Connecticut
Advance Restoration Plan
For Total Phosphorus
in Non-Tidal Surface Waters

September 19, 2024

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ACRONYM LIST

BMP	Best Management Practice
CFR	Code of Federal Regulations
CLEAR	UConn's Center for Land Use Education and Research
CT DEEP	Connecticut Department of Energy and Environmental Protection
CWA	Clean Water Act
DOT	Department of Transportation
EPA	United States Environmental Protection Agency
HSPF	Hydrological Simulation Program Fortran
IDDE	Illicit Discharge Detection and Elimination
IWQR	Integrated Water Quality Report
IC	Impervious Cover
LA	Load Allocation
MS4	Municipal Separate Storm Sewer System
NEIWPCC	New England Interstate Water Pollution Control Commission
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint Source
NRCS	Natural Resource Conservation Service
PPP	Pollution Prevention Plan
PS	Point Source
RCSA	Regulations of Connecticut State Agencies
TMDL	Total Maximum Daily Load
USGS	United States Geological Survey
WBP	Watershed Based Plan
WLA	Waste Load Allocation
WPCF	Wastewater Pollution Control Facilities
WQS	Water Quality Standards

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1. Introduction

1.1. Phosphorus and Impacts to Aquatic Communities

Phosphorus, as well as algae and cyanobacteria, naturally occur in the environment, including rivers, streams, lakes and impoundments and their contributing watersheds, and are essential to the health of surface water resources. Under natural conditions, algae and cyanobacteria concentrations are regulated by limited nutrient inputs and mixing processes that keep them from growing too rapidly. However, human related disturbances, such as erosion, overapplied fertilizers, polluted stormwater runoff, excessive domesticated animal waste, and inadequately treated wastewater, can dramatically increase the amount of phosphorus entering surface water bodies.

Excess phosphorus loading to human-disturbed non-tidal freshwater surface water systems, in combination with a warming climate, has fueled the increasing prevalence of nutrient-related water quality impacts such as reduced dissolved oxygen, increased algal biomass, and impacts to aquatic communities. Diatoms are one of those members of the aquatic community. A study conducted by the United States Environmental Protection Agency (EPA) and Connecticut Department of Energy and Environmental Protection (CT DEEP, Smucker et al., 2013) identified a shift in the species composition within diatom communities from pollution sensitive species to pollution tolerant species in response to excess levels of human-derived phosphorus. Diatoms provide an early signal for phosphorus related impacts since they are single cell algae that form the lower levels of the aquatic community food chain. Zooplankton, which are small aquatic organisms that live in the water column, aquatic insects, and fish eat diatoms as part of their diets (Spaulding, et al 2021) (Figure 1-1).

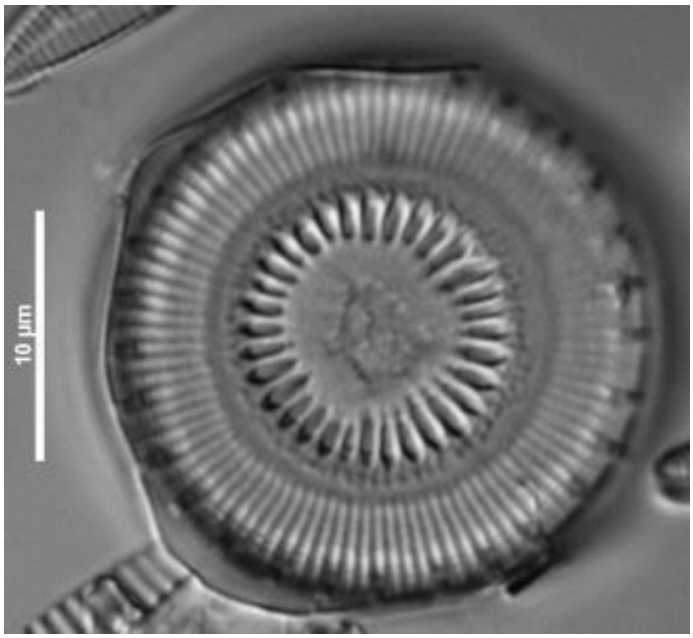

Figure 1-1: Example of a Diatom

1.2. Development of an Interim Strategy to Address Phosphorus Impacts on Freshwater Rivers and Streams

Excess nutrients, including Total Phosphorus, from human-derived sources have been shown to impact water quality in Connecticut and in water bodies across the country. This is seen through impacts to the aquatic community that lead to water quality impairments as well as algal blooms that affect recreational and aquatic life uses of surface waters (CT DEEP, 2018a). The study of the diatom community in Connecticut and associated changes in the diatom community structure led to the development of the Interim Phosphorus Reduction Strategy for Connecticut Freshwater Non-Tidal Waste-Receiving Rivers and Streams Technical Support Document (CT

DEEP, 2014). This strategy provided a biological basis for protecting aquatic life designated uses in freshwaters in Connecticut.

1.3. Water Quality-based Planning under the Clean Water Act

Since 1972, the Federal Clean Water Act (CWA) provides the regulatory framework and legal authority for the protection of lakes, rivers, streams, wetlands, and coastal areas within the United States. The CWA requires the United States Environmental Protection Agency (EPA) and states to institute and execute a planning and implementation process for the restoration and protection of all surface waters within their boundaries in meeting state water quality standards (WQS) for applicable designated uses (Figure 1-2). The planning and implementation process includes: 1) adopting WQS; 2) monitoring the water quality of surface waters to evaluate consistency with WQS; 3) prioritizing surface waters for development of action plans to restore or protect water quality consistent with WQS; (4) developing action plans; and (5) implementing those plans to achieve consistency with WQS. In Connecticut, waterbodies not meeting WQS for one or more pollutant(s) and that require a Total Maximum Daily Load (TMDL) are listed as Category 5 in the 303(d) List of Impaired Waters of the Connecticut Integrated Water Quality Report (IWQR, CT DEEP 2020). In some cases, an Advance Restoration Plan is developed in place of a TMDL to achieve consistency with WQS. However, if consistency with WQS is not achieved through the Advance Restoration Plan, then a TMDL would be required. States may also develop Action Plans for water quality protection in waterbodies that are meeting WQS.

As an enhancement of the TMDL prioritization process for the IWQR, CT DEEP began employing an approach known as Integrated Water Planning Management, previously Integrated Water Resource Management which is based on six key elements: prioritization, assessment, protection, alternatives, engagement, and integration. The approach allows CT DEEP to identify waterbodies for Action Plan development including TMDLs, Advance Restoration Plans and Restoration Plans, and Watershed-Based Plans (WBP) based on state-specific concerns and provides CT DEEP sufficient time to develop plans using flexible approaches under existing TMDL authority. During initiation of the Integrated Water Planning Management approach, CT DEEP worked with the public to identify focus areas for water quality restoration and protection. One of the primary focus areas identified by the public was nutrient management. Managing and reducing excessive amounts of nutrients in the environment for the protection of water quality for aquatic communities and recreational opportunities is a priority at both the state and national level.

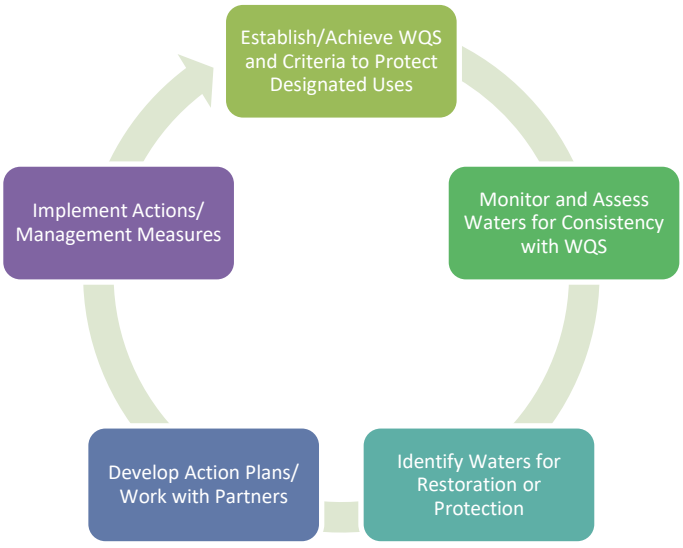

Figure 1-2. Conceptual diagram of the planning and implementation cycle.

*A **TMDL** defines the maximum amount of the pollutant that a waterbody can assimilate while continuing to meet WQS and allocates that maximum allowable pollutant load between point and nonpoint sources of the pollutant. A TMDL also provides a framework for EPA, states, and partner organizations to establish and implement pollution control and management plans, with the ultimate goal described in Section 101(a)(2) of the CWA: to achieve "water quality which provides for the protection and propagation of fish, shellfish, and wildlife, and recreation in and on the water, wherever attainable."*

Prior to the use of Integrated Water Planning Management, Public Act 12-155 *An Act Concerning Phosphorus Reduction in State Waters* was passed and required CT DEEP and select municipalities to collaboratively develop recommendations for a statewide strategy to reduce phosphorus loadings consistent with WQS in inland non-tidal waters. A coordinating committee and working groups were formed to accomplish this task. Work groups evaluated phosphorus in ambient waters affected by nonpoint sources and in point source discharges from Water Pollution Control Facilities (WPCFs). The committee and work groups then developed and provided a final report with recommendations to the Connecticut legislature. The final report identified the need to manage phosphorus impacts on lakes and recommended taking an integrated approach to phosphorus management. TMDL studies, Advance Restoration Plans, and WBPs were all identified as important tools for addressing nutrient-related water quality impacts (CT DEEP, 2017).

1.4. Purpose and Overview of this Advance Restoration Plan

The purpose of the *Connecticut Statewide Phosphorus Advance Restoration Plan for Non-Tidal Fresh Waters* is to use a **watershed-based approach** implemented through an **Advance Restoration Plan** to set Total Phosphorus water quality-based requirements for reducing phosphorus loads from regulated discharges that, if achieved, will result in consistency with the State of Connecticut WQS. Water quality that is consistent with WQS is expected to support designated uses. The surface waters in this Advance Restoration Plan may be listed on Connecticut's 303(d) Impaired Waters List as impaired for aquatic life use due to Total Phosphorus and are in a Municipal Separate Storm Sewer System (MS4) municipality, are identified within the Interim Phosphorus Reduction Strategy Technical Support Document (CT DEEP, 2014), or may be part of the watershed that includes those strategy waters. This Advance Restoration Plan is based on reducing excessive nutrient loading from permitted activities to achieve water quality, based on an understanding of the responses within the diatom community to excessive nutrient loadings. This Plan focuses on the Total Phosphorus contributions from WPCFs and industries that discharge phosphorus, municipal stormwater discharged under the MS4 permit, and non-regulated, Nonpoint Sources (NPS) of stormwater.

*A **watershed-based approach** that uses the surface drainage area as the basic study unit enables managers to gain a more complete understanding of the potential pollutant sources impacting a waterbody and increases the precision of identifying local problem areas or "hot spots" which may detrimentally affect water quality. Further, addressing many waterbodies across multiple watersheds through a statewide Advance Restoration Plan is more efficient than developing plans for each waterbody individually. This approach also provides a useful format for guiding both remediation and protection efforts at the municipal and regional level by providing a coordinating framework for environmental management that supports efforts to systematically identify, evaluate, and prioritize point and nonpoint sources of pollutants using natural hydrologic boundaries to define the problem areas.*

The *Connecticut Statewide Phosphorus Advance Restoration Plan* was developed to support an efficient and effective approach to water quality-based planning and implementation, consistent with the Connecticut Integrated Water Resource Management and updated through Integrated Water Planning Management efforts, and with the allowance for the use of alternative approaches to restoration planning under EPA's 303(d) Program Vision. The use of an Advance Restoration Plan is an effective planning tool since it is based on a "straight-to-implementation" approach that initiates actions within a regulatory framework to restore water quality based on attainment of WQS and includes a public review and comment processes. This document incorporates by reference the following documents: Interim Phosphorus Reduction Strategy for Connecticut Freshwater Non-Tidal Waste-Receiving Rivers and Streams Technical Support Document (4/24/14) as amended, Recommendations for Phosphorus Strategy Pursuant to PA 12-155 Final Report (2/16/2017), and associated reports available through the

CT DEEP Phosphorus Strategy website. The recommendations from this Plan have been incorporated into the applicable National Pollutant Discharge Elimination System (NPDES) permits. Additionally, as part of this process, public outreach materials (town-specific fact sheets for all CT cities and towns) and web pages with interactive maps were developed to provide information to link stormwater quality with potential impacts on water quality.

As mentioned earlier, nutrients including phosphorus are also a contaminant of NPS pollution which comes from many diffuse sources on the landscape and is more difficult to identify and control than regulated discharges. NPS pollution can result from contaminants transported by overland runoff (e.g., agricultural runoff or runoff from unregulated suburban and rural areas), groundwater flow, or deposition of pollutants to receiving waters. This Plan addresses NPS phosphorus pollution, specifically unregulated stormwater runoff. Additionally, this Plan can support future development of Watershed-Based Plans to address nonpoint source pollution by identifying water quality objectives for the watersheds included herein.

The main objectives of this Advance Restoration Plan include describing existing conditions and applicable standards and identifying the water-quality based actions and conditions necessary to support water quality restoration based on preventing impacts to biological communities due anthropogenic sources of Total Phosphorus and maintaining those biological communities after water quality restoration is achieved.

This Plan describes approaches and actions that were put into place through May 2024. Changes to the control of Total Phosphorus in Connecticut may be made in the future through updates to the implementation approaches and permit requirements described within this Plan.

1.5. Waterbodies included in the Plan

Waterbodies included in this Plan belong to either one of the following two categories:

1. Waterbodies included in the watersheds that are identified in the Interim Phosphorus Reduction Strategy for Connecticut Freshwater Non-Tidal Waste-Receiving Rivers and Streams Technical Support Document. These watersheds are characterized by the presence of WPCFs or industries which are known sources of phosphorus to surface waters (Figure 1-3).

These watersheds are:

- Bantam River Watershed
- Blackberry River Watershed
- Factory Brook Watershed
- Farmington River Watershed
- Fivemile River Watershed
- Hockanum River Watershed
- Housatonic River Main Stem Watershed
- Limekiln Brook Watershed
- Naugatuck River Watershed
- Norwalk River Watershed
- Pequabuck River Watershed
- Pomperaug River Watershed
- Pootatuck River Watershed
- Quinebaug River Watershed
- Quinnipiac River Watershed
- Shetucket River Watershed
- Still River Watershed
- Willimantic River Watershed

If additional watersheds, WPCFs or industries are subsequently identified and managed under the Interim Phosphorus Reduction Strategy, those watersheds, WPCFs, or industries will be administratively added to this Alternate Restoration Action Plan during the Integrated Water Quality Report process.

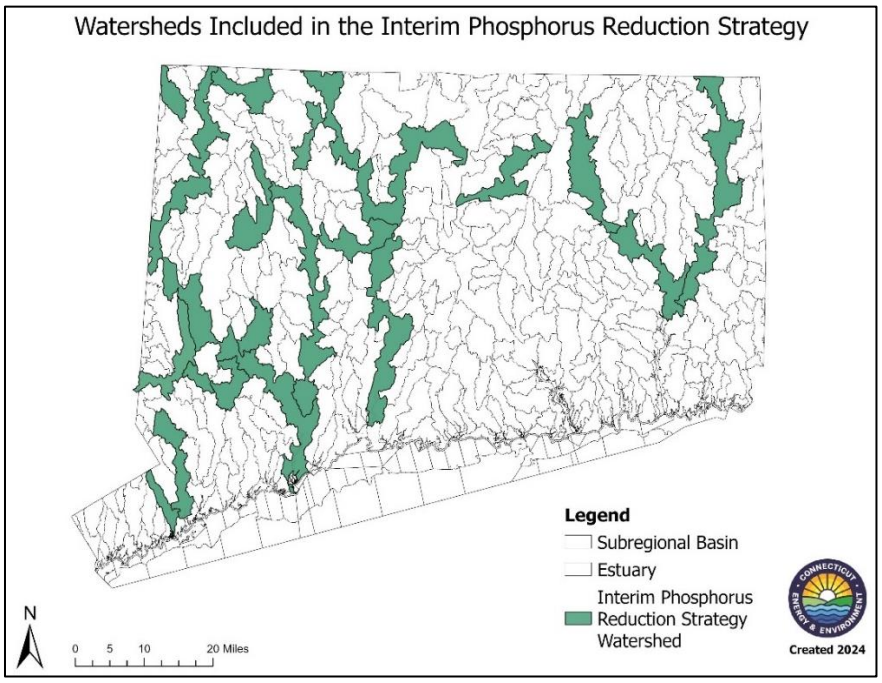

Figure 1-3. Watersheds identified in the Interim Phosphorus Reduction Strategy as of May 2024.

2. Non-tidal rivers and streams in MS4 municipalities listed as impaired for Total Phosphorus as they become listed in the most recent Connecticut Integrated Water Quality Report (Figure 1-4). As additional waterbodies in MS4 municipalities are listed as impaired for Total Phosphorus in future Connecticut Integrated Water Quality Reports, these waterbodies will be administratively added to this Alternate Restoration Action Plan as part of the Integrated Water Quality Report process.

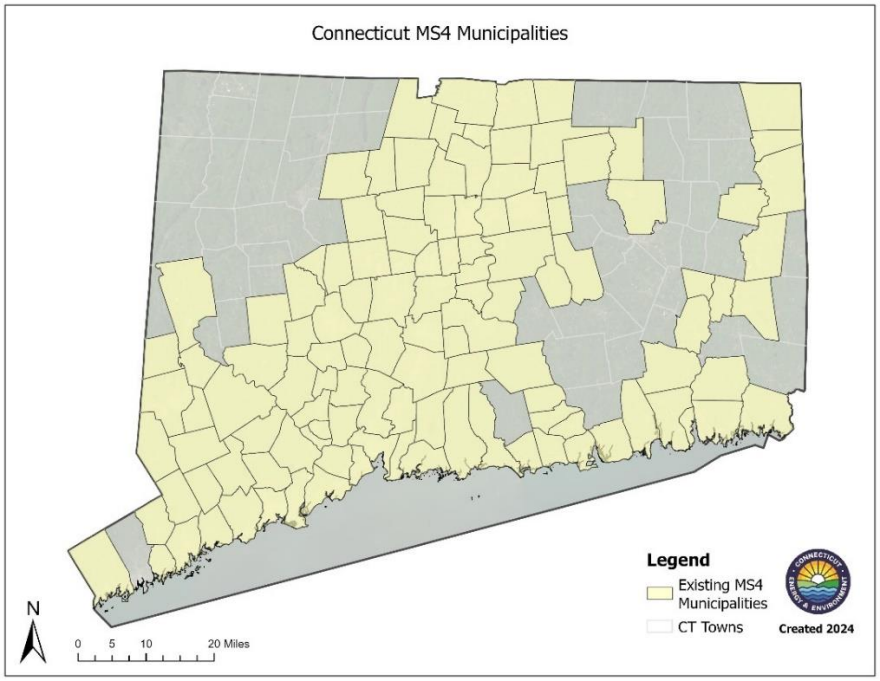

Figure 1-4. Connecticut MS4 municipalities as of May 2024.

A complete list of river and stream segments included in this Plan is listed in Appendix A of the document. As additional waters are administratively added to this document, they will be identified within Appendix A and the Document History table.

2. Water Quality Standards

WQS determine the baseline water quality that all waters of a state must meet to protect the intended uses for each waterbody. The Connecticut WQS are the foundation for the State's water pollution control and water quality management efforts and are applicable to both surface and groundwaters. Section 22a-426 of the Connecticut General Statutes requires that the Commissioner of the CT DEEP adopt WQS consistent with the CWA. The Connecticut WQS themselves are contained within the Regulations of Connecticut State Agencies (RCSA) § 22a-426 (the same section number is used for both statute and regulations relating to WQS, CT DEEP 2015b).

The Connecticut WQS are formally composed of three parts: Standards, Criteria, and Classification Maps. The Standards designate use goals and set overall policy for managing surface and ground waters (including antidegradation provisions). The Criteria set the narrative and numerical targets for water quality which are necessary to protect the designated uses. The Classification Maps are a series of municipal level maps which indicate waterbody classification, and thus the designated uses and criteria that apply to each waterbody in the State. For this Advance Restoration Plan, the applicable nutrient WQS are presented in the following order: surface water quality classification by designated uses; water quality criteria for nutrients; and antidegradation standards and implementation policies.

While many aspects of the WQS are applicable to nutrient-related water quality in rivers and stream, the following are particularly pertinent: surface water classifications, narrative nutrient criteria, standards pertaining to natural conditions, and the Antidegradation Policy and Implementation Strategy. More information on this topic is available from CT DEEP online, including a multimedia story map on WQS and classifications.

2.1. Surface Water Classification by Designated Uses

Classification of surface waters in the Connecticut Water Quality Standards is based on the Designated Uses established for each waterbody. Waterbodies that share the same designated uses are assigned the same surface water classification.

Connecticut's designated uses for surface waters consist of Existing or Proposed Drinking Water Supply, Potential Drinking Water Supply, Habitat for Fish and Other Aquatic Life and Wildlife, Recreation, Navigation, Industrial/Agricultural Water Supply, plus additional saltwater uses, such as Shellfishing. In addition, Fish Consumption is an implicit designated use based on fish and aquatic habitat uses and recreational uses. All freshwater surface waters of the State have been assigned to one of three classes: AA, A, or B.

- **Class AA:** designated as a source of existing or proposed drinking water supply; habitat for fish and other aquatic life and wildlife; recreation; industrial and agricultural water supply; and shall have excellent aesthetic value.

- **Class A:** designated for potential drinking water supply; habitat for fish and other aquatic life and wildlife; recreation; navigation; industrial and agricultural water supply; and shall have excellent aesthetic value.
- **Class B:** designated as habitat for fish and other aquatic life and wildlife; recreation; navigation; industrial and agricultural water supply; and shall have good to excellent aesthetic value.

The classification for each waterbody is indicated by a series of maps, one per municipality, in Connecticut. Classification maps are available online through the Water Quality Classification Maps webpage, CT DEEP's GIS Data Repository, and Connecticut Environmental Conditions Online.

Water quality standards and criteria are established within the Water Quality Standards to support attainment and protection of these Designated Uses. The standards and criteria applicable to each designated use apply to those waters for which that use is established. Because the classifications pertain to uses, they do not reflect present conditions or environmental quality of the waterbody.

The WQS allow for discharges from WPCFs and industries to Class B waters. However, since stormwater may discharge to any classification of surface water and this Advance Restoration Plan includes all the surface waters throughout the target watersheds, surface waters classified as AA, A, or B may be included in this Plan. This Plan was developed to support attainment and protection of the designated use of "habitat for fish and other aquatic life and wildlife" which has been established for all non-tidal waters within Connecticut. The Plan focuses on restoring and protecting waters which receive anthropogenic sources of Total Phosphorus.

2.2. Applicable Water Quality Criteria and Standards

2.2.1. Narrative Criteria for Biological Condition

Healthy biological conditions and communities are the basis for attaining the Designated Use of "habitat for fish and other aquatic life and wildlife". Connecticut has adopted the Biological Condition Gradient Model within Section 22a-426-5 of the WQS (Figure 2-1). This model describes how ecological attributes within a waterbody change in response to increasing levels of stressors. Stressors are defined as any physical, chemical, or biological entity that can induce an adverse response (EPA, 1998: Cormier et al., 2000). As the level of stressors increase within a waterbody, changes to the biological communities may be observed. In waters minimally affected by stressors, the level of impact to the biological communities is described as either "native condition" or "minimal changes" which would represent natural conditions within the waterbody. "Natural" is defined within the WQS as the biological, chemical and physical conditions and communities that occur within the environment which are unaffected or minimally affected by human influence (RCSA § 22a4261(47)).

With increasing levels of stressors, further changes to the biological condition occur until the condition of the biological communities is degraded or impaired. This is expressed as Tiers 5 and 6 within the Biological Condition Gradient model.

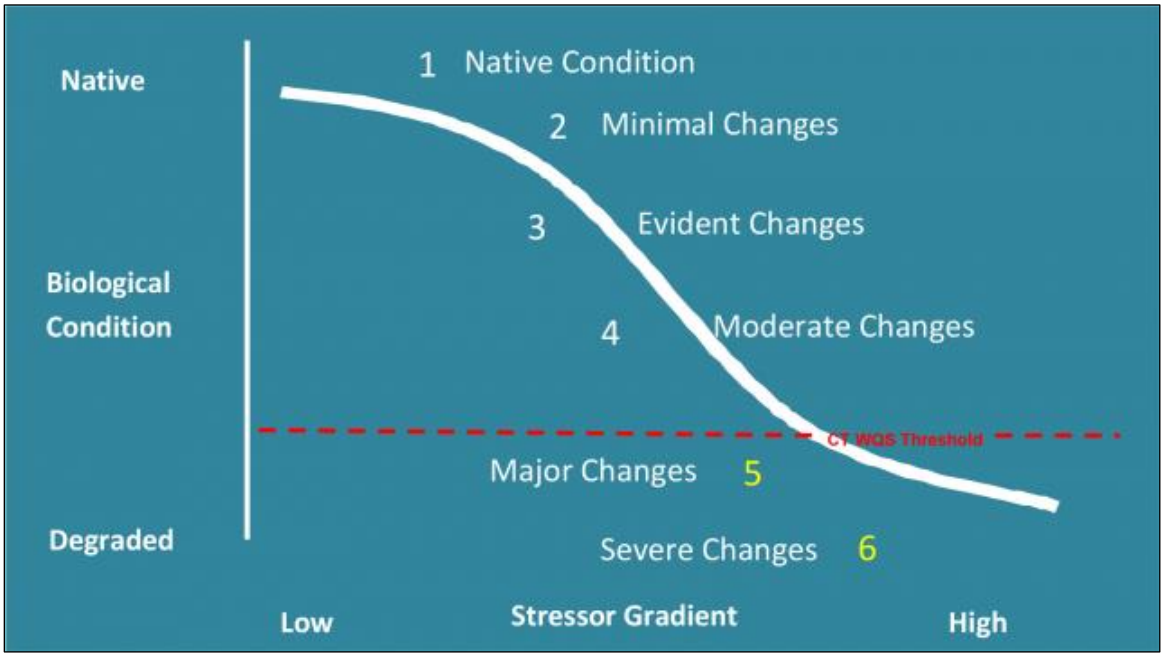

Figure 2-1. Biological Condition Gradient Model depicting how as stressors increase, biological communities change in response. Community responses are characterized into tiers, with Tiers 5 & 6 exceeding the CT WQS threshold for the designated use of aquatic life use support.

Surface water criteria for Biological Condition in Class AA, A and B Waters are included in Table 1 within Section 22a-426-9 Environmental Criteria within the WQS. These criteria are to be met within surface waters to support the designated uses for these Classifications. The Biological Condition criteria for Class AA, A and B surface waters is:

> *"Sustainable, diverse biological communities of indigenous taxa shall be present. Moderate changes, from natural conditions, in the structure of the biological communities, and minimal changes in ecosystem function may be evident; however, water quality shall be sufficient to sustain a biological condition within the range of Connecticut Biological Condition Gradient Tiers 1 – 4 as assessed along a 6 tier stressor gradient of Biological Condition Gradient (See section 22a-426-5 of the Regulations of Connecticut State Agencies)."*

This Advance Restoration Plan addresses excess levels of Total Phosphorus from anthropogenic sources as a stressor that can impact the biological conditions and communities within surface waters.

2.2.2. Narrative Criteria for Nutrients

Because the effect of nutrients including Total Phosphorus on the biological response of individual waterbodies is influenced by many factors, only narrative criteria are described for nutrients (refer to RCSA § 22a-426-9, Table 1). Use of narrative nutrient criteria allows for the development of waterbody-specific nutrient loadings that support maintenance or attainment of designated uses. The narrative nutrient criteria are the same for Class AA, A, and B waters:

> *"The loading of nutrients, principally phosphorus and nitrogen, to any surface waterbody shall not exceed that which supports maintenance or attainment of designated uses."*

The WQS also includes provisions that exempt waterbodies not meeting WQS due to natural environmental conditions defined as being unaffected or minimally affected by human influences (RCSA § 22a-426-4(a)(4); RCSA § 22a-426-1(47)). This Advance Restoration Plan focuses on reducing and preventing excessive human-derived nutrient inputs from impacting surface waters.

Additionally, the WQS provides for the use of Best Management Practices (BMPs) "as necessary" for the reduction of nutrient pollution (RCSA § 22a-426-4(a)(11)).

> *"The Commissioner shall require Best Management Practices, including the imposition of discharge limitations or other reasonable controls on a case-by-case basis as necessary for point and nonpoint sources of phosphorus and nitrogen, including sources of atmospheric deposition, which have the potential to contribute to the impairment of any surface water, to ensure maintenance and attainment of existing and designated uses, restore impaired waters, and prevent excessive anthropogenic inputs of nutrients or impairment of downstream waters."*

Thus, BMPs are an essential and mandatory component of restoring nutrient impaired waterbodies in Connecticut. BMPs refer to a wide range of possible options that help prevent or reduce the movement of pollutants from the landscape to surface or ground waters. The term has a specific meaning in the context of Connecticut WQS, defined by RCSA § 22a-426-1(7):

> *"'Best Management Practices' means those practices which reduce pollution and which have been determined by the Commissioner to be acceptable based on, but not limited to, technical, economic and institutional feasibility."*

EPA regulation 40 CFR § 122.44(d)(1)(vi) provides for the use of narrative criteria as the basis for limiting specific pollutants for which the state does not have numeric criteria. This Advance Restoration Plan is based on procedures to translate the narrative nutrient criteria for Total Phosphorus into waterbody-specific numeric water quality targets protective of the aquatic life biological communities and the Designated Use of habitat for fish and other aquatic life and wildlife.

2.2.3. Antidegradation Standards & Implementation Policies

Antidegradation standards are designed to preserve and protect the designated uses of the State's surface waters and to limit the degradation of such waters (RCSA § 22a-426-8(a)). The standards focus on the maintenance, protection, and improvement of water quality of all waters to support designated uses (Antidegradation Standard 1) and provide additional protection for high quality and Outstanding National Resource Waters (Antidegradation Standards 2-4).

Antidegradation implementation policies for evaluation and implementation review contained in RCSA § 22a-426-8(b) follow a tiered approach pursuant to federal regulations (Title 40 Part Code of Federal Regulations (CFR) 131.12). The purpose of antidegradation evaluation and implementation review for Tier 1 is to ensure that existing and designated uses of all surface waters and the water quality necessary for their protection are maintained and preserved consistent with Connecticut WQS and Antidegradation Standard 1. The purpose of Tier 2 evaluation and implementation review is to ensure high quality surface waters and wetlands with existing water quality better than the WQS are maintained at their existing high quality, pursuant to Antidegradation Standards 2 and 3. The purpose of Tier 3 evaluation and implementation review is to ensure that water quality of Outstanding National Resource Waters is maintained and protected pursuant to Antidegradation Standard 4.

For this Advance Restoration Plan, the Antidegradation Standards & Implementation Policies are implemented through the issuance of water quality-based permits to the facilities and dischargers included under this Plan.

2.3. Translating Narrative Water Quality Criteria for Biological Condition and Nutrients with respect to Total Phosphorus

CT DEEP developed a process to identify excess anthropogenic loading of phosphorus on a watershed scale based on the diatom community within rivers and streams and using a calculated enrichment factor to define phosphorus loading. This process is presented in detail in Interim Phosphorus Reduction Strategy for Connecticut Freshwater Non-Tidal Waste-Receiving Rivers and Streams Technical Support Document (CT DEEP, 2017) and is summarized here.

Diatoms are a collection of microalgae that respond to nutrient levels in rivers and streams, providing an indication of trophic status for the water bodies and have been used as indicators of water quality. The diatom community was studied at 85 sites across the state during 2002-2004 to determine the taxonomic composition of the diatom community with identifications typically at the species level or lower. The taxonomic distribution of diatoms was identified at each site and a Threshold Indicator Taxa ANanlsyis (TITAN) (Baker & King, 2010) was used to identify points where the response of the diatom community changed based on seasonal phosphorus loading (April – October). The diatom species used in the TITAN analysis were associated with one of two groups, species that increased in abundance with increasing phosphorus enrichment in the rivers and streams, and those that decreased in abundance with increasing phosphorus enrichment.

Phosphorus enrichment was calculated as an Enrichment Factor representing the anthropogenic phosphorus loads for each watershed. Phosphorus load from WPCFs and industries was added to the phosphorus load from regulated and unregulated stormwater from undeveloped, urban, and agricultural land uses, and the sum was divided by the phosphorus load predicted for the watershed under fully forested conditions.

$$\text{Enrichment Factor (EF)} = \frac{\text{Total NPDES Load (lbs/day)} + \text{Land Cover Load (lbs/day)}}{\text{Forested Condition Load (lbs/day)}}$$

The analysis showed that above an Enrichment Factor of 8.4, major changes in the diatom community composition were observed. Within the context of the Biological Condition Gradient model, major changes to the structure of the biological community and moderate changes in ecosystem function including observations that sensitive taxa are markedly diminished, would place waterbodies with an Enrichment Factor greater than 8.4 in either Tier 5 or 6 (Figure 2-2). Such changes are inconsistent with supporting the Designated Use of habitat for fish and other aquatic life and wildlife, and the associated narrative criteria for Biological Condition which requires water quality sufficient to sustain waters within Biological Condition Gradient Tiers 1-4.

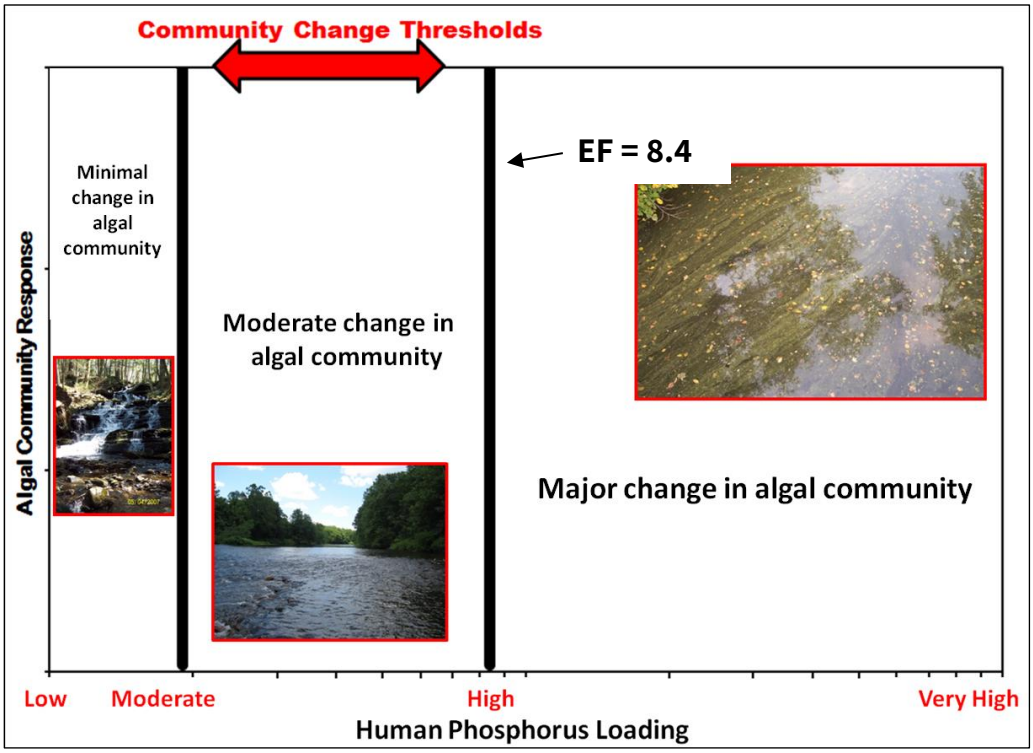

Figure 2-2. Conceptual diagram depicting the relationship between anthropogenic phosphorus loading and diatom community response. As loading increases, community changes increase. The water quality target is an EF of 8.4. Above this, major changes in biological communities occur.

Therefore, to prevent major changes in the diatom community in response to human-based phosphorus loading, a water quality target of an Enrichment Factor of 8.4 was established in the Interim Phosphorus Reduction Strategy for Connecticut Freshwater Non-Tidal Waste-Receiving Rivers and Streams Technical Support Document. An Enrichment Factor of 8.4 is consistent with Biological Condition Gradient Tier 4, representing the minimum required water quality conditions sufficient for consistency with the Biological Condition Criteria and support the Designated Use of habitat for fish and other aquatic life and wildlife.

3. Establishing Water Quality Based Total Phosphorus Loading Targets and Permit Requirements

CWA Section 301(b)(1)(C) requires that permits include any effluent limitations necessary to meet water quality standards. This includes both narrative and numeric water quality criteria and biological criteria. In order to provide a mechanism to implement the narrative criteria for biological condition and nutrients with respect to Total Phosphorus, the water quality-based Enrichment Factor of 8.4 was translated into facility-specific Waste Load Allocations for phosphorus within the Interim Phosphorus Reduction Strategy for Connecticut Freshwater Non-Tidal Waste-Receiving Rivers and Streams Technical Support Document. A watershed approach was used to

ensure that the Enrichment Factor of 8.4 would be met throughout each watershed and permit limits were established for 43 WPCF and 2 industrial facilities.

This Advance Restoration Plan includes the permit limits established for these facilities within the Interim Phosphorus Reduction Strategy. Additionally, permit requirements are identified for regulated stormwater to prevent the excess discharge of phosphorus from anthropogenic sources within the watersheds included in the Interim Phosphorus Reduction Strategy or that discharge to other non-tidal freshwaters impaired for phosphorus or related parameters within MS4 municipalities. These requirements provide additional assurance that following this Plan will result in attainment of water quality standards. Waterbodies included in this Plan are identified in Section 1.5 and Appendix A of this document.

3.1. Water quality-based limits for WPCFs and Industrial Facilities included in the Interim Phosphorus Reduction Strategy

The State of Connecticut's Water Permitting and Enforcement Division of the Bureau of Materials Management and Compliance Assurance, as well as the Municipal Facilities Section of the Bureau of Water Protection and Land Reuse, administer the NPDES program for point source discharges from individual, industrial and municipal WPCFs, respectively. Wastewater treatment at WPCFs remove or greatly reduce a variety of organic and inorganic pollutants so that final effluent discharges are consistent with unique permit limits protecting the State WQS. Figure 3-1 shows the locations of 45 NPDES facilities (43 of which are municipal WPCFs) discharging phosphorus to non-tidal freshwater rivers in Connecticut.

Total Phosphorus permit limits for these facilities were established within the Interim Phosphorus Reduction Strategy using the Enrichment Factor calculated for each stream segment in the target watersheds. The necessary reduction in phosphorus loading was calculated by subtracting the current Enrichment Factor from the Target Enrichment factor of 8.4. The reduction targets were then applied to the Waste Load Allocation for the permitted facilities, ensuring that the target enrichment factor was met throughout the watershed. For facilities where the current waste load allocation in the permit was sufficient to meet the target Enrichment Factor, the phosphorus load from the facility was maintained at the current waste load allocation, consistent with the Antidegradation Policy in the WQS. Details of the analysis for each facility are provided in the Interim Phosphorus Reduction Strategy Technical Support Document. The permit limits are identified in Table 8 of the Interim Phosphorus Strategy and provided in Appendix B of this document.

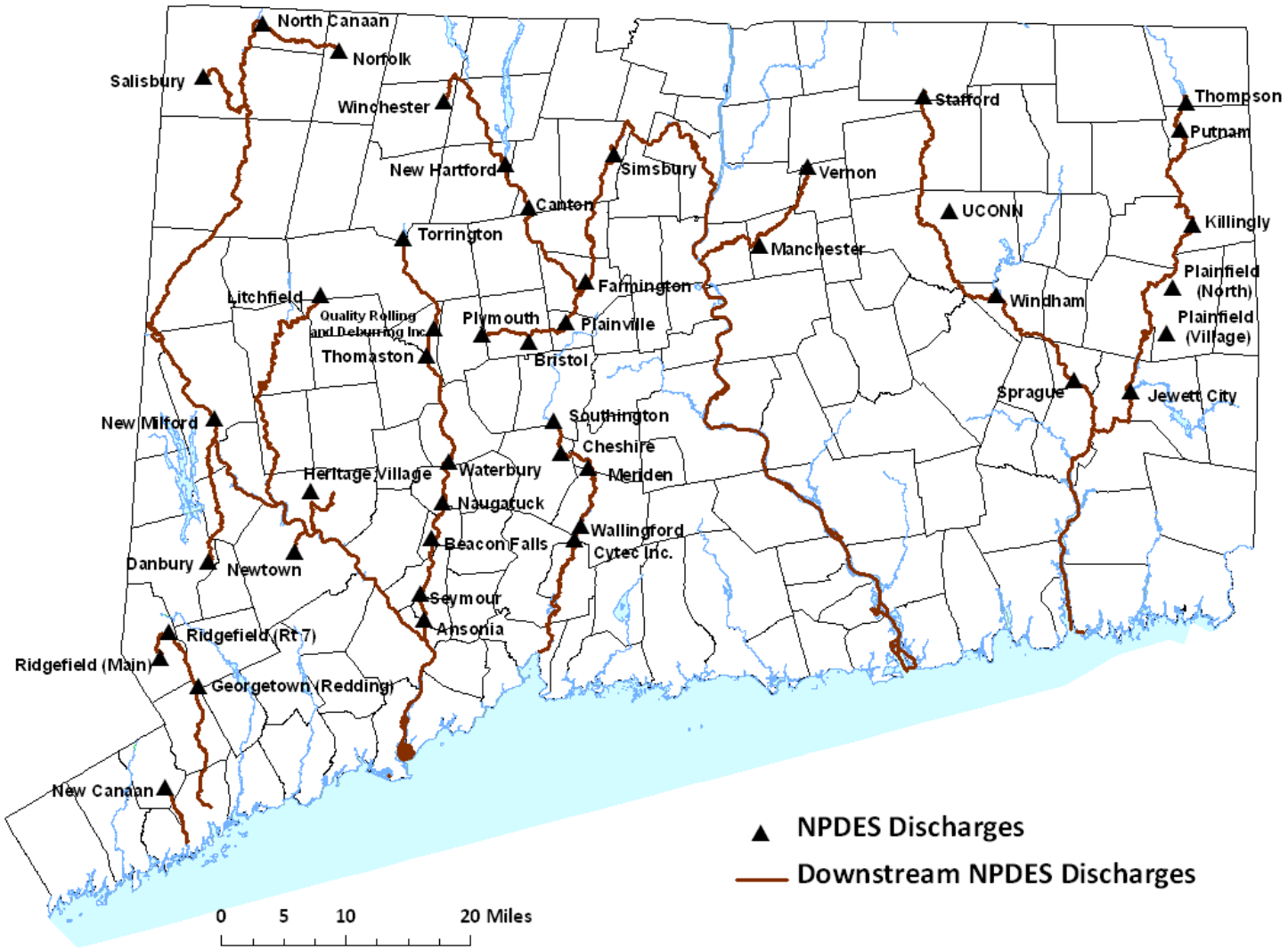

Figure 3-1. Map of 45 NPDES-permitted wastewater pollution control and industrial facilities discharging phosphorus to non-tidal freshwater rivers in the State of Connecticut. Part of the statewide Phosphorus Reduction Strategy.

3.2. Stormwater from Regulated Point Sources

The “Recommendations for Phosphorus Strategy Pursuant to PA 12-155” NPS Workgroup evaluated potential sources of phosphorus including from regulated stormwater. Recommendations from the workgroup included “enhance CT DEEP’s Stormwater Permitting program by targeting sources of phosphorus.” The workgroup also recommended that “CT DEEP and municipalities should continue to explore cost-effective best management practices and treatment technologies for phosphorus management".

Stormwater is a recognized source of nutrients to surface waters (EPA, 2017: CT DEEP, 2017). This Advance Restoration Plan incorporates several approaches to address water quality impacts of stormwater on surface waters in Connecticut, consistent with recommendations in the Interim Phosphorus Strategy to enhance stormwater permitting in Connecticut to target sources of phosphorus. The strategy recognizes the role of using Best Management Practices to manage sources of phosphorus as well as the utility of TMDLs and other alternative plans under section 303(d) of the CWA, such as this Plan, as an effective approach in addressing water quality impacts from phosphorus.

As part of this Plan, water quality-based requirements to address phosphorus in permitted discharged stormwater are applied to waters included in the Interim Phosphorus Plan and additional waters identified as impaired due to phosphorus in MS4 municipalities as determined through the monitoring and assessment process. Additional water quality-based recommendations to address phosphorus from regulated stormwater were developed and incorporated into stormwater permits as they become available for review and renewal. With subsequent renewal of these permits, water-quality based requirements in the permit are maintained or adjusted as needed to restore or protect water quality in the waters included in this Plan (Appendix A). The permit conditions described below highlight CT DEEP's ongoing efforts to reduce anthropogenic phosphorus inputs in permitted stormwater. In the future, permit conditions may be altered, or conditions may be added to additional stormwater permits.

General Permits for the Discharge of Stormwater from Small Municipal Separate Storm Sewer Systems (MS4)

The Municipal MS4 permit in CT covers stormwater from municipalities and institutions, excluding facilities managed by the Connecticut Department of Transportation (CTDOT). A separate MS4 permit was issued to CTDOT, which is modified based on the Municipal MS4 permit and covers stormwater from the CT Department of Transportation. Both permits provide a baseline of required actions to manage stormwater. In addition to those baseline requirements, additional requirements were included in these permits to address potential impacts from phosphorus for waters included in this Plan. These requirements were first incorporated into the Municipal MS4 General Permit starting in 2017 (CT DEEP, 2016). The 2017 permit was updated to reflect the 2010 Census data. In addition, federal and state institutions, military facilities, and eight municipalities were added. As of February 5, 2018, 121 municipalities and 12 institutions were covered by the permit (CT DEEP, 2018b) (Figure 3-2). At that time, additional permit requirements were added for waters for which phosphorus was identified as a Stormwater Pollutant of Concern, as described in Appendix D of the permit and provided below. This includes waterbodies with TMDLs established for phosphorus, watersheds included in the Interim Phosphorus Reduction Strategy, and waters impaired for Aquatic Life Uses for phosphorus or other related causes identified. Waterbody segments that are included in this Plan and are within a MS4 municipality are identified in Appendix A of the document.

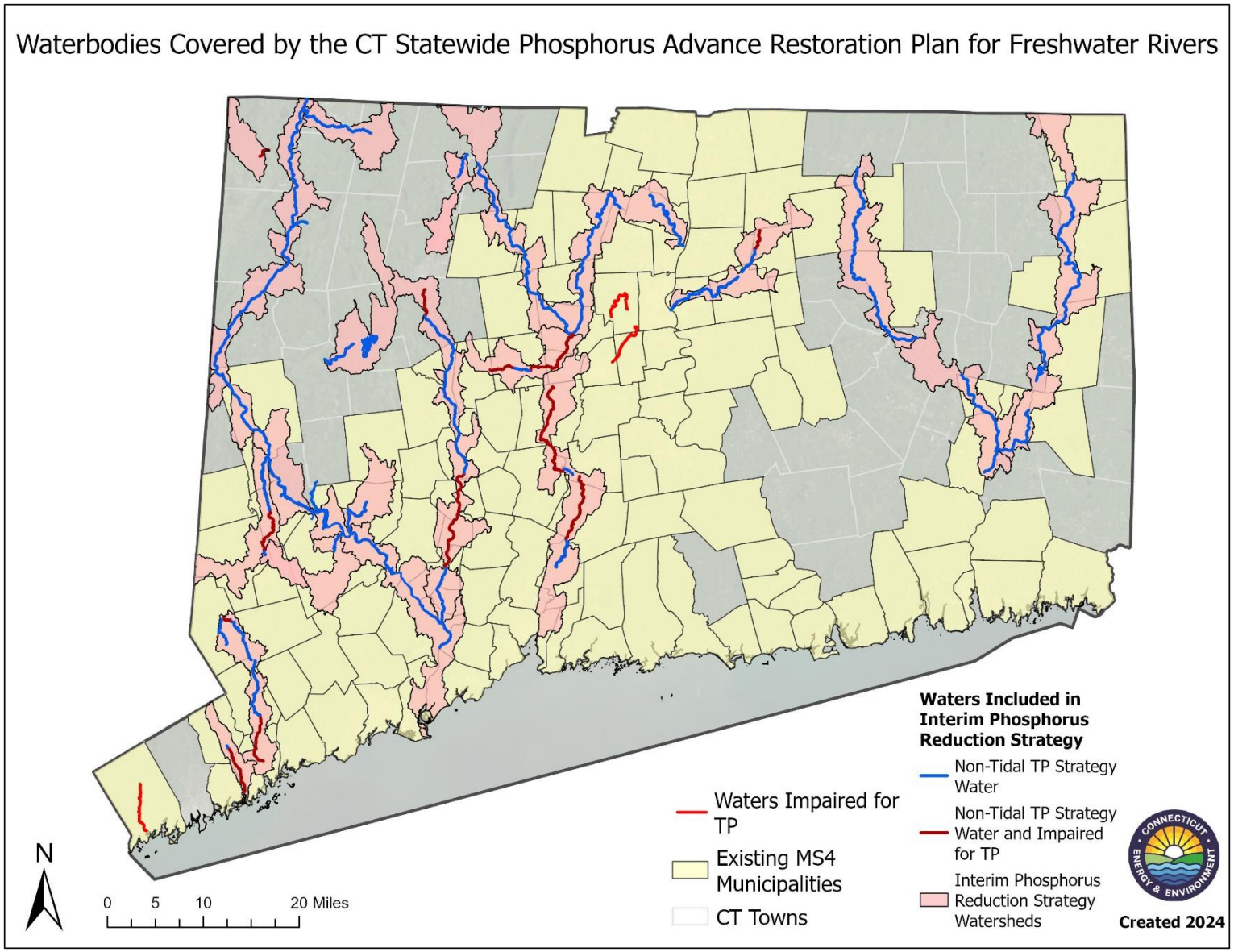

Figure 3-2: Map of the waterbodies covered by this Alternative Restoration Plan and CT towns covered by the MS4 permit as of May 2024.

Table 3-1: Appendix D – Impaired Waters Guidance from MS4 Permit*

Surface Waters and Associated Stormwater Pollutants of Concern			
Stormwater Pollutant of Concern	**Waterbodies included within a TMDL or Waters Included in Pollution Control Strategy Developed by CT DEEP**	**Impaired waters without a TMDL**	
		Impaired Designated Use	**Cause**
Phosphorus	Any water body subject to a TMDL pollutant load reduction for Phosphorus or any waterbody included in the Interim Phosphorus Reduction Strategy for Connecticut Freshwater Non-tidal Receiving Rivers and Streams Technical Support Document (2014 or as amended) , including but not limited to the Bantam River Watershed, Blackberry River Watershed, Factory Brook Watershed, Farmington River Watershed, Fivemile River Watershed, Hockanum River Watershed, Housatonic River Main Stem Watershed, Limekiln Brook Watershed, Naugatuck River Watershed, Norwalk River Watershed, Pequabuck River Watershed Pomperaug River Watershed, Pootatuck River Watershed, Quinebaug River Watershed, Quinnipiac River Watershed, Shetucket River Watershed or Willimantic River Watershed	Habitat for Fish, Other Aquatic Life and Wildlife or Recreation	Phosphorus, Nutrient/ Eutrophication Biological Indicators, Dissolved Oxygen, Chlorophyll-a, or Excess Algal Growth

*language included in MS4 permits effective from 2017 through 2025.

For these waters, the following additional permit requirements were added to the Minimum Control Measures to address phosphorus:

- **Education**: When Phosphorus is the Stormwater Pollutant of Concern- educational materials shall be specifically tailored and targeted to provide education on the sources, impacts, and available pollution reduction practices from the following:

    a. Septic systems
    b. Fertilizer use
    c. Grass clippings and leaves management
    d. Detergent use
    e. Discharge of sediment (to which phosphorus binds) from construction sites
    f. Other erosive surfaces

- **Illicit discharge detection and elimination (IDDE)**- When Phosphorus is a Stormwater Pollutant of Concern: To address septic system failures, the **IDDE** program shall give highest priority for the areas with the highest potential to discharge bacteria, phosphorus, and nitrogen to the MS4.
- **Post-construction stormwater management in new development or redevelopment-)**- When Phosphorus is a Stormwater Pollutant of Concern: address erosion and sediment problems noted during inspections. Develop, fund, implement, and prioritize these problems under the Retrofit program to

correct the problem(s) and short term and long-term maintenance. Include in the annual report which problem areas were retrofitted, the cost of the retrofit, and the anticipated pollutant reduction.

- **Pollution Prevention/Good Housekeeping:** For impaired waters (with or without a TMDL) where Phosphorus is a Stormwater Pollutant of Concern on permittee-owned or -operated lands, implement a turf management practices and procedures policy, such as proper fertilizer application and the planting of native plant materials. Discuss in each Annual Report the actions taken to implement this policy with an estimate of fertilizer and turf reduction.
- **Monitoring Requirements**: The permittee is required to screen (monitor) outfalls to waters when Phosphorus is the Pollutant of Concern during a rain event at least once during the permit term. The permittee may use a portable phosphorus meter to take a field reading during wet weather discharge. If Total Phosphorus > 0.3 mg/L the outfall shall be identified for follow-up investigation described in the permit (page 43 of 50). The Total Phosphorus benchmark was based on the average amount of phosphorus in monitored MS4 discharges based on data collected from 2004 to 2011.
    - **Follow up investigation**:
        - **Drainage Area Investigation**: Investigate activities within the drainage area contributing to the outfall.
        - **Control Measure Implementation**: Implement a BMP program focusing on the impaired waters provisions of each Control Measure and based on the findings of the Drainage Area Investigation.
        - **Prioritized Outfall Monitoring:** Once outfall screening has been completed for at least half of the outfalls, select six of the highest contributors of any of the pollutants of concern. These outfalls shall be sampled annually.

In order to facilitate issuance and then future compliance with the permit, CT DEEP created a series of fact sheets which provide water quality charts, maps, and applicable TMDLs or alternative plans for every municipality in the State. The purpose of these fact sheets is to provide information based on available stormwater quality data at the time the MS4 permit was proposed for revision in 2017, providing context and data to identify the relationship between stormwater and water quality within each municipality, and highlighting existing information on assessment and impairment data for surface waters. CT DEEP had also partnered with UConn's Center for Land Use Education and Research (CLEAR) to support and assist municipalities with MS4 permit compliance.

The current MS4 permit, in force from 9/29/2023 to 9/30/2025 is available online: MS4 Stormwater General Permit (ct.gov). Changes to the MS4 permit conditions regarding the control of Total Phosphorus or other permit provisions such as those for Illicit Discharge Detection and Elimination or other permit provisions may be made in the future.

General Permit for the Discharge of Stormwater Associated with Industrial Activity

The General Permit for the Discharge of Stormwater Associated with Industrial Activity (Industrial Stormwater General Permit) regulates industrial facilities to protect the waters of the state from industrial stormwater runoff. The permit was first issued in 1992 and has since been reissued, most recently in 2021. Facilities must register for the permit and develop and implement a Stormwater Pollution Prevention Plan. This plan includes information about the site's operations, a summary of potential pollutants, and the description and implementation of stormwater control measures and monitoring.

Within this permit, requirements were included for the monitoring of Total Phosphorus from all permittees authorized under this permit on a semiannual basis. A performance-based benchmark of 0.4 mg/l Total Phosphorus was established within the permit based on the 80th percentiles of the cumulative relative frequency graphs developed from stormwater results reported under this permit for the sampling years 2003-2007. If after the collection of 4 semiannual samples, the average of the 4 monitoring values for TP is less than the benchmark, continued sampling for TP is not required under the permit. However, if the average exceeds the benchmark, the permittee must evaluate and make necessary modifications to stormwater control measures and the facility's stormwater pollution prevention plan. Monitoring is required to continue until the average of 4 consecutive semiannual monitoring events does not exceed the benchmark. The permittee may obtain a waiver from these requirements if documentation is submitted and approved by the Commissioner indicating that further pollutant reductions are not technologically available and economically practicable and achievable.

The permit also has a requirement for monitoring discharge(s) to impaired waters with a TMDL for the corresponding parameter. The current Industrial Stormwater General Permit, in force from 10/01/2021 to 9/30/2024, is available online: Industrial Stormwater General Permit (ct.gov). Changes to the permit conditions regarding the control of Total Phosphorus or other permit provisions may be made in the future.

3.3. Stormwater from Nonpoint Sources

Approximately one-third of the municipalities in the State do not fall under the MS4 permit. Non-MS4 municipalities can voluntarily implement the BMPs within the MS4 permit and this document. Any facilities that discharge non-regulated stormwater can update their Pollution Prevention Plans to include BMPs that can reduce phosphorus from stormwater from entering surface waters. These BMPs could include revised housekeeping procedures to reduce pollutants, or techniques that increase infiltration to reduce runoff. Additionally, sites or areas that are not regulated by a NPDES permit (such as small scale commercial and construction sites, residential sites, etc.) should consider implementation measures to minimize and/or disconnect impervious areas. Improving water quality within the community to address nonpoint source phosphorus pollution requires actions, large and small, by the community. Apart from of these discharge categories, successful implementation will be best accomplished through incorporating an adaptive management strategy on a watershed basis. Additional investigation is necessary for all watersheds in order to fully document problem areas and begin the restoration process. The implementation strategy should include: 1) conducting parcel-level field work to locate potential sources of phosphorus and directly connected impervious cover; 2) reducing IC and phosphorus in stormwater where practical; 3) implementing BMPs to reduce phosphorus in stormwater including disconnecting IC from the surface waterbody; 4) minimizing additional disturbance to maintain existing natural buffering capacity; and 5) installing engineered BMPs and LID practices to reduce the impact of phosphorus and IC on receiving water hydrology and water quality.

3.4. Public Participation

For this Advance Restoration Plan all components have been through the public notice process. Public meetings were held with municipality officials early in the process to collaborate on, evaluate, and make recommendations regarding the Phosphorus reduction strategy. Public comments were collected both in person and in writing. To foster collaboration through the drafting process, a coordinating committee and three workgroups were established. The workgroups met monthly, often with stakeholder involvement. Meeting notes from all work group meetings have been made accessible to the public.

4. Public Education and Outreach

4.1. Stormwater and Water Quality Website

Extensive public education and outreach has been done regarding phosphorus reduction in CT's surface waters. CT DEEP developed a Stormwater and Water Quality webpage that defines what stormwater is, the contaminants it can contain, including phosphorus, and discusses its effects on water quality. The website describes the tools and measures CT DEEP uses to manage stormwater discharges and preserve surface water quality, including information on applicable permits that cover stormwater under the CWA NPDES program. The webpage also discusses how TMDLs and Watershed Response Plans are used to limit pollution in receiving water bodies. Additional resources are provided where citizens can find more information on tools used to reduce stormwater pollution.

4.2. Interactive Maps

One of those resources is an Interactive Map website that shows stormwater pollution management in CT. The website contains a series of maps that address common pollutants found in stormwater, including phosphorus. One of the maps shows CT watersheds covered by the Interim Phosphorus Reduction Strategy, highlighting the waterbodies and their watersheds that are downstream from WPCFs. Another map shows the relationship between impervious cover (IC) and waterbodies not meeting CT Water Quality Standards and can help identify areas where stormwater management can be improved, thus also reducing Phosphorus. Percent IC is shown both by subregional watershed basin and by town.

4.3. Water Quality Factsheets

In 2015 CT DEEP completed a set of water quality factsheets for each of CT's 169 towns and municipalities, regardless of if they are covered under the MS4 permit. Each factsheet describes the impacts of IC on water quality and includes specific data on the percentage of IC present in each town. A list of the applicable TMDLS or pollution reduction strategies, the pollutants they cover, and the waterbody the plans apply to are included in each factsheet. Also discussed within the factsheet are a few pollutants commonly monitored in stormwater under the MS4 permit, including phosphorus. A description of how a pollutant when elevated can affect a waterbodies health and its designated uses, potential sources, and applicable stormwater water quality targets are discussed for each pollutant. For towns under the MS4 permit that submitted stormwater outfall monitoring data to CT DEEP, summary graphs are included tracking the results of five parameters: *Escherichia coli* (E. coli), Total Suspended Solids, Total Nitrogen, Total Phosphorus, and Turbidity. Results for individual samples, averages of samples collected on a particular day, statistical ranges of samples for each day, outlier data, and basic statistics are all included for the five parameters. The end of each factsheet includes two maps which show the town's waterbodies, their assessment statuses for both recreation and aquatic life uses, subregional basins present in the town, and the percent of IC. The maps can help identify areas where towns can aim to make stormwater management improvements. All water quality factsheets in the State of CT can be found on the Stormwater and Water Quality webpage.

5. Phosphorus Monitoring and Management for Future Actions

5.1. Effectiveness Monitoring

In an effort to develop and improve diatom tolerance metrics to assist in identifying phosphorus as a contributing cause of aquatic life impairments, CT DEEP continues to annually sample for diatom community assemblages and phosphorus in wadable rivers and streams across the state. Diatom samples are collected and then sent out to contract laboratories for taxonomic identification. Chemistry testing is typically conducted in conjunction with biological monitoring site visits. Surface grab samples are taken for chemical parameters, including Total Phosphorus. CT DEEP has developed an assessment methodology using diatoms and total phosphorus samples to identify phosphorus as a cause of aquatic life impairment (Becker & Bellucci, 2019).

CT DEEP receives additional chemical data from the USGS New England Water Science Center - Connecticut Office who maintains a network of fixed stream monitoring stations, some of which occur on several rivers covered by this Plan. Stations are sampled for water chemistry, including Total Phosphorus, and stream flow at a frequency ranging from quarterly to monthly (CT DEEP, 2015a).

In response to The Connecticut Academy of Science and Engineering recommendations outlined in Methods to Measure Phosphorus and Make Future Projections (2014), CT DEEP partnered with the USGS and the New England Interstate Water Pollution Control Commission (NEIWPCC) to collect continuous dissolved oxygen (DO) data. In the summers of 2015-2018, continuous DO measurements were collected at 18 sites in streams throughout the state with varying phosphorus concentrations. The USGS also collected discrete nutrient data at 11 of the 18 stations. Data collected showed that daily fluxes of DO (minimum and maximum values) may be a beneficial metric for assessment in relation to aquatic life impairments due to phosphorus in CT streams and rivers. Additional data was also collected to better understand how DO varies under different environmental conditions, for example in low flow vs high flow years (Izbicki & Morrison, 2021). This effort is ongoing, as several stations in the state continue to collect continuous DO measurements.

5.2. Nutrient Modeling

CT DEEP also is completing a statewide Hydrological Simulation Program - FORTRAN (HSPF) nutrient model that will be available for use statewide. The model is validated and calibrated with nutrient data from across the state and can be used to estimate nutrient loads, including phosphorus, from watershed areas, calculate contributions from point and nonpoint sources, and run different management scenarios. The modeling results can also be used as input data to link with site specific models. The model will provide a useful tool, should updated approaches to manage phosphorus for water quality restoration or protection be needed in the future.

5.3. Permit Monitoring

In accordance with the Interim Phosphorus Reduction Strategy, the identified NPDES permitted facilities must monitor for Total Phosphorus. The frequency of sampling is specific to each permit and depends on the design flow rate of the WPCF as well as on the time of year, e.g. in season (April – October) vs out of season (November – March) but all samples must be taken during the time of day when peak hourly flows occur. At all applicable facilities, the average Total Phosphorus seasonal load must also be calculated and reported. This load is

calculated by adding together all Total Phosphorus sample results obtained during each April-October season in pounds per day and dividing by the total number of those samples in that season. Samples results, average seasonal loads, average monthly concentrations, maximum daily concentrations and a detailed explanation of any violations where Total Phosphorus exceeds permit set levels identified in the Interim Phosphorus Strategy (Appendix B) and included in NPDES permits are included in Monthly Operating Reports and Discharge Monitoring Reports submitted to CT DEEP. These monitoring requirements may change in future permit renewals.

Under the current MS4 Stormwater General Permit, in force from 9/29/2023 to 9/30/2025, Permittees are required to conduct screening (monitoring) of outfalls that discharge to phosphorus impaired waters. Outfalls must be sampled during rain events, and those with Total Phosphorus levels exceeding the permit benchmark must be identified for follow-up investigations. Permittees must submit an annual report to CT DEEP detailing monitoring and investigation efforts, including a summary of any control measures implemented (CT DEEP, 2016). These monitoring requirements may change in future permit renewals.

Permittees under the current Industrial Stormwater General Permit, in force from 10/01/2021 to 9/30/2024, are also required to monitor for Total Phosphorus. If sampling results exceed the benchmark set in the permit, Permittees must update their stormwater management plans and control measures to comply with the benchmark. Additionally, there is a requirement to monitor discharges to Impaired Waters, with or without a TMDL for the corresponding parameter (CT DEEP, 2019). The collected monitoring data ensures adherence to CT WQS and aids CT DEEP in assessing phosphorus loading from permitted sites. These monitoring requirements are subject to change in future permit renewals.

5.4. Nonpoint Source Monitoring

Non-regulated areas or sites are not required to develop discharge monitoring plans, but simple tracking techniques can still be beneficial towards reducing phosphorus in non-regulated stormwater and making water quality improvements. Tracking improvements can help identify areas of concern and assist in future planning. Tracking implementation is simple to establish by noting an area or a total of actions, such as actions to reduce phosphorus run off, disconnecting rain gutters, stormwater retrofits or installing porous pavement. In some cases, this information is helpful to secure funding or get connected to shovel-ready projects. Tracking information can be used to calculate areas that have implemented BMPs which points to reducing the impact of hard surfaces and showing progress towards reducing pollution. Tracking any activity can assist with defining improvements in water quality, documenting implementation actions and achieving restoration goals.

5.5. Stormwater Management & Implementation Assurance

CT DEEP can work with watershed partners, including towns and conservation organizations to implement better stormwater management in the impaired streams and watersheds. Additionally, there is a combination of regulatory and non-regulatory program support in Connecticut, including: regulatory enforcement requirements, availability of financial incentives, and local, State, and federal programs for pollution control. Enforcement of regulations controlling non-point source discharges includes local implementation of Connecticut's Enhanced State Nonpoint Source Management . CT DEEP continues to work with watershed stakeholders to draft Watershed Based Plans (WBPs) under the CWA 319 program. As part of these WBPs, watershed stakeholders investigate impairments and promote the implementation of nonpoint source pollution best management practices and stormwater management practices that reduce phosphorus in the watershed. CT DEEP approves various WBPs, including those that recommend watershed-wide and place-based

management measures to reduce nonpoint source pollution and source mitigation. These recommended WBP projects may be eligible for CWA 319 funding, as long as such projects are not used for permit compliance.

6. Conclusions

Meeting aquatic life use goals in most watersheds will need to be based on a variety of approaches and actions. Taking the approach to address individual stressors causing or contributing to water quality impairments through established water quality targets is an effective method to building a comprehensive planning and implementation strategy to address impairments with varied and complex causes, such as Total Phosphorus. The monitoring efforts identified within this Plan provide ongoing efforts to study the inputs of phosphorus in the state and its effects in water bodies and allow for adjustments to the Plan's approach as our understanding of these effects evolves. Likewise, the permit requirements described in this Plan detail efforts that were put into place through May 2024 and may expand to additional permits or provisions within the permits may change in the future. This Plan provides a procedure to make incremental improvements to water quality that when combined with other actions, as needed, will eventually restore water quality and result in attainment of aquatic life designated uses in Connecticut’s freshwaters.

7. References

Becker, M.E., Becker, T.J., Bellucci, C.J., 2018. *Diatom tolerance metrics to identify total phosphorus as candidate cause of aquatic life impairment in Connecticut, USA freshwater streams.* Ecol. Indic. 93. Available online at: https://doi.org/10.1016/j.ecolind.2018.05.046

CASE (The Connecticut Academy of Science and Engineering). 2014. *Methods to measure phosphorus and make future projections.* Rocky Hill, CT. Available online at: phosphorus.pdf (ctcase.org)

Cormier, S., S. Norton, G. Suter, and D. Reed-Judkins. 2000. *Stressor Identification Guidance Document*. U.S. Environmental Protection Agency, Washington, DC, EPA/822/B-00/025. Available online at: Document Display | NEPIS | US EPA

CT DEEP. 2004. 2004 Connecticut Stormwater Quality Manual. Connecticut Department of Energy & Environmental Protection. Available online at: https://portal.ct.gov/DEEP/Water-Regulating-and-Discharges/Stormwater/Stormwater-Manual

CT DEEP. 2014. *Interim Phosphorus Reduction Strategy for Connecticut Freshwater Non Tidal Waste-Receiving Rivers and Streams Technical Support Document*. Included as Appendix B to Recommendations for Phosphorus Strategy Pursuant to PA 12-155 (CT DEEP 2017)

CT DEEP. 2015a. *Ambient Water Quality Monitoring Program Strategy, 2015-2024*. Connecticut Department of Energy and Environmental Protection. Hartford, CT 06106. Available online at: monstrategy20152024finalpdf.pdf (ct.gov)

CT DEEP. 2015b. Regulations of Connecticut State Agencies, Title 22a. Environmental Protection. Connecticut Water Quality Standards, § § 22a-426-1 – 22a-426-9. Revised 2015-11-21. Available online at: https://eregulations.ct.gov/eRegsPortal/Browse/getDocument?guid={C0A3E155-0100-C1CF-85C3-D3C28F298640}

CT DEEP. 2016. General Permit for the Discharge of Stormwater from Small Municipal Separate Storm Sewer Systems, Issued January 20, 2016, Effective July 1, 2017, DEEP-WPED-GP-021. Connecticut Department of Energy & Environmental Protection, Bureau of Materials Management & Compliance Assurance, Water Permitting & Enforcement Division. Available online at: https://portal.ct.gov/-/media/DEEP/Permits_and_Licenses/Water_Discharge_General_Permits/MS4gppdf.pdf

CT DEEP. 2017. Recommendations for Phosphorus Strategy Pursuant to PA 12-155 Final Report, February 16, 2017. Coordinating Committee – Phosphorus Reduction Strategy, Connecticut Department of Energy & Environmental Protection. Available online at: https://portal.ct.gov/DEEP/Water/Water-Quality/-/media/DEEP/water/water_quality_standards/p/PA12155FullCCreportpdf.pdf?la=en&hash=BD60BF6C14C1C398205DA30F17CB1FB3

CT DEEP. 2018a. *A Method to Identify Total Phosphorus as a Cause of Aquatic Life Impairment in Connecticut Freshwater High Gradient Non-Tidal Streams*. CT 2018 Integrated Water Quality Report Appendix A5. Available online at: 2018CTIWQRAppendixA5pdf.pdf

CT DEEP. 2018b. MS4 Municipalities Active Registrations, 2/5/2018. Connecticut Department of Energy & Environmental Protection. Available online at: https://portal.ct.gov/-/media/DEEP/water_regulating_and_discharges/stormwater/municipal/180223MS4MunicipalitiesFeb2018pdf.pdf

CT DEEP. 2019. General Permit for the Discharge of Stormwater Associated with Industrial Activity. Connecticut Department of Energy & Environmental Protection, Bureau of Materials Management & Compliance Assurance, Water Permitting & Enforcement Division. Effective October 1, 2019: DEEP-WPED-GP-014. Available online at: https://portal.ct.gov/-/media/DEEP/Permits_and_Licenses/Water_Discharge_General_Permits/stormindustgppdf.pdf

CT DEEP. 2020. 2020 Integrated Water Quality Report, September 2020. Available online at: https://portal.ct.gov/DEEP/Water/Water-Quality/Water-Quality-305b-Report-to-Congress

EPA. 1991. *Technical Support Document for Water Quality-based Toxics Control.* EPA/505/2-90-001. Available online at: Technical Support Document for Water Quality-Based Toxics Control (epa.gov)

EPA. 1998. *Guideline for Ecological Risk Assessment*. EPA/630/R-95/002F. Available online at: Guidelines for Ecological Risk Assessment (epa.gov)

EPA. 2017. Causal Analysis/Diagnosis Decision Information System (CADDIS) Online Application. Volume 2. Sources, Stressors, and Responses, Nutrients. Available online at: https://www.epa.gov/caddis-vol2/nutrients

Izbicki, B., and Morrison, J., 2021, *Use of dissolved oxygen monitoring to evaluate phosphorus loading in Connecticut streams, 2015–18*: U.S. Geological Survey Scientific Investigations Report 2021–5024, 25 p., URL: https://doi.org/10.3133/sir20215024

Smucker N.J., Becker M., Detenbeck N.E. & Morrison A.C. (2013) *Using algal metrics and biomass to evaluate multiple ways of defining concentration-based nutrient criteria in streams and their ecological relevance*. Ecological Indicators 32, 51–61

Spaulding et al. 2021. *Diatoms.org: supporting taxonomists, connecting communities*. Diatom Research 36(4)201-304. Doi: 10”1080/0269249X.2021.2006790 (Retrieved from Diatoms of North America)

State of Connecticut (2012). Substitute Senate Bill no. 440. Public Act No. 12-155, An Act Concerning Phosphorus Reduction in State Waters. Approved June 15, 2012 Available online at: https://www.cga.ct.gov/2012/ACT/PA/2012PA-00155-R00SB-00440-PA.htm

8. Document History

With each revision of this Phosphorus Advance Restoration Plan document, Appendix A will be updated to reflect all segments including the year of addition, waterbody segment ID and name, and the reason for the inclusion. Reasons for inclusion include surface waters that are listed on Connecticut's 303(d) Impaired Waters List as impaired for aquatic life use due to Total Phosphorus and are in a MS4 municipality, identified and managed under the Interim Phosphorus Reduction Strategy, or within a watershed that includes those strategy waters. The Document History table (Table 8-1) tracks the month and year of the document revision, as well as any new segments with assigned waterbody IDs added to the Phosphorus Advance Restoration Plan at the time of revision.

Table 88-1: Document History

Table 8-1. Document History	
Revision Date	**Segments Covered:**
May 2024	CT3100-00_01; CT3100-00_02; CT3100-00_03; CT3100-00_04; CT3100-00_05; CT3100-00_06; CT3700-00_01; CT3700-00_02; CT3700-00_03; CT3700-00_04; CT3700-00_05; CT3800-00_01; CT3800-00_02; CT3800-00_03; CT4300-00_01; CT4300-00_02; CT4300-00_03; CT4300-00_04; CT4303-00_02; CT4315-00_01; CT4315-00_02; CT4315-00_03; CT4315-00_04; CT4315-00_05; CT4402-00_02; CT4403-00_03; CT4500-00_01; CT4500-00_02; CT4500-00_03; CT4500-00_04a; CT4500-00_04b; CT4500-00_05; CT5200-00_01; CT5200-00_02; CT5200-00_03; CT5200-00_04; CT5200-00_05; CT6000-00_01; CT6000-00_02; CT6000-00_03; CT6000-00_04; CT6000-00_05; CT6000-00_06; CT6000-00_07; CT6000-00-5+L1_01; CT6000-00-5+L2_01; CT6000-00-5+L2_02; CT6000-00-5+L4_01; CT6005-00_01; CT6008-00_01; CT6020-00_01; CT6100-00_01; CT6100-00_02a; CT6100-00_02b; CT6100-00_03; CT6100-00_04; CT6600-00_01; CT6600-00_02; CT6606-00_01; CT6705-00_01; CT6705-00-3-L3_01; CT6800-00_01; CT6800-00_02; CT6800-00_03; CT6900-00_01; CT6900-00_02; CT6900-00_03; CT6900-00_04; CT6900-00_05; CT6900-00_06; CT6900-00_07; CT7300-00_01; CT7300-00_02; CT7300-00_03a; CT7300-00_03b; CT7300-00_04; CT7300-00_05; CT7300-02_01; CT7300-02_02; CT7401-00_01; CT7401-00_02; CT7409-00_01

Appendix A: Updated List of Waterbodies Covered by this Advance Restoration Plan

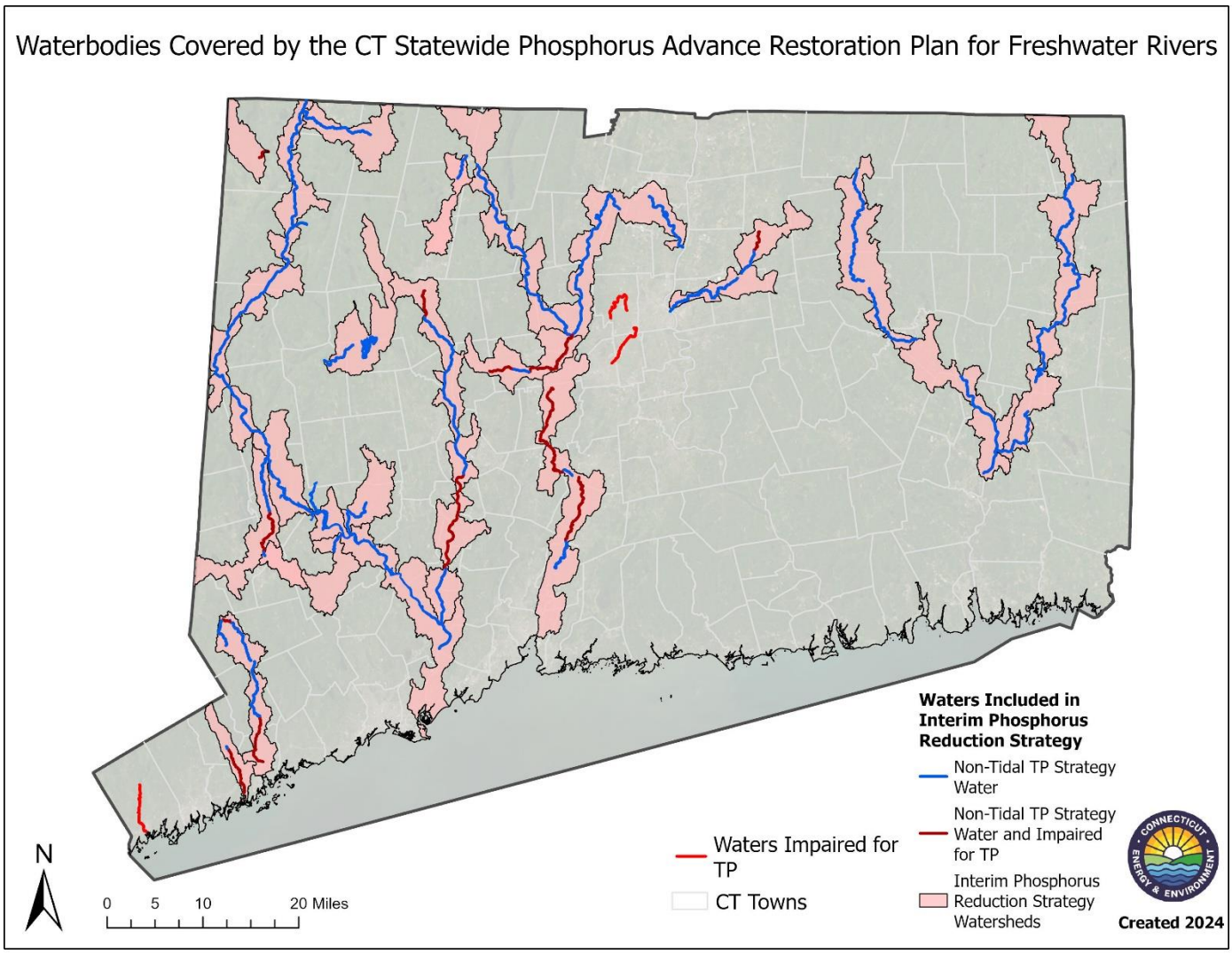

Figure 8-1. Waterbodies covered by this Advance Restoration Plan as of May 2024.

TP Action Plan Year	Waterbody Segment ID	Waterbody Name	Included in Interim Non-Tidal TP Strategy	Impaired Waters for TP (IWQR Listing Year)	Within MS4 Municipality
2024	CT3100-00_01	Willimantic River (Windham/Columbia)-01	Non-Tidal Strategy Water		Within a MS4 Municipality

TP Action Plan Year	Waterbody Segment ID	Waterbody Name	Included in Interim Non-Tidal TP Strategy	Impaired Waters for TP (IWQR Listing Year)	Within MS4 Municipality
2024	CT3100-00_02	Willimantic River (Windham/Mansfield/Coventry)-02	Non-Tidal Strategy Water		Within a MS4 Municipality
2024	CT3100-00_03	Willimantic River (Willington/Tolland)-03	Non-Tidal Strategy Water		Within a MS4 Municipality
2024	CT3100-00_04	Willimantic River (Tolland/Willington)-04	Non-Tidal Strategy Water		Within a MS4 Municipality
2024	CT3100-00_05	Willimantic River (Tolland/Willington/Ellington/Stafford)-05	Non-Tidal Strategy Water		Within a MS4 Municipality
2024	CT3100-00_06	Willimantic River (Tolland)-06	Non-Tidal Strategy Water		
2024	CT3700-00_01	Quinebaug River (Lisbon/Griswold)-01	Non-Tidal Strategy Water		Within a MS4 Municipality
2024	CT3700-00_02	Quinebaug River (Canterbury)-02	Non-Tidal Strategy Water		
2024	CT3700-00_03	Quinebaug River (Canterbury/Plainfield)-03	Non-Tidal Strategy Water		Within a MS4 Municipality
2024	CT3700-00_04	Quinebaug River (Putnam)-04	Non-Tidal Strategy Water		Within a MS4 Municipality
2024	CT3700-00_05	Quinebaug River (Putnam/Thompson)-05	Non-Tidal Strategy Water		Within a MS4 Municipality
2024	CT3800-00_01	Shetucket River (Norwich)-01	Non-Tidal Strategy Water		Within a MS4 Municipality
2024	CT3800-00_02	Shetucket River-02	Non-Tidal Strategy Water		Within a MS4 Municipality
2024	CT3800-00_03	Shetucket River-03	Non-Tidal Strategy Water		Within a MS4 Municipality
2024	CT4300-00_01	Farmington River (Windsor)-01	Non-Tidal Strategy Water		Within a MS4 Municipality
2024	CT4300-00_02	Farmington River (Bloomfield/Farmington)-02	Non-Tidal Strategy Water		Within a MS4 Municipality
2024	CT4300-00_03	Farmington River (Farmington/Burlington)-03	Non-Tidal Strategy Water		Within a MS4 Municipality

TP Action Plan Year	Waterbody Segment ID	Waterbody Name	Included in Interim Non-Tidal TP Strategy	Impaired Waters for TP (IWQR Listing Year)	Within MS4 Municipality
2024	CT4300-00_04	Farmington River-04	Non-Tidal Strategy Water		Within a MS4 Municipality
2024	CT4303-00_02	Still River (Colebrook)-02	Non-Tidal Strategy Water		
2024	CT4315-00_01	Pequabuck River (Plainville)-01	Non-Tidal Strategy Water	2022	Within a MS4 Municipality
2024	CT4315-00_02	Pequabuck River-02	Non-Tidal Strategy Water	2022	Within a MS4 Municipality
2024	CT4315-00_03	Pequabuck River-03	Non-Tidal Strategy Water		Within a MS4 Municipality
2024	CT4315-00_04	Pequabuck River-04	Non-Tidal Strategy Water		Within a MS4 Municipality
2024	CT4315-00_05	Pequabuck River (Bristol/Plymouth)-05	Non-Tidal Strategy Water	2022	Within a MS4 Municipality
2024	CT4402-00_02	Piper Brook-02		2022	Within a MS4 Municipality
2024	CT4403-00_03	Trout Brook (West Hartford)-03		2022	Within a MS4 Municipality
2024	CT4500-00_01	Hockanum River-01	Non-Tidal Strategy Water		Within a MS4 Municipality
2024	CT4500-00_02	Hockanum River (East Hartford/Manchester)-02	Non-Tidal Strategy Water		Within a MS4 Municipality
2024	CT4500-00_03	Hockanum River-03	Non-Tidal Strategy Water		Within a MS4 Municipality
2024	CT4500-00_04a	Hockanum River-04a	Non-Tidal Strategy Water		Within a MS4 Municipality
2024	CT4500-00_04b	Hockanum river-04b	Non-Tidal Strategy Water		Within a MS4 Municipality
2024	CT4500-00_05	Hockanum River (Vernon)-05	Non-Tidal Strategy Water	2022	Within a MS4 Municipality
2024	CT5200-00_01	Quinnipiac River (North Haven/Wallingford)-01	Non-Tidal Strategy Water		Within a MS4 Municipality

TP Action Plan Year	Waterbody Segment ID	Waterbody Name	Included in Interim Non-Tidal TP Strategy	Impaired Waters for TP (IWQR Listing Year)	Within MS4 Municipality
2024	CT5200-00_02	Quinnipiac River (North Haven/Meriden)-02	Non-Tidal Strategy Water	2022	Within a MS4 Municipality
2024	CT5200-00_03	Quinnipiac River-03	Non-Tidal Strategy Water		Within a MS4 Municipality
2024	CT5200-00_04	Quinnipiac River (Cheshire/Meriden/Southington)-04	Non-Tidal Strategy Water	2022	Within a MS4 Municipality
2024	CT5200-00_05	Quinnipiac River (Southington)-05	Non-Tidal Strategy Water	2022	Within a MS4 Municipality
2024	CT6000-00_01	Housatonic River (Orange/Shelton/Derby)-01	Non-Tidal Strategy Water		Within a MS4 Municipality
2024	CT6000-00_02	Housatonic River (Shelton/Derby)-02	Non-Tidal Strategy Water		Within a MS4 Municipality
2024	CT6000-00_03	Housatonic River (New Milford/Bridgewater)-03	Non-Tidal Strategy Water		Within a MS4 Municipality
2024	CT6000-00_04	Housatonic River-04	Non-Tidal Strategy Water		Within a MS4 Municipality
2024	CT6000-00_05	Housatonic River-05	Non-Tidal Strategy Water		
2024	CT6000-00_06	Housatonic River-06	Non-Tidal Strategy Water		
2024	CT6000-00_07	Housatonic River (Salisbury/North Canaan at MA border)-07	Non-Tidal Strategy Water		
2024	CT6000-00-5+L1_01	Lillinonah, Lake (Newtown/Southbury/Bridgewater/Brookfield)	Non-Tidal Strategy Water		Within a MS4 Municipality
2024	CT6000-00-5+L2_01	Zoar, Lake (Monroe/Newtown/Oxford/Southbury)	Non-Tidal Strategy Water		Within a MS4 Municipality
2024	CT6000-00-5+L2_02	Zoar, Lake (Newtown/Southbury)	Non-Tidal Strategy Water		Within a MS4 Municipality
2024	CT6000-00-5+L4_01	Housatonic Lake (Shelton/Derby/Seymour/Oxford/Monroe)	Non-Tidal Strategy Water		Within a MS4 Municipality
2024	CT6005-00_01	Factory Brook (Salisbury)-01	Non-Tidal Strategy Water	2022	

TP Action Plan Year	Waterbody Segment ID	Waterbody Name	Included in Interim Non-Tidal TP Strategy	Impaired Waters for TP (IWQR Listing Year)	Within MS4 Municipality
2024	CT6008-00_01	Mill Brook (Cornwall)-01	Non-Tidal Strategy Water		
2024	CT6020-00_01	Pootatuck River-01	Non-Tidal Strategy Water		Within a MS4 Municipality
2024	CT6100-00_01	Blackberry River (North Canaan)-01	Non-Tidal Strategy Water		Within a MS4 Municipality
2024	CT6100-00_02a	Blackberry River (North Canaan)-02a	Non-Tidal Strategy Water		
2024	CT6100-00_02b	Blackberry River (North Canaan)-02b	Non-Tidal Strategy Water		
2024	CT6100-00_03	Blackberry River (Norfolk)-03	Non-Tidal Strategy Water		
2024	CT6100-00_04	Blackberry River (Norfolk)-04	Non-Tidal Strategy Water		
2024	CT6600-00_01	Still River (New Milford/Brookfield)-01	Non-Tidal Strategy Water		Within a MS4 Municipality
2024	CT6600-00_02	Still River (Brookfield/Danbury)-02	Non-Tidal Strategy Water	2022	Within a MS4 Municipality
2024	CT6606-00_01	Limekiln Brook-01	Non-Tidal Strategy Water		Within a MS4 Municipality
2024	CT6705-00_01	Bantam River-01	Non-Tidal Strategy Water		Within a MS4 Municipality
2024	CT6705-00-3-L3_01	Bantam Lake (Litchfield/Morris)	Non-Tidal Strategy Water		
2024	CT6800-00_01	Pomperaug River-01	Non-Tidal Strategy Water		Within a MS4 Municipality
2024	CT6800-00_02	Pomperaug River-02	Non-Tidal Strategy Water		Within a MS4 Municipality
2024	CT6800-00_03	Pomperaug River-03	Non-Tidal Strategy Water		Within a MS4 Municipality
2024	CT6900-00_01	Naugatuck River (Derby/Seymour)-01	Non-Tidal Strategy Water		Within a MS4 Municipality

TP Action Plan Year	Waterbody Segment ID	Waterbody Name	Included in Interim Non-Tidal TP Strategy	Impaired Waters for TP (IWQR Listing Year)	Within MS4 Municipality
2024	CT6900-00_02	Naugatuck River (Seymour/Waterbury)-02	Non-Tidal Strategy Water	2022	Within a MS4 Municipality
2024	CT6900-00_03	Naugatuck River-03	Non-Tidal Strategy Water		Within a MS4 Municipality
2024	CT6900-00_04	Naugatuck River-04	Non-Tidal Strategy Water		Within a MS4 Municipality
2024	CT6900-00_05	Naugatuck River (Waterbury/Thomaston)-05	Non-Tidal Strategy Water		Within a MS4 Municipality
2024	CT6900-00_06	Naugatuck River-06	Non-Tidal Strategy Water		Within a MS4 Municipality
2024	CT6900-00_07	Naugatuck River (Litchfield/Harwinton/Torrington)-07	Non-Tidal Strategy Water	2022	
2024	CT7300-00_01	Norwalk River (Norwalk/Wilton)-01	Non-Tidal Strategy Water	2022	Within a MS4 Municipality
2024	CT7300-00_02	Norwalk River (Wilton)-02	Non-Tidal Strategy Water		Within a MS4 Municipality
2024	CT7300-00_03a	Norwalk River (Wilton/Redding)-03a	Non-Tidal Strategy Water		Within a MS4 Municipality
2024	CT7300-00_03b	Norwalk River (Redding)-03b	Non-Tidal Strategy Water		Within a MS4 Municipality
2024	CT7300-00_04	Norwalk River (Wilton/Ridgefield)-04	Non-Tidal Strategy Water		Within a MS4 Municipality
2024	CT7300-00_05	Norwalk River (Ridgefield)-05	Non-Tidal Strategy Water		Within a MS4 Municipality
2024	CT7300-02_01	Ridgefield Brook (Ridgefield)-01	Non-Tidal Strategy Water	2022	Within a MS4 Municipality
2024	CT7300-02_02	Ridgefield Brook (Ridgefield)-02	Non-Tidal Strategy Water		Within a MS4 Municipality
2024	CT7401-00_01	Fivemile River (New Canaan)-01	Non-Tidal Strategy Water	2022	Within a MS4 Municipality
2024	CT7401-00_02	Fivemile River (New Canaan)-02	Non-Tidal Strategy Water		Within a MS4 Municipality

TP Action Plan Year	Waterbody Segment ID	Waterbody Name	Included in Interim Non-Tidal TP Strategy	Impaired Waters for TP (IWQR Listing Year)	Within MS4 Municipality
2024	CT7409-00_01	Horseneck Brook (Greenwich)-01		2022	Within a MS4 Municipality

Appendix B: Phosphorus Permit Limits for NPDES Facilities Included in the Interim Phosphorus Reduction Strategy

The current average phosphorus load (lbs/day) and the phosphorus load after reductions are met, as well as the proposed performance limit needed to meet reductions at the 45 NPDES facilities as described in Table 8 of the Interim Phosphorus Reduction Strategy Technical Support Document (CT DEEP, 2014). The concentration performance limits were converted into enforceable NPDES permit limits, considering effluent variability and monitoring frequency at each facility. DEEP used EPA's Technical Support Document (EPA/505/2-90-001) for this process, resulting in recommended maximum daily and average monthly limits for each municipal facility (Appendix C). These concentration limits are now included in the NPDES permits.

NPDES	Watershed	Current Average Phosphorus Load (lbs/day) 2001 - 2007	Phosphorus Load After Reductions to meet EF goal (lbs/day)	Proposed Performance Limit (mg/L)
LITCHFIELD WPCF	Bantam River Watershed	13.07	9.97	2.39
NORFOLK SEWER DISTRICT	Blackberry River Watershed	3.45	3.45	Cap
NORTH CANAAN WPCF	Blackberry River Watershed	4.29	4.29	Cap
SALISBURY WPCF	Factory Brook Watershed	7.14	1.97	0.62
WINSTED WPCF	Farmington River Watershed	20.03	17.16	1.49
NEW HARTFORD WPCF	Farmington River Watershed	10.92	10.92	Cap
CANTON WPCF	Farmington River Watershed	24.8	24.8	Cap
FARMINGTON WPCF	Farmington River Watershed	119.01	70.11	2
SIMSBURY WPCF	Farmington River Watershed	85.99	46.95	2.5
NEW CANAAN WPCF	Fivemile River Watershed	10.45	1.47	0.19
VERNON WPCF	Hockanum River Watershed	72.19	4.56	0.14
MANCHESTER WATER & SEWER	Hockanum River Watershed	110.4	13.21	0.25
New Milford WPCF	Housatonic River Main Stem Watershed	5.76	5.76	Cap
DANBURY WPCF	Limekiln Brook Watershed	78.51	7.55	0.1
TORRINGTON WPCF	Naugatuck River Watershed	64.73	17.29	0.4
QUALITY ROLLING AND DEBURRING INC.	Naugatuck River Watershed	0.54	0.53	0.7
THOMASTON WPCF	Naugatuck River Watershed	22.68	7.35	1
WATERBURY WPCF	Naugatuck River Watershed	539.92	34.26	0.2
NAUGATUCK WPCF	Naugatuck River Watershed	159.97	16.43	0.4
BEACON FALLS WPCF	Naugatuck River Watershed	7.91	2.67	1
SEYMOUR WPCF	Naugatuck River Watershed	41.09	7.54	0.7

NPDES	Watershed	Current Average Phosphorus Load (lbs/day) 2001 - 2007	Phosphorus Load After Reductions to meet EF goal (lbs/day)	Proposed Performance Limit (mg/L)
ANSONIA WPCF	Naugatuck River Watershed	43.32	11.92	0.7
RIDGEFIELD MAIN WPCF	Norwalk River Watershed	5.99	0.52	0.1
RIDGEFIELD RTE 7 *	Norwalk River Watershed	0	1	1
REDDING WPCF	Norwalk River Watershed	1.08	1.08	Cap
PLYMOUTH WPCF	Pequabuck River Watershed	28.64	4.38	0.5
BRISTOL WPCF	Pequabuck River Watershed	189.33	7.48	0.1
PLAINVILLE WPCF	Pequabuck River Watershed	82.35	3.49	0.2
SOUTHBURY HERITAGE VILLAGE WPCF	Pomperaug River Watershed	10.92	10.92	Cap
NEWTOWN WPCF	Pootatuck River Watershed	4.01	4.01	Cap
THOMPSON WPCF	Quinebaug River Watershed	6.29	2.1	0.7
PUTNAM WPCF	Quinebaug River Watershed	19.69	8.41	0.7
KILLINGLY WPCF	Quinebaug River Watershed	40.64	18.23	0.7
PLAINFIELD NORTH WPCF	Quinebaug River Watershed	17.82	3.86	0.7
PLAINFIELD WPCF	Quinebaug River Watershed	10.51	2.51	0.7
GRISWOLD WPCA	Quinebaug River Watershed	5.52	2.92	0.7
SOUTHINGTON WPCF	Quinnipiac River Watershed	100	7.53	0.2
CHESHIRE WPCF	Quinnipiac River Watershed	88.2	4.06	0.2
MERIDEN WPCF	Quinnipiac River Watershed	121.64	8.71	0.1
WALLINGFORD WATER & SEWER	Quinnipiac River Watershed	145.16	8.95	0.2
ALLNEX USA INC. (formerly CYTEC INDUSTRIES INC.)	Quinnipiac River Watershed	19.44	1.49	0.1
SPRAGUE WPCF	Shetucket River Watershed	3.11	3.11	Cap
STAFFORD WPCA	Willimantic River Watershed	8.61	8.61	Cap
UCONN WPCF	Willimantic River Watershed	23.76	23.76	Cap
WILLIMANTIC WPCF	Willimantic River Watershed	18.63	18.63	Cap

* Current phosphorus loading data was not available for the Ridgefield Rte. 7 WPCF at the time the Enrichment Factor analysis was conducted.

Appendix C: Procedure for Translating TP Concentration-Based Limits to Permit Limits

The Connecticut Water Quality Standards (WQS) do not include numeric criteria for nutrients but rather incorporate narrative standards and criteria for nutrients. These narrative policy statements direct the Connecticut Department of Environmental Protection to impose discharge limitations or other reasonable controls on point and nonpoint sources to support maintenance or attainment of designated uses. In the absence of numeric criteria for phosphorus, the Department has developed an interim nutrient management strategy for freshwater non-tidal streams based on the narrative policy statements in the WQS to meet the pressing need to issue NPDES permits and be protective of the environment. The strategy includes methods that focus on phosphorus because it is the primary limiting nutrient in freshwater systems. These methods were approved by the United States Environmental Protection (EPA) in their letter dated October 26, 2010 as an interim strategy to establish water quality based phosphorus limits in non-tidal freshwater for industrial and municipal water pollution control facilities (WPCFs) national pollutant discharge elimination system (NPDES) permits.

The method in the Interim Strategy uses best available science to identify phosphorus enrichment levels in waste receiving rivers and streams that adequately support aquatic life uses. The methodology focuses on diatom communities as the key aquatic life nutrient response variable and phosphorus enrichment factors that represent significant changes in communities based on data collected statewide. Ongoing work is currently being conducted to refine the approach through additional data collection and by expanding the methodology to include non-waste receiving streams. The current approach provides for a major statewide advancement in the level of phosphorus control that is expected to meet all freshwater designated uses. The adaptive nature of Connecticut's strategy allows for revisions to permit limits in future permit cycles without delaying action that we know needs to be taken today.

The current approach follows a watershed-based framework incorporating many of the elements from the U.S. EPA Watershed –Based National Pollutant Discharge Elimination System (NPDES) Permitting Technical Guidance (2007). Consistent with the 2007 Guidance, the approach "explicitly considers the impact of multiple pollutant sources and stressors, including nonpoint source contributions, when developing point source permits". Expected current conditions are based on the probability of excess phosphorus export from land cover and municipal and industrial facilities in the upstream drainage basin. Connecticut's policy for phosphorus management is translated into a numeric expression through geo-spatial and statistical analyses that determines the maximum acceptable seasonal phosphorus mass load per unit area of watershed contributing flow to the point of assessment.

The goal of the Interim Strategy is to achieve or maintain an Enrichment Factor (EF) of 8.4 or below throughout a watershed. An EF is representative of the amount of anthropogenic phosphorus loading to river and streams. It is calculated by dividing the current total seasonal phosphorus load by a modeled total phosphorus load under complete forested conditions at a particular point along the river. An enrichment factor is representative of the amount of anthropogenic phosphorus loading to rivers and streams. The goal of an 8.4 Enrichment Factor represents a threshold at which a significant change is seen in the diatom communities indicating highly enriched conditions and impacts to aquatic life uses.

A seasonal load was established by the Department for each facility discharging to non-tidal waters based on the current degree of enrichment of the receiving water body at the point of discharge and the facilities contribution to the total watershed enrichment at the point of discharge. For facilities where the current waste load allocation in the permit was sufficient to meet the target Enrichment Factor, the phosphorus load from the facility was maintained at the current waste load allocation

Federal regulations at 40 CFR 122.44(d) indicate that permit issuers are required to determine whether a given point source discharge causes, has the reasonable potential to cause, or contributes to an in-stream excursion above a narrative or numeric criteria within a State water quality standard after consideration of existing controls on point and non-point sources of pollution. If a discharge is found to cause an excursion of a numeric or narrative state water quality criterion, NPDES regulations implementing section 301(b)(1)(C) of the Clean Water Act provide that a permit must contain effluent limits as necessary to achieve state water quality standards. The limit in the permit and the strategy are consistent with the narrative policy statements in the CT WQS and are expected to result in the attainment and maintenance of all designated uses for the water body when the strategy is fully implemented. If the Department develops numeric criteria in the future, or it is found that the current limit under the strategy is not sufficient to achieve designated uses, the goal will be modified and the WPCF will be expected to meet the more stringent water quality goal.

Translating the proposed average permit load (lbs/day) into enforceable permit limits requires consideration of effluent variability and frequency of monitoring in order to comply with federal permitting regulations. The procedure used, compliant with EPA's Technical Support Document (EPA/505/2-90-001), is as follows. This procedure is currently in use, but may change, as needed, in the future:

1. Consider the proposed treatment performance level (mg/l) to be equivalent to the Long Term Average (LTA).
2. Calculate the Maximum Daily Limit by multiplying the LTA by the 99th percentile LTA Multiplier appearing in Table 5-2 of the Technical Support Document (page 103 of EPA/505/2-90-001) corresponding to a CV of 0.6 to account for effluent variability.
3. Calculate the Average Monthly Limit by multiplying the LTA by the 95th percentile LTA Multiplier appearing in Table 5-2 of the Technical Support Document corresponding to a CV of 0.6 to account for effluent variability and either n=4 samples/month or n=10 samples/month as appropriate for the facility's design flow to account for the precision of estimating the true monthly average based on an average for the days the effluent was sampled:

This method produces a summary or limits for the facility including the Average Daily Load, Total Seasonal Load (Average Daily Load * 214 days/season), Maximum Daily Limit, and Average Monthly Limit.

With respect to the foregoing summary of limits, it should be noted that compliance with the Maximum Daily Limit or the Average Monthly Limit during the time the seasonal load limit is calculated will not ensure compliance with the Total Seasonal Load limit. For example, if the Permittee discharged phosphorus at the maximum permitted by either the Maximum Daily Limit or the Average Monthly Limit throughout the time that the seasonal load is calculated, the Permittee would exceed the Total Seasonal Load limit. For this reason, the Permittee must monitor compliance with the Total Seasonal Load limit independent of its compliance with the Maximum Daily Limit and the Average Monthly Limit.