Socioeconomic, institutional, technological, and environmental (SITE) study

January 2019

To determine the impacts of the water quality standard revisions

Contents

List of Tables

Summary

The District of Columbia's Department of Energy and Environment (DOEE) is revising water quality standards (WQS) for District surface waters as required by the federal Clean Water Act[1] and the District's Water Pollution Control Act, D.C. Code 8-103.04. The states (including the District), territories, and authorized tribes are required to conduct a review of their WQS at least every three years.

The District initially proposed WQS revisions on September 15, 2017,[2] which were based on EPA recommendations. The proposed 2017 WQS revisions received three sets of comments from EPA, DC Water, and a collective of 11 environmental organizations during the public comment period. Those comments informed DOEE's second proposed WQS revisions, which include updates to the aquatic life criteria for ammonia and cadmium and human health criteria for 94 human health constituents just as the first proposed WQS. The District, however, is not proposing to adopt EPA's recommended *E. coli* criteria, which were included in the first proposed WQS. The current E.*coli* criteria will remain in the WQS.

Prior to promulgating the revisions, DOEE is required to consider the socioeconomic, institutional, technological, and environmental (SITE) impacts of applying and enforcing the revisions.[3] This SITE analysis will review these impacts, but the analysis will not represent the actual control strategies that permittees will have to employ to achieve the various water quality standards. The SITE analysis will be published concurrently with the second proposed WQS revisions.

Socioeconomic Impacts

For this document, the term "socioeconomic" refers to financial costs associated with the positive and negative impacts of revising the District's WQS. Protecting water quality will provide socioeconomic value to all residents by protecting the water bodies for purposes of human contact (including fish consumption), wildlife conservation, and recreational opportunities. The benefits are increased opportunities for swimming, boating, wading, and sport-fishing that result from direct human interaction with water in the stream. Other benefits include aesthetics valued by nearby picnickers, stream-side trail hikers, and property owners.

Various methods, such as willingness of District residents to pay for better water quality, can be used to estimate the monetary value of environmental benefits. For example, a 2015 study[4] found that households in Utah were willing to pay between $8 and $13 a month to prevent deterioration of surface water quality and were willing to pay up to $32 per month to improve water quality.

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[1] 40 CFR 131.20
[2] DOEE. 2017. Notice of Proposed Rulemaking Water Quality Standards - 2016 Triennial Review. https://doee.dc.gov/sites/default/files/dc/sites/ddoe/release_content/attachments/Proposed%20WQS%202016.pdf
[3] D.C. Official Code 8-103.04(c)
[4] N.M. Nelson et al. 2015. Linking ecological data and economics to estimate the total economic value of improving water quality by reducing nutrients. Ecological Economics. 118:1-9.

Nationally, EPA estimates that losses of approximately $1 billion in tourism each year are due to water quality degradation such as nutrient pollution and harmful algal blooms.[5] In addition, EPA notes that clean water can raise the value of a nearby home by up to 25%.

In the Chesapeake Bay watershed, a 1989 study[6] noted that there was a willingness on the part of impacted parties to pay for improved water quality in the Chesapeake Bay. The dollar amount that those surveyed were willing to pay ranged between $10 million and $100 million (1984 dollars). The Chesapeake Bay Foundation estimated that the lands and water in the Chesapeake Bay watershed provide a range of natural benefits worth $107 billion, expressed in 2013 dollars.[7] This estimate includes natural benefits such as recreation, water supply, water flow regulation, food production, and climate stability. If the Chesapeake Bay regional TMDL,[8] with limits for nitrogen, phosphorus, and total suspended solids, is fully implemented to address water quality problems, the report estimated that benefits to residents and users in the Chesapeake Bay watershed will increase by $22 billion annually. This same study outlined that fully implementing the Chesapeake Bay TMDL would result in benefits of $29 million annually to the District.

Institutional Impacts

The term "institutional" in this document refers to known institutions in the District that may be impacted by revising the District's WQS. These include the District Government which manages TMDLs and pollution prevention programs and various stakeholder groups, such as National Pollutant Discharge Elimination System (NPDES) permittees.

DOEE, in conjunction with EPA, is revising the District's TMDLs. DOEE is also currently contributing to interjurisdictional TMDLs with Maryland such as the Anacostia River Toxics TMDL and also coordinates on the Chesapeake Bay regional TMDL. WQS are often used as the end points for TMDL calculations; other impacts of WQS revisions regarding TMDLs is discussed in each of the Impairments and TMDLs sections later in this document.

Currently, there are 11 NPDES permits in the District. The proposed WQS revisions may also affect future permittees. All NPDES permits in the District are issued by EPA and certified by DOEE. The impact of WQS revisions on some of these permittees is discussed in detail in each of the How Criteria Affect Permitting and Compliance sections later in this document. Three notable permittees are discussed below.

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[5] EPA. 2018. Nutrient Pollution. The effects: Economy. Accessed September 14, 2018. https://www.epa.gov/nutrientpollution/effects-economy.

[6] N.E.Bockstael, K.E. McConnell, I.E., Strand. 1989. Measuring the benefits of Improvements in Water Quality: Chesapeake Bay. Marine Resource Economics. 6:1-18.

[7] Chesapeake Bay Foundation. 2014. The Economic Benefits of Cleaning up the Chesapeake. A Valuation of the Natural Benefits Gained by Implementing the Chesapeake Clean Water Blueprint.

[8] EPA. 2010. Chesapeake Bay Total Maximum Daily Load (TMDL). Accessed November 15, 2018. https://www.epa.gov/chesapeake-bay-tmdl.

DC Water's Blue Plains is cited as the largest advanced wastewater treatment plant in the world,[9] treating wastewater from the District of Columbia, Montgomery County and Prince Georges County, MD, and Fairfax County and Loudon County, VA. Blue Plains also has a significant portion of waste load allocations for the District's TMDLs. The system treats approximately 300 million gallons of wastewater per day and has enhanced nitrogen removal (both nitrification and denitrification) facilities that already reduce the level of nitrogen to meet the NPDES permit limit. The treated water is then discharged to the Potomac River. The enhanced nitrogen removal facility was put into operation in 2014 at an estimated cost of $950 million.[10,11]

In addition to DC Water's Blue Plains extensive denitrification operations, the first of two Anacostia tunnels of DC Water's Long Term Control Plan (LTCP) is online. With the implementation of the remaining LTCP, water that was once diverted to District surface waters will now be captured, stored, and conveyed via the underground tunnels to DC Water's Blue Plains wastewater treatment facility. This additional water treatment is intended to reduce the quantity of pollutants reaching the District's surface waters. Consequently, DOEE does not expect the proposed WQS revisions to have a negative impact on DC Water's ability to maintain compliance with the NPDES permit.

The District's MS4 NPDES permit[12] covers stormwater discharges from the MS4 to Rock Creek, Potomac River, Anacostia River, and their tributaries. The MS4 permit also has a significant portion of waste load allocations for the District's TMDLs. The requirements of the permit include the development and implementation of a comprehensive stormwater management program that includes pollution prevention measures, treatment and removal techniques, monitoring, and other measures to control the quality and quantity of stormwater discharged to the storm drains and as runoff to the District waters. Because of those facts and the District's continued pollution prevention activities, DOEE does not expect the proposed WQS revisions to negatively impact the District's ability to implement the requirements of the MS4 permit.

The third permit facility of note is the Washington Aqueduct system, which supplies drinking water for the District and Northern Virginia and is operated by the U.S. Army Corp of Engineers. Raw river water is obtained from the Great Falls Raw Water Intake or the Little Falls Pumping Station on the Potomac River. [13] The water flows through the Dalecarlia Reservoir and is then diverted for settling to either the Dalecarlia plant or the Georgetown Reservoirs. Residual solids from the Dalecarlia plant sedimentation basins are periodically discharged to the Potomac River through an outfall located upstream of Chain Bridge.[14] Residuals from the McMillan plant are periodically discharged into the Potomac River. These discharges are allowed by the Aqueduct's

[9] DC Water. 2018. The Largest Advanced Wastewater Treatment Plant in the World. Accessed September 13, 2018. https://www.dcwater.com/blue-plains.
[10] DC Water. 2018. Blue Plains Advanced Wastewater Treatment Plant Brochure. Accessed September 13, 2018.https://www.dcwater.com/sites/default/files/Blue_Plains_Plant_brochure.pdf.
[11] JMT Inc. 2018. Independent Engineering Inspection of the DC Water Wastewater and Water Systems.
[12] EPA Region 3. *District of Columbia Phase I Municipal Separate Storm Sewer System (MS4) Permit Reissuance*. Philadelphia. 2018. Accessed August 13, 2018. https://www.epa.gov/dc/district-columbia-phase-i-municipal-separate-storm-sewer-system-ms4-permit-reissuance.
[13] US Army Corps of Engineers. Washington Aqueduct. Accessed November 15, 2018. https://www.nab.usace.army.mil/Missions/Washington-Aqueduct/.
[14] US Army Corps of Engineers. Washington Aqueduct. Water Treatment Process. Accessed November 16, 2018. https://www.nab.usace.army.mil/Missions/Washington-Aqueduct/Treatment-Process/.

NPDES permit.[15] The chemical constituents that are listed in the Aqueduct's NPDES permit are not affected in the proposed revisions. The District foresees no negative impacts to the Aqueduct's ability to remain in compliance with its NPDES permit.

Technological Impacts

The term "technological" in this document refers to information technology, environmental sampling, analysis technology, and discharge treatment that may need to be updated as a result of revising the District's WQS.

This document considers the potential for additional treatment costs and best management practices (BMPs) if needed to provide treatment at higher levels for the more stringent criteria. For less stringent limits resulting from these changes, the cost of BMPs that would be required to meet the new criteria would likely be reduced from that required under the current WQS, or the need for BMPs may be eliminated.

Environmental Impacts

The term "environmental" in this document refers to positive or negative impacts to the District's environment, in particular District water bodies, as a result of revising the District's WQS. Revising the District's WQS is intended to improve water quality. This aids the District in meeting goals in the District's Comprehensive Plan,[16] the Wildlife Action Plan,[17] the Sustainable DC Plan,[18] and the Anacostia 2032 Plan.[19] The Comprehensive Plan guides future District growth and development. Within the plan, critical environmental issues such as improving the District's rivers, streams, and stream valleys, and sustaining plant and animal habitat are noted. The Wildlife Action Plan focuses on wildlife and their habitats, which include rivers and streams.[20] One of the Sustainable DC Plan's goals is to "protect and restore wetlands, waterways, and aquatic ecosystems.[21] Also, water quality improvement is a foundational component of the District's Anacostia 2032 Plan for a Fishable and Swimmable Anacostia River.[22] The Plan identifies the Anacostia River as one of the District's "most valuable resources."

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[15] EPA Region 3. *Permit No. DC0000019 Authorization to Discharge under the National Pollutant Discharge Elimination System*. Philadelphia. 2008. Accessed November 16, 2018.
[16] DCOP. 2006. *Comprehensive Plan*. Accessed October 2, 2018. https://plandc.dc.gov/page/comp-plan-101.
[17] DOEE. 2015. *Wildlife Action Plan*. Accessed October 25, 2018. https://doee.dc.gov/service/2015-district-columbia-wildlife-action-plan.
[18] DOEE. 2018. Sustainable DC. Accessed October 25, 2018. http://www.sustainabledc.org/in-dc/planprogress/.
[19] DOEE. 2008. *Anacostia 2032: Plan for Fishable and Swimmable Anacostia River*. Accessed October 1, 2018. https://doee.dc.gov/sites/default/files/dc/sites/ddoe/publication/attachments/Anacostia2032.pdf
[20] DOEE. 2015. *Wildlife Action Plan*. Accessed October 25, 2018. https://doee.dc.gov/service/2015-district-columbia-wildlife-action-plan
[21] DOEE. 2018. Sustainable DC. Accessed November 16, 2018. http://www.sustainabledc.org/in-dc/planprogress/.
[22] DOEE. 2008. *Anacostia 2032: Plan for Fishable and Swimmable Anacostia River*. Accessed November 16, 2018. https://doee.dc.gov/sites/default/files/dc/sites/ddoe/publication/attachments/Anacostia2032.pdf

Impacts of Revised Criteria

***E. coli*.** In response to the extensive public comment on the proposed E. *coli* criteria, the current E.*coli* will remain in the WQS. Therefore, this SITE study does not consider the impacts of this criteria.

Implementation of DC Water's Long-Term Control Plan (LTCP) for combined sewer overflows is well underway. This plan was based, in part, on compliance with the current *E. coli* criteria. The Anacostia River Tunnel, which is part of the LTCP, was put into operation in March 2018. According to DC Water, the tunnel system captured over 80 percent of the combined sewer overflow volume through September 2018. It is anticipated that the tunnel system will reduce combined sewer overflows even further when the Anacostia River Tunnel System is complete. The Consent Decree deadline to complete the system is 2025.

DOEE requires more time to analyze the available information and understand the impacts before revising the District's *E. coli* criteria.

Ammonia. The District's current ammonia criteria are based on EPA's 1999 recommendations, which were established using a science-based approach that considered fish and invertebrate data. The 2013 EPA recommendations take into account additional data, such as the sensitivity that some freshwater mussels and snails have to ammonia. In the updated EPA recommended criteria, which the District is proposing to adopt, the chronic criterion is less stringent and the acute criterion is more stringent. Wastewater treatment is centralized in the District, and DC Water's Blue Plains facility already has enhanced nitrification and denitrification technology that remove ammonia to meet EPA issued NPDES permit limit. DOEE anticipates no negative impacts in applying the revised ammonia criteria for aquatic life.

Cadmium. The current cadmium criteria are based on EPA's 2001 recommendations. The 2016 recommendations take into account 100 new studies that include acute and chronic toxicity data. The updated EPA recommended criteria, which the District is proposing to adopt, are more stringent. The District does not anticipate any negative impact in applying the revised cadmium criteria for aquatic life. There is only one EPA NPDES permit, Pepco Benning Generating Station, that places an effluent limit on cadmium. It is anticipated that the permit will be in compliance with the proposed changes to the cadmium criteria.

Human Health Criteria for 94 Constituents. The current human health criteria for 94 constituents (94 human health constituents) are also based on past EPA recommendations. Example constituents include carcinogenic compounds such as DDT and its breakdown products and heptachlor epoxide. The 2015 EPA recommendations are based on the latest scientific studies, which include changes to bioaccumulation factors that are used to calculate toxicity levels. The District does not expect any negative impact in applying the revised human health criteria for the 94 constituents. No current NPDES permits contain effluent limits for these constituents; however, there are two NPDES permits that require monitoring for some of the 94 human health constituents (e.g., benzene, DDT and its breakdown products, and heptachlor epoxide).

Methodology

The District initially proposed WQS revisions, based on EPA recommendations, on September 15, 2017[23]. To determine the impacts of those revisions, it is necessary to understand the underlying structure of the affected industries or dischargers and their linkages throughout the District's economy. This includes an understanding of the condition of a particular industry in terms of its finances and structure in the absence of the regulation. A rule may impose different requirements and costs on new versus existing entities. Such rules may affect industry competition, growth, and innovation by raising barriers to new entries or encouraging continued use of outdated technologies.

The methodology for this SITE analysis was based on a review of multiple references, including EPA's 1995 Economic Guidance for Water Quality Standards Workbook[24] and studies done by agencies in Pennsylvania[25] and Virginia, [26] which analyzed the economic impact of adopting EPA's recommended WQS.

The District is providing this SITE analysis as required in the District's Water Pollution Control Act, D.C. Official Code 8-103.04(c). This SITE analysis does not prescribe the strategies that may be employed by the permittees, and does not predict when costs will be incurred.

This SITE analysis covers proposed WQS revisions for: ammonia for aquatic life, cadmium for aquatic life, and 94 human health constituents for human health.

For each constituent, this document provides the following:

1. **Introduction**—Discusses whether the constituent is found in nature, how the constituent is manufactured or used in manufacturing, and how it is transported in the environment.
2. **Current and Proposed District Water Quality Criteria**—Describes the water quality criteria in the District's current WQS regulations and the proposed revisions based on EPA's recommended criteria.
3. **EPA Recommendation**—Describes the rationale for EPA's update to the criteria and why the District is proposing adoption of EPA's updated criteria.
4. **How Criteria Affect Permitting and Compliance**—Discusses how the revised criteria may affect permitting and compliance in certain NPDES permits potentially affected by the proposed criteria.
5. **Impairments and TMDLs**—Describes whether a District waterbody has a known impairment for the constituent and if the constituent has an associated TMDL.
6. **Anticipated Impact of Adopting the Revised Criteria**—Discusses the anticipated impact of adopting the revised criteria, and explains the outcomes, positive and negative, of adopting the criteria.

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[23] DOEE. 2017. Notice of Proposed Rulemaking Water Quality Standards - 2016 Triennial Review. https://doee.dc.gov/sites/default/files/dc/sites/ddoe/release_content/attachments/Proposed%20WQS%202016.pdf
[24] US EPA. 1995. Interim Economic Guidance for Water Quality Standards Workbook. (EPA-823-B-95-002).
[25] Pennsylvania Environmental Quality Board. 2017. *Proposed Rulemaking – Triennial Review of Water Quality Standards*. https://www.pabulletin.com/secure/data/vol47/47-42/1766.html
[26] Virginia Department of Planning and Budget. 2015. *9 VAC 25-210 – Economic Impact Analysis.* http://townhall.virginia.gov/L/GetFile.cfm?File=103%5C4159%5C7208%5CEIA_DEQ_7208_v5.pdf

Ammonia

Introduction

Ammonia is a form of nitrogen and commonly found in surface waters. In nature, ammonia can be found in the breakdown of organic matter, in feces, as a byproduct of forest fires, in gas exchange with the atmosphere, and in the nitrogen fixation process.[27] Commercial sources are mainly fertilizers.[28] At high concentrations, ammonia can accumulate in aquatic organisms to the point they are unable to process or excrete it, thereby increasing the likelihood of illness or death.[29]

As discussed later in the How Criteria Affect Permitting section, some permits require monitoring and reporting for total nitrogen, ammonia, nitrates, and nitrites. To clarify, total nitrogen is the sum of all forms of nitrogen in the water (ammonia, organic nitrogen, nitrates, and nitrites).

Current and Proposed District Water Quality Criteria

The ammonia criteria in the District's current WQS are based on EPA's 1999 freshwater recommendations. The District's WQS for ammonia contain two criteria: 1) criterion continuous concentration (CCC), a 30-day average and extrapolated to a 4-day average, and 2) criterion maximum concentration (CMC), a 1-hour average. Calculations for both criteria are dependent on pH and temperature.

Both of the ammonia CCC and CMC include duration, magnitude, and frequency. The duration for both is the one-hour average, the four-hour average, and the 30-day rolling average. The magnitudes are the numeric criteria shown in Table 1.[30] The frequency for the ammonia CCC and CMC is that the numeric standards are not to be exceeded more than once in three years on average.

Table 1 shows both the current and proposed ammonia criteria. The proposed chronic 30-day average is slightly less stringent than the current chronic 30-day average. The proposed chronic 4-day average is slightly less stringent than the current chronic 4-day average. The proposed acute one-hour average is twice as stringent.

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[27] EPA. *Aquatic Life Criteria – Ammonia.* Last modified July 12, 2017. Accessed September 25, 2018. https://www.epa.gov/wqc/aquatic-life-criteria-ammonia

[28] EPA. *Aquatic Life Ambient Water Quality Criteria for Ammonia - Freshwater (2013).* Washington DC: US EPA, 2013. 820-F-13-013. Accessed October 2, 2018. https://www.epa.gov/sites/production/files/2015-08/documents/fact_sheet_aquatic-life-ambient-water-quality-criteria-for-ammonia-freshwater-2013.pdf

[29] EPA. *Aquatic Life Criteria – Ammonia.* Last modified July 12, 2017. Accessed September 25, 2018. https://www.epa.gov/wqc/aquatic-life-criteria-ammonia

[30] EPA. *Aquatic Life Ambient Water Quality Criteria for Ammonia - Freshwater (2013).* Washington DC: US EPA, 2013. 820-F-13-013. Accessed October 2, 2018. https://www.epa.gov/sites/production/files/2015-08/documents/fact_sheet_aquatic-life-ambient-water-quality-criteria-for-ammonia-freshwater-2013.pdf

Table 1: Current and Proposed Ammonia Criteria

pH of 7.0 20°C	District's Current Ammonia Freshwater Criteria[31] Total Ammonia mg N/L	District's Proposed Ammonia Freshwater Criteria[32] Total Ammonia Nitrogen mg/L
Criterion Continuous Concentration (CCC) – Chronic 30-day rolling average	1.7	1.9*
Criterion Continuous Concentration (CCC) – Chronic 4-day average March-June	4.2	–
Criterion Continuous Concentration (CCC) – Chronic 4-day average July-February	4.2	–
Criterion Continuous Concentration (CCC) – Chronic 4-day average	–	4.8
Criterion Maximum Concentration (CMC) – Acute 1-hour average	36.1	17

Criteria frequency: Not to be exceeded more than once in three years on average.

Notes: *Not to exceed 2.5 times the criterion continuous concentration as a 4-day average within a 30-day period.

EPA Recommendations

Proposed updates to the ammonia criteria are based on EPA's latest scientific studies and new toxicity data on freshwater mussels and gill-breathing snails.[33] EPA continues to include duration, magnitude, and frequency in the updated ammonia criteria and they remain the same, see Table 1. The ammonia criteria's frequency is that the numeric standards are not to be exceeded more than once in three years on average.[34]

EPA also provides two versions of the ammonia criteria, one for which the *Oncorhynchus* spp. (salmon and trout species) is present and one for which *Oncorhynchus* spp. is not present. The

[31] Title 21 DCMR § 1104 (2013).
[32] EPA. *Aquatic Life Ambient Water Quality Criteria for Ammonia - Freshwater (2013)*. Washington DC: US EPA, 2013. 820-F-13-013. Accessed October 2, 2018. https://www.epa.gov/sites/production/files/2015-08/documents/fact_sheet_aquatic-life-ambient-water-quality-criteria-for-ammonia-freshwater-2013.pdf
[33] US EPA. *Aquatic Life Ambient Water Quality Criteria for Ammonia - Freshwater (2013)*. Washington DC: US EPA, 2013. EPA 822-R-13-001. Accessed October 2, 2018. https://www.epa.gov/sites/production/files/2015-08/documents/aquatic-life-ambient-water-quality-criteria-for-ammonia-freshwater-2013.pdf
[34] US EPA. *Aquatic Life Ambient Water Quality Criteria for Ammonia - Freshwater (2013)*. Washington DC: US EPA, 2013. EPA 822-R-13-001. Accessed October 2, 2018. https://www.epa.gov/sites/production/files/2015-08/documents/aquatic-life-ambient-water-quality-criteria-for-ammonia-freshwater-2013.pdf

District is proposing to adopt the ammonia criteria for which *Oncorhynchus* spp. is present. According to the DOEE's Fisheries and Wildlife Division, District waters do not seem to provide habitat for *Oncorhynchus* spp., as surface waters are too warm. When *Oncorhynchus* sp. is found in District waters, it is believed to have migrated from areas that have been stocked with that species. While the District does not provide the habitat for *Oncorhynchus* spp., to be protective of all aquatic life, the District is proposing to adopt the more stringent ammonia criteria that are protective of *Oncorhynchus* spp.

How Criteria Affect Permitting and Compliance

One EPA issued NPDES permit in the District has an ammonia effluent limit: DC Water's permit (DC0021199). Five other EPA issued NPDES permits have limits and requirements to monitor for total nitrogen, which is the sum of organic nitrogen, ammonia, nitrate, and nitrite. These permits are held by the Navy Yard (DC0000141), the World War II Memorial (DC0000345), the Lincoln Memorial (DC0000370), Washington Metropolitan Area Transit Authority (WMATA) (DC0000337), and the District's MS4 (DC0000221).

DC Water. The DC Water NPDES permit has seasonal weekly and monthly effluent limits for ammonia. These limits are associated with DC Water's Blue Plains wastewater treatment facility Outfall 002, which discharges to the Potomac River. Since ammonia toxicity is related to temperature and pH, it is appropriate to have different discharge limits throughout the year. Table 2 details the average monthly and weekly effluent limit throughout the year.[35]

Table 2: DC Water's NPDES Permit Effluent Limits for Ammonia[36]

Timeframe	Average Monthly Concentration mg/L	Average Weekly Concentration mg/L
Summer – May 1 through October 31	4.1	6.1
Winter 1 – November 1 through February 14	12.8	19.3
Winter 2 – February 15 through April 30	10.3	15.4

DC Water's NPDES permit also requires monitoring for nitrate-nitrite, total Kjeldahl nitrogen (ammonia and organic nitrogen), and total nitrogen from Outfall 002 and monitoring of total nitrogen from Outfall 001. Outfall 001 is a combined sewer overflow bypass.

DC Water's current NPDES permit also requires an effluent limit of 4,689,000 pounds of total nitrogen per year.[37] This load limit is the Chesapeake Bay TMDL wasteload allocation to DC Water's Blue Plains wastewater treatment facility. The load allocated to Outfall 002 is 4,370,078 pounds of total nitrogen and the load allocated to Outfall 001 is 318,922 pounds of total nitrogen.

[35] EPA Region 3. *Permit No. DC0021199 Authorization to Discharge under the National Pollutant Discharge Elimination System*. Philadelphia. 2018. Accessed September 27, 2018.
[36] EPA Region 3. *Permit No. DC0021199 Authorization to Discharge under the National Pollutant Discharge Elimination System*. Philadelphia. 2018. Accessed September 27, 2018.
[37] EPA Region 3. *Permit No. DC0021199 Authorization to Discharge under the National Pollutant Discharge Elimination System*. Philadelphia. 2018. Accessed September 27, 2018.

According to a review of monitoring data submitted to DOEE's Inspection and Enforcement Division, there are no exceedances of the ammonia effluent limit for Outfall 002 from 2013 to present day. Since 2013, DC Water has completed construction and put into operation an enhanced nitrogen removal facility.

The District, therefore, anticipates that DC Water will remain in compliance with its current NPDES permit and with future NPDES permits that include updated ammonia criteria.

Navy Yard. This permit authorizes the applicant to discharge stormwater from multiple locations that include outfalls to the lower Anacostia River. The permit does not have an ammonia effluent limit, however, there is a total nitrogen waste load allocation of 695 pounds per year.[38] This waste load allocation pertains to the 2008 Anacostia River Nutrients/Biochemical Oxygen Demand for the Anacostia Basin.[39]

World War II Memorial. This NPDES permit was issued in the summer of 2018[40] and authorizes the discharge of water to the Tidal Basin, which contributes water to the Potomac River. There are no ammonia permit limits. The current permit requires quarterly monitoring of total nitrogen to meet the assumptions of the waste load allocations associated with the Chesapeake Bay TMDL.

Lincoln Memorial Reflecting Pool. This NPDES permit was also issued in the summer of 2018 and authorizes discharge to the Tidal Basin, which contributes water to the Potomac River. Discharge monitoring occurs when the Pool is cleaned and discharges to the Basin. The permit requires monitoring and reporting of total nitrogen (total Kjeldahl nitrogen, ammonia, and nitrate-nitrite), total phosphorus, and total suspended solids (TSS), which informs the Chesapeake Bay TMDL.

WMATA. Washington Metropolitan Area Transit Authority's (WMATA's) NPDES permit[41] requires total nitrogen monitoring. There are no nitrogen discharge limits. The permit's factsheet[42] notes that total nitrogen is not discharged at concentrations that have a potential to exceed the WQS.

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[38] EPA Region 3. *Permit No. DC0000141 Authorization to Discharge under the National Pollutant Discharge Elimination System*. Philadelphia. 2010. Accessed October 2, 2018.
[39] Maryland Department of Environment and District of Columbia Department of the Environment. 2008. Total Maximum Daily Load of Nutrients/Biochemical Oxygen Demand for the Anacostia River Basin, Montgomery County and Prince George's Counties, Maryland and the District of Columbia.
[40] EPA Region 3. *Authorization to Discharge under the National Pollutant Discharge Elimination System Permit Number DC0000345*. Philadelphia. 2018. Accessed November 16, 2018.
[41] EPA Region 3. *Authorization to Discharge under the National Pollutant Discharge Elimination System Permit Number DC0000337*. Philadelphia. 2012. Accessed September 6, 2018. https://www3.epa.gov/reg3wapd/pdf/pdf_npdes/Wastewater/DC/DC0000361WRAMCFinalPermit.pdf
[42] EPA Region 3. *Final Fact Sheet.* Philadelphia. 2012. Accessed October 2, 2018. https://www3.epa.gov/reg3wapd/pdf/pdf_npdes/Wastewater/DC/DC0000337WMATAFactSheet2012.pdf 11

The District's MS4. The District has a NPDES permit for its MS4,[43] which states that total nitrogen is a parameter for monitoring only. There is no discharge limit for ammonia.

Table 3 shows the total nitrogen maximum and minimum concentrations in the Potomac River and Anacostia River over two MS4 permit cycles, which were reported in the 2017 MS4 annual report.

Table 3: Total Nitrogen Concentration over Two NPDES Permit Reporting Cycles[44]

	Estimated Total Nitrogen Concentration (mg/L)			
	2005-2011		2013-2017	
Watershed	Low	High	Low	High
Potomac River	1.0	9.2	1.2	7.13
Anacostia River	0.9	13.0	1.7	6.82

The maximum total nitrogen concentrations in both the Potomac River and the Anacostia River in the second permit cycle were significantly lower than the concentrations in the first permit cycle.

The District must also report total nitrogen load reductions in its MS4 annual reports. For 2017, the District reported a 1,428-pound load reduction for the Potomac River, Anacostia River, and Rock Creek watersheds.

DOEE anticipates that the number of pollution prevention projects and BMPs in the District's MS4 area will continue to increase. Therefore, DOEE expects that no additional costs will result from revising the ammonia criteria.

Impairments and TMDLs

There are no ammonia TMDLs in the District. There is, however, one local and one regional nutrient TMDL that includes total nitrogen. Both the 2008 TMDL for Nutrients and Biochemical Oxygen Demand (BOD) in the Anacostia River Basin[45] and the 2010 Chesapeake Bay TMDL[46] for total nitrogen, total phosphorus, and total suspended solids have waste load and load allocations for total nitrogen.

[43] EPA Region 3. *District of Columbia Phase I Municipal Separate Storm Sewer System (MS4) Permit Reissuance*. Philadelphia. 2018. Accessed August 13, 2018. https://www.epa.gov/dc/district-columbia-phase-i-municipal-separate-storm-sewer-system-ms4-permit-reissuance.
[44] DOEE. 2017. *MS4 Annual Report*. https://doee.dc.gov/sites/default/files/dc/sites/ddoe/publication/attachments/00%20MS4%20Annual%20Report%20FY%202017.pdf.
[45] DOEE. "Total Maximum Daily Load (TMDL) Documents." *Department of Energy and Environment*. Accessed August 8, 2018. https://doee.dc.gov/service/total-maximum-daily-load-tmdl-documents.
[46] EPA. 2010. Chesapeake Bay Total Maximum Daily Load (TMDL). Accessed November 15, 2018. https://www.epa.gov/chesapeake-bay-tmdl.

According to the District's draft 2018 Integrated Report,[47] the main stems of Rock Creek, Anacostia River, and the Potomac River have no exceedances of the current ammonia water quality criteria.

Anticipated Impact of Adopting the Revised Criteria

Based on this study, the District sees no negative impacts of applying the revised ammonia criteria. No costs to stakeholders, such as NPDES permit holders, are expected.

Socioeconomic. The situation in the District is unique in the region. Facilities within the District typically route their wastewater to DC Water's Blue Plains wastewater treatment facility. No additional costs are expected for DC Water if the proposed water quality criteria for ammonia are adopted.

Institutional. No changes are expected to the District government, stakeholders, or other institutions if the revised ammonia criteria are adopted.

Technological. No changes or additions to effluent treatment systems for NPDES permit holders are expected as a result of adopting the revised ammonia criteria. No impacts to the District's analytical water quality laboratories are expected.

Environmental. For new and reissued EPA NPDES permits, it is anticipated that the revised ammonia water quality criteria will be used in calculating effluent limits. More stringent effluent limits means that less pollution will enter the District's waterways, resulting in healthier, swimmable, and fishable waters.

Cadmium

Introduction

In nature, cadmium is found naturally in varying amounts in soils throughout the United States. According to the U.S. Geological Survey (USGS), the Potomac River and Anacostia River watersheds have cadmium naturally occurring in soils with concentration ranges between about 0.1 and 0.4 mg/kg.[48] In urbanized areas, cadmium can also be found due to its use in "the manufacturing of batteries, pigments, plastic stabilizers, metal coatings, alloys and electronics."[49] Cadmium can be transported from soil and industry point sources to waterways via stormwater flow, groundwater seepage, or soil runoff.[50] EPA states that about 90 percent of the cadmium

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[47] DOEE. *Draft 2018 Integrated Report*. 2018. https://doee.dc.gov/release/notice-public-comment-period-draft-2018-district-columbia-integrated-report-water-quality.
[48] USGS. "Geochemical and Mineralogical Maps for Soils of the Conterminous U.S." *Mineral Resources On-Line Spatial Data*. May 16, 2014. Accessed August 8, 2018. https://mrdata.usgs.gov/soilgeochemistry/#/detail/element/48.
[49] US EPA. "Aquatic Life Criteria – Cadmium." *US EPA Water Quality Criteria*. July 12, 2017. Accessed August 8, 2018. https://www.epa.gov/wqc/aquatic-life-criteria-cadmium.
[50] National Research Council. *Toxicologic assessment of the army's zinc cadmium sulfide dispersion tests*. National Academies Press, 1997.

found in waterways is directly caused by human activities such as mining and urban processes.[51] Chronic exposure to cadmium can have lasting negative impacts to aquatic organisms' biological growth, reproduction, immune system, and endocrine system.[52]

Current and Proposed District Water Quality Criteria

The District's current cadmium water quality criteria include two criterion. One is the criterion continuous concentration (CCC) for chronic and the other is the criterion maximum concentration (CMC) for acute. The chronic criterion is a 4-day average and the acute is a 1-hour average. Both criteria apply to surface waters that have a designated use of protection and propagation of fish, shellfish, and wildlife (Class C). The criteria are calculated using the hardness, measured as mg/L of calcium carbonate ($CaCO_3$), in the receiving water body.

For comparison, Table 4 shows both the current and the proposed criteria. The proposed criteria are based on EPA's 2016 recommendations. The EPA recommendations for the chronic cadmium criterion is nearly three times less stringent than the District's current criterion, while EPA's 2016 acute cadmium criterion is slightly more stringent than the District's current criterion.

Table 4: Current and Proposed Cadmium Criteria

	District's Current Cadmium Criteria[53] µg/L at 100 mg/L of $CaCO_3$	District's Proposed Cadmium Criteria[54] µg/L at 100 mg/L of $CaCO_3$
Criterion Continuous Concentration (CCC) – Chronic	0.25	0.72
Criterion Maximum Concentration (CMC) – Acute	2.0	1.8

EPA Recommendations

In 2016, EPA updated its 2001 recommended cadmium aquatic life ambient water quality criteria to utilize the latest scientific information, including an update to the effects of total hardness on

[51] US EPA. "Aquatic Life Criteria – Cadmium." *US EPA Water Quality Criteria*. July 12, 2017. Accessed August 8, 2018. https://www.epa.gov/wqc/aquatic-life-criteria-cadmium.
[52] US EPA. *Aquatic Life Ambient Water Quality Criteria Cadmium – 2016*. Washington DC: US EPA, 2016. EPA 820-R-16-002.
[53] Title 21 DCMR § 1104 (2013).
[54] US EPA. "Aquatic Life Criteria – Cadmium." *US EPA Water Quality Criteria*. July 12, 2017. Accessed August 8, 2018. https://www.epa.gov/wqc/aquatic-life-criteria-cadmium.

cadmium toxicity.[55] The updates reflect the results of more than 100 new studies since 2001, including the newest toxicity data for 75 new species and 49 new genera.[56]

How Criteria Affect Permitting and Compliance

One individual NPDES permit has a cadmium effluent limit: Pepco/Benning Road (DC0000094). Two NPDES permits have cadmium listed as a parameter to only monitor: the District's MS4 (DC0000221) and DC Water's Blue Plains (DC0021199) permits.

Pepco/Benning Road. The current NPDES permit has a permit limit for cadmium at Outfall 013. The limit is an average monthly concentration of 2.08 µg/L and a maximum daily concentration of 4.95 µg/L.[57] Pepco/Benning Road is not currently an active power-generating facility, but the site does contain a Pepco Service Center. Therefore, the cadmium found on site or in the site's effluent is attributed to legacy contamination. According to the review of monitoring data submitted to DOEE's Inspection and Enforcement Division, since 2012 there has been no known water quality standard exceedance for cadmium at this site. Current treatment methods for metals (copper, lead, zinc, and iron) adequately treat for cadmium. Additionally, Pepco/Benning Road completed a TMDL implementation report in 2012 that was designed to minimize contamination by metals, including cadmium, PCBs, and other contaminants of concern.[58] No additional compliance costs are expected for Pepco/Benning Road if the water quality criteria for cadmium become more stringent.

Since the cadmium chronic criterion is becoming less stringent, the acute criterion is slightly more stringent, and Pepco is currently meeting their NPDES permit effluent discharge limits, the District anticipates that Pepco will remain in compliance with their current NPDES permit and with future NPDES permits adjusted to the updated cadmium criteria.

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[55] US EPA. *Aquatic Life Ambient Water Quality Criteria Update for Cadmium – 2016*. Washington, DC: US EPA, 2016. EPA 822-F-16-003.

[56] US EPA. *Aquatic Life Ambient Water Quality Criteria Cadmium – 2016*. Washington DC: US EPA, 2016. EPA 820-R-16-002.

[57] EPA Region 3. *Authorization to Discharge under the National Pollutant Discharge Elimination System Industrial Permit No. DC0000094*. Philadelphia. 2009. Accessed August 13, 2018. https://www3.epa.gov/reg3wapd/pdf/pdf_npdes/Wastewater/DC/DC0000094PEPCOFinalPermit.pdf

[58] Potomac Electric Power Company, Inc. *Benning Service Center Phase 3 TMDL Implementation Plan for Compliance with the NPDES Permit. Washington, DC. 2014.*

The District's MS4. The District's MS4 has known presence of cadmium. These sources can be attributed to a combination of legacy contamination and small current industrial operations within the sewershed. The MS4's NPDES permit states that cadmium is a parameter for monitoring only and has no discharge limit. Cadmium must be sampled at outfalls during wet weather events. In the District's 2017 MS4 annual report, cadmium was reported as a load reduction.[59] Table 5 shows the cadmium maximum and minimum concentrations reported over two NPDES permit cycles.

Table 5: Total Cadmium Concentration over Two NPDES Permit Reporting Cycles[60]

Watershed	Estimated Total Cadmium Concentration (µg/L)			
	2005-2011		2013-2017	
	Low	High	Low	High
Potomac River	0.22	16	ND	8.5
Anacostia River	0.3	12	ND	3.7
Rock Creek	0.5	31	ND	0.77

ND – Not detected at or above the reporting limit

Table 5 shows low and high cadmium concentrations for all three watersheds over the two NPDES permit cycles are above both the District's current cadmium criteria and the proposed cadmium criteria. When the highest concentrations in the respective watersheds are compared over the two permit cycles, the Potomac River watershed shows a 47 percent decrease, the Anacostia River watershed shows a 69 percent decrease, and the Rock Creek watershed shows a 97 percent decrease.

In addition, associated with pollution prevention projects and stormwater retrofits within the sewershed, cadmium loads for the District's watershed were reduced by 8.19 pounds during 2017.[61] The load reductions are calculated using the TMDL Implementation Plan Modeling Tool,[62] which was developed to model the stormwater runoff volumes, pollutant loads generated, and load reductions achieved through stormwater management.

Because there are no permit limits for cadmium and because of a projected increase in pollution prevention projects and BMPs being implemented in the District, no additional costs are expected for the District if the water quality criteria for cadmium become more stringent.

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[59] DOEE. *2017 MS4 Annual Report*. https://doee.dc.gov/sites/default/files/dc/sites/ddoe/publication/attachments/00%20MS4%20Annual%20Report%20FY%202017.pdf.

[60] DOEE. *2017 MS4 Annual Report*. https://doee.dc.gov/sites/default/files/dc/sites/ddoe/publication/attachments/00%20MS4%20Annual%20Report%20FY%202017.pdf.

[61] DOEE. *2017 MS4 Annual Report*. https://doee.dc.gov/sites/default/files/dc/sites/ddoe/publication/attachments/00%20MS4%20Annual%20Report%20FY%202017.pdf

[62] DOEE. *Consolidated Total Maximum Daily Load Implementation Plant Report.* August 2016. http://dcstormwaterplan.org/documents-and-deliverables/.

DC Water. The DC WASA (DC Water) NPDES permit lists a monitoring requirement of dissolved cadmium for the permitted outfall, Outfall 002.[63] This is a monitoring and reporting requirement only, and there are no permit discharge limits for cadmium. According to the review of monitoring data submitted to DOEE's Inspection and Enforcement Division, within the past year DC Water has not detected cadmium in its outfall effluent.

With DC Water's Long Term Control Plan tunnels coming online, water that was diverted to District surface waters will now be captured, stored, and conveyed via the underground tunnels to DC Water's Blue Plains wastewater treatment facility. This treatment of additional waters should reduce pollutants reaching the District's surface waters. Therefore, no additional costs are expected for DC Water if the water quality criteria for cadmium become more stringent.

Impairments and TMDLs

Historic cadmium sampling of the District's surface waterbodies does not demonstrate cadmium impairment. In addition, according to the District's 2018 Draft Integrated Report, there are no known cadmium impairments to the District's surface waters.[64] There are no TMDLs for cadmium in the District. Out of the six metal TMDLs in the District, none have cadmium listed as a constituent.[65] Currently, no TMDLs are believed to be necessary when the cadmium water quality criteria are revised.

Anticipated Impact of Adopting the Revised Criteria

Based on this study, the District sees no adverse impacts to stakeholders if the cadmium criteria are included in the District's revised Water Quality Standards. No costs to stakeholders, such as NPDES permit holders, are expected.

Socioeconomic. There are no expected costs to the District, NPDES permit holders, or other stakeholders due to adoption of the revised cadmium criteria. Benefits to improved water quality and natural resources will have positive socioeconomic impacts.

Institutional. No changes are expected to the District government, stakeholders, or other institutions if the revised cadmium criteria are adopted.

Technological. No changes or additions to effluent treatment systems for NPDES permit holders are expected as a result of adopting the revised cadmium criteria. No impacts to the District's analytical water quality laboratories are expected.

Environmental. For new and reissued EPA NPDES permits, it is anticipated that the revised cadmium water quality criteria will be used in calculating cadmium effluent limits. More stringent effluent limits means that less pollution will enter the District's waterways, resulting in healthier, swimmable, and fishable waters.

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[63] EPA Region 3. *Permit No. DC0021199 Authorization to Discharge under the National Pollutant Discharge Elimination System*. Philadelphia. 2018. Accessed August 13, 2018.
[64] DOEE. *Draft 2018 Integrated Report*. 2018. https://doee.dc.gov/release/notice-public-comment-period-draft-2018-district-columbia-integrated-report-water-quality.
[65] DOEE. "Total Maximum Daily Load (TMDL) Documents." *Department of Energy and Environment*. Accessed August 8, 2018. https://doee.dc.gov/service/total-maximum-daily-load-tmdl-documents.

Human Health Criteria for 94 Constituents

Introduction

For the purposes of this document, DOEE has profiled a select number of the 94 human health constituents that are proposed to be revised. The full list of 94 constituents can be viewed at the National Recommended Water Quality Criteria – Human Health Criteria Table[66] and in Appendix 1. The sample constituents in this SITE analysis were chosen because they are typically found in urban areas within the US and, from a human health perspective, reflect criteria based on carcinogenicity. Thus, this section reviews benzene, DDT and its derivatives, and heptachlor epoxide. Benzene was chosen because it is considered the parent material from which many organic compounds are derived and can be found in all environmental media.[67] DDT, DDT's derivatives, and heptachlor epoxide were chosen because these organic chemical constituents have a known historical presence in the District and are both controlled and mitigated by EPA NPDES permits, TMDLs, or both. For example, the 2003 toxics TMDL for the Anacostia River uses heptachlor epoxide water quality criteria as end points for the TMDL.

Benzene is derived from petroleum and is used as a parent chemical from which other chemicals are derived. Benzene is used as a solvent for fats and paints and is used in the manufacturing of detergents and pharmaceuticals. Natural sources of benzene include forest fires and gas eruptions from volcano emissions. Benzene can be found in air, water, soil, and groundwater. Exposure to benzene can cause drowsiness, dizziness, rapid heart rate, headaches, vomiting, or sleepiness.[68]

DDT does not naturally occur in the environment. Before its ban in 1972, DDT was used mainly as an insecticide. Through its use and production, it has been released into the air, soil, and water. Even though it can still be found in the environment today, it is considered a legacy contaminant as it is currently not authorized for use for any reason in the United States. A high dose exposure to DDT can cause tremors, seizures, sweating, headache, nausea, vomiting, or dizziness.[69]

Heptachlor and heptachlor epoxide do not naturally occur in the environment. Heptachlor epoxide is both a component and a breakdown chemical of heptachlor. It is a chlorinated hydrocarbon. Before its ban in 1988, heptachlor was manufactured as an insecticide for use in domestic and agricultural settings. Specifically, it was used for termite extermination in homes and as a general pesticide on grain crops. Through these uses, heptachlor and heptachlor epoxide

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[66] US EPA. 2015. National Recommended Water Quality Criteria - Human Health Criteria Table. Accessed October 22, 2018. https://www.epa.gov/wqc/national-recommended-water-quality-criteria-human-health-criteria-table

[67] National Center for Biotechnology Information. PubChem Compound Database; CID=241. Accessed October 25, 2018. https://pubchem.ncbi.nlm.nih.gov/compound/241

[68] ATSDR. 2007. *Toxicological Profile for Benzene*. U.S. Department of Health and Human Services. Atlanta, GA. Accessed September 13, 2018. http://www.atsdr.cdc.gov/toxprofiles/tp3.pdf.

[69] ATSDR. 2002. *Toxicological Profile for DDT, DDE, and DDD*. U.S. Department of Health and Human Services. Atlanta, GA. Accessed September 13, 2018. https://www.atsdr.cdc.gov/ToxProfiles/tp35.pdf.

entered the air and soil. Significant exposure to heptachlor can cause liver effects, neurological effects, reproductive system dysfunction, and developmental effects.[70]

Current and Proposed District Water Quality Criteria

The District's current water quality criteria for human health are based on EPA's previous recommended human health criteria. The current version of the District's water quality criteria can be found in Title 21, § 1104 of District of Columbia Municipal Regulations.[71]

EPA has a table of the human health criteria for the 94 constituents.[72] EPA has provided numeric criterion to use based on 1) the consumption of an aquatic organism and water or 2) based on the consumption of an aquatic organism only. To remain consistent with previous human health criteria for the District, the proposed WQS will continue to use the criteria related to the consumption of an aquatic organism only.

EPA's 2015 updates for the human health criteria delineate 59 criterion that are more stringent than previous versions of the criteria, 28 that are less stringent, 1 criterion that is currently listed in the District's water quality standards but has no numeric criteria, 1 criterion for which there is no change, 1 criterion which is currently listed for Class C that will now have a Class D numeric criterion, and 4 criterion that are new to the District's water quality standards. See Table 6 for a list of example changes.

Table 6: Examples of Current and Proposed Human Health Criteria

Constituent CAS Registry	District's Current Class D (µg/L)	District's Proposed Class D (µg/L)	Notes
Benzene 71432	51.0	16	District's proposed criterion is more stringent than current.
Heptachlor Epoxide 1024573	0.000039	0.000032	District's proposed criterion is more stringent than current.
4,4'-DDT 50293	0.00022	0.000030	District's proposed criterion is more stringent than current.
4,4'-DDD 72548	0.00031	0.00012	District's proposed criterion is more stringent than current.
4,4'-DDE 72559	0.00022	0.000018	District's proposed criterion is more stringent than current.
Methoxychlor 72435	–	0.02	District has no criteria for Class D but has criteria for Class C use than current.

[70] ATSDR. 2007. *Toxicological Profile for Heptachlor and Heptachlor Epoxide*. U.S. Department of Health and Human Services. Atlanta, GA. Accessed September 13, 2018. https://www.atsdr.cdc.gov/ToxProfiles/tp12.pdf.
[71] Title 21 DCMR § 1104 (2013).
[72] US EPA. *Comparison of EPA's 2015 Final Updated Human Health AWQC and Previous AWQC.* Accessed August 30, 2018. https://www.epa.gov/sites/production/files/2015-10/documents/comparison-of-epa-s-2015-final-updated-human-health-awqc-and-previous-awqc-june-2015.pdf

Constituent CAS Registry	District's Current Class D (µg/L)	District's Proposed Class D (µg/L)	Notes
Chrysene 218019	0.018	0.13	District's proposed criterion is less stringent than current.
1,2-Diphenylhydrazine 122667	0.20	0.20	No change from current.
1,1,1-Trichloroethane 71556	–	200,000	Constituent not currently in District's WQS.

EPA Recommendations

The updated 2015 human health criteria[73] is based on the latest scientific studies and EPA policies. The scientific studies found that to accurately calculate the 94 human health constituents toxicity, changes were required in the factors that were considered in developing past criteria. Those changes included "body weight, drinking water consumption rate, fish consumption rate, bioaccumulation factors, health toxicity values, and relative source contributions."[74] For each of the 94 human health constituents, EPA has written a technical document detailing the updated toxicity and exposure input values.[75]

How Criteria Affect Permitting and Compliance

The Pepco/Benning Road (DC0000094) and WMATA (DC0000337) NPDES permits are the only permits within the District that contain any of the 94 human health constituents. These permits do not have effluent limits for the human health constituents. Instead, the permits only require monitoring and reporting of select human health constituents.

Pepco/Benning Road. This NPDES[76] permit has benzene listed as a parameter to monitor and report only. The numeric criterion for benzene is currently 51 µg/L[77] and will be reduced to 16 µg /L in the revised WQS,[78] a greater than three-fold reduction in concentration. According to DOEE's Inspection and Enforcement Division, Pepco/Benning Road's outfall where benzene monitoring occurred is no longer operational and no effluent has been released from there. The facility was decommissioned in June 2012 and demolished in May 2015. Due to that, the District

[73] US EPA. 2015 EPA Updated Ambient Water Quality Criteria for the Protection of Human Health. *EPA.* March 30, 2017. Accessed August 14, 2018. https://www.epa.gov/wqc/2015-epa-updated-ambient-water-quality-criteria-protection-human-health.
[74] US EPA. *Human Health Ambient Water Quality Criteria: 2015 Update*. Washington, DC: US EPA, 2015. EPA 820-F-15-001.
[75] US EPA. *Human Health Ambient Water Quality Criteria: 2015 Update*. Washington, DC: US EPA, 2015. EPA 820-F-15-001.
[76] EPA Region 3. *Authorization to Discharge under the National Pollutant Discharge Elimination System Industrial Permit No. DC0000094*. Philadelphia. 2009. Accessed September 6, 2018. https://www3.epa.gov/reg3wapd/pdf/pdf_npdes/Wastewater/DC/DC0000094PEPCOFinalPermit.pdf
[77] Title 21 DCMR § 1104 (2013).
[78] US EPA. National Recommended Water Quality Criteria - Human Health Criteria Table. *EPA.* August 14, 2018. Accessed September 6, 2018. https://www.epa.gov/wqc/national-recommended-water-quality-criteria-human-health-criteria-table.

does not expect issues arising from or additional costs in relation to the adoption of a more stringent benzene criterion that will impact Pepco/Benning Road's current NPDES permit.

WMATA. Washington Metropolitan Area Transit Authority's (WMATA's) EPA NPDES permit[79] requires the monitoring and reporting of 21 listed human health constituents, 13 of which are included in EPA's revised 2015 human health criteria. Table 7 describes the human health constituents that are listed in WMATA's NPDES permit, which have numeric criteria in the District's current WQS, and which are included in EPA's revised 2015 human health criteria.[80]

Table 7: Human Health Constituents Listed in WMATA's NPDES Permit

Human Health Constituents in WMATA's NPDES Permit – Monitor and Report Only; No Discharge Limits.	District's Current WQS			District Proposed Criteria
	Class C CCC 4-Day Average (µg/L)	Class C CMC 1-Hour Average (µg/L)	Class D 30-Day Average (µg/L)	Class D 30-day Average (µg/L)
Naphthalene	600	–	–	No change in update
2-methyl naphthalene	Not listed	Not listed	Not listed	No change in update
Acenaphthylene	Listed, no numeric criteria	Listed, no numeric criteria	Listed, no numeric criteria	No change in update
Acenaphthene	50	–	990	Decrease to 90
Fluorene	–	–	5300	Decrease to 70
Perylene	Not listed	Not listed	Not listed	No change in update
Indeno[1,2,3-c,d]pyrene	–	–	0.018,c	No change in update
Benzo[g,h,i]perylene	Not listed	Not listed	Not listed	No change in update
Chlordane	0.0043	2.4	0.00081,c	Decrease to 0.00032
DDT	0.001	1.1	0.00022,c	Decrease to 0.000030
DDD	0.001	1.1	0.00031,c	Decrease to 0.00012
DDE	0.001	1.1	0.00022,c	Decrease to 0.000018
Phenanthrene	Not listed	Not listed	Not listed	No change in update
Fluoranthene	400	–	140.0	Decrease to 20
Pyrene	–	–	4000	Decrease to 30
Benzo[a]anthracene	–	–	0.018,c	Decrease to 0.0013
Chrysene	–	–	0.018,c	Increase to 0.13
Benzo[k]fluoranthene	–	–	0.018,c	Decrease to 0.013
Benzo[a]pyrene	–	–	0.018,c	Decrease to 0.00013
Dieldrin	0.056	0.24	0.000054,c	Decrease to 0.0000012
Heptachlor Epoxide	0.0038	0.52	0.000039,c	Decrease to 0.000032

Note: ",c" after the Class D Human Health Criteria numeric value means that the criterion is based on carcinogenicity of 10^{-6} risk level.

[79] EPA Region 3. *Authorization to Discharge under the National Pollutant Discharge Elimination System Permit Number DC0000337*. Philadelphia. 2012. Accessed September 6, 2018. https://www3.epa.gov/reg3wapd/pdf/pdf_npdes/Wastewater/DC/DC0000361WRAMCFinalPermit.pdf

[80] EPA Region 3. *Authorization to Discharge under the National Pollutant Discharge Elimination System Permit Number DC0000337*. Philadelphia. 2012. Accessed September 6, 2018. https://www3.epa.gov/reg3wapd/pdf/pdf_npdes/Wastewater/DC/DC0000361WRAMCFinalPermit.pdf

According to the review of monitoring data submitted to DOEE's Inspection and Enforcement Division, WMATA has not detected the required analytes in their effluent discharges since 2014. Due to that fact, the District does not expect issues arising from or additional costs relating to the adoption of more or less stringent human health criteria to impact WMATA's current NPDES permit.

Impairments and TMDLs

According to DOEE's 2018 Draft Integrated Report, there are known impairments to the District's surface waters[81] including several TMDLs[82] for those constituents in the human health criteria updates. See Table 8 for details. The Toxics TMDL for the Anacostia River, which was published in 2003, is currently being revised. To model waste load allocations and load allocations, water quality criteria are used as TMDL end points. The proposed criteria will help inform the revisions to the toxics TMDL for the Anacostia River.

Table 8: Human Health Constituent TMDLs in the District's Waters

TMDL Document	Human Health Constituents in TMDL Document

Organics and Metals for Anacostia River and Tributaries (2003)	• Chlordane
	• DDE
	• DDD
	• DDT
	• Dieldrin
	• Heptachlor Epoxide
	• PAH1
	  o Naphthalene
	  o 2-methyl naphthalene
	  o Acenaphthylene
	  o Acenaphthene
	  o Fluorene
	  o Phenanthrene
	• PAH2
	  o Fluoranthene
	  o Pyrene
	  o Benz[a]anthracene
	  o Chrysene

Organics and Metals TMDL in Kingman Lake (2003)	
Organics and Metals TMDLs in Battery Kemble Creek, Foundry Branch, and Dalecarlia Tributary (2004)	
Organics TMDLs for the Tidal Basin and Washington Ship Channel (2004)	

[81] DOEE. *Draft 2018 Integrated Report*. 2018. https://doee.dc.gov/release/notice-public-comment-period-draft-2018-district-columbia-integrated-report-water-quality.
[82] DOEE. Total Maximum Daily Load (TMDL) Documents. Accessed September 11, 2018. https://doee.dc.gov/service/total-maximum-daily-load-tmdl-documents.

TMDL Document	Human Health Constituents in TMDL Document

Organics and Metals TMDLs for Rock Creek Tributaries (2004)	• PAH3
	  o Benzo[k]fluoranthene
	  o Benzo[a]pyrene
	  o Perylene
	  o Indeno[1,2,3-c,d]pyrene
	  o Benzo[g,h,i]perylene
	  o Dibenz[a,h+ac]anthracene

Organics, Metals and Bacteria TMDLs for Oxon Run (2004, 2014)	• Chlordane
	• DDT
	• Dieldrin
	• Heptachlor Epoxide
	• PAH1
	  o Naphthalene
	  o 2-methyl naphthalene
	  o Acenaphthylene
	  o Acenaphthene
	  o Fluorene
	  o Phenanthrene
	• PAH2
	  o Fluoranthene
	  o Pyrene
	  o Benz[a]anthracene
	  o Chrysene
	• PAH3
	  o Benzo[k]fluoranthene
	  o Benzo[a]pyrene
	  o Perylene
	  o Indeno[1,2,3-c,d]pyrene
	  o Benzo[g,h,i]perylene
	  o Dibenz[a,h+ac]anthracene

Anticipated Impact of Adopting the Revised Criteria

Based on this study, the District expects no adverse impacts to stakeholders if the revised human health criteria are included in the District's revised WQS. No costs to stakeholders, such as NPDES permit holders, are expected.

Socioeconomic. There are no expected costs to the District, NPDES permit holders, or other stakeholders due to adoption of the revised human health criteria. Benefits to improved water quality and natural resources will have positive socioeconomic impacts.

Institutional. No changes are expected to the District government, stakeholders, or other institutions if the revised human health criteria are adopted.

Technological. No changes or additions to effluent treatment systems for NPDES permit holders are expected as a result of adopting the revised human health criteria. No impacts to the District's analytical water quality laboratories are expected.

Environmental. For new and reissued EPA NPDES permits, it is anticipated that the revised human health criteria will be used in the calculating effluent limits. More stringent effluent limits means that less pollution will enter the District's waterways, resulting in healthier, swimmable, and fishable waters.

Conclusions

DOEE has analyzed the potential socioeconomic, institutional, technical, and environmental impacts of the revisions to the District's water quality criteria that it proposes for adoption, specifically for ammonia, cadmium, and 94 human health constituents. It has reviewed how the proposed criteria differ from the current criteria, how the proposed criteria may affect EPA issued NPDES permittees, how the proposed criteria may affect TMDLs, and what effects there might be due to adoption of the revisions. DOEE has also reviewed the effects of improved water quality and its benefits.

By adopting the proposed water quality criteria for ammonia, cadmium, and 94 human health constituents, DOEE believes that the benefits of enhanced protection for rivers and streams outweigh any potential costs or adverse impacts.

Appendix 1

District's Current and Proposed Human Health (Class D) Criteria[83]

Constituent CAS Registry	District's Current Class D (µg/L)	District's Proposed Class D (µg/L)	Notes
Acenaphthene 83329	990	90	District's proposed criterion is more stringent than current.
Acrolein 107028	9.0	400	District's proposed criterion is less stringent than current.
Acrylonitrile 107131	0.25	7.0	District's proposed criterion is less stringent than current.
Aldrin 309002	0.000050	0.00000077	District's proposed criterion is more stringent than current.
alpha-BHC 319846	0.0049	0.00039	District's proposed criterion is more stringent than current.
alpha-Endosulfan 959988	89.0	30	District's proposed criterion is more stringent than current.
Anthracene 120127	40,000	400	District's proposed criterion is more stringent than current.
Benzene 71432	51.0	16	District's proposed criterion is more stringent than current.
Benzidine 92875	0.00020	0.011	District's proposed criterion is less stringent than current.
Benzo(a) Anthracene 56553	0.018	0.0013	District's proposed criterion is more stringent than current.
Benzo(a) Pyrene 50328	0.018	0.00013	District's proposed criterion is more stringent than current.
Benzo(b) Fluoranthene 205992	0.018	0.0013	District's proposed criterion is more stringent than current.
Benzo(k) Fluoranthene 207089	0.018	0.013	District's proposed criterion is more stringent than current.
beta-BHC 319857	0.017	0.014	District's proposed criterion is more stringent than current.
beta-Endosulfan 33213659	89.0	40	District's proposed criterion is more stringent than current.
Bis(2-Chloroethyl) Ether 111444	0.53	2.2	District's proposed criterion is less stringent than current.
Bis(2-Chloro-1-Methylethyl) Ether 108601	65,000	4000	District's proposed criterion is more stringent than current.
Bis(2-Ethylhexyl) Phthalate 117817	2.2	0.37	District's proposed criterion is more stringent than current.
Bromoform 75252	140.0	120	District's proposed criterion is more stringent than current.

[83] US EPA. 2015. National Recommended Water Quality Criteria - Human Health Criteria Table. Accessed October 22, 2018. https://www.epa.gov/wqc/national-recommended-water-quality-criteria-human-health-criteria-table

Constituent CAS Registry	District's Current Class D (µg/L)	District's Proposed Class D (µg/L)	Notes
Butylbenzyl Phthalate 85687	1,900	0.10	District's proposed criterion is more stringent than current.
Carbon Tetrachloride 56235	1.6	5	District's proposed criterion is less stringent than current.
Chlordane 57749	0.00081	0.00032	District's proposed criterion is more stringent than current.
Chlorobenzene 108907	1,600	800	District's proposed criterion is more stringent than current.
Chlorodibromomethane 124481	13.0	21	District's proposed criterion is less stringent than current.
Chloroform 67663	470.0	2000	District's proposed criterion is less stringent than current.
Chrysene 218019	0.018	0.13	District's proposed criterion is less stringent than current.
Cyanide, free 57125	140	400	District's proposed criterion is less stringent than current.
Dibenzo (a,h)Anthracene 53703	0.018	0.00013	District's proposed criterion is more stringent than current.
Dichlorobromomethane 75274	17.0	27	District's proposed criterion is less stringent than current.
Dieldrin 60571	0.000054	0.0000012	District's proposed criterion is more stringent than current.
Diethyl Phthalate 84662	44,000	600	District's proposed criterion is more stringent than current.
Dimethyl Phthalate 131113	1,100,000	2000	District's proposed criterion is less stringent than current.
Di-n-Butyl Phthalate 84742	4,500	30	District's proposed criterion is more stringent than current.
Endosulfan Sulfate 1031078	89	40	District's proposed criterion is more stringent than current.
Endrin 72208	0.060	0.03	District's proposed criterion is more stringent than current.
Endrin Aldehyde 7421934	0.30	1	District's proposed criterion is less stringent than current.
Ethylbenzene 100414	2,100	130	District's proposed criterion is more stringent than current.
Fluoranthene 206440	140.0	20	District's proposed criterion is more stringent than current.
Fluorene 86737	5,300	70	District's proposed criterion is more stringent than current.
gamma-BHC (Lindane) 58899	1.8	4.4	District's proposed criterion is less stringent than current.
Heptachlor 76448	0.000079	0.0000059	District's proposed criterion is more stringent than current.
Heptachlor Epoxide 1024573	0.000039	0.000032	District's proposed criterion is more stringent than current.
Hexachlorobenzene	0.00029	0.000079	District's proposed criterion is

Constituent CAS Registry	District's Current Class D (µg/L)	District's Proposed Class D (µg/L)	Notes
118741			more stringent than current.
Hexachlorobutadiene 87683	18.0	0.01	District's proposed criterion is more stringent than current.
Hexachlorocyclo-hexane-608731 Technical Grade	–	0.010	Constituent listed in DC WQS but has no numeric criteria than current.
Hexachloro-cyclopentadiene 77474	1,100	4	District's proposed criterion is more stringent than current.
Hexachloroethane 67721	3.3	0.1	District's proposed criterion is more stringent than current.
Ideno (1,2,3-cd)Pyrene 193395	0.018	0.0013	District's proposed criterion is more stringent than current.
Isophorone 78591	960	1800	District's proposed criterion is less stringent than current.
Methyl Bromide 74839	1,500	10,000	District's proposed criterion is less stringent than current.
Methylene Chloride 75092	590	1,000	District's proposed criterion is less stringent than current.
Nitrobenzene 98953	690	600	District's proposed criterion is more stringent than current.
Pentachlorophenol 87865	3.0	0.04	District's proposed criterion is more stringent than current.
Phenol 108952	860,000	300,000	District's proposed criterion is more stringent than current.
Pyrene 129000	4,000	30	District's proposed criterion is more stringent than current.
Tetrachloroethylene 127184	3.3	29	District's proposed criterion is less stringent than current.
Toluene 108883	15,000	520	District's proposed criterion is more stringent than current.
Toxaphene 8001352	0.00028	0.00071	District's proposed criterion is less stringent than current.
Trichloroethylene 79016	30.0	7	District's proposed criterion is more stringent than current.
Vinyl Chloride 75014	2.4	1.6	District's proposed criterion is more stringent than current.
1,1,1-Trichloroethane 71556	–	200,000	Constituent not currently in DC WQS.
1,1,2,2-Tetrachloro-ethane 79345	4.0	3	District's proposed criterion is more stringent than current.
1,1,2-Trichloroethane 79005	16.0	8.9	District's proposed criterion is more stringent than current.
1,1-Dichloroethylene 75354	7,100	20,000	District's proposed criterion is less stringent than current.
1,2,4-Trichlorobenzene	70	0.076	District's proposed criterion is

Constituent CAS Registry	District's Current Class D (µg/L)	District's Proposed Class D (µg/L)	Notes
120821			more stringent than current.
1,2-Dichlorobenzene 95501	1,300	3,000	District's proposed criterion is less stringent than current.
1,2-Dichloroethane 107062	37.0	650	District's proposed criterion is less stringent than current.
1,2-Dichloropropane 78875	15	31	District's proposed criterion is less stringent than current.
1,2-Diphenylhydrazine 122667	0.20	0.20	No change.
1,2-Trans-Dichloroethylene 156605	10,000	4,000	District's proposed criterion is more stringent than current.
1,3-Dichlorobenzene 541731	960	10	District's proposed criterion is more stringent than current.
1,3-Dichloropropene 542756	21	12	District's proposed criterion is more stringent than current.
1,4-Dichlorobenzene 106467	190	900	District's proposed criterion is less stringent than current.
2,4,6-Trichlorophenol 88062	2.4	2.8	District's proposed criterion is less stringent than current.
2,4-Dichlorophenol 120832	290	60	District's proposed criterion is more stringent than current.
2,4-Dimethylphenol 105679	850	3,000	District's proposed criterion is less stringent than current.
2,4-Dinitrophenol 51285	5,300	300	District's proposed criterion is more stringent than current.
2,4-Dinitrotoluene 121142	3.4	1.7	District's proposed criterion is more stringent than current.
2-Chloronaphthalene 91587	1,600	1,000	District's proposed criterion is more stringent than current.
2-Chlorophenol 95578	150	800	District's proposed criterion is less stringent than current.
2-Methyl-4,6-Dinitrophenol 534521	280	30	District's proposed criterion is more stringent than current.
3,3'-Dichlorobenzidine 91941	0.028	0.15	District's proposed criterion is less stringent than current.
3-Methyl-4-Chloro-phenol 59507	–	2000	Constituent not currently in DC WQS.
4,4'-DDD 72548	0.00031	0.00012	District's proposed criterion is more stringent than current.
4,4'-DDE 72559	0.00022	0.000018	District's proposed criterion is more stringent than current.
4,4'-DDT 50293	0.00022	0.000030	District's proposed criterion is more stringent than current.
Bis(Chloromethyl) Ether	0.00029	0.017	District's proposed criterion is less stringent than current.

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542881			
Chlorophenoxy Herbicide (2, 4-D) 94757	–	12,000	Constituent not currently in DC WQS.
Chlorophenoxy Herbicide (2, 4, 5-TP) 93721	–	400	Constituent not currently in DC WQS.
Dinitrophenols 25550587	5,300	1,000	District's proposed criterion is more stringent than current.
Methoxychlor 72435	–	0.02	DC has no criteria for Class D but has criteria for Class C use.
Pentachlorobenzene 608935	1.5	0.1	District's proposed criterion is more stringent than current.
1,2,4,5-Tetrachlorobenzene- 95943	1.1	0.03	District's proposed criterion is more stringent than current.
2,4,5-Trichlorophenol- 95954	3,600	600	District's proposed criterion is more stringent than current.