: (202) 566-1224; email address: *Lesch.Hannah@epa.gov*.

SUPPLEMENTARY INFORMATION:

The information in this preamble is organized as follows:

I. General Information

A. Does this Action Apply to Me?

Table 1 of this preamble identifies a range of individuals and entities that could be indirectly affected by this final rule. For example, entities that discharge pollutants to certain waters under the jurisdiction of the States of Delaware, New Jersey, and Pennsylvania — such as industrial facilities and municipalities that manage stormwater, separate sanitary, or combined sewer systems — could be indirectly affected by this rule because the Federal WQS promulgated by the EPA in this rule are applicable WQS for these waters for CWA purposes. Specifically, these Federal WQS are the applicable standards that must be used in CWA regulatory programs, such as permitting under the National Pollutant Discharge Elimination System (NPDES) under CWA section 402[1] and identifying impaired waters under CWA section 303(d). In addition, individuals and entities who rely on or benefit from aquatic life in these waters may be indirectly affected.

Table 1—Entities Potentially Indirectly Affected by this Rule.

Category	Examples of Potentially Indirectly Affected Entities
Industry	Industrial point sources discharging to certain waters in Delaware, New Jersey, and Pennsylvania. Commercial fishing operations that harvest fish.
Municipalities, including those with stormwater or combined sewer system outfalls	Publicly owned treatment works or similar facilities responsible for managing stormwater, separate sanitary, or combined sewer systems that discharge to certain waters in Delaware, New Jersey, and Pennsylvania.
Recreation and Tourism	Anglers and tourists seeking recreational opportunities related to aquatic life in certain waters in Delaware, New Jersey, and Pennsylvania.

This table is not intended to be exhaustive, but rather provides a guide for readers regarding entities that could be indirectly affected by this action. If you have questions regarding the applicability of this action to a particular entity, consult the person listed in the **FOR FURTHER INFORMATION CONTACT** section above.

B. How Did the EPA Develop this Final Rule?

[1] Before any water quality-based effluent limit could be included in an NPDES permit, the permitting authority (here, the states of Delaware, New Jersey, and Pennsylvania), must first determine whether a discharge "will cause or has the reasonable potential to cause, or contribute to an excursion above any WQS." 40 CFR 122.44(d)(1)(i) and(ii).

In developing this final rule, the EPA carefully considered the public comments and input received from interested parties. The EPA provided a 60-day public comment period after publishing the proposed rulemaking in the *Federal Register* on December 21, 2023.[2] In addition, the EPA held two online public hearings on February 6 and 7, 2024, to discuss the contents of the proposed rulemaking and accept verbal public comments.

The EPA received approximately 4,800 total comments on a range of issues. Most commenters were supportive of the EPA's proposal to revise WQS in the Delaware River. Some commenters expressed concerns regarding potential implementation costs and the potential cost to water utility ratepayers. Other commenters focused on aspects of the methods the EPA used to derive the dissolved oxygen criteria and the stringency of the proposed criteria. In this preamble, the EPA explains how it responded to certain comments received on aspects of the proposal. A complete record of the comments received and the EPA's responses is available in the associated response to comments document in the official public docket.[3]

II. Background

A. Statutory and Regulatory Authority

CWA section 101(a)(2) establishes a national goal of "water quality which provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water" (hereafter, collectively referred to as "101(a)(2) uses" or "101(a)(2) goals"), wherever attainable.[4] CWA section 303(c)(2)(A) provides that WQS must protect the public

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[2] United States Environmental Protection Agency. Proposed Rule: Water Quality Standards to Protect Aquatic Life in the Delaware River. 88 FR 88315, December 21, 2023.

[3] A complete record of the comments received and the EPA's responses is available in the associated Response to Comments document in the official public docket (regulations.gov, docket ID EPA-HQ-OW-2023-0222).

[4] 33 U.S.C. 1251(a)(2); *see also* 40 CFR 131.2.

health or welfare, enhance water quality, and serve the purposes of the CWA, taking into consideration the use and value of water for the propagation of fish and wildlife.[5] The EPA's regulation at 40 CFR 131.10 implements these statutory provisions.

Under CWA section 303(c), states[6] have the primary responsibility for reviewing, establishing, and revising WQS applicable to their waters. In CWA section 303(c)(4), Congress directs the EPA to promulgate Federal WQS in two situations. First, if the EPA determines that a state's new or revised WQS are not consistent with the requirements of the CWA and specifies changes to meet such requirements, the state has 90 days to submit a modified standard to the EPA. If the state fails to submit new or revised WQS that meet the CWA's requirements, then the EPA must propose and promulgate new or revised Federal WQS for the waters involved.[7] Second, the EPA Administrator has the authority to propose and promulgate standards in any case where the Administrator determines that a new or revised standard is necessary to meet the requirements of the CWA.[8] The EPA refers to a determination pursuant to CWA section 303(c)(4)(B) as an "Administrator's Determination."[9] In either instance, CWA section 303(c)(4) states that the EPA must promulgate new or revised WQS, "unless prior to such promulgation," a state adopts and EPA approves new or revised WQS that meet the CWA's requirements.

WQS define the desired condition of a water body by designating the use or uses to be made of the water[10] and by setting water quality criteria to protect those uses.[11] There are two

[5] 33 U.S.C. 1313(c)(2)(A).
[6] Pursuant to 40 CFR 131.3(j), "states" also includes territories and "Indian Tribes that EPA determines to be eligible for purposes of the water quality standards program."
[7] CWA section 303(c)(4)(A).
[8] CWA section 303(c)(4)(B).
[9] CWA section 303(c)(4)(B); 40 CFR 131.22(b).
[10] 40 CFR 131.2 and 131.10.
[11] 40 CFR 131.2 and 131.11.

primary categories of water quality criteria: human health criteria and aquatic life criteria. Human health criteria protect designated uses such as public water supply, recreation, and fish and shellfish consumption. Aquatic life criteria protect designated uses such as survival, growth, and reproduction of fish, invertebrates, and other aquatic species. The EPA's regulation provides that water quality criteria "must be based on sound scientific rationale and must contain sufficient parameters or constituents to protect the designated use. For waters with multiple use designations, the criteria shall support the most sensitive use."[12]

States are required to hold a public hearing to review applicable WQS at least once every three years and, if appropriate, revise or adopt new standards, including additional attainable designated uses.[13] Any new or revised WQS must be submitted to the EPA for review and approval or disapproval.[14] As explained above, CWA section 303(c)(4)(B) independently authorizes the Administrator to determine that a new or revised standard is necessary to meet CWA requirements.

B. Relevant Ecological History of the Delaware River

The Delaware River has historically been home to numerous species of ecological, recreational, and economic importance. However, water quality impacts and habitat degradation, peaking in the mid-twentieth century, made portions of the river unsuitable for many aquatic species — such as the Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*), Shortnose Sturgeon (*A. brevirostrum*), American Shad (*Alosa sapidissima*), and Striped Bass (*Morone saxatilis*),

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[12] 40 CFR 131.11(a)(1).
[13] CWA section 303(c)(1); 40 CFR 131.20(a).
[14] CWA section 303(c)(2)(A) and (c)(3).

among others[15] — that are sensitive to seasonal anoxia (i.e., absence of sufficient oxygen) in the mainstem Delaware River in Zone 3, Zone 4, and the upper portion of Zone 5 (in total, river miles 108.4 to 70.0; hereafter, referred to as "specified zones" or "relevant zones").[16,17]

Dissolved oxygen is an important water quality parameter that can significantly influence the distribution and abundance of aquatic organisms and their ecological relationships in aquatic ecosystems. Aquatic organisms need adequate levels of dissolved oxygen to maintain and support normal functions, especially during the sensitive early life history when spawning, larval development, and juvenile growth occur.[18] As dissolved oxygen levels decrease in a waterbody, the rate at which aquatic organisms can obtain oxygen from the water decreases, resulting in

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[15] Stoklosa, A.M., Keller, D.H., Marano, R., and Horwitz, R.J. (2018). "A Review of Dissolved Oxygen Requirements for Key Sensitive Species in the Delaware Estuary." Academy of Natural Sciences of Drexel University. November 2018. *https://www.nj.gov/drbc/library/documents/Review_DOreq_KeySensSpecies_DelEstuary_ANStoDRBCnov2018.pdf*.

[16] Hardy, C. A. (1999). Fish or Foul: A History of the Delaware River Basin Through the Perspective of the American Shad, 1682 to the Present. Pennsylvania History, 66(4), 506-534. *https://digitalcommons.wcupa.edu/hist_facpub/13*;
Secor, D.H. and Waldman, J. (1999). Historical abundance of Delaware Bay Atlantic sturgeon and potential rate of recovery. American Fisheries Society Symposium. 23. 203-216. *https://www.researchgate.net/publication/291783957_Historical_abundance_of_Delaware_Bay_Atlantic_sturgeon_and_potential_rate_of_recovery*;
Smith, T.I.J., & Clugston, J.P. (1997) Status and management of Atlantic sturgeon, Acipenser oxyrinchus, in North America. Environmental Biology of Fishes 48, 335–346. *https://doi.org/10.1023/A:1007307507468*;
National Marine Fisheries Service. (1998). Recovery Plan for the Shortnose Sturgeon (Acipenser brevirostrum). Prepared by the Shortnose Sturgeon Recovery Team for the National Marine Fisheries Service, Silver Spring, Maryland. 104 pages. *https://repository.library.noaa.gov/view/noaa/15971*;
Atlantic States Marine Fisheries Commission. (1981). Interstate Fisheries Management Plan for the Striped Bass. *http://www.asmfc.org/uploads/file/1981FMP.pdf*.

[17] A map showing the Delaware River watershed and the specified zones is available in the docket (Docket ID No. EPA-HQ-OW-2023-0222) as well as in each of the supporting documents associated with this final rule: *Technical Support Document for the Final Rule: Water Quality Standards to Protect Aquatic Life in the Delaware River*; and *Economic Analysis for the Final Rule: Water Quality Standards to Protect Aquatic Life in the Delaware River*.

[18] United States Environmental Protection Agency. (2021). Factsheet on Water Quality Parameters: Dissolved Oxygen. July 2021. Document ID: EPA 841F21007B. *https://www.epa.gov/system/files/documents/2021-07/parameter-factsheet_do.pdf*;
United States Environmental Protection Agency. (2023a). Indicators: Dissolved Oxygen. June 9, 2023. *https://www.epa.gov/national-aquatic-resource-surveys/indicators-dissolved-oxygen*.

impaired growth and reduced survival. Maintaining a healthy ecosystem requires dissolved oxygen at levels that do not impair growth and survival of aquatic species.

1. Causes of Low Dissolved Oxygen in the Specified Zones of the Delaware River

Discharges of untreated or poorly treated municipal and industrial wastewater into the Delaware River have historically been a major cause of water quality degradation, including oxygen depletion, in the specified zones.[19] While conditions have significantly improved, inputs of oxygen-consuming wastes from wastewater dischargers, especially ammonia (NH_3) and ammonium (NH_4^+) (which in combination are hereafter referred to as "ammonia nitrogen"), as well as sediment-water ammonium flux and sediment oxygen demand, continue to be significant sources of oxygen demand in the specified zones of the Delaware River.[20]

Along the Delaware River, untreated wastewater discharges typically occur during and after rainfall events due to combined sewer overflows (CSOs), which are a source of nutrients (i.e., nitrogen and phosphorus), sediments, and toxic contaminants, and can lead to increased chemical and biological oxygen demand in the river.[21] Although the cumulative impact of historical CSOs on sediment oxygen demand in the Delaware River has not been estimated, over time, CSOs can increase or maintain sediment oxygen demand as untreated organic material settles on the riverbed and is broken down by oxygen consuming bacteria (thus, removing

[19] Hardy (1999); Delaware River Basin Commission. (2024a). A Pathway for Continued Restoration: Improving Dissolved Oxygen in the Delaware River Estuary. Technical Report No. 2024-6. September 2024. *https://www.nj.gov/drbc/library/documents/ALDU_RestorationPathway/Report_RestorationPathway_sept2024.pdf*.
[20] Delaware River Basin Commission (2024a); Delaware River Basin Commission. (2024b). Modeling Eutrophication Processes in the Delaware River Estuary: Three-Dimensional Water Quality Model. Technical Report No. 2024-5. August 2024. *https://www.nj.gov/drbc/library/documents/ALDU_RestorationPathway/WQCalibration_FinalRpt_aug2024.pdf*.
[21] Miskewitz, R. and Uchrin, C. (2013). In-Stream Dissolved Oxygen Impacts and Sediment Oxygen Demand Resulting from Combined Sewer Overflow Discharges. Journal of Environmental Engineering, 139(10). *https://doi.org/10.1061/(ASCE)EE.1943-7870.0000739*.

oxygen from the water column), a process that continues long after the end of an overflow event.[22] CSOs have been a persistent source of pollutants in the specified zones of the Delaware River for over a century. For example, sewer overflows from Philadelphia in the early 1900s deposited over 200,000 tons of solids per year, which, in combination with other solid wastes, created deposits 12 feet deep in the river.[23] From July 1, 2022 to June 30, 2023, Philadelphia's wastewater system alone discharged over 1.35 billion cubic feet of CSOs into the Delaware River and its tributaries.[24]

Although most point source discharges today are treated, treated effluent can still contain high levels of ammonia nitrogen, which depletes oxygen in the water as microbes oxidize ammonia into nitrite, nitrate, and dinitrogen gas.[25] During the reporting periods from July through October 2023, major wastewater treatment facilities along the Delaware River discharged ammonia nitrogen at monthly average concentrations ranging from a low of 0.1 milligrams nitrogen per liter (mg-N/L) at the Easton Area Joint Sewer Authority in Pennsylvania (discharging into Zone 1 of the Delaware River) to a high of 34.5 mg-N/L at the Gloucester County Utilities Authority in New Jersey (discharging into Zone 4 of the Delaware River).[26] The effect of any one discharge on dissolved oxygen in the river depends on a variety of factors,

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[22] Miskewitz and Uchrin (2013).
[23] Hardy (1999).
[24] Philadelphia Water Department. (2023). Combined Sewer Management Program Annual Report. Stormwater Management Program Annual Report. See Appendix D – "NPDES Annual CSO Status Report FY 2023," Table 2 — "Overflow Summary for 7/1/2022 – 6/30/2023." *https://water.phila.gov/pool/files/fy23-npdes-annual-report.pdf*.
[25] United States Environmental Protection Agency. (2023b). Ammonia. *https://www.epa.gov/caddis-vol2/ammonia*.
[26] Each individual reporting period is one month long. For the reporting periods ending on August 31, 2023, and October 31, 2023, the Easton Area Joint Sewer Authority discharged an average of 0.1 mg/L of ammonia. For the reporting period ending on August 31, 2023, the Gloucester County Utilities Authority discharged an average of 34.5 mg/L of ammonia. Source: U.S. Environmental Protection Agency. Integrated Compliance Information System (ICIS). Database. Retrieved May 22, 2024.

including the discharge concentration, the magnitude of the discharge, the location of the discharge, and conditions in the river, which may also be affected by other dischargers.

2. Endangered Species in the Specified Zones of the Delaware River

The Delaware River is home to multiple oxygen-sensitive fish species, two of which — Shortnose Sturgeon and Atlantic Sturgeon — are protected under the Federal Endangered Species Act (ESA). All populations of Shortnose Sturgeon have been listed as endangered since 1967.[27] Across the U.S., Shortnose Sturgeon face ongoing threats due to water pollution, among other factors.[28] While the historic population size of Shortnose Sturgeon in the Delaware River remains unknown, in 2006 the Delaware River population was estimated to be approximately 12,000 adults.[29]

The New York Bight distinct population segment (DPS) of Atlantic Sturgeon — which includes the population found in the Delaware River — was listed as endangered under the ESA in 2012.[30] In 2017, the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NMFS) designated the Delaware River, among others, as critical habitat for the New York Bight DPS of Atlantic Sturgeon,[31] and reaffirmed its endangered listing status in

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[27] *Federal Register*, Vol. 32, No. 48 (32 FR 4000). March 11, 1967. *https://www.fisheries.noaa.gov/s3//2022-12/4000-4002.pdf*.
[28] NMFS. (2023a). Shortnose Sturgeon — Overview. *https://www.fisheries.noaa.gov/species/shortnose-sturgeon*.
[29] *Id.*; NMFS. (2023b). Shortnose Sturgeon — Populations. *https://www.fisheries.noaa.gov/species/shortnose-sturgeon#populations*.
[30] *Federal Register*, Vol. 77, No. 24 (77 FR 5879). February 6, 2012. *https://www.federalregister.gov/documents/2012/02/06/2012-1946/endangered-and-threatened-wildlife-and-plants-threatened-and-endangered-status-for-distinct*.
[31] *Federal Register*, Vol. 82, No. 158 (82 FR 39160). August 17, 2017. 50 CFR part 226. *https://www.federalregister.gov/documents/2017/08/17/2017-17207/endangered-and-threatened-species-designation-of-critical-habitat-for-the-endangered-new-york-bight*.

2022 following a five-year review.[32] The remnant population of the New York Bight DPS of Atlantic Sturgeon faces ongoing threats due to water quality in natal rivers, such as the Delaware River, among other factors.[33,34] Like the Shortnose Sturgeon, the historic population size of Atlantic Sturgeon is not well documented. However, in 1890, when the population was already declining, there were approximately 180,000 female Atlantic Sturgeon in the Delaware River.[35] Despite improvements in dissolved oxygen levels since the 1970s, it is estimated that only 125 – 250 adult (male and female) Atlantic Sturgeon currently return to spawn in the Delaware River.[36]

In addition to being listed as endangered under the ESA, available evidence suggests that Shortnose Sturgeon and Atlantic Sturgeon are the most oxygen-sensitive species in the specified zones of the Delaware River. In general, all sturgeon species share common physiological traits,[37] which include being relatively more sensitive to low dissolved oxygen levels than other

[32] National Marine Fisheries Service. (2022). New York Bight Distinct Population Segment of Atlantic Sturgeon (*Acipenser oxyrinchus oxyrinchus*), 5-Year Review: Summary and Evaluation. February 17, 2022. *https://www.fisheries.noaa.gov/resource/document/new-york-bight-distinct-population-segment-atlantic-sturgeon-5-year-review*.

[33] *Ibid.* See Section 2.3.2, "Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms)", A. through E., pp. 14-25.

[34] Dunton, K.J., Jordaan, A., Conover, D.O., McKown, K.A., Bonacci, L.A., and Frisk, M.G. (2015). Marine Distribution and Habitat Use of Atlantic Sturgeon in New York Lead to Fisheries Interactions and Bycatch. Marine and Coastal Fisheries 7:18-32. *https://doi.org/10.1080/19425120.2014.986348*;
Atlantic Sturgeon Bycatch Working Group. (2022). Action Plan to Reduce Atlantic Sturgeon Bycatch in Federal Large Mesh Gillnet Fisheries. NOAA National Marine Fisheries Service. *https://media.fisheries.noaa.gov/2022-09/Final-Action-Plan-to-Reduce-Atlantic-Sturgeon-Bycatch.pdf*.

[35] Secor and Waldman (1999).

[36] White, S.L., Sard, N.M., Brundage, H.M., Johnson, R.L., Lubinski, B.A., Eackles, M.S., Park, I.A., Fox, D.A., and Kazyak, D.C. (2022). Evaluating Sources of Bias in Pedigree-Based Estimates of Breeding Population Size. Ecological Applications 32(5): e2602. *https://doi.org/10.1002/eap.2602*.

[37] *Federal Register*, Vol. 82, No. 158 (82 FR 39161). August 17, 2017. 50 CFR part 226. pp. 39161-39163. *https://www.federalregister.gov/documents/2017/08/17/2017-17207/endangered-and-threatened-species-designation-of-critical-habitat-for-the-endangered-new-york-bight*.

co-occurring fish.[38,39] Sturgeon are considered unusually sensitive to hypoxia (i.e., low oxygen) given their documented metabolic and behavioral responses and limited ability to oxyregulate.[40] Juvenile Atlantic Sturgeon are particularly sensitive to low dissolved oxygen levels, especially at high water temperatures,[41] such as those typically present at the peak of summer in the Delaware River.[42] A literature review across oxygen-sensitive species in the Delaware River indicates that Atlantic Sturgeon, particularly juveniles, have the highest documented dissolved oxygen requirements for growth and survival when compared to other oxygen-sensitive species in the specified zones of the Delaware River.[43] In its five-year review of the listing of the New York Bight DPS of Atlantic Sturgeon, NMFS observed a continuation of low dissolved oxygen conditions in known Atlantic Sturgeon juvenile rearing habitat in the Delaware River.[44] Juvenile Atlantic Sturgeon seeking relief from areas with low oxygen may move to waters that limit their growth due to other factors, such as reduced prey availability.[45] NMFS also noted studies showing fewer juvenile Atlantic Sturgeon captured in the Delaware River in the fall when the

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[38] *Ibid*. p. 39162, see Dees (1961), Sulak and Clugston (1999), Billard and Lecointre (2001), Secor and Niklitschek (2002), and Pikitch et al. (2005), cited therein.
[39] Stoklosa et al. (2018); Secor, D.H. and Niklitschek, E.J. (2001). Hypoxia and Sturgeons: Report to the Chesapeake Bay Program Dissolved Oxygen Criteria Team. March 29, 2001. Reference Number: [UMCES] CBL 01-0080. *https://www.researchgate.net/publication/277065759_Hypoxia_and_Sturgeons_report_to_the_Chesapeake_Bay_Program_Dissolved_Oxygen_Criteria_Team*.
[40] Secor and Niklitschek (2001). Oxyregulation refers to an organism's ability to maintain metabolic rates as the oxygen level in the water declines.
[41] Secor, D., and T. Gunderson. (1998). Effects of hypoxia and temperature on survival, growth, and respiration of juvenile Atlantic sturgeon, Acipenser oxyrinchus. Fishery Bulletin 96:603-613;
Niklitschek, E. (2001). Bioenergetics modeling and assessment of suitable habitat for juvenile Atlantic and shortnose sturgeons (Acipenser oxyrinchus and A. brevirostrum) in the Chesapeake Bay. University of Maryland at College Park.
[42] More information is available in the associated document, *Technical Support Document for the Final Rule: Water Quality Standards to Protect Aquatic Life in the Delaware River*.
[43] Stoklosa et al. (2018).
[44] National Marine Fisheries Service (2022). See Section 2.3.2.1, "Present or threatened destruction, modification, or curtailment of its habitat or range."
[45] *Ibid*. See Allen et al. (2014), cited therein.

preceding summer dissolved oxygen levels were low, providing further evidence that low dissolved oxygen levels are a contributor to the mortality of juvenile Atlantic Sturgeon.[46]

3. Dissolved Oxygen Trends in the Specified Zones of the Delaware River

Dissolved oxygen levels in the relevant zones of the Delaware River mirror trends in historic pollutant loading and recent pollution control efforts in the river. Average summer dissolved oxygen levels in the Delaware River near Chester, Pennsylvania (Zone 4) declined from near saturation in the late 1880s to near zero (i.e., anoxia) in the 1950s and 1960s.[47] Starting in 1970, dissolved oxygen levels began to increase steadily following reductions in carbonaceous biological oxygen demand from wastewater treatment plants.[48] Ammonia nitrogen concentrations in the Delaware River declined contemporaneously while nitrate concentrations increased,[49] which likely reflects increased nitrification rates in the river, enabled by increased dissolved oxygen concentrations. Reductions in nutrient concentrations, including ammonia nitrogen, have been documented across the Delaware River watershed through at least 2018.[50] However, dissolved oxygen levels in the summer are not yet high enough to avoid continued limitations on the growth and survival of oxygen-sensitive species, such as juvenile Atlantic Sturgeon.[51] Recent modeling studies have shown that further reductions in pollutant loading,

[46] *Ibid*. See Moberg and DeLucia (2016), Stetzar et al. (2015), and Park (2020), cited therein.
[47] Sharp, J. (2010). Estuarine oxygen dynamics: What can we learn about hypoxia from long-time records in the Delaware estuary? Limnology and Oceanography, 55(2), 535-548.
[48] Albert, R. C. (1988). The Historical Context of Water-Quality Management for the Delaware Estuary. Estuaries 11(2): 99-107.
[49] Sharp (2010).
[50] Shoda, M.E., and Murphy, J.C. (2022). Water-quality trends in the Delaware River Basin calculated using multisource data and two methods for trend periods ending in 2018. U.S. Geological Survey Scientific Investigations Report 2022–5097. *https://doi.org/10.3133/sir20225097*.
[51] More information is available in the associated document, *Technical Support Document for the Final Rule: Water Quality Standards to Protect Aquatic Life in the Delaware River*;

including enhanced treatment of ammonia nitrogen discharges and, to a lesser extent, a reduction in the volume and frequency of CSOs, could significantly improve the dissolved oxygen conditions in the relevant zones of the Delaware River.[52] Accordingly, this could better support the growth and survival of oxygen-sensitive species.

C. Administration of Water Quality Standards in the Delaware River

In 1961, the Delaware River Basin Compact established the Delaware River Basin Commission (DRBC), comprised of the states of Delaware, New Jersey, New York, and Pennsylvania and the Federal Government, to jointly manage the Delaware River Basin's water resources.[53] Through the DRBC, each state participates in the shared governance of this regional resource and maintains sovereign rights over the portion of the river within its jurisdiction.[54] This final rule is not applicable to the upstream portions of the Delaware River under New York's jurisdiction and neither the EPA nor the DRBC presently have data or information indicating that sources of pollution in New York's upstream waters would impact dissolved oxygen levels in the downstream specified zones.

Pursuant to the Delaware River Basin Compact, the DRBC adopts WQS for interstate waters, including the Delaware River.[55] However as noted above, under the CWA, states have

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Delaware River Basin Commission (2024a);
Niklitschek, E., and D. Secor. (2009a). Dissolved oxygen, temperature and salinity effects on the ecophysiology and survival of juvenile Atlantic sturgeon in estuarine waters: I. Laboratory results. Journal of Experimental Marine Biology and Ecology 381:S150-S160. *https://doi.org/10.1016/j.jembe.2009.07.018*; Stoklosa et al. (2018).

[52] Delaware River Basin Commission (2024a, 2024b).

[53] The DRBC was established pursuant to Federal law (75 Stat. 688 (1961)).

[54] Delaware River Basin Compact, art. 1, "Short Title, Definitions, Purpose and Limitations," § 1.3(a), (b), & (c) "Purpose and Findings," pp. 3 & 4, and art. 5, "Pollution Control," § 5.5(b), "Further Jurisdiction," p. 11, (1961), available at *https://www.nj.gov/drbc/library/documents/compact.pdf*.

[55] Delaware River Basin Compact, art. 5, "Pollution Control," § 5.2, "Policy and Standards," p. 11 (1961), available at *https://www.nj.gov/drbc/library/documents/compact.pdf* (DRBC "may adopt and from time to time amend and

the primary responsibility for reviewing, establishing, and revising WQS applicable to their waters, and must submit new or revised WQS to the EPA for review and approval or disapproval. Accordingly, WQS for the Delaware River are submitted to the EPA for review through a process coordinated across the state, regional, and Federal levels. This process begins when the DRBC adopts WQS for the Delaware River. To comply with CWA section 303(c), Delaware, New Jersey, and Pennsylvania have provisions in their state WQS regulations that explicitly reference or implicitly incorporate the DRBC's WQS as the applicable WQS for the portions of the Delaware River under their jurisdictions. When the DRBC adopts new or revised WQS, each relevant member state submits a certification to the EPA from that state's attorney general or other appropriate legal authority, in accordance with 40 CFR 131.6(e). Those certifications provide that the DRBC's new or revised WQS were duly adopted pursuant to state law. The EPA then reviews those WQS for consistency with the requirements of the CWA pursuant to CWA section 303(c)(3).

D. Relevant Aquatic Life Designated Uses and Dissolved Oxygen Criteria Prior to Promulgation of this Final Rule

In 1967, the DRBC adopted WQS for the zones of the Delaware River included in this final rule.[56] Based on the conditions of the Delaware River at the time, the DRBC concluded that "propagation of fish" was not an attainable use for the specified zones due to the presence of industrial and municipal discharges and associated low dissolved oxygen levels. Therefore, the

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repeal rules, regulations and standards to control . . . future pollution and abate existing pollution"). The DRBC, the states, and the EPA refer to these rules, regulations, and standards as equivalent to WQS under the CWA. As such, the term WQS is used herein to refer to these rules, regulations, and standards.

[56] Delaware River Basin Commission. (2013). Delaware River Basin Water Code. *https://www.nj.gov/drbc/library/documents/watercode.pdf*.

DRBC adopted designated uses of "maintenance of resident fish and other aquatic life," and "passage of anadromous fish," (table 2 of this preamble) and a year-round numeric water quality criterion for dissolved oxygen of 3.5 mg/L as a 24-hour average, as well as a seasonal criterion of 6.5 mg/L, for these zones of the Delaware River (table 3 of this preamble).[57,58] Because these WQS provided for the "maintenance" and "passage" of aquatic life (i.e., "protection") but not the "propagation of fish, shellfish and wildlife," these WQS do not protect those uses reflected in CWA section 101(a)(2) or the uses to be considered under CWA section 303(c)(2)(A).

Prior to this final rule, the DRBC's 1967 WQS remained applicable for CWA purposes for the specified zones of the Delaware River as directly referred to or implicitly incorporated in Delaware's, New Jersey's, and Pennsylvania's WQS.

1. Aquatic Life Designated Uses in the Specified Zones Prior to Promulgation of the EPA's Final Rule

As described in section II.C. of this preamble, Delaware, New Jersey, and Pennsylvania each has its own WQS for the specified zones of the Delaware River under its jurisdiction. Prior to the EPA's final rule, the aquatic life designated use for Delaware's portion of the specified zones of the Delaware River included all life stages, including the propagation component of the CWA section 101(a)(2) use. Prior to the EPA's final rule, the aquatic life designated use for New Jersey's portions of the specified zones of the Delaware River incorporated by reference the designated uses in the DRBC's Water Quality Regulations. The aquatic life designated use for

[57] *Id*; Delaware River Basin Commission. (2015). "Existing Use Evaluation for Zones 3, 4, & 5 of the Delaware Estuary Based on Spawning and Rearing of Resident and Anadromous Fishes." September 30, 2015. *https://www.state.nj.us/drbc/library/documents/ExistingUseRpt_zones3-5_sept2015.pdf*.

[58] Anadromous fish are species that are born and reared as juveniles in freshwater, migrate to marine waters where they spend most of their adult lives, and return to their natal, freshwater rivers to spawn.

Pennsylvania's portions of the specified zones of the Delaware River prior to the EPA's final rule aligned with the DRBC's "maintenance" and "passage" designated use (table 2 of this preamble). Therefore, before this final rule, the aquatic life designated uses for New Jersey's and Pennsylvania's portions of the specified zones of the Delaware River did not include the propagation component of the CWA section 101(a)(2) use.

Table 2. Aquatic Life Designated Uses for the Mainstem Delaware River in Zone 3, Zone 4, and Upper-Zone 5 Prior to the Promulgation of the EPA's Final Rule

Entity	Designated Use
DRBC[59]	Maintenance of resident fish and other aquatic life, passage of anadromous fish, wildlife.
Delaware[60]	Fish, Aquatic Life & Wildlife.[61]
New Jersey[62]	The designated uses for the mainstem Delaware River and Delaware Bay are those contained in the DRBC Water Quality Regulations.
Pennsylvania[63]	Warm Water Fishes (Maintenance Only); Migratory fishes (Passage Only).[64]

2. Previously Applicable Dissolved Oxygen Criteria in the Specified Zones

[59] Delaware River Basin Commission. "Administrative Manual — Part III Water Quality Regulations with Amendments Through December 7, 2022." Accessed August 7, 2024. *https://www.nj.gov/drbc/library/documents/WQregs.pdf*.
[60] Delaware Administrative Code. "7401 Surface Water Quality Standards." Title 7 Natural Resources & Environmental Control. Delaware Department of Natural Resource and Environmental Control. Accessed August 7, 2024. *https://regulations.delaware.gov/AdminCode/title7/7000/7400/7401.pdf*.
[61] Delaware defines *Fish, Aquatic Life & Wildlife* as, "all animal and plant life found in Delaware, either indigenous or migratory, regardless of life stage or economic importance." A footnote specifies that this use includes shellfish propagation.
[62] New Jersey Administrative Code. "N. J. A. C. 7:9B Surface Water Quality Standards." Accessed August 7, 2024. *https://dep.nj.gov/wp-content/uploads/rules/rules/njac7_9b.pdf*.
[63] Pennsylvania Code. "Chapter 93. Water Quality Standards." Commonwealth of Pennsylvania. Accessed August 7, 2024. *https://www.pacodeandbulletin.gov/secure/pacode/data/025/chapter93/025_0093.pdf*.
[64] Pennsylvania defines its "Warm Water Fishes" designated use as, "Maintenance and propagation of fish species and additional flora and fauna which are indigenous to a warm water habitat" and defines its "Migratory Fishes" designated use as, "Passage, maintenance and propagation of anadromous and catadromous fishes and other fishes which move to or from flowing waters to complete their life cycle in other waters." For the specified zones of the Delaware River, Pennsylvania excluded propagation from the designated uses by specifying "Maintenance Only" and "Passage Only" in parentheses.

For dissolved oxygen in the relevant zones, all three states incorporated the DRBC's water quality criteria by reference; therefore, prior to this final rule, the DRBC's dissolved oxygen criteria were the applicable criteria for the relevant zones in each state for CWA purposes (table 3 of this preamble). As explained above with respect to the aquatic life designated use, the DRBC's dissolved oxygen criteria for the specified zones of the Delaware River do not protect aquatic life propagation and therefore do not protect those uses reflected in CWA section 101(a)(2) or the uses to be considered under CWA section 303(c)(2)(A).

Table 3. Previously Applicable Dissolved Oxygen Criteria for the Mainstem Delaware River in Zone 3, Zone 4, and Upper-Zone 5

Entity	Dissolved Oxygen Aquatic Life Criteria
DRBC[65]	24-hour average concentration shall not be less than 3.5 mg/l. During the periods from April 1 to June 15, and September 16 to December 31, the dissolved oxygen shall not have a seasonal average less than 6.5 mg/l in the entire zone.
Delaware[66]	For waters of the Delaware River and Delaware Bay, duly adopted Delaware River Basin Commission (DRBC) Water Quality Regulations shall be the applicable criteria.
New Jersey[67]	For parameters with criteria in the DRBC Water Quality Regulations, the criteria contained therein are the applicable criteria.
Pennsylvania[68]	See DRBC Water Quality Regulations.

[65] Delaware River Basin Commission. "Administrative Manual — Part III Water Quality Regulations with Amendments Through December 7, 2022." Accessed August 7, 2024. *https://www.nj.gov/drbc/library/documents/WQregs.pdf*.
[66] Delaware Administrative Code. "7401 Surface Water Quality Standards." Title 7 Natural Resources & Environmental Control. Delaware Department of Natural Resource and Environmental Control. Accessed August 7, 2024. *https://regulations.delaware.gov/AdminCode/title7/7000/7400/7401.pdf*.
[67] New Jersey Administrative Code. "N. J. A. C. 7:9B Surface Water Quality Standards." Accessed August 7, 2024. *https://dep.nj.gov/wp-content/uploads/rules/rules/njac7_9b.pdf*.
[68] Pennsylvania Code. "Chapter 93. Water Quality Standards." Commonwealth of Pennsylvania. Accessed August 7, 2024. *https://www.pacodeandbulletin.gov/secure/pacode/data/025/chapter93/025_0093.pdf*.

3. Intersection of Delaware's, New Jersey's, and Pennsylvania's Aquatic Life Designated Uses and Dissolved Oxygen Criteria with the CWA Prior to the Promulgation of the EPA's Final Rule

Table 4 of this preamble provides a summary outlining whether, prior to the EPA's final rule, the aquatic life designated uses in each of the three states in the specified zones aligned with CWA section 101(a)(2) goals and consideration of such uses under CWA section 303(c)(2)(A), and whether each state's dissolved oxygen criteria were protective of an aquatic life designated use that includes propagation. As explained above, only Delaware included aquatic life propagation in its designated uses for the specified zones of the Delaware River. However, none of the three states' dissolved oxygen criteria for the specified zones were protective of fish and shellfish propagation. Prior to this final rule, none of the states, and by extension none of the specified zones of the Delaware River, had WQS for aquatic life that were consistent with the CWA section 101(a)(2) goals and the consideration of such uses under CWA section 303(c)(2)(A).

Table 4. Intersection of Delaware's, New Jersey's, and Pennsylvania's Aquatic Life Designated Uses and Dissolved Oxygen Criteria with CWA 101(a)(2) Goals Prior to the Promulgation of the EPA's Final Rule

State	Applicable Zone(s) of the Mainstem Delaware River	Designated Use Included CWA section 101(a)(2) Propagation Component	Dissolved Oxygen Criteria Protective of Aquatic Life Propagation
Delaware	Upper-5	Yes	No
New Jersey	3, 4, Upper-5	No	No
Pennsylvania	3, 4	No	No

E. Summary of the EPA Administrator's Determination

On December 1, 2022, the EPA issued an Administrator's Determination, pursuant to CWA section 303(c)(4)(B), finding that a revised designated use to protect aquatic life propagation and corresponding dissolved oxygen criteria to protect that use are necessary in the specified zones of the Delaware River.[69] The Administrator's Determination can be accessed at *https://www.epa.gov/wqs-tech/federally-promulgated-water-quality-standards-specific-states-territories-and-tribes*.

III. Final Water Quality Standards

A. Scope of the EPA's Rule

The EPA's rule applies to the mainstem Delaware River in Zone 3, Zone 4, and the upper portion of Zone 5 (in total, river miles 108.4 to 70.0), for the states of Delaware, New Jersey, and Pennsylvania (table 5 of this preamble). In the final rule, the EPA made a non-substantive change to add the word "mainstem" to paragraphs (a)(1) and (2) and (d)(1) and (2) to clarify the scope of the rule, in response to comments requesting such clarification.

Table 5. Zones Corresponding with the Mainstem Delaware River Covered by the EPA's Rule

Segment of the Delaware River	River Miles	States Affected
Zone 3	108.4 to 95.0	New Jersey, Pennsylvania
Zone 4	95.0 to 78.8	New Jersey, Pennsylvania
Zone 5 – Upper Portion	78.8 to 70.0	Delaware, New Jersey

[69] December 1, 2022. Letter from Radhika Fox, Assistant Administrator, EPA Office of Water, to Steven J. Tambini, Executive Director, Delaware River Basin Commission; Shawn M. Garvin, Secretary, Delaware Department of Natural Resources and Environmental Control; Shawn M. LaTourette, Commissioner, New Jersey Department of Environmental Protection; and Ramez Ziadeh, Acting Secretary, Pennsylvania Department of Environmental Protection.

B. Aquatic Life Designated Use

The EPA is promulgating an aquatic life designated use of "*Protection and propagation of resident and migratory aquatic life*" for the specified zones in New Jersey and Pennsylvania that is consistent with CWA section 101(a)(2) goals and reflects the considerations for setting WQS in CWA section 303(c)(2)(A). This is the same aquatic life designated use that the EPA proposed for the portions of the affected zones in these two states.[70] Several commenters supported the EPA's proposal to upgrade the designated uses of the specified zones of the Delaware River to include propagation of resident and migratory aquatic life, and some of these commenters asserted that such an upgrade is legally and scientifically mandated. Additionally, some commenters asserted that the designated use upgrade and stronger dissolved oxygen criteria are essential to protect aquatic life in the specified zones of the Delaware River, including the endangered sturgeon, and to support recreational and commercial fishing. Some commenters asserted that fish, including the endangered Atlantic Sturgeon and Shortnose Sturgeon, have been propagating in the specified zones for many years. No commenters opposed the EPA's proposed aquatic life designated use.

CWA section 303(c) assigns states the primary role in adopting WQS; accordingly, the EPA evaluated the aquatic life uses for the relevant zones on a state-by-state basis and proposed a revised use only for New Jersey and Pennsylvania consistent with CWA section 303(c)(2)(A)'s instruction to take into consideration the use of waters for "propagation of fish and wildlife." As

[70] United States Environmental Protection Agency. (2023). *Water Quality Standards to Protect Aquatic Life in the Delaware River*. Proposed Rule. 88 FR 88315. December 21, 2023.

explained in section II.D. of this preamble, Delaware's "Fish, Aquatic Life & Wildlife" designated use includes all life stages of indigenous and migratory organisms; therefore, for the specified zones under its jurisdiction, Delaware's aquatic life designated use is already consistent with the CWA's 101(a)(2) goals and the considerations in CWA section 303(2)(c)(A) and no revisions to the aquatic life designated uses in Delaware's portion of the specified zones are necessary. In contrast, New Jersey's and Pennsylvania's aquatic life designated uses for the relevant zones of the Delaware River under their jurisdiction do not include "propagation" and therefore do not fully achieve the CWA's 101(a)(2) goals or reflect the considerations in CWA section 303(c)(2)(A). As explained in section II.E. of this preamble, the EPA determined that propagation is an attainable use in the specified zones of the Delaware River.[71] Thus, the EPA is promulgating an aquatic life designated use that includes propagation for New Jersey and Pennsylvania's portions of the mainstem Delaware River in Zone 3, Zone 4, and the upper portion of Zone 5 (in total, river miles 108.4 to 70.0).

One commenter asked the EPA whether the propagation designated use in the EPA's rule is equivalent to Pennsylvania's Warm Water Fishes (WWF) use to help Pennsylvania evaluate which of its WWF aquatic life criteria could apply to protect the new Federal designated use. Pennsylvania's WWF use is one of the state's EPA-approved aquatic life uses. Pennsylvania's WQS define the WWF use as "[m]aintenance and propagation of fish species and additional flora and fauna which are indigenous to a warm water habitat," and identify various criteria associated

[71] December 1, 2022. Letter from Radhika Fox, Assistant Administrator, EPA Office of Water, to Steven J. Tambini, Executive Director, Delaware River Basin Commission; Shawn M. Garvin, Secretary, Delaware Department of Natural Resources and Environmental Control; Shawn M. LaTourette, Commissioner, New Jersey Department of Environmental Protection; and Ramez Ziadeh, Acting Secretary, Pennsylvania Department of Environmental Protection.

with the WWF use.[72] The WWF use is consistent with the CWA and applies to warm waters in Pennsylvania but does not apply to the zones of the Delaware River affected by this rulemaking. As discussed in section II.D. of this preamble, Pennsylvania's currently applicable designated uses for the zones covered by this rule are "WWF (maintenance only)" and "Migratory Fishes (passage only)." Pennsylvania has not established its own criteria to protect these uses. Therefore, the currently applicable criteria for Pennsylvania's portions of these zones are the DRBC's criteria for Zones 3 and 4, which Pennsylvania has adopted by reference.

Pennsylvania's WWF use and criteria are outside the scope of this rulemaking. This is because Pennsylvania's WWF designated use and the EPA-approved aquatic life criteria associated with Pennsylvania's WWF use do not currently apply for CWA purposes to the specified zones of the Delaware River for which EPA is promulgating the designated use and associated dissolved oxygen criteria in this rule. If Pennsylvania would like to apply its WWF use and criteria to Pennsylvania's portions of the specified zones of the Delaware River, it could revise its state WQS and submit that revision to the EPA for CWA section 303(c) review. The EPA is available to provide Pennsylvania with technical support on any such future WQS revisions.

The EPA reiterates that the CWA vests the primary responsibility for developing WQS in the states, and that states have substantial discretion in designating uses consistent with the CWA's emphasis on cooperative federalism. CWA section 303(c)(2)(A), for example, provides that states must establish WQS for waters within their jurisdiction "taking into consideration

[72] Pennsylvania Code. "Chapter 93. Water Quality Standards." Commonwealth of Pennsylvania. Accessed August 7, 2024. *https://www.pacodeandbulletin.gov/secure/pacode/data/025/chapter93/025_0093.pdf*.

their use and value for public water supplies, propagation of fish and wildlife, recreational purposes, and agricultural, industrial, and other purposes," thereby providing states discretion in selecting the uses to designate. In this rule, under the circumstances here, as authorized by CWA section 303(c)(4)(B), the EPA is finalizing a designated use that is attainable and consistent with the CWA.

C. Dissolved Oxygen Criteria to Protect Aquatic Life Propagation

The EPA is establishing dissolved oxygen criteria largely as proposed for Delaware, New Jersey, and Pennsylvania, for the specified zones of the Delaware River based on a sound scientific rationale. The dissolved oxygen criteria protect the EPA's promulgated designated use for New Jersey and Pennsylvania, as well as Delaware's current aquatic life designated use for the specified zones.

1. Derivation of Dissolved Oxygen Criteria

To derive protective dissolved oxygen criteria for the specified zones of the Delaware River, the EPA used methods adapted from peer-reviewed literature and data from laboratory studies relevant to oxygen-sensitive sturgeon species in the Delaware River. Although the methods and data are from peer-reviewed scientific literature, the EPA nonetheless completed an external peer review on the data and application of these methods to develop the criteria; the peer review and the EPA's response to the peer review comments are available in the docket for this rulemaking. This section presents a summary of the data and methods that the EPA used to derive protective dissolved oxygen criteria for this final rule. First, the EPA describes the Agency's existing dissolved oxygen national recommendations and guidance documents. Then, the EPA explains how the Agency selected three seasons to derive criteria protective of oxygen-sensitive species in the relevant zones of the Delaware River. Next, the EPA details an Atlantic Sturgeon cohort model it used to derive criteria protective of juvenile Atlantic Sturgeon during the season associated with their growth and development. After that, the EPA explains how the Agency developed criteria to protect oxygen-sensitive species during the other two seasons. Lastly, the EPA concludes with an explanation for promulgating criteria expressed as percent oxygen saturation, rather than as concentration.

This section is intended to be a high-level summary of the EPA's criteria derivation methods and results for this final rule. While the EPA utilized the below described methodologies for finalizing these criteria, states may use different approaches so long as the resulting criteria are protective of the relevant designated uses[73] and based on sound scientific rationale, as provided in the regulations.[74] More details and information are available in the associated document, *Technical Support Document for the Final Rule: Water Quality Standards to Protect Aquatic Life in the Delaware River*.

Existing EPA Methodology and Guidance Documents

Under CWA section 304(a), the EPA publishes, from time to time, national recommended aquatic life criteria for a variety of pollutants and parameters. The EPA's national recommended criteria for dissolved oxygen in freshwater and saltwater environments are from the 1986 *Quality Criteria for Water* ("Gold Book")[75] and the 2000 *Ambient Aquatic Life Water Quality Criteria for Dissolved Oxygen (Saltwater): Cape Cod to Cape Hatteras* ("Virginian

[73] CWA section 303(c)(2)(A).
[74] 40 CFR 131.11(a).
[75] United States Environmental Protection Agency. (1986). Quality Criteria for Water 1986. Document ID: EPA 440/5-86-001. May 1, 1986. *https://www.epa.gov/sites/default/files/2018-10/documents/quality-criteria-water-1986.pdf*.

Province Document"),[76] respectively. The EPA's recommendations in the Virginian Province Document state that, "in cases where a threatened or endangered species occurs at a site, and sufficient data exist to suggest that it is more sensitive at concentrations above the criteria, it is appropriate to consider development of site-specific criteria based on this species."[77]

As explained previously in section II.B. of this preamble, Atlantic Sturgeon and Shortnose Sturgeon are federally listed as endangered under the ESA and are uniquely sensitive to hypoxia. Given the availability of laboratory data specific to the oxygen requirements of Atlantic Sturgeon and Shortnose Sturgeon, the EPA chose to derive site-specific criteria to protect the oxygen-sensitive endangered species in the specified zones of the Delaware River and did not rely on the national recommendations in the Gold Book or Virginian Province Document to derive criteria in this instance. While some commenters cited the Gold Book or Virginian Province Document as support for their assertions that the EPA's proposed criteria were too stringent or not stringent enough, no commenter suggested that the EPA promulgate criteria values directly from either of those documents.

Delineating Seasons for Criteria Derivation

Given available information, including information developed by the DRBC, the EPA delineated three distinct seasons for dissolved oxygen criteria development that are intended to protect Atlantic Sturgeon throughout their life history, while also protecting a range of other aquatic species during their sensitive early life histories in the specified zones. For this rule, the

[76] United States Environmental Protection Agency. (2000). Ambient Aquatic Life Water Quality Criteria for Dissolved Oxygen (Saltwater): Cape Cod to Cape Hatteras. Document ID: EPA-822-R-00-012. November 2000. *https://www.epa.gov/sites/default/files/2018-10/documents/ambient-al-wqc-dissolved-oxygen-cape-code.pdf*.
[77] *Id.* Page 41.

EPA defines the *Spawning and Larval Development* season as occurring from March 1 to June 30, which generally covers spawning and egg and larval development periods for many oxygen-sensitive species, including Atlantic Sturgeon, Shortnose Sturgeon, American Shad, Atlantic Rock Crab, Channel Catfish, Striped Bass, Largemouth Bass, White Perch, and Yellow Perch.[78] The EPA defines the *Juvenile Development* season in this final rule as occurring from July 1 to October 31 and the *Overwintering* season as occurring from November 1 to February 28/29, based on young-of-the-year juvenile Atlantic Sturgeon growth rates.[79] By November, oxygen levels are relatively high and not expected to limit growth and survival, a characteristic of the overwintering period.[80] While the EPA defines seasons for this rule largely based on the life history of Atlantic Sturgeon, these seasons also generally correspond with early life histories of other oxygen-sensitive species in the specified zones of the Delaware River. By developing criteria that are protective of Atlantic Sturgeon, which, as described in section II.B. of this preamble, is the most oxygen-sensitive species in the relevant zones of the Delaware River, the EPA concluded that the criteria will also be protective of other less oxygen-sensitive resident and migratory aquatic species in the specified zones of the Delaware River. While not the only appropriate way to develop such criteria, the EPA determined that this approach is appropriate and scientifically sound under the circumstances.

[78] Stoklosa et al. (2018); Delaware River Basin Commission (2015); Moberg, T. and M. DeLucia. (2016). Potential Impacts of Dissolved Oxygen, Salinity and Flow on the Successful Recruitment of Atlantic Sturgeon in the Delaware River. The Nature Conservancy. *https://www.conservationgateway.org/ConservationPractices/Freshwater/HabitatProtectionandRestoration/Documents/DelawareAtlanticSturgeonReport_TNC5172016.pdf*.

[79] Moberg and DeLucia. (2016).

[80] Additional information is described in sections 3.3.3 and 4.1.2 of the associated document, *Technical Support Document for the Final Rule: Water Quality Standards to Protect Aquatic Life in the Delaware River*.

The EPA received several comments requesting that the Agency finalize dissolved oxygen criteria based on monthly periods rather than the seasons that the EPA proposed. Many of these commenters asserted that the EPA's seasonal approach could result in too many days during which the criteria could be exceeded and expressed concerns about the impact of those exceedances on aquatic life. These commenters asserted that monthly assessment periods would reduce the number of consecutive days where dissolved oxygen could be below protective levels. Additionally, one commenter asserted that the seasonal approach would lead to challenges for organizations that monitor water quality and/or assess attainment of applicable WQS, stating that the EPA's criteria cannot be adequately assessed with grab samples collected once or twice a month and continuous monitoring data can be time-consuming and prohibitively expensive to collect.

As discussed below in this section of the preamble, the EPA's approach for deriving dissolved oxygen criteria in this instance is based on defining suitable habitat conditions as those that provide each year's juvenile cohort the potential to increase its biomass during the season. Developing criteria that would apply at a monthly interval would require the EPA to specify a scientifically defensible operational definition, in accordance with the CWA and the EPA's implementing regulations, of supporting the propagation designated use for each month, rather than for the season. Commenters did not provide an explanation or technical rationale for how the EPA could define suitable habitat in each month. The EPA also could not identify such an operational definition because propagation is ecologically a seasonal process and the amount of dissolved oxygen required in each month may depend on what the fish are exposed to in other months. Therefore, the EPA concluded that retaining the seasonal criteria approach applied sound scientific information to ensure the propagation designated use is protected.

The EPA acknowledges that each four-month season allows for the dissolved oxygen criteria to be exceeded for up to 12 days during the season.[81] However, the EPA's empirical approach in this rulemaking ensures that the criteria are set at a level that is expected to protect aquatic life propagation despite these potential exceedances. As described in detail below (and in the associated technical support document and response to comments document), when the seasonal 10th percentile of oxygen saturation meets the EPA's criteria, the Agency expects that the oxygen saturation values on the 12 days with the lowest daily average oxygen level will not be low enough to prevent attainment of the designated use.

Consistent with the EPA's implementing regulations at 40 CFR 131.11(a), the EPA developed the dissolved oxygen criteria based on sound science to protect an aquatic life designated use that includes propagation. Regarding comments suggesting that the Agency's seasonal approach presents an obstacle to water quality assessments, the EPA has identified potential strategies that could be used to assess attainment of the Federal criteria. The EPA concluded that the seasonal structure of the dissolved oxygen criteria will not impede assessment of the EPA's criteria in the specified zones, regardless of the types of data collected. For example, dissolved oxygen measurements could be needed for as few as 13 days to demonstrate that there are more than 12 days of exceedance and therefore to demonstrate non-attainment of the 10th percentile criterion in a season. The publicly available water quality data that have been

[81] Additionally, for the *Juvenile Development* season the dissolved oxygen criteria at the 50% exceedance frequency can be exceeded up to 61 days.

collected in the specified zones by the DRBC and the U.S. Geological Survey indicate which days and locations are least likely to attain the criteria magnitudes. Thus, organizations that monitor water quality could readily implement a targeted monitoring strategy focused on the most critical times and locations, using dissolved oxygen sensors (i.e., continuous measurements) or discrete measurements. While the most precise assessment would rely on quality-assured continuous measurements, a daily time series computed by interpolation of discrete measurements could also provide valid evidence to support an assessment decision. The DRBC and the U.S. Geological Survey have maintained continuous monitoring at two locations in the specified zones of the river since the 1960s, have shared the data in near real-time, and have indicated that they intend to maintain the continuous monitoring into the future. Therefore, the EPA concluded that water quality assessments are feasible under the seasonal criteria construct, and that such assessments could rely on continuous data and/or discrete data collected by a wide array of stakeholders. A more detailed discussion about monitoring and assessment is available in the associated response to comments document.

Ecological Modeling to Derive Criteria for the Juvenile Development Season

The EPA obtained recent and high-quality data from a variety of sources, described below and detailed in the associated technical support document, to evaluate the oxygen requirements of juvenile Atlantic Sturgeon. These data include measurements quantifying water quality conditions at two locations in the specified zones of the Delaware River. Since 2012 when the Atlantic Sturgeon was listed as an endangered species, there have been few studies documenting the oxygen requirements of this species. However, the EPA obtained sufficient data to establish quantitative relationships between age–0 juvenile sturgeon (Atlantic Sturgeon and

Shortnose Sturgeon) growth, mortality, and habitat suitability. These include data from Campbell and Goodman (2004), Niklitschek and Secor (2009a), and EPA (2003), along with methods from Niklitschek and Secor (2005) and Niklitschek and Secor (2009b), water quality monitoring data, and juvenile Atlantic Sturgeon abundance data from the Delaware Department of Natural Resources and Environmental Control (DNREC).[82]

The EPA followed the peer-reviewed cohort modeling approach of Niklitschek and Secor (2005) to evaluate the effects of temperature, salinity, and dissolved oxygen on the potential growth and mortality of a hypothetical cohort or group of juvenile Atlantic Sturgeon spawned during a single year.[83] The cohort model uses growth and mortality rates to calculate the instantaneous daily production potential, or the instantaneous daily rate of biomass production per unit of cohort biomass per day. The EPA used the cohort model to estimate the fraction of

[82] Campbell, J., and L. Goodman. (2004). Acute sensitivity of juvenile shortnose sturgeon to low dissolved oxygen concentrations. Transactions of the American Fisheries Society 133:722-776;
Niklitschek, E., and D. Secor. (2009a). Dissolved oxygen, temperature and salinity effects on the ecophysiology and survival of juvenile Atlantic sturgeon in estuarine waters: I. Laboratory results. Journal of Experimental Marine Biology and Ecology 381:S150-S160. *https://doi.org/10.1016/j.jembe.2009.07.018*;
United States Environmental Protection Agency. (2003). Ambient Water Quality Criteria for Dissolved Oxygen, Water Clarity and Chlorophyll a for the Chesapeake Bay and its Tidal Tributaries. Document ID: EPA 903-R-03-002. April 2003. *https://nepis.epa.gov/Exe/ZyPDF.cgi/P100YKPQ.PDF?Dockey=P100YKPQ.PDF*;
Niklitschek, E. J., and D. H. Secor. (2005). Modeling spatial and temporal variation of suitable nursery habitats for Atlantic sturgeon in the Chesapeake Bay. Estuarine, Coastal and Shelf Science 64:135-148. *https://doi.org/10.1016/j.ecss.2005.02.012*;
Niklitschek, E. J., and D. H. Secor. (2009b). Dissolved oxygen, temperature and salinity effects on the ecophysiology and survival of juvenile Atlantic sturgeon in estuarine waters: II. Model development and testing. Journal of Experimental Marine Biology and Ecology 381:S161-S172. *https://doi.org/10.1016/j.jembe.2009.07.019*;
USGS 01467200 Delaware River at Penn's Landing, Philadelphia, PA. Retrieved March 9, 2023. *https://waterdata.usgs.gov/nwis/inventory/?site_no=01467200&agency_cd=USGS*;
USGS 01477050 Delaware River at Chester PA. Retrieved January 31, 2023. *https://waterdata.usgs.gov/nwis/inventory?agency_code=USGS&site_no=01477050*;
Park, I. (2023). State of Delaware Annual Compliance Report for Atlantic Sturgeon. Delaware Division of Fish and Wildlife, Department of Natural Resources and Environmental Control. September 2023.
[83] Water temperature and salinity can affect the oxygen requirements of aquatic species and are needed to compute percent oxygen saturation, a measure of dissolved oxygen availability to aquatic organisms, from dissolved oxygen concentrations.

the cohort that could survive from July 1 through October 31 (i.e., the *Juvenile Development* season) and the relative change in biomass for the same period.

As part of the cohort model, the EPA developed a new mortality model and implemented a peer-reviewed bioenergetics-based growth model described by Niklitschek and Secor (2009b) to predict the daily instantaneous minimum mortality rate and potential growth rate, respectively, for members of the cohort. To develop a mortality model, the EPA fit a regression to experimental data to predict mortality resulting from low dissolved oxygen at any given temperature and percent oxygen saturation.[84] Mortality rates of juvenile sturgeon increased with declining dissolved oxygen levels and increased at higher rates where there was both declining dissolved oxygen and increasing water temperature. The EPA validated the results of the mortality model by using observed water quality data from 2002 – 2022 to predict the relative abundance of the Atlantic Sturgeon young-of-year cohort on October 31 of each year and comparing those results to available catch data from DNREC's juvenile abundance surveys.[85] The growth model takes a bioenergetic approach that accounts for temperature-controlled maximum metabolic rates that may be further limited by oxygen levels. Low oxygen levels limit overall metabolic rates and cause a shift in the allocation of available energy away from growth. Predicted growth rates reflect the balance between energy inputs and losses and are therefore reduced by low oxygen. Water quality monitoring data in the relevant zones of the Delaware

[84] Experimental data are from Campbell and Goodman 2004, Niklitschek and Secor 2009a.
[85] USGS 01467200 Delaware River at Penn's Landing, Philadelphia, PA. Retrieved March 9, 2023. *https://waterdata.usgs.gov/nwis/inventory/?site_no=01467200&agency_cd=USGS*; USGS 01477050 Delaware River at Chester PA. Retrieved January 31, 2023. *https://waterdata.usgs.gov/nwis/inventory?agency_code=USGS&site_no=01477050*; Park (2023).

River show that the lowest oxygen levels coincided with the highest water temperatures, resulting in lower growth rates than either condition would cause alone.

Habitat Suitability Indices have been used in the context of fish-habitat relationships, conservation management, and habitat evaluation to quantify the capacity of a given habitat to support essential life functions (e.g., growth, survival, reproduction) of a selected species.[86] At proposal, the EPA defined a Habitat Suitability Index (HSI) for Atlantic Sturgeon as the instantaneous daily production potential, which was calculated using the cohort model. The EPA maintained that definition of HSI for the final rule. HSI evaluates the combined effect of percent oxygen saturation, water temperature, and salinity on the potential growth and survival of juvenile Atlantic Sturgeon during the *Juvenile Development* season. The EPA used quantile generalized additive models (QGAMs) to quantify relationships between computed values of HSI in each year and corresponding seasonal percentiles of daily average dissolved oxygen for that year.[87] QGAMs can model the non-linear relationship between dissolved oxygen and HSI as well as predict the expected median HSI, rather than the expected mean.

The EPA followed the approach of Niklitschek and Secor (2005) to define suitable habitat for juvenile Atlantic Sturgeon growth and survival as habitat with water quality resulting

[86] E.g., Woodland, R.J., Secor, D.H., and Niklitschek, E.J. (2009). Past and Future Habitat Suitability for the Hudson River Population of Shortnose Sturgeon: A Bioenergetic Approach to Modeling Habitat Suitability for an Endangered Species. American Fisheries Society Symposium 69: 589-604;
Collier, J.J., Chiotti, J.A., Boase, J., Mayer, C.M., Vandergoot, C.S., and Bossenbroek, J.M. (2022). Assessing habitat for lake sturgeon (Acipenser fulvescens) reintroduction to the Maumee River, Ohio using habitat suitability index models. Journal of Great Lakes Research. 48(1): 219-228. https://doi.org/10.1016/j.jglr.2021.11.006;
Brown, S.K., Buja, K.R., Jury, S.H., Monaco, M.E., and Banner, A. (2000). Habitat Suitability Index Models for Eight Fish and Invertebrate Species in Casco and Sheepscot Bays, Maine. North American Journal of Fisheries Management, 20(2): 408-435, *https://doi.org/10.1577/1548-8675(2000)020%3C0408:HSIMFE%3E2.3.CO;2*.
[87] A percentile (e.g., 10th percentile) is the dissolved oxygen level below which the corresponding fraction (e.g., 10%) of the daily dissolved oxygen values during the season falls below. In this case, the season is the *Juvenile Development* season (July 1 to October 31).

in HSI greater than zero. When HSI is less than or equal to zero, seasonal average mortality rates are greater than or equal to seasonal average growth rates and the overall biomass of the cohort is likely to decrease, reducing the potential for propagation, or recruitment of juveniles to the population. Conversely, a cohort of juveniles utilizing habitat with HSI greater than zero has the potential to increase its biomass during the *Juvenile Development* season, thus contributing to successful propagation. Therefore, to derive protective dissolved oxygen criteria, the EPA evaluated seasonal percentiles of daily average percent oxygen saturation to find the lowest value at which the QGAMs predict expected median HSI greater than zero as the minimum threshold for percent oxygen saturation that, if attained, would provide suitable habitat during that seasonal period.

The predicted HSI value relies on an expected distribution of daily average percent oxygen saturation values during the season; therefore, the EPA selected two percent oxygen saturation percentiles as thresholds at or above which median HSI is expected to be greater than zero to maintain the expected distribution of percent oxygen saturation values. These two percentiles — the 10^{th} percentile and the 50^{th} percentile — describe the protective seasonal distribution of daily average dissolved oxygen values. When both the 10^{th} percentile and 50^{th} percentile are attained, they function together to ensure that a detrimental shift in the oxygen distribution (i.e., a shift causing more low oxygen levels) at either the low end (10^{th} percentile) or the center (50^{th} percentile) of the dissolved oxygen daily average distribution has not occurred. Median HSI is expected to be zero or higher, allowing the annual cohort of juvenile Atlantic Sturgeon to maintain or increase its biomass, when the 10^{th} percentile of daily average oxygen saturation is at least 66% and the 50^{th} percentile, or median, of daily average oxygen saturation is at least 74%. Therefore, the EPA expects oxygen levels will protect propagation of oxygen-sensitive fish species during the *Juvenile Development* season if the 10th percentile of daily average oxygen saturation is at least 66% and the 50th percentile of daily average oxygen saturation is at least 74%.

The EPA received several comments requesting that the Agency finalize dissolved oxygen criteria that include an instantaneous minimum criterion (i.e., a lower bound criterion that can never be exceeded). Many of these commenters asserted that an instantaneous minimum criterion was necessary to support propagation and protect against high rates of mortality. While many commenters did not provide a suggested magnitude for an instantaneous minimum criterion, a few commenters suggested a minimum criterion of 6 mg/L.

The EPA recognizes that, unlike an instantaneous minimum criterion, the 10th percentile criterion allows for 12 days of exceedance with no lower bound. However, monitoring data from the Delaware River show that the minimum percent oxygen saturation in each year is closely related to the 10th percentile. Based on a linear regression of 2002 – 2022 data from the monitoring stations at Chester and Penn's Landing, the EPA expects that when the 10th percentile of daily average oxygen saturation in the *Juvenile Development* season is 66%, the minimum daily average oxygen saturation will be 61% ($r^2 = 0.93$, 95% confidence interval: 60.6% to 61.7% saturation). Based on the EPA's cohort modeling approach, if the 10th percentile criterion is attained, then the oxygen values expected to occur during the 12 days of potential exceedance will not be low enough to result in seasonal HSI values less than zero or prevent attainment of the propagation use, making the addition of an instantaneous minimum criterion unnecessary. The EPA also concluded that the 10th percentile dissolved oxygen condition can be calculated with greater statistical certainty than the instantaneous minimum because, by definition, no dissolved oxygen data points are less than the minimum. In contrast, dissolved oxygen data points are present both below and above the 10th percentile, providing ample data to increase the statistical confidence in estimates of the 10th percentile. Using a more statistically robust criterion like a 10th percentile compared to an instantaneous minimum criterion will ensure more predictable water quality assessments, thus reducing the need for states to account for uncertainty and variability when assessing attainment of the EPA's criteria. Given issues with variability, representativeness, and measurement uncertainty associated with assessment of an instantaneous minimum value, many states add an extra layer of allowable exceedance frequency to their assessment protocols for such criteria (e.g., 10% exceedance). The rationale for considering additional exceedance frequencies is eliminated when setting criteria at the 10th percentile and median values, as the EPA has done in this final rule.

In addition to the above stated considerations about why an instantaneous minimum criterion is not the best approach to protect the propagation use, the EPA considered if the Agency should include an instantaneous minimum criterion of 6 mg/L, as suggested by a commenter. However, the commenter did not provide a sound scientific rationale for this value, and the EPA's own evaluation does not support the need for a 6 mg/L instantaneous minimum criterion to protect the propagation use. Rather, the EPA's evaluation suggested that a defensible value for an instantaneous minimum would be below 6 mg/L, were the EPA to calculate an instantaneous minimum criterion to protect the propagation use. Therefore, the EPA concluded that finalizing a 10th percentile daily average criterion, and not including an instantaneous minimum criterion, reflects the latest scientific knowledge and is an appropriate way to ensure that aquatic life propagation is protected based on current data.

Several commenters asserted that the EPA's criteria are too stringent. Some commenters stated that the criteria in the EPA's rule are higher than criteria for some other waters with designated uses that include propagation, including surrounding areas of the Delaware River. Some commenters asserted that the EPA's criteria are too stringent because Atlantic Sturgeon propagation is already occurring in the Delaware River and that existing dissolved oxygen levels do not appear to be adversely affecting sturgeon. Some of these commenters recommended that the EPA promulgate dissolved oxygen criteria of 4.5 mg/L at a 10% exceedance frequency and 5.0 mg/L at a 50% exceedance frequency for the *Juvenile Development* season.

The EPA disagrees that the criteria in this final rule are more stringent than the dissolved oxygen criteria for surrounding areas of the Delaware River or other waters cited by commenters with designated uses that include propagation, such as the Chesapeake Bay. Upstream Zone 2 and downstream Zone 6 of the Delaware River have daily average dissolved oxygen criteria in the summer months (June 16 to September 15) of 5 mg/L and 6 mg/L, respectively. Because these criteria in Zones 2 and 6 have comparable magnitudes and no exceedance frequency, they are more stringent than the EPA's final dissolved oxygen criteria for the *Juvenile Development* season. Please refer to the associated response to comments document for more discussion about the comparison between the criteria in this final rule with dissolved oxygen criteria for some other waters along the East Coast, such as the Chesapeake Bay.

Commenters recommending the EPA adopt dissolved oxygen criteria of 4.5 mg/L at a 10% exceedance frequency and 5.0 mg/L at a 50% exceedance frequency for the *Juvenile*

Development season did not provide a sound scientific rationale as to how these values would be protective of the propagation designated use, in accordance with 40 CFR 131.11(a). A dissolved oxygen criterion of 4.5 mg/L generally reflects current conditions in the specified zones. Under current conditions, propagation of oxygen-sensitive species has been "weak and inconsistent" according to the DRBC[88] and the New York Bight DPS of Atlantic Sturgeon remains at a high risk of extinction according to NMFS.[89] Please refer to the associated response to comments document for more discussion about Atlantic Sturgeon propagation under current conditions in the specified zones.

Criteria Development for Spawning and Larval Development and Overwintering Seasons

The Atlantic Sturgeon cohort model described above relies on experimental studies that were conducted using juvenile sturgeon and therefore provides information that is most relevant to juvenile growth and survival.[90] Additionally, the underlying studies allocated most experimental treatments to water temperatures between 12°C and 28°C, with a single experimental treatment at 6°C and none at lower water temperatures.[91] The EPA's cohort modeling approach therefore does not apply to the *Spawning and Larval Development* season and is not well-constrained by data for application to the *Overwintering* season. For example,

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[88] "Weak and inconsistent spawning by Atlantic Sturgeon and limited spatial recovery in spawning and rearing by American Shad and Striped Bass suggested that full restoration of the "propagation" use is not supported by the current available data." Delaware River Basin Commission. (2015).

[89] In their Biological Opinion, NMFS explained that, "[t]he New York Bight DPS's risk of extinction is "High" due to low productivity (e.g., relatively few adults compared to historical levels and irregular spawning success), low abundance (e.g., only three known spawning populations and low DPS abundance, overall), and limited spatial distribution (e.g., limited spawning habitat within each of the few known rivers that support spawning)." Documents associated with Endangered Species Act consultation, including the Biological Opinion, are available in the docket for this rule.

[90] Experimental data are from Campbell and Goodman 2004 and Niklitschek and Secor 2009a.

[91] Niklitschek and Secor 2009a.

overwintering juveniles experience lower water temperatures for longer periods than juvenile Atlantic Sturgeon experienced in available experimental studies. Causes of overwintering mortality, which do not include low oxygen, are not addressed. While juveniles are present during the spawning and larval development period, they are from the prior season and are larger than fish whose oxygen sensitivity has been studied. Accordingly, the EPA did not use the cohort model to derive criteria for the *Spawning and Larval Development* or *Overwintering* seasons.

Instead, the EPA reviewed available literature and concluded that Atlantic Sturgeon larvae were likely to be at least as sensitive to low dissolved oxygen as juvenile Atlantic Sturgeon[92] and that overwintering juveniles have temperature-limited metabolism and therefore have similar or slightly lower oxygen requirements than juveniles in warmer waters (e.g., summer water temperatures).[93] Thus, the EPA determined that the percent oxygen saturation threshold that would be protective of juveniles experiencing stressful (high) water temperatures during the *Juvenile Development* season would also be protective of larvae and overwintering juveniles not experiencing high water temperatures. Therefore, the EPA is finalizing criteria requiring the 10^{th} percentile of daily average oxygen saturation to be at least 66% during the *Spawning and Larval Development* and *Overwintering* seasons. From 2002 – 2022, typical oxygen levels during the *Spawning and Larval Development* and *Overwintering* seasons were well above the level expected to negatively impact either Atlantic Sturgeon or other oxygen-

[92] Stoklosa et al. (2018); United States Environmental Protection Agency. (2000). Ambient Aquatic Life Water Quality Criteria for Dissolved Oxygen (Saltwater): Cape Cod to Cape Hatteras. Document ID: EPA-822-R-00-012. November 2000. *https://www.epa.gov/sites/default/files/2018-10/documents/ambient-al-wqc-dissolved-oxygen-cape-code.pdf*.

[93] Niklitschek and Secor (2009a, 2009b).

sensitive species. Therefore, the EPA concluded that a second criterion at the 50th percentile of daily average oxygen was not needed during these seasons.

Criteria Expressed as Percent Oxygen Saturation

Finally, the EPA proposed and is finalizing criteria derived in terms of percent oxygen saturation in this instance, rather than in units of concentration (such as milligrams per liter or mg/L) for two related reasons.[94] Most importantly, percent oxygen saturation determines the maximum rate at which aquatic organisms can absorb oxygen from the water and therefore, is the measurement of oxygen level that most directly relates to growth and survival of aquatic organisms.[95] If the maximum rate at which an aquatic organism can absorb oxygen from the water is less than needed to meet basic metabolic requirements, the organism is at increased risk of mortality. Because organisms require an increased rate of oxygen supply to obtain and digest food, a reduced rate of oxygen supply may also cause reduced growth, even if it does not cause mortality. Although dissolved oxygen concentration is related to percent oxygen saturation, it also varies in relation to water temperature and, to a lesser extent, in relation to salinity, which together determine oxygen concentration at equilibrium with the atmosphere. For any level of oxygen saturation, dissolved oxygen concentration will be relatively low when water temperature and salinity are high, and relatively high when water temperature and salinity are low. Therefore, protective dissolved oxygen concentrations vary with water temperature, as is reflected in the

[94] Percent oxygen saturation and dissolved oxygen concentration are two different ways to measure oxygen levels in water. Dissolved oxygen concentration is the amount of oxygen dissolved in the water, typically represented as milligrams of oxygen per liter of water. Percent oxygen saturation is the ratio, expressed as a percentage, of the dissolved oxygen concentration in the water relative to the dissolved oxygen concentration when at equilibrium with the atmosphere (i.e., if there were nothing in the water producing or consuming oxygen).
[95] Niklitschek and Secor (2009a).

seasonally varying concentration-based criteria for the specified zones of the Delaware River that the EPA sought public comment on in the proposed rule as an alternative to the proposed percent saturation criteria. The effect of temperature is especially challenging for deriving protective concentration-based criteria for periods within which water temperature varies substantially. Given the relationship between water temperature and dissolved oxygen concentration, criteria expressed as a concentration could be either higher than needed to protect the use or not high enough to protect the use, depending on water temperature. Conversely, the EPA's criteria for the 10th percentile do not vary seasonally, despite substantial seasonal differences in water temperature. Therefore, criteria expressed as percent oxygen saturation provide more consistent protection of aquatic life across seasonally changing water temperatures and provide a more direct scientific rationale linking oxygen levels and aquatic life use protection. A summary of comments the EPA received on the expression of criteria in percent oxygen saturation is available below in section III.C.3. of this preamble.

2. Final Dissolved Oxygen Criteria

The EPA is finalizing the dissolved oxygen criteria as proposed, with only one non-substantive textual change to the language describing the criteria exceedance frequencies for clarity.[96]

The EPA's dissolved oxygen criteria cover three distinct seasons and are intended to protect oxygen-sensitive species in the Delaware River, as explained above. The *Spawning and Larval Development* season is March 1 to June 30 and captures a comprehensive range of

[96] United States Environmental Protection Agency. (2023). *Water Quality Standards to Protect Aquatic Life in the Delaware River*. Proposed Rule. 88 FR 88315. December 21, 2023.

resident aquatic species' spawning periods.[97] The *Juvenile Development* season is July 1 to October 31 and captures critical early growth and development for young-of-the-year Atlantic Sturgeon. The *Overwintering* season is November 1 to February 28 (or 29, in a leap year), when juvenile Atlantic Sturgeon growth is limited by low water temperatures.

Each season has water quality criteria that consist of three components: magnitude, duration, and exceedance frequency. The magnitude component indicates the required level of dissolved oxygen in the water, which in this rule is expressed as percent oxygen saturation. The duration component specifies the time period over which water quality is averaged before it can be compared with the criteria magnitude; in this rule, the duration is a daily average. The EPA selected a daily average duration because it is readily measurable using dissolved oxygen sensors and is protective in the relevant zones of the Delaware River because variations at time scales of less than one day are relatively small. Additionally, while the available science for Atlantic Sturgeon does not address the effect of low oxygen exposures lasting less than one day, calculations outlined in the Virginian Province Document suggest that to cause high mortality within a few hours, daily minimum oxygen concentrations would have to be lower than the minimum oxygen levels that the EPA expects would be likely in the specified zones if the EPA's criteria are attained.[98] The exceedance frequency component specifies how often each criterion magnitude can be exceeded while still ensuring that the use is protected. For this rulemaking, the exceedance frequency was determined based on the percentile of percent oxygen saturation from

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[97] Stoklosa et al. (2018); Delaware River Basin Commission (2015).

[98] United States Environmental Protection Agency. (2000). Ambient Aquatic Life Water Quality Criteria for Dissolved Oxygen (Saltwater): Cape Cod to Cape Hatteras. Document ID: EPA-822-R-00-012. November 2000. *https://www.epa.gov/sites/default/files/2018-10/documents/ambient-al-wqc-dissolved-oxygen-cape-code.pdf.*

which the magnitude is derived. For example, the 10th percentile criterion magnitude can be exceeded on 10% of days in the season, which for a season consisting of 123 days is no more than 12 cumulative days of exceedance. For dissolved oxygen, an exceedance occurs when the daily average oxygen level in the water is below the criterion magnitude.

In this final rule, the *Spawning and Larval Development* and *Overwintering* seasons each have a single, identical dissolved oxygen criterion with a magnitude of 66% oxygen saturation, a daily average duration, and an exceedance frequency that allows for up to 12 days of cumulative exceedance during each of these two seasons (i.e., 10% of each 123-day season) (table 6 of this preamble). The *Juvenile Development* season has two individually applicable dissolved oxygen criteria that together define a protective seasonal distribution of percent oxygen saturation. The criteria differ in both magnitude and exceedance frequency and both levels must be attained. The first *Juvenile Development* criterion defines the lower end of the distribution of oxygen levels and consists of a magnitude of 66% oxygen saturation, a daily average duration, and an exceedance frequency that allows for up to 12 days of cumulative exceedance during the season (i.e., 10% of the 123-day season). The second *Juvenile Development* criterion defines the center of the distribution of oxygen levels and consists of a magnitude of 74% oxygen saturation, a daily average duration, and an exceedance frequency that allows for up to 61 days of cumulative exceedance during the season (i.e., 50% of the 123-day season) (table 6 of this preamble).

The dissolved oxygen criteria in this final rule are the same as the criteria that the EPA proposed, with one non-substantive textual change for clarity.[99] The EPA altered the expression

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[99] United States Environmental Protection Agency. (2023). *Water Quality Standards to Protect Aquatic Life in the Delaware River*. Proposed Rule. 88 FR 88315. December 21, 2023.

of the criteria exceedance frequency, as reflected in the rightmost column in table 6 of this preamble and in the final regulatory text. Whereas the EPA proposed exceedance frequencies expressed as, for example, “10% (12 Days Cumulative),” for the final rule, the EPA reversed the order (e.g., “12 Days Cumulative (10% of the 123-day season)”) to make clear that assessment in each season is based on the entire season and not the number of measurements collected.

Table 6. Final Dissolved Oxygen Criteria

Season	Magnitude (Percent Oxygen Saturation)	Duration	Exceedance Frequency
Spawning and Larval Development *(March 1 – June 30)*	66%	Daily Average	12 Days Cumulative *(10% of the 123-day season)*
Juvenile Development *(July 1 – October 31)*	66%	Daily Average	12 Days Cumulative *(10% of the 123-day season)*
	74%	Daily Average	61 Days Cumulative *(50% of the 123-day season)*
Overwintering *(November 1 – February 28/29)*	66%	Daily Average	12 Days Cumulative *(10% of the 123-day season)*

3. Comments Received on Criteria Alternatives Presented at Proposal

At proposal, the EPA included three alternative options for dissolved oxygen criteria that the Agency considered but ultimately did not propose due to concerns about whether each alternative would be protective of aquatic life propagation. The EPA requested comment and additional information on whether and how one or more of these alternatives could protect the proposed aquatic life designated uses in the specified zones of the Delaware River and if so, what anticipated benefits would be associated with the alternative compared to the EPA’s proposed criteria. This section provides summaries of the comments received regarding the three criteria alternatives and summaries of the EPA's responses.

Alternative 1: Dissolved Oxygen Criteria Expressed as Concentration (mg/L).

For the reasons described above in section III.C. of this preamble, the EPA proposed dissolved oxygen criteria expressed as percent oxygen saturation. For the first alternative, the EPA provided an example of potential criteria expressed as concentration (mg/L) and requested comment on whether criteria expressed as concentration would be protective of oxygen-sensitive species during each season. The EPA also requested public input and supporting information about other ways the Agency could develop dissolved oxygen criteria expressed as concentration — particularly for the *Spawning and Larval Development* and *Overwintering* seasons — to protect the relevant aquatic life uses in accordance with the CWA.

Most commenters indicated a preference for criteria expressed as concentration due to concerns regarding implementation, specifically NPDES permitting, and ease of public communication. In addition, some commenters asserted that criteria expressed as concentration are more protective of aquatic life, especially in warmer water temperatures. Conversely, commenters supporting criteria expressed as percent oxygen saturation agreed with the EPA's rationale as presented in the associated technical support document and summarized in section III.C.2. of this preamble. In addition to public comments, the EPA also solicited comment on this alternative from external peer reviewers. External peer reviewers supported the criteria expressed as percent oxygen saturation, rather than concentration, as percent oxygen saturation is the measurement of oxygen level that most directly relates to growth and survival of aquatic organisms.

The EPA understands that the switch from concentration-based dissolved oxygen criteria to percent saturation because of this rule could require changes to each state's NPDES permitting procedures and could necessitate additional public education and outreach. However, the EPA is committed to working with Delaware, New Jersey, Pennsylvania, and the DRBC to address implementation and outreach concerns and provide technical support. To inform the Agency's consideration of this alternative for the final rule, the EPA met with the DRBC, Delaware, New Jersey, and Pennsylvania to discuss the percent oxygen saturation aspect of the proposal and potential solutions to implementation challenges and ways in which the EPA could assist in a transition to percent oxygen saturation for NPDES permits.

The EPA disagrees with commenters' assertions that criteria expressed as concentration are more protective of aquatic life than criteria expressed as percent oxygen saturation. The EPA derived equally protective values expressed as concentration and percent oxygen saturation for the *Juvenile Development* season using the Atlantic Sturgeon cohort model. For informational purposes, the EPA is providing the corresponding values in concentration for the *Juvenile Development* season in table 7 of this preamble.

Table 7. Corresponding Dissolved Oxygen Values in Concentration for the *Juvenile Development* Season

Season	Magnitude (mg/L)	Duration	Exceedance Frequency
Juvenile Development *(July 1 – October 31)*	5.4	Daily Average	12 Days Cumulative *(10% of the 123-day season)*
	6.1	Daily Average	61 Days Cumulative *(50% of the 123-day season)*

For the *Spawning and Larval Development* and *Overwintering* seasons, the EPA requested, but did not receive, information and methods for deriving protective concentration-based criteria in those seasons.[100] In the absence of such information, the EPA could not derive protective concentration-based criteria for the *Spawning and Larval Development* and *Overwintering* seasons. Instead, the Agency is finalizing criteria for each of the seasons expressed as percent saturation for the reasons explained in section III.C.1 of this preamble. Monitoring data from the last decade indicate that the EPA's percent saturation-based dissolved oxygen criteria for the *Spawning and Larval Development* and *Overwintering* seasons are being attained in the specified zones of the Delaware River, and therefore the EPA does not anticipate implementation of the criteria in these seasons to require additional pollutant controls from any regulated entities. Nonetheless, given that some commenters expressed greater familiarity with dissolved oxygen criteria expressed as concentration, for informational purposes, transparency, and completeness, the EPA is reproducing in table 8 of this preamble the concentration-based dissolved oxygen values for the *Spawning and Larval Development* and *Overwintering* seasons that the Agency took comment on in the proposed rule.[101] As noted in the preamble to the proposed rule, the EPA calculated alternative concentration-based dissolved oxygen values for the *Spawning and Larval Development* and *Overwintering* seasons that differed based on water temperature assumptions and noted concerns about whether these alternative values would be protective in these seasons when temperatures are cooler.[102] As one option, the EPA used the 90th

[100] United States Environmental Protection Agency. Proposed Rule: Water Quality Standards to Protect Aquatic Life in the Delaware River. 88 FR 88315. December 21, 2023.
[101] *Ibid*.
[102] *Ibid*.

percentile of water temperatures in each season to convert the proposed 66% oxygen saturation criterion to a concentration, and as a second option, the EPA used the average water temperature in each season.[103] Unlike the equally protective concentration-based values for the *Juvenile Development* season that the EPA derived using the Atlantic Sturgeon cohort model and is providing for illustrative purposes in table 7 of this preamble, the EPA reiterates that the values in table 8 of this preamble should not be viewed as necessarily protective of the aquatic life designated use that the EPA is promulgating in this final rule. Rather, these values in table 8 of this preamble are simply an illustrative conversion of the protective percent saturation criteria for the *Spawning and Larval Development* and *Overwintering* seasons using specific temperature assumptions. The concentration-based values provided in tables 7 and 8 for informational purposes are not being promulgated as criteria in this final rule.

Table 8. Illustrative Example Dissolved Oxygen Values in Concentration for the *Spawning and Larval Development* and *Overwintering* Seasons

Season	Water Temperature (°C)	Magnitude (mg/L)
Spawning and Larval Development *(March 1 – June 30)*	23.3 (14.7)*	5.6 (6.7)*
Overwintering *(November 1 – February 28/29)*	12.4 (5.6)*	7.0 (8.3)*
* The 90th percentile of seasonal water temperature and corresponding value is used for the main estimate, while the average water temperature and corresponding value is shown in parentheses.		

One commenter suggested that concentration-based criteria calculated for critical conditions (examples provided were low flow conditions or high temperatures) could be applied

[103] Seasonal 90th percentile and mean water temperature were calculated using the daily climatology computed for Chester for March 1, 2012 – June 30, 2022, for the *Spawning and Larval Development* season and November 1, 2011 – February 28, 2022, for the *Overwintering* season.

year-round. However, given the negative relationship between dissolved oxygen concentrations and temperature, as explained previously in section III.C.1. of this preamble, year-round concentration-based criteria calculated using summer high temperatures may not be protective at lower temperatures. The EPA recognizes that criteria expressed as concentration would become more stringent if water temperatures increase; however, the EPA's criteria are derived to protect aquatic life designated uses that include propagation in the specified zones of the Delaware River based on current water quality data. As explained in section II of this preamble, states are required to review their WQS at least once every three years and if appropriate, revise or adopt new standards. The EPA's technical approach for this rulemaking illustrates one potential way in which new water quality data could be evaluated to determine if a change to criteria is needed to maintain protectiveness. Thus, the EPA anticipates that Delaware, New Jersey, and Pennsylvania will reexamine the applicable aquatic life uses and dissolved oxygen criteria promulgated in this rule when completing their triennial reviews and determine if revised criteria are necessary to comply with the CWA. During their triennial review, states may also consider making other revisions to their applicable WQS.

For all these reasons, the EPA has concluded that criteria expressed as percent oxygen saturation are protective and consistent with the latest science and therefore, the Agency did not move forward with this alternative for the final rule.

Alternative 2: Single Dissolved Oxygen Criterion During the Juvenile Development Season with a 10% Exceedance Frequency.

The EPA proposed dissolved oxygen criteria for the *Juvenile Development* season that consisted of two values that would both have to be met during the season. For the second alternative, the EPA requested comment and supporting information on instead applying a single daily average dissolved oxygen criterion with an exceedance frequency of 10% of days during the *Juvenile Development* season.

Some commenters preferred the single criterion construct, with one commenter asserting that the EPA's methodology provides a stronger technical basis for a single criterion. Other commenters did not support Alternative 2, with one commenter expressing a preference for a single instantaneous minimum criterion, and another supporting lower criteria magnitudes expressed as concentration.

The EPA's responses to comments regarding an instantaneous minimum criterion and criteria expressed as concentration are articulated above in this section of this preamble. The EPA disagrees that there is a stronger technical basis for a single criterion construct. As explained above, the dual criteria construct is intended to ensure that oxygen levels throughout the critical *Juvenile Development* season consistently support aquatic life propagation. Therefore, the Agency did not move forward with this alternative for the final rule.

Alternative 3: Inclusion of a 1-in-3-Year Interannual Exceedance Frequency.

The EPA proposed criteria that must be met every year. For the third alternative, the EPA requested comment and supporting information on the addition of a 1-in-3-year interannual exceedance frequency as part of the dissolved oxygen criteria, and specifically how and why this approach would protect the applicable aquatic life uses.

Most commenters did not support the inclusion of an interannual exceedance frequency. These commenters noted that due to the small population size of Atlantic Sturgeon in the Delaware River, combined with the interannual variability in the number of spawning adults, even one year with a criteria exceedance could reduce the ability of sturgeon to propagate and be detrimental to the year class. Some commenters expressed support for inclusion of an interannual exceedance frequency. These commenters preferred this alternative to address uncertainty in the EPA's criteria derivation methods for this rulemaking and dissolved oxygen variability caused by factors such as drought or low flow. In addition to public comments, the EPA also solicited comment on this alternative from external peer reviewers. External peer reviewers did not support the inclusion of a 1-in-3-year interannual exceedance frequency. One reviewer noted that the effect of a failed year class resulting from poor water quality could impact the population for many years. This reflects the fact that Atlantic Sturgeon often have a long lifespan, with consistently low rates of mortality as adults. In contrast, mortality is highest among young-of-the-year juveniles and has the most potential to be reduced; therefore, reduction in juvenile mortality can have the greatest impact on population growth.[104] If recruitment is low in a year due to high juvenile mortality, a demographic gap can persist in the adult population for several decades, potentially reducing the number of adults returning to spawn. Overall, reviewers noted that uncertainties around this alternative are significantly higher and that it is a less biologically relevant option.

As described above, the EPA specifically requested comment on whether and how this alternative would protect aquatic life propagation. Commenters who supported this alternative did not provide such supporting information. Therefore, the EPA did not have sufficient information to conclude that this alternative would protect designated uses that include aquatic

[104] Gross, M. R., J. Repka, C. T. Robertson, D. Secor and W. Van Winkle (2002). Sturgeon Conservation: Insights from Elasticity Analysis. American Fisheries Society Symposium 28: 13-30.

life propagation. The EPA agrees with commenters and peer reviewers that allowing one year of exceedance could have detrimental impacts on sturgeon propagation, which in turn could impact the population for decades. Therefore, the EPA did not move forward with this alternative for the final rule.

IV. Endangered Species Act Consultation

Section 7(a)(2) of the Endangered Species Act (ESA) requires that each Federal agency ensure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat.[105] Pursuant to section 7(a)(2) of the ESA, and prior to finalizing this rulemaking, the EPA consulted with the U.S. Fish and Wildlife Service (FWS) and NMFS (collectively, "the Services") on the WQS the EPA is promulgating in this final rule. For species in the action area that are under the jurisdiction of the FWS,[106] on April 4, 2024, the FWS concurred with the EPA's determination that the EPA's action is not likely to have an adverse effect on those listed species.[107] NMFS determined in a final Biological Opinion dated October 11, 2024,[108] that the EPA's action is not likely to adversely affect certain

[105] 16 U.S.C. 1536(a)(2).
[106] These species include three mammals (Indiana Bat, Northern Long-eared Bat, and Tricolored Bat), one bird (Rufa Red Knot), one reptile (Bog Turtle), one insect (Monarch Butterfly), and two flowering plants (Sensitive-joint Vetch and Swamp Pink).
[107] United States Fish and Wildlife Service. (2024). Letter to Gregory Voigt. Reference: Biological Evaluation for the Establishment of the Aquatic Life Propagation Designated Use and Dissolved Oxygen Criteria for the Delaware River, States of New Jersey, Pennsylvania, and Delaware. Document ID 2024-0046899. April 4, 2024.
[108] National Marine Fisheries Service. Establishment of Aquatic Life Propagation Designated Use and Dissolved Oxygen Criteria for the Delaware River by the United States Environmental Protection Agency. Endangered Species Act Section 7 Biological Opinion. OPR-2022-03643. National Oceanic and Atmospheric Administration. October 11, 2024. *https://doi.org/10.25923/jqht-ke64*.

species and critical habitat in the action area,[109] and is likely to adversely affect certain other species but will not jeopardize their continued existence or destroy or adversely modify their designated critical habitat.[110] NMFS concluded that "the EPA set the [dissolved oxygen] criteria at levels expected to allow for the successful propagation of [S]hortnose and New York Bight DPS of Atlantic [S]turgeon, improving prospects for increasing population sizes for both species spawning in the river." Documents associated with ESA consultation are available in the docket for this rule.

NMFS included an Incidental Take Statement (ITS) in its Biological Opinion to address the incidental take of Shortnose Sturgeon and Atlantic Sturgeon in the Delaware River due to exposure to dissolved oxygen levels in waters that attain the EPA's final criteria. The ESA and its implementing regulations provide that incidental take by a Federal agency is not prohibited if performed in compliance with the terms and conditions of an ITS.[111] The ITS included two Reasonable and Prudent Measures (RPMs) NMFS considered necessary and appropriate for the EPA to follow to minimize the effects of incidental take on Shortnose Sturgeon and Atlantic Sturgeon:[112]

1. EPA is to work within its authorities to ensure that its final dissolved oxygen criteria are implemented in a timely manner to minimize the aggregate adverse effects to ESA-listed

[109] These species and critical habitat include two mammals (Fin Whale and North Atlantic Right Whale), five reptiles (Green Sea Turtle, Kemp's Ridley Sea Turtle, Leatherback Sea Turtle, Hawksbill Sea Turtle, Loggerhead Sea Turtle), Atlantic Sturgeon Distinct Population Segments (DPSs) that do not spawn in the Delaware River (i.e., Gulf of Maine, Chesapeake Bay, Carolina, and South Atlantic DPSs), and designated critical habitat for the New York Bight DPS of Atlantic Sturgeon.
[110] These species are the Shortnose Sturgeon and the New York Bight DPS of Atlantic Sturgeon.
[111] 16 U.S.C. 1536(b)(4), (o)(2); 50 CFR 402.14(i)(6).
[112] The EPA does not necessarily endorse or concede that these RPMs are necessary or appropriate to minimize the impact of any incidental take.

Shortnose Sturgeon and New York Bight DPS of Atlantic Sturgeon and critical habitat designated for the New York Bight DPS of Atlantic Sturgeon specifically within the Delaware River.

2. EPA is to work within its authorities to oversee the implementation of the dissolved oxygen criteria, coordinating with the Services and encouraging other entities to coordinate with the Services, as appropriate.

NMFS specified in the Terms and Conditions of the ITS that to meet the first RPM, the EPA is to notify regulatory agencies and the regulated community that, in NMFS's view as of October 2024, existing dissolved oxygen conditions in the Delaware River violate the ESA by resulting in the take of endangered Shortnose Sturgeon and the New York Bight DPS of Atlantic Sturgeon through increased mortality and reductions in growth of juvenile fish. Per the ITS, the EPA is to reference the following sections of the ESA and its implementing regulations. Section 9 of the ESA[113] prohibits the "take" of endangered species by any person, defined by the ESA.[114] The ESA defines "take" as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct."[115] The terms "harass" and "harm" are currently further defined in NMFS guidance[116] and in regulation,[117] respectively. Entities that are discharging in accordance with limits based on the EPA's final criteria are covered by the ITS exemption in the Biological Opinion; entities that are not discharging in accordance with such

[113] 16 U.S.C. 1538.
[114] 16 U.S.C. 1532(13). NMFS also specified in the Terms and Conditions that the EPA is to reference ESA section 11, which authorizes criminal and civil penalties for violations of the take prohibition. 16 U.S.C. 1540.
[115] 16 U.S.C. 1532(19).
[116] NMFS Policy Directive 02-110-19.
[117] 50 CFR 222.102. On April 17, 2025, the Services proposed a rule to rescind the regulatory definition of "harm" in the ESA implementing regulations. Rescinding the Definition of "Harm" Under the Endangered Species Act, 90 FR 161102 (April 17, 2025).

limits may elect to seek separate incidental take coverage under section 10 of the ESA. For more information, see NMFS's ESA section 7 Biological Opinion, available in the docket for this rule.

Additionally, to meet the first RPM, the EPA is to remind regulatory agencies, the regulated community, and the interested public of the EPA's authorities under the CWA that are potentially relevant to this final rule. These authorities include reviewing TMDLs pursuant to CWA section 303(d); objecting to certain state-issued CWA section 402 pollutant discharge permits under CWA section 402(d)(2); issuing CWA section 402 pollutant discharge permits under CWA section 402(d)(4) if the EPA's objections to state-issued permits are not adequately addressed; or withdrawing state pollutant discharge permitting programs in certain circumstances under CWA section 402(c)(3).

V. Applicability

The EPA is promulgating a Federal designated use that applies in New Jersey and Pennsylvania, in addition to those states' designated uses that are already applicable. This means that for the specified zones of the Delaware River, the EPA is supplementing, rather than replacing, New Jersey's and Pennsylvania's currently applicable aquatic life designated uses. Therefore, New Jersey's and Pennsylvania's currently applicable aquatic life designated uses remain applicable for CWA purposes. Those states' current water quality criteria associated with those uses also remain applicable for CWA purposes, with the exception of any aquatic life criteria for dissolved oxygen, which are discussed below. The EPA concluded that this approach is the best way to make clear which of the states' WQS are and are not revised by this final rule.

In addition, the EPA is promulgating dissolved oxygen criteria that replace Delaware's, New Jersey's, and Pennsylvania's existing dissolved oxygen criteria for the specified zones of the Delaware River. In the final rule, the EPA made a minor, non-substantive change to paragraph (d)(2) to simplify the language used to describe the other state water quality criteria that apply to these zones of the Delaware River in addition to the federally promulgated criteria for dissolved oxygen. Specifically, the EPA replaced the language "with applicable water quality criteria for other parameters" with "with other applicable water quality criteria." One commenter shared that Delaware's regulations specify that the applicable criteria for the specified zones of the Delaware River are those adopted by the DRBC in its Water Quality Regulations, unless no criteria exist in the DRBC's regulations in which case the state's criteria apply. This commenter asserted that the proposed rule did not define how the proposed designated use and criteria will be adopted into the DRBC's Water Quality Regulations. The designated use and dissolved oxygen criteria in this final rule do not need to be adopted into the DRBC's Water Quality Regulations in order to apply to these zones of the Delaware River. Pursuant to 40 CFR 131.21, where a WQS in effect under state law is applicable for CWA purposes, if the EPA promulgates a more stringent standard for that state, then the EPA-promulgated standard becomes the applicable standard for CWA purposes. Further, under CWA section 303(c)(4)(B), the EPA Administrator has the authority to promulgate standards in any case where the Administrator determines that a new or revised standard is necessary to meet the requirements of the CWA, as discussed more in section II.A of this preamble. Pursuant to CWA section 303(c), the Agency made an Administrator's Determination and is promulgating Federal WQS for Delaware, New Jersey, and Pennsylvania in accordance with that Administrator's Determination. As such, the WQS in this final rule will be effective for CWA purposes even though they have not been adopted by the DRBC.

The EPA recognizes, however, that with this final rule, there will now be a mix of state and Federal WQS that are applicable to the specified zones for CWA purposes. The EPA compiles and publishes on its website[118] the state-adopted and federally promulgated WQS in effect for CWA purposes in each state, including the Federal CWA-effective WQS for the specified zones covered by this rule. For transparency and ease of implementation, the EPA recommends that Delaware, New Jersey, and Pennsylvania similarly identify in a publicly available place that the WQS in the EPA's final rule are part of the CWA-effective WQS in each state (e.g., by including a notation in each state's WQS and/or on the website that hosts each state's WQS, directing people to the *Federal Register* publication for this final rule, appropriate section of 40 CFR part 131, and/or the EPA's website).

The EPA notes that there are aquatic life criteria for pollutants and parameters other than dissolved oxygen that are still in effect for CWA purposes in all three states — not only in the zones covered by this final rule, but also for other zones of the Delaware River that already include aquatic life propagation as a designated use. Those criteria are not impacted by this final rule. As the EPA is only promulgating revised dissolved oxygen criteria for the specified zones of the Delaware River, Delaware, New Jersey, and Pennsylvania should evaluate whether other aquatic life criteria should similarly be added or revised for the specified zones or other zones of the Delaware River. One way these states can review their WQS is through the triennial review process. As explained in section II of this preamble, states must review their WQS at least once every three years and, if appropriate, revise standards or adopt new standards (CWA section

[118] United States Environmental Protection Agency. State-Specific Water Quality Standards Effective under the Clean Water Act (CWA). *https://www.epa.gov/wqs-tech/state-specific-water-quality-standards-effective-under-clean-water-act-cwa*. Accessed September 19, 2024.

303(c)(1) and 40 CFR 131.20(a)). The EPA anticipates that Delaware, New Jersey, and Pennsylvania will review their existing aquatic life criteria during their next triennial review to determine if new or revised aquatic life criteria are appropriate to protect the applicable aquatic life designated uses, including the designated use that the EPA is promulgating in this final rule, in addition to considering whether to make other changes to their WQS.

One commenter asserted that Pennsylvania has a minimum dissolved oxygen criterion of 5 mg/L that currently applies to the specified zones of the Delaware River under Pennsylvania's jurisdiction and that the EPA failed to recognize the application of this criterion. This commenter asserted that the EPA's proposed dissolved oxygen criteria would result in a weakening of the applicable WQS because the EPA's criteria could allow daily excursions down to or below 4 mg/L, and that this would violate the antidegradation requirement at 40 CFR 131.12(a)(1) to maintain and protect existing uses. Further, this commenter asserted that the EPA has a duty under the Endangered Species Act to ensure no jeopardy to the endangered sturgeon in the specified zones and that the EPA's effort to update the WQS must be consistent with full recovery of the sturgeon rather than only slight improvements in their condition, which may be insufficient.

As noted in sections II.D. and III.B. of this preamble, Pennsylvania's WWF designated use and the EPA-approved aquatic life criteria associated with Pennsylvania's WWF use, including the state's WWF dissolved oxygen criteria of 5.5 mg/L as a 7-day average and 5.0 mg/L as a minimum, do not currently apply for CWA purposes to the specified zones of the Delaware River. For the WWF use and associated criteria to apply in the relevant zones for CWA purposes, Pennsylvania would need to revise its WQS accordingly and the EPA would need to approve that revision under CWA section 303(c). Rather, prior to this final rule, the applicable aquatic life designated use for Pennsylvania's portions of the specified zones of the Delaware River aligned with the DRBC's "maintenance" and "passage" designated use and the applicable dissolved oxygen criteria in Pennsylvania's portions of the relevant zones were the DRBC's criteria that Pennsylvania had adopted into its WQS by reference — namely, a year-round numeric water quality criterion for dissolved oxygen of 3.5 mg/L as a 24-hour average, as well as a seasonal criterion of 6.5 mg/L. Therefore, the EPA's aquatic life designated use of "protection and propagation of resident and migratory aquatic life" and dissolved oxygen criteria in this final rule represent a strengthening, rather than a weakening, of the applicable WQS in the relevant zones in Pennsylvania and are consistent with all 40 CFR part 131 requirements. For responses to the comments about daily excursions allowed under the EPA's criteria and the inclusion of an instantaneous minimum criterion value, please see section III.C. of this final rule preamble. Regarding the comment about the EPA's obligations under the Endangered Species Act, please refer to section IV of this preamble.

VI. Conditions Under Which Federal Water Quality Standards Would be Withdrawn

Under the CWA, states and authorized tribes have the primary responsibility in developing and adopting WQS for their navigable waters (CWA section 303(a) through (c)). Although the EPA is promulgating a revised aquatic life designated use and protective dissolved oxygen criteria for the specified zones of the Delaware River, each state retains the option to adopt and submit to the EPA for review its own revised designated use and dissolved oxygen criteria that are consistent with the requirements of the CWA. If Delaware, New Jersey, and Pennsylvania subsequently adopt and submit revised WQS to the EPA, and the EPA approves those WQS, then the EPA would undertake a rulemaking to withdraw the federally promulgated use and/or dissolved oxygen criteria (40 CFR 131.21(c)). Similarly, if one state adopts and submits revised WQS to the EPA, and the EPA approves those WQS, then the EPA would undertake a rulemaking to withdraw the federally promulgated WQS for that state. As noted earlier in this preamble, the EPA maintains that states have the primary role to develop WQS.

Pursuant to 40 CFR 131.21(c), if Delaware, New Jersey, and/or Pennsylvania adopt dissolved oxygen criteria that are as stringent or more stringent than the federally promulgated criteria, then once the EPA approves those criteria, they would become the applicable criteria for CWA purposes.[119] After approving any state criteria that are as stringent or more stringent, the EPA would conduct a ministerial rulemaking to withdraw the Federal criteria. If Delaware's, New Jersey's, and/or Pennsylvania's adopted dissolved oxygen criteria are less stringent than the federally promulgated criteria, and the EPA approves those less stringent criteria, then those EPA-approved criteria would become the applicable criteria for CWA purposes only after the EPA withdraws its federally promulgated criteria for the relevant state(s).

VII. Alternative Regulatory Approaches and Implementation Mechanisms

In the preamble to the proposed rulemaking, 88 FR 88315, December 21, 2023, the EPA noted several approaches provided at 40 CFR part 131 that Delaware, New Jersey, and Pennsylvania could explore when implementing or deciding how to implement federally promulgated criteria. Specifically, the EPA focused the discussion in the proposed rule preamble on two approaches — WQS variances and NPDES permit compliance schedules. Additionally,

[119] CWA section 303(c)(3) ("If the Administrator . . . determines that such standard meets the requirements of this Act, such standard shall thereafter be the water quality standard for the applicable waters of that State.").

the EPA included a discussion of CWA section 303(d)/305(b) water quality assessments in the specific circumstances relevant to this rulemaking. Each of these topics is discussed in turn directly below.

A. Water Quality Standards Variances and NPDES Permit Compliance Schedules

With respect to WQS variances and NPDES permit compliance schedules, some commenters asserted that implementation of the WQS in the EPA's rule should be phased and adaptively managed with incremental pollutant reductions followed by monitoring of water chemistry and fish communities to gauge the effectiveness of the pollutant controls. A few of these commenters asserted that WQS variances and NPDES permit compliance schedules are the tools the states should use to allow for such incremental progress, as needed. Conversely, one commenter asserted that because propagation is an attainable use in the specified zones of the Delaware River, WQS variances, which are used when attaining the designated use and associated criterion is not feasible during the term of the WQS variance, would defeat the purpose of the EPA's rule and would inappropriately require subsequent time-consuming rulemakings by states. Instead, this commenter asserted that NPDES permit compliance schedules are the appropriate implementation mechanism to use when dischargers need time to implement additional treatment technologies.

Regarding the appropriateness of WQS variances to implement the WQS in this final rule, the commenter is correct that the EPA determined that the propagation use is attainable in the specified zones. As discussed in the associated response to comments document, the EPA also recognizes the comments received on the proposed rule from certain dischargers regarding potential economic and social impacts. However, the EPA did not receive information from the states, the DRBC, or other stakeholders to demonstrate that attaining the propagation use is infeasible due to one of the factors listed at 40 CFR 131.10(g). Where a state believes that a discharger may not be able to meet any more stringent permit limits based on the propagation use and dissolved oxygen criteria for a specific period of time but can make incremental water quality improvements towards attaining the propagation use, then the state should work with the EPA to determine whether a WQS variance consistent with 40 CFR 131.14 would be appropriate for that discharger. The EPA has approved WQS variances adopted by states for various designated uses and criteria.[120] For example, states may adopt WQS variances for dischargers based on a demonstration of substantial and widespread economic and social impacts consistent with 40 CFR 131.14(b)(2)(i)(A)(*1*) and 40 CFR 131.10(g)(6). Such WQS variances may consider circumstances such as the degree to which: permit limits would become more stringent as a result of revised WQS for which incremental, though not immediate, improvements could be made; technological limitations exist; facility space constraints limit installation of certain technologies; and initial capital costs place significant burdens on the surrounding community. WQS variances can help mitigate near-term compliance burdens and costs while ensuring effective implementation.[121] The EPA, in coordination with the DRBC and the states of Delaware, New Jersey, and Pennsylvania, may issue further guidance on the available WQS flexibilities and permitting tools available to address implementation concerns for any affected

[120] For example: Minnesota (*https://www.pca.state.mn.us/business-with-us/water-quality-variances*), Wisconsin (*https://dnr.wisconsin.gov/topic/Wastewater/variances.html*), and Missouri (*https://dnr.mo.gov/water/business-industry-other-entities/variances/water-quality-standards*).

[121] The EPA would review any state-adopted WQS variances on a case-by-case basis for consistency with CWA section 303(c) and 40 CFR 131.14.

entities. Additional information on WQS variances and a WQS variance building tool is available on the EPA's website.[122]

Regarding the use of compliance schedules, the EPA agrees that where dischargers need additional time to implement an enforceable sequence of actions — such as facility upgrades or operation changes — that will lead to compliance with a water quality-based limit based on the applicable designated use and criteria, the permitting authority should consider an NPDES permit compliance schedule, addressed in the EPA's regulations at 40 CFR 122.47 and 131.15. If a permittee cannot immediately meet a water quality-based limit, the permitting authority may include a compliance schedule[123] in the permit, consistent with 40 CFR 122.47, to provide time to achieve the water quality-based limit. Generally, a compliance schedule must "require compliance as soon as possible."[124] Where a permit compliance schedule is longer than one year, the NPDES permit must include interim requirements and dates for their achievement.[125] The EPA's regulation at 40 CFR 131.15 specifies that if a state intends to authorize the use of compliance schedules in NPDES permits, "the [s]tate must adopt a permit compliance schedule authorizing provision. Such authorizing provision is a [WQS] subject to EPA review and approval under section 303 of the [Clean Water] Act and must be consistent with sections 502(17) and 301(b)(1)(C) of the [Clean Water] Act." Such compliance schedules may be used to implement the WQS in this final rule.

B. Clean Water Act Section 303(d)/305(b) Water Quality Assessments

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[122] *https://www.epa.gov/wqs-tech/water-quality-standards-variances*.

[123] The definition of "schedule of compliance" is available at 40 CFR 122.2.

[124] 40 CFR 122.47(a)(1).

[125] 40 CFR 122.47(a)(3).

Delaware, New Jersey, and Pennsylvania each have an obligation under CWA sections 303(d) and 305(b) to assess whether CWA-effective WQS in their jurisdictions are being attained. The EPA anticipates that there may be a period of time immediately after issuance of this final rule when the WQS will not be attained because the actions and procedures required to achieve compliance will take time to implement. In this scenario, any of the relevant zones not attaining the WQS should be classified as impaired on the relevant CWA section(s) 303(d)/305(b) Integrated Report(s) (IR) submitted to the EPA for review.

Per the CWA and the EPA's implementing regulations, waters that are assessed under CWA section 303(d) as impaired by a pollutant typically require the development of a Total Maximum Daily Load (TMDL), which is a regulatory planning tool designed to restore water quality via allocations of pollutant reductions to relevant point and non-point sources. The EPA's regulations also recognize that other pollution control requirements may obviate the need for a TMDL. Specifically, impaired waters do not require a TMDL if (1) technology-based effluent limitations required by the CWA, (2) more stringent effluent limitations required by a state, local, or Federal authority, or (3) other pollution control requirements (e.g., best management practices) required by a state, local, or Federal authority are stringent enough to implement applicable WQS.[126] Impaired waters that do not require a TMDL because one of these alternatives is satisfied are commonly referred to as Category 4b waters, as described in the EPA's Integrated Reporting Guidance for CWA sections 303(d), 305(b), and 314.[127]

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[126] 40 CFR 130.7(b)(1).

[127] The EPA's Integrated Reporting Guidance is available at: *https://www.epa.gov/tmdl/integrated-reporting-guidance-under-cwa-sections-303d-305b-and-314*.

The DRBC developed a model to evaluate sources of pollution that affect dissolved oxygen levels in the specified zones of the Delaware River and concluded that point sources are the primary contributor to oxygen depletion within those zones.[128] The EPA's economic analysis evaluates point source controls that are expected to result in dissolved oxygen levels that meet the EPA's criteria.[129] In the preamble to the proposed rule, the EPA noted that if Delaware, New Jersey, and/or Pennsylvania require effluent limitations and/or other pollution control requirements that the EPA agrees are stringent enough to implement the final dissolved oxygen criteria, the specified zones may be a candidate for Category 4b in future IRs. The EPA remains committed to working with Delaware, New Jersey, and Pennsylvania, in consultation with the DRBC, on future IRs to determine the appropriate assessment status for the waters that are subject to this rulemaking.

VIII. Economic Analysis

The EPA conducted an economic analysis pursuant to Executive Order 12866 to evaluate the potential benefits and costs associated with this final rule. The EPA prepared this analysis of one potential implementation scenario for informational purposes to provide the public and potentially affected entities with estimates of the potential costs and benefits that could accrue when the relevant states implement this final rule. The EPA did not rely upon this economic analysis in setting these WQS. For more information about how costs are addressed in the WQS context, please refer to the associated response to comments document. Despite evaluation of

[128] Delaware River Basin Commission (2024a, 2024b).
[129] More details are available in the document, *Economic Analysis for the Final Rule: Water Quality Standards to Protect Aquatic Life in the Delaware River*.

one potential implementation scenario in the economic analysis, the EPA's rule does not prescribe any specific pollutant controls, and the EPA expects that states will work with affected dischargers to identify the most appropriate compliance options.

In the high-level summary of the EPA's economic analysis below, the EPA first describes a baseline scenario that is intended to characterize the world in the absence of the EPA's rule. Next, the EPA describes the development of a policy scenario based on potential pollution control actions that, if implemented, can be expected to meet the EPA's dissolved oxygen criteria. Finally, the EPA evaluates the anticipated potential costs associated with the policy scenario and the potential benefits of the specified zones attaining the EPA's dissolved oxygen criteria. More details and information are available in the associated document, *Economic Analysis for the Final Rule: Water Quality Standards to Protect Aquatic Life in the Delaware River*, available in the docket for this rule.

A. Baseline for the Analysis

The baseline is intended to characterize the world in the absence of the EPA's rule. The EPA typically assumes full compliance with existing regulations and requirements — including Combined Sewer Overflow (CSO) Long-Term Control Plans (LTCPs)[130] — even if they are not yet fully implemented, as a basis for estimating the benefits and costs of regulations. This baseline approach ensures that the benefits and costs of the existing regulations and requirements are not double counted.

[130] As provided in the CSO Control Policy, incorporated under CWA section 402(q), "[NPDES p]ermittees with CSOs are responsible for developing and implementing long-term CSO control plans [or LTCP] that will ultimately result in compliance with the requirements of the CWA." CSO Control Policy, 59 FR 18688, 18691 (April. 19, 1994).

In this economic analysis, the EPA assumes that without the final rule, the prior, less stringent WQS (that do not adequately support aquatic life propagation) would have remained in effect. Accordingly, the EPA assumes that water quality conditions in the specified zones of the Delaware River, particularly during the *Juvenile Development* season (July 1 to October 31), would continue to exhibit low oxygen levels that do not adequately support aquatic life propagation, even with implementation of existing and planned CSO LTCPs, as well as other related expansions or plans.[131] Along the specified zones of the Delaware River, there are three combined sewer systems with CSO LTCPs that are relevant for consideration by the EPA as part of the baseline. The Philadelphia Water Department, Camden County Municipal Utilities Authority, and Delaware County Regional Water Quality Control Authority all have LTCPs that are either approved or in progress.[132] The EPA expects implementation of these LTCPs, when finalized, to occur regardless of the EPA's final rule. Therefore, the EPA included estimated CSO volume reductions for these three dischargers as part of the baseline for this economic analysis.

During the public comment period, the EPA received comments regarding the consideration of CSO LTCPs in the EPA's economic analysis. Some commenters asserted that the EPA should address CSO control costs in the economic analysis, while other commenters

[131] While the EPA normally assumes full compliance with *existing* LTCPs, for this rule, the EPA is also assuming full compliance with *planned* LTCPs. Because planned LTCPs are not final and therefore are subject to change, this adds uncertainty to the baseline conditions.

[132] Delaware River Basin Commission (2024a);
DELCORA. (2023). Combined Sewer System: DELCORA CSO LTCP. *https://www.delcora.org/combined-sewer-systems/delcora-cso-ltcp/*;
Philadelphia Water Department. (2023). CSO Long Term Control Plan. *https://water.phila.gov/reporting/ltcp/*;
State of New Jersey Division of Water Quality. (2023). Long Term Control Plan Submittals. *https://www.nj.gov/dep/dwq/cso-ltcpsubmittals.htm*.

asserted that these LTCPs would not be completed either at all or prior to promulgation of the final rule. The EPA disagrees with commenters' assertions that the Agency should include CSO control costs as part of the cost analysis for the EPA's rule. CSO controls are expected to be implemented at certain wastewater treatment plants, described above, along the specified zones of the Delaware River regardless of the EPA's rule; therefore, costs associated with these controls cannot be attributed to the EPA's rule. The EPA acknowledges that the assumption of full compliance with draft LTCPs, in addition to final LTCPs, could add uncertainty to baseline conditions since draft LTCPs are subject to change. The EPA includes a discussion of this uncertainty in table 2-1 of the associated economic analysis. However, the EPA notes that these draft LTCPs represent the best available information on planned CSO controls and are therefore appropriately used in the economic analysis.

The DRBC modeled the effect of pollution reduction on dissolved oxygen levels in the Delaware River and provided the EPA with water quality simulation results under both baseline and "restored" conditions for the years 2012, 2018, and 2019.[133] Baseline simulations predict water quality conditions associated with the discharge of actual wastewater treatment plant (WWTP) flows at existing levels of treatment and after full implementation of existing and planned LTCPs. The restored simulations predict water quality conditions associated with the discharge of actual WWTP flows at treatment levels that include additional effluent treatment and after full implementation of LTCPs.

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[133] The EPA determined that the model runs from the DRBC were sufficient for use in this economic analysis. Delaware River Basin Commission (2024b).

Of the three available years (2012, 2018, and 2019), the EPA selected 2019 as representative of the most typical conditions in the relevant zones of the Delaware River. In comparison, 2012 had atypically poor conditions (low percent oxygen saturation, high water temperature), while 2018 had atypically good conditions (high percent oxygen saturation, low water temperature). Therefore, model runs used in this economic analysis are based on 2019 conditions.

One commenter asserted that the EPA's use of a single year of water quality data reduced the reliability of the EPA's technical and economic assessments because a single year cannot be relied upon to predict how future infrastructure might address pollution, given interannual variations in precipitation and temperature. The EPA acknowledges that relying on a single year of data limits the ability of the economic analysis to reflect any future changes in water temperature and/or precipitation. However, as discussed in the associated technical support document and in the response to comments document, there are no existing modeling studies that directly predict future water temperatures in the specified zones of the Delaware River, which limits the EPA from factoring these future conditions into additional analyses. Given these limitations, the economic analysis relies on the most representative year of data available and therefore, this approach to the analysis was reasonable.

B. Development of the Policy Scenario

There is a wide range of potential paths that Delaware, New Jersey, and Pennsylvania may choose to take when implementing the EPA's final WQS. For this economic analysis, the EPA relied on available data to develop a policy scenario based on modeled pollution controls developed by the DRBC that the EPA expects would meet the Agency's dissolved oxygen criteria. Actual benefits, costs, and impacts will depend on the choices that states make in implementing the final WQS, which may differ from the policy scenario presented in this economic analysis.

The EPA's dissolved oxygen criteria apply to three seasons; therefore, when developing a single policy scenario, the EPA evaluated potential pollution control actions that would be expected to meet the EPA's criteria in each of the three seasons. The EPA began by evaluating water quality monitoring data for the past decade from two continuous monitoring stations in the relevant zones of the Delaware River — Penn's Landing in Zone 3 and Chester in Zone 4. As noted in section III.C.3. of this preamble, based on the monitoring data, the EPA expects that the Agency's dissolved oxygen criteria for the *Spawning and Larval Development* and *Overwintering* seasons will likely be met without the need for additional WWTP upgrades or other controls beyond those accounted for in the baseline simulation. Monitoring data for the *Juvenile Development* season indicated that additional pollution control actions are likely necessary to meet the EPA's criteria in that season. To develop a policy scenario for the *Juvenile Development* season, the EPA relied on modeled data from the DRBC predicting oxygen levels in 2019 in the specified zones of the Delaware River following a set of WWTP pollution control actions for certain dischargers. Modeled data for restored conditions are described in the baseline section above in this preamble, while WWTP controls are described in the cost section below in this preamble. The EPA expects that this policy scenario (hereafter, the 2019 restored scenario) will meet the final criteria during the *Juvenile Development* season.

C. Potential Costs

The EPA estimated compliance costs for the final WQS based on estimates for WWTPs to reduce effluent ammonia nitrogen concentrations and raise effluent dissolved oxygen concentrations. Although there are several causes that contribute to low dissolved oxygen conditions in the specified zones of the Delaware River, the DRBC identified ammonia nitrogen loadings from WWTPs as the leading cause of oxygen-depletion in the river.[134] The DRBC also identified controlling these loads as a feasible solution to addressing dissolved oxygen conditions through their modeling efforts. As a result, for this economic analysis, the EPA assumed that implementation of additional pollution control technologies at WWTPs is the most likely way that Delaware, New Jersey, and Pennsylvania will implement the final WQS. Therefore, the EPA evaluated WWTP controls rather than other controls, such as non-point source controls, for this cost analysis.

Some commenters asserted that the EPA should consider habitat restoration and pollution reductions other than ammonia treatment controls at wastewater treatment plants. While the EPA did consider other sources of nutrients into the Delaware River, the Agency concluded that point source controls are the most likely pathway that Delaware, New Jersey, and Pennsylvania would choose to take when implementing the rule. However, the EPA's rule does not preclude each state from evaluating controls on other pollutant sources, including non-point sources, or evaluating the potential benefits of habitat restoration, and the EPA encourages each state to consider all available and relevant pollution control approaches when implementing the Federal standards.

[134] Delaware River Basin Commission (2024a).

The EPA relied on cost information from several DRBC studies to estimate the costs of achieving the final WQS.[135] The DRBC's *A Pathway for Continued Restoration: Improving Dissolved Oxygen in the Delaware River Estuary* report categorized WWTPs as either class A', A, or B facilities.[136] The DRBC determined that discharges from Class A', A, and B facilities have a major impact, a marginal impact, or no measurable impact on oxygen levels in the specified zones, respectively. The EPA's 2019 restored scenario follows the DRBC's approach by including the seven Class A' and two Class A facilities and excluding the three Class B facilities.[137]

The EPA used WWTP-specific (capital, operations and maintenance (O&M)) compliance costs from Kleinfelder Inc. (2021, 2023) to estimate compliance costs, based on the discharger classification. Total compliance costs include the costs associated with both of the following:

1. Class A' Facilities (7 WWTPs): Reductions in effluent ammonia nitrogen concentrations to 1.5 mg/L from May 1 through October 31 and increases in effluent oxygen concentrations to a monthly average of 6 mg/L year-round.[138]

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[135] *Id*.; Kleinfelder Inc. (2021). Nitrogen Reduction Cost Estimation Study Final Summary Report. *https://www.nj.gov/drbc/library/documents/NitrogenReductionCostEstimates_KleinfelderJan2021.pdf*; Kleinfelder Inc. (2023). Delaware River Basin Commission Nitrogen Reduction Cost Estimation Study — Supplemental Cost Addendum 2 Technical Memorandum — Final. *https://www.nj.gov/drbc/library/documents/NitrogenReductionCostEstimates_Kleinfelder_aug2023addendum.pdf*.

[136] Delaware River Basin Commission (2024a).

[137] *Id*.

[138] These effluent concentrations are consistent with the DRBC's own water quality regulations, adopted in 1967, and modified in 1992 to reflect that "Best Demonstrable Technology (BDT)" for new or expanding wastewater treatment facilities was 1.5 mg/L or less of ammonia nitrogen and 6.0 mg/L or greater of dissolved oxygen. These BDT requirements are applicable to wastewater discharges within the 197-mile non-tidal portion of the Delaware River, immediately upstream of the specified zones in the EPA's rule. Delaware River Basin Commission. "Administrative Manual — Part III Water Quality Regulations with Amendments Through December 7, 2022." Accessed August 7, 2024. *https://www.nj.gov/drbc/library/documents/WQregs.pdf*.
Further, a nationwide evaluation of discharge concentrations among "major" NPDES-permitted wastewater treatment plants (i.e., facilities that discharge more than 1 million gallons of effluent per day) indicates that roughly

2. Class A Facilities (2 WWTPs): Reductions in effluent ammonia nitrogen concentrations to 5 mg/L from May 1 through October 31.

Some commenters expressed concerns with the EPA's reliance on information published or commissioned by the DRBC. These commenters asserted that the cost estimates from the Kleinfelder reports were unrealistically low, a limited number of economic variables were considered, and costs associated with other regulatory mandates were not considered, among other concerns. The EPA disagrees that basing the Agency's economic analysis on inputs from previous DRBC analyses is inappropriate. The DRBC analyses reflect the most reliable, up-to-date information on pollution, pollution controls, and dissolved oxygen conditions in the Delaware River. The ammonia nitrogen treatment technologies that the DRBC costed for are proven treatment technologies (i.e., readily available, established technologies with long-term performance records) that are reasonably expected to attain the EPA's criteria. Wastewater treatment plants might be able to achieve the target effluent limits at a lower cost through more efficient technological or operational upgrades. Many comparable wastewater treatment plants, including several in major cities on the U.S. East Coast (e.g., Washington D.C., Baltimore, New York City, Pittsburgh), have already installed and are using similar technologies to treat ammonia nitrogen to levels at or below the levels the EPA expects will result in attainment of the EPA's final dissolved oxygen criteria for the specified zones of the Delaware River. As such, a

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75% are discharging ammonia at levels necessary to achieve compliance with the EPA's dissolved oxygen criteria for the Delaware River. United States Environmental Protection Agency (2025). Nutrient Removal Study Dashboard. Webpage. Accessed May 23, 2025. *https://ordspub.epa.gov/ords/wfc/f?p=259:49:8670036276255*. The EPA acknowledges that the operation time period for the treatment technologies that are necessary to meet the final WQS may differ from the assumptions in Kleinfelder Inc. (2021, 2023). Actual operation time periods will impact the technology lifespan and O&M costs. Since time period assumptions in Kleinfelder Inc. (2021, 2023) exceed the July 1 – October 31 *Juvenile Development* season, O&M costs may be overestimated.

majority of similarly situated dischargers have been able to comply with comparably stringent dissolved oxygen-related discharge limits that support fish propagation designated uses. The EPA performed data quality checks (e.g., compared results to observed data, checked for outliers) before using the DRBC analyses in the economic analysis. Regarding the Kleinfelder cost estimates, the DRBC coordinated extensively with dischargers in development of the Kleinfelder report, and incorporated comments from dischargers into the final report as appropriate. The EPA considers regulatory mandates as part of the baseline that is unaffected by this rulemaking and those mandates are therefore not applicable to the EPA's cost estimates for this rule.

The EPA assumed capital costs occur upfront in 2026 followed by a five-year construction period. Consistent with Kleinfelder Inc. (2021, 2023), the EPA assumed O&M costs occur over a 25-year period from 2031 through 2055. The EPA then annualized costs over a 30-year analysis period between 2026 and 2055 and discounted all cost values to 2025, using 3 and 7 percent discount rates and payment at the beginning of each year in the analysis period.

Some commenters asserted that the EPA underestimated the costs of the rule. In particular, one commenter asserted that the EPA underestimated costs at the Philadelphia Water Department's (PWD's) wastewater treatment plants by between $1.3 billion and $2.5 billion. The EPA disagrees. The EPA's cost analysis is based on one potential implementation scenario using cost estimates based on proven wastewater treatment plant treatment technologies (i.e., established technologies with long-term performance records), including the standard practice of a 30% contingency to reflect a pre-design planning level of accuracy, without consideration of whether other technologies might be more cost effective for each individual treatment plant.

Regarding cost estimates for the PWD facilities, the EPA requested and received additional information from PWD regarding its cost estimates. The EPA determined that PWD proposed a different and more expensive technology approach than the EPA, which is not necessary for compliance with the revised WQS, so the EPA retained the Kleinfelder Inc.-based estimates for the final economic analysis.[139] Thus, the EPA concluded it is reasonable to cost for a less expensive technology that can achieve compliance with the revised WQS and therefore, the EPA's cost estimates are reasonable. However, to account for additional uncertainty in the cost estimates, for the final rule and in response to public comments, the EPA applied "expected accuracy range" values (-15 percent for a low estimate and +20 percent for a high estimate) from the Association for the Advancement of Cost Engineering to produce low and high estimates.[140] The EPA used expected accuracy range values for Class 4 estimates for consistency with the class of estimates used by Kleinfelder Inc. (2021). The EPA applied expected accuracy range values to the central cost estimates to present low, central, and high estimates for the annualized compliance costs associated with achieving the EPA's final WQS, using 3 and 7 percent discount rates (table 9 of this preamble).

Using a 3 percent discount rate, the estimated total annualized compliance cost for nine WWTPs ranges from $121.6 million to $171.6 million, with a central estimate of $143.0 million (2024$). These costs vary considerably between the nine WWTPs (based on flow and technology), with central estimates ranging from $2.0 million at the Lower Bucks County Joint

[139] Additional information comparing the EPA's and PWD's cost estimates is available in the associated response to comments document.

[140] Christensen, P., Dysert, L. R., Bates, J., Burton, D., Creese, R., & Hollmann, J. (2005). Cost Estimate Classification system–as Applied in Engineering, Procurement, and Construction for the Process Industries: TCM Framework: 7.3 — Cost Estimating and Budgeting. AACE International Recommended Practices, 18R-97, 1-9.

Municipal Authority WWTP to $39.2 million at the PWD Southwest Water Pollution Control Plant (2024$). Among the dischargers, PWD bears the highest proportion of total costs, with its three facilities' combined costs accounting for over 50 percent of total costs. Overall, across all dischargers, approximately 66 percent of the costs are attributable to capital and 34 percent are attributable to O&M. Using a 7 percent discount rate, the estimated total annualized compliance cost for nine WWTPs ranges from $157.8 million to $222.7 million, with a central estimate of $185.6 million (2024$).

Table 9. Annualized Compliance Costs using 3 and 7 Percent Discount Rates (million 2024$)

Plant	State	Class	Annualized Costs (3% discount rate)			Annualized Costs (7% discount rate)		
			Low	Central	High	Low	Central	High
Camden County Municipal Utilities Authority	NJ	A'	$14.3	$16.9	$20.2	$17.2	$20.2	$24.2
City of Wilmington	DE	A'	$21.2	$24.9	$29.9	$27.7	$32.6	$39.1
Delaware County Regional Water Pollution Control Authority	PA	A'	$8.0	$9.4	$11.3	$10.5	$12.4	$14.9
Gloucester County Utilities Authority	NJ	A'	$4.3	$5.1	$6.1	$4.6	$5.4	$6.5
PWD Northeast	PA	A'	$23.2	$27.3	$32.8	$33.7	$39.7	$47.6

Plant	State	Class	Annualized Costs (3% discount rate)			Annualized Costs (7% discount rate)		
			Low	Central	High	Low	Central	High
Water Pollution Control Plant								
PWD Southeast Water Pollution Control Plant	PA	A’	$12.5	$14.7	$17.6	$18.3	$21.5	$25.8
PWD Southwest Water Pollution Control Plant	PA	A’	$33.3	$39.2	$47.1	$40.2	$47.3	$56.8
Hamilton Township	NJ	A	$2.9	$3.4	$4.1	$3.7	$4.3	$5.2
Lower Bucks County Joint Municipal Authority	PA	A	$1.7	$2.0	$2.4	$2.0	$2.3	$2.8
		Total	**$121.6**	**$143.0**	**$171.6**	**$157.8**	**$185.6**	**$222.7**

Some commenters asserted that the EPA did not correctly account for the impact of increased debt service costs that would occur from the EPA’s rule. The EPA disagrees with the assertion that the Agency did not properly account for debt service costs. As explained in the associated economic analysis, the EPA’s economic analysis focuses on social costs, the total cost to society. In this context, it does not take more of society’s real resources to finance through debt than when paid or financed in another way. The EPA notes that the Agency has followed OMB's Circular A-4 guidance for the presentation of annualized costs.[141]

Some commenters stated that wastewater treatment plants face future substantial capital expenditures that are necessary to fulfill other infrastructure, public health, operational, and regulatory obligations, which the proposed rule did not fully consider. Commenters also suggested that state, Federal, or grant funding should be made available to cover the costs of the EPA's rule. The EPA acknowledges that entities affected by this rulemaking have limited budgets and might have capital expenditures allocated to other projects related to protecting public health and the environment, infrastructure, or other regulatory obligations. The EPA's economic analysis is intended to provide information regarding the potential social costs associated with this rule and is not intended to provide a holistic picture of a particular utility's or municipality's financial commitments or anticipated future commitments. As described above, other regulatory obligations or budgetary commitments would be considered part of the analysis baseline since they are expected to occur in the absence of the EPA's rule. The EPA notes that wastewater treatment plants may have various financing options available, such as low-interest loans through state revolving funds, and will presumably pursue the option that works best for their individual circumstances.

D. Potential Benefits

Water quality improvements can have a wide range of effects on water resources and the environmental goods and services that they provide, including services valued by people (e.g.,

[141] Office of Management and Budget. (2003). Circular A-4. Subject: Regulatory Analysis. Retrieved from *https://obamawhitehouse.archives.gov/omb/circulars_a004_a-4/*.

recreation, commercial fishing, aesthetic beauty, support and preservation of aquatic life and wildlife). Some environmental goods and services (e.g., commercially caught fish) are traded in markets, and thus their value may be directly observed. Other environmental goods and services (e.g., recreation and support of aquatic life) cannot be bought or sold directly and thus do not have observable market values; these types of environmental goods and services are classified as “non-market.” The non-market values of environmental goods and services include both use (e.g., recreation) and nonuse (e.g., existence and bequest) values.

The EPA used a benefit transfer approach based on a meta-analysis of surface water valuation studies to evaluate the non-market benefits (including both use and nonuse values) of improved surface water quality resulting from achievement of the EPA’s final WQS in the 2019 restored scenario. The benefit transfer approach involves three main steps:

1. Estimate water quality improvements associated with attainment of the EPA’s final WQS relative to the baseline;

2. Translate these improvements into a water quality index (WQI) that can be linked to ecosystem services and uses that are valued by society. The WQI used for this analysis includes six parameters: dissolved oxygen, biochemical oxygen demand, fecal coliform, total nitrogen, total phosphorus, and total suspended solids; and

3. Estimate the dollar value of the water quality improvements based on estimates of the public’s willingness-to-pay (WTP) derived from a meta-analysis of surface water

valuation studies. For the final rule, the EPA used a locally weighted application of the meta-analysis.[142,143]

To assess baseline water quality, the EPA obtained water quality modeling data of baseline conditions from the DRBC, including dissolved oxygen, total nitrogen, and total phosphorus levels for various effluent treatment scenarios. For the remaining parameters included in the WQI (i.e., biochemical oxygen demand, fecal coliform, and total suspended solids), the EPA relied on monitoring data at various locations within the specified zones. To assess water quality under the 2019 restored scenario, the EPA used the DRBC's modeled output of dissolved oxygen levels in the specified zones following implementation of effluent controls (described above in the cost section of this preamble), making minor adjustments as needed to ensure that predicted oxygen levels meet the EPA's final WQS.[144]

The effluent treatment measures implemented for the 2019 restored scenario will directly affect the amount of ammonia nitrogen discharged to the specified zones of the Delaware River and therefore also reduce biochemical oxygen demand. Given the inverse proportional relationship between biological oxygen demand and dissolved oxygen levels, the EPA

[142] Additional details are available in section 4.3 and Appendices C and D in the associated economic analysis.
[143] The EPA has used a benefit transfer approach based on the meta-analysis of surface water valuation studies on numerous occasions, for example, *Benefit and Cost Analysis for Revisions to the Effluent Limitations Guidelines and Standards for the Steam Electric Power Generating Point Source Category* (U.S. Environmental Protection Agency. (2020). Benefit and Cost Analysis for Revisions to the Effluent Limitations Guidelines and Standards for the Steam Electric Power Generating Point Source Category. (EPA-821-R-20-003)). The locally weighted regression approach used for the final rule builds upon this approach by reducing error associated with benefit transfer.
[144] The EPA selectively adjusted the daily modeled dissolved oxygen concentrations in each model cell within the specified zones to meet the final WQS. In total, the EPA adjusted approximately ten percent of observations in the modeled dataset to meet the dissolved oxygen criteria during the *Juvenile Development* season. The EPA did not estimate costs for additional treatment technologies to account for the minimal adjustments needed to the modeled dissolved oxygen values. The calculated differences between modeled dissolved oxygen and the EPA's final criteria are within the bounds of uncertainty related to dissolved oxygen measurements and model assumptions.

approximated biochemical oxygen demand concentrations following effluent treatment by assuming that baseline biochemical oxygen demand concentrations are reduced by the same percentage change that dissolved oxygen improves within each zone (i.e., Zone 3, 4, and Upper 5) of the model. Table 10 of this preamble summarizes the percent change in dissolved oxygen and biochemical oxygen demand by zone between the baseline and the 2019 restored scenario. The EPA kept levels for the remaining parameters (total nitrogen, total phosphorus, total suspended solids, and fecal coliform) unchanged from baseline conditions.

Table 10. Dissolved Oxygen and Biochemical Oxygen Demand Changes between the Baseline and 2019 Restored Scenarios

Zone	% Change from Baseline[a]
3	11.1%
4	19.9%
5-upper	7.6%

a. The percent change for dissolved oxygen and biochemical oxygen demand is the same, but in opposite directions, i.e., the percent decrease in biochemical oxygen demand concentration is the same as the percent increase in dissolved oxygen concentration.

To quantify benefits of water quality improvements, as is consistent with past practice, the EPA analyzed the values held by households residing within 100 miles of the specified zones of the Delaware River for water quality improvements associated with the EPA's final WQS.[145] Households may consider waters unaffected by the EPA's rule to be substitute waters for those affected, and this can influence what households are willing to pay for improvements associated

[145] The EPA's 100-mile radius assumption follows Viscusi et al. (2008), which states: "The survey defined relevant water quality as residing in a region that is 'a 2-hour drive or so of your home, in other words, within 100 miles.' About 80 percent of all recreational uses of bodies of water are within such a radius of users' homes." This 80 percent figure was based on data generated by the EPA from the 1996 National Survey on Recreation and the Environment. Data indicates that 77.9 percent of boating visits, 78.1 percent of fishing visits, and 76.9 percent of swimming recreational visits are within a 100-mile radius of a given waterbody. (Citation: Viscusi, W. K., Huber, J., & Bell, J. (2008). The economic value of water quality. Environmental and resource economics, 41(2), 169-187).

with the final WQS. The EPA deems similar waters unaffected by the rule within the 100-mile buffer around each census block group as viable substitutes.[146]

One commenter asserted that the 100-mile distance buffer used by the EPA is inappropriate for a localized policy, while another commenter stated that using the 100-mile radius does not consider the limited access and recreational experience of the river near Philadelphia, and it includes many households that likely only hold nonuse value for the resource. The EPA disagrees that use of a 100-mile radius for estimating benefits of a localized policy is inappropriate. The EPA followed best practices from the resource valuation literature to define the "extent of market" of affected households, or locations of households likely to hold values for water quality improvements in the specified zones of the Delaware River. For example, many water quality valuation studies considered the entire state or region in which the affected waterbodies reside as the appropriate extent of the market.[147] The EPA acknowledges that WTP for water quality improvements is likely to vary within the 100-mile range based on proximity to the specified zones of the Delaware River, recreational use of the affected waters, or property ownership. The EPA's estimated household WTP value represents an average across all households residing within the 100-mile radius. However, the Agency did not use an equal household WTP throughout the 100-mile radius, but rather, model variables account for Census

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[146] The EPA defined "similar waters" as waters with a stream order of five or higher.

[147] For example, Johnston, R.J., Moeltner, K., Peery, S., Ndebele, T., Yao, Z., Crema, S., Wollheim, W.M., and Besedin, E. Y. (2023). Spatial dimensions of water quality value in New England river networks. Proceedings of the National Academy of Sciences, 120(18), e2120255119. *https://doi.org/10.1073/pnas.2120255119*;
Lupi, F., Herriges, J.A., Kim, H., & Stevenson, R.J. (2023). Getting off the ladder: Disentangling water quality indices to enhance the valuation of divergent ecosystem services. Proceedings of the National Academy of Sciences, 120(18), e2120261120. *https://doi.org/10.1073/pnas.2120261120*;
Moore, C., Guignet, D., Dockins, C., Maguire, K. B., & Simon, N. B. (2018). Valuing Ecological Improvements in the Chesapeake Bay and the Importance of Ancillary Benefits. Journal of Benefit-Cost Analysis, 9(1), 1-26. *https://doi.org/10.1017/bca.2017.9*.

block group-level differences within the 100-mile radius. The EPA also disagrees with the commenter that the Agency did not account for the presence of competing water bodies in the region. The EPA's model for this economic analysis includes a variable to account for the size of affected resources (i.e., specified zones of the Delaware River) relative to the size of substitute waters within the 100-mile radius.

The EPA estimated the economic value of water quality changes using results of a meta-analysis of total WTP estimates (including both use and nonuse values) for water quality improvements, provided by original studies conducted between 1981 and 2017. Using information extracted from these studies, the EPA estimated an econometric model that calculates total WTP for changes in a variety of environmental services affected by water quality and valued by people, including changes in recreational fishing opportunities, other water-based recreation, and existence services such as aquatic life, wildlife, and habitat designated uses. The model also allows the EPA to adjust WTP values based on the core geospatial factors predicted by theory to influence WTP, including scale (the size of affected resources or areas), market extent (the size of the area over which WTP is estimated), and the availability of substitute waters. The model also takes into account important characteristics, such as population and income, which vary spatially. For the proposed rule, the EPA used the standard model application used in prior EPA rulemakings.[148] For the final rule, the EPA used a locally weighted application of the model.[149] The locally weighted regression approach is a flexible regression approach that can attach larger weights to study observations more similar to the area affected by

[148] Additional information is available in Appendix C of the associated economic analysis.
[149] Additional information is available in Appendix D of the associated economic analysis.

the rule (e.g., similar income levels or similar land use) and less weight to dissimilar observations. This flexibility allows the locally weighted regression approach to often be better suited for benefit transfer than the standard meta-regression approach with universally fixed coefficients. In this case, the 95 percent confidence bounds for annual household WTP using the locally weighted regression method are, on average, approximately 70 percent tighter compared to those produced by the model used for the proposed rule analysis.[150]

Table 11 of this preamble presents estimated household and total annualized WTP values for water quality improvements following attainment of the EPA's final WQS, based on the locally weighted approach, 3 and 7 percent discount rates, and payment at the beginning of each year in the analysis period.[151] The total annualized value of water quality improvements from attainment of the final WQS is $154.9 million using a 3 percent discount rate and $134.3 million using a 7 percent discount rate.

Table 11. Estimated Household and Total Annualized Willingness-to-Pay (WTP) for Water Quality Improvements under the EPA's Final Water Quality Standards, using 3 and 7 Percent Discount Rates

Average Number of Affected Households (Millions)[a]	Average Annual WTP Per Household (2024$)[b,c]	Total Annualized WTP (Millions 2024$, 3% Discount Rate)[b,d]	Total Annualized WTP (Millions 2024$, 7% Discount Rate)[b,d]
15.49	$10.90	$154.9	$134.3

a. Average number of affected households during the 2026 – 2055 analysis period. The number of households for each year in the analysis period accounts for projected population growth.
b. Estimates are based on the locally weighted approach; additional details are available in Appendix D of the associated economic analysis.
c. The average annual WTP per household includes values of $0 for the years 2026 – 2030 when technology implementation will occur. Positive household WTP values begin during the assumed first year of technology operation (2031) and continue for the estimated lifespan of the technology (25 years, or through 2055).

[150] *Id.*
[151] Appendix B of the associated economic analysis reports benefit estimates using the alternative 2% discount rate reported in the proposed rule.

d. Value is not based on a simple multiplication of the first two columns in the table. Additional details are available in section 4.3 of the associated economic analysis.

One commenter expressed concerns that the EPA's meta-regression model overestimated benefits at proposal because, among other reasons, the EPA assumes the criteria will be attained and does not account for treatment processes that are under development, such as PWD's sidestream ammonia treatment facility. The EPA disagrees that application of the meta-regression model resulted in overestimation of the rule's benefits. The EPA evaluated high quality modeling data from the DRBC for a recent year with typical water quality (2019) and determined that the Agency's potential implementation scenario is expected to result in criteria attainment, given the DRBC's model results and associated uncertainties in the model (for example, the model does not account for changes in sediment oxygen demand, which the EPA expects to decrease following pollution reductions, thus leading to higher oxygen levels in the river). Regarding the planned treatment processes, at the time the EPA conducted the economic analysis for the proposed rule, PWD had not yet announced its intention of adding a sidestream ammonia treatment facility to the Southwest Water Pollution Control Plant. Following announcement of this additional treatment facility, the EPA accordingly revised the baseline scenario in the economic analysis for the final rule; please refer to the final rule economic analysis for more details.

In addition to the quantitative benefits of water quality improvements resulting from the final WQS, the EPA described additional benefits qualitatively in section 4.1 of the associated economic analysis, including recreational and commercial fishing benefits. For example, the qualitative assessment summarizes the findings of Kauffman (2019), which estimated that dissolved oxygen improvements similar to the improvements anticipated under the final rule WQS would improve annual recreational and commercial fishing benefits in the Delaware River watershed by $187 million and $24.5 million, respectively (2024$).[152]

E. Conclusion

The EPA estimates that the implementation of additional effluent treatment controls at certain WWTPs could lead to annualized costs over 30 years of $143.0 million using a 3 percent discount rate and $185.6 million using a 7 percent discount rate (2024$). The EPA has overstated annualized costs by allocating all capital costs to the first year when costs would likely be spread across five years. The EPA quantified non-market benefits through average annual household WTP for water quality improvements. Annualized monetized non-market benefits from water quality improvements over 30 years total $154.9 million using a 3 percent discount rate and $134.3 million using a 7 percent discount rate (2024$). The EPA's monetary estimation of benefits does not account for benefits related to protections for endangered species (Atlantic Sturgeon and Shortnose Sturgeon), increased housing values, or increased commercial fishing, among other benefits. Therefore, the EPA's estimation of non-market benefits is an underestimate of total benefits. In addition, the difference between the benefit and cost estimates to society under 3 percent and 7 percent is due to capital costs being attributed to the early years of the analysis even though capital costs will likely be financed throughout the period of analysis, while the benefits of environmental improvements occur more evenly throughout the period of analysis. This leads to evaluations under higher discount rates showing a larger

[152] Kauffman, G. J. (2019). Economic benefits of improved water quality in the Delaware River (USA). River Research and Applications, 35(10), 1652-1665.

discrepancy between benefits and costs. Table 12 of this preamble summarizes annualized cost and benefit estimates for the rule.[153]

Table 12. Annualized Cost and Benefit Estimates (Million 2024$)

	3% Discount Rate	7% Discount Rate
Costs	$143.0	$185.6
Benefits	$154.9	$134.3
Net Benefits[a]	**$11.9**	**-$51.3**
a. Net benefits equal benefits minus costs.		

IX. Statutory and Executive Order Reviews

Additional information about these statutes and executive orders can be found at *https://www.epa.gov/laws-regulations/laws-and-executive-orders*.

A. Executive Order 12866: Regulatory Planning and Review and Executive Order 13563: Improving Regulation and Regulatory Review

This action is a significant regulatory action as defined under section 3(f)(1) of Executive Order 12866. Accordingly, it was submitted to the Office of Management and Budget (OMB) for review. Any changes made in response to OMB recommendations have been documented in the docket. The EPA prepared an analysis of the potential costs and benefits associated with this action. This analysis, *Economic Analysis for the Final Rule: Water Quality Standards to Protect*

[153] Note that annualized costs under a 7% discount rate are higher than under a 3% discount rate. While a higher discount rate more heavily discounts the future and therefore discounting will lead to a lower present value under a 7% rate than a 3% rate, the annualizing step can appear to produce counterintuitive results depending on the timing of when future costs will be incurred. Since capital costs, which occur in 2026, dominate O&M costs, which are evenly distributed after 2031, once these costs are discounted *and then annualized* across the period of analysis, annualized costs under a 7% discount rate are higher than under a 3% rate. Conversely, annualized benefits are lower under the 7% discount rate relative to 3% because benefits are fairly evenly distributed through time.

Aquatic Life in the Delaware River, is available in the docket and summarized in section VIII of this preamble.

B. Executive Order 14192: Unleashing Prosperity Through Deregulation

This action is considered an Executive Order 14192 regulatory action. Details on the estimated costs of this final rule can be found in the EPA's analysis of the potential costs and benefits associated with this action.

C. Paperwork Reduction Act (PRA)

This action does not impose any new information collection burden under the PRA. OMB has previously approved the information collection activities contained in the existing regulations and has assigned OMB control number 2040-0049.

D. Regulatory Flexibility Act (RFA)

I certify that this action will not have a significant economic impact on a substantial number of small entities under the RFA. This action will not impose any requirements on small entities. Small entities, such as small businesses or small governmental jurisdictions, are not directly regulated by this rule.

EPA-promulgated WQS are implemented through various water quality control programs including the NPDES program, which limits discharges to navigable waters, except in compliance with a NPDES permit. CWA section 301(b)(1)(C) and the EPA's implementing regulations at 40 CFR 122.44(d)(1) provide that all NPDES permits must include any limits on discharges that are necessary to meet applicable WQS. Thus, under the CWA, the EPA's promulgation of WQS establishes standards that states implement through the NPDES permit process. While states have discretion in developing discharge limits, those limits "must control all pollutants or pollutant parameters (either conventional, nonconventional, or toxic pollutants) which the Director determines are or may be discharged at a level that will cause, have the reasonable potential to cause, or contribute to an excursion above any [s]tate water quality standard, including [s]tate narrative criteria for water quality."[154]

As a result of this action, the states of Delaware, New Jersey, and Pennsylvania will need to ensure that permits they issue include any limitations on discharges necessary to comply with the WQS established in this final rule. In doing so, each state will have several choices associated with permit writing. While each state's implementation of the rule may ultimately result in new or revised permit conditions for some dischargers, including small entities, the EPA's action, by itself, does not impose any of these requirements on small entities; in other words, these requirements are not self-implementing.

E. Unfunded Mandates Reform Act (UMRA)

This action does not contain an unfunded mandate as described in UMRA, 2 U.S.C. 1531–1538, and does not significantly or uniquely affect small governments. The action imposes no enforceable duty on any state, local, or tribal governments or the private sector.

F. Executive Order 13132: Federalism

This action does not have federalism implications, as defined in Executive Order 13132. It will not have substantial direct effects on the states, on the relationship between the national government and the states, or on the distribution of power and responsibilities among the various levels of government. This rule does not alter Delaware's, New Jersey's, or Pennsylvania's

[154] 40 CFR 122.44(d)(1)(i).

considerable discretion in implementing these WQS, nor does it preclude any of those states from adopting revised WQS and submitting them to the EPA for review and approval after promulgation of this final rule.

G. Executive Order 13175: Consultation and Coordination with Indian Tribal Governments

This action does not have tribal implications as specified in Executive Order 13175. This rule will not affect federally recognized Indian tribes in Delaware, New Jersey, or Pennsylvania because the WQS would not apply to waters in Indian lands nor affect tribal interests. Thus, Executive Order 13175 does not apply to this action.

H. Executive Order 13045: Protection of Children from Environmental Health Risks and Safety Risks

The EPA interprets Executive Order 13045 as applying only to those regulatory actions that concern environmental health or safety risks that the EPA has reason to believe may disproportionately affect children, per the definition of "covered regulatory action" in section 2-202 of the Executive Order. Therefore, this action is not subject to Executive Order 13045 because it does not concern an environmental health risk or safety risk. Since this action does not concern human health, the EPA's Policy on Children's Health also does not apply.

I. Executive Order 13211: Actions That Significantly Affect Energy Supply, Distribution, or Use

This action is not a "significant energy action" because it is not likely to have a significant adverse effect on the supply, distribution, or use of energy. This action establishes

Federal WQS for specified zones of the Delaware River under the jurisdiction of the states of Delaware, New Jersey, and Pennsylvania.

J. National Technology Transfer and Advancement Act (NTTAA)

This rule does not involve technical standards.

K. Congressional Review Act (CRA)

This action is subject to the CRA, and the EPA will submit a rule report to Congress and to the Comptroller General of the United States. This action meets the criteria set forth in 5 U.S.C. 804(2).

List of Subjects in 40 CFR Part 131

Environmental protection, Indians-lands, Intergovernmental relations, Reporting and recordkeeping requirements, Water pollution control.

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Lee Zeldin,

Administrator.

For the reasons set forth in the preamble, the EPA amends 40 CFR part 131 as follows:

PART 131—WATER QUALITY STANDARDS

1. The authority citation for part 131 continues to read as follows:

Authority: 33 U.S.C. 1251 *et seq.*

2. Add § 131.48 to read as follows:

§ 131.48 Water quality standards to protect aquatic life in the Delaware River.

(a) *Scope*. (1) The designated use in paragraph (b) of this section applies to river miles 108.4 to 70.0 of the mainstem Delaware River for the states of New Jersey and Pennsylvania.

(2) The aquatic life criteria in paragraph (c) of this section apply to river miles 108.4 to 70.0 of the mainstem Delaware River for the states of Delaware, New Jersey, and Pennsylvania.

(b) *Aquatic life designated use*. The aquatic life designated use is protection and propagation of resident and migratory aquatic life.

(c) *Dissolved oxygen criteria.* The applicable dissolved oxygen criteria are shown in table 1 to this paragraph (c).

TABLE 1 TO PARAGRAPH (c)—DISSOLVED OXYGEN CRITERIA

Season	**Magnitude (Percent Oxygen Saturation)**	**Duration**	**Exceedance Frequency**
Spawning and Larval Development *(March 1 – June 30)*	66%	Daily Average	12 Days Cumulative *(10% of the 123-day season)*

This document is a prepublication version, signed by the EPA Administrator, Lee Zeldin, on 09/22/2025. EPA is submitting it for publication in the *Federal Register*. We have taken steps to ensure the accuracy of this version, but it is not the official version. Notwithstanding the fact that EPA is posting a pre-publication version, the final rule will not be promulgated until published in the *Federal Register*.

Juvenile Development *(July 1 – October 31)*	66%	Daily Average	12 Days Cumulative *(10% of the 123-day season)*
	74%	Daily Average	61 Days Cumulative *(50% of the 123-day season)*
Overwintering *(November 1 – February 28/29)*	66%	Daily Average	12 Days Cumulative *(10% of the 123-day season)*

(d) *Applicability*. (1) The aquatic life designated use in paragraph (b) of this section applies concurrently with other applicable designated uses in New Jersey and Pennsylvania for river miles 108.4 to 70.0 of the mainstem Delaware River.

(2) The dissolved oxygen aquatic life water quality criteria in paragraph (c) of this section are the applicable dissolved oxygen criteria in Delaware, New Jersey, and Pennsylvania for river miles 108.4 to 70.0 of the mainstem Delaware River and apply concurrently with other applicable water quality criteria.

(3) The designated use and criteria established are subject to Delaware's, New Jersey's, and Pennsylvania's general rules of applicability in the same way and to the same extent as are other federally promulgated and state-adopted water quality standards in those states.