October 2024 Addendum to the September 14, 2022 Preliminary Clean Water Act Residual Designation Determination for Certain Stormwater Discharges in the Charles, Mystic, and Neponset River Watersheds, in Massachusetts

To support the U.S. Environmental Protection Agency (EPA) Region 1’s Preliminary Clean Water Act Residual Designation Determination for Certain Stormwater Discharges in the Charles, Mystic, and Neponset River Watersheds, in Massachusetts, this addendum provides a notice of data availability in support of the preliminary determination and a clarifying statement on mixed use parcels.

The notice of data availability includes two new technical analyses and one updated technical analysis. The two new analyses summarize a parcel-level land use and pollutant loading analysis for the Mystic and Neponset River Watersheds and the updated technical analysis summarizes an updated parcel-level land use and pollutant loading analysis for the Charles River Watershed. All three analyses are summarized in reports available on EPA’s website https://www.epa.gov/npdes-permits/residual-designation-charles-river-watershed-mystic-river-watershed-and-neponset. The new and updated analyses are consistent with the preliminary determination, and do not change the scope of the preliminary determination.

Additionally, EPA is clarifying that mixed use parcels with large areas of impervious cover (≥ 1 acre) were included in the preliminary determination for residual designation and NPDES permitting. In the preliminary determination, EPA proposed to designate all commercial entities with 1 acre or more of impervious cover in the Charles, Mystic, and Neponset River Watershed as requiring NPDES permits. Mixed-use parcels are included in this category because these parcels have some level of commercial land use associated with them.

Clean Water Act Residual Designation Determination for Certain Stormwater Discharges in the Charles, Mystic, and Neponset River Watersheds, in Massachusetts

The U.S. Environmental Protection Agency (EPA) Region 1 is exercising its discretionary Clean Water Act (CWA) residual designation authority (RDA) under CWA § 402(p)(2)(E) and implementing regulations to designate for National Pollutant Discharge Elimination System (NPDES) permitting certain stormwater discharges from commercial, industrial, and institutional properties[1] with one acre or more of impervious surface[2] in the Charles, Neponset, and Mystic River watersheds in Massachusetts (See Attachment 1 for full list of communities). The dischargers or categories of dischargers that this designation identifies do not have to apply for individual permit coverage as EPA plans to issue one or more general permits for these discharges, under which operators may seek coverage within defined deadlines in the general permit(s).[3] Moreover, "The question whether the initial designation was proper will remain open for consideration during the public comment period under § 124.11 [for NPDES permits] and in any subsequent hearing." 40 C.F.R. § 124.52(c).

I. Summary of Petitions

On May 9, 2019, the Conservation Law Foundation (CLF) and the Charles River watershed Association (CRWA) submitted to the Regional Administrator of EPA Region 1 a "Petition for a Determination that Certain Commercial, Industrial, Institutional, and Multi-Family Residential Property Dischargers Contribute to Water Quality Standards Violations in the Charles River

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[1] For the purposes of this determination, "commercial parcels" are parcels with Massachusetts Department of Revenue/Division of Local Services Property Type Classification Code 3; "industrial parcels" are parcels with Massachusetts Department of Revenue/Division of Local Services Property Type Classification Code 4; and "institutional parcels" are parcels with Massachusetts Department of Revenue/Division of Local Services Property Type Classification Code 9 (Massachusetts Department of Revenue/Division of Local Services, June 2016); this designation does not apply to any parcel owned or operated by an MS4 permit holder where the discharge of stormwater from the parcel is subject to NPDES permitting.

[2] For the purposes of this determination, "impervious surface" is defined as "any surface that prevents or significantly impedes the infiltration of water into the underlying soil. This can include but is not limited to: roads, driveways, parking areas and other areas created using non porous material; buildings, rooftops, structures, artificial turf and compacted gravel or soil" (US EPA, 2016a). In this determination, EPA uses "impervious surface," "impervious area," and "impervious cover" interchangeably.

[3] EPA's regulations do not require public notice of a residual designation determination. Nonetheless, EPA has made this determination available on its public website. When EPA issues a draft general NPDES permit(s) or any individual NPDES permits to cover the discharges described in this determination, EPA will provide public notice in accordance with 40 C.F.R. § 124.10. Note that 40 C.F.R. § 124.10(c)(2)(iv) deems posting of relevant material on "the permitting authority's public website" to be sufficient for public notice purposes.

watershed, Massachusetts, and that NPDES Permitting of Such Properties is Required."[4] On August 24, 2020, CLF followed this submission with two additional petitions requesting the same residual designations for two other watersheds in Massachusetts: the Mystic River watershed[5] and the Neponset River watershed.[6] The three petitions call for "a determination pursuant to 40 C.F.R. § 122.26(f)(2) that discharges of stormwater that are not currently subject to direct permitting by EPA from privately owned commercial, industrial, institutional, and multi-family residential real properties of one acre or greater" in the Charles River, Mystic River, and Neponset River watersheds "contribute to violations of water quality standards" in (1) the Charles River, (2) Boston Harbor, of which the Mystic River watershed is a sub-basin, and (3) the Neponset River, "and require permits under the National Pollutant Discharge Elimination System ('NPDES')."[7]

The petitions allege that urban stormwater discharges from non-permitted urban commercial, industrial, and high-density residential areas with high levels of impervious surface "are a primary cause of"[8] or "significant contributor to"[9] ongoing water quality standards violations in the respective Massachusetts bodies of water and therefore should be designated and subjected to NPDES permitting. To support these assertions, the petitions cite studies by EPA, Massachusetts Department of Environmental Protection (MassDEP), and private entities; water quality monitoring; and Total Maximum Daily Load reports (TMDLs) for the affected waters indicating that they do not meet Massachusetts Water Quality Standards (WQS).[10]

Specifically, the Charles River Petition alleges that the high levels of impervious surface in urbanized areas result in stormwater runoff discharging high levels of phosphorous and pathogens into the Charles River.[11] The petition further alleges that these high levels of phosphorous trigger "excessive algae and aquatic plant growth and low and/or highly variable dissolved oxygen levels."[12] The petition cites the 2007 and 2011 Charles River TMDLs showing that to attain water quality standards, phosphorous loading would have to be reduced "by 48 percent above the Watertown Dam and by 62 percent in each of the sub-watersheds draining to the Lower Charles River" and by 51 percent in the Upper/Middle Charles River including by 65 percent "from all intense land uses (commercial, industrial, and high density residential sites)."[13]

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[4] Petition from Caitlin Peale Sloan, Senior Attorney, Conservation Law Found., to Deborah Szaro, Acting Reg'l Adm'r, Envtl. Prot. Agency Region 1 (May 9, 2019) [hereinafter Charles River Petition]. "Any person may petition the Director to require a NPDES permit for a discharge which is composed entirely of storm water which contributes to a violation of a water quality standard or is a significant contributor of pollutants to waters of the United States." *See* 40 C.F.R. § 122.26(f)(2).
[5] Petition from Caitlin Peale Sloan, Senior Attorney, Conservation Law Found., to Dennis Deziel, Acting Reg'l Adm'r, Envtl. Prot. Agency Region 1 (Aug. 24, 2020) [hereinafter Mystic River Petition].
[6] Petition from Caitlin Peale Sloan, Senior Attorney, Conservation Law Found., to Dennis Deziel, Acting Reg'l Adm'r, Envtl. Prot. Agency Region 1 (Aug. 24, 2020) [hereinafter Neponset River Petition].
[7] Charles River Petition at 1; Mystic River Petition at 1–2; Neponset River Petition at 1.
[8] Charles River Petition at 5–7, 12–13.
[9] Mystic River Petition at 5–6, 12–13; Neponset River Petition at 4–5, 10–11.
[10] Charles River Petition at 4–7; Mystic River Petition at 6–7; Neponset River Petition at 4–5.
[11] Charles River Petition at 5–7.
[12] *Id.* at 5.
[13] *Id.* at 7.

The Mystic River and Neponset River petitions allege that "stormwater runoff is a significant contributor" of pathogens and bacteria and that "most of the bacteria sources in the watershed[s] are believed to be stormwater-related."[14] The Mystic River Petition alleges that phosphorus loads from stormwater sources would need to be reduced by as much as 67 percent to meet WQS according to a 2020 alternative TMDL prepared by Eastern Research Group, Inc.[15] The Neponset River Petition cites a 2002 EPA and MassDEP TMDL indicating that the methods employed to control bacterial pollution caused by stormwater were insufficient.[16] The Petition also states that the TMDL indicated that "concentrations of pollutants, particularly in the form of fecal coliform and E. coli, have to be reduced by at a minimum 90 [percent] and in some places up to 99 [percent] to comply with the TMDL" and meet the WQS.[17]

Since receiving the petitions, EPA has been in contact with CLF, CRWA, and other stakeholders and has been gathering and analyzing additional evidence to help the Agency decide whether to make a determination. For example, in 2020, EPA Region 1 staff conducted five focus group sessions with Charles River watershed stakeholders to inform initial deliberations and discuss the RDA concept generally.[18]

On July 14, 2022, EPA received a Notice of Intent to File Suit Under the Clean Water Act (NOI) from CLF and CRWA.[19] The NOI alleges that EPA failed "to perform an act or duty that is not discretionary under Section 402(p)(2)(E), 33 U.S.C. § 1342(p)(2)(E)" based on EPA's failure to make a final determination on CLF's and CRWA's petitions within the regulatory 90-day period. 40 C.F.R. § 122.26(f)(5).[20] EPA is now acting on CLF's and CRWA's residual designation petitions.

II. Residual Designation Legal Authority

In 1987, Congress amended the CWA to establish categories of industrial and municipal stormwater point source discharges that require NPDES permits. *See* CWA § 402(p)(2)(B-E). Congress instructed EPA to develop stormwater regulations in two phases. In the first phase, Congress required EPA to develop regulations and NPDES permits for stormwater discharges associated with industrial activity and discharges from municipal separate storm sewer systems (MS4s) serving populations larger than 100,000 persons (i.e., large and medium MS4s). CWA § 402(p)(4)(A). In the second phase, Congress instructed EPA to study stormwater discharges from small MS4s and other sources not covered by § 402(p)(4)(A) and report back to Congress on

[14] Mystic River Petition at 6; Neponset River Petition at 4.
[15] Mystic River Petition at 6–7.
[16] Neponset River Petition at 5.
[17] *Id.*
[18] *See* Consensus Building Institute, "Charles River Stormwater Permitting: Residual Designation Authority Focus Group Sessions Summary," Feb. 2021. (describes the information presented at the five focus group sessions and then details the feedback received in each session).
[19] Notice from Caitlin Peale Sloan, Senior Attorney, Conservation Law Found., to Michael S. Regan, Adm'r, Envtl. Prot. Agency (July 14, 2022) [hereinafter NOI].
[20] *Id.* at 2.

how such stormwater discharges should be regulated. Congress also gave EPA "residual designation authority" over a category of stormwater discharges that would be subject to NPDES permit requirements only if EPA or a State "determines that the stormwater discharge contributes to a violation of a water quality standard or is a significant contributor of pollutants to waters of the United States." CWA § 402(p)(2)(E). Also, the CWA authorizes EPA to take action to designate additional stormwater sources to be regulated to "protect water quality." CWA § 402(p)(6). EPA proceeded with two stormwater rulemaking phases. In the 1990 Phase I Rule, EPA promulgated NPDES permit application regulations for large and medium MS4s and certain industrial stormwater discharges (including large construction sites disturbing equal to or greater than five acres). *See* 55 Fed. Reg. 47990 (Nov. 16, 1990). The 1999 Phase II Rule set forth NPDES permitting requirements for discharges from certain small MS4s and from small construction sites (disturbing equal to or greater than one acre and less than five acres) and required NPDES permits for these discharges.[21] *See* 64 Fed. Reg. 68722 (December 8, 1999).

CWA sections 402(p)(2)(E) and 402(p)(6) and implementing regulations provide that in states where there is no approved state program,[22] the EPA Regional Administrator may designate a storm water discharge as requiring an NPDES permit where he/she determines that: " …(C) storm water controls are needed for the discharge based on wasteload allocations that are part of total maximum daily loads (TMDLs) that address the pollutants of concern, or (D) the discharge, or category of discharges within a geographic area, contributes to a violation of a water quality standard or is a significant contributor of pollutants to waters of the United States." 40 C.F.R. §§ 122.26(a)(1)(v), 122.26(a)(9)(i)(C), (D). When it promulgated these regulations, EPA explained that it "intend[ed] that the NPDES permitting authority have discretion in the matter of designations based on TMDLs." 64 Fed. Reg. at 68,781. That discretion allows EPA (or a State) to address "individual instances of storm water discharge" that "might warrant special regulatory attention, but do not fall neatly into a discrete, predetermined category." *Id*. As these regulations authorize and as supported by EPA's record in this matter, EPA is using its residual designation authority to designate stormwater discharges from commercial, industrial, and institutional properties with one acre or more of impervious surface in the Charles, Neponset, and Mystic River watersheds for NPDES permitting. As this designation explains, such stormwater discharges contribute to water quality standards violations,[23] are significant contributors of pollutants to waters of the United States, and need to be controlled based on wasteload allocations that are part of the TMDLs that address phosphorus and/or bacteria.[24]

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[21] In limited circumstances, a prospective permittee may apply for and EPA may grant a waiver from stormwater permitting requirements. *See* 40 C.F.R. §§ 122.32(c)-(e) (small MS4 waivers) and § 122.26(b)(15)(i) (waivers for small construction activity).

[22] EPA issues NPDES permits in Massachusetts. As of the date of this designation, Massachusetts is one of three states (along with New Hampshire and New Mexico) that are not authorized to issue NPDES permits.

[23] EPA views WQS "violations" to be the same as WQS "exceedances."

[24] While any one of the factors in 40 C.F.R. § 122.26(a)(9)(i)(C), (D) are alone sufficient to support an RDA determination, EPA demonstrates that all three factors are present for this RDA determination.

EPA plans to implement this residual designation determination through one or more NPDES general permits.[25] The dischargers or categories of dischargers that this designation identifies will not be required to obtain NPDES permit coverage until EPA issues a general permit(s) for such discharges, under which operators may seek coverage within defined deadlines in the general permit(s). Consistent with 40 C.F.R. § 124.52(c), "the question whether the initial designation was proper will remain open for consideration during the [NPDES permit] public comment period under § 124.11 and in any subsequent hearing."

III. Municipal Stormwater Permitting

a. This designation does not apply to discharges already authorized under the 2016 Massachusetts Small MS4 Permit.

On April 13, 2016, EPA issued a final NPDES general permit for discharges of stormwater from small municipal separate storm sewer systems (MS4s) in Massachusetts (MA MS4 permit). The 2016 MA MS4 permit replaced the 2003 small MS4 permit.[26] The MA MS4 permit took effect on July 1, 2018, and EPA modified the permit on December 7, 2020. The MA MS4 permit covers municipal stormwater discharges from (1) traditional cities and towns; (2) non-traditional state, federal, county, and other publicly owned MS4s; and (3) non-traditional transportation MS4s.

EPA wrote the MA MS4 permit to be consistent with CWA section 402(p)(3)(B) and the Phase II stormwater rule, which requires small MS4 permits to include permit terms and conditions "to "reduce the discharge of pollutants from the MS4 to the maximum extent practicable (MEP), to protect water quality, and to satisfy the appropriate water quality requirements of the Clean Water Act." *See* 40 C.F.R. §122.34(a); 81 Fed. Reg. 89320, 89349; 64 Fed. Reg. 68722, 68843; see also 64 Fed. Reg. at 68752-53. The 2016 MA MS4 permit Part 2.3 requires small MS4s to implement the following six minimum control measures: (1) public education and outreach on stormwater impacts; (2) public involvement and participation; (3) illicit discharge detection and elimination; (4) construction site stormwater runoff control; (5) post construction stormwater management in new development and redevelopment; and (6) pollution prevention/good housekeeping for municipal operations. In addition, 2016 MA MS4 permit parts 2.2.1 and 2.2.2 contain water quality-based requirements for those permittees subject to a TMDL or discharging to a waterbody impaired for pollutants found in stormwater. The permit gives each permittee flexibility to establish controls and measures applicable to their system to control stormwater inputs into and discharges from their MS4 such that discharges from the permittee's small MS4 meet applicable water quality standards. The permit's Appendices F and H include compliance timelines for addressing the requirements and assumptions of approved TMDLs and for addressing complex or widespread sources of water quality impairments in the absence of a

[25] EPA's regulations provide for the issuance of general permits to authorize one or more categories or subcategories of discharges, including storm water point source discharges within a geographic area pursuant to 40 CFR §122.28(a)(1) and (2)(i)).
[26] The 2003 Small MS4 Permit covered small MS4s in Massachusetts and New Hampshire.

TMDL, including specific requirements for MS4s discharging to waterbodies impaired for phosphorus, nitrogen, and bacteria. The permit is consistent with the assumptions and requirements of TMDLs that were approved as of the issuance date of the permit, including the Upper and Lower Charles River TMDLs, and bacteria and pathogens TMDLs in the Charles River and Neponset River watershed.

Currently, all communities in the Charles, Mystic, and Neponset River watersheds hold small MS4 permit coverage under the MA MS4 permit. The City of Boston has an individual MS4 permit. In addition, there are multiple non-traditional permittees covered under the MA MS4 permit within all three watersheds (e.g., state and federal facilities and state colleges and universities).[27] As indicated above, the 2016 MA MS4 permit contains requirements specifically targeting the reduction of nutrients and bacteria in stormwater from permittee-owned parcels; therefore, this designation does not apply to any parcel subject to the 2016 MA MS4 permit that is owned or operated by a current permittee under the 2016 MA MS4 permit.

b. This designation does not apply to discharges already authorized under the Boston Individual MS4 Permit.

EPA issued an individual large MS4 permit to Boston Water and Sewer Commission (BWSC) in 1999 (NPDES No. MAS010001). This permit is a Phase I MS4 permit written in accordance with 40 C.F.R. § 122.26. The permit expired October 30, 2004 and EPA administratively continued the permit in accordance with 40 C.F.R. § 122.6. In 2012, BWSC entered into a Consent Decree with EPA, MassDEP, and Conservation Law Foundation to address violations of the 1999 BWSC permit and other CWA violations. The Consent Decree required BWSC to address illicit connections to the MS4, reducing nutrient and bacteria discharges, as well as comply with phosphorus reductions in stormwater sources consistent with the two Charles River Phosphorus TMDLs. In 2016, BWSC completed an Implementation Plan consistent with the Consent Decree and will implement this plan over a 30-year period ultimately resulting in the removal of 7,362 pounds of phosphorus from stormwater per year by 2046 (CH2M Hill, 2016). BWSC continues to undertake actions through its Implementation Plan to address the two Charles River Phosphorus TMDLs as well as fully implement their MS4 permit; therefore, this designation does not apply to any parcel owned or operated by the City of Boston or Boston Water and Sewer Commission that is subject to NPDES permit MAS010001.

c. This designation does not apply to parcels owned or operated by the Massachusetts Department of Transportation, Highway Division (MassDOT) already subject to an NPDES permit.

Massachusetts Department of Transportation, Highway Division (MassDOT) operates a regulated MS4 in the Charles River, Mystic River, and Neponset River watersheds. Regulated stormwater discharges from the MassDOT MS4 are currently covered under the 2003 MS4 general permit under permit number MA043025. The 2003 MS4 general permit was issued by

[27] A list of 2016 MA MS4 permit holders can be found here: https://www.epa.gov/npdes-permits/regulated-ms4-massachusetts-communities (Retrieved August 10, 2022).

EPA Region 1 on May 1, 2003 and while the 2016 MA MS4 permit replaced the 2003 MS4 permit for most Massachusetts small MS4 permit holders, MassDOT communicated with EPA during the 2003 permit term that based on the size and complexity of their MS4, along with the stormwater management approach used under the 2003 permit, MassDOT would be better served under an individual permit consistent with 40 CFR §122.34, rather than seeking coverage under a re-issued MS4 general permit. This request was made in accordance with 40 C.F.R. §122.28(b)(3). On September 25, 2018, EPA received a complete application for individual MS4 permit coverage from MassDOT. Regulated stormwater discharges from MassDOT remain covered under the 2003 MS4 permit (permit number MA043025) until the effective date of a new MassDOT individual permit, which EPA will draft to be consistent with 40 C.F.R. § 122.34. During the 2003 permit term, MassDOT was required to update its stormwater management program to address discharges to impaired waters as detailed in a letter from EPA dated April 22, 2010. As subsequently incorporated into a May 11, 2010 Order by the U.S. District Court of Massachusetts in *CLF v. Deval Patrick* (No. 06-11295 WGY), EPA's April 22, 2010 letter required MassDOT to immediately begin to identify control measures and BMPs for impaired waters without TMDLs that will collectively control the discharge of pollutants of concern. EPA also required MassDOT to propose schedules for implementation of identified BMPs as expeditiously as possible, based on water quality considerations. MassDOT continues to undertake actions through its Impaired Waters Program (MassDOT, 2022) to address discharges to nutrient and bacteria impaired waterbodies as well as fully implement the 2003 MS4 permit; therefore, this designation does not apply to any parcel owned or operated by MassDOT that is subject to NPDES permit MA043025.

IV. Water Quality and TMDL Status

a. Applicable Massachusetts Water Quality Standards

Table 1 presents a summary of the Massachusetts water quality criteria applicable to the Charles River, Mystic River, and Neponset River and pollutant loading from stormwater sources. Massachusetts has established narrative but not numeric criteria for phosphorus and nitrogen. Massachusetts does have, however, numeric criteria for pH, dissolved oxygen (DO), color and turbidity and aesthetics. Excess phosphorus and nitrogen can cause a violation of these numeric criteria and cause the narrative criteria to not be attained. In both marine and freshwater systems, excess nutrients result in degraded water quality, adverse impacts to ecosystems, and limits on the use of water resources (Center For Watershed Protection, 2003) (Shaver, Horner, Skupien, May, & Ridley, 2007) (Howarth & Marino, 2006) (USEPA, 2000) (USEPA, 2001). The most common forms of nutrient pollution are nitrogen and phosphorus. "When excessive levels of these chemical nutrients are introduced into a water system, algae populations rapidly multiply to nuisance levels. As populations 'bloom' and die-off in quick succession, dead algae accumulate and decompose—their nutrient-laden remains further enriching the immediate environment, thereby perpetuating the eutrophication cycle. Increased rates of respiration and decomposition deplete the available dissolved oxygen in the water, threatening other plant and animal life in the system. When oxygen saturation levels drop below what is needed by fish and invertebrates to breathe, the waters become host to fish kills, red tides, and shellfish poisonings, events which can pose threats to human health as well." *Upper Blackstone Water Pollution Abatement Dist. v. U.S. E.P.A.*, 690 F.3d 9, 11–12 (1st Cir. 2012).

Pollutant	Criteria	Source
Bacteria/Pathogens	for *E. coli*: concentrations shall not exceed 126 colony-forming units (cfu) per 100 mL, calculated as the geometric mean of all samples collected within any 90-day or smaller interval; and ii. no more than 10% of all such samples shall exceed 410 cfu per 100 mL (a statistical threshold value); or for enterococci: concentrations shall not exceed 35 cfu per 100 mL, calculated as the geometric mean of all samples collected within any 90-day or smaller interval; and ii. no more than 10% of all such samples shall exceed 130 cfu per 100 mL (the statistical threshold value).	314 CMR 4.05(5)(f)
DO	Inland Waters. Shall not be less than 5.0 mg/L in warm water fisheries unless background conditions are lower; natural seasonal and daily variations above these levels shall be maintained; and levels shall not be below 60 percent of saturation in warm water fisheries due to a discharge. Coastal and Marine Waters. Shall not be less than 5.0 mg/L. Where natural background conditions are lower, DO shall not be less than natural background. Natural seasonal and daily variations that are necessary to protect existing and designated uses shall be maintained.	314 CMR: 4.05:(3)(b) 1 and 314 CMR: 4.05:(4)(b) 1
pH	Shall be in the range of 6.5 - 8.3 standard units and not more than 0.5 units outside of the background range. There shall be no change from background conditions that would impair any use assigned to this Class.	314 CMR: 4.05 (3)(b) 3 and 314 CMR 4.05: (4)(b) 3
Solids	These waters shall be free from floating, suspended, and settleable solids in concentrations and combinations that would impair any use	314 CMR: 4.05(3)(b) 5. And 314 CMR: 4.05(4)(b) 5.

	assigned to this Class, that would cause aesthetically objectionable conditions, or that would impair the benthic biota or degrade the chemical composition of the bottom.	
Color and Turbidity	These waters shall be free from color and turbidity in concentrations or combinations that are aesthetically objectionable or would impair any use assigned to this Class.	314 CMR: 4.05(3)(b) 6 and 314 CMR: 4.05(4)(b) 6
Aesthetics	All surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits; float as debris, scum or other matter to form nuisances; produce objectionable odor, color, taste or turbidity; or produce undesirable or nuisance species of aquatic life.	314 CMR: 4.05(5)(a)
Nutrients	Unless naturally occurring, all surface waters shall be free from nutrients in concentrations that would cause or contribute to impairment of existing or designated uses and shall not exceed the site specific criteria developed in a TMDL or as otherwise established by the Department.	314 CMR: 4.05(5)(c)

Table 1: Relevant Massachusetts water quality standards

b. Charles River Watershed

The entire Charles River drains a watershed area of 310 square miles and encompasses at least part of 36 communities. The Upper Charles River upstream of the Watertown Dam drains an area of 268 square miles, while the Lower Charles River downstream from the Watertown Dam to Boston Harbor drains an additional 42 square miles. Based on water quality data available for the Charles River and applicable Massachusetts surface water quality standards for a Class B surface water, MassDEP included many segments of the Charles River that are impaired due to excess nutrients and bacteria on the State’s 2002 Section 303(d) list, also known as the impaired waters list. Throughout the years, including the latest EPA-approved Section 303(d) list in 2021 (2018/2021 303(d) list), MassDEP continues to indicate widespread impairments due to excess nutrients and bacteria (Massachusetts Department of Environmental Protection, 2021) in the Charles River System (see Attachment 2 for a full list of impairments in the Charles River watershed based on the 2018/2021 303(d) list).

Phosphorus Impairments

Among the 303(d)-listed pollutants on the 2018/2020 Section 303(d) list are several related to excessive phosphorus loading (see Attachment 2):

- Phosphorus
- Low Dissolved Oxygen
- Low Dissolved Oxygen Saturation
- Algae
- Harmful Algal Blooms
- Chlorophyll-a
- Nutrient/Eutrophication Biological Indicators
- Aquatic Plants (Macrophytes)
- Transparency/Clarity

The causal relationship between excessive phosphorus loads and water quality impairments is well understood and is covered extensively in research literature.[28] Analyses of water quality data collected from the Charles River indicate that phosphorus is the key nutrient that controls the amount of algal and aquatic plant growth during the middle to later summer period in the Charles River when recreational use of the river peaks (Massachusetts Department of Environmental Protection, 2011) (Massachusetts Department of Environmental Protection, 2007b). Excess phosphorus in the Charles River system leads to increased algal and aquatic plant growth, which can lower dissolved oxygen in the water column, affect the pH of the water, increase the turbidity in the water column, and decrease the clarity of the water (Massachusetts Department of Environmental Protection, 2007b) (Massachusetts Department of Environmental Protection, 2011).

As early as 2000, a MassDEP water quality assessment analysis indicated that phosphorus in stormwater runoff is causing water quality impairments in almost all the Charles River segments (Massachusetts Department of Environmental Protection, 2000). All segments of the Charles River except the headwater segment are impaired, at least in part, because of elevated phosphorus, excessive aquatic plant growth and/or algae.

In 2006, the Charles River Watershed Association (CRWA) and EPA began monitoring for the presence of harmful algal blooms (HABs) and the presence of cyanobacteria, also known as blue-green algae, in the lower Charles River basin. HABs in the lower Charles River basin frequently contain cyanobacteria, which produce extremely dangerous toxins that have been known to sicken or kill people and animals as well as cause low dissolved oxygen levels in the water column, harming aquatic life. CRWA has documented the presence of cyanobacteria and HABs in the lower basin every year since 2006 (Charles River Watershed Association, 2015), with more than 150 days in 2020 (Charles River Watershed Association, 2021), severely impacting public use of the river in the summer of 2020. In 2015 EPA began monitoring water quality in the Charles River lower basin with a real-time buoy deployed during the summer months and has monitored and tracked HABs every summer through the presence of Phycocyanin and Chlorophyll in the water column (USEPA, 2022c).

[28] See Part VII - References section of this document.

The Charles River has two EPA-approved phosphorus TMDLs assigning waste load allocations (WLAs) to phosphorus sources within the watershed. On October 17, 2007, EPA approved the *Final TMDL for Nutrients in the Lower Charles River Basin* (Lower Charles TMDL) (Massachusetts Department of Environmental Protection, 2007b) and on June 10, 2011 EPA approved the *Total Maximum Daily Load for Nutrients in the Upper/Middle Charles River* (Upper/Middle Charles TMDL) (Massachusetts Department of Environmental Protection, 2011). The two phosphorus TMDLs address severe water quality impairments resulting from the excessive algae growth caused by excessive amounts of phosphorus in discharges to the Charles River system. The Lower Charles TMDL and the Upper/Middle Charles TMDL calculated the baseline phosphorus load from stormwater sources as 87,432 pounds of total phosphorus per year. Both TMDLs set WLAs that specify reductions for discharges of phosphorus throughout the entire Charles River watershed from publicly owned treatment works, combined sewer overflows, and stormwater discharges. According to the TMDLs, to meet TMDL goals, the more developed lands (commercial, industrial, and high and medium density residential) need to reduce total phosphorus loads in stormwater by 65% annually while the less developed, low density residential lands need to reduce total phosphorus loads in stormwater by 45% annually. The TMDLs set a watershed-wide stormwater phosphorus load reduction target of 47,347 pounds per year, bringing the overall phosphorus load from stormwater from a baseline of 87,432 pounds per year to a reduced load of 40,085 pounds per year of phosphorus from stormwater sources. Overall, according to the TMDLs' analyses, the stormwater total phosphorus load reduction would need to come from many private and public stormwater sources to meet TMDL goals.[29]

Bacteria Impairments

The 2018/2020 EPA-approved 303(d) list indicates widespread impairments for bacteria, including 25 segments of the Charles River that are impaired for E. coli or fecal coliform (Massachusetts Department of Environmental Protection, 2021). The bacteria impairments have been linked to stormwater discharges since 2000, where a MassDEP water quality assessment analysis indicated that bacteria in stormwater is causing water quality impairments in many segments of the Charles River (Massachusetts Department of Environmental Protection, 2000). In addition, EPA has been assigning a "report card" grade for the lower Charles River since 1995 and multiple segments of the Charles River since 2019. EPA uses the Charles River Report Card to measure and evaluate progress towards meeting the Massachusetts bacterial water quality standards for swimming and boating as well as to assess general health of the watershed. The 2021 Report Card indicates that segments of the Charles River are meeting water quality standards for swimming and boating based on bacteria concentrations ranging from 58.6% of the time (Muddy River) to 94% of the time (Upper Middle Watershed) (USEPA, 2022f). While this

[29] See Final TMDL for Nutrients in the Lower Charles River Basin (Massachusetts Department of Environmental Protection, 2007b) pp 46-53 and Total Maximum Daily Load for Nutrients in the Upper/Middle Charles River (Massachusetts Department of Environmental Protection, 2011) pp 46-51 and A Hydrodynamic and Water Quality Model for the Lower Charles River Basin, Massachusetts (USEPA, 2005) pp 19-27.

is a significant improvement since 1995, there are still yearly water quality standards violations in the Charles River system due to excess bacteria, limiting recreational access to the river.

EPA approved a TMDL for pathogen indicators (e.g., fecal coliform, E. coli, and enterococcus bacteria) in the Charles River watershed on May 22, 2007. (Massachusetts Department of Environmental Protection, 2007a). The TMDL found that over 80% of the watershed segments assessed were impaired due to bacteria or pathogens. The TMDL identified bacterial sources such as failing septic systems, combined sewer overflows (CSO), sanitary sewer overflows (SSO), sewer pipes connected to storm drains, certain recreational activities, wildlife (including domestic pets), and direct storm water discharges. While the TMDL does not attempt to assign specific WLAs or Load Allocations (LAs) to specific sources, it indicates that stormwater sources of bacteria from direct runoff and discharges from storm sewer systems need to be reduced to meet in stream water quality standards.[30]

c. Mystic River Watershed

The Mystic River watershed is a 76-square mile watershed that drains into Boston Harbor. It encompasses all or portions of 21 urban and suburban communities. The outlet of Lower Mystic Lake is recognized as the beginning of the Mystic River. Horn Pond Brook in Woburn, Mill Brook in Arlington, and Alewife Brook in Cambridge contribute to the flows in the middle Mystic River. The river flows southeast and joins the Malden River. In 1966, the Amelia Earhart Dam was built on the Mystic River just downstream from its confluence with the Malden River. This dam separates the estuarine and freshwater river portions. As described below, the watershed faces multiple water quality impacts related to cultural eutrophication including excessive algal growth, harmful cyanobacteria blooms, and invasive macrophyte growth. The Mystic River watershed's pollution sources include stormwater runoff, combined sewer overflows (CSO), sanitary sewer overflows (SSO), non-point source runoff, contaminated sediment, and three Superfund sites (Massachusetts Department of Environmental Protection, 2006) (USEPA, 2020). The watershed suffers from many legacy pollutants as well as present day pollutant loadings, as discussed below. Much of the basin is highly developed with considerable industrial and commercial activity, and the watershed faces high development and re-development pressure (Massachusetts Department of Environmental Protection, 2006) (USEPA, 2020).

Based on water quality data available for the Mystic River and applicable state surface water quality standards for Class B and SB surface waters, MassDEP included many segments of the Mystic River on the Massachusetts' 2002 303(d) impaired waters list. In the latest EPA-approved 303(d) list (the 2018/2021 303(d) list), MassDEP continues to indicate widespread impairments due to excess nutrients and bacteria (Massachusetts Department of Environmental Protection,

[30] See Final Pathogen TMDL for the Charles River Watershed (Massachusetts Department of Environmental Protection, 2007a) pp 58-61.

2021) in the Mystic River system (see Attachment 3 for a full list of impairments in the Mystic River watershed based on the 2018/2021 303(d) list.

Nutrient Impairments

Among the 303(d)-listed pollutants on the 2018/2020 Section 303(d) list are several related to excessive nutrient loading (see Attachment 3):

- Phosphorus
- Low Dissolved Oxygen
- Low Dissolved Oxygen Saturation
- Algae
- Harmful Algal Blooms
- Chlorophyll-a
- Nutrient/Eutrophication Biological Indicators
- Transparency/Clarity

As indicated above for the Charles River, the causal relationship between excessive phosphorus loads and water quality impairments is well understood and is covered extensively in research literature. Similarly, the causal relationship between excess nitrogen and water quality impairments in marine and estuarine systems is also well understood and is extensively covered in literature.[31] Excess phosphorus in the Mystic River system in the inland freshwater portions of the Mystic River and excess nitrogen in the marine portions of the Mystic River lead to increased algal and aquatic plant growth, which can lower dissolved oxygen in the water column, affect the pH of the water, increase the turbidity in the water column, and decrease the clarity of the water. The 2018/2020 Section 303(d) list indicate that 19 waterbody segments in the Mystic River watershed are impaired due to excess nutrients.

As early as 2004, a MassDEP water quality assessment analysis indicated that nutrients in stormwater are causing water quality impairments in the Mystic River watershed (Massachusetts Department of Environmental Protection, 2010a).

Beginning in 2015, EPA deployed a real-time buoy during the summer months to monitor for the presence of HABs and the presence of cyanobacteria, also known as blue-green algae, in the Mystic River near the Blessing of the Bay (USEPA, 2022b). Like the Charles River, HABs in the Mystic River frequently contain cyanobacteria, which produce extremely dangerous toxins that have been known to sicken or kill people and animals as well as cause low dissolved oxygen levels in the water column, harming aquatic life. Since deployment, EPA has tracked HABs every summer through the presence of phycocyanin and chlorophyll in the water column (USEPA, 2022b).

In 2020, EPA supported MassDEP in piloting an "Alternative TMDL" designed to address nonattainment of nutrient related water quality standards over a period of time in the Mystic River, consistent with the 2013 framework for prioritizing and implementing TMDLs and

[31] See Part VII - References section of this document.

pollution control strategies (USEPA, 2013). The Alternative TMDL, entitled "Mystic River Watershed Alternative TMDL Development for Phosphorus Management - Final Report (Mystic Alternative TMDL)," addresses impairments associated with excessive nutrient loading including phosphorus, chlorophyll, dissolved oxygen, and secchi depth (water clarity). The Mystic Alternative TMDL indicates that inadequately controlled stormwater runoff from developed landscapes is the predominant source of nutrient loads to the surface waters of the Mystic River watershed. Under existing conditions, the study estimated that to meet the selected chlorophyll-a water quality target for attaining water quality standards in the most impacted segment, the lower Mystic River above the Amelia Earhart Dam, will require a 67 percent reduction of stormwater phosphorus loadings in the freshwater portion of the watershed and assumes all reduction will be achieved through stormwater control measures.[32] The Mystic Alternative TMDL did not address the impairments in the estuarine portion of the watershed (below the Amelia Earhart Dam) that are associated with excess nitrogen.

Bacteria Impairments

Similar to the Charles River, the 2018/2020 EPA-approved 303(d) list indicates widespread bacteria impairments, including eleven segments of the Mystic River that are impaired for E. coli or fecal coliform (Massachusetts Department of Environmental Protection, 2021). The bacteria impairments have been linked to stormwater since a 2002 MassDEP water quality assessment analysis indicated that bacteria in stormwater is a significant cause of water quality impairments in many segments of the Mystic River (Massachusetts Department of Environmental Protection, 2010a). EPA has been assigning a "report card" grade for the Mystic River watershed since 2006. Prior to 2014, a single grade was assigned to the entire watershed; however, for the last eight years, grades have been assigned to 14 individual stretches of the river and its tributaries. The latest Report Card from 2021 indicates that the monitored segments of the Mystic River are meeting water quality standards for swimming and boating based on bacteria concentrations ranging from 30.2% of the time (Mill Creek) to 98.6% of the time (Upper Mystic Lake) (USEPA, 2022d).

In 2018, EPA approved a TMDL for pathogen indicators (i.e., fecal coliform, Enterococci, and E.coli) in the Mystic River watershed (Massachusetts Department of Environmental Protection, 2018). The TMDL found 24 river miles out of a total of 27.6 river miles in the watershed are impaired due to bacteria and pathogens, including the Aberjona River, Alewife Brook, Malden River, Chelsea River, and the main stem of the Mystic River and four out of a total of five estuaries are impaired for bacteria and pathogens. The TMDL identified bacterial sources such as failing septic systems, CSOs, SSOs, sewer pipes connected to storm drains, certain recreational activities, wildlife (including domestic pets), and storm water discharges. While the TMDL does not attempt to assign specific WLAs or LAs to specific sources, it indicates that stormwater sources of bacteria need to be reduced to meet in stream water quality standards.[33]

[32] See Mystic River Watershed Alternative TMDL Development for Phosphorus Management - Final Report (USEPA, 2020) p. 5 and pp. 48-56.
[33]See Final Pathogen TMDL for the Boston Harbor, Weymouth-Weir, and Mystic Watersheds (Massachusetts Department of Environmental Protection, 2018) pp 66-67.

d. Neponset River Watershed

The Neponset River watershed is located in eastern Massachusetts within the metropolitan Boston area and encompasses all or portions of portions 14 communities. The Neponset River is 29.5 miles long and drains approximately 120 square miles. At its most downstream point, the Neponset River is tidally influenced for three miles from Baker Dam in Milton to its confluence with Dorchester Bay in Boston Harbor (Massachusetts Department of Environmental Protection, 2012). Since 1994, many waterbody segments within the Neponset River watershed have been identified as impaired for bacteria and other impairments associated with excess nutrients (Massachusetts Department of Environmental Protection, 1995) (Massachusetts Department of Environmental Protection, 2010b). Based on water quality data available for the Neponset River and applicable Massachusetts surface water quality standards for a Class B and SB surface water, MassDEP included many segments of the Neponset River on the 2018/2021 303(d) list, where MassDEP continues to indicate widespread impairments due to excess nutrients and bacteria in the Neponset River watershed (Massachusetts Department of Environmental Protection, 2021) (see Attachment 4 for a full list of impairments in the Neponset River watershed based on the 2018/2021 303(d) list).

Nutrient Impairments

Among the 303(d)-listed pollutants on the 2018/2020 Section 303(d) list are several related to excessive nutrient loading (see Attachment 4):

- Phosphorus
- Low Dissolved Oxygen
- Algae
- Aquatic Plants (Macrophytes)
- Nutrient/Eutrophication Biological Indicators
- Transparency/Clarity
- Turbidity
- Algae

As indicated above for the Charles River and the Mystic River, the causal relationship between excessive phosphorus and nitrogen loads and water quality impairments is well understood.[34] Excess phosphorus in the Neponset River system in the inland freshwater portions of the Neponset River and excess nitrogen in the marine portions of the Neponset River lead to increased algal and aquatic plant growth, which can lower dissolved oxygen in the water column, affect the pH of the water, increase the turbidity in the water column, and decrease the clarity of the water (Massachusetts Department of Environmental Protection, 2010b) (Massachusetts Department of Environmental Protection, 2004). The current 2018/2020 Section 303(d) list

[34] See Part VII – References.

indicates 26 waterbody segments in the Neponset River watershed are impaired due to excess nutrients in the waterbody.

A MassDEP 2004 assessment report found widespread impairments in the Neponset River watershed due to excess nutrients with only one segment sampled between 2001 and 2003 found to have no nutrient related problems (Massachusetts Department of Environmental Protection, 2004). Nutrient related issues throughout the Neponset River watershed have been linked to stormwater sources since 1994.[35]

Bacteria Impairments

Similar to the Mystic River, the 2018/2020 EPA-approved 303(d) list indicates widespread bacteria impairments, including 20 segments of the Neponset River that are impaired for E. coli, enterococcus or fecal coliform (Massachusetts Department of Environmental Protection, 2021). The bacteria impairments have been linked to stormwater since a 1994 MassDEP water quality assessment analysis, which indicated that bacteria in stormwater is causing of water quality impairments in many segments of the Neponset River (Massachusetts Department of Environmental Protection, 1995) (Massachusetts Department of Environmental Protection, 2002) (Massachusetts Department of Environmental Protection, 2004). EPA and the Neponset River watershed Association have been assigning a "report card" grade for the Neponset River to measure and evaluate progress towards meeting Massachusetts bacterial water quality standards for swimming and boating as well as to assess general health of the watershed. The latest Report Card from 2021 indicates that segments of the Neponset River are meeting water quality standards for swimming and boating based on bacteria concentrations ranging from 25.1% of the time (Meadows Brook) to 100% of the time (Crack Rock Pond). These 2021 grades in the Neponset are similar to the 2020 report card grades (USEPA, 2022e).

In 2002, EPA approved a TMDL for pathogen indicators (e.g., fecal coliform and E.coli) in the Neponset River watershed with an approved addendum in 2013 (Massachusetts Department of Environmental Protection, 2002) (Massachusetts Department of Environmental Protection, 2012). The TMDL and associated addendum found that most of the Neponset River, and tributaries, do not fully support the designated Class B or SB uses for primary and secondary contact recreation, nor its class SB designated use of restricted shellfish harvesting due to excess bacteria and pathogens. The TMDL identified bacterial sources such as failing septic systems, CSOs, SSOs, sewer pipes connected to storm drains, certain recreational activities, wildlife (including domestic pets), and stormwater. While the TMDL does not attempt to assign specific

[35] See The Neponset River Watershed 1994 Resource Assessment Report (Massachusetts Department of Environmental Protection, 1995) pp 8-1 through 8-10; Neponset River Watershed 2004 Water Quality Assessment Report (Massachusetts Department of Environmental Protection, 2010b)p 10; Neponset River Estuary ACEC Water Quality and Restoration Action Plan (Neponset River Watershed Association, 2014) pp 40-41.

WLAs or LAs to specific sources, it indicates that stormwater sources of bacteria need to be reduced in order to meet in-stream water quality standards.[36]

V. Analysis of Petitions and Designation

a. Water Quality Progress in the Charles River, Mystic River, Neponset River, and Boston Harbor

For decades, EPA, CLF, the Commonwealth of Massachusetts, the Massachusetts Water Resources Authority (MWRA), the Boston Water and Sewer Commission (BWSC), and many municipalities and watershed groups have played important roles in improving water quality in Boston Harbor and its tributaries. A landmark effort to clean up Boston Harbor began in earnest in 1983 when CLF filed a suit against the sewage authority at the time, the Metropolitan District Commission (MDC),[37] and EPA alleging that the discharge of untreated sewage into Boston Harbor violated the CWA. In 1985, EPA filed suit against a newly created sewage authority, MWRA, and the cases were consolidated. The complex federal litigation included a key 1985 ruling setting forth a schedule with mandatory construction and operation deadlines for new sewage treatment infrastructure and facilities.[38] It resulted in the construction of a new wastewater treatment facility at Deer Island in Boston Harbor which became operational in phases between 1995 and the early 2000s; sewage sludge processing facilities in Quincy; a tunnel from Nut Island to Deer Island allowing the closure of the old Nut Island wastewater treatment facility; and a 9.5-mile outfall tunnel to discharge treated effluent offshore in Massachusetts Bay. These four major construction projects were designed to deal with the problem of untreated and poorly treated sewage that had been dumped into Boston Harbor for decades. The offshore outfall significantly reduced the nutrient and bacteria load in Boston Harbor (Massachusetts Department of Environmental Protection, 2018). Deer Island's expanded capacity also reduced SSOs and backups in communities surrounding Boston Harbor that were once caused by an overloaded sewer system (Massachusetts Department of Environmental Protection, 2018).

In 1995, EPA launched an additional effort to make the Charles River fishable and swimmable. This effort included work that would impact areas throughout the Boston Harbor watershed, reducing nutrients and bacteria in all waterways and improving water quality. Since then, BWSC, MWRA, and other municipalities have made significant progress towards improving water quality by reducing illicit sewage discharges to storm drain systems and CSOs. The work by BWSC, MWRA, and municipalities within the Charles River, Neponset River, and Mystic River watersheds has reduced CSO discharges to the Charles River by over 95% (USEPA, 2022f); eliminated all CSO discharges to the Neponset River (Massachusetts Water Resources

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[36] Total Maximum Daily Loads of Bacteria for Neponset River Basin (Massachusetts Department of Environmental Protection, 2002) pp 31-37.

[37] The State of Massachusetts legislature created the Massachusetts Water Resources Authority (MWRA) in 1984. MWRA is the successor entity to the MDC.

[38] *U.S. et al. v. Metropolitan Dist. Comm'n.,* 1985 WL 9071 (Sept. 5, 1985).

Authority, 2022); and significantly reduced the CSO events in the Mystic River watershed (Massachusetts Water Resources Authority, 2022). In addition, targeted enforcement by EPA and MassDEP focused on removing illicit sewage connections to MS4 systems in the Boston Harbor watershed, including many enforcement actions in the Charles, Mystic, and Neponset River watersheds, have reduced the amount of nutrients and bacteria entering local waterways (Massachusetts Department of Environmental Protection, 2018) (USEPA, 2020) (USEPA, 2022a) (USEPA, 2022f). While significant progress has occurred since 1995, recent water quality data collected by the Charles River Watershed Association, Mystic River Watershed Association, the Neponset River watershed Association, MWRA, EPA and MassDEP continue to indicate widespread impairments caused by nutrients and bacteria in each system as described in Part IV of this document.

Since at least 2004, MassDEP has indicated that stormwater discharges are a source of nutrients and bacteria causing impairments in the three watersheds. However, the priorities for the past three decades were to focus on wastewater treatment plant upgrades and CSO reductions to remove the largest sources of nutrients and bacteria in each watershed, and eventually Boston Harbor. As work finishes on MWRA's Long-Term Control Plan for CSO discharges (Massachusetts Water Resources Authority, 2022) and because Deer Island has been operating since 2000, energy and resources are now focused on the remaining sources of nutrients and bacteria that continue to degrade water quality in each watershed, including stormwater discharges that are not currently regulated.

Recent studies in all three watersheds indicate that stormwater is the current leading cause of water quality issues. *See* Part IV of this document. These studies include TMDLs in the Charles River watershed and an Alternative TMDL in the Mystic River watershed that both indicate that water quality standards and TMDL targets can only be achieved with a reduction of phosphorus in stormwater discharges from both public and private developed lands. The most recent Three Rivers Report Card (USEPA, 2022f) (USEPA, 2022d) (USEPA, 2022e) underscores the importance of stormwater controls in achieving bacteria water quality standards in all three watersheds (CRWA, MyRWA, NepRWA, 2022). In EPA's technical and scientific judgment, based on careful consideration of record information, controlling nutrients and bacteria in stormwater discharges from developed lands in all three watersheds is necessary to meet water quality standards and TMDL WLAs. Whereas the 2016 MA Small MS4 permit, Boston individual MS4 permit, and MassDOT MS4 permit regulate stormwater discharges from most publicly owned parcels in the three watersheds, EPA has concluded based on the available evidence in the record before it that more must be done to control stormwater discharges from commercial, industrial, and institutional parcels to meet WQS and TMDL WLAs which is why EPA is designating these sites for NPDES permitting.

b. *Environmental Justice and Climate Change*

EPA is making this residual designation determination now because of the urgent need to make progress toward regulating currently unregulated stormwater discharges in these highly populated urban and suburban areas. In addition to the overall environmental and human health reasons described above, EPA has determined it must act expeditiously because these watersheds include communities with environmental justice concerns. EPA recognizes that the burdens of environmental pollution disproportionately fall on population groups of concern (e.g., minority, low income, and indigenous populations as specified in Executive Order 12898).[39] EPA also recognizes that climate change is impacting stormwater pollution and management in many Massachusetts communities and ecosystems,[40] and typically has a disproportionate adverse impact on communities with environmental justice concerns.[41,42]

EPA has defined environmental justice as the "fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation and enforcement of environmental laws, regulations and policies."[43] In May 2022, EPA published *EPA Legal Tools to Advance Environmental Justice* and identified RDA as a potential method for addressing environmental justice concerns.[44] EPA expects that designating stormwater sources for permitting that are (1) not currently regulated but that contribute to water quality standards exceedances, (2) are significant contributors of pollutants to waters of the U.S., and/or (3) that need to be controlled to meet TMDL WLAs, is likely to improve water quality in many communities, including communities with environmental justice concerns. "These [stormwater] controls could result in healthier urban streams, thereby providing benefits not only to the ecosystem itself, but also to the surrounding communities. Stormwater controls may also yield the additional benefit of transforming gray urban environments into more inviting green spaces, enhancing recreational opportunities and quality of life. They may also help to address bigger and more frequent storms caused by climate change."[45]

Wet weather and heavy precipitation can have a significant effect on communities, especially in areas with high amounts of impervious cover, and climate change augments those effects. Increased (or decreased) flows of stormwater from climate change will likely lead to increased pollution, either from additional loads (from increased flows), or greater concentration (from decreased flows).[46]

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[39] Executive Order 12898 (59 Fed. Reg. 7629, February 16, 1994).
[40] Massachusetts Department of Environmental Protection, *Assessment of Climate Change Impacts on Stormwater BMPs and Recommended BMP Design Considerations in Coastal Communities* (Dec. 2015).
[41] U.S. EPA, *Climate Adaptation Action Plan* (October 2021), at 2–3, *available at* https://www.epa.gov/system/files/documents/2021-09/epa-climate-adaptation-plan-pdf-version.pdf; *See also* U.S. EPA, EPA 43-R-21-003, Climate Change and Social Vulnerability in the United States: A Focus on Six Impacts (2021), *available at* Climate Change and Social Vulnerability in the United States: A Focus on Six Impacts (epa.gov) (analyzing six categories of climate change impacts on four socially vulnerable groups and finding that minorities and low-income individuals are more likely to currently live in areas with the highest projected climate change impacts compared to reference populations of people not included in those groups).
[42] *See* Mystic River Watershed Association, "Sewage: An Environmental Justice Tragedy," blog post, Feb. 5, 2021.
[43] *See* https:// www.epa.gov/environmentaljustice/learn-aboutenvironmental-justice.
[44] *See* U.S. EPA, EPA Legal Tools to Advance Environmental Justice (May 2022).
[45] *Id.* at 81.
[46] *See* U.S. EPA, Climate Adaptation Action Plan 5 (Oct. 2021) (noting that climate change impacts, "if combined with sufficiently high nutrient levels and temperatures, [can lead to] more harmful algal blooms, pathogens, and water related illnesses"); *see also* U.S. EPA, Climate Change and Harmful Algal Blooms, https://www.epa.gov/nutrientpollution/climate-change-and-harmful-algal-

In the Charles, Mystic, and Neponset River watersheds, the farthest downstream segments are generally the most impaired (Massachusetts Department of Environmental Protection, 2021) due to the accumulation of pollutants (specifically nutrients) in these downstream reaches. Moreover, in all three watersheds, communities with environmental justice concerns are concentrated in these same lower watershed reaches with the highest degree of impairment in all three watersheds. In addition, these same areas are also closest to Boston Harbor, at the lowest elevation in the watersheds, likely making them the most prone to sea level rise and other effects of climate change (See Attachment 5 for maps of the three watersheds and EJ communities and Attachments 2-4 for list of impaired waters in each watershed).

While this residual designation determination does not impose immediate permitting requirements or obligations on the owners or operators of the sources of the designated discharges, it will ultimately improve environmental conditions in communities with environmental justice concerns by improving water quality in nearby waterways, which may include creating more green infrastructure in these areas. EPA will follow this residual designation determination with one or more draft NPDES general permits that will offer coverage for eligible operators of designated sources, spell out the specific requirements and obligations for the operators of the sources of the designated discharges, and offer an opportunity to comment on the residual designation determination and EPA's proposed general permit(s). EPA recognizes that these permits may impact owners and operators of facilities in communities with environmental justice concerns (as well as other parts of the watersheds); when issuing the draft permits, EPA will provide an analysis of environmental justice and climate change considerations, and provide an opportunity to comment on those issues as well as any other aspect of the permits.

c. *Nutrients and Bacteria in New England Stormwater*

Nutrients

EPA, states, and the scientific community have effective tools for characterizing the mass load of nutrients in stormwater. As discussed in more detail below, nutrient loading to waterbodies is often characterized not only through event mean concentrations (EMCs) but also through export coefficients (i.e., export rates) from land uses with similar characteristics in areas with similar rainfall patterns which represents the total amount (expressed in pounds) of either nitrogen or phosphorus delivered annually to a system from a defined area (expressed in acres). Annual export coefficients for nutrients are particularly useful at characterizing stormwater because of the cumulative effects nutrients have on receiving water bodies, including effects on downstream receiving waters. Receiving waters respond to the overall annual load of nutrients they receive, not just a snapshot in time of the stormwater nutrient concentration. The results of this can be

blooms#:~:text=Warmer%20temperatures%20prevent%20water%20from,warmer%20and%20promoting%20more%20blooms.

seen in the impairments in each watershed, with downstream reaches exhibiting the higher levels of degradation due to excess nutrients which accumulate as the tributaries in each watershed deliver nutrient loads to the main stem of each river (Massachusetts Department of Environmental Protection, 2021). Below is a further explanation of nitrogen and phosphorus in stormwater in New England.

<u>Nitrogen</u>

The primary sources of nitrogen in stormwater are (*See, e.g.,* (Carpenter, et al., 1998) (Chen, Theller, Gitau, Engel, & Harbor, 2017) (Jani, Jang, Lusk, & Toor, 2020) (Moore, Johnston, Smith, & Milstead, 2011) (Shaver, Horner, Skupien, May, & Ridley, 2007) (Driscoll, et al., 2003) (National Research Council, 2000)):

- Atmospheric deposition including mobile source deposition (deposition from combustion engines);
- Wash-off of fertilizers;
- Nitrogen attached to eroded soils and stream banks;
- Organic matter (such as pollen and leaves) and pet wastes that are deposited on impervious surfaces; and
- Leaching of nitrate from functioning septic systems.

The median nutrient concentration of total nitrogen seen in stormwater is 2.0 mg/L across the New England region, based on the data available in NSQD (USEPA, 2014) (Pitt, Maestre, & Morquecho, 2004). Similar levels of total nitrogen were seen in stormwater discharges in the Chesapeake region (Schueler, 2011) as well as across the nation, with Lin reporting a national average EMC of 2.415 mg/L for nitrogen (TKN +NO_2 and NO_3) (Lin, 2004). While the concentrations of nitrogen in stormwater may appear low when compared to other sources (e.g., sewage overflow), it has been shown that stormwater from impervious surfaces, particularly from roads, is the main source of nitrogen delivered to urban streams due to the large amounts of pollutants transported by the significant stormwater volume that would otherwise be infiltrated. *See, e.g.,* (Wang, Ma, Zhang, & Shen, 2022) (Jacobson, 2011) (Jani, Jang, Lusk, & Toor, 2020). While EMC data are important in characterizing nitrogen concentrations in stormwater derived from different land uses, it is more useful to define the impacts of stormwater discharges in terms of average annual load given the cumulative impacts of nutrients on downstream waterbody segments. The total nitrogen load delivered from stormwater sources in any given area is controlled by the precipitation patterns, the amount of impervious surface in that drainage area, and the land use type of that drainage area. Table 2 below displays the average annual total nitrogen export from different land use classes and land cover types for New England. Annual export coefficients for total nitrogen from developed lands is controlled by precipitation patterns, land use within the drainage area, and the amount of impervious surface in the drainage area. In New England, the average annual nitrogen loading (export coefficient/rate) from impervious surfaces ranges from 10.5 and 17 pounds per acre per year depending on land use type and 0.3 and 3.6 pounds per acre per year from pervious areas depending on the infiltration rate of the pervious area (US EPA, 2016a).

Nitrogen Source Category by Land Use	Land Surface Cover	N Load Export Rate, lbs./acre/year
Commercial and Industrial	Directly connected impervious	15.0
All Residential	Directly connected impervious	14.1
Highway	Directly connected impervious	10.5
Forest Agriculture and Open Land	Directly connected impervious	11.3
Developed Land Pervious– HSG A	Pervious	0.3
Developed Land Pervious – HSG B	Pervious	1.2
Developed Land Pervious– HSG C	Pervious	2.4
Developed Land Pervious– HSG C/D	Pervious	3.1
Developed Land Pervious– HSG D	Pervious	3.6

Table 2: Average annual distinct nitrogen (N) load export rates for use in estimating N load reduction credits in the 2016 MA MS4 permit (US EPA, 2016a). The Commercial and Industrial export rate would also apply to institutional lands. HSG stands for Hydrologic Soil Group

Phosphorus

The primary sources of phosphorus in stormwater are (*See e.g.* (Carpenter, et al., 1998) (Lin, 2004) (Massachusetts Department of Environmental Protection, 2007b) (Massachusetts Department of Environmental Protection, 2011) (Waschbusch, 2000) (Mattson & Isaac, 1999):

- Wash-off of phosphorus-based lawn fertilizers used in residential areas, parks, cemeteries, and golf courses and fertilizers used by agriculture;
- Wash-off of organic matter (such as pollen and leaves) and pet wastes that are deposited on impervious surfaces;

- Atmospheric deposition;
- Soil erosion; and
- Leaching from failed or inadequate septic systems.

The median nutrient concentration of total phosphorus in stormwater is 0.25 mg/L across the New England region, based on data available in NSQD (USEPA, 2014) (Pitt, Maestre, & Morquecho, 2004). An analysis of data nationwide found the concentration of phosphorus during storms is very consistent with a mean EMC of 0.30 mg/L (Center For Watershed Protection, 2003). Like total nitrogen, while EMCs of phosphorus in stormwater are important, it is more useful to define the impacts of stormwater discharges in terms of average annual load given the cumulative impacts of nutrients on downstream waterbody segments. Also, like total nitrogen, the total phosphorus load delivered from stormwater sources in any given area is controlled by the precipitation patterns, the amount of impervious surface in that drainage area, and the land use type of that drainage area. Table 3 below displays the average annual total phosphorus export rates from different land use classes and land cover types for the New England region. In New England, average annual phosphorus loading (export coefficient/rate) from impervious cover ranges from between 1.34 and 2.32 pounds per acre per year of total phosphorus based on land use type, and 0.03 and 0.37 pounds per acre per year from pervious areas depending on infiltration rate of the pervious area (US EPA, 2016a) (USEPA, 2016b).

Phosphorus Source Category by Land Use	**Land Surface Cover**	**P Load Export Rate, lbs/acre/year**
Commercial and Industrial	Directly connected impervious	1.78
Multi-Family and High-Density Residential	Directly connected impervious	2.32
Medium -Density Residential	Directly connected impervious	1.96
Low Density Residential	Directly connected impervious	1.52
Highway	Directly connected impervious	1.34
Forest Agriculture and Open Land	Directly connected impervious	1.52
Developed Land Pervious – HSG A	Pervious	0.03

Developed Land Pervious – HSG B	Pervious	0.12
Developed Land Pervious – HSG C	Pervious	0.21
Developed Land Pervious – HSG C/D	Pervious	0.29
Developed Land Pervious – HSG D	Pervious	0.37

Table 3: Average annual distinct phosphorus load export rates for use in estimating phosphorus load reduction credits in the 2016 MA MS4 permit (US EPA, 2016a). The Commercial and Industrial export rate would also apply to Institutional lands. HSG stands for Hydrologic Soil Group

Bacteria/Pathogens

Stormwater discharged to recreational waters such as beaches and lakes or stormwater that comes into contact with shellfish beds can impair the water's designated uses, which may include swimming, boating, and shellfish propagation. Bacteria in stormwater also poses a public health risk from exposure to pathogen contamination. Several indicator organisms may be used to evaluate the presence of harmful pathogens in stormwater: fecal coliform, E. coli, streptococci, and enterococci (US EPA, 1999). Primary sources of pathogens in stormwater runoff are (*See e.g.* (Massachusetts Department of Environmental Protection, 2018) (Massachusetts Department of Environmental Protection, 2002) (Massachusetts Department of Environmental Protection, 2007a) (Lin, 2004)):

- Leaky sanitary sewer lines,
- Sanitary sewer cross-connections,
- Wash-off of wildlife and pet excrement, and
- Failing septic systems.

Bacteria and pathogen concentrations in stormwater vary greatly with total E. coli concentrations ranging from 10 colonies per 100 ml to 35,000 colonies per 100 ml across the New England Region, based on data available in NSQD (USEPA, 2014) (Pitt, Maestre, & Morquecho, 2004). As a point of reference, to meet water quality standards, Massachusetts Class B waters cannot exceed 235 colonies per 100 ml during the bathing season due to the threat to human health. Generally, bacteria and pathogen concentrations increase with increased impervious surface and increased urbanization (Mallin, Johnson, & Ensign, 2009). Bacteria concentrate on impervious surfaces during dry weather and are readily washed off into receiving waterbodies during storm events, a process that would otherwise not occur if the land was pervious instead of impervious.

d. Selection of Designation Sites

Selection of Land Use Categories

Table 4 below contains the land use breakdown by land area for the Charles River, Mystic River, and Neponset River watersheds. As Table 4 demonstrates, residential land use (single and multi-family) is the dominant land use in all three watersheds with 41% of the total area in the Charles River watershed, 35% of the Mystic River watershed, and 39% of the Neponset River watershed classified as residential land area. While residential land use represents the dominant land use in all three watersheds, EPA's data analysis for the Charles River watershed[47] indicates that the average multi-family and single-family parcel discharges approximately six times less phosphorus in stormwater than the average commercial, industrial, or institutional parcel. Given EPA's understanding of the similar pattern of increasing impact with increasing proportion of impervious surface on a parcel and the consistency of pollutant loading in New England from stormwater discharged from developed lands, in EPA's technical judgment, the same pattern seen in phosphorus in stormwater would also be seen in nitrogen and bacteria contributions. EPA's data analysis for the Charles River watershed also indicates that, generally, residential parcels have a smaller water quality impact from stormwater discharges on a per-parcel basis compared to commercial, industrial, and institutional parcels. Similarly, given the similarities in land use in all three watersheds (Table 4), EPA can reasonably apply this information to all three watersheds, not just the Charles River watershed.

Therefore, EPA is choosing to focus this designation on commercial, industrial, and institutional parcels[48] and focus on permitting such stormwater discharges given their greater pollutant loading impact on a per parcel basis, as opposed to residential parcels. At the same time, EPA explicitly considered whether to designate residential properties and the adaptive methodology it adopted for the purpose of this RDA accounts for the possibility of extending the RDA to encompass certain of those sources in the future, should the facts and circumstances on the ground warrant such an action. In other words, the question of whether to designate certain residential properties is integral to EPA's ongoing evaluation of the RDA implementation using an adaptive management model. Depending in part on the progress that occurs as a result of this designation and ensuing permit action(s), and on an evaluation of data and other analysis resulting from those actions, EPA may designate multi-family parcels in the future. EPA also intends to conduct further analysis on the impact permitting multi-family parcels will have on receiving water quality and an analysis of environmental justice considerations such an action may have. This approach will also allow MS4 permit holders in each watershed to focus efforts on residential properties in their communities as they see fit to meet MS4 permit obligations. Overall, in EPA's judgment, this stepwise, adaptive approach will (1) avoid duplicative or potentially conflicting regulatory mandates on residential parcels,[49] and (2) will enable EPA to

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[47] *See* Attachment 6, Charles River Watershed Stormwater Total Phosphorus Analysis.

[48] *Id*

[49] A related benefit of this iterative approach that EPA also factored into its decision making is that reliance on existing MS4 implementation activity with respect to residential properties will reduce the administrative burden on EPA associated with regulating those sources. Logistically and administratively, municipal governments are better

pursue any necessary incremental reductions from residential parcels in a more targeted, impactful, and cost-effective manner, as decisions can be made with the benefit of more detailed information and more extensive implementation experience. EPA's objective is to evaluate options for maximizing stormwater pollution reductions as efficiently as possible (i.e., fewest necessary stormwater controls installed to fully address the problem). This approach is consistent with how courts have construed agency action that is at once compelled by a sense of urgency given the gravity of the problem from the standpoint of human health and the environment but is also calibrated and measured. The U.S. Court of Appeals for the D.C. Circuit has held that "agencies have great discretion to treat a problem partially." *City of Las Vegas v. Lujan*, 891 F.2d 927 (D.C. Cir. 1989) ("we [sh]ould not strike down [a regulation] if it [is] a first step toward a complete solution."). In sum, the methodology here is designed to ensure EPA neither over nor underregulates in its attempts to solve an indisputably complex environmental problem. This adaptive approach to managing stormwater in these watersheds is also appropriate given EPA's decision to act with dispatch based on the best information reasonably available and without awaiting the development of costly water quality and land use models. "As in many science-based policymaking contexts, under the CWA the EPA is required to exercise its judgment even in the face of some scientific uncertainty." *Upper Blackstone Water Pollution Abatement Dist. v. U.S. E.P.A.*, 690 F.3d 9, 23 (1st Cir. 2012), *accord City of Taunton, Massachusetts v. United States Env't Prot. Agency*, 895 F.3d 120, 135 (1st Cir. 2018) and *American Iron and Steel Institute v. EPA*, 151 F.3d 979, 1004 (D.C. Cir. 1997).

Land Use	Charles River Watershed Percent of Total Land Area	Mystic River Watershed Percent of Total Land Area	Neponset River Watershed Percent of Total Land Area
Commercial	4%	6%	6%
Industrial	3%	4%	4%
Institutional	20%	17%	16%
Residential – single-family	34%	23%	33%
Residential – multi-family + other	7%	12%	6%
Mixed Use	3%	1%	1%
Other	29%	37%	34%

Table 4: Land Use comparison Charles River, Mystic River and Neponset River Watersheds. All Data based on MassGIS 2016 Land

situated to interact with residential property owners than EPA. Prior to assuming an administrative burden of that magnitude, EPA concluded that it made sense to determine whether the controls contemplated by this action were sufficient to achieve its intended aim of restoring and maintaining designated uses in the Charles, Mystic and Neponset Rivers.

Use/Land Cover dataset (MassGIS, 2016). "Other" includes unknown, open land, forest, agriculture, recreation, right of way, and water land use categories. "Institutional" land use is renamed from "Tax Exempt"

Selection of Size Threshold

In general, the amount of impervious surface[50] on a property increases the volume of stormwater discharged from that property or land use class, which increases the loading of pollutants to waters of the U.S., including phosphorus, nitrogen, and bacteria. (Shaver, Horner, Skupien, May, & Ridley, 2007) (Center For Watershed Protection, 2003) (Schueler, 2011) (Chen, Theller, Gitau, Engel, & Harbor, 2017). All three watersheds contain a significant amount of impervious surface with 23 percent of the land area in the Charles River watershed mapped as impervious, 41 percent of the land area in the Mystic River watershed mapped as impervious, and 21 percent of the land area in the Neponset River watershed mapped as impervious (MassGIS, 2016). All three watersheds contain impervious surface totals over thresholds (e.g. greater than ten percent impervious surface) that have been linked to water quality impairments due to stormwater discharges (Center For Watershed Protection, 2003) (King, Maker, Kazyak, & Weller, 2011) (Jacobson, 2011) (Roy & Schuster, 2009) (National Research Council, 2008). As Table 2 and Table 3 above demonstrate, impervious surfaces can deliver up to ten times the annual load of phosphorus and nitrogen via stormwater as opposed to pervious areas. In addition, bacteria in stormwater increases with increasing impervious surface in a drainage area. Parcels can also contain both impervious and pervious surfaces. For these reasons, this designation focuses on the amount of impervious surface contained on a parcel instead of the overall size of the parcel, as requested by the petitioners[51]. All three petitions contain detailed information about the impact of impervious cover on water quality, and this designation criteria is consistent with that finding.

Data analysis[52] for the Charles River watershed examined phosphorus inputs from private parcels to the Charles River and indicates that stormwater from private parcels is contributing the majority of phosphorus to the Charles River system. However, the analysis also shows that not all parcels will need to reduce phosphorus in stormwater discharges to meet WQS and TMDL goals. The analysis[53] suggests that WQS and TMDL goals can be met through a combination of actions by municipalities as required by the 2016 MA MS4 permit as well as actions on private parcels containing the largest amount of impervious surface (the parcels with the largest relative contribution of pollutants via stormwater) but cannot be met by municipalities' actions alone. EPA can reasonably assume that bacteria and nitrogen would show similar patterns of increasing impact with increasing proportion of impervious surface because of New England's consistent stormwater pollutant loading patterns described above. Where there are impairments due to excess nitrogen in the tidal portions of all three watersheds, stormwater that reaches surface waters from parcels with a large amount of impervious surface is contributing a large amount of

[50] *See* Attachment 6, Charles River Watershed Stormwater Total Phosphorus Analysis
[51] see Part I Summary of Petitions
[52] *See* Attachment 6, Charles River Watershed Stormwater Total Phosphorus Analysis
[53] *Id.*

nitrogen to the receiving waterbodies and all downstream waterbodies, thus contributing to the impairments, i.e., WQS violations. Similarly, where there are impairments due to excess phosphorus in freshwater portions of all three watersheds, stormwater that reaches surface waters from parcels with a large amount of impervious surface is contributing a large amount of phosphorus to the receiving waterbody and all downstream waterbodies, contributing to the impairments, i.e., WQS violations. Bacteria impairments are ubiquitous throughout the Charles, Mystic, and Neponset watersheds, and stormwater that reaches an impaired surface water from parcels with a large amount of impervious surface contributes a large amount of bacteria to the receiving waterbody, thus contributing to the impairments, i.e., WQS violations.

As EPA continues to implement the 2016 MA MS4 permit, municipal permittees in all three watersheds are likely to make significant improvements in reducing total nitrogen, total phosphorus, and bacteria discharges in stormwater. However, municipalities largely lack the authority to control existing private commercial, industrial, and institutional parcels' direct stormwater discharges to waterbodies. As to indirect stormwater discharges through municipalities' MS4 systems, it may be challenging for municipalities to adequately address the water quality impacts of properties with the largest amount of impervious surface. As discussed above, without action on private parcels within all three watersheds specifically targeting the reduction of pollutants in stormwater from those parcels with the largest amount of impervious surface, WQS and TMDL targets cannot be met.

Data analysis[54] for the Charles River watershed indicates that that there are approximately 14,800 private commercial, industrial, and institutional parcels within the Charles River watershed, 12% of which have one acre or more of impervious surface. These parcels contribute approximately 70% of the overall phosphorus load from all commercial, industrial, and institutional parcels within the watershed. The relative proportion is also applicable to nitrogen and bacteria loads based on the impact of impervious surface, and is likely similar in all three watersheds based on similarities in land use distribution (see Table 4) and impervious surface percentage in all three watersheds. The focus of this determination is therefore on those commercial, industrial, and institutional properties with greater than or equal to one acre of impervious surface within these three watersheds. This designation targets parcels with a large amount of impervious surface and the majority of phosphorus, nitrogen, and bacteria loads from these land use classes, resulting in reduced nutrient and bacteria inputs to MS4 systems and directly to waterbodies in all three watersheds. In addition, this designation's focus on parcels with a large amount of impervious surface will alleviate some MA MS4 permit requirements for municipalities and allow municipalities the flexibility to address smaller parcels within their jurisdiction as they see fit to meet MA MS4 permit requirements.

e. Designation Determination

Pursuant to the discretionary authority provided under CWA § 402(p)(2)(E) and 40 C.F.R. § 122.26(a)(9)(i), EPA is designating for NPDES permitting certain stormwater discharges from commercial, industrial, and institutional properties[55] with one acre or more of impervious

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[54] *Id*

[55] See footnote 1.

surface[56] in the Charles, Mystic, and Neponset River watersheds.[57] EPA finds that the designated stormwater discharges contribute to violations of water quality standards; are significant contributors of pollutants to waters of the United States; and require stormwater controls based on wasteload allocations that are part of TMDLs that address phosphorus, nitrogen, and/or bacteria. Each of these bases is sufficient on its own to designate under the applicable regulations at 40 C.F.R. § 122.26(a)(9)(i)(C) and (D). This designation includes contiguous commercial, industrial, or institutional properties with the same owner or operator where the combined land area contains one acre or greater of impervious surface. This designation does not apply to any parcel subject to the 2016 MA MS4 permit that is owned or operated by a current permittee under the 2016 MA MS4 permit; any parcel owned or operated by the City of Boston or BWSC that is subject to NPDES permit MAS010001; or any parcel owned or operated by MassDOT that is subject to NPDES permit MA043025. Consistent with 40 C.F.R. § 124.52(c), "the question whether the initial designation was proper will remain open for consideration during the [NPDES permit] public comment period under § 124.11 and in any subsequent hearing."

DAVID CASH

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David W. Cash

Regional Administrator, EPA Region 1

[56] See footnote 2.

[57] See Attachment 1: List of Communities Included in the Clean Water Act Residual Designation Determination for Certain Stormwater Discharges in the Charles, Mystic, and Neponset River Watersheds, in Massachusetts.

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ATTACHMENT 1

Clean Water Act Residual Designation Determination for Certain Stormwater Discharges in the Charles, Mystic, and Neponset River Watersheds, in Massachusetts

List of Communities Included in this Residual Designation

Charles River Watershed	Mystic River Watershed	Neponset River Watershed
Arlington	Arlington	Quincy
Ashland	Belmont	Boston
Bellingham	Boston	Milton
Belmont	Burlington	Dedham
Boston	Cambridge	Westwood
Brookline	Chelsea	Dover
Cambridge	Everett	Medfield
Dedham	Lexington	Walpole
Dover	Malden	Foxborough
Foxborough	Medford	Sharon
Franklin	Melrose	Stoughton
Holliston	Reading	Canton
Hopedale	Revere	Norwood
Hopkinton	Somerville	Randolph
Lexington	Stoneham	
Lincoln	Wakefield	
Medfield	Watertown	
Medway	Wilmington	
Mendon	Winchester	
Milford	Winthrop	
Millis	Woburn	
Natick		
Needham		
Newton		
Norfolk		
Somerville		
Sherborn		
Walpole		
Waltham		
Watertown		
Wayland		
Wellesley		
Weston		

Westwood		
Wrentham		

ATTACHMENT 2

Clean Water Act Residual Designation Determination for Certain Stormwater Discharges in the Charles, Mystic, and Neponset River Watersheds, in Massachusetts

Charles River Watershed Impairments Based on Final Massachusetts Integrated List of Waters for the Clean Water Act 2018/2020 Reporting Cycle

Waterbody	AU_ID	Description	Impairment
Charles: Alder Brook	MA72-22	Headwaters, perennial portion northwest of the Route 135 and South Street intersection, Needham to mouth at confluence with the Charles River, Needham.	Benthic Macroinvertebrates; Nutrient/Eutrophication Biological Indicators
Charles: Beaver Brook	MA72-12	Headwaters, outlet Beaver Pond, Bellingham to mouth at confluence with the Charles River, Bellingham.	Escherichia Coli (E. Coli)
Charles: Beaver Brook	MA72-28	Headwaters, perennial portion north of Route 2, Lexington to mouth at confluence with the Charles River, Waltham (one culverted portion approximately 2900 feet (0.55mile)).	(Flow Regime Modification*); (Non-Native Aquatic Plants*); (Other anthropogenic substrate alterations*); (Water Chestnut*); Algae; Chloride; Dissolved Oxygen; Escherichia Coli (E. Coli); Organic Enrichment (Sewage) Biological Indicators; Phosphorus, Total; Sedimentation/Siltation
Charles: Beaver Pond	MA72004	Bellingham/Milford.	Mercury in Fish Tissue
Charles: Beaver Pond	MA72006	Franklin.	(Fanwort*); (Non-Native Aquatic Plants*)
Charles: Bogastow Brook	MA72-16	Headwaters, outlet Factory Pond, Holliston to mouth at inlet South End Pond, Millis.	(Dewatering*); Escherichia Coli (E. Coli); Fecal Coliform
Charles: Brookline Reservoir	MA72010	Brookline.	--
Charles: Bulloughs Pond	MA72011	Newton.	Algae; Nutrient/Eutrophication Biological Indicators
Charles: Cambridge Reservoir	MA72014	Waltham/Lincoln/Lexington.	Chloride
Charles: Cambridge Reservoir, Upper Basin	MA72156	Lincoln/Lexington.	Aquatic Plants (Macrophytes); Chloride; Turbidity

Charles: Cedar Swamp Pond	MA72016	locally known as "Milford Pond", Milford.	(Eurasian Water Milfoil, Myriophyllum Spicatum*); (Non-Native Aquatic Plants*); Dissolved Oxygen; Mercury in Fish Tissue
Charles: Chandler Pond	MA72017	Boston.	Algae; Nutrient/Eutrophication Biological Indicators; Phosphorus, Total; Transparency / Clarity
Charles: Charles River	MA72-01	Headwaters, outlet Echo Lake, Hopkinton to Dilla Street (just upstream of Cedar Swamp Pond), Milford.	(Dewatering*); (Flow Regime Modification*); Dissolved Oxygen
Charles: Charles River	MA72-03	From Milford WWTF discharge (NPDES: MA0100579), Hopedale to outlet Box Pond, Bellingham (through former 2006 segment: Box Pond MA72008).	Algae; DDT in Fish Tissue; Dissolved Oxygen Supersaturation; Escherichia Coli (E. Coli); Organic Enrichment (Sewage) Biological Indicators; Phosphorus, Total
Charles: Charles River	MA72-04	From outlet Box Pond, Bellingham to inlet Populatic Pond, Norfolk/Medway (one culverted portion approximately 350 feet (0.07mile)).	(Flow Regime Modification*); Ambient Bioassays - Chronic Aquatic Toxicity; Chlordane in Fish Tissue; DDT in Fish Tissue; Escherichia Coli (E. Coli); Fish Bioassessments; Mercury in Fish Tissue; Nutrient/Eutrophication Biological Indicators; Phosphorus, Total; Temperature
Charles: Charles River	MA72-05	From outlet Populatic Pond, Norfolk/Medway to South Natick Dam (NATID: MA00341), Natick.	(Fanwort*); (Non-Native Aquatic Plants*); (Water Chestnut*); Algae; Benthic Macroinvertebrates; Chlordane in Fish Tissue; DDT in Fish Tissue; Dissolved Oxygen; Dissolved Oxygen Supersaturation; Mercury in Fish Tissue; Nutrient/Eutrophication Biological Indicators; Phosphorus, Total; Turbidity

Charles: Charles River	MA72-06	From South Natick Dam (NATID: MA00341), Natick to Chestnut Street, Needham/Dover.	(Eurasian Water Milfoil, Myriophyllum Spicatum*); (Fanwort*); (Flow Regime Modification*); (Non-Native Aquatic Plants*); (Water Chestnut*); Algae; Cause Unknown [Fish Population Imbalance]; DDT in Fish Tissue; Fish Bioassessments; Nutrient/Eutrophication Biological Indicators; PCBs in Fish Tissue; Phosphorus, Total
Charles: Charles River	MA72-07	From Chestnut Street, Needham/Dover to Watertown Dam (NATID: MA00456), Watertown.	(Curly-leaf Pondweed*); (Eurasian Water Milfoil, Myriophyllum Spicatum*); (Fish Passage Barrier*); (Flow Regime Modification*); (Non-Native Aquatic Plants*); (Water Chestnut*); Benthic Macroinvertebrates; DDT in Fish Tissue; Escherichia Coli (E. Coli); Fish Bioassessments; Harmful Algal Blooms; Nutrient/Eutrophication Biological Indicators; PCBs in Fish Tissue; Phosphorus, Total; Temperature
Charles: Charles River	MA72-33	From outlet Cedar Swamp Pond, Milford to the Milford WWTF discharge (NPDES: MA0100579), Hopedale (formerly part of 2006 segment: Charles River MA72-02) (two culverted portions totaling approximately 1100 feet (0.21mile) (as of 2008 excluding the approximately 0.8 mile through segment: Cedar Swam	(Physical substrate habitat alterations*); Escherichia Coli (E. Coli); Nutrient/Eutrophication Biological Indicators

Charles: Charles River	MA72-36	From Watertown Dam (NATID: MA00456), Watertown to the Boston University Bridge, Boston/Cambridge (formerly part of 2006 segment: Charles River MA72-08).	(Fish Passage Barrier*); (Flow Regime Modification*); (Non-Native Aquatic Plants*); (Non-Native Fish/Shellfish/Zooplankton*); (Water Chestnut*); Chlorophyll-a; DDT in Fish Tissue; Dissolved Oxygen; Escherichia Coli (E. Coli); Fish Bioassessments; Harmful Algal Blooms; Nutrient/Eutrophication Biological Indicators; Oil and Grease; PCBs in Fish Tissue; pH, High; Phosphorus, Total; Sediment Bioassay [Acute Toxicity Freshwater]; Transparency / Clarity; Unspecified Metals in Sediment
Charles: Charles River	MA72-38	From Boston University Bridge, Boston/Cambridge to mouth at the New Charles River Dam (NATID: MA01092), Boston (formerly part of 2006 segment: Charles River MA72-08).	(Fish Passage Barrier*); (Flow Regime Modification*); Cause Unknown [Sediment Screening Value (Exceedance)]; Chlorophyll-a; Combined Biota/Habitat Bioassessments; DDT in Fish Tissue; Dissolved Oxygen; Dissolved Oxygen Supersaturation; Escherichia Coli (E. Coli); Harmful Algal Blooms; Nutrient/Eutrophication Biological Indicators; Odor; Oil and Grease; PCBs in Fish Tissue; Phosphorus, Total; Salinity; Temperature; Transparency / Clarity
Charles: Cheese Cake Brook	MA72-29	Emerges south of Route 16, Newton to mouth at confluence with the Charles River, Newton.	(Alteration in stream-side or littoral vegetative covers*); (Other anthropogenic substrate alterations*); Algae; Dissolved Oxygen Supersaturation; Escherichia Coli (E. Coli); Fish Bioassessments; Phosphorus, Total
Charles: Chestnut Hill Reservoir	MA72023	Boston.	--

Charles: Chicken Brook	MA72-34	Source, outlet Waseeka Sanctuary Pond, Holliston to mouth at confluence with the Charles River, Medway.	Escherichia Coli (E. Coli)
Charles: Crystal Lake	MA72030	Newton.	Harmful Algal Blooms
Charles: Dopping Brook	MA72-40	Headwater outlet small unnamed pond on Holliston/Sherborn border to mouth at confluence with Bogastow Brook, Holliston/Sherborn.	--
Charles: Dug Pond	MA72034	Natick.	(Curly-leaf Pondweed*); (Non-Native Aquatic Plants*)
Charles: Echo Lake	MA72035	Milford/Hopkinton.	Mercury in Fish Tissue
Charles: Factory Pond	MA72037	Holliston.	(Non-Native Aquatic Plants*); Aquatic Plants (Macrophytes)
Charles: Farm Pond	MA72039	Sherborn.	--
Charles: Franklin Reservoir Northeast	MA72095	Franklin.	(Water Chestnut*); Aquatic Plants (Macrophytes); Turbidity
Charles: Franklin Reservoir Southwest	MA72032	Franklin.	Aquatic Plants (Macrophytes); Turbidity
Charles: Fuller Brook	MA72-18	Headwater south of Route 135, Needham to mouth at confluence with Waban Brook, Wellesley (one culverted portion approximately 360 feet (0.07mile)).	(Physical substrate habitat alterations*); Escherichia Coli (E. Coli); Nutrient/Eutrophication Biological Indicators; Sedimentation/Siltation
Charles: Godfrey Brook	MA72-51	Perennial portion, South Main Street, Milford to mouth at confluence with the Charles River, Milford.	--
Charles: Halls Pond	MA72043	Brookline.	--
Charles: Hammond Pond	MA72044	Newton.	--
Charles: Hardys Pond	MA72045	Waltham.	(Non-Native Aquatic Plants*); (Water Chestnut*); Algae; Phosphorus, Total; Turbidity
Charles: Hobbs Brook	MA72-45	Headwaters west of Bedford Road, Lincoln to inlet Cambridge Reservoir, Upper Basin, Lincoln	Chloride

Charles: Hobbs Brook	MA72-46	From outlet Cambridge Reservoir, Waltham to mouth at confluence with Stony Brook, Weston.	Chloride
Charles: Hopping Brook	MA72-35	Source in Cedar Swamp, Holliston to mouth at confluence with the Charles River, Bellingham/Medway.	Escherichia Coli (E. Coli)
Charles: Houghton Pond	MA72050	Holliston.	(Non-Native Aquatic Plants*); Algae; Turbidity
Charles: Jamaica Pond	MA72052	Boston.	(Eurasian Water Milfoil, Myriophyllum Spicatum*); Dissolved Oxygen; Phosphorus, Total
Charles: Jennings Pond	MA72053	Natick.	--
Charles: Kendrick Street Pond	MA72055	Needham.	Turbidity
Charles: Kingsbury Pond	MA72056	Norfolk.	(Dewatering*)
Charles: Lake Archer	MA72002	Wrentham.	(Non-Native Aquatic Plants*)
Charles: Lake Pearl	MA72092	Wrentham.	(Eurasian Water Milfoil, Myriophyllum Spicatum*); (Non-Native Aquatic Plants*); Dissolved Oxygen
Charles: Lake Waban	MA72125	Wellesley.	(Eurasian Water Milfoil, Myriophyllum Spicatum*); (Fanwort*); (Non-Native Aquatic Plants*)
Charles: Lake Winthrop	MA72140	Holliston.	(Fanwort*); (Non-Native Aquatic Plants*); 2,3,7,8-Tetrachlorodibenzo-p-dioxin; Aquatic Plants (Macrophytes)
Charles: Linden Pond	MA72063	Holliston.	Aquatic Plants (Macrophytes); Turbidity
Charles: Little Farm Pond	MA72064	Sherborn.	--
Charles: Louisa Lake	MA72068	Milford.	(Non-Native Aquatic Plants*)
Charles: Lymans Pond	MA72070	Dover.	Aquatic Plants (Macrophytes); Turbidity
Charles: Mill Brook	MA72-39	Source wetlands, Pine Street, Medfield to mouth at confluence with the Charles River, Medfield.	--

Charles: Mill River	MA72-15	Headwaters, outlet Bush Pond, Norfolk to mouth at confluence with the Charles River, Norfolk.	(Curly-leaf Pondweed*); (Non-Native Aquatic Plants*); Temperature
Charles: Mine Brook	MA72-14	Headwaters in Franklin State Forest, Franklin to mouth at confluence with the Charles River, Franklin (through former 2006 segment: Mine Brook Pond MA72077) (HQW applies upstream of former Franklin WWTP discharge, approximately 4 miles upstream of mouth (note: Franklin WWTP tied into Medway (CRWPCD) on	(Habitat Assessment*); Escherichia Coli (E. Coli); Temperature
Charles: Mirror Lake	MA72078	Wrentham/Norfolk.	(Curly-leaf Pondweed*); (Non-Native Aquatic Plants*); Nutrient/Eutrophication Biological Indicators; Phosphorus, Total; Transparency / Clarity
Charles: Morses Pond	MA72079	Wellesley/Natick.	(Eurasian Water Milfoil, Myriophyllum Spicatum*); (Fanwort*); (Non-Native Aquatic Plants*)
Charles: Muddy River	MA72-11	Headwaters, outlet Ward Pond in Olmstead Park, Boston through Leverett Pond, Boston/Brookline to confluence with Charles River, Boston (four culverted portions totaling approximately 2200 feet (0.42mile)).	(Bottom Deposits*); (Flow Regime Modification*); (Non-Native Aquatic Plants*); (Physical substrate habitat alterations*); DDT in Fish Tissue; Dissolved Oxygen; Escherichia Coli (E. Coli); Odor; Oil and Grease; PCBs in Fish Tissue; Phosphorus, Total; Turbidity; Unspecified Metals in Sediment
Charles: Noannet Pond	MA72084	Westwood/Dover.	(Non-Native Aquatic Plants*)
Charles: Nonesuch Pond	MA72085	Natick/Weston.	(Curly-leaf Pondweed*); (Non-Native Aquatic Plants*)
Charles: Norumbega Reservoir	MA72086	[North Basin] Weston.	--
Charles: Norumbega Reservoir	MA72087	[South Basin] Weston.	--

Charles: Populatic Pond	MA72096	Norfolk.	Algae; Chlordane in Fish Tissue; DDT in Fish Tissue; Dissolved Oxygen; Dissolved Oxygen Supersaturation; Mercury in Fish Tissue; Nutrient/Eutrophication Biological Indicators
Charles: Powissett Brook	MA72-20	Headwaters, outlet Noannet Pond, Westwood to mouth at confluence with the Charles River, Dover.	Combined Biota/Habitat Bioassessments
Charles: Rock Meadow Brook	MA72-21	Headwaters, Fisher Meadow, Westwood to mouth at confluence with the Charles River, Dedham.	Algae; Benthic Macroinvertebrates; Dissolved Oxygen; Nutrient/Eutrophication Biological Indicators; Organic Enrichment (Sewage) Biological Indicators; Phosphorus, Total
Charles: Rosemary Brook	MA72-25	Headwaters, outlet Rosemary Lake, Needham to mouth at confluence with the Charles River, Wellesley.	Dissolved Oxygen; Phosphorus, Total
Charles: Sandy Pond	MA72105	Lincoln.	--
Charles: Sawmill Brook	MA72-23	Headwaters, Newton to mouth at confluence with the Charles River, Boston.	Chloride; Dissolved Oxygen; Escherichia Coli (E. Coli); Organic Enrichment (Sewage) Biological Indicators; Phosphorus, Total
Charles: Scarboro Golf Course Pond	MA72107	Boston.	(Non-Native Aquatic Plants*)
Charles: Seaverns Brook	MA72-44	Headwaters outlet Norumbega Reservoir, Weston to mouth at confluence with the Charles River, Weston.	Escherichia Coli (E. Coli)
Charles: Sewall Brook	MA72-49	Headwaters outlet Washington Street Pond, south off Route 16 (Washington Street), Sherborn to mouth at confluence with Charles River, Sherborn.	--
Charles: Shepards Brook	MA72-50	Perennial portion, north of Brook Street, Franklin to mouth at confluence with Charles River, Franklin.	--
Charles: South End Pond	MA72109	Millis.	--

Charles: South Meadow Brook	MA72-24	From emergence west of Parker Street, Newton to mouth at confluence with the Charles River, Newton (three culverted portions totaling approximately 2870 feet (0.54mile)).	(Bottom Deposits*); (Debris*); (Physical substrate habitat alterations*); Dissolved Oxygen; Escherichia Coli (E. Coli); Fish Bioassessments; Phosphorus, Total; Trash; Turbidity
Charles: Stony Brook	MA72-26	Headwaters, outlet Beaver Pond, Lincoln to mouth at inlet Stony Brook Reservoir, Waltham/Weston (mileage includes length of braid).	Temperature
Charles: Stony Brook	MA72-37	Headwaters, outlet Turtle Pond, Boston to culvert entrance, Boston (two culverted portions totaling approximately 740 feet (0.14mile)).	--
Charles: Stony Brook Reservoir	MA72114	Waltham/Weston.	--
Charles: Stop River	MA72-09	Headwaters south of Route 1A, Wrentham to Norfolk-Walpole MCI discharge (NPDES: MA0102253), Norfolk (through former 2006 segment: Highland Lake MA72047).	Ambient Bioassays - Chronic Aquatic Toxicity; Dissolved Oxygen; Phosphorus, Total
Charles: Stop River	MA72-10	From Norfolk-Walpole MCI discharge, Norfolk to confluence with Charles River, Medfield.	Organic Enrichment (Sewage) Biological Indicators; Phosphorus, Total; Temperature
Charles: Todd Pond	MA72117	Lincoln.	--
Charles: Trout Brook	MA72-19	Headwaters, outlet Channings Pond, Dover to mouth at confluence with the Charles River, Dover.	Nutrient/Eutrophication Biological Indicators; Temperature
Charles: Uncas Pond	MA72122	Franklin.	(Non-Native Aquatic Plants*); Dissolved Oxygen
Charles: Unnamed Tributary	MA72-27	Headwaters, outlet Stony Brook Reservoir, Waltham/Weston to mouth at confluence with the Charles River, Waltham/Weston.	(Dewatering*); (Flow Regime Modification*)

Charles: Unnamed Tributary	MA72-30	Locally known as "Laundry Brook" - emerges north of California Street, Watertown to mouth at confluence with the Charles River, Watertown (stream not depicted on 1987 Newton USGS map).	(Physical substrate habitat alterations*); Enterococcus; Escherichia Coli (E. Coli); Odor; Phosphorus, Total; Total Suspended Solids (TSS); Turbidity
Charles: Unnamed Tributary	MA72-31	Locally known as "Millers River" - from emergence near Route 93, Cambridge/Boston to mouth at confluence with the Charles River, Cambridge.	(Bottom Deposits*); (Debris*); (Habitat Assessment*); Flocculant Masses; Metals; Odor; Oil and Grease; Petroleum Hydrocarbons; Polychlorinated Biphenyls (PCBs); Polycyclic Aromatic Hydrocarbons (PAHs) (Aquatic Ecosystems); Scum/Foam; Sedimentation/Siltation; Trash; Turbidity; Unspecified Metals in Sediment
Charles: Unnamed Tributary	MA72-32	Locally known as "Sawins Brook" - emerges east of Elm Street, Watertown to mouth at confluence with the Charles River, Watertown (one culverted portion approximately 360 feet (0.07mile)).	Escherichia Coli (E. Coli)
Charles: Unnamed Tributary	MA72-41	Unnamed tributary to the Charles River, outlet Lymans Pond, Dover to mouth at confluence with the Charles River, Dover.	Escherichia Coli (E. Coli)
Charles: Unnamed Tributary	MA72-42	Unnamed tributary to the Charles River, from outlet unnamed pond north of South Street, Natick to mouth at confluence with the Charles River, Natick.	Benthic Macroinvertebrates
Charles: Unnamed Tributary	MA72-43	Unnamed tributary to Morses Pond, headwaters outlet Reeds Pond, Wellesley to mouth at confluence with Morses Pond, Wellesley.	Escherichia Coli (E. Coli)

Charles: Unnamed Tributary	MA72-47	Headwaters west of Forbes Road, Lexington to mouth at confluence with Hobbs Brook, Lincoln.	Chloride
Charles: Unnamed Tributary	MA72-48	Headwaters northeast of the Trapelo Road/Smith Street intersection, Waltham to mouth at inlet Cambridge Reservoir, Lexington.	Chloride
Charles: Waban Brook	MA72-17	Headwaters, outlet Lake Waban, Wellesley to mouth at confluence with the Charles River, Wellesley.	Temperature
Charles: Walker Pond	MA72126	Millis.	--
Charles: Waseeka Sanctuary Pond	MA72155	Holliston.	--
Charles: Weld Pond	MA72131	Dedham.	--
Charles: Weston Reservoir	MA72134	Weston.	--
Charles: Weston Station Pond	MA72135	Weston.	--

ATTACHMENT 3

Clean Water Act Residual Designation Determination for Certain Stormwater Discharges in the Charles, Mystic, and Neponset River Watersheds, in Massachusetts

Mystic River Watershed Impairments Based on Final Massachusetts Integrated List of Waters for the Clean Water Act 2018/2020 Reporting Cycle

Waterbody	AU_ID	Description	Impairment
Boston Harbor: Mystic: Aberjona River	MA71-01	Source just south of Birch Meadow Drive, Reading to inlet Upper Mystic Lake at Mystic Valley Parkway, Winchester (portion culverted underground). (through former 2010 segments: Judkins Pond MA71021 and Mill Pond MA71031).	(Physical substrate habitat alterations*); Ammonia, Un-ionized; Arsenic; Arsenic in Sediment; Benthic Macroinvertebrates; Chloride; Dissolved Oxygen; Escherichia Coli (E. Coli); Fish Bioassessments; Phosphorus, Total; Sediment Bioassay [Chronic Toxicity Freshwater]
Boston Harbor: Mystic: Alewife Brook	MA71-20	From emergence north of Cambridgepark Drive, Cambridge to mouth at confluence with Mystic River, Arlington/Somerville (formerly part of 2016 segment: Alewife Brook MA71-04).	(Debris*); (Water Chestnut*); Chloride; Copper; Copper in Sediment; Dissolved Oxygen; Escherichia Coli (E. Coli); Flocculant Masses; Lead; Lead in Sediment; Odor; Oil and Grease; PCBs in Fish Tissue; Phosphorus, Total; Scum/Foam; Sediment Bioassay [Chronic Toxicity Freshwater]; Transparency / Clarity; Trash
Boston Harbor: Mystic: Belle Isle Inlet	MA71-14	From tidegate at Bennington Street, Boston/Revere to confluence with Winthrop Bay, Boston/Winthrop.	Cause Unknown [Contaminants in Fish and/or Shellfish]; Fecal Coliform; PCBs in Fish Tissue
Boston Harbor: Mystic: Bellevue Pond	MA71004	Medford.	--
Boston Harbor: Mystic: Blacks Nook	MA71005	Cambridge.	(Non-Native Aquatic Plants*); (Water Chestnut*); Nutrient/Eutrophication Biological Indicators; Transparency / Clarity

Boston Harbor: Mystic: Chelsea River	MA71-06	From confluence with Mill Creek, Chelsea/Revere to confluence with Boston Inner Harbor, Chelsea/East Boston.	(Debris*); Ammonia, Un-ionized; Cause Unknown [Contaminants in Fish and/or Shellfish; Sediment Screening Value (Exceedance)]; Dissolved Oxygen; Fecal Coliform; Odor; PCBs in Fish Tissue; Petroleum Hydrocarbons; Trash; Turbidity
Boston Harbor: Mystic: Clay Pit Pond	MA71011	Belmont.	Chlordane in Fish Tissue
Boston Harbor: Mystic: Cummings Brook	MA71-10	Headwaters east of Wright Street, Woburn to confluence with Fowle Brook, Woburn.	Escherichia Coli (E. Coli)
Boston Harbor: Mystic: Ell Pond	MA71014	Melrose.	Chlorophyll-a; Fecal Coliform; Harmful Algal Blooms; Phosphorus, Total; Total Suspended Solids (TSS); Transparency / Clarity
Boston Harbor: Mystic: Fellsmere Pond	MA71016	Malden.	Harmful Algal Blooms
Boston Harbor: Mystic: Hills Pond	MA71018	Arlington.	(Eurasian Water Milfoil, Myriophyllum Spicatum*)
Boston Harbor: Mystic: Horn Pond	MA71019	Woburn.	(Curly-leaf Pondweed*); (Fish Passage Barrier*); (Non-Native Aquatic Plants*); DDT in Fish Tissue; Dissolved Oxygen; Harmful Algal Blooms; Phosphorus, Total
Boston Harbor: Mystic: Little Pond	MA71024	Belmont.	(Water Chestnut*); Harmful Algal Blooms
Boston Harbor: Mystic: Little River	MA71-21	Headwaters, outlet Little Pond, Belmont to MWRA CSO outfall (MWR003) approximately 150 feet upstream of mouth at the confluence with Alewife Brook, Cambridge (formerly part of 2016 segment: Alewife Brook MA71-04).	(Debris*); (Water Chestnut*); Chloride; Copper; Copper in Sediment; Dissolved Oxygen; Escherichia Coli (E. Coli); Flocculant Masses; Lead; Lead in Sediment; Odor; Oil and Grease; PCBs in Fish Tissue; Phosphorus, Total; Scum/Foam; Sediment Bioassay; Transparency / Clarity; Trash
Boston Harbor: Mystic: Little River	MA71-22	From MWRA CSO outfall (MWR003, approximately 150 feet upstream of mouth), Cambridge to mouth at confluence with Alewife Brook, Cambridge (formerly part of 2016 segment: Alewife Brook MA71-04).	(Debris*); Copper; Copper in Sediment; Dissolved Oxygen; Escherichia Coli (E. Coli); Flocculant Masses; Lead; Lead in Sediment; Odor; Oil and Grease; PCBs in Fish Tissue; Phosphorus, Total; Scum/Foam; Sediment Bioassay; Transparency / Clarity; Trash

Boston Harbor: Mystic: Lower Mystic Lake	MA71027	Arlington/Medford.	DDT in Fish Tissue; Dissolved Oxygen; Hydrogen Sulfide; PCBs in Fish Tissue; Salinity; Sediment Bioassay [Chronic Toxicity Freshwater]
Boston Harbor: Mystic: Malden River	MA71-05	From culverted portion south of Charles Street, Malden to confluence with Mystic River, Everett/Medford.	(Debris*); (Water Chestnut*); Chlordane in Fish Tissue; DDT in Fish Tissue; Dissolved Oxygen; Dissolved Oxygen Supersaturation; Escherichia Coli (E. Coli); Fecal Coliform; Flocculant Masses; Odor; Oil and Grease; PCBs in Fish Tissue; pH, High; Phosphorus, Total; Scum/Foam; Sediment Bioassay [Chronic Toxicity Freshwater]; Temperature; Total Suspended Solids (TSS); Transparency / Clarity; Trash
Boston Harbor: Mystic: Mill Brook	MA71-07	Headwaters south of Massachusetts Avenue, Lexington to inlet of Lower Mystic Lake, Arlington (portions culverted underground).	(Physical substrate habitat alterations*); Benthic Macroinvertebrates; Escherichia Coli (E. Coli)
Boston Harbor: Mystic: Mill Creek	MA71-08	From Route 1, Chelsea/Revere to confluence with Chelsea River, Chelsea/Revere.	Cause Unknown [Contaminants in Fish and/or Shellfish]; Fecal Coliform; PCBs in Fish Tissue
Boston Harbor: Mystic: Munroe Brook	MA71-15	Headwaters, north of Solomon Pierce Road, Lexington to the mouth at inlet Arlington Reservoir, Lexington (includes culverted portion).	Escherichia Coli (E. Coli)
Boston Harbor: Mystic: Mystic River	MA71-02	Outlet Lower Mystic Lake, Arlington/Medford to Amelia Earhart Dam, Somerville/Everett.	(Eurasian Water Milfoil, Myriophyllum Spicatum*); (Fish Passage Barrier*); (Non-Native Aquatic Plants*); (Water Chestnut*); Arsenic; Chlordane in Fish Tissue; Chlorophyll-a; DDT in Fish Tissue; Dissolved Oxygen; Dissolved Oxygen Supersaturation; Escherichia Coli (E. Coli); PCBs in Fish Tissue; pH, High; Phosphorus, Total; Sediment Bioassay [Chronic Toxicity Freshwater]; Transparency / Clarity

Boston Harbor: Mystic: Mystic River	MA71-03	Amelia Earhart Dam, Somerville/Everett to confluence with Boston Inner Harbor, Chelsea/Charlestown (Includes Island End River).	Ammonia, Un-ionized; Cause Unknown [Contaminants in Fish and/or Shellfish; Sediment Screening Value (Exceedance)]; Dissolved Oxygen; Fecal Coliform; Flocculant Masses; Nutrient/Eutrophication Biological Indicators; Odor; Oil and Grease; PCBs in Fish Tissue; Petroleum Hydrocarbons; Scum/Foam
Boston Harbor: Mystic: Pond Brook	MA71-16	Headwaters, outlet Horn Pond, Woburn to mouth at inlet Wedge Pond, Winchester.	(Fish Passage Barrier*); Benthic Macroinvertebrates
Boston Harbor: Mystic: Sales Creek	MA71-12	Headwaters near Route 145, Revere to Bennington Street tidegate/confluence with Belle Isle Inlet, Boston/Revere.	--
Boston Harbor: Mystic: Shaker Glen Brook	MA71-11	Headwaters, west of Dix Road Extention, Woburn to confluence with Fowle Brook, Woburn (portion culverted underground).	Escherichia Coli (E. Coli)
Boston Harbor: Mystic: Spot Pond	MA71039	Stoneham/Medford.	--
Boston Harbor: Mystic: Spot Pond Brook	MA71-17	Headwaters outlet Spot Pond, Stoneham to mouth at confluence with Malden River, south of Charles Street, Malden (approximately 55% culverted).	--
Boston Harbor: Mystic: Spy Pond	MA71040	Arlington.	(Curly-leaf Pondweed*); (Eurasian Water Milfoil, Myriophyllum Spicatum*); (Water Chestnut*); Chlordane in Fish Tissue; DDT in Fish Tissue; Dissolved Oxygen; Harmful Algal Blooms; Phosphorus, Total
Boston Harbor: Mystic: Unnamed Tributary	MA71-13	Unnamed tributary locally known as 'Meetinghouse Brook', from emergence south of Route 16/east of Winthrop Street, Medford to confluence with the Mystic River, Medford. (brook not apparent on 1985 Boston North USGS quad - 2005 orthophotos used to delineate stream).	Escherichia Coli (E. Coli)

Boston Harbor: Mystic: Unnamed Tributary	MA71-19	Unnamed tributary to Little River (locally known as 'Wellington Brook'), headwaters south of Trapelo Road, Belmont to inlet Claypit Pond, Belmont (portions culverted underground) (1893 Boston USGS quad used to delineate stream).	Benthic Macroinvertebrates
Boston Harbor: Mystic: Upper Mystic Lake	MA71043	Winchester/Arlington/Medford.	(Curly-leaf Pondweed*); (Non-Native Aquatic Plants*); Dissolved Oxygen; Dissolved Oxygen Supersaturation; Enterococcus
Boston Harbor: Mystic: Wedge Pond	MA71045	Winchester.	Dissolved Oxygen; Harmful Algal Blooms; Phosphorus, Total
Boston Harbor: Mystic: Winn Brook	MA71-09	Headwaters near Juniper Road and the Belmont Hill School, Belmont to confluence with Little Pond, Belmont (portions culverted underground).	(Physical substrate habitat alterations*); Escherichia Coli (E. Coli)
Boston Harbor: Mystic: Winter Pond	MA71047	Winchester.	(Non-Native Aquatic Plants*); Nutrient/Eutrophication Biological Indicators

ATTACHMENT 4

Clean Water Act Residual Designation Determination for Certain Stormwater Discharges in the Charles, Mystic, and Neponset River Watersheds, in Massachusetts

Mystic River Watershed Impairments Based on Final Massachusetts Integrated List of Waters for the Clean Water Act 2018/2020 Reporting Cycle

Waterbody	AU_ID	Description	Impairment
Boston Harbor: Neponset: Beaver Brook	MA73-19	Headwaters (perennial portion), near Moose Hill Street, Sharon through Sawmill Pond to mouth at confluence with Massapoag Brook, Sharon.	Benthic Macroinvertebrates; Dissolved Oxygen
Boston Harbor: Neponset: Beaver Meadow Brook	MA73-20	Headwaters, outlet of Glenn Echo Pond, Stoughton, to mouth at inlet of Bolivar Pond, Canton.	Dissolved Oxygen; Escherichia Coli (E. Coli)
Boston Harbor: Neponset: Billings Street/East Street Pond	MA73065	Sharon.	(Non-Native Aquatic Plants*)
Boston Harbor: Neponset: Blue Hills Reservoir	MA73004	Quincy.	--
Boston Harbor: Neponset: Bolivar Pond	MA73005	Canton.	(Fanwort*); (Non-Native Aquatic Plants*); Turbidity
Boston Harbor: Neponset: Bubbling Brook	MA73-11	Headwaters (perennial portion), near North Street, Walpole to mouth at inlet Pettee Pond, Walpole/Westwood border.	Benthic Macroinvertebrates; Fish Bioassessments
Boston Harbor: Neponset: Buckmaster Pond	MA73006	Westwood.	--
Boston Harbor: Neponset: Clark Pond	MA73008	Walpole.	(Non-Native Aquatic Plants*); (Water Chestnut*)

Boston Harbor: Neponset: Cobbs Pond	MA73009	Walpole.	(Non-Native Aquatic Plants*); Dissolved Oxygen; Nutrient/Eutrophication Biological Indicators; Transparency / Clarity
Boston Harbor: Neponset: East Branch	MA73-05	East Branch Neponset River - Headwaters, outlet of Forge Pond, Canton through East Branch Pond to mouth at confluence with Neponset River, Canton (locally known as Canton River).	(Dewatering*); (Flow Regime Modification*); Benthic Macroinvertebrates; DDT in Fish Tissue; Dissolved Oxygen; Escherichia Coli (E. Coli); Fecal Coliform; Metals; PCBs in Fish Tissue; Temperature; Unspecified Metals in Sediment
Boston Harbor: Neponset: Ellis Pond	MA73018	Norwood.	(Fanwort*); (Non-Native Aquatic Plants*)
Boston Harbor: Neponset: Farrington Pond	MA73040	Stoughton.	(Non-Native Aquatic Plants*)
Boston Harbor: Neponset: Flynns Pond	MA73019	Medfield.	--
Boston Harbor: Neponset: Forge Pond	MA73020	Canton.	Turbidity
Boston Harbor: Neponset: Ganawatte Farm Pond	MA73037	Walpole/Sharon/Foxborough.	Aquatic Plants (Macrophytes); Dissolved Oxygen; Transparency / Clarity
Boston Harbor: Neponset: Germany Brook	MA73-15	Headwaters, east of Winter Street, Norwood to inlet of Ellis Pond, Norwood.	Escherichia Coli (E. Coli); Fecal Coliform; pH, High; Phosphorus, Total
Boston Harbor: Neponset: Glen Echo Pond	MA73022	Canton/Stoughton.	(Non-Native Aquatic Plants*)
Boston Harbor: Neponset: Gulliver Creek	MA73-30	From confluence Unquity Brook, Milton to confluence Neponset River, Milton (Note: Unquity Brook culverted, confluence not visible on quad).	Cause Unknown [Contaminants in Fish and/or Shellfish]; Fecal Coliform; PCBs in Fish Tissue
Boston Harbor: Neponset: Hammer Shop Pond	MA73023	Sharon.	--

Boston Harbor: Neponset: Hawes Brook	MA73-16	Headwaters, outlet of Ellis Pond, Norwood to mouth at confluence with Neponset River, Norwood.	Escherichia Coli (E. Coli); Fecal Coliform; Odor
Boston Harbor: Neponset: Jewells Pond	MA73026	Medfield.	(Non-Native Aquatic Plants*)
Boston Harbor: Neponset: Lymans Pond	MA73021	Westwood.	--
Boston Harbor: Neponset: Massapoag Brook	MA73-21	Headwaters, outlet Hammer Shop Pond, Sharon to mouth at inlet Forge Pond, Canton (through former 2010 segment: Manns Pond MA73028).	(Curly-leaf Pondweed*); (Fanwort*); (Non-Native Aquatic Plants*); Benthic Macroinvertebrates; Phosphorus, Total
Boston Harbor: Neponset: Massapoag Lake	MA73030	Sharon.	(Non-Native Aquatic Plants*); Mercury in Fish Tissue
Boston Harbor: Neponset: Memorial Pond	MA73012	Walpole.	Aquatic Plants (Macrophytes); Turbidity
Boston Harbor: Neponset: Mill Brook	MA73-08	From headwaters (perennial portion) north of Hartford Street, Medfield to mouth at inlet of Jewells Pond, Medfield.	(Dewatering*); Benthic Macroinvertebrates; Dissolved Oxygen; Temperature
Boston Harbor: Neponset: Mill Brook	MA73-12	Source northeast of Ledgewood Drive, Dover to inlet of Pettee Pond, Westwood.	--
Boston Harbor: Neponset: Mine Brook	MA73-09	Headwaters, outlet of Jewells Pond, Medfield, to the inlet of Turner Pond, Walpole.	Dissolved Oxygen
Boston Harbor: Neponset: Mother Brook	MA73-28	Headwaters at the Charles River Diversion control structure, Dedham to mouth at confluence with Neponset River, Boston [Reported as MA72-13 until May 3, 2000].	(Debris*); (Dewatering*); (Flow Regime Modification*); Color; DDT in Fish Tissue; Dissolved Oxygen; Escherichia Coli (E. Coli); Fecal Coliform; Mercury in Fish Tissue; Odor; PCBs in Fish Tissue; Phosphorus, Total; Trash

Boston Harbor: Neponset: Neponset Reservoir	MA73034	Foxborough.	(Fanwort*); (Non-Native Aquatic Plants*); Algae; Turbidity
Boston Harbor: Neponset: Neponset River	MA73-01	Outlet of Neponset Reservoir, Foxborough to confluence with East Branch, Canton (through former 2010 segments: Crackrock Pond MA73010 and Bird Pond MA73002) (HQW qualifer applies upstream of Crackrock Pond Dam (NATID: MA00816)) (SARIS note: the upper portion of segment between Neponset Reservoir Dam	(Curly-leaf Pondweed*); (Fish Passage Barrier*); (Non-Native Aquatic Plants*); Cadmium; DDT in Fish Tissue; Dissolved Oxygen; Escherichia Coli (E. Coli); Metals; Nutrient/Eutrophication Biological Indicators; PCBs in Fish Tissue; Phosphorus, Total; Unspecified Metals in Sediment
Boston Harbor: Neponset: Neponset River	MA73-02	Confluence with East Branch, Canton to confluence with Mother Brook, Boston.	(Debris*); (Fish Passage Barrier*); DDT in Fish Tissue; Dissolved Oxygen; Escherichia Coli (E. Coli); Fecal Coliform; Flocculant Masses; Metals; Oil and Grease; PCBs in Fish Tissue; Scum/Foam; Trash; Turbidity; Unspecified Metals in Sediment
Boston Harbor: Neponset: Neponset River	MA73-03	Confluence with Mother Brook, Boston to Neponset River Baker Chocolate Dam (NATID: MA01093), Milton/Boston.	(Curly-leaf Pondweed*); (Debris*); (Fish Passage Barrier*); DDT in Fish Tissue; Dissolved Oxygen; Enterococcus; Escherichia Coli (E. Coli); Fecal Coliform; Flocculant Masses; Metals; Oil and Grease; PCBs in Fish Tissue; PCBs in Sediment; Polychlorinated Biphenyls (PCBs); Scum/Foam; Trash; Unspecified Metals in Sediment
Boston Harbor: Neponset: Neponset River	MA73-04	Milton Lower Falls Dam (Neponset River Baker Chocolate Dam, NAT ID: MA01093), Milton/Boston to mouth at Dorchester Bay, Boston/Quincy.	(Debris*); Cause Unknown [Contaminants in Fish and/or Shellfish]; Dissolved Oxygen; Enterococcus; Fecal Coliform; PCBs in Fish Tissue; Trash; Turbidity
Boston Harbor: Neponset: Pecunit Brook	MA73-25	Headwaters east of Carey Circle and west of Pecunit Street, Canton to mouth at confluence with Neponset River, Canton.	Benthic Macroinvertebrates; Escherichia Coli (E. Coli)

Boston Harbor: Neponset: Pequid Brook	MA73-22	Headwaters east of York Street, Canton to mouth at inlet of Forge Pond, Canton (excluding the approximately 1.3 miles through Reservoir Pond, segment MA73048).	Dissolved Oxygen
Boston Harbor: Neponset: Pettee Pond	MA73036	Walpole/Westwood.	Mercury in Fish Tissue
Boston Harbor: Neponset: Pine Tree Brook	MA73-29	Headwaters, outlet Hillside Pond, Milton to mouth at confluence with the Neponset River, Milton (through former 2010 segment: Pope's Pond MA73044).	(Physical substrate habitat alterations*); Aquatic Plants (Macrophytes); Dissolved Oxygen; Escherichia Coli (E. Coli); Fecal Coliform; Turbidity
Boston Harbor: Neponset: Pinewood Pond	MA73039	Stoughton.	(Aquatic Plants (Macrophytes)*); (Non-Native Aquatic Plants*)
Boston Harbor: Neponset: Plantingfield Brook	MA73-23	Headwaters east of Thatcher Street, Westwood, to mouth at confluence with Purgatory Brook, Norwood (portion culverted).	(Dewatering*); Escherichia Coli (E. Coli)
Boston Harbor: Neponset: Ponkapoag Pond	MA73043	Canton/Randolph.	(Eurasian Water Milfoil, Myriophyllum Spicatum*); (Fanwort*); (Non-Native Aquatic Plants*); Mercury in Fish Tissue
Boston Harbor: Neponset: Ponkapog Brook	MA73-27	Headwaters, outlet of Ponkapoag Pond, Canton to confluence with Neponset River, Canton.	Escherichia Coli (E. Coli); Fecal Coliform
Boston Harbor: Neponset: Purgatory Brook	MA73-24	Headwaters east of Farm Lane, Westwood to confluence with Neponset River, Norwood.	(Debris*); Escherichia Coli (E. Coli); Fecal Coliform; Trash
Boston Harbor: Neponset: Reservoir Pond	MA73048	Canton.	(Eurasian Water Milfoil, Myriophyllum Spicatum*); (Fanwort*); (Non-Native Aquatic Plants*); Mercury in Fish Tissue
Boston Harbor: Neponset: Russell Pond	MA73003	Milton.	(Curly-leaf Pondweed*); (Non-Native Aquatic Plants*); Turbidity

Boston Harbor: Neponset: Sprague Pond	MA73053	Boston/Dedham.	--
Boston Harbor: Neponset: Steep Hill Brook	MA73-18	Headwaters, outlet of Pinewood Pond, Stoughton, to mouth at inlet of Bolivar Pond, Canton.	Escherichia Coli (E. Coli)
Boston Harbor: Neponset: Town Pond	MA73056	Stoughton.	(Fanwort*); (Non-Native Aquatic Plants*)
Boston Harbor: Neponset: Tubwreck Brook	MA73-07	Headwaters - small unnamed pond southeast of Powissett Street, Dover to confluence with Mill Brook just southwest of Dover/Medfield border.	--
Boston Harbor: Neponset: Turner Pond	MA73058	Walpole.	(Fanwort*); (Non-Native Aquatic Plants*)
Boston Harbor: Neponset: Turners Pond	MA73059	Milton.	Dissolved Oxygen; Nutrient/Eutrophication Biological Indicators; Turbidity
Boston Harbor: Neponset: Unnamed Tributary	MA73-10	Headwaters, outlet Turner Pond, Walpole to confluence with Neponset River, Walpole.	--
Boston Harbor: Neponset: Unnamed Tributary	MA73-14	Headwaters, outlet Willet Pond, Walpole/Norwood, to inlet Ellis Pond, Norwood.	--
Boston Harbor: Neponset: Unnamed Tributary	MA73-31	Headwaters, outlet of Massapoag Lake, Sharon to mouth at inlet of Hammer Shop Pond, Sharon (not depicted on 1987 Mansfield USGS quad).	Fecal Coliform
Boston Harbor: Neponset: Unnamed Tributary	MA73-32	From the outlet of Town Pond, Stoughton to mouth at confluence with Steep Hill Brook, Stoughton.	Benthic Macroinvertebrates; Escherichia Coli (E. Coli); pH, Low; Phosphorus, Total

Boston Harbor: Neponset: Unnamed Tributary	MA73-33	Locally known as "Meadow Brook" - From where the underground/culverted stream emerges east of Pleasant Street, Norwood to confluence with Neponset River, Norwood.	Benthic Macroinvertebrates; Escherichia Coli (E. Coli); Phosphorus, Total
Boston Harbor: Neponset: Unnamed Tributary	MA73-34	Headwaters, outlet Clark Pond, Walpole to confluence with Neponset River, Walpole (locally considered part of Spring Brook) (excluding the approximately 0.2 miles through Diamond Pond and the approximately 0.2 miles through Memorial Pond segment MA73012).	(Debris*); Benthic Macroinvertebrates; Trash
Boston Harbor: Neponset: Unnamed Tributary	MA73-35	Unnamed tributary to Beaver Brook, headwaters outlet small unnamed pond east of Moose Hill Street, Sharon to mouth at confluence with Beaver Brook, Sharon.	--
Boston Harbor: Neponset: Unquity Brook	MA73-26	Isolated (urban): Headwaters (perennial portion) near Randolph Avenue, Milton to mouth at confluence with Gulliver Creek, Milton (Note: culverted portions of segment total approximately 1/3 of segment length, or 0.5 miles).	(Dewatering*); (Physical substrate habitat alterations*); Dissolved Oxygen; Escherichia Coli (E. Coli); Fecal Coliform; Fish Bioassessments; pH, Low; Phosphorus, Total; Sedimentation/Siltation
Boston Harbor: Neponset: Willet Pond	MA73062	Walpole/Westwood/Norwood (at northern end, includes former 2008 segment: Unnamed Tributary MA73-13).	Mercury in Fish Tissue
Boston Harbor: Neponset: Woods Pond	MA73055	Stoughton.	(Non-Native Aquatic Plants*)

ATTACHMENT 5

Clean Water Act Residual Designation Determination for Certain Stormwater Discharges in the Charles, Mystic, and Neponset River Watersheds, in Massachusetts

Watershed Maps Including Communities with EJ Concerns

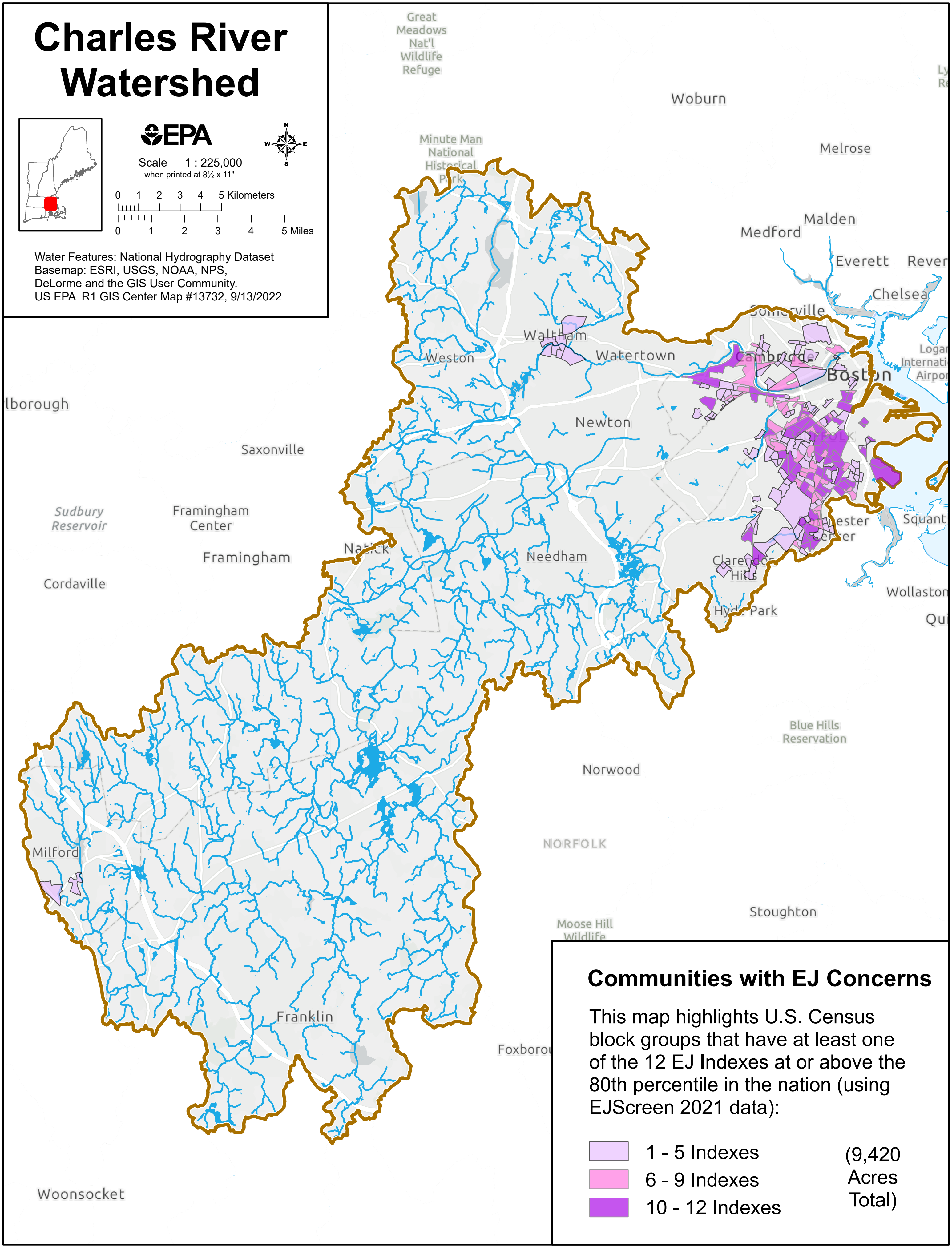
Charles River Watershed

EPA

Scale 1 : 225,000
when printed at 8½ x 11"

0 1 2 3 4 5 Kilometers
0 1 2 3 4 5 Miles

Water Features: National Hydrography Dataset
Basemap: ESRI, USGS, NOAA, NPS,
DeLorme and the GIS User Community.
US EPA R1 GIS Center Map #13732, 9/13/2022

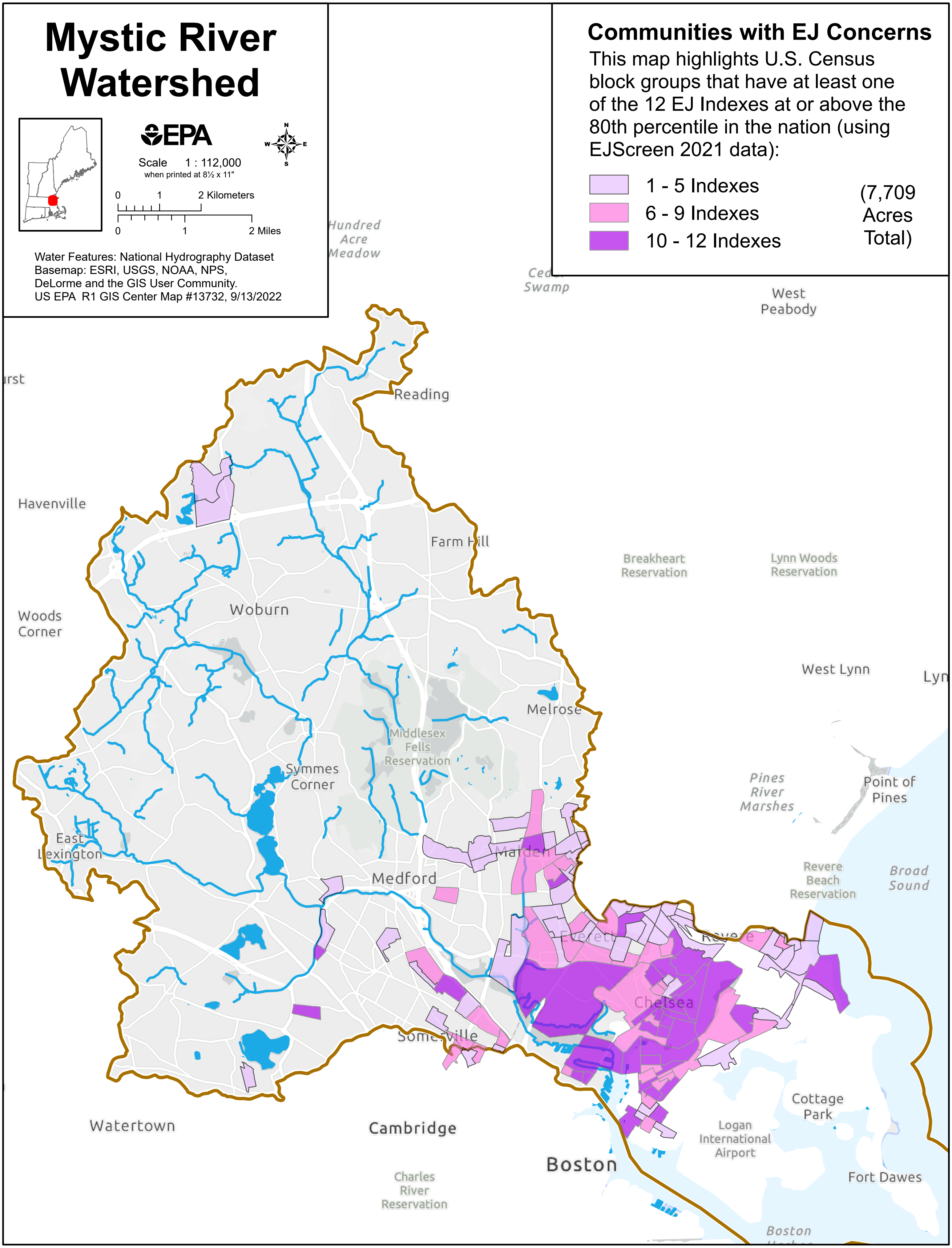


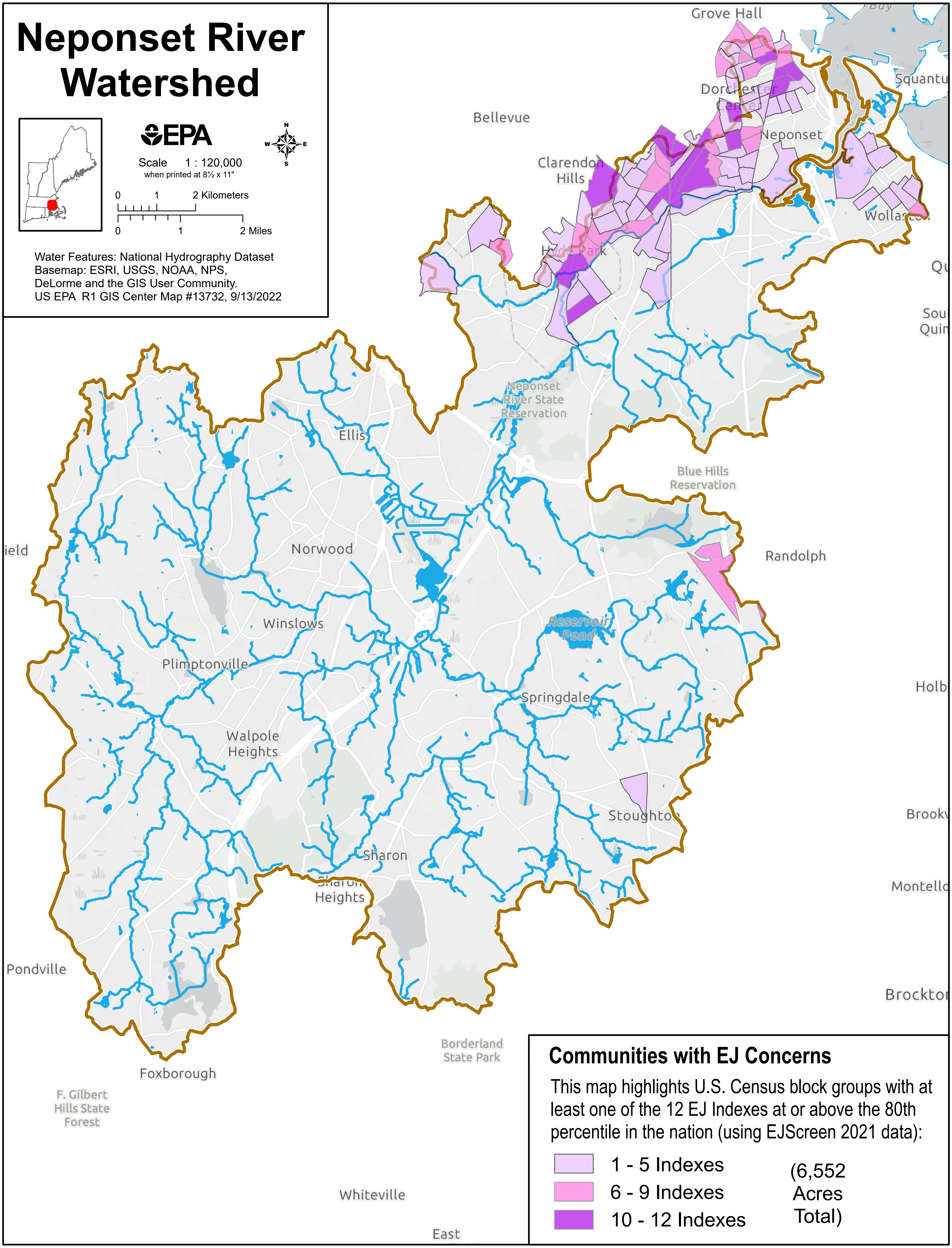
Communities with EJ Concerns

This map highlights U.S. Census block groups that have at least one of the 12 EJ Indexes at or above the 80th percentile in the nation (using EJScreen 2021 data):

- 1 - 5 Indexes
- 6 - 9 Indexes
- 10 - 12 Indexes

(9,420 Acres Total)


Mystic River Watershed
EPA
Scale 1 : 112,000
when printed at 8½ x 11"
0 1 2 Kilometers
0 1 2 Miles
N
W
E
S
Water Features: National Hydrography Dataset
Basemap: ESRI, USGS, NOAA, NPS,
DeLorme and the GIS User Community.
US EPA R1 GIS Center Map #13732, 9/13/2022
Communities with EJ Concerns
This map highlights U.S. Census block groups that have at least one of the 12 EJ Indexes at or above the 80th percentile in the nation (using EJScreen 2021 data):
1 - 5 Indexes
6 - 9 Indexes
10 - 12 Indexes
(7,709 Acres Total)
Hundred Acre Meadow
West Peabody
Reading
Havenville
Farm Hill
Breakheart Reservation
Lynn Woods Reservation
Woods Corner
Woburn
West Lynn
Melrose
Middlesex Fells Reservation
Symmes Corner
Pines River Marshes
Point of Pines
East Lexington
Malden
Medford
Revere Beach Reservation
Broad Sound
Everett
Revere
Chelsea
Somerville
Cottage Park
Watertown
Cambridge
Logan International Airport
Boston
Charles River Reservation
Fort Dawes


Neponset River Watershed
EPA
Scale 1 : 120,000
when printed at 8½ x 11"
0 1 2 Kilometers
0 1 2 Miles
N
W
E
S
Water Features: National Hydrography Dataset
Basemap: ESRI, USGS, NOAA, NPS,
DeLorme and the GIS User Community.
US EPA R1 GIS Center Map #13732, 9/13/2022
Grove Hall
Squantu
Dorchester Center
Bellevue
Neponset
Clarendon Hills
Wollaston
Hyde Park
Qu
Sou Quin
Neponset River State Reservation
Ellis
Blue Hills Reservation
ield
Norwood
Randolph
Winslows
Reservoir Pond
Plimptonville
Holb
Springdale
Walpole Heights
Stoughton
Brook
Sharon
Montello
Sharon Heights
Pondville
Brockton
Borderland State Park
Foxborough
F. Gilbert Hills State Forest
Whiteville
East
Communities with EJ Concerns
This map highlights U.S. Census block groups with at least one of the 12 EJ Indexes at or above the 80th percentile in the nation (using EJScreen 2021 data):
1 - 5 Indexes
6 - 9 Indexes
10 - 12 Indexes
(6,552 Acres Total)

ATTACHMENT 6

Clean Water Act Residual Designation Determination for Certain Stormwater Discharges in the Charles, Mystic, and Neponset River Watersheds, in Massachusetts

Charles River Watershed Stormwater Total Phosphorus Analysis

I. INTRODUCTION

On May 19, 2019, the Conservation Law Foundation (CLF) and the Charles River Watershed Association (CRWA) petitioned EPA to use its Clean Water Act residual designation authority to designate commercial, industrial, institutional, and multi-family residential properties greater than 1 acre in size in the Charles River Watershed (CRW) as needing National Pollutant Discharge Elimination System (NPDES) permits for stormwater discharges that significantly contribute pollutants to waters of the U.S., contribute to water quality standards violations, and/or that need to be controlled in order to meet Total Maximum Daily Load (TMDL) wasteload allocations (WLAs). EPA then undertook an analysis to quantify the total phosphorus (TP) loading from all private properties in the CRW. The goal of this analysis was to determine whether stormwater discharges from private properties were contributing to violations of water quality standards in the Charles River and required NPDES permit coverage. In addition, this analysis set out to identify which land use classes were contributing the most phosphorus to the Charles River through stormwater and to identify and evaluate options for maximizing phosphorus reductions efficiently (i.e., fewest stormwater controls installed). The results of the analysis can be used to better understand the potential magnitude of impact on TP loads from private properties, as well as understand the TP reductions in the CRW necessary to meet water quality standards that would result from designation and permitting actions. As described below, the analysis resulted in the following broad conclusions:

1. Private properties in the CRW generate approximately 50,738 pounds of TP per year from stormwater, which is 58% of the baseline TP load from stormwater sources identified in the Charles River TMDLs.
2. Without stormwater controls on some private properties in the CRW, the burden of phosphorus reduction falls completely on municipalities and this burden makes achieving the TMDL goals and water quality standards in the Charles River unlikely if not infeasible.
3. The greater the percent impervious cover (IC) on a property, the greater the mass load of phosphorus in stormwater from that property compared to other properties of similar size.
4. Of private properties in the CRW, commercial, industrial, and institutional classifications have the highest percentage of impervious cover per property.
5. Over 50% of the IC in the CRW is located on a subset of commercial, industrial, institutional, and multi-family residential properties, all of which contain greater than 1 acre of IC.
6. The most efficient way to reduce TP discharges from private properties is to target stormwater controls on properties based on the amount of IC on the properties (which is proportional to the amount of TP generated) and based on property types (which also affects amount of TP

generated), thereby maximizing TP reduction while minimizing the number of properties installing controls.

II. METHODS

To quantify TP loads in stormwater derived from private properties within the CRW, the first step was to identify the private properties within the watershed, identify the land use of each property, and calculate the area of IC on each property. To accomplish this, the following data files were used:

- Files obtained from MassGIS:
  - **Municipal Boundaries Shapefile** – provides town name and town boundary
  - **Tax Assessors Parcels Shapefile** – provides location, parcel ID (Loc_ID), and area of each parcel (property)
  - **Assessors Table L3** – provides use code, site address, owner information, and year built
  - **Land Cover Land Use Shapefile** - provides land cover name and generalized use name
  - **Land Use Table L3** - provides type code and a code description
  - **UC Land Use Table L3** - provides use code and use code description
  - **2005 Impervious Cover Raster File** – provides location and area of 2005 IC
  - **2016 Impervious Cover Shapefile** – provides location and area of 2016 IC

- Files obtained from EPA:
  - **MS4 Boundary** – provides location and area covered under the MS4
  - **CRW Boundary** – provides location and area of the CRW
  - **CSA Boundary** – provides location and area of communities with Combined Sewer Systems (CSSs)

A Geographic Information System (GIS) model was used to create a data file that calculated the property area, the associated land use, and the amount of IC on each property in the watershed (USEPA, 2022). Extensive quality assurance and quality control was completed on the resulting dataset to ensure proper classification of property information and to correct any errors in the underlying dataset (USEPA, 2022).

From this data file, EPA identified or quantified the following for each individual property: size (acres), land use classification, ownership information, location, and area (acres) and percent of impervious cover, pervious cover, forest, and wetlands.

The dataset was then used to calculate the TP generated from each property in pounds per year using the Phosphorus Load Export Rates (PLERs) documented in the MA MS4 Permit. This parcel loading analysis was accomplished by applying stormwater PLERs to land surface areas with differing land use and cover types such as commercial, industrial, high-density residential uses with impervious cover (IC) and pervious grassed and landscaped cover (i.e., developed land pervious). The PLERs provide estimates of the average annual phosphorus load export delivered by untreated stormwater from areas with distinct cover and use types for the same climatic conditions as used in the development of the Charles River phosphorus TMDLs. In general, the amount of impervious cover on a property increases the volume of stormwater derived from that property or land use class, which increases the loading of pollutants found in stormwater, including phosphorus. (Shaver, Horner, Skupien, May, & Ridley, 2007) (Center For Watershed Protection, 2003) (Schueler, 2011) (Chen, Theller, Gitau, Engel, & Harbor, 2017). Multiplying the area of interest by the distinct PLER provides an estimate of the average annual phosphorus loading rate. For example, one (1) acre of impervious cover in commercial use is estimated to deliver 1.78 lbs of phosphorus per year (e.g., 1.0 acre of commercial IC X 1/78 lbs/acre/yr = 1.78 lb/yr). Attachment 1 to Appendix F of the 2016 Massachusetts MS4 Permit includes a detailed description of assigning PLERs to different land use classes in the CRW (USEPA, 2016) and this is also summarized in the MEMORANDUM- Charles River Watershed Private Parcel Analysis GIS Methods (USEPA, 2022). These specific PLERs create a comprehensive methodology for calculating phosphorus load reductions and increases based on land use information for projects and properties in the CRW. Table 1 below displays the land use classifications used in this analysis and the associated PLERs for impervious cover and pervious cover for the given land use. As seen in Table 1, the amount of phosphorus generated by a land use type increases with the increased human utilization of that land use. For instance, the forest land use has a phosphorus loading rate of 1.52 lb/acre/year of TP for impervious areas within the forested area, while Commercial areas have a phosphorus loading rate of 1.78 lb/acre/year of TP for impervious areas. In addition, as seen in Table 1, impervious cover generates up to, and in excess of, 10 times the annual phosphorus load compared to pervious areas on that same land use class due to the increase in stormwater generated by impervious cover compared to previous cover (USEPA, 2016). For a detailed description of PLER and land use classes used for this analysis see MEMORANDUM- Charles River Watershed Private Parcel Analysis GIS Methods (USEPA, 2022).

PLER Aggregate Land Use Category	**PLER Impervious Cover (lbs/acre/year)**	**PLER – Developed Land Pervious Area (e.g., landscaped area) (lbs/acre/year)**
Commercial/Industrial	1.78	0.207
Multi Family/High Density Residential	2.32	0.207
Single Family/Medium Density Residential	1.96	0.207
Forest/Agriculture	1.52	0.207

Table 1 : PLERs used to calculate annual phosphorus load from properties in the CRW. PLERs for Developed Land Pervious Area do not include forested or wetland areas

a. Limitations

This analysis used the Massachusetts Tax Assessors Database to assign land uses to properties and calculate impervious cover contained on each property. The Massachusetts Tax Assessors Database and the 2016 Impervious Cover Shapefile does not contain information for public roads, highways, and right of ways, and therefore, the analysis did not capture all the impervious cover and phosphorus loading from all land area in the CRW. However, this analysis focuses on total phosphorus load in stormwater from private properties, not from public parcels already regulated under the 2016 MA MS4 permit, the Boston Individual MS4 Permit, or to parcels owned or operated by the Massachusetts Department of Transportation already subject to an NPDES permit.

For the purposes of this analysis, EPA excluded privately owned roads and properties on the border of the watershed where less than 50% of the property is in the watershed. Applying this exclusion to the analysis resulted in less than 1% of the total land area (2.5 square miles) of the private properties in the CRW being omitted from the analysis (USEPA, 2022). Given the low number of missing properties in the dataset, it is not expected that the overall watershed loading analysis and comparison of phosphorus loading from different sources is impacted.

The analysis does not attempt to estimate or calculate the connectedness (i.e., how much stormwater is delivered directly to nearby waterbodies) of any property identified in the analysis. The values in Table 1 represent the delivery of phosphorus from an area that is directly connected to a waterbody or municipal stormwater system. In addition, the pervious annual phosphorus loading rate was set at the weighted average of pervious area estimated loading rate based on soil type distribution in the CRW. Given the significantly lower contribution of phosphorus from pervious areas (approximately 25% of the stormwater phosphorus load in the CRW (USEPA, 2016)) this value is meant to approximate the impact of pervious cover stormwater without having site specific soil type data. Therefore, all phosphorus loading estimates in the property analysis should be considered conservative for the property or land use classification identified. This removes assumptions necessary for stormwater delivery and focuses on phosphorus generated at the source on each property, allowing for a more direct comparison of potential magnitude of impact.

This analysis does not contain calculations of phosphorus export from public lands. Given the limitations contained in the 2016 Land Cover Dataset and Impervious Cover Dataset from MassGIS, accurate calculation of phosphorus loading from public lands (primarily roadways and rights-of-way) is not feasible. However, given this analysis focuses on phosphorus export stormwater from private properties, the exclusion of public land does not affect the analysis.

b. Other Relevant Information for this Analysis

Massachusetts Department of Environmental Protection (MassDEP) established two Total Maximum Daily Loads (TMDLs) for the CRW. On October 17, 2007, EPA approved the Final TMDL for Nutrients in the Lower Charles River Basin (Lower Charles TMDL) (Massachusetts Department of Environmental Protection , 2007) and on June 10, 2011 EPA approved the Total Maximum Daily Load for Nutrients in the Upper/Middle Charles River (Upper/Middle Charles TMDL) (Massachusetts Department of Environmental Protection, 2011). The Lower Charles TMDL and the Upper/Middle Charles TMDL baseline phosphorus load from stormwater sources was calculated at 87,432 pounds of total phosphorus per year. Both TMDLs set Waste Load Allocations (WLAs) that specify reductions for discharges of phosphorus throughout the entire CRW from publicly owned treatment works, combined sewer overflows and stormwater discharges. To meet TMDL goals, the more developed lands (Commercial, Industrial, and High and Medium Density Residential) need to reduce total phosphorus loads by 65% annually while the less developed, low density residential lands need to reduce total phosphorus loads by 45% annually. While the TMDLs did not consider land classified as “institutional” as its own category, this analysis included a 65% reduction requirement for this classification, which is consistent with the other similarly developed land use categories. The TMDLs set a watershed-wide stormwater phosphorus load reduction requirement of 47,347 pounds per year, bringing the overall phosphorus load from stormwater from a baseline of 87,432 pounds per year to an allowable load of

40,085 pounds per year of phosphorus from stormwater sources. Overall, the stormwater TP load reduction will need to come from multiple stormwater sources; this analysis does not attempt to partition this overall stormwater TP required reduction between private and public properties. The 47,347 pounds per year TP reduction is referenced in this analysis as the stormwater required TP reduction from all stormwater sources in the CRW.

III. RESULTS AND DISCUSSION

a. Current Charles River Watershed Characterization

Based on the analysis described above, EPA identified 196,645 properties in the CRW. These properties comprise a total of 166,703 acres or 84% of the entire watershed. These properties are primarily single family residential (36%), institutional (20%), commercial (10.5%), open land (8.6%), multi-family residential (5.4%) Industrial (2.6%) and Agricultural (1.2%) (Figure 1). The remaining 16% of the watershed is comprised of waterbodies, public roads, and rights-of-way without tax codes in the Tax Assessors Parcels Shapefile (indicated as "other" in Figure 1). Figure 2 displays a map of the Charles River Watershed and 2016 land use classifications. In total, the CRW is approximately 40% public land (Institutional Federal, Institutional State, Institutional Local, Open Land and "Other" land use categories) and 60% private land (all other land use categories displayed in Figure 1).

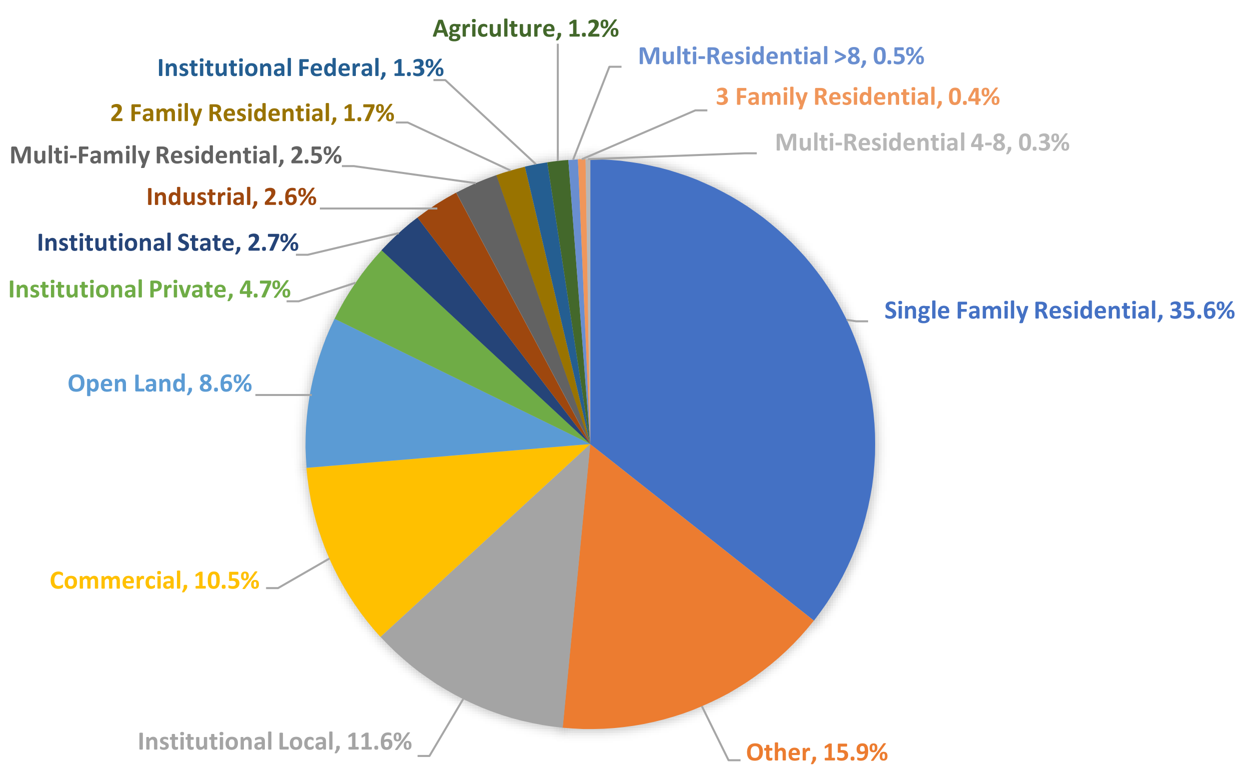


Figure 1: Acres of CRW Property by Classifications*

*The "Other" category accounts for land not in the property analysis, including waterbodies, public roads, and rights-of-way.

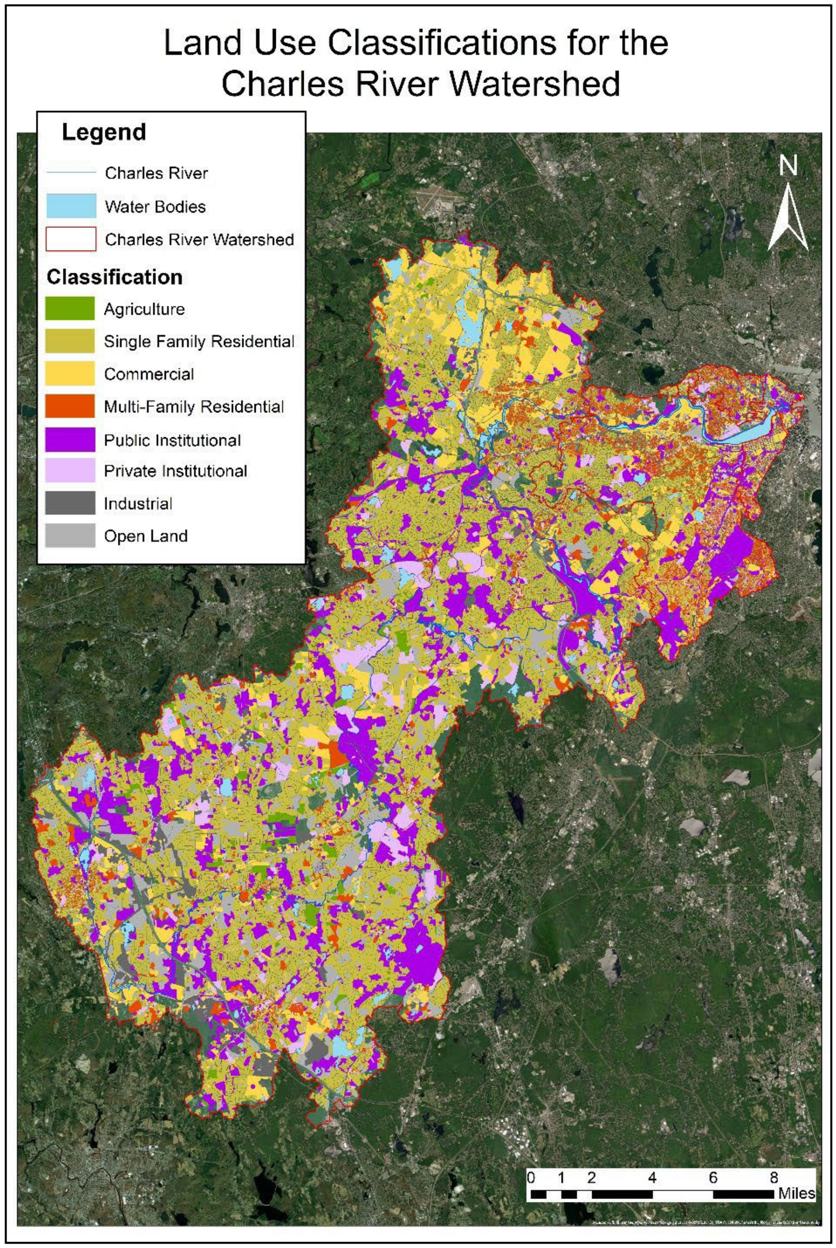


Figure 2: Land Use Classifications in the Charles River Watershed. Land Use data from MassGIS 2016 Land Cover Land Use Shapefile

b. Private Properties

Since stormwater discharges from most of the public land area (state and federal roads, public institutions, state and locally owned open space, etc.) in the CRW are currently regulated by the 2016 Massachusetts MS4 Permit, the Boston Individual MS4 Permit, or are on parcels owned or operated by the Massachusetts Department of Transportation already subject to an NPDES permit, this analysis focuses on phosphorus loads from private property including commercial, industrial, private institutional, single family residential, and multi-family residential properties.[1] In addition, there are 13,635 properties located in areas served by combined sewers; these properties were removed from this analysis as the stormwater is delivered to the Deer Island Wastewater Treatment Plant. Agricultural land was also excluded from the analysis due to the low number of properties (208) and relatively low phosphorus load compared to the other private property land uses (approximately 0.5% of the overall TP load). Therefore, this analysis focused on 166,489 private commercial, industrial, institutional, and residential properties in the CRW which comprise 114,298 acres (Table 2). As demonstrated in Table 1, the phosphorus loading rate of IC is approximately 10 times that of developed, pervious cover (e.g. for commercial/industrial the load is 1.78 lbs/acre/year for impervious vs 0.207 lbs/acre/year for pervious). Therefore, EPA's analysis of phosphorus load included a parcel-by-parcel calculation of the amount of IC land area and pervious land area. The appropriate PLERs (Impervious vs Pervious) were then applied on a parcel-by-parcel basis in accordance with its designated the land use (USEPA, 2022). From this parcel-by-parcel analysis, EPA determined that the stormwater runoff from private commercial, industrial, institutional, and residential properties identified in the analysis generate 50,738 pounds (43,787+6,951) of total phosphorus per year. In addition, EPA also determined that while impervious cover comprises about 20% of the total land area from these properties (22,424/114,298 acres), it actually contributes 86% of the total phosphorus load from these properties (43,787/50,738 lbs/year) (Table 2). While pervious areas, such as lawns and other various covers, generate stormwater runoff and contribute to the overall phosphorus loading, the load from these areas is much less than the load from impervious cover.

Classification	# Properties	Acres	IC Area (Acres)	% IC	IC TP Load (lbs/yr)	Pervious TP Load (lbs/yr)*	Average TP Load per Property (lbs/yr/property)
Commercial	9,548	20,120	5,657	28%	10,102	1,273	1.19
Industrial	1,000	5,016	1,468	29%	2,609	330	2.94
Institutional Private	4,255	8,986	1,412	16%	2,446	416	0.67
Multi-Family Residential	33,412	9,870	3,987	40%	9,223	428	0.29
Single Family Residential	118,274	70,307	9,900	14%	19,407	4,504	0.20
TOTAL	166,489	114,298	22,424		43,787	6,951	

Table 2: Private Properties

*Pervious load does not include TP loads from forest or wetland areas on private properties

[1] The GIS dataset contained several different designations for multi-family residential (see Figure 1). For this analysis, EPA combined all residential properties with two or more families into one category called "multi-family residential."

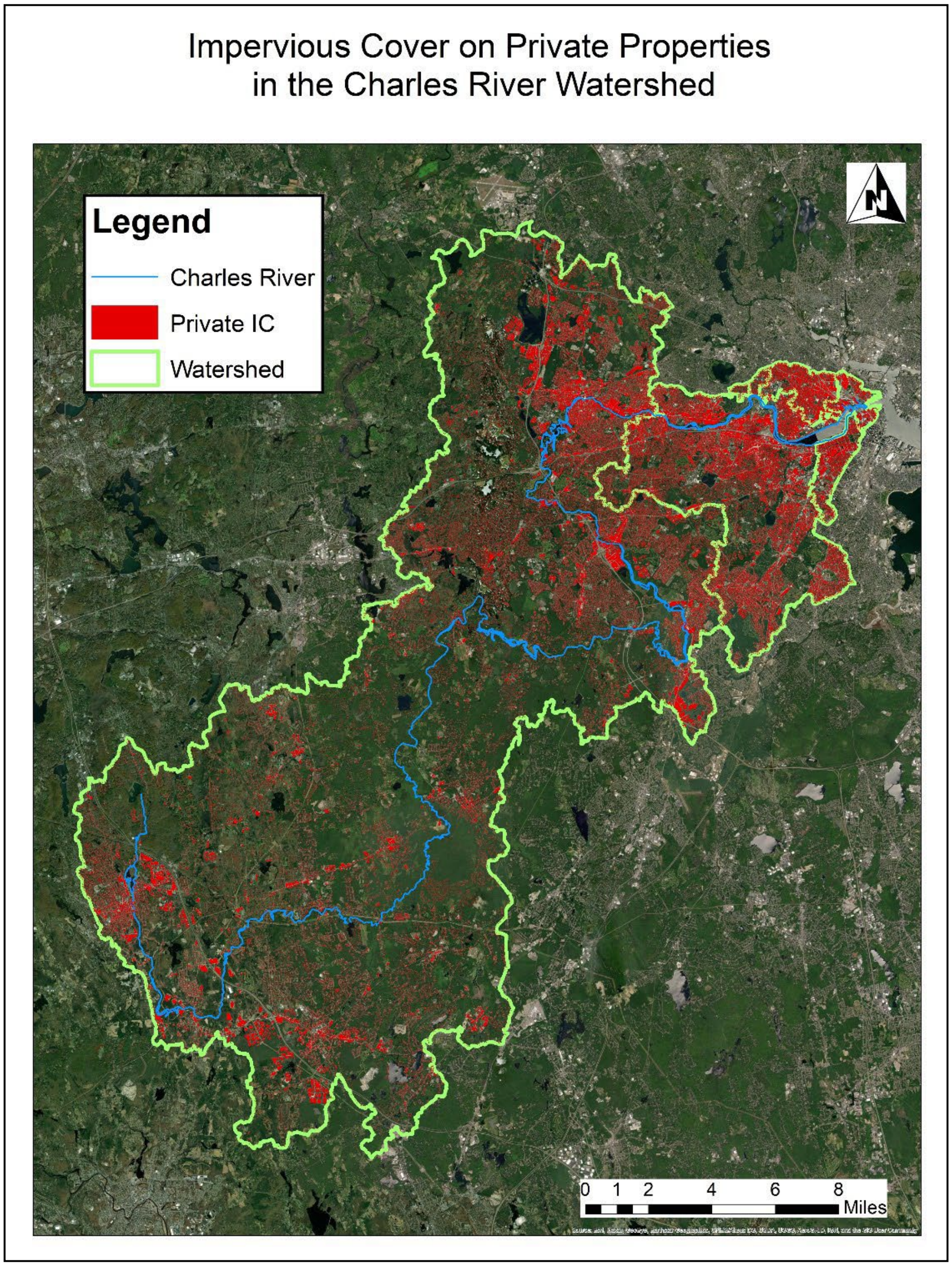


Figure 3: Impervious cover on private property in the Charles River Watershed. Data from MassGIS 2016 Impervious Cover Layer

Based on the analysis and as shown in Table 2, the estimated overall TP generated by private properties in the CRW is substantial and could be as much as 50,738 pounds per year (43,787+6,951), which is 58% (50,738/87,432) of the baseline stormwater load estimated by the TMDL analysis.

If all 166,489 private properties were to install stormwater controls on their properties to reduce TP in stormwater discharges by 65% on Commercial, Industrial, Institutional and Multi-family properties and by 45% from single family homes (as suggested by the Lower and Upper/Middle Charles TMDLs), the overall TP reduction from stormwater sources could be up to 28,197 pounds of phosphorus per year, or approximately 60% of the required watershed reduction in TP from the TMDLs (28,197/47,347). However, requiring all private properties to take action on their properties presents several challenges and may not be necessary to meet TMDL reduction goals. For instance, if we assume the public properties in the CRW contribute 36,694 pounds of phosphorus per year (baseline loading from the TMDL [87,432]– calculated load from private property [50,738]) and all public properties were able to reduce this load by 65%, the resulting reduction in TP load would be 23,851 pounds of phosphorus per year, or approximately 50% of the required reduction from the TMDL (23,851/47,347). These scenarios added together would equal a reduction of 52,048 (28,197+23,851) pounds of phosphorus per year removed, which would be greater than the TMDL target reduction of 47,347 pounds of phosphorus per year. While simplified, this indicates that there has to be a mix of actions on public and private land in order to meet TMDL goals and also highlights the fact that no one group can meet the TMDL goals alone (e.g. if no actions were taken on private property to reduce phosphorus in stormwater discharges the TMDL goals cannot be met).

c. Single Family Properties

There are approximately 118,274 single family residential properties in the watershed that consist of approximately 70,307 acres (Table 2 and Figure 5). Single family residential land use accounts for the highest number and acreage of properties; however, just 14% of its acreage (10,114 acres) is impervious. Therefore, the resulting phosphorus load for single family residential land use is distributed over many properties making the contribution from any one property relatively low (0.20 lbs/year/property) compared to other land use types (Figure 4).

From a phosphorus reduction perspective, this suggests that focusing efforts on other property types would lead to larger reductions while also requiring stormwater controls on fewer properties. For instance, if all single-family homes implemented structural controls to treat phosphorus on their properties and achieved a 45% reduction in TP generated per year in stormwater as required by the TMDL, the watershed would see an approximate reduction of 10,760 pounds of TP per year for the implementation of 118,274 individual structural practices, or 0.09 pounds of TP reduced per year per property. If, however, a 65% reduction as required by the TMDL was applied to commercial properties, the watershed would see an approximate reduction of 7,394 pounds per year of TP for the implementation of 9,548 structural practices, or 0.77 pounds of TP reduced per year per property. This example indicates an increase in efficiency of 8.6 times if controls were focused on commercial property instead of single-family residential properties. This efficiency is primarily driven by the amount of IC in the different land use classes. Looking at Table 2, it is evident that the phosphorus load from IC is larger than the phosphorus load from pervious cover on private properties. Single family residential properties have an average of 7.4 times less IC per property when compared to commercial properties in the CRW, indicating that structural controls would be needed on over seven single family properties to achieve the same amount of phosphorus reduction that could be achieved by placing controls on one commercial property.

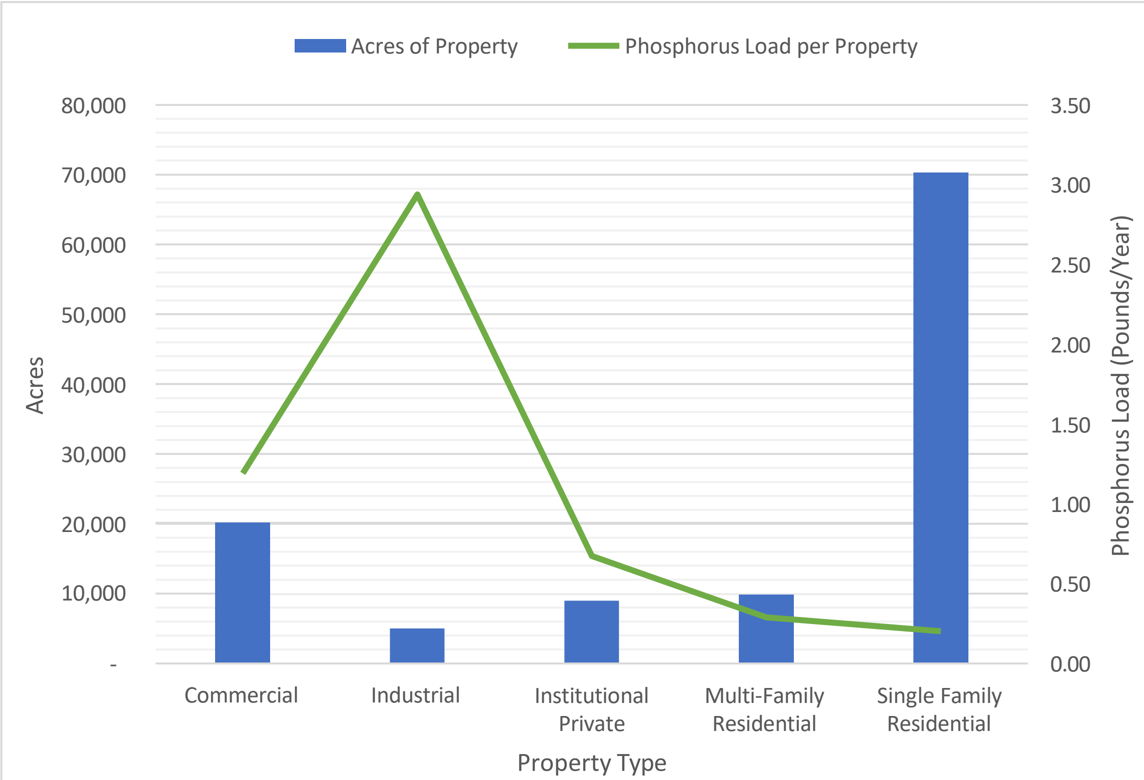


Figure 4: Acres of Commercial, Industrial, Private Institutional, Multi-Family Residential and Single Family Residential are in the CRW with associated phosphorus load generated by each land use

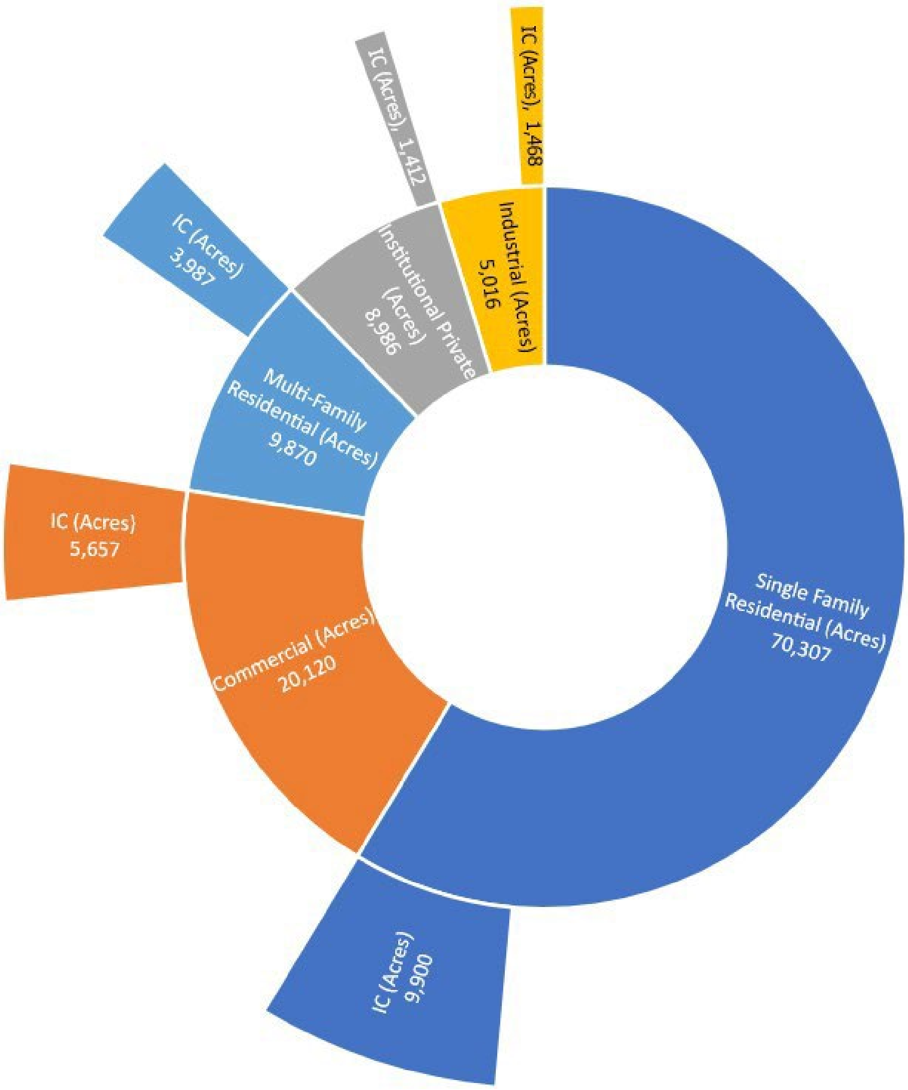


Figure 5: Acres of Private Properties by Classification and the Associated Impervious Cover (IC) (Acres) of Each Classification

d. Other Private Properties

When single family residential properties are removed from the dataset, the annual total phosphorus load from commercial, industrial, institutional, and multi-family residential (CIIM) properties is 26,827 pounds per year (Table 3 and Table 4), including 24,380 pounds per year (91%) generated from IC. A 65% reduction in the total load from CIIM properties as suggested by the TMDL would result in a potential reduction of 17,437 pounds per year. This reduction amounts to approximately 37% of the 47,347 pounds per year stormwater TP reduction required by the TMDL for the CRW. This reduction would require stormwater controls on 48,215 properties (i.e. the total number of CIIM properties in the CRW).

While it may be possible to achieve 37% of the overall TP reduction needed through practices on all 48,215 CIIM properties, it likely is not the most efficient way to reduce TP in stormwater from CIIM properties in the watershed. To identify a more efficient way to target properties for stormwater controls, EPA compared the impact of requiring controls on properties based on property size versus requiring controls based on the amount of impervious cover. As shown in Figure 6, there are 4,728 CIIM properties ≥1 acre in property size. These properties generate around 18,476 pounds of TP per year. There are 2,257 CIIM properties with ≥1 acre of IC, which generate around 15,048 pounds of TP per year. Comparatively, the properties ≥1 acre in size generate on average about 3.9 pounds of TP per property per year, while the properties with IC ≥1 acre generate approximately 6.7 pounds of TP per property per year. Overall, targeting phosphorus reduction actions on properties with larger IC instead of overall property size is more effective to reduce the phosphorus load. In this example it would require stormwater controls on approximately half the number of properties while achieving only a slight decline in TP reduction.

Property Size	Acres	IC Area (Acres)	# Properties	% of Total CRW CIIM IC	TP Load (lbs/yr)	Annual TP Load Reduction Assuming 65% Removal (lbs/yr)	% of Total Reduction Required in Watershed	# Properties per % of Total Reduction Required	Average IC Acres/Property
All Properties*	43,991	12,524	48,215	100%	26,827	17,437	36.8	1,309.2	0.26
≥0.1 Acre	43,091	11,851	35,193	95%	25,339	16,471	34.8	1,011.7	0.34
≥0.25 Acre	39,629	9,757	12,354	78%	20,635	13,412	28.3	436.1	0.79
≥0.5 Acre	37,793	8,792	7,016	70%	18,611	12,097	25.6	274.6	1.25
≥1 Acre	36,045	7,845	4,519	63%	16,737	10,879	23.0	196.7	1.74
≥2 Acres	33,640	6,619	2,797	53%	14,353	9,329	19.7	141.9	2.37
≥3 Acres	31,953	5,882	2,107	47%	12,910	8,391	17.7	118.9	2.79
≥4 Acres	30,711	5,405	1,749	43%	11,959	7,774	16.4	106.5	3.09
≥5 Acres	29,534	4,970	1,487	40%	11,090	7,209	15.2	97.7	3.34
≥6 Acres	28,451	4,567	1,288	36%	10,295	6,692	14.1	91.1	3.55
≥7 Acres	27,292	4,231	1,109	34%	9,606	6,244	13.2	84.1	3.81
≥8 Acres	26,425	3,961	994	32%	9,047	5,880	12.4	80.0	3.99
≥9 Acres	25,644	3,754	902	30%	8,619	5,602	11.8	76.2	4.16
≥10 Acres	24,870	3,558	820	28%	8,214	5,339	11.3	72.7	4.34
≥11 Acres	24,095	3,382	746	27%	7,845	5,099	10.8	69.3	4.53
≥12 Acres	23,141	3,073	663	25%	7,225	4,696	9.9	66.8	4.63
≥13 Acres	22,405	2,947	604	24%	6,946	4,515	9.5	63.3	4.88
≥14 Acres	21,944	2,865	570	23%	6,762	4,395	9.3	61.4	5.03
≥15 Acres	21,219	2,673	520	21%	6,361	4,135	8.7	59.5	5.14
≥16 Acres	20,773	2,530	491	20%	6,076	3,949	8.3	58.9	5.15
≥17 Acres	20,181	2,378	455	19%	5,749	3,737	7.9	57.6	5.23
≥18 Acres	19,726	2,272	429	18%	5,529	3,594	7.6	56.5	5.30
≥19 Acres	19,301	2,169	406	17%	5,310	3,452	7.3	55.7	5.34
≥20 Acres	18,634	2,039	372	16%	5,015	3,260	6.9	54.0	5.48

Table 3: Commercial, Industrial, Institutional, and Multi-Family Residential Properties Based on Property Size.

Impervious Cover Size	Acres	IC Area (Acres)	# Properties	% of Total CRW CIIM IC	TP Load (lbs/yr)	Annual TP Load Reduction Assuming 65% removal (lbs/yr)	% of Total Reduction Required in Watershed	# Properties per % of Total Reduction Required	Average IC Acres/Property
All Properties	43,991	12,524	48,215	100%	26,827	17,437	36.8	1,309.2	0.26
≥0.1 Acre	31,240	10,660	17,238	85%	21,908	14,240	30.1	573.2	0.62
≥0.25 Acre	26,955	9,119	6,320	73%	18,439	11,985	25.3	249.7	1.44
≥0.5 Acre	23,013	8,230	3,808	66%	16,477	10,710	22.6	168.3	2.16
≥1 Acre	19,721	7,041	2,120	56%	14,091	9,159	19.3	109.6	3.32
≥2 Acres	15,252	5,540	1,048	44%	11,033	7,171	15.1	69.2	5.29
≥3 Acres	12,206	4,592	658	37%	9,121	5,929	12.5	52.5	6.98
≥4 Acres	10,097	3,919	463	31%	7,782	5,059	10.7	43.3	8.46
≥5 Acres	8,274	3,358	337	27%	6,642	4,317	9.1	37.0	9.97
≥6 Acres	7,198	2,917	256	23%	5,747	3,736	7.9	32.4	11.39
≥7 Acres	6,195	2,545	199	20%	5,008	3,255	6.9	28.9	12.79
≥8 Acres	5,505	2,267	162	18%	4,461	2,900	6.1	26.5	14.00
≥9 Acres	4,984	2,020	133	16%	3,986	2,591	5.5	24.3	15.19
≥10 Acres	4,436	1,757	105	14%	3,474	2,258	4.8	22.0	16.74
≥11 Acres	4,042	1,570	87	13%	3,120	2,028	4.3	20.3	18.05
≥12 Acres	3,488	1,397	72	11%	2,761	1,795	3.8	19.0	19.40
≥13 Acres	3,002	1,248	60	10%	2,439	1,586	3.3	17.9	20.80
≥14 Acres	2,496	1,099	49	9%	2,132	1,386	2.9	16.7	22.42
≥15 Acres	2,391	1,041	45	8%	2,016	1,310	2.8	16.3	23.14
≥16 Acres	2,300	995	42	8%	1,930	1,254	2.6	15.9	23.69
≥17 Acres	2,066	880	35	7%	1,709	1,111	2.3	14.9	25.14
≥18 Acres	1,881	811	31	6%	1,563	1,016	2.1	14.4	26.15
≥19 Acres	1,777	755	28	6%	1,462	950	2.0	14.0	26.98
≥20 Acres	1,610	659	23	5%	1,273	828	1.7	13.2	28.64

Table 4: Commercial, Industrial, Institutional, and Multi-Family Residential Properties Based on Impervious Cover Size

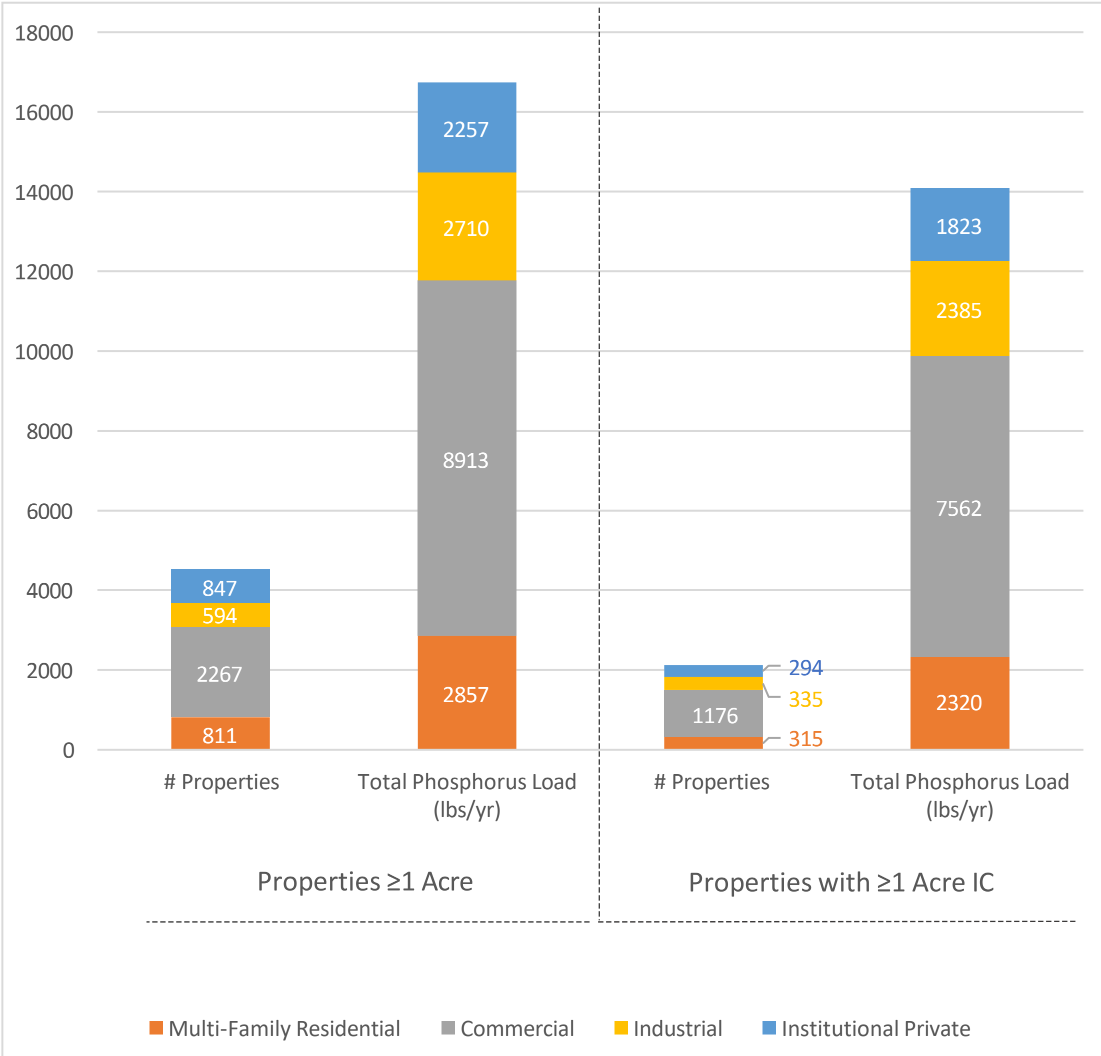


Figure 6: Number of Properties and Total Phosphorus Load by Property Classifications for Both Properties ≥1 Acre and Properties with IC ≥1 Acre

To further refine this evaluation, EPA evaluated the optimum size of IC that would most effectively capture the largest load reduction over the fewest number of properties. The private properties in the CRW were first broken up into groups based on the amount of IC contained on the property. Figure 7 displays the potential TP reduction (assuming a 65% reduction from the total load) from CIIM properties and the number of properties where the reduction would occur. The trendline in Figure 7 provides insight on the size of IC area that would result in optimizing the tradeoff between TP reduction and number of properties installing controls. Ultimately the optimal implementation scenario would lie where the trendline is "curving" or moving from high slope to low slope. In Figure 7, this optimal zone is highlighted in light orange and lies between properties with ≥0.25 acres and ≥5 acres of IC. [2]

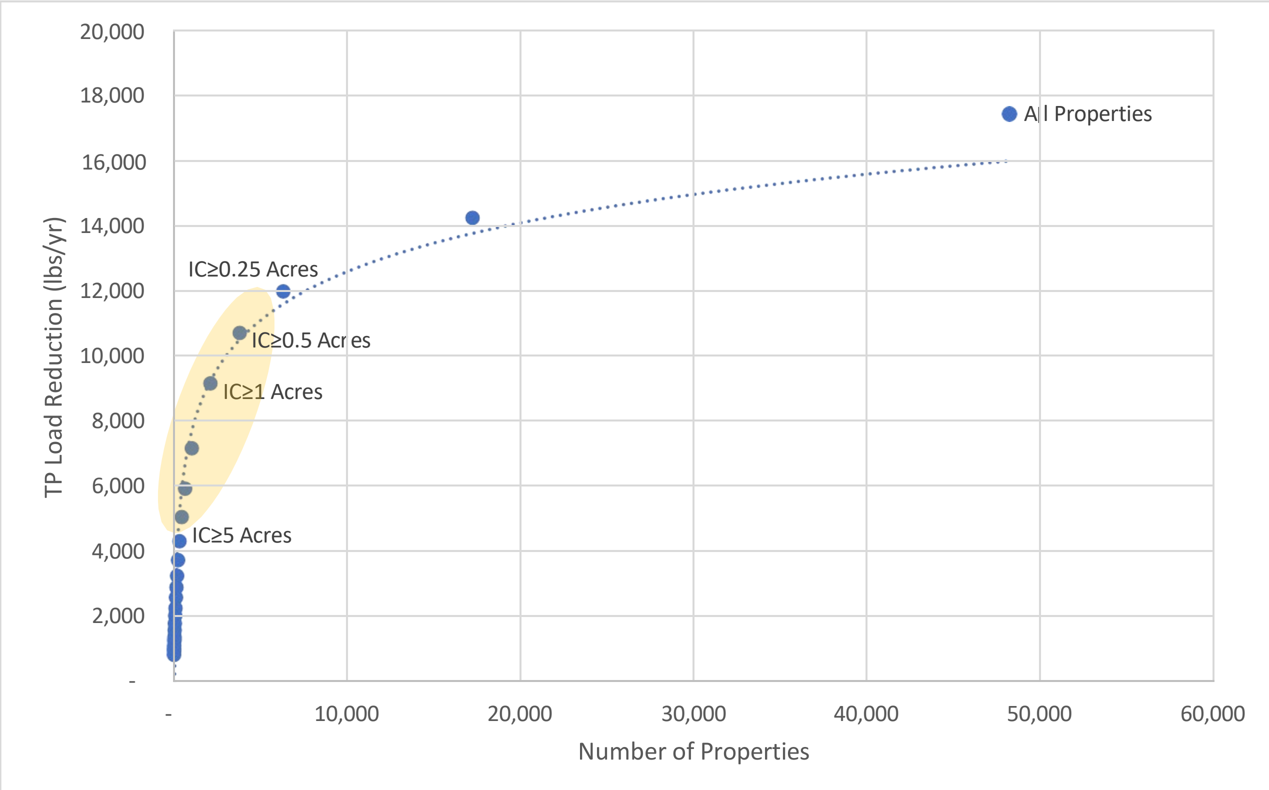


Figure 7: TP Load Reduction Assuming 65% Reduction vs. Number of Properties for CIIM Properties. The light orange represents a potential optimal IC size for stormwater control implementation

To understand the potential TP reductions from stormwater controls on properties at different IC thresholds, thresholds between 0.5 acres of IC and 5 acres of IC, were evaluated more closely. Specifically, thresholds of ≥0.5, 1.0, 2.0, and 5.0 acres of IC are discussed in further detail below.

An IC size of ≥ 0.5 acre includes 3,808 CIIM properties and contributes a TP load of approximately 16,477 pounds per year (Table 5). Approximately 93% of the TP load is generated from IC on these properties. Of the 3,808 properties, 2,151 are commercial, 632 are multi-family residential, 517 are industrial, and 508 are institutional. The average IC per property ranges from 1.85 acres to 2.69 acres with multi-family residential as the lowest and industrial as the highest. Reducing TP from these properties by 65% has the

[2] While Figure 7 provides a tool for visualizing one way to optimize implementation, it should not be interpreted without taking into account other factors for efficiency of stormwater control sighting within the watershed, namely targeting those properties with the greatest proportion of IC and targeting those land use classes contributing the largest amount of TP proportionally (Figure 4).

potential TP reduction of 10,710 pounds per year, which equates to 22.6% of the reduction needed in the CRW (Table 4).

Classification	# Properties	Acres	IC Area (Acres)	IC TP Load (lbs/yr)	Pervious TP Load (lbs/yr)*	TP Load (lbs/yr)	Average IC Area (Acres)/Property
Commercial	2151	12,234	4,592	8,199	669	8,868	2.13
Industrial	517	3,280	1,389	2,470	168	2,638	2.69
Institutional Private	508	3,789	1,083	1,902	204	2,107	2.13
Multi-Family Residential	632	3,711	1,167	2,688	177	2,864	1.85
TOTAL	3,808	23,013	8,230	15,259	1,218	16,477	

Table 5: Commercial, Industrial, Institutional, and Multi-Family Residential Properties with ≥0.5 Acre Impervious Cover

*Pervious load does not include TP loads from forest or wetland areas on private properties

An IC size of ≥ 1.0 acre includes 2,120 CIIM properties and contributes a TP load of approximately 14,091 pounds per year (Table 6). Around 92% of the phosphorus load is generated from IC. Of the 2,120 properties, 1,176 are commercial, 335 are industrial, 315 are multi-family residential and 294 are institutional properties, and the TP load from each property type follows the same order. They include 56% of the total impervious cover from all CIIM properties. The average IC area per property ranges from 3.01 to 3.74 acres with multi-family residential as the lowest and industrial as the highest (Table 6). Reducing the phosphorus load from these properties by 65% has the potential TP reduction of 9,159 pounds per year, which equates to 19% of the reduction needed in the CRW (Table 4).

Classification	# Properties	Acres	IC Area (Acres)	IC TP Load (lbs/yr)	Pervious TP Load (lbs/yr)	TP Load (lbs/yr)	Average IC Area (Acres)/Property
Commercial	1,176	10,500	3,903	6,969	593	7,562	3.32
Industrial	335	2,957	1,254	2,230	156	2,385	3.74
Institutional Private	294	3,330	937	1,648	175	1,823	3.19
Multi-Family Residential	315	2,934	947	2,181	139	2,320	3.01
TOTAL	2,120	19,721	7,041	13,028	1,063	14,091	

Table 6: Commercial, Industrial, Institutional, and Multi-Family Residential Properties with ≥1 Acre Impervious Cover

*Pervious load does not include TP loads from forest or wetland areas on private properties

An IC size ≥ 2.0 acres includes 1,048 CIIM properties and contributes a phosphorus load of approximately 10,242 pounds per year (Table 7). They include 44% of the total impervious cover from all CIIM properties. The average IC per property ranges from 4.74 acres for multi-family residential to 5.42 acres for commercial properties, which indicates that many properties have more than 2 acres IC (Table 7). Reducing the phosphorus load from these properties by 65% has the potential TP reduction of 7,171 pounds per year, which equates to 15% of the reduction needed CRW (Table 4).

Classification	# Properties	Acres	IC Area (Acres)	IC TP Load (lbs/yr)	Pervious TP Load (lbs/yr)*	TP Load (lbs/yr)	Average IC Area (Acres)/Property
Commercial	561	7,865	3,043	5,432	430	5,861	5.42
Industrial	199	2,471	1,064	1,892	127	2,019	5.35
Institutional Private	137	2,581	717	1,268	126	1,394	5.23
Multi-Family Residential	151	2,334	716	1,651	108	1,759	4.74
TOTAL	1,048	15,252	5,540	10,242	790	11,033	

Table 7: Commercial, Industrial, Institutional, and Multi-Family Residential Properties with ≥2 Acres Impervious Cover
*Pervious load does not include TP loads from forest or wetland areas on private properties

An IC size ≥ 5.0 acres includes 337 CIIM properties where 188 are commercial, 71 are industrial, 45 are multi-family residential and 33 are institutional and the phosphorus load from each property type follows the same order (Table 8). These properties include 27% of the impervious cover of all CIIM properties. The average IC area per property ranges from 8.65 to 12.14 acres with multi-family residential as the lowest and institutional as the highest (Table 8). These values are much higher than the 5-acre threshold, indicating that some properties likely have more than 5 acres IC. These properties generate 6,642 pounds of TP per year and reducing the load by 65% has the potential TP reduction of 4,317 pounds per year, which equates to 9% of the reduction needed in the CRW (Table 4).

Classification	# Properties	Acres	IC Area (Acres)	IC TP Load (lbs/yr)	Pervious TP Load (lbs/yr)*	TP Load (lbs/yr)	Average IC Area (Acres)/Property
Commercial	188	4,393	1,908	3,407	258	3,665	10.15
Industrial	71	1,393	661	1,173	72	1,246	9.31
Institutional Private	33	1,171	401	718	55	773	12.14
Multi-Family Residential	45	1,317	389	900	57	958	8.65
TOTAL	337	8,274	3,358	6,199	443	6,642	

Table 8: Commercial, Industrial, Institutional, and Multi-Family Residential Properties with ≥5 Acres Impervious Cover
*Pervious load does not include TP loads from forest or wetland areas on private properties

Figure 8 displays the potential TP reduction realized for each land use type assuming the CIIM properties in the scenarios described above were required to achieve a 65% reduction in TP in stormwater discharges called for in the TMDL WLAs. Commercial properties have the largest phosphorus reduction potential for all IC sizes. While multi-family residential properties have the second highest phosphorus reduction potential when looking at CIIM properties with any IC size (all properties), the proportion of total reduction from Multi-family residential properties in each scenario decreases as the IC threshold increases (Figure 6) due to the fact that Multi-family residential properties have the lowest amount of IC per property in each scenario (Table 5-Table 8).

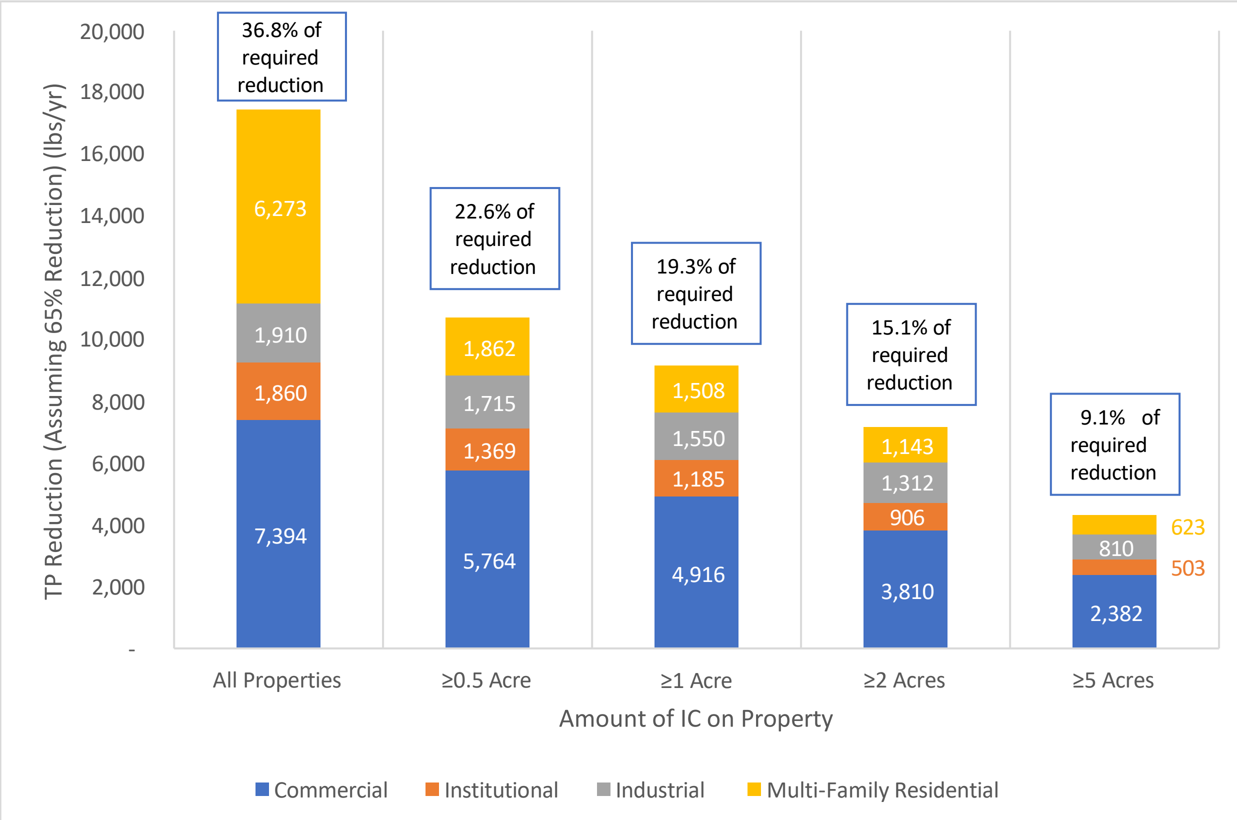


Figure 8: TP Reduction Assuming a 65% Reduction for CIIM Properties Based on Impervious Cover Size on Properties

IV. CONCLUSION

Stormwater systems in general, and in the highly-developed Charles River Watershed in particular, are complex, comprising different stormwater flow paths based on soils, slope, road design, piped network design, among other factors. This analysis does not attempt to reproduce stormwater flow paths from any property or land use group and focuses solely on the potential phosphorus in stormwater that could be discharged off any given property. It analyzes stormwater impacts and assesses the need for their reduction on a gross, aggregate scale, as EPA is entitled to do. *Natural Resources Defense Council, Inc. v. Costle*, 568 F.2d 1369, 1380 (D.C. Cir. 1977) (emphasis added). ("EPA may issue permits with conditions designed to reduce the level of effluent discharges to acceptable levels. This may well mean opting for a gross reduction in pollutant discharge rather than the fine-tuning suggested by numerical limitations. *But this ambitious statute is not hospitable to the concept that the appropriate response to a difficult pollution problem is not to try at all.*"). The analysis demonstrated that private properties make up most of the phosphorus load in stormwater (over 60% of the baseline phosphorus load) in this watershed and that load is contributing to the Charles River not meeting water quality standards. Therefore, reducing the phosphorus in stormwater discharges from private properties is necessary to meet TMDL goals and water quality standards. While some action must be taken on private properties, it may be beneficial to target certain private properties for stormwater controls over others. It is likely that most of the discharges from private properties is discharged through the local community's municipal separate storm sewer system (MS4), making that municipality ultimately responsible for the phosphorus load coming off all private properties tied into their systems and regulated in the 2016 MA MS4 Permit. Municipalities will therefore likely be responsible for the majority of the phosphorus reductions in the CRW. However, placing the entire burden of phosphorus reductions on municipalities will likely not result in sufficient reduction to reach TMDL goals and WQS, indicating that designating stormwater discharges from certain classes of private properties for NPDES permits is required. In any scenario, municipalities will still need to engage the private property owners with smaller property size or IC size in order to eventually meet TMDL goals and WQS, but requiring action on private properties with larger amounts of IC now through NPDES permitting provides greater flexibility to the communities in deciding which private properties to target to meet their own MS4 permit obligations. Requiring actions through NPDES permitting on those properties with larger IC sizes reduces the burden on the community that holds an MS4 permit, targets those properties generating the largest amount of phosphorus in stormwater on a per-property scale, and makes meeting TMDL goals and water quality standards possible.

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