City of Newton
MS4 Annual Report #5
July 1, 2022 – June 30, 2023

Attachment A

City of Newton Interim Phase 1 PCP

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CITY OF NEWTON, MA

Interim Phase 1 Phosphorus Control Plan

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EXECUTIVE SUMMARY

Background and Permit Obligations

The EPA approved a total maximum daily load for nutrients in the Lower Charles River Basin and the Upper/Middle Charles River, establishing the amount of phosphorus the Charles River can assimilate without exceeding water quality standards. Appendix F of the Municipal Separate Storm Sewer Systems (MS4) General Permit establishes the required stormwater-related phosphorus load reductions that municipalities in the Charles River watershed must achieve for the Charles River to meet water quality standards. In accordance with the MS4 General Permit, and City of Newton Permit Number MAR041080, the City of Newton is required to develop and execute a Phosphorus Control Plan (PCP) to reduce phosphorus in its stormwater discharges to the Charles River. The PCP is a 20-year plan to be developed and implemented in three phases from 2018 to 2038. This report is the first PCP phase to be developed; the Phase 1 PCP.

In accordance with the MS4 General Permit, the Phase 1 PCP must be completed by June 30, 2023, and executed by June 30, 2028. The Phase 1 PCP (Plan) outlines implementation measures to achieve the Year-10 (2028) Permit requirement of a 25% reduction in the City's stormwater-related phosphorus load. This Plan identifies the City of Newton's obligations under Phase 1 of the MS4 General Permit (Permit), methods to satisfy the Phase 1 Permit requirements, and associated costs and schedule. This Plan is the Interim Phase 1 PCP, as the City anticipated the subsequent submittal of a Phase 1 Alternate Schedule Request.

Land use and land cover are important contributing factors when considering and quantifying pollutants, such as phosphorus, in stormwater. Impervious surfaces such as roadways, buildings, and parking areas prevent infiltration of stormwater into the ground and therefore contribute to increased stormwater runoff, and in-turn increased runoff of pollutants to receiving waters such as the Charles River. Land use is also a contributing factor in phosphorus runoff as commercial, industrial, and high/medium density residential areas tend to have more sources of phosphorus than natural land use, such as forests and meadows. Stormwater runoff has higher concentrations of phosphorus when phosphorus sources like leaf litter, sediment, pet waste, and fertilizer are washed off impervious surfaces into stormwater conveyance systems and waterways rather than infiltrated into the ground.

The City of Newton has a closed conduit drainage system which collects and conveys stormwater runoff. The City's stormwater system consists of approximately 320 miles of drainage pipes, 13,250 catch basins, two drainage pump stations and over 350 outfalls (155 directly to the Charles River). The City's sanitary wastewater is conveyed separately via nearly 300 miles of sewer pipes. The City developed a stormwater infrastructure improvement plan in 2015, allowing the City to understand and invest in stormwater needs. Newton maintains a stormwater utility fee to assist with maintenance of stormwater infrastructure, comply with MS4 Permit requirements and advance City stormwater goals. In 2022, the City promulgated their latest Stormwater Management Ordinance and their Stormwater Management and Erosion Control Rules and Regulations in continued advancement of stormwater initiatives.

The MS4 General Permit identifies the annual baseline load (the amount of phosphorus generated by stormwater runoff in the community), an allowable phosphorus load (the amount of phosphorus generated by stormwater runoff which the community (Newton) is allowed to discharge to the Charles River) and the associated required phosphorus load reduction, for the year 2005. Per the MS4 General Permit, Newton's 2005 annual baseline phosphorus load is 8,563 lbs/year, the allowable phosphorus load is 3,349 lbs/year, and 2005 required load reduction is 5,214 lbs/year. Since land use and land cover types change over time,

largely due to development/redevelopment, the MS4 General Permit requires communities to update their baseline phosphorus load accordingly. The City of Newton's 2023 baseline load is estimated to be 9,028 lbs/year, with a Permit allowable load of 3,349 lbs/year, resulting in a phosphorus load reduction requirement of 5,679.4 lbs/year to be achieved by 2038. Phase 1 of the Permit requires that 20% of the required load reduction be achieved by 2026 and 25% of the total required load reduction be achieved by 2028. Therefore, in accordance with the Permit, the City of Newton must achieve an estimated phosphorus load reduction of **1,135.9 lbs by 2026** and **1,419.9 lbs by 2028**.

Phase 1 Phosphorus Load Reduction Measures

The reduction of phosphorus pollution is primarily achieved through two methods: pollution prevention and reduction of discharges of pollutants (phosphorus) in stormwater. Pollution prevention measures, herein referred to as non-structural stormwater control measures consist of practices which reduce pollution by minimizing the generation and exposure of pollutants to stormwater runoff. These non-structural control measures include management of organics such as leaf-litter collection, street sweeping and catch basin cleaning.

Reducing the discharge of phosphorus in stormwater is generally achieved by treating stormwater runoff through filtration or infiltration practices. These methods to reduce the discharge of phosphorus are referred to as structural control measures as they are primarily achieved through constructed structures or measures.

Non-Structural Control Measures

Newton maintains approximately 660 lane miles of City-owned roadway and approximately 13,250 catch basins. The City's on-going annual street sweeping program includes regular sweeping of all City owned roadways and more concentrated sweeping of select City village areas. Many of the City village squares are swept on a daily, weekly, or multiple times a week frequency. All other City roads are swept at least eight times per year. Approximately half of the City owned catch basins are cleaned annually, on a rotating frequency. These non-structural control measures result in a phosphorus reduction of **50.1 lbs/year**.

It should be noted that the EPA and MassDEP are considering changes to the crediting policy associated with these non-structural control measures. A "modeled" approach and a "measured" approach are being considered for future crediting under a revised Permit issuance. The "modeled" approach is anticipated to result in a similar reduction credit (42 lbs/year). The "measured" approach, which is based on mass of organic material removed via street sweeping and other leaf-litter collection measures, could result in a more significant phosphorus load reduction credit (estimated up to 1,856.7 lbs). This could have a significant impact on the City's long-term reduction credit. As such, it is recommended that the City of Newton implement methods of tracking select data, such as mass/weight and volume of captured organic waste, to support potential crediting modifications associated with any future Permit modifications.

Structural Control Measures

The City's stormwater management regulations, which are more stringent than state standards, support phosphorus reduction in stormwater through required infiltration practices (structural control measures). Through existing structural control measures on public properties, the City achieves a reduction of **25.9 lbs/year**. The City issues approximately 200 Major stormwater permits per year, requiring stormwater mitigation; an average phosphorus load reduction of 0.2 lbs/year/Major Stormwater permit has been assumed for planning purposes. Therefore, from on-going economic activity within the City via private

redevelopment, the City anticipates achieving an additional **200 lbs/year** reduction in association with Phase 1; or 5 years of cumulative credits at 40 lbs/year.

To achieve the Phase 1 load reduction required by the MS4 General Permit (1,419.9 lbs by June 2028), City owned parcels and roadways were assessed for stormwater phosphorus load reduction opportunities. Municipal parcels (430 total) were assessed for stormwater control measure retrofit potential, each being assessed to treat runoff generated on the parcel as well as runoff from surrounding areas discharging onto or near the parcel. Of the 430 municipally owned parcels, 111 were identified as having potential for stormwater retrofit; these 111 parcels were further reviewed and categorized as prioritized for Phase 1, pursuable, or not currently pursuable based on subsequent review. The evaluation identified 58 structural stormwater retrofit projects on 52 municipally owned properties with an estimated load reduction of **1,161.6 lbs/yr** for inclusion in the Phase 1 Plan. These stormwater improvements range is size, type and complexity.

Similarly, City owned roadways were also assessed for stormwater phosphorus reduction retrofit opportunities. This assessment identified 10 stand-alone roadway stormwater quality retrofit projects as part of the Phase 1 plan with an estimated load reduction of 54 lbs/year. Additionally, the City continues to perform roadway intersection improvements and traffic calming projects. Through these transportation projects, the Phase 1 plan estimates that 1-2 lbs/year load reduction can be achieved. Transportation and traffic calming projects are anticipated to conservatively total 6.4 lbs/year of reduction credit by the end of Phase 1. Therefore, a total phosphorus reduction of **60.4 lbs/yr** is estimated to be achieved during Phase 1 through stand-alone roadway stormwater quality retrofits and on-going transportation improvement projects.

The City's Phase 1 plan has identified an estimated load reduction that slightly exceeds that required by the Permit to accommodate additional baseline load increases and unforeseen design and construction constraints associated with planned opportunities.

Operation and Maintenance

The City's Operation and Maintenance (O&M) program for existing structural controls on City and private property was reviewed as part of the Phase 1 plan development, and steps to expand the program for planned future structural controls were evaluated. The Department of Public Works (DPW) is the party responsible for the O&M program. They will maintain DPW-owned stormwater control measures, while other municipal departments will be individually responsible for inspection and maintenance of their facilities, similar to private parties. The City's O&M program will require, enforce, and audit the inspection, maintenance, and annual reporting for Major stormwater permittees, and have permittees self-certify that their SCMs are being inspected and maintained and are performing as designed.

Phase 1 Implementation

Implementation Costs

The anticipated Phase 1 implementation costs are estimated at $142.24 million. Costs include those associated with on-going implementation of non-structural control measures, implementation (design and construction) of planned structural control measures, operation and maintenance of city-owned structural control measures, and management costs associated with oversight of Phase 1 implementation. These estimated costs are broken down as follows: non-structural controls $14.85M, planned structural control

measures $111.98M, operation and maintenance of city control measures $11.66M and program management $3.75M.

Anticipated non-structural control costs identified in the Phase 1 plan are based on current cost expenditures associated with the program.

Costs to implement planned structural control measures are based on EPA unit costs, with assumptions to account for recent inflation. These adjusted EPA costs provide estimates of the total implementation cost per cubic foot of physical static storage capacity that the system can hold. Each unit cost includes construction/installation of the system and a 35% design/engineering/contingency cost. These adjusted EPA unit costs were used to develop total costs for each prioritized opportunity (parcel and roadway) identified for Phase 1 implementation. The EPA unit costs do not include any operation and maintenance costs, which were estimated separately. Woodard & Curran also developed unit construction costs, following a similar methodology as EPA, based on 2023 construction costs in the local area. Soft cost, applied as a percentage of the construction cost, to estimate design, permitting, bidding and construction administration costs were estimated by Woodard & Curran to be 28.5% of construction costs. EPA budgetary cost totals per project were generally found to be higher than the Woodard & Curran estimates, therefore the EPA adjusted costs have been conservatively utilized in the Plan for budgeting and planning purposes, with an anticipated Phase 1 cost of $111.98M.

Operation and maintenance costs associated with City owned stormwater quality control measures identified in the plan were estimated at $11.66M. These O&M costs include routine inspection and maintenance as well as replacement costs based on average component lifespan.

Program management costs are estimated at $3.75M to support the City's management, oversight of design and construction, and auditing measures.

As noted, the cost to implement new stormwater quality control measures by June 2028 (design and construction) is anticipated to exceed $111M. The applicable City of Newton Stormwater Fund and Sustainable Materials Division Street Cleaning budget are currently the primary sources of funding for Phase 1 implementation, with a FY '24 budget of approx. $5.46M. In anticipation of Phase 1 implementation, a stormwater fee increase of 10% was approved in May 2023. The Stormwater Fund supports approximately $2.13M of capital projects annually, while the balance ($2.41M) of the fund supports stormwater operation and existing stormwater project debt. Additionally, the City has accrued a budget reserve in the Stormwater Fund of approximately $3.6M. These sources total to an estimated $9M; however, a significant Phase 1 implementation funding deficit remains. The City has and will continue to assess and pursue available funding mechanisms, such as SRF (State Revolving Fund), to support phosphorus control work. Additional stormwater improvements, unrelated to phosphorus control, such as flood mitigation, conveyance and infrastructure improvements are also important to the City and further limit the City's resources to support various types of stormwater and infrastructure improvements.

Implementation Schedule

The Permit requires implementation of Phase 1 by June 30, 2028. This includes implementation of program modifications such as operation and maintenance tracking and auditing measures, non-structural control measures and structural control measures. The City already employs non-structural control measures and the City's Phase 1 Plan maintains the on-going non-structural control program. The City's Plan envisions

the design and construction of approximately 68 structural control projects for compliance with the Permit Year 8 (2026) and Year 10 (2028) phosphorus load milestone requirements. Planned structural SCMs were evaluated for typical project phases necessary to facilitate design and construction. Phases generally include design procurement, feasibility, design, permitting, construction bidding, and construction. Durations were assigned to each project phase based on a project's general sizing categorized as small, medium, large, and extra-large. The planned structural SCMs were then grouped by project types defined as school properties, parks / recreational area, roadways, and other municipal properties.

To detail structural control implementation, two schedules have been developed for reference in the Phase 1 Plan. The first, the Permit Timeline Schedule, identifies implementation of planned structural controls within the Phase 1 timeline necessary to comply with the Permit Year 8 and Year 10 requirements. The Phase 1 Permit Timeline Schedule considers alignment with the City of Newton Capital Improvement Plan (CIP), meeting Permit Year load reductions, available yearly construction windows, and balancing disturbance of municipal lots. 63 projects are identified for Permit Year 8 compliance with the remaining 5 completed for Permit Year 10. The Permit Timeline Schedule aligns stormwater quality projects with other CIP projects, to minimize community impact and maximize cost effectiveness; however, this schedule depicts only one of many permutations which may fulfill permit requirements. The Permit Timeline Schedule is a planning level schedule that is subject to change as feasibility, design, planning, funding, regulatory changes and other considerations of Phase 1 implementation evolve.

It is not anticipated to be feasible for the City to concurrently execute the number of projects necessary in the Phase 1 Permit required timeline of 5 years. The number of projects, their associated complexity and cost, along with community impacts present a significant schedule challenge for the City. As such, a Phase 1 Constraints Schedule was developed to better identify implementation schedule implications. The Constraints Schedule continues to consider alignment with the City's CIP, considers a typical number of concurrent projects managed (3), and further assumes the stormwater budget is solely utilized for structural control stormwater quality implementation and no external funding mechanisms are utilized. The Constraints Schedule results in a timeline of approximately 55 years for Phase 1 implementation. As noted, this Constraints Schedule is developed to further inform both short-term and long-term phosphorus planning; the Constraints Schedule is not compliant with Permit required timeframes.

Alternate Schedule Request Assessment

The City's Phase 1 PCP has been prepared to support Permit compliance. As required, the Phase 1 Plan identifies Newton's obligations under Phase 1 of the Permit and presents methods to satisfy the Phase 1 permit requirements, with their associated costs and implementation schedule. However, implementation of the approximately 68 projects anticipated for permit compliance is not achievable within the 5-year permit timeline. The burden associated with the schedule, community impacts, and associated financial implications is not realistic for the City. Under Appendix F, Section A.I.3 of the MG4 General Permit, permittees may submit an Alternate Schedule Request to EPA and MassDEP if the permittee determines that the schedule to meet the Phase 1 reduction is impracticable. Therefore, it is anticipated the City of Newton will file a subsequent Phase 1 Alternate Schedule Request.

1. PHASE 1 INTRODUCTION

The U.S. Environmental Protection Agency (EPA) established the National Pollutant Discharge Elimination System (NPDES) program as part of the Clean Water Act (CWA) to regulate discharges of pollutants to surface waters. In Massachusetts, EPA and the Massachusetts Department of Environmental Protection (MassDEP) are the co-permitting authorities that regulate stormwater runoff that enters local water bodies from Municipal Separate Storm Sewer Systems (MS4s) in areas that meet certain population density criteria, formerly defined by the U.S. Bureau of Census as "Urbanized Areas."

The City of Newton is required to obtain a permit for their municipal stormwater discharges from the EPA and MassDEP and is currently covered under a NPDES "General Permit for Stormwater Discharges from Small MS4s in Massachusetts" (the MS4 General Permit, Permit), under Permit Number MAR041080.

Under Part 2.2.1.b.i and Appendix F of the Permit, the City of Newton (the City) is required to develop and execute a Phosphorus Control Plan (PCP) to reduce phosphorus in its stormwater discharges in the Charles River watershed. The PCP will be implemented in three phases. This report is the Phase 1 PCP Plan, in accordance with the MS4 Permit; however, the City of Newton anticipates subsequent submittal of an Alternate Schedule Request for Phase 1 implementation. The development of this Plan has identified that the financial implications, community impacts and 5-year implementation schedule required for Phase 1 implementation is not realistic for the City.

On October 17, 2007, and June 10, 2011, the EPA approved a total maximum daily load (TMDL) for nutrients into the Lower Charles River Basin and the Upper/Middle Charles River, respectively. These TMDLs establish the amount of phosphorus that the Charles River can assimilate without exceeding water quality standards. Excessive nutrients, like phosphorus, in a waterbody can cause algal blooms which are harmful to humans and wildlife. Currently, the amount of phosphorus discharged to the Charles River exceeds the TMDLs and therefore needs to be reduced.

Appendix F of the MS4 General Permit establishes Newton's stormwater-related phosphorus load reduction requirement. The City is responsible for a 61% reduction in phosphorus load from stormwater. This Plan identifies the City of Newton's strategy to meet this reduction requirement.

1.1 Required PCP Implementation Schedule

The MS4 General Permit PCP requirements are organized into three phases which are required to be implemented within a 20-year timeframe. The MS4 General Permit became effective July 1, 2018, and a modification to the MS4 General Permit became effective January 6, 2021. Figure 1-1 below presents the schedule in 5-year MS4 General Permit-defined phases.

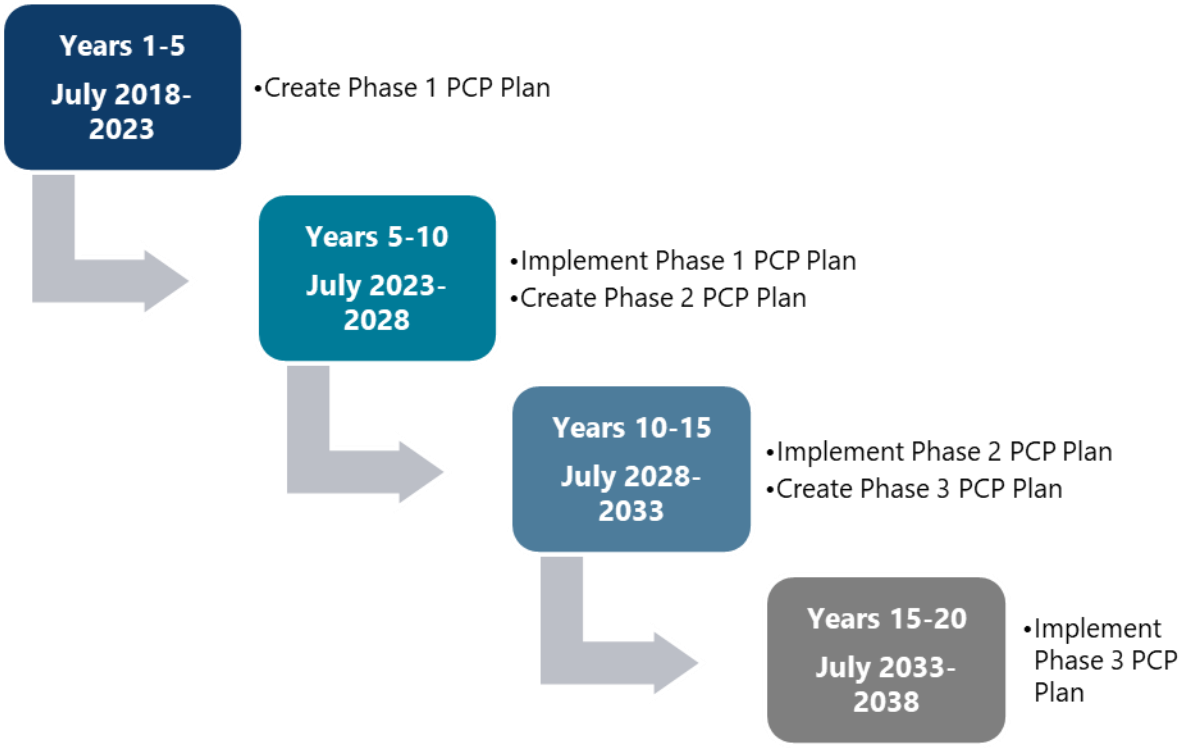


Figure 1-1: MS4 General Permit-Defined Phases

1.2 Phase 1 of the PCP

Phase 1 plan elements (through Year 5) are outlined below in Figure 1-2. This Plan provides a summary of stormwater-based phosphorus load reduction requirements, documents existing stormwater control measures (SCMs) and associated nutrient load reduction credits, describes planned control measures to meet the Phase 1 Year 10 25% reduction requirement, outlines operation and maintenance program options for structural controls, and presents a Phase 1 implementation schedule and cost estimate.

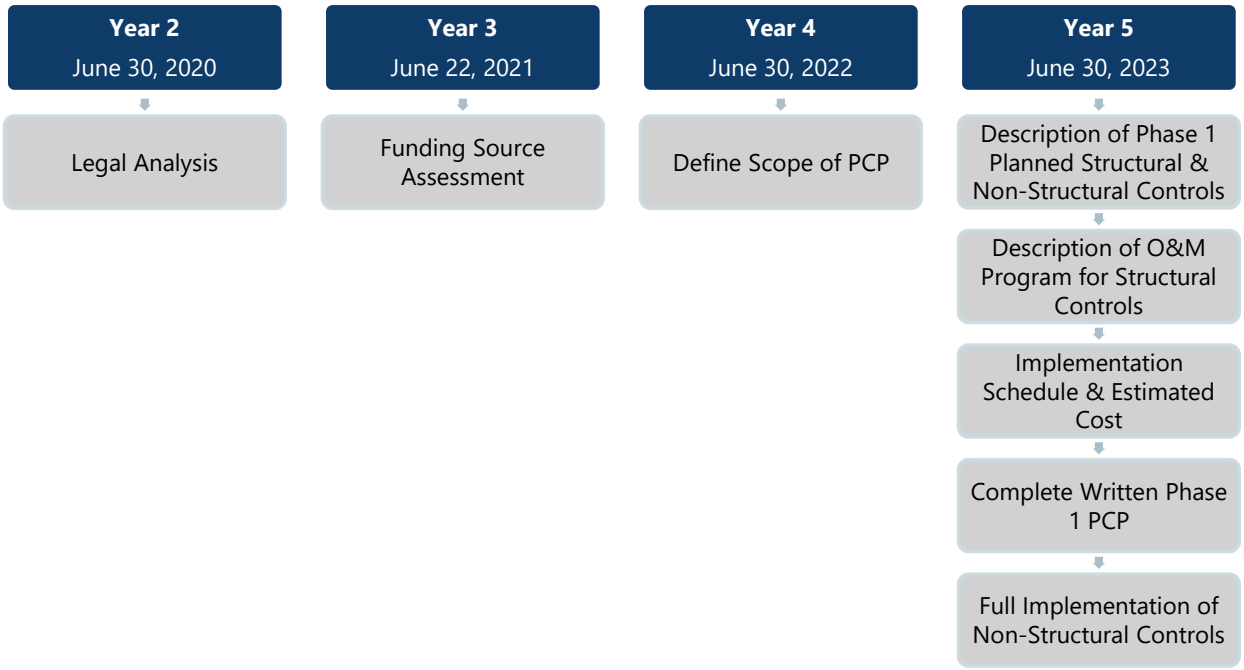


Figure 1-2: Phase 1 Plan Elements

This Plan includes components previously performed in accordance with MS4 General Permit requirements, including the Legal Analysis and Funding Source Assessment. Applicable elements have been updated through the development of the Plan. These components are further described and appended to the Plan.

2. CHARACTERIZATION OF THE WATERSHED AND OF NEWTON

The Charles River watershed consists of approximately 308 square miles of land area. The Charles River is approximately 80-miles long and spans from Echo Lake in Hopkinton to Boston Harbor. The river flows through 23 communities and the watershed includes 35 communities, as shown in Figure 2-1. The Charles River watershed is home to approximately one million residents.

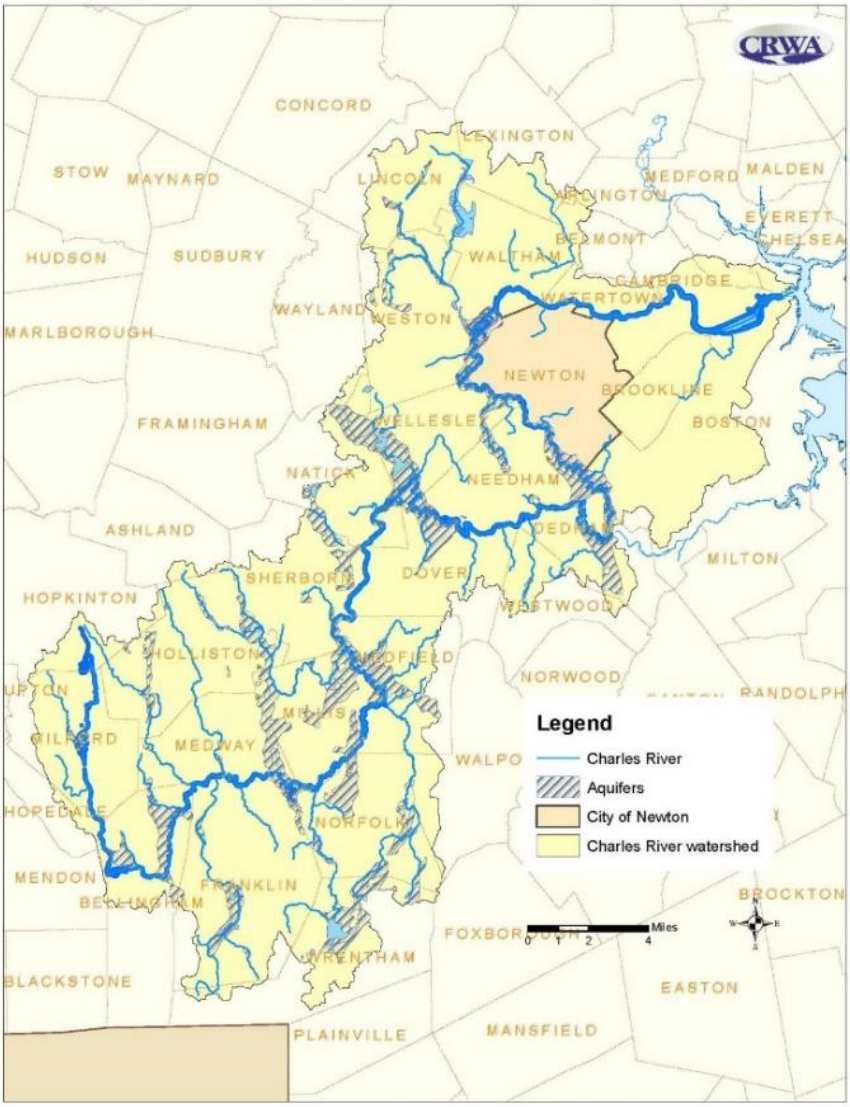


Figure 2-1: Charles River Watershed Map by CRWA

*Map not to scale

As an urban river, the Charles River is impaired by multiple pollutants. Three Total Maximum Daily Loads (TMDLs) have been developed for the watershed: one for pathogens and two for phosphorus (Upper/Middle and Lower Charles River Basins). A nearly five-decade cleanup effort has resulted in water quality improvements, primarily from elimination of industrial and municipal wastewater discharges and a significant reduction in untreated sewage overflows discharging into the river. The primary challenge facing the river today is stormwater runoff. The nutrient phosphorus is transported to the river through stormwater runoff. In excessive quantities, phosphorus can lead to harmful algal blooms (HABs) and an associated reduction in river dissolved oxygen levels, which can impact aquatic life and create toxic cyanobacteria outbreaks. Stormwater-based phosphorus sources in the urban environment are typically organic materials (leaves, grass clippings, etc.) washed from impervious areas during rain and snowmelt, sediments eroded from construction sites, wash off from winter sand application, and runoff containing phosphorus-based fertilizers.

The City of Newton occupies a land area of approximately 18.2 square miles and is located seven miles west of downtown Boston. As of July 2022, the City had a population of approximately 87,400 (U.S. Census Bureau) and consists primarily of suburban-residential land uses. Approximately 80% of the City's land area is considered developed1. Of the roughly 20% that is open space, 60% is in public ownership. The City maintains approximately 1,200 acres of parkland, playgrounds, school grounds, and burial grounds, and is known as "The Garden City". The City contains roughly 20,000 street trees and hundreds of trees in City parks. Newton's street trees are considered Public Shade Trees and are protected under Massachusetts General Law Chapter 87.

Despite the parkland and open space, the City is an urban municipality that is highly developed with impervious cover. Approximately 35% of the City's land cover is impervious. For this reason, excessive stormwater is generated by the built environment within the City which, without control measures in place, can contribute stormwater-based pollutants to the Charles River watershed. Reducing stormwater runoff and phosphorus in the City's stormwater runoff is essential for the long-term sustainability and recovery of the Charles River.

2.1 Hydrography

The City contains multiple waterbodies in addition to the Charles River, as shown in Figure 1 in Appendix A. Many of these receiving waters are impaired with one or more pollutants. Table 2-1 below outlines the major receiving rivers and brooks in the City and impairments as presented in the "Massachusetts Draft 2022 Integrated List of Waters".

[1] Newton's Open Space and Recreation Plan, dated June 30, 2021

Table 2-1: Impaired Waterbodies within Newton

Waterbody Segment	Impairments
Charles River (MA72-07)	Benthic Macroinvertebrates, DDT in Fish Tissue, E. Coli, Fish Bioassessments, Harmful Algal Blooms, Nutrient/Eutrophication Biological Indicators, PCBs in Fish Tissue, Total Phosphorus, Temperature
Charles River (MA 72-36)	Chlorophyll-a, DDT in Fish Tissue, Dissolved Oxygen, E. Coli, Fish Bioassessments, Harmful Algal Blooms, Nutrient/Eutrophication Biological Indicators, Oil and Grease, PCBs in Fish Tissue, High pH, Total Phosphorus, Sediment Bioassay, Transparency/Clarity, Unspecified Metals in Sediment
South Meadow Brook (MA72-24)	Dissolved Oxygen, E. Coli, Fish Bioassessments, Total Phosphorus, Trash, Turbidity
Cheesecake Brook (MA72-29)	Algae, Dissolved Oxygen Supersaturation, E. Coli, Fish Bioassessments, Total Phosphorus
Sawmill Brook (MA72-23)	Chloride, Dissolved Oxygen, E. Coli, Organic Enrichment (Sewage) Biological Indicators, Total Phosphorus
Bulloughs Pond (MA72011)	Algae, Nutrient/Eutrophication Biological Indicators
Crystal Lake (MA72030)	Harmful Algal Blooms

2.1.1 Land Cover

Impervious surfaces contribute to increased stormwater runoff, route surface pollutants quickly to receiving waters and restrict the recharge of groundwater. Pervious areas allow the infiltration of precipitation to recharge shallow and deep groundwater and preserve the hydrologic integrity of a watershed. Most impervious cover is made up of buildings, parking lots, driveways, and roads. The percentage of impervious cover in a watershed can indicate the probable health of the watershed and associated waterbody. It is well established in scientific literature that watersheds with greater than 10% of their land area covered by impervious surfaces exhibit various signs of impairment due to stormwater runoff. This is primarily because runoff cannot infiltrate and therefore washes off and transports more pollutants to downstream waterbodies. As of 2005, the City consisted of approximately 35% impervious area, as discussed in further detail in Section 2.1.2 below.

2.1.2 Land Use

Land use is also an important factor when evaluating a watershed for sources of stormwater-based runoff pollution. In most cases, commercial, industrial, high and medium density residential, and highway land uses generate higher concentrations of pollutants in stormwater runoff than undeveloped or rural areas.

The MassGIS 2016 land use/cover data set was used to evaluate land use in the City. Land use distribution is illustrated in Figure 2 included in Appendix A.

Table 2-2 summarizes the percent of total impervious cover by land use category in the City. This data was presented in an EPA Region 1 memorandum dated April 22, 2014, with the subject Overview of Methodology to Calculate Baseline Stormwater Phosphorus Loads and Phosphorus Load Reduction Requirements for Charles River Watershed. As demonstrated in the table below, commercial, industrial, high density residential, and highway areas in the City have higher percent impervious cover than other land use types which results in higher concentrations of pollutants in stormwater runoff. Additionally, the City's overall percent total impervious area cover of 35% (2005) is 3.5 times higher than the 10% impervious surface indicator for impairments due to stormwater runoff.

Table 2-2: Percent Total Impervious Area Cover of Aggregate Land Use Categories

Community	Commercial	Industrial	High Density Residential	Medium Density Residential	Low Density Residential	Highway	Open Land	Agriculture	Forest	Overall % TIA
Newton	67.8	77.3	44.1	33.8	23.6	75.5	20.2	7.0	4.5	35.3

2.1.3 Soils

Based on data from the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS), the City consists primarily of hydrologic soil group (HSG) B soils, followed by HSG A, D, and C soils. The City also has a significant area of unrated or not available soils, which typically consists of developed land with human transported material (fill). Based on the EPA Region 1 memorandum dated April 22, 2014, Newton's approximate HSG distribution is as follows: unrated (64%), HSG B (18.7%), HSG A (7.4%), HSGD (3.9%), HSG C (3.1%), HSG C/D (2.7%). HSG A has the lowest runoff potential and HSG D the greatest.

Soil classification data is used in evaluating the feasibility of structural control measures, since stormwater runoff mitigation is more effective on HSG A and B soils. Many areas within the City of Newton have shallow bedrock, limiting feasibility of structural control measures in those areas. The methodology for evaluating and ranking structural control measures is explained in Section 5 of this report. Figure 3 in Appendix A illustrates the locations of each hydrologic soil group in the City.

2.2 Storm Sewer and Sanitary Sewer Infrastructure

The majority of stormwater runoff within the City is captured and conveyed via an existing closed conduit drainage system. Per the City's Open Space and Recreation Plan, the City's MS4 is comprised of approximately 320 miles of drainage pipes, 13,250 catch basins, two drainage pump stations, and over 350 outfalls. The City's drain and sewer systems are separated. The City is undergoing on-going storm drain and sanitary system improvement programs including an Illicit Discharge Detection and Elimination program for their storm drain system as well as a significant infiltration and inflow reduction program for the City sewer system. The City's sewer system consists of approximately 9,000 sewer manholes, 295 miles of sewer pipes, and 10 sewer pump stations. Most properties in the City are connected to the sewer system, although there is a small percentage of properties (approximately 400) with septic systems.

2.3 Stormwater Management Approach

Under the MS4 General Permit, the City is required to implement a stormwater management program (SWMP) intended to reduce pollutants in stormwater. The City's latest SWMP, dated September 20, 2019, outlines the activities and measures that the City implements to meet the terms and conditions of the MS4 General Permit. The six minimum control measures, or main elements of the SWMP, include public education and outreach, public participation, illicit discharge detection and elimination (IDDE), management of construction site runoff, management of post-construction site runoff, and good housekeeping in municipal operations.

The City's Stormwater Management Ordinance dated May 2, 2022, and their Stormwater Management and Erosion Control Rules and Regulations dated April 14, 2022, ensure that stormwater from development and redevelopment projects is adequately controlled. The City requires a stormwater management and erosion control permit for the following projects:

- Land Disturbance: Projects disturbing greater than 5,000 square feet of land.
- Minor Stormwater:
    - Any residential development or redevelopment with four or fewer units with land disturbance less than 0.5-acres.
    - Any residential, commercial, industrial, institutional, or municipal development or redevelopment creating 401-1,000 square feet of new impervious area.
    - New retaining walls and trench excavations requiring dewatering.
- Major Stormwater: Required for projects exceeding the Minor Stormwater thresholds.

Minor and major stormwater activities are required to have a final inspection after construction and submit the following to receive a certificate of compliance from the city engineer:

- Certified as-builts with acknowledgement that the stormwater management system has been constructed in accordance with the stormwater management permit.
- Proof of recording the O&M plan at the South Middlesex County Registry of Deeds

Applicable City's stormwater management design standards, and Massachusetts Stormwater Handbook standards, as follows:

- Minor Stormwater:
    - Systems for new development and redevelopment shall retain the volume of runoff ≥ two inches multiplied by the net increase in impervious area. If the project proposes to tear down, dismantle, or remove a primary structure from its existing location such that a majority of the structural elements are replaced, two inches of runoff for all impervious area is required.
    - No net increase in volume or peak flow up to the 100-year event using NOAA Atlas 14 (8.78 inches of precipitation in 24 hours).
    - Minimum 2-foot separation to seasonal high groundwater.
    - Stormwater infiltration setbacks: 10 foot minimum from any building and 50 foot minimum from any slope greater than 15%.

- Soil testing required.
- Infiltration systems must drain fully within 72 hours.

- Major Stormwater: In addition to meeting the Minor Stormwater requirements, Major Stormwater projects are required to meet the following additional requirements:
  - New Development:
    - Retain volume of runoff ≥ 2" multiplied by the total post-construction impervious area on the site.
    - Remove 90% TSS load generated from the total post-construction impervious area.
    - Calculation existing and proposed total phosphorus (TP) load and demonstrate 60% reduction generated from total post-construction impervious area.
  - Redevelopment:
    - Retain volume of runoff ≥ 2" multiplied by the total post-construction impervious area on the site.
    - Remove 80% TSS
    - Reduce 50% TP
- Post-construction annual reporting on O&M of stormwater management systems for Major stormwater permits only. Annual inspection reports shall be submitted to the Engineering Division by January 15th of the following year.

These regulations require more treatment than the current state requirements through the Massachusetts Stormwater Handbook. Retaining the volume of runoff equivalent to or greater than 2 inches times the total post-construction impervious area will support the City in achieving their MS4 General Permit requirements by reducing phosphorus in stormwater discharges through redevelopment.

The City has also enacted a stormwater utility fee to help maintain infrastructure and comply with the MS4 General Permit requirements. Residential homeowners for 1-4 family dwellings are currently required to pay a flat fee of $114 per year. All other property owners, including private commercial and industrial property owners, pay based on the amount of impervious area on their property. The rate is $0.056 per square foot of impervious surface area, except if the square footage charge multiplied by the total impervious area of the parcel equals a sum less than $150, then the annual fee is $150.

The City also developed a Stormwater Infrastructure Improvement Plan in February 2015 to understand the full range of current and future stormwater needs, allowing the City to efficiently invest in infrastructure improvements to meet their stormwater goals over the next 20 years. The plan focuses on federal permit compliance, localized flooding, stream/water quality improvements, and culverts/infrastructure improvements.

2.4 Economic Development Activity

Stormwater management can help create healthier, more sustainable, and resilient communities through infrastructure investment and smart community redevelopment. Newton's economic development goals

and locations of planned growth have been evaluated as part of this integrated Plan to identify areas where stormwater management investments can support the City's economic development goals.

An Economic Development Action Plan was developed for the City in January 2019. The five main goals identified during the planning process included:

1) Pursue development sectors that make Newton commercially successful and a great place to live, work, and play.
2) Focus redevelopment efforts on key parcels and corridors, including Needham Street, Riverside, Charles River Mill District, Wells Avenue Business Park, Newton Centre, and larger villages.
3) Support the start-up, growth, stability, and vitality of businesses and entrepreneurs.
4) Make the development process more predictable and efficient, including community consensus and refinement of the review process.
5) Maintain and enhance the special qualities of Newton while improving transportation throughout the City for residents, businesses, and visitors.

Four priority first steps were identified as part of the action plan, including:

1) Complete the review of the zoning code to align it with the goals of the community.
2) Update the City of Newton's Economic Development website.
3) Continue to reevaluate the Newton Innovation Center.
4) Improve the land use policies and development review process to encourage appropriately scaled transit-oriented development and walkability.

Additionally, the City has created a web GIS based economic development tool that identifies where opportunity-generating activity is occurring or planned to occur for new business and investment opportunities[1]. The tool identifies new residential and commercial developments which increase the number of people living and working in the area, generating additional demand for goods and services. The tool also identifies major infrastructure projects, which create opportunities for economic activity and demand. A few opportunities identified in the tool, as of the date of this report, include Needham Street and Washington Street visioning areas, Riverside Station and Chestnut Hill Square mixed use development projects, and the Jewish Community Center Greater Boston and Jackson Walnut Schools institutional developments.

This section will be revisited and updated throughout the MS4 General Permit lifespan to ensure that planning for economic development aligns with stormwater management goals and requirements.

[1] Newton's economic development tool: Economic Development | City of Newton, MA (newtonma.gov)

3. PHOSPHORUS LOAD REDUCTION REQUIREMENTS

3.1 PCP Area

The PCP area is defined in the MS4 General Permit as being the PCP implementation area selected by the permittee. The permittee has the following options when defining the PCP area:

- Option 1: The entire area within its jurisdiction within the Charles River watershed
- Option 2: Only the urbanized area portion of its jurisdiction within the Charles River watershed.

As shown in Figure 4 in Appendix A, the entire City of Newton is urbanized and within the Charles River Watershed. Therefore, the PCP area is the entire area within the City of Newton's municipal boundary.

The City of Newton's PCP area excludes facilities regulated under separate National Pollutant Discharge Elimination System (NPDES) permits. These include non-traditional (i.e., federal and state agencies and institutions) MS4s. Non-traditional MS4s with facilities or roads in the City of Newton include the Massachusetts Department of Conservation and Recreation (MassDCR), Massachusetts Department of Transportation (MassDOT) and Massachusetts Bay Transit Authority (MBTA), and University of Massachusetts Amherst (Mount Ida Campus). Area owned by these non-traditional MS4s was excluded from the City of Newton's PCP area since these non-traditional MS4s have their own PCP load reduction targets. These areas are summarized in Table 3-1 below and identified in a figure included in Appendix B. The process to estimate non-traditional MS4 area is summarized in a memorandum in Appendix B.

Table 3-1: Newton's PCP Area

Area (Acres)		
Newton s Total Charles River Watershed Urbanized Land Area	**Non Traditional MS4 Area**	**Newton s PCP Area**
11,382	687	10,695

3.2 Baseline Load

The annual baseline phosphorus load is the amount of phosphorus generated by stormwater runoff in the PCP Area. The City is only allowed to discharge a certain amount of phosphorus into the Charles River, identified as their allowable load. The City is required to reduce its discharge phosphorus load to meet its allowable load per MS4 General Permit requirements. Table 3-2 below summarizes the permit defined 2005 annual baseline phosphorus load, allowable phosphorus load, and required load reduction for the City of Newton's stormwater discharges in the Charles River watershed by 2038.

Table 3-2: 2005 Stormwater Phosphorus Load Reduction Requirements

Annual Load (kg/yr / lb/yr)			
Baseline Phosphorus Load (Permit 2005)	**Allowable Phosphorus Load**	**Phosphorus Load Reduction Requirement (2038)**	**Percent Reduction in Phosphorus Load**
3,884 / 8,563	1,519 / 3,349	2,365 / 5,214	61%

3.3 Change in Baseline Load Since 2005

The baseline load in Table 3-2 above was calculated by EPA using land use and land cover data from 2005. Land use and land cover (LULC) changes have occurred since 2005 that could change the 2005 baseline load. As such, permittees are required to account for and mitigate any increases in phosphorus load due to development since 2005.

The City's updated baseline load was calculated using MassGIS 2016 LULC data. The 2016 baseline load was then used to forecast changes due to development through 2023 using a percent increase; this updates the baseline load through Permit Year 5 (June 2023). The baseline load calculations and methodology are detailed in Appendix B. Table 3-3 below presents the updated 2023 baseline load, which is being used as the target 2028 management goal and will be updated in subsequent permit years based on new data.

Table 3-3: 2023 Stormwater Phosphorus Load Reduction Requirements

Annual Load (kg/yr / lb/yr)				
Updated Baseline Phosphorus Load (2023)	**Allowable Phosphorus Load**	**Phosphorus Load Reduction Requirement (2038)**	**Percent Reduction in Phosphorus Load**	**Updated Phase 1 Permit Year 10 Reduction (lb/yr) (2028)**
4,095 / 9,028	1,519 / 3,349	2,576 / 5,679.4	63%	1,419.9

It is anticipated that the baseline load will be further refined using 2021 LULC data prepared by the University of Vermont's Spatial Analysis Laboratory in conjunction with the Charles River Watershed Association. This data is anticipated to be available July 2023. The 2021 LULC data defines land use and land cover consistently with the 2005 data the permit used. This ensures that changes in load are due to development rather than inconsistencies with data resolution or categorization compared to the 2005 data. Load changes from development after 2021 through June 30, 2028, will be evaluated using updated LULC data if available or on a project-by-project basis using available permit documentation review.

3.4 Load Reduction Strategies

Sections 4 and 5 of this Plan outline strategies that will support the City's efforts to reduce its phosphorus load to the Charles River. The MS4 General Permit defines phosphorus reduction efficiencies for the following non-structural and structural measures.

Non-Structural/Semi-Structural:

- Enhanced sweeping program
- Catch basin cleaning program
- Organic waste and leaf litter collection program
- Impervious area disconnection through storage
- Impervious area disconnection
- Conversion of impervious area to pervious area
- Conversion of low permeable pervious area to high permeable pervious area

Structural:

- Infiltration trench
- Surface infiltration practices
- Biofiltration practices
- Gravel wetland system
- Enhanced biofiltration with internal storage reservoir (ISR)
- Sand filter
- Porous pavement
- Wet pond or wet detention basin
- Dry pond or extended dry detention basin
- Dry water quality swale

Additionally, the MS4 General Permit states that EPA will consider SCMs that have not been explicitly included in the MS4 General Permit, if the desired SCM has functionality that is similar to one of the included SCM types. Proprietary manufactured SCMs, such as cartridge and membrane filters and engineered bio-filtration media systems, are viable treatment options in addition to those listed in the MS4 General Permit. The State of Washington Department of Ecology reviews and certifies stormwater treatment technologies under their Technology Assessment Protocol – Ecology (TAPE) program. The TAPE program has a tiered approval system for proprietary systems for various pollutants, and the systems listed as General Use Level Designation (highest approval level) for Phosphorus Treatment are defensible tools that could be proposed for EPA approval.

Section 4 of this plan outlines non-structural and structural SCMs that currently exist in the PCP area that the City can take phosphorus reduction credit for. After outlining existing SCMs, Section 4 estimates the

load reduction gap, the City's required load reduction to achieve regulatory compliance after accounting for existing SCM credit. Section 5 outlines potential additional structural SCMs that could support the City in achieving their total required load reduction.

4. EXISTING STORMWATER CONTROLS

This section describes the City's existing non-structural and structural stormwater control measures and their associated phosphorus load reduction credits. A summary of the total estimated phosphorus load reduction gap compared to the required reduction under Phase 1 of the PCP implementation (up to Permit Year 10) is also provided. The remaining load reduction requirement will be achieved by planned stormwater control measures, which are summarized in Section 5 of this Plan.

4.1 Non-Structural Stormwater Controls

Non-structural pollution prevention practices prevent or reduce pollution from stormwater runoff by reducing the exposure and generation of pollutants that can be washed off during precipitation events. This includes managing organics such as leaf-litter, street sweeping, and catch basin cleaning. Non-structural management approaches can also include public education and outreach and regulatory policies that minimize sources of stormwater pollution, such as creation of new impervious surfaces through land development. Non-structural stormwater management practices typically refer to stormwater runoff management that does not require extensive engineering design and construction efforts, hence the term non-structural. Non-structural controls provide important stormwater quality improvements for any given watershed but require careful planning and organization of labor resources, enforcement or incentives, education and outreach, and may require specialized equipment.

4.1.1 Current MS4 Permit Credit Policy

The MS4 General Permit currently allows phosphorus removal credit for three non-structural control measures: enhanced sweeping, catch basin cleaning, and organic waste and leaf litter collection. The City currently implements all three non-structural control measures through their annual non-structural management program. The program was discussed through a series of coordination meetings with the City. The City maintains a detailed inventory of non-structural operations, their location, and frequency, which was used in support of this Phase 1 Plan. The following section summarizes the City's current program, and the phosphorus reduction credits they are able to achieve through the current MS4 General Permit non-structural credit policy. The City's program and associated credit calculations are described in further detail in the non-structural memorandum provided in Appendix C.

There are approximately 660 lane miles of City-owned roadways throughout Newton. The City's current, on-going, annual street sweeping program includes routine sweeping of all City owned roadways as well as more concentrated sweeping of select City village areas. The current sweeping program includes enhanced sweeping of many City village squares on a daily, weekly, or 2 to3 times per week frequency, utilizing a mechanical broom sweeper. The City also sweeps approximately 29 miles of roads or bike lanes utilizing a vacuum-assisted sweeper. All other City streets are swept eight times during the calendar year with a mechanical broom. Street sweeping also manages collection of organic leaf litter; therefore, the City's existing program also accounts for leaf litter collection by nature of the annual street sweeping program. Roadways swept annually on a weekly frequency provide additional nutrient control and associated phosphorus reduction credit.

The City's non-structural management program also includes regular catch basin cleaning. The City of Newton has approximately 13,250 municipal catch basins, of which approximately half are cleaned annually, including limited structures which are cleaned semi-annually. This catch basin cleaning program is executed

year-round. Due to the high number of structures owned and maintained by the City, semi-annual cleaning of all structures is not practical given current staffing and equipment limitations. The City's focus is on routine maintenance of all structures as opposed to targeted cleaning of fewer structures at a higher frequency.

Table 4-1 below outlines the City's current operational standards and the associated phosphorus reduction credit based on the crediting guidelines defined under Appendix F Attachment 2 of the MS4 General Permit.

Table 4-1: Newton's Non-Structural Control Operational Standards

Non Structural Control	Current City Operational Standard	Phosphorus Reduction Factor (per MS4 Permit)
Enhanced Sweeping	Municipally owned paved areas and roadways are swept using a mechanical broom or vacuum assisted sweepers at the following frequencies: twice a year (spring and fall), monthly, or weekly	Varies between 1% - 8% based on cleaning frequency
Catch Basin Cleaning	Approximately half of all municipally owned catch basins within roadways and municipal properties are cleaned annually. Limited catch basins are cleaned semi-annually	2% annual reduction for catch basins cleaned semi-annually
Organic Waste and Leaf Litter Collection	Municipally owned roadways, parking lots and other municipally operated impervious surfaces are swept weekly from September 1 to December 1	5% annual reduction for roadways swept weekly

These current non-structural control measures performed on municipal properties and roadways represent a phosphorus reduction of **50.1 lbs/year**, as noted in Table 4-2 below.

Table 4-2: Non-Structural Controls Load Reduction

	Load Reduction (lbs/year)			
	Enhanced Sweeping	Catch Basin Cleaning	Organic Waste/ Leaf Litter Collection	Total
Municipally Owned Properties & Roadways	43.5	0.1	6.5	50.1

A detailed summary of the City-provided data and the calculations for phosphorus reduction credits for these non-structural control measures are provided in a memorandum under Appendix C. This appendix also includes calculation sheets for each control measure (enhanced sweeping, catch basin cleaning, organic waste/leaf litter collection), as well as map overlays of all measured lane miles and lane widths for enhanced sweeping credits.

4.1.2 Clean Sweep Credit Policy and Potential Associated Credit

MassDEP and EPA have indicated that the next issuance of the MS4 General Permit, expected in late 2023 or early 2024, will likely include changes to the crediting policy for non-structural controls. These changes are likely to be based on recent work conducted by the University of New Hampshire's Stormwater Center, along with an expert panel of state and regional regulators, experts in the field of watershed hydrology and stormwater management, stormwater consultants, and representatives of several municipalities. As stated in the memorandum titled "Clean Sweep – Recommendations for New and Updated Credits for Street Cleaning in New Hampshire" (Clean Sweep Memorandum), dated April 2023, "science suggests that enhanced street cleaning practices can achieve pollutant reductions far beyond what is currently recognized in [existing] credit programs." A copy of the Clean Sweep Memorandum is provided in Appendix C.

The Clean Sweep Memorandum focuses on crediting for enhanced street cleaning, which includes street sweeping and leaf litter collection on roadways, parking lots, and operated impervious surfaces. It suggests two options for obtaining credit for enhanced street cleaning: a modeled approach and a measured approach. The proposed modeled approach is similar to the current crediting policy, factoring in credit for area or lane miles swept, adopting a uniform medium density residential land use loading value for all areas swept, and changing the creditable sweeping frequencies. The proposed measured approach for crediting uses locally derived data paired with a crediting approach currently used in Minnesota to provide credit for collected organic matter based on mass.

In anticipation of this policy change, the City of Newton will collect additional data necessary to support and refine the proposed modeled and measured approaches for enhanced street cleaning. Data collection will begin in PY 6 (FY 2024) and will continue to be collected, as needed to support regulatory changes. This data is anticipated to include measured mass and volume of captured organic waste and leaf litter material, organized by the fall (September to December) and non-fall (January to August) seasons, among other data which may be identified as beneficial for future program efficiencies and crediting policy

justification. The collected data will be analyzed to refine a leaf litter collection program and develop an updated standard operating procedure for the City at such time as the policy allows.

Since the regulatory changes are anticipated to occur during the Phase 1 implementation period, preliminary calculations utilizing the anticipated future policy methods were performed to better understand the potential implications to the City of Newton's non-structural load reduction. The non-structural control reduction factors in Table 4-3 below are based on the proposed crediting methodologies outlined in the Clean Sweep Memorandum. Preliminary calculations show that the City could receive greater phosphorus reduction credit using the proposed measured approach for enhanced street cleaning over the proposed modeled approach. These preliminary calculations are based on the methodology as described in the Clean Sweep Memorandum and can be found under Appendix C.

Table 4-3: Non-Structural Control Operational Standards for Anticipated Credit Policy

Non Structural Control	Current City Operational Standard	Anticipated Phosphorus Reduction Factor Defined by Future MS4 Permit
Organic Matter Collection Credit (Measured Approach)	Sweeping each municipally owned roadway, parking lot, and operated impervious surface within the PCP area with a mechanical broom sweeper or vacuum assisted sweeper, at various frequencies (e.g., daily, weekly, monthly) and weighing of total captured mass	Reduction factor varies based on dry mass of collected street sweepings
Street Cleaning Credit (Model-Based)		Reduction factor varies on cleaning frequency and sweeper type

Implementation of the City's current non-structural control program on municipal properties and roadways using the MS4 General Permit's anticipated crediting policy change provides a phosphorus reduction potential that is significantly greater than the existing crediting policy. The City plans to perform annual on-going review of their planned non-structural control program and associated crediting upon the collection of further data (e.g., mass of organic matter collection, sweeping efforts based on frequency and equipment) over the next several years, and upon the issuance of the updated MS4 General Permit and the anticipated crediting policy, will update load reduction credits accordingly.

Table 4-4 below summarizes the phosphorus reduction credit potential under the anticipated future crediting policy per the Clean Sweep Memorandum, for either the measured or model-based credit option based on the City's current operational standard. The potential credits were calculated using data of collected mass of leaf-litter for the fall and non-fall seasons provided by the City, as well as the previously noted on-going sweeping program details. Should this new credit policy be implemented during the Phase 1 permit timeframe, the policy change has potential to dramatically impact the City's achievable load reduction through existing measures. This has the potential to reduce the need for planned structural control measures to fulfill the long-term reduction requirements of the MS4 General Permit.

Table 4-4: Non-Structural Controls Load Reduction Anticipated Credit Potential

	Measured Based Credit	Model Based Credit
Municipally Properties & Roadways	1,856.7	41.9

A detailed summary of the City-provided data and the calculations for phosphorus reduction credits for these planned non-structural control measures based on anticipated crediting policy changes is provided in the non-structural memorandum in Appendix C. This appendix also includes calculation sheets for both the measured approach (organic collection) and model-based approach (street cleaning credit), based on City-provided data.

4.2 Structural Stormwater Controls

Structural SCMs are permanent structures and/or facilities constructed and operated to reduce the discharge of pollutants in stormwater by treating runoff via filtration, infiltration, and/or biological processes. A structural SCM is creditable towards the City's total phosphorus reduction requirement if it meets the design requirements outlined by EPA in the MS4 General Permit and is being inspected, operated, and maintained to ensure it is functioning as designed with associated certification to maintenance and functionality.

4.2.1 Municipal

16 municipal properties were evaluated for phosphorus reduction from existing structural SCMs. The structural SCMs on one property have been designed and permitted but are pending installation. Phosphorus reduction calculations were calculated using EPA's Best Management Practice Accounting and Tracking Tool (BMP-BATT), which is a spreadsheet-based tool that provides accounting, tracking, and reporting for pollutant load reduction associated with structural SCMs. The total credit estimated for the 16 municipal properties is **25.9 pounds per year** (lbs/year). The existing structural control credit calculations are included in Appendix D.

4.2.2 Private

Thousands of private structural SCMs are anticipated to be in place throughout the City; however many were constructed prior to local regulatory changes requiring annual operation and maintenance reporting. The City's Rules and Regulations were updated in Spring 2022 and now require annual operation and maintenance (O&M) reports be submitted for Major stormwater permit projects. Permits issued prior to these updates are required to perform O&M on their SCMs, but the City does not currently have a mechanism to require annual reporting on these O&M activities. Therefore, under the current MS4 General Permit requirements, only municipal SCMs and Major stormwater permit SCMs (permitted after Spring 2022) are creditable towards Phase 1 load reduction requirements. Private structural SCMs constructed after these regulation changes are considered under Section 5.2.3, the Planned Structural Control Redevelopment section of this report. The Operation and Maintenance Program Memorandum in Appendix F and Section 5 further detail measures to credit and track private structural SCMs toward Permit Year 8 and Permit Year 10 load reduction requirements.

The City's stormwater management requirements ensure that stormwater from development and redevelopment projects is adequately controlled through strict on-site retention standards; however, it is not currently feasible for the City to certify that existing, private systems (including single family residential) providing on-site retention are currently performing as originally designed. Future coordination with EPA is anticipated to discuss O&M requirements and tracking for private systems installed prior to local regulatory changes including private residential systems.

4.3 Phosphorus Load Reduction Gap to Meet MS4 Permit Requirements

Table 4-5 below summarizes Newton's anticipated stormwater phosphorus load reduction gap estimated by crediting existing non-structural and structural controls as outlined above.

Table 4-5: Anticipated Overall 2038 Phosphorus Load Reduction Gap (lbs/year)

Required Phosphorus Load Reduction (2038)	Estimated Reduction Achieved			Estimated Load Reduction Gap (2038)
	Non-Structural	Structural	Total Existing Non-Structural and Structural Reduction	
5,679.4	50.1	25.9	76.0	**5,603.4**

The MS4 General Permit requires that municipalities achieve reduction targets in a phased approach. Under Phase 1 of the PCP implementation, the City of Newton is obligated to meet 20% of the reduction target at the end of Permit Year 8 (July 2026) and 25% of this target at the end of Permit Year 10 (July 2028), as summarized in Table 4-6:

Table 4-6: Anticipated Phased Phosphorus Load Reduction Gap (lbs/year)

Target Milestones	Reduction Required	Reduction Provided by Existing Structural and Non Structural Controls	Estimated Load Reduction Gap
Phase 1-Year 8 Reduction Requirement July 2026	20% (1,135.9 lbs/year)	1.3% (76.0 lbs/year)	18.7% (1,059.9 lbs/year)
Phase 1-Year 10 Reduction Requirement July 2028	25% (1,419.9 lbs/year)	1.3% (76.0 lbs/year)	23.7% (1,343.9 lbs/year)
Total 20-Year Permit Reduction Requirement July 2038	100% (5,679.4 lbs/year)	1.3% (76.0 lbs/year)	98.7% (5,603.4 lbs/year)

Section 5 of this plan summarizes planned controls to meet the Phase 1 reduction target of 25% by Permit Year 10 (2028).

5. PLANNED STORMWATER CONTROLS

This section summarizes the City's planned non-structural and structural stormwater control measures and their associated phosphorus load reduction credits, as well provides a summary of the total estimated phosphorus load reduction gap compared to the required reduction under Phase 1 of the PCP implementation (up to Permit Year 10).

5.1 Non-Structural Stormwater Controls

As described in Section 4.1, the MS4 General Permit currently allows phosphorus removal credit for three non-structural control measures: enhanced sweeping, catch basin cleaning, and organic waste and leaf litter collection. The City plans to continue to implement their current management program for all three non-structural control measures, therefore maintaining their existing efforts at a minimum. The City is considering expanding their existing enhanced sweeping program, in particular by increasing street sweeping frequency in specific, targeted municipally paved areas as well as investing in additional sweeping equipment. If the City's program modification is implemented, the City would achieve additional phosphorus reduction beyond the current credit of 50.1 lbs, however, potential non-structural management program changes have not been finalized. As such, the City plans to re-evaluate their non-structural control management program and associated phosphorus reduction on an on-going annual basis. Additionally, the City plans to reassess their non-structural control measure program to optimize and target additional areas where phosphorus reduction may be achieved, based on further data collection over the next several permit years, as well as based on any upcoming MS4 General Permit updates.

5.2 Structural Stormwater Controls

Woodard & Curran completed a preliminary evaluation to determine if the City could achieve its required load reduction for Permit Years 10, 15, and 20 solely by treating stormwater runoff from municipal property. The evaluation found that City property generates approximately half of the total load reduction required by 2038. The City-owned property does not generate enough TP load to meet required reductions, even if 100% of the City's property generated load was eliminated. To meet their required load reductions, the City will need to consider a variety of strategies such as accounting for existing private SCMs, requiring new private SCMs through redevelopment or other measures if crediting policies change. The Phase 1 strategies focus on providing stormwater treatment of upstream municipal and private land runoff on municipal parcels and roadways.

5.2.1 Municipal Parcels

Woodard & Curran assessed each of Newton's 430 municipal parcels for SCM retrofit potential. Each municipal parcel was assessed for SCM retrofit opportunities to treat stormwater runoff generated on the parcel (on-site) and stormwater runoff from surrounding areas discharging onto or near the parcel (off-site). SCMs treating off-site runoff that discharges onto or near municipal parcels via the City's existing closed conduit drainage system were considered regional retrofits. The opportunity identification process, TP reduction calculations, and prioritization of opportunities to meet the City's Phase 1 load reduction requirement is described in detail in the Planned Structural SCM Evaluation Memorandum in Appendix E.

Of the 430 municipal parcels, 111 parcels were identified as having potential retrofit opportunities. The remaining 319 parcels were not evaluated further for treatment opportunities, given that they did not have

adequate space to site an SCM; had site or environmental conflicts such as utilities, unsuitable topography, or resource areas; or did not have on-site or divertible off-site impervious area that would provide phosphorus reduction potential.

The parcels that were identified as having potential retrofit opportunities were further analyzed to select the most effective and applicable SCM type and location to maximize the TP reduction potential. Potential load reduction was estimated for each identified retrofit opportunity using methodology from Attachments 1 and 3 to Appendix F of the MS4 General Permit.

The 111 parcels with potential retrofit opportunities were organized into three categories of projects. Opportunities in each category were ordered from highest to lowest TP reduction potential. The opportunity categories are described below.

1. Prioritized: Identified opportunities that have been prioritized for possible implementation and crediting towards the Phase 1 Permit Year 10 TP reduction requirement. Includes 52 parcels.

2. Pursuable: Identified opportunities that are considered pursuable for future consideration beyond Phase 1. Includes 36 parcels.

3. Not Currently Pursuable: Identified opportunities which are not currently considered pursuable but remain for potential future consideration in subsequent permit phases. Includes 23 parcels.

The prioritized list of opportunities was developed using the City's Capital Improvement Plan (CIP)[1] for fiscal years 2024 through 2028. The CIP includes a list of planned projects (215 total) to be implemented within the Phase 1 Permit period. Pursuable opportunities were compared to the list of CIP projects. If the identified retrofit opportunity could be reasonably aligned with the work outlined in the CIP, the opportunity was selected for Phase 1 prioritization.

Additional aspects were considered when opportunities were reviewed for Phase 1 prioritization including: opportunities for multi-benefit projects, areas with historical flooding, City feedback, cost-benefit, and feasibility. Dry and wet weather stormwater outfall screening and monitoring results collected during the permit term was also reviewed for consideration. For reporting purposes, individual opportunity sheets are provided based on data in the list of prioritized opportunities. These opportunity sheets are included in Appendix E. In total, 52 parcels were identified containing 58 retrofit opportunities selected for Phase 1 implementation and crediting. The cumulative estimated TP load reduction from these opportunities is 1,161.6 lbs/year.

The pursuable opportunities for future consideration did not meet the criteria for Phase 1 prioritization. These are viable opportunities that are not as advantageous to implement during Phase 1 because there was no alignment with the projects proposed in the CIP, there were limiting site considerations, or the cost-benefit was unfavorable. A total of 36 parcels were identified containing 39 retrofit opportunities that are viable options for future consideration beyond Phase 1. The cumulative, estimated TP load reduction from these opportunities is 276.0 lbs/year.

[1] Newton's Capital Improvement Plan: Capital Improvement Plan | City of Newton, MA (newton.org)

The opportunities not currently considered pursuable are potential opportunities that were unfavorable to the City due to site concerns or community impacts such as the presence of mature trees or planned future facility improvements. Of the 111 parcels that were originally deemed feasible for retrofit opportunities, 23 parcels containing 25 retrofit opportunities could require significant removal of mature trees and other unavoidable community impacts. These opportunities are not currently considered by the City, but they can potentially be considered for subsequent permit phases if necessary. The cumulative, estimated TP load reduction from these opportunities is 479.1 lbs/year.

The number of prioritized, pursuable, and not currently pursuable opportunities and their associated phosphorus load reduction potential is summarized in Table 5-1 below. Parcel Opportunity Report Sheets are provided in Appendix E for more detail. In total, approximately 1,916.7 lbs/year of phosphorus reduction credit was identified on 111 of 430 municipal parcels. Of this total potential credit, opportunities resulting in **1,161.6 lbs/year** have been prioritized for Phase 1 implementation.

Table 5-1: Parcel Opportunities and Phosphorus Reductions

Opportunity Category	Number of Parcels	TP Reduction Potential (lb/yr)
Prioritized	52	1,161.6
Pursuable	36	276.0
Not Currently Pursuable	23	479.1

5.2.2 Municipal Roadways

Per the City's Open Space and Recreation Plan, developed June 2021, the City contains approximately 300 miles of City streets, most of which are owned and operated by the City's Department of Public Works. Woodard & Curran assessed City-owned roadways to identify structural retrofit opportunities that could be implemented to supplement the parcel opportunities described in Section 5.2.1. Woodard & Curran developed resources and recommendations, as listed below, that the City can reference and utilize to identify retrofit opportunities when planning for and performing roadway work. These resources and recommendations are described in further detail in the Planned Structural SCM Evaluation Memorandum included in Appendix E.

1. A roadway matrix was prepared to provide guidance on SCM selection for various road types.
2. Concept designs were developed to demonstrate the retrofit options outlined in the matrix and serve as pursuable opportunities for TP reduction. These concepts were prepared for reference only.
3. Plans provided by the City, associated with planned roadway intersection improvements, either in design or construction, were evaluated to quantify TP reduction to credit towards the Phase 1 Permit Year 10 TP reduction requirement.
4. Priority roadways were evaluated for regional roadway retrofit opportunities similar to the regional parcel opportunities to credit towards the Phase 1 Permit Year 10 TP reduction requirement.

A total of 16 regional roadway retrofit opportunities were identified. Of these, 10 opportunities were prioritized for Phase 1 and result in a planned reduction of *54.0 lbs/year*. An additional 6 projects were identified but are not currently being considered by the City due to tree removal implications and community impacts. These opportunities are feasible and can potentially be considered for subsequent permit phases. The cumulative, estimated TP load reduction for these opportunities is 132.6 lbs/yr. Refer to the Roadway Opportunity Report Sheets in Appendix E for more detail.

The City provided plans for roadway intersection improvement projects for incorporation into the Plan as described in the Planned Structural SCM Evaluation Memorandum in Appendix E. These intersection improvement projects currently vary in status from design to construction. These projects primarily consist of impervious area reduction and result in a planned phosphorus reduction of *1.4 lbs/year*. An additional 1-2 lbs of reduction credit per year is anticipated, totaling *5 lbs* over Phase 1, through ongoing City-wide roadway redevelopment work. This roadway redevelopment work, such as transportation improvement and traffic calming projects, or utility work (such as water and sewer), will incorporate SCMs as the City roads are being disturbed and repaved. Transportation and traffic calming projects are anticipated to conservatively total 6.4 lbs/year of reduction credit by the end of Phase 1.

These three roadway project categories total an anticipated **60.4 lbs/year** of Phase 1 phosphorus reduction. Phosphorus load reduction calculations are included in Appendix E.

5.2.3 Redevelopment

The City issues approximately 200 Major stormwater permits per year. As stated in Section 2.3, Major stormwater permits are triggered for projects exceeding land disturbance of 0.5-acres and/or creating greater than 1,000 square feet of new impervious area. Permittees are required to mitigate the volume of stormwater runoff equivalent to or exceeding 2 inches over the entire post-construction impervious area on the site, and reduce generated phosphorus loads by at least 50-60%.

Major stormwater permits will be evaluated in detail for phosphorus reduction, using BATT and the methodology presented in the MS4 General Permit Appendix F Attachment 3, prior to Permit Year 8. However, to account for Major stormwater permit SCMs in this Plan, an interim average phosphorus reduction of 0.2 lbs/year per project is assumed, resulting in an estimated reduction credit of 40 lbs/year. This conservative estimate is based on review of typical load reduction associated with previously permitted projects. As previously noted, new regulations were promulgated in the spring of 2022; affording a 1-year construction period, this allows for 5 years of cumulative credits. Therefore, **200 lbs/year** of planned phosphorus credit is estimated for Major stormwater projects permitted (constructed) between Spring 2023 and Spring 2027 (constructed spring 2024 to spring 2028). Of this, 120 lbs/year of future credit is estimated to be constructed prior to PY8 and 80 lbs/year prior to PY10. These credit estimates will be refined annually as Major stormwater projects are permitted and constructed.

The planned structural controls reduction for municipal parcels and roadways and private redevelopment is summarized in Figure 5-1 below.

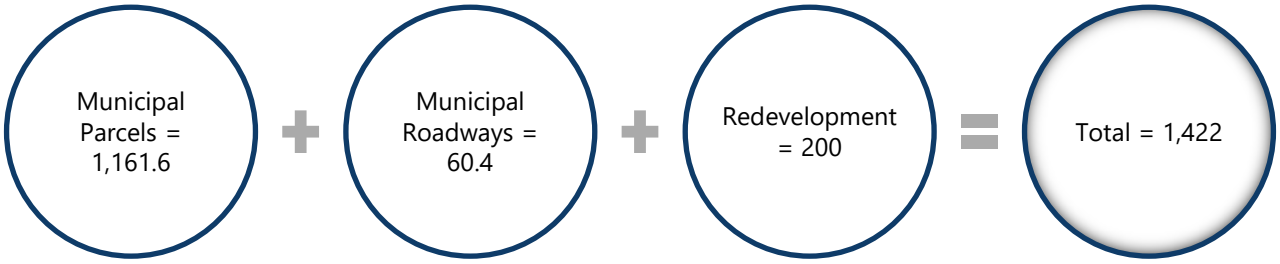


Figure 5-1: Planned Structural Controls Load Reduction (lbs/year)

5.3 Phosphorus Load Reduction Gap to Meet MS4 Permit Requirements

Table 5-2 below summarizes Newton's anticipated stormwater phosphorus load reduction gap estimated by crediting existing and planned non-structural and structural controls as outlined above.

Table 5-2: Anticipated PY10 Phosphorus Load Reduction Gap (lbs/year)

Required PY10 Phosphorus Load Reduction	Estimated Reduction Achieved					Estimated PY10 Load Reduction Gap
	Non-Structural		Structural		Total Non-Structural and Structural Reduction	
	Existing	Planned	Existing	Planned		
1,419.9	50.1	N/A	25.9	1,422.0	1,498.0	**-78.1**

The total Phase 1 reduction provided by existing and planned non-structural and structural controls exceeds the required reduction by 78.1 lbs/year. This additional reduction credit was included in this Plan to conservatively accommodate additional baseline load increases and unforeseen design or construction constraints for planned projects.

The MS4 General Permit requires that municipalities achieve reduction targets in a phased approach. Under Phase 1 of the PCP implementation, the City of Newton is obligated to meet 20% of the reduction target at the end of Permit Year 8 (July 2026) and 25% of this target at the end of Permit Year 10 (July 2028), as summarized in Table 5-3:

Table 5-3: Anticipated Phosphorus Load Reduction Gap

Target Milestones	Reduction Required	Reduction Provided by Existing and Planned Controls	Estimated Load Reduction Gap
Phase 1-Year 8 Reduction Requirement July 2026	20% (1,135.9 lbs/year)	22.7% (1,287.4 lbs/year)	0% (0 lbs/year)
Phase 1-Year 10 Reduction Requirement July 2028	25% (1,419.9 lbs/year)	26.4% (1,498.0 lbs/year)	0% (0 lbs/year)
Total 20-Year Permit Reduction Requirement July 2038	100% (5,679.4 lbs/year)	26.4% (1,498.0 lbs/year)	73.6% (4,181.4 lbs/year)

Considering the City's remaining required reduction gap of 4,181.4 lbs/year, the City will need to consider other load reduction strategies for future permit phases. These strategies might include accounting for existing private SCMs, modifying redevelopment requirements, or incorporating other control measures if crediting policies change, such as collaborating with adjacent communities to implement a credit trading program or regional SCMs. Potential anticipated regulatory changes regarding non-structural control crediting are also anticipated to impact the City's strategies for load reduction implementation.

5.4 Residual Designation Authority

In addition to the EPA and authorized states regulating stormwater discharge for MS4s, industrial sites, and construction sites under the Clean Water Act, the EPA can use its Residual Designation Authority (RDA) to require National Pollutant Discharge Elimination System (NPDES) permits for other, currently unregulated, stormwater dischargers. The circumstances where RDA is used are on a case-by-case basis and may include where known stormwater discharges contribute to a violation in water quality standards or areas contributing a high amount of pollutants to federally protected surface waters.

On September 14, 2022, EPA announced that they intend to require privately owned commercial, industrial, and institutional properties with 1-acre or greater impervious cover located in the Charles River Watershed to seek coverage to reduce their phosphorus loads to the Charles River watershed under an EPA Clean Water Act permit. No action is currently required by these properties; however, EPA will develop a NPDES general permit covering these dischargers, and they will be required to obtain permit coverage and begin to reduce pollutants in stormwater. As of April 2023, EPA's estimated target of issuing a draft permit is the end of the summer of 2024. This target is an estimate due to technical complexities and may be adjusted. It is uncertain if actions resulting from the RDA requirements will be implemented in time to impact the City's required reduction for Phase 1. Therefore, the City has not yet evaluated or credited any load reductions as a result of the RDA. The RDA has potential to have significant impacts to the City's required load reduction, and the City will evaluate these impacts once the issue date of the final permit is known.

6. OPERATION AND MAINTENANCE PROGRAM FOR STRUCTURAL CONTROLS

In support of Phase 1 planning, Woodard & Curran and City staff conducted a series of meetings to discuss the City's current operation and maintenance (O&M) program for existing structural controls on City and private property and evaluate steps to expand the program for planned future structural controls. The goals of these meetings were the following:

1. Understand current inspection, maintenance, and tracking operations;
2. Understand current mechanisms to require and enforce maintenance on private controls;
3. Outline program updates to ensure the City can efficiently credit existing and planned SCMs; and
4. Plan for updated program implementation.

A memorandum outlining the City's O&M program is included in Appendix F. The memorandum summarizes the City's current O&M program and outlines planned program updates, including enhanced tracking and documenting of existing and planned SCMs, evaluating existing private SCMs for creditable phosphorus reduction, education and outreach, enforcement, and auditing.

The City's DPW will be the responsible party for the O&M program. The DPW plans to maintain DPW-owned and operated SCMs in-house. Other municipal departments that operate SCMs will be individually responsible for inspection and maintenance of their own facilities, similar to private facility owners.

The City's O&M program for private facility owners proposes to require, enforce, and audit the inspection, maintenance, and annual reporting for Major stormwater permittees, and have permittees self-certify that their SCMs are being inspected and maintained and are performing as designed. To do this, the City will improve SCM tracking, commence an O&M education and outreach program, and enforce and audit O&M of private SCMs as needed. The primary updated program elements are summarized below:

- Tracking: Tracking and documenting SCMs and their inspection and maintenance activities is necessary for the City to take phosphorus reduction credit for these structural controls. The City will modify their NewGov permit process to require phosphorus increase, SCM system type, and SCM reduction credit to be included as required fields in the permit applicable. The City will also use NewGov to track annual O&M reporting and self-certification for Major stormwater permitholders. NewGov will also be used to manually track SCM information and O&M activities for existing controls that were not permitted through NewGov and therefore are not currently in the system. Finally, the City will use the NewGov database to geographically map existing SCMs and relevant system information.
- Existing SCM Crediting: The City will implement an ongoing evaluation program for existing SCMs to be inspected, maintained, and credited. Newton's robust stormwater regulations have resulted in what is estimated to be thousands of existing SCMs. Major stormwater projects permitted after the Stormwater Ordinance and Rules and Regulations update in Spring 2022 are held to annual O&M reporting requirements. Projects permitted prior to these regulation updates have O&M requirements but were not required to submit annual reports to the City to document annual inspection and maintenance activities. Therefore, the City does not have a legal enforcement

mechanism to require private facility owners with SCMs permitted prior to Spring 2022 to report annually on inspection and maintenance activities, and the City is not currently able to take phosphorus reduction credit for these systems.

- The City will credit phosphorus reduction from SCMs permitted after Spring 2022 and will complete education, outreach, and enforcement activities to ensure facility owners inspect, maintain, and provide annual reports to the City. For systems permitted before Spring 2022, the City will focus on education and outreach to encourage voluntary compliance with O&M and reporting obligations. The City will reevaluate the program after assessing participation during Phase 1 and may consider additional program updates, such as those summarized in the Legal Analysis.
- Education and Outreach: Education and outreach will be crucial components for a successful SCM O&M program. The education and outreach component of the City's O&M program will consist of presentations, outreach material, and engagement with other municipal departments and private property owners to inform them of the O&M self-certification process.
- Enforcement: Section 29-153 of the Ordinance outlines the City's enforcement authority. This section provides the City a mechanism to enforce inspection and maintenance of private SCMs through civil penalties of up to $300 per day of violation. The City will reevaluate civil penalties based on public participation in the program after thorough education and outreach. If annual inspection and maintenance reports are not submitted to the DPW by January 15th of the following year, a civil penalty could be added to the owner's next quarterly stormwater bill.
- Auditing: An auditing program will be enacted to ensure the credibility of the self-certification reporting of private SCMs. The number of annual audits will be based on the total number of existing controls being credited. The City's DPW and representatives will be responsible for notifying, performing, and tracking private SCM audits.

The goal of this enhanced O&M program is to report the date of last completed maintenance and inspection for each structural SCM credited by PY10 in this Phase 1 Plan and obtain the necessary information for the City to certify to the following certification statement required by the permit:

I certify under penalty of law that all source control and treatment Best Management Practices being claimed for phosphorus reduction credit have been inspected, maintained, and repaired in accordance with manufacturer or design specification. I certify that, to the best of my knowledge, all Best Management Practices being claimed for a phosphorus reduction credit are performing as originally designed.

7. PHASE 1 IMPLEMENTATION

7.1 Estimated Phase 1 Implementation Costs

As required by the Permit, estimated costs to implement Phase 1 are included herein. The anticipated costs include those associated with on-going implementation of non-structural control measures, implementation (design and construction) of planned structural control measures, operation and maintenance of city-owned structural control measures, and management costs associated with oversight of Phase 1 implementation.

Per the MS4 General Permit, the permittee shall estimate the cost of implementing the Phase 1 SCMs and associated Operation and Maintenance Programs. This cost estimate has been used to assess the validity of the funding source assessment completed by year 3 and has been used to update funding sources as necessary to complete Phase 1. Supporting cost estimates are outlined below and included in Appendix G.

Phase 1 implementation is estimated to cost $142.24M. Details of these cost estimates are further described in the sections below.

Non Structural SCMs	•$2.97M Annually for 5 Yrs •$14.85M Phase 1 Total
Planned Structural SCMs	•$111.98M Phase 1 Total
O&M	•Permit Year Anticipated Costs: PY 6-$0.7M; PY7-$0.7M; PY8-$1.17M; PY9–$4.43M; PY10–$4.66M •$11.66M Phase 1 Total
Program Management	•$0.75M Annually for 5 Years •$3.75M Phase 1 Total

Figure 7-1: Phase 1 Implementation Cost Elements

Figure 7-2: Phase 1 Total Implementation Costs

7.1.1 Non-Structural SCMs

The City of Newton's non-structural stormwater control measures currently being implemented through their non-structural control management programs include catch basin cleaning, street sweeping and leaf-litter collection. These measures have been being implemented on an annual basis for many years and will continue to be part of the on-going management program. Costs associated with these programs are assessed annually as part of the City's DPW budget allocation. A breakdown of the City's most recent non-structural control budgets and associated allocations are provided below.

Fiscal year 2023 non-structural control measure budget - $2,868,492:

- Street Sweeping and Leaf Litter Collection - $907,077
- Stormwater Maintenance - $1,924,353
- Sweeping Equipment Debt & Interest - $37,062

Fiscal Year 2024 non-structural control measure budget $2,874,868:

- Street Sweeping and Leaf-Litter Collection - $921,101
- Stormwater Maintenance - $1,918,005
- Sweeping Equipment Debt & Interest - $35,762

Additionally, the average annual costs to maintain equipment used in the execution of non-structural control SCMs, including street-sweepers and clam shell trucks, is approximately $97,200. This average is based on city maintenance records from 2020-2022.

The average annual cost associated with the implementation of non-structural SCMs is **$2.97M**.

7.1.2 Planned Structural SCMs

Cost estimates were developed for each of the potential structural control measure opportunities prioritized for Phase 1 implementation. Project costs were developed using EPA published unit costs, as well as estimated unit costs developed by Woodard & Curran. This provided an anticipated range in implementation costs for planning purposes.

7.1.2.1 EPA Costs

EPA Region 1, in conjunction with Tetra Tech, developed unit cost estimates to be included in the Opti-Tool. The methodology used to develop these unit cost estimates is presented in an Opti-Tool Technical Memorandum entitled "Methodology for developing cost estimates for Opti-Tool", dated February 20, 2016 and prepared by Karen Mateleska from EPA Region 1.

The EPA costs are provided as total implementation cost per cubic foot physical static storage capacity that the system can hold. Each unit cost includes construction/installation of the system and a 35% design/engineering/contingency cost. The EPA unit costs do not include any operation and maintenance costs. The EPA unit costs assume linearity for different size systems. These cost estimates were originally prepared in 2010 but are presented as 2016 dollars in Opti-Tool. Given Newton's highly urban setting and associated potential for complex SCM installation, a cost adjustment factor of 3 was used.

The EPA unit costs were converted to 2020 costs using the U.S. Department of Labor Statistics consumer price index inflation calculator and as presented in the University of New Hampshire Stormwater Center's (UNHSC's) Performance Curves. The Performance Curves also separated the materials and installation cost from the design cost for rural, mixed, and urban settings. The urban costs were used for the City of Newton, again assuming that these systems will be complex installations given the highly urban setting.

The most recently published EPA costs are from 2020; however, significant inflation has occurred since then. As such, annual inflation of approx. 5.5% was applied to the published EPA costs to derive an associated 2023 EPA cost for use in this cost estimation. Table 7-1 below provides EPA unit costs utilized in the preparation of the prioritized SCM opportunities.

Table 7-1: EPA Unit Costs

SCM	EPA Total (20) ($/CF) [1]	EPA Construction (20) ($/CF)	EPA Construction (23 Adj) ($/CF)
Infiltration Trench	$38	$25	$29
Infiltration Chamber	$68	$44	$51
Infiltration Basin	$19	$13	$15
Biofiltration	$48	$31	$36
Bioretention	N/A	N/A	N/A
Gravel Wetland	$27	$18	$21
Enhanced Biofiltration Basin	$48	$31	$37
Porous Pavement	$57	$36	$42
Water Quality Swale	N/A	N/A	N/A
Subsurface Sand Filter	$55	$36	$42
Wet Pond	$21	$14	$16
Dry Pond	$21	$14	$16

[1] EPA Total ('20) Unit Costs include construction, design, engineering, and contingency.

EPA construction unit costs were then applied to each prioritized project opportunity, utilizing the SCM type and size, to develop an estimated EPA construction cost for each project. Soft costs, generally including design, permitting, bidding and construction administration, were developed using 35% of the estimated construction cost. The estimated EPA Construction cost and estimated EPA soft costs were summed to provide a total estimated cost for each project opportunity prioritized for Phase 1 implementation. In limited instances where SCM unit costs were not provided, costs were assumed based on relation to other measures with EPA provided costs.

7.1.2.2 Woodard & Curran Cost Estimate

To provide a direct correlation of cost estimates, Woodard & Curran estimated costs following a similar methodology as EPA. Construction unit costs were developed to inform project construction costs. Soft costs were also applied as a percentage of the construction cost, consistent with the EPA cost estimate approach above, to develop a total W&C project cost. The soft cost percentages are outlined in more detail below.

Woodard & Curran developed unit costs based on a cost/static volume treated basis for each of the structural control methods identified above. These construction unit costs were developed using a standard system cross section and average system size for each control measure based on the planning process described in Appendix G. Prioritized project opportunities are considered both in City-owned parcels as well as City-owned rights-of-way. Construction within a City roadway is anticipated to have increased complexity associated with traffic management and utilities. Therefore, construction unit costs were increased by approximately 40% on average from that of the associated structural control on a city parcel. The impervious area (IA) removal unit cost was based on MassDOT rates.

The Woodard & Curran (W&C) construction unit costs are provided in Table 7-2 below. Additional information on the development of these costs can be found in Appendix G.

Table 7-2: Woodard & Curran Unit Costs

SCM Type	W&C Construction Unit Costs per Treatment Volume ($/CF)	Roadway Work W&C Construction Unit Costs per Unit Volume ($/CF)
Infiltration Trench	43	60
Infiltration Chamber	19	27
Infiltration Basin	9	13
Porous Pavement	60	84
Biofiltration	18	26
Enhanced Bioretention with ISR	16	23
Gravel/Constructed Wetland	23	33
Sand Filter	34	48
Wet Pond	7	10
Dry Pond	8	12
WQ Grass Swale	31	44
IA Removal	25/SY	25/SY

Woodard & Curran also developed a standard soft cost, applied as a percentage of the construction cost, to estimate design, permitting, bidding and construction administration costs. This is a common method for budgetary planning of engineering and construction projects. These percentages were developed based on industry experience and are provided below.

Table 7-3: Woodard & Curran Soft Cost Percentages

Cost	Percentage (%)
Site Investigation (survey, soil test, etc.)	2.5%
Design	10%
Permitting	5%
Bidding/Const. Admin	10%
City Administration	1%
Woodard & Curran Estimated Soft Cost Total	**28.5%**

7.1.2.3 Woodard & Curran Estimation Method

Woodard & Curran construction unit costs were then applied to each prioritized project opportunity, utilizing the project type and size, to develop an estimated base construction cost for each project. Prioritized regional projects were also reviewed for potential incorporation of two additional construction cost factors: an additional excavation cost and a site-specific project complexity cost.

The additional excavation cost was incorporated to account for earthwork and material management of subsurface infiltration systems since the regional projects may be significantly deeper than the on-site projects or typical section depth estimated. This excavation factor was estimated at $8/SF for smaller systems (generally those approx. 40,000 sf or less) and $4/SF for larger systems, based on economy of scale.

The regional site-specific estimated cost adjustment factor was applied to account for individual project complexity which includes but is not limited to components such as sports equipment impacts, school impacts, traffic management and roadway interconnectivity. Projects anticipated to incur additional costs associated with these elements received adjustments generally estimated to be 15,000, 25,000 or 50,000, although specific adjustments may vary. Adjustments of 15,000 are largely associated with limited roadway coordination, such as limited construction within a residential street, while a 50,000 adjustment was applied for projects where construction in major arterial roads is anticipated.

Soft cost estimates for each project were then developed using 28.5% of the estimated construction cost. As these prioritized projects are in a planning level stage, consistent with industry standards, an overall project contingency of 20% was then added to the sum of the construction and soft costs. The estimated construction cost, soft cost and contingency was then summed to develop a total estimated Woodard & Curran cost for each project prioritized for Phase 1 implementation.

7.1.2.4 Planned Structural Control Estimated Implementation Cost Summary

Phase 1 implementation costs associated with structural controls necessary to meet the Phase 1 load reduction are estimated to vary between $63.48M (W&C) and $111.98M (EPA). Prioritized opportunity cost report sheets can be found in Appendix G. For the purpose of this Plan, the estimated EPA projects costs are conservatively used for planning and budgeting. The majority of the prioritized projects for Phase 1 implementation are necessary to support the PY8 load reduction requirements; this estimated cost is approximately $98.86M. The associated cost to complete the remaining prioritized projects between PY8 and PY 10 is $13.12M. However, as further described in the schedule section below, a significant number of structural SCMs are anticipated to be implemented to support PY8 and PY10 requirements; this may be achieved in multiple ways given the high number of controls anticipated. Therefore, the associated implementation costs for PY8 and PY10 may vary though the percentage of total costs is anticipated to remain consistent should implementation of specific opportunities vary from the Permit Timeline Schedule. Figure 7-3 presents estimated implementation costs for planned structural controls based on the Permit Timeline Schedule.

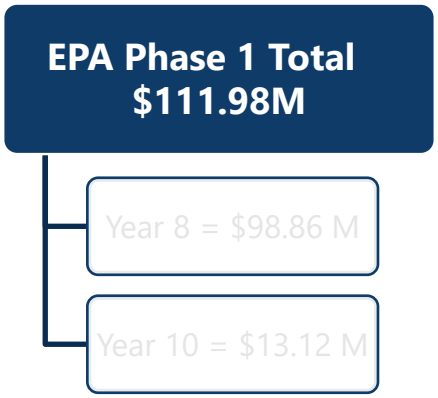


Figure 7-3: Estimated Planned Structural Control Implementation Costs (EPA)

7.1.3 Operation & Maintenance Program

Operation and Maintenance Costs were developed for City maintained structural stormwater control measures. This includes both existing structural controls as well as planned structural control measures which are or will be maintained by the City of Newton.

The estimated O&M costs associated with City owned/maintained structural SCMs are based on system type, number of existing and planned municipal systems, typical maintenance activities for that system type and their associated frequencies. Maintenance frequencies are consistent with or more stringent than MA Stormwater Handbook recommendations. Hourly durations for labor and equipment necessary to execute each activity were estimated for each activity. Labor and equipment costs are based on local prevailing wage rates and equipment costs. A total annual maintenance cost of $1.58M was estimated to maintain existing and planned City owned structural controls identified for Phase 1 implementation.

Additionally, components of existing and planned structural controls are anticipated to require replacement. A total replacement cost of approximately $45.42M was estimated, and an assumed approximate average

annual rate of 3% was used based on a 30-year system lifespan. This resulted in an annualized cost of approximately $1.53M.

After including contingency and administration of approximately $1.55M (or profit if privately contracted), the total annual operation and maintenance costs are estimated to be $4.66M.

O&M costs are anticipated to be phased in conjunction with the construction of planned structural SCMs to meet PY 8 and PY 10 implementation requirements. Existing structural SCMs are anticipated to account for approximately 15% of the total O&M cost. Construction of planned structural controls is anticipated to be completed between PY 8 and PY 10, with the majority completed in PY 9. Therefore, annual O&M costs are estimated to be incurred as follows:

- PY 6 – Annual O&M Costs for Existing SCMs (initial 15%) = $0.7M
- PY 7 – On-going Annual O&M Costs (remains 15%) = $0.7M
- PY 8 – Additional 10% of Annual O&M Costs (25% total) = $1.17M
- PY 9 – Additional 70% of Annual O&M Costs (95% total) = $4.43M
- PY 10 – Additional 5% of Annual O&M Costs (100% total) = $4.66M

The total anticipated cost to inspect, operate, and maintain municipal SCMs during Phase 1 is **$11.66M**.

7.1.4 Program Management Costs

As Phase 1 implementation progresses, so will associated program management costs to support oversight and auditing. At the time of Plan development, the City's program management strategy has not been fully developed; however, a cost allowance is addressed herein as the Phase 1 implementation management will be significant to support the execution of planned projects and future auditing of private SCMs. City Department of Public Works support is anticipated to increase from approximately $150,000 annually to $750,000 annually; a **$0.75M** annual cost has been used throughout Phase 1 implementation. This support is in association with public outreach, stormwater permit review and tracking, software upgrades to support stormwater management, tracking and auditing, inspection program auditing and management and oversight of the design and construction of planned structural control measures needed to support the Phase 1 load reduction requirements.

7.2 Schedule

Phase 1 requires a schedule for implementation of stormwater controls in compliance with the MS4 General Permit. All non-structural SCMs are to be implemented at the start of Permit Year 6 (2024), while planned structural SCMs must be implemented to comply with the Permit Year 8 (2026) and Year 10 (2028) phosphorus load milestones.

To comply with the Phase 1 requirement timelines, the City evaluated its ongoing program elements and its elements which are to be implemented during Permit Phase 1. The City reviewed existing structural SCMs through their stormwater program updates and non-structural control measures to determine the phosphorus load remaining. The remaining phosphorus load reduction is met with planned prioritized structural SCM opportunities. The design, construction, and funding timeline was then assessed for the

prioritized structural SCMs. This report section provides details regarding the Phase 1 implementation elements and their associated schedule.

7.2.1 Schedule Implementation Elements

Figure 7-4 below outlines the Phase 1 implementation schedule elements for Permit Year 6 (2024) through Permit Year 10 (2028). The primary elements of the schedule include:

Figure 7-4: Phase 1 Implementation Schedule Elements

7.2.1.1 Program Elements

Program elements for implementation during Phase 1 include those programmatic measures which are planned to support load reduction crediting of public and private SCMs as well as Phase 2 PCP planning, in accordance with the permit requirements. Program measures are anticipated to be implemented throughout Phase 1, to ensure necessary mechanisms are in place to maximize the available Phase 1 load reduction as well as for future Phases. Planning for Phase 2 will also need to be completed by 2028.

The program updates are anticipated to be completed as depicted in Figure 7-4 and further outlined below.

Permit Year 6 (2023-2024)

Existing SCM Credit Program Evaluation

As discussed previously in this report, many existing municipal and private structural SCMs may be creditable toward Phase 1 load reductions. Throughout Phase 1, the City will continue to evaluate their program surrounding crediting of existing structural SCMs; this may include assessment of regulatory mechanisms associated with existing structural controls and further program coordination to identify additional existing structural controls which exist and meet the criteria (such as reporting requirements) to be credited towards Phase 1. This program evaluation will occur during Permit Year 6 with the results of the evaluation assessed to understand if ongoing program evaluation is warranted.

Tracking

Also in Permit Year 6, the City will perform updates to their NewGov software, which the City currently utilizes to support Stormwater Permits. NewGov is anticipated to be updated to track phosphorus load changes for new permitted projects. Additionally, tracking of Major stormwater permit annual O&M reporting and self-certification will be implemented in NewGov. To support future auditing requirements, NewGov will be used to generate auditing lists for the City's use. These tracking measures will position the City to maximize the credits associated with stormwater permit projects, through better accounting of critical components.

Education and Outreach

On-going education and outreach is performed regularly by the City regarding MS4 requirements and the City's efforts to comply with these requirements. More targeted PCP outreach has recently been performed by the City in support of the Phase 1 Plan. During Permit Year 6, the City will expand the PCP specific education and outreach performed to educate the public on the requirements associated with operation, maintenance and reporting of private SCMs. Targeted outreach to Major stormwater permit holders will be performed. Information regarding future enforcement will also be provided to prepare the public for this implementation. Selective outreach will also target major stakeholders within the City to educate and inform them of the PCP requirements and importance of stormwater management. General education and outreach regarding Phase 1 implementation and future PCP phases will also be continued. Further detail regarding this education and outreach is provided in the Operations & Maintenance memorandum in Appendix F.

Permit Year 7 (2024-2025)

Enforcement

The City plans to initiate enforcement of their annual reporting requirements for structural SCMs in PY7 (2024-2025) as needed. The City requires annual reporting of inspection and maintenance of structural SCMs permitted via a Major Stormwater Permit. However, the City rarely receives annual reports from Major stormwater permit holders. Therefore, education and outreach targeting this topic will be performed in PY6 (noted above) to inform permit holders of upcoming enforcement measures to afford them time for planning and compliance. Enforcement may include civil penalties should the City decide they are necessary.

Permit Year 7 (2024-2025)

Auditing Program

The City will initiate an auditing program in PY8 to ensure private property owners are properly inspecting, operating, and maintaining the structural SCMs for which the City is crediting towards the PY8 load reduction requirements. To accomplish this, the City will develop an auditing program to allow auditing to occur in PY8. The auditing program will continue to be implemented throughout Phase 1 and subsequent permit phases.

Permit Year 10 (2028)

Phase 2 PCP Plan Development

The MS4 General Permit requires the Phase 2 plan to be completed by the end of Phase 1. This allows Phase 2 implementation to be initiated at the completion of Phase 1. As such, the City will advance their Phase 2 Plan, for completion by the end of PY10.

7.2.1.2 Stormwater Control Elements

In addition to Phase 1 programmatic elements, the implementation schedule includes stormwater control elements to be implemented throughout Phase 1. These include measures which are ongoing and planned to continue throughout Phase 1 in addition to new measures to support load reduction requirements. These Stormwater Control Elements and their associated implementation timelines are outlined below.

Permit Year 6 - 10 (2024 - 2028)

Non-structural

The City currently implements non-structural SCMs such as street sweeping, catch basin cleaning, and leaf litter collection. These existing and ongoing non-structural controls will continue to be implemented in compliance with Permit Year 6 (2024) requirements.

Existing Municipal Structural Controls

The City has existing structural controls at multiple municipal facilities which will continue to be maintained in accordance with the O&M program (25.9 lbs/yr). As previously noted, planned projects currently in design and/or construction have been evaluated and included in the Plan (1.4 lbs/yr). The City also routinely executes transportation improvement and traffic calming projects annually. These projects will continue to be executed throughout Phase 1 with an approximate load reduction accrual of 1-2 lbs/year.

Major Stormwater Permits

City of Newton stormwater regulations, discussed in Section 2, which went into effect Spring 2022 require projects exceeding land disturbance of 0.5-acres and/or creating greater than 1,000 square feet of new impervious area to meet phosphorus removal requirements. Permittees are required to mitigate the volume of stormwater runoff equivalent to or exceeding 2 inches over the entire post-construction impervious area on the site, and reduce generated phosphorus loads by at least 50-60%. For the Phase

1 Plan, an interim average phosphorus reduction of 40 lbs/year is assumed. A total of 200 lbs/year of future phosphorus credit is estimated for Major Stormwater Permit projects permitted between Spring 2022 through Spring 2027 (constructed spring 2023-spring 2028). These credit estimates will be refined annually as Major stormwater projects are permitted and constructed. Major stormwater permits will be implemented and tracked throughout the duration of Phase 1.

Planned Structural Controls

Structural SCMs are needed to achieve the Phase 1 load reduction. An estimated 68 projects on City municipal properties and roadways require implementation by Permit Year 10 (2028). Further discussion on structural SCMs prioritized for Phase 1 implementation is provided in Section 5. More detailed schedules and narrative are provided in Appendix H. Planned structural SCMs will be implemented throughout the duration of Phase 1.

7.2.2 Permit Timeline Schedule

The Phase 1 Permit Timeline Schedule includes the implementation of existing control measures and the completion of all planned structural controls within the Phase 1 timelines necessary to comply with Year 8 and Year 10 load reductions. The Permit Timeline Schedule can be found in Appendix H.

To comply with the MS4 General Permit, the City must design, and construct planned structural SCMs within the Phase 1 implementation 5-year period, beginning in Permit Year 6 (2024). The required load reduction is discussed in Section 5. Approximately 68 planned structural SCM projects of varying size and complexity are anticipated to meet the Permit requirements.

To develop a Permit Timeline Schedule, the planned structural SCMs were evaluated for the project phases required to execute project design and construction. Those six phases were Design Proposal & Procurement, Feasibility & Planning, Design Phase, Permitting, Construction Bidding, and Construction. The planned structural SCMs were then grouped by project types defined as school properties, parks / recreational area, roadways, and other municipal properties. Durations were then assigned to each project type phase based on a project's general sizing separated into small, medium, large, and extra-large.

The list of 68 planned structural SCM projects were then scheduled into the Phase 1 Permit Timeline Schedule based on synchrony with the City of Newton Capital Improvement Plan (CIP), meeting Permit Year load reductions, available yearly construction windows, and balancing disturbance of municipal lots. To comply with Permit Year 8 load reduction requirements, 63 projects are to be completed, and the remaining 5 completed for Permit Year 10. This Permit Timeline Schedule represents one of many possible ways in which the Phase 1 implementation requirements may be achieved. The Permit Timeline Schedule is a planning level schedule that is subject to change as feasibility, design, planning, funding, regulatory changes and other considerations of Phase 1 implementation evolve.

The Permit Timeline Schedule was reviewed with the City, and concerns were raised regarding the feasibility of implementing the large number of planned SCMs in Phase 1. A second schedule was evaluated and prepared based upon schedule planning constraints and is discussed in the following section.

Further narrative on the creation and planning of the Phase 1 Permit Timeline Schedule is provided in Appendix H.

7.2.3 Constraints Schedule

A Phase 1 Constraints Schedule was developed based upon the infeasibility to concurrently execute the number and complexity of projects, adverse community impact, and total cost required to implement Phase 1 planned structural control measures by 2028. The Constraints Schedule only includes the implementation of prioritized structural control measures identified to meet the Phase 1 load reduction gap, as these prioritized structural control measures present the most significant implementation challenge. Other planned control measures are primarily on-going, to continue, or planning measures which will continue to be advanced in support of the Phase 1 Plan and were therefore not considered in the Constraints Schedule. The Constraints Schedule can be found in Appendix H.

Constraints used in creation of the schedule include: the number of projects concurrently in design or construction; planned project costs compared to City budget currently available for SCMs; and balancing the number of project types for distribution between school properties, parks/recreational area, roadways, and other municipal properties. Consideration was also given to overlapping projects which pair with the City of Newton CIP between the years of 2023 - 2028. These constraints were used and projects with the most favorable (lowest) cost-benefit ratio were prioritized when scheduled. Many projects represent total costs which exceed the yearly available City budget for new control measure projects. These projects were split between design and then completion of construction in later years when budget was accrued for construction.

The Constraints Schedule depicts an implementation timeline of approximately 55 years and represents only one of multiple ways the projects could be aligned for completion. The purpose of this schedule is to depict the significant variation in timelines between what is required by the 5-year Permit Timeline Schedule and what the City may achieve based on current constraints. Additionally, the Constraint Schedule developed for planning considerations, assumes all City stormwater funding is expended in support of phosphorus control implementation and existing programs, however the City will also need to fund other important stormwater infrastructure improvements during this timeframe further impacting the implementation timeline.

Further narrative on the creation and planning of the Phase 1 Constraints Schedule is provided in Appendix H.

7.3 Public Engagement

The City of Newton and Woodard & Curran have worked collaboratively over the last several years in the planning and development of the Phase 1 PCP. Meetings have been held annually with the Public Facilities Committee to discuss efforts the City is making in compliance with MS4 requirements. Public Facilities Committee meetings are open to the public and agendas are posted on the City website. Various City departments have also been engaged during the development of the Plan, including but not limited to planning and conservation departments. Over 10 meetings were held between City Department of Public Works staff and Woodard & Curran to inform the content of the Phase 1 Plan. DPW participation varied by meeting topic and other City representatives participated in select meetings. This extensive series of meetings was performed to ensure alignment of the Phase 1 Plan with the City's stormwater goals and environmental commitment to support a healthier City. Public outreach and engagement will continue through the Summer and Fall 2023 in support of Phase 1.

8. LEGAL ANALYSIS

A legal analysis was performed in February 2020, in accordance with permit requirements, to analyze the City's existing regulatory mechanisms and/or changes to those mechanisms which may be necessary to support implementation of the Phosphorus Control Plan. A memorandum documenting the 2020 analysis is included in Appendix I for reference.

The MS4 General Permit describes the scope of the required legal analysis as a document that identifies existing regulatory mechanisms available to the City, such as bylaws and ordinances, and describes changes to regulatory mechanisms that may be necessary to effectively implement all phases of the PCP. This may include the creation or amendment of both financial and regulatory authorities. The permit requires any necessary regulatory changes to be adopted by the end of the permit term (PY10).

The City has historically exhibited robust stormwater regulations, such as requiring Special Permit projects to consider existing conditions as undeveloped (100% pervious) for the purpose of stormwater management design or regulating projects that increase impervious area by the lesser of 4% lot area or 400 SF. Since the preparation of the 2020 legal analysis, the City of Newton has adopted revised and expanded stormwater regulations which were pending at that time. The current regulations are attached in Appendix I. A stormwater fee is also in place, with a 10% rate increase having been approved by City Council in May 2023. The City is well positioned with multiple mechanisms in place to support implementation of the PCP. Through development of the Phase 1 plan, some modifications to these mechanisms have been identified to support Phase 1 implementation. Additional future modifications have been identified for further consideration to support Phase 2 and 3. These regulatory mechanisms will continue to be assessed throughout Phase 1 implementation to inform potential efficacy of the modifications considered.

8.1 Anticipated Phase 1 Modifications to Newton's Programs and Policies

In conjunction with the City's Operation and Maintenance Program for municipal and private structural SCMs, the City of Newton anticipates regulatory modifications to be implemented in Permit Year 7. These measures are primarily associated with tracking and enforcement necessary to support Permit required credit certification.

The City currently requires Major stormwater permit holders to submit annual reports documenting yearly inspection and maintenance performed on structural SCMs; however compliance is limited. The City anticipates two regulatory modifications in conjunction with these private annual reports: requirement of a self-certification (compliant with EPA reporting requirements) and stronger enforcement mechanisms of a daily fine if annual reports are not submitted. As noted in the Operation & Maintenance Program Memorandum in Appendix F, the City currently has authority to enforce fines for lack of compliance; however, the City will revise the Rules and Regulations to specifically link them to this Ordinance enforcement section for greater clarity and emphasis. These measures are considered for implementation in PY7 to afford the City a period to perform education and outreach specifically to these Major permit holders in advance.

8.2 Potential City Program and Policy Modifications Identified for Future Consideration

As Phase 1 implementation progresses and into future Phases of the Plan, additional regulatory modifications may be considered. Possible regulatory modifications which have already been identified for consideration include expansion of the annual inspection and maintenance requirements and self-certification to Minor Stormwater Permits; imposing an additional fee for delinquent annual report submission; and requiring inspection, maintenance, and annual reporting through the property transfer process. These considerations are further described below.

- Expansion of Reporting to Minor Permits **–** The City of Newton requires stormwater nutrient reduction from Minor stormwater permits through volume control requirements. Though the phosphorus load reduction associated with these projects is substantially less significant than that of Major permits, it is nonetheless provided. The City may consider the cost effectiveness of modifying regulations to require that Minor stormwater permit holders provide annual self-certification of inspection, maintenance and functionality along with reporting on the inspections and maintenance performed. However, the cost and implications of the additional tracking and auditing of these systems should be evaluated to assess the potential benefit of this possible modification.
- Fee Credit for Reporting Compliance – The City may consider the efficacy of offering an additional stormwater fee credit to incentivize owners of private structural SCMs to comply with annual reporting requirements. This includes owners of all structural SCMs, regardless of permit type.
- Added Stormwater Inspection & Maintenance Fee – The City may consider imposing a fee through the stormwater utility bill, either in addition to, or in lieu of daily fines, for private structural SCM owners who do not comply with annual reporting requirements. This would allow the City to fund a municipal inspection and maintenance program for private SCMs which are not actively being maintained to ensure the City may account for the associated phosphorus load reduction provided by the system.
- Property Transfer Stormwater Requirements - Though the City of Newton has historically required mitigation of stormwater volume through infiltration, and as a result is estimated to have thousands of private structural controls, no regulatory mechanism existed prior to 2022 affording the City maintenance and reporting mechanisms of private structural SCMs necessary for compliance with the permit required crediting protocol. Therefore, the City may consider adding maintenance and reporting requirements with the transfer/sale of a property. These requirements would necessitate inspection and maintenance of a private structural SCM at the time of property transfer, as well as subsequent compliance with annual reporting requirements to ensure over time that the City is able to take credit for all private structural SCMs. The associated crediting would be gradual, but in the long-term, the additional creditable load reduction is anticipated to be significant.

9. FUNDING SOURCE ASSESSMENT

A Funding Source Assessment was completed in June of 2021 in compliance with the MS4 General Permit requirements. The funding source assessment provided an overview of existing and potential future funding programs that may be available to the City to assist with phosphorus reduction goals required by the MS4 General Permit. Possible funding entities identified by the funding source assessment included Newton Department of Public Works Stormwater Fund, Department of Public Works Street Cleaning Budget, Clean Water State Revolving Loan Fund, Coastal Pollutant Remediation Grant, MS4 Municipal Assistance Grant Program, Section 604(b) Water Quality Management Program, Section 319 Water Quality Management Planning Grant Program, Massachusetts Municipal Vulnerability Preparedness Grant. This document is included in Appendix J. The funding source assessment was reviewed and updated to confirm the funding mechanisms previously identified are still available to support the Phase 1 Plan. The updated 2023 funding source assessment is also included in Appendix J.

At the time of the required funding source assessment (PY3) the Phase 1 implementation costs were not yet known. As detailed in Section 7.1 above, the Phase 1 implementation costs are anticipated to range upwards of $142 million for implementation by fiscal year (FY) 2028.

The applicable City of Newton Stormwater Fund and Sustainable Materials Division Street Cleaning budget continue to be the primary source of funding for Phase 1 implementation. The FY 2024 total budget of these two sources is approximately $5.46M. The City's Stormwater Fund has historically generated approximately $4M annually and is anticipated to increase to approximately $4.54M annually in FY24. In anticipation of Phase 1 implementation, the City of Newton approved a stormwater fee increase of 10%; this rate increase was approved by the City Council in May 2023. The Stormwater Fund supports approximately $2.13M of capital projects annually, while the balance ($2.41M) of the fund supports stormwater operation and existing stormwater project debt. Additionally, the City has accrued a budget reserve in the Stormwater Fund of approximately $3.6M. These sources total to an estimated $9M; however, a significant Phase 1 implementation funding deficit remains.

The City of Newton will continue to assess and pursue funding mechanisms, specifically SRF funding, in support of not only Phase 1 implementation but also preparation for subsequent regulatory Phases. Anticipated regulatory changes, specifically the non-structural control crediting policy, may positively impact the City of Newton's Phase 1 load reduction approach. These MS4 General Permit changes are anticipated in the winter of PY 6 (2023-2024). Should these regulatory changes occur, the financial burden associated with Phase 1 implementation is anticipated to lessen.

The City anticipates a rate analysis will be performed to better define the anticipated financial burden associated with the current requirements necessary to support Phase 1 implementation. Additionally, financial implications of full implementation, including Phases 2 and 3 of the PCP, are anticipated to be evaluated. Phase 1 load reduction requirements are 25% of the total required load reduction and is anticipated to result in capital expenses of $142.24M by 2028. Assuming a similar cost per pound of phosphorus reduction to implement the remaining 75% in Phases 2 and 3, the additional capital expenses required to support full compliance of Phases 2 and 3 by 2038 are anticipated to be over $430M with a total implementation cost potential (Phases 1-3 over $575M).

Additional stormwater improvements, unrelated to phosphorus control, such as flood mitigation are also important to the City and further limit the City's financial resources to support various types of stormwater improvements.

At present, the City has maintained a healthy ratio of reserve funds to annual expenses (>20%). However, as Phase 1 implementation occurs, reserves funds would likely be used to offset the debt burden. Even with substantial rate increases, the City will be unable to build and grow their reserves fund balance. Considering subsequent regulatory phases and associated increases to debt service, the City's stormwater reserve fund balance will represent just a small fraction of annual expenses, putting the fund in a challenging position.

The City of Newton anticipates the future submittal of an Alternative Schedule Request for Phase 1 implementation, as the burden associated with the schedule, community impacts and associated financial implications is not practicable.

10. ALTERNATIVE SCHEDULE REQUEST ASSESSMENT

The City of Newton's phosphorus load reduction requirement based on 2005 EPA data is 5,214 lbs. The City is required to account for land use/land cover changes which have occurred since 2005, increasing the load reduction requirement. Preliminary baseline load updates (to be refined) indicate a required load reduction of 5,679 lbs be implemented by 2038. Twenty-five percent (25%) or approximately 1,420 lbs must be mitigated under Phase 1 by 2028. This load reduction requirement is the second highest in the state, exceeded only by Boston. Through the development of this Plan, the impacts and implications to the City of Newton associated with a 5-year implementation timeline were identified as unrealistic. This section summarizes key components of assessment pertinent to an Alternate Schedule Request which is anticipated to be submitted subsequently.

A preliminary evaluation determined that the City cannot achieve its required load reduction solely by treating stormwater runoff from municipal property. The evaluation found that City property does not generate enough phosphorus load to meet required reductions, even if 100% of the City's property generated load was eliminated. To meet their required load reductions, the City will need to consider a variety of strategies such as accounting for existing private SCMs, implementing new private SCMs through redevelopment, or acquiring private property in strategic locations for retrofits. The Phase 1 strategies focus on providing treatment on municipal parcels and roadways.

To achieve the required Phase 1 load reduction requirement, it is anticipated that the City will need to implement approximately 68 structural SCM projects within City owned property. The majority of these opportunities are on City parcels with the remainder considered in City roadways. This results in 52 of the 430 City Owned parcels being disrupted by construction over the next 5 years; nearly 15%. Due to the nature of City controlled properties, significant concurrent impacts to City schools and parks are anticipated with this implementation. The estimated cost to implement these structural SCM projects is $111.98M, with nearly $100M associated with implementation by 2026 and the balance by 2028 (PY 10). Not only is the impact to the community significant, the associated construction materials and labor necessary to execute these structural SCMs in such a short period may be limited, especially considering that similar implementation is required of other communities pulling from the same resource pool.

Industry standard planning costs range between $50K to $100K per pound of phosphorus removed. Cost analysis performed in support of this Phase 1 plan indicates a slightly broader, but similar range; the majority of the prioritized opportunities were estimated to range between $35K and $130K (using EPA costs) with outliers. The City of Newton's Phase 1 implementation costs are anticipated to be approximately $142.24M, to achieve 25% of the overall reduction requirement. Based on this industry range, full implementation costs (Phases 1-3) could range from $285 to $570M; $575M is estimated for full implementation assuming a similar cost/pound as Phase 1.

The EPA and MassDEP anticipate issuance of revised regulations for non-structural control measure phosphorus reduction credit in the fall of 2023. Based on preliminary calculations and the City's non-structural control program, the anticipated regulatory changes could result in significantly higher load reduction credits and have a significant impact to the City's implementation of phosphorus load reduction. As such, it is important to consider these potential changes not only in Phase 1 PCP planning but also for implementation of all phases of the Plan.

The City of Newton anticipates the subsequent submittal of an Alternative Schedule Request. The potential regulatory changes, cost implications, community impacts, volume of construction and potential associated labor and material constraints should all be considered and coordinated for effective implementation of phosphorus reduction in the community. The uncertainty surrounding many of these interconnected elements suggests further coordination between the City and EPA is warranted to ensure effective implementation.

APPENDIX A: FIGURES

Figure 1: City Hydrography

Figure 2: 2016 Land Use

Figure 3: Hydrologic Soil Groups

Figure 4: Urbanized Area

Figure 5: Roadway Jurisdiction

City Hydrography (Fig. 1)

CITY OF NEWTON MASSACHUSETTS

DRAINAGE BASIN MAP

Legend

- Major Drainage Basins
- Contributing Drainage Basins
- Parks & Open Space
- Public Schools
- Aqueducts
- Water Bodies
- Streams
- Railroads

Scale: 1000 0 1000 FT. 2000 3000 4000FT.

April 1998

NOTES

1. STREET MAP PROVIDED BY CITY OF NEWTON GIS/ENGINEERING DEPARTMENT PERSONNEL.
2. MAP NOT INTENDED FOR ENGINEERING PURPOSE, BUT, TO DEPICT FLOW CONDITIONS DURING DRY WEATHER PERIODS AS IDENTIFIED BY WOODARD AND CURRAN DURING DRY WEATHER FLOW INVESTIGATION PROJECT TO RESPOND TO U.S. EPA ADMINISTRATIVE ORDER, DOCKET 96-07.

OUTFALL 1
OUTFALL 2
OUTFALL 3
OUTFALL 4
OUTFALL 4A
OUTFALL 5
OUTFALL 6
OUTFALL 7
OUTFALL 8
OUTFALL 9
OUTFALL 9A
OUTFALL 10
OUTFALL 11
OUTFALL 12
OUTFALL 13,13A
OUTFALL 14
OUTFALL 15
OUTFALL 15B
OUTFALL 16
OUTFALL 17
OUTFALL 18
OUTFALL 18A
OUTFALL 19
OUTFALL 20
OUTFALL 22
OUTFALL 23
OUTFALL 24A
OUTFALL 25
OUTFALL 26
OUTFALL 27
OUTFALL 27A (UNDER CONSTRUCTION)
OUTFALL 28
OUTFALL 29
OUTFALL 30
OUTFALL 31
OUTFALL 32
OUTFALL 32A
OUTFALL 33
OUTFALL 34
OUTFALL 36
OUTFALL 36A
OUTFALL 37
OUTFALL 37A
OUTFALL 38
OUTFALL 39
OUTFALL 40
OUTFALL 41
OUTFALL 43
OUTFALL 44
OUTFALL 44A
OUTFALL 44B
OUTFALL 47
OUTFALL 48
OUTFALL 49
OUTFALL 50
OUTFALLS 51, 51A & 51B
OUTFALL 52
OUTFALL 53
OUTFALL 56
OUTFALL 57
OUTFALL 58A
OUTFALL 58
OUTFALL 60
WETLAND BASIN 64
OUTFALL 61
OUTFALL 63 (PLUGGED)
OUTFALL 65
OUTFALL 65A
OUTFALL 68
OUTFALL 69
OUTFALL 70
OUTFALL 72
OUTFALL 73
OUTFALL 74
OUTFALL 75
OUTFALL 80
OUTFALL 81
OUTFALL 82
OUTFALL 86
MASS. TURNPIKE DRAINAGE

WEST NEWTON
AUBURNDALE
LOWER FALLS
WABAN
NONANTUM
NEWTONVILLE
WATERTOWN
HIGHLANDS
ELIOT
UPPER FALLS
WEST ROXBURY
CHESTNUT HILL
THOMPSONVILLE
OAK HILL
BROOKLINE
BOSTON
WESTON
WALTHAM
NEEDHAM

Charles River
Crystal Lake
Hammond Pond
Newton Cemetery
Newton Centre
Newton North High School
Newton South High School
Boston College Law School
Newton Commonwealth Golf Course
Woodland Country Club Golf Course
Brae Burn Country Club Golf Course
The Charles River Country Club
Mt. Ida Jr. College
Dresser Pond
Purgatory Cove
Crams Cove
Chestnut Hill Reservoir
Hammond Brook
Chestnut Hill Brook
Cheesecake Brook
Saw Mill Brook
Hyde Brook
Laundry Brook
Meadow Brook
King Brook
College Brook
Hemlock Gorge
Cold Spring Brook
Quinobequin Road
Commonwealth Avenue
Massachusetts Turnpike
Mass Pike
M.B.T.A.
U.S. Route 90
Mass. Rte. 128
Interstate 95
N.Y. N.H. Harford RR

2016 Land Use (Fig. 2)

Land Use Areas

Charles River Watershed
Phase 1 Phosphorus Control Plan
City of Newton
Department of Public Works

Newton, MA

Legend

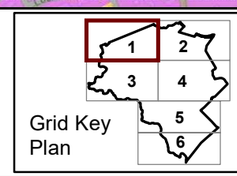
Newton Boundary
City Grid

Landuse Category

- Commercial and Industrial
- Medium-Density Residential
- Multi-Family and High-Density Residential
- Open Land
- Right of Way
- Water

0 0.125 0.25 0.5 Miles

Grid Key Plan



N

Woodard & Curran

Project #: 0233351.00
Map Created: June 2023

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Any reliance upon the map or data contained herein shall be at the users' sole risk. **Data Sources:** MassGIS, USDA

Figure Exported: 6/23/2023 By: eenneeby Using: \\woodardcurran.net\shared\Projects\0233351.00 Newton MA Phase 1 Phosphorus Control Plan\wip\GIS\Project Files\Watershed Landuse 2016.mxd

Land Use Areas

Charles River Watershed
Phase 1 Phosphorus Control Plan
City of Newton
Department of Public Works

Newton, MA

Legend

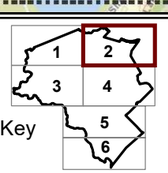
Newton Boundary
City Grid

Landuse Category

- Commercial and Industrial
- Medium-Density Residential
- Multi-Family and High-Density Residential
- Open Land
- Right of Way
- Water

0 0.125 0.25 0.5 Miles

Grid Key Plan



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Woodard & Curran

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Land Use Areas

Charles River Watershed
Phase 1 Phosphorus Control Plan
City of Newton
Department of Public Works

Newton, MA

Legend

Newton Boundary
City Grid

Landuse Category

- Commercial and Industrial
- Medium-Density Residential
- Multi-Family and High-Density Residential
- Open Land
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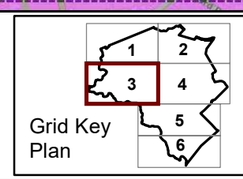
- Water

0 0.125 0.25 0.5 Miles

Grid Key Plan



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Woodard & Curran

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Figure Exported: 6/23/2023 By: eenneeby Using: \\woodardcurran.net\shared\Projects\0233351.00 Newton MA Phase 1 Phosphorus Control Plan\wip\GIS\Project Files\Watershed Landuse 2016.mxd

Land Use Areas

Charles River Watershed
Phase 1 Phosphorus Control Plan
City of Newton
Department of Public Works

Newton, MA

Legend

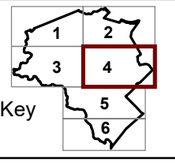
Newton Boundary
City Grid

Landuse Category

- Commercial and Industrial
- Medium-Density Residential
- Multi-Family and High-Density Residential
- Open Land
- Right of Way
- Water

0 0.125 0.25 0.5 Miles

Grid Key Plan



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Woodard & Curran

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Figure Exported: 6/23/2023 By: esmeesby Using: \\woodardcurran.net\shared\Projects\0233351.00 Newton MA Phase 1 Phosphorus Control Plan\wip\GIS\Project Files\Watershed Landuse 2016.mxd

Land Use Areas

Charles River Watershed
Phase 1 Phosphorus Control Plan
City of Newton
Department of Public Works

Newton, MA

Legend

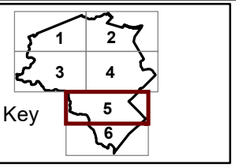
Newton Boundary
City Grid

Landuse Category

- Commercial and Industrial
- Medium-Density Residential
- Multi-Family and High-Density Residential
- Open Land
- Right of Way
- Water

0 0.125 0.25 0.5 Miles

Grid Key Plan



N

Woodard & Curran

Project #: 0233351.00
Map Created: June 2023

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Land Use Areas

Charles River Watershed
Phase 1 Phosphorus Control Plan
City of Newton
Department of Public Works

Newton, MA

Legend

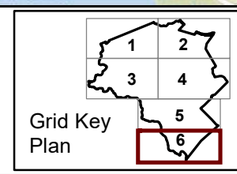
Newton Boundary
City Grid

Landuse Category

- Commercial and Industrial
- Medium-Density Residential
- Multi-Family and High-Density Residential
- Open Land
- Right of Way
- Water

0 0.125 0.25 0.5 Miles

Grid Key Plan



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Woodard & Curran

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Figure Exported: 6/23/2023 By: eenneeby Using: \\woodardcurran.net\shared\Projects\0233351.00 Newton MA Phase 1 Phosphorus Control Plan\wip\GIS\Project Files\Watershed Landuse 2016.mxd

Hydrologic Soil Groups (Fig. 3)

Hydrologic Soils

Charles River Watershed
Phase 1 Phosphorus Control Plan
City of Newton
Department of Public Works

Newton, MA

Legend

Newton Boundary
City Grid

Hydrologic Soil Group

A	B	C/D	
A/D	B/D	D	
	C	Not rated or not available	

0 0.125 0.25 0.5 Miles

Grid Key Plan

1 2
3 4
5
6

N

Woodard & Curran

Project #: 0233351.00
Map Created: June 2023

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Figure Exported: 6/23/2023 By: esneesby Using: \\woodardcurran.net\shared\Projects\0233351.00 Newton MA Phase 1 Phosphorus Control Plan\wip\GIS\Project Files\Hydrologic Soils.mxd

Hydrologic Soils

Charles River Watershed
Phase 1 Phosphorus Control Plan
City of Newton
Department of Public Works

Newton, MA

Legend

Newton Boundary
City Grid

Hydrologic Soil Group

A
A/D
B
B/D
C
C/D
D
Not rated or not available

0 0.125 0.25 0.5 Miles

Grid Key Plan

1 2
3 4
5
6

N

Woodard & Curran

Project #: 0233351.00
Map Created: June 2023

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Figure Exported: 6/23/2023 By: esneesby Using: \\woodardcurran.net\shared\Projects\0233351.00 Newton MA Phase 1 Phosphorus Control Plan\wip\GIS\Project Files\Hydrologic Soils.mxd

Hydrologic Soils

Charles River Watershed
Phase 1 Phosphorus Control Plan
City of Newton
Department of Public Works

Newton, MA

Legend

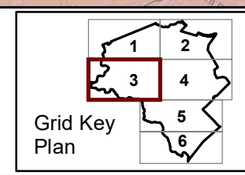
Newton Boundary
City Grid

Hydrologic Soil Group

A	B	C/D	
A/D	B/D	D	
	C	Not rated or not available	

0 0.125 0.25 0.5 Miles

Grid Key Plan



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Woodard & Curran

Project #: 0233351.00
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Hydrologic Soils

Charles River Watershed
Phase 1 Phosphorus Control Plan
City of Newton
Department of Public Works

Newton, MA

Legend

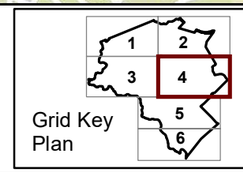
Newton Boundary
City Grid

Hydrologic Soil Group

A	B	C/D	
A/D	B/D	D	
	C	Not rated or not available	

0 0.125 0.25 0.5 Miles

Grid Key Plan



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Woodard & Curran

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Hydrologic Soils

Charles River Watershed
Phase 1 Phosphorus Control Plan
City of Newton
Department of Public Works

Newton, MA

Legend

Newton Boundary
City Grid

Hydrologic Soil Group

A
A/D
B
B/D
C
C/D
D
Not rated or not available

0 0.125 0.25 0.5 Miles

Grid Key Plan

1 2 3 4 5 6

N

Woodard & Curran

Project #: 0233351.00
Map Created: June 2023

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Figure Exported: 6/23/2023 By: esneesby Using: \\woodardcurran.net\shared\Projects\0233351.00 Newton MA Phase 1 Phosphorus Control Plan\wip\GIS\Project Files\HydrologicSoils.mxd

Hydrologic Soils

Charles River Watershed
Phase 1 Phosphorus Control Plan
City of Newton
Department of Public Works

Newton, MA

Legend

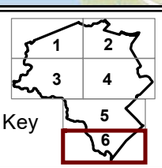
Newton Boundary
City Grid

Hydrologic Soil Group

A	B	C/D	
A/D	B/D	D	
	C	Not rated or not available	

0 0.125 0.25 0.5 Miles

Grid Key Plan



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Woodard & Curran

Project #: 0233351.00
Map Created: June 2023

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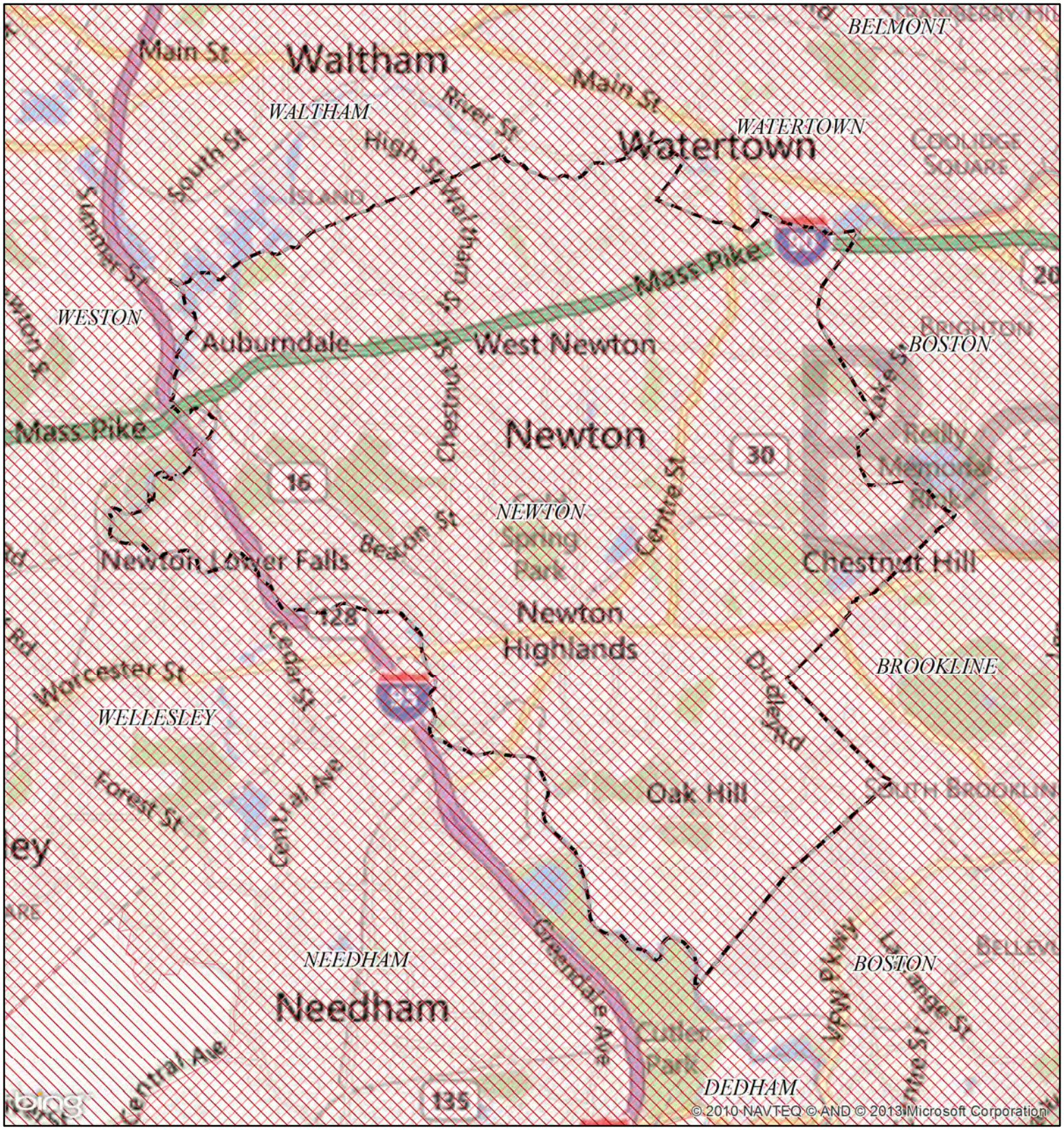
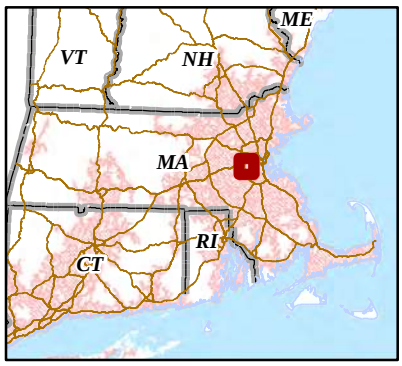
Figure Exported: 6/23/2023 By: esmeesby Using: \\woodardcurran.net\shared\Projects\0233351.00 Newton MA Phase 1 Phosphorus Control Plan\wip\GIS\Project Files\Hydrologic Soils.mxd

Urbanized Area (Fig. 4)





NPDES Phase II Stormwater Program
Automatically Designated MS4 Areas

Newton MA

Regulated Area:

UA Based on 2000 Census | UA Based on 2010 Census

0 1 2 3 4 Kilometers

0 1 2 3 Miles

Town Population: 85213

Regulated Population: 85213

(Populations estimated from 2010 Census)

EPA

Urbanized Areas, Town Boundaries:
US Census (2000, 2010)
Base map © 2013 Microsoft Corporation
and its data suppliers

US EPA Region 1 GIS Center Map #8824, 8/9/2013

Roadway Jurisdiction (Fig. 5)

Roadway Jurisdiction

Charles River Watershed
Phase 1 Phosphorus Control Plan
City of Newton
Department of Public Works
Newton, MA

Legend

Newton Boundary

Roadway Jurisdiction
- No Designation
- Unaccepted by Town
- MDOT
- Town
- DCR

0 0.25 0.5 1 1.5 2 Miles

N

Woodard & Curran

Project #: 0233351.00
Map Created: June 2023

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Figure Exported: 6/23/2023 By: esmeesby Using: \\woodardcurran.net\shared\Projects\0233351.00 Newton MA Phase 1 Phosphorus Control Plan\wip\GIS\Project Files\Roadway Jurisdiction.mxd

APPENDIX B: BASELINE LOAD

Baseline Load Memorandum

Attachment 1: Non-Traditional MS4 Area Figure

Attachment 2: Calculations

Baseline Load Memorandum

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MEMORANDUM

PROJECT: Newton, MA Phosphorus Control Plan

PROJECT NUMBER: 0233351.00

DATE: June 2023

SUBJECT: Baseline Load Memorandum

The MS4 General Permit requires permittees to account and mitigate for any phosphorus load increases due to development since 2005. This memorandum summarizes the methodology used to update the City of Newton's baseline total phosphorus load due to development within the PCP Area.

1.1 PCP Area

The PCP Area is defined in the MS4 General Permit as being the PCP implementation area selected by the permittee. The City of Newton's PCP Area excludes facilities or areas regulated under separate National Pollutant Discharge Elimination System (NPDES) permit. These include non-traditional (i.e. federal and state agencies) Municipal Separate Storm Sewer Systems (MS4s) MS4, such as the Massachusetts Department of Conservation and Recreation (MassDCR), Massachusetts Department of Transportation (MassDOT) and Massachusetts Bay Transit Authority (MBTA), and University of Massachusetts Amherst (Mount Ida Campus).

Newton's PCP Area was estimated by excluding the non-traditional MS4 areas from the total City area. The non-traditional MS4 area includes parcels and roadways. A figure showing the parcels and roads excluded from Newton's PCP Area is attached. Table 1 below summarizes Newton's PCP Area.

TABLE 1: NEWTON'S PCP AREA

Area (Acres)		
Newton s Total Charles River Watershed Urbanized Land Area	Non Traditional MS4 Area	Newton s PCP Area
11,382	687	10,695

1.1.1 Parcels

The non-traditional MS4 parcel area was estimated using MassGIS 2020 parcel data property type classification codes (Use Codes). The non-traditional MS4 area, excluded from Newton's PCP Area, consists of the following Use Codes:

90 Public Service Properties

- 901 – (Intentionally left blank)

91 Commonwealth of Massachusetts – Reimbursable Land

- 910 – Department of Conservation and Recreation, Division of State Parks and Recreation
- 912 – Department of Corrections, Division of Youth Services
- 915 – Department of Conservation and Recreation, Division of Water Supply Protection
- 917 – Education – University of Massachusetts, State Colleges, Community Colleges

92 Commonwealth of Massachusetts – Non-Reimbursable Land

- 920 – Department of Conservation and Recreation, Division of Urban Parks and Recreation
- 922 – Department of Corrections, Division of Youth Services, Mass Military, State Police, Sheriffs' Departments
- 924 – Mass Highway Department
- 925 – Department of Conservation and Recreation Division of Water Supply Protection conservation restrictions and sewer easements, Urban Parks
- 927 – Education – University of Massachusetts, State Colleges, Community Colleges

97 Authorities

- 972 – Transportation Authority
- 975 – Vacant, Transportation Authority

1.1.2 Roadways

The non-traditional MS4 roadway area was estimated using roadway jurisdiction and Right-Of-Way width data. MassDOT and MassDCR roadway area was excluded from Newton's PCP Area.

1.2 Baseline Load Update

Newton's updated baseline load due to development was calculated using two approaches:

1. Using MassGIS 2016 land use land cover data and Brown & Caldwell's baseline load spreadsheet

2. Using MassGIS 2016 land cover data and applying a percent increase in impervious area compared to EPA's 2005 data

Both approaches excluded non-traditional MS4 areas. Approach 1 introduces inconsistencies with land use definitions between MassGIS 2005 LULC and MassGIS 2016 LULC, whereas Approach 2 only uses the land cover data from MassGIS 2016. Therefore, Approach 2 eliminates the inconsistency between 2005 and 2016 land use definitions. Table 2 below summarizes the findings from both approaches, and baseline load calculations are attached.

TABLE 2: APPROACH 1 AND 2 RESULTS

Approach	Change in Baseline Load (lbs/year)	
	2016	2023 Projected
Approach 1	-467.4	Not Calculated
Approach 2	284.5	465.5

Approach 1 resulted in a decreased baseline load. This is likely because:

1. Woodard & Curran's estimated PCP Area is approximately 190 acres less than the PCP Area that EPA used to calculate Newton's permit requirements.

   While the total MS4 area is the same, EPA accounted for less non-traditional MS4 area to be excluded from Newton's PCP Area. This could be due to a change in ownership since 2005, or an inconsistency with the way non-traditional MS4 areas were estimated.

2. Land use definition inconsistencies between MassGIS 2005 and 2016 data.

Approach 2 results were used in this PCP. Approach 2 compared the change in impervious cover between 2005 and 2016 data. Despite Newton's PCP Area being 190 acres less than the area EPA used to develop the 2005 permit defined baseline load, the 2016 data showed an increase in impervious area of about 140 acres. Approach 2 calculation steps are outlined below:

1. A percent increase in the impervious area between 2005 and 2016 was calculated (approximately 3.5%).

2. The 2005 impervious area breakdown by land use was increased by 3.5% to distribute this increase in impervious area over each land use type.

3. These areas were multiplied by their respective phosphorus load export rate (PLER) and summed to estimate the increase in baseline phosphorus load between 2005 and 2016.

4. The impervious area percent increase between 2005 and 2016 (11 years) was projected to 2023 (18 years). The impervious area percent increase from 2005 to 2023 was estimated to be approximately 5.8%.

5. Steps 2 and 3 were repeated to estimate the increase in baseline phosphorus load between 2005 and 2023.

Approach 2 results for 2023, summarized in Table 2 below, were used to estimate Newton's phosphorus load reduction requirement and to inform this Phase 1 PCP.

TABLE 3: 2023 STORMWATER PHOSPHORUS LOAD REDUCTION

Annual Load (kg / lb)				
Updated Baseline Phosphorus Load (2023)	Allowable Phosphorus Load	Phosphorus Load Reduction Requirement	Percent Reduction in Phosphorus Load	Updated Phase 1 Permit Year 10 Reduction (lb)
4,095 / 9,028	1,519 / 3,349	2,576 / 5,679.4	63%	1,419.9

Based on the updated baseline load, the Yr-10 reduction requirement of 1,419.9 represents an additional reduction of 116.2 lbs beyond the permit requirement (1,303.2 lbs). The associated updated Yr-8 reduction is 1,135.9 lbs, or an additional 93.1 lb reduction.

It is anticipated that the baseline load will be updated using 2021 LULC data prepared by the University of Vermont's Spatial Analysis Laboratory in conjunction with the Charles River Watershed Association. This data is anticipated to be available July 2023. The 2021 LULC data defines land use and land cover consistently with the 2005 data the permit used. This ensures that changes in load are due to development rather than inconsistencies with data resolution or categorization compared to the 2005 data. Load changes from development after 2021 through June 30, 2028 will be evaluated on a project-by-project basis using available permit documentation review.

Attachments

Attachment 1: Non-Traditional MS4 Area Figure

Attachment 2: Calculations

Attachment 1: Non-Traditional MS4 Area Figure

State Lands

Charles River Watershed
Phosphorous Control Plan

Newton, MA

Legend

- Newton Boundary
- MDOT Roadway (273 Acres)
- DCR Roadway (27 Acres)
- Commonwealth of Massachusetts Parcels (387 Acres)

0 0.25 0.5 1 1.5 2 Miles

N

Woodard & Curran

Project #: 0233351.00
Map Created: June 2023

Third Party GIS Disclaimer: This map is for reference and graphical purposes only and should not be relied upon by third parties for any legal decisions.
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Attachment 2: Calculations

Approach 1 Calculations

Phosphorus Land Use Group	Total Area (ac)	Impervious Area (ac)	Directly Connected Impervious Area							Pervious Area Phosphorus Load																					Disconnected Impervious Area			Total Avg Annual Phosphorus Load (lb/yr)
				Sutherland Coeffs						Perv HSG Area (ac)								Phosphorus Export Loading Rate (lb/ac/yr)							Avg Annual Phosphorus Export Load (lb/yr)												
			Percent Impervious	A	B	Percent Directly Connected Impervious Area (%)	Directly Connected Impervious Area (ac)	Phosphorus Loading Export Rate (lb/ac/yr)	Avg Annual Phosphorus Export Load (lb/yr)	A	B	C	C/D	D	Unk	Total	A	B	C	C/D	D	Unk	A	B	C	C/D	D	Unk	Total	Disconnected Impervious Area (ac)	Pervious Area Composite Phosphorus Export Loading Rate (lb/ac/yr)	Avg Annual Phosphorus Load (lb/yr)	
Commercial	1288.9	810.3	63%	0.4	1.2	57.6%	742.0	1.78	1,320.8	132.4	83.9	230.6	-	31.7	-	478.6	0.04	0.18	0.36	0.46	0.54	0.36	5.3	15.1	83.0	-	17.1	-	120.5	68.3	0.3	17.2	1,458.5
Industrial			0%	0.4	1.2	0.0%	0.0	1.78	-	-	-	-	-	-	-	-	0.04	0.18	0.36	0.46	0.54	0.36	-	-	-	-	-	-	-	-	-	-	-
High-density residential	865.5	619.4	72%	0.4	1.2	67.3%	582.1	2.32	1,350.5	137.1	25.3	65.8	-	17.9	-	246.1	0.04	0.18	0.36	0.46	0.54	0.36	5.5	4.5	23.7	-	9.7	-	43.4	37.3	0.2	6.6	1,400.5
Medium-density residential	2307.0	1404.7	61%	0.1	1.5	47.5%	1096.1	1.96	2,148.4	631.2	23.4	130.9	-	116.7	-	902.3	0.04	0.18	0.36	0.46	0.54	0.36	25.2	4.2	47.1	-	63.0	-	139.6	308.6	0.2	47.8	2,335.8
Low-density residential			0%	0.1	1.5	0.0%	0.0	1.52	-	-	-	-	-	-	-	-	0.04	0.18	0.36	0.46	0.54	0.36	-	-	-	-	-	-	-	-	-	-	-
Right of Way	1319.8	1128.0	85%	0.1	1.5	79.0%	1042.8	1.95	2,033.5	96.7	3.9	73.3	-	17.9	-	191.8	0.04	0.18	0.36	0.46	0.54	0.36	3.9	0.7	26.4	-	9.7	-	40.6	85.2	0.2	18.0	2,092.2
Forest	4142.4	0.0	0%	0.01	2	0.0%	0.0	1.52	-	2,539.7	194.1	725.0	-	683.5	-	4,142.4	0.11	0.14	0.19	0.21	0.23	0.19	279.4	27.2	137.8	-	157.2	-	601.5	-	0.1	-	601.5
Open land	771.2	79.7	10%	0.1	1.5	3.3%	25.6	1.52	39.0	260.3	173.3	139.8	-	118.1	-	691.5	0.04	0.18	0.36	0.46	0.54	0.36	10.4	31.2	50.3	-	63.8	-	155.7	54.1	0.2	12.2	206.9
Agriculture			0%	0.01	2	0.0%	0.0	1.52	-	-	-	-	-	-	-	-	0.07	0.29	0.60	0.76	0.91	0.60	-	-	-	-	-	-	-	-	-	-	-
Total	10,694.8	4,042.2	38%			33%	3,488.7		6,892.2	3,797.4	503.9	1,365.4	-	985.8	-	6,652.6							329.7	82.9	368.3	-	320.4	-	1,101.4	553.5		101.8	8,095.3

Fill in these cells

EPA-provided values (Source: EPA Memorandum, Authored by: Mark Voorhees, Dated: 1/14/2014, Entitled: Overview of Methodology to Calculate Baseline Stormwater Phosphorus Loads and Phosphorus Load Reduction Requirements for Charles River)

Calculated values

Total Avg Annual Phosphorus Load (kg/yr)	3,672.0
Baseline Load Decrease (kg/yr)	212.0

NOTES:
1. This spreadsheet was developed by Brown and Caldwell to calculate baseline phosphorus loads in accordance with the methodology used in the Massachusetts Small MS4 General Permit. EPA documented the baseline phosphorus load calculations in the EPA Memornadum authored by Mark Voorhess and dated 1/14/2014.
2. Only edit the yellow cells.
3. Brown and Caldwell is providing this spreadsheet as a courtesy to third parties. Brown and Caldwell makes no guarantees or warranties about its accuracy. You are responsible for verying all calculations. If you identify any issues, please contact Matt Davis (see contact info below)
4. This spreadsheet is valid only for calculating baseline phosphorus loads. The calculation of current loads is performed using a different methodology and phosphorus export loading rates.
5. For a detailed discussion of how baseline phosphorus loads are calculated, please watch the recorded video from the Charles River Watershed Association Phopshorus Control Planning Workshop #1 that was held on 3/8/2022.
6. Please contact Matt Davis at Brown and Caldwell if you have any questions. Email: mdavis@brwncald.com.

Approach 2 Calculations

From Mark Vorhees Spreadsheet - 2005

Total Area (acres)

Commercial	Industrial	High Density Residential (HDR)	Medium Density Residential (MDR)	Low Density Residential (LDR)	Highway	Open Land	Agriculture	Forest	Total
1111.7	142.3	4345.5	2391.3	230.7	122.0	494.1	470.5	1576.9	10884.9

Impervious Area (acres)

Municipal Only (less DOT and DCR) Impervious Area of aggregate land use categories in the Charles River Watershed, acres (ac)

Commercial	Industrial	HDR	MDR	LDR	Highway	Open Land	Agriculture	Forest	Total
752.5	110.2	1908.7	803.7	54.1	78.8	99.8	33.3	62.7	3903.9

Pervious Area (acres)

Commercial	Industrial	HDR	MDR	LDR	Highway	Open Land	Agriculture	Forest	Total
359.1	32.0	2436.8	1587.7	176.6	43.2	394.3	437.2	1514.2	6981.0

From W&C - 2016

Total Area (acres)

Commercial	Industrial	High Density Residential (HDR)	Medium Density Residential (MDR)	Low Density Residential (LDR)	Highway	Open Land	Agriculture	Forest	Total
1288.9	0.0	865.5	2307.0	0.0	1319.8	771.2	0.0	4142.4	10694.8

Impervious Area (acres)

Municipal Only (less DOT and DCR) Impervious Area of aggregate land use categories in the Charles River Watershed, acres (ac)

Commercial	Industrial	HDR	MDR	LDR	Highway	Open Land	Agriculture	Forest	Total
810.3	0.0	619.4	1404.7	0.0	1128.0	79.7	0.0	0.0	4042.2

Pervious Area (acres)

Commercial	Industrial	HDR	MDR	LDR	Highway	Open Land	Agriculture	Forest	Total
478.6	0.0	246.1	902.3	0.0	191.8	691.5	0.0	4142.4	6652.6

Step 1: Estimate % Increase in Impervious Area (2005-2016)

Increase in Impervious: 138.4
% Increase in Impervious: 3.5%

Step 2: Increase 2005 Impervious Area Breakdown by Land Use by % Increase in Impervious

2005 Impervious Area + 3.5% Increase to 2016 (acres)

Commercial	Industrial	HDR	MDR	LDR	Highway	Open Land	Agriculture	Forest	Total
779.2	114.1	1976.4	832.2	56.0	81.6	103.3	34.4	65.0	4042.2

Step 3: Multiply Step 2 results by respective phosphorus load export rate (PLER)

2016 Impervious PLER Increase (TP lb/yr)

Commercial	Industrial	HDR	MDR	LDR	Highway	Open Land	Agriculture	Forest	Total
47.5	7.0	157.0	55.8	2.9	3.7	5.4	1.8	3.4	**284.5**

Step 4: Estimate projected % Increase in Impervious Area (2005-2023)

Increase in Impervious: 138.4
% Increase in Impervious: 5.8%

Step 5: Repeat Step 2 & 3 for 2005-2023

2005 Impervious Area + 5.8% Increase to 2023 (acres)

Commercial	Industrial	HDR	MDR	LDR	Highway	Open Land	Agriculture	Forest	Total
796.2	116.6	2019.4	850.3	57.2	83.4	105.6	35.2	66.4	4130.3

2023 Impervious PLER Increase (TP lb/yr)

Commercial	Industrial	HDR	MDR	LDR	Highway	Open Land	Agriculture	Forest	Total
77.7	11.4	256.9	91.4	4.8	6.1	8.8	2.9	5.5	**465.5**

APPENDIX C: EXISTING NON-STRUCTURAL CONTROLS

Existing Non-Structural Controls Calculations Memorandum

- Attachment 1: Mechanical Broom (Weekly) Sweeping Calculations
- Attachment 2: Vacuum Assisted Sweeping Calculations
- Attachment 3: Mechanical Broom (Monthly) Sweeping Calculations
- Attachment 4: Catch Basin Cleaning Calculations
- Attachment 5: Organic Matter and Leaf Litter Collection Calculations
- Attachment 6: Clean Sweep Memo Existing Non-Structural Controls Calculations

Enhanced Sweeping Lane Measurement Figures

Clean Sweep Memorandum dated April 2023

Existing Non-Structural Controls Calculations Memorandum

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MEMORANDUM

PROJECT: Newton, MA Phosphorus Control Plan

PROJECT NUMBER: 0233351.00

DATE: June 2023

SUBJECT: Existing Non-Structural Controls Calculations

This technical memorandum documents phosphorus load reduction calculations for the existing and anticipated crediting policies for all three non-structural control measures currently employed by the City of Newton: enhanced sweeping, catch basin cleaning, and organic matter and leaf litter collection. Calculations are based on City-provided data for the 2022 calendar year which are representative of the City's on-going annual non-structural control management program. The City of Newton provided records of catch basin cleanings performed, including date, depth of sediment, and sump storage capacity which was analyzed for this assessment. Additionally, the City provided data for use in the street sweeping and leaf-litter assessment, including specific data on sweepers utilized in particular neighborhoods/streets as well as frequency data and specifics regarding extent/geographical limits of specific program components. Finally, the City-provided data for enhanced sweeping and organic matter collection was utilized for calculating the anticipated crediting policy under the next issuance of the EPA permit. The memorandum is broken down into two sections: the existing crediting policy, and the anticipated future crediting policy.

1. Existing Crediting Policy

This section provides phosphorus load reduction calculations under the existing crediting policy for each of the three non-structural control measures. A summary of the creditable reduction is provided under Table 1, below.

Table 1: Non-Structural Total Existing Phosphorus Reduction Summary

City of Newton Total Existing Non Structural SCM Phosphorus Reduction Analysis			
Non Structural Phosphorus Load Reduction (lbs/year)			
Enhanced Sweeping	Catch Basin Cleaning	Organic Waste / Leaf Litter Collection	Total Reduction
43.5	0.1	6.5	50.1

1.1 Enhanced Sweeping

Per the permit, the City may earn phosphorus reduction credits through their enhanced sweeping program of impervious surfaces. The reduction credit varies based on type of sweeper used, and the frequency of cleaning, and is summarized in in Table 1 below (referenced from Table 2-4 of Appendix F Attachment 2 of the MS4 General Permit).

Table 1: Nutrient Reduction Efficiency Factors for Sweeping Impervious Areas

Frequency	Sweeper Technology	PRF_sweeping
2/year (spring and fall)	Mechanical Broom	0.01
2/year (spring and fall)	Vacuum Assisted	0.02
2/year (spring and fall)	High-Efficiency Regenerative Air-Vacuum	0.02
Monthly	Mechanical Broom	0.03
Monthly	Vacuum Assisted	0.04
Monthly	High-Efficiency Regenerative Air-Vacuum	0.08
Weekly	Mechanical Broom	0.05
Weekly	Vacuum Assisted	0.08
Weekly	High-Efficiency Regenerative Air-Vacuum	0.10

The equation to determine the total phosphorus credit for catch basin cleaning, per the permit, is outlined below.

$$P\ Credit_{ng} = IA_{t} * PLER_{ng} * PRF_{ng} * AF$$

The City currently owns, operates, and maintains six mechanical broom sweepers, and one vacuum assisted sweeper; therefore, all credit calculations are based off of these two sweeper types.

The City swept every street in the City a minimum of eight times in 2022, utilizing mechanical broom sweepers. In addition, several roadways, bike lanes, and village squares were swept at a significantly higher frequency and some with vacuum assisted sweepers, therefore increasing the reduction credit for these select impervious areas. The sum of the three calculated TP reduction credits result in a total overall credit for enhanced sweeping of **43.5 lbs.** These sweeping credits are further described below.

Vacuum Assisted Sweeping

The total areas swept with a vacuum assisted sweeper were identified. The City swept all bike lanes, and sections of the following roadways – Albemarle Road, Lake Avenue, Rogers Road, Cabot Street, and Webster Street – using a vacuum assisted sweeper, performed on a weekly frequency. These bike lanes and roadways were measured utilizing Google Earth for total lane miles and average lane width. The mileage and width were multiplied to calculate a total impervious area acreage for the swept areas. This was then multiplied by the PLER for roadway land use (1.95 lb/ac/yr), and the phosphorus reduction factor (PRF) which is 0.08 for a vacuum assisted sweeper with weekly frequency, per Table 1. The total credit achieved is 3.7 lbs. Table

2 below summarizes the lane measurements, the resulting impervious area, and TP reduction credit calculations.

Table 2: Vacuum assisted sweeper summary of measurements, impervious area, and TP reduction credit, weekly frequency

	Lane Miles	Avg Lane Width (ft)	IA (acres)	TP Credit
Albemarle Rd	2.07	18	5	0.47
Lake Ave	1.59	11	2	0.22
Rogers Rd	0.19	12	0	0.03
Cabot St	0.86	12	1	0.13
Webster St	1.53	12	2	0.23
Bike Lanes	22.63	5	14	1.43
Total Road Lane Miles	6.24	**Total IA Swept**	24	2.51

$$P\ Credit_{ng} = IA_{t} * PLER_{ng} * PRF_{ng} * AF$$

- IA_{swept} = 24 acres (sum of impervious areas swept with vacuum assisted sweeper, weekly)
- $PLER_{sweeping}$ = 1.95 lb/ac/yr (per MS4 General Permit)
- $PRF_{sweeping}$ = 0.08, per Table 2-4, Appendix F Attachment 2
- AF = 1 (adjustment factor, year-round sweeping)
- Result
    - P $Credit_{sweeping}$ = 24 * 1.95 * 0.08 * 1 = **3.7 lbs**

Weekly Mechanical Broom Sweeping

Additionally, the areas swept with a mechanical broom at a higher frequency than the eight times per calendar year were identified. The City swept many Village Squares at a minimum weekly frequency (daily, 2-3x per week, or once per week depending on the Village), and these areas include sections of the following Squares: Newton Corner, Nonantum, Newtonville, West Newton, Newton Highlands, Newton Centre, Auburndale, Waban, and Pettee Square. It shall be noted that the current permit does not allow for an increase of credit for any frequency higher than weekly, therefore the daily sweeping frequency performed results in the same credit as weekly frequency. These village squares include both roadways and paved parking lot areas.

Similarly to the vacuum assisted measurements, the same approach was taken utilizing Google Earth to calculate total lane miles and average lane width for each Village Square, to determine a total impervious acreage for roadways swept daily/weekly. For parking lots, the total square footage of the area was measured. These areas were then multiplied by the PLER for roadway land use (1.95 lb/ac/yr), and the phosphorus reduction factor (PRF) which is 0.05 for a mechanical broom sweeper with weekly frequency, per Table 1. The total credit achieved is 4.2 lbs. Table 3 below summarizes the lane measurements, the resulting impervious area, and TP reduction credit calculations.

Table 3: Mechanical Broom Sweeper summary of measurements, impervious area, and TP reduction credit, weekly frequency

	Lane Miles	Avg Lane Width (ft)	Parking Lot Area (acres)	IA (acres)	TP Credit (lb/yr)
Newton Corner	5.6	13	1.1	8.7	0.9
Nomantum	2.5	12	1.9	5.5	0.5
Newtonville	3.9	11	N/A	5.4	0.5
West Newton	4.3	12	0.5	6.4	0.6
Newton Highlands	1.9	12	0.4	3.4	0.3
Newton Centre	3.3	14	1.2	6.6	0.6
Auburndale	0.9	12	N/A	2.8	0.3
Waban	0.7	15	N/A	2.0	0.2
Pettee Square	0.6	14	N/A	2.0	0.2
SUM TOTAL OR AVERAGE	25.9	13	5.1	42.8	4.2

$$P\ Credit_{ng} = IA_{t} * PLER_{ng} * PRF_{ng} * AF$$

- IA_{swept} = 42.8 acres (sum of impervious areas swept with vacuum assisted sweeper, weekly)
- $PLER_{sweeping}$ = 1.95 lb/ac/yr (per MS4 General Permit)
- $PRF_{sweeping}$ = 0.05, per Table 2-4, Appendix F Attachment 2
- AF = 1 (adjustment factor, year-round sweeping)
- Result
    - P $Credit_{sweeping}$ = 24 * 1.95 * 0.08 * 1 = **4.2 lbs**

Monthly Mechanical Broom Sweeping

Lastly, all the remaining roadways that are swept at a frequency of eight times per year were identified. The City has an estimated total of 660 lane miles, of which 32.2 miles are swept weekly; therefore, the remaining lane miles utilized in the assessment of monthly sweeping crediting is 627.8 miles. An average lane mile width of 12 feet was utilized for the monthly assessment. The lane miles and lane width were multiplied to calculate a total impervious acreage. The total acreage was then multiplied by the PLER for roadway land use (1.95 lb/ac/yr), and the PRF (0.02). The total credit achieved is 35.6 lbs. The equation to determine the total phosphorus credit for catch basin cleaning, per the permit, is outlined below.

$$P\ Credit_{ng} = IA_{t} * PLER_{ng} * PRF_{ng} * AF$$

- IA_{swept} = 913 acres (sum of impervious areas swept with mechanical broom, monthly assessment)
- $PLER_{sweeping}$ = 1.95 lb/ac/yr (per MS4 General Permit)
- $PRF_{sweeping}$ = 0.03, per Table 2-4, Appendix F Attachment 2
- AF = 0.67 (adjustment factor, eight times per year (8/12))
- Result
    - P $Credit_{sweeping}$ = 913 * 1.95 * 0.03 * 0.67 = **35.6 lbs**

The total phosphorus load reduction credit for enhanced sweeping is the sum of the weekly mechanical broom, weekly vacuum assisted, and monthly mechanical broom sweeping credits. The sum total is calculated to be 43.5 lbs.

$$\textbf{P Credit}_{\textbf{total sweeping}} \textbf{ = 3.7 + 4.2 + 35.6 = 43.5 lbs}$$

1.2 Catch Basin Cleaning

Per the permit, the City may earn phosphorus reduction credits through catch basin cleaning, such that a minimum sump storage capacity of 50% is maintained throughout the year. The permit also requires that for a catch basin to qualify, it must be cleaned on a semi-annual frequency. The PRF for catch basin cleaning is 2% (0.02).

The City of Newton owns and maintains approximately 13,250 catch basins. The City cleans approximately half (~7,000) of all municipally-owned catch basins annually. Based on review of the detailed cleaning records, the majority of the catch basins are cleaned once; however, a limited number of catch basins were cleaned twice. Catch basins cleaned twice within a short calendar period were discounted, only those reasonably considered cleaned semi-annually are accounted for. In 2022, a total of (35) catch basins were cleaned semi-annually. Given the limited number of catch basins cleaned semi-annually, approximately 0.5%, this may be reasonably considered the annual average. The catchment areas for each of these catch basins were delineated to determine the contributing impervious acreage for each catch basin. The impervious acreage for the (35) catch basins were summed to calculate a total impervious acreage, which totaled 2.85 acres. Again, given the standardized design practices associated with catch basin spacing and grate capacities, a tributary area of slightly under 3 acres is reasonable for an associated annual average. The total acreage was then multiplied by the PLER for roadway land use (1.95 lb/ac/yr), and the PRF (0.02). The total credit achieved is 0.1 lbs. The equation to determine the total phosphorus credit for catch basin cleaning, per the permit, is outlined below.

$$P\ Credit_{CB} = IA_{CB} * PLER_{IC-lan\ \ u} \quad * PRF_{CB}$$

- $PLER_{IC\text{-land use}}$ = 1.95 lb/ac/yr (per MS4 General Permit)
- IA_{CB} = 2.85 acres (sum of contributing catchment areas for all catch basins that were cleaned semi-annually)
- PRF_{CB} = 0.02 (Per Table 2-5, Appendix F Attachment 2)
- Result
    - P $Credit_{CB}$ = 2.85 * 1.95 * 0.02 = **0.1 lbs**

1.3 Organic Waste/Leaf Litter Collection

Per the permit, the City may earn phosphorus reduction credits through their organic waste and leaf litter collection program, such that all landscaping wastes, organic debris, and leaf litter from impervious roadways and parking lots are removed weekly during the period between September 1st to December 1st of each year. The phosphorus reduction factor (PRF) for organic waste and leaf litter collection is 5%.

As mentioned under the enhanced sweeping section of this memorandum, the City cleans nine Village Square areas on a minimum of a weekly frequency, using a mechanical broom sweeper.

The City also cleans sections of three roadways (Albemarle Road, Lake Avenue, Rogers Road) and all bike lanes once per week, with a vacuum assisted sweeper. The lane miles and lane width for each roadway and bike lanes were calculated using Google Earth. The mileage and widths were multiplied to calculate a total impervious area acreage for the swept areas. This was then multiplied by the PLER for roadway land use (1.95 lb/ac/yr), and the PRF (0.05). The total credit achieved is 6.5 lbs. The equation to determine the total phosphorus credit for organic waste and leaf litter collection, per the permit, is outlined below.

$$P\ Credit_{l\ af\ l\ tt\ r} = IA_{coll\ ct} * PLER_{roa} * 0.05$$

- $PLER_{road}$ = 1.95 lb/ac/yr (per MS4 General Permit)
- $IA_{Collected}$ = 67 acres (sum of impervious area swept weekly)
- $PRF_{leaf\ litter}$ = 0.05 (Per Equation 2-5, Appendix F Attachment 2)
- Result
    - P $Credit_{leaf\ litter}$ = 67 * 1.95 * 0.05 = **6.5 lbs**

2. Clean Sweep Memorandum (Anticipated Policy)

Changes are expected to the existing crediting policy for non-structural control measures in the next issuance of the MS4 General Permit. These changes are likely to be based on the findings of the in the Clean Sweep Memorandum, which includes updated phosphorus load reduction calculations for enhanced street sweeping and leaf litter collection. The City will update their credit tracking in accordance with any regulatory changes; therefore, preliminary calculations have been performed in accordance with the Clean Sweep Memo methodology to understand the resulting potential credit changes. A summary of these calculations is provided below. There are two options for obtaining credit for enhanced street cleaning: a modeled approach and a measured approach, and calculations for each approach is outlined below.

2.1 Measured Organic Matter Collection Credit

The City measures the total wet mass collected from street sweeping measures, organized by the fall and non-fall seasons. The City collected a total of 2,676,300 lbs during the fall, and 2,056,180 lbs during the non-fall season. These wet masses were converted to dry mass based on the average moisture content for sweeping matter per the Clean Sweep Memo by season; this was calculated to be 1,391,676 lbs and 1,603,829 lbs for the fall and non-fall season, respectively. The dry mass was then multiplied by the total phosphorus concentration from dry mass, per the Clean Sweep Memo. Table 3 below summarizes the average moisture content and TP concentration for both seasons per the findings of the memo, and the equation for the fall season is also provided below.

Table 4: Average Moisture Content and TP Concentration from Mass by Season

Season	Average Moisture Content	TP Concentration from Mass (mg/kg)
Fall (Sept. to Dec.)	0.48	857
Non-fall (Jan. to Aug.)	0.22	414

$$P\ Credit_{M\ a\ ur} = WM * (1 - MC) * Concentration$$

Fall Season Calculation

- WM = 2,676,300 lbs (Wet Mass for fall season, as measured and provided by the City)
- MC = 0.48 (Moisture Content, per Table 3)
- Concentration = 857 x (1 x 10^{-6}) (TP concentration from mass in mg/kg, per Table 3, converted to mg/mg)
- Result
    - $P\ Credit_{Measured}$ = 2,676,300 * (1 – 0.48) * 857 * 1 x 10^{-6} = **1,192.7 lbs**

Non-Fall Season Calculation

- WM = 2,056,180 lbs (Wet Mass for non-fall season, as measured and provided by the City)
- MC = 0.22 (Moisture Content, per Table 3)
- Concentration = 414 x (1 x 10^{-6}) (TP concentration from mass in mg/kg, per Table 3, converted to mg/mg)
- Result
    - $P\ Credit_{Measured}$ = 2,056,180 * (1 – 0.22) * 414 * 1 x 10^{-6} = **664.0 lbs**

The TP removed was calculated to be 1,193 lbs in the fall, and 664 lbs in the non-fall season. The net reduction is a sum of both seasons for the calendar year which **totals 1,856.7 lbs**.

2.2 Model-Based Street Cleaning Credit

Per the Clean Sweep Memo, the City may elect to utilize an alternate method of calculating load reduction credits associated with their street sweeping program; the model based approach. The model-based approach only requires tracking of lane miles, frequency, and equipment type. The PRF varies based on the level of effort ("minimum", "medium", or "maximum") as described in Table 5 of the memo, below.

Table 5: Updated Parameters for New Hampshire's Model-based Credit for Street Sweeping

Parameter	Minimum Effort	Medium Effort	Maximum Effort
Frequency	Up to 2 times per year in any season. NRF/PRF* = 0.01 for a mechanical sweeper and 0.02 for a vacuum.	Every other week in the fall (Sept. to Dec.). NRF/PRF = 0.15	Monthly routine maintenance with more intensive (weekly) in Fall (Sept. to Dec.) and early spring. NRF/PRF = 0.25 with enhanced leaf collection. Assumes a vacuum sweeper (defined above), but may be combined with other efforts.
Location and seasonality	To accommodate seasonal increases in TN and TP and simplify the location parameter: 1) Use medium density residential impervious cover land use, which integrates the majority of likely land uses. 2) For intensive (weekly) fall sweeping in times of high organic material deposition (leaf fall), offer a 10% additional removal factor. This is a 5% increase over the enhanced leaf collection credit in the current model and better reflects removals in the recent literature. (Synonymous with maximum effort.)		

The City has approximately 960 total impervious acres of roadways, of which 24 acres qualify for the Maximum Effort, and 43 acres qualify for the Medium Effort, per the alignment of the City's sweeping frequencies with the descriptions on Table 5. The Maximum Effort is based on the City's existing sweeping program utilizing a vacuum assisted sweeper, and with a PRF of 0.25 and export rate of 1.95 lb/ac/year, the total load reduction is calculated to be 11.7 lbs. The Medium Effort is based on the City's existing sweeping of the Village Squares, as they are swept at a minimum weekly frequency, and with a PRF of 0.25 and export rate of 1.95 lbs/ac/year, the total load reduction is calculated to be 12.5 lbs. The rest of the roadway areas, approximately 893 acres, qualify for the Minimum Effort with a PRF of 0.01. The total load reduction was calculated to be 17.4 lbs. An example calculation is provided below. The sum of all the Efforts as described totals to 41.6 lbs.

"Minimum Effort" Calculations:

$$P\ Credit_{Mo\quad l-Ba\quad ,M\ n.Effort} = IA_{M\ n.\ ffort} * PLER_{roa\quad} * PLER_{M\ n.\ ffort}$$

- $IA_{Min.\ effort}$ = 893 acres (sum of impervious area swept twice per year, excluding maximum or medium effort areas)
- $PLER_{road}$ = 1.95 lb/ac/yr (per MS4 General Permit)
- $PRF_{Min.\ effort}$ = 0.01 (Per Table 5, Clean Sweep Memo)
- Result
    - P $Credit_{Min.\ effort}$ = 893 * 1.95 * 0.01 = **17.4 lbs**

"Medium Effort" Calculations:

$$P\ Credit_{Mo\quad l-Ba\quad ,M\quad .Effort} = IA_{M\quad .\ ffort} * PLER_{roa\quad} * PLER_{M\quad .\ ffort}$$

- $IA_{Min.\ effort}$ = 42.8 acres (sum of impervious area swept weekly during the fall season, September to December, with mechanical broom sweeper)
- $PLER_{road}$ = 1.95 lb/ac/yr (per MS4 General Permit)
- $PRF_{Min.\ effort}$ = 0.15 (Per Table 5, Clean Sweep Memo)
- Result
    - P $Credit_{Min.\ effort}$ = 42.8 * 1.95 * 0.15 = **12.5 lbs**

"Maximum Effort" Calculations:

$$P\ Credit_{Mo\quad l-Ba\quad ,Max.Effort} = IA_{Max.\ ffort} * PLER_{roa\quad} * PLER_{Max.\ ffort}$$

- $IA_{Min.\ effort}$ = 24 acres (sum of impervious area swept weekly during the fall season, September to December, with vacuum assisted sweeper)
- $PLER_{road}$ = 1.95 lb/ac/yr (per MS4 General Permit)
- $PRF_{Min.\ effort}$ = 0.25 (Per Table 5, Clean Sweep Memo)
- Result
    - P $Credit_{Min.\ effort}$ = 24 * 1.95 * 0.25 = **11.7 lbs**

The total phosphorus load reduction credit for the model-based approach is the sum of the minimum, medium, and maximum effort credits. The sum total is calculated to be 41.9 lbs.

P $Credit_{total\ model\text{-}based}$ = 17.4 + 12.5 + 11.7 = 41.6 lbs

The model-based approach is similar to the current EPA approved approach associated with street sweeping crediting. It results in a similar phosphorus load reduction credit to the current policy, which is significantly lower than the Clean Sweep Memo measured approach.

2.3 Anticipated City Program Considerations

Pending EPA regulation changes, the City plans to utilize the most cost-effective crediting approach which is anticipated to be the measured approach. Should the anticipated crediting policy be implemented in the next issuance of the MS4 Permit, the City plans to utilize the measured approach in association with Phase 1 implementation, as it would provide the highest possible phosphorus load reduction. The City will continue to gather and collect information needed for both the model-based and measure approaches and will be equipped to provide updated calculations if the anticipated policy is adopted by the EPA.

Attachments

Attachment 1: Existing Non-Structural Calculations – Mechanical Broom (Weekly)

Attachment 2: Existing Non-Structural Calculations – Vacuum Assisted

Attachment 3: Existing Non-Structural Calculations – Mechanical Broom (Monthly)

Attachment 4: Existing Non-Structural Calculations – Catch Basin Cleaning

Attachment 5: Existing Non-Structural Calculations – Organic Matter and Leaf Litter Collection

Attachment 6: Clean Sweep Memo Existing Non-Structural Calculations

Attachment 1: Mechanical Broom (Weekly) Sweeping Calculations

City of Newton Phase 1 Phosphorus Control Plan - City-Owned Non-Structural Phosphorus Reduction Analysis

Mechanical Broom, Minimum Weekly Frequency

Village Square	Roadways Swept	Length (ft)	Area (sq.ft.) (Parking Lots only)	Miles	Lane Width (ft)	Number of Lanes	IA (acres)	Estimated Lane Miles
Newton Corner	Washington St from Adams St	1,920	-	0.36	9	2	0.79	0.73
	Centre Ave to Centre St	610	-	0.12	12	4	0.67	0.46
	Centre St to Church St	605	-	0.11	12	2	0.33	0.23
	Centre St to Washington St	665	-	0.13	12	2	0.37	0.25
	Washington St to Park St	836	-	0.16	11	4	0.84	0.63
	Park St to Tremont St	558	-	0.11	20	1	0.26	0.11
	Park St to Washington St	554	-	0.10	20	1	0.25	0.10
	Washington St to Centre St	885	-	0.17	11	5	1.12	0.84
	Washington St. to Adams St.	2,960	-	0.56	11	4	2.99	2.24
	Pearl St Parking Lot	-	26,211	-	-	-	0.60	-
	Richmond St Parking Lot	-	21,883	-	-	-	0.50	-
	Sum Total or Average	**9,593**	**48,094**	**1.8**	**13**		**8.7**	**5.6**
Nonantum	Watertown St from Craft St to Capital St	3472	-	0.66	12	2	1.91	1.32
	Pearl St	100	-	0.02	11	2	0.05	0.04
	Chapel St (North of Watertown)	100	-	0.02	12	2	0.06	0.04
	Chapel St (South of Watertown)	100	-	0.02	12	2	0.06	0.04
	Bridge St	100	-	0.02	12	2	0.06	0.04
	Nevada St	100	-	0.02	15	2	0.07	0.04
	Adams St from Watertown St to Washington St	2506	-	0.47	12	2	1.38	0.95
	Adams St Parking Lot	-	73715	-	-	-	1.69	-
	Chapel St Parking Lot	-	9479	-	-	-	0.22	-
	Sum Total or Average	**6,478**	**83,194**	**1.2**	**12**		**5.5**	**2.5**
Newtonville	Washington St from Craft St to Lowell Ave	3336	-	0.63	12	4	3.68	2.53
	Walnut St from Cabot to Austin	978	-	0.19	11	2	0.49	0.37
	Walnut from Austin to Washington	384	-	0.07	9	5	0.40	0.36
	Walnut from Washington to Foster	447	-	0.08	11	3	0.34	0.25
	Austin St from Walnut St to Lowell St	970	-	0.18	11	2	0.49	0.37
	Sum Total or Average	**6,115**	**-**	**1.2**	**11**		**5.4**	**3.9**
West Newton	Washington St from Dustan St to Perkins St	7716	-	1.46	11	2	3.90	2.92
	Washington St 3rd Lanes	719	-	0.14	11	1	0.18	0.14
	Watertown St from Davis St to Washington St	679	-	0.13	11	2	0.34	0.26
	Cherry St from Washington to Webster	435	-	0.08	13	2	0.26	0.16
	Elm St from Washington St to Webster St	427	-	0.08	14	2	0.27	0.16

Village Square	Roadways Swept	Length (ft)	Area (sq.ft.) (Parking Lots only)	Miles	Lane Width (ft)	Number of Lanes	IA (acres)	Estimated Lane Miles
West Newton	Waltham St from Washington St to Webster St	428	-	0.08	14	2	0.28	0.16
	Highland St from Washington St to Hunter St	548	-	0.10	13	2	0.33	0.21
	Chestnust St from Washington St to Hillside Ter	697	-	0.13	12	2	0.38	0.26
	Elm St Parking Lot	-	20455	-	-	-	0.47	-
	Sum Total or Average	**11,649**	**20,455**	**2.2**	**12**		**6.4**	**4.3**
Newton Highlands	Lincoln St from Woodward St to Walnut St	2096	-	0.40	14	2	1.35	0.79
	Mountford Rd	100	-	0.02	11	2	0.05	0.04
	Bowdoin St	100	-	0.02	12	2	0.06	0.04
	Chester St	100	-	0.02	9	2	0.04	0.04
	Columbus St	100	-	0.02	12	2	0.06	0.04
	Hartford St to Erie St to Bowdoin St	1213	-	0.23	12	2	0.67	0.46
	Walnut St from Forest St to Centre St	1242	-	0.24	12	2	0.68	0.47
	Station Ave	100	-	0.02	14	2	0.06	0.04
	Floral St	100	-	0.02	12	2	0.06	0.04
	Hartford St Parking Lot	-	18207	-	-	-	0.42	-
	Sum Total or Average	**5,151**	**18,207**	**1.0**	**12**		**3.4**	**2.0**
Newton Centre	Centre St from Bowen St to Paul St	3,343	-	0.63	15	2	2.30	1.27
	Beacon St from Lake Ave to Grant Ave	3,043	-	0.58	12	2	1.68	1.15
	Union St	787	-	0.15	14	1	0.25	0.15
	Langley from Centre St to Braeland Ave	997	-	0.19	12	1	0.27	0.19
	Pleasant St from Centre St to Pleasant St Parking Lot	232	-	0.04	15	1	0.08	0.04
	Pelham St from Centre St to Pelham St Parking Lot	203	-	0.04	15	1	0.07	0.04
	Lyman St from Centre St to Sumner St	558	-	0.11	16	1	0.20	0.11
	Willow St from Sumner St to Centre St	575	-	0.11	10	2	0.26	0.22
	Centre Green from Lyman to Langley	295	-	0.06	14	1	0.09	0.06
	Sumner St from Beacon St to Willow St	468	-	0.09	15	1	0.16	0.09
	Beacon St Parking Lot	-	53,092	-	-	-	1.22	-
	Sum Total or Average	**10,501**	**53,092**	**2.0**	**13.8**		**6.6**	**3.3**
Auburndale	Commonewealth Ave from Auburn St to Ash St	1,937	-	0.37	12	2	1.07	0.73
	Lexington/Auburn from Auburndale Ave to Grove St	1,937	-	0.37	13	2	1.16	0.73
	Auburn St from Lexington to Melrose	406	-	0.08	12	2	0.22	0.15
	Melrose from Auburn to Comm Ave	614	-	0.12	12	2	0.34	0.23
	Sum Total or Average	**4,894**	**-**	**0.9**	**12**	**8**	**2.8**	**1.9**

Village Square	Roadways Swept	Length (ft)	Area (sq.ft.) (Parking Lots only)	Miles	Lane Width (ft)	Number of Lanes	IA (acres)	Estimated Lane Miles
Waban	Beacons St from Chestnut to Manitoba Rd	2,657	-	0.50	11	2	1.34	1.01
	Waban Ave to Collins	267	-	0.05	12	1	0.07	0.05
	Collins to Beacon	524	-	0.10	15	1	0.18	0.10
	Woodward from Beacon to Wyman	88	-	0.02	25	2	0.10	0.03
	Wyman from Beacon to MBTA Waban Station	246	-	0.05	15	2	0.17	0.09
	Windsor Rd from Beacons St to Kinmonth	140	-	0.03	14	2	0.09	0.05
	Sum Total or Average	**3,922**	**-**	**1**	**92**		**2**	**1**
Peter Square	Chestnut St from Upper Falls Playground to Oak St	1,033	-	0.20	12	2	0.57	0.39
	Chestnut St from Oak St to Linden St	390	-	0.07	17	2	0.30	0.15
	Oak St from Saco to Chestnut St	410	-	0.08	16	2	0.30	0.16
	Oak St from Chestnut St to Elliot St	1,160	-	0.22	12	2	0.64	0.44
	Elliot St from Linden to High St	370	-	0.07	13	2	0.22	0.14
	Sum Total or Average	**3,363**	**-**	**1**	**70**	**-**	**2**	**1.27**

$$P_{credit} = \quad e\ t * PLER_{road\ \ ay} * PRF\ \ ee\ \ er$$

Total IA	Total Lane Miles
42.8	**25.9**

PLER road	1.95	(lb/acre/yr)
PRF	0.05	(weekly, mechanical broom sweeper)
IA swept	42.84	(acres)
Pcredit	**4.18**	(lb/acre/yr)

Notes

All Village Squares are swept at a minimum frequency of once per week.
Newton Corner, Nomantum, Newtonville, West Newton, and Newton Hgihlands are swept daily
Newton Centre is swept 2-3x per week
Auburndale, Waban, and Peter Square are swept once per week
Length of each roadway, lane width, and number of lanes as measured on Google Earth
Lane miles calculated by multiplying lane width by number of lanes
Lane miles are rounded to the hundredth

Attachment 2: Vacuum Assisted Sweeping Calculations

Woodard & Curran

City of Newton Phase 1 Phosphorus Control Plan
City-Owned Non-Structural Phosphorus Reduction Analysis
Vacuum-Assisted Sweeper, Minimum Weekly Frequency

Location	Lane Miles	Average Lane Width (ft)	Impervious Area (acres)	Phosphorus Load Reduction (lbs/year)
Albemarle Rd	2.07	18	5	0.71
Lake Ave	1.59	11	2	0.33
Rogers Rd	0.19	12	0	0.04
Cabot St	0.86	12	1	0.20
Webster St	1.53	12	2	0.35
Bike Lanes	22.63	5	14	2.14
Sum Total	**28.87**	**12**	**24**	**3.76**

$$P_{credit} = \quad e\ \ t * PLER_{road\ \ ay} * PRF\ \ ee\ \ er$$

IA Swept	24	(acres)
PLER road	1.95	(lb/acre/year)
PRF	0.08	(weekly, vacuum-assisted sweeper)
Pcredit	**3.76**	(lb/year)

Notes:

All areas with vacuum assisted sweeper was swept once per week

All bike lanes are swept with vacuum assisted sweeper, with an average lane width of 5 ft

Amongst the bike lanes, Cabot Street and Webster Street are counted as a vacuum roadway

Phosphorus Reduction Factor (PRF) of 0.08 is used, per Appendix F Attachment 2.

Attachment 3: Mechanical Broom (Monthly) Sweeping Calculations

Woodard & Curran

City of Newton Phase 1 Phosphorus Control Plan
City-Owned Non-Structural Phosphorus Reduction Analysis
Mechanical Broom Sweeping, Monthly Frequency

Location	Lane Miles	Average Lane Width (ft)	Impervious Area (acres)
All roadways that are swept eight times per year	628	12	913

$$P_{credit} = \quad e\ \ t * PLER_{road\ \ ay} * PRF\ \ _{ee\ \ er} * \quad F$$

IA Swept	913	(acres)
PLER road	1.95	(lb/acre/yr)
PRF	0.03	(weekly, vacuum-assisted sweeper)
AF	0.67	(months done out of a year, 8/12)
Pcredit	**35.61**	(lb/year)

Notes:

All City-owned roadways excluding roads that are swept at a minimum weekly frequency (provided under Attachments 1 and 2)
Adjustment Frequency of 0.67 is used, to reflect sweeping frequency of eight times during calendar year
All lanes are swept with mechanical broom sweeper
Phosphorus Reduction Factor (PRF) of 0.03 is used, per Appendix F Attachment 2.

Attachment 4: Catch Basin Cleaning Calculations

Woodard & Curran

City of Newton Phase 1 Phosphorus Control Plan
City-Owned Non-Structural Phosphorus Reduction Analysis
Catch Basin Cleaning, Semi-Annual Frequency

Catch Basin ID	Contributing Drainage Area (acres)	Yearly Cleaning Count
SWIN-10759	0.00	3
SWIN-3787	0.00	2
SWIN-3599	0.00	2
SWIN-10552	0.00	2
SWIN-1842	0.01	2
SWIN-3262	0.01	2
SWIN-4144	0.01	2
SWIN-13318	0.01	2
SWIN-4100	0.02	2
SWIN-5594	0.03	2
SWIN-10763	0.03	2
SWIN-4101	0.03	2
SWIN-4064	0.03	2
SWIN-13184	0.04	2
SWIN-3058	0.04	2
SWIN-4851	0.04	2
SWIN-10928	0.04	2
SWIN-1504	0.05	2
SWIN-1831	0.06	2
SWIN-3455	0.06	2
SWIN-2717	0.07	2
SWIN-4339	0.08	2
SWIN-8486	0.08	2
SWIN-785	0.09	2
SWIN-3961	0.09	2
SWIN-2459	0.09	2
SWIN-13316	0.09	2
SWIN-2792	0.10	2
SWIN-528	0.11	2
SWIN-4753	0.15	2
SWIN-3301	0.16	2
SWIN-3607	0.24	2
SWIN-12967	0.25	2
SWIN-1843	0.37	2
SWIN-2118	0.37	2
Sum Total	**2.85**	

$$P_{credit} = \quad * PLER_{roadway} * PRF$$

IA Swept	2.85	(acres)
PLER road	1.95	(lb/acre/yr)
PRF CB	0.02	(semi-annual frequency, ca
Pcredit	**0.11**	(lb/year)

Notes:

Includes all catch basins that were cleaned twice in a year in 2022

Phosphorus Reduction Factor (PRF) of 0.032 is used, per Appendix F Attachment 2.

Attachment 5: Organic Matter and Leaf Litter Collection Calculations

Woodard & Curran

City of Newton Phase 1 Phosphorus Control Plan
City-Owned Non-Structural Phosphorus Reduction Analysis
Organic Matter and Leaf Litter Collection

Location	Lane Miles	Average Lane Width (ft)	Impervious Area (acres)
Areas Swept Weekly with Mechanical Broom Sweeper	26	12	43
Areas Swept Weekly with Vacuum Assisted Sweeper	29	12	24
Sum Total or Average	**55**	**12**	**67**

$$P_{credit} = \quad c \quad ected * PLER_{r\ adway} * PRF\ _{rganics/\ eaf\ \ itter}$$

IA Collected	67	(acres)
PLER road	1.95	(lb/acre/yr)
PRF	0.05	(weekly, vacuum-assisted sweeper)
Pcredit	**6.53**	

Notes:

Credit is applied for all roadways swept at a minimum of weekly frequency, between September 1st and December 1st
Lanes are swept with either a mechanical broom sweeper or vacuum assisted sweeper
Phosphorus Reduction Factor (PRF) of 0.05 is used, per Appendix F Attachment 2.

Attachment 6: Clean Sweep Memo Existing Non-Structural Controls Calculations

City of Newton Phase 1 Phosphorus Control Plan
City-Owned Non-Structural Phosphorus Reduction Analysis

Measured Organic Matter Collection Credit

Total Collected Wet Mass of Street Sweepings - Fall Season (lb)	2,676,300
Total Collected Wet Mass of Street Sweepings - Non-Fall Season (lb)	2,056,180

Table 1

Season	Average Moisture Content	TP Concentration from Mass (mg/kg)
Fall (Sept-Dec)	0.48	857
Non-fall (Jan-Aug)	0.2	414.00

Step 1) Determine the dry mass of sweeping matter collected, using Equation 1.

Equation 1: $Dry\ Mass\ (lb) = Wet\ Mass\ (lb) * (1 - Percent\ Moisture\ Content)$

Dry Mass for Fall Season (lb) =	1,391,676
Dry Mass for Non-Fall Season (lb) =	1,603,820

Step 2) Determine the TN or TP load removed by multiplying the dry mass determined in Step 1 and the seasonal TN or TP concentration, using Equation 2.

Equation 2: $TN\ or\ TP\ Removed\ (lb) = Dry\ Mass(lb) * TN\ or\ TP\ Concentration\ (mg/kg) * 1 \times 10^{-6}$

TP Removed - Fall (lb) =	1192.7
TP Removed - Non-Fall (lb) =	664.0
Net Reduction (lbs/year)	**1856.6**

Model-Based Street Cleaning Credit

"Minimum Effort"

Sweeper Type	PRF (Phosphorus Reduction Factor)	Export Rate (lbs/ac/year)	Roadway Area (ac)	Phosphorus Load Reduction (lbs/year) Enhanced Sweeping
Mechanical Broom	0.01	1.95	893.0	17.4
			Net Reduction (lbs/year)	17.4

"Medium Effort"

Sweeper Type	PRF (Phosphorus Reduction Factor)**	Export Rate (lbs/ac/year)	Roadway Area (ac)	Phosphorus Load Reduction (lbs/year) Enhanced Sweeping
Mechanical Broom	0.15	1.95	42.8	12.5
			Net Reduction (lbs/year)	12.5

"Maximum Effort"

Sweeper Type	PRF (Phosphorus Reduction Factor)	Export Rate (lbs/ac/year)	Roadway Area (ac)	Phosphorus Load Reduction (lbs/year) Enhanced Sweeping
Vacuum-Assisted	0.25	1.95	24.0	11.7
			Net Reduction (lbs/year)	11.7

Sum of Street Cleaning Credit

Summary of Credits	Phosphorus Load Reduction (lbs/year)
Minimal Effort	17.4
Medium Effort	12.5
Maximum Effort	11.7
Net Reduction (lbs/year)	**41.6**

NOTES:

1. Clean Sweep Memorandum for enhanced sweeping credit: 2x/year sweeping using a mechanical broom sweeper (PRF = 1%), or vacuum-assisted sweeper (PRF = 2%). Entire paved area (driveways, parking lots, sidewalks, patios, etc.) is swept. Use Medium-Density Residential Land Use Export Rate.

**Phosphorus Reduction Factor for "Medium Effort" calculations is increased by 10% as an additional removal factor based on weekly sweeping during fall season, per the Clean Sweep Memo

Enhanced Sweeping Lane Measurement Figures

CLIENT: CITY OF NEWTON, MA
DEPARTMENT OF PUBLIC WORKS

PROJECT: CITY OF NEWTON PHASE 1 PHOSPHORUS CONTROL PLAN

JOB NO: 023335 1.00
DATE: JUNE 2023
SCALE: N.T.S.

1

WEEKLY MECHANICAL
BROOM SWEEPING -
NEWTON CORNER

DESIGNED BY: SM
DRAWN BY: CJ
CHECKED BY: SK
NON-STRUCTURAL SCM VIII.* dwg

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WEEKLY MECHANICAL BROOM SWEEPING - NONANTUM

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DRAWN BY:	CJ
CHECKED BY:	SK
	NON-STRUCTURAL SCM VILL*.dwg

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DEPARTMENT OF PUBLIC WORKS

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DEPARTMENT OF PUBLIC WORKS

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WEEKLY MECHANICAL BROOM SWEEPING - NEWTON HIGHLANDS

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WEEKLY MECHANICAL BROOM SWEEPING - NEWTON CENTRE

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WEEKLY MECHANICAL BROOM SWEEPING - AUBURNDALE

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WEEKLY MECHANICAL BROOM SWEEPING - WABAN

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WEEKLY MECHANICAL BROOM SWEEPING - PETTEE SQUARE

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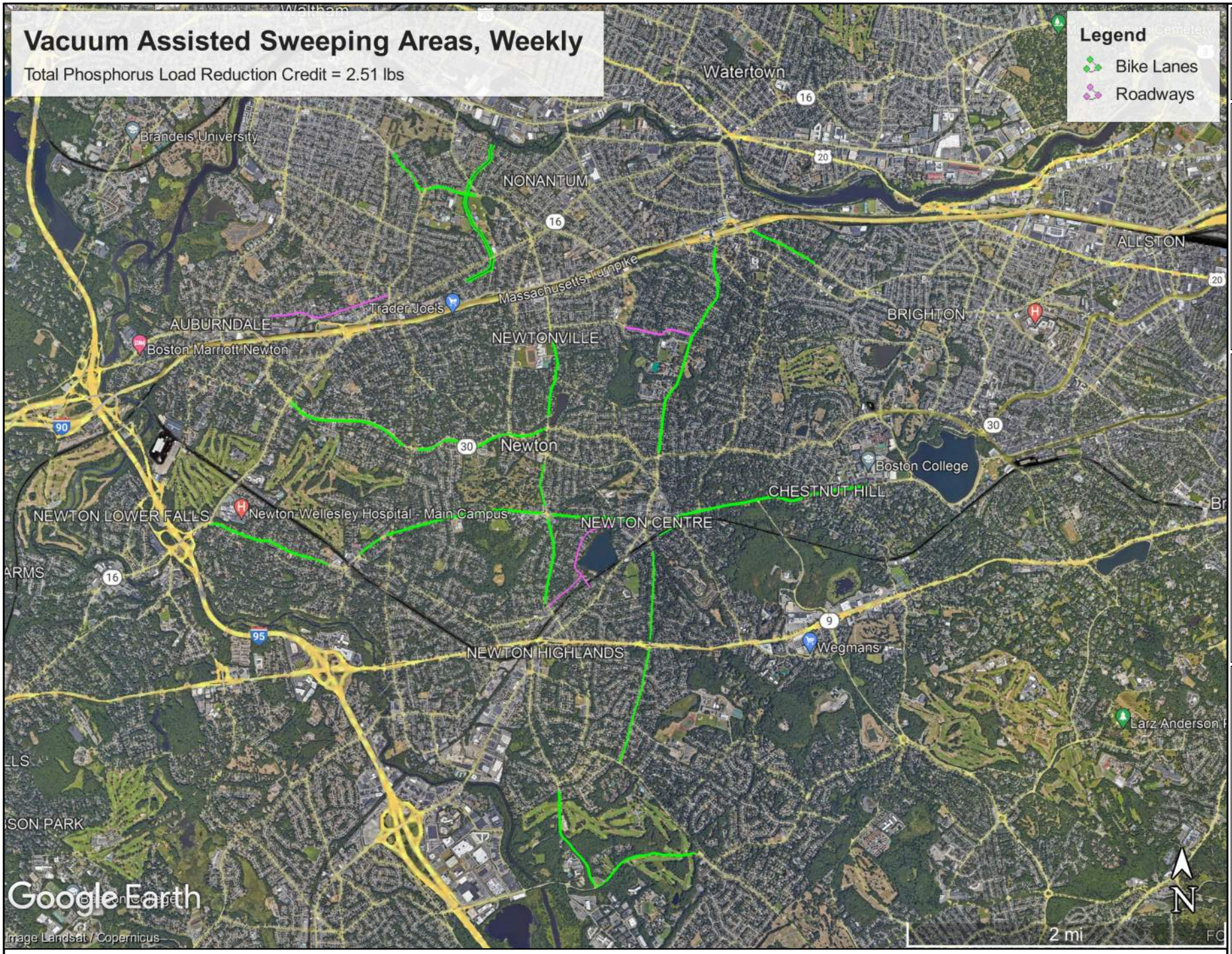

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WEEKLY VACUUM ASSISTED SWEEPING

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Clean Sweep Memorandum dated April 2023

Clean Sweep

Recommendations for New and Updated Credits for Street Cleaning in New Hampshire

Technical Memorandum

Updated April 21, 2023

PREP Piscataqua Region Estuaries Partnership

NH Stormwater Center

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1. Executive Summary

This technical memorandum summarizes the recommendations of an expert panel to update New Hampshire's current Enhanced Street/Pavement Cleaning credit (USEPA 2017) and create a new measured credit for organic matter collection. The intention for these new and modified credits is to provide communities, consulting engineers, and technical assistance providers with the tools and incentives to reduce Total Nitrogen (TN) and Total Phosphorus (TP) loading associated with these nonstructural Best Management Practices (BMPs) under the National Pollutant Discharge Elimination System Stormwater Permit Program for NH (USEPA, 2017).

Issued in January 2017, New Hampshire's current Small Municipal Separate Storm Sewer System (MS4) General Permit (USEPA 2017) describes tracking and accounting metrics to quantify nutrient and sediment pollutant loading for different land uses. Under this permit, municipalities may earn TN or TP reduction credits through enhanced cleaning of impervious surfaces or by gathering, removing, and properly disposing of organic matter. However, these credits do not offer the sufficient return on the investment required to maintain such programs, and the current standard of street cleaning practice in the Great Bay Watershed is low (Town of Exeter 2015, University of Florida 2019). At the same time, a growing body of science suggests that enhanced street cleaning practices can achieve pollutant reductions far beyond what is currently recognized in New Hampshire's existing credit programs (Tetra Tech 2020).

Updates to the Great Bay Total Nitrogen General Permit and a new MS4 permit for New Hampshire are anticipated to include these credit options in the near future. Together, they represent opportunities for broadening the use of non-structural control credits. If accepted by state and federal regulators, the recommendations in this memorandum will

generate two options for obtaining credit for street cleaning under the state's permits. Through the first option, permittees can receive credit by measuring the amount of organic matter collected throughout the year—an approach pioneered in Minnesota (Minnesota Pollution Control Agency 2022). The second option would allow permittees to use an updated version of the model that informs New Hampshire's current Enhanced Street/Pavement Cleaning Program. This would offer credit for municipal sweeping efforts depending on the technology used, frequency of cleaning, seasonality, and location. Permittees could use either option to receive credit, but not both, within one reporting year. The U.S. Environmental Protection Agency, Region 1, has endorsed piloting these credits to provide insight into, and the adaptive improvement of current credits into the next New Hampshire and Massachusetts Small MS4 General Permits.

Both options, but in particular the measured approach, would increase the amount of the credit permittees can earn through implementation of these BMPs beyond what is currently possible. By providing two options, the panel hopes to give permittees the flexibility they need to pursue credit in the way that best suits their objectives and resources, while creating incentives for them to conduct street cleaning when and where it will have the greatest water quality benefit.

The interim between summer 2022 and the release of the new MS4 permit offers municipalities and the State of New Hampshire a unique opportunity to test these recommendations and collect data to assess their feasibility. As a result, the panel recommends that these proposed updates to New Hampshire's current credit programs be subject to adaptation when, and if, new science and data become available. They also offer a list of research topics that could support improvement of either credit in the future. (See Appendix B.)

This memorandum was generated by the Clean Sweep Project, which used an expert panel process to develop consensus-based recommendations to modify pollutant load reductions for street cleaning BMPs in ways supported by existing science and data. (See Appendix C for an overview of Clean Sweep.) The project was modeled after Credit for Going Green, a similar initiative that used techniques from the Chesapeake Bay to develop pollutant reduction performance curves for using restored or constructed buffers to meet in-stream pollution reduction targets. Clean Sweep is sponsored by the U.S. Environmental Protection Agency, the Piscataqua Region Estuaries Partnership, and the Town of Durham, New Hampshire. The project team gratefully acknowledges the contributions of time and expertise from members of the

expert panel and advisory committee.

2. Definition of Terms

This memorandum uses the following definitions for key terms.

- **AF**: Annual Frequency of sweeping. For example, if sweeping does not occur in December, January, or February, the AF would be 9 months /12 months, or 0.75. For year-round sweeping, AF would be 1 or something less than 1.
- ***Area:*** measured amount of street surface swept
- ***Credit:*** Estimated pollutant load reduction given for the application of BMPs, such as street cleaning, under the NPDES Stormwater Permit Program and other efforts to manage stormwater
- ***Credit sweeping:*** Amount of nutrient load removed by enhanced sweeping program (lbs/year)
- ***Delivery coefficient factor:*** Number between 0 and 1 that the measurement of collected TN or TP is multiplied by to account for natural attenuation of nutrients between the street and the receiving water body
- ***Dry mass:*** Mass of sweepings with all water removed, determined by oven drying a subsample and multiplying the wet mass of the sweeper load by the ratio of the dry mass to wet mass of the subsample
- ***Efficiency:*** Ability to decrease the nutrient load export rate
- ***IA swept:*** Area of impervious surface that is swept under the enhanced sweeping program (acres)
- ***Length (or lane miles) swept:*** Linear distance traveled by a sweeper with an assumed width of eight feet.
- ***Total Nitrogen concentration from mass:*** Ratio of TN to dry mass of sweepings, expressed in mg/kg and taken from the 25th percentile of the Minnesota data set
- ***NLER IC-land use*****:** Nitrogen (TN) Load Export Rate for impervious cover and specified land use (lb/acre/yr) (Table 2-2)
- ***NRF sweeping:*** Nitrogen (TN) Reduction Factor for sweeping based on sweeper type and frequency (Table 2-4)
- ***Percent moisture:*** Mass of water divided by total wet mass of subsample.
- ***Performance*****:** Ability of a Best Management Practice (BMP), such as street cleaning, to remove TN, TSS, and/or TP
- ***Phosphorus concentration from mass:*** Ratio of phosphorus to dry mass of sweepings, expressed in mg/kg and taken from the 25th percentile of the Minnesota data set

- ***PLER IC-land use*:** Phosphorus (TP) Load Export Rate for impervious cover and specified land use (lb/acre/yr) (Table 2-1)
- ***PRF sweeping*:** Phosphorus (TP) Reduction Factor for sweeping based on sweeper type and frequency (Table 2-4)
- ***Sweeper width:*** Measurement of a street sweeper from side to side, often assumed to be eight feet
- ***Wet mass:*** Raw mass of street sweepings, including any moisture

3. About the Expert Panel and Its Process

Clean Sweep applied the FAST expert panel process (Houle et al., 2019), which creates a structure to synthesize the opinions of a group of authorities on a subject around which there had been uncertainty due to insufficient and/or unattainable data because of physical constraints or lack of resources. This panel included state and regional regulators, experts in the field of watershed hydrology and stormwater management, a stormwater consultant, and representatives of New Hampshire and Massachusetts municipalities. The panel's focus and work was guided by an advisory committee, which was comprised of similar stakeholders, including some from Vermont and Minnesota. (For an overview of panelists and advisory committee members and their roles in the Clean Sweep project, see Appendix D.)

The advisory committee's charge to the panel was to characterize street sweeping and leaf collection as separate best management practices (BMPs) for reducing nutrient loading in urban stormwater runoff; identify which aspects of these BMPs overlap in practice and in terms of current crediting in New Hampshire; and ultimately make recommendations to update these programs in keeping with existing science and in support of communities getting maximum, appropriate credit for these practices. The panel was supported by a core team, which provided technical guidance and support for project coordination, facilitation, and product development.

To meet their charge, panelists reviewed and enhanced a synthesis of relevant literature and emerging regulatory strategies in Wisconsin, Vermont, and Minnesota (see Appendix E), and compared the crediting programs in these states (see Appendix F). Ultimately, they determined that New Hampshire's current crediting approaches did not offer sufficient incentive for robust and effective street cleaning programs, and there was significant opportunity for change based on existing science.

The panel held six meetings to assess potential changes and make recommendations for change. These discussions, as well as further review of additional scientific and regulatory resources, helped them identify potential modifications to New Hampshire's current street sweeping program that would allow permittees to fulfill the upper boundaries of performance and therefore be eligible for maximum credit under New Hampshire's MS4 permit. They also provided guidance for adapting the organic matter collection credit pioneered in Minnesota (Minnesota Pollution Control Agency 2022) for use in New Hampshire.

4. Key Decisions

The options for credit recommended in this memorandum reflect panel decisions related to topics for which there was sufficient existing data, as well as others for which further research or data collection may be warranted. This section provides an overview of these decisions.

1. **Create two options for permittees:** The panel recommended adapting New Hampshire's current Enhanced Street/Pavement Cleaning credit ***and*** establishing a new measured credit for organic matter collection. This decision was based on deliberations of the merits and limitations of both approaches and the ways they overlap. While the measured approach presented the prospect of significantly more credit, to apply it in New Hampshire would rely on practices unfamiliar to its communities and would, initially, be based on Minnesota data. The more familiar, model-based option offers little credit as written, however, the panel saw opportunities to change the model's parameters and increase the amount of credit allowable. Ultimately, they felt having two options would give communities the flexibility to design street cleaning programs to meet their objectives and resources.

2. **Use Minnesota's Street Sweeping Credit Calculator as the basis to develop a similar program in New Hampshire.** Minnesota's program was a compelling model for three primary reasons. It is based on a rigorous study conducted by Tetra Tech and the University of Minnesota (Hobbie et al., 2020); results of this study have been integrated into the state's stormwater program (Minnesota Pollution Control Agency 2022); and the state is working with permittees to facilitate its implementation. This provided enough of a foundation to pilot a version of this approach in New Hampshire. The only significant difference would be to omit the modeling option outlined in Minnesota's approach, given the panel's decision to adapt New Hampshire's model-based, street cleaning credit.

3. **Use Minnesota data to develop a measured credit:** Given the lack of relevant data from New Hampshire, the panel assessed the feasibility of using data from Minnesota's Developing a Street Sweeping Credit for Stormwater Phosphorus Source Reduction Final Report (Hobbie et al., 2020) as a basis for the credit. In response to sample calculations using this data for frequent sweeping (19 times annually) and infrequent sweeping (four times annually in times of high deposition), the panel was concerned that awarding more credit for infrequent collection could disincentivize more frequent collection. However, they appreciated the caution inherent in Minnesota's conservative use of the 25th percentile TP and TN concentrations (as opposed to, for example, the median or mean) in collected organic material to estimate TP and TN recovered through sweeping. Given the low standard of practice in New Hampshire, they thought the suggested interval for infrequent collection would be an improvement. Ultimately, they felt comfortable starting

with Minnesota data, but underscored it would be important to assess data collected by New Hampshire communities piloting this approach.

4. **Do *not* use a delivery coefficient factor in New Hampshire's measured credit program.** A primary concern was related to the fate in transport of TN or TP. The current assumption in the Minnesota approach is that all TP removed from the street would have reached receiving waters. There is no science to fully describe this dynamic in New Hampshire, and several panelists felt this assumption could lead to over crediting, i.e., not all TN and TP in collected organic matter was destined for receiving waters. To balance concerns about over crediting in their state, Minnesota adopted conservative loading rates, using the 25th percentile, rather than a mean or median concentration of TP, in collected organic material. This decision was sufficiently cautious for the panel *not* to recommend the application of a delivery coefficient factor—a multiplier less than one to account for TN and TP in collected organic matter that would not reach receiving waters—for New Hampshire.

5. **Allow for a range of acceptable technologies in the current, model-based street cleaning credit:** The panel agreed that a range of technologies should be allowable in the updated credit, and that a mechanical sweeper represented minimal effort and the use of additional technology, e.g., a vacuum assisted sweeper, should be recognized as a maximum effort. This decision reflected the panel's focus on making changes consistent with the different goals and resources of communities.

6. **Identify a minimum, medium, and maximum sweeping effort in the current, model-based street cleaning credit:** The panel defined 1) minimum effort as sweeping at least two times annually (as in the current credit); 2) medium effort as sweeping *every other* week in the fall (September to December); and 3) maximum effort as monthly sweeping with *weekly* sweeping in the fall (September to December) and early spring.

7. **Simplify the location parameter and accommodate seasonal changes in TN and TP loading in the model-based street cleaning credit:** The panel recommended using medium density residential impervious cover (IC) land use to generate a pollutant load to which to apply the NRF/PRF value. They believe this represents the majority of land use available for sweeping in most New Hampshire communities. For seasonal leaf collection (i.e., intensive weekly sweeping in times of high organic material deposition), the panel recommended an additional 10% removal factor—a 5% increase over the existing enhanced leaf collection credit— to better reflect removals demonstrated in recent literature (Tetra Tech 2020).

5. New: Measured Organic Matter Collection Credit

Municipal responsibility

Permittees who choose to use this approach would receive credit for organic matter that is collected from impervious surfaces. Under the proposed credit, they would have the option for tracking TN and TP reductions from street sweeping activities with some ability to use locally derived data (see calculation steps below). These were adopted from the approach developed and used in Minnesota. (See Appendix G for a summary of Minnesota's approach.)

How credit would be calculated (For example credit calculations, see Appendix I.)

Step 1) Determine the dry mass of sweeping matter collected, using Equation 1.

Equation 1: $Dry\ Mass\ (lb)\ =\ Wet\ Mass\ (lb)\ *\ (1\ -\ Percent\ Moisture\ Content\ )$

If percent moisture content is known, it may be input into Equation 1 in decimal form, otherwise apply a seasonally averaged percent moisture content developed from the University of Minnesota dataset for the appropriate season (Table 1).

Step 2) Determine the TN or TP load removed by multiplying the dry mass determined in Step 1 and the seasonal TN or TP concentration, using Equation 2.

Equation 2: TN or TP Removed (lb) = $Dry\ Mass(lb\ *\ TN\ or\ TP$ *Concentration (mg/kg)* $*\ 1\ x\ 10^{-6}$

Apply the TN or TP concentration from the University of Minnesota dataset for the appropriate season (Table 1).

Table 1

Season	Average Moisture Content	TP Concentration from Mass (mg/kg)	TN Concentration from Mass (mg/kg)
Fall (Sept - Dec)	0.48	857	2,762
Non-fall (Jan - Aug)	0.22	414	994

6. Update to Current Model-Based Street Cleaning Credit

New Hampshire's current Enhanced Street/Pavement Cleaning credit was introduced in Appendix F of New Hampshire's (USEPA 2017) and Massachusetts' (USEPA 2016) MS4 permits. (See Appendix H for a synthesis of New Hampshire's program.) The panel recommends the following modifications to New Hampshire's current credit:

- Municipalities track and receive credit for area or lane miles swept, sweeper type, and sweeping frequency. (The current credit requires municipalities to also track *land use* in the watershed area swept.)

- Adopt *medium density residential land use loading values for IC* and add an option for tracking lane miles. If permittees can differentiate area and land use, those values could be utilized. (See Tables 3-1 and 3-2 in Appendix F and Attachment 3 of New Hampshire's MS4 permit.) For those who lack this capacity, the panel recommends the default medium density residential land use as it represents most of the potential sweeping routes.

- Municipalities can use mechanical broom and vacuum sweepers, which include true vacuum, vacuum assisted, and regenerative air sweepers. (The current credit includes three technology options.)

- Municipalities can use one of two options for sweeping frequency to characterize minimum and maximum effort. (See Table 3). (The current credit has three frequency options.)

How credit would be calculated (For example credit calculations, see Appendix I.)

Under this modified version of New Hampshire's Enhanced Street/Pavement Cleaning Program, permittees could earn a TN and TP reduction credit for conducting a municipal sweeping program. The credit would calculated by using the following equations and values in Table 3:

Equation 3: Credit TP Sweeping (lb/yr) =

$$Impervious\ Area\ (ac)\ *\ TP\ Load\ Reduction\ Factor\ (PRF)\ of\ Sweeper\ Type\ *\ PLER\ IC\ land\ use\ (lb/ac/year)$$

Equation 4: Credit TN sweeping (lb/yr) =

$$Impervious\ area\ (ac)\ *\ TN\ Load\ Reduction\ Factor\ (NRF)\ of\ Sweeper\ Type\ *\ NLER\ IC\ land\ use\ (lb/ac/year)$$

PRF/NRF credits range from a minimum effort (0.01 - 0.02) to a medium effort (0.15), and a maximum effort (up to 0.25) depending on the municipal program approach.

Table 3: Updated Parameters for New Hampshire's Model-based Credit for Street Cleaning

Parameter	Minimum Effort	Medium effort	Maximum Effort
Frequency	Up to 2 times per year in any season. NRF/PRF = 0.01 for a mechanical sweeper and 0.02 for a vacuum.	Every other week in the fall (Sept. to Dec.). NRF/PRF = 0.15	Monthly routine maintenance with more intensive (weekly) in Fall (Sept. to Dec.) and early spring. NRF/PRF = 0.25 with enhanced leaf collection. Assumes a vacuum sweeper (defined above), but may be combined with other efforts.
Location and seasonality	To accommodate seasonal increases in TN and TP and simplify the location parameter: 1) Use medium density residential IC land use, which integrates the majority of likely land uses. 2) For intensive (weekly) fall sweeping in times of high organic material deposition, offer a 10% additional removal factor. This is a 5% increase over the enhanced leaf collection credit in the current model and better reflects removals in the recent literature. (Synonymous with maximum effort.)		

For the area conversion from lane miles, sweeper width is assumed to be eight feet. This method, since it is based on the least informative inputs, is necessarily conservative and will likely result in less credit than the measured approach.

7. Considerations When Applying the Credits

The relationship between seasonality and nutrient loading has been incorporated in the measured approach based on recent research from the U.S. Geological Survey and University of Minnesota (Selbig 2016, Hobbie et al., 2020). This work demonstrated a pronounced difference in moisture content and TN and TP concentration depending on the season.

The measured approach is designed to represent two periods of street sweeping throughout the year: fall leaf collection and non-fall collection. The current model-based approach does not differentiate between seasons and is likely too conservative.

Adoption of the proposed measured organic collection credit and updated model-based street cleaning credit will allow permittees more flexibility in reporting and potentially greater accuracy when leaf collection is a major component of sweeping. Clean Sweep partners will pilot the measured approach in New Hampshire communities in 2022 and 2023.

The U.S. Environmental Protection Agency has commended the recommendations and the Clean Sweep approach. In a letter dated August 15, 2022, they observed: "The piloting of these methods will provide insight and adaptive improvement of the new credits and offer opportunities to validate the approaches for future use throughout New England. Information gained during the piloting of the new credits could allow EPA R1 to integrate these credits, or an iteration of these credits, into the next New Hampshire and Massachusetts Small MS4 General Permits." (See Appendix J.)

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Appendix A: References

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Selbig, William, 2016. “Evaluation of leaf removal as a means to reduce nutrient concentrations and loads in urban stormwater,” Science of the Total Environment. https://drive.google.com/file/d/1IK7Qgp25Lta3Uy008PeOOlx6ZFzAK-X-/view

Appendix B: Suggested Areas of Future Research

Ground truth Minnesota data for New Hampshire: The panel recommends pilot studies with a level of analysis sufficient to validate that data collected in New Hampshire for percent moisture and other variables are consistent with those used for Minnesota's calculations.

Citizen collection programs & loading: Both the expert panel and the advisory committee acknowledge growing interest in, and adoption, of leaf bagging and composting programs and other citizen-based efforts. Given the panel's focus on municipal street cleaning, this was beyond its purview. However, the panel feels there is value in synthesizing science and data to support the contribution of such programs to load reductions in relation to street cleaning efforts. In relation to this, the panel suggested studies to better characterize the relative loading from different types of landscapes and impervious cover.

Nutrient loading rates associated with different land uses: The panel recommends studies to better characterize the nutrient loading rates associated with different land uses in general, and in different seasons.

Tree canopy: The extent and composition of tree canopy can influence the nutrient load associated with organic matter deposition. For example, areas where the canopy is more extensive may contribute to higher nutrient loads. Likewise, different tree species may be associated with higher loading, or they may drop their leaves at different times, which could influence appropriate timing of collection. While there is relevant research underway and municipal capacity for canopy assessment is increasing, the panel did not feel that science currently existed to support the integration of this into recommendations in this report. Research questions to help address could include the following:

- How does the extent of canopy influence potential nutrient loading?
- How do different tree species (and composition of canopy) influence potential nutrient loading?
- What are the influences of climate change on the leaf drop of representative tree species in New Hampshire?

Lane miles: The panel considered whether the width of lane miles used in the current model-based street sweeping credit adequately reflected the potential nutrient loading and therefore potential credit. However, new data and more modeling would be required to decide whether, for example, the width could be expanded to represent a greater area or whether parking restrictions should be coordinated with sweeping.

Seasonality: The panel acknowledged that the concentration embedded in the current model-based street sweeping credit was based on data that wasn't entirely collected in the fall, and that seasonality is not represented well. Future versions of the model could address this with new data and more modeling.

Location of sweeping and phosphorus loading: The release of legacy phosphorus from retention ponds is a growing issue. Research is underway to clarify whether sweeping upstream of those ponds can remove sources of phosphorus that would otherwise wash into the pond. If so, the efficiency of ponds should be adjusted to account for less phosphorus available for removal.

Relative loading by watershed type: Panelists suggested there was potential for enrichment factors for base loading rates to be created for different watershed types based on existing data from Minnesota and Wisconsin.

Clean Sweep

This project will develop consensus-based recommendations for pollutant load reductions for street sweeping BMPs. Our goal is to ensure that the credit received under regulatory permits issued by the NPDES Stormwater Permit Program is commensurate with the latest science. The team will develop a technical memorandum and other outreach products to share these recommendations with communities, regulators, consultants, and others in the Piscataqua Region Watershed in fall 2022.

Why this project

Urban stormwater is one of the fastest growing sources of pollution in communities nationwide. In New Hampshire, local governments have raised concerns about meeting pollutant reduction goals for total nitrogen (TN), total phosphorus (TP), and total suspended solids (TSS). Street sweeping and seasonal leaf collection are nonstructural best management practices (BMPs) that historically have received inconsistent pollutant removal credit under regulatory permits. However, recent science and data indicate these BMPs may be much more effective at removing pollutants than previously expected, especially at certain times of the year. This project will provide regulators and communities with science-based recommendations to quantify the water quality benefits of these BMPs.

Our approach

We will use the expert panel process FAST, an iterative, weight-of-evidence approach to synthesizing expert opinion and reaching general agreement around science based recommendations for resource management. This process was refined in the Credit for Going Green project, which developed pollutant reduction performance curves for restored or constructed buffers,so that they could receive pollutant removal credits under New Hampshire's regulatory permits. This process will be supported by an advisory committee, composed of municipal representatives, regulators, and consultants, as well as an expert panel of scientists in the fields of hydrology, fate and transport of urban pollutants, and engineering.

Project partners

University of New Hampshire Stormwater Center (UNHSC)

Piscataqua Region Estuaries Partnership (PREP)

Roca Communications

Advisors

New Hampshire Department of Environmental Services

United States Environmental Protection Agency Region 1

City of Dover (and municipalities to be determined)

Consultant Engineers

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This project is sponsored by the US Environmental Protection Agency, PREP, and the Town of Durham, N.H.

PREP Piscataqua Region Estuaries Partnership

NH Stormwater Center

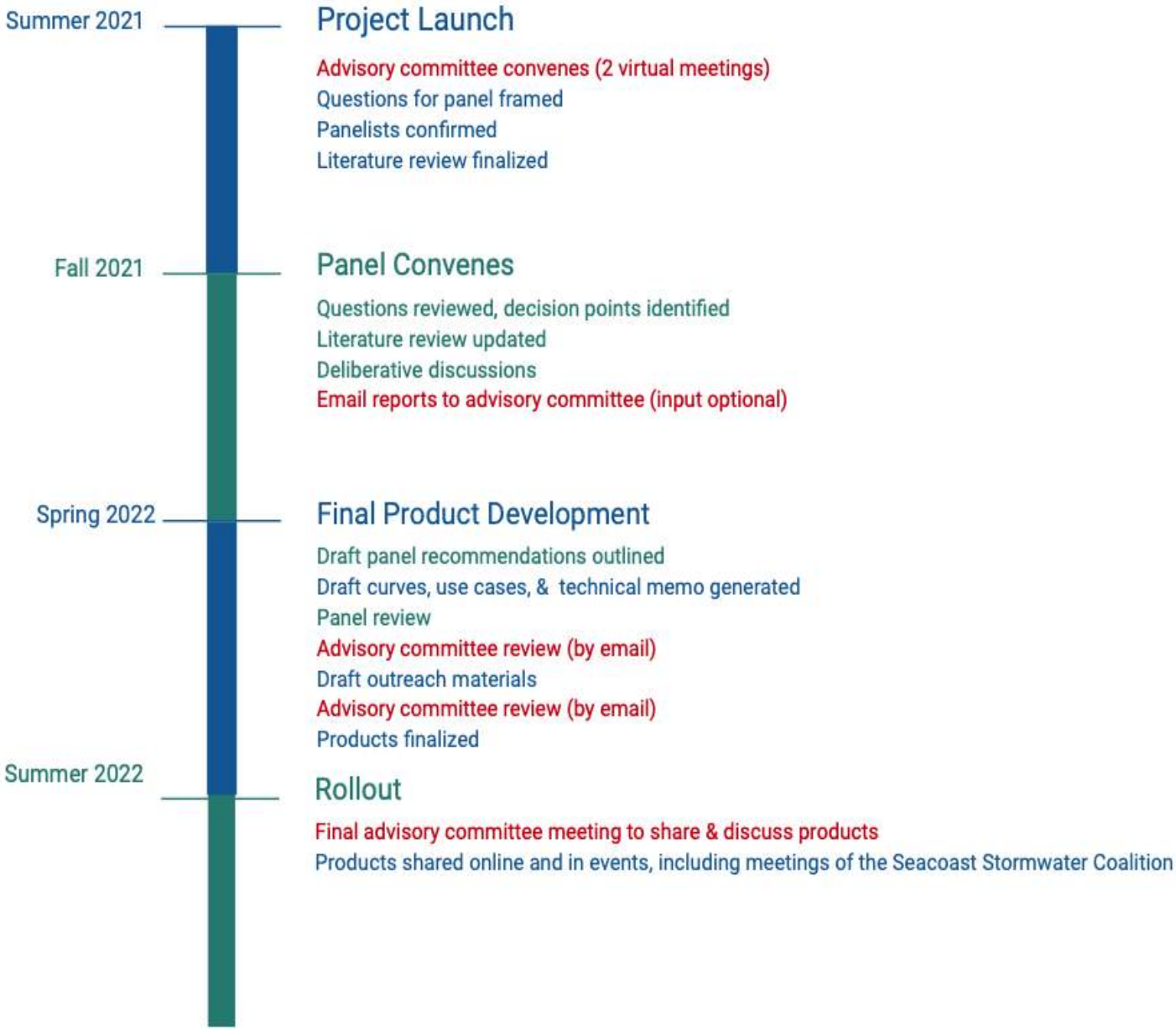
Appendix D: Clean Sweep Roles, Responsibilities, Timeline

Participant	Role	Responsibilities
Core Team		
James Houle, Director, University of New Hampshire Stormwater Center	Technical lead, panel chair	Oversee advisory engagement of committee and expert panel, development of products, and sharing of results
Abigail Lyon, Technical Assistance Program Manager, Piscataqua Region Estuaries Partnership	Project lead, fiscal agent	Oversee additional stakeholder engagement, project budget, and reporting
Elizabeth Buschert, Project Manager, University of New Hampshire Stormwater Center	Technical support	Conduct literature analysis, develop synthesis, and provide technical support
Dolores Leonard, Principal Roca Communications	Group process, products	Support core team in convening and facilitating advisory committee and expert panel and in developing final products.
Lola Jalbert Combs, Assistant Producer, Roca Communications	Meeting support, products	Support core team in convening and facilitating advisory committee and expert panel and in developing final products
Advisory Committee: Frame questions for panel, suggest panelists, provide feedback on progress and input on final products. Participation includes three virtual meetings and responding to email requests for input. Up to 10 hour time commitment.		
Bill Boulanger, Deputy Director of Community Services, City of Dover, N.H.	Committee member	Advise on municipal level needs, interests, and applicability
David Bowley, Utilities Systems Manager, University of New Hampshire	Committee member	Advise on needs, interests, and applicability within a large scale, non municipal setting.
Zach Henderson, Water Resources Technical Manager, Woodard & Curran	Committee member	Advise on BMP design and implementation
Caroline Kendall, Town Administrator, Town of Rollinsford, N.H.	Committee member	Advise on municipal level needs, interests, and applicability
James McCarty, GIS Manager, City of Portsmouth, N.H.	Committee member	Advise on municipal level needs, interests, and applicability
Randy Neprash, Stantec, National Municipal Stormwater Association	Committee member	Advise on municipal level needs, interests, and applicability, as well as credit design & implementation in other regions.
James Pease, Analyst-Biologist, VT Dept. of Environmental Conservation	Committee member	Advise on state level policy interests and perspectives
Sally Soule, Coastal Watershed Supervisor, N.H. Dept. of Environmental Services	Committee member	Advise on state level policy interests and perspectives
April Talon, Town Engineer, Town of Durham, N.H.	Committee member	Advise on municipal level needs, interests, and applicability

Newton Tedder, U.S., Environmental Engineer, MS4 Permit Writer, U.S. Environmental Protection Agency, Region 1	Committee member	Advise on federal level policy interests and perspectives
Michelle Vuto, Environmental Engineer, U.S. Environmental Protection Agency, Region 1	Committee member	Advise on federal level policy interests and perspectives

Participant	Role	Responsibilities
Expert Panel: Develop science-based recommendations to inform changes to NH's approach to crediting street weeping and/or leaf collection.		
Bill Boulanger, Deputy Director of Community Services, City of Dover, N.H.	Panelist	Provide firsthand experience with application of BMPs at municipal scale and perspectives on changes to these BMPs considered by the panel.
Ted Diers, Administrator, N.H. Dept. of Environmental Services	Panelist	Provide perspective on state level policy interests and perspectives
Sarah Hobbie, Distinguished McKnight University Professor, Dept. of Ecology, Evolution, and Behavior, University of Minnesota	Panelist	Provide scientific expertise and understanding on how changes to BMPs could impact water quality impacts
James Houle, Director, University of New Hampshire Stormwater Center	Panel Chair	Provide perspective on engagement of committee and expert panel, development of products, and sharing of results,
James McGonagle, Commissioner of Public Works, Newton, MA	Panelist	Provide firsthand experience with application of BMPs at municipal scale and perspectives on changes to these BMPs considered by the panel.
Theresa McGovern, Director of Water Resources at VHB	Panelist	Provide firsthand experience with application of BMPs and to the extent possible, changes to these BMPs considered by the panel.
Bill Selbig, Research Hydrologist, Upper Midwest Water Science Center	Panelist	Provide scientific expertise and understanding on how changes to BMPs could impact water quality impacts
Sally Soule, Coastal Watershed Supervisor, N.H. Dept. of Environmental Services	Committee member	Provide perspective on state level policy interests and perspectives
Mark Voorhees, Environmental Engineer, U.S. Environmental Protection Agency, Region 1	Panelist	Provide perspective on federal level policy interests and perspectives
Michelle Vuto, Environmental Engineer, U.S. Environmental Protection Agency, Region 1	Panelist	Provide perspective on federal level policy interests and perspectives
Gretchen Young, Environmental Projects Manager, City of Dover, N.H.	Panelist	Provide firsthand experience with application of BMPs at municipal scale and perspectives on changes to these BMPs considered by the panel.

Timeline


Summer 2021
Project Launch
Advisory committee convenes (2 virtual meetings)
Questions for panel framed
Panelists confirmed
Literature review finalized
Fall 2021
Panel Convenes
Questions reviewed, decision points identified
Literature review updated
Deliberative discussions
Email reports to advisory committee (input optional)
Spring 2022
Final Product Development
Draft panel recommendations outlined
Draft curves, use cases, & technical memo generated
Panel review
Advisory committee review (by email)
Draft outreach materials
Advisory committee review (by email)
Products finalized
Summer 2022
Rollout
Final advisory committee meeting to share & discuss products
Products shared online and in events, including meetings of the Seacoast Stormwater Coalition

Appendix E: Clean Sweep Synthesis of Literature and Other Resources

Tetra Tech Literature Reviews

- Street sweeping: extended / summary
- Leaf collection: extended / summary

New Hampshire Resources

- Integrated memo on NH leaf collection & street sweeping crediting programs.
- Total Maximum Daily Load (TMDL) Report for 44 Bacteria Impaired Waters in New Hampshire
- Joint Adaptive Management Plan

Vermont Resources

- Vermont crediting information
- Vermont literature review
- Clean Sweep Webinar: Recording. Presentation: Vermont Clean Streets
- VT ski soils and runoff on page 72. It states: "Both logging and ski slopes were assumed to have a curve number equivalent to lawn in fair condition. Thus, for B/C soils, the equivalent curve number would be 74."
- Study from S Burlington. The issue with this study is that the P-load calculated from the measured leaf mass was close to the TMDL target for the City (114 vs 135) and if we added in the CB cleaning they would meet the target using the current practices.
- Sorenson, J.R., Pease, J.M., Foote, J.K., Chalmers, A.T., Ainley, D.H., and Williams, C.J., in review, Estimated Phosphorus Load Reductions from Leaf Litter Removal in the Lake Champlain drainage area, Vermont: U.S. Geological Survey Scientific Investigations Report 2021–####, 50 p.
- Sorenson, J.R., Pease, J.M., Foote, J.K., Chalmers, A.T., Ainley, D.H., and Williams, C.J., in review, Data supporting phosphorus load-reduction estimates from leaf-litter removal in central and northwestern Vermont: U.S. Geological Survey data release,

Minnesota Resources

- Street Sweeping: Minnesota Stormwater Manual
    - Street Sweeping SOP
- Street Sweeping Phosphorus Credit Calculator: User Guide - Minnesota Stormwater Manual

- Developing a Street Sweeping Credit for Stormwater Phosphorus Source Reduction
- Minnesota Street Sweeping Phosphorus Load Credit Development
- Clean Sweep Webinar: Recording. Presentations: Minnesota Street Sweeping
- Evaluation of leaf removal as a means to reduce nutrient concentrations and loads in urban stormwater (Summer phosphorus concentration estimates from residential areas detailed in Figure 3)

Massachusetts

- USGS report looking at materials on streets before and after regenerative-air removal of 32 elements (including total P) in Cambridge, MA

Wisconsin resources

- Interim Municipal Phosphorus Reduction Credit for Leaf Management Programs
- Evaluation of leaf removal as a means to reduce nutrient concentrations and loads in urban stormwater
- Reducing Leaf Litter Contributions of Phosphorus and Nitrogen to Urban Stormwater through Municipal Leaf Collection and Street Cleaning Practices
- Leachable phosphorus from senesced green ash and Norway maple leaves in urban watersheds
- Roger Bannerman's data analysis on lawns as a source of phosphorus
- Reducing Leaf Litter Contributions of Phosphorus and Nitrogen to Urban Stormwater through Municipal Leaf Collection and Street Cleaning Practices (Selbig).

Rhode Island resources

- Analysis performed on behalf of RIDOT to evaluate cost-effectiveness of sweeping vs. structural controls

General

- World Sweeper
- Adopt-A-Drain
- Leave the Leaves to Benefit Wildlife | Xerces Society

Appendix F: Summary of Credit Programs in New Hampshire, Minnesota & Vermont

Calculating Credit: What is the Best Option for New Hampshire?

February 11, 2022

Why this Memo?

This memo is intended to support the Clean Sweep Advisory Committee's discussion of the pros and cons of a model-based or measured approach to assigning credit for a new BMP focused on organic matter removal. This memo compares the municipal responsibilities and calculation methods for New Hampshire's current model-based approach with Minnesota's Street Sweeping Credit Calculator—which gives municipalities the option to use a measured approach—and the new approach used in Vermont. The memo also provides a comparison of the credits that theoretically would be awarded for each approach using data collected in Minnesota.

I. Minnesota's Street Sweeping Credit Calculator

Municipal responsibility

Municipalities have three options to track phosphorus reductions from street sweeping:

1. Measure dry mass of sweepings **and** either record season swept or measure organic matter content
2. Measure wet mass of sweepings **and** record either season swept **or** report some combination of season swept, organic matter content, and percent moisture
3. Track lane miles swept

How credit is calculated

In the first two scenarios, phosphorus removal is calculated using the following equations:

- *Phosphorus Removed = Dry Mass * Phosphorus Concentration from Mass (mg/kg)*
- *Dry Mass (lb) = Wet Mass (lb) * 100/ (Dry Basis Moisture Content + 100)*

Values for average seasonal percent moisture and phosphorus concentration are taken from University of Minnesota (UNM) study data in Table 1 below. (Note: this is not average P concentration, but rather the 25% percentile P concentration, making this a conservative estimate of P removal.) This reflects the distinct differences in moisture content and

phosphorus concentration the UMN study found in sweepings collected during fall leaf drop and those collected the rest of the year. Fall designation is not month-specific, which allows for reporting of leaf collection whenever leaf drop occurs.

Table 1

Season	Average Percent Moisture	Phosphorus Concentration from Mass (mg/kg)
Fall	0.48	857.0
Non-fall	0.22	413.6

In the last scenario (lane miles swept), phosphorus removal is calculated using this formula:
*Phosphorus Removed = Length Swept * Sweeper Width * Areal Phosphorus Removal*

Sweeper Width is assumed to be 8.5 feet and Areal Phosphorus Removal (APR) is set at 0.00017 pounds per acre per pass. (Note: the APR is set based on the P8 model.) The set APR value was derived from 10 years of simulated street sweeping in a Minnesota community. This method, since it is based on the least informative inputs, is necessarily conservative and will likely result in the smallest amount of credit.

II. New Hampshire Modeling Method for Sweeping & Leaf Collection

Municipal responsibility

Municipalities must track area swept, land use, sweeper type, and sweeping frequency.

How credit is calculated

Under the New Hampshire Enhanced Street/Pavement Cleaning Program, permittees may earn a phosphorus or a nitrogen reduction credit for conducting an enhanced cleaning program of impervious surfaces. The credit is calculated by using the following equations:

- Credit P sweeping (lb/year) = impervious area swept (acres) * P load export rate of land use (lb/acre/year) * P reduction efficiency factor of sweeper type * annual frequency

- Credit N sweeping (lb/year) = impervious area swept (acres) * N load export rate of land use (lb/acre/year) * N reduction efficiency factor of sweeper type * annual frequency

Technology allowed include mechanical broom sweepers, vacuum assisted sweepers, and high-efficiency regenerative air-vacuums. Sweeping frequency can be twice annually (spring & fall), monthly, or weekly.

Under New Hampshire's Enhanced Organic Matter and Leaf Litter Collection Program, permittees may earn phosphorus and nitrogen reduction credits by performing regular gathering, removal, and proper disposal of landscaping wastes, organic debris, and leaf litter from impervious surfaces within applicable watershed areas (i.e., Lake Phosphorus Control Plan area or Great Bay watershed). The permittee may use an enhanced sweeping program (e.g., weekly) as part of earning this credit provided the sweeping is effective at removing leaf litter and organic material. Credit is calculated with these equations:

- Credit P leaf litter (lb/year) = (IA leaf litter acres) * P load export rate of land use (lb/acre/year) * 0.05

- Credit N leaf litter (lb/year) = (IA leaf litter acres) * N load export rate of land use (lb/acre/year) * 0.05

To receive credit, municipalities gather and remove landscaping wastes, organic debris, and leaf litter from impervious roadways and parking lots at least once a week between September 1 and December 1 each year; immediately following any landscaping activities in the applicable watershed and at additional times necessary to ensure removal of all aforementioned materials at least once a week; and ensure disposal of these materials will not contribute pollutants to any surface water discharge. (More information about these credits and calculations are here.)

III. VT Modeling Method for Sweeping*

Municipal Responsibility

Municipalities must track area swept, land use, watershed swept, percent tree canopy cover over sidewalks and streets, presence of curb and gutter, sweeping frequency, and sweeper type.

How credit is calculated

Permittees may earn phosphorus credit for street sweeping of impervious surfaces, calculated with the following formula:

Credit P sweeping (lb/year) = area swept (acres) * P export rate for watershed and land use swept (lb/acre/year) * P reduction factor

This P credit is only valid if the following conditions are met:

- Streets swept have curb and gutter
- Percent tree canopy cover of roads and sidewalks in the area swept is greater than 4%
- Streets are swept at least four times in the fall to pick up leaves

The P reduction factor is prorated based on the percent canopy cover of the area swept and the maximum credit given is 25% for areas with 40-45% canopy cover.

** Vermont is updating their street sweeping credit but has not yet published a final report, this summary is our best understanding of their new guidelines but may not reflect all details.*

IV. Comparison

In order to evaluate the difference between the calculation methods, a comparison was conducted using examples from the MN calculator training. These areas were then modeled according to the current NH crediting approach, outlined in appendix F of the NH MS4 permit.

Results

This exercise demonstrated large differences in pollutant load reduction between the modeled and measured approaches. All modeling results (NH, VT and MN) lead to much lower calculated reductions for total phosphorus. On the low end the measured results lead to 12-30 times more credit then the VT and NH methods respectively. On the upper end the measured results lead to 21-50 times more credit then the VT and NH methods respectively. We will discuss these methods and the differences in load reduction at the February 15 Clean Sweep Expert Panel Meeting.

Example 1 Frequent Sweeping

	Method	Information required for calculation	Sweeper type	Number of times route was swept	Calculated annual P credit (lbs)
Modeled Approach	NH	area swept, type of sweeper, land use, times swept per year	Regenerative air	19	1.32
	VT	area swept, area P export rate, sweeping frequency, canopy cover, curb and gutter, sweeper type	Regenerative air	19	4.50
	MN 3	curb miles	Regenerative air	19	0.02
Measured Approach	MN 1	dry mass of sweepings, percent organic matter of sweepings	Regenerative air	19	31.99
	MN 1	dry mass of sweepings, time of year swept	Regenerative air	19	19.34
	MN 2	wet mass of sweepings, percent organic matter of sweepings, time of year swept	Regenerative air	19	31.28
	MN 2	wet mass of sweepings, time of year swept	Regenerative air	19	19.09

Example 2 Infrequent Sweeping

	Method	Information required for calculation	Sweeper type	Number of times route was swept	Calculated annual P credit (lbs)
Modeled Approach	NH	area swept, type of sweeper, land use, times swept per year	Mechanical/Regenerative (mix)	4	0.41
	VT	area swept, area P export rate, sweeping frequency, canopy cover, curb and gutter, sweeper type	Mechanical/Regenerative (mix)	4	NA
	MN 3	curb miles	Mechanical/Regenerative (mix)	4	0.01
Measured Approach	MN 1	dry mass of sweepings, percent organic matter of sweepings	Mechanical/Regenerative (mix)	4	
	MN 1	dry mass of sweepings, time of year swept	Mechanical/Regenerative (mix)	4	50.14
	MN 2	wet mass of sweepings, percent organic matter of sweepings, time of year swept	Mechanical/Regenerative (mix)	4	
	MN 2	wet mass of sweepings, time of year swept	Mechanical/Regenerative (mix)	4	52.46

Example 1 (top): TP credits from sweeping activities on one 10 mile long, frequently swept sweeper route with 15% canopy cover using all three modeling approaches (New Hampshire's current credit, Vermont's new credit, and Minnesota's option 3) as well as four variations of Minnesota's measured approach.
Example 2 (bottom): TP credit from a less frequently swept 22 mile long sweeper route with 22% canopy cover calculated using the same methods.

Appendix G: Summary of Minnesota's Credit Calculator

Minnesota Street Sweeping Credit Calculator Memo

Updated July, 15, 2022

Why this Memo?

This memo is intended to support the Clean Sweep Expert Panel as they consider the potential application of Minnesota's Street Sweeping Credit Calculator in New Hampshire. It summarizes how credit is allocated according to the state's user guide and this video.

Minnesota municipalities have three options to track phosphorus reductions from street sweeping:

1. Measure dry mass of sweepings **AND** either record season swept or measure organic matter content
2. Measure wet mass of sweepings **AND** record either season swept **OR** report some combination of season swept, organic matter content, and percent moisture
3. Track lane miles swept

In the first two scenarios, phosphorus removed is calculated using the following equations (also see flow chart on page 2):

i) Phosphorus Removed = Dry Mass * Phosphorus Concentration from Mass (mg/kg)

ii) Phosphorus Concentration = 0.044 + 0.0018 * Organic Matter %
Dry Mass = (Wet Mass * 100)/(Dry Basis Moisture Content % + 100)

Values for average percent moisture and phosphorus concentration from mass are taken from University of Minnesota (UNM) studyxx data in Table 1. This reflects the distinct differences in moisture content and phosphorus concentration the UMN study found in sweepings collected during fall leaf drop and sweepings collected during the rest of the year.

Table 1

Season	Dry Basis Moisture Content (%)	Phosphorus Concentration from Mass (mg/kg)
Fall	90.46	857.0
Non-fall	27.76	413.6

- Note the NH adaptation to the MN method uses average seasonal Percent Moisture content converted from the Dry Basis Moisture Content as Percent Moisture content is a more commonly used measure.

The fall designation is flexible rather than month-specific, which allows for reporting of leaf collection whenever the autumn leaf drop occurs.

In the last scenario phosphorus removed is calculated using the formula

Phosphorus Removed = Length Swept x Sweeper Width * Areal Phosphorus Removal

Where Sweeper Width is assumed to be 8.5 feet and Areal Phosphorus Removal (APR) is set at 0.00017 pounds per acre per pass. The set APR value was derived from 10 years of simulated street sweeping in a Minnesota community using the P8 model. This method, since it is based on the least informative inputs, is necessarily conservative and will likely result in the smallest amount of credit.

Appendix H: Summary of New Hampshire's Current Street Sweeping Credit

New Hampshire Enhanced Street/Pavement Cleaning & Leaf Collection Credit Memo Revised *11/1/21*

Why this Memo?

This memo is intended to support deliberations of the Clean Sweep Expert Panel by summarizing how credit is allocated under New Hampshire's Enhanced Street/Pavement Cleaning and Organic Matter and Leaf Litter Collection programs.

Contents

I. Street Sweeping/Pavement Cleaning Program Summary
- A. Factors influencing Credit
- B. Example Credit Calculations
- C. Questions for the Panel

II. Organic Matter & Leaf Litter Collection Program Summary
- A. Factors Influencing Credit
- B. Example Credit Calculations
- C. Associated Street/Pavement Cleaning Credit

III. Tables: 2-1, 2-2, & Consolidated

I. Street Sweeping Credit Program Summary

Under the New Hampshire Enhanced Street/Pavement Cleaning Program, permittees may earn a phosphorus (Table 2-1) or a nitrogen reduction credit (Table 2-2) for conducting an enhanced cleaning program of impervious surfaces. The credit is calculated by using the following equations:

- *Equation 2-1:* Phosphorus Credit P sweeping = IA swept * PLER IC-land use * PRF sweeping * AF
- *Equation 2-2:* Nitrogen Credit N sweeping = IA swept * NLER IC-land use * NRF sweeping * AF

Definition of Terms

- *Credit sweeping:* Amount of nutrient load removed by enhanced sweeping program (lbs/year)
- *IA swept:* Area of impervious surface that is swept under the enhanced sweeping program (acres)
- *PLER IC-land use*: Phosphorus Load Export Rate for impervious cover and specified land use (lb./acre/yr.) (Table 2-1).
- *NLER IC-land use*: Nitrogen Load Export Rate for impervious cover and specified land use (lb./acre/yr.) (Table 2-2).
- *PRF sweeping*: Phosphorus Reduction Factor for sweeping based on sweeper type and frequency (Table 2-4).
- *NRF sweeping:* Nitrogen Reduction Factor for sweeping based on sweeper type and frequency (Table 2-4).
- *AF* = Annual Frequency of sweeping. For example, if sweeping does not occur in Dec/Jan/Feb, the AF would be 9 months /12 months = 0.75. For year-round sweeping, AF=1.01
- *Efficiency:* Ability to decrease the nutrient load export rate

A. Factors Influencing Credit

Type of Technology Used

- Mechanical broom sweepers: An older technology, less costly, generally less effective with regard to dirt removal.
- Vacuum assisted sweepers: Brooms place refuse in the path of a vacuum intake, which transports the dirt to a hopper. Overall efficiency is generally higher than that of mechanical broom sweepers, especially for smaller particles.
- High-efficiency regenerative air-vacuum: The highest efficiency sweeper and the most costly.

Frequency of Sweeping

- Twice annually, in spring and fall
- Monthly: PRF and NFR is reduced by the ratio of # months swept / 12
- Weekly

Impact of Technology & Frequency on Efficiency

Table 2-4: Nutrient reduction efficiency factors for sweeping impervious areas ($PRF_{sweeping}$ & $NRF_{sweeping}$)

Frequency[1]	Sweeper Technology	$PRF_{sweeping}$	$NFR_{sweeping}$
2/year (spring and fall)[2]	Mechanical Broom	0.01	0.01
2/year (spring and fall)[2]	Vacuum Assisted	0.02	0.02
2/year (spring and fall)[2]	High-Efficiency Regenerative Air-Vacuum	0.02	0.02
Monthly	Mechanical Broom	0.03	0.03
Monthly	Vacuum Assisted	0.04	0.04
Monthly	High Efficiency Regenerative Air-Vacuum	0.08	0.08
Weekly	Mechanical Broom	0.05	0.06
Weekly	Vacuum Assisted	0.08	0.07
Weekly	High Efficiency Regenerative Air-Vacuum	0.10	0.10

B. Example Credit Calculations

The following is an example of an application to NH's Enhanced Street/Pavement Cleaning Program for a phosphorus load reduction credit (Credit P sweeping): The permittee proposes an enhanced street/pavement cleaning program, including monthly cleanings from March 1 to December 1 (9 months), using a high efficiency, regenerative air-vacuum assisted sweeper on 20.3 acres of parking lot and roadway in a high-density residential (HDR) area of the Lake Phosphorus Control Plan (LPCP) area. For this site, the information needed to calculate the **phosphorus** load reduction is:

- IA swept = 20.3 acres
- PLER IC-HDR = 2.32 lb./acre/yr. (from Table 2-1)
- PRF sweeping = 0.08 (from Table 2-4 above)
- AF = (9 months / 12 months) = 0.75

Applying these values to equation 2-1 yields a credit of 2.8 pounds of phosphorus removed per year.

IA swept 20.3 acres * PLER IC-HDR 2.32 lbs./acre/yr * PRF sweeping 0.08 * AF 0.75 = Phosphorus Credit P sweeping 2.8 lbs./yr.

In the same LPCP area, the following information is needed to calculate nitrogen load reduction credit:

- IA swept = 20.3 acres
- NLER IC-HDR = 14.1 lb./acre/yr. (from Table 2-2)

- NRF sweeping =0.08 (from Table 2-4)
- AF (9 months / 12 months): 0.75

Applying these values to equation 2-2 yields a credit of 17.2 pounds of nitrogen removed per year.

IA swept 20.3 acres x NLER IC-HDR 14.1 lb./acre/yr. x NRF sweeping .08 x AF 0.75 = Nitrogen Credit N sweeping 17.2 lbs./yr.

C. Questions for the Clean Sweep Expert Panel to Consider

Clean Sweep will engage an Expert Panel to 1) consider whether the NH program (as outlined above) adequately reflects the science on nutrient load reductions associated with street sweeping and 2) make recommendations to update the crediting system based on what they determine. It is important for panelists to understand, for example, the type of data municipalities can realistically collect or whether there is flexibility to adapt the crediting process to consider other factors beyond land use, frequency, and technology type. We hope the panel will consider questions like the following:

- What is flexible with respect to the credit calculation process? E.g.: Could additional or different technologies or frequencies be added? Are there factors used in other states that could be considered? Are sweeping activities, and the current credits associated with them, realistic in winter months in the Northeast?

- Are there areas of the NH Enhanced Street/Pavement Cleaning Program that require clarification and/or would benefit from closer examination from a scientific perspective? E.g.: Should deposition areas be solely related to roadways or parking lots or should they expand to adjacent land use areas? What role should curb lines or sweeping medians play in assigning credit? Should we assume loading rates are consistent and uniform across seasons?

- What units make the most sense to collect from a municipal perspective? E.g.Do municipalities measure sweeping in acres? Are there policies (e.g., parking restrictions to facilitate sweeping) that could be considered in the credit calculation process?

2. Organic Matter and Leaf Litter Collection Program Summary

Under New Hampshire's Enhanced Organic Matter and Leaf Litter Collection Program, permittees may earn phosphorus and nitrogen reduction credits by performing regular gathering, removal and proper disposal of landscaping wastes, organic debris, and leaf litter from impervious surfaces within applicable watershed areas (i.e., Lake Phosphorus Control Plan area or Great Bay watershed). The permittee may use an enhanced sweeping program (e.g., weekly frequency) as part of earning this credit provided the sweeping is effective at removing leaf litter and organic materials. Credit is calculated with the following equations:

- Equation 2-6: Credit P leaf litter (lbs/year) = (IA leaf litter(acres)) x (PLER IC-land use(lb/ac/year)) x (0.05)

- Equation 2-7: Credit N leaf litter (lbs/year) = (IA leaf litter(acres)) x (NLER IC-land use(lb/ac/year)) x (0.05)

Definitions

- *Credit leaf litter*: Amount of nutrient load reduction credit for organic waste and leaf litter collection program (lb. /year)
- *IA leaf litter*: Impervious area (acre) in applicable watersheds that are subject to enhanced organic waste and leaf litter collection program
- *PLER IC-land use*: Phosphorus Load Export Rate for impervious cover and specified land use (lbs./acre/yr.) (see Table 2-1)
- *NLER IC-land use*: Phosphorus Load Export Rate for impervious cover and specified land use (lbs./acre/yr.) (see Table 2-1) 0.05 = 5% nutrient reduction factor for organic waste and leaf litter collection program in the applicable watershed

A. Factors Influencing Credit

- **Frequency & timing:** To receive credit, permittees must gather and remove all landscaping wastes, organic debris, and leaf litter from impervious roadways and parking lots at least once a week between September 1 and December 1 each year.
    - To receive credit, permittees must remove landscaping wastes, organic debris, and leaf litter immediately following any landscaping activities in the applicable watershed and at additional times necessary to ensure removal of all aforementioned materials at least once a week.

- **Disposal:** To receive credit, permittees must ensure that disposal of these materials will not contribute pollutants to any surface water discharges.

B. Example Credit Calculations

The permittee proposes an enhanced sweeping program to address leaf litter collection for 12.5 acres of impervious roadways and parking lots in an industrial/commercial part of an LPCP area. They intend to sweep the parking lots and access drives at a minimum of once a week, using a mechanical broom sweeper for the period of September 1 to December 1. They will ensure that organic materials are removed from impervious areas immediately following all landscaping activities in the area.

For this site, the needed information to calculate the Credit leaf litter for phosphorus is:

- IA leaf litter = 12.5 acres
- PLER IC-commercial = 1.78 lbs./acre/yr. (from Table 2-1)

Applying these values to equation 2-6 yields:
Credit P leaf litter = (12.5 acre) x (1.78 lbs./acre/yr.) x (0.05) = 1.1 lbs. P/yr.

For the same site, the following information is needed to calculate credit for nitrogen:
IA leaf litter = 12.5 acres
NLER IC-commercial = 15.0 lbs/acre/yr (from Table 2-2)

Applying these values to equation 2-7 yields:
Credit N leaf litter =(12.5 acre) x (15.0 lbs./acre/yr.) x (0.05) = 9.4 lbs. N/yr.

C. Associated Street/Pavement Cleaning Credit

The permittee also may earn an additional phosphorus reduction credit for enhanced cleaning of roads and parking lot areas (i.e., Credit P sweeping) for using a mechanical broom sweeper weekly during a three-month leaf litter collection program. Using equation 2-1, Credit P sweeping is:

Credit P sweeping = IA swept x PLER IC-land use x PRF sweeping x AF (Equation 2-1)

- IA swept = 12.5 acre
- PLE IC-commercial = 1.78 lbs./acre/yr. (from Table 2-1)
- PRF sweeping = 0.05 (from Table 2-4) AF = 3 mo./12 mo. = 0.25

Applying these values to equation 2-1 yields a Credit P sweeping of 0.3 pounds of phosphorus removed per year.

Credit P sweeping = IA swept x PLER IC-commercial x PRF sweeping x AF = 12.5 acre x 1.78 lbs./acre/yr. x 0.05 x 0.25 = 0.3 lbs. P/yr.

III. Tables 2-1, 2-2, & Consolidated

Table 2-1: Average annual distinct phosphorus (P) load export rates for use in estimating P load reduction credits in the NH MS4 Permit

Phosphorus Source Category by Land Use	Land Surface Cover	P Load Export Rate, lbs./acre/year	P Load Export Rate, kg/ha/yr.
Commercial (COM) and Industrial (IND)	Directly connected impervious	1.78	2.0
	Pervious	See* DevPERV	See* DevPERV
Multi-Family (MFR) and High-Density Residential (HDR)	Directly connected impervious	2.32	2.6
	Pervious	See* DevPERV	See* DevPERV
Medium -Density Residential (MDR)	Directly connected impervious	1.96	2.2
	Pervious	See* DevPERV	See* DevPERV
Low Density Residential (LDR) - "Rural"	Directly connected impervious	1.52	1.7
	Pervious	See* DevPERV	See* DevPERV
Highway (HWY)	Directly connected impervious	1.34	1.5
	Pervious	See* DevPERV	See* DevPERV
Forest (FOR)	Directly connected impervious	1.52	1.7
	Pervious	0.13	0.13
Open Land (OPEN)	Directly connected impervious	1.52	1.7
	Pervious	See* DevPERV	See* DevPERV
Agriculture (AG)	Directly connected impervious	1.52	1.7
	Pervious	0.45	0.5
*Developed Land Pervious (DevPERV) HSG A	Pervious	0.03	0.03
*Developed Land Pervious (DevPERV) – HSG B	Pervious	0.12	0.13
*Developed Land Pervious (DevPERV) – HSG C	Pervious	0.21	0.24
*Developed Land Pervious (DevPERV) – HSG C/D	Pervious	0.29	0.33
*Developed Land Pervious (DevPERV) – HSG D	Pervious	0.37	0.41

Notes:

- For pervious areas, if the hydrologic soil group (HSG) is known, use the appropriate value from this table. If the HSG is not known, assume HSG C conditions for the phosphorus load export rate.
- Agriculture includes row crops, actively managed hay fields, and pasture lands. Institutional land uses, such as government properties, hospitals and schools, are to be included in the commercial and industrial land use grouping for the purpose of calculating phosphorus loading.
- Impervious surfaces within the forest land use category are typically roadways adjacent to forested pervious areas.

Table 2-2: Average annual distinct nitrogen (N) load export rates for use in estimating N load reduction credits in the NH MS4 Permit

Nitrogen Source Category by Land Use	Land Surface Cover	N Load Export Rate, lbs./acre/year	N Load Export Rate, kg/ha/yr.
Commercial (COM) and Industrial (IND)	Directly connected impervious	15.0	16.9
	Pervious	See* DevPERV	See* DevPERV
All Residential	Directly connected impervious	14.1	15.8
	Pervious	See* DevPERV	See* DevPERV
Highway (HWY)	Directly connected impervious	10.5	11.8
	Pervious	See* DevPERV	See* DevPERV
Forest (FOR)	Directly connected impervious	11.3	12.7
	Pervious	0.5	0.6
Open Land (OPEN)	Directly connected impervious	11.3	12.7
	Pervious	See* DevPERV	See* DevPERV
Agriculture (AG)	Directly connected impervious	11.3	12.7
	Pervious	2.6	2.9
*Developed Land Pervious (DevPERV) HSG A	Pervious	0.3	0.3
*Developed Land Pervious (DevPERV) – HSG B	Pervious	1.2	1.3
*Developed Land Pervious (DevPERV) HSG C	Pervious	2.4	2.7
*Developed Land Pervious (DevPERV) – HSG C/D	Pervious	3.1	3.5
*Developed Land Pervious (DevPERV) – HSG D	Pervious	3.6	4.1

Notes:

- For pervious areas, if the hydrologic soil group (HSG) is known, use the appropriate value from this table. If the HSG is not known, assume HSG C conditions for the phosphorus load export rate.
- Agriculture includes row crops. Actively managed hay fields and pasture lands. Institutional land uses such as government properties, hospitals and schools are to be included in the commercial and industrial land use grouping for the purpose of calculating phosphorus loading.
- Impervious surfaces within the forest land use category are typically roadways adjacent to forested pervious areas.

Consolidated Table

Land Use Code	Description	Pollutant Load Export Rate (lbs/acre/yr)	TSS	TP	TN
	Residential	DCIA (IC)	439.0	1.93	14.1
		Pervious (Non-IC)	see devperv	see devperv	see devperv
	Commercial/Institutional	DCIA (IC)	377.4	1.78	15.1
		Pervious (Non-IC)	see devperv	see devperv	see devperv
	Industrial	DCIA (IC)	377.4	1.78	15.1
		Pervious (Non-IC)	see devperv	see devperv	see devperv
	Transportation	DCIA (IC)	1480.1	1.34	10.2
		Pervious (Non-IC)	see devperv	see devperv	see devperv
	Open Space	DCIA (IC)	649.5	1.52	11.3
		Pervious (Non-IC)	see devperv	see devperv	see devperv
	Agriculture	DCIA (IC)	649.5	1.52	11.3
		Pervious (Non-IC)		1.03	2.6
	Forest	DCIA (IC)	649.5	1.52	11.3
		Pervious (Non-IC)		0.13	0.5
	Surface Water	DCIA (IC)	NA	NA	NA
		Pervious (Non-IC)	NA	NA	NA
	Wetlands	DCIA (IC)	NA	NA	NA
		Pervious (Non-IC)	NA	NA	NA
	Developed Pervious				
	HSG A	Pervious (Non-IC)	6.9	0.03	0.3
	HSG B	Pervious (Non-IC)	29.0	0.12	1.2
	HSG C	Pervious (Non-IC)	59.8	0.21	2.4
	HSG D	Pervious (Non-IC)	91.2	0.37	3.6

Appendix I: Example Credit Calculations

Example 1: Measured Organic Matter Collection Credit

Treesville—a beautiful, but *fictional* New Hampshire town—wanted to receive more credit for its leaf collection activities. Last year, they tracked the mass of material collected by their mechanical broom sweeper. They swept twice, the "minimum" effort, and collected 5,708 lbs of material in the spring and 5,840 lbs in the fall.

To calculate Treesville's credit using the **measured organic matter collection** approach, the following measurements were needed:

- Wet mass of material collected
- Month in which organic matter was collected

The following information was also required to calculate the credits:

- Average percent moisture content (Table 1)
- TN concentration from mass (Table 1)
- TP concentration from mass (Table 1)

Table 1

Season	Average Percent Moisture	TP Concentration from Mass (mg per kg)	TN Concentration from Mass (mg per kg)
Fall (Sept - Dec)	0.48	857	2,762
Non-fall (Jan - Aug)	0.22	414	994

Seasonal TN and TP load reductions are derived from wet mass collected using the factors represented in Table 1. Alternatively, users can calculate their own percent moisture values developed from sub sample analysis from field collections where:

$$\textit{Percent Moisture (\%)} = \frac{Mass\ of\ Water\ in\ Subsample}{Total\ mass\ of\ water\ and\ solids\ in\ subsample} * 100$$

Credit Calculation Steps

Step 1) Calculate the dry mass of material collected in the fall and "non-fall" using Equation 2 and values from Table 1:

Equation 2: $dry\ mass = wet\ mass * (1 - percent\ moisture\ as\ a\ decimal)$

Non fall collected dry mass = $5708lb * (1 - 0.22) = 4500lb$

Fall Collected dry mass = $5840 * (1 - 0.48) = 3000lb$

Step 2) Calculate the TN and TP credit using Equation 1 and values from Table 1:

Equation 1:

$TN\ or\ TP\ credit = dry\ mass\ (lbs) * TN\ or\ TP\ concentration\ (mg/kg) * 10^{-6}$*(kg/mg)*

Non fall TP credit = $4500 * 141 * 10^{-6}$ = 1.8 lbs

To prevent mixing up fall and non fall credit, it is helpful to make a table (Figure 1).

Figure 1: Seasonal Measured Credit Calculations in Different Seasons

Wet mass (lbs)	Time of year collected	Seasonal avg. dry moisture content (%)	Calc. dry mass (lbs)	TN Con (mg/kg)	TP Conc. (mg/kg)	TN Calc. Credit	TP Calc. Credit
Municipality	Municipality	Table 1	Equat. 2	Table 1	Table 1	Equat. 1	Equat. 1
5708	Not Fall	0.22	4500	994	413.6	4.4	1.8
5840	Fall	0.48	3000	2762	857	8.4	2.6
Total						**12.8**	**4.4**

After calculating TN and TP credits for material collected during the fall and the non fall, Treesville would receive credit for 12.8 lbs of TN and 4.4 lbs of TP removed for the year. Note that the credit for TN using this approach is roughly 10 times more than Treesville would have received had they applied the model-based approach with a minimum level of effort. If the town chose to sweep more frequently, particularly in the fall, they could have received more credit.

Example 2: Model-based Street Cleaning Credit

Treesville sweeps their streets twice a year with a mechanical broom sweeper—once in the fall and once in the spring. The sweeper travels 9.5 miles on its route. Since they do not track mass collected, and they only sweep twice a year, they can only pursue the "low effort," model-based street cleaning credit.

To calculate the **modeled** credit, they need the following information:

- Acreage swept by sweeper: Assuming the sweeper clears an 8ft wide path on its 22 mile route it covers 9.2 acres $9.5mi * \frac{5280ft}{mi} * 8ft * \frac{1ac}{43560sq\ ft}$
- Type of sweeper: mechanical broom, therefore the sweeper PRF/NRF is 0.01 (Table 3)
- TP land export rate: 1.96 lb/ac/yr (Table 3)
- TN land export rate: 14.1 lb/ac/yr (from Table 3)

Table 3: Updated Parameters for New Hampshire's Model-based Credit for Street Cleaning

Parameter	Minimum Effort	Medium effort	Maximum Effort
Frequency	Up to twice per year in any season. NRF/PRF = 0.01 for mechanical sweeper and 0.02 for vacuum.	Every other week in the fall (September to December). NRF/PRF = 0.15	Monthly routine maintenance with more intensive (weekly) in Fall (September. to December.) and early spring. NRF/PRF = 0.25 with enhanced leaf collection. Assumes a vacuum sweeper (defined above), but may be combined with other efforts.
Location & seasonality	**To accommodate seasonal increases in TN and TP and simplify the location parameter:** 3) Use the medium density residential IC land use, which integrates the most conservative TP and TN loading rates of all land uses in the current model. 4) For intensive weekly sweeping during the fall in times of high organic material deposition, offer a 10% additional removal factor. This is a 5% increase over the existing enhanced leaf collection credit in the current model and better reflects removals in recent literature. (This is synonymous with maximum effort.)		

Credit Calculation Steps

Step 1) Calculate area swept:

$$Area\ swept\ (acres) = lane\ miles\ swept * \frac{5280\ ft}{mi} * \frac{1\ acre}{43560\ sq\ ft}$$

Step 2) Calculate TP credit using Equation 3:

Equation 3: Credit TP = area swept * TP load export rate * TP reduction factor (PRF) of sweeper type.

TP credit = $9.2ac * 0.01 * \frac{1.96lbs}{ac \cdot yr} = \frac{0.18lbs}{yr}$

Step 2) Calculate annual TN credit using Equation 4:

Equation 4: Credit TN = area swept * TN load export rate * TN reduction factor (PRF) of sweeper type.

TN credit = $9.2ac * 0.01 * \frac{41.1lbs}{ac \cdot yr} = \frac{1.3lbs}{yr}$

Example 3: Comparison of Different Levels of Effort for Model-based Street Cleaning Credits

Figure 2 compares credit received by applying the model-based street cleaning approach in three towns using different levels of effort.

Figure 2: Model Credit Calculations for Towns Using Different Levels of Effort

Modeled Inputs (from Permittee)			**Credit Calculation**					
	lane miles	**times swept**	**area swept (ac)**	**TN export rate lb/ac/yr**	**TP export rate lb/ac/yr**	**PRF/NRF**	**TN CREDIT lbs/yr**	**TP CREDIT lbs/yr**
				Table 3	Table 3	Table 3	Equation 4	Equation 3
Minimum Effort Town	9.5	twice	9.21	14.1	1.96	0.01	**1.3**	**0.18**
Medium Effort Town	9.5	6 times in fall	9.21	14.1	1.96	0.15	**19**	**2.7**
Maximum Effort Town	9.5	more than monthly	9.21	14.1	1.96	0.25	**32**	**4.5**

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region 1
5 Post Office Square
BOSTON, MA 02109-3912

August 15, 2022

James Houle, Director
University of New Hampshire Stormwater Center
West Edge Lot, NW Corner
Durham, NH 03824
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RE: EPA Support on 2021-2022 Clean Sweep Panel Process Results for Adaptive Management Plans for the Great Bay Total Nitrogen General Permit

EPA Region 1 (R1) commends the University of New Hampshire Stormwater Center and Piscataqua Region Estuaries Partnership for a successful Clean Sweep Panel process for developing enhanced and updated street sweeping credits for municipalities. The panel process has again demonstrated an excellent model for leveraging both regional and national subject matter experts on a specific topic for developing new approaches for stormwater management backed by the latest research.

The Clean Sweep Panel developed two alternative options for obtaining pollution reduction credits for street cleaning. Through the first option, permittees could receive credit by measuring the amount of organic matter collected throughout the year—an approach pioneered in Minnesota (Minnesota Pollution Control Agency 2022). The second option would allow permittees to use an updated version of the model that specifies New Hampshire's current Enhanced Street/Pavement Cleaning Program credits. This would offer credit for municipal sweeping efforts depending on the technology used, frequency of cleaning, seasonality, and location.

The Great Bay Total Nitrogen General Permit in New Hampshire represents adaptive implementation opportunities for broadening the use of non-structural nitrogen control credits. EPA looks forward to implementation of the two alternative options developed by the panel for obtaining credit for street cleaning under the adaptive management plans adopted by Great Bay permitted municipalities. The Great Bay municipalities with adaptive management plans could use either option to receive credit, but not both, within a single reporting year. EPA R1, through this communication, supports the use of these alternative methods.

The piloting of these methods will provide insight and adaptive improvement of the new credits and offer opportunities to validate the approaches for future use throughout New England. Information gained during the piloting of the new credits could allow EPA R1 to integrate these

credits, or an iteration of these credits, into the next New Hampshire and Massachusetts Small MS4 General Permits. Overall, enhanced street sweeping credits will hopefully incentivize municipalities to modernize street sweeping programs throughout the Great Bay watershed and help make progress towards pollution reductions in Great Bay. We look forward to continued collaboration and analysis of the pilot's results.

Sincerely,

Melville P. Coté, Jr., Chief
Surface Water Protection Branch
Water Division

cc: Abigail Lyon, Region Estuaries Partnership—Via Email
Sally Soule, New Hampshire Department of Environmental Services—Via Email

Appendix K: Ground Truthing Minnesota Data for New Hampshire, an Addendum to the Clean Sweep Technical Memo

April 21, 2023

Contents

1. Summary
2. Pilot results: Option 1: Organic Matter Collection Credit (Measured Approach)
3. Pilot results: Option 2: Updated Street Cleaning Credit (Model-Based Approach)
4. Sweeping and Structural BMP Cost Comparison

1. Summary

In *Clean Sweep: Recommendations for New and Updated Credits for Street Cleaning in New Hampshire,* an expert panel recommended updating the state's model-based street/pavement cleaning credit and creating a new, "measured" option that offers credit for the amount of organic matter collected. This addendum summarizes a pilot study conducted by the University of New Hampshire (UNH) Stormwater Center to provide local data to ground truth the utility of the panel's recommendations.

Overall, the pilot's results supported the adoption of Minnesota's street sweeping nutrient and moisture content values in New Hampshire and provided promising preliminary results for a volume-based credit. This effort was made possible with support from the Piscataqua Region Estuaries Partnership, the Town of Durham, the City of Dover, and UNH's Facilities Division.

2. Option 1: Organic Matter Collection Credit (Measured Approach)

To receive the proposed credit, communities first track the mass of sweepings and time of year they are collected. Then, to determine pounds of Total Phosphorus (TP) and Total Nitrogen (TN) removed, they use a series of conversion factors based on moisture and nutrient content typical for organic matter in that season. These conversion factors are based on the street sweeping credit recently adopted by Minnesota. That credit is based on a rigorous study in the Minneapolis/St. Paul Metropolitan Area, conducted by the University of Minnesota and the Minnesota Pollution Control Agency.

The Minnesota credit (and the ones proposed for New Hampshire) rely on three conversion factors from the Minnesota study: average moisture content, and TP and TN concentrations. Each of these have two values depending on whether the material was collected in the fall or during the rest of the year (Table 1).

Table 1: MInnesota-based Conversion Factors			
Season	**Average Moisture Content**	**TP Concentration from Mass (mg/kg)**	**TN Concentration from Mass (mg/kg)**
Fall (Sept to Dec)	0.48	857	2,762
Non-fall (Jan to Aug)	0.22	414	994

Since these conversion factors are based on research conducted in Minnesota, the Clean Sweep expert panel recommended a study to assess whether moisture content and TP and TN concentrations in New Hampshire are comparable. In response, the UNH Stormwater Center ground truthed the Minnesota conversion factors using local data. As a secondary aim, they tried to establish average bulk density by looking at the relationship between measured mass and measured volume. This analysis was based on subsamples from 27 sweeper loads provided by the City of Dover, which did ten intensive days of sweeping in the fall of 2022 (Table 2).

Table 2: Sample Collection in Partnership with Dover				
Days	**Sweeper Man Hours**	**Estimated Cubic Yards Collected**	**Measured Wet Weight Collected (lbs)**	**Subsamples Analyzed**
10	144	228	83,520	27

Samples were analyzed for TP, TN, and moisture content. The results, and the corresponding values from the Minnesota study, are shown in Table 3, with first quartile results for the TP and TN concentrations. (Minnesota's credit uses the first quartile of the TP dataset, which their study found to be conservative, a conclusion supported by the Clean Sweep expert panel.)

Table 3: Analysis of New Hampshire Samples			
	Average Percent Moisture Content	**TP concentration from mass (mg/kg)**	**TN concentration from mass (mg/kg)**
MN data (fall)	48%	857*	2,762*
Dover data (fall)	42%	1,003*	2,900*
			* first quartile

The moisture content and TP and TN concentrations of the New Hampshire samples were similar to Minnesota values. While the study only looked at fall sweepings, its results do not raise concerns that New Hampshire values would differ greatly from those in Minnesota. For further confirmation, a similar study could be repeated in the spring or summer.

To support the secondary aim of the study, the UNH Stormwater Center team also analyzed sweeper subsamples for wet and dry bulk density. (The volume of material in the hopper was estimated before weighing.) Using hopper volume and wet bulk density, the research team calculated hopper mass and plotted that against the measured hopper mass. (See Figure 1.)

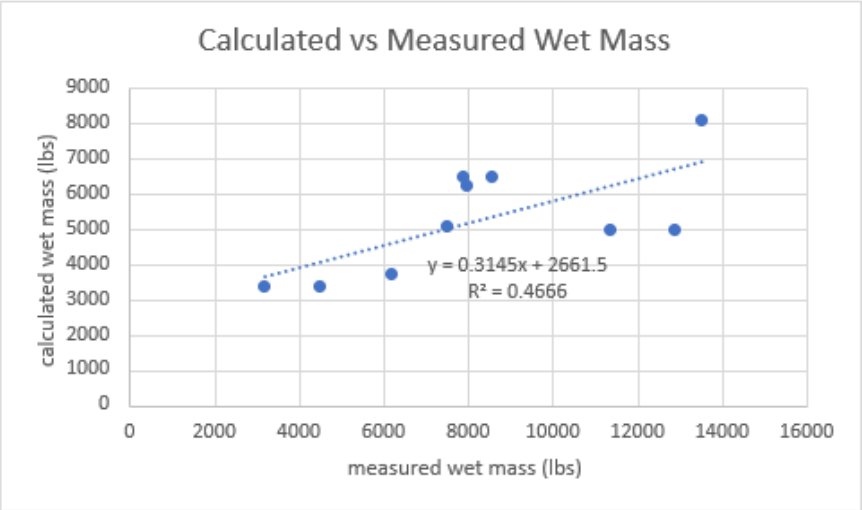

Figure 1: Calculating the Wet Mass

The relationship between calculated and measured wet mass is not perfect, but reasonable, given the variability of environmental data. While the measured credit currently could be applied now using mass, additional research to explore the relationship between mass and volume may allow the credit to be calculated from sweeping volume. Given that many communities are not able to measure mass of sweepings easily, an option based on volume would greatly expand the usability of the new credit. While not the focus of this study, the Measured Approach gives substantially more credit than the current sweeping credit and better reflects the latest research on the effectiveness of organic matter cleanup (Table 4).

Table 4. Estimated Credit for Measured Approach, Based on Pilot

Wet Mass Collected (lbs)	Season	Area Swept (ac)	% Moisture	Dry Weight (lbs)	TP conc from mass (mg/kg)	TP removed (lbs)	TN conc from mass (mg/kg)	TN removed (lbs)
4480	Fall	0.76	0.48	2330	857	2.0	2762	6.4
11340	Fall	1.10	0.48	5897	857	5.1	2762	16.3
12900	Fall	0.73	0.48	6708	857	5.7	2762	18.5
13520	Fall	1.31	0.48	7030	857	6.0	2762	19.4
7960	Fall	0.82	0.48	4139	857	3.5	2762	11.4
7500	Fall	0.82	0.48	3900	857	3.3	2762	10.8
3200	Fall	0.67	0.48	1664	857	1.4	2762	4.6
7900	Fall	2.12	0.48	4108	857	3.5	2762	11.3
8540	Fall	2.78	0.48	4441	857	3.8	2762	12.3
6180	Fall	2.15	0.48	3214	857	2.8	2762	8.9
Totals 83520		13.27		43430		**37.2**		**120.0**

Option 2: Updated Street Cleaning Credit (Model-Based Approach)

New Hampshire's current street sweeping regulations require communities to track multiple parameters, are inflexible around sweeping timing, and provide relatively little credit. That credit is determined by a model that requires inputs of sweeper type, land use, area swept, and annual frequency of sweeping. Tracking miles swept in each land use area is not always simple given that one route may pass through different land uses. Further, the annual frequency of sweeping is based on the number of months of sweeping, which makes it difficult to determine credit for intensive or intermittent sweeping. To qualify for additional credit for enhanced organic matter collection, communities must sweep at least weekly from September to December, even after leaf and organic matter collection activities are complete.

The revised credit proposed by the Clean Sweep expert panel simplifies the current model and only requires tracking of lane miles and frequency. Other parameters are determined by fitting a sweeping program into three categories of effort: minimal, medium, and maximum (Table 5).

Table 5: Updated Parameters for New Hampshire's Model-based Credit for Street Sweeping

Parameter	Minimum Effort	Medium Effort	Maximum Effort
Frequency	Up to 2 times per year in any season. NRF/PRF* = 0.01 for a mechanical sweeper and 0.02 for a vacuum.	Every other week in the fall (Sept. to Dec.). NRF/PRF = 0.15	Monthly routine maintenance with more intensive (weekly) in Fall (Sept. to Dec.) and early spring. NRF/PRF = 0.25 with enhanced leaf collection. Assumes a vacuum sweeper (defined above), but may be combined with other efforts.
Location and seasonality	To accommodate seasonal increases in TN and TP and simplify the location parameter: 1) Use medium density residential impervious cover land use, which integrates the majority of likely land uses. 2) For intensive (weekly) fall sweeping in times of high organic material deposition (leaf fall), offer a 10% additional removal factor. This is a 5% increase over the enhanced leaf collection credit in the current model and better reflects removals in the recent literature. (Synonymous with maximum effort.)		

The UNH Stormwater analysis was primarily concerned with ground truthing the proposed measured credit, but also tracked lane miles swept. This made it possible to calculate the annual sweeping credit with both the current and proposed model (Table 6). Since Dover did not track land use along all sweeper routes, it was necessary to assume a medium density residential land use. Also, since their intensive sweeping was in the fall, the annual frequency is two out of 12 months of the year.

The updated model gives substantially more credit for the same effort and better reflects the latest research on the effectiveness of organic matter cleanup. It is also a better fit for the metrics tracked by municipalities and the current sweeping practices.

Table 6: 2022 Dover Sweeping Example									
	Lane Miles	**Impervious area (acres)**	**Annual Frequency**	**PRF***	**PLER * (lb/ac/yr)**	**NRF***	**NLER * (lb/ac/yr)**	**TP credit (lb/yr)**	**TN credit (lb/yr)**
Old Model	13.68	13.27	0.17	0.01	1.96	0.01	14.1	**0.04**	**0.31**
New Model	13.68	13.27	NA	0.15	1.96	0.15	14.1	**3.9**	**28.06**

*__NLER IC-land use__: Nitrogen (TN) Load Export Rate for impervious cover and specified land use (lb/acre/yr)

__PLER IC-land use__: Phosphorus (TP) Load Export Rate for impervious cover and specified land use (lb/acre/yr).

__NRF sweeping:__ Nitrogen (TN) Reduction Factor for sweeping based on sweeper type and frequency.

__PRF sweeping__: Phosphorus (TP) Reduction Factor for sweeping based on sweeper type and frequency

4. Sweeping and Structural BMP Cost Comparison

The UNH Stormwater Center team compared City of Dover cost figures, recorded during the pilot sweeping study, to cost estimates for structural stormwater control measures built into the UNH BMP Performance Calculator (Table 7). For this comparison, structural BMPs were sized to treat a one-inch storm, and costs of both sweeping and structural BMPs were normalized to one acre of impervious area.

There are many factors that affect costs, and this estimate does not take into account the costs of sweeping equipment or ongoing maintenance on structural BMPs. However, it does indicate that sweeping can be a cost effective option for reducing TN and TP pollution in watersheds.

Table 7: Cost Comparison

Treatment	TP reduced (lb/ac/year)	TN reduced (lb/ac/year)	Estimated Cost	$/lb TP	$/lb TN
Fall Sweeping (Measured)	2.8	9.0	$2,300	$820	$260
Fall Sweeping (Modeled)	0.3	2.8	$2,300	$7,700	$820
Biofiltration	1.0	4.5	$135,000	$140,000	$30,000
Bioretention	1.9	14.1	$135,000	$71,000	$10,000
Enhanced Biofiltration	1.5	10.6	$136,000	$91,000	$13,000
Dry Detention Basin	0.4	1.8	$59,000	$150,000	$33,000
Gravel Wetland	1.2	9.6	$77,000	$64,000	$8,000
Infiltration Trench	1.9	14.0	$109,000	$57,000	$7,800
Sand Filter	1.0	4.5	$156,000	$160,000	$35,000
Surface Infiltration	1.9	14.1	$55,000	$29,000	$3,900
Water Quality Grass Swale	0.4	1.8	$49,000	$120,000	$27,000
Wet Pond	1.0	4.5	$59,000	$59,000	$13,000

*Structural SCMs sized to treat the 1" storm and assume a 1"/hr infiltration rate where applicable, cost multiplier=2, 2023 dollars

APPENDIX D: EXISTING STRUCTURAL CONTROLS

Existing Municipal Structural Control Credit Calculations

Existing Municipal Structural Control Credit Calculations

Non-Residential Projects												
Date	Parcel ID	Address	Facility	Land Use	BMP Type	Soil Infiltration Rate (in/hr)	Impervious Drainage Area (AC)	Pervious Drainage Area (AC)	Pervious Drainage Area Soil Type	TP Removed (lbs/year)	Total Reduction/ Property	BMP Storage Volume (cf)
Municipal												
7/29/2015	54013 0003	30 Beethoven Ave	Frank Zervas Elementary School	Commercial	Bio-filtration Practice	0.27	0.227	0.18	C	0.39	0.96	2,096
					Bio-filtration Practice	0.27	0.245	0.15	C	0.24		343
					Porous Pavement	-	0.300	-	-	0.33		-
5/27/2014	55010 0056	1697 Beacon Street	Angier Elementary School	Commercial	Infiltration Chambers	8.27	0.681	-	A	1.21	3.27	4,989
					Infiltration Chambers	8.27	1.158	-	A	2.06		10,469
3/6/2017	22008 0008	229 Cabot Street	Cabot Elementary School	Commercial	Infiltration Chambers	2.41	0.338	0.16	A	0.60	0.82	3,211
					Porous Pavement	-	0.031	-	-	0.03		-
					Bio-filtration Practice	2.41	0.089	0.03	A	0.07		162
					Bio-filtration Practice	2.41	0.110	-	A	0.08		200
					Bio-filtration Practice	2.41	0.060	-	A	0.04		109
4/20/2012	21022 0002	21 Minot Place	F.A. Day Middle School	Commercial	Infiltration Trench	8.27	0.109	-	A	0.19	0.19	447
4/29/2008	24018 0001	457 Walnut Street	Newton North High School	Commercial	Infiltration Trench	1.02	5.518	3.42	B	10.18	10.18	36,750
6/20/2001	81051 0047	140 Brandeis Rd.	Newton South High School	Commercial	Infiltration Basin	0.17	1.500	-	C	1.34	1.34	1,026
6/13/2019	23001 0020	225 Nevada Street	Carr School/Horace Mann Elementary	Commercial	Infiltration Basin	8.27	0.085	0.02	A	0.14	0.14	212
1/26/2015	61032 0002	25 Willow Street	Fire Station #3	Commercial	Infiltration Trenches (2)	0.27	0.897	0.24	C	1.42	1.49	2,657
					Porous Pavement	0.27	0.067	-	-	0.07		-
11/6/2013	84033 0003	755 Dedham Street	Fire Station #10	Commercial	Infiltration Basin	2.41	0.101	0.36	A	0.19	1.05	432
				Commercial	Infiltration Basin	2.41	0.490	-	A	0.86		3,610
7/10/2019	34037 0021	125 Derby Street	Franklin School	Commercial	Infiltration Trench	0.17	0.117	0.04	C	0.20	0.20	2,430
9/18/2016	51001 0012	391 Elliot Street	Next to Elliot St Bridge	Commercial	Drywell	0.09	0.071	-	B	0.15	0.15	780
4/27/2021	64003 0005	330 Homer Street	Newton Free Library	Commerical	Infiltration Trench	2.41	1.542	0.278	A	2.08	2.42	1,996
					Porous Pavement	2.41	0.251	-	-	0.34		-
2/25/2020	21022 0001A	687 Watertown Street	Early Childhood Program	Commercial	Infiltration Chambers	0.52	0.131	0.022	-	0.23	0.23	765
-	62001 0001	30 Rogers Street	Crystal Lake Bath House	Medium Density Residential	Infiltration Chambers	2.41	0.367	-	A	0.60	0.60	600
10/22/2021	ROW	Chestnut Street Parking	Upper Falls Greenway at Oak Street	Right-of-Way	Porous Pavement	-	0.126	-	-	0.15	0.15	-
Pending Installation	12003 0004AQ	150 Jackson Road	Lincoln-Eliot Elementary School	Commercial	Porous Pavement	2.41	0.160	0.13	A	0.18	2.69	-
					Infiltration Chambers	2.41	1.349	0.637	A	2.39		13,713
					Bioretention Basin 1	2.41	0.270	0.45	A	0.12		130
					Bioretention Basin 2	2.41	0.040	0.2	A	-		1,432
										Total Credit:	**25.88**	

APPENDIX E: PLANNED STRUCTURAL CONTROLS

Planned Structural SCM Evaluation Memorandum

- Attachment 1: Resources, Assumptions, and Limitations Table
- Attachment 2: Roadway Concepts
- Attachment 3: Roadway Concepts Calculations
- Attachment 4: Alternatives Analysis Calculations

Prioritized Parcel Opportunity Report Sheets

Pursuable Parcel Opportunity Report Sheets

Not Currently Pursuable Parcel Opportunity Report Sheets

Prioritized Roadway Opportunity Report Sheets

Not Currently Pursuable Roadway Opportunity Report Sheets

Planned Structural SCM Evaluation Memorandum

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MEMORANDUM

PROJECT: Newton, MA Phosphorus Control Plan

PROJECT NUMBER: 0233351.00

DATE: June 2023

SUBJECT: Planned Structural SCM Evaluation Memorandum

Woodard & Curran completed a preliminary evaluation to determine if the City of Newton (the City) could achieve its required load reduction for Permit Years 10, 15, and 20 solely on municipal property. The evaluation found that City property does not generate enough total phosphorus (TP) load to meet required reductions, even if 100% of the City's generated load was eliminated. Phosphorus generated through City properties (parcels and roadways) only generates approximately half of the YR 20 load reduction requirement. Therefore, to meet their required load reductions, the City will need to consider a variety of strategies such as accounting for existing private stormwater control measures (SCMs), requiring new private SCMs through redevelopment or other measures if crediting policies change.

Though the City is unable to ultimately meet the required load reductions solely though phosphorus management of City controlled land, management opportunities within City land is the primary focus of load reduction for the Phase 1 Plan since this management strategy is solely within the City's control. This memorandum outlines the Phase 1 strategies which focus on implementing new SCMs on municipal parcels and roadways.

1.0 Parcels

Woodard & Curran assessed each of the four hundred thirty (430) municipally owned parcels for SCM retrofit potential. Each municipal parcel was assessed for SCM retrofit opportunity to treat stormwater runoff generated on the parcel (on-site) and stormwater runoff from surrounding areas discharging onto or near the parcel (off-site). SCMs treating off-site runoff that discharges onto or near municipal parcels via the City's existing closed conduit drainage system were considered regional retrofits. The following sections describe the opportunity identification process, TP treatment and credit calculations, and prioritization of opportunities to meet the City's Phase 1 load reduction requirement. After the parcels analyses were completed, the opportunities were categorized. Three lists of categorized opportunities and calculations were developed: prioritized for Phase 1 implementation, pursuable for future consideration, and not currently pursuable. Descriptive opportunity report sheets for the three category lists can be found in Appendix E of the Phase 1 Phosphorus Control Plan (PCP).

1.1 Opportunity Identification

The City's four hundred thirty (430) municipal properties were assessed for both on-site and regional retrofit opportunities using the iterative process of considerations and decisions shown in the Logic Flow Chart, Figure 1 and outlined below.

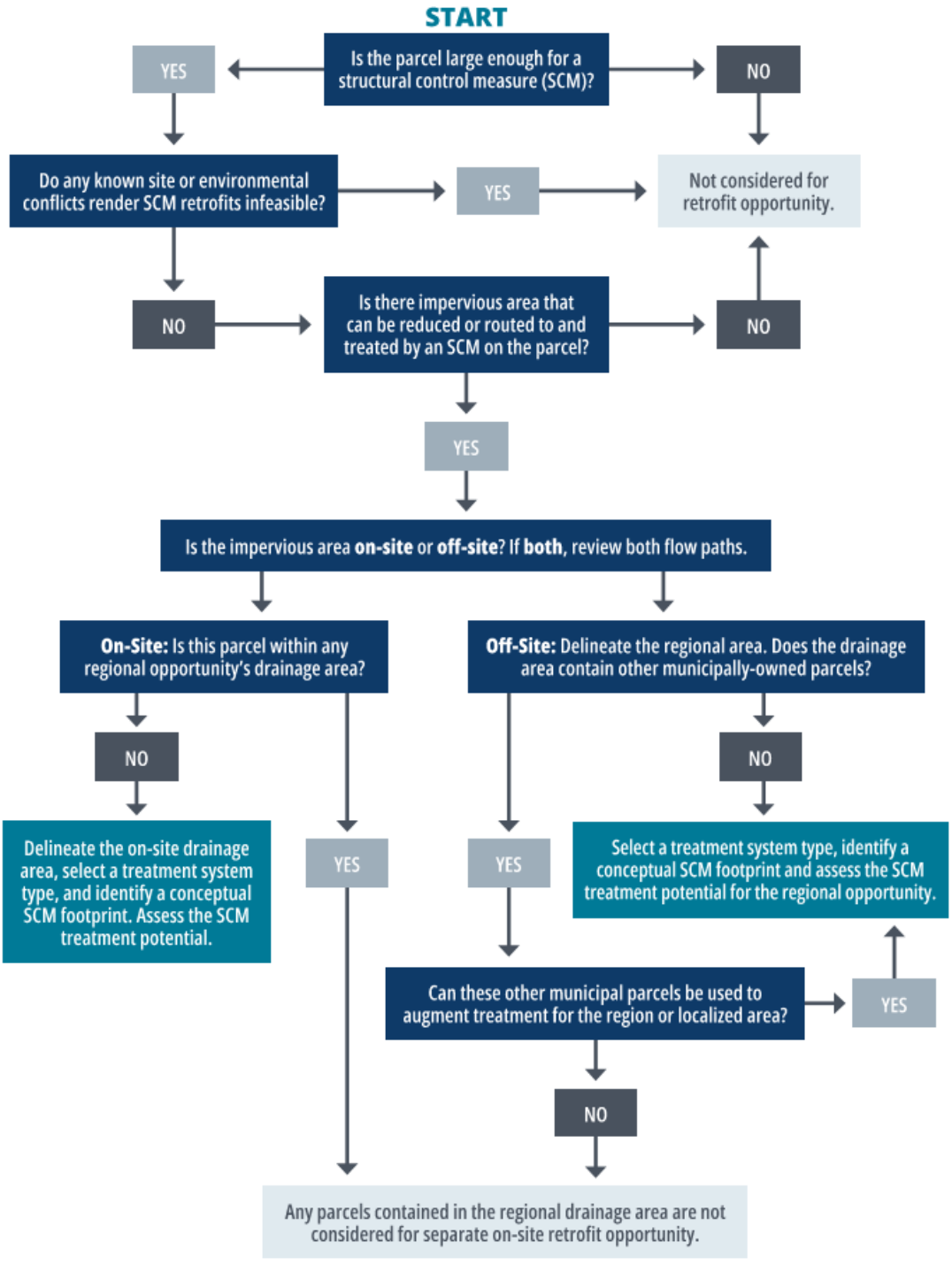

Figure 1: Logic Flow Chart

The opportunity identification steps were as follows:

1. Space: The parcel was first visually assessed using GIS mapped parcel boundaries and aerial/photo imagery to evaluate if there was adequate space to site an SCM. This was a subjective decision based on engineering judgement. If the parcel did not appear to have sufficient space, such as a narrow strip of land constrained between other properties, it was not considered further for retrofit opportunity.

2. Site and Environmental Conflicts: Conflicts that could restrict SCM retrofits were identified using available GIS data, Google Street View, aerial imagery, and property as-builts provided by the City (as available). Potential site conflicts evaluated included utilities, unsuitable topography, accessibility, setbacks, land use protections, and existing SCMs. Environmental resource areas were also assessed, including streams, wetlands, flood zones, outstanding resource areas, and public water supply zones. Assessment of environmental resources was performed using MA GIS data. Depth to groundwater was not considered an environmental conflict that would prevent retrofitting, but it was considered later in the assessment. Parcels with site or environmental conflicts that could render retrofitting infeasible were not considered further.

3. Treatment Potential (On-site and Off-site): Undeveloped parcels with no on-site impervious area or no divertible off-site impervious area were not evaluated further. Regional retrofits were identified by evaluating existing drainage infrastructure. Topography was the determining factor used to assess diversion and treatment feasibility, as existing stormwater system invert information is limited with varying datums. When a parcel was identified to be viable for a regional opportunity, the regional catchment area was delineated in GIS. If multiple regional opportunities were identified as nested within the same larger regional catchment area, the catchment area was broken out into multiple smaller retrofit opportunities to treat runoff closer to its source. Some small regional areas were not broken out if they did not significantly reduce the contributing area to the larger downstream opportunity.

   Parcels with viable regional opportunities were also considered for additional on-site opportunities if on-site impervious area was outside the regional catchment area. Parcels with no regional opportunities were considered only for on-site opportunities. Multiple on-site opportunities were evaluated within a single parcel, depending on the amount of on-site impervious area and site topography. On-site catchment areas were also delineated in GIS.

This process resulted in a list of municipal parcels with either on-site SCM opportunities, regional SCM opportunities, or both. Of the 430 City-owned parcels, retrofit opportunities were deemed to be feasible at 111 parcels. These parcels were then further analyzed to select the most effective SCM type and location to maximize the TP load reduction potential. Infiltration SCMs are preferred because they have the highest TP removal efficiencies as noted in the performance curves provided in Attachment 3 of the MS4 Permit Appendix F.

The NRCS Web Soil Survey and the Nation Groundwater Monitoring Network provided limited groundwater information to reference. Since groundwater reference material was limited, infiltration SCM feasibility was based on site plans from nearby projects and City input based

on knowledge of the area, as available. When no groundwater information was available, SCM infiltration feasibility was assumed based on assessment of vertical and horizontal separation from waterbodies. Biofiltration and gravel/constructed wetlands were considered at locations adjacent to waterbodies where groundwater is a known concern.

A list of resources and datasets, how each was used, and associated limitations and assumptions is included as Attachment 1.

1.1.1 Load Reduction Calculations

The following procedure was used to estimate potential load reduction for each identified retrofit opportunity:

1. Generated Load: The generated TP load was estimated using the delineated catchment areas for each retrofit opportunity in conjunction with the baseline phosphorus load methodology from Attachment 1 to Appendix F in the MS4 General Permit. The MassGIS 2016 Land Use/Cover dataset was used to sort the total catchment area into land use and cover categories. The generated TP load in pounds per year was calculated for each land use group by multiplying the land areas by their respective phosphorus load export rate (PLER), and the total generated load for the catchment was estimated by summing the land use loads.

2. SCM Size:

    a. SCM footprints were sized to provide the maximum feasible runoff treatment depth up to one inch. Considering site constraints and conflicts, the footprints were delineated in Google Earth Pro. The hydrologic soil groups (HSGs) within the SCM footprints were recorded for subsequent TP load reduction calculations.

    b. The SCM water quality volume was used for sizing and treatment calculations as it is the static volume of water that is physically stored within the SCM and treated to credit TP reductions. This volume is stored as ponding, filled filtering media void space, or both depending on the SCM type. The SCM water quality volume was calculated by multiplying the SCM footprint by an average water storage depth, provided in Table 1 below. These average depth estimates were calculated to efficiently estimate the potential water quality volume for these planning-level concepts.

        The estimates were calculated using the MA Stormwater Handbook, manufacturer recommendations and previous design examples for typical SCM configurations, depths, and materials. The vertical storage depth was calculated to account for ponding and media void space as necessary.

Table 1: SCM Average Storage Depth

SCM Type	Calculation	Vertical Storage Depth (ft)
Infiltration Trench	3ft standard depth x 40% stone porosity	1.2
Infiltration Chamber	Based on HydroCAD models	2
Infiltration Basin	4ft ponding depth	4
Porous Pavement	Sum of thickness of layers	Depth Varies
Bio-Filtration/Retention	0.75ft ponding depth + (2ft subsurface storage x 40% stone porosity)	1.55
Enhanced Bioretention with ISR	0.75ft ponding depth + (2ft subsurface storage x 40% stone porosity)	1.55
Gravel/Constructed Wetland	2ft ponding depth	2
Sand Filter	0.75ft ponding depth + (2ft subsurface storage x 40% stone porosity)	1.55
Wet Pond	3ft ponding depth	3
Dry Pond	2ft ponding depth	2
WQ Grass Swale	1ft ponding depth + (2ft subsurface storage x 40% stone porosity)	1.8

HydroCAD modeling software was used to generate models for some of the larger chamber system opportunities to provide more precise volume estimates, since these systems are major contributors to the overall phosphorous reductions.

c. The treated runoff depth was calculated by dividing the SCM volume by the catchment's contributing impervious area. Typically, rainfall treatment depth and SCM reduction efficiency is calculated considering both previous and impervious land cover. This can be done using EPA's BMP Accounting and Tracking Tool (BATT). However, to efficiently complete this planning exercise, only the impervious area was considered rather than running BATT for every opportunity identified. This approach was compared to the BATT calculation for a sample of opportunities ranging in size and land uses to understand the magnitude of treatment depth and SCM reduction efficiency discrepancies. The margin of error between both methodologies, for the sample SCMs compared, was not significant enough to warrant using BATT for every opportunity for this planning level analysis.

   The treated runoff depth was capped at one inch because SCM treatment efficiency plateaus beyond one inch and the cost-benefit ratio increases.

3. TP Load Reduction: The SCM's type, treated runoff depth, and HSG were used to estimate its TP reduction efficiency per Attachment 3 to Appendix F of the MS4 General Permit. The SCM performance curves provide reduction efficiencies for 0.1, 0.2, 0.4, 0.6, 0.8, 1.0, 1.5, and 2.0 inches of treatment depth. The reduction efficiencies were interpolated from 0.1 to 1.0 inches in increments of 0.05 inches to increase dataset

resolution. Calculated treated runoff depth values were rounded down to the nearest 0.05 inch to match the interpolation intervals. The TP reduction potential for each retrofit opportunity was estimated by multiplying the SCM TP reduction efficiency by the generated TP load.

1.1.2 Prioritization

Once feasible City-owned parcel opportunities were identified, three categories were developed and associated lists ordered from highest to lowest TP reduction potential:

1. Opportunities identified which have been prioritized for possible implementation and crediting towards the Phase 1 Permit Year 10 TP reduction requirement: Prioritized Opportunities.

2. Opportunities identified which are considered pursuable for future consideration beyond Phase 1: Pursuable Opportunities.

3. Opportunities identified which are not currently considered pursuable but remain for future potential consideration in subsequent permit phases: Not Currently Pursuable Opportunities.

Prioritized Opportunities

The prioritized list of opportunities was developed using the City's Capital Improvement Plan[1] (CIP) for fiscal years 2024 through 2028. The CIP includes a list of planned projects (215 total) to be implemented within the Phase 1 Permit period. Pursuable opportunities were compared to the list of CIP projects. If the identified retrofit opportunity could be reasonably aligned with the work outlined in the CIP, the opportunity was selected for Phase 1 prioritization. The quality of alignment varied as some projects involved excavation for utilities where the SCM opportunities were ideal additions to the planned project work while others involved minimal disturbances where the addition of an SCM was less optimal but provides efficiency and minimizes local construction impacts.

Additional aspects were considered when opportunities were reviewed for Phase 1 prioritization including opportunities for multi-benefit projects, areas with historical flooding, City feedback, cost-benefit, and feasibility. Excerpts from the City's Climate Vulnerability Assessment were utilized to assess if any opportunities were in an area of documented local flooding or flood damage. The relation to flooding was noted and considered for a multi-benefit opportunity, but it was not considered a primary identifier of prioritization. Lastly, effective opportunities with a favorable cost-benefit were included in the prioritized list. Dry and wet weather stormwater outfall phosphorus screening and monitoring results collected during the permit term on the evaluated parcels was reviewed for consideration in project

[1] Newton's Capital Improvement Plan: Capital Improvement Plan | City of Newton, MA (newton.org)

prioritization; however, available data was limited, so prioritization was focused on achieving the Phase 1 required load reduction.

For reporting purposes, individual opportunity sheets are provided based on data in the list of prioritized opportunities. These opportunity report sheets are included in Appendix E. In total, 52 parcels were identified containing 58 retrofit opportunities selected for Phase 1 implementation and crediting. The cumulative, estimated TP load reduction for these opportunities is 1,161.6 pounds per year (lb/yr).

Pursuable Opportunities

The pursuable opportunities for future consideration did not meet the criteria for Phase 1 prioritization. These are viable opportunities that are not as advantageous to implement during Phase 1 due to lack of alignment with other City improvement efforts, there were limiting site constraints, or the cost-benefit was unfavorable. A total of 36 parcels were identified containing 39 retrofit opportunities that are viable options for future consideration beyond Phase 1. The cumulative, estimated TP load reduction for these opportunities is 276.0 lb/yr.

Not Currently Pursuable Opportunities

The opportunities not currently considered for Phase 1 are potential opportunities that were not favored by the City due to site concerns or community impacts such as the presence of mature trees or planned future facility improvements. Newton is known as the "Garden City" having an abundance of open and forested spaces incorporated throughout its landscape. The estimates below describing the complexity and range of the City's urban forest[1].

- Over 20,000 Street Trees
- 32% of the trees are in good condition
- 42% of the trees are in fair condition
- 26% of the trees are in poor condition
- 80% of trees are Maple trees
- 4% of trees are Linden trees
- 3% of trees are Honeylocust
- 3% of trees are Ornamental Pear
- 3% of trees are Ash
- 7% of trees are one of over 40 different varieties not listed above.
- 18% of the trees are 7 inches in diameter or less. 1 to 20 years old*
- 44% of the trees are 8 inches to 16 inches in diameter. 20 to 40 years old*
- 35% of the trees are 17 inches to 24 in diameter 40-60 years old*
- 3% of the trees are greater than 24 inches in diameter. 60+ years old*

*Age range is only approximate based on data collected in the field from trees that have been removed due to death and hazardous conditions.

Facing continued urban development, the City of Newton is strongly committed to the protection and preservation of its trees and does not support the removal of trees for

[1] Newton's urban forest description: Newton's Urban Forest | City of Newton, MA (newton.org)

stormwater management if avoidable. Of the 111 parcels that were originally deemed feasibly for retrofit opportunities, 23 parcels containing 25 retrofit opportunities require significant removal of mature trees or other unavoidable community impacts. These opportunities are not currently considered by the City, but are feasible and can potentially be considered for subsequent permit phases if necessary. The cumulative, estimated TP load reduction for these opportunities is 479.1 lb/yr.

2.0 Roadways

Per the City's Open Space and Recreation Plan, developed June 2021, the City contains approximately 300 miles of City streets, most of which are owned and operated by the City's Department of Public Works. Woodard & Curran performed a high-level assessment of City-owned roadways to identify structural retrofit opportunities that could be implemented to supplement the parcel opportunities described in Section 1. Woodard & Curran developed resources and recommendations as listed below that the City can reference and utilize to identify retrofit opportunities when planning for and performing roadway work.

1. A roadway matrix was prepared to provide guidance on SCM selection for various road types.

2. Concept designs were developed to demonstrate the retrofit options outlined in the matrix and support average estimated load reductions for planning use in future transportation planning.

3. City provided concepts and design plans of planned roadway intersection improvements were evaluated to quantify TP reduction to credit towards the Phase 1 Permit Year 10 TP reduction requirement.

4. Priority roadways were evaluated for regional roadway retrofit opportunities similar to the regional parcel opportunities to credit towards the Phase 1 Permit Year 10 TP reduction requirement.

2.1 Roadway Matrix

Utilizing the Newton Leads 2040 strategy in conjunction with industry standard Green Streets guides, the roadway matrix was developed to provide the City with a comprehensive guide for planning future roadway improvements. It aims to streamline the roadway retrofit planning process and to provide SCM recommendations based on roadway types and features, treatment potential, and aesthetics. The purpose of the matrix is to provide a planning tool for the City's use in implementation of stormwater retrofit measures in transportation projects.

The City's right-of-way is composed of a variety of roadways with varying traffic demands, travel patterns, and surrounding communities. The matrix categorizes City roads based on the following:

- Roadway Typology – Cul-de-sacs, intersections, one-way, opposing traffic, and greenways.
- Street Characteristics – Number of travel lanes and speed limit. Slope was determined to be a case-by-case consideration and not a determining factor in SCM selection.
- Street Features – Grassed buffer areas, underutilized impervious area, on-street parking, existing catch basins, and wide travel lanes.

Using the MA Stormwater Handbook, applicable SCMs were recommended for each category and street feature based on treatment potential and aesthetics. A tiered recommendation system was developed with the highest recommendation being infiltration practices with aesthetic purposes and the lowest recommendation being filtration/other practices with no aesthetic purposes. See Table 2 for the matrix, recommendations, and notes. Table 3 includes supplemental information describing the SCM options and additional roadway design considerations.

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Table 2: Roadway Matrix
Phase 1 Phosphorus Control Plan
City of Newton, MA

Typology	Diagram	Street Characteristics		Treatment Location	Street Feature	Applicable SCM Opportunities									
		Lanes	Speed (mph)			IA	PP	BB	SF	FC	WQ	IT	IB	RG	IC
Cul-de-sac	=◯	2	≤25	Surface	Grassed buffer areas between sidewalk and road										
					Underutilized IA at the center and edges of the cul-de-sac										
				Subsurface	Existing catch basins										
Intersections	Varies	Varies	Any	Surface	Underutilized IA at center of intersection, medians, wide turning radii, wide sidewalks, and crosswalks										
				Surface	Grassed buffer areas between sidewalk and road										
				Subsurface	Existing catch basins										
One-Way	|↑|	1	≤25	Surface	Grassed buffer areas between sidewalk and road										
					On-street parking to remain										
					Underutilized IA at medians, wide turning radii, wide sidewalks, crosswalks, and parking										
				Subsurface	Existing catch basins										
				Varies	Travel lanes >12 feet in width										
Opposing Traffic	|↓|↑|	2	≤25	Surface	Main roadway surface for smaller, less traveled roads (<20ft in width)										
	|↓|↔|↑|	2	Any	Surface	On-street parking to remain										
					Underutilized IA at medians, wide turning radii, wide sidewalks, crosswalks, and parking										
	|↓↓|↑|	3			Grassed buffer areas between sidewalk and road										
				Subsurface	Existing catch basins										
	|↓↓|↑↑|	4		Varies	Excess travel capacity and travel lanes >12 feet in width										
Greenways	|↓|↑|grass| Saw Mill Brook Pkwy & Chestnut St @ Oak St	2	≤25	Surface	On-street parking to remain										
					Underutilized IA at medians, wide turning radii, wide sidewalks, crosswalks, and parking										
					Grassed buffer areas between sidewalk and road										
				Subsurface	Existing catch basins										
				Varies	Grassed open areas within the greenways										
					Travel lanes >12 feet in width										
	|↓|grass|↑| Albemarle Rd	2 (one way lanes)	≤25	Surface	On-street parking to remain										
					Underutilized IA at medians, wide turning radii, wide sidewalks, crosswalks, and parking										
				Varies	Grassed open areas within the greenway										
					Travel lanes >12 feet in width										
	|↓|↑|grass|↑| Commonwealth Ave	3 (one way and opposing)	Any	Surface	On-street parking to remain										
					Underutilized IA at medians, wide turning radii, wide sidewalks, crosswalks, and parking										
					Grassed buffer areas between sidewalk and road										
				Subsurface	Existing catch basins										
				Varies	Grassed open areas within the greenways										
					Excess travel capacity and travel lanes >12 feet in width										

Notes

- High recommendation: SCM option is an infiltration practice with higher TP removal with aesthetic purposes.
- High recommendation: SCM option is an infiltration practice with higher TP removal without aesthetic purposes.
- Moderate recommendation: SCM option is a filtration practice with lower TP removal with aesthetic purposes.
- Low recommendation: SCM option is a filtration practice with lower TP removal without aesthetic purposes.

1. For all opportunities, consider including Non-Stormwater Components for Complete Street Designs as described in the attached table.
2. Inlet configurations for all/most SCM opportunities may vary between catch basins, curb cuts, trench drains, and sheet flow.
3. Stormwater conveyance for all/most SCM opportunities may vary between grade, speed bump/water bar, and street table.
4. Greenways possess more open space which may allow for larger, more regional treatment options that can treat flows from drainage networks.
5. The SCM opportunities identified to be suitable for the different greenways are based on more specific site considerations/conflicts (parking, space, nearby brook, etc.).
6. The filter cartridges/membranes and some biofiltration basin options are proprietary systems which will require approval from the EPA to receive treatment credit.
7. The IA SCM option can be paired with a multitude of additional SCM opportunities in any of the recommended categories. Due to this flexibility, it is considered as highly recommended with no determination of aesthetics.

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Table 3: Roadway Matrix Supporting Information
Phase 1 Phosphorus Control Plan
City of Newton, MA

Key	SCM Type	Treatment	Slope	SCM Notes
IA	IA Removal / Replacing IA with Permeable Surface Types	Varies	Any	Reduce turn radii at cul-de-sacs and intersections. Convert outermost IA to pervious area and/or SCM. See additional SCM options below.
				Replace IA medians/islands or create new medians/islands with pervious area and/or SCM. Expand pervious medians to reduce turning speeds and consume underutilized IA. See SCM options below.
				Utilize bump outs and/or chicanes to replace IA with pervious area and/or SCM. These pair well with on-street parking. See SCM options below.
PP	Porous Pavement	Varies	Any	Porous pavement can be used to replace IA over a roadway and/or on-street parking areas. Suitable for roadways≤25 mph with relatively low traffic flow. On-street parking could be added as porous pavement and can be paired with other opportunities like bumpouts and chicanes.
BB	Biofiltration Basin	Filtration	Any	Filter stormwater through soil media (natural or engineered) and discharge through an underdrain. Include appropriate plantings for surface aesthetics, treatment, and natural purposes. Plantings include shrubs, grasses, trees (tree box filters), and more. Use stepped basin configuration when encountering slopes >5%. System footprint configurations vary widely. Proprietary systems may be used for smaller contributing areas. See attached recommended proprietary system information.
SF	Sand Filter	Filtration	<5%	Filter stormwater through sand and discharge through an underdrain. This is a slender, linear filter system that can be both surface and subsurface.
FC	Precast system with filter cartridges / membranes	Filtration	<5%	Filter stormwater though engineered cartridges/membranes within a precast box. There are many subsurface configurations and options for this proprietary system. See attached recommended proprietary system information.
WQ	Water Quality Swale	Filtration	<5%	Collect, convey, and filter stormwater in this surface depression and discharge through an underdrain. The water quality swale design must follow the MA Stormwater Handbook Standards.
IT	Infiltration Trench	Infiltration	<5%	Filter stormwater through a soil, sand, and gravel mixture and infiltrate through the existing soil for discharge. This is a slender, linear filter system that can be both surface and subsurface.
IB	Infiltration Basin	Infiltration	Any	Collect the stormwater in this surface depression and infiltrate through the existing soil for discharge. Use stepped basin configuration when encountering slopes >5%. There are many surface configurations that are possible.
RG	Bioretention Basin	Infiltration	Any	Collect the stormwater in this surface depression and infiltrate through the existing soil for discharge. Include
IC	Infiltration Chamber	Infiltration	<5%	Filter stormwater though chambers/filter fabric, gravel, and sand, and infiltrate through the existing soil for discharge.

Non-Stormwater Components for Complete Street Designs	Traffic calming via drive lane width reductions and added drive lane obstructions. See IA removal opportunities specified above.
	Increased ROW user safety via implementation of speed bumps (≤25 mph) or street tables (≥30 mph).
	Increased bicycle safety via establishing a bike lane and/or providing additional buffer area from the vehicle travel lane.
	Increased vehicle safety via conversion of an intersection to a rotary. This is a good opportunity to pair with IA removal SCMs.
	There are multiple configurations for road/lane diet. This reduces the with of the roadway leaving more room in the ROW for buffer zones, bump outs/chicanes, bike lanes, and parking.

Proprietary, manufactured SCMs, such as cartridge and membrane filters and engineered bio-filtration media systems, are included as SCM options in the matrix. The State of Washington Department of Ecology reviews and certifies stormwater treatment technologies under their Technology Assessment Protocol – Ecology (TAPE) program. The TAPE program has a tiered approval system for proprietary systems for various pollutants. The systems listed in the roadway matrix are General Use Level Designation (highest approval level) for Phosphorus Treatment. Proprietary systems are not yet approved treatment methods in the current MS4 General Permit. Proprietary systems will require EPA approval before crediting their TP reduction, but they are still viable treatment options.

2.2 Roadway Concepts

With the established matrix categorizations and SCM recommendations, roadway concept figures and supporting treatment calculations were developed as shown in Attachment 2 and 3. These were developed as planning level resources to inform estimated treatment potentials for SCM options. This estimated treatment information may be used by the City in roadway retrofits (excluding proprietary systems) planning. Additionally, the results were used to guide further roadway analyses described in Section 2.4.

The SCM configurations and selections depicted in the six concept figures identity options for the highest TP removal for each location, from the options considered. The feasibility evaluation, SCM sizing, and treatment calculations were completed similar to those done for the City-owned parcel opportunities and are described in Section 1.1.1. These concepts are feasible, yet they were created primarily as planning level resources and are not considered pursuable projects.

A broad range of roadways were selected to provide generalized treatment estimates; catchment areas with varying land use, land cover, and hydrologic soil groups were selected, along with a variety of SCM types. This variety was used to develop estimates that could be commonly applied to roadways.

The original concepts were used as the basis for an alternatives analysis that was conducted to provide an even broader evaluation of average load reductions for each SCM option. In this analysis, alternative SCM options were substituted for those originally depicted in the six concepts. The treatment potential for each alternative SCM was evaluated. Average treatment efficiencies were calculated. The results as shown in Table 4 can be used as a planning level guide to estimate future City roadway retrofits. The supporting calculations are shown in Attachment 3 and 4.

Table 4: Roadway SCM TP Reduction Estimates

SCM Type	lbs TP/yr/1000SF
Infiltration Basin	2.20
Bio-Retention	1.77
Infiltration Chamber	1.48
Infiltration Trench	1.38
Bio-Filtration	0.60
Sand Filter	0.60
WQ Grass Swale	0.24
IA Removal	0.04
Porous Pavement	0.03

2.3 Intersection Improvements

Conceptual and design plans for planned intersection improvement projects throughout the City, which are anticipated to be executed during the Phase 1 permit timeframe, were provided by the City for inclusion in Phase 1 planning. For projects which included a phosphorus load reduction method, the TP load reduction was calculated for inclusion in Phase 1. Projects with insignificant reduction of impervious area were not assessed for load reduction.

The load reductions were calculated using EPA's BATT and the impervious area conversion to pervious area reduction efficiencies provided in Attachment 3 of the MS4 Permit Appendix F. The phosphorus load reductions credited for the applicable, planned intersection improvements are included in Table 5. The cumulative, estimated TP load reduction for these projects is 1.4 lb/yr.

Table 5: Intersection Improvements
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City of Newton, MA

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Intersection	Design Phase	SCM Type	Catchment Area (ac)	Impervious Area (ac)	HSG Soil Type	Reduction Efficiency	Footprint (sf)	Estimated TP Credit (lb/yr)
Chestnut St @ Fuller St	Concept	IA Removal	--	--	A	98%	1045	0.05
Commonwealth Ave @ Temple St	Concept	IA Removal	--	--	A	98%	1940	0.09
Crafts St @ Walnut St	Completed	Infiltration Basin/Trench (1)	0.21	0.13	A	--	720	0.25
		Infiltration Basin/Trench (2)	0.26	0.10	A	--	370	0.18
		IA Removal	--	--	A	98%	2370	0.10
Langley Rd @ Jackson St	Design Plans	IA Removal	--	--	Not Rated	73%	185	0.01
Langley Rd @ Union St	Design Plans	IA Removal	--	--	Not Rated	73%	725	0.02
Waltham @ River	Design Plans	IA Removal	--	--	A	98%	2830	0.12
Lowell Ave @ Highland & Austin	Design Plans	IA Removal	--	--	Not Rated	73%	880	0.03
California St @ Los Angeles St	Design Plans	IA Removal	--	--	Not Rated	73%	947	0.03
Langley Rd @ Warren St	Construction	IA Removal	--	--	A	98%	758	0.03
Elliot St @ Mechanic St	Concept	IA Removal	--	--	A	98%	647	0.03
Oak St @ Chestnut St	Design Plans	IA Removal	--	--	Not Rated	73%	812	0.03
		Porous Pavement	0.13	0.13	Not Rated	--	5490	0.19
Rt 30 Commonwealth Ave	Design Plans	IA Removal	--	--	Not Rated	73%	6887	0.22
						Total Intersection TP Credit		**1.38**

Notes

1. Both infiltration trench/basin volumes were based on an estimated 6" ponding depth across the entire footprint.
2. Infiltration chamber volume was modeled in HydroCAD using 3 rows of 4 chambers each of ADS RC-310 chamber system as this system fit the available footprint.
3. IA removal TP load generations were calculated using a PLER of 1.95 lb/yr.

2.4 In-Depth Roadway Analysis

To meet the City's Phase 1 load reduction requirement, roadway retrofit opportunities were assessed to supplement the opportunities identified for the municipally owned parcels. Using the roadway matrix, concept figures and supporting City documents, City-owned roadways were evaluated similar to the parcel opportunities to assess the feasibility of locating retrofit opportunities within the limits of City right-of way. The in-depth roadway analysis opportunity report sheets are provided in Appendix E.

The concept roadway retrofit opportunities, developed to inform average SCM treatment reductions indicated that localized roadway retrofits result in low treatment potential. This was due to two factors: small catchment areas and limited availability of space. Therefore, roadway retrofit opportunity assessment focused on treating regional drainage areas. Ideally for roadway retrofits, treating a large area at a single location limits disturbance. Since regional opportunities require larger footprint areas, the utilization of space within the roadways had to be optimized. Surface SCMs are limited as they would likely interfere with the drive lanes, bike lanes, or sidewalks. Subsurface space is more abundant but is limited by underground utilities. Subsurface infiltration chambers are the most suitable opportunities for roadway retrofits as they have the most effective TP reduction and utilization of space as seen in Table 4.

Focusing on regional subsurface retrofit opportunities, the 2021 Traffic Calming Evaluation was used to identify possible multi-benefit opportunities. The roadway sections specified in this document along with adjacent areas were reviewed for stormwater retrofit opportunities. In an effort to identify roadway opportunities City-wide, an aerial and GIS inspection of the City-owned arterial and collector roads was completed to identify locations with large upstream drainage areas with few known utility conflicts and/or large areas of available space like greenways and grassed medians. Lastly, additional opportunities discussed/designed by the City were reviewed to be tracked and credited.

It is important to note that any roadway sections that were recently paved or included within a regional parcel opportunity's catchment were not considered in the roadway retrofit assessment. Additionally, City input was received regarding the feasibility of implementing the roadway retrofits identified and the opportunities were adjusted accordingly. Most feedback was focused on high groundwater and/or the presence of mature trees in the retrofit location. This feedback supported retrofit opportunity and SCM type selection.

In total, 16 roadway retrofit opportunities were identified and deemed feasible throughout the City right-of-way. Ten roadway retrofit opportunities were prioritized for possible Phase 1 implementation and crediting. The cumulative, estimated TP load reduction for the prioritized opportunities is 54.0 lb/yr. Six opportunities are not currently considered by the City due to tree removal implications and community impacts. These opportunities are feasible and can potentially be considered for subsequent permit phases if necessary. The cumulative, estimated TP load reduction for the not currently pursuable roadway opportunities is 132.6 lb/yr.

2.5 Load Reduction Calculations

The process for the roadway analyses was similar to that of the city-owned parcel opportunities as described in Section 1.0. An initial feasibility study was performed using GIS and Google imagery to assess availability of space for retrofit opportunities and if there were any environmental or site/utility conflicts. Once the section of roadway was deemed feasible, the SCM type was selected, and the catchment area was delineated using GIS.

The load reduction calculations were completed using the same process described in Section 1.1.1 except there were no estimates using HydroCAD models.

See Attachment 1 for the list of resources and datasets, how each was used, and associated limitations and assumptions.

Attachments

Attachment 1 Resources, Assumptions and Limitations Table

Attachment 2 Roadway Concepts

Attachment 3 Roadway Concepts Calculations

Attachment 4 Alternatives Analysis Calculations

Attachment 1: Resources, Assumptions, and Limitations Table

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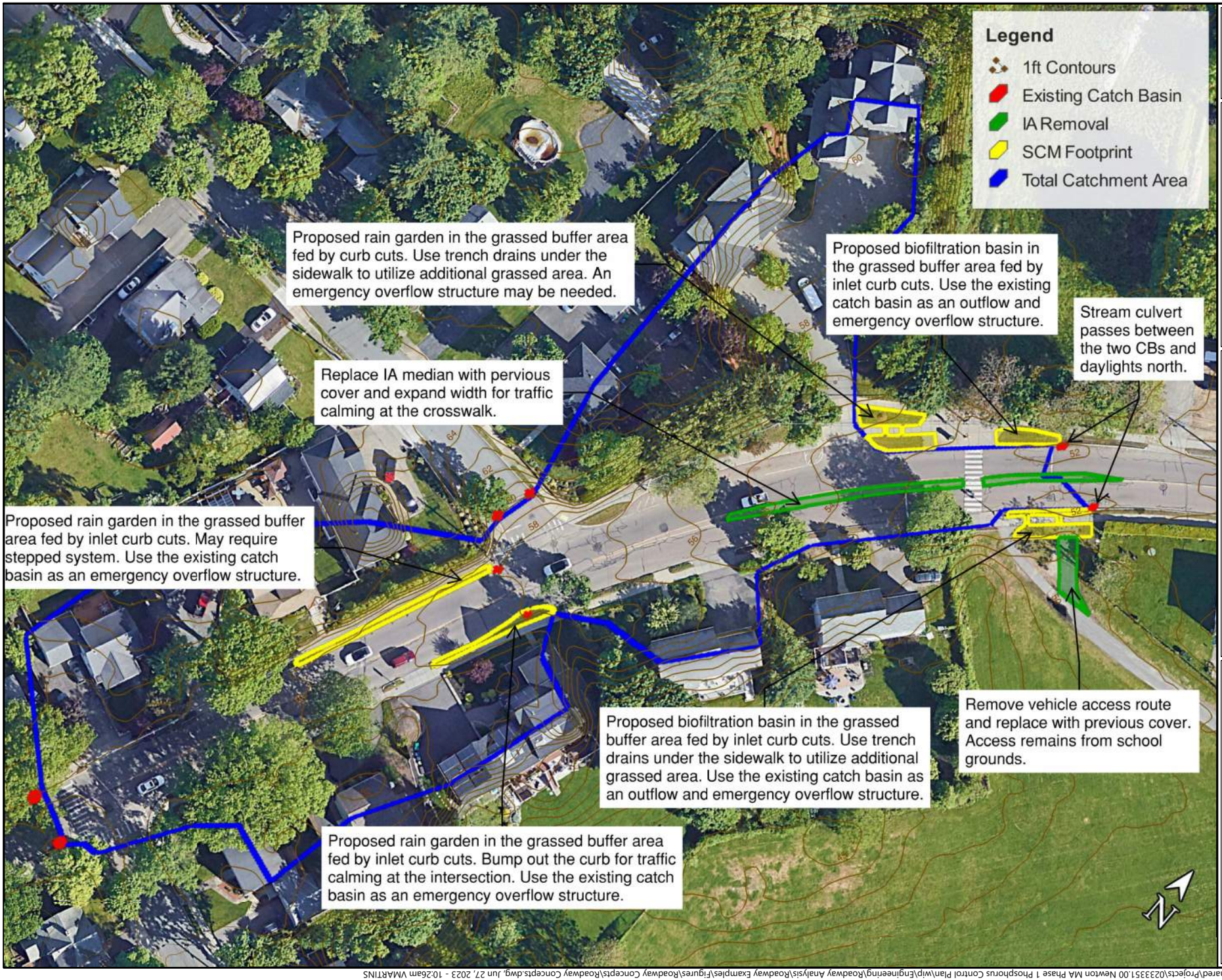
Resource/Dataset	Source	Publish Date	PCP Use	Limitations/Assumptions
Drainage: SCMs, Discharge Points, Inlets, Manholes, Culverts, Gravity Drains	Newton	May 2022	Evaluate existing drainage infrastructure for catchment delineations	Limited invert information. Possible mapping inaccuracies checked against available site plans and Google street view.
Sanitary Sewer: Manholes, Force Mains, Gravity Mains	Newton	May 2022	Assess for utility conflicts	Invert information unknown. Possible mapping inaccuracies checked against available site plans and Google street view.
Water: Hydrants, System Valves, Mains	Newton	May 2022	Assess for utility conflicts	Invert information unknown. Possible mapping inaccuracies checked against available site plans and Google street view.
Open Space	Newton	July 2022	Evaluate conservation restrictions and land protection/jurisdiction	--
FEMA Flood Hazard	MassGIS	July 2017	Evaluate environmental impacts and estimate groundwater depth	--
Wetlands	MassGIS	December 2017	Evaluate environmental conflicts and estimate groundwater depth	Presence of wetlands was assumed to signify high groundwater limiting infiltration practices.
Zone IIs	MassGIS	November 2022	Consider environmental impacts and SCM setbacks	--
Public Water Supply	MassGIS	November 2022	Consider environmental impacts and SCM setbacks	Presence of reservoirs excluded infiltration practices.
Outstanding Water Resource Area	MassGIS	March 2010	Consider environmental impacts and SCM setbacks	--
Hydrologic Soils	USDA/NRCS	November 2021 (June 2020 data)	Soil type dictates pervious area infiltration and pollutant load export rates	Generalization of soil groups can lead to inaccurate infiltration assumptions
Impervious Area	MassGIS	May 2019 (2016 Land Use/Cover)	Delineate areas of imperviousness to determine generated stormwater runoff and phosphorous export loads based on land use type	Land use/cover has changed due to development since 2016.
Land Use	MassGIS	May 2019 (2016 Land Use/Cover)	Categorized different land areas to further assess for PLER	Land use/cover has changed due to development since 2016.
Roadway Jurisdiction	MassGIS	May 2022	Identify and categorize roadways for inputs into an SCM matrix analysis	MassDOT and MassDCR roadways were excluded in PCP assessments.
Environmental Justice Areas	MassGIS	November 2022 (2020 Census data)	Identify areas of concern where some SCM opportunities may be located	--
Contours	Newton	February 2018	Delineate drainage network catchments and to estimate topographic limitations for SCMs	Land use/cover and associated topography has changed due to development since 2018 in some locations.
City Parcels	Newton/W&C	July 2021	Identify City-owned parcels for structural SCM placement	--
Town-Wide Parcels	Newton	June 2022	Identify abutting properties to city-owned parcels that may be affected	--
Newton City Boundary	Newton	January 2012	Defines the study area	--
NRCS Web Soil Survey	USDA/NRCS	Continually updated	Referenced for groundwater depth approximation and soil type	Limited groundwater information.
Google Earth Pro	Google	Varies	Application allowing the placement of unique markers to show the location and footprint of SCM opportunities	Aerial imagery quality and dates vary. Footprints and measurements are planning level estimates.
Google Maps	Google	Varies	Supplements GIS data using overhead and street view to confirm topography, utility locations, land use/cover, etc.	Aerial and street view imagery quality and dates vary.
MassMapper	MassGIS	Varies	Reference Massachusetts environmental GIS data	Layer data may differ from current conditions. Data layer dates vary.
Massachusetts Stormwater Handbook	MassDEP	February 2008	Setbacks and SCM design guidance	Used as guidance with the understanding that SCMs are retrofits and will meet Handbook requirements to the maximum extent practical.
Land Use Land Cover Guidance	EPA Region 1/MassDEP	2/15/22 email from Mark Voorhees	Assign PLERs for different land use/cover to estimate generated load	--
Massachusetts Small MS4 General Permit - Appendix F	EPA Region 1	Effective July 1, 2018, Modifications Effective January 6, 2021	Required load reduction, plan requirements	--
Appendix F Attachment 1			Estimate increase in baseline load	--
Appendix F Attachment 2			Estimate load reduction for non-structural SCMs	--
Appendix F Attachment 3			Estimate load reduction performance for structural SCMs	--
FY24-28 Capital Improvement Plan	Newton	October 2022	Identify and prioritize SCM opportunities for Phase 1 implementation that coincide with project locations planned throughout the City	The planned schedule and funding may differ from implementation.
Stormwater Infrastructure Improvement Plan	Newton	February 2015	Identify and prioritize SCM opportunities that coincide with project locations planned throughout the City	Predictions and projects plans could have changed since 2015. Some projects mentioned have already been completed.
Open Space and Recreation Plan	Newton	September 2020	Identify specific open space areas that may be prioritized for future opportunities	Implementation information is limited.
2021 Traffic Calming Evaluation	Newton	May 2022	Identify and prioritize areas for roadway retrofit opportunities for Phase 1 implementation that coincide with areas requiring improvement	Implementation plans unknown. City input was provided on the roadway sections identified for opportunities.
Newton Street Design Guide	Newton	June 2018	Guided roadway classifications for the roadway SCM selection matrix	--
Newton Leads 2040	Newton	February 2017	Guided roadway classifications for the roadway SCM selection matrix	--
Holyoke Greenstreet Guidebook	Newton	Winter 2014	Guided roadway classifications for the roadway SCM selection matrix	--
Traffic and Parking Regulations	Newton	March 2020	Guided roadway classifications for the roadway SCM selection matrix	--
PeopleGIS	Newton	Continually updated	Download stormwater, sewer, and water utility GIS data. Gather invert information.	Limited invert information with varying datums. Possible mapping inaccuracies checked against available site plans and Google street view.
Site Plans and Drainage Reports (Various Properties)	Newton	Varies	Identify existing SCMs on city-owned parcels and their catchment areas. Credit TP reduction from existing SCMs. Additionally referenced for utility information.	--

Attachment 2: Roadway Concepts



CONCEPT 1A
OPPOSING TRAFFIC
LEXINGTON STREET

DESIGNED BY: CJ | CHECKED BY: SK
DRAWN BY: VM | ROADWAY CONCEPTS.dwg

CLIENT: CITY OF NEWTON, MA
DEPARTMENT OF PUBLIC WORKS

PROJECT: CITY OF NEWTON PHASE 1 PHOSPHORUS CONTROL PLAN

JOB NO: 023335100
DATE: JUNE 2023
SCALE: N.T.S.

1

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CONCEPT 1B
OPPOSING TRAFFIC
LEXINGTON STREET

DESIGNED BY: CJ | CHECKED BY: SK
DRAWN BY: VM | ROADWAY CONCEPTS.dwg

CLIENT: CITY OF NEWTON, MA
DEPARTMENT OF PUBLIC WORKS

PROJECT: CITY OF NEWTON PHASE 1 PHOSPHORUS CONTROL PLAN

JOB NO: 0233351.00
DATE: JUNE 2023
SCALE: N.T.S.

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CONCEPT 2
ONE WAY TRAFFIC
BOWEN STREET

DESIGNED BY: CJ
DRAWN BY: VM
CHECKED BY: SK
ROADWAY CONCEPTS.dwg

CLIENT:
CITY OF NEWTON, MA
DEPARTMENT OF PUBLIC WORKS

PROJECT:
CITY OF NEWTON PHASE 1 PHOSPHORUS CONTROL PLAN

JOB NO: 0233351.00
DATE: JUNE 2023
SCALE: N.T.S.

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CONCEPT 3
CUL-DE-SAC CONCEPT
ASCENTA TERRACE

DESIGNED BY: CJ | CHECKED BY: SK
DRAWN BY: VM | ROADWAY CONCEPTS.dwg

CLIENT: CITY OF NEWTON, MA
DEPARTMENT OF PUBLIC WORKS

PROJECT: CITY OF NEWTON PHASE 1 PHOSPHORUS CONTROL PLAN

JOB NO: 023335 1.00
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SCALE: N.T.S.

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JOB NO: 0233351.00
DATE: JUNE 2023
SCALE: N.T.S.

5

CLIENT: CITY OF NEWTON, MA
DEPARTMENT OF PUBLIC WORKS

PROJECT: CITY OF NEWTON PHASE 1 PHOSPHORUS CONTROL PLAN

CONCEPT 4 - INTERSECTION CONCEPT
HAMMOND STREET AND BEACON STREET INTERSECTION

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GREENWAY CONCEPT
ALBEMARLE ROAD

CLIENT:
CITY OF NEWTON, MA
DEPARTMENT OF PUBLIC WORKS

PROJECT:
CITY OF NEWTON PHASE 1 PHOSPHORUS CONTROL PLAN

JOB NO: 0233351.00
DATE: JUNE 2023
SCALE: N.T.S.

6

DESIGNED BY: CJ
DRAWN BY: VM
CHECKED BY: SK
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Attachment 3: Roadway Concepts Calculations

Roadway Concept Calculations
Phase 1 Phosphorus Control Plan
City of Newton, MA

40 Shattuck Road | Suite 110 T 800.426.4262
Andover, Massachusetts 01810 T 978.557.8150
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Location	Concept Number	SCM Description	SCM	Treatment Type	HSG Soil Type at SCM	Impervious Drainage Area (ac.)	Total Drainage Area (ac.)	Generated TP Load from Total Area (lb/yr)	SCM Footprint (SF)	Treatment Depth (in.)	Reduction Efficiency	SCM Volume (CF)	Load Reduction (lb/yr)	Total Load Reduction
Lexington St	1A	SW Rain Garden (1) *	Infiltration Trench	Infiltration	A	0.38	0.58	0.75	350	0.30	68%	420	0.51	1.73
		SE Rain Garden (2) *	Infiltration Trench	Infiltration	A	0.29	0.44	0.57	250	0.25	62%	300	0.35	
		NW Rain Garden (3)	Bio-Retention	Infiltration	Not Rated	0.41	0.70	0.86	380	0.35	67%	589	0.57	
		NW Biofiltration (1)	Bio-Filtration	Filtration	Not Rated	0.04	0.05	0.09	100	1.00	53%	155	0.05	
		NE Biofiltration (2)	Bio-Filtration	Filtration	Not Rated	0.20	0.26	0.40	430	0.90	51%	667	0.20	
		IA Removal	IA Removal	IA Removal	Not Rated	0.03	0.03	0.06	1362	--	81%	--	0.05	
Lexington St	1B	SW Rain Garden (1)	Bio-Retention	Infiltration	A	0.36	0.54	0.71	350	0.40	87%	543	0.62	2.87
		SE Rain Garden (2)	Bio-Retention	Infiltration	A	0.29	0.44	0.57	250	0.35	82%	388	0.47	
		W Chicane Rain Garden	Bio-Retention	Infiltration	A	0.48	0.86	0.95	450	0.40	87%	698	0.83	
		E Chicane Rain Garden	Bio-Retention	Infiltration	Not Rated	0.14	0.21	0.30	150	0.45	75%	233	0.22	
		NW Biofiltration (1)	Bio-Filtration	Filtration	Not Rated	0.44	0.72	0.86	1000	0.95	52%	1,550	0.45	
		NE Biofiltration (2)	Bio-Filtration	Filtration	Not Rated	0.15	0.19	0.31	350	0.95	52%	543	0.16	
		IA Removal	IA Removal	IA Removal	Not Rated	0.08	0.08	0.15	3330	--	81%	--	0.12	
Bowen St	2	N Rain Garden	Bio-Retention	Infiltration	A	0.21	0.47	0.59	250	0.50	91%	388	0.54	0.85
		S Rain Garden *	Infiltration Trench	Infiltration	A	0.20	0.27	0.39	200	0.30	68%	240	0.27	
		IA Removal	IA Removal	IA Removal	A	0.02	0.02	0.04	920	--	99%	--	0.04	
Ascenta Ter	3	W Chambers	Infiltration Chamber	Infiltration	C	0.35	0.95	0.81	650	1.00	92%	1,300	0.75	1.46
		E Rain Garden	Bio-Retention	Infiltration	C	0.41	0.89	0.90	400	0.40	74%	620	0.67	
		IA Removal	IA Removal	IA Removal	C	0.03	0.03	0.05	1130	--	85%	--	0.04	
Beacon St	4	W Infiltration Trench	Infiltration Trench	Infiltration	Not Rated	0.33	1.10	0.93	350	0.35	51%	420	0.48	4.24
		W Rain Garden (1)	Bio-Retention	Infiltration	Not Rated	0.48	1.16	1.19	370	0.30	62%	574	0.74	
		W Rain Garden (2) *	Infiltration Trench	Infiltration	Not Rated	0.10	0.60	0.38	100	0.30	45%	120	0.17	
		S Chambers	Infiltration Chamber	Infiltration	Not Rated	0.84	1.75	1.98	350	0.20	33%	700	0.65	
		E Rain Garden (1)	Bio-Retention	Infiltration	Not Rated	0.29	0.68	0.71	275	0.40	72%	426	0.51	
		E Rain Garden (2)	Bio-Retention	Infiltration	Not Rated	0.30	0.45	0.64	275	0.35	67%	426	0.43	
		N Biofiltration	Bio-Filtration	Filtration	Not Rated	0.21	0.44	0.51	500	1.00	53%	775	0.27	
		Rotary Biofiltration	Bio-Filtration	Filtration	Not Rated	0.36	1.37	1.07	850	1.00	53%	1,318	0.57	
		Porous Pavement	Porous Pavement	Filtration	Not Rated	0.18	0.18	0.36	7971	1.00	62%	7,174	0.22	
		IA Removal	IA Removal	IA Removal	Not Rated	0.12	0.12	0.24	5434	--	81%	--	0.20	
Albemarle Rd (Watertown to Crafts)	5	West Combined Bio Filt	Bio-Filtration	Infiltration	Not Rated	2.64	6.97	6.78	1200	0.15	20%	1,860	1.32	2.98
		East Combined Bio Filt	Bio-Filtration	Infiltration	Not Rated	3.11	4.24	6.36	1425	0.15	20%	2,209	1.24	
		Porous Pavement	Porous Pavement	Filtration	Not Rated	0.34	0.34	0.67	14990	1.00	62%	13,491	0.42	

Notes

1. Infiltration SCMs within "Not Rated" soils are assumed to have suitable soils for infiltration based on HSG of surrounding soils.
2. The Albemarle Road concept from Watertown St to Crafts St is included in the In-Depth Roadway Analysis opportunity report sheets in Appendix E along with the analysis of Albemarle Rd from Crafts St to the Charles River.

* Infiltration trench performance calculations are used for bio-retention systems when the majority of the storage is subsurface in the media void space per the UNHSC BMP Performance Fact Sheets.

Attachment 4: Alternatives Analysis Calculations

Alternatives Analysis Calculations
Phase 1 Phosphorus Control Plan
City of Newton, MA

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Location	Concept Number	SCM Description	SCM	Treatment Type	HSG Soil Type at SCM	Impervious Drainage Area (ac.)	Total Drainage Area (ac.)	Generated TP Load from Total Area (lb/yr)	SCM Footprint (SF)	Treatment Depth (in.)	Reduction Efficiency	SCM Volume (CF)	Load Reduction (lb/yr)
Lexington St	1A	Alt. Sand Filter for NW RG (3)	Sand Filter	Filtration	Not Rated	0.41	0.70	0.86	625	0.65	45%	969	0.39
		Alt. WQ Swale for SW RG (1)	WQ Grass Swale	Filtration	A	0.38	0.58	0.75	350	0.45	10%	630	0.08
		Alt. Infil. Basin for NW RG (3)	Infiltration Basin	Infiltration	Not Rated	0.41	0.70	0.86	380	1.00	92%	1,520	0.79
		Alt. Infil. Trench for NW RG (3)	Infiltration Trench	Infiltration	Not Rated	0.41	0.70	0.86	380	0.30	45%	456	0.39
		Alt. Biofiltration for NW RG (3)	Bio-Filtration	Filtration	Not Rated	0.41	0.70	0.86	625	0.65	45%	969	0.39
Lexington St	1B	Alt. Biofilt. for W Chicane RG	Bio-Filtration	Filtration	Not Rated	0.47	0.86	0.93	675	0.60	44%	1,046	0.41
		Alt. Sand Filter for W Chicane RG	Sand Filter	Filtration	Not Rated	0.47	0.86	0.93	675	0.60	44%	1,046	0.41
		Alt. Infil. Basin for SW RG (1)	Infiltration Basin	Infiltration	A	0.36	1	0.71	350	1.00	98%	1,400	0.70
		Alt. Infil. Basin for SE RG (2)	Infiltration Basin	Infiltration	A	0.29	0	0.57	250	0.90	98%	1,000	0.56
		Alt. Infil. Basin for W Chicane RG	Infiltration Basin	Infiltration	A	0.48	1	0.95	450	1.00	98%	1,800	0.93
		Alt. Infil. Basin for E Chicane RG	Infiltration Basin	Infiltration	Not Rated	0.14	0	0.30	150	1.00	92%	600	0.28
		Alt. WQ Swale for NW BF (1)	WQ Grass Swale	Filtration	Not Rated	0.44	0.72	0.96	900	1.00	21%	1,620	0.20
		Alt. WQ Swale for NE BF (2)	WQ Grass Swale	Filtration	Not Rated	0.13	0.17	0.31	300	1.00	21%	540	0.06
Bowen St	2	Alt. Biofiltration for N RG	Bio-Filtration	Filtration	A	0.26	0.47	0.52	625	1.00	53%	969	0.27
		Alt. Infil. Basin for N RG	Infiltration Basin	Infiltration	A	0.21	0.47	0.59	250	1.00	98%	1,000	0.58
		Alt. WQ Swale for N RG	WQ Grass Swale	Filtration	A	0.26	0.47	0.52	525	1.00	21%	945	0.11
		Alt Infil Chamber for N RG	Infiltration Chamber	Infiltration	A	0.26	0.47	0.52	475	1.00	98%	950	0.51
		Alt. Sand Filter for N RG	Sand Filter	Filtration	A	0.26	0.47	0.52	625	1.00	53%	969	0.27
Ascenta Ter	3	Alt WQ Swale for E RG	WQ Grass Swale	Filtration	C	0.41	0.89	0.90	500	0.60	13%	900	0.12
		Alt. Infil. Basin for E RG	Infiltration Basin	Infiltration	C	0.41	0.89	0.90	400	1.00	93%	1,600	0.84
		Alt Biofiltration for E RG	Bio-Filtration	Filtration	C	0.41	0.89	0.90	500	0.50	41%	775	0.37
		Alt Sand filter for E RG	Sand Filter	Filtration	C	0.41	0.89	0.90	500	0.50	41%	775	0.37
Beacon St	4	Alt BF for E Rain Garden (1)	Bio-Filtration	Filtration	Not Rated	0.29	0.68	0.71	700	1.00	53%	1,085	0.37
		Alt BF for E Rain Garden (2)	Bio-Filtration	Filtration	Not Rated	0.30	0.45	0.64	725	1.00	53%	1,124	0.34
		Alt. Infil. Basin for E RG (1)	Infiltration Basin	Infiltration	Not Rated	0.29	0.68	0.71	275	1.00	92%	1,100	0.65
		Alt. Infil. Basin for E RG (2)	Infiltration Basin	Infiltration	Not Rated	0.30	0.45	0.64	275	1.00	92%	1,100	0.59
		Alt Infil Chamber for W IT	Infiltration Chamber	Infiltration	Not Rated	0.33	1.10	0.93	350	0.55	69%	700	0.64
		Alt Sand Filter for N Biofiltration	Sand Filter	Filtration	Not Rated	0.21	0.44	0.51	500	1.00	53%	775	0.27
		Alt WQ Swale for W RG (1)	WQ Grass Swale	Filtration	Not Rated	0.48	1.16	1.19	375	0.35	8%	675	0.10
		Alt. Infil. Basin for W RG (1)	Infiltration Basin	Infiltration	Not Rated	0.48	1.16	1.19	370	0.80	88%	1,480	1.05
		Alt WQ Swale for W IT (2)	WQ Grass Swale	Filtration	Not Rated	0.10	0.60	0.38	225	1.00	21%	405	0.08
Albemarle Rd	5	Alt. Sand Filter for W IB	Sand Filter	Filtration	Not Rated	2.64	6.97	6.78	5900	0.95	52%	9,145	3.51
		Alt. WQ Swale for W IB	WQ Grass Swale	Filtration	Not Rated	2.64	6.97	6.78	5900	1.00	21%	10,620	1.42
		Alt WQ Swale for E IB	WQ Grass Swale	Filtration	Not Rated	3.11	4.24	6.36	6400	1.00	21%	11,520	1.34

Prioritized Parcel Opportunity Report Sheets

Davis Playground

Infiltration Chamber

Project Reference Number	1
Parcel ID	31016 0017
Address/Location	EDEN AVE
Property Description	Davis Playground

Additional Municipal Parcels Treated
33034 0049, 31021 0050A, 33034 0009

Invert Depth at Intercepted Pipe (ft)	Unk
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	77.1
Total Contributing Area (ac.)	156.4
Generated TP Load from Total Area (lb/yr)	164.0
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	39,764
Treatment Depth (in.)	0.30
Reduction Efficiency	68%
SCM Volume (CF)	87,285

Project Duration	
Total Feasibility, Design & Permitting	14 months
Construction	7 months
Total	**21 months**

Total Load Reduction (lb/y) :	**111.5**

2023 EPA Total Cost Estimate:	**$ 6,010,200**
W&C Total Cost Estimate:	**$ 2,841,992**
EPA Cost/Benefit ($/lb/y):	**$ 53,897**
W&C Cost/Benefit ($/lb/y):	**$ 25,486**

Project Considerations	The softball field historically has poor drainage. Place subsurface chambers under the entire field and basketball court. Connecting the Waltham St drainage will require an easement. Avoid the culverted brook along the southern border of the parcel.
2024-2028 Capital Improvement Plan Notes	Court resurfacing could be paired with this opportunity.
Climate Vulnerability/Flooding Notes	--

Elliot St DPW Yard

Infiltration Chamber

Project Reference Number	2
Parcel ID	51029 0037
Address/Location	60 ELLIOT ST
Property Description	Elliot St DPW Yard

Additional Municipal Parcels Treated
51015 00170, 51015 0018, 51015 0019, 51015 0020, 51019 0002, 51019 0003, 51019 0004, 51019 0005, 51029 0039, 51029 0037A

Invert Depth at Intercepted Pipe (ft)	2 (along pipe, not at a MH)
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	71.6
Total Contributing Area (ac.)	148.3
Generated TP Load from Total Area (lb/yr)	149.6
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	44,027
Treatment Depth (in.)	0.35
Reduction Efficiency	75%
SCM Volume (CF)	96,670

Project Duration	
Total Feasibility, Design & Permitting	13 months
Construction	7 months
Total	**20 months**

Total Load Reduction (lb/y) :	**111.5**

2023 EPA Total Cost Estimate:	**$ 6,656,850**
W&C Total Cost Estimate:	**$ 3,142,763**
EPA Cost/Benefit ($/lb/y):	**$ 59,710**
W&C Cost/Benefit ($/lb/y):	**$ 28,190**

Project Considerations	Place subsurface chambers under the southern portion of the DPW yard south of the solar canopies.
2024-2028 Capital Improvement Plan Notes	Elliot St DPW Yard Stormwater Improvements Project
Climate Vulnerability/Flooding Notes	Located in historic wetland area.

Newton Center Playground

Infiltration Basin

Project Reference Number	3A
Parcel ID	64032 0001 (1)
Address/Location	TYLER TER
Property Description	Newton Center Playground

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	7
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	3.9
Total Contributing Area (ac.)	7.5
Generated TP Load from Total Area (lb/yr)	8.0
Dimensions (Length x Width)	80x45
SCM Footprint (SF)	3,600
Treatment Depth (in.)	1.00
Reduction Efficiency	98%
SCM Volume (CF)	14,400

Project Duration	
Total Feasibility, Design & Permitting	12 months
Construction	4 months
Total	**16 months**

Total Load Reduction (lb/y) :	**7.8**

2023 EPA Total Cost Estimate:	**$ 291,600**
W&C Total Cost Estimate:	**$ 200,460**
EPA Cost/Benefit ($/lb/y):	**$ 37,335**
W&C Cost/Benefit ($/lb/y):	**$ 25,666**

Project Considerations	Place infiltration basin in the open grassed area at the corner of Bowen St and Centre St Remain 50 feet away from the daylighted Hammond Brook.
2024-2028 Capital Improvement Plan Notes	CIP includes Performance Stage in Newton Centre Playground project to be located behind the Hut.
Climate Vulnerability/Flooding Notes	Locally identified area of flooding.

Newton Center Playground

Infiltration Chamber

Project Reference Number	3B
Parcel ID	64032 0001 (2)
Address/Location	TYLER TER
Property Description	Newton Center Playground

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	4
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	77.6
Total Contributing Area (ac.)	157.2
Generated TP Load from Total Area (lb/yr)	163.8
Dimensions (Length x Width)	160x250
SCM Footprint (SF)	40,050
Treatment Depth (in.)	0.30
Reduction Efficiency	45%
SCM Volume (CF)	87,932

Project Duration	
Total Feasibility, Design & Permitting	15 months
Construction	7 months
Total	**22 months**

Total Load Reduction (lb/y) :	**73.7**

2023 EPA Total Cost Estimate:	**$ 6,054,750**
W&C Total Cost Estimate:	**$ 2,823,710**
EPA Cost/Benefit ($/lb/y):	**$ 82,136**
W&C Cost/Benefit ($/lb/y):	**$ 38,305**

Project Considerations	Place subsurface chambers between the two baseball fields in the northwest corner of the parcel. A structure is required at Homer St to divert the drainage network before it daylights alongside the baseball fields.
2024-2028 Capital Improvement Plan Notes	CIP includes Performance Stage in Newton Centre Playground project to be located behind the Hut.
Climate Vulnerability/Flooding Notes	Locally identified area of flooding.

Pellegrini Park

Infiltration Chamber

Project Reference Number	4
Parcel ID	14016 0033
Address/Location	11 HAWTHORN ST
Property Description	Pellegrini Park

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	Unk, (~3 at Hawthorn)
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	39.3
Total Contributing Area (ac.)	63.3
Generated TP Load from Total Area (lb/yr)	80.8
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	65,147
Treatment Depth (in.)	1.00
Reduction Efficiency	98%
SCM Volume (CF)	143,302

Project Duration	
Total Feasibility, Design & Permitting	14 months
Construction	7 months
Total	**21 months**

Total Load Reduction (lb/y) :	**79.2**

2023 EPA Total Cost Estimate:	**$ 9,867,150**
W&C Total Cost Estimate:	**$ 4,600,693**
EPA Cost/Benefit ($/lb/y):	**$ 124,609**
W&C Cost/Benefit ($/lb/y):	**$ 58,101**

Project Considerations	The park is very active and hosts an annual festival. There are drainage issues in the existing network. Place subsurface chambers under the entire field avoiding utilities as needed.
2024-2028 Capital Improvement Plan Notes	Pellegrini Park Drain Replacement 2027
Climate Vulnerability/Flooding Notes	Identified area of local flooding just upstream of reported flooding damage in 2010.

Cabot Park

Infiltration Chamber

Project Reference Number	5
Parcel ID	13001 0001
Address/Location	101 EAST SIDE PKWY
Property Description	Cabot Park

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	Unk (N&S)
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	27.3
Total Contributing Area (ac.)	63.1
Generated TP Load from Total Area (lb/yr)	61.3
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	45,842
Treatment Depth (in.)	1.00
Reduction Efficiency	98%
SCM Volume (CF)	99,100

Project Duration	
Total Feasibility, Design & Permitting	14 months
Construction	7 months
Total	**21 months**

Total Load Reduction (lb/y) :	**60.1**

2023 EPA Total Cost Estimate:	**$ 6,824,250**
W&C Total Cost Estimate:	**$ 3,232,599**
EPA Cost/Benefit ($/lb/y):	**$ 113,544**
W&C Cost/Benefit ($/lb/y):	**$ 53,785**

Project Considerations	Place large subsurface chamber system under northern baseball field between Hilltop St and Winchester Rd. Relocate existing drainage network as required. Avoid existing sewer line located on west side of park.
2024-2028 Capital Improvement Plan Notes	CIP identifies several Cabot Park improvements.
Climate Vulnerability/Flooding Notes	Cabot Park Village is within area of historic wetlands (close proximity to park).

Peirce School

Infiltration Chamber

Project Reference Number	6
Parcel ID	32021 0006
Address/Location	BERKELEY ST
Property Description	Peirce School

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	3
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	27.8
Total Contributing Area (ac.)	83.6
Generated TP Load from Total Area (lb/yr)	60.6
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	46,523
Treatment Depth (in.)	1.00
Reduction Efficiency	98%
SCM Volume (CF)	102,178

Project Duration	
Total Feasibility, Design & Permitting	14 months
Construction	7 months
Total	**21 months**

Total Load Reduction (lb/y) :	**59.4**

2023 EPA Total Cost Estimate:	**$ 7,036,200**
W&C Total Cost Estimate:	**$ 3,320,068**
EPA Cost/Benefit ($/lb/y):	**$ 118,394**
W&C Cost/Benefit ($/lb/y):	**$ 55,865**

Project Considerations	Place subsurface chamber system under Pierce School baseball field. Mature trees along Berkley St not to be disturbed. Located on municipal lots 32012 0005 and 32012 0006.
2024-2028 Capital Improvement Plan Notes	Peirce Feasibility/Addition - Feasibility Study/Design and Construction
Climate Vulnerability/Flooding Notes	--

Stearns Park

Infiltration Chamber

Project Reference Number	7
Parcel ID	11010 0007
Address/Location	54 JASSET ST
Property Description	Stearns Park

Additional Municipal Parcels Treated
14012 0022

Invert Depth at Intercepted Pipe (ft)	6 (Jasset), 3 (Allison)
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	30.8
Total Contributing Area (ac.)	44.7
Generated TP Load from Total Area (lb/yr)	64.5
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	18,977
Treatment Depth (in.)	0.35
Reduction Efficiency	75%
SCM Volume (CF)	41,286

Project Duration	
Total Feasibility, Design & Permitting	15 months
Construction	6 months
Total	**21 months**

Total Load Reduction (lb/y) :	**48.0**

2023 EPA Total Cost Estimate:	**$ 2,843,100**
W&C Total Cost Estimate:	**$ 1,467,700**
EPA Cost/Benefit ($/lb/y):	**$ 59,206**
W&C Cost/Benefit ($/lb/y):	**$ 30,564**

Project Considerations	Place subsurface chambers in northern end of park under the basketball court and baseball field. Chambers to be placed on either side of water and sewer lines crossing middle of lot. Existing trees surrounding park to remain.
2024-2028 Capital Improvement Plan Notes	Stearns Park courts are to be resurfaced.
Climate Vulnerability/Flooding Notes	--

Ward Park

Infiltration Chamber

Project Reference Number	8
Parcel ID	73016 0022
Address/Location	MONTROSE ST
Property Description	Ward Park

Additional Municipal Parcels Treated
73016 0021, 63005 0002

Invert Depth at Intercepted Pipe (ft)	6 (Montrose), 7 (Fellesmere), 6 (Lot), Unk (Woodchester)
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	23.2
Total Contributing Area (ac.)	52.0
Generated TP Load from Total Area (lb/yr)	51.2
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	39,125
Treatment Depth (in.)	1.00
Reduction Efficiency	90%
SCM Volume (CF)	85,660

Project Duration	
Total Feasibility, Design & Permitting	14 months
Construction	6 months
Total	**20 months**

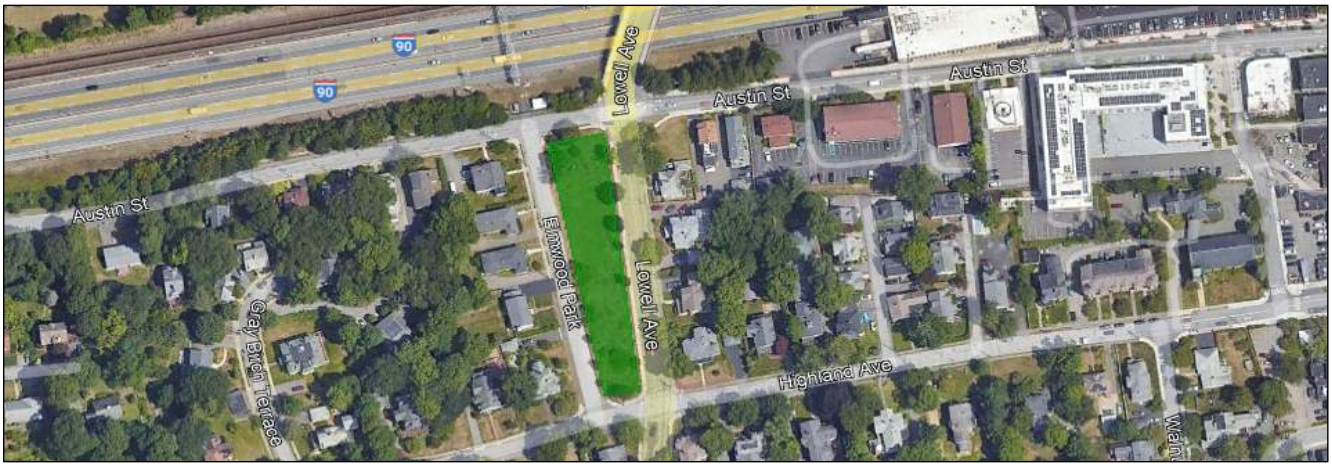
Total Load Reduction (lb/y) :	**46.1**

2023 EPA Total Cost Estimate:	**$ 5,898,150**
W&C Total Cost Estimate:	**$ 2,774,829**
EPA Cost/Benefit ($/lb/y):	**$ 128,062**
W&C Cost/Benefit ($/lb/y):	**$ 60,248**

Project Considerations	Place subsurface chambers in northwest and southeast corner of park ballfields. Chambers to be placed to avoid existing sewer lines crossing park. Existing atheletic fields with poor surface drainage.
2024-2028 Capital Improvement Plan Notes	Ward School Renovation/Replacement
Climate Vulnerability/Flooding Notes	Located in historic wetland area.

Elmwood Park

Infiltration Chamber



Project Reference Number	9
Parcel ID	24008 0001
Address/Location	LOWELL AVE
Property Description	Elmwood Park

Additional Municipal Parcels Treated
24006 0016, 24006 0017, 24009 0004

Invert Depth at Intercepted Pipe (ft)	8 (Austin), 10 (Highland)
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	44.0
Total Contributing Area (ac.)	114.8
Generated TP Load from Total Area (lb/yr)	97.1
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	23,970
Treatment Depth (in.)	0.30
Reduction Efficiency	45%
SCM Volume (CF)	52,467

Project Duration	
Total Feasibility, Design & Permitting	14 months
Construction	5 months
Total	**19 months**

Total Load Reduction (lb/y) :	**43.7**

2023 EPA Total Cost Estimate:	**$ 3,612,600**
W&C Total Cost Estimate:	**$ 1,910,168**
EPA Cost/Benefit ($/lb/y):	**$ 82,639**
W&C Cost/Benefit ($/lb/y):	**$ 43,696**

Project Considerations	Place subsurface chambers in park grassed open space avoiding mature trees.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	--

Albemarle Park/Halloran Sports Complex

Infiltration Chamber

Project Reference Number	10
Parcel ID	21022 0001
Address/Location	250 ALBEMARLE RD
Property Description	Albemarle Park/Halloran Sports Complex

Additional Municipal Parcels Treated
21022 0002, 21023 0019A, 23003 0001, 23004 0010

Invert Depth at Intercepted Pipe (ft)	Unk
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	21.4
Total Contributing Area (ac.)	50.5
Generated TP Load from Total Area (lb/yr)	46.1
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	35,489
Treatment Depth (in.)	1.00
Reduction Efficiency	90%
SCM Volume (CF)	77,900

Project Duration	
Total Feasibility, Design & Permitting	15 months
Construction	6 months
Total	**21 months**

Total Load Reduction (lb/y) :	**41.5**

2023 EPA Total Cost Estimate:	**$ 5,363,550**
W&C Total Cost Estimate:	**$ 2,798,594**
EPA Cost/Benefit ($/lb/y):	**$ 129,170**
W&C Cost/Benefit ($/lb/y):	**$ 67,398**

Project Considerations	Place subsurface chambers in field south of Harry Gath Memorial Pool. Drainage network from F.A. Day Middle School to be diverted while avoiding sewer line.
2024-2028 Capital Improvement Plan Notes	Albemarle Park/Halloran Sports Complex FY24 Project
Climate Vulnerability/Flooding Notes	Just upstream of flood claims.

Wellington Playground

Infiltration Chamber

Project Reference Number	11
Parcel ID	33030 0020
Address/Location	HENSHAW PL OFF
Property Description	Wellington Playground

Additional Municipal Parcels Treated
34026 0002A

Invert Depth at Intercepted Pipe (ft)	8 (North), 9 (South)
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	18.0
Total Contributing Area (ac.)	35.2
Generated TP Load from Total Area (lb/yr)	38.3
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	33,085
Treatment Depth (in.)	1.00
Reduction Efficiency	98%
SCM Volume (CF)	72,560

Project Duration	
Total Feasibility, Design & Permitting	14 months
Construction	6 months
Total	**20 months**

Total Load Reduction (lb/y) :	**37.5**

2023 EPA Total Cost Estimate:	**$ 4,996,350**
W&C Total Cost Estimate:	**$ 2,573,105**
EPA Cost/Benefit ($/lb/y):	**$ 133,219**
W&C Cost/Benefit ($/lb/y):	**$ 68,607**

Project Considerations	Place subsurface chambers in open grass areas in north and south portions of park. Residential properties directly abut park. Retrofit existing drain infrastructure in grass areas.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	Located where there are flood claims and flood damage reported in 2010.

Cold Spring Park

Gravel/Constructed Wetland

Project Reference Number	12
Parcel ID	54021 0002
Address/Location	170 R PLYMOUTH RD
Property Description	Cold Spring Park

Additional Municipal Parcels Treated
54021 0001, 54017 0013, 54027 0001, 54030 0010, 54030 0017, 54031 0006

Invert Depth at Intercepted Pipe (ft)	Unk
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	26.9
Total Contributing Area (ac.)	85.1
Generated TP Load from Total Area (lb/yr)	59.4
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	33,000
Treatment Depth (in.)	0.65
Reduction Efficiency	53%
SCM Volume (CF)	66,000

Project Duration	
Total Feasibility, Design & Permitting	15 months
Construction	7 months
Total	**22 months**

Total Load Reduction (lb/y) :	**31.2**

2023 EPA Total Cost Estimate:	**$ 1,871,100**
W&C Total Cost Estimate:	**$ 2,340,756**
EPA Cost/Benefit ($/lb/y):	**$ 59,952**
W&C Cost/Benefit ($/lb/y):	**$ 75,000**

Project Considerations	Place gravel wetland in southern baseball field no longer in use. Direct drainage network outfall open channel to flow through gravel wetland for treatment. Gravel wetland to avoid existing trees and sewer line.
2024-2028 Capital Improvement Plan Notes	Renovation of Old Cold Spring Park field space to include regrading, drainage, irrigation, and accessibility upgrades.
Climate Vulnerability/Flooding Notes	--

Oak Hill Middle School Parking

Infiltration Chamber

Project Reference Number	13
Parcel ID	81006 0001
Address/Location	WHEELER RD
Property Description	Oak Hill Middle School Parking

Additional Municipal Parcels Treated
81005 0011

Invert Depth at Intercepted Pipe (ft)	Unk
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	18.3
Total Contributing Area (ac.)	37.2
Generated TP Load from Total Area (lb/yr)	37.8
Dimensions (Length x Width)	200x115
SCM Footprint (SF)	23,000
Treatment Depth (in.)	0.65
Reduction Efficiency	76%
SCM Volume (CF)	46,000

Project Duration	
Total Feasibility, Design & Permitting	14 months
Construction	5 months
Total	**19 months**

Total Load Reduction (lb/y) :	**28.5**

2023 EPA Total Cost Estimate:	**$ 3,167,100**
W&C Total Cost Estimate:	**$ 1,708,536**
EPA Cost/Benefit ($/lb/y):	**$ 111,026**
W&C Cost/Benefit ($/lb/y):	**$ 59,895**

Project Considerations	Place subsurface chambers under existing parking lot. Solar canopies are planned to be added to this parcel in the future.
2024-2028 Capital Improvement Plan Notes	CIP identifies Brown/Oak Hill Middle School playing fields as tentative future project (FY25-30).
Climate Vulnerability/Flooding Notes	--

Richard McGrath Park

Infiltration Chamber

Project Reference Number	14
Parcel ID	32024 0006A
Address/Location	WASHINGTON ST
Property Description	Richard McGrath Park

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	8
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	13.1
Total Contributing Area (ac.)	23.7
Generated TP Load from Total Area (lb/yr)	27.6
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	12,000
Treatment Depth (in.)	0.50
Reduction Efficiency	86%
SCM Volume (CF)	24,000

Project Duration	
Total Feasibility, Design & Permitting	12 months
Construction	4 months
Total	**16 months**

Total Load Reduction (lb/y) :	**23.7**

2023 EPA Total Cost Estimate:	**$ 1,652,400**
W&C Total Cost Estimate:	**$ 928,284**
EPA Cost/Benefit ($/lb/y):	**$ 69,656**
W&C Cost/Benefit ($/lb/y):	**$ 39,131**

Project Considerations	Place subsurface chambers in grassed area between tennis courts and parking lot to treat Washington St drainage network. Place subsurface chambers in grassed area adjacent to Myrtle St to treat Myrtle St drainage network. Mature trees to be avoided.
2024-2028 Capital Improvement Plan Notes	CIP identifies field improvement project. Water repairs to be done in 2024 on Washington St as well.
Climate Vulnerability/Flooding Notes	Directly upstream of flood damage reported in 2010.

Richardson Playground

Infiltration Chamber

Project Reference Number	15
Parcel ID	53016 0007
Address/Location	ALLEN AVE
Property Description	Richardson Playground

Additional Municipal Parcels Treated
53016 0002, 53022 0009, 54012 0010

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	10.7
Total Contributing Area (ac.)	36.0
Generated TP Load from Total Area (lb/yr)	23.5
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	19,500
Treatment Depth (in.)	1.00
Reduction Efficiency	98%
SCM Volume (CF)	39,000

Project Duration	
Total Feasibility, Design & Permitting	13 months
Construction	5 months
Total	**18 months**

Total Load Reduction (lb/y) :	**23.0**

2023 EPA Total Cost Estimate:	**$ 2,685,150**
W&C Total Cost Estimate:	**$ 1,421,724**
EPA Cost/Benefit ($/lb/y):	**$ 116,509**
W&C Cost/Benefit ($/lb/y):	**$ 61,689**

Project Considerations	Place chambers in grassed area north of baseball field. Treatment provided for both Allen Ave and Beethoven Ave networks. Chambers system to be designed around existing water line which crosses park.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	Upstream of flood claims and reported flood damages in 2010.

Auburndale and Lyons Parks

Gravel/Constructed Wetland

Project Reference Number	16
Parcel ID	41022 0001
Address/Location	COMMONWEALTH AVE
Property Description	Auburndale and Lyons Parks

Additional Municipal Parcels Treated
41013 0012, 41013 0013, 43031 0002, 43031 0003

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	30.3
Total Contributing Area (ac.)	65.5
Generated TP Load from Total Area (lb/yr)	63.8
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	19,000
Treatment Depth (in.)	0.30
Reduction Efficiency	34%
SCM Volume (CF)	38,000

Project Duration	
Total Feasibility, Design & Permitting	17 months
Construction	6 months
Total	**23 months**

Total Load Reduction (lb/y) :	**21.4**

2023 EPA Total Cost Estimate:	**$ 1,077,300**
W&C Total Cost Estimate:	**$ 1,424,808**
EPA Cost/Benefit ($/lb/y):	**$ 50,386**
W&C Cost/Benefit ($/lb/y):	**$ 66,639**

Project Considerations	Place gravel/constructed wetland SCM in open grassed area north of Lyons Field. Trail boardwalk planned to include wetland restoration and expansion.
2024-2028 Capital Improvement Plan Notes	Lyons Field Drainage Improvements to include renovation of the natural grass field to improve drainage. This is also part of the Marty Sender Greenway Project. It looks like this opportunity falls within Phase 2 of the CIP project.
Climate Vulnerability/Flooding Notes	Locally identified areas of flooding.

Mason-Rice School

Infiltration Basin

Project Reference Number	17A
Parcel ID	64032 0005 (1)
Address/Location	149 PLEASANT ST CTR
Property Description	Mason-Rice School

Additional Municipal Parcels Treated
64032 0006

Invert Depth at Intercepted Pipe (ft)	Unk
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	13.1
Total Contributing Area (ac.)	26.9
Generated TP Load from Total Area (lb/yr)	27.6
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	3,200
Treatment Depth (in.)	0.25
Reduction Efficiency	72%
SCM Volume (CF)	12,800

Project Duration	
Total Feasibility, Design & Permitting	12 months
Construction	4 months
Total	**16 months**

Total Load Reduction (lb/y) :	**19.9**

2023 EPA Total Cost Estimate:	**$ 259,200**
W&C Total Cost Estimate:	**$ 217,422**
EPA Cost/Benefit ($/lb/y):	**$ 13,024**
W&C Cost/Benefit ($/lb/y):	**$ 10,925**

Project Considerations	Infiltration basin located adjacent to Pleasant St and school parking entrance. Mature trees to be avoided.
2024-2028 Capital Improvement Plan Notes	Part of a larger school parking lot repaving effort. Roof replacement and mid-range renovation/addition to building as well.
Climate Vulnerability/Flooding Notes	--

Mason-Rice School

Porous Pavement

Project Reference Number	17B
Parcel ID	64032 0005 (2)
Address/Location	149 PLEASANT ST CTR
Property Description	Mason-Rice School

Project Duration	
Total Feasibility, Design & Permitting	13 months
Construction	5 months
Total	**18 months**

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	0.5
Total Contributing Area (ac.)	0.5
Generated TP Load from Total Area (lb/yr)	0.9
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	23,000
Treatment Depth (in.)	1.00
Reduction Efficiency	62%
SCM Volume (CF)	20,700

Total Load Reduction (lb/y) :	**0.6**

2023 EPA Total Cost Estimate:	**$ 1,174,500**
W&C Total Cost Estimate:	**$ 1,915,164**
EPA Cost/Benefit ($/lb/y):	**$ 2,015,586**
W&C Cost/Benefit ($/lb/y):	**$ 3,286,656**

Project Site Considerations	Existing Mason-Rice Elementary School parking lot to be converted to porous pavement.
2024-2028 Capital Improvement Plan Notes	Part of a larger school parking lot repaving effort. Roof replacement and mid-range renovation/addition to building as well.
Climate Vulnerability/Flooding Notes	--

West Pine St Parking lot

Infiltration Chamber

Project Reference Number	18
Parcel ID	41031 0037
Address/Location	WEST PINE ST
Property Description	West Pine St Parking lot

Additional Municipal Parcels Treated
41031 0036A

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	9.0
Total Contributing Area (ac.)	20.3
Generated TP Load from Total Area (lb/yr)	18.9
Dimensions (Length x Width)	164x100
SCM Footprint (SF)	16,400
Treatment Depth (in.)	1.00
Reduction Efficiency	98%
SCM Volume (CF)	32,800

Project Duration	
Total Feasibility, Design & Permitting	12 months
Construction	5 months
Total	**17 months**

Total Load Reduction (lb/y) :	**18.5**

2023 EPA Total Cost Estimate:	**$ 2,258,550**
W&C Total Cost Estimate:	**$ 1,187,648**
EPA Cost/Benefit ($/lb/y):	**$ 122,179**
W&C Cost/Benefit ($/lb/y):	**$ 64,247**

Project Considerations	Place subsurface chamber system under Auburndale Playground parking lot for West Pine St drainage network.
2024-2028 Capital Improvement Plan Notes	This is part of the Marty Sender Greenway Project. It looks like this opportunity falls within Phase 3 of the CIP project.
Climate Vulnerability/Flooding Notes	--

Franklin Elementary School

Infiltration Chamber

Project Reference Number	19
Parcel ID	34037 0021
Address/Location	125 DERBY ST
Property Description	Franklin Elementary School

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	C
Impervious Drainage Area (ac.)	9.1
Total Contributing Area (ac.)	18.0
Generated TP Load from Total Area (lb/yr)	20.0
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	17,000
Treatment Depth (in.)	1.00
Reduction Efficiency	92%
SCM Volume (CF)	34,000

Project Duration	
Total Feasibility, Design & Permitting	13 months
Construction	5 months
Total	**18 months**

Total Load Reduction (lb/y) :	**18.4**

2023 EPA Total Cost Estimate:	**$ 2,340,900**
W&C Total Cost Estimate:	**$ 1,244,394**
EPA Cost/Benefit ($/lb/y):	**$ 127,279**
W&C Cost/Benefit ($/lb/y):	**$ 67,660**

Project Considerations	Place subsurface chamber system in grassed fields. Chambers to be split around sewer line which crosses lot.
2024-2028 Capital Improvement Plan Notes	Franklin School Renovation/Addition - Feasibility study/design and construction
Climate Vulnerability/Flooding Notes	Upstream of many reported damages in 2010.

Countryside School

Infiltration Basin

Project Reference Number	20A
Parcel ID	83006 0011 (1)
Address/Location	191 DEDHAM ST
Property Description	Countryside School

Project Duration	
Total Feasibility, Design & Permitting	13 months
Construction	4 months
Total	**17 months**

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	1.7
Total Contributing Area (ac.)	3.2
Generated TP Load from Total Area (lb/yr)	3.5
Dimensions (Length x Width)	40x40
SCM Footprint (SF)	1,600
Treatment Depth (in.)	1.00
Reduction Efficiency	92%
SCM Volume (CF)	6,400

Total Load Reduction (lb/y) :	**3.2**

2023 EPA Total Cost Estimate:	**$ 129,600**
W&C Total Cost Estimate:	**$ 89,436**
EPA Cost/Benefit ($/lb/y):	**$ 40,729**
W&C Cost/Benefit ($/lb/y):	**$ 28,107**

Project Site Considerations	Place infiltration basin SCM in grassed area in southeast corner of lot adjacent to Dedham St. SCM to be planned with school building/lot future development.
2024-2028 Capital Improvement Plan Notes	Countryside School renovation/addition - Feasibility study/design and construction
Climate Vulnerability/Flooding Notes	Located in a location of many flood claims along the South Meadow Brook.

Countryside School
Infiltration Chamber

Project Reference Number	20B
Parcel ID	83006 0011 (2)
Address/Location	191 DEDHAM ST
Property Description	Countryside School

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	8.1
Total Contributing Area (ac.)	17.1
Generated TP Load from Total Area (lb/yr)	16.8
Dimensions (Length x Width)	148x100
SCM Footprint (SF)	14,800
Treatment Depth (in.)	1.00
Reduction Efficiency	90%
SCM Volume (CF)	29,600

Project Duration	
Total Feasibility, Design & Permitting	14 months
Construction	5 months
Total	**19 months**

Total Load Reduction (lb/y) :	**15.1**

2023 EPA Total Cost Estimate:	**$ 2,038,500**
W&C Total Cost Estimate:	**$ 1,089,269**
EPA Cost/Benefit ($/lb/y):	**$ 135,112**
W&C Cost/Benefit ($/lb/y):	**$ 72,197**

Project Considerations	Place subsurface chamber system in grassed area north of school and west of parking. SCM to be planned with school building/lot future development.
2024-2028 Capital Improvement Plan Notes	Countryside School renovation/addition - Feasibility study/design and construction
Climate Vulnerability/Flooding Notes	Located in a location of many flood claims along the South Meadow Brook.

Resource Recovery Center

Infiltration Chamber

Project Reference Number	21
Parcel ID	41031 0043
Address/Location	211 LEXINGTON ST
Property Description	Resource Recovery Center

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	Unk
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	24.9
Total Contributing Area (ac.)	60.8
Generated TP Load from Total Area (lb/yr)	54.3
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	18,213
Treatment Depth (in.)	0.20
Reduction Efficiency	33%
SCM Volume (CF)	18,213

Project Duration	
Total Feasibility, Design & Permitting	11 months
Construction	5 months
Total	**16 months**

Total Load Reduction (lb/y) :	**17.9**

2023 EPA Total Cost Estimate:	**$ 1,254,150**
W&C Total Cost Estimate:	**$ 836,850**
EPA Cost/Benefit ($/lb/y):	**$ 69,943**
W&C Cost/Benefit ($/lb/y):	**$ 46,670**

Project Considerations	Place subsurface chambers beneath recycling center paved lot. Divert drainage from Rumford Ave for treatment. Possible high ground water may be paired with smaller chambers. Design to consider and mitigate potential pollutants and environmental hazard introductions from the site.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	--

Boyd Park

Infiltration Chamber

Project Reference Number	22
Parcel ID	11020 0002
Address/Location	44 JACKSON RD
Property Description	Boyd Park

Additional Municipal Parcels Treated
12004 0033

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	8.9
Total Contributing Area (ac.)	14.8
Generated TP Load from Total Area (lb/yr)	19.2
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	16,300
Treatment Depth (in.)	1.00
Reduction Efficiency	90%
SCM Volume (CF)	32,600

Project Duration	
Total Feasibility, Design & Permitting	15 months
Construction	6 months
Total	**21 months**

Total Load Reduction (lb/y) :	**17.3**

2023 EPA Total Cost Estimate:	**$ 2,245,050**
W&C Total Cost Estimate:	**$ 1,195,667**
EPA Cost/Benefit ($/lb/y):	**$ 129,668**
W&C Cost/Benefit ($/lb/y):	**$ 69,059**

Project Considerations	Place subsurface chamber system south of basketball courts beneath parking, playground, and grassed areas. Divert drain networks for treatment prior to connection to Laundry Brook culvert.
2024-2028 Capital Improvement Plan Notes	150 Jackson Rd project to replace Lincoln-Eliot School and add new park/field space
Climate Vulnerability/Flooding Notes	--

DPW Yard

Infiltration Chamber

Project Reference Number	23A
Parcel ID	23015 0027 (1)
Address/Location	90 CRAFTS ST
Property Description	DPW Yard

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	6.3
Total Contributing Area (ac.)	9.4
Generated TP Load from Total Area (lb/yr)	13.2
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	11,400
Treatment Depth (in.)	1.00
Reduction Efficiency	90%
SCM Volume (CF)	22,800

Project Duration	
Total Feasibility, Design & Permitting	12 months
Construction	5 months
Total	**17 months**

Total Load Reduction (lb/y) :	**11.9**

2023 EPA Total Cost Estimate:	**$ 1,570,050**
W&C Total Cost Estimate:	**$ 809,858**
EPA Cost/Benefit ($/lb/y):	**$ 131,830**
W&C Cost/Benefit ($/lb/y):	**$ 68,000**

Project Considerations	Place subsurface chamber system under parking lot along Crafts St. Avoid water and sewer utilities east of building.
2024-2028 Capital Improvement Plan Notes	Craft St DPW Yard SW Improvements. To include resurfacing and re-grading pavement for accessibility.
Climate Vulnerability/Flooding Notes	--

DPW Yard

Infiltration Chamber

Project Reference Number	23B
Parcel ID	23015 0027 (2)
Address/Location	90 CRAFTS ST
Property Description	DPW Yard

Project Duration	
Total Feasibility, Design & Permitting	11 months
Construction	4 months
Total	**15 months**

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	2.5
Total Contributing Area (ac.)	3.2
Generated TP Load from Total Area (lb/yr)	4.5
Dimensions (Length x Width)	50x90
SCM Footprint (SF)	4,500
Treatment Depth (in.)	1.00
Reduction Efficiency	90%
SCM Volume (CF)	9,000

Total Load Reduction (lb/y) :	**4.1**

2023 EPA Total Cost Estimate:	**$ 619,650**
W&C Total Cost Estimate:	**$ 263,682**
EPA Cost/Benefit ($/lb/y):	**$ 152,942**
W&C Cost/Benefit ($/lb/y):	**$ 65,082**

Project Site Considerations	Place subsurface chambers in southwest of lot under the large open pavement area northeast of the storage warehouses.
2024-2028 Capital Improvement Plan Notes	Craft St DPW Yard SW Improvements. To include resurfacing and re-grading pavement for accessibility.
Climate Vulnerability/Flooding Notes	--

Hunnewell Playground

Infiltration Basin

Project Reference Number	24
Parcel ID	71026 0024
Address/Location	GRASMERE ST
Property Description	Hunnewell Playground

Additional Municipal Parcels Treated
71026 0023

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	7.7
Total Contributing Area (ac.)	18.0
Generated TP Load from Total Area (lb/yr)	17.6
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	6,600
Treatment Depth (in.)	0.90
Reduction Efficiency	90%
SCM Volume (CF)	26,400

Project Duration	
Total Feasibility, Design & Permitting	12 months
Construction	5 months
Total	**17 months**

Total Load Reduction (lb/y) :	**15.8**

2023 EPA Total Cost Estimate:	**$ 534,600**
W&C Total Cost Estimate:	**$ 366,996**
EPA Cost/Benefit ($/lb/y):	**$ 33,835**
W&C Cost/Benefit ($/lb/y):	**$ 23,227**

Project Considerations	Place basin on western limit of park grassed open space. Intercept and divert drainage network which drains down from Grasmere St. Limited tree removal required for network diversion connection.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	--

E. Side Parkway Grassed Median

Infiltration Chamber

Project Reference Number	25
Parcel ID	13001 0002
Address/Location	EAST SIDE PKWY
Property Description	E. Side Parkway Grassed Median

Additional Municipal Parcels Treated
13001 0001, 13001 0002

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	10.2
Total Contributing Area (ac.)	22.8
Generated TP Load from Total Area (lb/yr)	22.7
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	4,800
Treatment Depth (in.)	0.25
Reduction Efficiency	62%
SCM Volume (CF)	9,600

Project Duration	
Total Feasibility, Design & Permitting	10 months
Construction	4 months
Total	**14 months**

Total Load Reduction (lb/y) :	**14.0**

2023 EPA Total Cost Estimate:	**$ 661,500**
W&C Total Cost Estimate:	**$ 418,499**
EPA Cost/Benefit ($/lb/y):	**$ 47,389**
W&C Cost/Benefit ($/lb/y):	**$ 29,980**

Project Considerations	Placement of two subsurface chamber SCMs. One in grassed island at intersection of Newtonville Ave and East Side Pkwy, second east of tennis courts adjacent to East Side Pkwy. Avoid existing mature trees.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	--

Newton Commonwealth Golf Course

Infiltration Chamber

Project Reference Number	26A
Parcel ID	72039 0017 (1)
Address/Location	KENRICK ST OFF
Property Description	Newton Commonwealth Golf Course

Additional Municipal Parcels Treated
72039 0018

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	5.2
Total Contributing Area (ac.)	16.8
Generated TP Load from Total Area (lb/yr)	13.5
Dimensions (Length x Width)	50x200
SCM Footprint (SF)	10,000
Treatment Depth (in.)	1.00
Reduction Efficiency	98%
SCM Volume (CF)	20,000

Project Duration	
Total Feasibility, Design & Permitting	10 months
Construction	5 months
Total	**15 months**

Total Load Reduction (lb/y) :	**13.2**

2023 EPA Total Cost Estimate:	**$ 1,377,000**
W&C Total Cost Estimate:	**$ 732,450**
EPA Cost/Benefit ($/lb/y):	**$ 103,929**
W&C Cost/Benefit ($/lb/y):	**$ 55,281**

Project Considerations	Place subsurface chamber system in grassed rough and fairway area south of maintenance building parking lot. Avoid sewer line crossing. SCM to be coordinated with Conservation Commission and course operator.
2024-2028 Capital Improvement Plan Notes	Newton Commonwealth Golf Course Maintenance Facility Project (Renovation/addition)
Climate Vulnerability/Flooding Notes	--

Newton Commonwealth Golf Course

Infiltration Trench

Project Reference Number	26B
Parcel ID	72039 0017 (2)
Address/Location	KENRICK ST OFF
Property Description	Newton Commonwealth Golf Course

Project Duration	
Total Feasibility, Design & Permitting	12 months
Construction	4 months
Total	**16 months**

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	0.5
Total Contributing Area (ac.)	0.8
Generated TP Load from Total Area (lb/yr)	0.8
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	800
Treatment Depth (in.)	0.50
Reduction Efficiency	65%
SCM Volume (CF)	960

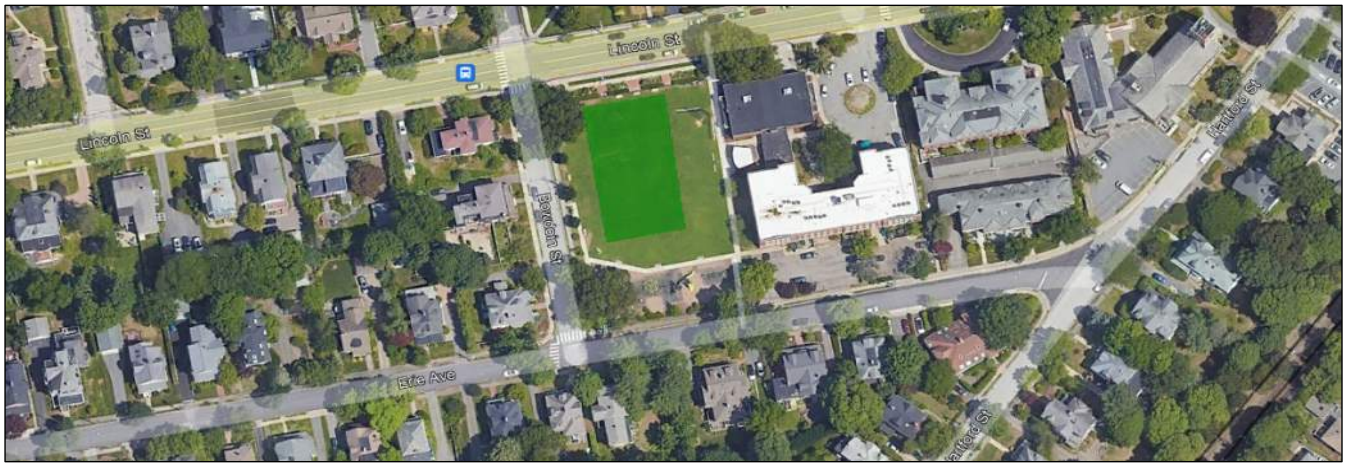
Total Load Reduction (lb/y) :	**0.5**

2023 EPA Total Cost Estimate:	**$ 37,800**
W&C Total Cost Estimate:	**$ 64,764**
EPA Cost/Benefit ($/lb/y):	**$ 69,077**
W&C Cost/Benefit ($/lb/y):	**$ 118,351**

Project Site Considerations	Place infiltration trenches in the expanded driveway area just north of the parking lot and in the grassed parking lot island.
2024-2028 Capital Improvement Plan Notes	Newton Commonwealth Golf Course Maintenance Facility Project (Renovation/addition)
Climate Vulnerability/Flooding Notes	--

Hyde Playground and Park

Infiltration Chamber



Project Reference Number	27
Parcel ID	52041 0001
Address/Location	100 LINCOLN ST
Property Description	Hyde Playground and Park

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	6.3
Total Contributing Area (ac.)	17.4
Generated TP Load from Total Area (lb/yr)	13.9
Dimensions (Length x Width)	125x92
SCM Footprint (SF)	11,500
Treatment Depth (in.)	1.00
Reduction Efficiency	98%
SCM Volume (CF)	23,000

Project Duration	
Total Feasibility, Design & Permitting	13 months
Construction	5 months
Total	**18 months**

Total Load Reduction (lb/y) :	**13.6**

2023 EPA Total Cost Estimate:	**$ 1,583,550**
W&C Total Cost Estimate:	**$ 854,268**
EPA Cost/Benefit ($/lb/y):	**$ 116,654**
W&C Cost/Benefit ($/lb/y):	**$ 62,931**

Project Considerations	Place subsurface chambers beneath grassed open space. Design SCM to avoid perimeter trees.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	--

Newton Police Headquarters Parking Lot

Infiltration Chamber

Project Reference Number	28
Parcel ID	33011 0001
Address/Location	1321 WASHINGTON ST
Property Description	Newton Police Headquarters Parking Lot

Additional Municipal Parcels Treated
33011 0011

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	6.2
Total Contributing Area (ac.)	9.3
Generated TP Load from Total Area (lb/yr)	12.8
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	7,900
Treatment Depth (in.)	0.70
Reduction Efficiency	94%
SCM Volume (CF)	15,800

Project Duration	
Total Feasibility, Design & Permitting	12 months
Construction	5 months
Total	**17 months**

Total Load Reduction (lb/y) :	**12.0**

2023 EPA Total Cost Estimate:	**$ 1,088,100**
W&C Total Cost Estimate:	**$ 600,146**
EPA Cost/Benefit ($/lb/y):	**$ 90,698**
W&C Cost/Benefit ($/lb/y):	**$ 50,025**

Project Considerations	Place subsurface chamber system beneath parking lot between Police garage and headquarters building. Divert Cherry St network for treatment and retrofit existing lot drainage infrastructure for treatment.
2024-2028 Capital Improvement Plan Notes	New police headquarter facility project for comprehensive headquarters renovation and upgrades. Parking lot and building envelope upgrades included.
Climate Vulnerability/Flooding Notes	Located in historic wetland area.

Bigelow Middle School

Infiltration Chamber

Project Reference Number	29
Parcel ID	72010 0001
Address/Location	42 VERNON ST
Property Description	Bigelow Middle School

Additional Municipal Parcels Treated
72009 0003

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	5.7
Total Contributing Area (ac.)	13.9
Generated TP Load from Total Area (lb/yr)	13.0
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	10,400
Treatment Depth (in.)	1.00
Reduction Efficiency	90%
SCM Volume (CF)	20,800

Project Duration	
Total Feasibility, Design & Permitting	12 months
Construction	5 months
Total	**17 months**

Total Load Reduction (lb/y) :	**11.7**

2023 EPA Total Cost Estimate:	**$ 1,432,350**
W&C Total Cost Estimate:	**$ 777,476**
EPA Cost/Benefit ($/lb/y):	**$ 122,501**
W&C Cost/Benefit ($/lb/y):	**$ 66,494**

Project Considerations	Place subsurface chambers under parking lot. Design SCM not avoid existing parking lot shade tree.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	--

Spears Park

Infiltration Chamber

Project Reference Number	30
Parcel ID	12003 0001
Address/Location	WALNUT PK
Property Description	Spears Park

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	6.3
Total Contributing Area (ac.)	10.7
Generated TP Load from Total Area (lb/yr)	14.0
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	8,000
Treatment Depth (in.)	0.65
Reduction Efficiency	76%
SCM Volume (CF)	16,000

Project Duration	
Total Feasibility, Design & Permitting	12 months
Construction	5 months
Total	**17 months**

Total Load Reduction (lb/y) :	**10.6**

2023 EPA Total Cost Estimate:	**$ 1,101,600**
W&C Total Cost Estimate:	**$ 644,556**
EPA Cost/Benefit ($/lb/y):	**$ 104,204**
W&C Cost/Benefit ($/lb/y):	**$ 60,971**

Project Considerations	Place subsurface chambers in open grassed area of Spears Park. Avoid mature trees at perimeter of park.
2024-2028 Capital Improvement Plan Notes	Spears Park Community Garden project identified in the CIP. This could be a good opportunity for water reuse and education.
Climate Vulnerability/Flooding Notes	Upstream of flooding damages reported in 2010 and located in historic wetland area.

Cold Spring Park

Gravel/Constructed Wetland

Project Reference Number	31
Parcel ID	54022 0049B
Address/Location	BEACON ST REAR
Property Description	Cold Spring Park

Additional Municipal Parcels Treated
54022 0051A, 54022 0057, 54022 0052A, 54022 0050A, 62004 0015

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	B/D
Impervious Drainage Area (ac.)	26.2
Total Contributing Area (ac.)	55.5
Generated TP Load from Total Area (lb/yr)	55.0
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	4,800
Treatment Depth (in.)	0.10
Reduction Efficiency	19%
SCM Volume (CF)	9,600

Project Duration	
Total Feasibility, Design & Permitting	13 months
Construction	5 months
Total	**18 months**

Total Load Reduction (lb/y) :	**10.5**

2023 EPA Total Cost Estimate:	**$ 272,700**
W&C Total Cost Estimate:	**$ 363,912**
EPA Cost/Benefit ($/lb/y):	**$ 26,094**
W&C Cost/Benefit ($/lb/y):	**$ 34,822**

Project Considerations	Place gravel/constructed wetland SCM southeast of field. Beaconwood Rd drainage to be diverted to SCM for treatment. Avoid or limit disturbance to mature trees for SCM diversion. Historic landfill at site; additional research and site investigation required to determine feasibility and/or limitations. Pair with project project reference number 46.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	--

Newton Commonwealth Golf Course

Infiltration Chamber

Project Reference Number	32
Parcel ID	72039 0021
Address/Location	MAGNOLIA AVE
Property Description	Newton Commonwealth Golf Course

Additional Municipal Parcels Treated
73009 0019

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	D
Impervious Drainage Area (ac.)	5.8
Total Contributing Area (ac.)	20.8
Generated TP Load from Total Area (lb/yr)	14.3
Dimensions (Length x Width)	125x80
SCM Footprint (SF)	6,600
Treatment Depth (in.)	0.60
Reduction Efficiency	73%
SCM Volume (CF)	13,200

Project Duration	
Total Feasibility, Design & Permitting	12 months
Construction	5 months
Total	**17 months**

Total Load Reduction (lb/y) :	**10.4**

2023 EPA Total Cost Estimate:	**$ 909,900**
W&C Total Cost Estimate:	**$ 530,140**
EPA Cost/Benefit ($/lb/y):	**$ 87,098**
W&C Cost/Benefit ($/lb/y):	**$ 50,747**

Project Considerations	Place subsurface chambers in northwest corner of golf course. Site chambers with topography. SCM to be coordinated with Conservation Commission and course operator.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	--

Brown Middle School

Infiltration Chamber

Project Reference Number	33
Parcel ID	81005 0011
Address/Location	125 MEADOWBROOK RD
Property Description	Brown Middle School

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	5.4
Total Contributing Area (ac.)	14.9
Generated TP Load from Total Area (lb/yr)	11.5
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	9,800
Treatment Depth (in.)	1.00
Reduction Efficiency	90%
SCM Volume (CF)	19,600

Project Duration	
	12 months
Construction	5 months
Total	**17 months**

Total Load Reduction (lb/y) :	**10.4**

2023 EPA Total Cost Estimate:	**$ 1,350,000**
W&C Total Cost Estimate:	**$ 734,609**
EPA Cost/Benefit ($/lb/y):	**$ 130,219**
W&C Cost/Benefit ($/lb/y):	**$ 70,859**

Project Considerations	Place subsurface chamber system in grassed area in north east corner of Charles E. Brown Middle School lot. System to be located on either side of drainage network.
2024-2028 Capital Improvement Plan Notes	Brown/Oak Hill Middle School Fields Development to renovate natural grass areas.
Climate Vulnerability/Flooding Notes	Located in historic wetland area.

Newton South High School

Infiltration Chamber

Project Reference Number	34A
Parcel ID	81051 0047 (1)
Address/Location	140 BRANDEIS RD
Property Description	Newton South High School

Project Duration	
Total Feasibility, Design & Permitting	15 months
Construction	6 months
Total	**21 months**

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	3.9
Total Contributing Area (ac.)	4.8
Generated TP Load from Total Area (lb/yr)	7.2
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	7,200
Treatment Depth (in.)	1.00
Reduction Efficiency	90%
SCM Volume (CF)	14,400

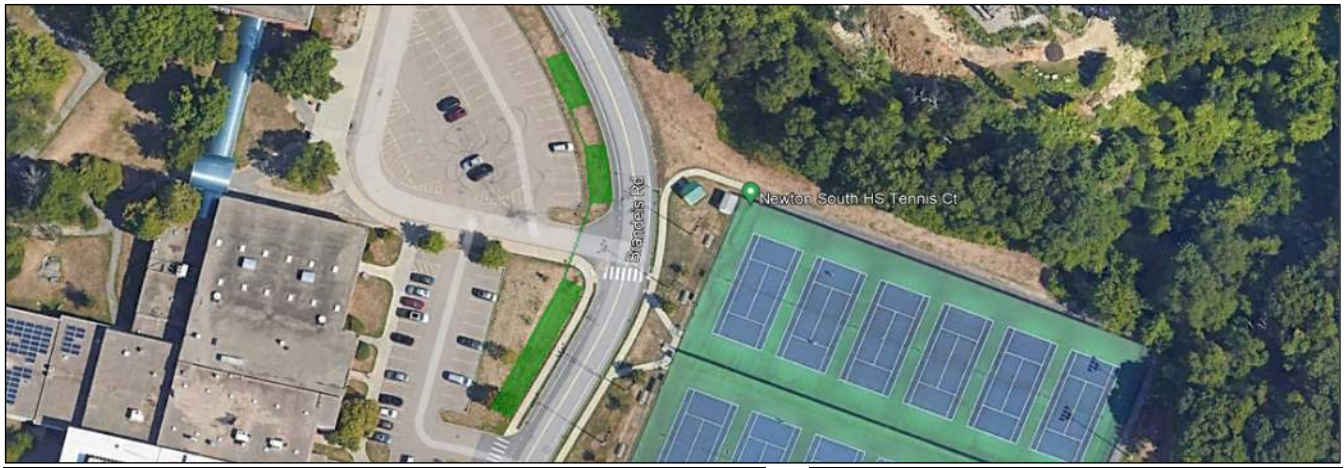
Total Load Reduction (lb/y) :	**6.5**

2023 EPA Total Cost Estimate:	**$ 992,250**
W&C Total Cost Estimate:	**$ 422,508**
EPA Cost/Benefit ($/lb/y):	**$ 153,295**
W&C Cost/Benefit ($/lb/y):	**$ 65,274**

Project Site Considerations	Subsurface chambers to be installed beneath Winkler Stadium sysnthetic turf field. Onsite drainage network to be re-routed from parking lot turnaround at south east corner of building to chambers. Existing drainline beneath baseball field to be abandoned.
2024-2028 Capital Improvement Plan Notes	Replacement of synthetic turf and track.
Climate Vulnerability/Flooding Notes	--

Newton South High School

Infiltration Chamber



Project Reference Number	34B
Parcel ID	81051 0047 (2)
Address/Location	140 BRANDEIS RD
Property Description	Newton South High School

Project Duration	
Total Feasibility, Design & Permitting	11 months
Construction	4 months
Total	**15 months**

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	1.5
Total Contributing Area (ac.)	2.1
Generated TP Load from Total Area (lb/yr)	2.9
Dimensions (Length x Width)	50x28
SCM Footprint (SF)	2,300
Treatment Depth (in.)	0.80
Reduction Efficiency	83%
SCM Volume (CF)	4,600

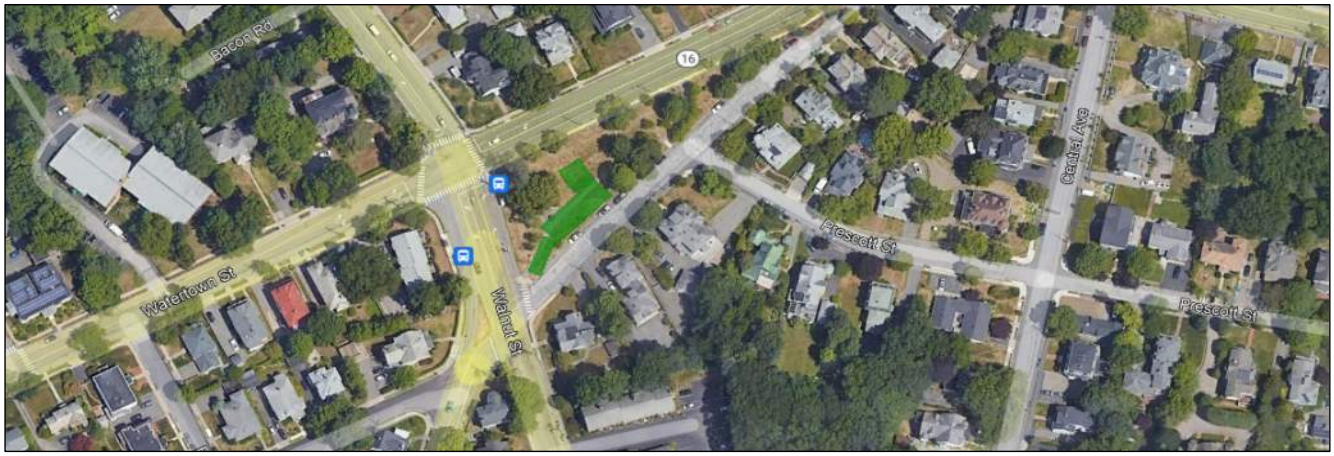
Total Load Reduction (lb/y) :	**2.4**

2023 EPA Total Cost Estimate:	**$ 317,250**
W&C Total Cost Estimate:	**$ 135,696**
EPA Cost/Benefit ($/lb/y):	**$ 132,970**
W&C Cost/Benefit ($/lb/y):	**$ 56,875**

Project Site Considerations	Place subsurface chambers in grassed parking lot islands across the street from the tennis courts. SCM to treat roadway and parking lot drainage. Small trees will need to be removed and replaced.
2024-2028 Capital Improvement Plan Notes	Replacement of synthetic turf and track.
Climate Vulnerability/Flooding Notes	--

Lowell Park

Infiltration Chamber



Project Reference Number	35
Parcel ID	23013 0001
Address/Location	WATERTOWN ST
Property Description	Lowell Park

Additional Municipal Parcels Treated
23008 0001

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	4.2
Total Contributing Area (ac.)	6.8
Generated TP Load from Total Area (lb/yr)	8.5
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	4,200
Treatment Depth (in.)	0.55
Reduction Efficiency	89%
SCM Volume (CF)	8,400

Project Duration	
Total Feasibility, Design & Permitting	11 months
Construction	4 months
Total	**15 months**

Total Load Reduction (lb/y) :	**7.6**

2023 EPA Total Cost Estimate:	**$ 579,150**
W&C Total Cost Estimate:	**$ 337,081**
EPA Cost/Benefit ($/lb/y):	**$ 76,589**
W&C Cost/Benefit ($/lb/y):	**$ 44,577**

Project Considerations	Place subsurface chambers in park south west open spaces. Avoid existing mature trees.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	Upstream of reported flooding damage in 2010.

Reverend Ford Playground

Infiltration Chamber

Project Reference Number	36
Parcel ID	33006 0061
Address/Location	70 CRESCENT ST
Property Description	Reverend Ford Playground

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	13.5
Total Contributing Area (ac.)	26.1
Generated TP Load from Total Area (lb/yr)	28.6
Dimensions (Length x Width)	50x80
SCM Footprint (SF)	4,000
Treatment Depth (in.)	0.15
Reduction Efficiency	26%
SCM Volume (CF)	8,000

Project Duration	
Total Feasibility, Design & Permitting	14 months
Construction	5 months
Total	**19 months**

Total Load Reduction (lb/y) :	**7.3**

2023 EPA Total Cost Estimate:	**$ 550,800**
W&C Total Cost Estimate:	**$ 283,728**
EPA Cost/Benefit ($/lb/y):	**$ 75,587**
W&C Cost/Benefit ($/lb/y):	**$ 38,937**

Project Considerations	Place subsurface chambers in grassed area and beneath playground as required. Divert drainage at intersection of Crescent and Robinhood St. Avoid mature trees.
2024-2028 Capital Improvement Plan Notes	Rehabilitation and expansion of Ford Playground to include stormwater improvements.
Climate Vulnerability/Flooding Notes	Reported flood damage in 2010.

Bobby Braceland Playground

Infiltration Chamber

Project Reference Number	37
Parcel ID	51045 0003
Address/Location	PENNSYLVANIA AVE
Property Description	Bobby Braceland Playground

Additional Municipal Parcels Treated
51045 0004

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	3.3
Total Contributing Area (ac.)	7.3
Generated TP Load from Total Area (lb/yr)	7.2
Dimensions (Length x Width)	60x100
SCM Footprint (SF)	6,000
Treatment Depth (in.)	1.00
Reduction Efficiency	90%
SCM Volume (CF)	12,000

Project Duration	
Total Feasibility, Design & Permitting	12 months
Construction	5 months
Total	**17 months**

Total Load Reduction (lb/y) :	**6.5**

2023 EPA Total Cost Estimate:	**$ 826,200**
W&C Total Cost Estimate:	**$ 464,142**
EPA Cost/Benefit ($/lb/y):	**$ 128,085**
W&C Cost/Benefit ($/lb/y):	**$ 71,955**

Project Considerations	Place subsurface chambers under parking lot. Divert drainage network off Chestnut
2024-2028 Capital Improvement Plan Notes	CIP identifies playing fields as a tentative future project (FY25-30).
Climate Vulnerability/Flooding Notes	Flood claims reported nearby.

Emerson Playground

Infiltration Chamber

Project Reference Number	38
Parcel ID	51008 0001A1
Address/Location	51 I PETTEE ST
Property Description	Emerson Playground

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	2.1
Total Contributing Area (ac.)	4.7
Generated TP Load from Total Area (lb/yr)	4.6
Dimensions (Length x Width)	50x78
SCM Footprint (SF)	3,900
Treatment Depth (in.)	1.00
Reduction Efficiency	98%
SCM Volume (CF)	7,800

Project Duration	
Total Feasibility, Design & Permitting	10 months
Construction	5 months
Total	**15 months**

Total Load Reduction (lb/y) :	**4.5**

2023 EPA Total Cost Estimate:	**$ 537,300**
W&C Total Cost Estimate:	**$ 300,998**
EPA Cost/Benefit ($/lb/y):	**$ 119,598**
W&C Cost/Benefit ($/lb/y):	**$ 66,999**

Project Considerations	Place subsurface chamber system in the southeast corner of the field.
2024-2028 Capital Improvement Plan Notes	Possible court resurfacing to pair with this opportunity.
Climate Vulnerability/Flooding Notes	--

Memorial-Spaulding School

Infiltration Chamber

Project Reference Number	39
Parcel ID	82021 0001
Address/Location	250 BROOKLINE ST
Property Description	Memorial-Spaulding School

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	2.5
Total Contributing Area (ac.)	4.4
Generated TP Load from Total Area (lb/yr)	5.0
Dimensions (Length x Width)	92x50
SCM Footprint (SF)	4,600
Treatment Depth (in.)	1.00
Reduction Efficiency	90%
SCM Volume (CF)	9,200

Project Duration	
Total Feasibility, Design & Permitting	12 months
Construction	5 months
Total	**17 months**

Total Load Reduction (lb/y) :	**4.5**

2023 EPA Total Cost Estimate:	**$ 634,500**
W&C Total Cost Estimate:	**$ 365,146**
EPA Cost/Benefit ($/lb/y):	**$ 141,858**
W&C Cost/Benefit ($/lb/y):	**$ 81,637**

Project Considerations	Place subsurface chambers in field southwest of school parking lot. SCM to be coordinated with any future building renovations of developments.
2024-2028 Capital Improvement Plan Notes	Identified as a new priority location for traffic calming on Brookline Street.
Climate Vulnerability/Flooding Notes	Directly upstream of flood claims and reports of flood damage in 2010.

Loring Park
Infiltration Basin

Project Reference Number	40
Parcel ID	73001 0019
Address/Location	CENTRE ST
Property Description	Loring Park

Additional Municipal Parcels Treated
73001 0018

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	2.1
Total Contributing Area (ac.)	4.8
Generated TP Load from Total Area (lb/yr)	4.3
Dimensions (Length x Width)	50x40
SCM Footprint (SF)	2,000
Treatment Depth (in.)	1.00
Reduction Efficiency	98%
SCM Volume (CF)	8,000

Project Duration	
Total Feasibility, Design & Permitting	10 months
Construction	4 months
Total	**14 months**

Total Load Reduction (lb/y) :	**4.2**

2023 EPA Total Cost Estimate:	**$ 162,000**
W&C Total Cost Estimate:	**$ 149,574**
EPA Cost/Benefit ($/lb/y):	**$ 38,395**
W&C Cost/Benefit ($/lb/y):	**$ 35,450**

Project Considerations	Place basin in northern portion of grassed area.
2024-2028 Capital Improvement Plan Notes	Edmands Brook Drainage Area Stormwater Improvements. Blake Street water main replacement in 2028 as well.
Climate Vulnerability/Flooding Notes	--

Edmands Park (North)

Infiltration Basin

Project Reference Number	41
Parcel ID	13020 0001
Address/Location	70 BLAKE ST
Property Description	Edmands Park (North)

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	1.4
Total Contributing Area (ac.)	6.8
Generated TP Load from Total Area (lb/yr)	3.5
Dimensions (Length x Width)	50x26
SCM Footprint (SF)	1,300
Treatment Depth (in.)	1.00
Reduction Efficiency	98%
SCM Volume (CF)	5,200

Project Duration	
Total Feasibility, Design & Permitting	13 months
Construction	5 months
Total	**18 months**

Total Load Reduction (lb/y) :	**3.4**

2023 EPA Total Cost Estimate:	**$ 105,300**
W&C Total Cost Estimate:	**$ 72,474**
EPA Cost/Benefit ($/lb/y):	**$ 30,640**
W&C Cost/Benefit ($/lb/y):	**$ 21,088**

Project Considerations	Place basin in grassed open area located down access drive off of Blake St. Mature trees to be avoided.
2024-2028 Capital Improvement Plan Notes	Edmands Brook Drainage Area Stormwater Improvements. Blake Street water main replacement in 2028 as well.
Climate Vulnerability/Flooding Notes	--

Crystal Lake Park

Infiltration Chamber

Project Reference Number	42
Parcel ID	62001 0002
Address/Location	20 ROGERS ST
Property Description	Crystal Lake Park

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	1.6
Total Contributing Area (ac.)	3.3
Generated TP Load from Total Area (lb/yr)	3.4
Dimensions (Length x Width)	75x40
SCM Footprint (SF)	3,000
Treatment Depth (in.)	1.00
Reduction Efficiency	98%
SCM Volume (CF)	6,000

Project Duration	
Total Feasibility, Design & Permitting	12 months
Construction	4 months
Total	**16 months**

Total Load Reduction (lb/y) :	**3.4**

2023 EPA Total Cost Estimate:	**$ 413,100**
W&C Total Cost Estimate:	**$ 235,926**
EPA Cost/Benefit ($/lb/y):	**$ 122,639**
W&C Cost/Benefit ($/lb/y):	**$ 70,041**

Project Considerations	Place subsurface chambers in open grassed area adjacent to Rogers St. Area of high use during summers.
2024-2028 Capital Improvement Plan Notes	Crystal Lake Park and Left Beach Redesign Project. Renovation/replacement of the bathhouse is also planned.
Climate Vulnerability/Flooding Notes	--

Senior Center

Infiltration Chamber

Project Reference Number	43
Parcel ID	24010 0001
Address/Location	345 WALNUT ST
Property Description	Senior Center

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	1.7
Total Contributing Area (ac.)	2.7
Generated TP Load from Total Area (lb/yr)	3.7
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	3,200
Treatment Depth (in.)	1.00
Reduction Efficiency	90%
SCM Volume (CF)	6,400

Project Duration	
Total Feasibility, Design & Permitting	13 months
Construction	5 months
Total	**18 months**

Total Load Reduction (lb/y) :	**3.3**

2023 EPA Total Cost Estimate:	**$ 441,450**
W&C Total Cost Estimate:	**$ 266,149**
EPA Cost/Benefit ($/lb/y):	**$ 132,872**
W&C Cost/Benefit ($/lb/y):	**$ 80,108**

Project Considerations	Place subsurface chambers beneath parking lot. Existing subsurface chambers system on site may be able to be expanded. Pair SCM design with future development of parcel.
2024-2028 Capital Improvement Plan Notes	CIP identified existing senior center to undergo a complete facility redesign.
Climate Vulnerability/Flooding Notes	--

Frank Zervas Elementary School

Infiltration Chamber

Project Reference Number	44
Parcel ID	54013 0003
Address/Location	30 BEETHOVEN AVE
Property Description	Frank Zervas Elementary School

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	1.7
Total Contributing Area (ac.)	2.3
Generated TP Load from Total Area (lb/yr)	3.3
Dimensions (Length x Width)	16x100
SCM Footprint (SF)	3,100
Treatment Depth (in.)	1.00
Reduction Efficiency	90%
SCM Volume (CF)	6,200

Project Duration	
Total Feasibility, Design & Permitting	11 months
Construction	4 months
Total	**15 months**

Total Load Reduction (lb/y) :	**2.9**

2023 EPA Total Cost Estimate:	**$ 427,950**
W&C Total Cost Estimate:	**$ 258,748**
EPA Cost/Benefit ($/lb/y):	**$ 145,713**
W&C Cost/Benefit ($/lb/y):	**$ 88,101**

Project Considerations	Place subsurface chambers west of playground in grassed area. Fence around school required, SCM design to accomodate.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	Directly upstream/adjacent to flood claims and reported flood damages in 2010.

Adams St Parking Lot

Infiltration Chamber

Project Reference Number	45
Parcel ID	14008 0003
Address/Location	ADAMS ST
Property Description	Adams St Parking Lot

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	1.6
Total Contributing Area (ac.)	2.1
Generated TP Load from Total Area (lb/yr)	3.1
Dimensions (Length x Width)	75x40
SCM Footprint (SF)	3,000
Treatment Depth (in.)	1.00
Reduction Efficiency	90%
SCM Volume (CF)	6,000

Project Duration	
Total Feasibility, Design & Permitting	11 months
Construction	4 months
Total	**15 months**

Total Load Reduction (lb/y) :	**2.8**

2023 EPA Total Cost Estimate:	**$ 413,100**
W&C Total Cost Estimate:	**$ 235,926**
EPA Cost/Benefit ($/lb/y):	**$ 146,187**
W&C Cost/Benefit ($/lb/y):	**$ 83,489**

Project Considerations	Subsurface chambers to be located beneath parking lot. SCM to be coordinated and designed with other utilites on lot.
2024-2028 Capital Improvement Plan Notes	EV charging installations at Adams Street Lot as part of municipal parking
Climate Vulnerability/Flooding Notes	Just upstream of identified area of local flooding.

Cold Spring Park

Infiltration Trench

Project Reference Number	46
Parcel ID	54022 0058
Address/Location	BEACON ST
Property Description	Cold Spring Park

Project Duration	
Total Feasibility, Design & Permitting	10 months
Construction	3 months
Total	**13 months**

HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	0.9
Total Contributing Area (ac.)	2.0
Generated TP Load from Total Area (lb/yr)	1.6
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	2,650
Treatment Depth (in.)	1.00
Reduction Efficiency	98%
SCM Volume (CF)	3,180

Total Load Reduction (lb/y) :	**1.6**

2023 EPA Total Cost Estimate:	**$ 125,550**
W&C Total Cost Estimate:	**$ 211,254**
EPA Cost/Benefit ($/lb/y):	**$ 78,587**
W&C Cost/Benefit ($/lb/y):	**$ 132,233**

Project Site Considerations	Multiple infiltration trenches at edge of the parking lot turn-around or edge of courts. Historic landfill at site; additional research and site investigation required to determine feasibility and/or limitations. Pair with project reference number 31.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	--

Forte Park

Infiltration Basin

Project Reference Number	47
Parcel ID	11004 0013
Address/Location	229 R CALIFORNIA ST
Property Description	Forte Park

Project Duration	
Total Feasibility, Design & Permitting	10 months
Construction	4 months
Total	**14 months**

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	0.5
Total Contributing Area (ac.)	2.0
Generated TP Load from Total Area (lb/yr)	1.2
Dimensions (Length x Width)	9x50
SCM Footprint (SF)	450
Treatment Depth (in.)	1.00
Reduction Efficiency	92%
SCM Volume (CF)	1,800

Total Load Reduction (lb/y) :	**1.1**

2023 EPA Total Cost Estimate:	**$ 36,450**
W&C Total Cost Estimate:	**$ 26,214**
EPA Cost/Benefit ($/lb/y):	**$ 33,837**
W&C Cost/Benefit ($/lb/y):	**$ 24,335**

Project Site Considerations	Basin to be located in grassed area adjacent to parking lot. Second basin to be considered in turnaround island.
2024-2028 Capital Improvement Plan Notes	CIP identifies Forte Park as a tentative future project (FY 25-30).
Climate Vulnerability/Flooding Notes	Flood damages occurred during 2010.

Underwood School

Infiltration Chamber

Project Reference Number	48
Parcel ID	72002 0003
Address/Location	101 VERNON ST
Property Description	Underwood School

Project Duration	
Total Feasibility, Design & Permitting	11 months
Construction	4 months
Total	**15 months**

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	0.6
Total Contributing Area (ac.)	0.6
Generated TP Load from Total Area (lb/yr)	1.1
Dimensions (Length x Width)	50x22
SCM Footprint (SF)	1,100
Treatment Depth (in.)	1.00
Reduction Efficiency	90%
SCM Volume (CF)	2,200

Total Load Reduction (lb/y) :	**0.9**

2023 EPA Total Cost Estimate:	**$ 152,550**
W&C Total Cost Estimate:	**$ 64,764**
EPA Cost/Benefit ($/lb/y):	**$ 161,261**
W&C Cost/Benefit ($/lb/y):	**$ 68,462**

Project Site Considerations	Place chamber system under the southern portion of the parking lot.
2024-2028 Capital Improvement Plan Notes	Underwood School renovation/replacement and roof replacement planned.
Climate Vulnerability/Flooding Notes	--

Angier School

Infiltration Trench

Project Reference Number	49
Parcel ID	55010 0049
Address/Location	1697 R BEACON ST
Property Description	Angier School

Project Duration	
Total Feasibility, Design & Permitting	9 months
Construction	4 months
Total	**13 months**

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	0.4
Total Contributing Area (ac.)	0.8
Generated TP Load from Total Area (lb/yr)	0.6
Dimensions (Length x Width)	4x300
SCM Footprint (SF)	1,200
Treatment Depth (in.)	1.00
Reduction Efficiency	90%
SCM Volume (CF)	1,440

Total Load Reduction (lb/y) :	**0.6**

2023 EPA Total Cost Estimate:	**$ 56,700**
W&C Total Cost Estimate:	**$ 95,604**
EPA Cost/Benefit ($/lb/y):	**$ 99,534**
W&C Cost/Benefit ($/lb/y):	**$ 167,828**

Project Site Considerations	Infiltration trench to be placed at perimeter of tennis and basketball courts. Surface water appears to drain off courts to the north. Coordinate if swing sets will need to be relocated.
2024-2028 Capital Improvement Plan Notes	Possible court resurfacing to pair with this.
Climate Vulnerability/Flooding Notes	--

Peirce Elementary School

Bio-Filtration

Project Reference Number	50
Parcel ID	32021 0005
Address/Location	170 TEMPLE ST
Property Description	Peirce Elementary School

Project Duration	
Total Feasibility, Design & Permitting	11 months
Construction	4 months
Total	**15 months**

HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	0.6
Total Contributing Area (ac.)	0.6
Generated TP Load from Total Area (lb/yr)	1.0
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	1,400
Treatment Depth (in.)	1.00
Reduction Efficiency	53%
SCM Volume (CF)	2,170

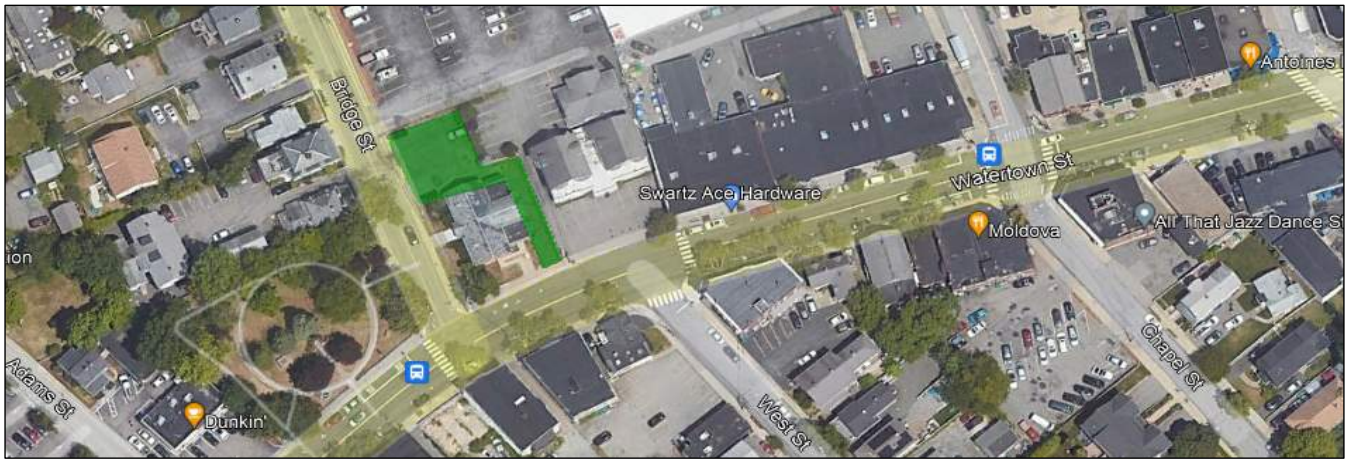
Total Load Reduction (lb/y) :	**0.5**

2023 EPA Total Cost Estimate:	**$ 106,650**
W&C Total Cost Estimate:	**$ 61,680**
EPA Cost/Benefit ($/lb/y):	**$ 195,137**
W&C Cost/Benefit ($/lb/y):	**$ 112,856**

Project Site Considerations	Place biofiltration systems between Temple St and walkway. Downspouts from the roof to be directed to SCMs. Biofiltration gardens may be located closer downspouts space permitting. Coordinate SCM with any future building development.
2024-2028 Capital Improvement Plan Notes	Peirce Feasibility/Addition - Feasibility Study/Design and Construction
Climate Vulnerability/Flooding Notes	--

Newton Free Library

Porous Pavement



Project Reference Number	51
Parcel ID	14001 0004
Address/Location	144 BRIDGE ST
Property Description	Newton Free Library

Project Duration	
Total Feasibility, Design & Permitting	11 months
Construction	4 months
Total	**15 months**

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	0.1
Total Contributing Area (ac.)	0.1
Generated TP Load from Total Area (lb/yr)	0.2
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	5,000
Treatment Depth (in.)	1.00
Reduction Efficiency	62%
SCM Volume (CF)	4,500

Total Load Reduction (lb/y) :	**0.1**

2023 EPA Total Cost Estimate:	**$ 255,150**
W&C Total Cost Estimate:	**$ 416,340**
EPA Cost/Benefit ($/lb/y):	**$ 2,014,196**
W&C Cost/Benefit ($/lb/y):	**$ 3,286,656**

Project Site Considerations	Porous pavement. Replace the entire parking area and rear driveway.
2024-2028 Capital Improvement Plan Notes	Nonatum library accessibility/site improvements to reconfigure entry and ADA ramp.
Climate Vulnerability/Flooding Notes	--

Newton Center Playground

Infiltration Trench

Project Reference Number	52
Parcel ID	64032 0003
Address/Location	TYLER TER
Property Description	Newton Center Playground

Project Duration	
Total Feasibility, Design & Permitting	9 months
Construction	4 months
Total	**13 months**

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	0.1
Total Contributing Area (ac.)	0.3
Generated TP Load from Total Area (lb/yr)	0.1
Dimensions (Length x Width)	5x40
SCM Footprint (SF)	200
Treatment Depth (in.)	1.00
Reduction Efficiency	90%
SCM Volume (CF)	240

Total Load Reduction (lb/y) :	**0.13**

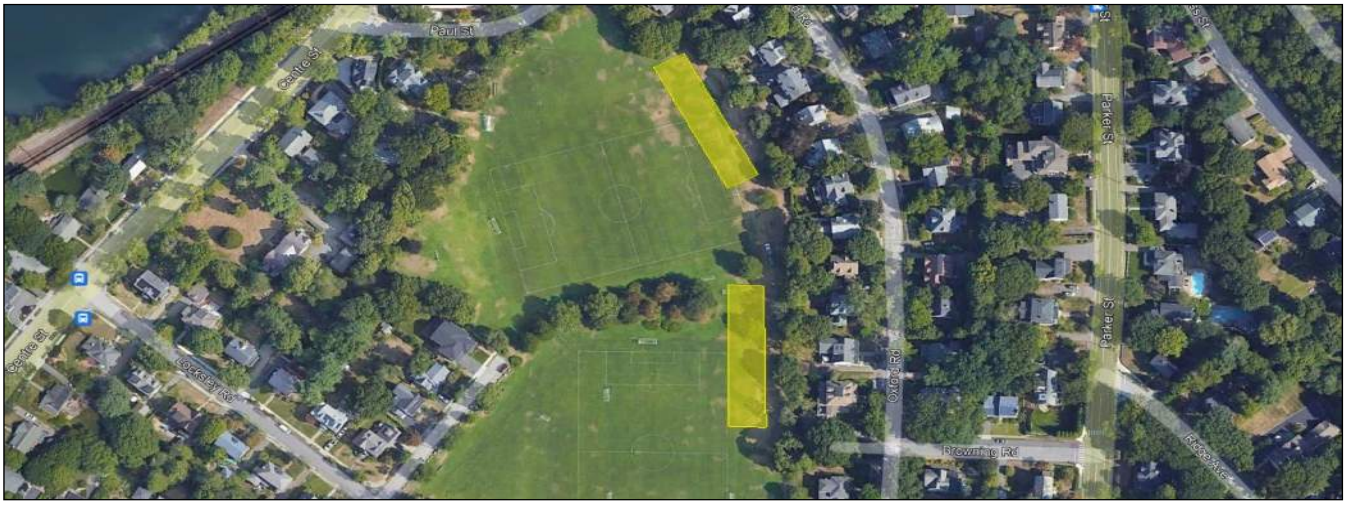
2023 EPA Total Cost Estimate:	**$ 9,450**
W&C Total Cost Estimate:	**$ 16,962**
EPA Cost/Benefit ($/lb/y):	**$ 75,012**
W&C Cost/Benefit ($/lb/y):	**$ 134,640**

Project Site Considerations	Infiltration trench to be placed east of building and paved access drive. SCM to help with ponding.
2024-2028 Capital Improvement Plan Notes	CIP includes Performance Stage in Newton Centre Playground project to be located behind the Hut.
Climate Vulnerability/Flooding Notes	Locally identified area of flooding.

Pursuable Parcel Opportunity Report Sheets

Weeks House and Park

Infiltration Chamber



Project Reference Number	1A
Parcel ID	62016 0013 (1)
Address/Location	7 HEREWARD RD
Property Description	Weeks House and Park

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	5 (North), 12 (South)
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	16.0
Total Contributing Area (ac.)	42.5
Generated TP Load from Total Area (lb/yr)	35.7

Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	23,000
Treatment Depth (in.)	0.75
Reduction Efficiency	81%
SCM Volume (CF)	46,000

Total Load Reduction (lb/y) :	**28.7**

Project Site Considerations	Two infiltration chambers systems to treat the regional drainage before entering a culverted brook. Place along the eastern side of the two fields. Groundwater may be limiting. Significant field use.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	--

Weeks House and Park

Infiltration Basin

Project Reference Number	1B
Parcel ID	62016 0013 (2)
Address/Location	7 HEREWARD RD
Property Description	Weeks House and Park

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	1.8
Total Contributing Area (ac.)	2.1
Generated TP Load from Total Area (lb/yr)	3.2

Dimensions (Length x Width)	16x100
SCM Footprint (SF)	1,600
Treatment Depth (in.)	1.00
Reduction Efficiency	92%
SCM Volume (CF)	6,400

Total Load Reduction (lb/y) :	**2.9**

Project Site Considerations	The park's field use is very active. Place an infiltration basin along the trees lining the southern end of the field avoiding active field areas.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	--

City Hall

Infiltration Chamber

Project Reference Number	2A
Parcel ID	64001 0001 (1)
Address/Location	1000 COMMONWEALTH AVE
Property Description	City Hall

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	Unk (Old invert info), 4 (Cummings)
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	30.3
Total Contributing Area (ac.)	79.7
Generated TP Load from Total Area (lb/yr)	65.0

Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	9,300
Treatment Depth (in.)	0.15
Reduction Efficiency	44%
SCM Volume (CF)	18,600

Total Load Reduction (lb/y) :	**28.6**

Project Site Considerations	Subsurface chambers in grassed area west of War Memorial Circle. Avoid War Memorial Circle and mature trees. East of the circle is not feasible due to topography and invert depths.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	Directly upstream of locally identified area of flooding and damages reported in 2010. This is surrounding the City Hall ponds area.

City Hall
Infiltration Chamber

Project Reference Number	2B
Parcel ID	64001 0001 (2)
Address/Location	1000 COMMONWEALTH
Property Description	City Hall

HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	1.5
Total Contributing Area (ac.)	2.1
Generated TP Load from Total Area (lb/yr)	2.6

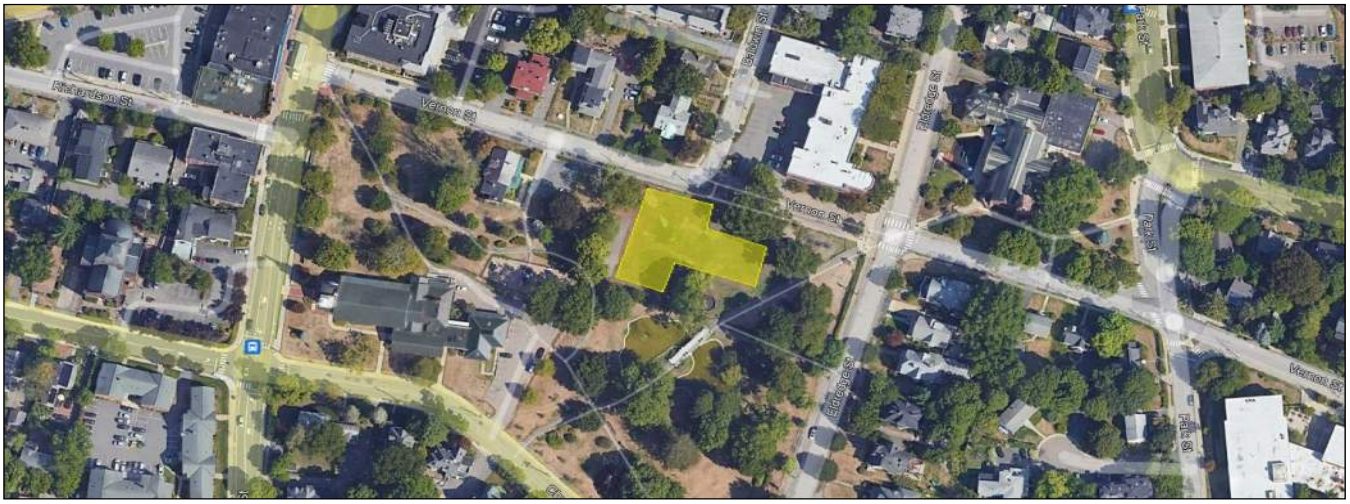
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	2,700
Treatment Depth (in.)	1.00
Reduction Efficiency	98%
SCM Volume (CF)	5,400

Total Load Reduction (lb/y) :	**2.6**

Project Site Considerations	Subsurface chamber systems to be placed on both sides of City Hall Dr and under the southern parking lot. Design to coordinate location of existing utilities.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	Directly upstream of locally identified area of flooding and damages reported in 2010. This is surrounding the City Hall ponds area.

Farlow Park

Infiltration Chamber



Project Reference Number	3
Parcel ID	72004 0001
Address/Location	129 CHURCH ST
Property Description	Farlow Park

Additional Municipal Parcels Treated
72008 0001, 72026 0016

Invert Depth at Intercepted Pipe (ft)	10
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	50.9
Total Contributing Area (ac.)	133.3
Generated TP Load from Total Area (lb/yr)	116.3

Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	15,500
Treatment Depth (in.)	0.15
Reduction Efficiency	26%
SCM Volume (CF)	31,000

Total Load Reduction (lb/y) :	**29.7**

Project Site Considerations	Subsurface chambers between Vernon St (north) and ponds. Extend westward towards the parking lot of Chaffin House. Avoid utilities south of ponds. Park has mature trees and is of historic significance. Decorative pond and bridge renovated some years ago.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	--

Chaffin Park
Infiltration Chamber

Project Reference Number	4
Parcel ID	72004 0003
Address/Location	VERNON ST
Property Description	Chaffin Park

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	27.0
Total Contributing Area (ac.)	49.4
Generated TP Load from Total Area (lb/yr)	60.8

Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	10,000
Treatment Depth (in.)	0.20
Reduction Efficiency	33%
SCM Volume (CF)	20,000

Total Load Reduction (lb/y) :	**20.1**

Project Site Considerations	Chambers placed under grassed areas in the park avoiding trees and walkways. Significant excavation needed to get chambers below road grade as park is 2-3' above the road. Excavation efforts may impact mature tree roots.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	--

Fire Station

Infiltration Chamber

Project Reference Number	5
Parcel ID	43040 0001
Address/Location	1750 COMMONWEALTH AVE
Property Description	Fire Station

Additional Municipal Parcels Treated
--

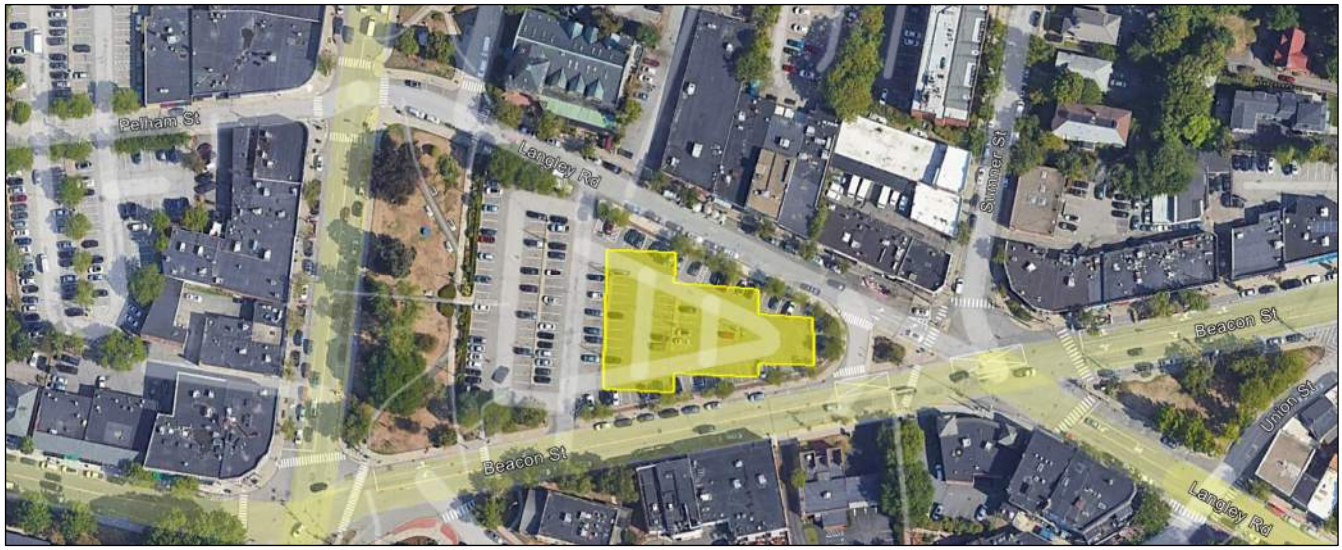
Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	25.1
Total Contributing Area (ac.)	57.7
Generated TP Load from Total Area (lb/yr)	51.4

Dimensions (Length x Width)	46x100
SCM Footprint (SF)	4,600
Treatment Depth (in.)	0.10
Reduction Efficiency	33%
SCM Volume (CF)	9,200

Total Load Reduction (lb/y) :	**17.0**

Project Site Considerations	Chambers under the fire station parking lot. Proximity to the building limits the size of the SCM.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	--

Langley Parking Lot
Infiltration Chamber



Project Reference Number	6
Parcel ID	61034 0001
Address/Location	BEACON ST
Property Description	Langley Parking Lot

Additional Municipal Parcels Treated
61034 0002, 61035 0004, 61035 0003, 61035 0001

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	9.9
Total Contributing Area (ac.)	12.2
Generated TP Load from Total Area (lb/yr)	18.6

Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	18,000
Treatment Depth (in.)	1.00
Reduction Efficiency	90%
SCM Volume (CF)	36,000

Total Load Reduction (lb/y) :	**16.8**

Project Site Considerations	Chambers under the east side of the parcel under the parking lot. Possible utility conflicts with electric lines. Some chambers in the west will need to be relatively deep due to large footprint and slope.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	--

Bowen School and Thompsonville Playground

Infiltration Chamber

Project Reference Number	7A
Parcel ID	65019 0046 (1)
Address/Location	280 CYPRESS ST
Property Description	Bowen School and Thompsonville Playground

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	5.3
Total Contributing Area (ac.)	19.2
Generated TP Load from Total Area (lb/yr)	12.5

Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	9,700
Treatment Depth (in.)	1.00
Reduction Efficiency	90%
SCM Volume (CF)	19,400

Total Load Reduction (lb/y) :	**11.2**

Project Site Considerations	Chamber system under the southern playground area. Avoid playground, but placed under the grassed area and basketball court.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	--

Bowen School and Thompsonville Playground

Infiltration Chamber

Project Reference Number	7B
Parcel ID	65019 0046 (2)
Address/Location	280 CYPRESS ST
Property Description	Bowen School and Thompsonville Playground

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	2.8
Total Contributing Area (ac.)	5.7
Generated TP Load from Total Area (lb/yr)	6.0

Dimensions (Length x Width)	150x20
SCM Footprint (SF)	3,000
Treatment Depth (in.)	0.55
Reduction Efficiency	69%
SCM Volume (CF)	6,000

Total Load Reduction (lb/y) :	**4.2**

Project Site Considerations	Chamber system under the bus drop-off and parallel parking spots on west side of building to capture south flowing drainage on Cypress St.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	--

Newton Early Childhood Program
Infiltration Basin

Project Reference Number	8
Parcel ID	21022 0001A
Address/Location	687 WATERTOWN ST
Property Description	Newton Early Childhood Program

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	13.5
Total Contributing Area (ac.)	24.5
Generated TP Load from Total Area (lb/yr)	28.5

Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	2,900
Treatment Depth (in.)	0.20
Reduction Efficiency	52%
SCM Volume (CF)	11,600

Total Load Reduction (lb/y) :	**14.8**

Project Site Considerations	Basin in southern grassed area avoiding the new sidewalk to the entrance. Construction completed in 2022, but the southern grassed area was the office site, so it is unlikely SCM was added here.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	City identified flooding nearby.

Hamilton Playground

Infiltration Chamber

Project Reference Number	9
Parcel ID	42021 0001
Address/Location	541 GROVE ST
Property Description	Hamilton Playground

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	7.9
Total Contributing Area (ac.)	22.3
Generated TP Load from Total Area (lb/yr)	16.3

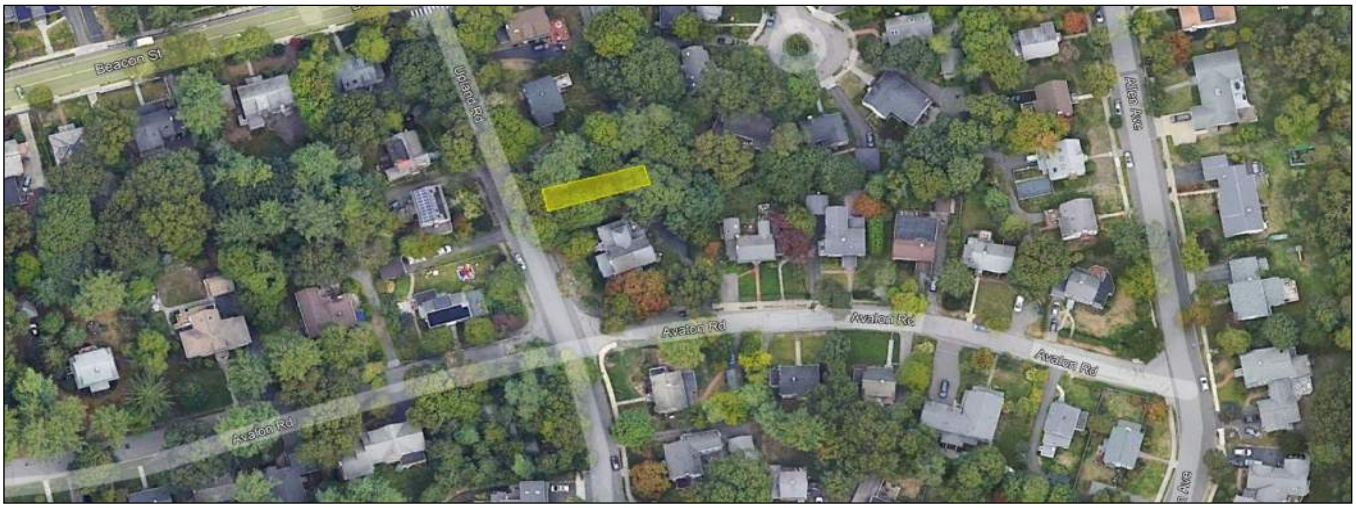
Dimensions (Length x Width)	150x48
SCM Footprint (SF)	7,200
Treatment Depth (in.)	0.50
Reduction Efficiency	86%
SCM Volume (CF)	14,400

Total Load Reduction (lb/y) :	**14.0**

Project Site Considerations	Basin in northern grassed area. This area is built up about 3 ft above the road and has gardens and trees. Significant excavation will be needed. Inverts are most likely about 4' below grade. A sewer line may cause conflicts that runs from the building to Pine Grove Ave.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	--

Abandoned Sewer Pump Station

Infiltration Basin



Project Reference Number	10
Parcel ID	53015 0002
Address/Location	UPLAND RD
Property Description	Abandoned Sewer Pump Station

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	8.6
Total Contributing Area (ac.)	26.3
Generated TP Load from Total Area (lb/yr)	18.7

Dimensions (Length x Width)	25x80
SCM Footprint (SF)	2,000
Treatment Depth (in.)	0.25
Reduction Efficiency	72%
SCM Volume (CF)	8,000

Total Load Reduction (lb/y) :	**13.5**

Project Site Considerations	Basin on former pump station lot. Remove the structure and abandoned pipes, use most of the parcel for the basin. Mature trees will need to be removed and other tree roots will likely be impacted.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	Directly upstream/adjacent to flood claims and reported flood damages in 2010.

Peirce House

Infiltration Chamber

Project Reference Number	11
Parcel ID	32003 0001
Address/Location	88 CHESTNUT ST
Property Description	Peirce House

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	7.8
Total Contributing Area (ac.)	19.6
Generated TP Load from Total Area (lb/yr)	16.5

Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	4,500
Treatment Depth (in.)	0.30
Reduction Efficiency	68%
SCM Volume (CF)	9,000

Total Load Reduction (lb/y) :	**11.2**

Project Site Considerations	Chamber system in the northern grassed area near the front of the building. Significant excavation efforts will be needed due to topography. The trees in the front lot will need to be removed.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	--

Warren-Lincoln Playground

Infiltration Chamber

Project Reference Number	12
Parcel ID	53032 0013
Address/Location	MONTCLAIR RD
Property Description	Warren-Lincoln Playground

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	3.6
Total Contributing Area (ac.)	14.2
Generated TP Load from Total Area (lb/yr)	8.7

Dimensions (Length x Width)	67x100
SCM Footprint (SF)	6,700
Treatment Depth (in.)	1.00
Reduction Efficiency	90%
SCM Volume (CF)	13,400

Total Load Reduction (lb/y) :	**7.8**

Project Site Considerations	Chamber system to the northeast of the baseball field outside of active field areas. Intercept the DMH at the Montclair/Karen intersection for treatment. Very active field area; minimal potential for SCM.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	--

Wolcott Park

Infiltration Chamber

Project Reference Number	13
Parcel ID	44027 0001
Address/Location	WOLCOTT ST
Property Description	Wolcott Park

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	3.8
Total Contributing Area (ac.)	10.2
Generated TP Load from Total Area (lb/yr)	8.2

Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	3,600
Treatment Depth (in.)	0.50
Reduction Efficiency	86%
SCM Volume (CF)	7,200

Total Load Reduction (lb/y) :	**7.0**

Project Site Considerations	Two basins. One basin on the east end of the circle and one basin on the west end. Very small trees and plantings will need to be removed.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	--

Newton Commonwealth Golf Course

Infiltration Chamber

Project Reference Number	14
Parcel ID	72039 0020
Address/Location	KENRICK ST REAR
Property Description	Newton Commonwealth Golf Course

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	D
Impervious Drainage Area (ac.)	2.4
Total Contributing Area (ac.)	6.6
Generated TP Load from Total Area (lb/yr)	5.4

Dimensions (Length x Width)	80x55
SCM Footprint (SF)	4,400
Treatment Depth (in.)	1.00
Reduction Efficiency	90%
SCM Volume (CF)	8,800

Total Load Reduction (lb/y) :	**4.8**

Project Site Considerations	Chambers near the outlet structure on parcel. Chambers so as to not add any new obstacles to the course. Groundwater may present an issue.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	--

Newton Commonwealth Golf Course

Infiltration Basin

Project Reference Number	15
Parcel ID	63001 0024A1
Address/Location	ALGONQUIN RD
Property Description	Newton Commonwealth Golf Course

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	D
Impervious Drainage Area (ac.)	1.9
Total Contributing Area (ac.)	3.1
Generated TP Load from Total Area (lb/yr)	4.7

Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	1,750
Treatment Depth (in.)	1.00
Reduction Efficiency	92%
SCM Volume (CF)	7,000

Total Load Reduction (lb/y) :	**4.3**

Project Site Considerations	Basin on NW edge of parcel along the tree line. The basin would add an unplayable area to the par 3. Chambers are possible alternative.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	--

Richardson Parking Lot

Infiltration Chamber

Project Reference Number	16
Parcel ID	12012 0010
Address/Location	RICHARDSON ST
Property Description	Richardson Parking Lot

Additional Municipal Parcels Treated
12012 0006, 12012 0009

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	2.1
Total Contributing Area (ac.)	2.6
Generated TP Load from Total Area (lb/yr)	4.3

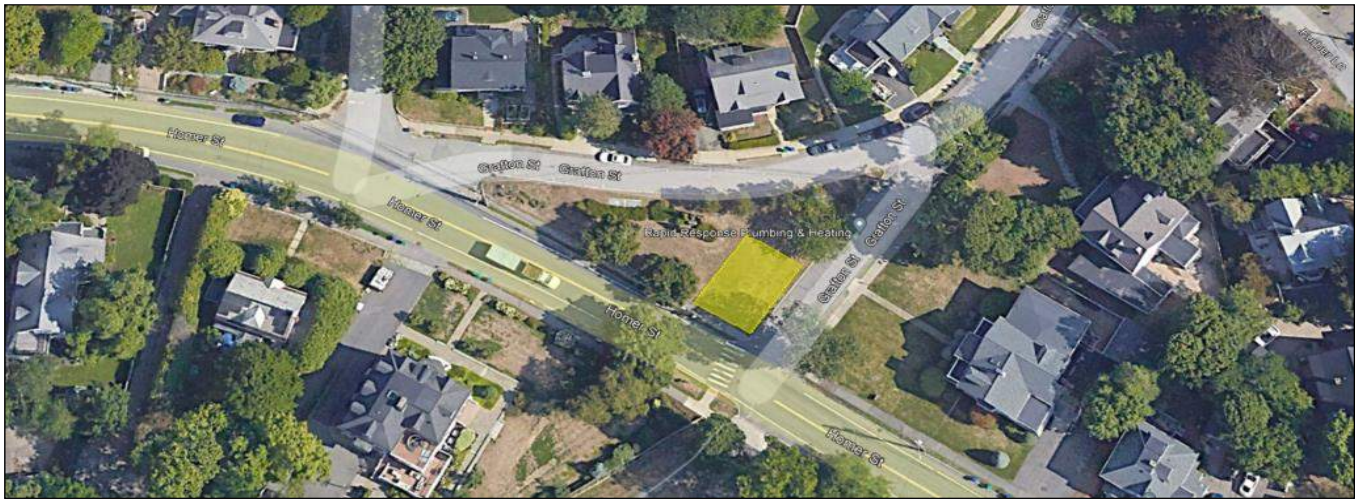
Dimensions (Length x Width)	39x100
SCM Footprint (SF)	3,900
Treatment Depth (in.)	1.00
Reduction Efficiency	90%
SCM Volume (CF)	7,800

Total Load Reduction (lb/y) :	**3.8**

Project Site Considerations	Chambers under the parking lot in the east. OHWs at the entrance and unknown utility conflicts in the parking lot.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	--

Homer St Grassed Median

Infiltration Chamber



Project Reference Number	17
Parcel ID	64039 0008
Address/Location	HOMER ST
Property Description	Homer St Grassed Median

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	2.3
Total Contributing Area (ac.)	4.1
Generated TP Load from Total Area (lb/yr)	4.6

Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	1,500
Treatment Depth (in.)	0.35
Reduction Efficiency	75%
SCM Volume (CF)	3,000

Total Load Reduction (lb/y) :	**3.4**

Project Site Considerations	Basin in the southern corner of the parcel which will occupy most of the open space in this area. No tree removal is necessary.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	Within locally identified area of flooding.

Newton Center Lot Pelham St

Infiltration Chamber

Project Reference Number	18
Parcel ID	64028 0018
Address/Location	24 PELHAM ST
Property Description	Newton Center Lot Pelham St

Additional Municipal Parcels Treated
64029 0004

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	2.3
Total Contributing Area (ac.)	2.4
Generated TP Load from Total Area (lb/yr)	3.7

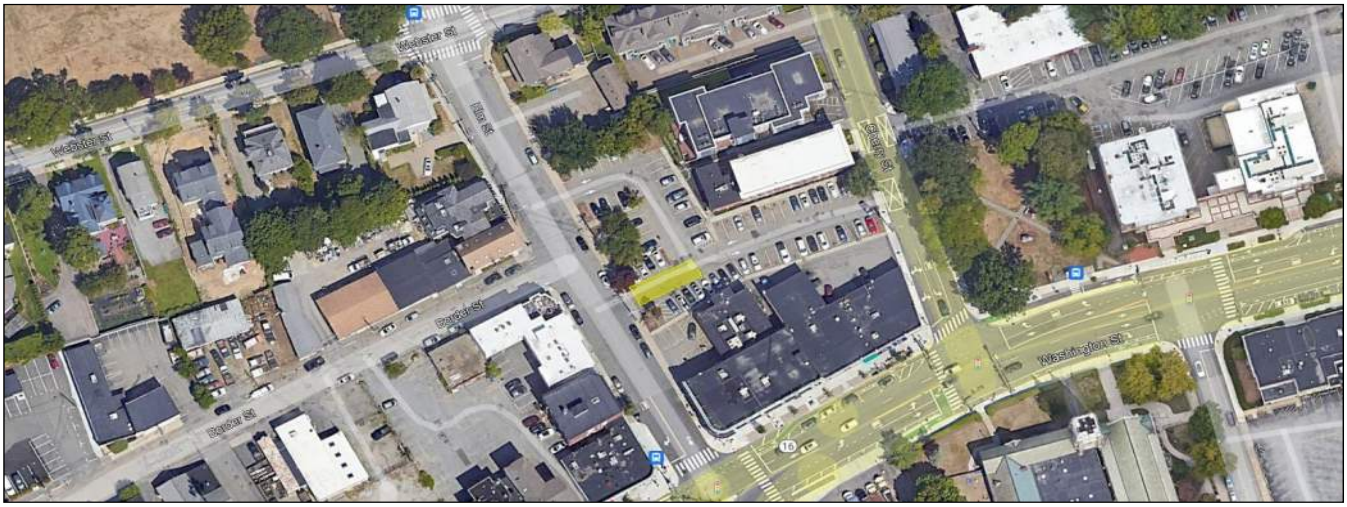
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	4,150
Treatment Depth (in.)	1.00
Reduction Efficiency	90%
SCM Volume (CF)	8,300

Total Load Reduction (lb/y) :	**3.4**

Project Site Considerations	Chambers in the southern portion of the lot retrofitting the existing catch basins. May be utility conflicts but usable area under the paved areas for treatment.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	--

Elm St Parking lot

Infiltration Chamber



Project Reference Number	19
Parcel ID	33012 0003
Address/Location	ELM ST
Property Description	Elm St Parking lot

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	3.0
Total Contributing Area (ac.)	3.0
Generated TP Load from Total Area (lb/yr)	5.5

Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	1,200
Treatment Depth (in.)	0.20
Reduction Efficiency	55%
SCM Volume (CF)	2,400

Total Load Reduction (lb/y) :	**3.0**

Project Site Considerations	Chamber system under parking lot. Space restricted due to existing utilities, culverted Cheesecake Brook, and an abutting building. Place the chamber system as south as possible in the parcel.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	--

Central St Grassed Median

Infiltration Chamber

Project Reference Number	20
Parcel ID	43018 0004A
Address/Location	CENTRAL ST
Property Description	Central St Grassed Median

Additional Municipal Parcels Treated
43017 0021

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	2.3
Total Contributing Area (ac.)	4.1
Generated TP Load from Total Area (lb/yr)	4.7

Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	1,800
Treatment Depth (in.)	0.40
Reduction Efficiency	57%
SCM Volume (CF)	3,600

Total Load Reduction (lb/y) :	**2.7**

Project Site Considerations	Chambers in the grassed median on Central St. Gas utility will need to be relocated. Small street trees will need to be relocated.
2024-2028 Capital Improvement Plan Notes	Upgrades and improvements to traffic signals, ADA, and stormwater drainage planned at Auburn Street/Grove Street/Central Street intersection (concept phase).
Climate Vulnerability/Flooding Notes	--

Wooded Parcel on Evergreen Ave

Infiltration Trench

Project Reference Number	21
Parcel ID	41003 0001
Address/Location	AUBURN ST
Property Description	Wooded Parcel on Evergreen Ave

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	1.4
Total Contributing Area (ac.)	3.4
Generated TP Load from Total Area (lb/yr)	3.0

Dimensions (Length x Width)	250x7
SCM Footprint (SF)	1,750
Treatment Depth (in.)	0.40
Reduction Efficiency	81%
SCM Volume (CF)	2,100

Total Load Reduction (lb/y) :	**2.4**

Project Site Considerations	Long infiltration trench treating Evergreen St drainage as it naturally flows towards the northern uncurbed edge of pavement. Mature trees should not need to be removed but it may interfere with roots.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	--

Fire Station Headquarters

Infiltration Chamber

Project Reference Number	22
Parcel ID	61032 0002
Address/Location	25 WILLOW ST
Property Description	Fire Station Headquarters

Additional Municipal Parcels Treated
61033 0001

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	2.2
Total Contributing Area (ac.)	3.2
Generated TP Load from Total Area (lb/yr)	4.3

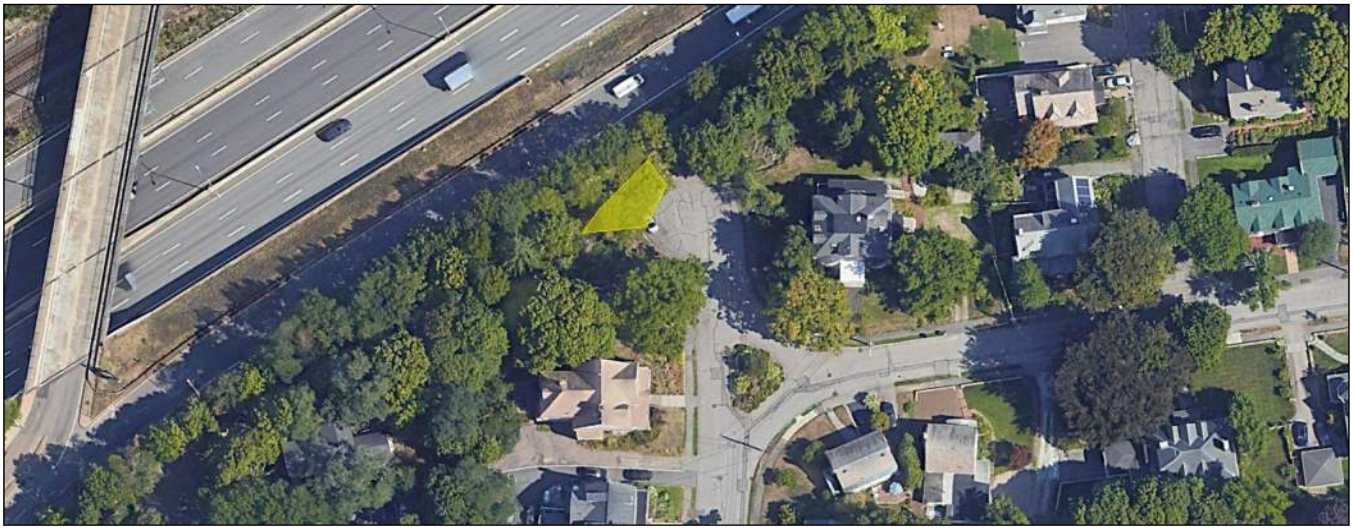
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	1,600
Treatment Depth (in.)	0.40
Reduction Efficiency	57%
SCM Volume (CF)	3,200

Total Load Reduction (lb/y) :	**2.4**

Project Site Considerations	Chambers in SW corner which is the only location identified for a new SCM. Chamber SCM are currently onsite. There are possible conflicts with existing utilities.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	--

Parcel Bordering Highway Barrier

Infiltration Basin



Project Reference Number	23
Parcel ID	71032 0005
Address/Location	HUNNEWELL TER
Property Description	Parcel Bordering Highway Barrier

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	1.1
Total Contributing Area (ac.)	2.6
Generated TP Load from Total Area (lb/yr)	2.5

Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	1,050
Treatment Depth (in.)	1.00
Reduction Efficiency	92%
SCM Volume (CF)	4,200

Total Load Reduction (lb/y) :	**2.3**

Project Site Considerations	Basin in small vegetated area between the lawn and sound barrier and extend into the cul-de-sac. Small brush and trees to be removed.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	--

Elm St Parking lot

Infiltration Chamber

Project Reference Number	24
Parcel ID	33012 0005
Address/Location	94 ELM ST
Property Description	Elm St Parking lot

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	1.1
Total Contributing Area (ac.)	1.2
Generated TP Load from Total Area (lb/yr)	2.2

Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	2,050
Treatment Depth (in.)	1.00
Reduction Efficiency	98%
SCM Volume (CF)	4,100

Total Load Reduction (lb/y) :	**2.2**

Project Site Considerations	Chamber system under the mulched median in the lot and under two lanes of parking around the median. Avoid water and sewer utilities and culverted Cheesecake Brook.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	--

Webster Park

Infiltration Basin

Project Reference Number	25
Parcel ID	33021 0001
Address/Location	WEBSTER PK
Property Description	Webster Park

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	0.9
Total Contributing Area (ac.)	1.7
Generated TP Load from Total Area (lb/yr)	1.9

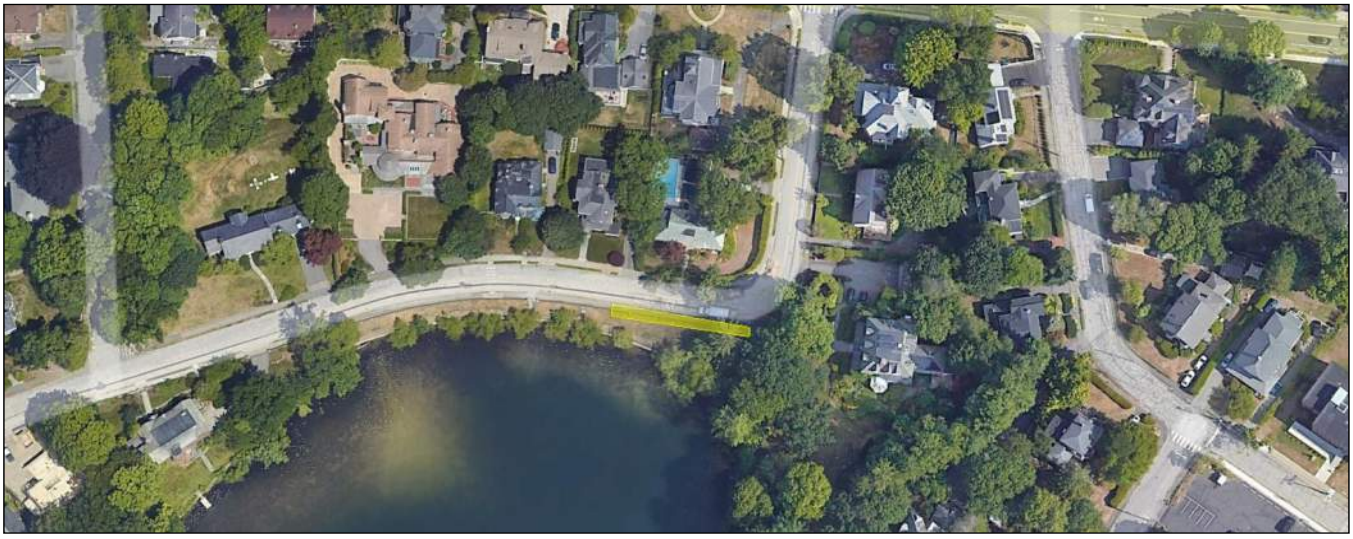
Dimensions (Length x Width)	25x32
SCM Footprint (SF)	800
Treatment Depth (in.)	1.00
Reduction Efficiency	98%
SCM Volume (CF)	3,200

Total Load Reduction (lb/y) :	**1.9**

Project Site Considerations	Basin along the northwestern side of the circle. Tree roots may be disturbed.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	Forte House & Townhouses located within flood zone and close to a flood claim.

Cronin's Cove

Infiltration Chamber



Project Reference Number	26
Parcel ID	62001 0016
Address/Location	LAKE AVE CTR
Property Description	Cronin's Cove

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	1.0
Total Contributing Area (ac.)	1.8
Generated TP Load from Total Area (lb/yr)	2.0

Dimensions (Length x Width)	125x10
SCM Footprint (SF)	1,250
Treatment Depth (in.)	0.70
Reduction Efficiency	94%
SCM Volume (CF)	2,500

Total Load Reduction (lb/y) :	**1.9**

Project Site Considerations	Chambers under elevated road & sidewalk edge before the drop down to the lake.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	--

Nonatum Pl Empty Parcel

Infiltration Chamber

Project Reference Number	27
Parcel ID	71007 0012A
Address/Location	NONANTUM PL
Property Description	Nonatum Pl Empty Parcel

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	0.7
Total Contributing Area (ac.)	1.0
Generated TP Load from Total Area (lb/yr)	1.6

Dimensions (Length x Width)	50x20
SCM Footprint (SF)	1,000
Treatment Depth (in.)	0.75
Reduction Efficiency	95%
SCM Volume (CF)	2,000

Total Load Reduction (lb/y) :	**1.5**

Project Site Considerations	Chambers under the grassed parcel and sidewalk. Small street trees will need to be replaced.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	--

Prescott St Oval

Infiltration Chamber

Project Reference Number	28
Parcel ID	23015 0018A
Address/Location	PRESCOTT ST
Property Description	Prescott St Oval

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	0.6
Total Contributing Area (ac.)	1.0
Generated TP Load from Total Area (lb/yr)	1.3

Dimensions (Length x Width)	100x12
SCM Footprint (SF)	1,200
Treatment Depth (in.)	1.00
Reduction Efficiency	98%
SCM Volume (CF)	2,400

Total Load Reduction (lb/y) :	**1.3**

Project Site Considerations	Chambers to be placed on the south edge of the parcel into the roadway. Avoid water, gas, and sewer. Gas utility runs directly though the island, placement depends on laterals and location.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	--

Wooded Parcel and Fire Station 7

Infiltration Chamber

Project Reference Number	29
Parcel ID	51029 0035
Address/Location	CHANDLER PL
Property Description	Wooded Parcel and Fire Station 7

HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	0.6
Total Contributing Area (ac.)	0.7
Generated TP Load from Total Area (lb/yr)	1.1

Dimensions (Length x Width)	20x60
SCM Footprint (SF)	1,200
Treatment Depth (in.)	1.00
Reduction Efficiency	98%
SCM Volume (CF)	2,400

Total Load Reduction (lb/y) :	**1.1**

Project Site Considerations	Subsurface chambers to be placed under the rear parking lot. Design to coordinate location of possible unknown existing utilities.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	--

Charlesbank Park

Infiltration Chamber

Project Reference Number	30
Parcel ID	71007 0043
Address/Location	NONANTUM PL
Property Description	Charlesbank Park

Additional Municipal Parcels Treated
71007 0039, 71007 0041, 71007 0042, 71007 0012

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	0.5
Total Contributing Area (ac.)	1.4
Generated TP Load from Total Area (lb/yr)	1.1

Dimensions (Length x Width)	20x50
SCM Footprint (SF)	1,000
Treatment Depth (in.)	1.00
Reduction Efficiency	98%
SCM Volume (CF)	2,000

Total Load Reduction (lb/y) :	**1.1**

Project Site Considerations	Chambers along the eastern edge of the park as south as possible to avoid unsuitable topography. Chambers chosen to maintain vehicle access to park.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	--

Lexington Street Municipal Parking Lot

Infiltration Chamber

Project Reference Number	31
Parcel ID	41015 0008
Address/Location	LEXINGTON ST
Property Description	Lexington Street Municipal Parking Lot

HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	0.4
Total Contributing Area (ac.)	0.4
Generated TP Load from Total Area (lb/yr)	0.6

Dimensions (Length x Width)	10x65
SCM Footprint (SF)	650
Treatment Depth (in.)	1.00
Reduction Efficiency	98%
SCM Volume (CF)	1,300

Total Load Reduction (lb/y) :	**0.6**

Project Site Considerations	Subsurface chamber system to be placed under the northwest corner of the parking lot along Melrose Ave for the capture of on-site and offsite drainage. Design to coordinate location of existing utilties.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	--

Newton Police HQ Annex

Infiltration Chamber

Project Reference Number	32
Parcel ID	33010 0006
Address/Location	25 CHESTNUT ST
Property Description	Newton Police HQ Annex

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	0.4
Total Contributing Area (ac.)	0.4
Generated TP Load from Total Area (lb/yr)	0.7

Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	700
Treatment Depth (in.)	1.00
Reduction Efficiency	90%
SCM Volume (CF)	1,400

Total Load Reduction (lb/y) :	**0.6**

Project Site Considerations	Subsurface chamber systems to retrofit existing CBs at both entrances/exits to the parking lot.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	--

Kennard Park and Newton Parks and Rec Dept

Infiltration Trench

Project Reference Number	33
Parcel ID	82004 0023
Address/Location	246 DUDLEY RD
Property Description	Kennard Park and Newton Parks and Rec Dept

HSG Soil Type at SCM	D
Impervious Drainage Area (ac.)	0.2
Total Contributing Area (ac.)	1.3
Generated TP Load from Total Area (lb/yr)	0.5

Dimensions (Length x Width)	5x100
SCM Footprint (SF)	500
Treatment Depth (in.)	1.00
Reduction Efficiency	90%
SCM Volume (CF)	600

Total Load Reduction (lb/y) :	**0.5**

Project Site Considerations	Surface infiltration trenches to be placed along the edge(s) of the driveway/road where ponding occurs.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	--

Waban Library

Infiltration Basin

Project Reference Number	34
Parcel ID	53028 0011
Address/Location	1608 BEACON ST
Property Description	Waban Library

HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	0.1
Total Contributing Area (ac.)	0.2
Generated TP Load from Total Area (lb/yr)	0.3

Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	130
Treatment Depth (in.)	1.00
Reduction Efficiency	98%
SCM Volume (CF)	520

Total Load Reduction (lb/y) :	**0.3**

Project Site Considerations	Shallow infiltraiton basin to be placed in the grassed area between the parking lot and building entrances. Abandon the existing catch basin and allow overland flow to enter the basin.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	--

Chaffin House

Infiltration Basin

Project Reference Number	35
Parcel ID	72004 0004
Address/Location	124 VERNON ST
Property Description	Chaffin House

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	0.1
Total Contributing Area (ac.)	0.2
Generated TP Load from Total Area (lb/yr)	0.3

Dimensions (Length x Width)	25x6
SCM Footprint (SF)	150
Treatment Depth (in.)	1.00
Reduction Efficiency	92%
SCM Volume (CF)	600

Total Load Reduction (lb/y) :	**0.2**

Project Site Considerations	Infiltration basin to be placed in the grassed area east of the parking lot. Overland flow to be catpured with curb cut inlets.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	--

Fire Station

Infiltration Basin

Project Reference Number	36
Parcel ID	12013 0021
Address/Location	241 CHURCH ST
Property Description	Fire Station

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	0.1
Total Contributing Area (ac.)	0.2
Generated TP Load from Total Area (lb/yr)	0.2

Dimensions (Length x Width)	10x12.5
SCM Footprint (SF)	125
Treatment Depth (in.)	1.00
Reduction Efficiency	92%
SCM Volume (CF)	500

Total Load Reduction (lb/y) :	**0.2**

Project Site Considerations	Infiltraiton basin to be placed in the grassed area where the flag pole currently resides. Use a curb cut and trench drain under the sidewalk.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	--

Not Currently Pursuable Parcel Opportunity Report Sheets

Newton Highlands Playground

Infiltration Chamber

Project Reference Number	1
Parcel ID	83003 0025
Address/Location	WINCHESTER ST
Property Description	Newton Highlands Playground

Additional Municipal Parcels Treated
52041 0001B, 52040 0010, 52040 0011, 52029 0025, 62023 0013A, 62023 0015A, 81024 0004A, 51028 0029

HSG Soil Type at SCM	B/D
Impervious Drainage Area (ac.)	104.8
Total Contributing Area (ac.)	208.6
Generated TP Load from Total Area (lb/yr)	219.7

Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	188,760
Treatment Depth (in.)	1.00
Reduction Efficiency	94%
SCM Volume (CF)	416,423

Total Load Reduction (lb/y) :	**206.5**

Project Site Considerations	Large subsurface chambers to replace the current underdrains/drainage system in the park under the tennis courts, parking lot, and baseball field. Extend north under the soccer field. Preliminary WSS soil report shows possible shallow water table. Large disruption to new park therefore, not feasible.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	Located upstream of many flood claims along the South Meadow Brook.

Newton North High School

Infiltration Chamber

Project Reference Number	2
Parcel ID	24018 0001
Address/Location	360 LOWELL AVE
Property Description	Newton North High School

Additional Municipal Parcels Treated
24034 0001, 24017 0007

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	29.6
Total Contributing Area (ac.)	82.5
Generated TP Load from Total Area (lb/yr)	65.6

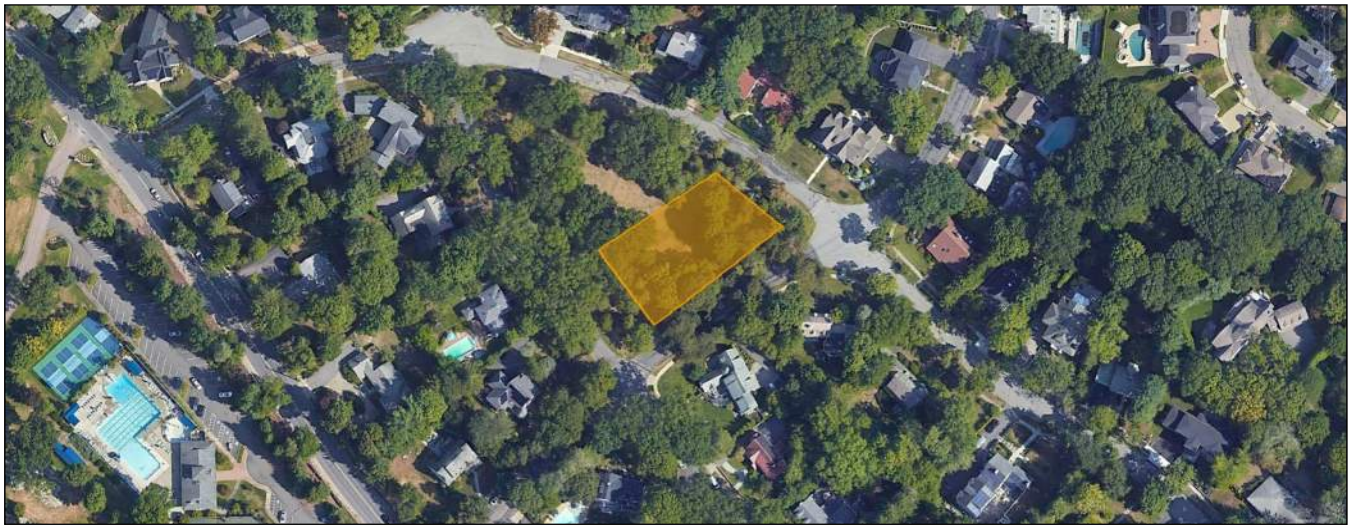
Dimensions (Length x Width)	450x120
SCM Footprint (SF)	49,250
Treatment Depth (in.)	1.00
Reduction Efficiency	90%
SCM Volume (CF)	108,147

Total Load Reduction (lb/y) :	**59.1**

Project Site Considerations	Large system of chambers to replace the current underdrains under the field. AUL on portion of the site. West parking lot covered by new solar canopies is unavailable. Not feasible due to field usage.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	Located in historic wetland area.

Hartmann Park

Infiltration Chamber



Project Reference Number	3
Parcel ID	81009 0001
Address/Location	COUNTRY CLUB RD
Property Description	Hartmann Park

Additional Municipal Parcels Treated
--

HSG Soil Type at SCM	C
Impervious Drainage Area (ac.)	22.6
Total Contributing Area (ac.)	66.2
Generated TP Load from Total Area (lb/yr)	50.3

Dimensions (Length x Width)	210x100
SCM Footprint (SF)	21,000
Treatment Depth (in.)	0.50
Reduction Efficiency	71%
SCM Volume (CF)	42,000

Total Load Reduction (lb/y) :	**35.5**

Project Site Considerations	Large chamber system placed in grassed/wooded island. Mature trees will need to be removed. Sloping topography. Not feasible due to significant tree removal.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	Directly upstream of reported 2010 flood damage .

Waban/Alban Wooded Parcel

Infiltration Basin

Project Reference Number	4
Parcel ID	55023 0001
Address/Location	WABAN AVE
Property Description	Waban/Alban Wooded Parcel

Additional Municipal Parcels Treated
--

HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	10.0
Total Contributing Area (ac.)	28.7
Generated TP Load from Total Area (lb/yr)	21.7

Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	9,100
Treatment Depth (in.)	1.00
Reduction Efficiency	98%
SCM Volume (CF)	36,400

Total Load Reduction (lb/y) :	**21.2**

Project Site Considerations	Basin in a heavily wooded natural depression parcel surrounded by roads. Not feasible due to significant tree removal.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	--

Newton Community Farm

Infiltration Chamber

Project Reference Number	5
Parcel ID	83036 0009
Address/Location	303 NAHANTON ST
Property Description	Newton Community Farm

Additional Municipal Parcels Treated
--

HSG Soil Type at SCM	B/D
Impervious Drainage Area (ac.)	8.6
Total Contributing Area (ac.)	38.4
Generated TP Load from Total Area (lb/yr)	22.5

Dimensions (Length x Width)	157x100
SCM Footprint (SF)	15,700
Treatment Depth (in.)	1.00
Reduction Efficiency	94%
SCM Volume (CF)	31,400

Total Load Reduction (lb/y) :	**21.2**

Project Site Considerations	Infiltration chambers below community farm field. Construction to be considered outside growing seasons. Roadway runoff design concerns. Not feasible due to impact to community farm.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	--

Oak Hill Middle School

Infiltration Chamber

Project Reference Number	6
Parcel ID	81051 0052
Address/Location	130 WHEELER RD
Property Description	Oak Hill Middle School

Additional Municipal Parcels Treated
--

HSG Soil Type at SCM	B/D
Impervious Drainage Area (ac.)	8.4
Total Contributing Area (ac.)	21.7
Generated TP Load from Total Area (lb/yr)	18.4

Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	15,300
Treatment Depth (in.)	1.00
Reduction Efficiency	94%
SCM Volume (CF)	30,600

Total Load Reduction (lb/y) :	**17.3**

Project Site Considerations	Subsurface chambers under the soccer and baseball field. Baseball field was recently renovated. Significant impact to school athletics if disturbance and construction is prolonged. South Meadowbrook culvert design considerations further limit opportunity.
2024-2028 Capital Improvement Plan Notes	CIP identifies Brown/Oak Hill Playing Fields as a tentative future project (FY 25-30).
Climate Vulnerability/Flooding Notes	Located in historic wetland area.

Nahanton Park Canoe and Kayak Put In

Infiltration Trench

Project Reference Number	7A
Parcel ID	83035 0004A (1)
Address/Location	NAHANTON ST
Property Description	Nahanton Park Canoe and Kayak Put In

Dimensions (Length x Width)	5x120
SCM Footprint (SF)	600
Treatment Depth (in.)	1.00
Reduction Efficiency	98%
SCM Volume (CF)	720

HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	0.2
Total Contributing Area (ac.)	1.9
Generated TP Load from Total Area (lb/yr)	0.5

Total Load Reduction (lb/y) :	**0.5**

Project Site Considerations	Infiltration trench along access road where the boulders are currently placed. Opportunity for public education. Limited buffer distance from the Charles.
2024-2028 Capital Improvement Plan Notes	Nahanton Park - Nature center accessibility improvements, renovation of two parking areas, and more.
Climate Vulnerability/Flooding Notes	--

Nahanton Park Canoe and Kayak Put In

Infiltration Basin

Project Reference Number	7B
Parcel ID	83035 0004A (2)
Address/Location	NAHANTON ST
Property Description	Nahanton Park Canoe and Kayak Put In

Additional Municipal Parcels Treated
--

HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	6.0
Total Contributing Area (ac.)	18.0
Generated TP Load from Total Area (lb/yr)	13.4

Dimensions (Length x Width)	55x100
SCM Footprint (SF)	5,500
Treatment Depth (in.)	1.00
Reduction Efficiency	98%
SCM Volume (CF)	22,000

Total Load Reduction (lb/y) :	**13.1**

Project Site Considerations	Basin to be placed in wooded area east of the parking lot along Nahanton St. Area is relatively flat and heavily vegetated with new growth and invasive species. Significant vegetation removal required, therefore not pursuable.
2024-2028 Capital Improvement Plan Notes	Nahanton Park - Nature center accessibility improvements, renovation of two parking areas, and more.
Climate Vulnerability/Flooding Notes	--

Washington Park

Infiltration Chamber

Project Reference Number	8
Parcel ID	22012 0001
Address/Location	WASHINGTON PK
Property Description	Washington Park

Additional Municipal Parcels Treated
--

HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	7.4
Total Contributing Area (ac.)	12.7
Generated TP Load from Total Area (lb/yr)	16.2

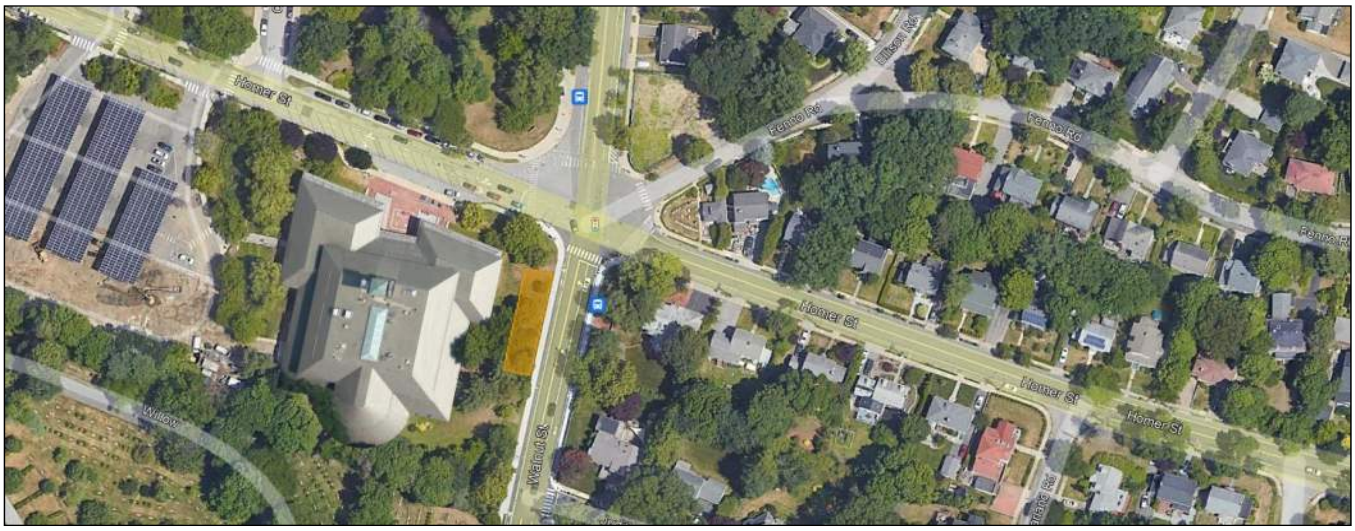
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	6,200
Treatment Depth (in.)	0.45
Reduction Efficiency	84%
SCM Volume (CF)	12,400

Total Load Reduction (lb/y) :	13.5

Project Site Considerations	Basin in the eastern portion of the parcel. Narrow available space. Mature trees and vegetation removal required, therefore, opportunity not feasible.
2024-2028 Capital Improvement Plan Notes	Washington Park North Side Water Replacement
Climate Vulnerability/Flooding Notes	Just upstream of locally identified areas of flooding.

Newton Free Library

Infiltration Chamber



Project Reference Number	9
Parcel ID	64003 0005
Address/Location	330 HOMER ST
Property Description	Newton Free Library

Additional Municipal Parcels Treated
64014 0012, 62004 0015A

HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	17.9
Total Contributing Area (ac.)	41.7
Generated TP Load from Total Area (lb/yr)	37.0

Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	3,300
Treatment Depth (in.)	0.10
Reduction Efficiency	33%
SCM Volume (CF)	6,600

Total Load Reduction (lb/y) :	12.2

Project Site Considerations	Basin on the east side of the building. Mature trees will need to be removed. Narrow area and slope limiting larger SCM.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	Locally identified area of flooding and area where damages reported in 2010.

Edmands Park (Central)

Infiltration Basin

Project Reference Number	10
Parcel ID	13021 0004
Address/Location	MILL ST
Property Description	Edmands Park (Central)

Additional Municipal Parcels Treated
--

HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	5.6
Total Contributing Area (ac.)	16.0
Generated TP Load from Total Area (lb/yr)	12.3

Dimensions (Length x Width)	80x65
SCM Footprint (SF)	5,200
Treatment Depth (in.)	1.00
Reduction Efficiency	98%
SCM Volume (CF)	20,800

Total Load Reduction (lb/y) :	**12.1**

Project Site Considerations	Relatively large area needed to be cleared in conservation land for this basin's footprint along Blake St. Many mature trees will need to be removed. South of the parking area and dirt road appears to be the location where the fewest trees will be removed. Opportunity not pursuable.
2024-2028 Capital Improvement Plan Notes	Edmands Brook Drainage Area Stormwater Improvements. Blake Street water main replacement in 2028 as well.
Climate Vulnerability/Flooding Notes	--

Bonica Park

Infiltration Basin

Project Reference Number	11
Parcel ID	34014 0001
Address/Location	CRAFTS ST
Property Description	Bonica Park

Additional Municipal Parcels Treated
--

HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	5.0
Total Contributing Area (ac.)	12.6
Generated TP Load from Total Area (lb/yr)	10.7

Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	3,200
Treatment Depth (in.)	0.70
Reduction Efficiency	96%
SCM Volume (CF)	12,800

Total Load Reduction (lb/y) :	**10.2**

Project Site Considerations	Basin located in wooded area east of Blake St. Removal of large mature trees required, therefore, not pursuable.
2024-2028 Capital Improvement Plan Notes	Identified as a new priority location for traffic calming on Waltham Street.
Climate Vulnerability/Flooding Notes	Flood damages occurred around parcel in 2010.

Wooded Parcel Bordering Highway Barrier

Infiltration Basin

Project Reference Number	12
Parcel ID	71024 0015
Address/Location	FAIRVIEW ST
Property Description	Wooded Parcel Bordering Highway Barrier

Additional Municipal Parcels Treated
--

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	4.4
Total Contributing Area (ac.)	10.2
Generated TP Load from Total Area (lb/yr)	9.8

Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	4,100
Treatment Depth (in.)	1.00
Reduction Efficiency	92%
SCM Volume (CF)	16,400

Total Load Reduction (lb/y) :	**9.1**

Project Site Considerations	Basin north of Fairview St in wooded parcel between roadway and I-90 sound barrier. Removal of vegetation needed, therefore, not pursuable.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	--

West Newton Common

Infiltration Chamber

Project Reference Number	13
Parcel ID	33023 0001
Address/Location	ELM ST
Property Description	West Newton Common

Additional Municipal Parcels Treated
--

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	4.3
Total Contributing Area (ac.)	9.9
Generated TP Load from Total Area (lb/yr)	10.0

Dimensions (Length x Width)	78x100
SCM Footprint (SF)	7,800
Treatment Depth (in.)	1.00
Reduction Efficiency	90%
SCM Volume (CF)	15,600

Total Load Reduction (lb/y) :	**9.0**

Project Site Considerations	Chambers located in the SW corner of the park under the playground extending west into field to maximize the drainage area. Mature trees require removal for SCM.
2024-2028 Capital Improvement Plan Notes	Identified as a new priority locations for traffic calming on Webster Street.
Climate Vulnerability/Flooding Notes	--

Nahanton Community Gardens

Infiltration Basin

Project Reference Number	14A
Parcel ID	83035 0003 (1)
Address/Location	525 WINCHESTER ST
Property Description	Nahanton Community Gardens

Additional Municipal Parcels Treated
--

HSG Soil Type at SCM	B
Impervious Drainage Area (ac.)	2.2
Total Contributing Area (ac.)	13.4
Generated TP Load from Total Area (lb/yr)	5.4

Dimensions (Length x Width)	40x50
SCM Footprint (SF)	2,000
Treatment Depth (in.)	1.00
Reduction Efficiency	97%
SCM Volume (CF)	8,000

Total Load Reduction (lb/y) :	**5.2**

Project Site Considerations	Basin located in wooded area at the outfall located east of the driveway. Removal of mature trees not pursuable.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	--

Nahanton Community Gardens

Infiltration Trench

Project Reference Number	14B
Parcel ID	83035 0003 (2)
Address/Location	525 WINCHESTER ST
Property Description	Nahanton Community Gardens

Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	3,400
Treatment Depth (in.)	1.00
Reduction Efficiency	98%
SCM Volume (CF)	4,080

HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	1.1
Total Contributing Area (ac.)	3.1
Generated TP Load from Total Area (lb/yr)	2.2

Total Load Reduction (lb/y) :	**2.2**

Project Site Considerations	Infiltration trenches to treat the driveway and parking areas.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	--

Short St Median

Infiltration Chamber

Project Reference Number	15
Parcel ID	53034 0019
Address/Location	BEACON ST
Property Description	Short St Median

Additional Municipal Parcels Treated
--

HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	3.2
Total Contributing Area (ac.)	7.3
Generated TP Load from Total Area (lb/yr)	6.6

Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	3,000
Treatment Depth (in.)	0.50
Reduction Efficiency	86%
SCM Volume (CF)	6,000

Total Load Reduction (lb/y) :	**5.7**

Project Site Considerations	Chambers in the vegetated median with mature trees. Smaller trees will need to be removed and replaced. Tree removal, therefore, not pursuable.
2024-2028 Capital Improvement Plan Notes	Complete Streets Improvements - Beacon Street at Chestnut Street (Concept phase)
Climate Vulnerability/Flooding Notes	--

Gasparri Park

Infiltration Chamber

Project Reference Number	16
Parcel ID	65010 0025
Address/Location	BOYLSTON ST
Property Description	Gasparri Park

Additional Municipal Parcels Treated
--

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	3.8
Total Contributing Area (ac.)	4.9
Generated TP Load from Total Area (lb/yr)	7.9

Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	4,000
Treatment Depth (in.)	0.55
Reduction Efficiency	69%
SCM Volume (CF)	8,000

Total Load Reduction (lb/y) :	**5.4**

Project Site Considerations	Small memorial park along RT 9; elevated above existing roads; SCM would disturb whole park and existing memorial area; no real opportunities for SCM
2024-2028 Capital Improvement Plan Notes	Identified as a new priority location for traffic calming on Langley Street.
Climate Vulnerability/Flooding Notes	Upstream of a locally identified area of flooding.

Langley/Beacon Median

Infiltration Chamber

Project Reference Number	17
Parcel ID	61038 0001
Address/Location	BEACON ST
Property Description	Langley/Beacon Median

Additional Municipal Parcels Treated
--

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	7.7
Total Contributing Area (ac.)	10.2
Generated TP Load from Total Area (lb/yr)	15.4

Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	3,300
Treatment Depth (in.)	0.20
Reduction Efficiency	33%
SCM Volume (CF)	6,600

Total Load Reduction (lb/y) :	**5.1**

Project Site Considerations	Sloped park with mature perimeter trees and open lawn. Chambers in the northern portion of the grassed park/median.
2024-2028 Capital Improvement Plan Notes	Water replacement along Beacon Street in 2027.
Climate Vulnerability/Flooding Notes	Just upstream of reported flooding damage in 2010.

Kerry Court Conservation Area

Infiltration Basin

Project Reference Number	18
Parcel ID	44017 0114
Address/Location	KERRY CT
Property Description	Kerry Court Conservation Area

Additional Municipal Parcels Treated
44017 0109, 44018 0001

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	2.4
Total Contributing Area (ac.)	5.4
Generated TP Load from Total Area (lb/yr)	5.2

Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	2,300
Treatment Depth (in.)	1.00
Reduction Efficiency	92%
SCM Volume (CF)	9,200

Total Load Reduction (lb/y) :	**4.8**

Project Site Considerations	Basin in heavily wooded conservation area natural low point. Removal of vegetation, therefore, not pursuable.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	--

Edmands Park (South)

Infiltration Basin

Project Reference Number	19
Parcel ID	22031 0001
Address/Location	MILL ST
Property Description	Edmands Park (South)

Additional Municipal Parcels Treated
--

HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	1.8
Total Contributing Area (ac.)	4.9
Generated TP Load from Total Area (lb/yr)	3.9

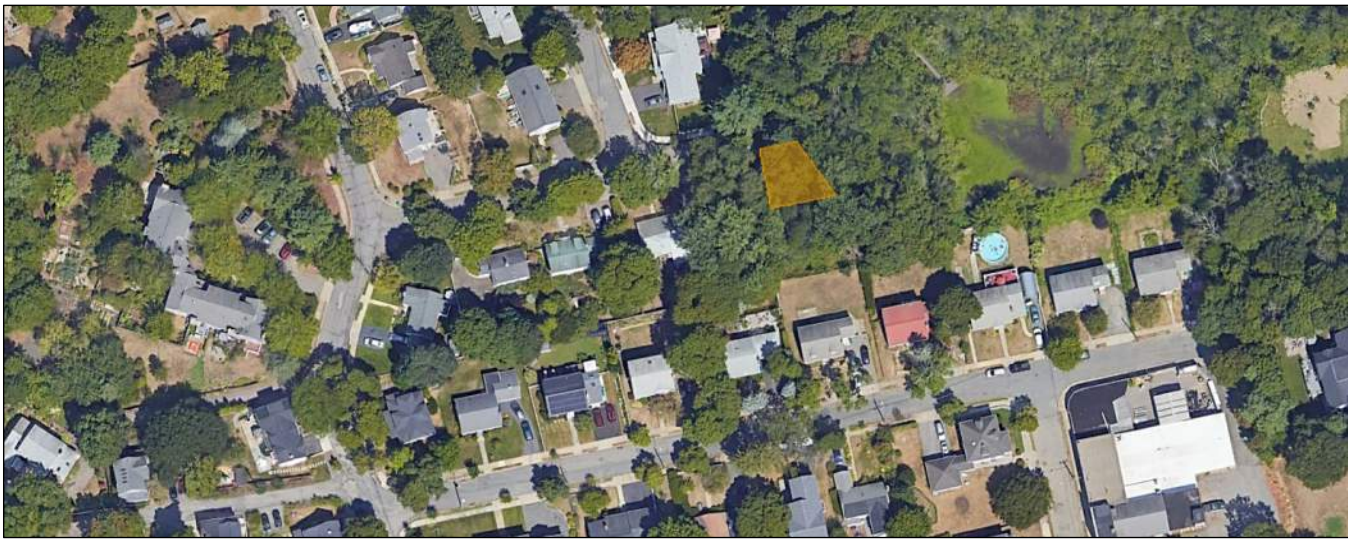
Dimensions (Length x Width)	50x34
SCM Footprint (SF)	1,700
Treatment Depth (in.)	1.00
Reduction Efficiency	98%
SCM Volume (CF)	6,800

Total Load Reduction (lb/y) :	**3.9**

Project Site Considerations	Basin in the north corner of the wooded parcel. Removal of mature trees, therefore, not pursuable.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	--

Wooded Conservation Land

Gravel/Constructed Wetland



Project Reference Number	20
Parcel ID	33017 0005
Address/Location	CUMBERLAND RD
Property Description	Wooded Conservation Land

Additional Municipal Parcels Treated
33019 0012

HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	2.0
Total Contributing Area (ac.)	4.8
Generated TP Load from Total Area (lb/yr)	4.1

Dimensions (Length x Width)	50x40
SCM Footprint (SF)	2,000
Treatment Depth (in.)	0.55
Reduction Efficiency	49%
SCM Volume (CF)	4,000

Total Load Reduction (lb/y) :	**2.0**

Project Site Considerations	Gravel/constructed wetland near the end of the road to the south to avoid the trail to the north. There is a wetland/pond very close to this location. Wooded parcel where mature trees would need to be removed.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	Upstream of flood damage reported in 2010.

Upper Falls Riverwalk Conservation Area

Bio-Filtration

Project Reference Number	21
Parcel ID	51046 0013
Address/Location	PROPOSED ST
Property Description	Upper Falls Riverwalk Conservation Area

Additional Municipal Parcels Treated
--

HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	2.7
Total Contributing Area (ac.)	5.0
Generated TP Load from Total Area (lb/yr)	5.6

Dimensions (Length x Width)	100x25
SCM Footprint (SF)	2,500
Treatment Depth (in.)	0.35
Reduction Efficiency	34%
SCM Volume (CF)	3,875

Total Load Reduction (lb/y) :	**1.9**

Project Site Considerations	Basin in wooded area between the two trails. Removal of wooded vegetation, therefore, not pursuable.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	--

Veterans Memorial Park

Sand Filter

Project Reference Number	22
Parcel ID	12015 0014
Address/Location	WASHINGTON ST
Property Description	Veterans Memorial Park

Additional Municipal Parcels Treated
12003 0001, 12003 0003, 12016 0001

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	2.5
Total Contributing Area (ac.)	4.2
Generated TP Load from Total Area (lb/yr)	5.2

Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	2,200
Treatment Depth (in.)	0.35
Reduction Efficiency	34%
SCM Volume (CF)	3,410

Total Load Reduction (lb/y) :	**1.8**

Project Site Considerations	Sand filters to the east and west of the existing memorial. Avoid the memorial in the central portion of the parcel. Due to setback limitations, infiltration is not viable.
2024-2028 Capital Improvement Plan Notes	Washington St Improvements - West Newton to Newton Corner identifies community garden on Spears Park (12003 0001). A portion of this catchment was pulled out and treated on the Spears Park parcel.
Climate Vulnerability/Flooding Notes	--

Wooded Conservation Land

Gravel/Constructed Wetland

Project Reference Number	23
Parcel ID	33019 0009
Address/Location	CUMBERLAND RD
Property Description	Wooded Conservation Land

Additional Municipal Parcels Treated
33019 0008, 33017 0011

HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	0.8
Total Contributing Area (ac.)	1.9
Generated TP Load from Total Area (lb/yr)	1.6

Dimensions (Length x Width)	25x30
SCM Footprint (SF)	750
Treatment Depth (in.)	0.50
Reduction Efficiency	46%
SCM Volume (CF)	1,500

Total Load Reduction (lb/y) :	**0.7**

Project Site Considerations	Gravel / constructed wetland near the end of the road to the west. Existing trail may need to be redirected. There is a wetland/pond very close to this location. Wooded parcel where mature trees will need to be removed, therefore, not pursuable.
2024-2028 Capital Improvement Plan Notes	--
Climate Vulnerability/Flooding Notes	--

Prioritized Roadway Opportunity Report Sheets

Nevada St

Infiltration Chamber

Project Reference Number	1
Roadway Name	Nevada St
Location Description	Nevada @ Village

HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	10.5
Total Contributing Area (ac.)	22.8
Generated TP Load from Total Area (lb/yr)	21.5
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	5,400
Treatment Depth (in.)	0.25
Reduction Efficiency	62%
SCM Volume (CF)	10,800

Project Duration	
Total Feasibility, Design & Permitting	14 months
Construction	6 months
Total	**20 months**

Total Load Reduction (lb/y) :	**13.2**

2023 EPA Total Cost Estimate:	**$ 743,850**
W&C Total Cost Estimate:	**$ 516,878**
EPA Cost/Benefit ($/lb/y):	**$ 56,158**
W&C Cost/Benefit ($/lb/y):	**$ 39,023**

Project Site Considerations	Subsurface chamber systems to be placed at the intersections of Nevada with Village, Fessenden, and Schofield. Place long, linear system under the westbound lanes of Nevada. Space is limited, water, sewer and gas to be coordinated for layout. Possible relocation of gas utility to accommodate SCM. Place subsurface chambers under intersection median of Nevada St and Schofield Dr. Small trees and one larger tree in the median to be removed. Minimize tree disturbance to the max. extent possible.
Identified in 2021 Traffic Calming Evaluation	Yes
Climate Vulnerability/Flooding Notes	Witihin area of mutiple reports of flood damages in 2010.

Brandeis Rd

Infiltration Chamber

Project Reference Number	2
Roadway Name	Brandeis Rd
Location Description	Greenwood @ Brandeis

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	21.7
Total Contributing Area (ac.)	50.9
Generated TP Load from Total Area (lb/yr)	45.5
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	7,500
Treatment Depth (in.)	0.15
Reduction Efficiency	26%
SCM Volume (CF)	15,000

Project Duration	
Total Feasibility, Design & Permitting	15 months
Construction	5 months
Total	**20 months**

Total Load Reduction (lb/y) :	**11.6**

2023 EPA Total Cost Estimate:	**$ 1,032,750**
W&C Total Cost Estimate:	**$ 717,030**
EPA Cost/Benefit ($/lb/y):	**$ 89,098**
W&C Cost/Benefit ($/lb/y):	**$ 61,860**

Project Site Considerations	Place subsurface chamber system along the western side of Brandeis Rd north of intersection with Greenwood St. Divert drainage at intersection with Greenwood before drainage network outfall to the wetland.
Identified in 2021 Traffic Calming Evaluation	Yes
Climate Vulnerability/Flooding Notes	Adjacent to flood claims area.

Waban Ave

Infiltration Chamber

Project Reference Number	3
Roadway Name	Waban Ave
Location Description	Waban @ Quinobequin

HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	5.5
Total Contributing Area (ac.)	18.5
Generated TP Load from Total Area (lb/yr)	12.2
Dimensions (Length x Width)	105x40
SCM Footprint (SF)	2,800
Treatment Depth (in.)	0.25
Reduction Efficiency	62%
SCM Volume (CF)	5,600

Project Duration	
Total Feasibility, Design & Permitting	13 months
Construction	4 months
Total	**17 months**

Total Load Reduction (lb/y) :	**7.5**

2023 EPA Total Cost Estimate:	**$ 386,100**
W&C Total Cost Estimate:	**$ 268,925**
EPA Cost/Benefit ($/lb/y):	**$ 51,504**
W&C Cost/Benefit ($/lb/y):	**$ 35,874**

Project Site Considerations	Place subsurface chamber system below the grassed median (parcel # 99099 0076). Avoid mature trees. Design drainage network relocation for SCM with surronding utilities. Expansion beyond the median is limited on both sides due to water, gas, and sewer lines.
Identified in 2021 Traffic Calming Evaluation	No
Climate Vulnerability/Flooding Notes	Directly upstream from a locally identified area of flooding.

Albemarle Rd

Bio-Filtration

Project Reference Number	4
Roadway Name	Albemarle Rd
Location Description	Crafts to the Charles

HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	5.7
Total Contributing Area (ac.)	12.1
Generated TP Load from Total Area (lb/yr)	11.6
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	11,100
Treatment Depth (in.)	0.8
Reduction Efficiency	48%
SCM Volume (CF)	17,205

Project Duration	
Total Feasibility, Design & Permitting	16 months
Construction	6 months
Total	**22 months**

Total Load Reduction (lb/y) :	**5.6**

2023 EPA Total Cost Estimate:	**$ 837,000**
W&C Total Cost Estimate:	**$ 690,816**
EPA Cost/Benefit ($/lb/y):	**$ 150,513**
W&C Cost/Benefit ($/lb/y):	**$ 124,225**

Project Site Considerations	Place bio-filtration SCMs along the edge of Albemarle on both sides of the greenway. Some SCMs will require curb cuts to accept stormwater via overland flow. Possible pavement removal along edge of road to create more SCM space, but may require that trees be removed and replaced or relocated.
Identified in 2021 Traffic Calming Evaluation	No
Climate Vulnerability/Flooding Notes	Within a locally identified area of flooding

Beacon St
Infiltration Chamber

Project Reference Number	5
Roadway Name	Beacon St
Location Description	Beacon @ Glen

HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	4.9
Total Contributing Area (ac.)	17.1
Generated TP Load from Total Area (lb/yr)	11.2
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	1,500
Treatment Depth (in.)	0.15
Reduction Efficiency	44%
SCM Volume (CF)	3,000

Project Duration	
Total Feasibility, Design & Permitting	15 months
Construction	5 months
Total	**20 months**

Total Load Reduction (lb/y) :	**4.9**

2023 EPA Total Cost Estimate:	**$ 206,550**
W&C Total Cost Estimate:	**$ 143,406**
EPA Cost/Benefit ($/lb/y):	**$ 41,929**
W&C Cost/Benefit ($/lb/y):	**$ 29,111**

Project Site Considerations	Place subsurface chamber system on the north side of Beacon St. Design to coordinate locations of existing utilites. Possible re-location of water main. Chambers to be placed on both sides of Glen Ave intersection to divert and treat the drainage before bypassing peak flows down Glen Ave. Chamber system length/size limited due to the roadway slope.
Identified in 2021 Traffic Calming Evaluation	No
Climate Vulnerability/Flooding Notes	Upstream of flood damage reported in 2010.

Valentine St

Infiltration Chamber

Project Reference Number	6
Roadway Name	Valentine St
Location Description	Valentine @ Fountain

HSG Soil Type at SCM	C
Impervious Drainage Area (ac.)	5.6
Total Contributing Area (ac.)	20.3
Generated TP Load from Total Area (lb/yr)	12.6
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	2,100
Treatment Depth (in.)	0.2
Reduction Efficiency	37%
SCM Volume (CF)	4,200

Project Duration	
Total Feasibility, Design & Permitting	13 months
Construction	4 months
Total	**17 months**

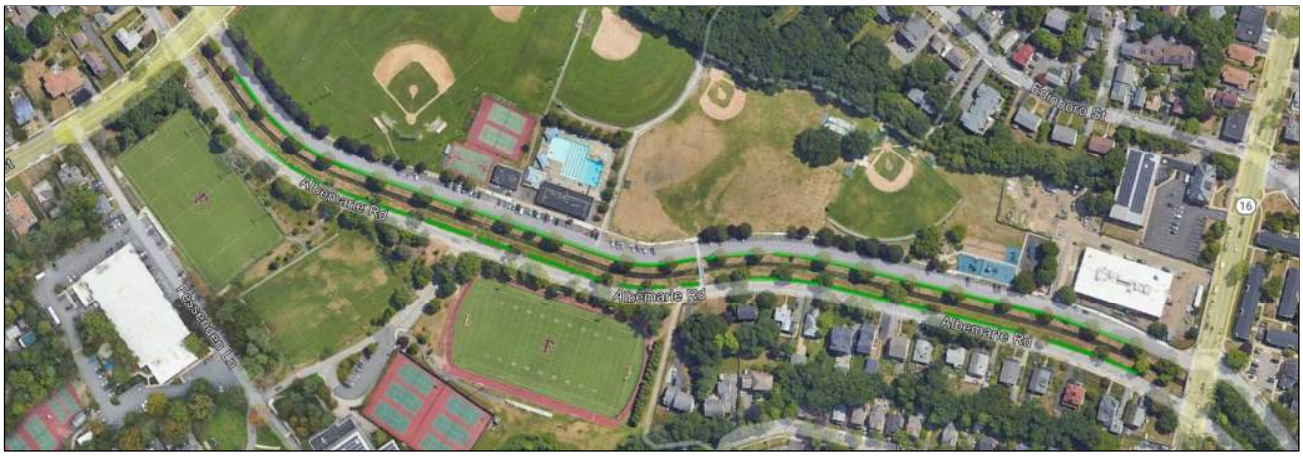
Total Load Reduction (lb/y) :	**4.7**

2023 EPA Total Cost Estimate:	**$ 290,250**
W&C Total Cost Estimate:	**$ 201,694**
EPA Cost/Benefit ($/lb/y):	**$ 62,179**
W&C Cost/Benefit ($/lb/y):	**$ 43,208**

Project Site Considerations	Place subsurface chamber system at Valentine St and Hampshire St intersection. Design to coordinate location of existing utilities.
Identified in 2021 Traffic Calming Evaluation	Yes
Climate Vulnerability/Flooding Notes	--

Albemarle Rd

Bio-Filtration



Project Reference Number	7A
Roadway Name	Albemarle Rd
Location Description	Watertown to Crafts

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	5.8
Total Contributing Area (ac.)	11.2
Generated TP Load from Total Area (lb/yr)	13.1
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	2,625
Treatment Depth (in.)	0.15
Reduction Efficiency	20%
SCM Volume (CF)	4,069

Project Duration	
Total Feasibility, Design & Permitting	16 months
Construction	6 months
Total	**22 months**

Total Load Reduction (lb/y) :	**2.6**

2023 EPA Total Cost Estimate:	**$ 198,450**
W&C Total Cost Estimate:	**$ 163,452**
EPA Cost/Benefit ($/lb/y):	**$ 77,454**
W&C Cost/Benefit ($/lb/y):	**$ 63,795**

Project Site Considerations	Place bio-filtration SCMs along the edge of Albemarle on both sides of the greenway. Some SCMs will require curb cuts to accept stormwater via overland flow. Possbile pavement removal along edge of road to create more SCM space, but may require that trees be removed and replaced or relocated.
Identified in 2021 Traffic Calming Evaluation	No
Climate Vulnerability/Flooding Notes	Within a locally identified area of flooding

Albemarle Rd

Porous Pavement

Project Reference Number	7B
Roadway Name	Albemarle Rd
Location Description	Watertown to Crafts

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	0.3
Total Contributing Area (ac.)	0.3
Generated TP Load from Total Area (lb/yr)	0.7
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	14,990
Treatment Depth (in.)	1
Reduction Efficiency	62%
SCM Volume (CF)	13,491

Project Duration	
Total Feasibility, Design & Permitting	16 months
Construction	6 months
Total	**22 months**

Total Load Reduction (lb/y) :	**0.4**

2023 EPA Total Cost Estimate:	**$ 765,450**
W&C Total Cost Estimate:	**$ 1,748,628**
EPA Cost/Benefit ($/lb/y):	**$ 1,830,439**
W&C Cost/Benefit ($/lb/y):	**$ 4,181,537**

Project Site Considerations	Porous pavement SCM along the eastern shoulder of the southbound lane from Crafts St to Watertown St. Porous pavement SCM along the western shoulder of the southbound lane from Crafts St to the Fessenden School access.
Identified in 2021 Traffic Calming Evaluation	No
Climate Vulnerability/Flooding Notes	Within a locally identified area of flooding

Crystal St
Infiltration Chamber

Project Reference Number	8
Roadway Name	Crystal St
Location Description	Crystal @ Lake

HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	4.2
Total Contributing Area (ac.)	4.7
Generated TP Load from Total Area (lb/yr)	8.3
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	925
Treatment Depth (in.)	0.1
Reduction Efficiency	33%
SCM Volume (CF)	1,850

Project Duration	
Total Feasibility, Design & Permitting	14 months
Construction	5 months
Total	**19 months**

Total Load Reduction (lb/y) :	**2.7**

2023 EPA Total Cost Estimate:	**$ 128,250**
W&C Total Cost Estimate:	**$ 88,511**
EPA Cost/Benefit ($/lb/y):	**$ 46,688**
W&C Cost/Benefit ($/lb/y):	**$ 32,222**

Project Site Considerations	Subsurface chamber system under Crystal St and Lake Ave intersection island. Design to avoid the sewer line to the north. Water line to south of system to be relocated. Design to coordinate location of existing utilities.
Identified in 2021 Traffic Calming Evaluation	No
Climate Vulnerability/Flooding Notes	--

Grove St

Infiltration Chamber

Project Reference Number	9
Roadway Name	Grove St
Location Description	Grove Public Parking

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	0.4
Total Contributing Area (ac.)	0.8
Generated TP Load from Total Area (lb/yr)	0.8
Dimensions (Length x Width)	25x30
SCM Footprint (SF)	750
Treatment Depth (in.)	1
Reduction Efficiency	90%
SCM Volume (CF)	1,500

Project Duration	
Total Feasibility, Design & Permitting	10 months
Construction	4 months
Total	**14 months**

Total Load Reduction (lb/y) :	**0.8**

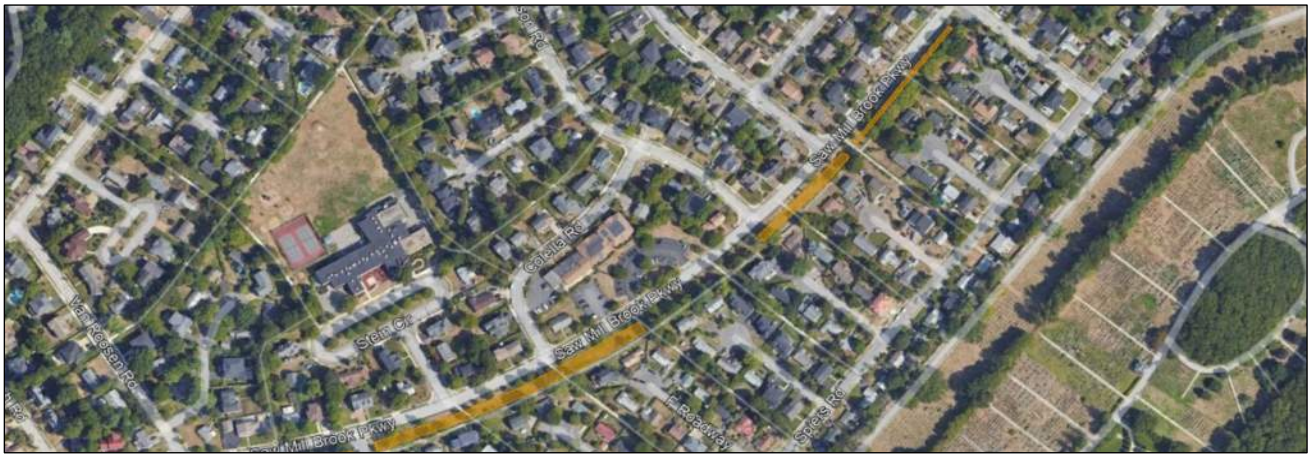
2023 EPA Total Cost Estimate:	**$ 103,950**
W&C Total Cost Estimate:	**$ 72,474**
EPA Cost/Benefit ($/lb/y):	**$ 135,922**
W&C Cost/Benefit ($/lb/y):	**$ 94,765**

Project Site Considerations	Place subsurface chamber system in the western portion of the public parking/turn-around area of Grove St. Avoid existing water line. Design to coordinate location of existing utilities.
Identified in 2021 Traffic Calming Evaluation	No
Climate Vulnerability/Flooding Notes	--

Not Currently Pursuable Roadway Opportunity Report Sheets

Saw Mill Brook Parkway

Infiltration Chamber



Project Reference Number	1
Roadway Name	Saw Mill Brook Parkway
Location Description	Saw Mill Brook @ Stein

HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	74.0
Total Contributing Area (ac.)	121.6
Generated TP Load from Total Area (lb/yr)	145.8

Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	44,100
Treatment Depth (in.)	0.30
Reduction Efficiency	68%
SCM Volume (CF)	88,200

Total Load Reduction (lb/y) :	**99.1**

Project Site Considerations	Subsurface chamber systems to be placed in the greenway from Van Roossen Rd to Fredette Rd. Tree removal anticipated; minimize to max. extent practical. Design to coordinate location of existing utilities. Possible high groundwater may limit infiltration.
Identified in 2021 Traffic Calming Evaluation	No
Climate Vulnerability/Flooding Notes	Upstream of flood damage reported in 2010.

Washington St

Infiltration Chamber

Project Reference Number	2
Roadway Name	Washington St
Location Description	Walker Park

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	7.2
Total Contributing Area (ac.)	9.2
Generated TP Load from Total Area (lb/yr)	15.4

Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	12,500
Treatment Depth (in.)	0.95
Reduction Efficiency	88%
SCM Volume (CF)	25,000

Total Load Reduction (lb/y) :	**13.6**

Project Site Considerations	Subsurface chamber system to be placed under the eastbound lanes of Washington St from Eddy St to Walker St. Coordinate with future Washington St redesign.
Identified in 2021 Traffic Calming Evaluation	Place the large chamber system in Washington St from the edge of the property to the center line. This spans across most of the northern property border. There appears to be no utilties located on the south side of the street other than the drain line.
Climate Vulnerability/Flooding Notes	No

Maynard St

Infiltration Chamber

Project Reference Number	3
Roadway Name	Maynard St
Location Description	Maynard @ Mosman

HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	5.9
Total Contributing Area (ac.)	10.1
Generated TP Load from Total Area (lb/yr)	11.8

Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	7,200
Treatment Depth (in.)	0.65
Reduction Efficiency	92%
SCM Volume (CF)	14,400

Total Load Reduction (lb/y) :	**10.9**

Project Site Considerations	Subsurface chamber systems to be placed under the Mosman St intersection and eastbound lane of Maynard St. Design to coordinate location of existing utilities.
Identified in 2021 Traffic Calming Evaluation	Chamber systems to be placed under the Mosman St intersection median and to the east on Maynard. The eastbound side seems to have the fewest utilities other than service lines. The chambers will need to be in line with the drainage line.Remain at least 50 feet from Cheesecake Brook on Albemarle.
Climate Vulnerability/Flooding Notes	Yes

Dexter Rd

Infiltration Chamber

Project Reference Number	4
Roadway Name	Dexter Rd
Location Description	Dexter @ Walnut

HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	2.1
Total Contributing Area (ac.)	2.3
Generated TP Load from Total Area (lb/yr)	4.1

Dimensions (Length x Width)	16x100
SCM Footprint (SF)	1,600
Treatment Depth (in.)	0.40
Reduction Efficiency	81%
SCM Volume (CF)	3,200

Total Load Reduction (lb/y) :	**3.3**

Project Site Considerations	Subsurface chamber system to be placed under the westbound lane of Dexter St at the Walnut St intersection. Avoid mature trees to max. extent practical. Adjacent topography may limit infiltration.
Identified in 2021 Traffic Calming Evaluation	Chamber to be placed along the south edge of parcel/north shoulder of the road. This should avoid the mature trees. This is immediately on top of steep terrain that may limit infiltration efforts.
Climate Vulnerability/Flooding Notes	No

Clark St

Infiltration Chamber

Project Reference Number	5A
Roadway Name	Clark St
Location Description	Clark Park

HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	3.9
Total Contributing Area (ac.)	5.4
Generated TP Load from Total Area (lb/yr)	7.7

Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	2,200
Treatment Depth (in.)	0.30
Reduction Efficiency	68%
SCM Volume (CF)	4,400

Total Load Reduction (lb/y) :	**5.2**

Project Site Considerations	Subsurface chamber systems to be placed under the Rowena Rd intersection and along the east side of the park. Design to avoid the water line in the intersection. Design to coordinate location of existing utilities.
Identified in 2021 Traffic Calming Evaluation	Chambers to be placed at the southern corner or Clark Park and under the Clark St/Rowena Rd intersection. The chambers will need to be designed around the drainage line entering from the east side of the park, and a water utility line will need to be relocated.
Climate Vulnerability/Flooding Notes	No

Clark St

IA Removal

Project Reference Number	5B
Roadway Name	Clark St
Location Description	Clark Park

HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	0.2
Total Contributing Area (ac.)	0.2
Generated TP Load from Total Area (lb/yr)	0.5

Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	10,400
Treatment Depth (in.)	--
Reduction Efficiency	98%
SCM Volume (CF)	--

Total Load Reduction (lb/y) :	**0.5**

Project Site Considerations	Remove the section of Clark St east of the park for IA removal and park expansion. Coordinate driveway redesign for the affected private properties.
Identified in 2021 Traffic Calming Evaluation	No
Climate Vulnerability/Flooding Notes	--

APPENDIX F: OPERATION AND MAINTENANCE

Operation and Maintenance Program Memorandum

Attachment 1: Informational Stormwater Handout

Attachment 2: Example SCM Inspection Tracking Sheets

Operation and Maintenance Program Memorandum

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MEMORANDUM

PROJECT: Newton, MA Phosphorus Control Plan

PROJECT NUMBER: 0233351.00

DATE: June 2023

SUBJECT: Operation and Maintenance Program Memorandum

Woodard & Curran and City staff conducted a series of meetings to discuss the City's current operation and maintenance (O&M) program for existing structural controls on City and private property and evaluate steps to expand the program for planned future structural controls. The goals of these meetings were the following:

1. Understand current inspection, maintenance, and tracking operations;
2. Understand current mechanisms to require and enforce maintenance on private controls;
3. Outline program updates to ensure the City can efficiently credit existing and planned SCMs;
4. Plan for updated program implementation.

1.1 Current Program

The City's Stormwater Management Ordinance (Ordinance) dated May 2, 2022, and their Stormwater Management and Erosion Control Rules and Regulations (Rules and Regulations) dated April 14, 2022, ensure that stormwater from development and redevelopment projects is adequately controlled. The Rules and Regulations define Major and Minor stormwater project activities as the following:

- Minor Stormwater:
  - Any residential development or redevelopment with four or fewer units with land disturbance less than 0.5-acres.
  - Any residential, commercial, industrial, institutional, or municipal development or redevelopment creating 401-1,000 square feet of new impervious area.
  - New retaining walls and trench excavations requiring dewatering.
- Major Stormwater: Required for projects exceeding the Minor Stormwater thresholds.

The Rules and Regulations require construction-period and post-construction inspections to confirm SCMs are constructed per approved plans and permit conditions. The Rules and Regulations also require proof of recording the project's O&M Plan at the South Middlesex Registry of Deeds, and they require post-construction annual reporting on O&M of SCMs for

Major stormwater permits. Major stormwater permits require annual inspection reports be submitted to the Engineering Division by January 15th of the following year; however, the City rarely receives these reports, and subsequent inspection and maintenance tracking has not been enforced.

The City currently uses NewGov as their permit submission and tracking software platform. The Rules and Regulations require submission of existing and proposed impervious surface areas and average annual total phosphorus load. This information is not currently tracked through NewGov.

1.2 Program Updates

The City's O&M program updates will focus on tracking, private facility owner education and outreach, enforcement, and auditing. The City's Department of Public Works (DPW) Engineering Division will be the primary responsible party for these components of the O&M program.

Program updates are anticipated to be implemented in phases to align with MS4 PCP implementation. Updates described herein focus primarily on program updates in support of Phase 1 PCP implementation. These program updates include advanced tracking of impervious and phosphorus data for all stormwater projects, as well as stronger enforcement of Major permit inspection reporting. In subsequent PCP Phases, it is anticipated that the City will consider an expansion of maintenance tracking (and associated load reduction crediting) to include Minor stormwater permits. However, data tracking will be expanded for all projects now, to position the City for subsequent O&M program expansion.

The City will require annual self-certification of inspection and maintenance of private facilities subject to Major stormwater permits. Municipal SCMs owned and operated by the DPW will be maintained in-house by the DPW. Other municipal departments that operate SCMs will be individually responsible for inspection and maintenance of their own facilities, similar to a private facility owner.

1.2.1 Tracking

Tracking and documenting SCMs and their inspection and maintenance activities is necessary for the City to take phosphorus reduction credit for these structural controls. The City currently does not track phosphorus reduction credit for new permits or have a complete mapping database of their existing SCMs., Therefore, improvements to the City's credit tracking program are necessary to meet Permit requirements more efficiently and economically.

The City will modify their NewGov permit process to require phosphorus increase, SCM system type, and SCM reduction credit to be included as a field in the permit application. This will provide the City a mechanism for tracking changes to their baseline load due to development and phosphorus reduction credit through permitted SCMs.

As part of this phase of program modifications, the City will also implement measures using NewGov to track the annual O&M reporting and self-certification required for Major stormwater permitholders and associated enforcement thereof. The NewGov software will also be used to generate a random list for the City's use in auditing the self-certifications.

The City will use NewGov and O&M annual reports to manually track SCM system type, SCM reduction credit, and O&M activities for existing controls that were not permitted through NewGov and therefore not currently in the NewGov system. The City will also use the NewGov database to geographically map existing SCMs and relevant system information. This will allow the City to effectively manage these stormwater assets similar to other City utilities and infrastructure. As part of this mapping exercise, the City will assign SCM IDs to the systems to support future tracking efforts.

1.2.2 Existing SCM Crediting Program Evaluation

The City will implement an ongoing evaluation program for existing SCMs to be inspected, maintained, and credited. Newton's robust stormwater regulations have resulted in what is estimated to be thousands of existing SCMs. The majority of these have not been evaluated for credit in Phase 1 of this PCP. Major stormwater projects permitted after the Ordinance and Rules and Regulations update in Spring 2022 are held to annual O&M reporting requirements. Projects permitted prior to these regulation updates have O&M requirements but were not required to submit annual reports to the City to document annual inspection and maintenance activities. Therefore, the City does not have a legal enforcement mechanism to require private facility owners with SCMs permitted prior to Spring 2022 to report annually on inspection and maintenance activities. The following sections describe the existing SCM crediting program evaluation for systems permitted before and after the Spring 2022 regulation updates.

1.2.2.1 Existing Systems Permitted After Spring 2022

The City will evaluate existing and future Major permit SCMs, phosphorus load reduction and maintenance costs for consideration of program modifications in subsequent phases. It is anticipated that the City will take credit for Major permit SCMs in Phase 1 of the PCP. In order to do this, the City will complete education and outreach and enforcement activities, as needed, to ensure facility owners inspect, maintain, and provide annual reports to the City.

Additionally, it is anticipated that the City will expand reporting and self-certification requirements to Minor stormwater permits in future years. Local amendments to regulations are likely to be necessary to facilitate this expansion. Additional direction from EPA regarding maintenance requirements for residential SCMs will also be used to inform future program modifications. This could provide significant load reduction if economical maintenance measures to support crediting can be achieved.

1.2.2.2 Existing Systems Permitted Before Spring 2022

The City will first focus on education and outreach for large commercial, industrial, and multi-family facilities with SCMs permitted before Spring 2022. The City will directly contact these private facility owners to schedule facility site visits. This will provide an opportunity to discuss the importance of SCM maintenance and to facilitate compliance support. The City will reevaluate this program after assessing participation during Phase 1. If participation is limited during Phase 1, the City will consider additional program updates, such as the following, to be able to take credit for these existing SCMs. These programs are discussed in more detail in the Legal Analysis.

- Increase stormwater user fee credit, to incentivize SCM maintenance and reporting.

- Require inspection, maintenance, and annual reporting during property transfer process.
- Add additional fee to stormwater user bills if private facility owners do not submit annual inspection and maintenance reports, so the City can fund a municipal inspection and maintenance program for private SCMs.

1.2.3 Education and Outreach

Education and outreach will be crucial components for a successful SCM O&M program. The education and outreach component of the City's O&M program will consist of presentations, outreach material, and engagement with other municipal departments and private property owners to inform them of the O&M self-certification process.

The City has a stormwater user fee, which is billed quarterly with water and sewer bills. The City's stormwater fee credit program could provide a financial incentive for private SCM owners to inspect and maintain their systems. The City currently has very limited participation in the credit program, but participation may increase with additional education and outreach.

Quarterly billing of the stormwater fee provides an opportunity to send informational pamphlets to property owners outlining the importance of SCM maintenance, inform the public of O&M requirements, upcoming enforcement changes, as well as educate on the O&M self-certification process. The City will send mailers in the summer of 2023. Mailers will include general informational mailers to all property owners as well as targeted mailers for Major stormwater permitholders to reinforce upcoming O&M reporting enforcement. An example general informational stormwater handout is attached In Permit Year 7 (July 2024 – June 2025), mailers provided with quarterly stormwater bills will also be used to notify Major stormwater permit holders of auditing, as applicable.

The City will hold presentations to major stakeholders, including other City departments, the City Council, and major private property stakeholders to further engage the community surrounding the O&M requirements, program modifications and associated timing. Quarterly presentations will begin in the summer of 2023 continuing through 2024; semi-annual presentations will continue thereafter.

In addition to group outreach, targeted outreach to key Major stormwater permit holders and community advocates will be held through Permit Years 6 & 7. This is intended to raise awareness among key stakeholders and increase program engagement. City representatives will meet with select stakeholders to individually review program requirements and facilitate compliance support.

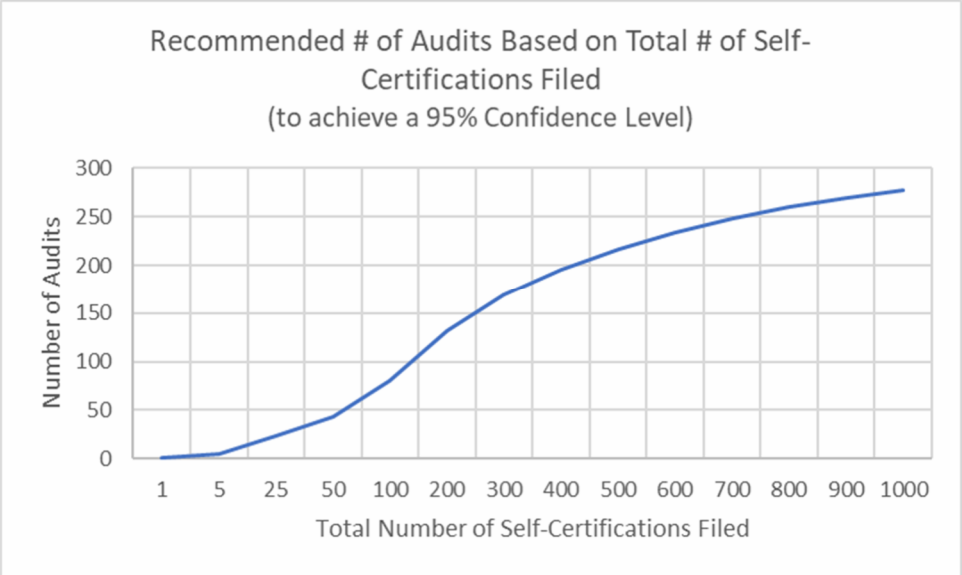
1.2.4 Enforcement

Section 29-153 of the Ordinance outlines the City's enforcement authority. This section provides the City a mechanism to enforce inspection and maintenance of private SCMs through civil penalties of up to $300 per day of violation. The Rules and Regulations do not currently reference this section of the Ordinance; however, the City will revise the Rules and Regulations to link them to this enforcement section. The City will start by enforcing only Major permit holders and will consider enforcing Minor permits, which largely consist of small single family

residential projects, for Phase 2 and 3 of the Permit. The City will provide adequate time for the public to become aware and educated of this change and to plan for required inspection, maintenance, and reporting activities (refer to 1.2.2 Education and Outreach). The City will reevaluate civil penalties based on public participation in the program after this period of thorough education and outreach. If annual inspection and maintenance reports are not submitted to the DPW by January 15th of the following year, a civil penalty will be added to the owner's next quarterly stormwater bill.

1.2.5 Auditing

An auditing program will be enacted to ensure the credibility of the self-certification reporting of private SCMs. The Rules and Regulations will be modified, as needed, to outline the auditing program and provide municipal staff authorization to inspect existing SCMs as part of the auditing process. The number of annual audits will be based on the total number of existing controls being credited, with the goal of ensuring a 95% confidence level that the audited systems are representative of the total number of credited systems. As the number of credited systems increases, the relative number of audited systems will decrease, as shown in the chart below. For example, if there are 50 systems or less, all systems should be audited. If there are 400 systems, about 200 systems should be audited. About 275 systems should be audited for every 1,000 self-certified systems. Another goal of the program will be to perform the audits over the 5-year permit cycle. Municipal SCMs are not planned to be audited.



The City's DPW and representatives will be responsible for notifying, performing, and tracking private SCM audits. As previously noted, NewGov will be modified to implement measures to support the auditing program. An annual auditing list will be generated; the City intends to focus auditing on SCM's which provide significant phosphorus reduction. Billing mailer inserts will be used for initial notifications to the properties selected for auditing. Subsequently, direct letters to property owners will be used to facilitate scheduling the audit date.

1.3 Program Implementation

The program updates are anticipated to be completed based on the following program implementation commencement schedule:

- Tracking: Permit Year 6 (July 2023- June 2024)
    - Update NewGov to track phosphorus load changes for new projects
    - Update NewGov for tracking of Major stormwater permit annual O&M reporting and self-certification
    - Implement measure in NewGov to support future auditing list generation measures
- Education and Outreach: Permit Year 6 (2023-2024)
- Existing SCM Crediting Program Evaluation: Permit Year 6 (2023-2024)
    - Ongoing review of programs and measures for implementation
- Enforcement: Permit Year 7 (2024-2025)
    - Update Rules and Regulations to link to Ordinance
    - Enforce civil penalties as needed
- Auditing: Permit Year 8 (2025-2026)

Guidance on O&M frequency and maintenance activities for various SCM types is included as an attachment to this memorandum.

Attachments

Attachment 1: Newton Stormwater Handout

Attachment 2: SCM O&M Frequency and Maintenance Activities

Attachment 1: Informational Stormwater Handout

CLEAN WATER IS EVERYBODY'S BUSINESS

NEWTON

Ruthanne Fuller, Mayor

Jim McGonagle, DPW Commissioner

NEWTON'S COMMITMENT TO CLEAN WATER

As part of the City's ongoing efforts to improve our waterways and recreational waterbodies, and meet regulatory requirements, we are preparing a city-wide plan required by the federal Clean Water Act permit, to reduce phosphorus pollution in stormwater runoff discharging to the Charles River.

This work is part of Mayor Fuller's pledge to build a greater, better, and more beautiful Newton for our children and grandchildren through multi-benefit city infrastructure improvement projects. Improving the water quality of our lakes and rivers by reducing harmful nutrients (described below) also enhances our recreational facilities and public amenities. Stormwater drainage infrastructure, when maintained correctly, significantly reduces environmental pollution.

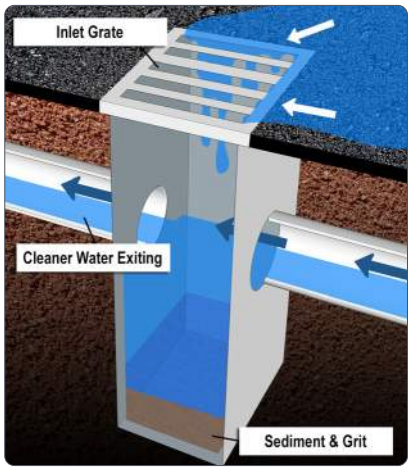
Newton Department of Public Works (DPW)

A MUNICIPAL SEPARATE STORMWATER SEWER SYSTEM (ALSO KNOWN AS MS4) IS:

A SYSTEM THAT COLLECTS AND/OR MOVES STORMWATER THROUGHOUT THE CITY.

The MS4 General Permit regulates things like...

- Illicit Discharge Detection and Elimination (ensuring we keep our stormwater separate from our sewer system)
- Pollution Prevention through limiting discharge of nutrients (see below), which are harmful to the environment, like phosphorus



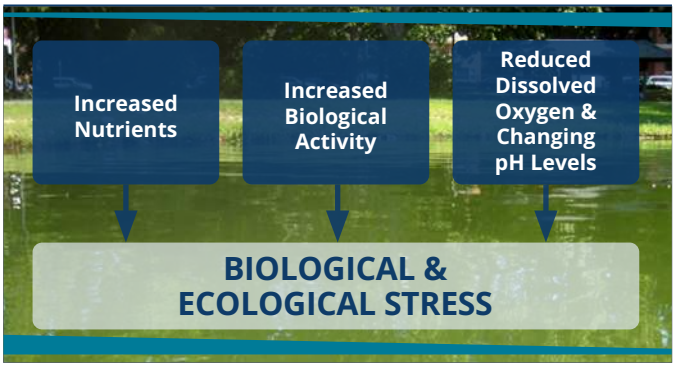
NEWTON'S MS4 INCLUDES:

- 320 miles of stormwater drainage pipe
- 12,750 catch basins
- 5,852 drainage manholes
- 2 pump stations
- 384 outfalls/interconnections
- 14 miles of streams

NUTRIENTS AS A POLLUTANTS IN OUR MS4

Excess nutrients in stormwater runoff can be caused by:

- Fertilizers and pesticides
- Yard waste (leaves and grass clippings)
- Pet and animal waste
- Car washing (detergents)
- Exposed soil erosion



WHAT WE HAVE DONE TO PREPARE?

Implemented more stringent stormwater regulations requiring Phosphorus mitigations

Investigated >80 % of City's stormwater system for illicit discharges

Site plans reviewed for compliance with construction erosion control and stormwater control policies

Construction site inspections

Ongoing street sweeping, leaf litter and catchbasin cleaning programs

CLEAN WATER IS EVERYBODY'S BUSINESS

NEWTON

Ruthanne Fuller, Mayor

Jim McGonagle, DPW Commissioner

NEWTON'S COMMITMENT TO CLEAN WATER

NEWTON IS REQUIRED TO REDUCE PHOSPHORUS LOAD IN STORMWATER BY 61% BY 2038, THAT'S A REDUCTION OF APPROXIMATELY 1,100 LBS BY 2026 AND APPROXIMATELY 1,400 LBS BY 2028.

Newton's phosphorus control plan outlines an approach to do this through structural and non-structural stormwater control measures (SCMs) on public and private property.

WHAT IS A STRUCTURAL SCM? A physical, permanent system that is designed and constructed. Examples include: green roofs, permeable pavement, bioretention/rain gardens, infiltration (basins, underground chambers), swales, stormwater wetlands, dry ponds, etc.

WHAT IS A NON-STRUCTURAL SCM? An operational management activity for pollution prevention. Examples include: street sweeping, catch basin cleaning, and public education & outreach.

WHAT CAN YOU DO TO HELP REDUCE NUTRIENT POLLUTION IN STORMWATER?

Idenfity, locate, and inspect any structural SCMs on your property. The effectiveness of structural SCMs depends on regular inspection and maintenance to ensure the systems are operating as designed. Depending on the type of system, look for signs of erosion, water ponding, or excess vegetation. If an operations and maintenance manual was prepared for your system, follow it's guidance.

The city can benefit from existing SCMs by taking credit. The EPA requires certification that SCMs are being maintained. Submit an Annual SCM Maintenance Report to Newton's DPW by January 15th to document that maintenance was performed on your system.

EVERY POUND OF PHOSPHORUS REDUCED WILL SAVE NEWTON $50,000-$100,000!

STAY TUNED FOR MORE INFORMATION:

We will share additional education materials, announcements, and presentations starting in Summer 2023.

CLEAN WATER IS EVERYBODY'S BUSINESS

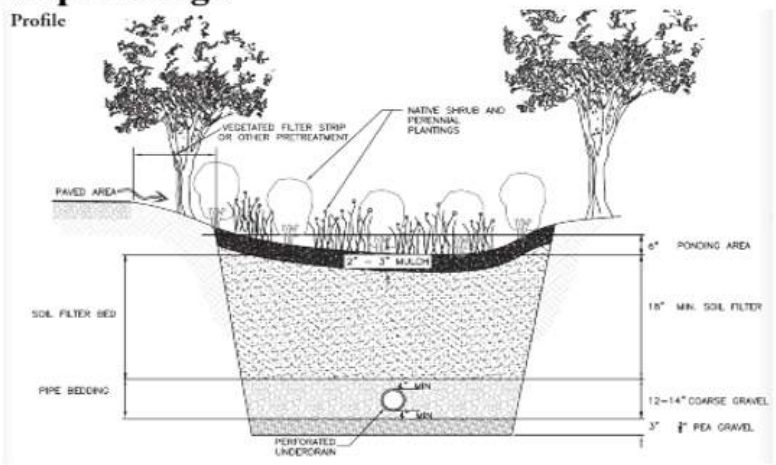
NEWTON

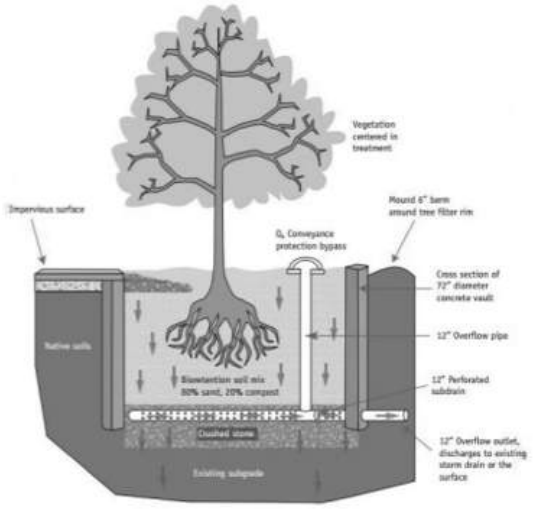
Attachment 2: Example SCM Inspection Tracking Sheets

Biofiltration / Bioretention / Rain Garden / Tree Well / Enhanced Biofiltration with Internal Storage Reservoir

Sample Design

Profile





Examples images from the *New Hampshire Stormwater Manual, Volume 2*, p. 116 & 112

Inspection & Maintenance Record

Facility Owner (Municipal, State, Private, Other):		Owner Name:	
		Owner Address:	
		Owner Phone Number:	
Inspection Date:		Maintenance Date:	
Inspector:		Maintained By:	
SCM Location:		Type of Maintenance (see below):	
Weather:		Date of Previous Maintenance:	

SAMPLE

Inspection & Maintenance Recommendations

	Procedure	Objective	Frequency
1.	**Mowing, Landscaping, and Vegetation Management**	Minimize establishment / takeover of non-intentional woody vegetation. Mowing specifically for embankment / side slopes / areas where bioretention plantings are not present. Trim vegetation and remove weeds. Maintain mulch layer to retain soil moisture. Divide plants as needed to avoid overcrowding and reduce blooms.	Mow / landscape at least twice per year and remove mowed material / clippings. Apply mulch layer in Spring and as needed. Remove dead vegetation annually.
2.	**Debris and Litter Removal**	Remove for aesthetics and to mitigate contribution of downstream floatables.	As needed by inspection. Monthly debris and litter removal.
3.	**Sediment Removal**	Maintain flow capacity. Inspect and remove sediment, particularly at pipe discharge.	Inspect quarterly for the first year. Establish a specific schedule based on first year accumulations.
4.	**Structural Integrity**	Minimize erosion and channelization of stormwater. Inspect for signs of scouring, particularly near high velocity areas.	After large storms (2.5 inches of rainfall), but not less than twice per year.
5.	**Water Level Inspection**	Inspect water level in unit. System should be drained completely 72 hours after a storm event.	At a minimum inspect twice a year at least 72 hours after storm event.

Condition Assessment

	Circle all that apply:					
Does SCM Appear to Be Working Properly?	Yes	No				
Is Maintenance Required?	Yes	No				
Maintenance Access	No Direct Access / Limited Access	Foot	ATV	Truck	No Access Restrictions	
Is Underdrain Working Properly?	Yes	No	Not Applicable	Unknown		
Standing Water in System?	Yes	No				
Evidence of Flooding / Overtopping?	Yes	No				
Emergency Spillway	Good Condition	Erosion	Excess Vegetation	Other: _____		
Maximum Sediment Depth (inches)	_____ *inches* **Push ruler into sediment deposits until flush with surface elevation of the designed system.*					
Pretreatment System	Forebay	Oil / Water Separator	Proprietary Settling / Swirl Chamber	Sediment Chamber	Not Applicable	
Pretreatment System Condition	Good Condition	Heavy Sediment Accumulation	Slight Sediment Accumulation	Undesirable Woody Plants	Not Applicable	
Inlet	Good Condition	Erosion	Pipe Damaged	Not Applicable		
Outlet	Good Condition	Erosion	Pipe Damaged	Not Applicable		
Outlet Control Structure	Good Condition	Cracked	Exposed Steel	Corroded	Clogged	Not Applicable
Rodent Control	Needs Work	Holes >3"	Holes <3"	None		
Deposits	None	Oil/Grease	Grass Clippings/ Compost	Trash/ Debris	Sediment	Other: _____
Vegetation	None	Healthy	Unhealthy	Sparse	Undesirable Woody Plants	
Erosion	None	Inlet/Outlet Erosion	Embankment/ Side Slope Erosion	Channeling/ Depressions	Displaced Riprap	Other: _____
Does System Drain Within 72-Hours?	Yes	No				

SAMPLE

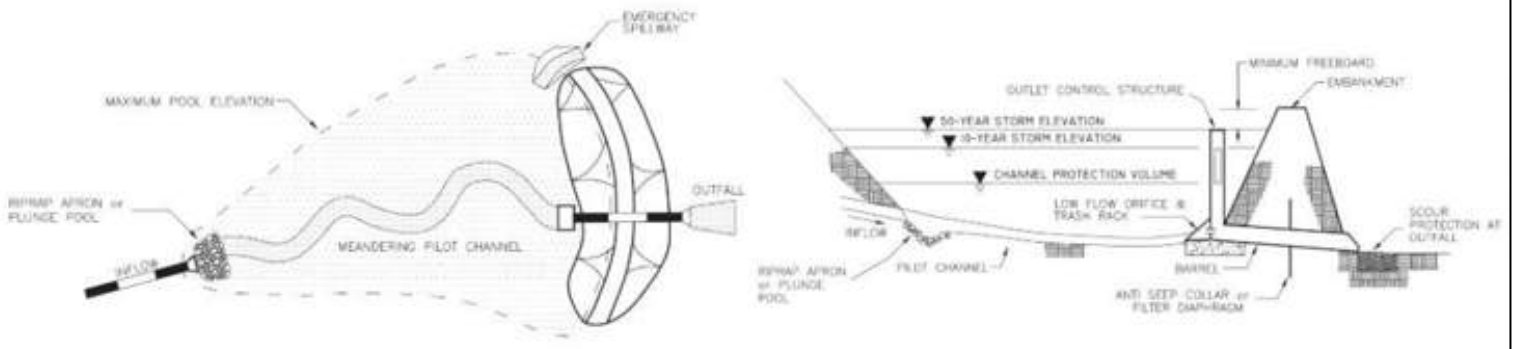
Additional Comments:	

Photos / Files / Attachments:	**Photo:**		**Description:**	

SAMPLE

Detention Basin

Sample Design



Examples images from the *New Hampshire Stormwater Manual, Volume 2*, p. 159

Inspection & Maintenance Record

Facility Owner (Municipal, State, Private, Other):		Owner Name:	
		Owner Address:	
		Owner Phone Number:	
Inspection Date:		Maintenance Date:	
Inspector:		Maintained By:	
SCM Location:		Type of Maintenance (see below):	
Weather:		Date of Previous Maintenance:	

SAMPLE

Inspection & Maintenance Recommendations

	Procedure	Objective	Frequency
1.	**Mowing, Landscaping, and Vegetation Management**	Minimize establishment / takeover of non-intentional woody vegetation. Mowing specifically for embankment / side slopes / areas where bioretention plantings are not present. Trim vegetation and remove weeds. Maintain mulch layer to retain soil moisture. Divide plants as needed to avoid overcrowding and reduce blooms.	Mow / landscape at least twice per year and remove mowed material / clippings. Apply mulch layer in Spring and as needed. Remove dead vegetation annually.
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5.	**Water Level Inspection**	Inspect water level in unit. System should be drained completely 72 hours after a storm event.	At a minimum inspect twice a year at least 72 hours after storm event.

Condition Assessment

	Circle all that apply:					
Does SCM Appear to Be Working Properly?	Yes	No				
Is Maintenance Required?	Yes	No				
Maintenance Access	No Direct Access / Limited Access	Foot	ATV	Truck	No Access Restrictions	
Is Underdrain Working Properly?	Yes	No	Not Applicable	Unknown		
Standing Water in System?	Yes	No				
Evidence of Flooding / Overtopping?	Yes	No				
Emergency Spillway	Good Condition	Erosion	Excess Vegetation	Other: _____		
Maximum Sediment Depth (inches)	_____ *inches* **Push ruler into sediment deposits until flush with surface elevation of the designed system.*					
Pretreatment System	Forebay	Oil / Water Separator	Proprietary Settling / Swirl Chamber	Sediment Chamber	Not Applicable	
Pretreatment System Condition	Good Condition	Heavy Sediment Accumulation	Slight Sediment Accumulation	Undesirable Woody Plants	Not Applicable	
Inlet	Good Condition	Erosion	Pipe Damaged	Not Applicable		
Outlet	Good Condition	Erosion	Pipe Damaged	Not Applicable		
Outlet Control Structure	Good Condition	Cracked	Exposed Steel	Corroded	Clogged	Not Applicable
Rodent Control	Needs Work	Holes >3"	Holes <3"	None		
Deposits	None	Oil/Grease	Grass Clippings/ Compost	Trash/ Debris	Sediment	Other: _____
Vegetation	None	Healthy	Unhealthy	Sparse	Undesirable Woody Plants	
Erosion	None	Inlet/Outlet Erosion	Embankment/ Side Slope Erosion	Channeling/ Depressions	Displaced Riprap	Other: _____
Does System Drain Within 72-Hours?	Yes	No				

SAMPLE

Additional Comments:	

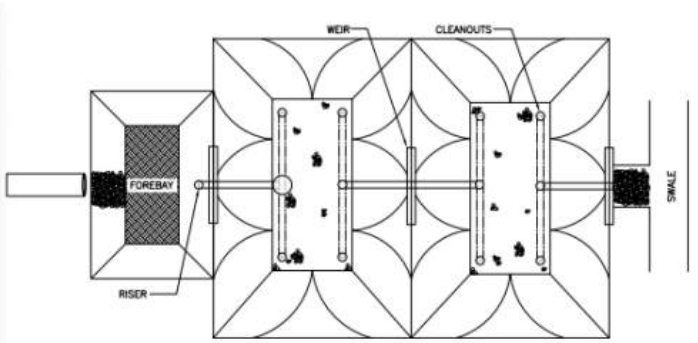
Photos / Files / Attachments:	**Photo:**		**Description:**	

SAMPLE

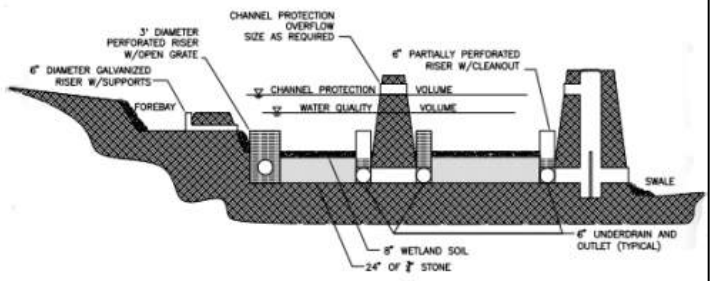
Gravel / Constructed Wetland

Sample Design

Plan View



Profile View



Examples images from the *New Hampshire Stormwater Manual, Volume 2*, p. 80

Inspection & Maintenance Record

Facility Owner (Municipal, State, Private, Other):		Owner Name:	
		Owner Address:	
		Owner Phone Number:	
Inspection Date:		Maintenance Date:	
Inspector:		Maintained By:	
SCM Location:		Type of Maintenance (see below):	
Weather:		Date of Previous Maintenance:	

SAMPLE

Inspection & Maintenance Recommendations

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Condition Assessment

Circle all that apply:						
Does SCM Appear to Be Working Properly?	Yes	No				
Is Maintenance Required?	Yes	No				
Maintenance Access	No Direct Access / Limited Access	Foot	ATV	Truck	No Access Restrictions	
Is Underdrain Working Properly?	Yes	No	Not Applicable	Unknown		
Standing Water in System?	Yes	No				
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Vegetation	None	Healthy	Unhealthy	Sparse	Undesirable Woody Plants	
Erosion	None	Inlet/Outlet Erosion	Embankment/ Side Slope Erosion	Channeling/ Depressions	Displaced Riprap	Other: _____
Does System Drain Within 72-Hours?	Yes	No				

SAMPLE

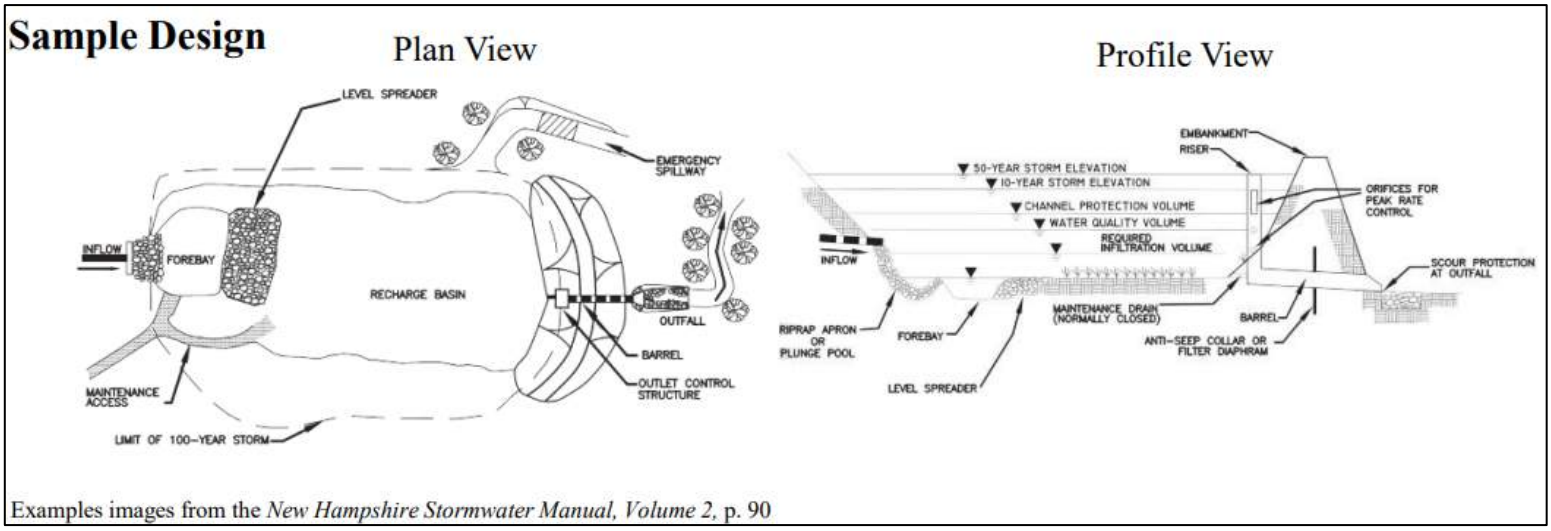
Additional Comments:	

Photos / Files / Attachments:	**Photo:**		**Description:**	

SAMPLE

Infiltration Basin

Sample Design



Examples images from the *New Hampshire Stormwater Manual, Volume 2*, p. 90

Inspection & Maintenance Record

Facility Owner (Municipal, State, Private, Other):		Owner Name:	
		Owner Address:	
		Owner Phone Number:	
Inspection Date:		Maintenance Date:	
Inspector:		Maintained By:	
SCM Location:		Type of Maintenance (see below):	
Weather:		Date of Previous Maintenance:	

SAMPLE

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Evidence of Flooding / Overtopping?	Yes	No				
Emergency Spillway	Good Condition	Erosion	Excess Vegetation	Other: _____		
Maximum Sediment Depth (inches)	_____ *inches* **Push ruler into sediment deposits until flush with surface elevation of the designed system.*					
Pretreatment System	Forebay	Oil / Water Separator	Proprietary Settling / Swirl Chamber	Sediment Chamber	Not Applicable	
Pretreatment System Condition	Good Condition	Heavy Sediment Accumulation	Slight Sediment Accumulation	Undesirable Woody Plants	Not Applicable	
Inlet	Good Condition	Erosion	Pipe Damaged	Not Applicable		
Outlet	Good Condition	Erosion	Pipe Damaged	Not Applicable		
Outlet Control Structure	Good Condition	Cracked	Exposed Steel	Corroded	Clogged	Not Applicable
Rodent Control	Needs Work	Holes >3"	Holes <3"	None		
Deposits	None	Oil/Grease	Grass Clippings/ Compost	Trash/ Debris	Sediment	Other: _____
Vegetation	None	Healthy	Unhealthy	Sparse	Undesirable Woody Plants	
Erosion	None	Inlet/Outlet Erosion	Embankment/ Side Slope Erosion	Channeling/ Depressions	Displaced Riprap	Other: _____
Does System Drain Within 72-Hours?	Yes	No				

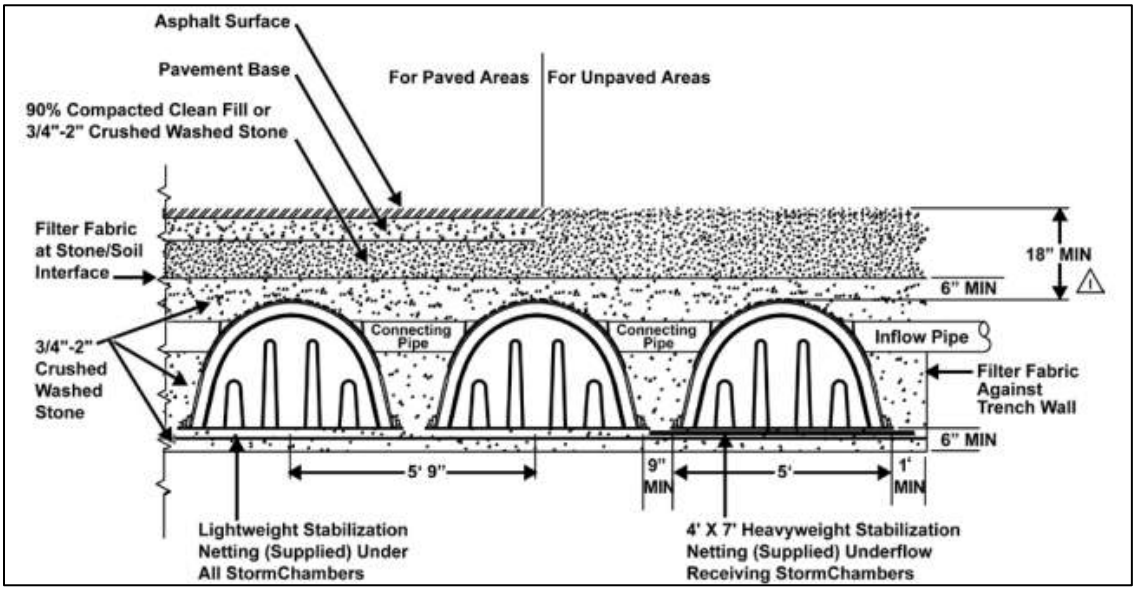
SAMPLE

Additional Comments:	

Photos / Files / Attachments:	**Photo:**		**Description:**	

SAMPLE

Infiltration Chamber



Inspection & Maintenance Record

Facility Owner (Municipal, State, Private, Other):		Owner Name:	
		Owner Address:	
		Owner Phone Number:	
Inspection Date:		Maintenance Date:	
Inspector:		Maintained By:	
SCM Location:		Type of Maintenance (see below):	
Weather:		Date of Previous Maintenance:	

SAMPLE

Inspection & Maintenance Recommendations

	Procedure	Objective	Frequency
1.	**Mowing, Landscaping, and Vegetation Management**	Minimize establishment / takeover of non-intentional woody vegetation. Mowing specifically for embankment / side slopes / areas where bioretention plantings are not present. Trim vegetation and remove weeds. Maintain mulch layer to retain soil moisture. Divide plants as needed to avoid overcrowding and reduce blooms.	Mow / landscape at least twice per year and remove mowed material / clippings. Apply mulch layer in Spring and as needed. Remove dead vegetation annually.
2.	**Debris and Litter Removal**	Remove for aesthetics and to mitigate contribution of downstream floatables.	As needed by inspection. Monthly debris and litter removal.
3.	**Sediment Removal**	Maintain flow capacity. Inspect and remove sediment, particularly at pipe discharge.	Inspect quarterly for the first year. Establish a specific schedule based on first year accumulations.
4.	**Structural Integrity**	Minimize erosion and channelization of stormwater. Inspect for signs of scouring, particularly near high velocity areas.	After large storms (2.5 inches of rainfall), but not less than twice per year.
5.	**Water Level Inspection**	Inspect water level in unit. System should be drained completely 72 hours after a storm event.	At a minimum inspect twice a year at least 72 hours after storm event.

Condition Assessment

	Circle all that apply:					
Does SCM Appear to Be Working Properly?	Yes	No				
Is Maintenance Required?	Yes	No				
Maintenance Access	No Direct Access / Limited Access	Foot	ATV	Truck	No Access Restrictions	
Is Underdrain Working Properly?	Yes	No	Not Applicable	Unknown		
Standing Water in System?	Yes	No				
Evidence of Flooding / Overtopping?	Yes	No				
Emergency Spillway	Good Condition	Erosion	Excess Vegetation	Other: _____		
Maximum Sediment Depth (inches)	_____ *inches* **Push ruler into sediment deposits until flush with surface elevation of the designed system.*					
Pretreatment System	Forebay	Oil / Water Separator	Proprietary Settling / Swirl Chamber	Sediment Chamber	Not Applicable	
Pretreatment System Condition	Good Condition	Heavy Sediment Accumulation	Slight Sediment Accumulation	Undesirable Woody Plants	Not Applicable	
Inlet	Good Condition	Erosion	Pipe Damaged	Not Applicable		
Outlet	Good Condition	Erosion	Pipe Damaged	Not Applicable		
Outlet Control Structure	Good Condition	Cracked	Exposed Steel	Corroded	Clogged	Not Applicable
Rodent Control	Needs Work	Holes >3"	Holes <3"	None		
Deposits	None	Oil/Grease	Grass Clippings/ Compost	Trash/ Debris	Sediment	Other: _____
Vegetation	None	Healthy	Unhealthy	Sparse	Undesirable Woody Plants	
Erosion	None	Inlet/Outlet Erosion	Embankment/ Side Slope Erosion	Channeling/ Depressions	Displaced Riprap	Other: _____
Does System Drain Within 72-Hours?	Yes	No				

SAMPLE

Additional Comments:	

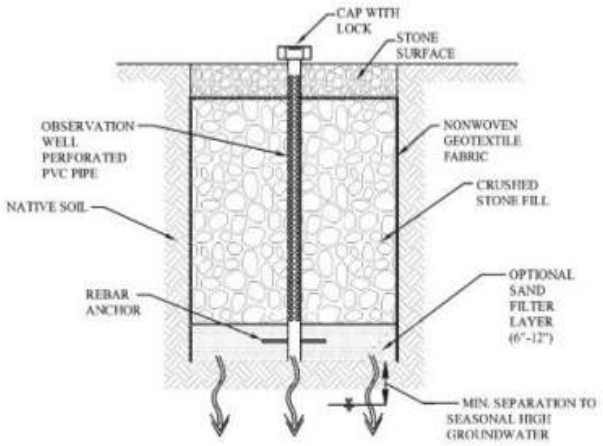
Photos / Files / Attachments:	**Photo:**		**Description:**	

SAMPLE

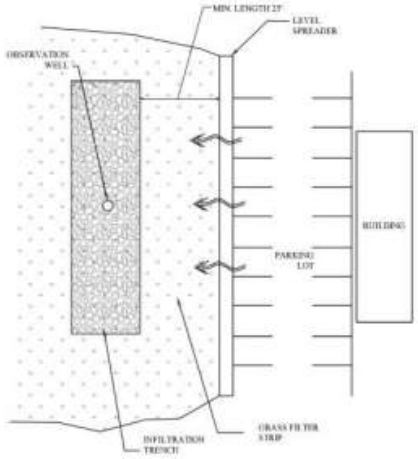
Infiltration Trench / Dry Well / Leaching Catch Basin / Leaching Galley

Sample Design

Cross Section



Plan View



Examples images from the *New Hampshire Stormwater Manual, Volume 2*, p. 86

Inspection & Maintenance Record

Facility Owner (Municipal, State, Private, Other):		Owner Name:	
		Owner Address:	
		Owner Phone Number:	
Inspection Date:		Maintenance Date:	
Inspector:		Maintained By:	
SCM Location:		Type of Maintenance (see below):	
Weather:		Date of Previous Maintenance:	

SAMPLE

Inspection & Maintenance Recommendations

	Procedure	Objective	Frequency
1.	**Mowing, Landscaping, and Vegetation Management**	Minimize establishment / takeover of non-intentional woody vegetation. Mowing specifically for embankment / side slopes / areas where bioretention plantings are not present. Trim vegetation and remove weeds. Maintain mulch layer to retain soil moisture. Divide plants as needed to avoid overcrowding and reduce blooms.	Mow / landscape at least twice per year and remove mowed material / clippings. Apply mulch layer in Spring and as needed. Remove dead vegetation annually.
2.	**Debris and Litter Removal**	Remove for aesthetics and to mitigate contribution of downstream floatables.	As needed by inspection. Monthly debris and litter removal.
3.	**Sediment Removal**	Maintain flow capacity. Inspect and remove sediment, particularly at pipe discharge.	Inspect quarterly for the first year. Establish a specific schedule based on first year accumulations.
4.	**Structural Integrity**	Minimize erosion and channelization of stormwater. Inspect for signs of scouring, particularly near high velocity areas.	After large storms (2.5 inches of rainfall), but not less than twice per year.
5.	**Water Level Inspection**	Inspect water level in unit. System should be drained completely 72 hours after a storm event.	At a minimum inspect twice a year at least 72 hours after storm event.

Condition Assessment

Circle all that apply:						
Does SCM Appear to Be Working Properly?	Yes	No				
Is Maintenance Required?	Yes	No				
Maintenance Access	No Direct Access / Limited Access	Foot	ATV	Truck	No Access Restrictions	
Is Underdrain Working Properly?	Yes	No	Not Applicable	Unknown		
Standing Water in System?	Yes	No				
Evidence of Flooding / Overtopping?	Yes	No				
Emergency Spillway	Good Condition	Erosion	Excess Vegetation	Other: _____		
Maximum Sediment Depth (inches)	_____ *inches* **Push ruler into sediment deposits until flush with surface elevation of the designed system.*					
Pretreatment System	Forebay	Oil / Water Separator	Proprietary Settling / Swirl Chamber	Sediment Chamber	Not Applicable	
Pretreatment System Condition	Good Condition	Heavy Sediment Accumulation	Slight Sediment Accumulation	Undesirable Woody Plants	Not Applicable	
Inlet	Good Condition	Erosion	Pipe Damaged	Not Applicable		
Outlet	Good Condition	Erosion	Pipe Damaged	Not Applicable		
Outlet Control Structure	Good Condition	Cracked	Exposed Steel	Corroded	Clogged	Not Applicable
Rodent Control	Needs Work	Holes >3"	Holes <3"	None		
Deposits	None	Oil/Grease	Grass Clippings/ Compost	Trash/ Debris	Sediment	Other: _____
Vegetation	None	Healthy	Unhealthy	Sparse	Undesirable Woody Plants	
Erosion	None	Inlet/Outlet Erosion	Embankment/ Side Slope Erosion	Channeling/ Depressions	Displaced Riprap	Other: _____
Does System Drain Within 72-Hours?	Yes	No				

SAMPLE

Additional Comments:	

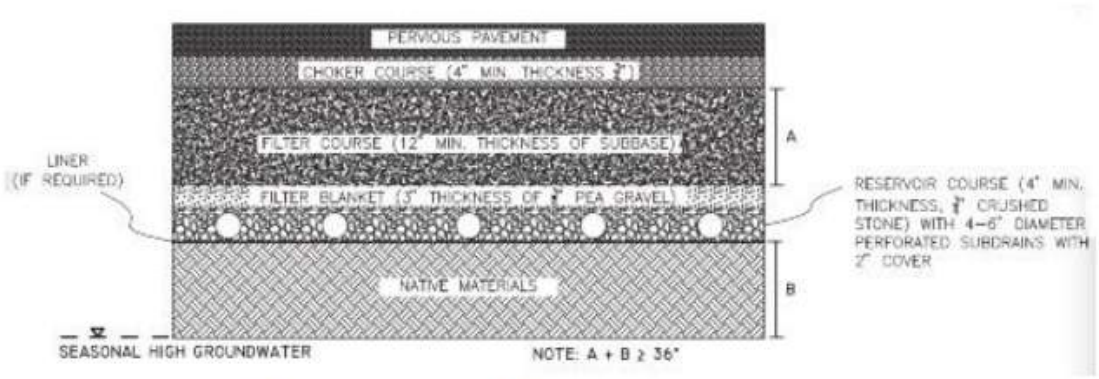
Photos / Files / Attachments:	**Photo:**		**Description:**	

SAMPLE

Porous Pavement

Sample Design

Profile View



Examples images from the *New Hampshire Stormwater Manual, Volume 2*, p. 120

Inspection & Maintenance Record

Facility Owner (Municipal, State, Private, Other):		Owner Name:	
		Owner Address:	
		Owner Phone Number:	
Inspection Date:		Maintenance Date:	
Inspector:		Maintained By:	
SCM Location:		Type of Maintenance (see below):	
Weather:		Date of Previous Maintenance:	

SAMPLE

Inspection & Maintenance Recommendations

	Procedure	Objective	Frequency
1.	**Mowing, Landscaping, and Vegetation Management**	Minimize establishment / takeover of non-intentional woody vegetation. Mowing specifically for embankment / side slopes / areas where bioretention plantings are not present. Trim vegetation and remove weeds. Maintain mulch layer to retain soil moisture. Divide plants as needed to avoid overcrowding and reduce blooms.	Mow / landscape at least twice per year and remove mowed material / clippings. Apply mulch layer in Spring and as needed. Remove dead vegetation annually.
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3.	**Sediment Removal**	Maintain flow capacity. Inspect and remove sediment, particularly at pipe discharge.	Inspect quarterly for the first year. Establish a specific schedule based on first year accumulations.
4.	**Structural Integrity**	Minimize erosion and channelization of stormwater. Inspect for signs of scouring, particularly near high velocity areas.	After large storms (2.5 inches of rainfall), but not less than twice per year.
5.	**Water Level Inspection**	Inspect water level in unit. System should be drained completely 72 hours after a storm event.	At a minimum inspect twice a year at least 72 hours after storm event.

Condition Assessment

Circle all that apply:						
Does SCM Appear to Be Working Properly?	Yes	No				
Is Maintenance Required?	Yes	No				
Maintenance Access	No Direct Access / Limited Access	Foot	ATV	Truck	No Access Restrictions	
Is Underdrain Working Properly?	Yes	No	Not Applicable	Unknown		
Standing Water in System?	Yes	No				
Evidence of Flooding / Overtopping?	Yes	No				
Emergency Spillway	Good Condition	Erosion	Excess Vegetation	Other: _____		
Maximum Sediment Depth (inches)	_____ *inches* **Push ruler into sediment deposits until flush with surface elevation of the designed system.*					
Pretreatment System	Forebay	Oil / Water Separator	Proprietary Settling / Swirl Chamber	Sediment Chamber	Not Applicable	
Pretreatment System Condition	Good Condition	Heavy Sediment Accumulation	Slight Sediment Accumulation	Undesirable Woody Plants	Not Applicable	
Inlet	Good Condition	Erosion	Pipe Damaged	Not Applicable		
Outlet	Good Condition	Erosion	Pipe Damaged	Not Applicable		
Outlet Control Structure	Good Condition	Cracked	Exposed Steel	Corroded	Clogged	Not Applicable
Rodent Control	Needs Work	Holes >3"	Holes <3"	None		
Deposits	None	Oil/Grease	Grass Clippings/ Compost	Trash/ Debris	Sediment	Other: _____
Vegetation	None	Healthy	Unhealthy	Sparse	Undesirable Woody Plants	
Erosion	None	Inlet/Outlet Erosion	Embankment/ Side Slope Erosion	Channeling/ Depressions	Displaced Riprap	Other: _____
Does System Drain Within 72-Hours?	Yes	No				

SAMPLE

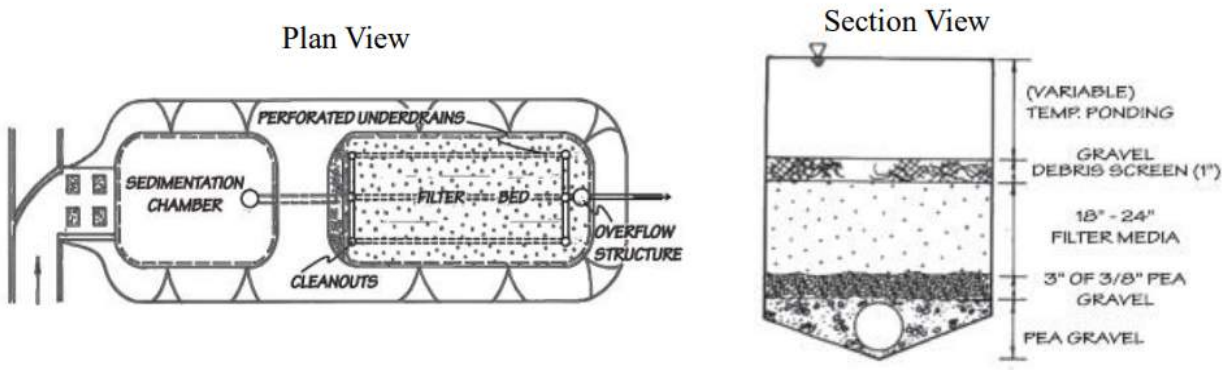
Additional Comments:	

Photos / Files / Attachments:	**Photo:**		**Description:**	

SAMPLE

Sand Filter

Sample Design



Examples images from the *New Hampshire Stormwater Manual, Volume 2*, p. 104

Inspection & Maintenance Record

Facility Owner (Municipal, State, Private, Other):		Owner Name:	
		Owner Address:	
		Owner Phone Number:	
Inspection Date:		Maintenance Date:	
Inspector:		Maintained By:	
SCM Location:		Type of Maintenance (see below):	
Weather:		Date of Previous Maintenance:	

SAMPLE

Inspection & Maintenance Recommendations

	Procedure	Objective	Frequency
1.	**Mowing, Landscaping, and Vegetation Management**	Minimize establishment / takeover of non-intentional woody vegetation. Mowing specifically for embankment / side slopes / areas where bioretention plantings are not present. Trim vegetation and remove weeds. Maintain mulch layer to retain soil moisture. Divide plants as needed to avoid overcrowding and reduce blooms.	Mow / landscape at least twice per year and remove mowed material / clippings. Apply mulch layer in Spring and as needed. Remove dead vegetation annually.
2.	**Debris and Litter Removal**	Remove for aesthetics and to mitigate contribution of downstream floatables.	As needed by inspection. Monthly debris and litter removal.
3.	**Sediment Removal**	Maintain flow capacity. Inspect and remove sediment, particularly at pipe discharge.	Inspect quarterly for the first year. Establish a specific schedule based on first year accumulations.
4.	**Structural Integrity**	Minimize erosion and channelization of stormwater. Inspect for signs of scouring, particularly near high velocity areas.	After large storms (2.5 inches of rainfall), but not less than twice per year.
5.	**Water Level Inspection**	Inspect water level in unit. System should be drained completely 72 hours after a storm event.	At a minimum inspect twice a year at least 72 hours after storm event.

Condition Assessment

Circle all that apply:						
Does SCM Appear to Be Working Properly?	Yes	No				
Is Maintenance Required?	Yes	No				
Maintenance Access	No Direct Access / Limited Access	Foot	ATV	Truck	No Access Restrictions	
Is Underdrain Working Properly?	Yes	No	Not Applicable	Unknown		
Standing Water in System?	Yes	No				
Evidence of Flooding / Overtopping?	Yes	No				
Emergency Spillway	Good Condition	Erosion	Excess Vegetation	Other: _____		
Maximum Sediment Depth (inches)	_____ *inches* **Push ruler into sediment deposits until flush with surface elevation of the designed system.*					
Pretreatment System	Forebay	Oil / Water Separator	Proprietary Settling / Swirl Chamber	Sediment Chamber	Not Applicable	
Pretreatment System Condition	Good Condition	Heavy Sediment Accumulation	Slight Sediment Accumulation	Undesirable Woody Plants	Not Applicable	
Inlet	Good Condition	Erosion	Pipe Damaged	Not Applicable		
Outlet	Good Condition	Erosion	Pipe Damaged	Not Applicable		
Outlet Control Structure	Good Condition	Cracked	Exposed Steel	Corroded	Clogged	Not Applicable
Rodent Control	Needs Work	Holes >3"	Holes <3"	None		
Deposits	None	Oil/Grease	Grass Clippings/ Compost	Trash/ Debris	Sediment	Other: _____
Vegetation	None	Healthy	Unhealthy	Sparse	Undesirable Woody Plants	
Erosion	None	Inlet/Outlet Erosion	Embankment/ Side Slope Erosion	Channeling/ Depressions	Displaced Riprap	Other: _____
Does System Drain Within 72-Hours?	Yes	No				

SAMPLE

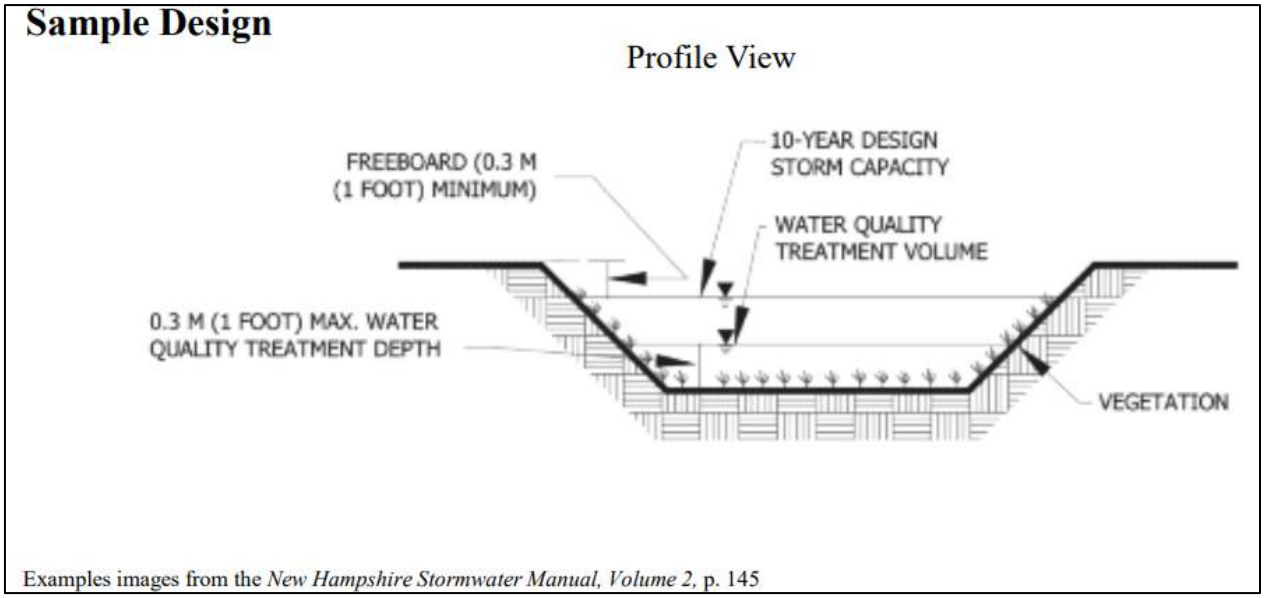
Additional Comments:	

Photos / Files / Attachments:	**Photo:**		**Description:**	

SAMPLE

Vegetated Swale

Sample Design



Examples images from the *New Hampshire Stormwater Manual, Volume 2*, p. 145

Inspection & Maintenance Record

Facility Owner (Municipal, State, Private, Other):		Owner Name:	
		Owner Address:	
		Owner Phone Number:	
Inspection Date:		Maintenance Date:	
Inspector:		Maintained By:	
SCM Location:		Type of Maintenance (see below):	
Weather:		Date of Previous Maintenance:	

SAMPLE

Inspection & Maintenance Recommendations

	Procedure	Objective	Frequency
1.	**Mowing, Landscaping, and Vegetation Management**	Minimize establishment / takeover of non-intentional woody vegetation. Mowing specifically for embankment / side slopes / areas where bioretention plantings are not present. Trim vegetation and remove weeds. Maintain mulch layer to retain soil moisture. Divide plants as needed to avoid overcrowding and reduce blooms.	Mow / landscape at least twice per year and remove mowed material / clippings. Apply mulch layer in Spring and as needed. Remove dead vegetation annually.
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4.	**Structural Integrity**	Minimize erosion and channelization of stormwater. Inspect for signs of scouring, particularly near high velocity areas.	After large storms (2.5 inches of rainfall), but not less than twice per year.
5.	**Water Level Inspection**	Inspect water level in unit. System should be drained completely 72 hours after a storm event.	At a minimum inspect twice a year at least 72 hours after storm event.

Condition Assessment

Circle all that apply:						
Does SCM Appear to Be Working Properly?	Yes	No				
Is Maintenance Required?	Yes	No				
Maintenance Access	No Direct Access / Limited Access	Foot	ATV	Truck	No Access Restrictions	
Is Underdrain Working Properly?	Yes	No	Not Applicable	Unknown		
Standing Water in System?	Yes	No				
Evidence of Flooding / Overtopping?	Yes	No				
Emergency Spillway	Good Condition	Erosion	Excess Vegetation	Other: _____		
Maximum Sediment Depth (inches)	_____ *inches* **Push ruler into sediment deposits until flush with surface elevation of the designed system.*					
Pretreatment System	Forebay	Oil / Water Separator	Proprietary Settling / Swirl Chamber	Sediment Chamber	Not Applicable	
Pretreatment System Condition	Good Condition	Heavy Sediment Accumulation	Slight Sediment Accumulation	Undesirable Woody Plants	Not Applicable	
Inlet	Good Condition	Erosion	Pipe Damaged	Not Applicable		
Outlet	Good Condition	Erosion	Pipe Damaged	Not Applicable		
Outlet Control Structure	Good Condition	Cracked	Exposed Steel	Corroded	Clogged	Not Applicable
Rodent Control	Needs Work	Holes >3"	Holes <3"	None		
Deposits	None	Oil/Grease	Grass Clippings/ Compost	Trash/ Debris	Sediment	Other: _____
Vegetation	None	Healthy	Unhealthy	Sparse	Undesirable Woody Plants	
Erosion	None	Inlet/Outlet Erosion	Embankment/ Side Slope Erosion	Channeling/ Depressions	Displaced Riprap	Other: _____
Does System Drain Within 72-Hours?	Yes	No				

SAMPLE

Additional Comments:	

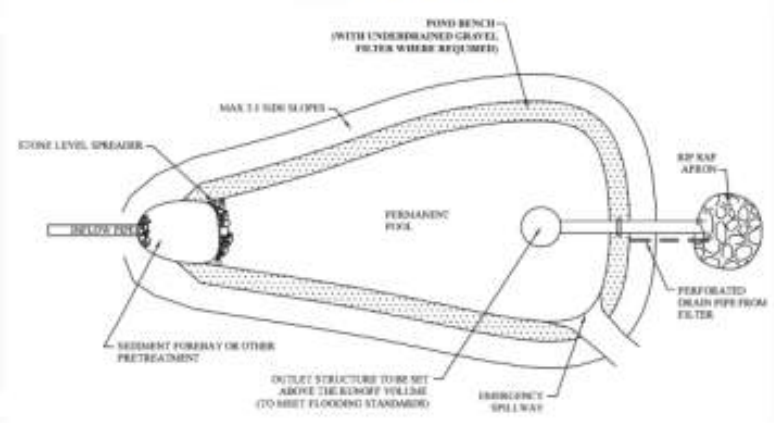
Photos / Files / Attachments:	**Photo:**		**Description:**	

SAMPLE

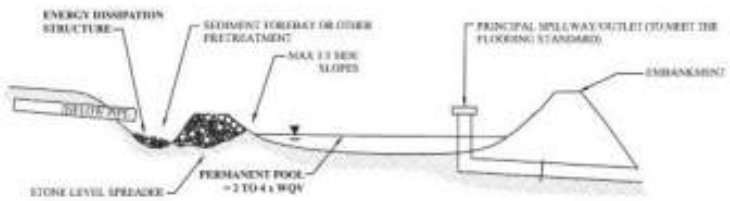
Wet Pond

Sample Design

Plan View



Profile View



Examples images from the *New Hampshire Stormwater Manual, Volume 2*, p. 61

Inspection & Maintenance Record

Facility Owner (Municipal, State, Private, Other):		Owner Name:	
		Owner Address:	
		Owner Phone Number:	
Inspection Date:		Maintenance Date:	
Inspector:		Maintained By:	
SCM Location:		Type of Maintenance (see below):	
Weather:		Date of Previous Maintenance:	

SAMPLE

Inspection & Maintenance Recommendations

	Procedure	Objective	Frequency
1.	**Mowing, Landscaping, and Vegetation Management**	Minimize establishment / takeover of non-intentional woody vegetation. Mowing specifically for embankment / side slopes / areas where bioretention plantings are not present. Trim vegetation and remove weeds. Maintain mulch layer to retain soil moisture. Divide plants as needed to avoid overcrowding and reduce blooms.	Mow / landscape at least twice per year and remove mowed material / clippings. Apply mulch layer in Spring and as needed. Remove dead vegetation annually.
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Condition Assessment

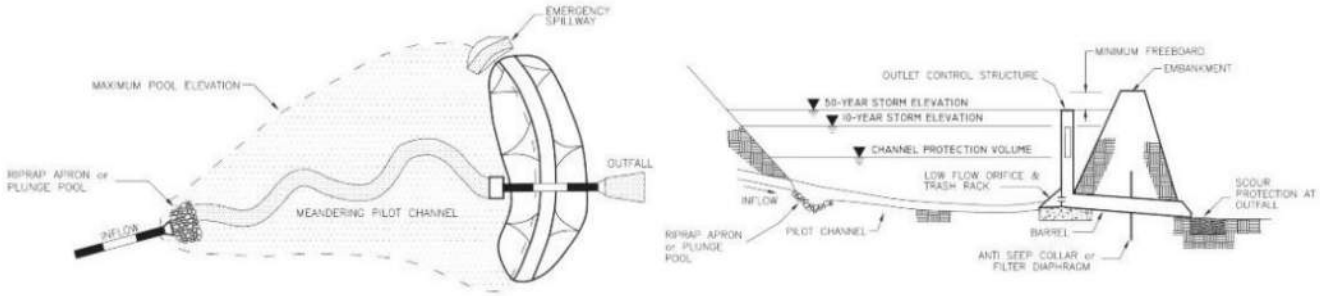
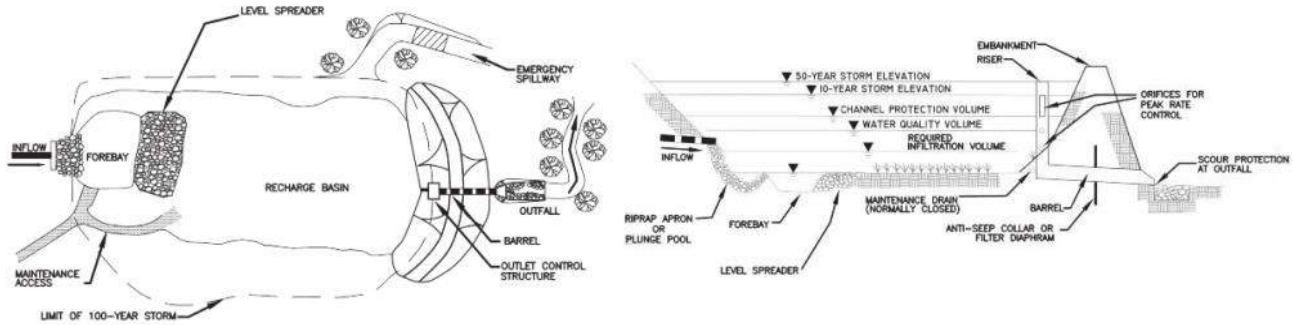
	Circle all that apply:					
Does SCM Appear to Be Working Properly?	Yes	No				
Is Maintenance Required?	Yes	No				
Maintenance Access	No Direct Access / Limited Access	Foot	ATV	Truck	No Access Restrictions	
Is Underdrain Working Properly?	Yes	No	Not Applicable	Unknown		
Standing Water in System?	Yes	No				
Evidence of Flooding / Overtopping?	Yes	No				
Emergency Spillway	Good Condition	Erosion	Excess Vegetation	Other: _____		
Maximum Sediment Depth (inches)	_____ *inches* **Push ruler into sediment deposits until flush with surface elevation of the designed system.*					
Pretreatment System	Forebay	Oil / Water Separator	Proprietary Settling / Swirl Chamber	Sediment Chamber	Not Applicable	
Pretreatment System Condition	Good Condition	Heavy Sediment Accumulation	Slight Sediment Accumulation	Undesirable Woody Plants	Not Applicable	
Inlet	Good Condition	Erosion	Pipe Damaged	Not Applicable		
Outlet	Good Condition	Erosion	Pipe Damaged	Not Applicable		
Outlet Control Structure	Good Condition	Cracked	Exposed Steel	Corroded	Clogged	Not Applicable
Rodent Control	Needs Work	Holes >3"	Holes <3"	None		
Deposits	None	Oil/Grease	Grass Clippings/ Compost	Trash/ Debris	Sediment	Other: _____
Vegetation	None	Healthy	Unhealthy	Sparse	Undesirable Woody Plants	
Erosion	None	Inlet/Outlet Erosion	Embankment/ Side Slope Erosion	Channeling/ Depressions	Displaced Riprap	Other: _____
Does System Drain Within 72-Hours?	Yes	No				

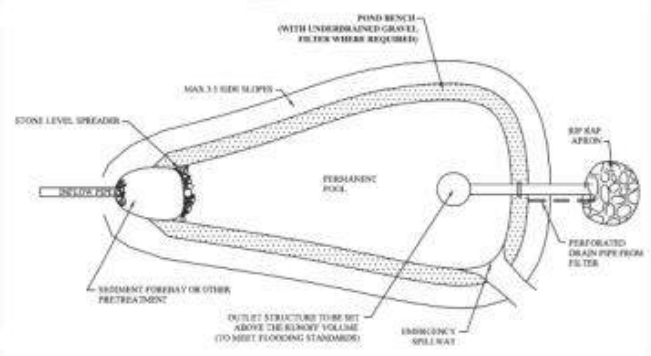
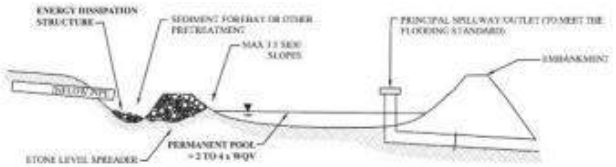
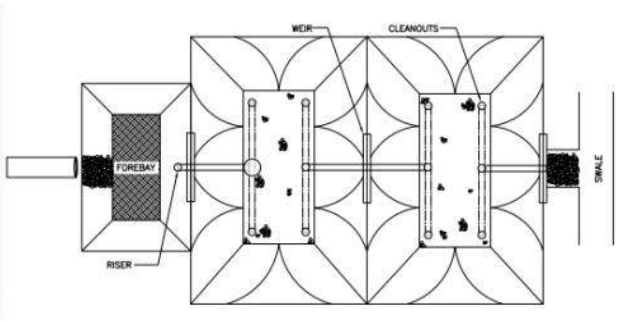
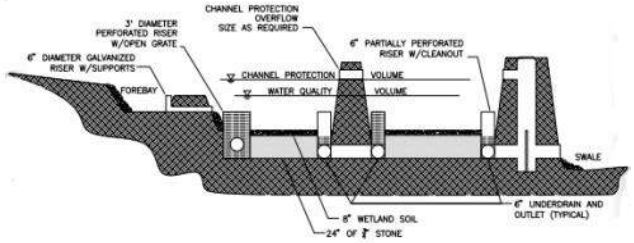
SAMPLE

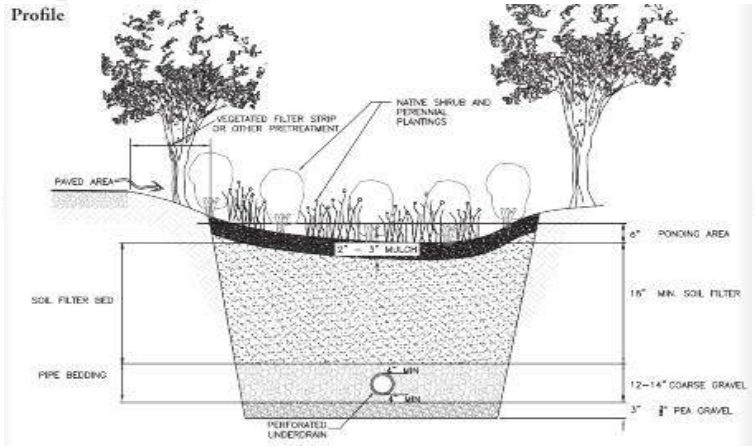
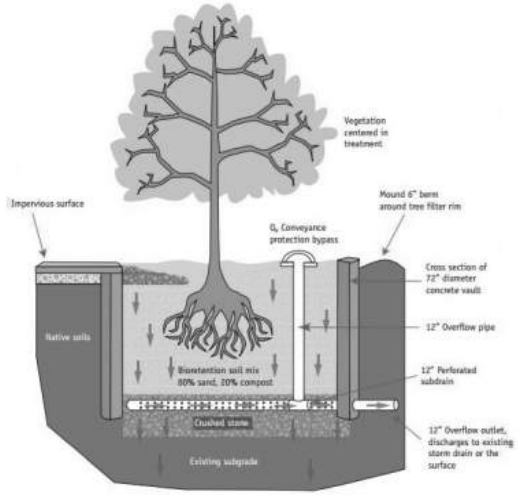
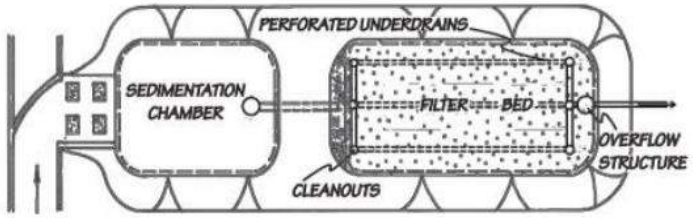
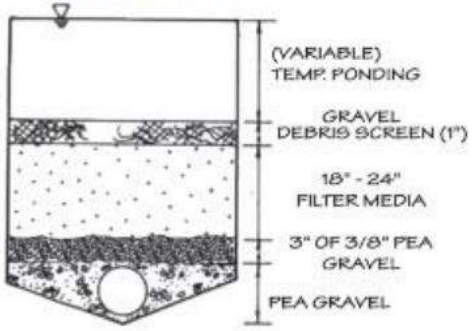
Additional Comments:	

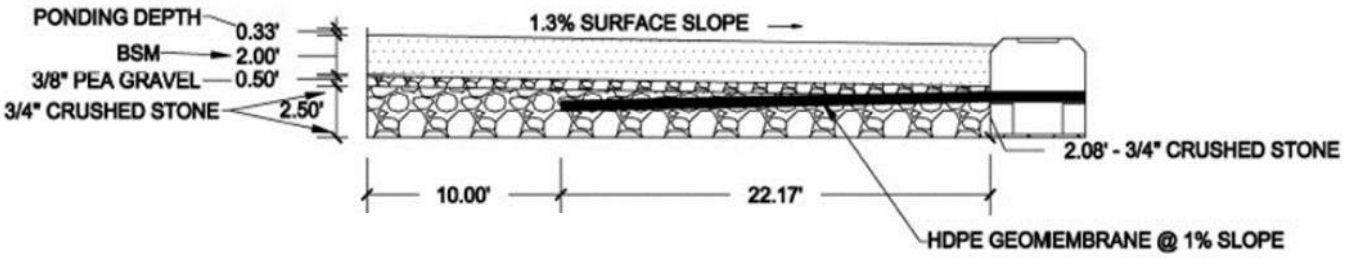
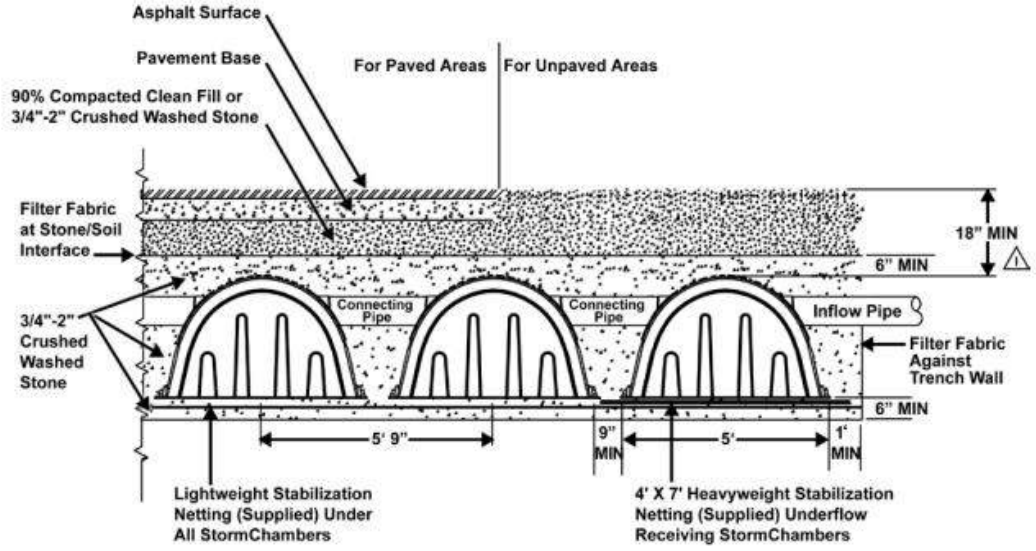
Photos / Files / Attachments:	**Photo:**		**Description:**	

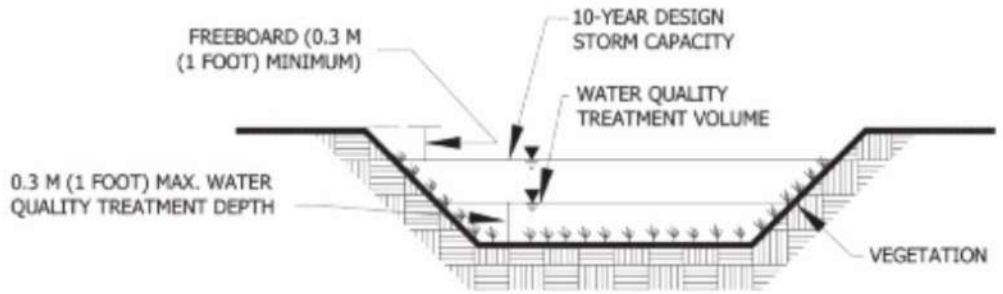
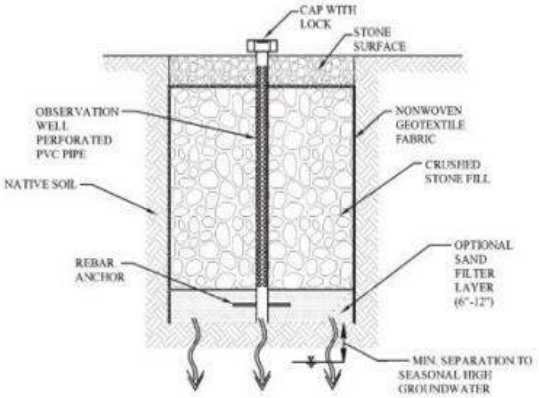
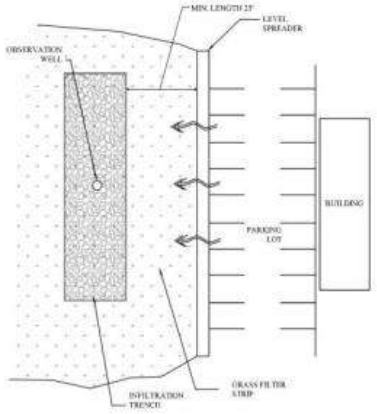
SAMPLE

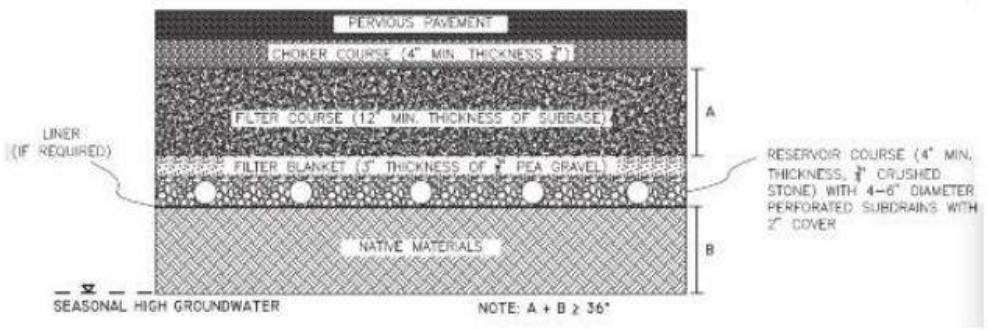
SCM Type	SCM Description
Dry Detention Basin **Sample Design** Plan View Profile View  Examples images from the *New Hampshire Stormwater Manual, Volume 2*, p. 159	A dry detention basin is an impoundment or excavated basin that provides flood protection by storing stormwater runoff and gradually releasing the stormwater over an extended period of time (typically 24-hours). This system is primarily intended to reduce local and downstream flooding and allow time for sediment to settle out of the stormwater.
Infiltration Basin **Sample Design** Plan View Profile View  Examples images from the *New Hampshire Stormwater Manual, Volume 2*, p. 90	Infiltration basins provide temporary surface storage of stormwater runoff in an area constructed over permeable soils. Stormwater initially ponds in the basin while it gradually infiltrates into soil of the basin floor. Infiltration basins are highly effective in reducing local flooding and removing pollutants from stormwater runoff.

SCM Type	SCM Description
Wet Pond **Sample Design** Plan View  Profile View  Examples images from the *New Hampshire Stormwater Manual, Volume 2*, p. 61	A wet pond is designed to maintain a permanent pool of water that treats stormwater via settling, biological uptake, and decomposition. An underdrain gravel trench in the bench area around the permanent pool can be added in areas where temperature is a concern. This allows for the extended release of stormwater and minimizing the potential for clogging.
Gravel / Constructed Wetland **Sample Design** Plan View  Profile View  Examples images from the *New Hampshire Stormwater Manual, Volume 2*, p. 80	A gravel / constructed wetland first captures stormwater runoff in a pretreatment forebay to allow for initial settling of sediment. As the runoff volume increases, the stormwater flows through one or more constructed wetland cells filled with gravel, engineered organic soils, and wetland vegetation. In this system, stormwater treatment occurs through microbial, chemical, and physical processes within the constructed wetland.

SCM Type	SCM Description
Biofiltration / Bioretention / Rain Garden / Tree Well **Sample Design**   Examples images from the *New Hampshire Stormwater Manual, Volume 2*, p. 116 & 112	Biofiltration provides temporary storage in the void space of an engineered soil media with temporary ponding on the surface. After runoff passes through the soil media that acts as a pollutant filter, it is collected by an underdrain to be discharged. Bioretention systems use soil, plants, and microbes to treat stormwater runoff before it infiltrates into the ground and/or is discharged. A rain garden and tree well are examples of bioretention cells.
Sand Filter **Sample Design** Plan View  Section View  Examples images from the *New Hampshire Stormwater Manual, Volume 2*, p. 104	A sand filter provides stormwater treatment through engineered sand and allows for temporary water storage in the void spaces of the sand. Once water has filtered completely through the system, it is discharged by an underdrain.

SCM Type	SCM Description
Enhanced Biofiltration with Internal Storage Reservoir (ISR)  https://www.unh.edu/unhsc/sites/default/files/media/undersized_systems.pdf	Enhanced biofiltration with an Internal Storage Reservoir (ISR) provides temporary water storage in the void space of engineered soils and temporary ponding on the surface. This system has enhanced phosphorus removal capabilities, and achieves detention and nitrogen removal in the ISR comprised of gravel and stone. Once the runoff filters through the engineered soils into the ISR via an impermeable membrane, it is stored for at least 24-hours and released with an elevated outlet control structure.
Infiltration Chamber  Example images from StormChamberDesignManual.pdf (stormchambers.com)	Infiltration chambers are subsurface treatment systems comprised of manufactured pipes containing open or sometimes perforated bottoms. The chambers are placed upon a stone bed that allows for infiltration into the underlying native soil which acts as a filter for pollutants. These systems provide treatment and reduce local flooding by using the large void space of the chambers to temporarily store stormwater runoff.

SCM Type	SCM Description
Vegetated Swale **Sample Design** Profile View  Examples images from the *New Hampshire Stormwater Manual, Volume 2*, p. 145	A vegetated swale is an open channel designed to convey and treat stormwater runoff. A swale may contain check dams that prevent erosion within the system by slowing the velocity of stormwater runoff flowing through the SCM. The system is designed to treat stormwater pollutants by filtering the runoff through the vegetation before infiltrating into the subsurface soil media or discharging.
Leaching Catch Basin / Dry Well / Infiltration Trench / Leaching Galley **Sample Design** Cross Section  Plan View  Examples images from the *New Hampshire Stormwater Manual, Volume 2*, p. 86	Leaching catch basins are precast concrete barrels with an open bottom to allow runoff to infiltrate into the ground. Infiltration trenches are long, shallow excavations filled with stone that provide temporary subsurface storage of runoff in the void spaces between the stone. The stored runoff gradually infiltrates into the soil through the bottom and/or sides of the trench.

SCM Type	SCM Description
Porous Pavement **Sample Design** Profile View  Examples images from the *New Hampshire Stormwater Manual, Volume 2*, p. 120	Porous pavement is an alternative to traditional asphalt that has a much higher percentage of void space. These voids allow stormwater runoff to pass through the paved surface into a layer of crushed stone below ground. Stormwater is temporarily stored in the crushed stone before infiltrating into the underlying soils. The surface layer can consist of paving blocks or grids, pervious asphalt, or pervious concrete.

APPENDIX G: IMPLEMENTATION COST

Woodard & Curran Unit Cost Development Memorandum

- Attachment 1: Opti-Tool Cost Technical Memorandum
- Attachment 2: W&C Unit Cost Estimate Summary

UNHSC Performance Curves

Prioritized Parcel Opportunity Cost Report Sheets

Prioritized Roadway Opportunity Cost Report Sheets

Municipal Structural SCM Operation & Maintenance Costs

Non-Structural Control Equipment Maintenance Records (2020-2022)

Woodard & Curran Unit Cost Development Memorandum

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MEMORANDUM

PROJECT: Newton, MA Phosphorus Control Plan

PROJECT NUMBER: 0233351.00

DATE: June 2023

SUBJECT: Structural SCM Unit Cost Estimate

This memorandum provides an overview of the methodology that Woodard & Curran (W&C) utilized to calculate unit costs for each structural SCMs to estimate the total project construction costs for planned control measures. W&C developed these unit costs to compare with those developed by the EPA for the Opti-Tool. A technical memorandum by EPA regarding the development of these unit costs are included as Attachment 1 of this memorandum. The W&C estimated unit costs were developed based on 2023 construction costs and are indicative of present-day estimates; future inflation, considering execution over Phase 1, was not considered. Supporting calculations of these estimates are provided in detail in this memorandum.

The W&C construction unit costs were developed by identifying typical construction material takeoffs and their estimated quantities based on the static treatment volume each SCM is sized for. The static volume was chosen as the unit of measurement for the unit cost to align with EPA's methodology. Table 1 below shows the estimated treatment volumes established for each SCM. A design volume of 18,000 CF was applied to all SCMs except for the infiltration trench and water quality swale. The 18,000 CF volume is based on treatment of 0.5" runoff depth over a 10-acre impervious drainage area. This drainage area was determined as a reasonable 'average' contributing drainage area to establish linearity for the unit cost estimates. As infiltration trenches and water quality swales are commonly used for smaller drainage areas, under recommended design considerations, the footprint and design volumes are therefore significantly smaller compared to the other systems. The length, width, and depth for each SCM was determined based on the design volume and the design standards and cross section per Volume 2 Chapter 2 of the Massachusetts Stormwater Handbook, "Stormwater Best Management Practices".

TABLE 1: SCM FOOTPRINT, DEPTH, AND DESIGN VOLUME

System	Length (ft)	Width (ft)	Total Depth (ft)	Design Volume (CF)[1]
Infiltration Trench	25	3	3	90
Infiltration Chamber	96	87	4	18,164
Infiltration Basin	150	40	3	18,000
Biofiltration	125	80	3	18,000
Gravel Wetland	130	50	4	18,200
Enhanced Bioretention with Internal Storage Reservoir	150	40	6	18,000
Porous Pavement	250	180	1	18,000

System	Length (ft)	Width (ft)	Total Depth (ft)	Design Volume (CF)[1]
Water Quality Swale	210	3	3	1,764
Subsurface Sand Filter	125	80	3	18,000
Wet Pond	90	40	5	18,000
Extended Dry Detention Basin/Dry Pond	90	40	5	18,000

1. Design storage volume is based on the system horizontal footprint and vertical depth. The total depth is inclusive of open spaces as well as media/stone, which comprise of varying void ratios. This table summarizes the total vertical depth inclusive of open space depth and media/stone depth.

The construction cost estimate is inclusive of all construction materials (goods and delivery to project site), equipment and labor to execute the work, as well as standard indirect costs such insurance, bonds, overhead, general conditions, and profit. The estimates are reflective of typical 2023 construction costs, and no escalation is included.

Construction materials vary for each SCM; however, standard construction measures typical for most SCMs were considered, including but not limited to excavation and trenching, hauling of excavated material, and installation of new storm drainage structures. For SCMs with vegetation and plantings, such as bioretention basins, biofiltration systems, water quality grass swales, and gravel wetlands, an allowance for plantings and site restoration was included. Other typical construction cost elements include bedding and backfill (which may vary based on SCM, such as stone, pea gravel, sand, and other typical fill material types), rip rap, geotextiles, observation wells, and underdrain piping. The SCM total cost was then divided by its static treatment storage volume to determine a unit cost in dollars per cubic foot, as presented in Table 2 of this memorandum.

Due to the conceptual nature of this cost estimate and the assumed linearity for the cost estimate (i.e. the same unit cost would be applied regardless of SCM size, whether it would be a small on-site SCM, or a regional SCM), the following assumptions were made:

- The excavated material is assumed to be hauled and disposed of at a location less than 30 minutes haul time from the project site.
- The sites are all assumed to be in locations where existing grade is relatively flat, thus not requiring berms for construction of the SCMs.
- Inlet and outlet piping and connections to the existing storm drain system are not included, as the size, length, and location of this piping will be highly dependent on site-specific conditions.

It shall be noted that amongst the list of SCMs evaluated, two involve proprietary systems that can be provided by various stormwater equipment manufacturers: infiltration chambers, and porous pavement. For infiltration chambers, a StormTech SC-740 chamber system was evaluated for the cost estimate. For any infiltration chambers assessed for site-specific design, it shall be noted that other alternate products and manufacturers will be evaluated, which may impact the overall footprint and costs of the system to achieve the same storage volume capacity as the StormTech system. However, the SC-740 chamber system is a product that has been installed on many sites across the City of Newton, is a commonly utilized chamber height for both small and large projects. Therefore, it was the system selected to evaluate for the

purposes of developing an average unit construction cost estimate. For porous pavement, the thicknesses for each layer (e.g., porous asphalt, choker course, filter course, filter blanket, reservoir course) was determined by the porous pavement detail per the Massachusetts Stormwater Management Handbook. Depending on the selected vendor that provides the pavement, the thicknesses and associated costs, for each layer may vary.

A summary of the W&C construction unit costs is summarized in Table 2 below. As described in section 1.2.2., the construction unit costs were increased by approximately 40% for the roadway work projects.

TABLE 2: W&C UNIT COSTS

SCM Type	W&C Construction Unit Costs per Treatment Volume ($/CF)	Roadway Work W&C Construction Unit Costs per Unit Volume ($/CF)
Infiltration Trench	43	60
Infiltration Chamber	19	27
Infiltration Basin	9	13
Porous Pavement	60	84
Biofiltration	18	26
Enhanced Bioretention with Internal Storage Reservoir	16	23
Gravel/Constructed Wetland	23	33
Subsurface Sand Filter	34	48
Wet Pond	7	10
Dry Pond	8	12
Water Quality Swale	31	44

The total construction cost and unit cost for each SCM, organized by total labor, material, and equipment costs are summarized in the Woodard & Curran Unit Cost Estimate Summary

included as Attachment 2 of this memorandum. It should be noted that the unit costs as shown in the calculation sheet vary slightly compared to Table 2 for the following SCMs: Infiltration trench, subsurface sand filter, and water quality swale. For those three SCMs, cost adjustments were made based on recent market findings and reference installations in MA. For subsurface sand filters, the unit cost estimate was doubled to conservatively account for the variability in the sizing and design of the precast encasement system. For infiltration trenches, the unit cost was reduced by approximately 15% from the original W&C estimate based on research and bid prices from recent installations in surrounding communities within the Charles River Watershed. For water quality swales, an adjustment was made to reduce the number of check dams while maintaining compliance with design standards to meet the MA Stormwater Handbook requirements.

Attachments

Attachment 1: Opti-Tool Cost Technical Memorandum

Attachment 2: W&C Unit Cost Estimate Summary

Attachment 1: Opti-Tool Cost Technical Memorandum

MEMORANDUM

DATE: February 20, 2016

TO: Opti-Tool TAC

FROM: Karen Mateleska, EPA Region- I

SUBJECT: **Methodology for developing cost estimates for Opti-Tool**

Introduction

EPA – Region I offered to provide TetraTech with BMP cost information for the New England Stormwater Management Optimization Tool (Opti-Tool). The goal was to include the latest available information that would accurately reflect capital costs for select BMPs installed in the New England region. This document describes the approach used to determine these values.

The unit cost estimates originally developed as part of a 2010 study were used as the basis/starting-point for the cost estimates for the Opti-Tool. This study, entitled *Stormwater Management Plan for Spruce Pond Brook Subwatershed,* was produced by the Charles River Watershed Association (CRWA). The full report can be viewed at: http://www.crwa.org/hs-fs/hub/311892/file-636820515-pdf/Our_Work_/Blue_Cities_Initiative/Scientific_and_Technical/CRWA_Franklin_Plan.pdf. This subwatershed in the Town of Franklin (in eastern Massachusetts) was selected, in part, because it represented one of the many communities in the watershed that would be required to reduce nutrient (phosphorus) loads in stormwater runoff as part of EPA's Phase II MS4 General Stormwater Permit and a TMDL for Nutrients in the Upper/Middle Charles River. The cost estimates developed in the study can predominantly be attributed to CRWA and both Rich Claytor and Nigel Pickering of Horsley Witten Group (CRWA *et al.* 2010). The development of these costs was based on a literature review of BMP cost information and Claytor's extensive experience working in this field with Massachusetts communities. These values were originally reported in Appendix B of the aforementioned CRWA document. Those cost estimates have also been used in additional stormwater studies supported by EPA – Region I, including the *Sustainable Stormwater Funding Evaluation for the Upper Charles River Communities of Bellingham, Franklin, and Milford, MA (*2011). (That report can be viewed at: http://www.epa.gov/region1/npdes/charlesriver/pdfs/20110930-SWUtilityReport.pdf)

Before simply relying on the CRWA cost estimates, additional research was conducted of publicly available (online) resources to determine if more recent BMP cost information for the New England region was available. These resources included:

- EPA's LID webpage: http://water.epa.gov/polwaste/green/
- EPA's 2013 Article: *Case Studies Analyzing the Economic Benefits of Low Impact Development and Green Infrastructure Programs: http://water.epa.gov/polwaste/green/upload/lid-gi-programs_report_8-6-13_combined.pdf*

- New England Environmental Finance Center: http://efc.muskie.usm.maine.edu/
- UNC Environmental Finance Center's *Catalog of Finance Publications on Green Infrastructure Approaches to Stormwater Management* (This spreadsheet provides a catalog of 46 publications related on green infrastructure for stormwater management that have finance relevance; Several of the sources from the catalog were reviewed for this document) : http://www.efc.sog.unc.edu/reslib/item/catalog-green-infrastructure-and-stormwater-finance-publications
- Houle, *et al. Comparison of Maintenance Cost, Labor Demands, and System Performance for LID and Conventional Stormwater Management*: http://www.unh.edu/unhsc/sites/unh.edu.unhsc/files/Houle_JEE_July-2013.pdf
- University of New Hampshire Stormwater Center's *Forging the Link: Linking the Economic Benefits of LID and Community Decisions: http://www.unh.edu/unhsc/forging-link-topics*
- Center for Neighborhood Technology's *Green Values Stormwater Tool Box: http://greenvalues.cnt.org/* which included the Green Values Calculator: http://greenvalues.cnt.org/national/calculator.php
- Water Environment Research Foundation (WERF): User's Guide to the BMP and LID Whole Life Cost Models, Version 2.0: www.werf.org/bmpcost
- Low Impact Development Center: http://www.lowimpactdevelopment.org/
- ECONorthwest's *The Economics of Low-Impact Development: A Literature Review:* http://www.econw.com/our-work/publications/the-economics-of-low-impact-development-a-literature-review/
- Drexel University's Low Impact Development Rapid Assessment (LIDRA Model) http://www.lidratool.org/home/publications.aspx

A review of these resources did highlight the multitude of variables that can impact the cost of installing LID BMPs and the variety of cost analysis methods that can be used when assessing the cost effectiveness of various LID storm water controls. For example, many of the resources emphasized that costs tend to be site specific. Costs often differ significantly among different geographical locations, depending upon labor and material expenses and the constraints of a particular site. Unfortunately, most of the aforementioned resources highlighted projects outside of the New England region (with the exception of the articles by Houle of the UNHSC and New England Environmental Finance Center.)

EPA's recent (2013) report entitled *Case Studies Analyzing the Economic Benefits of Low Impact Development and Green Infrastructure Programs* listed the 7 different types of economic analyses that were represented by the 13 case studies highlighted in the report. These ranged from the simplest form of economic analysis (i.e., the capital cost assessment) to more robust forms, including the life cycle cost assessment. Whole life-cycle costs would provide a more accurate estimate of the cost of installing, operating, maintaining, and replacing a project (i.e., BMP) throughout its expected lifetime. However this type of analysis requires solid estimates for capital, land purchase, O&M, and other related costs.

Ideally, the goal was to include a more advanced economic analysis (i.e. – life cycle costs) in the Opti-Tool while still maintaining some level of simplicity for the end user. However, such a robust economic analysis does not currently appear possible because the literary search for more recent BMP cost estimates, reflective of New England states, was largely unsuccessful. However, the search was not

entirely fruitless. Jamie Houle of the UNHSC did provide extremely valuable information on capital and maintenance costs for various BMPs that have been tested at the UNHSC. Cost estimates for a particular BMP available from *both* the CRWA study and UNHSC were discussed among Mark Voorhees of EPA, Jamie Houle of UNHSC, and Karen Mateleska of EPA, and a best professional judgment decision was made.

The recommendation at this time is to use a combination of the CRWA cost estimates **and** UNHSC costs estimates as the basis for the Opti-Tool BMP cost estimates, and to use a modified capital cost assessment (which includes a fixed percentage for Design and Contingency Costs) as well as a separate field for maintenance hours (from the UNHSC). The details supporting this approach are described below.

Overview of Scope and Approach

According to a draft memo, dated 6/20/14 from Tetra Tech to EPA Region I, the current SUSTAIN BMP Cost function has seven major individual components, using a formula that would likely be useful in a more detailed design mode. For purposes of simplicity, EPA Region I is proposing the following cost function formula for the tool's "planning" mode:

General Cost Function Formula = Storage Volume of BMP* (ft^3) X Cost Estimate for BMP ($/$ft^3$)

X Adjustment Factor

* Storage Volume of BMP is more accurately defined as (Design) Physical Storage Capacity of BMP; See Section A below for more details

Initially, the intention was to include the preliminary Operations and Maintenance (O&M) costs in the general formula (page 3) by simply multiplying the formula results by our Preliminary O & M costs. However, such an approach would only include **one year's worth** of operations and maintenance, which could have been misleading because it would not have reflected the true life cycle cost of the BMP (i.e., assume life cycle of 20 years). However, simply including the 20 year life cycle cost (O&M cost *20) in the above formula would have greatly increased the cost value and perhaps have created misconceptions about BMP use and affordability.

Therefore, the subcommittee decided to include the anticipated operation and maintenance **hours** required for each BMP per year instead. This parameter was included as a completely separate field in the Opti-Tool. The rationale was that Opti-Tool users need to understand that operation and maintenance impact the overall cost-effectiveness of BMPs and should be considered when selecting a BMP. Including O&M hours (instead of costs) as a separate field, would still highlight this important consideration for stormwater managers.

A. Storage Volume and Proposed Cost Estimate Values

As highlighted above, the general cost function formula used in the Opti-Tool consists of 3 factors: the BMP storage volume, the proposed BMP storage volume cost estimate, and the adjustment factor. The first two factors will be covered together in this memo because they are so closely linked. Table 1 below summarizes the proposed BMP cost estimates for the Opti-Tool.

Table 1: Proposed BMP Cost Estimates for Opti-Tool

BMP (From Opti-Tool)	Cost ($/ft^3) [1]	Cost ($/ft^3) – 2016 dollars[6]
Bioretention (Includes rain garden)	13.37 [2,4]	15.46
Dry Pond or detention basin	5.88 [2,4]	6.80
Enhanced Bioretention (aka-Bio-filtration Practice)	13.5 [2,3]	15.61
Infiltration Basin (or other Surface Infiltration Practice)	5.4 [2,3]	6.24
Infiltration Trench	10.8 [2,3]	12.49
Porous Pavement - Porous Asphalt Pavement	4.60 [2,4]	5.32
Porous Pavement - Pervious Concrete	15.63 [2,4]	18.07
Sand Filter	15.51 [2,4]	17.94
Gravel Wetland System (aka-subsurface gravel wetland)	7.59 [2,4]	8.78
Wet Pond or wet detention basin	5.88 [2,4]	6.80
Subsurface Infiltration/Detention System (aka-Infiltration Chamber)	54.54[5]	67.85

[1] Footnote: Includes 35% add on for design engineering and contingencies

[2] Costs in 2010 dollars

[3] From CRWA Cost Estimates

[4] From UNHSC Cost Estimates; Most of original costs were from 2004 and converted to 2010 dollars using U.S. Department of Labor (USDOL). (2012). Bureau of Labor Statistics consumer price index inflation calculator. http://www.bls.gov/data/inflation_calculator.htm

[5] From Cost Estimate of MA TT Rizzo Project (2008 Dollars)

[6] 2010 costs were converted to 2016 values to adjust for inflation. The ENR Cost Index Method was used for this conversion.

Table 1 includes all of the BMPs that are included in the Opti-Tool. The unit costs represent the dollar amount ($) per cubic foot of storage volume (ft^3), where the storage volume reflects the (design) physical static storage capacity that the relevant BMP can hold. This volume includes the volume of ponding water *and* the volume of water retained in the porous media or subbase materials if applicable. (This storage volume does *not* represent the *treated* volume of stormwater, which may be significantly higher than the physical storage volume of a BMP particularly for systems that are sized dynamically or

by a water quality flow rate as opposed to a water quality volume.) This unit cost per storage volume captured by a BMP differs from other (perhaps more traditional) methods that can be used. By choosing to use the unit cost per storage volume instead of volume of water treated, we are trying to eliminate confusion over what the actual dimensions of the BMP will be for the costs being estimated. Additionally, this use of the unit cost per storage volume is consistent with the approach used in developing the BMP performance curves (used in the Opti-Tool) where the x-axis is the actual **physical storage capacity** to hold water. Lastly, expressing the unit costs in this manner will benefit users who are simply interested in using the unit costs (outside of the Opti-Tool) by eliminating the step of modeling hydrology and routing the water through the BMP, which can yield widely varying results depending on modeling approach and supporting assumptions. Attachment A describes the method used in calculating the design storage volume for each of the selected BMPs.

Also, each unit cost per storage value represents the capital cost of construction/installation of the BMP and includes a 35% design/engineering/contingency (D & E) cost. This 35% fixed percentage of the total construction cost follows a general "rule of thumb," often used by consulting firms. Based upon a conversation between Mark Voorhees and Jamie Houle (two members of the Opti-Tool cost subcommittee), a decision was made to include this D&E cost. The values in Table 1 do *not* include the cost of purchasing any land, nor does it include any O&M costs (which is discussed in more detail in a subsequent section). Therefore, each unit cost in Table 1 that was based on the CRWA's 2010 values was calculated by multiplying the relevant BMP cost by 1.35.

Since the CRWA study did not include cost estimates for porous pavement or sand filters, which are BMPs included in the Opti-Tool, relevant data was obtained from Jamie Houle of the University of New Hampshire Stormwater Center (UNHSC). He also provided additional cost estimates (as denoted by Footnote 4 in Table 1) for some of the other BMPs included in the tool. UNHSC can provide valuable data because they have been directly involved with the engineering, design and construction of numerous LID controls, as well as evaluating multiple stormwater treatment systems over multiple years at their primary field research facility in Durham, N.H. Since they could provide cost information for both porous asphalt pavement and pervious concrete, separately, the general category of porous pavement was divided into the aforementioned two sub-categories.

It should be noted that the costs used for the Opti-tool *assume linearity*, which will both allow for *and* incentivize the scaling to smaller-sized systems. For example, EPA has estimated that *smaller* capacity designs for BMPs, rather than large-sized BMPs, can increase both the technical and economic feasibility of installing controls, particularly for retrofits. The assumption of linearity was made for the following reasons: 1) Limited data currently exists on the cost of small capacity systems. Until a larger pool of cost data becomes available which will allow for the development of a non-linear cost curve, the current method is the best available alternative; 2) As the installation of smaller systems becomes more wide-spread, it is likely that economies of scale will develop and cost savings will occur. For example, if one entity is contracted to install multiple small systems at once, materials can be bought in bulk and the installation process can become more efficient and less expensive; 3) An undersized system built to treat a large area can be a very cost effective approach. As an example, there should not be a significant cost difference between a 1-inch system treating 1 acre and a 1/10-inch-system that treats 10 acres, since the absolute capacity of the system is the same in both cases. This topic of linearity will be revisited in the future when more data is available.

Since UNHSC typically calculates the capital costs per cubic foot (ft^3) *treated*, using WQv, Jamie Houle converted the costs to represent the capital costs per BMP storage volume (ft^3). This was necessary so the capital cost data would be consistent with the method used in the Opti-Tool. Also, all of the costs were converted to 2010, and ultimately 2015, dollars. As with the CRWA costs, the UNHSC capital costs were already adjusted to include the 35% design/engineering/contingency (D & E) cost. Details of all of these calculations, and any other assumptions made, are presented in Attachment B.

When developing cost estimates, another topic for consideration was whether or not to address the issue of inflation. CRWA's BMP cost estimates were based on capital costs from 2010. As previously stated, UNHSW's cost estimates have also already been converted to constant 2010 dollars using consumer price index inflation rates [U.S. Department of Labor (USDOL) 2014].[1] Therefore, there was the option of converting all of these 2010 costs to 2016 costs, using the U.S. Department of Labor's consumer price index inflation calculator. However, another suggestion was made to use the ENR Cost Index method to adjust for inflation instead because it more closely tracks construction work. At least one New England state (i.e., Vermont) also uses the ENR Cost Index method, so this could provide some consistency, as well. Therefore, the decision was made to ultimately convert all of the costs to 2016 values using the ENR Cost Index method. These values are reflected in Table 1.

To use the index, one calculates the quotient of the current index number (based on the month and year of *current* date) divided by the index number from a given date (e.g., June of 2010). Since the month was not known for the 2010 costs, the month of June was used as an estimate. This assumption was used because it falls mid-way between the construction season and would likely provide a reasonable estimate. Once the quotient was calculated, it was multiplied by the construction cost (found in the middle column in Table 1, above) to provide the 2016 construction cost value

B. Cost Adjustment Factor

Since the cost of installing a BMP will vary depending on the specific site location, the TAC subcommittee believed it was important for the Opti-Tool to include a scalable cost adjustment factor. The proposed cost estimates for the Opti-Tool (in Table 1) are all based on a Cost Adjustment Factor of 1. However, each Opti-Tool user has the option to choose and enter into the tool a cost adjustment factor that is appropriate for their site. This will adjust the storage volume cost function in the Opti-Tool.

For example, the CRWA report included the cost factors summarized in Table 2.

[1] Reference: U.S. Department of Labor (USDOL). (2014). Bureau of Labor Statistics consumer price index inflation calculator." ⟨http://www.bls.gov/data/inflation_calculator.htm⟩(Sep. 12, 2014)

Table 2: Example of Cost Adjustment Factors

BMP Type	**EXAMPLE** Cost Adjustment Factor
New BMP in undeveloped area	1
New BMP in partially developed area	1.5
New BMP in developed area	2
Difficult installation in highly urban settings	3

(Source: Table 4 of Appendix B of CRWA's Spruce Pond Brook Subwatershed Project for Town of Franklin)

The assumption made was that it would cost more to install a new BMP in a developed area (with more site constraints) than it would cost to install the same BMP in a previously undeveloped area. So in the above example, the cost adjustment factor would be 2 for installing a BMP in a previously developed area versus a cost adjustment factor of 1 for installing a BMP in an undeveloped area.

It should be noted that Table 2 (above) provides just *one example* of adjustment factors. The factor should be flexible enough so that another location (or Opti-Tool user) can adjust it, as needed. For example, the Charles River Watershed (in eastern Massachusetts) used an adjustment factor of 2 for installing a BMP in a developed area, while the State of Vermont uses an adjustment factor of 1.4 to estimate the cost of installing a BMP for existing development.

C. Maintenance (O&M) Costs

Originally, one goal was to include Operation and Maintenance (O&M) costs as part of the cost estimates for the Opti-Tool. These O&M costs would help to provide a more realistic reflection of the long-term expenses of structural storm water controls, which is obviously critical in the practical, real-world implementation of BMPs. However, it is difficult to obtain accurate maintenance costs and they will be highly variable depending on the size, location and equipment needed to perform long-term O&M.

This point was highlighted by a key finding in EPA's recent (2013) publication, *Case Studies Analyzing the Economic Benefits of Low Impact Development and Green Infrastructure Programs.* The report indicated that only a small percentage of the entities that implement LID and GI approach for stormwater management conduct economic analyses due to the "uncertainties surrounding costs, operation and maintenance (O&M) requirements, budgetary constraints, and difficulties associated with quantifying the benefits provided by LID/GI" and the need "to obtain better estimates of the O&M costs associated with different types of LID/GI projects" was a key finding of the report.

As previously mentioned, one article entitled, *Comparison of Maintenance Cost, Labor Demands, and System Performance for LID and Conventional Stormwater Management* (Houle *et al. 2013)*, did contain relevant information for BMP costs in the New England region. During initial discussions between EPA Region I (Mark Voorhees) and UNHSC (Jamie Houle), there was concern that not enough data existed on O&M costs to propose accurate values for each of the BMPs included in the Opti-Tool. There was also

the concern that the O&M costs were not scaleable. For example, initial O&M costs for each BMP were based on the cost of operation and maintenance per year per acre of IC treated. Scaled differences such as the annual O&M costs for treating 0.5 acres of IC or 2 acres of IC have **not** been evaluated and may or may **not** result in a simple linear relationship. Yet the Opti-Tool costs subcommittee also realized the importance of including some maintenance parameter in order to *initiate* the conversation on the importance of accounting for O&M to maintain the functionality of the BMPs. Therefore Table 3, below, presents these annual maintenance costs (in $) for select BMPs, as well as the annual maintenance hours. Although the O&M costs have been presented in this memo, only the O&M **hours** will be included (as a separate field) in the Opti-Tool.

Table 3: Maintenance Costs ($) and Hours per year for select BMPs – From UNHSC

BMP	Maintenance Cost ($) per year	Annual Maintenance Hours
Bioretention	$1,890.00	20.7
Chamber System	Not Assessed	Not Assessed
Detention Pond	$2,380.00	24.0
Gravel Wetland	$2,138.33	21.7
Porous Asphalt	$1,080.00	6.0
Pervious Concrete	$1,080.00	6.0
Retention Pond	$3,060.00	28.0
Sand Filter	$2,807.50	28.5

*Note: initial costs based on cost of maintenance per year per acre of IC treated

Annual maintenance strategies were evaluated by directly quantifying hours spent categorizing maintenance activities, and assessing difficulty of those activities. To better illustrate costs and anticipate maintenance burdens, activities were characterized into distinct categories and a standard cost structure was applied. This unit conversion can easily be adapted according to local conditions, current economic climate, and regional cost variations which is why we decided to go with maintenance **hours** as those were directly measured and should remain constant. These maintenance activity categories allow more accurate cost predictions and provide insight into the appropriate assignment of maintenance responsibilities.

Annual maintenance costs were normalized to 2012 dollars and calculated for all SCMs by both dollars and personnel hours per acre of IC treated per system per year. It is important to note that inflation was not considered in life cycle maintenance cost projections.

Attachment 2: W&C Unit Cost Estimate Summary

Estimate Recap - Newton MA - Stormwater Control Measures

Recap - With Taxes and Insurance ,Indirect Costs are Spread | Group 1: Stormwater Control Measure

Estimator : K Rosner
Project Size : 0 SQFT

Description	Quantity	UM	Lab.Total	Mat.Total	Sub.Total	Eqp.Total	Process Equip.	Tot.UnitCost	TotalCost
Infiltration Trench	**90**	**CF**	**1,165**	**946**	**2,316**	**119**		**50.500**	**4,545**
Infiltration Chamber	**18,164**	**CF**			**342,411**			**18.851**	**342,411**
Infiltration Basin	**18,000**	**CF**	**20,766**	**20,159**	**107,477**	**11,042**		**8.858**	**159,445**
Biofiltration	**18,000**	**CF**	**69,506**	**75,007**	**142,249**	**26,694**		**17.414**	**313,456**
Gravel Wetland	**18,200**	**CF**	**32,788**	**27,609**	**338,632**	**11,405**		**22.551**	**410,434**
Enhanced Bioretention Basin	**18,000**	**CF**	**60,228**	**93,184**	**107,477**	**16,751**		**15.424**	**277,641**
Porous Asphalt	**18,000**	**CF**	**356,244**	**564,687**	**86,898**	**58,714**		**59.252**	**1,066,543**
Water Quality Swale	**1,764**	**CF**	**26,012**	**8,799**	**18,967**	**11,275**		**36.878**	**65,052**
Subsurface Sand Filter	**18,000**	**CF**	**66,705**	**74,306**	**142,249**	**24,196**		**17.081**	**307,456**
Wet Pond	**18,000**	**CF**	**9,121**	**17,111**	**86,930**	**8,390**		**6.753**	**121,551**
Dry Pond	**18,000**	**CF**	**17,270**	**18,032**	**86,930**	**9,526**		**7.320**	**131,759**
Total Estimate			**659,805**	**899,838**	**1,462,536**	**178,112**			**3,200,292**

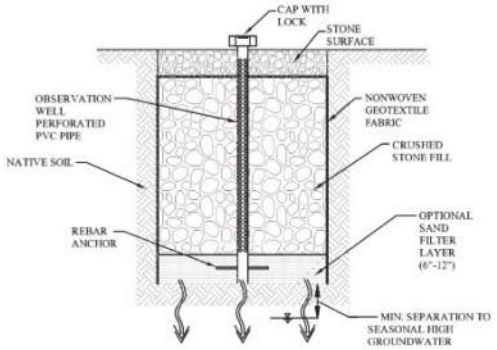
UNHSC Performance Curves

Infiltration Trench Factsheet

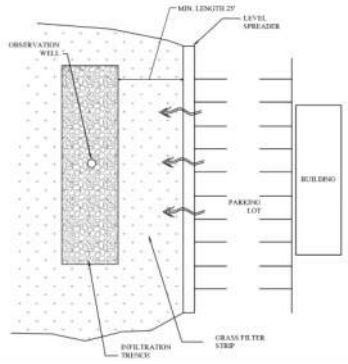
Infiltration Trench is a practice that provides temporary storage of runoff using the void spaces within the soil/sand/gravel mixture that is used to backfill the trench for subsequent infiltration into the surrounding sub-soils. Performance results for the infiltration trench can be used for all subsurface infiltration practices including systems that include pipes and/or chambers that provide temporary storage. Also, the results for this BMP type can be used for bio-retention systems that rely on infiltration when the majority of the temporary storage capacity is provided in the void spaces of the soil filter media and porous pavements that allow infiltration to occur. General design specifications for infiltration trench systems are provided in the most recent version of *The New Hampshire Stormwater Manual, Volume 2: Post-Construction Best Management Practices Selection and Design*.

Sample Design

Cross Section



Plan View



Examples images from the *New Hampshire Stormwater Manual, Volume 2,* p. 86

Pollutant Export Rate by Land Use[1]

Source Category by Land Use	Land Surface Cover	P Load Export Rate[1] (lbs./acre/year)	N Load Export Rate[2] (lbs./acre/year)
Commercial (COM) and Industrial (IND)	Directly connected impervious	1.78	15
Multi-Family (MFR) and High-Density Residential (HDR)	Directly connected impervious	2.32	14.1
Medium-Density Residential (MDR)	Directly connected impervious	1.96	14.1
Low-Density Residential (LDR) - "Rural"	Directly connected impervious	1.52	14.1

[1] From NH Small MS4 General Permit, Appendix F

General Equations

Physical Storage Capacity: Depth of Runoff * Drainage Area
Cost: Physical Storage Capacity * Cost Index * Adjustment Factor[1]
Yearly Pollutant Removal: Pollutant Load Export Rate * Drainage Area * Efficiency

Cost

	Materials and Installation Cost ($/ft^3) (2020)	Design Cost ($/ft^3) (2020)	Total Cost ($/ft^3) (2020)[1,2]
Rural	8.33	4.49	12.82
Mixed	16.67	8.97	25.64
Urban	25.00	13.46	38.46

[1] EPA Memorandum "Methodology for developing cost estimates for Opti-Tool." Februrary 20, 2016
[2] Converted from 2010 to 2020 dollars using U.S. Department of Labor (USDOL). (2012). Bureau of Labor Statistics consumer price index inflation calculator. http://www.bls.gov/data/inflation_calculator.htm

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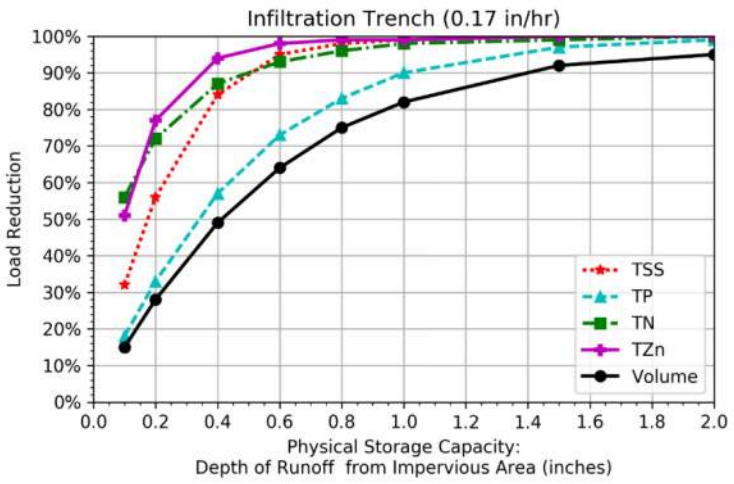
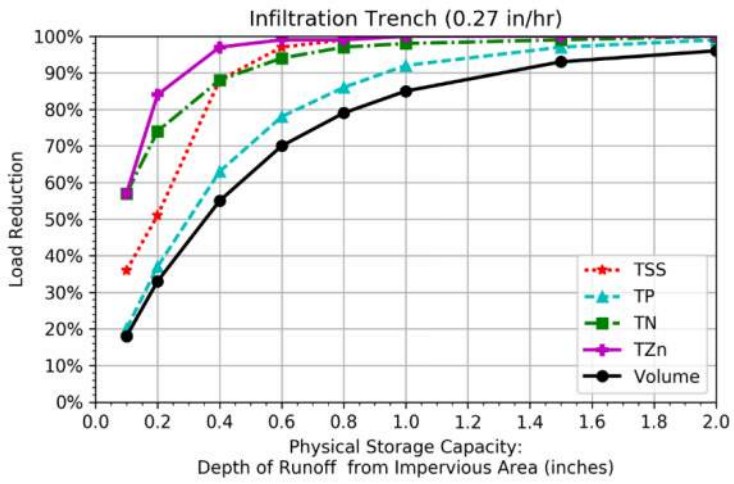
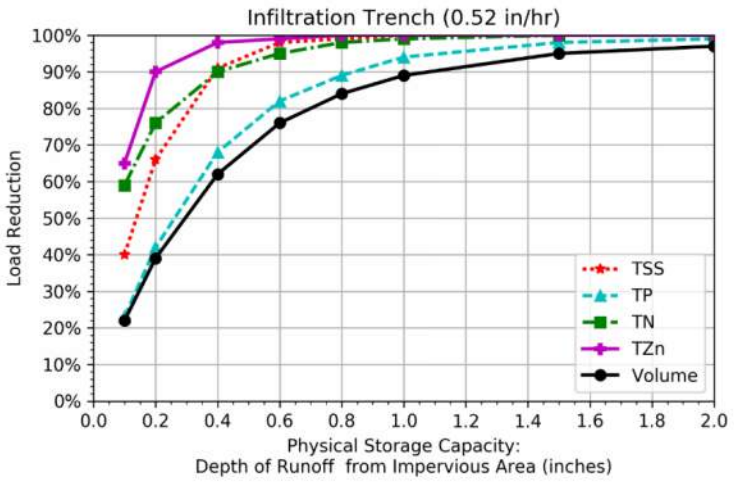
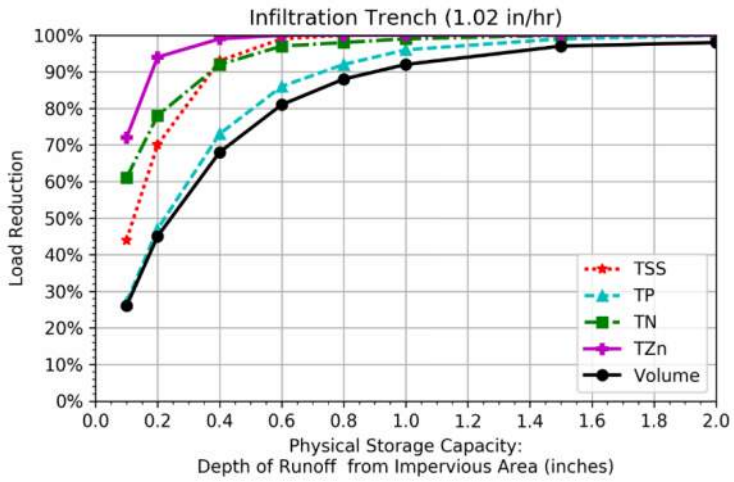
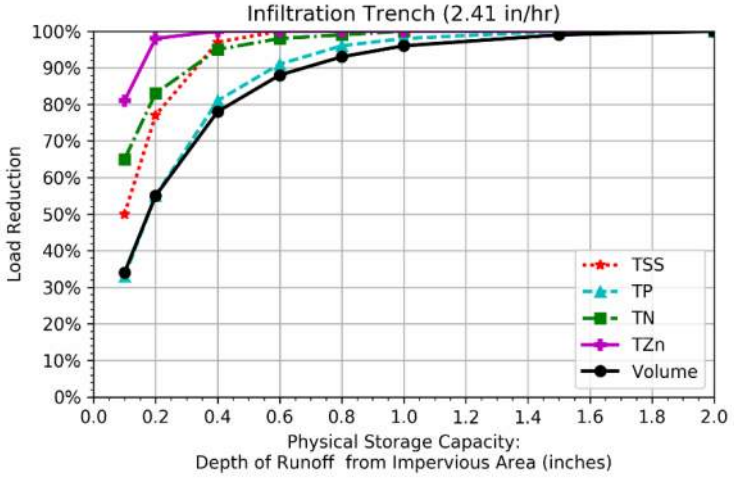
BMP Performance Curves for Soil Infiltration Rate: Infiltration Trench

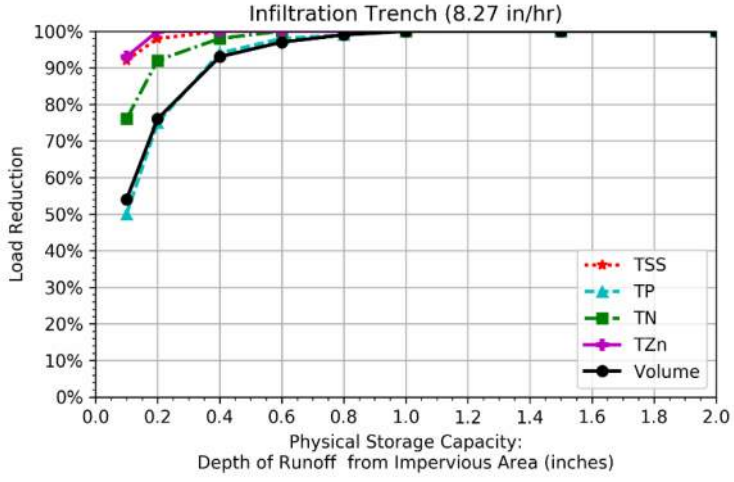












BMP Performance Tables for Soil Infiltration Rate: Infiltration Trench

		Cumulative Load Reduction				
Infiltration Rate (in/hr)	Depth of Runoff from Impervious Area (inches)	TSS	Phosphorus	Nitrogen	Zinc	Runoff Volume
0.17	0.1	32%	18%	56%	51%	15%
	0.2	56%	33%	72%	77%	28%
	0.4	84%	57%	87%	94%	49%
	0.6	95%	73%	93%	98%	64%
	0.8	98%	83%	96%	99%	75%
	1.0	99%	90%	98%	99%	82%
	1.5	100%	97%	99%	100%	92%
	2.0	100%	99%	100%	100%	95%
0.27	0.1	36%	20%	57%	57%	18%
	0.2	51%	37%	74%	84%	33%
	0.4	88%	63%	88%	97%	55%
	0.6	97%	78%	94%	99%	70%
	0.8	99%	86%	97%	99%	79%
	1.0	100%	92%	98%	100%	85%
	1.5	100%	97%	99%	100%	93%
	2.0	100%	99%	100%	100%	96%
0.52	0.1	40%	23%	59%	65%	22%
	0.2	66%	42%	76%	90%	39%
	0.4	91%	68%	90%	98%	62%
	0.6	98%	82%	95%	99%	76%
	0.8	99%	89%	98%	100%	84%
	1.0	100%	94%	99%	100%	89%
	1.5	100%	98%	100%	100%	95%
	2.0	100%	99%	100%	100%	97%

BMP Performance Tables for Soil Infiltration Rate: Infiltration Trench

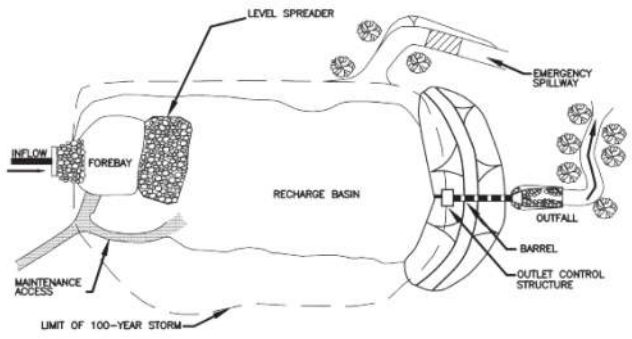
		Cumulative Load Reduction				
Infiltration Rate (in/hr)	Depth of Runoff from Impervious Area (inches)	TSS	Phosphorus	Nitrogen	Zinc	Runoff Volume
1.02	0.1	44%	27%	61%	72%	26%
	0.2	70%	47%	78%	94%	45%
	0.4	93%	73%	92%	99%	68%
	0.6	99%	86%	97%	100%	81%
	0.8	100%	92%	98%	100%	88%
	1.0	100%	96%	99%	100%	92%
	1.5	100%	99%	100%	100%	97%
	2.0	100%	100%	100%	100%	98%
2.41	0.1	50%	33%	65%	81%	34%
	0.2	77%	55%	83%	98%	55%
	0.4	97%	81%	95%	100%	78%
	0.6	100%	91%	98%	100%	88%
	0.8	100%	96%	99%	100%	93%
	1.0	100%	98%	100%	100%	96%
	1.5	100%	100%	100%	100%	99%
	2.0	100%	100%	100%	100%	100%
8.27	0.1	92%	50%	76%	93%	54%
	0.2	98%	75%	92%	100%	76%
	0.4	100%	94%	98%	100%	93%
	0.6	100%	98%	100%	100%	97%
	0.8	100%	99%	100%	100%	99%
	1.0	100%	100%	100%	100%	100%
	1.5	100%	100%	100%	100%	100%
	2.0	100%	100%	100%	100%	100%

Infiltration Basin Factsheet

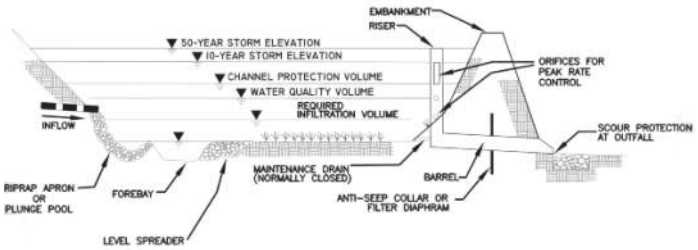
Infiltration Basin represents a practice that provides temporary surface storage of runoff (e.g. ponding) for subsequent infiltration into the ground. Appropriate practices for use of the surface infiltration performance estimates include infiltration basins, infiltration swales (not conveyance swales), rain gardens, and bio-retention systems that rely on infiltration and provide the majority of storage capacity through surface-ponding. If an infiltration system includes both surface storage through ponding and a lesser storage volume within the void spaces of a coarse filter media, then the physical storage volume capacity used to determine the long-term cumulative phosphorus removal efficiency from the infiltration basin performance curves would be equal to the sum of the surface storage volume and the void space storage volume. General design specifications for infiltration basin systems are provided in the most recent version of *The New Hampshire Stormwater Manual, Volume 2: Post-Construction Best Management Practices Selection and Design*.

Sample Design

Plan View



Profile View



Examples images from the *New Hampshire Stormwater Manual, Volume 2,* p. 90

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Medium-Density Residential (MDR)	Directly connected impervious	1.96	14.1
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[1] From NH Small MS4 General Permit, Appendix F

General Equations

Physical Storage Capacity: Depth of Runoff * Drainage Area
Cost: Physical Storage Capacity * Cost Index * Adjustment Factor[1]
Yearly Pollutant Removal: Pollutant Load Export Rate * Drainage Area * Efficiency

Cost

	Materials and Installation Cost ($/ft^3) (2020)	Design Cost ($/ft^3) (2020)	Total Cost ($/ft^3) (2020)[1,2]
Rural	4.17	2.24	6.41
Mixed	8.33	4.49	12.82
Urban	12.50	6.73	19.23

[1] EPA Memorandum "Methodology for developing cost estimates for Opti-Tool." Februrary 20, 2016
[2] Converted from 2010 to 2020 dollars using U.S. Department of Labor (USDOL). (2012). Bureau of Labor Statistics consumer price index inflation calculator. http://www.bls.gov/data/inflation_calculator.htm

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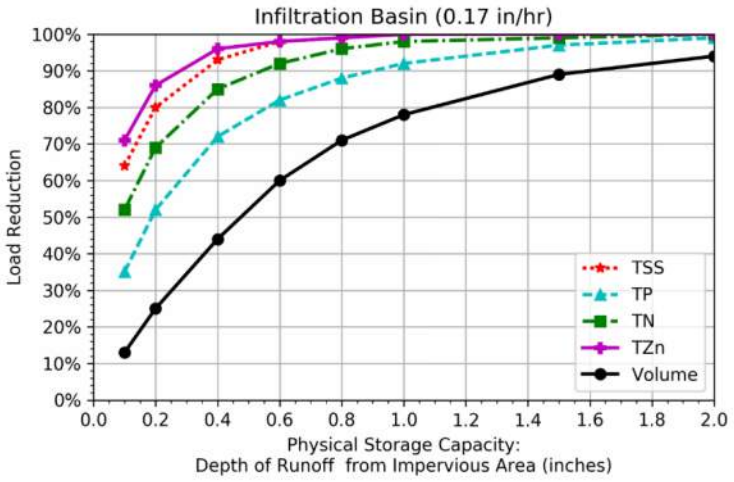
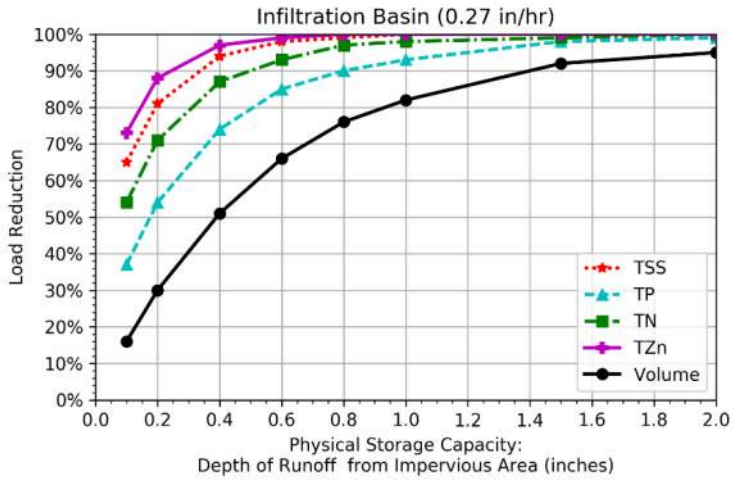
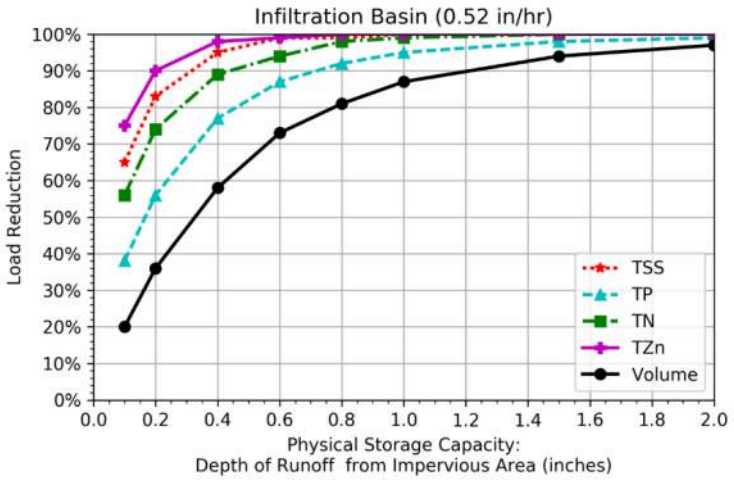
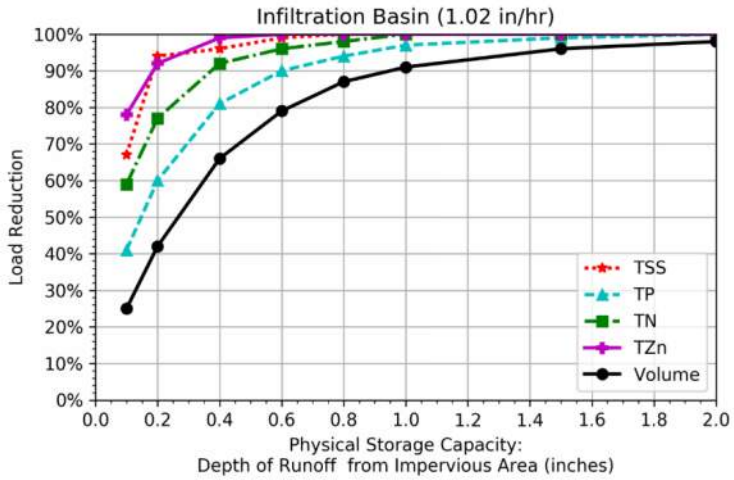
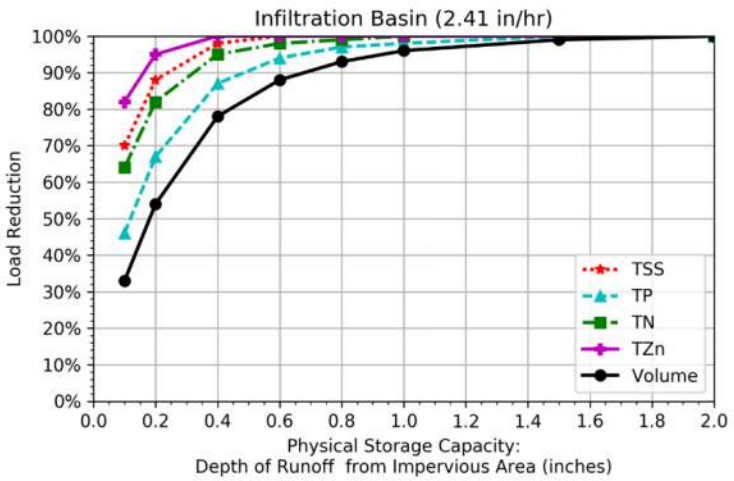
BMP Performance Curves for Soil Infiltration Rate: Infiltration Basin

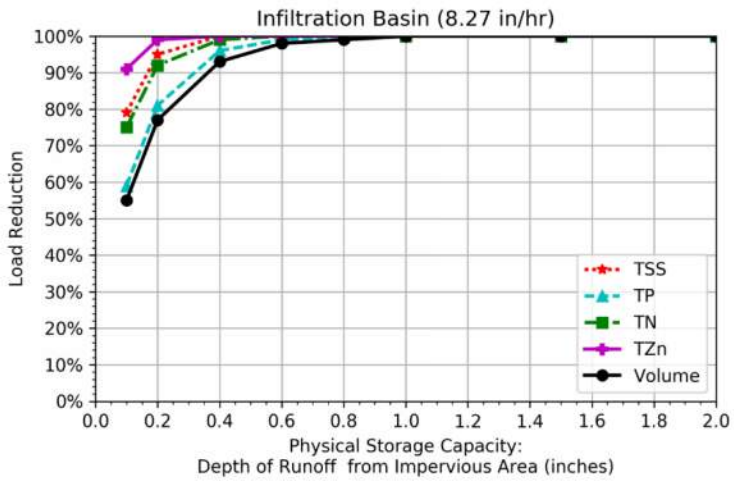












BMP Performance Tables for Soil Infiltration Rate: Infiltration Basin

		Cumulative Load Reduction				
Infiltration Rate (in/hr)	Depth of Runoff from Impervious Area (inches)	TSS	Phosphorus	Nitrogen	Zinc	Runoff Volume
0.17	0.1	64%	35%	52%	71%	13%
	0.2	80%	52%	69%	86%	25%
	0.4	93%	72%	85%	96%	44%
	0.6	98%	82%	92%	98%	60%
	0.8	99%	88%	96%	99%	71%
	1.0	100%	92%	98%	100%	78%
	1.5	100%	97%	99%	100%	89%
	2.0	100%	99%	100%	100%	94%
0.27	0.1	65%	37%	54%	73%	16%
	0.2	81%	54%	71%	88%	30%
	0.4	94%	74%	87%	97%	51%
	0.6	98%	85%	93%	99%	66%
	0.8	99%	90%	97%	100%	76%
	1.0	100%	93%	98%	100%	82%
	1.5	100%	98%	99%	100%	92%
	2.0	100%	99%	100%	100%	95%
0.52	0.1	65%	38%	56%	75%	20%
	0.2	83%	56%	74%	90%	36%
	0.4	95%	77%	89%	98%	58%
	0.6	99%	87%	94%	99%	73%
	0.8	99%	92%	98%	100%	81%
	1.0	100%	95%	99%	100%	87%
	1.5	100%	98%	100%	100%	94%
	2.0	100%	99%	100%	100%	97%

BMP Performance Tables for Soil Infiltration Rate: Infiltration Basin

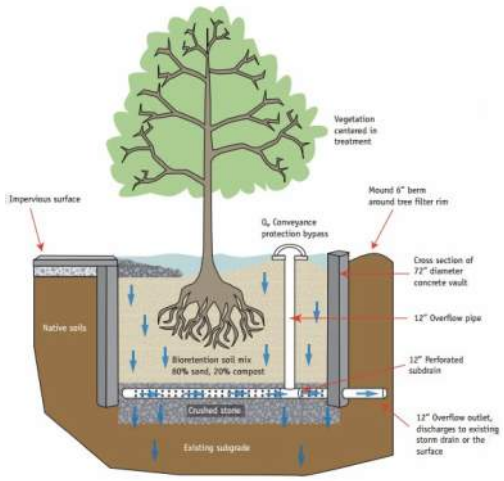
		Cumulative Load Reduction				
Infiltration Rate (in/hr)	Depth of Runoff from Impervious Area (inches)	TSS	Phosphorus	Nitrogen	Zinc	Runoff Volume
1.02	0.1	67%	41%	59%	78%	25%
	0.2	94%	60%	77%	92%	42%
	0.4	96%	81%	92%	99%	66%
	0.6	99%	90%	96%	100%	79%
	0.8	100%	94%	98%	100%	87%
	1.0	100%	97%	100%	100%	91%
	1.5	100%	99%	100%	100%	96%
	2.0	100%	100%	100%	100%	98%
2.41	0.1	70%	46%	64%	82%	33%
	0.2	88%	67%	82%	95%	54%
	0.4	98%	87%	95%	100%	78%
	0.6	100%	94%	98%	100%	88%
	0.8	100%	97%	99%	100%	93%
	1.0	100%	98%	100%	100%	96%
	1.5	100%	100%	100%	100%	99%
	2.0	100%	100%	100%	100%	100%
8.27	0.1	79%	59%	75%	91%	55%
	0.2	95%	81%	92%	99%	77%
	0.4	100%	96%	99%	100%	93%
	0.6	100%	99%	100%	100%	98%
	0.8	100%	100%	100%	100%	99%
	1.0	100%	100%	100%	100%	100%
	1.5	100%	100%	100%	100%	100%
	2.0	100%	100%	100%	100%	100%

Biofiltration Factsheet

Biofiltration is a practice that provides temporary storage of runoff for filtering through an engineered soil media. The storage capacity is typically made of void spaces in the filter media and temporary ponding at the surface of the practice. Once the runoff has passed through the filter media it is collected by an under-drain pipe for discharge. The performance curve for this control practice assumes zero infiltration. If a filtration system has subsurface soils that are suitable for infiltration, then user should use either the performance curves for the infiltration trench or the infiltration basin depending on the predominance of storage volume made up by free standing storage or void space storage. Depending on the design of the manufactured or packaged bio-filter systems such as tree box filters may be suitable for using the bio-filtration performance results. Design specifications for biofiltration systems are provided in the most recent version of *The New Hampshire Stormwater Manual, Volume 2: Post-Construction Best Management Practices Selection and Design*.

Sample Design

Profile view of a Tree Box Filter. The underdrain makes the system one example of a biofiltration system.



Examples images from the *New Hampshire Stormwater Manual, Volume 2,* p. 116

Pollutant Export Rate by Land Use[1]

Source Category by Land Use	Land Surface Cover	P Load Export Rate[1] (lbs./acre/year)	N Load Export Rate[2] (lbs./acre/year)
Commercial (COM) and Industrial (IND)	Directly connected impervious	1.78	15
Multi-Family (MFR) and High-Density Residential (HDR)	Directly connected impervious	2.32	14.1
Medium-Density Residential (MDR)	Directly connected impervious	1.96	14.1
Low-Density Residential (LDR) - "Rural"	Directly connected impervious	1.52	14.1

[1] From NH Small MS4 General Permit, Appendix F

General Equations

Physical Storage Capacity: Depth of Runoff * Drainage Area
Cost: Physical Storage Capacity * Cost Index * Adjustment Factor[1]
Yearly Pollutant Removal: Pollutant Load Export Rate * Drainage Area * Efficiency

Cost

	Materials and Installation Cost ($/ft^3) (2020)	Design Cost ($/ft^3) (2020)	Total Cost ($/ft^3) (2020)[1,2]
Rural	10.32	5.55	15.87
Mixed	20.63	11.11	31.74
Urban	30.95	16.66	47.61

[1] EPA Memorandum "Methodology for developing cost estimates for Opti-Tool." Februrary 20, 2016
[2] Converted from 2010 to 2020 dollars using U.S. Department of Labor (USDOL). (2012). Bureau of Labor Statistics consumer price index inflation calculator. http://www.bls.gov/data/inflation_calculator.htm

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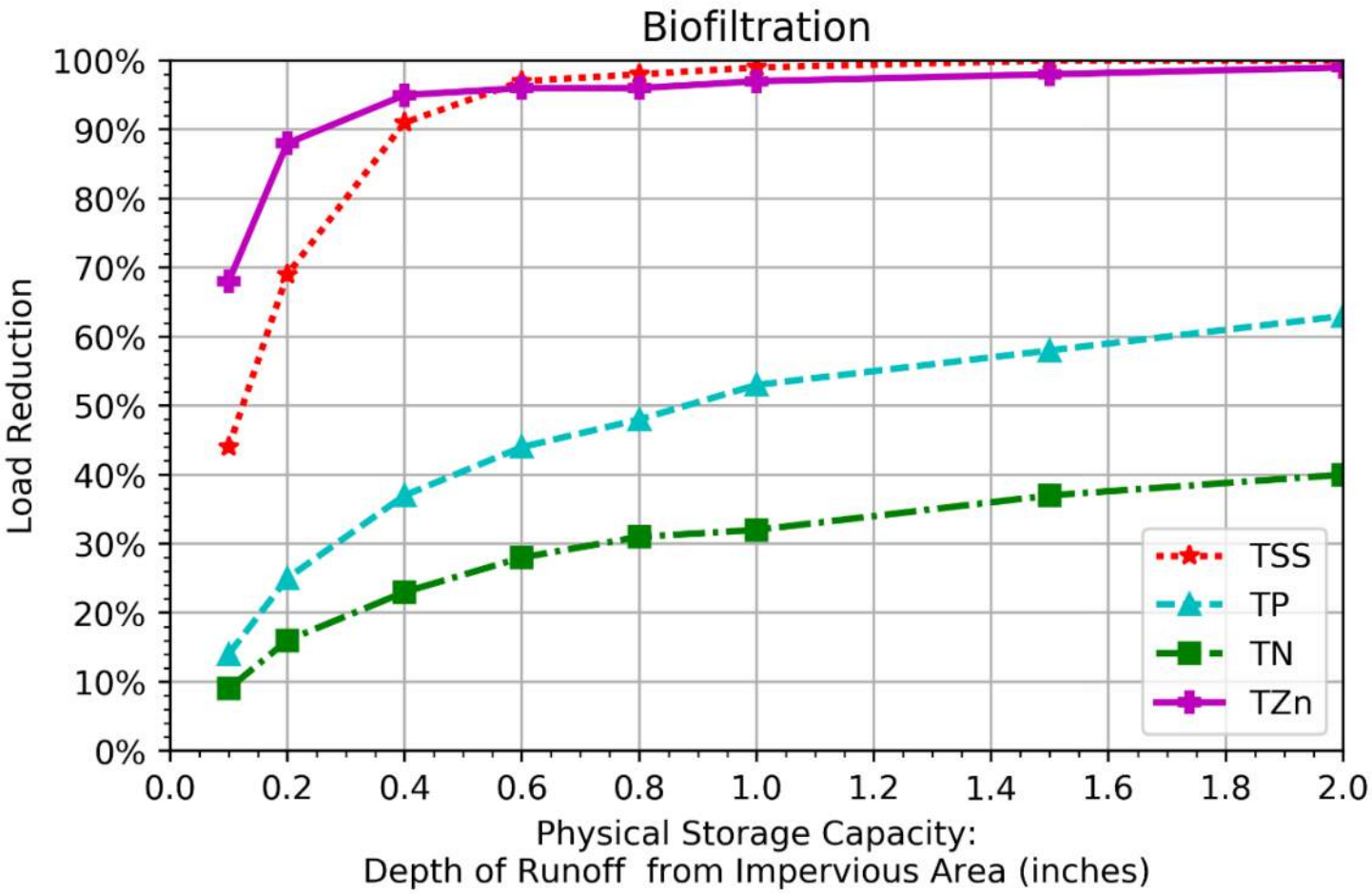
BMP Performance Curve for Biofiltration



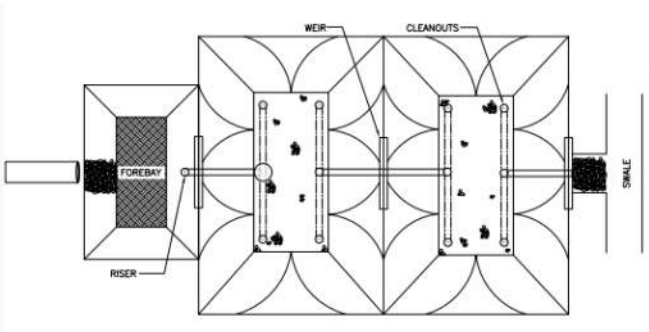
Biofiltration BMP Performance Table								
BMP Capacity: Depth of Runoff from Impervious Area (inches)	0.1	0.2	0.4	0.6	0.8	1.0	1.5	2.0
Cumulative TSS Phosphorus Load Reduction	44%	69%	91%	97%	98%	99%	100%	100%
Cumulative Phosphorus Load Reduction	14%	25%	37%	44%	48%	53%	58%	63%
Cumulative Nitrogen Load Reduction	9%	16%	23%	28%	31%	32%	37%	40%
Cumulative Zinc Phosphorus Load Reduction	68%	88%	95%	96%	96%	97%	98%	99%

Gravel Wetlands Factsheet

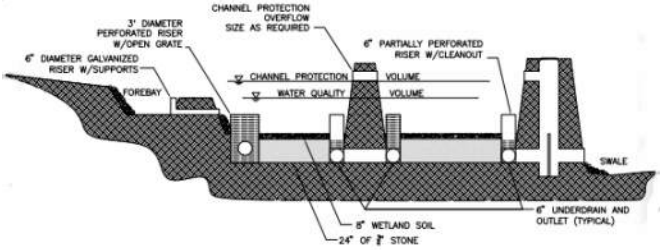
Gravel Wetlands consists of one or more flow-through constructed wetland cells, preceded by a forebay. The cells are filled with a gravel media, supporting an organic substrate that is planted with wetland vegetation. During low-flow storm events, the systems is designed to promote subsurface horizontal flow through the gravel media, allowing contact with the root zone of the wetland vegetation. The gravel and planting media support a community of soil microorganisms. Water quality treatment occurs through microbial, chemical, and physical processes within this media. Treatment may also be enhanced by vegetative uptake.. General design specifications for infiltration basin systems are provided in the most recent version of *The New Hampshire Stormwater Manual, Volume 2: Post-Construction Best Management Practices Selection and Design*.

Sample Design

Plan View



Profile View



Examples images from the *New Hampshire Stormwater Manual, Volume 2,* p. 80

Pollutant Export Rate by Land Use[1]

Source Category by Land Use	Land Surface Cover	P Load Export Rate[1] (lbs./acre/year)	N Load Export Rate[2] (lbs./acre/year)
Commercial (COM) and Industrial (IND)	Directly connected impervious	1.78	15
Multi-Family (MFR) and High-Density Residential (HDR)	Directly connected impervious	2.32	14.1
Medium-Density Residential (MDR)	Directly connected impervious	1.96	14.1
Low-Density Residential (LDR) - "Rural"	Directly connected impervious	1.52	14.1

[1] From NH Small MS4 General Permit, Appendix F

General Equations

Physical Storage Capacity: Depth of Runoff * Drainage Area
Cost: Physical Storage Capacity * Cost Index * Adjustment Factor[1]
Yearly Pollutant Removal: Pollutant Load Export Rate * Drainage Area * Efficiency

Cost

	Materials and Installation Cost ($/ft^3) (2020)	Design Cost ($/ft^3) (2020)	Total Cost ($/ft^3) (2020)[1,2]
Rural	5.86	3.15	9.01
Mixed	11.71	6.31	18.02
Urban	17.57	9.46	27.03

[1] EPA Memorandum "Methodology for developing cost estimates for Opti-Tool." Februrary 20, 2016
[2] Converted from 2010 to 2020 dollars using U.S. Department of Labor (USDOL). (2012). Bureau of Labor Statistics consumer price index inflation calculator. http://www.bls.gov/data/inflation_calculator.htm

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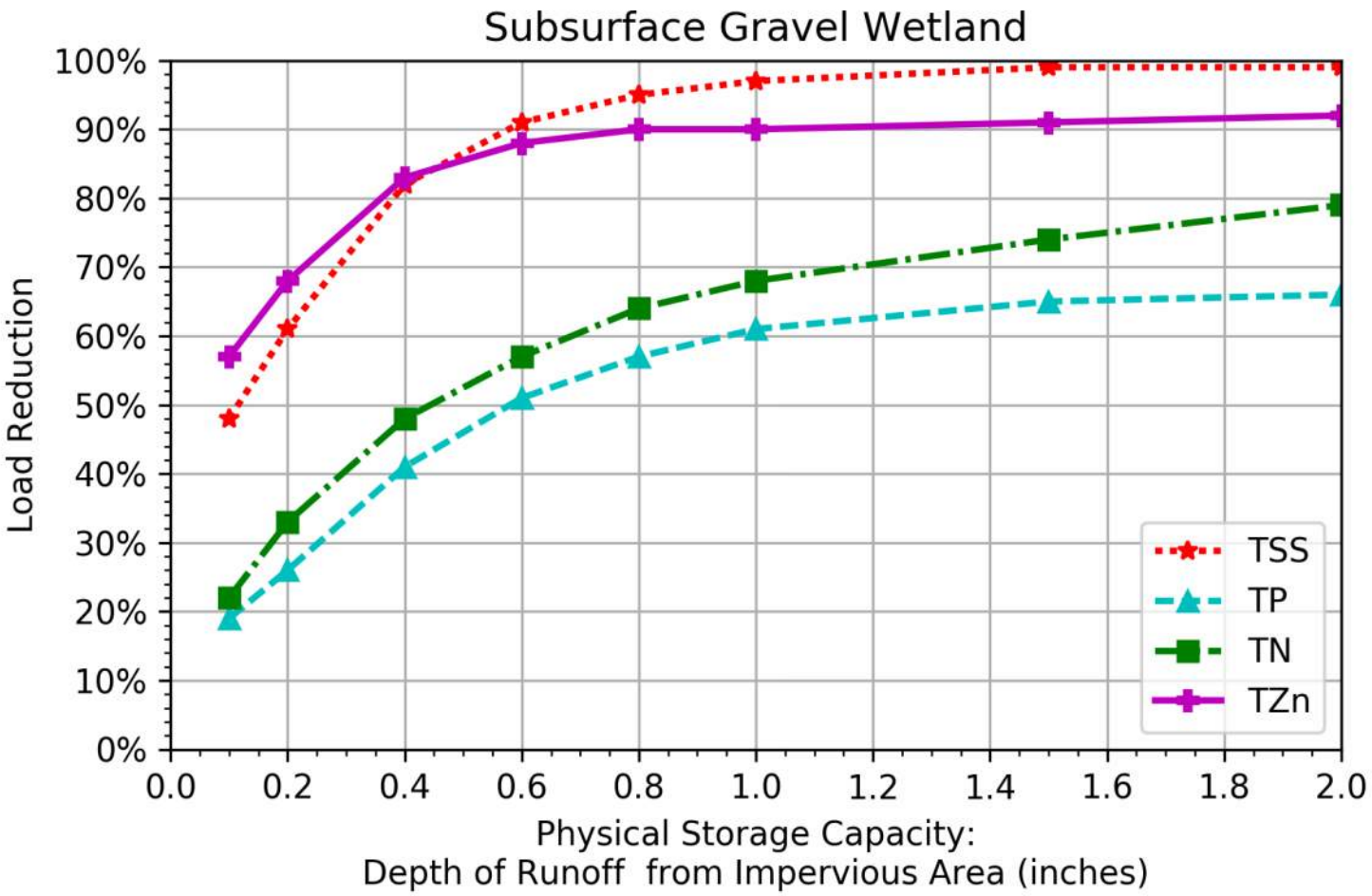
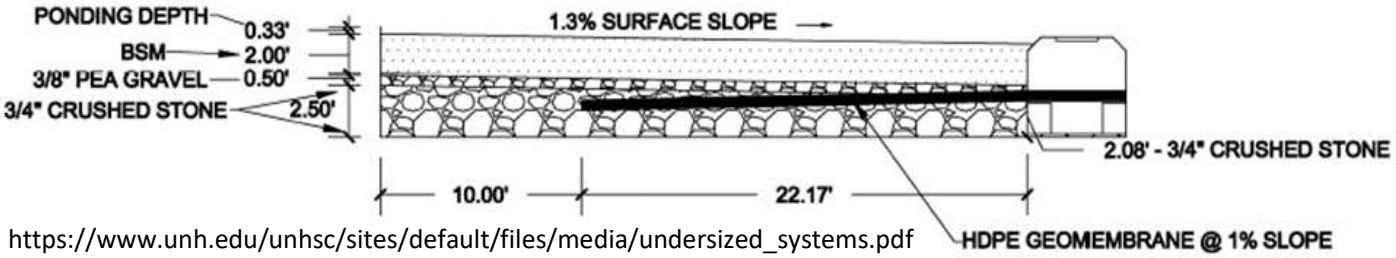
BMP Performance Curve for Gravel Wetlands



Gravel Wetland BMP Performance Table								
BMP Capacity: Depth of Runoff from Impervious Area (inches)	0.1	0.2	0.4	0.6	0.8	1.0	1.5	2.0
Cumulative TSS Phosphorus Load Reduction	48%	61%	82%	91%	95%	97%	99%	99%
Cumulative Phosphorus Load Reduction	19%	26%	41%	51%	57%	61%	65%	66%
Cumulative Nitrogen Load Reduction	22%	33%	48%	57%	64%	68%	74%	79%
Cumulative Zinc Phosphorus Load Reduction	57%	68%	83%	88%	90%	90%	91%	92%

Enhanced Biofiltration with Internal Storage Reservoir (ISR) Factsheet

Enhanced Biofiltration is a practice the provides temporary storage of runoff for filtering through an engineered soil media, augmented for enhanced phosphorus removal, followed by detention and denitrification in a subsurface internal storage reservoir (ISR) comprised of gravel. Runoff flows are routed through filter media and directed to the underlying ISR via an impermeable membrane for temporary storage. An elevated outlet control at the top of the ISR is designed to provide a retention time of at least 24 hours in the system to allow for sufficient time for denitrification and nitrogen reduction to occur prior to discharge. The design storage capacity for using the cumulative performance curves is comprised of void spaces in the filter media, temporary ponding at the surface of the practice and the void spaces in the gravel ISR. The cumulative phosphorus load reduction curve for this control is intended to be used for systems in which the filter media has been augmented with materials designed and/or known to be effective at capturing phosphorus. If the filter media is not augmented to enhance phosphorus capture, then the phosphorus performance curve for the Bio-Filter should be used for estimating phosphorus load reductions. The University of New Hampshire Stormwater Center (UNHSC) developed the design of this control practice and a design templated can be found at UNHSC's website.



https://www.unh.edu/unhsc/sites/default/files/media/undersized_systems.pdf

Pollutant Export Rate by Land Use[1]

Source Category by Land Use	Land Surface Cover	P Load Export Rate[1] (lbs./acre/year)	N Load Export Rate[2] (lbs./acre/year)
Commercial (COM) and Industrial (IND)	Directly connected impervious	1.78	15
Multi-Family (MFR) and High-Density Residential (HDR)	Directly connected impervious	2.32	14.1
Medium-Density Residential (MDR)	Directly connected impervious	1.96	14.1
Low-Density Residential (LDR) - "Rural"	Directly connected impervious	1.52	14.1

[1] From NH Small MS4 General Permit, Appendix F

General Equations

Physical Storage Capacity: Depth of Runoff * Drainage Area
Cost: Physical Storage Capacity * Cost Index * Adjustment Factor[1]
Yearly Pollutant Removal: Pollutant Load Export Rate * Drainage Area * Efficiency

Cost

	Materials and Installation Cost ($/ft^3) (2020)	Design Cost ($/ft^3) (2020)	Total Cost ($/ft^3) (2020)[1,2]
Rural	10.42	5.61	16.02
Mixed	20.83	11.22	32.05
Urban	31.25	16.83	48.07

[1] EPA Memorandum "Methodology for developing cost estimates for Opti-Tool." Februrary 20, 2016
[2] Converted from 2010 to 2020 dollars using U.S. Department of Labor (USDOL). (2012). Bureau of Labor Statistics consumer price index inflation calculator. http://www.bls.gov/data/inflation_calculator.htm

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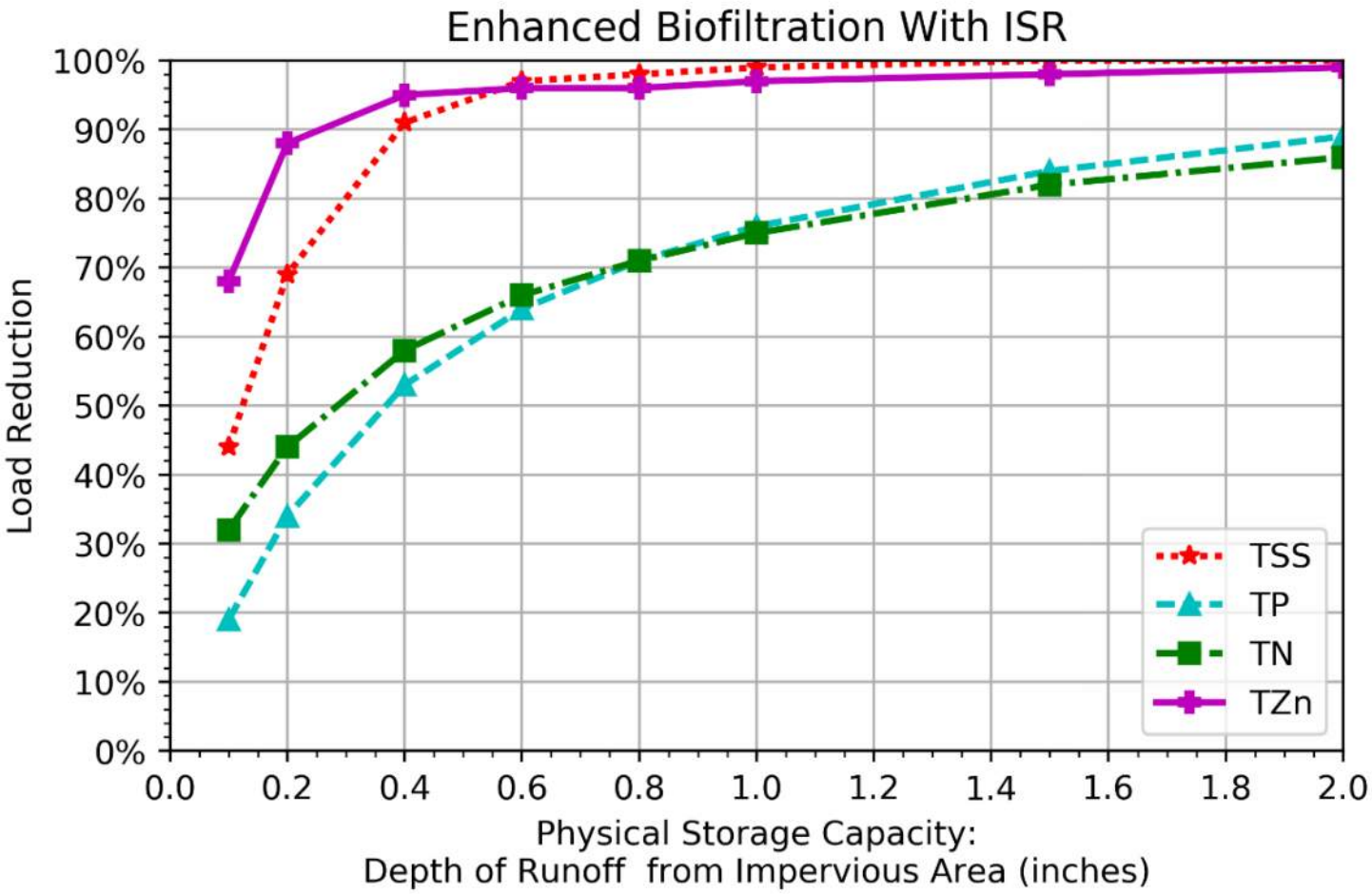
BMP Performance Curve for Enhanced Biofiltration w/ ISR



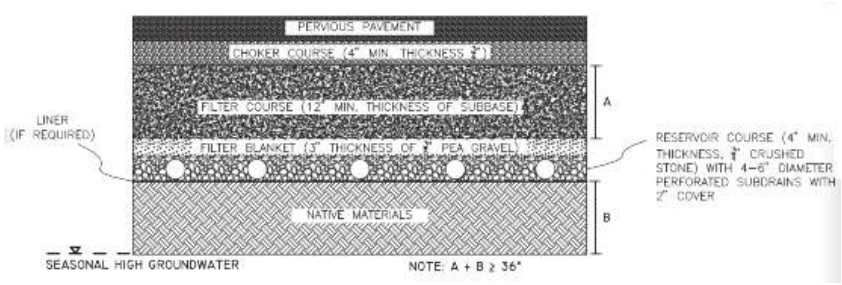
Enhanced Biofiltration w/ ISR BMP Performance Table: Long-Term Phosphorus & Nitrogen Load Reduction								
BMP Capacity: Depth of Runoff from Impervious Area (inches)	0.1	0.2	0.4	0.6	0.8	1.0	1.5	2.0
Cumulative TSS Phosphorus Load Reduction	44%	69%	91%	97%	98%	99%	100%	100%
Cumulative Phosphorus Load Reduction	19%	34%	53%	64%	71%	76%	84%	89%
Cumulative Nitrogen Load Reduction	32%	44%	58%	66%	71%	75%	82%	86%
Cumulative Zinc Phosphorus Load Reduction	68%	88%	95%	96%	96%	97%	98%	99%

Porous Pavement Factsheet

Porous Pavement consists of a porous surface, base, and sub-base materials which allow penetration of runoff through the surface into underlying soils. The surface materials for porous pavements can consist of paving blocks or grids, pervious asphalt, or pervious concrete. These materials are installed on a base which serves as a filter course between the pavement surface and the underlying sub-base material. The sub-base material typically comprises a layer of crushed stone that not only supports the overlying pavement structure, but also serves as a reservoir to store runoff that penetrates the pavement surface until it can percolate into the ground. General design specifications for porous pavement systems are provided in the most recent version of *The New Hampshire Stormwater Manual, Volume 2: Post-Construction Best Management Practices Selection and Design*.

Sample Design

Profile View



Examples images from the *New Hampshire Stormwater Manual, Volume 2,* p. 120

Pollutant Export Rate by Land Use[1]

Source Category by Land Use	Land Surface Cover	P Load Export Rate[1] (lbs./acre/year)	N Load Export Rate[2] (lbs./acre/year)
Commercial (COM) and Industrial (IND)	Directly connected impervious	1.78	15
Multi-Family (MFR) and High-Density Residential (HDR)	Directly connected impervious	2.32	14.1
Medium-Density Residential (MDR)	Directly connected impervious	1.96	14.1
Low-Density Residential (LDR) - "Rural"	Directly connected impervious	1.52	14.1

[1] From NH Small MS4 General Permit, Appendix F

General Equations

Physical Storage Capacity: Depth of Runoff * Drainage Area
Cost: Physical Storage Capacity * Cost Index * Adjustment Factor[1]
Yearly Pollutant Removal: Pollutant Load Export Rate * Drainage Area * Efficiency

Cost

	Materials and Installation Cost ($/ft^3) (2020)		Design Cost ($/ft^3) (2020)		Total Cost ($/ft^3) (2020)[1,2]	
	Porous Asphalt	Porous Concrete	Porous Asphalt	Porous Concrete	Porous Asphalt	Porous Concrete
Rural	3.55	12.06	1.91	6.49	5.46	18.55
Mixed	7.10	24.12	3.82	12.99	10.92	37.11
Urban	10.65	36.18	5.73	19.48	16.38	55.66

[1] EPA Memorandum "Methodology for developing cost estimates for Opti-Tool." Februrary 20, 2016
[2] Converted from 2010 to 2020 dollars using U.S. Department of Labor (USDOL). (2012). Bureau of Labor Statistics consumer price index inflation calculator. http://www.bls.gov/data/inflation_calculator.htm

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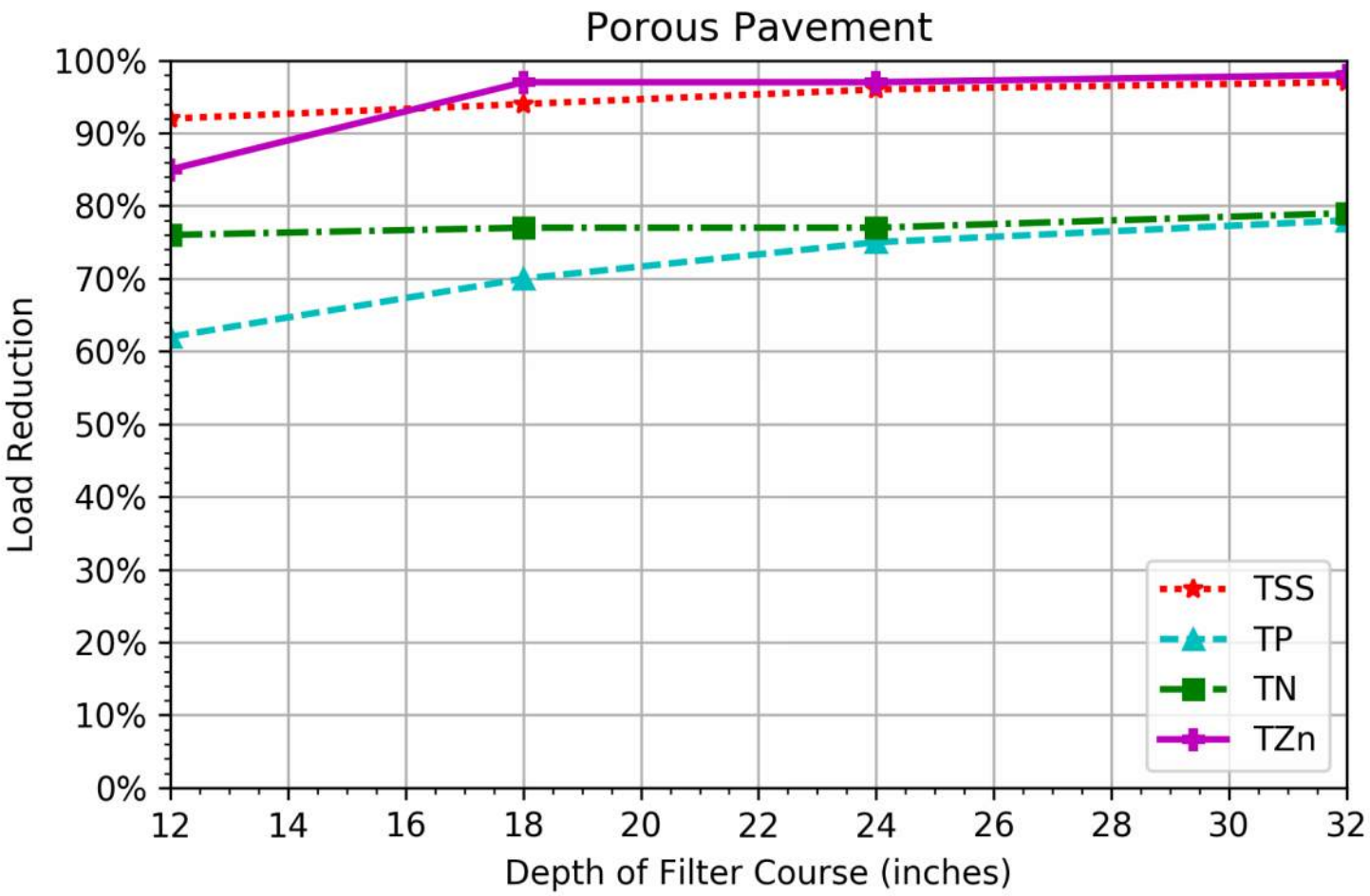
BMP Performance Curve for Porous Pavement



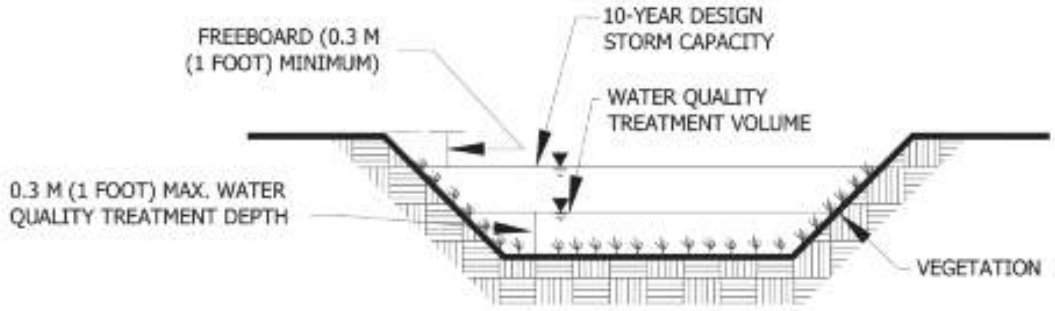
Porous Pavement BMP Performance Table				
BMP Capacity: Depth of Filter Course Area (inches)	12	18	24	32
Cumulative TSS Phosphorus Load Reduction	92%	94%	96%	97%
Cumulative Phosphorus Load Reduction	62%	70%	75%	78%
Cumulative Nitrogen Load Reduction	76%	77%	77%	79%
Cumulative Zinc Phosphorus Load Reduction	85%	97%	97%	98%

Grass Swale Factsheet

Grass Swale is a system which consists of a vegetated channel with check dams designed to convey and treat stormwater runoff. The design of allows filtration through the vegetation and check dams and infiltration through the subsurface soil media. Vegetation for the swale is selected based on mowing requirements, expected design flow, and site soil conditions. The channel should be designed to carry the max design flow within the design depth while preventing erosion within the channel. General design specifications for grass swale systems are provided in the most recent version of *The New Hampshire Stormwater Manual, Volume 2: Post-Construction Best Management Practices Selection and Design*.

Sample Design

Profile View



Examples images from the *New Hampshire Stormwater Manual, Volume 2,* p. 145

Pollutant Export Rate by Land Use[1]

Source Category by Land Use	Land Surface Cover	P Load Export Rate[1] (lbs./acre/year)	N Load Export Rate[2] (lbs./acre/year)
Commercial (COM) and Industrial (IND)	Directly connected impervious	1.78	15
Multi-Family (MFR) and High-Density Residential (HDR)	Directly connected impervious	2.32	14.1
Medium-Density Residential (MDR)	Directly connected impervious	1.96	14.1
Low-Density Residential (LDR) - "Rural"	Directly connected impervious	1.52	14.1

[1] From NH Small MS4 General Permit, Appendix F

General Equations

Physical Storage Capacity: Depth of Runoff * Drainage Area
Cost: Physical Storage Capacity * Cost Index * Adjustment Factor[1]
Yearly Pollutant Removal: Pollutant Load Export Rate * Drainage Area * Efficiency

[1] EPA Memorandum "Methodology for developing cost estimates for Opti-Tool." Februrary 20, 2016

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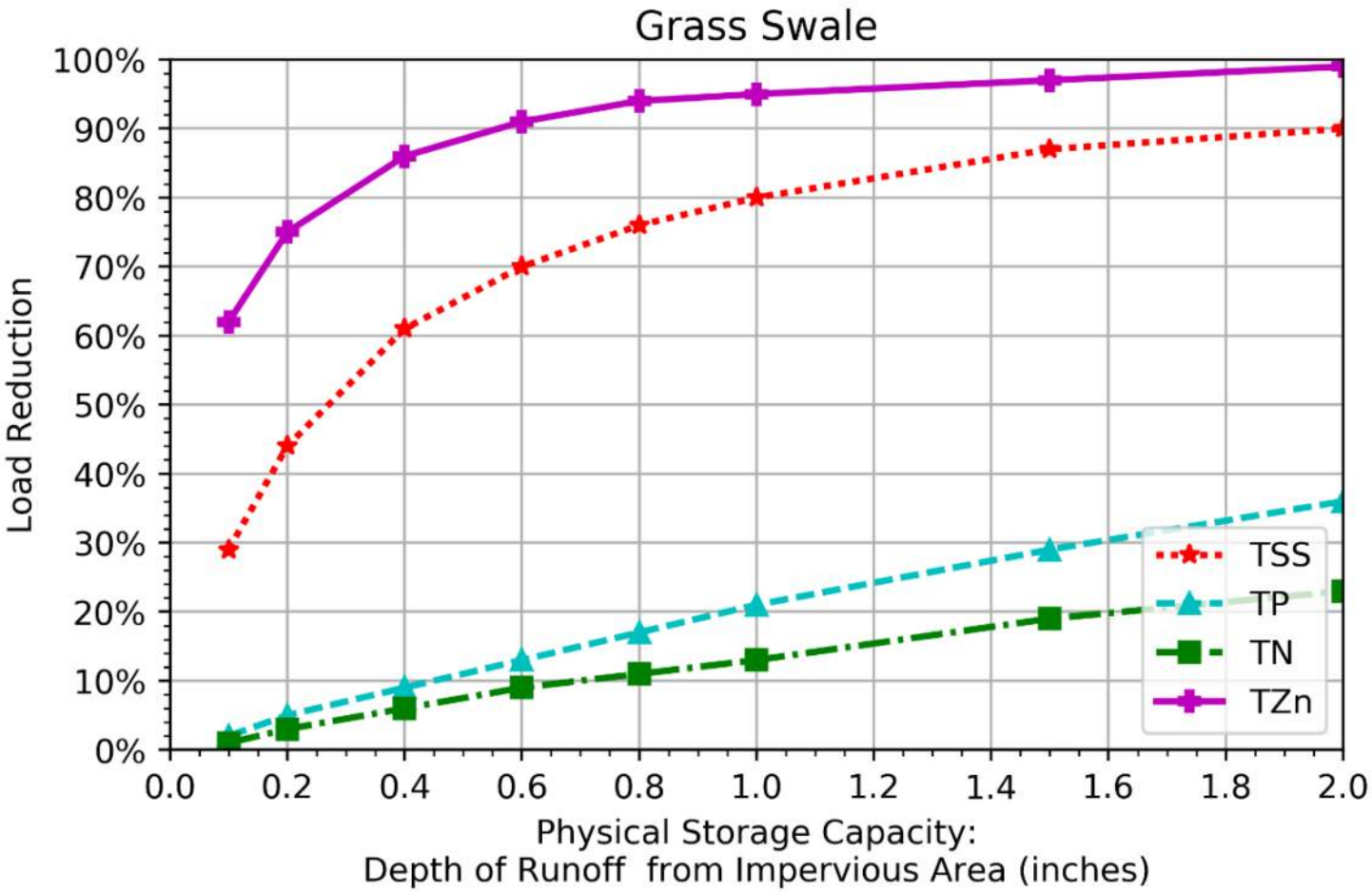
January 2020

BMP Performance Curve for Grass Swale



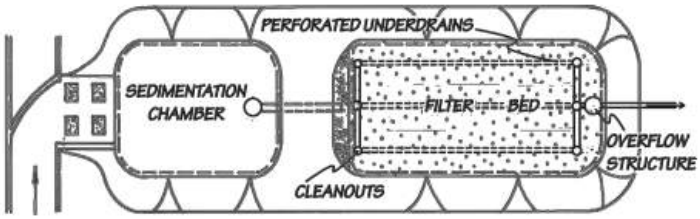
Grass Swale BMP Performance Table								
BMP Capacity: Depth of Runoff from Impervious Area (inches)	0.1	0.2	0.4	0.6	0.8	1.0	1.5	2.0
Cumulative TSS Phosphorus Load Reduction	29%	44%	61%	70%	76%	80%	87%	90%
Cumulative Phosphorus Load Reduction	2%	5%	9%	13%	17%	21%	29%	36%
Cumulative Nitrogen Load Reduction	1%	3%	6%	9%	11%	13%	19%	23%
Cumulative Zinc Phosphorus Load Reduction	62%	75%	86%	91%	94%	95%	97%	99%

Sand Filter Factsheet

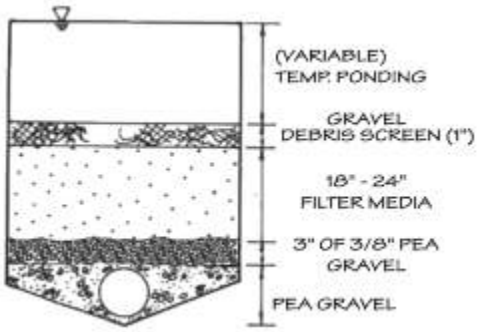
Sand Filter is a system which provides filtering of runoff through a sand filter media and temporary storage of runoff within the void spaces prior to discharge by way of an underdrain. Sand filters are generally used for overflow conditions of the primary BMP, and as such often include a pretreatment device to allow coarse settlements to settle out of the water. The top surface of the filter is kept clear of vegetation. General design specifications for sand filter systems are provided in the most recent version of *The New Hampshire Stormwater Manual, Volume 2: Post-Construction Best Management Practices Selection and Design*.

Sample Design

Plan View



Section View



Examples images from the *New Hampshire Stormwater Manual, Volume 2,* p. 104

Pollutant Export Rate by Land Use[1]

Source Category by Land Use	Land Surface Cover	P Load Export Rate[1] (lbs./acre/year)	N Load Export Rate[2] (lbs./acre/year)
Commercial (COM) and Industrial (IND)	Directly connected impervious	1.78	15
Multi-Family (MFR) and High-Density Residential (HDR)	Directly connected impervious	2.32	14.1
Medium-Density Residential (MDR)	Directly connected impervious	1.96	14.1
Low-Density Residential (LDR) - "Rural"	Directly connected impervious	1.52	14.1

[1] From NH Small MS4 General Permit, Appendix F

General Equations

Physical Storage Capacity: Depth of Runoff * Drainage Area
Cost: Physical Storage Capacity * Cost Index * Adjustment Factor[1]
Yearly Pollutant Removal: Pollutant Load Export Rate * Drainage Area * Efficiency

Cost

	Materials and Installation Cost ($/ft^3) (2020)	Design Cost ($/ft^3) (2020)	Total Cost ($/ft^3) (2020)[1,2]
Rural	11.97	6.44	18.41
Mixed	23.93	12.89	36.82
Urban	35.90	19.33	55.23

[1] EPA Memorandum "Methodology for developing cost estimates for Opti-Tool." Februrary 20, 2016
[2] Converted from 2010 to 2020 dollars using U.S. Department of Labor (USDOL). (2012). Bureau of Labor Statistics consumer price index inflation calculator. http://www.bls.gov/data/inflation_calculator.htm

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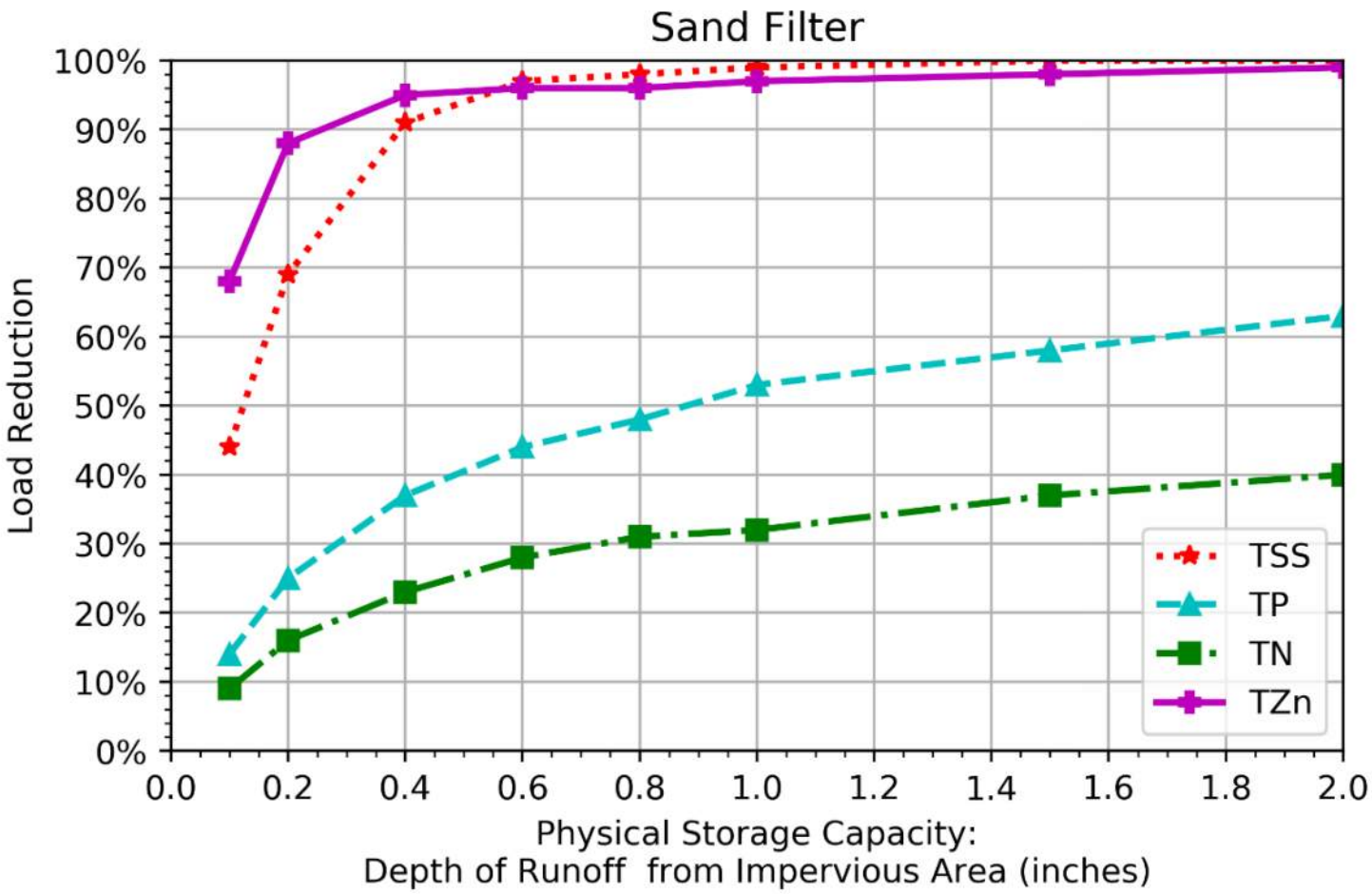
January 2020

BMP Performance Curve for Sand Filter



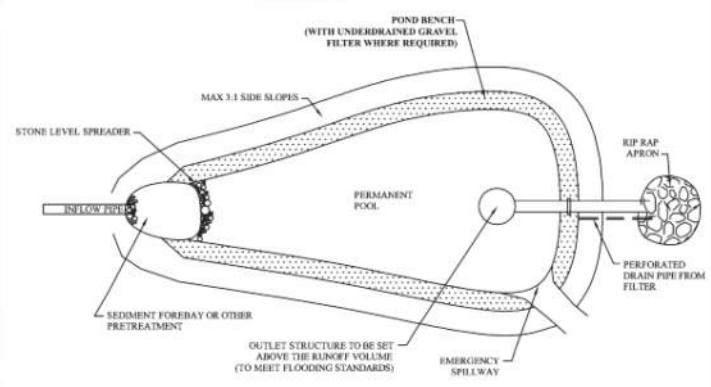
Sand Filter BMP Performance Table								
BMP Capacity: Depth of Runoff from Impervious Area (inches)	0.1	0.2	0.4	0.6	0.8	1.0	1.5	2.0
Cumulative TSS Phosphorus Load Reduction	44%	69%	91%	97%	98%	99%	100%	100%
Cumulative Phosphorus Load Reduction	14%	25%	37%	44%	48%	53%	58%	63%
Cumulative Nitrogen Load Reduction	9%	16%	23%	28%	31%	32%	37%	40%
Cumulative Zinc Phosphorus Load Reduction	68%	88%	95%	96%	96%	97%	98%	99%

Wet Pond Factsheet

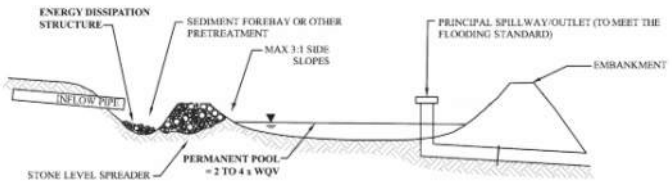
Wet Pond is a class of systems designed to maintain a permanent pool of water year-round. The pool allows for pollutant removal via settling, biological uptake, and decomposition. This allows the system to treat both sediment loads and its commonly associated pollutants along with treating dissolved nutrients through the pond's biological processes. For areas where water temperature is a concern, an underdrained gravel trench in the bench area around the permanent pool can allow for the extended release of stormwater, minimizing risk of clogging. General design specifications for wet pond systems are provided in the most recent version of *The New Hampshire Stormwater Manual, Volume 2: Post-Construction Best Management Practices Selection and Design*.

Sample Design

Plan View



Profile View



Examples images from the *New Hampshire Stormwater Manual, Volume 2,* p. 61

Pollutant Export Rate by Land Use[1]

Source Category by Land Use	Land Surface Cover	P Load Export Rate[1] (lbs./acre/year)	N Load Export Rate[2] (lbs./acre/year)
Commercial (COM) and Industrial (IND)	Directly connected impervious	1.78	15
Multi-Family (MFR) and High-Density Residential (HDR)	Directly connected impervious	2.32	14.1
Medium-Density Residential (MDR)	Directly connected impervious	1.96	14.1
Low-Density Residential (LDR) - "Rural"	Directly connected impervious	1.52	14.1

[1] From NH Small MS4 General Permit, Appendix F

General Equations

Physical Storage Capacity: Depth of Runoff * Drainage Area
Cost: Physical Storage Capacity * Cost Index * Adjustment Factor[1]
Yearly Pollutant Removal: Pollutant Load Export Rate * Drainage Area * Efficiency

Cost

	Materials and Installation Cost ($/ft^3) (2020)	Design Cost ($/ft^3) (2020)	Total Cost ($/ft^3) (2020)[1,2]
Rural	4.54	2.44	6.98
Mixed	9.07	4.89	13.96
Urban	13.61	7.33	20.94

[1] EPA Memorandum "Methodology for developing cost estimates for Opti-Tool." Februrary 20, 2016
[2] Converted from 2010 to 2020 dollars using U.S. Department of Labor (USDOL). (2012). Bureau of Labor Statistics consumer price index inflation calculator. http://www.bls.gov/data/inflation_calculator.htm

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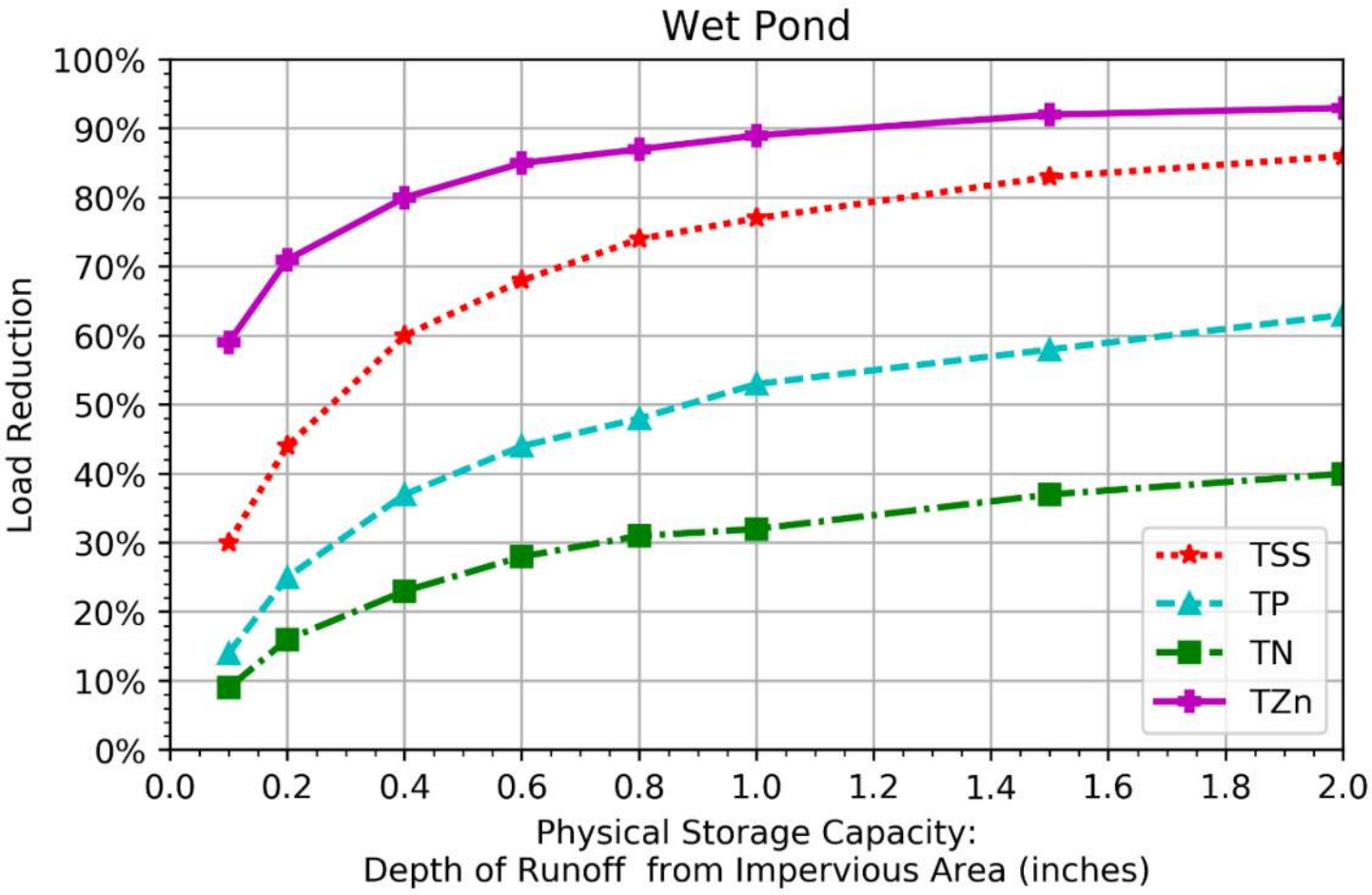
BMP Performance Curve for Wet Pond



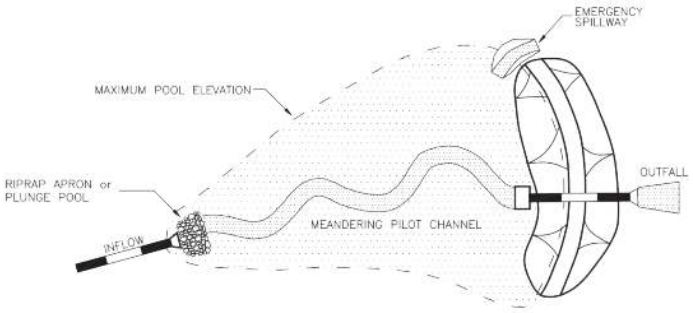
Wet Pond BMP Performance Table								
BMP Capacity: Depth of Runoff from Impervious Area (inches)	0.1	0.2	0.4	0.6	0.8	1.0	1.5	2.0
Cumulative TSS Phosphorus Load Reduction	30%	44%	60%	68%	74%	77%	83%	86%
Cumulative Phosphorus Load Reduction	14%	25%	37%	44%	48%	53%	58%	63%
Cumulative Nitrogen Load Reduction	9%	16%	23%	28%	31%	32%	37%	40%
Cumulative Zinc Phosphorus Load Reduction	59%	71%	80%	85%	87%	89%	92%	93%

Extended Dry Detention Basin Factsheet

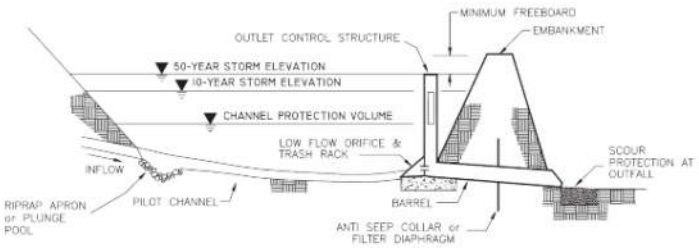
Detention Basin consists of a type of system which is primarily intended to provide flood protection by containing the flow within an excavated area and gradually releasing it over the course of a design length of time, with extended dry detention basins typically having a detention time of 24 hours. This reduces the intensity of peak flows, and the detention time allows the treatment of some pollutants, particularly those associated with suspended solids. A detention basin may be combined with other BPMs to combine detention with other treatment methods. Dry detention basins are often referred to as dry ponds, due to their similarity in design to wet ponds. General design specifications for detention basin systems are provided in the most recent version of *The New Hampshire Stormwater Manual, Volume 2: Post-Construction Best Management Practices Selection and Design*.

Sample Design

Plan View



Profile View



Examples images from the *New Hampshire Stormwater Manual, Volume 2,* p. 159

Pollutant Export Rate by Land Use[1]

Source Category by Land Use	Land Surface Cover	P Load Export Rate[1] (lbs./acre/year)	N Load Export Rate[2] (lbs./acre/year)
Commercial (COM) and Industrial (IND)	Directly connected impervious	1.78	15
Multi-Family (MFR) and High-Density Residential (HDR)	Directly connected impervious	2.32	14.1
Medium-Density Residential (MDR)	Directly connected impervious	1.96	14.1
Low-Density Residential (LDR) - "Rural"	Directly connected impervious	1.52	14.1

[1] From NH Small MS4 General Permit, Appendix F

General Equations

Physical Storage Capacity: Depth of Runoff * Drainage Area
Cost: Physical Storage Capacity * Cost Index * Adjustment Factor[1]
Yearly Pollutant Removal: Pollutant Load Export Rate * Drainage Area * Efficiency

Cost

	Materials and Installation Cost ($/ft^3) (2020)	Design Cost ($/ft^3) (2020)	Total Cost ($/ft^3) (2020)[1,2]
Rural	4.54	2.44	6.98
Mixed	9.07	4.89	13.96
Urban	13.61	7.33	20.94

[1] EPA Memorandum "Methodology for developing cost estimates for Opti-Tool." Februrary 20, 2016
[2] Converted from 2010 to 2020 dollars using U.S. Department of Labor (USDOL). (2012). Bureau of Labor Statistics consumer price index inflation calculator. http://www.bls.gov/data/inflation_calculator.htm

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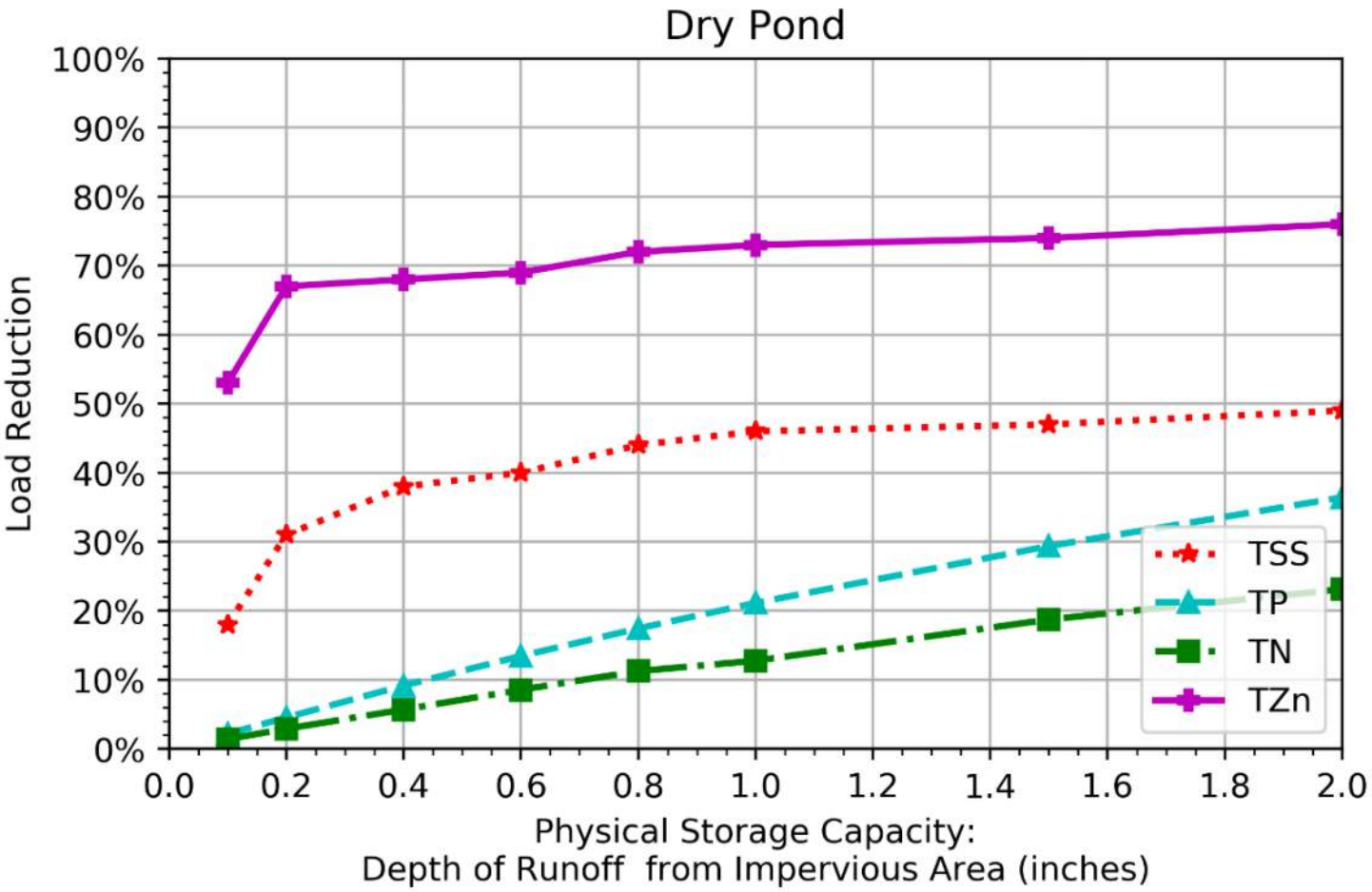
January 2020

BMP Performance Curve for Extended Dry Detention Basin



Dry Pond BMP Performance Table								
BMP Capacity: Depth of Runoff from Impervious Area (inches)	0.1	0.2	0.4	0.6	0.8	1.0	1.5	2.0
Cumulative TSS Phosphorus Load Reduction	18%	31%	38%	40%	44%	46%	47%	49%
Cumulative Phosphorus Load Reduction	2%	5%	9%	13%	17%	21%	29%	36%
Cumulative Nitrogen Load Reduction	1%	3%	6%	9%	11%	13%	19%	23%
Cumulative Zinc Phosphorus Load Reduction	53%	67%	68%	69%	72%	73%	74%	76%

Prioritized Parcel Opportunity Cost Report Sheets

Davis Playground

Infiltration Chamber

Project Reference Number	1
Parcel ID	31016 0017
Address/Location	EDEN AVE
Property Description	Davis Playground

Additional Municipal Parcels Treated
33034 0049, 31021 0050A, 33034 0009

Invert Depth at Intercepted Pipe (ft)	Unk
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	77.1
Total Contributing Area (ac.)	156.4
Generated TP Load from Total Area (lb/yr)	164.0
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	39,764.00
Treatment Depth (in.)	0.3
Reduction Efficiency	68%
SCM Volume (CF)	87,285
Total Load Reduction (lb/y) :	**111.5**

EPA Cost Breakdown (Adjusted for 2023)	
Construction Cost	$ 4,452,000
Soft Cost (35% of Construction Cost)	$ 1,558,200

W&C Cost Breakdown (2023)	
Construction Cost	$ 1,659,000
Excavation Adjustment	$ 159,056
Site Specific Adjustment	$ 25,000
Soft Cost (28.5% of Total Construction Cost)	$ 525,271
Project Contingency (20% Total Construction and Soft Costs)	$ 473,665

2023 EPA Total Cost Breakdown	
Total Cost	**$ 6,010,200**
Cost/Benefit ($/lb/yr)	**$ 53,897**

2023 W&C Total Cost Breakdown	
Total Cost	**$ 2,841,992**
Cost/Benefit ($/lb/yr)	**$ 25,486**

Elliot St DPW Yard

Infiltration Chamber

Project Reference Number	2
Parcel ID	51029 0037
Address/Location	60 ELLIOT ST
Property Description	Elliot St DPW Yard

Additional Municipal Parcels Treated
51015 00170, 51015 0018, 51015 0019, 51015 0020, 51019 0002, 51019 0003, 51019 0004, 51019 0005, 51029 0039, 51029 0037A

Invert Depth at Intercepted Pipe (ft)	2 (along pipe, not at a MH)
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	71.6
Total Contributing Area (ac.)	148.3
Generated TP Load from Total Area (lb/yr)	149.6
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	44,027.00
Treatment Depth (in.)	0.35
Reduction Efficiency	75%
SCM Volume (CF)	96,670
Total Load Reduction (lb/y) :	**111.5**

EPA Cost Breakdown (Adjusted for 2023)	
Construction Cost	$ 4,931,000
Soft Cost (35% of Construction Cost)	$ 1,725,850

W&C Cost Breakdown (2023)	
Construction Cost	$ 1,837,000
Excavation Adjustment	$ 176,108
Site Specific Adjustment	$ 25,000
Soft Cost (28.5% of Total Construction Cost)	$ 580,861
Project Contingency (20% Total Construction and Soft Costs)	$ 523,794

2023 EPA Total Cost Breakdown		
Total Cost	**$**	**6,656,850**
Cost/Benefit ($/lb/yr)	**$**	**59,710**

2023 W&C Total Cost Breakdown		
Total Cost	**$**	**3,142,763**
Cost/Benefit ($/lb/yr)	**$**	**28,190**

Newton Center Playground

Infiltration Basin

Project Reference Number	3A
Parcel ID	64032 0001 (1)
Address/Location	TYLER TER
Property Description	Newton Center Playground

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	7
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	3.9
Total Contributing Area (ac.)	7.5
Generated TP Load from Total Area (lb/yr)	8.0
Dimensions (Length x Width)	80x45
SCM Footprint (SF)	3,600.00
Treatment Depth (in.)	1
Reduction Efficiency	98%
SCM Volume (CF)	14,400
Total Load Reduction (lb/y) :	**7.8**

EPA Cost Breakdown (Adjusted for 2023)		
Construction Cost	$	216,000
Soft Cost (35% of Construction Cost)	$	75,600

W&C Cost Breakdown (2023)		
Construction Cost	$	130,000
Excavation Adjustment	$	-
Site Specific Adjustment	$	-
Soft Cost (28.5% of Total Construction Cost)	$	37,050
Project Contingency (20% Total Construction and Soft Costs)	$	33,410

2023 EPA Total Cost Breakdown		
Total Cost	**$**	**291,600**
Cost/Benefit ($/lb/yr)	**$**	**37,335**

2023 W&C Total Cost Breakdown		
Total Cost	**$**	**200,460**
Cost/Benefit ($/lb/yr)	**$**	**25,666**

Newton Center Playground

Infiltration Chamber

Project Reference Number	3B
Parcel ID	64032 0001 (2)
Address/Location	TYLER TER
Property Description	Newton Center Playground

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	4
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	77.6
Total Contributing Area (ac.)	157.2
Generated TP Load from Total Area (lb/yr)	163.8
Dimensions (Length x Width)	160x250
SCM Footprint (SF)	40,050.00
Treatment Depth (in.)	0.3
Reduction Efficiency	45%
SCM Volume (CF)	87,932
Total Load Reduction (lb/y) :	**73.7**

EPA Cost Breakdown (Adjusted for 2023)	
Construction Cost	$ 4,485,000
Soft Cost (35% of Construction Cost)	$ 1,569,750

W&C Cost Breakdown (2023)	
Construction Cost	$ 1,671,000
Excavation Adjustment	$ 160,200
Site Specific Adjustment	$ -
Soft Cost (28.5% of Total Construction Cost)	$ 521,892
Project Contingency (20% Total Construction and Soft Costs)	$ 470,618

2023 EPA Total Cost Breakdown		
Total Cost	**$**	**6,054,750**
Cost/Benefit ($/lb/yr)	**$**	**82,136**

2023 W&C Total Cost Breakdown		
Total Cost	**$**	**2,823,710**
Cost/Benefit ($/lb/yr)	**$**	**38,305**

Pellegrini Park

Infiltration Chamber

Project Reference Number	4
Parcel ID	14016 0033
Address/Location	11 HAWTHORN ST
Property Description	Pellegrini Park

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	Unk, (~3 at Hawthorn)
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	39.3
Total Contributing Area (ac.)	63.3
Generated TP Load from Total Area (lb/yr)	80.8
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	65,147.00
Treatment Depth (in.)	1
Reduction Efficiency	98%
SCM Volume (CF)	143,302
Total Load Reduction (lb/y) :	**79.2**

EPA Cost Breakdown (Adjusted for 2023)	
Construction Cost	$ 7,309,000
Soft Cost (35% of Construction Cost)	$ 2,558,150

W&C Cost Breakdown (2023)	
Construction Cost	$ 2,723,000
Excavation Adjustment	$ 260,588
Site Specific Adjustment	$ -
Soft Cost (28.5% of Total Construction Cost)	$ 850,323
Project Contingency (20% Total Construction and Soft Costs)	$ 766,782

2023 EPA Total Cost Breakdown	
Total Cost	**$ 9,867,150**
Cost/Benefit ($/lb/yr)	**$ 124,609**

2023 W&C Total Cost Breakdown	
Total Cost	**$ 4,600,693**
Cost/Benefit ($/lb/yr)	**$ 58,101**

Cabot Park

Infiltration Chamber

Project Reference Number	5
Parcel ID	13001 0001
Address/Location	101 EAST SIDE PKWY
Property Description	Cabot Park

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	Unk (N&S)
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	27.3
Total Contributing Area (ac.)	63.1
Generated TP Load from Total Area (lb/yr)	61.3
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	45,842.00
Treatment Depth (in.)	1
Reduction Efficiency	98%
SCM Volume (CF)	99,100
Total Load Reduction (lb/y) :	**60.1**

EPA Cost Breakdown (Adjusted for 2023)	
Construction Cost	$ 5,055,000
Soft Cost (35% of Construction Cost)	$ 1,769,250

W&C Cost Breakdown (2023)	
Construction Cost	$ 1,883,000
Excavation Adjustment	$ 183,368
Site Specific Adjustment	$ 30,000
Soft Cost (28.5% of Total Construction Cost)	$ 597,465
Project Contingency (20% Total Construction and Soft Costs)	$ 538,767

2023 EPA Total Cost Breakdown	
Total Cost	**$ 6,824,250**
Cost/Benefit ($/lb/yr)	**$ 113,544**

2023 W&C Total Cost Breakdown	
Total Cost	**$ 3,232,599**
Cost/Benefit ($/lb/yr)	**$ 53,785**

Peirce School

Infiltration Chamber

Project Reference Number	6
Parcel ID	32021 0006
Address/Location	BERKELEY ST
Property Description	Peirce School

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	3
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	27.8
Total Contributing Area (ac.)	83.6
Generated TP Load from Total Area (lb/yr)	60.6
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	46,523.00
Treatment Depth (in.)	1
Reduction Efficiency	98%
SCM Volume (CF)	102,178
Total Load Reduction (lb/y) :	**59.4**

EPA Cost Breakdown (Adjusted for 2023)	
Construction Cost	$ 5,212,000
Soft Cost (35% of Construction Cost)	$ 1,824,200

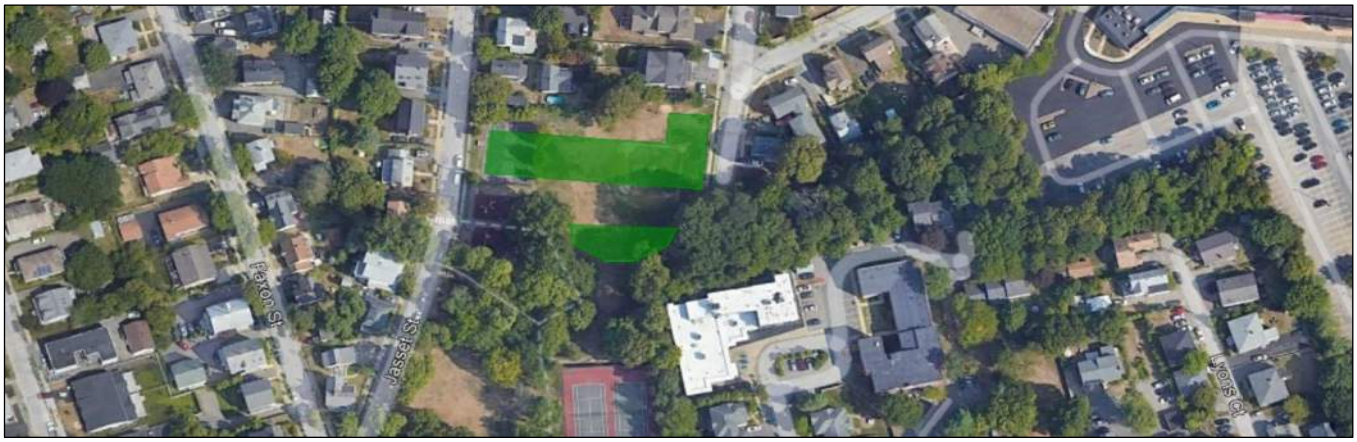
W&C Cost Breakdown (2023)	
Construction Cost	$ 1,942,000
Excavation Adjustment	$ 186,092
Site Specific Adjustment	$ 25,000
Soft Cost (28.5% of Total Construction Cost)	$ 613,631
Project Contingency (20% Total Construction and Soft Costs)	$ 553,345

2023 EPA Total Cost Breakdown	
Total Cost	**$ 7,036,200**
Cost/Benefit ($/lb/yr)	**$ 118,394**

2023 W&C Total Cost Breakdown	
Total Cost	**$ 3,320,068**
Cost/Benefit ($/lb/yr)	**$ 55,865**

Stearns Park

Infiltration Chamber



Project Reference Number	7
Parcel ID	11010 0007
Address/Location	54 JASSET ST
Property Description	Stearns Park

Additional Municipal Parcels Treated
14012 0022

Invert Depth at Intercepted Pipe (ft)	6 (Jasset), 3 (Allison)
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	30.8
Total Contributing Area (ac.)	44.7
Generated TP Load from Total Area (lb/yr)	64.5
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	18,977.00
Treatment Depth (in.)	0.35
Reduction Efficiency	75%
SCM Volume (CF)	41,286
Total Load Reduction (lb/y) :	**48.0**

EPA Cost Breakdown (Adjusted for 2023)	
Construction Cost	$ 2,106,000
Soft Cost (35% of Construction Cost)	$ 737,100

W&C Cost Breakdown (2023)	
Construction Cost	$ 785,000
Excavation Adjustment	$ 151,816
Site Specific Adjustment	$ 15,000
Soft Cost (28.5% of Total Construction Cost)	$ 271,268
Project Contingency (20% Total Construction and Soft Costs)	$ 244,617

2023 EPA Total Cost Breakdown	
Total Cost	**$ 2,843,100**
Cost/Benefit ($/lb/yr)	**$ 59,206**

2023 W&C Total Cost Breakdown	
Total Cost	**$ 1,467,700**
Cost/Benefit ($/lb/yr)	**$ 30,564**

Ward Park

Infiltration Chamber

Project Reference Number	8
Parcel ID	73016 0022
Address/Location	MONTROSE ST
Property Description	Ward Park

Additional Municipal Parcels Treated
73016 0021, 63005 0002

Invert Depth at Intercepted Pipe (ft)	6 (Montrose), 7 (Fellesmere), 6 (Lot), Unk (Woodchester)
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	23.2
Total Contributing Area (ac.)	52.0
Generated TP Load from Total Area (lb/yr)	51.2
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	39,125.00
Treatment Depth (in.)	1
Reduction Efficiency	90%
SCM Volume (CF)	85,660
Total Load Reduction (lb/y) :	**46.1**

EPA Cost Breakdown (Adjusted for 2023)	
Construction Cost	$ 4,369,000
Soft Cost (35% of Construction Cost)	$ 1,529,150

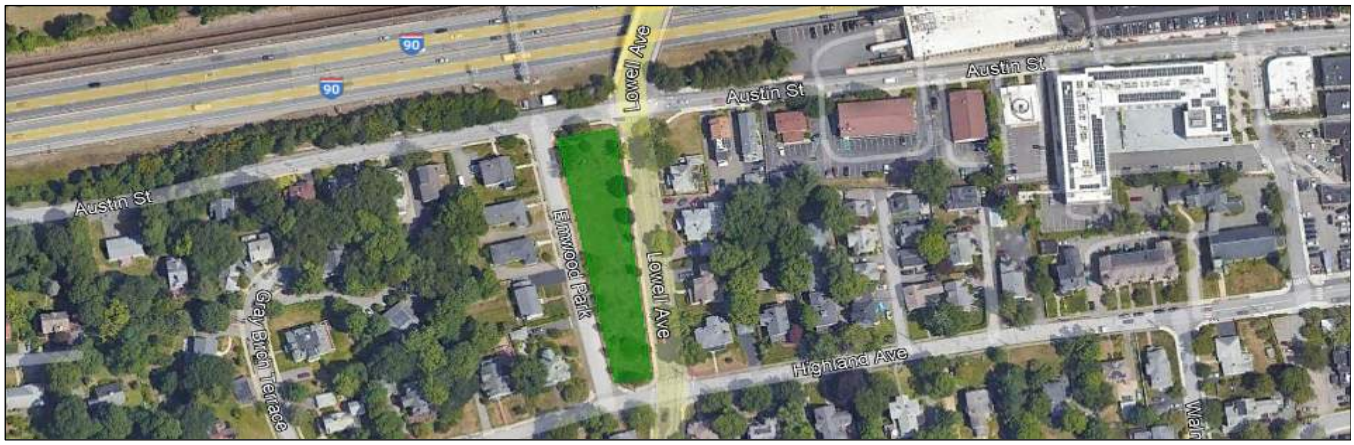
W&C Cost Breakdown (2023)	
Construction Cost	$ 1,628,000
Excavation Adjustment	$ 156,500
Site Specific Adjustment	$ 15,000
Soft Cost (28.5% of Total Construction Cost)	$ 512,858
Project Contingency (20% Total Construction and Soft Costs)	$ 462,472

2023 EPA Total Cost Breakdown	
Total Cost	**$ 5,898,150**
Cost/Benefit ($/lb/yr)	**$ 127,943**

2023 W&C Total Cost Breakdown	
Total Cost	**$ 2,774,829**
Cost/Benefit ($/lb/yr)	**$ 60,192**

Elmwood Park

Infiltration Chamber



Project Reference Number	9
Parcel ID	24008 0001
Address/Location	LOWELL AVE
Property Description	Elmwood Park

Additional Municipal Parcels Treated
24006 0016, 24006 0017, 24009 0004

Invert Depth at Intercepted Pipe (ft)	8 (Austin), 10 (Highland)
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	44.0
Total Contributing Area (ac.)	114.8
Generated TP Load from Total Area (lb/yr)	97.1
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	23,970.00
Treatment Depth (in.)	0.3
Reduction Efficiency	45%
SCM Volume (CF)	52,467
Total Load Reduction (lb/y) :	**43.7**

EPA Cost Breakdown (Adjusted for 2023)	
Construction Cost	$ 2,676,000
Soft Cost (35% of Construction Cost)	$ 936,600

W&C Cost Breakdown (2023)	
Construction Cost	$ 997,000
Excavation Adjustment	$ 191,760
Site Specific Adjustment	$ 50,000
Soft Cost (28.5% of Total Construction Cost)	$ 353,047
Project Contingency (20% Total Construction and Soft Costs)	$ 318,361

2023 EPA Total Cost Breakdown	
Total Cost	**$ 3,612,600**
Cost/Benefit ($/lb/yr)	**$ 82,668**

2023 W&C Total Cost Breakdown	
Total Cost	**$ 1,910,168**
Cost/Benefit ($/lb/yr)	**$ 43,711**

Albemarle Park/Halloran Sports Complex

Infiltration Chamber

Project Reference Number	10
Parcel ID	21022 0001
Address/Location	250 ALBEMARLE RD
Property Description	Albemarle Park/Halloran Sports Complex

Additional Municipal Parcels Treated
21022 0002, 21023 0019A, 23003 0001, 23004 0010

Invert Depth at Intercepted Pipe (ft)	Unk
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	21.4
Total Contributing Area (ac.)	50.5
Generated TP Load from Total Area (lb/yr)	46.1
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	35,489.00
Treatment Depth (in.)	1
Reduction Efficiency	90%
SCM Volume (CF)	77,900
Total Load Reduction (lb/y) :	**41.5**

EPA Cost Breakdown (Adjusted for 2023)	
Construction Cost	$ 3,973,000
Soft Cost (35% of Construction Cost)	$ 1,390,550

W&C Cost Breakdown (2023)	
Construction Cost	$ 1,481,000
Excavation Adjustment	$ 283,912
Site Specific Adjustment	$ 50,000
Soft Cost (28.5% of Total Construction Cost)	$ 517,250
Project Contingency (20% Total Construction and Soft Costs)	$ 466,432

2023 EPA Total Cost Breakdown		
Total Cost	**$**	**5,363,550**
Cost/Benefit ($/lb/yr)	**$**	**129,242**

2023 W&C Total Cost Breakdown		
Total Cost	**$**	**2,798,594**
Cost/Benefit ($/lb/yr)	**$**	**67,436**

Wellington Playground

Infiltration Chamber

Project Reference Number	11
Parcel ID	33030 0020
Address/Location	HENSHAW PL OFF
Property Description	Wellington Playground

Additional Municipal Parcels Treated
34026 0002A

Invert Depth at Intercepted Pipe (ft)	8 (North), 9 (South)
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	18.0
Total Contributing Area (ac.)	35.2
Generated TP Load from Total Area (lb/yr)	38.3
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	33,085.00
Treatment Depth (in.)	1
Reduction Efficiency	98%
SCM Volume (CF)	72,560
Total Load Reduction (lb/y) :	**37.5**

EPA Cost Breakdown (Adjusted for 2023)	
Construction Cost	$ 3,701,000
Soft Cost (35% of Construction Cost)	$ 1,295,350

W&C Cost Breakdown (2023)	
Construction Cost	$ 1,379,000
Excavation Adjustment	$ 264,680
Site Specific Adjustment	$ 25,000
Soft Cost (28.5% of Total Construction Cost)	$ 475,574
Project Contingency (20% Total Construction and Soft Costs)	$ 428,851

2023 EPA Total Cost Breakdown	
Total Cost	**$ 4,996,350**
Cost/Benefit ($/lb/yr)	**$ 133,219**

2023 W&C Total Cost Breakdown	
Total Cost	**$ 2,573,105**
Cost/Benefit ($/lb/yr)	**$ 68,607**

Cold Spring Park

Gravel/Constructed Wetland

Project Reference Number	12
Parcel ID	54021 0002
Address/Location	170 R PLYMOUTH RD
Property Description	Cold Spring Park

Additional Municipal Parcels Treated
54021 0001, 54017 0013, 54027 0001, 54030 0010, 54030 0017, 54031 0006

Invert Depth at Intercepted Pipe (ft)	Unk
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	26.9
Total Contributing Area (ac.)	85.1
Generated TP Load from Total Area (lb/yr)	59.4
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	33,000.00
Treatment Depth (in.)	0.65
Reduction Efficiency	53%
SCM Volume (CF)	66,000
Total Load Reduction (lb/y) :	**31.2**

EPA Cost Breakdown (Adjusted for 2023)	
Construction Cost	$ 1,386,000
Soft Cost (35% of Construction Cost)	$ 485,100

W&C Cost Breakdown (2023)	
Construction Cost	$ 1,518,000
Excavation Adjustment	$ -
Site Specific Adjustment	$ -
Soft Cost (28.5% of Total Construction Cost)	$ 432,630
Project Contingency (20% Total Construction and Soft Costs)	$ 390,126

2023 EPA Total Cost Breakdown	
Total Cost	**$ 1,871,100**
Cost/Benefit ($/lb/yr)	**$ 59,952**

2023 W&C Total Cost Breakdown	
Total Cost	**$ 2,340,756**
Cost/Benefit ($/lb/yr)	**$ 75,000**

Oak Hill Middle School Parking

Infiltration Chamber

Project Reference Number	13
Parcel ID	81006 0001
Address/Location	WHEELER RD
Property Description	Oak Hill Middle School Parking

Additional Municipal Parcels Treated
81005 0011

Invert Depth at Intercepted Pipe (ft)	Unk
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	18.3
Total Contributing Area (ac.)	37.2
Generated TP Load from Total Area (lb/yr)	37.8
Dimensions (Length x Width)	200x115
SCM Footprint (SF)	23,000.00
Treatment Depth (in.)	0.65
Reduction Efficiency	76%
SCM Volume (CF)	46,000
Total Load Reduction (lb/y) :	**28.5**

EPA Cost Breakdown (Adjusted for 2023)	
Construction Cost	$ 2,346,000
Soft Cost (35% of Construction Cost)	$ 821,100

W&C Cost Breakdown (2023)	
Construction Cost	$ 874,000
Excavation Adjustment	$ 184,000
Site Specific Adjustment	$ 50,000
Soft Cost (28.5% of Total Construction Cost)	$ 315,780
Project Contingency (20% Total Construction and Soft Costs)	$ 284,756

2023 EPA Total Cost Breakdown	
Total Cost	**$ 3,167,100**
Cost/Benefit ($/lb/yr)	**$ 111,026**

2023 W&C Total Cost Breakdown	
Total Cost	**$ 1,708,536**
Cost/Benefit ($/lb/yr)	**$ 59,895**

Richard McGrath Park

Infiltration Chamber

Project Reference Number	14
Parcel ID	32024 0006A
Address/Location	WASHINGTON ST
Property Description	Richard McGrath Park

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	8
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	13.1
Total Contributing Area (ac.)	23.7
Generated TP Load from Total Area (lb/yr)	27.6
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	12,000.00
Treatment Depth (in.)	0.5
Reduction Efficiency	86%
SCM Volume (CF)	24,000
Total Load Reduction (lb/y) :	**23.7**

EPA Cost Breakdown (Adjusted for 2023)	
Construction Cost	$ 1,224,000
Soft Cost (35% of Construction Cost)	$ 428,400

W&C Cost Breakdown (2023)	
Construction Cost	$ 456,000
Excavation Adjustment	$ 96,000
Site Specific Adjustment	$ 50,000
Soft Cost (28.5% of Total Construction Cost)	$ 171,570
Project Contingency (20% Total Construction and Soft Costs)	$ 154,714

2023 EPA Total Cost Breakdown	
Total Cost	**$ 1,652,400**
Cost/Benefit ($/lb/yr)	**$ 69,656**

2023 W&C Total Cost Breakdown	
Total Cost	**$ 928,284**
Cost/Benefit ($/lb/yr)	**$ 39,131**

Richardson Playground

Infiltration Chamber

Project Reference Number	15
Parcel ID	53016 0007
Address/Location	ALLEN AVE
Property Description	Richardson Playground

Additional Municipal Parcels Treated
53016 0002, 53022 0009, 54012 0010

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	10.7
Total Contributing Area (ac.)	36.0
Generated TP Load from Total Area (lb/yr)	23.5
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	19,500.00
Treatment Depth (in.)	1
Reduction Efficiency	98%
SCM Volume (CF)	39,000
Total Load Reduction (lb/y) :	**23.0**

EPA Cost Breakdown (Adjusted for 2023)	
Construction Cost	$ 1,989,000
Soft Cost (35% of Construction Cost)	$ 696,150

W&C Cost Breakdown (2023)	
Construction Cost	$ 741,000
Excavation Adjustment	$ 156,000
Site Specific Adjustment	$ 25,000
Soft Cost (28.5% of Total Construction Cost)	$ 262,770
Project Contingency (20% Total Construction and Soft Costs)	$ 236,954

2023 EPA Total Cost Breakdown	
Total Cost	**$ 2,685,150**
Cost/Benefit ($/lb/yr)	**$ 116,509**

2023 W&C Total Cost Breakdown	
Total Cost	**$ 1,421,724**
Cost/Benefit ($/lb/yr)	**$ 61,689**

Auburndale and Lyons Parks

Gravel/Constructed Wetland

Project Reference Number	16
Parcel ID	41022 0001
Address/Location	COMMONWEALTH AVE
Property Description	Auburndale and Lyons Parks

Additional Municipal Parcels Treated
41013 0012, 41013 0013, 43031 0002, 43031 0003

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	30.3
Total Contributing Area (ac.)	65.5
Generated TP Load from Total Area (lb/yr)	63.8
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	19,000.00
Treatment Depth (in.)	0.3
Reduction Efficiency	34%
SCM Volume (CF)	38,000
Total Load Reduction (lb/y) :	**21.4**

EPA Cost Breakdown (Adjusted for 2023)	
Construction Cost	$ 798,000
Soft Cost (35% of Construction Cost)	$ 279,300

W&C Cost Breakdown (2023)	
Construction Cost	$ 874,000
Excavation Adjustment	$ -
Site Specific Adjustment	$ 50,000
Soft Cost (28.5% of Total Construction Cost)	$ 263,340
Project Contingency (20% Total Construction and Soft Costs)	$ 237,468

2023 EPA Total Cost Breakdown	
Total Cost	**$ 1,077,300**
Cost/Benefit ($/lb/yr)	**$ 50,386**

2023 W&C Total Cost Breakdown	
Total Cost	**$ 1,424,808**
Cost/Benefit ($/lb/yr)	**$ 66,639**

Mason-Rice School

Infiltration Basin

Project Reference Number	17A
Parcel ID	64032 0005 (1)
Address/Location	149 PLEASANT ST CTR
Property Description	Mason-Rice School

Additional Municipal Parcels Treated
64032 0006

Invert Depth at Intercepted Pipe (ft)	Unk
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	13.1
Total Contributing Area (ac.)	26.9
Generated TP Load from Total Area (lb/yr)	27.6
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	3,200.00
Treatment Depth (in.)	0.25
Reduction Efficiency	72%
SCM Volume (CF)	12,800
Total Load Reduction (lb/y) :	**19.9**

EPA Cost Breakdown (Adjusted for 2023)	
Construction Cost	$ 192,000
Soft Cost (35% of Construction Cost)	$ 67,200

W&C Cost Breakdown (2023)	
Construction Cost	$ 116,000
Excavation Adjustment	$ -
Site Specific Adjustment	$ 25,000
Soft Cost (28.5% of Total Construction Cost)	$ 40,185
Project Contingency (20% Total Construction and Soft Costs)	$ 36,237

2023 EPA Total Cost Breakdown	
Total Cost	**$ 259,200**
Cost/Benefit ($/lb/yr)	**$ 13,024**

2023 W&C Total Cost Breakdown	
Total Cost	**$ 217,422**
Cost/Benefit ($/lb/yr)	**$ 10,925**

Mason-Rice School

Porous Pavement

Project Reference Number	17B
Parcel ID	64032 0005 (2)
Address/Location	149 PLEASANT ST CTR
Property Description	Mason-Rice School

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	0.5
Total Contributing Area (ac.)	0.5
Generated TP Load from Total Area (lb/yr)	0.9
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	23,000
Treatment Depth (in.)	1.00
Reduction Efficiency	62%
SCM Volume (CF)	20,700
Total Load Reduction (lb/y) :	**0.6**

EPA Cost Breakdown (Adjusted for 2023)	
Construction Cost	$ 870,000
Soft Cost (35% of Construction Cost)	$ 304,500
Total Cost	**$ 1,174,500**
Cost/Benefit ($/lb/yr)	**$ 2,015,586**

W&C Cost Breakdown (2023)	
Construction Cost	$ 1,242,000
Soft Cost (28.5% of Total Construction Cost)	$ 353,970
Project Contingency (20% Total Construction and Soft Costs)	$ 319,194
Total Cost	**$ 1,915,164**
Cost/Benefit ($/lb/yr)	**$ 3,286,656**

West Pine St Parking lot

Infiltration Chamber

Project Reference Number	18
Parcel ID	41031 0037
Address/Location	WEST PINE ST
Property Description	West Pine St Parking lot

Additional Municipal Parcels Treated
41031 0036A

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	9.0
Total Contributing Area (ac.)	20.3
Generated TP Load from Total Area (lb/yr)	18.9
Dimensions (Length x Width)	164x100
SCM Footprint (SF)	16,400.00
Treatment Depth (in.)	1
Reduction Efficiency	98%
SCM Volume (CF)	32,800
Total Load Reduction (lb/y) :	**18.5**

EPA Cost Breakdown (Adjusted for 2023)	
Construction Cost	$ 1,673,000
Soft Cost (35% of Construction Cost)	$ 585,550

W&C Cost Breakdown (2023)	
Construction Cost	$ 624,000
Excavation Adjustment	$ 131,200
Site Specific Adjustment	$ 15,000
Soft Cost (28.5% of Total Construction Cost)	$ 219,507
Project Contingency (20% Total Construction and Soft Costs)	$ 197,941

2023 EPA Total Cost Breakdown	
Total Cost	**$ 2,258,550**
Cost/Benefit ($/lb/yr)	**$ 122,179**

2023 W&C Total Cost Breakdown	
Total Cost	**$ 1,187,648**
Cost/Benefit ($/lb/yr)	**$ 64,247**

Franklin Elementary School

Infiltration Chamber

Project Reference Number	19
Parcel ID	34037 0021
Address/Location	125 DERBY ST
Property Description	Franklin Elementary School

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	C
Impervious Drainage Area (ac.)	9.1
Total Contributing Area (ac.)	18.0
Generated TP Load from Total Area (lb/yr)	20.0
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	17,000.00
Treatment Depth (in.)	1
Reduction Efficiency	92%
SCM Volume (CF)	34,000
Total Load Reduction (lb/y) :	**18.4**

EPA Cost Breakdown (Adjusted for 2023)	
Construction Cost	$ 1,734,000
Soft Cost (35% of Construction Cost)	$ 606,900

W&C Cost Breakdown (2023)	
Construction Cost	$ 646,000
Excavation Adjustment	$ 136,000
Site Specific Adjustment	$ 25,000
Soft Cost (28.5% of Total Construction Cost)	$ 229,995
Project Contingency (20% Total Construction and Soft Costs)	$ 207,399

2023 EPA Total Cost Breakdown	
Total Cost	**$ 2,340,900**
Cost/Benefit ($/lb/yr)	**$ 127,279**

2023 W&C Total Cost Breakdown	
Total Cost	**$ 1,244,394**
Cost/Benefit ($/lb/yr)	**$ 67,660**

Countryside School

Infiltration Basin

Project Reference Number	20A
Parcel ID	83006 0011 (1)
Address/Location	191 DEDHAM ST
Property Description	Countryside School

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	1.7
Total Contributing Area (ac.)	3.2
Generated TP Load from Total Area (lb/yr)	3.5
Dimensions (Length x Width)	40x40
SCM Footprint (SF)	1,600
Treatment Depth (in.)	1.00
Reduction Efficiency	92%
SCM Volume (CF)	6,400
Total Load Reduction (lb/y) :	**3.2**

EPA Cost Breakdown (Adjusted for 2023)		
Construction Cost	$	96,000
Soft Cost (35% of Construction Cost)	$	33,600
Total Cost	**$**	**129,600**
Cost/Benefit ($/lb/yr)	**$**	**40,729**

W&C Cost Breakdown (2023)		
Construction Cost	$	58,000
Soft Cost (28.5% of Total Construction Cost)	$	16,530
Project Contingency (20% Total Construction and Soft Costs)	$	14,906
Total Cost	**$**	**89,436**
Cost/Benefit ($/lb/yr)	**$**	**28,107**

Countryside School

Infiltration Chamber

Project Reference Number	20B
Parcel ID	83006 0011 (2)
Address/Location	191 DEDHAM ST
Property Description	Countryside School

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	8.1
Total Contributing Area (ac.)	17.1
Generated TP Load from Total Area (lb/yr)	16.8
Dimensions (Length x Width)	148x100
SCM Footprint (SF)	14,800.00
Treatment Depth (in.)	1
Reduction Efficiency	90%
SCM Volume (CF)	29,600
Total Load Reduction (lb/y) :	**15.1**

EPA Cost Breakdown (Adjusted for 2023)	
Construction Cost	$ 1,510,000
Soft Cost (35% of Construction Cost)	$ 528,500

W&C Cost Breakdown (2023)	
Construction Cost	$ 563,000
Excavation Adjustment	$ 118,400
Site Specific Adjustment	$ 25,000
Soft Cost (28.5% of Total Construction Cost)	$ 201,324
Project Contingency (20% Total Construction and Soft Costs)	$ 181,545

2023 EPA Total Cost Breakdown	
Total Cost	**$ 2,038,500**
Cost/Benefit ($/lb/yr)	**$ 135,000**

2023 W&C Total Cost Breakdown	
Total Cost	**$ 1,089,269**
Cost/Benefit ($/lb/yr)	**$ 72,137**

Resource Recovery Center

Infiltration Chamber

Project Reference Number	21
Parcel ID	41031 0043
Address/Location	211 LEXINGTON ST
Property Description	Resource Recovery Center

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	Unk
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	24.9
Total Contributing Area (ac.)	60.8
Generated TP Load from Total Area (lb/yr)	54.3
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	18,213.00
Treatment Depth (in.)	0.2
Reduction Efficiency	33%
SCM Volume (CF)	18,213
Total Load Reduction (lb/y) :	**17.9**

EPA Cost Breakdown (Adjusted for 2023)		
Construction Cost	$	929,000
Soft Cost (35% of Construction Cost)	$	325,150

W&C Cost Breakdown (2023)		
Construction Cost	$	347,000
Excavation Adjustment	$	145,704
Site Specific Adjustment	$	50,000
Soft Cost (28.5% of Total Construction Cost)	$	154,671
Project Contingency (20% Total Construction and Soft Costs)	$	139,475

2023 EPA Total Cost Breakdown		
Total Cost	**$**	**1,254,150**
Cost/Benefit ($/lb/yr)	**$**	**69,943**

2023 W&C Total Cost Breakdown		
Total Cost	**$**	**836,850**
Cost/Benefit ($/lb/yr)	**$**	**46,670**

Boyd Park

Infiltration Chamber

Project Reference Number	22
Parcel ID	11020 0002
Address/Location	44 JACKSON RD
Property Description	Boyd Park

Additional Municipal Parcels Treated
12004 0033

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	8.9
Total Contributing Area (ac.)	14.8
Generated TP Load from Total Area (lb/yr)	19.2
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	16,300.00
Treatment Depth (in.)	1
Reduction Efficiency	90%
SCM Volume (CF)	32,600
Total Load Reduction (lb/y) :	**17.3**

EPA Cost Breakdown (Adjusted for 2023)	
Construction Cost	$ 1,663,000
Soft Cost (35% of Construction Cost)	$ 582,050

W&C Cost Breakdown (2023)	
Construction Cost	$ 620,000
Excavation Adjustment	$ 130,400
Site Specific Adjustment	$ 25,000
Soft Cost (28.5% of Total Construction Cost)	$ 220,989
Project Contingency (20% Total Construction and Soft Costs)	$ 199,278

2023 EPA Total Cost Breakdown	
Total Cost	**$ 2,245,050**
Cost/Benefit ($/lb/yr)	**$ 129,668**

2023 W&C Total Cost Breakdown	
Total Cost	**$ 1,195,667**
Cost/Benefit ($/lb/yr)	**$ 69,059**

DPW Yard

Infiltration Chamber

Project Reference Number	23A
Parcel ID	23015 0027 (1)
Address/Location	90 CRAFTS ST
Property Description	DPW Yard

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	6.3
Total Contributing Area (ac.)	9.4
Generated TP Load from Total Area (lb/yr)	13.2
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	11,400.00
Treatment Depth (in.)	1
Reduction Efficiency	90%
SCM Volume (CF)	22,800
Total Load Reduction (lb/y) :	**11.9**

EPA Cost Breakdown (Adjusted for 2023)	
Construction Cost	$ 1,163,000
Soft Cost (35% of Construction Cost)	$ 407,050

W&C Cost Breakdown (2023)	
Construction Cost	$ 434,000
Excavation Adjustment	$ 91,200
Site Specific Adjustment	$ -
Soft Cost (28.5% of Total Construction Cost)	$ 149,682
Project Contingency (20% Total Construction and Soft Costs)	$ 134,976

2023 EPA Total Cost Breakdown	
Total Cost	**$ 1,570,050**
Cost/Benefit ($/lb/yr)	**$ 131,830**

2023 W&C Total Cost Breakdown	
Total Cost	**$ 809,858**
Cost/Benefit ($/lb/yr)	**$ 68,000**

DPW Yard

Infiltration Chamber

Project Reference Number	23B
Parcel ID	23015 0027 (2)
Address/Location	90 CRAFTS ST
Property Description	DPW Yard

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	2.5
Total Contributing Area (ac.)	3.2
Generated TP Load from Total Area (lb/yr)	4.5
Dimensions (Length x Width)	50x90
SCM Footprint (SF)	4,500
Treatment Depth (in.)	1.00
Reduction Efficiency	90%
SCM Volume (CF)	9,000
Total Load Reduction (lb/y) :	**4.1**

EPA Cost Breakdown (Adjusted for 2023)		
Construction Cost	$	459,000
Soft Cost (35% of Construction Cost)	$	160,650
Total Cost	**$**	**619,650**
Cost/Benefit ($/lb/yr)	**$**	**152,942**

W&C Cost Breakdown (2023)		
Construction Cost	$	171,000
Soft Cost (28.5% of Total Construction Cost)	$	48,735
Project Contingency (20% Total Construction and Soft Costs)	$	43,947
Total Cost	**$**	**263,682**
Cost/Benefit ($/lb/yr)	**$**	**65,082**

Hunnewell Playground

Infiltration Basin

Project Reference Number	24
Parcel ID	71026 0024
Address/Location	GRASMERE ST
Property Description	Hunnewell Playground

Additional Municipal Parcels Treated
71026 0023

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	7.7
Total Contributing Area (ac.)	18.0
Generated TP Load from Total Area (lb/yr)	17.6
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	6,600.00
Treatment Depth (in.)	0.9
Reduction Efficiency	90%
SCM Volume (CF)	26,400
Total Load Reduction (lb/y) :	**15.8**

EPA Cost Breakdown (Adjusted for 2023)		
Construction Cost	$	396,000
Soft Cost (35% of Construction Cost)	$	138,600

W&C Cost Breakdown (2023)		
Construction Cost	$	238,000
Excavation Adjustment	$	-
Site Specific Adjustment	$	-
Soft Cost (28.5% of Total Construction Cost)	$	67,830
Project Contingency (20% Total Construction and Soft Costs)	$	61,166

2023 EPA Total Cost Breakdown		
Total Cost	**$**	**534,600**
Cost/Benefit ($/lb/yr)	**$**	**33,835**

2023 W&C Total Cost Breakdown		
Total Cost	**$**	**366,996**
Cost/Benefit ($/lb/yr)	**$**	**23,227**

E. Side Parkway Grassed Median

Infiltration Chamber

Project Reference Number	25
Parcel ID	13001 0002
Address/Location	EAST SIDE PKWY
Property Description	E. Side Parkway Grassed Median

Additional Municipal Parcels Treated
13001 0001, 13001 0002

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	10.2
Total Contributing Area (ac.)	22.8
Generated TP Load from Total Area (lb/yr)	22.7
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	4,800.00
Treatment Depth (in.)	0.25
Reduction Efficiency	62%
SCM Volume (CF)	9,600
Total Load Reduction (lb/y) :	**14.0**

EPA Cost Breakdown (Adjusted for 2023)		
Construction Cost	$	490,000
Soft Cost (35% of Construction Cost)	$	171,500

W&C Cost Breakdown (2023)		
Construction Cost	$	183,000
Excavation Adjustment	$	38,400
Site Specific Adjustment	$	50,000
Soft Cost (28.5% of Total Construction Cost)	$	77,349
Project Contingency (20% Total Construction and Soft Costs)	$	69,750

2023 EPA Total Cost Breakdown		
Total Cost	**$**	**661,500**
Cost/Benefit ($/lb/yr)	**$**	**47,389**

2023 W&C Total Cost Breakdown		
Total Cost	**$**	**418,499**
Cost/Benefit ($/lb/yr)	**$**	**29,980**

Newton Commonwealth Golf Course

Infiltration Chamber

Project Reference Number	26A
Parcel ID	72039 0017 (1)
Address/Location	KENRICK ST OFF
Property Description	Newton Commonwealth Golf Course

Additional Municipal Parcels Treated
72039 0018

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	5.2
Total Contributing Area (ac.)	16.8
Generated TP Load from Total Area (lb/yr)	13.5
Dimensions (Length x Width)	50x200
SCM Footprint (SF)	10,000.00
Treatment Depth (in.)	1
Reduction Efficiency	98%
SCM Volume (CF)	20,000
Total Load Reduction (lb/y) :	**13.2**

EPA Cost Breakdown (Adjusted for 2023)	
Construction Cost	$ 1,020,000
Soft Cost (35% of Construction Cost)	$ 357,000

W&C Cost Breakdown (2023)	
Construction Cost	$ 380,000
Excavation Adjustment	$ 80,000
Site Specific Adjustment	$ 15,000
Soft Cost (28.5% of Total Construction Cost)	$ 135,375
Project Contingency (20% Total Construction and Soft Costs)	$ 122,075

2023 EPA Total Cost Breakdown	
Total Cost	**$ 1,377,000**
Cost/Benefit ($/lb/yr)	**$ 103,929**

2023 W&C Total Cost Breakdown	
Total Cost	**$ 732,450**
Cost/Benefit ($/lb/yr)	**$ 55,281**

Newton Commonwealth Golf Course

Infiltration Trench

Project Reference Number	26B
Parcel ID	72039 0017 (2)
Address/Location	KENRICK ST OFF
Property Description	Newton Commonwealth Golf Course

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	0.5
Total Contributing Area (ac.)	0.8
Generated TP Load from Total Area (lb/yr)	0.8
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	800
Treatment Depth (in.)	0.50
Reduction Efficiency	65%
SCM Volume (CF)	960
Total Load Reduction (lb/y) :	**0.5**

EPA Cost Breakdown (Adjusted for 2023)		
Construction Cost	$	28,000
Soft Cost (35% of Construction Cost)	$	9,800
Total Cost	**$**	**37,800**
Cost/Benefit ($/lb/yr)	**$**	**69,077**

W&C Cost Breakdown (2023)		
Construction Cost	$	42,000
Soft Cost (28.5% of Total Construction Cost)	$	11,970
Project Contingency (20% Total Construction and Soft Costs)	$	10,794
Total Cost	**$**	**64,764**
Cost/Benefit ($/lb/yr)	**$**	**118,351**

Hyde Playground and Park

Infiltration Chamber

Project Reference Number	27
Parcel ID	52041 0001
Address/Location	100 LINCOLN ST
Property Description	Hyde Playground and Park

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	6.3
Total Contributing Area (ac.)	17.4
Generated TP Load from Total Area (lb/yr)	13.9
Dimensions (Length x Width)	125x92
SCM Footprint (SF)	11,500.00
Treatment Depth (in.)	1
Reduction Efficiency	98%
SCM Volume (CF)	23,000
Total Load Reduction (lb/y) :	**13.6**

EPA Cost Breakdown (Adjusted for 2023)	
Construction Cost	$ 1,173,000
Soft Cost (35% of Construction Cost)	$ 410,550

W&C Cost Breakdown (2023)	
Construction Cost	$ 437,000
Excavation Adjustment	$ 92,000
Site Specific Adjustment	$ 25,000
Soft Cost (28.5% of Total Construction Cost)	$ 157,890
Project Contingency (20% Total Construction and Soft Costs)	$ 142,378

2023 EPA Total Cost Breakdown		
Total Cost	**$**	**1,583,550**
Cost/Benefit ($/lb/yr)	**$**	**116,654**

2023 W&C Total Cost Breakdown		
Total Cost	**$**	**854,268**
Cost/Benefit ($/lb/yr)	**$**	**62,931**

Newton Police Headquarters Parking Lot

Infiltration Chamber

Project Reference Number	28
Parcel ID	33011 0001
Address/Location	1321 WASHINGTON ST
Property Description	Newton Police Headquarters Parking Lot

Additional Municipal Parcels Treated
33011 0011

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	6.2
Total Contributing Area (ac.)	9.3
Generated TP Load from Total Area (lb/yr)	12.8
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	7,900.00
Treatment Depth (in.)	0.7
Reduction Efficiency	94%
SCM Volume (CF)	15,800
Total Load Reduction (lb/y) :	**12.0**

EPA Cost Breakdown (Adjusted for 2023)		
Construction Cost	$	806,000
Soft Cost (35% of Construction Cost)	$	282,100

W&C Cost Breakdown (2023)		
Construction Cost	$	301,000
Excavation Adjustment	$	63,200
Site Specific Adjustment	$	25,000
Soft Cost (28.5% of Total Construction Cost)	$	110,922
Project Contingency (20% Total Construction and Soft Costs)	$	100,024

2023 EPA Total Cost Breakdown		
Total Cost	**$**	**1,088,100**
Cost/Benefit ($/lb/yr)	**$**	**90,675**

2023 W&C Total Cost Breakdown		
Total Cost	**$**	**600,146**
Cost/Benefit ($/lb/yr)	**$**	**50,012**

Bigelow Middle School

Infiltration Chamber

Project Reference Number	29
Parcel ID	72010 0001
Address/Location	42 VERNON ST
Property Description	Bigelow Middle School

Additional Municipal Parcels Treated
72009 0003

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	5.7
Total Contributing Area (ac.)	13.9
Generated TP Load from Total Area (lb/yr)	13.0
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	10,400.00
Treatment Depth (in.)	1
Reduction Efficiency	90%
SCM Volume (CF)	20,800
Total Load Reduction (lb/y) :	**11.7**

EPA Cost Breakdown (Adjusted for 2023)	
Construction Cost	$ 1,061,000
Soft Cost (35% of Construction Cost)	$ 371,350

W&C Cost Breakdown (2023)	
Construction Cost	$ 396,000
Excavation Adjustment	$ 83,200
Site Specific Adjustment	$ 25,000
Soft Cost (28.5% of Total Construction Cost)	$ 143,697
Project Contingency (20% Total Construction and Soft Costs)	$ 129,579

2023 EPA Total Cost Breakdown	
Total Cost	**$ 1,432,350**
Cost/Benefit ($/lb/yr)	**$ 122,423**

2023 W&C Total Cost Breakdown	
Total Cost	**$ 777,476**
Cost/Benefit ($/lb/yr)	**$ 66,451**

Spears Park

Infiltration Chamber

Project Reference Number	30
Parcel ID	12003 0001
Address/Location	WALNUT PK
Property Description	Spears Park

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	6.3
Total Contributing Area (ac.)	10.7
Generated TP Load from Total Area (lb/yr)	14.0
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	8,000.00
Treatment Depth (in.)	0.65
Reduction Efficiency	76%
SCM Volume (CF)	16,000
Total Load Reduction (lb/y) :	**10.6**

EPA Cost Breakdown (Adjusted for 2023)		
Construction Cost	$	816,000
Soft Cost (35% of Construction Cost)	$	285,600

W&C Cost Breakdown (2023)		
Construction Cost	$	304,000
Excavation Adjustment	$	64,000
Site Specific Adjustment	$	50,000
Soft Cost (28.5% of Total Construction Cost)	$	119,130
Project Contingency (20% Total Construction and Soft Costs)	$	107,426

2023 EPA Total Cost Breakdown		
Total Cost	**$**	**1,101,600**
Cost/Benefit ($/lb/yr)	**$**	**103,925**

2023 W&C Total Cost Breakdown		
Total Cost	**$**	**644,556**
Cost/Benefit ($/lb/yr)	**$**	**60,807**

Cold Spring Park

Gravel/Constructed Wetland

Project Reference Number	31
Parcel ID	54022 0049B
Address/Location	BEACON ST REAR
Property Description	Cold Spring Park

Additional Municipal Parcels Treated
54022 0051A, 54022 0057, 54022 0052A, 54022 0050A, 62004 0015

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	B/D
Impervious Drainage Area (ac.)	26.2
Total Contributing Area (ac.)	55.5
Generated TP Load from Total Area (lb/yr)	55.0
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	4,800.00
Treatment Depth (in.)	0.1
Reduction Efficiency	19%
SCM Volume (CF)	9,600
Total Load Reduction (lb/y) :	**10.5**

EPA Cost Breakdown (Adjusted for 2023)		
Construction Cost	$	202,000
Soft Cost (35% of Construction Cost)	$	70,700

W&C Cost Breakdown (2023)		
Construction Cost	$	221,000
Excavation Adjustment	$	-
Site Specific Adjustment	$	15,000
Soft Cost (28.5% of Total Construction Cost)	$	67,260
Project Contingency (20% Total Construction and Soft Costs)	$	60,652

2023 EPA Total Cost Breakdown		
Total Cost	**$**	**272,700**
Cost/Benefit ($/lb/yr)	**$**	**25,971**

2023 W&C Total Cost Breakdown		
Total Cost	**$**	**363,912**
Cost/Benefit ($/lb/yr)	**$**	**34,658**

Newton Commonwealth Golf Course

Infiltration Chamber

Project Reference Number	32
Parcel ID	72039 0021
Address/Location	MAGNOLIA AVE
Property Description	Newton Commonwealth Golf Course

Additional Municipal Parcels Treated
73009 0019

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	D
Impervious Drainage Area (ac.)	5.8
Total Contributing Area (ac.)	20.8
Generated TP Load from Total Area (lb/yr)	14.3
Dimensions (Length x Width)	125x80
SCM Footprint (SF)	6,600.00
Treatment Depth (in.)	0.6
Reduction Efficiency	73%
SCM Volume (CF)	13,200
Total Load Reduction (lb/y) :	**10.4**

EPA Cost Breakdown (Adjusted for 2023)	
Construction Cost	$ 674,000
Soft Cost (35% of Construction Cost)	$ 235,900

W&C Cost Breakdown (2023)	
Construction Cost	$ 251,000
Excavation Adjustment	$ 52,800
Site Specific Adjustment	$ 40,000
Soft Cost (28.5% of Total Construction Cost)	$ 97,983
Project Contingency (20% Total Construction and Soft Costs)	$ 88,357

2023 EPA Total Cost Breakdown	
Total Cost	**$ 909,900**
Cost/Benefit ($/lb/yr)	**$ 87,490**

2023 W&C Total Cost Breakdown	
Total Cost	**$ 530,140**
Cost/Benefit ($/lb/yr)	**$ 50,975**

Brown Middle School

Infiltration Chamber

Project Reference Number	33
Parcel ID	81005 0011
Address/Location	125 MEADOWBROOK RD
Property Description	Brown Middle School

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	5.4
Total Contributing Area (ac.)	14.9
Generated TP Load from Total Area (lb/yr)	11.5
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	9,800.00
Treatment Depth (in.)	1
Reduction Efficiency	90%
SCM Volume (CF)	19,600
Total Load Reduction (lb/y) :	**10.4**

EPA Cost Breakdown (Adjusted for 2023)	
Construction Cost	$ 1,000,000
Soft Cost (35% of Construction Cost)	$ 350,000

W&C Cost Breakdown (2023)	
Construction Cost	$ 373,000
Excavation Adjustment	$ 78,400
Site Specific Adjustment	$ 25,000
Soft Cost (28.5% of Total Construction Cost)	$ 135,774
Project Contingency (20% Total Construction and Soft Costs)	$ 122,435

2023 EPA Total Cost Breakdown	
Total Cost	**$ 1,350,000**
Cost/Benefit ($/lb/yr)	**$ 129,808**

2023 W&C Total Cost Breakdown	
Total Cost	**$ 734,609**
Cost/Benefit ($/lb/yr)	**$ 70,635**

Newton South High School

Infiltration Chamber

Project Reference Number	34A
Parcel ID	81051 0047 (1)
Address/Location	140 BRANDEIS RD
Property Description	Newton South High School

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	3.9
Total Contributing Area (ac.)	4.8
Generated TP Load from Total Area (lb/yr)	7.2
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	7,200
Treatment Depth (in.)	1.00
Reduction Efficiency	90%
SCM Volume (CF)	14,400
Total Load Reduction (lb/y) :	**6.5**

EPA Cost Breakdown (Adjusted for 2023)		
Construction Cost	$	735,000
Soft Cost (35% of Construction Cost)	$	257,250
Total Cost	**$**	**992,250**
Cost/Benefit ($/lb/yr)	**$**	**152,654**

W&C Cost Breakdown (2023)		
Construction Cost	$	274,000
Soft Cost (28.5% of Total Construction Cost)	$	78,090
Project Contingency (20% Total Construction and Soft Costs)	$	70,418
Total Cost	**$**	**422,508**
Cost/Benefit ($/lb/yr)	**$**	**65,001**

Newton South High School

Infiltration Chamber

Project Reference Number	34B
Parcel ID	81051 0047 (2)
Address/Location	140 BRANDEIS RD
Property Description	Newton South High School

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	1.5
Total Contributing Area (ac.)	2.1
Generated TP Load from Total Area (lb/yr)	2.9
Dimensions (Length x Width)	50x28
SCM Footprint (SF)	2,300
Treatment Depth (in.)	0.80
Reduction Efficiency	83%
SCM Volume (CF)	4,600
Total Load Reduction (lb/y) :	**2.4**

EPA Cost Breakdown (Adjusted for 2023)		
Construction Cost	$	235,000
Soft Cost (35% of Construction Cost)	$	82,250
Total Cost	**$**	**317,250**
Cost/Benefit ($/lb/yr)	**$**	**132,188**

W&C Cost Breakdown (2023)		
Construction Cost	$	88,000
Soft Cost (28.5% of Total Construction Cost)	$	25,080
Project Contingency (20% Total Construction and Soft Costs)	$	22,616
Total Cost	**$**	**135,696**
Cost/Benefit ($/lb/yr)	**$**	**56,540**

Lowell Park

Infiltration Chamber

Project Reference Number	35
Parcel ID	23013 0001
Address/Location	WATERTOWN ST
Property Description	Lowell Park

Additional Municipal Parcels Treated
23008 0001

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	4.2
Total Contributing Area (ac.)	6.8
Generated TP Load from Total Area (lb/yr)	8.5
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	4,200.00
Treatment Depth (in.)	0.55
Reduction Efficiency	89%
SCM Volume (CF)	8,400
Total Load Reduction (lb/y) :	**7.6**

EPA Cost Breakdown (Adjusted for 2023)		
Construction Cost	$	429,000
Soft Cost (35% of Construction Cost)	$	150,150

W&C Cost Breakdown (2023)		
Construction Cost	$	160,000
Excavation Adjustment	$	33,600
Site Specific Adjustment	$	25,000
Soft Cost (28.5% of Total Construction Cost)	$	62,301
Project Contingency (20% Total Construction and Soft Costs)	$	56,180

2023 EPA Total Cost Breakdown		
Total Cost	**$**	**579,150**
Cost/Benefit ($/lb/yr)	**$**	**76,204**

2023 W&C Total Cost Breakdown		
Total Cost	**$**	**337,081**
Cost/Benefit ($/lb/yr)	**$**	**44,353**

Reverend Ford Playground

Infiltration Chamber

Project Reference Number	36
Parcel ID	33006 0061
Address/Location	70 CRESCENT ST
Property Description	Reverend Ford Playground

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	13.5
Total Contributing Area (ac.)	26.1
Generated TP Load from Total Area (lb/yr)	28.6
Dimensions (Length x Width)	50x80
SCM Footprint (SF)	4,000.00
Treatment Depth (in.)	0.15
Reduction Efficiency	26%
SCM Volume (CF)	8,000
Total Load Reduction (lb/y) :	**7.3**

EPA Cost Breakdown (Adjusted for 2023)		
Construction Cost	$	408,000
Soft Cost (35% of Construction Cost)	$	142,800

W&C Cost Breakdown (2023)		
Construction Cost	$	152,000
Excavation Adjustment	$	32,000
Site Specific Adjustment	$	-
Soft Cost (28.5% of Total Construction Cost)	$	52,440
Project Contingency (20% Total Construction and Soft Costs)	$	47,288

2023 EPA Total Cost Breakdown		
Total Cost	**$**	**550,800**
Cost/Benefit ($/lb/yr)	**$**	**75,452**

2023 W&C Total Cost Breakdown		
Total Cost	**$**	**283,728**
Cost/Benefit ($/lb/yr)	**$**	**38,867**

Bobby Braceland Playground

Infiltration Chamber

Project Reference Number	37
Parcel ID	51045 0003
Address/Location	PENNSYLVANIA AVE
Property Description	Bobby Braceland Playground

Additional Municipal Parcels Treated
51045 0004

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	3.3
Total Contributing Area (ac.)	7.3
Generated TP Load from Total Area (lb/yr)	7.2
Dimensions (Length x Width)	60x100
SCM Footprint (SF)	6,000.00
Treatment Depth (in.)	1
Reduction Efficiency	90%
SCM Volume (CF)	12,000
Total Load Reduction (lb/y) :	**6.5**

EPA Cost Breakdown (Adjusted for 2023)	
Construction Cost	$ 612,000
Soft Cost (35% of Construction Cost)	$ 214,200

W&C Cost Breakdown (2023)	
Construction Cost	$ 228,000
Excavation Adjustment	$ 48,000
Site Specific Adjustment	$ 25,000
Soft Cost (28.5% of Total Construction Cost)	$ 85,785
Project Contingency (20% Total Construction and Soft Costs)	$ 77,357

2023 EPA Total Cost Breakdown	
Total Cost	**$ 826,200**
Cost/Benefit ($/lb/yr)	**$ 127,108**

2023 W&C Total Cost Breakdown	
Total Cost	**$ 464,142**
Cost/Benefit ($/lb/yr)	**$ 71,406**

Emerson Playground

Infiltration Chamber

Project Reference Number	38
Parcel ID	51008 0001A1
Address/Location	51 I PETTEE ST
Property Description	Emerson Playground

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	2.1
Total Contributing Area (ac.)	4.7
Generated TP Load from Total Area (lb/yr)	4.6
Dimensions (Length x Width)	50x78
SCM Footprint (SF)	3,900.00
Treatment Depth (in.)	1
Reduction Efficiency	98%
SCM Volume (CF)	7,800
Total Load Reduction (lb/y) :	**4.5**

EPA Cost Breakdown (Adjusted for 2023)		
Construction Cost	$	398,000
Soft Cost (35% of Construction Cost)	$	139,300

W&C Cost Breakdown (2023)		
Construction Cost	$	149,000
Excavation Adjustment	$	31,200
Site Specific Adjustment	$	15,000
Soft Cost (28.5% of Total Construction Cost)	$	55,632
Project Contingency (20% Total Construction and Soft Costs)	$	50,166

2023 EPA Total Cost Breakdown		
Total Cost	**$**	**537,300**
Cost/Benefit ($/lb/yr)	**$**	**119,400**

2023 W&C Total Cost Breakdown		
Total Cost	**$**	**300,998**
Cost/Benefit ($/lb/yr)	**$**	**66,889**

Memorial-Spaulding School

Infiltration Chamber

Project Reference Number	39
Parcel ID	82021 0001
Address/Location	250 BROOKLINE ST
Property Description	Memorial-Spaulding School

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	2.5
Total Contributing Area (ac.)	4.4
Generated TP Load from Total Area (lb/yr)	5.0
Dimensions (Length x Width)	92x50
SCM Footprint (SF)	4,600.00
Treatment Depth (in.)	1
Reduction Efficiency	90%
SCM Volume (CF)	9,200
Total Load Reduction (lb/y) :	**4.5**

EPA Cost Breakdown (Adjusted for 2023)	
Construction Cost	$ 470,000
Soft Cost (35% of Construction Cost)	$ 164,500

W&C Cost Breakdown (2023)	
Construction Cost	$ 175,000
Excavation Adjustment	$ 36,800
Site Specific Adjustment	$ 25,000
Soft Cost (28.5% of Total Construction Cost	$ 67,488
Project Contingency (20% Total Construction and Soft Costs)	$ 60,858

2023 EPA Total Cost Breakdown	
Total Cost	**$ 634,500**
Cost/Benefit ($/lb/yr)	**$ 141,000**

2023 W&C Total Cost Breakdown	
Total Cost	**$ 365,146**
Cost/Benefit ($/lb/yr)	**$ 81,143**

Loring Park
Infiltration Basin

Project Reference Number	40
Parcel ID	73001 0019
Address/Location	CENTRE ST
Property Description	Loring Park

Additional Municipal Parcels Treated
73001 0018

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	2.1
Total Contributing Area (ac.)	4.8
Generated TP Load from Total Area (lb/yr)	4.3
Dimensions (Length x Width)	50x40
SCM Footprint (SF)	2,000.00
Treatment Depth (in.)	1
Reduction Efficiency	98%
SCM Volume (CF)	8,000
Total Load Reduction (lb/y) :	**4.2**

EPA Cost Breakdown (Adjusted for 2023)	
Construction Cost	$ 120,000
Soft Cost (35% of Construction Cost)	$ 42,000

W&C Cost Breakdown (2023)	
Construction Cost	$ 72,000
Excavation Adjustment	$ -
Site Specific Adjustment	$ 25,000
Soft Cost (28.5% of Total Construction Cost	$ 27,645
Project Contingency (20% Total Construction and Soft Costs)	$ 24,929

2023 EPA Total Cost Breakdown	
Total Cost	**$ 162,000**
Cost/Benefit ($/lb/yr)	**$ 38,571**

2023 W&C Total Cost Breakdown	
Total Cost	**$ 149,574**
Cost/Benefit ($/lb/yr)	**$ 35,613**

Edmands Park (North)

Infiltration Basin

Project Reference Number	41
Parcel ID	13020 0001
Address/Location	70 BLAKE ST
Property Description	Edmands Park (North)

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	1.4
Total Contributing Area (ac.)	6.8
Generated TP Load from Total Area (lb/yr)	3.5
Dimensions (Length x Width)	50x26
SCM Footprint (SF)	1,300.00
Treatment Depth (in.)	1
Reduction Efficiency	98%
SCM Volume (CF)	5,200
Total Load Reduction (lb/y) :	**3.4**

EPA Cost Breakdown (Adjusted for 2023)		
Construction Cost	$	78,000
Soft Cost (35% of Construction Cost)	$	27,300

W&C Cost Breakdown (2023)		
Construction Cost	$	47,000
Excavation Adjustment	$	-
Site Specific Adjustment	$	-
Soft Cost (28.5% of Total Construction Cost)	$	13,395
Project Contingency (20% Total Construction and Soft Costs)	$	12,079

2023 EPA Total Cost Breakdown		
Total Cost	**$**	**105,300**
Cost/Benefit ($/lb/yr)	**$**	**30,971**

2023 W&C Total Cost Breakdown		
Total Cost	**$**	**72,474**
Cost/Benefit ($/lb/yr)	**$**	**21,316**

Crystal Lake Park

Infiltration Chamber

Project Reference Number	42
Parcel ID	62001 0002
Address/Location	20 ROGERS ST
Property Description	Crystal Lake Park

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	1.6
Total Contributing Area (ac.)	3.3
Generated TP Load from Total Area (lb/yr)	3.4
Dimensions (Length x Width)	75x40
SCM Footprint (SF)	3,000.00
Treatment Depth (in.)	1
Reduction Efficiency	98%
SCM Volume (CF)	6,000
Total Load Reduction (lb/y) :	**3.4**

EPA Cost Breakdown (Adjusted for 2023)		
Construction Cost	$	306,000
Soft Cost (35% of Construction Cost)	$	107,100

W&C Cost Breakdown (2023)		
Construction Cost	$	114,000
Excavation Adjustment	$	24,000
Site Specific Adjustment	$	15,000
Soft Cost (28.5% of Total Construction Cost)	$	43,605
Project Contingency (20% Total Construction and Soft Costs)	$	39,321

2023 EPA Total Cost Breakdown		
Total Cost	**$**	**413,100**
Cost/Benefit ($/lb/yr)	**$**	**121,500**

2023 W&C Total Cost Breakdown		
Total Cost	**$**	**235,926**
Cost/Benefit ($/lb/yr)	**$**	**69,390**

Senior Center

Infiltration Chamber

Project Reference Number	43
Parcel ID	24010 0001
Address/Location	345 WALNUT ST
Property Description	Senior Center

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	1.7
Total Contributing Area (ac.)	2.7
Generated TP Load from Total Area (lb/yr)	3.7
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	3,200.00
Treatment Depth (in.)	1
Reduction Efficiency	90%
SCM Volume (CF)	6,400
Total Load Reduction (lb/y) :	**3.3**

EPA Cost Breakdown (Adjusted for 2023)		
Construction Cost	$	327,000
Soft Cost (35% of Construction Cost)	$	114,450

W&C Cost Breakdown (2023)		
Construction Cost	$	122,000
Excavation Adjustment	$	25,600
Site Specific Adjustment	$	25,000
Soft Cost (28.5% of Total Construction Cost)	$	49,191
Project Contingency (20% Total Construction and Soft Costs)	$	44,358

2023 EPA Total Cost Breakdown		
Total Cost	**$**	**441,450**
Cost/Benefit ($/lb/yr)	**$**	**133,773**

2023 W&C Total Cost Breakdown		
Total Cost	**$**	**266,149**
Cost/Benefit ($/lb/yr)	**$**	**80,651**

Frank Zervas Elementary School

Infiltration Chamber

Project Reference Number	44
Parcel ID	54013 0003
Address/Location	30 BEETHOVEN AVE
Property Description	Frank Zervas Elementary School

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	1.7
Total Contributing Area (ac.)	2.3
Generated TP Load from Total Area (lb/yr)	3.3
Dimensions (Length x Width)	16x100
SCM Footprint (SF)	3,100.00
Treatment Depth (in.)	1
Reduction Efficiency	90%
SCM Volume (CF)	6,200
Total Load Reduction (lb/y) :	**2.9**

EPA Cost Breakdown (Adjusted for 2023)		
Construction Cost	$	317,000
Soft Cost (35% of Construction Cost)	$	110,950

W&C Cost Breakdown (2023)		
Construction Cost	$	118,000
Excavation Adjustment	$	24,800
Site Specific Adjustment	$	25,000
Soft Cost (28.5% of Total Construction Cost)	$	47,823
Project Contingency (20% Total Construction and Soft Costs)	$	43,125

2023 EPA Total Cost Breakdown		
Total Cost	**$**	**427,950**
Cost/Benefit ($/lb/yr)	**$**	**147,569**

2023 W&C Total Cost Breakdown		
Total Cost	**$**	**258,748**
Cost/Benefit ($/lb/yr)	**$**	**89,223**

Adams St Parking Lot

Infiltration Chamber

Project Reference Number	45
Parcel ID	14008 0003
Address/Location	ADAMS ST
Property Description	Adams St Parking Lot

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	1.6
Total Contributing Area (ac.)	2.1
Generated TP Load from Total Area (lb/yr)	3.1
Dimensions (Length x Width)	75x40
SCM Footprint (SF)	3,000.00
Treatment Depth (in.)	1
Reduction Efficiency	90%
SCM Volume (CF)	6,000
Total Load Reduction (lb/y) :	**2.8**

EPA Cost Breakdown (Adjusted for 2023)		
Construction Cost	$	306,000
Soft Cost (35% of Construction Cost)	$	107,100

W&C Cost Breakdown (2023)		
Construction Cost	$	114,000
Excavation Adjustment	$	24,000
Site Specific Adjustment	$	15,000
Soft Cost (28.5% of Total Construction Cost)	$	43,605
Project Contingency (20% Total Construction and Soft Costs)	$	39,321

2023 EPA Total Cost Breakdown		
Total Cost	**$**	**413,100**
Cost/Benefit ($/lb/yr)	**$**	**147,536**

2023 W&C Total Cost Breakdown		
Total Cost	**$**	**235,926**
Cost/Benefit ($/lb/yr)	**$**	**84,259**

Cold Spring Park

Infiltration Trench

Project Reference Number	46
Parcel ID	54022 0058
Address/Location	BEACON ST
Property Description	Cold Spring Park

HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	0.9
Total Contributing Area (ac.)	2.0
Generated TP Load from Total Area (lb/yr)	1.6
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	2,650
Treatment Depth (in.)	1.00
Reduction Efficiency	98%
SCM Volume (CF)	3,180
Total Load Reduction (lb/y) :	**1.6**

EPA Cost Breakdown (Adjusted for 2023)		
Construction Cost	$	93,000
Soft Cost (35% of Construction Cost)	$	32,550
Total Cost	**$**	**125,550**
Cost/Benefit ($/lb/yr)	**$**	**78,469**

W&C Cost Breakdown (2023)		
Construction Cost	$	137,000
Soft Cost (28.5% of Total Construction Cost)	$	39,045
Project Contingency (20% Total Construction and Soft Costs)	$	35,209
Total Cost	**$**	**211,254**
Cost/Benefit ($/lb/yr)	**$**	**132,034**

Forte Park

Infiltration Basin

Project Reference Number	47
Parcel ID	11004 0013
Address/Location	229 R CALIFORNIA ST
Property Description	Forte Park

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	0.5
Total Contributing Area (ac.)	2.0
Generated TP Load from Total Area (lb/yr)	1.2
Dimensions (Length x Width)	9x50
SCM Footprint (SF)	450
Treatment Depth (in.)	1.00
Reduction Efficiency	92%
SCM Volume (CF)	1,800
Total Load Reduction (lb/y) :	**1.1**

EPA Cost Breakdown (Adjusted for 2023)		
Construction Cost	$	27,000
Soft Cost (35% of Construction Cost)	$	9,450
Total Cost	**$**	**36,450**
Cost/Benefit ($/lb/yr)	**$**	**33,136**

W&C Cost Breakdown (2023)		
Construction Cost	$	17,000
Soft Cost (28.5% of Total Construction Cost)	$	4,845
Project Contingency (20% Total Construction and Soft Costs)	$	4,369
Total Cost	**$**	**26,214**
Cost/Benefit ($/lb/yr)	**$**	**23,831**

Underwood School

Infiltration Chamber

Project Reference Number	48
Parcel ID	72002 0003
Address/Location	101 VERNON ST
Property Description	Underwood School

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	0.6
Total Contributing Area (ac.)	0.6
Generated TP Load from Total Area (lb/yr)	1.1
Dimensions (Length x Width)	50x22
SCM Footprint (SF)	1,100
Treatment Depth (in.)	1.00
Reduction Efficiency	90%
SCM Volume (CF)	2,200
Total Load Reduction (lb/y) :	**0.9**

EPA Cost Breakdown (Adjusted for 2023)		
Construction Cost	$	113,000
Soft Cost (35% of Construction Cost)	$	39,550
Total Cost	**$**	**152,550**
Cost/Benefit ($/lb/yr)	**$**	**169,500**

W&C Cost Breakdown (2023)		
Construction Cost	$	42,000
Soft Cost (28.5% of Total Construction Cost)	$	11,970
Project Contingency (20% Total Construction and Soft Costs)	$	10,794
Total Cost	**$**	**64,764**
Cost/Benefit ($/lb/yr)	**$**	**71,960**

Angier School

Infiltration Trench

Project Reference Number	49
Parcel ID	55010 0049
Address/Location	1697 R BEACON ST
Property Description	Angier School

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	0.4
Total Contributing Area (ac.)	0.8
Generated TP Load from Total Area (lb/yr)	0.6
Dimensions (Length x Width)	4x300
SCM Footprint (SF)	1,200
Treatment Depth (in.)	1.00
Reduction Efficiency	90%
SCM Volume (CF)	1,440
Total Load Reduction (lb/y) :	**0.6**

EPA Cost Breakdown (Adjusted for 2023)		
Construction Cost	$	42,000
Soft Cost (35% of Construction Cost)	$	14,700
Total Cost	**$**	**56,700**
Cost/Benefit ($/lb/yr)	**$**	**94,500**

W&C Cost Breakdown (2023)		
Construction Cost	$	62,000
Soft Cost (28.5% of Total Construction Cost)	$	17,670
Project Contingency (20% Total Construction and Soft Costs)	$	15,934
Total Cost	**$**	**95,604**
Cost/Benefit ($/lb/yr)	**$**	**159,340**

Peirce Elementary School

Bio-Filtration

Project Reference Number	50
Parcel ID	32021 0005
Address/Location	170 TEMPLE ST
Property Description	Peirce Elementary School

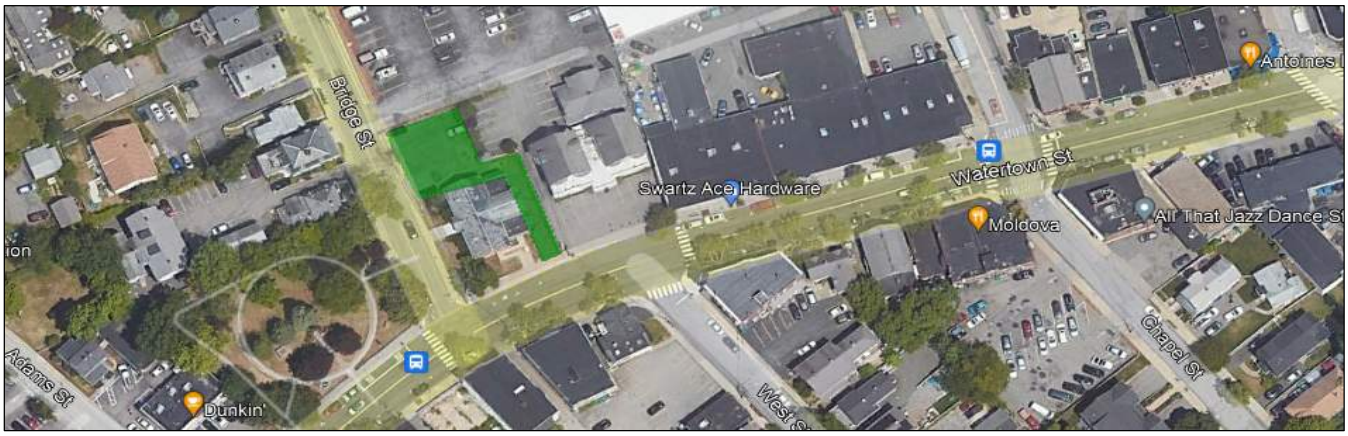
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	0.6
Total Contributing Area (ac.)	0.6
Generated TP Load from Total Area (lb/yr)	1.0
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	1,400
Treatment Depth (in.)	1.00
Reduction Efficiency	53%
SCM Volume (CF)	2,170
Total Load Reduction (lb/y) :	**0.5**

EPA Cost Breakdown (Adjusted for 2023)		
Construction Cost	$	79,000
Soft Cost (35% of Construction Cost)	$	27,650
Total Cost	**$**	**106,650**
Cost/Benefit ($/lb/yr)	**$**	**213,300**

W&C Cost Breakdown (2023)		
Construction Cost	$	40,000
Soft Cost (28.5% of Total Construction Cost)	$	11,400
Project Contingency (20% Total Construction and Soft Costs)	$	10,280
Total Cost	**$**	**61,680**
Cost/Benefit ($/lb/yr)	**$**	**123,360**

Newton Free Library

Porous Pavement



Project Reference Number	51
Parcel ID	14001 0004
Address/Location	144 BRIDGE ST
Property Description	Newton Free Library

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	0.1
Total Contributing Area (ac.)	0.1
Generated TP Load from Total Area (lb/yr)	0.2
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	5,000
Treatment Depth (in.)	1.00
Reduction Efficiency	62%
SCM Volume (CF)	4,500
Total Load Reduction (lb/y) :	**0.1**

EPA Cost Breakdown (Adjusted for 2023)		
Construction Cost	$	189,000
Soft Cost (35% of Construction Cost)	$	66,150
Total Cost	**$**	**255,150**
Cost/Benefit ($/lb/yr)	**$**	**2,551,500**

W&C Cost Breakdown (2023)		
Construction Cost	$	270,000
Soft Cost (28.5% of Total Construction Cost)	$	76,950
Project Contingency (20% Total Construction and Soft Costs)	$	69,390
Total Cost	**$**	**416,340**
Cost/Benefit ($/lb/yr)	**$**	**4,163,400**

Newton Center Playground

Infiltration Trench

Project Reference Number	52
Parcel ID	64032 0003
Address/Location	TYLER TER
Property Description	Newton Center Playground

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	0.1
Total Contributing Area (ac.)	0.3
Generated TP Load from Total Area (lb/yr)	0.1
Dimensions (Length x Width)	5x40
SCM Footprint (SF)	200
Treatment Depth (in.)	1.00
Reduction Efficiency	90%
SCM Volume (CF)	240
Total Load Reduction (lb/y) :	**0.1**

EPA Cost Breakdown (Adjusted for 2023)		
Construction Cost	$	7,000
Soft Cost (35% of Construction Cost)	$	2,450
Total Cost	**$**	**9,450**
Cost/Benefit ($/lb/yr)	**$**	**94,500**

W&C Cost Breakdown (2023)		
Construction Cost	$	11,000
Soft Cost (28.5% of Total Construction Cost)	$	3,135
Project Contingency (20% Total Construction and Soft Costs)	$	2,827
Total Cost	**$**	**16,962**
Cost/Benefit ($/lb/yr)	**$**	**169,620**

Prioritized Roadway Opportunity Cost Report Sheets

Nevada St

Infiltration Chamber

Project Reference Number	1
Roadway Name	Nevada St
Location Description	Nevada @ Village

HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	10.5
Total Contributing Area (ac.)	22.8
Generated TP Load from Total Area (lb/yr)	21.5
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	5,400
Treatment Depth (in.)	0.25
Reduction Efficiency	62%
SCM Volume (CF)	10,800
Total Load Reduction (lb/y) :	**13.2**

EPA Cost Breakdown (Adjusted for 2023)		
Construction Cost	$	551,000
Soft Cost (35% of Construction Cost)	$	192,850
Total Cost	**$**	**743,850**
Cost/Benefit ($/lb/yr)	**$**	**56,158**

W&C Cost Breakdown (2023)		
Construction Cost	$	292,000
Excavation Adjustment	$	43,200
Soft Cost (28.5% of Total Construction Cost)	$	95,532
Project Contingency (20% Total Construction and Soft Costs)	$	86,146
Total Cost	**$**	**516,878**
Cost/Benefit ($/lb/yr)	**$**	**39,023**

Brandeis Rd

Infiltration Chamber

Project Reference Number	2
Roadway Name	Brandeis Rd
Location Description	Greenwood @ Brandeis

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	21.7
Total Contributing Area (ac.)	50.9
Generated TP Load from Total Area (lb/yr)	45.5
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	7,500
Treatment Depth (in.)	0.15
Reduction Efficiency	26%
SCM Volume (CF)	15,000
Total Load Reduction (lb/y) :	**11.6**

EPA Cost Breakdown (Adjusted for 2023)		
Construction Cost	$	765,000
Soft Cost (35% of Construction Cost)	$	267,750
Total Cost	**$**	**1,032,750**
Cost/Benefit ($/lb/yr)	**$**	**89,098**

W&C Cost Breakdown (2023)		
Construction Cost	$	405,000
Excavation Adjustment	$	60,000
Soft Cost (28.5% of Total Construction Cost)	$	132,525
Project Contingency (20% Total Construction and Soft Costs)	$	119,505
Total Cost	**$**	**717,030**
Cost/Benefit ($/lb/yr)	**$**	**61,860**

Waban Ave

Infiltration Chamber

Project Reference Number	3
Roadway Name	Waban Ave
Location Description	Waban @ Quinobequin

HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	5.5
Total Contributing Area (ac.)	18.5
Generated TP Load from Total Area (lb/yr)	12.2
Dimensions (Length x Width)	105x40
SCM Footprint (SF)	2,800
Treatment Depth (in.)	0.25
Reduction Efficiency	62%
SCM Volume (CF)	5,600
Total Load Reduction (lb/y) :	**7.5**

EPA Cost Breakdown (Adjusted for 2023)		
Construction Cost	$	286,000
Soft Cost (35% of Construction Cost)	$	100,100
Total Cost	**$**	**386,100**
Cost/Benefit ($/lb/yr)	**$**	**51,504**

W&C Cost Breakdown (2023)		
Construction Cost	$	152,000
Excavation Adjustment	$	22,400
Soft Cost (28.5% of Total Construction Cost)	$	49,704
Project Contingency (20% Total Construction and Soft Costs)	$	44,821
Total Cost	**$**	**268,925**
Cost/Benefit ($/lb/yr)	**$**	**35,874**

Albemarle Rd

Bio-Filtration

Project Reference Number	4
Roadway Name	Albemarle Rd
Location Description	Crafts to the Charles

HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	5.7
Total Contributing Area (ac.)	12.1
Generated TP Load from Total Area (lb/yr)	11.6
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	11,100
Treatment Depth (in.)	0.80
Reduction Efficiency	48%
SCM Volume (CF)	17,205
Total Load Reduction (lb/y) :	**5.6**

EPA Cost Breakdown (Adjusted for 2023)		
Construction Cost	$	620,000
Soft Cost (35% of Construction Cost)	$	217,000
Total Cost	**$**	**837,000**
Cost/Benefit ($/lb/yr)	**$**	**150,513**

W&C Cost Breakdown (2023)		
Construction Cost	$	448,000
Excavation Adjustment	$	-
Soft Cost (28.5% of Total Construction Cost)	$	127,680
Project Contingency (20% Total Construction and Soft Costs)	$	115,136
Total Cost	**$**	**690,816**
Cost/Benefit ($/lb/yr)	**$**	**124,225**

Beacon St

Infiltration Chamber

Project Reference Number	5
Roadway Name	Beacon St
Location Description	Beacon @ Glen

HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	4.9
Total Contributing Area (ac.)	17.1
Generated TP Load from Total Area (lb/yr)	11.2
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	1,500
Treatment Depth (in.)	0.15
Reduction Efficiency	44%
SCM Volume (CF)	3,000
Total Load Reduction (lb/y) :	**4.9**

EPA Cost Breakdown (Adjusted for 2023)		
Construction Cost	$	153,000
Soft Cost (35% of Construction Cost)	$	53,550
Total Cost	**$**	**206,550**
Cost/Benefit ($/lb/yr)	**$**	**41,929**

W&C Cost Breakdown (2023)		
Construction Cost	$	81,000
Excavation Adjustment	$	12,000
Soft Cost (28.5% of Total Construction Cost)	$	26,505
Project Contingency (20% Total Construction and Soft Costs)	$	23,901
Total Cost	**$**	**143,406**
Cost/Benefit ($/lb/yr)	**$**	**29,111**

Valentine St

Infiltration Chamber

Project Reference Number	6
Roadway Name	Valentine St
Location Description	Valentine @ Fountain

HSG Soil Type at SCM	C
Impervious Drainage Area (ac.)	5.6
Total Contributing Area (ac.)	20.3
Generated TP Load from Total Area (lb/yr)	12.6
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	2,100
Treatment Depth (in.)	0.20
Reduction Efficiency	37%
SCM Volume (CF)	4,200
Total Load Reduction (lb/y) :	**4.7**

EPA Cost Breakdown (Adjusted for 2023)		
Construction Cost	$	215,000
Soft Cost (35% of Construction Cost)	$	75,250
Total Cost	**$**	**290,250**
Cost/Benefit ($/lb/yr)	**$**	**62,179**

W&C Cost Breakdown (2023)		
Construction Cost	$	114,000
Excavation Adjustment	$	16,800
Soft Cost (28.5% of Total Construction Cost)	$	37,278
Project Contingency (20% Total Construction and Soft Costs)	$	33,616
Total Cost	**$**	**201,694**
Cost/Benefit ($/lb/yr)	**$**	**43,208**

Albemarle

Bio-Filtration

Project Reference Number	7A
Roadway Name	Albemarle
Location Description	Watertown to Crafts

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	5.8
Total Contributing Area (ac.)	11.2
Generated TP Load from Total Area (lb/yr)	13.1
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	2,625
Treatment Depth (in.)	0.15
Reduction Efficiency	20%
SCM Volume (CF)	4,069
Total Load Reduction (lb/y) :	**2.6**

EPA Cost Breakdown (Adjusted for 2023)		
Construction Cost	$	147,000
Soft Cost (35% of Construction Cost)	$	51,450
Total Cost	**$**	**198,450**
Cost/Benefit ($/lb/yr)	**$**	**77,454**

W&C Cost Breakdown (2023)		
Construction Cost	$	106,000
Excavation Adjustment	$	-
Soft Cost (28.5% of Total Construction Cost)	$	30,210
Project Contingency (20% Total Construction and Soft Costs)	$	27,242
Total Cost	**$**	**163,452**
Cost/Benefit ($/lb/yr)	**$**	**63,795**

Albemarle Rd

Porous Pavement

Project Reference Number	7B
Roadway Name	Albemarle Rd
Location Description	Watertown to Crafts

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	0.3
Total Contributing Area (ac.)	0.3
Generated TP Load from Total Area (lb/yr)	0.7
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	14,990
Treatment Depth (in.)	1.00
Reduction Efficiency	62%
SCM Volume (CF)	13,491
Total Load Reduction (lb/y) :	**0.4**

EPA Cost Breakdown (Adjusted for 2023)	
Construction Cost	$ 567,000
Soft Cost (35% of Construction Cost)	$ 198,450
Total Cost	**$ 765,450**
Cost/Benefit ($/lb/yr)	**$ 1,830,439**

W&C Cost Breakdown (2023)	
Construction Cost	$ 1,134,000
Excavation Adjustment	$ -
Soft Cost (28.5% of Total Construction Cost)	$ 323,190
Project Contingency (20% Total Construction and Soft Costs)	$ 291,438
Total Cost	**$ 1,748,628**
Cost/Benefit ($/lb/yr)	**$ 4,181,537**

Crystal St

Infiltration Chamber

Project Reference Number	8
Roadway Name	Crystal St
Location Description	Crystal @ Lake

HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	4.2
Total Contributing Area (ac.)	4.7
Generated TP Load from Total Area (lb/yr)	8.3
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	925
Treatment Depth (in.)	0.10
Reduction Efficiency	33%
SCM Volume (CF)	1,850
Total Load Reduction (lb/y) :	**2.7**

EPA Cost Breakdown (Adjusted for 2023)		
Construction Cost	$	95,000
Soft Cost (35% of Construction Cost)	$	33,250
Total Cost	**$**	**128,250**
Cost/Benefit ($/lb/yr)	**$**	**46,688**

W&C Cost Breakdown (2023)		
Construction Cost	$	50,000
Excavation Adjustment	$	7,400
Soft Cost (28.5% of Total Construction Cost)	$	16,359
Project Contingency (20% Total Construction and Soft Costs)	$	14,752
Total Cost	**$**	**88,511**
Cost/Benefit ($/lb/yr)	**$**	**32,222**

Grove St
Infiltration Chamber

Project Reference Number	9
Roadway Name	Grove St
Location Description	Grove Public Parking

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	0.4
Total Contributing Area (ac.)	0.8
Generated TP Load from Total Area (lb/yr)	0.8
Dimensions (Length x Width)	25x30
SCM Footprint (SF)	750
Treatment Depth (in.)	1.00
Reduction Efficiency	90%
SCM Volume (CF)	1,500
Total Load Reduction (lb/y) :	**0.8**

EPA Cost Breakdown (Adjusted for 2023)		
Construction Cost	$	77,000
Soft Cost (35% of Construction Cost)	$	26,950
Total Cost	**$**	**103,950**
Cost/Benefit ($/lb/yr)	**$**	**135,922**

W&C Cost Breakdown (2023)		
Construction Cost	$	41,000
Excavation Adjustment	$	6,000
Soft Cost (28.5% of Total Construction Cost)	$	13,395
Project Contingency (20% Total Construction and Soft Costs)	$	12,079
Total Cost	**$**	**72,474**
Cost/Benefit ($/lb/yr)	**$**	**94,765**

Municipal Structural SCM Operation & Maintenance Costs

Woodard & Curran

Estimated Operations and Maintenance Costs
Phase 1 Phosphorus Control Plan
City of Newton, MA

40 Shattuck Road | Suite 110 T 800.426.4262
Andover, Massachusetts 01810 T 978.557.8150
www.woodardcurran.com F 978.557.7948

Section A - Reoccurring Labor and Equipment O&M Costs

SCM Type	Number of Municipal Systems: Existing	Number of Municipal Systems: Planned	Activity	Frequency*	Annual Multiplier	Labor Duration: Supervisor Hrs $88.00	Labor Duration: Operator Hrs $82.00	Labor Duration: Labor Hrs $63.00	Total Hours Per Year	Annual Cost	Labor Support: Vehicles and Mechanical Equipment (V&ME, see hourly rates below table)	V&ME Hrs.	Annualized Cost	Newton's Total Cost by SCM Type
Infiltration Basin	6	9	Pretreatment Structure - Sediment Removal	Twice per Year	2		4	8	24	$1,664	Dump Truck, Jet/Vac Truck	8	$5,888	
			Pretreatment Structure - Inspection	Twice per Year	2	1			2	$176	Pickup Truck	1	$62	
			Basin - Debris Removal	Twice per Year	2			1	2	$126	Dump Truck, Jet/Vac Truck	1	$736	
			Basin - Plant Maintenance/Mowing	Quarterly	4			1	4	$252	Pickup Truck, Saws, Weedwhacker	1	$124	
			Basin - Inspection	Twice per Year	2	1			2	$176	Pickup Truck	1	$62	
			Basin - Repairs and/or Infiltration Restoration	Every Tenth Year	0.1		8	16	2.4	$166	Rototiller, Dump-truck, Backhoe	16	$365	
			Subtotal per System			4.0	8.8	23.6	36.4	$2,560		28.0	$7,237	
			Total			60.0	132.0	354.0	**546.0**	**$38,406**		**420.0**	**$108,552**	**$146,958**
Infiltration Chambers	6	49	Diversion Structures - Sediment Removal	Twice per Year	2		2	2	8	$580	Pickup Truck, Jet/Vac Truck	2	$1,164	
			Diversion Structures - Inspection	Twice per Year	2	1			2	$176	Pickup Truck	1	$62	
			Pretreatment Structure - Sediment Removal	Twice per Year	2		4	8	24	$1,664	Dump Truck, Jet/Vac Truck	8	$5,888	
			Pretreatment Structure - Inspection	Twice per Year	2	1			2	$176	Pickup Truck	1	$62	
			Isolator Row - Inspection	Twice per Year	2	1			2	$176	Pickup Truck	1	$62	
			Isolator Row - Sediment Removal	Twice per Year	2		4	8	24	$1,664	Dump Truck, Jet/Vac Truck	8	$5,888	
			Infiltration Chambers - Visual Inspection	Annually	1	1			1	$88	Pickup Truck	1	$0	
			Subtotal per System			7.0	20.0	36.0	63.0	$4,524		22.0	$13,126	
			Total			385.0	1,100.0	1,980.0	**3,465.0**	**$248,820**		**1,210.0**	**$721,930**	**$970,750**
Infiltration Trench / Dry Well	7	9	Trench - Sediment/Floatable Removal	Twice per Year	2		4	8	24	$1,664	Pickup Truck, Jet/Vac Truck	8	$4,656	
			Trench and Monitoring Well - Inspection	Twice per Year	2	1			2	$176	Pickup Truck	1	$62	
			Trench - Repairs and/or Infiltration Restoration	Every Tenth Year	0.1		12	24	3.6	$250	Pickup Truck, Dump-truck, Backhoe	24	$622	
			Subtotal per System			2.0	9.2	18.4	29.6	$2,090		33.0	$5,340	
			Total			32.0	147.2	294.4	**473.6**	**$33,434**		**528.0**	**$85,434**	**$118,867**
Porous Pavement	5	4	Porous Pavement - Restoration/Sediment Removal	Twice per Year	2		8	16	48	$3,328	Jet/Vac Truck	16	$8,320	
			Porous Pavement - Inspection	Annually	1	1			1	$88	Pickup Truck	1	$31	
			Subtotal per System			1.0	16.0	32.0	49.0	$3,416		17.0	$8,351	
			Total			9.0	144.0	288.0	**441.0**	**$30,744**		**153.0**	**$75,159**	**$105,903**
Sand Filter	0	0	Pretreatment Structure - Sediment Removal	Twice per Year	2		4	8	24	$1,664	Dump Truck, Jet/Vac Truck	8	$5,888	
			Pretreatment Structure - Inspection	Twice per Year	2	1			2	$176	Pickup Truck	1	$62	
			Basin - Debris Removal	Quarterly	4			1	4	$252	Dump Truck, Jet/Vac Truck	1	$1,472	
			Basin - Inspection	Annually	1	1			1	$88	Pickup Truck	1	$31	
			Basin - Repairs	Every Tenth Year	0.1		8	16	2.4	$166	Rototiller, Dump-truck, Backhoe	16	$365	
			Subtotal per System			3.0	8.8	21.6	33.4	$2,346		27.0	$7,818	
			Total			0	0	0	**0**	**$0**		**0**	**$0**	**$0**
Biofiltration/Bioretention/ Rain Garden	7	3	Pretreatment Structure - Sediment Removal	Twice per Year	2		4	8	24	$1,664	Dump Truck, Jet/Vac Truck	8	$5,888	
			Pretreatment Structure - Inspection	Twice per Year	2	1			2	$176	Pickup Truck	1	$62	
			Basin - Debris Removal	Monthly	12			1	12	$756	Dump Truck, Jet/Vac Truck	1	$4,416	
			Basin - Mulch	Annually	1			1	1	$63	Pickup Truck, Dump-truck, Bobcat, Trailer	1	$182	
			Basin - Plant Maintenance/Mowing	Quarterly	4			1	4	$252	Pickup Truck, Saws, Weedwhacker	1	$296	
			Basin - Inspection	Annually	1	1			1	$88	Pickup Truck	1	$31	
			Basin - Repairs	Every Tenth Year	0.1		8	16	2.4	$166	Rototiller, Dump-truck, Backhoe	16	$365	
			Subtotal per System			3.0	8.8	34.6	46.4	$3,165		29.0	$11,240	
			Total			30.0	88.0	346.0	**464.0**	**$31,654**		**290.0**	**$112,398**	**$144,052**
Enhanced Biofiltration with ISR	0	0	Pretreatment Structure - Sediment Removal	Twice per Year	2		4	8	24	$1,664	Dump Truck, Jet/Vac Truck	8	$5,888	
			Pretreatment Structure - Inspection	Twice per Year	2	1			2	$176	Pickup Truck	1	$62	
			Basin - Mulch	Annually	1			1	1	$63	Dump Truck, Jet/Vac Truck	1	$368	
			Basin - Plant Maintenance/Mowing	Quarterly	4			1	4	$252	Pickup Truck, Dump-truck, Bobcat, Trailer	1	$259	
			Basin - Inspection	Annually	1	1			1	$88	Pickup Truck, Saws, Weedwhacker	1	$124	
			Basin - Repairs	Every Tenth Year	0.1		8	16	2.4	$166	Pickup Truck	1	$31	
			Subtotal per System			3.0	8.8	23.6	35.4	$2,472	Rototiller, Dump-truck, Backhoe	29.0	$7,097	
			Total			0	0	0	**0**	**$0**		**0.0**	**$0**	**$0**
Gravel / Constructed Wetland	0	3	Diversion Structures - Sediment Removal	Twice per Year	2		2	2	8	$580	Pickup Truck, Jet/Vac Truck	2	$1,164	
			Diversion Structures - Inspection	Twice per Year	2	1			2	$176	Pickup Truck	1	$62	
			Pretreatment Structure - Sediment Removal	Annually	1		4	8	12	$832	Dump Truck, Jet/Vac Truck	8	$2,944	
			Pretreatment Structure - Inspection	Annually	1	1			1	$88	Pickup Truck	1	$31	
			Wetland - Debris Removal	Annually	1			4	4	$252	Dump Truck, Jet/Vac Truck	4	$1,472	
			Wetland - Plant Maintenance	Quarterly	4			1	4	$252	Pickup Truck, Saws, Weedwhacker	1	$124	
			Wetland - Inspection	Twice per Year	2	1			2	$176	Pickup Truck	1	$62	
			Wetland - Repairs	Every Tenth Year	0.1		8	16	2.4	$166	Dump-truck, Backhoe	16	$365	
			Subtotal per System			5.0	8.8	21.6	35.4	2522.4		34.0	$6,224	
			Total			15.0	26.4	64.8	**106.2**	**$7,567**		**102.0**	**$18,671**	**$26,239**
Wet Pond	0	0	Diversion Structures - Sediment Removal	Twice per Year	2		2	2	8	$580	Pickup Truck, Jet/Vac Truck	2	$1,164	
			Diversion Structures - Inspection	Twice per Year	2	1			2	$176	Pickup Truck	1	$62	
			Pretreatment Structure - Sediment Removal	Twice per Year	2		4	8	24	$1,664	Dump Truck, Jet/Vac Truck	8	$5,888	
			Pretreatment Structure - Inspection	Twice per Year	2	1			2	$176	Pickup Truck	1	$62	
			Pond - Debris Removal	Annually	1			1	1	$63	Dump Truck, Jet/Vac Truck	1	$368	
			Pond - Inspection	Annually	1	1			1	$88	Pickup Truck	1	$31	
			Pond - Repairs	Every Tenth Year	0.1		8	16	2.4	$166	Dump-truck, Backhoe	16	$365	
			Subtotal per System			5.0	12.8	22.6	40.4	$2,913		30.0	$7,940	
			Total			0	0	0	**0**	**$0**		**0.0**	**$0**	**$0**
Dry Pond	0	0	Diversion Structures - Sediment Removal	Twice per Year	2		2	2	8	$580	Pickup Truck, Jet/Vac Truck	2	$1,164	
			Diversion Structures - Inspection	Twice per Year	2	1			2	$176	Pickup Truck	1	$62	
			Pretreatment Structure - Sediment Removal	Twice per Year	2		4	8	24	$1,664	Dump Truck, Jet/Vac Truck	8	$5,888	
			Pretreatment Structure - Inspection	Twice per Year	2	1			2	$176	Pickup Truck	1	$62	
			Pond - Debris Removal	Annually	1		2	2	4	$290	Dump Truck, Jet/Vac Truck	2	$736	
			Pond - Plant Maintenance/Mowing	Quarterly	4			1	4	$252	Pickup Truck, Saws, Weedwhacker	1	$124	
			Pond - Inspection	Twice per Year	2	1			2	$176	Pickup Truck	1	$62	
			Pond - Repairs	Every Tenth Year	0.1		8	16	2.4	$166	Dump-truck, Backhoe	16	$365	
			Subtotal per System			6.0	14.8	27.6	48.4	$3,480		32.0	$8,463	
			Total			0	0	0	**0**	**$0**		**0.0**	**$0**	**$0**
Vegetated Swale	0	5	Swale - Debris Removal	Annually	1		4	8	12	$832	Dump Truck, Jet/Vac Truck	8	$2,944	
			Swale - Plant Maintenance/Mowing	Quarterly	4			1	4	$252	Pickup Truck, Dump-truck	1	$124	
			Swale - Inspection	Twice per Year	2	1			2	$176	Pickup Truck	1	$62	
			Subtotal per System			2.0	4.0	12.0	18.0	$1,260		10.0	$3,130	
			Total			10	20	60	**90**	**$6,300**		**50.0**	**$15,650**	**$21,950**
Program Management	0	1	Issuing and Tracking Work Orders	Weekly	52	8			416	$36,608	N/A	0	$0	
			Annual Reporting	Annually	1	80			80	$7,040	N/A	0	$0	
			Subtotal per System			496.0	0	0	496.0	$43,648		0.0	$0	
			Total			496.0	0	0	**496.0**	**$43,648**		**0.0**	**$0**	**$43,648**
Total SCMs	31	82	*Inspection frequency may exceed Massachusetts Stormwater Handbook requirements to provide consistency across SCM types.										Section A Sum	**$1,578,367**

	Supervisor Hrs	Operator Hrs	Labor Hrs	Total
Annual Hrs. by Position	1,037	1,658	3,387	
Hourly Rate by Position	$88.00	$82.00	$63.00	
Annual Cost by Position	$91,256	$135,923	$213,394	
Total Annual Labor Cost				$440,600

Section B - Reoccurring Fees and Bills

Category	Unit Cost	Estimated Quantity Per	Annual Cost
Pretreament Waste (e.g., sediment) Disposal Cost	$50	89	$4,465
		Section B Sum	$5,000

Section C - Equipment and Plantings Replacement Costs

Category	Estimated Value	Assumed Annual Rate	Annual Cost
Stormwater Infrastructure Replacement (Every 30 Years)	$45,375,000	3%	$1,512,500
Plantings Replacement (Every 5 Years)	$41,278	20%	$8,256
		Section C Sum	$1,521,000

Total Cost		
Annual Subtotal (Section A, B, and C Sums)		$3,104,000
Contingency	30%	$932,000
Overhead and Profit (if Contracted) or Administration	20%	$621,000
Annual Total		**$4,657,000**

Section A Reference - Vehicles and Mechanical Equipment Rates

V&ME	Unit Cost (per Hour)
Pickup Truck	$31.00
Rototiller	$0.00
Trailer	$0.00
Mower	$0.00
Weedwhacker	$0.00
Saws	$0.00
Jet/Vac Truck, CCTV Rig	$260.00
Dump-truck	$108.00
Backhoe	$120.00
Bobcat	$43.00

Section B Reference

Treated Impervious Drainage Area	Area (acre)	TSS PLER (lb/yr) (Commercial)	Generated TSS Load	Removed TSS (lb/yr) (50% reduction)
Existing SCM	15	377.4	5,661	2,831
Planned SCM - Parcel Regional	762.5		287,768	143,884
Planned SCM - Parcel On-Site	30		11,322	5,661
Planned SCM - Roadway Regional	139		52,459	26,229

Section C Reference

	Number of SCMs	Unit Cost	Total Cost
Diversion Structures	58	$50,000	$2,900,000
Pretreatment Structures	83	$75,000	$6,225,000
Infiltration Basin	15	$100,000	$1,500,000
Infiltration Chambers	55	$500,000	$27,500,000
Infiltration Trenches/Dry Wells	16	$75,000	$1,200,000
Porous Pavement	9	$500,000	$4,500,000
Sand Filter	0	$100,000	$0
Biofiltration/Bioretention/Rain Garden	10	$100,000	$1,000,000
Enhanced Biofiltration with ISR	0	$100,000	$0
Gravel/Constructed Wetland	3	$100,000	$300,000
Wet Pond	0	$100,000	$0
Dry Pond	0	$100,000	$0
Vegetated Swale	5	$50,000	$250,000
Seed (per grassed SCM)	30	$50	$4,500
Plantings (per planted SCM) (1 plant per 100 SF)	30	$100	$9,000
Mulch (per biofiltration system) (2" mulch depth)	30	$50	$27,778

Seed cost = average SCM area (3000 SF) * seed mix rate of 1lb/1000SF * $50/lb
Plantings cost = average SCM area (3000 SF) * 1 plant/1000 SF * $100 per plant
Mulch cost = average SCM area (3000 SF) * 2" mulch depth * $50/CY mulch

Non-Structural Control Equipment Maintenance Records (2020-2022)

Maintenance Summary

Newton, MA

Date Range: 01/01/2020 - 12/31/2020

Department: SUSTAINABLE MATERIALS

Veh Id	Year/Make/Model	Date	Service	Service Request	Repair Description	Repair Category	Status	Labor ($)	Parts ($)	3rd ($)	Total ($)
141	2017 Elgin Pelican	12/09/2020	Repair	Bent wiper arm	Replaced wiper arm and blade	Exterior Body/Wiper Repairs	Closed	11.80	152.80	-	164.60
141	2017 Elgin Pelican	12/03/2020	Repair	Check belt adjustment	Adjusted conveyor belt	Sweepers/Conveyor System	Closed	48.80	-	-	48.80
141	2017 Elgin Pelican	11/18/2020	PM	PM-A		/	Closed	0.00	202.17	-	202.17
141	2017 Elgin Pelican	08/10/2020	Repair	Backup alarm inop	Replace backup alarm.	Accessories/Horns & Alarms	Closed	34.20	-	-	34.20
141	2017 Elgin Pelican	08/07/2020	PM	PM-A		/	Closed	91.20	665.23	-	756.43
141	2017 Elgin Pelican	08/06/2020	Repair	Conveyor INOP	Replace chain, sprockets/gears. Loosen belt and clean out debris causing overtighten condition. Readjust belt.	Sweepers/Conveyor System	Closed	91.20	244.37	-	335.57
141	2017 Elgin Pelican	07/21/2020	Repair	Flat tire	Replace RF tire at Elliot.	Chassis/Tires, Tubes, Liners & Valves	Closed	44.61	-	-	44.61
141	2017 Elgin Pelican	05/27/2020	PM	PM-A		/	Closed	114.00	587.23	-	701.23
141	2017 Elgin Pelican	03/04/2020	Repair	Right rear tire has a slow leak	Replace RR tire.	Chassis/Tires, Tubes, Liners & Valves	Closed	29.74	-	-	29.74
141	2017 Elgin Pelican	01/14/2020	PM	PM-A,PM-B,PM-C		/	Closed	-	-	2,060.77	2,060.77
141	2017 Elgin Pelican	01/09/2020	St Insp	Result: Pass			Closed	0.00	0.00	-	0.00
141	2017 Elgin Pelican	01/02/2020	Repair	Will not move	tmosca@newtonma.gov		Closed	-	-	0.00	0.00

Department totals:	$ 465.55	$ 1,851.80	$ 2,060.77	$ 4,378.12
Grand totals:	$ 465.55	$ 1,851.80	$ 2,060.77	$ 4,378.12

Maintenance Summary

Newton, MA

Date Range: 01/01/2020 - 12/31/2020

Department: SUSTAINABLE MATERIALS

Veh Id	Year/Make/Model	Date	Service	Service Request	Repair Description	Repair Category	Status	Labor ($)	Parts ($)	3rd ($)	Total ($)
142	2017 Elgin Pelican	12/15/2020	Repair	Broken bolt on main broom	Drilled and tapped broken bolt, fixed broken grease fitting	Sweepers/Conveyor System	Closed	61.00	-	-	61.00
142	2017 Elgin Pelican	12/14/2020	Repair	Broken grease line at rear wheel	Fixed grease line	Accessories/General Accessories	Closed	36.60	-	-	36.60
142	2017 Elgin Pelican	12/14/2020	Repair	Adjuster on driver seat INOP	Switched seats for now. Installed use seat	Interior/Upholstery	Closed	120.38	-	-	120.38
142	2017 Elgin Pelican	12/11/2020	Repair	Hopper mirror	Replaced hopper mirror off of 143	Exterior Body/Mirrors & Brackets	Closed	24.40	154.73	-	179.13
142	2017 Elgin Pelican	12/03/2020	Repair	Windshield wipers	Replaced wipers	Exterior Body/Wiper Repairs	Closed	24.40	599.60	-	624.00
142	2017 Elgin Pelican	11/23/2020	Repair	Headlight INOP	Replaced both headlight bulbs	Electrical/Lighting System	Closed	0.00	0.00	0.00	0.00
142	2017 Elgin Pelican	11/20/2020	PM	PM-A		/	Closed	97.60	202.17	-	299.77
142	2017 Elgin Pelican	11/20/2020	St Insp	Result: Pass			Closed	0.00	0.00	-	0.00
142	2017 Elgin Pelican	11/02/2020	Repair	RR tire damaged	Replaced 2 rear tires	Chassis/Wheels, Rims, Hubs & Bearings	Closed	44.61	479.98	-	524.59
142	2017 Elgin Pelican	09/24/2020	Repair	Tail light out	rgately@newtonma.gov	Electrical/	Closed	-	149.70	-	149.70
142	2017 Elgin Pelican	09/23/2020	Repair	Tail light out	Replace lamp.	Electrical/Lighting System	Closed	11.40	-	-	11.40
142	2017 Elgin Pelican	08/24/2020	Repair	Conveyor inop	Replace broken chain, sprockets, gears and adj belt.	Sweepers/Conveyor System	Closed	94.36	261.92	-	356.28
142	2017 Elgin Pelican	08/06/2020	Repair	Alarm keeps going off	No issue found	Engine/Motor/Power Plant	Closed	79.80	-	-	79.80
142	2017 Elgin Pelican	07/30/2020	Repair	Smell of diesel fuel	Replaced primer pump	Engine/Motor/Fuel System	Closed	79.80	120.89	-	200.69
142	2017 Elgin Pelican	07/30/2020	Repair	Hard starting	Believe hard starting is due to the leaking lift pump		Closed	11.40	-	-	11.40
142	2017 Elgin Pelican	07/09/2020	PM	PM-A		/	Closed	68.40	174.79	-	243.19
142	2017 Elgin Pelican	05/21/2020	Repair	Damage to RH door deflector	Replace RH branch guard.	Exterior Body/Body	Closed	61.26	963.96	-	1,025.22
142	2017 Elgin Pelican	03/10/2020	Repair	RH spot mirror is loose	Replace hopper mirrors.	Exterior Body/Mirrors & Brackets	Closed	23.59	117.10	-	140.69
142	2017 Elgin Pelican	03/10/2020	Repair	check tires	Replace 2 tires.	Chassis/Tires, Tubes, Liners & Valves	Closed	-	479.98	-	479.98

Maintenance Summary

Newton, MA

Date Range: 01/01/2020 - 12/31/2020

Department: SUSTAINABLE MATERIALS

Veh Id	Year/Make/Model	Date	Service	Service Request	Repair Description	Repair Category	Status	Labor ($)	Parts ($)	3rd ($)	Total ($)
142	2017 Elgin Pelican	02/11/2020	Repair	Conveyor belt ripped off	Replace conveyor belt.	Sweepers/Conveyor System	Closed	206.78	1,900.24	-	2,107.02
142	2017 Elgin Pelican	01/14/2020	PM	PM-A,PM-B,PM-C		/	Closed	-	-	1,979.39	1,979.39
142	2017 Elgin Pelican	01/09/2020	Repair	Replace hopper mirror	Replaced mirror	Exterior Body/Mirrors & Brackets	Closed	11.34	-	-	11.34
							Department totals:	$ 1,057.12	$ 5,605.06	$ 1,979.39	$ 8,641.57
							Grand totals:	$ 1,057.12	$ 5,605.06	$ 1,979.39	$ 8,641.57

Maintenance Summary

Newton, MA

Date Range: 01/01/2020 - 12/31/2020

Department: SUSTAINABLE MATERIALS

Veh Id	Year/Make/Model	Date	Service	Service Request	Repair Description	Repair Category	Status	Labor ($)	Parts ($)	3rd ($)	Total ($)
143	2014 Elgin Pelican	01/11/2021	PM	PM-A		/	Closed	97.60	90.69	-	188.29
143	2014 Elgin Pelican	12/15/2020	Repair	Weld main broom cover	Can't weld main broom cover		Closed	-	-	-	0.00
143	2014 Elgin Pelican	12/03/2020	Repair	Curbside dirtshoe need adjustment	No adjustment needed.	Sweepers/Main Broom	Closed	-	334.18	-	334.18
143	2014 Elgin Pelican	10/02/2020	Repair	Seat issue	Repair driver's seat.	Interior/Upholstery	Closed	148.51	-	-	148.51
143	2014 Elgin Pelican	08/21/2020	Repair	A/C works on and off?	Replaced A/C condenser and water shut off value for coolant, Recharged a/c and re-installed main broom	Interior/HVAC	Closed	456.00	2,490.76	-	2,946.76
143	2014 Elgin Pelican	08/14/2020	PM	PM-A		/	Closed	-	101.23	-	101.23
143	2014 Elgin Pelican	08/12/2020	Repair	MB skirt hanging down	Replaced main broom skirt	Sweepers/Main Broom	Closed	79.80	352.50	-	432.30
143	2014 Elgin Pelican	08/05/2020	Repair	Spray nozzle missing	parts only.	/	Closed	-	22.82	-	22.82
143	2014 Elgin Pelican	07/27/2020	Repair	Replace hopper mirrors	Replaced mirrors	Exterior Body/Mirrors & Brackets	Closed	11.40	-	-	11.40
143	2014 Elgin Pelican	07/24/2020	Repair	Replace left dirt shoe	Replaced dirt shoe	Sweepers/Conveyor System	Closed	148.20	929.59	-	1,077.79
143	2014 Elgin Pelican	07/17/2020	Repair	Ck water pressure	Replaced water pump, Removed paint chip from elbow on the bottom of the water tank	Sweepers/Sprayer System	Closed	102.60	1,119.96	-	1,222.56
143	2014 Elgin Pelican	07/17/2020	Repair	Water leak	Repaired water leak on right side side broom		Closed	0.00	0.00	0.00	0.00
143	2014 Elgin Pelican	07/17/2020	St Insp	Result: Pass		/	Closed	0.00	0.00	-	11.40
143	2014 Elgin Pelican	07/08/2020	Repair	Air ride seat inop	Repair broken wire under driver's seat.	Interior/Upholstery	Closed	11.80	-	-	11.80
143	2014 Elgin Pelican	06/30/2020	Repair	Crawls during sweeping	csilva@newtonma.gov	/	Closed	-	-	606.88	606.88
143	2014 Elgin Pelican	06/29/2020	Repair	A/C blowing warm	Blowing cold. Recharge a/c anyway.	Interior/HVAC	Closed	57.00	-	-	57.00
143	2014 Elgin Pelican	06/29/2020	Repair	Water won't shut off	Replaced water pump and water manifold	Sweepers/Sprayer System	Closed	136.80	2,043.45	-	2,180.25
143	2014 Elgin Pelican	06/24/2020	Repair	LH mirror broken	Replace LH mirror.	Exterior Body/Mirrors & Brackets	Closed	22.80	24.53	-	47.33

Maintenance Summary

Newton, MA

Date Range: 01/01/2020 - 12/31/2020

Department: SUSTAINABLE MATERIALS

Veh Id	Year/Make/Model	Date	Service	Service Request	Repair Description	Repair Category	Status	Labor ($)	Parts ($)	3rd ($)	Total ($)
143	2014 Elgin Pelican	06/23/2020	Repair	LH mirror loose again	Replaced mirror		Closed	23.59	58.28	-	81.87
143	2014 Elgin Pelican	06/18/2020	Repair	RH hopper hyd hoses chaffed	Replaced four hyd. lines to the dump pistons	Equipment Attachments/Hydraulic Systems	Closed	212.31	534.90	-	747.21
143	2014 Elgin Pelican	06/03/2020	Repair	Water siphons from water tank	tmosca@newtonma.gov	/	Closed	-	167.51	-	167.51
143	2014 Elgin Pelican	05/20/2020	Repair	Replace mirror	rgately@newtonma.gov	Accessories/	Closed	-	58.28	-	58.28
143	2014 Elgin Pelican	05/18/2020	Repair	Water INOP	No issue found	Sweepers/Sprayer System	Closed	11.80	-	-	11.80
143	2014 Elgin Pelican	05/15/2020	Repair	Missing mirror on the right side	Installed new mirror and bracket	Exterior Body/Mirrors & Brackets	Closed	11.80	213.01	-	224.81
143	2014 Elgin Pelican	04/01/2020	Repair	No crank, no start- towed in	Jimmy replaced starter and relay. Derek replaced battery, finding poor connections at the battery as the root cause.	Electrical/Cranking System	Closed	145.32	890.90	-	1,036.22
143	2014 Elgin Pelican	03/04/2020	Repair	Nail in front Left tire	Repaired tire	Chassis/Tires, Tubes, Liners & Valves	Closed	44.61	-	-	44.61
143	2014 Elgin Pelican	03/03/2020	Repair	Front mirror loose	Replaced mirror	Exterior Body/Mirrors & Brackets	Closed	22.80	58.28	-	81.08
143	2014 Elgin Pelican	02/10/2020	Repair	RH air seat inop	tmosca@newtonma.gov	/	Closed	-	-	0.00	0.00
143	2014 Elgin Pelican	02/05/2020	Repair	RH gutter broom motor leaking	tmosca@newtonma.gov		Closed	-	-	4,064.03	4,064.03
143	2014 Elgin Pelican	02/05/2020	Repair	Hydraulic leak	Replaced 4 hyd. lines	Equipment Attachments/Hydraulic Systems	Closed	148.20	1,154.13	-	1,302.33
143	2014 Elgin Pelican	01/20/2020	PM	PM-A,PM-B,PM-C		/	Closed	-	-	2,412.77	2,412.77

Department totals: $ 1,892.94 $ 10,645.00 $ 7,083.68 $ 19,633.02

Grand totals: $ 1,892.94 $ 10,645.00 $ 7,083.68 $ 19,633.02

Maintenance Summary

Newton, MA

Date Range: 01/01/2020 - 12/31/2020

Department: SUSTAINABLE MATERIALS

Veh Id	Year/Make/Model	Date	Service	Service Request	Repair Description	Repair Category	Status	Labor ($)	Parts ($)	3rd ($)	Total ($)
144	2013 Elgin Pelican	12/16/2020	Repair	Conveyor noise	No issue found, Noticed main down pressure was all the way down	Sweepers/Conveyor System	Closed	73.20	-	-	73.20
144	2013 Elgin Pelican	11/10/2020	Repair	Conveyor belt ripped	Replace conveyor belt.		Closed	200.52	2,225.54	-	2,426.06
144	2013 Elgin Pelican	09/23/2020	St Insp	Result: Pass		/	Closed	0.00	0.00	-	0.00
144	2013 Elgin Pelican	09/10/2020	Repair	Replace RH dirt shoe assy	Replaced dirt shoe assy.	Sweepers/Conveyor System	Closed	68.40	27.86	-	96.26
144	2013 Elgin Pelican	08/26/2020	Repair	Broken battery door	Replaced battery box door latches	Exterior Body/Body	Closed	22.80	51.26	-	74.06
144	2013 Elgin Pelican	08/26/2020	Repair	Large hyd leak	Replaced leaking hydraulic lines	Sweepers/Other	Closed	411.98	2,617.67	-	3,029.65
144	2013 Elgin Pelican	07/31/2020	PM	PM-A		/	Closed	91.20	118.06	-	209.26
144	2013 Elgin Pelican	07/31/2020	Repair	Ck water	Unclogged elbow below water tank	Sweepers/Sprayer System	Closed	34.20	-	-	34.20
144	2013 Elgin Pelican	07/24/2020	Repair	Check right side gutter broom	Replaced gutter broom swivel and components	Sweepers/Gutter Broom	Closed	182.40	1,416.69	-	1,599.09
144	2013 Elgin Pelican	06/19/2020	Repair	Broken bucket hinge	Weld on new pin for hopper hinge.	Sweepers/Other	Closed	51.98	-	-	51.98
144	2013 Elgin Pelican	06/08/2020	Repair	Needs front tires	Replace both front tires.	Chassis/Tires, Tubes, Liners & Valves	Closed	59.48	-	-	59.48
144	2013 Elgin Pelican	05/29/2020	Repair	RH steering tight	tmosca@newtonma.gov	/	Closed	-	-	1,000.00	1,000.00
144	2013 Elgin Pelican	05/27/2020	Repair	A/C not blowing cold	Replace shorted condenser fan which was tripping breaker. Clean coolers.	Interior/HVAC	Closed	136.80	538.12	-	674.92
144	2013 Elgin Pelican	05/26/2020	Repair	A/C INOP	Reset manual circuit breaker		Closed	57.00	-	-	57.00
144	2013 Elgin Pelican	05/21/2020	Repair	Check battery	Replace battery.	Electrical/Battery	Closed	11.80	103.45	-	115.25
144	2013 Elgin Pelican	05/06/2020	Repair	A/C blows warm	Recharge a/c.	Interior/HVAC	Closed	11.40	-	-	11.40
144	2013 Elgin Pelican	05/06/2020	Repair	Water light on	tmosca@newtonma.gov	/	Closed	-	-	290.92	290.92
144	2013 Elgin Pelican	05/05/2020	Repair	Adjust RH gutter brrom	tmosca@newtonma.gov		Closed	0.00	22.45	0.00	22.45
144	2013 Elgin Pelican	04/21/2020	Repair	Mirror brackets broken	Operator install bracket.		Closed	-	568.61	-	568.61

Maintenance Summary

Newton, MA

Date Range: 01/01/2020 - 12/31/2020

Department: SUSTAINABLE MATERIALS

Veh Id	Year/Make/Model	Date	Service	Service Request	Repair Description	Repair Category	Status	Labor ($)	Parts ($)	3rd ($)	Total ($)
144	2013 Elgin Pelican	03/25/2020	Repair	Driverside water line leaking	(Sweepers) Sprayer System	Sweepers/Sprayer System	Closed	34.20	17.30	0.00	51.50
144	2013 Elgin Pelican	03/25/2020	Repair	Broken grease line Driver side by main broom	Replace grease fitting.	Sweepers/Other	Closed	11.40	9.97	-	21.37
144	2013 Elgin Pelican	03/03/2020	Repair	Left side tow bar bushing loose	tmosca@newtonma.gov	/	Closed	-	-	2,708.11	2,708.11
144	2013 Elgin Pelican	03/02/2020	Repair	Air seat INOP	(Interior) Accessory Controls	Interior/Accessory Controls	Closed	57.00	333.80	0.00	390.80
144	2013 Elgin Pelican	02/03/2020	PM	PM-A,PM-B,PM-C		/	Closed	-	-	5,359.80	5,359.80
144	2013 Elgin Pelican	01/15/2020	Repair	RF hub leak	tmosca@newtonma.gov		Closed	-	-	13,098.73	13,098.73
144	2013 Elgin Pelican	01/02/2020	Repair	Road call Wont Move	Operate error. Driver switch is in was in the wrong position	Drive Train/Other	Closed	22.68	0.00	0.00	22.68

Department totals: $ 1,538.44 $ 8,050.78 $ 22,457.56 $ 32,046.78

Grand totals: $ 1,538.44 $ 8,050.78 $ 22,457.56 $ 32,046.78

Maintenance Summary

Newton, MA

Date Range: 01/01/2020 - 12/31/2020

Department: SUSTAINABLE MATERIALS

Veh Id	Year/Make/Model	Date	Service	Service Request	Repair Description	Repair Category	Status	Labor ($)	Parts ($)	3rd ($)	Total ($)
145	2019 Elgin Pelican	11/23/2020	Repair	Joystick broken for dump position	Replaced joystick	Sweepers/Conveyor System	Closed	47.18	-	-	47.18
145	2019 Elgin Pelican	11/23/2020	Repair	Grease leaking at the grease reservoir	Replaced grease reservoir cover	Sweepers/Other	Closed	58.98	-	-	58.98
145	2019 Elgin Pelican	11/17/2020	Repair	Autolube not pushing enough grease	tmosca@newtonma.gov	/	Closed	-	-	546.82	546.82
145	2019 Elgin Pelican	11/17/2020	Repair	Rough idle	tmosca@newtonma.gov		Closed	-	-	0.00	0.00
145	2019 Elgin Pelican	11/09/2020	PM	PM-A			Closed	0.00	186.66	-	186.66
145	2019 Elgin Pelican	11/02/2020	Repair	Double check convoy chain is tight	Replaced conveyor chain	Sweepers/Conveyor System	Closed	47.18	244.56	-	291.74
145	2019 Elgin Pelican	06/19/2020	Repair	Exhaust hitting hood	tmosca@newtonma.gov	/	Closed	-	-	0.00	0.00
145	2019 Elgin Pelican	06/19/2020	Repair	LH broom pivot bushing	tmosca@newtonma.gov		Closed	-	-	0.00	0.00
145	2019 Elgin Pelican	06/11/2020	Repair	Diesel fuel leak	tmosca@newtonma.gov		Closed	-	-	0.00	0.00
145	2019 Elgin Pelican	06/11/2020	Repair	Hyd restriction light on	tmosca@newtonma.gov		Closed	-	-	0.00	0.00
145	2019 Elgin Pelican	06/11/2020	Repair	Water leaking constantly	tmosca@newtonma.gov		Closed	-	-	0.00	0.00
145	2019 Elgin Pelican	06/11/2020	Repair	Air cleaner cap broken	tmosca@newtonma.gov		Closed	-	-	0.00	0.00
145	2019 Elgin Pelican	06/03/2020	PM	PM-A			Closed	117.95	189.69	-	307.64
145	2019 Elgin Pelican	06/03/2020	Repair	Autlube repair	Replace broken cap.	Chassis/Automatic/Manual Chassis Lubricator	Closed	23.59	193.41	-	217.00
145	2019 Elgin Pelican	04/01/2020	Repair	Flat right rear tire	Replaced both rear tires	Chassis/Wheels, Rims, Hubs & Bearings	Closed	23.59	479.98	-	503.57
145	2019 Elgin Pelican	03/20/2020	Repair	Machine sometimes starts, See VCR	csilva@newtonma.gov	Electrical/Other	Closed	-	-	0.00	0.00
145	2019 Elgin Pelican	03/19/2020	St Insp	Result: Pass		/	Closed	0.00	0.00	-	0.00
145	2019 Elgin Pelican	02/24/2020	Repair	LH MB arm broken			Closed	-	-	0.00	0.00
145	2019 Elgin Pelican	01/14/2020	PM	PM-A,PM-B,PM-C			Closed	-	-	2,060.77	2,060.77
145	2019 Elgin Pelican	11/08/2019	Repair	Replace spray water spray nozzles	Parts only.	Sweepers/Sprayer System	Closed	-	93.92	-	93.92

Maintenance Summary

Newton, MA

Date Range: 01/01/2020 - 12/31/2020

Department: SUSTAINABLE MATERIALS

Veh Id	Year/Make/Model	Date	Service	Service Request	Repair Description	Repair Category	Status	Labor ($)	Parts ($)	3rd ($)	Total ($)
						Department totals:		$ 318.47	$ 1,388.22	$ 2,607.59	$ 4,314.28
						Grand totals:		$ 318.47	$ 1,388.22	$ 2,607.59	$ 4,314.28

Maintenance Summary

Newton, MA

Date Range: 01/01/2020 - 12/31/2020

Department: SUSTAINABLE MATERIALS

Veh Id	Year/Make/Model	Date	Service	Service Request	Repair Description	Repair Category	Status	Labor ($)	Parts ($)	3rd ($)	Total ($)
146	2017 Elgin Pelican	11/17/2020	Repair	Replaced RH safety bar	Replaced safety bar of the right side for the bucket	Sweepers/Other	Closed	23.59	-	-	23.59
146	2017 Elgin Pelican	11/13/2020	Repair	Hydraulic leak	Replaced RH lift cylinder for conveyor	Sweepers/Conveyor System	Closed	48.80	0.00	0.00	48.80
146	2017 Elgin Pelican	11/12/2020	PM	PM-A		/	Closed	97.60	1,142.25	-	1,239.85
146	2017 Elgin Pelican	11/10/2020	Repair	Check operator panel switches	Replaced switches	Electrical/Modules, Relays, Switches	Closed	24.40	89.80	-	114.20
146	2017 Elgin Pelican	11/10/2020	St Insp	Result: Pass		/	Closed	0.00	0.00	-	0.00
146	2017 Elgin Pelican	11/03/2020	Repair	Check conveyor chain	Replaced chain and sprockets	Sweepers/Conveyor System	Closed	73.20	2,045.76	-	2,118.96
146	2017 Elgin Pelican	10/06/2020	Repair	Flat tire left rear	Replace both rear tires.	Chassis/Tires, Tubes, Liners & Valves	Closed	89.22	479.98	-	569.20
146	2017 Elgin Pelican	09/09/2020	Repair	Streetside dirt shoe/towbar	Parts were picked up by Rich Leone and he is going to install the parts	Sweepers/Conveyor System	Closed	-	1,708.07	-	1,708.07
146	2017 Elgin Pelican	08/24/2020	Repair	Hydraulic leak	tmosca@newtonma.gov	/	Closed	-	-	0.00	0.00
146	2017 Elgin Pelican	08/04/2020	Repair	Starting issue	tmosca@newtonma.gov		Closed	-	1,239.91	0.00	1,239.91
146	2017 Elgin Pelican	07/23/2020	Repair	Broken grease line again	tmosca@newtonma.gov		Closed	-	-	593.13	593.13
146	2017 Elgin Pelican	07/14/2020	Repair	Grease line popped off again	Rplace autolube connector that popped off a couple times.	Chassis/Automatic/Manual Chassis Lubricator	Closed	22.80	5.47	-	28.27
146	2017 Elgin Pelican	07/10/2020	Repair	Auto-lube grease line broken by pump	Re-installed line to fitting	Sweepers/Other	Closed	22.80	-	-	22.80
146	2017 Elgin Pelican	07/10/2020	Repair	Check A/C	Re-Charge A/C	Interior/HVAC	Closed	34.20	-	-	34.20
146	2017 Elgin Pelican	07/10/2020	Repair	Check hydraulic oil	Topped of hydraulic oil	Sweepers/Other	Closed	11.40	-	-	11.40
146	2017 Elgin Pelican	07/02/2020	Repair	Hydraulic leak	Replace 3 hyd hoses to the LH gutter broom.	Equipment Attachments/Hydraulic Systems	Closed	182.40	164.86	-	347.26
146	2017 Elgin Pelican	06/04/2020	PM	PM-A		/	Closed	-	-	-	0.00
146	2017 Elgin Pelican	06/04/2020	Repair	Streetside gutter broom pressure issue	csilva@newtonma.gov		Closed	-	-	0.00	0.00

Maintenance Summary

Newton, MA

Date Range: 01/01/2020 - 12/31/2020

Department: SUSTAINABLE MATERIALS

Veh Id	Year/Make/Model	Date	Service	Service Request	Repair Description	Repair Category	Status	Labor ($)	Parts ($)	3rd ($)	Total ($)
146	2017 Elgin Pelican	03/11/2020	Repair	Rear lights out	Repair chaffed wiring up near hopper. Fix shorted wiring at license plate connector.	Electrical/Lighting System	Closed	91.20	74.78	-	165.98
146	2017 Elgin Pelican	03/09/2020	Repair	Hydraulic leak	Replaced O-ring	Sweepers/Conveyor System	Closed	35.39	4.88	-	40.27
146	2017 Elgin Pelican	03/09/2020	Repair	No lights	Replaced wiring harness	Electrical/Lighting System	Closed	47.18	-	-	47.18
146	2017 Elgin Pelican	03/05/2020	Repair	No lights	Replaced blown fuse		Closed	11.40	-	-	11.40
146	2017 Elgin Pelican	02/11/2020	Repair	Grease line broken at pump	Replaced broken grease line	Sweepers/Other	Closed	22.80	40.71	-	63.51
146	2017 Elgin Pelican	01/23/2020	Repair	Swap correct tire onto back	Install correct tire onto rear steer axle.	Chassis/Tires, Tubes, Liners & Valves	Closed	11.40	-	-	11.40
146	2017 Elgin Pelican	01/22/2020	Repair	Install safety kit	supply missing safety kit.	/	Closed	-	54.92	-	54.92
146	2017 Elgin Pelican	01/21/2020	Repair	RH broom grease lines broken?	Repair broken grease lines to both sides gutter brooms.	Sweepers/Gutter Broom	Closed	11.40	28.26	-	39.66
146	2017 Elgin Pelican	01/16/2020	Repair	Missing dust cap on rear hub	Install missing rear hub caps.	Chassis/Wheels, Rims, Hubs & Bearings	Closed	11.40	35.74	-	47.14
146	2017 Elgin Pelican	01/15/2020	Repair	Check rear wheel bearings	Replace rear wheel bearings and races.		Closed	34.20	468.03	-	502.23
146	2017 Elgin Pelican	01/15/2020	Repair	Check LH broom pivot	Replace LH pivot weldment.	Sweepers/Gutter Broom	Closed	182.40	927.69	-	1,110.09
146	2017 Elgin Pelican	01/07/2020	PM	PM-A,PM-B,PM-C		/	Closed	-	-	2,467.64	2,467.64
146	2017 Elgin Pelican	01/03/2020	Repair	Flat rear tire	Replace flat rear tire at Elliot.	Chassis/Tires, Tubes, Liners & Valves	Closed	29.44	-	-	29.44

Department totals: $ 1,118.62 $ 8,511.11 $ 3,060.77 $ 12,690.50

Grand totals: $ 1,118.62 $ 8,511.11 $ 3,060.77 $ 12,690.50

Maintenance Summary

Newton, MA

Date Range: 01/01/2020 - 12/31/2020

Department: SUSTAINABLE MATERIALS

Veh Id	Year/Make/Model	Date	Service	Service Request	Repair Description	Repair Category	Status	Labor ($)	Parts ($)	3rd ($)	Total ($)
149	2018 Freightliner / Elgin M2-106	10/21/2020	Repair	Side door latch broken	Replaced broken latch	Exterior Body/Trim & Miscellaneous Hardware	Closed	23.59	106.84	-	130.43
149	2018 Freightliner / Elgin M2-106	09/21/2020	Repair	Broken grease line to caster	Hook up grease lines to vacuum tube casters.	Sweepers/Other	Closed	47.18	-	-	47.18
149	2018 Freightliner / Elgin M2-106	09/17/2020	Repair	Vacuum tubes not working correctly	Repair bent caster brackets and strengthen all.		Closed	339.72	-	0.00	339.72
149	2018 Freightliner / Elgin M2-106	09/17/2020	Repair	LF fender strobe light INOP	Replaced LF fender strobe	Electrical/Lighting System	Closed	23.59	111.86	0.00	135.45
149	2018 Freightliner / Elgin M2-106	08/19/2020	PM	PM-A		/	Closed	0.00	615.05	-	615.05
149	2018 Freightliner / Elgin M2-106	08/19/2020	Repair	Wire caught in right gutter broom	Removed wire from gutter broom	Sweepers/Sprayer System	Closed	22.80	-	-	22.80
149	2018 Freightliner / Elgin M2-106	08/10/2020	Repair	Broken mirror	Replace LH mirror damaged by accident.	Exterior Body/Mirrors & Brackets	Closed	11.40	-	-	11.40
149	2018 Freightliner / Elgin M2-106	07/01/2020	Repair	LR outer tire off bead	Repair LR outer tire.	Chassis/Tires, Tubes, Liners & Valves	Closed	44.61	-	-	44.61
149	2018 Freightliner / Elgin M2-106	06/29/2020	Repair	Rear engine leaking oil	tmosca@newtonma.gov	/	Closed	-	-	0.00	0.00
149	2018 Freightliner / Elgin M2-106	06/23/2020	Repair	Issue grease gun	parts only		Closed	-	-	-	0.00
149	2018 Freightliner / Elgin M2-106	06/19/2020	Repair	Water won't stop running	csilva@newtonma.gov		Closed	-	166.11	0.00	166.11
149	2018 Freightliner / Elgin M2-106	04/23/2020	Repair	Supply 2 sets of spare keys	parts only		Closed	-	28.80	-	28.80
149	2018 Freightliner / Elgin M2-106	02/24/2020	St Insp	Result: Pass			Closed	0.00	0.00	-	0.00
149	2018 Freightliner / Elgin M2-106	02/21/2020	Repair	New vehicle setup	tmosca@newtonma.gov		Closed	-	43.02	-	43.02

Department totals:	$ 512.89	$ 1,071.68	$ 0.00	$ 1,584.57
Grand totals:	$ 512.89	$ 1,071.68	$ 0.00	$ 1,584.57

Maintenance Summary

Newton, MA

Date Range: 01/01/2021 - 12/31/2021

Department: SUSTAINABLE MATERIALS

Veh Id	Year/Make/Model	Date	Service	Service Request	Repair Description	Repair Category	Status	Labor ($)	Parts ($)	3rd ($)	Total ($)
141	2017 Elgin Pelican	12/09/2021	PM	PM-A		/	Closed	117.63	182.01	-	299.64
141	2017 Elgin Pelican	12/09/2021	Repair	Front license plate broke off	Repair license plate bracket mount.	Exterior Body/Body	Closed	65.35	-	-	65.35
141	2017 Elgin Pelican	12/09/2021	Repair	Water switch broken	Replace switch face.	Electrical/Modules, Relays, Switches	Closed	26.14	-	-	26.14
141	2017 Elgin Pelican	12/09/2021	Repair	Conveyor chain and sprockets worn	rgately@newtonma.gov	/	Closed	-	256.71	-	256.71
141	2017 Elgin Pelican	11/16/2021	Repair	Repair hopper damage	Repair hopper damage.	Exterior Body/Body	Closed	63.07	-	-	63.07
141	2017 Elgin Pelican	11/03/2021	Repair	Issue fire extinguisher	tmosca@newtonma.gov	/	Closed	-	24.85	-	24.85
141	2017 Elgin Pelican	09/23/2021	Repair	Mirror broken	rgately@newtonma.gov	Exterior Body/Mirrors & Brackets	Closed	-	49.06	-	49.06
141	2017 Elgin Pelican	09/21/2021	PM	PM-A		/	Closed	97.60	224.33	-	321.93
141	2017 Elgin Pelican	09/21/2021	Repair	Check right gutter broom	Replaced dog bone	Sweepers/Gutter Broom	Closed	219.60	2,732.59	-	2,952.19
141	2017 Elgin Pelican	09/21/2021	Repair	Right side rear axle cap missing	Replaced wheel bearings and cab	Chassis/Wheels, Rims, Hubs & Bearings	Closed	97.60	165.40	-	263.00
141	2017 Elgin Pelican	09/21/2021	Repair	Check Radio	Replaced radio	Electrical/Modules, Relays, Switches	Closed	24.40	443.96	-	468.36
141	2017 Elgin Pelican	07/08/2021	Repair	Cab spot mirror broken	rgately@newtonma.gov	/	Closed	-	36.74	-	36.74
141	2017 Elgin Pelican	07/06/2021	Repair	Hopper mirrors broken	Replaced hopper mirrors	Exterior Body/Mirrors & Brackets	Closed	11.80	939.25	-	951.05
141	2017 Elgin Pelican	07/06/2021	Repair	RH hopper panel touching arm	Replaced hopper panel	Sweepers/Conveyor System	Closed	11.80	2,774.76	-	2,786.56
141	2017 Elgin Pelican	07/06/2021	Repair	Water won't shut off	Replaced manifold	Sweepers/Sprayer System	Closed	47.18	2.63	-	49.81
141	2017 Elgin Pelican	07/06/2021	Repair	Ripped conveyor belt	Replaced conveyor belt and bearings	Sweepers/Conveyor System	Closed	383.92	2,849.55	-	3,233.47
141	2017 Elgin Pelican	07/06/2021	Repair	Conveyor belt adjustment	Adjusted conveyor belt		Closed	47.18	1,500.10	-	1,547.28
141	2017 Elgin Pelican	07/06/2021	Repair	Wipers loose	Replaced wiper baldes	Exterior Body/Wiper Repairs	Closed	23.59	125.85	-	149.44
141	2017 Elgin Pelican	05/25/2021	Repair	RR tire cut in sidewall	Replace both rear tires.	Chassis/Tires, Tubes, Liners & Valves	Closed	29.74	479.98	-	509.72
141	2017 Elgin Pelican	04/16/2021	Repair	Grease line diconnected	Repair line on steer wheel.	Chassis/Automatic/Manual Chassis Lubricator	Closed	35.39	4.99	-	40.38

Maintenance Summary

Newton, MA

Date Range: 01/01/2021 - 12/31/2021

Department: SUSTAINABLE MATERIALS

Veh Id	Year/Make/Model	Date	Service	Service Request	Repair Description	Repair Category	Status	Labor ($)	Parts ($)	3rd ($)	Total ($)
141	2017 Elgin Pelican	04/15/2021	PM	PM-A,PM-B,PM-C		/	Closed	117.95	784.69	-	902.64
141	2017 Elgin Pelican	01/26/2021	Repair	License plate light	Replace light.	Electrical/Lighting System	Closed	-	2.21	-	2.21
141	2017 Elgin Pelican	01/26/2021	St Insp	Result: Pass		/	Closed	0.00	0.00	-	0.00
141	2017 Elgin Pelican	01/15/2021	Repair	Check conveyor drive chain	Replaced conveyor chain and sprocket	Sweepers/Conveyor System	Closed	82.57	259.07	-	341.64
141	2017 Elgin Pelican	01/14/2021	Repair	Hydraulic leak at the gutter broom	Replaced hyd. line at gutter broom	Sweepers/Gutter Broom	Closed	200.52	46.74	-	247.26
						Department totals:		$ 1,703.03	$ 13,885.47	-	$ 15,588.50
						Grand totals:		$ 1,703.03	$ 13,885.47	-	$ 15,588.50

Maintenance Summary

Newton, MA

Date Range: 01/01/2021 - 12/31/2021

Department: SUSTAINABLE MATERIALS

Veh Id	Year/Make/Model	Date	Service	Service Request	Repair Description	Repair Category	Status	Labor ($)	Parts ($)	3rd ($)	Total ($)
142	2017 Elgin Pelican	12/03/2021	PM	PM-A		/	Closed	67.65	182.01	-	249.66
142	2017 Elgin Pelican	12/03/2021	Repair	Hyd hose chaffed	Replace chaffed hyd hose to RH gutter broom.	Equipment Attachments/Hydraulic Systems	Closed	54.12	66.13	-	120.25
142	2017 Elgin Pelican	12/03/2021	Repair	Conveyor chain INOP	Replace chain and sprockets.	Sweepers/Conveyor System	Closed	108.24	280.78	-	389.02
142	2017 Elgin Pelican	12/03/2021	Repair	Check roll bar damage	Repair RH roll bar damage.	Exterior Body/Body	Closed	52.13	-	-	52.13
142	2017 Elgin Pelican	11/03/2021	Repair	Issue fire extinguisher	tmosca@newtonma.gov	/	Closed	-	24.85	-	24.85
142	2017 Elgin Pelican	10/08/2021	Repair	Hydraulic leak from left side gutter broom	Replaced o-ring on LH valve body	Equipment Attachments/Hydraulic Systems	Closed	94.36	-	-	94.36
142	2017 Elgin Pelican	09/21/2021	Repair	Replace wiper blades	Replaced wiper blades	Exterior Body/Wiper Repairs	Closed	23.59	256.72	-	280.31
142	2017 Elgin Pelican	09/21/2021	Repair	LH dirt shoe mount rotted off	Replaced LH dirt shoe	Sweepers/Conveyor System	Closed	106.16	-	-	106.16
142	2017 Elgin Pelican	09/21/2021	Repair	Rear flasher wiring pulled out	Repaired electrical connector	Electrical/Lighting System	Closed	82.57	-	-	82.57
142	2017 Elgin Pelican	08/30/2021	Repair	Dirt shoe runner plate damaged	parts only.	/	Closed	-	254.75	-	254.75
142	2017 Elgin Pelican	08/12/2021	Repair	Gutter broom adj	Adjusted gutter broom	Sweepers/Gutter Broom	Closed	97.60	-	-	97.60
142	2017 Elgin Pelican	07/14/2021	Repair	Engine misfire over 1100 rpms	Schmidt replace fuel pump under warranty. Paul replace soaked exhaust wrap.	Engine/Motor/Power Plant	Closed	24.40	3,934.68	-	3,959.08
142	2017 Elgin Pelican	05/11/2021	PM	PM-A		/	Closed	97.60	156.15	0.00	253.75
142	2017 Elgin Pelican	04/09/2021	Repair	License plate bracket broken	Relocated license plate	Exterior Body/Body	Closed	23.26	5.79	-	29.05
142	2017 Elgin Pelican	04/02/2021	Repair	Hydraulic leak	Replaced many hydraulic lines	Equipment Attachments/Hydraulic Systems	Closed	186.08	223.95	-	410.03
142	2017 Elgin Pelican	03/04/2021	PM	PM-A,PM-B,PM-C		/	Closed	146.40	721.97	0.00	868.37
142	2017 Elgin Pelican	03/01/2021	Repair	Damaged battery box cover	Replaced battery cover door	Exterior Body/Body	Closed	48.80	467.49	-	516.29
142	2017 Elgin Pelican	01/26/2021	Repair	Windshield wipers	Replaced both wipers	Exterior Body/Wiper Repairs	Closed	23.59	251.46	-	275.05

Maintenance Summary

Newton, MA

Date Range: 01/01/2021 - 12/31/2021

Department: SUSTAINABLE MATERIALS

Veh Id	Year/Make/Model	Date	Service	Service Request	Repair Description	Repair Category	Status	Labor ($)	Parts ($)	3rd ($)	Total ($)
142	2017 Elgin Pelican	01/26/2021	Repair	Back up camera loose	Tighten up back up camera	Other/Other	Closed	12.20	-	-	12.20
142	2017 Elgin Pelican	01/25/2021	Repair	Can not open door from inside	Adjusted linkage for inside door handle	Exterior Body/Body	Closed	25.99	-	-	25.99
142	2017 Elgin Pelican	01/11/2021	Repair	Grease fitting popped off	Replace grease fitting.	Chassis/Automatic/Manual Chassis Lubricator	Closed	12.20	-	-	12.20

Department totals:	$ 1,286.94	$ 6,826.73	$ 0.00	$ 8,113.67
Grand totals:	$ 1,286.94	$ 6,826.73	$ 0.00	$ 8,113.67

Maintenance Summary

Newton, MA

Date Range: 01/01/2021 - 12/31/2021

Department: SUSTAINABLE MATERIALS

Veh Id	Year/Make/Model	Date	Service	Service Request	Repair Description	Repair Category	Status	Labor ($)	Parts ($)	3rd ($)	Total ($)
143	2014 Elgin Pelican	12/14/2021	Repair	Conveyor switch INOP	Replaced switch	Electrical/Modules, Relays, Switches	Closed	27.06	22.47	-	49.53
143	2014 Elgin Pelican	11/12/2021	Repair	LH dirtshoe damaged from casting	Replaced dirt shoe	Equipment Attachments/Salt Spreader Conveyor & Spinner	Closed	73.20	1,842.45	-	1,915.65
143	2014 Elgin Pelican	11/03/2021	Repair	Issue fire extinguisher		/	Closed	-	24.85	-	24.85
143	2014 Elgin Pelican	09/24/2021	Repair	RH dirt shoe plate damaged	Replaced dirt shoe	Sweepers/Main Broom	Closed	122.00	1,031.91	-	1,153.91
143	2014 Elgin Pelican	09/15/2021	Repair	Water INOP	Remove debris from 90 degree elbow on bottom of water tank.	Sweepers/Sprayer System	Closed	35.39	-	-	35.39
143	2014 Elgin Pelican	09/15/2021	Repair	Check main broom adjustment	Replace up/down valve and coils and both cylinders.	Sweepers/Main Broom	Closed	200.52	1,068.46	1,232.76	2,501.74
143	2014 Elgin Pelican	08/24/2021	PM	PM-A		/	Closed	94.36	93.36	-	187.72
143	2014 Elgin Pelican	07/26/2021	Repair	Autolube inop	No problem found. Adjusted auto lube system	Sweepers/Other	Closed	129.75	-	-	129.75
143	2014 Elgin Pelican	07/22/2021	St Insp	Result: Pass		/	Closed	0.00	0.00	-	0.00
143	2014 Elgin Pelican	07/20/2021	Repair	Rocker switches broken	Replace broken rocker switches.	Electrical/Modules, Relays, Switches	Closed	23.59	262.50	-	286.09
143	2014 Elgin Pelican	07/15/2021	Repair	Check conveyor	Replaced conveyor chain and sprockets	Sweepers/Conveyor System	Closed	58.98	492.80	-	551.78
143	2014 Elgin Pelican	07/15/2021	Repair	Dirt deflector damaged	Replaced upper hopper seal and bracket		Closed	23.59	320.54	-	344.13
143	2014 Elgin Pelican	07/14/2021	PM	PM-A		/	Closed	0.00	199.96	-	199.96
143	2014 Elgin Pelican	06/03/2021	Repair	A/C blowing warm	Replac a/c compressor, receiver/dryer, evaperator w expansion valve and schrader valves.	Interior/HVAC	Closed	342.06	2,251.40	-	2,593.46
143	2014 Elgin Pelican	06/03/2021	Repair	Side cover latch broken	tmosca@newtonma.gov	/	Closed	-	25.65	-	25.65
143	2014 Elgin Pelican	04/27/2021	Repair	No start	Jump started	Electrical/Battery	Closed	24.40	-	-	24.40
143	2014 Elgin Pelican	04/12/2021	Repair	Hard wire GPS	Repaired ground wire	Electrical/Other	Closed	24.40	-	-	24.40

Maintenance Summary

Newton, MA

Date Range: 01/01/2021 - 12/31/2021

Department: SUSTAINABLE MATERIALS

Veh Id	Year/Make/Model	Date	Service	Service Request	Repair Description	Repair Category	Status	Labor ($)	Parts ($)	3rd ($)	Total ($)
143	2014 Elgin Pelican	04/12/2021	Repair	Battery door alignment	Replaced left hand door hinge	Exterior Body/Body	Closed	15.32	20.99	-	36.31
143	2014 Elgin Pelican	04/09/2021	Repair	Paint battery door cover	Paint door.		Closed	30.63	-	-	30.63
143	2014 Elgin Pelican	04/07/2021	Repair	Hyd leak, road call	Repaired many hydraulic lines	Equipment Attachments/Hydraulic Systems	Closed	244.00	566.62	-	810.62
143	2014 Elgin Pelican	04/05/2021	Repair	Battery door damaged	Replaced battery cover	Exterior Body/Body	Closed	24.40	430.39	-	454.79
143	2014 Elgin Pelican	03/22/2021	PM	PM-A,PM-B,PM-C		/	Closed	93.04	493.12	0.00	586.16
143	2014 Elgin Pelican	03/22/2021	Repair	A/C inop	Double written		Closed	-	-	-	0.00
143	2014 Elgin Pelican	03/12/2021	Repair	Engine will not start	Replaced lift pump	Engine/Motor/Fuel System	Closed	69.78	132.82	-	202.60
143	2014 Elgin Pelican	03/11/2021	Repair	Wiper blades	Replaced wiper blades	Exterior Body/Wiper Repairs	Closed	23.26	251.70	-	274.96
143	2014 Elgin Pelican	03/10/2021	Repair	HVAC switch inop intermittently	Replaced blower motor switch	Interior/HVAC	Closed	46.52	88.74	-	135.26
143	2014 Elgin Pelican	01/04/2021	Repair	Hopper mirror	Replace mirror.	Exterior Body/Mirrors & Brackets	Closed	-	-	-	0.00
143	2014 Elgin Pelican	12/15/2020	Repair	Broom dirt skirt repair	Replace main broom skirt and bracket.	Sweepers/Main Broom	Closed	129.75	799.87	-	929.62

Department totals: $ 1,856.00 $ 10,420.60 $ 1,232.76 $ 13,509.36

Grand totals: $ 1,856.00 $ 10,420.60 $ 1,232.76 $ 13,509.36

Maintenance Summary

Newton, MA

Date Range: 01/01/2021 - 12/31/2021

Department: SUSTAINABLE MATERIALS

Veh Id	Year/Make/Model	Date	Service	Service Request	Repair Description	Repair Category	Status	Labor ($)	Parts ($)	3rd ($)	Total ($)
144	2013 Elgin Pelican	11/24/2021	Repair	Dirt shoe damage	Replaced dirt shoe	Sweepers/Conveyor System	Closed	122.00	-	-	122.00
144	2013 Elgin Pelican	11/24/2021	Repair	Coolant leak	Replaced upper rad. hose	Engine/Motor/Cooling System	Closed	48.80	56.46	-	105.26
144	2013 Elgin Pelican	11/23/2021	PM	PM-A		/	Closed	73.20	119.12	-	192.32
144	2013 Elgin Pelican	11/03/2021	Repair	Issue fire extinguisher	tmosca@newtonma.gov		Closed	-	24.85	-	24.85
144	2013 Elgin Pelican	09/29/2021	Repair	Bent dirt shoe	Replaced LH dirt shoe	Sweepers/Conveyor System	Closed	106.16	157.80	-	263.96
144	2013 Elgin Pelican	09/21/2021	Repair	Nail in LF tire	Plug tire.	Chassis/Tires, Tubes, Liners & Valves	Closed	14.87	-	-	14.87
144	2013 Elgin Pelican	09/20/2021	St Insp	Result: Pass		/	Closed	0.00	0.00	-	0.00
144	2013 Elgin Pelican	09/15/2021	Repair	Right headlight inop	Replace RH headlamp.	Electrical/Lighting System	Closed	11.63	245.38	-	257.01
144	2013 Elgin Pelican	09/15/2021	Repair	Conveyor INOP	Replace conveyor chain.	Sweepers/Conveyor System	Closed	116.30	251.25	-	367.55
144	2013 Elgin Pelican	08/31/2021	Repair	RR tire flat	Replace both rear tires.	Chassis/Tires, Tubes, Liners & Valves	Closed	59.48	685.76	-	745.24
144	2013 Elgin Pelican	08/17/2021	Repair	Exhaust tip rotted off	Replaced tail pipe and wrap	Engine/Motor/Exhaust System	Closed	58.15	701.30	-	759.45
144	2013 Elgin Pelican	07/29/2021	Repair	Road call, engine derated	Replace corroded pin on low coolant sensor.	Engine/Motor/Cooling System	Closed	129.75	-	-	129.75
144	2013 Elgin Pelican	07/07/2021	Repair	coolant cap broken	Replaced overflow tank		Closed	46.52	141.94	-	188.46
144	2013 Elgin Pelican	07/06/2021	Repair	Hyd leak	Replaced 90 degree elbow at pump	Equipment Attachments/Hydraulic Systems	Closed	151.19	264.02	-	415.21
144	2013 Elgin Pelican	07/01/2021	PM	PM-A		/	Closed	-	117.45	-	117.45
144	2013 Elgin Pelican	05/11/2021	Repair	Gas gauge INOP	Replaced fuel tank, and fuel sender	Engine/Motor/Fuel System	Closed	195.20	1,449.63	-	1,644.83
144	2013 Elgin Pelican	05/10/2021	Repair	Fuel tank filler neck mod	Modify fuel tank filler neck.		Closed	45.95	-	-	45.95
144	2013 Elgin Pelican	04/07/2021	Repair	Left front tire valve stem leaking air and nail in tire	Patch tire, replace core.	Chassis/Tires, Tubes, Liners & Valves	Closed	37.18	-	-	37.18
144	2013 Elgin Pelican	03/12/2021	PM	PM-A,PM-B,PM-C		/	Closed	-	506.82	0.00	506.82

Maintenance Summary

Newton, MA

Date Range: 01/01/2021 - 12/31/2021

Department: SUSTAINABLE MATERIALS

Veh Id	Year/Make/Model	Date	Service	Service Request	Repair Description	Repair Category	Status	Labor ($)	Parts ($)	3rd ($)	Total ($)
144	2013 Elgin Pelican	03/10/2021	Repair	Autolube inop	Disconnected grease lines and various locations and no issue found	Accessories/Other	Closed	35.39	57.68	-	93.07
144	2013 Elgin Pelican	03/08/2021	Repair	Overheats easily	Blow out radiator and drove around to make sure it doesn't overheat	Engine/Motor/Cooling System	Closed	153.34	87.80	-	241.14
144	2013 Elgin Pelican	01/22/2021	Repair	Main broom arm bushings	tmosca@newtonma.gov	/	Closed	-	-	3,450.28	3,450.28
144	2013 Elgin Pelican	01/08/2021	Repair	Blown hydraulic line	tmosca@newtonma.gov		Closed	-	53.27	1,392.95	1,446.22
							Department totals:	$ 1,405.11	$ 4,920.53	$ 4,843.23	$ 11,168.87
							Grand totals:	$ 1,405.11	$ 4,920.53	$ 4,843.23	$ 11,168.87

Maintenance Summary

Newton, MA

Date Range: 01/01/2021 - 12/31/2021

Department: SUSTAINABLE MATERIALS

Veh Id	Year/Make/Model	Date	Service	Service Request	Repair Description	Repair Category	Status	Labor ($)	Parts ($)	3rd ($)	Total ($)
145	2019 Elgin Pelican	11/03/2021	Repair	Issue fire extinguisher	tmosca@newtonma.gov	/	Closed	-	24.85	-	24.85
145	2019 Elgin Pelican	10/21/2021	PM	PM-A			Closed	94.36	175.58	0.00	269.94
145	2019 Elgin Pelican	10/21/2021	Repair	Check conveyor belt+chain	Replaced top conv. roller, bearing and chain	Sweepers/Conveyor System	Closed	200.52	1,829.94	-	2,030.46
145	2019 Elgin Pelican	10/21/2021	Repair	Replace RH dirtshoe plate assy	Replaced RH dirt shoe	Sweepers/Main Broom	Closed	117.95	840.06	-	958.01
145	2019 Elgin Pelican	10/21/2021	Repair	RH gutter broom doesn't stay down	No issue found	Sweepers/Gutter Broom	Closed	35.39	721.67	-	757.06
145	2019 Elgin Pelican	10/21/2021	Repair	Hydraulic hose chafed	Replaced RH broom rotate hyd. liner	Equipment Attachments/Hydraulic Systems	Closed	94.36	59.70	-	154.06
145	2019 Elgin Pelican	07/08/2021	PM	PM-A		/	Closed	109.80	-	0.00	109.80
145	2019 Elgin Pelican	07/08/2021	Repair	Check conveyor belt	No issue found. Filters charged out on incorrect RR.		Closed	-	179.21	-	179.21
145	2019 Elgin Pelican	07/08/2021	Repair	Driver's seat doesn't air up	Repair air line. Replace shock and pump.	Interior/Upholstery	Closed	82.57	774.60	-	857.17
145	2019 Elgin Pelican	07/08/2021	Repair	MB won't go down	tmosca@newtonma.gov	/	Closed	-	-	0.00	0.00
145	2019 Elgin Pelican	07/08/2021	Repair	Reprogram autolube settings	Reprogram autolube.	Chassis/Automatic/Manual Chassis Lubricator	Closed	24.40	-	-	24.40
145	2019 Elgin Pelican	04/27/2021	St Insp	Result: Pass		/	Closed	0.00	0.00	-	0.00
145	2019 Elgin Pelican	04/06/2021	PM	PM-A,PM-B,PM-C			Closed	82.57	566.04	0.00	648.61
145	2019 Elgin Pelican	03/31/2021	Repair	Water leak RH side	Replaced hose to gutter broom	Sweepers/Sprayer System	Closed	47.18	176.38	-	223.56
145	2019 Elgin Pelican	03/30/2021	Repair	Both gutter broom lights out	Replaced both gutter broom lights	Electrical/Lighting System	Closed	47.18	171.06	-	218.24
145	2019 Elgin Pelican	03/30/2021	Repair	Driver seat won't stay up	Replaced seat piston	Interior/Other	Closed	46.85	58.76	-	105.61

Department totals: $ 983.13 $ 5,577.85 $ 0.00 $ 6,560.98

Grand totals: $ 983.13 $ 5,577.85 $ 0.00 $ 6,560.98

Maintenance Summary

Newton, MA

Date Range: 01/01/2021 - 12/31/2021

Department: SUSTAINABLE MATERIALS

Veh Id	Year/Make/Model	Date	Service	Service Request	Repair Description	Repair Category	Status	Labor ($)	Parts ($)	3rd ($)	Total ($)
146	2017 Elgin Pelican	02/11/2022	Repair	Broken windshield	tmosca@newtonma.gov	/	Closed	-	1,331.96	655.95	1,987.91
146	2017 Elgin Pelican	02/11/2022	Repair	Intermittently doesn't move	tmosca@newtonma.gov		Closed	-	-	7,156.15	7,156.15
146	2017 Elgin Pelican	12/17/2021	Repair	Broken hopper mirror	Replaced mirror	Exterior Body/Mirrors & Brackets	Closed	27.06	65.74	-	92.80
146	2017 Elgin Pelican	12/06/2021	St Insp	Result: Pass		/	Closed	0.00	0.00	-	0.00
146	2017 Elgin Pelican	11/23/2021	Repair	Grease fitting broken	rgately@newtonma.gov		Closed	-	10.97	-	10.97
146	2017 Elgin Pelican	10/22/2021	Repair	Broken rear springs	tmosca@newtonma.gov		Closed	-	-	2,015.40	2,015.40
146	2017 Elgin Pelican	10/22/2021	Repair	Rear wheel bearings loose	Replace rear wheel bearings and races.	Chassis/Wheels, Rims, Hubs & Bearings	Closed	97.60	223.54	-	321.14
146	2017 Elgin Pelican	10/12/2021	Repair	Check rear tires	Replace 2 rear tires.	Chassis/Tires, Tubes, Liners & Valves	Closed	29.74	479.98	-	509.72
146	2017 Elgin Pelican	09/24/2021	PM	PM-A		/	Closed	94.36	172.32	-	266.68
146	2017 Elgin Pelican	09/24/2021	Repair	MB down pressure switch frozen	Replaced switch	Electrical/Modules, Relays, Switches	Closed	24.40	222.16	-	246.56
146	2017 Elgin Pelican	09/24/2021	Repair	Check conveyor chain, no issue known	Checked chain, Chain is good	Sweepers/Conveyor System	Closed	35.39	-	-	35.39
146	2017 Elgin Pelican	09/24/2021	Repair	Both wiper arms loose	Adjusted wiper arms and tightened Arms	Exterior Body/Wiper Repairs	Closed	23.59	-	-	23.59
146	2017 Elgin Pelican	08/04/2021	Repair	LF tire flat	Replace both front tires.	Chassis/Tires, Tubes, Liners & Valves	Closed	44.61	969.80	-	1,014.41
146	2017 Elgin Pelican	07/14/2021	Repair	MB adjustment bracket collar missing	parts only.	/	Closed	-	517.24	-	517.24
146	2017 Elgin Pelican	07/01/2021	Repair	Yellow diamond on dash and alarm?	Exhaust filter warning light. Light going on and off Going to keep an eye on it and if it comes back he will come back	Engine/Motor/Exhaust - After Treatment	Closed	11.80	-	-	11.80
146	2017 Elgin Pelican	06/10/2021	Repair	Main broom arm broken?	Replace broken MB RH arm and dirt shoe assy.	Sweepers/Main Broom	Closed	224.11	2,465.91	-	2,690.02
146	2017 Elgin Pelican	06/10/2021	Repair	Conveyor chain and sprocket	Replace chain and sprockets.	Sweepers/Conveyor System	Closed	82.57	-	-	82.57
146	2017 Elgin Pelican	06/09/2021	PM	PM-A		/	Closed	94.36	271.08	-	365.44

Maintenance Summary

Newton, MA

Date Range: 01/01/2021 - 12/31/2021

Department: SUSTAINABLE MATERIALS

Veh Id	Year/Make/Model	Date	Service	Service Request	Repair Description	Repair Category	Status	Labor ($)	Parts ($)	3rd ($)	Total ($)
146	2017 Elgin Pelican	04/15/2021	Repair	Hydraulic leak	Replace damaged RH hyd lines.	Equipment Attachments/Hydraulic Systems	Closed	139.56	61.45	-	201.01
146	2017 Elgin Pelican	03/31/2021	Repair	Right gutter broom hydraulic leak	Replaced gutter broom motor	Sweepers/Gutter Broom	Closed	73.20	1,051.97	-	1,125.17
146	2017 Elgin Pelican	03/31/2021	Repair	Right headlight INOP	Replaced headlight	Electrical/Lighting System	Closed	24.40	255.42	-	279.82
146	2017 Elgin Pelican	03/31/2021	Repair	Check left gutter broom pin?	Replaced wishbone and pins	Sweepers/Gutter Broom	Closed	61.00	46.98	-	107.98
146	2017 Elgin Pelican	03/31/2021	Repair	Gutter broom lights INOP	Replaced wiring and replaced light	Electrical/Lighting System	Closed	36.60	-	-	36.60
146	2017 Elgin Pelican	03/17/2021	Repair	Gutter broom light is out	Replaced lights		Closed	36.60	461.31	-	497.91
146	2017 Elgin Pelican	03/03/2021	Repair	Gutter broom lights inop	Replaced fuse and replaced street side bulb		Closed	23.59	6.83	-	30.42
146	2017 Elgin Pelican	03/02/2021	PM	PM-A,PM-B,PM-C		/	Closed	146.40	567.21	-	713.61
146	2017 Elgin Pelican	01/04/2021	Repair	Hopper mirror broken	Replace mirror.	Exterior Body/Mirrors & Brackets	Closed	-	58.72	-	58.72

Department totals: $ 1,330.94 $ 9,240.59 $ 9,827.50 $ 20,399.03

Grand totals: $ 1,330.94 $ 9,240.59 $ 9,827.50 $ 20,399.03

Maintenance Summary

Newton, MA

Date Range: 01/01/2021 - 12/31/2021

Department: SUSTAINABLE MATERIALS

Veh Id	Year/Make/Model	Date	Service	Service Request	Repair Description	Repair Category	Status	Labor ($)	Parts ($)	3rd ($)	Total ($)
147	2021 Elgin Pelican	12/15/2021	PM	PM-A		/	Closed	81.18	273.04	-	354.22
147	2021 Elgin Pelican	12/15/2021	Repair	No start after service	Bleed fuel system a lot.	Engine/Motor/Fuel System	Closed	-	94.51	0.00	94.51
147	2021 Elgin Pelican	12/15/2021	Repair	Replace battery and refuel	Replace battery and refuel.	Electrical/Battery	Closed	270.60	-	-	270.60
147	2021 Elgin Pelican	11/08/2021	Repair	Broken windshield wiper	Replaced wiper motor and wiper	Exterior Body/Wiper Repairs	Closed	146.40	1,751.31	-	1,897.71
147	2021 Elgin Pelican	11/08/2021	Repair	Broken hood latch	Replaced hood hold down	Exterior Body/Trim & Miscellaneous Hardware	Closed	13.00	100.53	-	113.53
147	2021 Elgin Pelican	11/03/2021	Repair	Issue fire extinguisher	tmosca@newtonma.gov	/	Closed	-	24.85	-	24.85
147	2021 Elgin Pelican	09/16/2021	PM	PM-A			Closed	106.16	174.29	-	280.45
147	2021 Elgin Pelican	09/15/2021	Repair	Check RH wiper arm	Replace wiper blade and adj arm.	Exterior Body/Wiper Repairs	Closed	23.59	128.36	-	151.95
147	2021 Elgin Pelican	07/26/2021	Repair	Check rear grease fitting connections	Check programming, ok. No leaks after 2 hours. Pumped tank full and will watch usage. Currently 186.7 engine hours.	Chassis/Automatic/Manual Chassis Lubricator	Closed	153.34	-	-	153.34
147	2021 Elgin Pelican	06/21/2021	Repair	Install auto-lube fitting	Install QC fitting.		Closed	24.40	-	-	24.40
147	2021 Elgin Pelican	06/21/2021	Repair	Check autolube speed	Adjust 141, 142, 147 to every 20 mins run for 6 mins.		Closed	24.40	-	-	24.40
147	2021 Elgin Pelican	06/16/2021	PM	PM-A		/	Closed	73.20	137.11	0.00	210.31
147	2021 Elgin Pelican	06/01/2021	Repair	New vehicle setup			Closed	-	16.72	-	16.72
147	2021 Elgin Pelican	05/13/2021	St Insp	Result: Pass			Closed	0.00	0.00	-	0.00

Department totals:	$ 916.27	$ 2,700.72	$ 0.00	$ 3,616.99
Grand totals:	$ 916.27	$ 2,700.72	$ 0.00	$ 3,616.99

Maintenance Summary

Newton, MA

Date Range: 01/01/2021 - 12/31/2021

Department: SUSTAINABLE MATERIALS

Veh Id	Year/Make/Model	Date	Service	Service Request	Repair Description	Repair Category	Status	Labor ($)	Parts ($)	3rd ($)	Total ($)
149	2018 Freightliner / Elgin M2-106	10/21/2021	Repair	Water working poorly	Replaced water filter then replaced water pump and unclogged water nozzles	Sweepers/Sprayer System	Closed	122.00	1,223.85	-	1,345.85
149	2018 Freightliner / Elgin M2-106	09/03/2021	Repair	MB coning issue	tmosca@newtonma.gov	/	Closed	-	-	2,686.10	2,686.10
149	2018 Freightliner / Elgin M2-106	08/11/2021	PM	PM-A			Closed	207.40	745.42	-	952.82
149	2018 Freightliner / Elgin M2-106	07/28/2021	Repair	Check grease programming	Reprogram autolube timing.	Chassis/Automatic/Manual Chassis Lubricator	Closed	58.98	-	-	58.98
149	2018 Freightliner / Elgin M2-106	07/28/2021	Repair	Tailgate not latch issue/ in cab alarms	Tailgate latch system fine. Found overload alarm switch adjusted improperly.	Accessories/Horns & Alarms	Closed	106.16	-	-	106.16
149	2018 Freightliner / Elgin M2-106	06/28/2021	Repair	Side door latch broken	Replaced side door latch on right hopper	Exterior Body/Trim & Miscellaneous Hardware	Closed	16.22	99.09	-	115.31
149	2018 Freightliner / Elgin M2-106	06/28/2021	Repair	Rear hopper screen fell off	Reattached screen in hopper	Sweepers/Other	Closed	32.44	-	-	32.44
149	2018 Freightliner / Elgin M2-106	05/10/2021	Repair	Suction tubes not engaging	Water needs to be on for suction tubes to drop. No issue.	Sweepers/Sprayer System	Closed	12.20	-	-	12.20
149	2018 Freightliner / Elgin M2-106	04/28/2021	Repair	CEL on	tmosca@newtonma.gov	/	Closed	-	-	264.00	264.00
149	2018 Freightliner / Elgin M2-106	04/07/2021	Repair	RH vacuum tube damage	Straighten left turn brackets, Bent back LH vacuum tube	Sweepers/Gutter Broom	Closed	131.02	-	-	131.02
149	2018 Freightliner / Elgin M2-106	04/07/2021	Repair	No start	Jump started and replaced batteries	Electrical/Battery	Closed	47.66	206.90	-	254.56
149	2018 Freightliner / Elgin M2-106	03/29/2021	Repair	Fittings missing from pressure hose	Ordered and gave fitting to ricky fuentes	/	Closed	-	49.24	-	49.24
149	2018 Freightliner / Elgin M2-106	03/09/2021	St Insp	Result: Pass			Closed	0.00	0.00	-	0.00
149	2018 Freightliner / Elgin M2-106	03/08/2021	Repair	No start	Jump started	Electrical/Battery	Closed	24.40	-	-	24.40

Department totals: $ 758.48 $ 2,324.50 $ 2,950.10 $ 6,033.08

Grand totals: $ 758.48 $ 2,324.50 $ 2,950.10 $ 6,033.08

Maintenance Summary

Newton, MA

Date Range: 01/01/2022 - 12/31/2022

Department: SUSTAINABLE MATERIALS

Veh Id	Year/Make/Model	Date	Service	Service Request	Repair Description	Repair Category	Status	Labor ($)	Parts ($)	3rd ($)	Total ($)
141	2017 Elgin Pelican	12/29/2022	Repair	Rear wheel wobbling		/	Closed	-	-	4,000.00	4,000.00
141	2017 Elgin Pelican	12/29/2022	Repair	Fuel gauge inop			Closed	-	-	272.79	272.79
141	2017 Elgin Pelican	11/15/2022	PM	PM-A			Closed	99.45	875.26	-	974.71
141	2017 Elgin Pelican	11/15/2022	Repair	Gutter broom light out	replace gutter broom light and terminal	Electrical/Lighting System	Closed	39.78	186.61	-	226.39
141	2017 Elgin Pelican	11/15/2022	Repair	Check mirrors	replace right side mirror	Exterior Body/Mirrors & Brackets	Closed	19.89	26.89	-	46.78
141	2017 Elgin Pelican	07/06/2022	PM	PM-A		/	Closed	92.82	207.01	-	299.83
141	2017 Elgin Pelican	07/06/2022	Repair	Check work lights	Replaced LH broom light	Electrical/Lighting System	Closed	26.52	157.32	-	183.84
141	2017 Elgin Pelican	07/05/2022	Repair	Conveyor chain loose	Replaced conveyor chain	Sweepers/Conveyor System	Closed	92.82	264.21	-	357.03
141	2017 Elgin Pelican	07/01/2022	Repair	Rear wheel damaged	Replaced rear tire	Chassis/Tires, Tubes, Liners & Valves	Closed	26.52	0.00	-	26.52
141	2017 Elgin Pelican	06/16/2022	Repair	LH gutter broom not spinning	Could not duplicate concern.	Sweepers/Gutter Broom	Closed	66.30	-	-	66.30
141	2017 Elgin Pelican	06/09/2022	Repair	Bent RH dirt shoe	Replace both dirt shoes.	Sweepers/Main Broom	Closed	119.34	3,155.78	-	3,275.12
141	2017 Elgin Pelican	06/03/2022	Repair	Overfilled grease. Broke cover	Replaced grease cover	Sweepers/Other	Closed	79.56	0.00	-	79.56
141	2017 Elgin Pelican	05/19/2022	Repair	Check mirrors, LH broken	Replace mirrors	Exterior Body/Mirrors & Brackets	Closed	26.52	155.46	-	181.98
141	2017 Elgin Pelican	05/19/2022	Repair	Hyd leak	Replaced hydraulic solenoid	Equipment Attachments/Hydraulic Systems	Closed	79.56	396.28	-	475.84
141	2017 Elgin Pelican	05/19/2022	Repair	Directional lights inop	Found a loose connection at relay	Electrical/Lighting System	Closed	53.04	-	-	53.04
141	2017 Elgin Pelican	03/29/2022	Repair	Blinker and flash INOP at times	No issue found	/	Closed	39.78	-	-	39.78
141	2017 Elgin Pelican	03/28/2022	PM	PM-A,PM-B,PM-C			Closed	225.42	652.31	0.00	877.73
141	2017 Elgin Pelican	03/28/2022	St Insp	Result: Pass			Closed	0.00	0.00	-	0.00
141	2017 Elgin Pelican	01/19/2022	Repair	Flat tire	Replaced LF wheel	Chassis/Steering	Closed	66.30	-	-	66.30

Maintenance Summary

Newton, MA

Date Range: 01/01/2022 - 12/31/2022

Department: SUSTAINABLE MATERIALS

Veh Id	Year/Make/Model	Date	Service	Service Request	Repair Description	Repair Category	Status	Labor ($)	Parts ($)	3rd ($)	Total ($)
						Department totals:		$ 1,153.62	$ 6,077.13	$ 4,272.79	$ 11,503.54
						Grand totals:		$ 1,153.62	$ 6,077.13	$ 4,272.79	$ 11,503.54

Maintenance Summary

Newton, MA

Date Range: 01/01/2022 - 12/31/2022

Department: SUSTAINABLE MATERIALS

Veh Id	Year/Make/Model	Date	Service	Service Request	Repair Description	Repair Category	Status	Labor ($)	Parts ($)	3rd ($)	Total ($)
142	2017 Elgin Pelican	09/20/2022	Repair	Screw in RR tire sidewall	Replaced wheel, filled to proper psi	Chassis/Wheels, Rims, Hubs & Bearings	Closed	13.26	323.16	-	336.42
142	2017 Elgin Pelican	07/28/2022	Repair	Grease line broken off guide wheel	Repair broken fitting on guide wheel.	Chassis/Automatic/Manual Chassis Lubricator	Closed	27.45	32.65	-	60.10
142	2017 Elgin Pelican	07/21/2022	Repair	Fault codes active		/	Closed	-	-	5,552.53	5,552.53
142	2017 Elgin Pelican	05/26/2022	Repair	Rhythmic clunking noise under cab while sweeping	Replaced wish bone on dirt shoe	Sweepers/Conveyor System	Closed	106.08	695.05	-	801.13
142	2017 Elgin Pelican	05/09/2022	Repair	Warning light	Replace faulty fuel pressure sensor, barring machine from regening passively.	Engine/Motor/Power Plant	Closed	66.30	6.44	588.04	660.78
142	2017 Elgin Pelican	04/22/2022	PM	PM-A,PM-B,PM-C		/	Closed	106.08	97.45	-	203.53
142	2017 Elgin Pelican	04/22/2022	Repair	Stop engine light comes on when cold	Replaced crank case pressure sensor	Engine/Motor/Power Plant	Closed	82.35	51.82	611.29	745.46
142	2017 Elgin Pelican	04/22/2022	Repair	Conveyor chain	Replaced conveyor chain	Sweepers/Conveyor System	Closed	53.04	0.00	-	53.04
142	2017 Elgin Pelican	04/22/2022	Repair	Check RH dirt shoe plate mount	Replaced dirt shoe		Closed	132.60	865.26	-	997.86
142	2017 Elgin Pelican	04/22/2022	Repair	Check steer hubs	Replaced both steering hubs and bears	Chassis/Wheels, Rims, Hubs & Bearings	Closed	212.16	839.92	-	1,052.08
142	2017 Elgin Pelican	01/05/2022	Repair	Headlight broken	Replace LH headlight.	Electrical/Lighting System	Closed	-	271.47	-	271.47
142	2017 Elgin Pelican	01/05/2022	St Insp	Result: Pass		/	Closed	0.00	0.00	-	0.00

Department totals: $ 799.32 $ 3,183.22 $ 6,751.86 $ 10,734.40

Grand totals: $ 799.32 $ 3,183.22 $ 6,751.86 $ 10,734.40

Maintenance Summary

Newton, MA

Date Range: 01/01/2022 - 12/31/2022

Department: SUSTAINABLE MATERIALS

Veh Id	Year/Make/Model	Date	Service	Service Request	Repair Description	Repair Category	Status	Labor ($)	Parts ($)	3rd ($)	Total ($)
143	2014 Elgin Pelican	11/29/2022	Repair	Front brakes worn	replaced front brake pads and two calipers on F/R	Chassis/Brakes	Closed	459.04	3,823.28	-	4,282.32
143	2014 Elgin Pelican	11/28/2022	Repair	Hyd leak at LH gutter broom	re-tighten loose hydraulic line	Equipment Attachments/Hydraulic Systems	Closed	40.98	-	-	40.98
143	2014 Elgin Pelican	11/28/2022	Repair	left front tire slice in sidewall	replaced left front tire	Chassis/Tires, Tubes, Liners & Valves	Closed	34.15	484.66	-	518.81
143	2014 Elgin Pelican	11/10/2022	Repair	Gutter broom nozzle missing	replaced left side water nozzle	Equipment Attachments/Liquid Application System	Closed	13.66	24.16	-	37.82
143	2014 Elgin Pelican	11/07/2022	Repair	Check for leaks	Hydraulic system	Sweepers/Main Broom	Closed	26.52	-	-	26.52
143	2014 Elgin Pelican	11/04/2022	Repair	RH seat adjuster broken	Swap front seats. Lock broken seat adjuster in place.	Interior/Upholstery	Closed	139.68	-	-	139.68
143	2014 Elgin Pelican	11/04/2022	Repair	Hopper door bent, won't close	Straighten hopper door damage.	Exterior Body/Body	Closed	96.03	-	-	96.03
143	2014 Elgin Pelican	11/04/2022	Repair	Hyd fluid low	Top off hydraulic tank	Equipment Attachments/Hydraulic Systems	Closed	39.78	-	-	39.78
143	2014 Elgin Pelican	08/08/2022	PM	PM-A		/	Closed	109.80	320.69	-	430.49
143	2014 Elgin Pelican	06/23/2022	Repair	Dirt shoes won't lower with MB	Replaced conveyor lower solenoid	Sweepers/Conveyor System	Closed	132.60	256.45	-	389.05
143	2014 Elgin Pelican	06/07/2022	Repair	Hydraulic leak	Replaced 4 hydraulic lines that go thru the middle of the sweeper	Equipment Attachments/Hydraulic Systems	Closed	424.32	1,706.44	-	2,130.76
143	2014 Elgin Pelican	06/07/2022	Repair	Right hand mirror broken	Replaced mirror	Exterior Body/Mirrors & Brackets	Closed	13.26	26.89	-	40.15
143	2014 Elgin Pelican	05/26/2022	Repair	Check tires	Replaced tires	Chassis/Tires, Tubes, Liners & Valves	Closed	41.18	0.00	-	41.18
143	2014 Elgin Pelican	05/26/2022	Repair	Main broom repairs	Repaired main broom	Sweepers/Main Broom	Closed	233.33	2,340.27	-	2,573.60
143	2014 Elgin Pelican	05/26/2022	Repair	Exhaust pipe loose	Replaced broken exhaust pipe	Engine/Motor/Exhaust System	Closed	219.60	463.61	-	683.21
143	2014 Elgin Pelican	05/26/2022	Repair	Water doesn't shut off	Replaced water manifold	Sweepers/Sprayer System	Closed	54.90	834.05	-	888.95
143	2014 Elgin Pelican	05/26/2022	Repair	Hydraulic leak	Replaced hydraulic hoses	Equipment Attachments/Hydraulic Systems	Closed	219.60	1,050.78	-	1,270.38

Maintenance Summary

Newton, MA

Date Range: 01/01/2022 - 12/31/2022

Department: SUSTAINABLE MATERIALS

Veh Id	Year/Make/Model	Date	Service	Service Request	Repair Description	Repair Category	Status	Labor ($)	Parts ($)	3rd ($)	Total ($)
143	2014 Elgin Pelican	04/15/2022	Repair	Hydraulic leak	Replaced broken hydraulic actuator		Closed	39.78	317.95	-	357.73
143	2014 Elgin Pelican	04/15/2022	Repair	Broken battery cover door	Replaced battery door cover	Exterior Body/Body	Closed	13.26	445.05	-	458.31
143	2014 Elgin Pelican	04/15/2022	Repair	Paint battery door cover	Painted battery door cover	Exterior Body/Fenders & Flaps	Closed	60.58	-	-	60.58
143	2014 Elgin Pelican	03/21/2022	PM	PM-A,PM-B,PM-C		/	Closed	79.56	512.57	-	592.13
143	2014 Elgin Pelican	03/21/2022	Repair	Hyd leak LH broom area	Replace 2x gutter broom hyd hoses.	Equipment Attachments/Hydraulic Systems	Closed	79.56	181.51	-	261.07
143	2014 Elgin Pelican	03/21/2022	Repair	Faulty heat wrap on exhaust	Rewrap exhaust tip.	Engine/Motor/Exhaust System	Closed	26.52	62.42	-	88.94
143	2014 Elgin Pelican	03/21/2022	Repair	Hyd leak at RH lift arm	Replace o-ring and tighten fitting.	Equipment Attachments/Hydraulic Systems	Closed	13.26	-	-	13.26
143	2014 Elgin Pelican	03/21/2022	Repair	HVAC blower inop	Repair wiring at switch.	Interior/HVAC	Closed	26.52	-	-	26.52
143	2014 Elgin Pelican	03/16/2022	Repair	Right side door is hard to open from inside	Adjusted inside right door handle	Exterior Body/Body	Closed	17.46	-	-	17.46
143	2014 Elgin Pelican	03/14/2022	St Insp	Result: Pass		/	Closed	0.00	0.00	-	0.00
143	2014 Elgin Pelican	01/14/2022	Repair	Weld repair chain cover	Repaired chain cover	Exterior Body/Trim & Miscellaneous Hardware	Closed	32.92	-	-	32.92
143	2014 Elgin Pelican	01/10/2022	PM	PM-A		/	Closed	106.08	115.71	-	221.79
143	2014 Elgin Pelican	01/10/2022	Repair	Check lights	Repair marker lights.	Electrical/Lighting System	Closed	53.04	12.37	-	65.41
						Department totals:		$ 2,846.97	$ 12,978.86	-	$ 15,825.83
						Grand totals:		$ 2,846.97	$ 12,978.86	-	$ 15,825.83

Maintenance Summary

Newton, MA

Date Range: 01/01/2022 - 12/31/2022

Department: SUSTAINABLE MATERIALS

Veh Id	Year/Make/Model	Date	Service	Service Request	Repair Description	Repair Category	Status	Labor ($)	Parts ($)	3rd ($)	Total ($)
144	2013 Elgin Pelican	11/17/2022	Repair	LH broom inop, threw codes		/	Closed	-	-	0.00	0.00
144	2013 Elgin Pelican	11/07/2022	Repair	Hyd leak under machine	replaced hyd. lines	Sweepers/Other	Closed	364.65	204.49	-	569.14
144	2013 Elgin Pelican	10/21/2022	Repair	Hopper mirror broken	(Exterior Body) Mirrors & Brackets	Exterior Body/Mirrors & Brackets	Closed	6.63	86.68	-	93.31
144	2013 Elgin Pelican	10/21/2022	Repair	Grease pins	Grease pins	Sweepers/Main Broom	Closed	33.15	-	-	33.15
144	2013 Elgin Pelican	10/20/2022	Repair	Large hyd leak under cab	replaced, rerouted, secured hyd. feed hose	Sweepers/Other	Closed	304.98	92.09	-	397.07
144	2013 Elgin Pelican	10/07/2022	PM	PM-A,PM-B		/	Closed	-	368.11	5,534.42	5,902.53
144	2013 Elgin Pelican	07/20/2022	Repair	RR tire flat	Plug tire.	Chassis/Tires, Tubes, Liners & Valves	Closed	27.45	-	-	27.45
144	2013 Elgin Pelican	07/06/2022	Repair	Bent safety bar	Straighten bent roof protector bar.	Exterior Body/Body	Closed	69.84	-	-	69.84
144	2013 Elgin Pelican	05/18/2022	Repair	Switch covers missing	Ricky replaced missing switch covers	/	Closed	-	0.00	-	0.00
144	2013 Elgin Pelican	05/18/2022	Repair	Overheating	Replaced radiator and thermostat	Engine/Motor/Cooling System	Closed	686.25	3,092.99	-	3,779.24
144	2013 Elgin Pelican	05/18/2022	Repair	Headlight out	No issue found	Electrical/Lighting System	Closed	27.45	-	-	27.45
144	2013 Elgin Pelican	03/25/2022	Repair	Conveyor not working properly	Replaced conv chain	Sweepers/Conveyor System	Closed	26.52	277.24	-	303.76
144	2013 Elgin Pelican	03/25/2022	Repair	Check lights	Replaced light as needed for state inspection	Electrical/Lighting System	Closed	39.78	172.75	-	212.53
144	2013 Elgin Pelican	03/23/2022	Repair	Machine keeps overheating	No issue found. Blow out radiator	/	Closed	119.34	-	-	119.34
144	2013 Elgin Pelican	03/23/2022	Repair	Horn inop	Replaced missing fuse	Electrical/Modules, Relays, Switches	Closed	26.52	-	-	26.52
144	2013 Elgin Pelican	03/23/2022	Repair	Grease line fell off steering wheels, hose not long enough	Extended grease lines	Other/Other	Closed	39.78	-	-	39.78
144	2013 Elgin Pelican	03/22/2022	PM	PM-A,PM-B,PM-C		/	Closed	119.34	606.27	0.00	725.61
144	2013 Elgin Pelican	03/16/2022	Repair	RR flat tire	Replaced tire	Chassis/Tires, Tubes, Liners & Valves	Closed	14.07	89.28	-	103.35
144	2013 Elgin Pelican	03/16/2022	St Insp	Result: Pass		/	Closed	0.00	0.00	-	0.00

Maintenance Summary

Newton, MA

Date Range: 01/01/2022 - 12/31/2022

Department: SUSTAINABLE MATERIALS

Veh Id	Year/Make/Model	Date	Service	Service Request	Repair Description	Repair Category	Status	Labor ($)	Parts ($)	3rd ($)	Total ($)
144	2013 Elgin Pelican	01/03/2022	Repair	Hopper mirrors broken	tmosca@newtonma.gov		Closed	-	131.48	-	131.48

Department totals:	$ 1,905.75	$ 5,121.38	$ 5,534.42	$ 12,561.55
Grand totals:	$ 1,905.75	$ 5,121.38	$ 5,534.42	$ 12,561.55

Maintenance Summary

Newton, MA

Date Range: 01/01/2022 - 12/31/2022

Department: SUSTAINABLE MATERIALS

Veh Id	Year/Make/Model	Date	Service	Service Request	Repair Description	Repair Category	Status	Labor ($)	Parts ($)	3rd ($)	Total ($)
145	2019 Elgin Pelican	10/25/2022	Repair	Every morning when cold exclamation point on dash for 20 mins		/	Closed	-	-	4,014.06	4,014.06
145	2019 Elgin Pelican	10/25/2022	Repair	Engine smoking when hot, LH engine compartment seems oily			Closed	46.41	-	0.00	46.41
145	2019 Elgin Pelican	10/20/2022	Repair	RH gutter broom loses down pressure, piston leaking?	(Electrical) Modules, Relays, Switches	Electrical/Modules, Relays, Switches	Closed	112.71	161.48	-	274.19
145	2019 Elgin Pelican	10/20/2022	Repair	side panel latch	Replace side panel latch	Exterior Body/Body	Closed	13.26	25.24	-	38.50
145	2019 Elgin Pelican	08/31/2022	Repair	Weld repair bracket	Weld repair and reinforce cross bracket for side panels for conveyor top roller.	Sweepers/Conveyor System	Closed	30.29	-	-	30.29
145	2019 Elgin Pelican	08/30/2022	PM	PM-A		/	Closed	106.08	216.20	-	322.28
145	2019 Elgin Pelican	08/30/2022	Repair	Conveyor chain loose	Replace chain and sprockets for conveyor drive.	Sweepers/Conveyor System	Closed	119.34	271.87	-	391.21
145	2019 Elgin Pelican	08/30/2022	Repair	RH washer hose hanging	Replace hose.	Exterior Body/Wiper Repairs	Closed	26.52	-	-	26.52
145	2019 Elgin Pelican	07/26/2022	Repair	RR tire has a leak	Plug RR tire.	Chassis/Tires, Tubes, Liners & Valves	Closed	13.26	-	-	13.26
145	2019 Elgin Pelican	06/14/2022	Repair	Bolt broken on dirt shoe	Replaced broken bolt	Sweepers/Conveyor System	Closed	41.18	633.07	-	674.25
145	2019 Elgin Pelican	06/07/2022	Repair	Main broom bearing not getting grease	Replaced main broom bearing. Lube tech came out and repaired greasing unit		Closed	132.60	551.22	0.00	683.82
145	2019 Elgin Pelican	06/07/2022	Repair	Left dirt shoe bolt	Replaced bolt		Closed	26.52	-	-	26.52
145	2019 Elgin Pelican	04/20/2022	Repair	Check conveyor chain	Replaced conveyor chain		Closed	41.18	76.01	-	117.19
145	2019 Elgin Pelican	04/20/2022	Repair	Hyd leak, broke down on road	Replaced hydraulic lines	Equipment Attachments/Hydraulic Systems	Closed	384.30	810.32	-	1,194.62
145	2019 Elgin Pelican	04/06/2022	Repair	Cracked rear spring		/	Closed	-	-	1,588.75	1,588.75
145	2019 Elgin Pelican	03/28/2022	PM	PM-A,PM-B,PM-C			Closed	137.25	633.86	-	771.11

Maintenance Summary

Newton, MA

Date Range: 01/01/2022 - 12/31/2022

Department: SUSTAINABLE MATERIALS

Veh Id	Year/Make/Model	Date	Service	Service Request	Repair Description	Repair Category	Status	Labor ($)	Parts ($)	3rd ($)	Total ($)
145	2019 Elgin Pelican	03/28/2022	Repair	Check tires	Replaced both rear tires	Chassis/Tires, Tubes, Liners & Valves	Closed	54.90	479.98	-	534.88
145	2019 Elgin Pelican	03/28/2022	Repair	check steer wheel bearings	Replaced both side wheel bearings	Chassis/Wheels, Rims, Hubs & Bearings	Closed	109.80	752.23	-	862.03
145	2019 Elgin Pelican	03/28/2022	Repair	Check mirrors, hopper and LH side damaged	Replaced mirrors	Exterior Body/Mirrors & Brackets	Closed	27.45	138.75	-	166.20
145	2019 Elgin Pelican	03/18/2022	St Insp	Result: Pass		/	Closed	0.00	0.00	-	0.00
145	2019 Elgin Pelican	02/03/2022	Repair	No start	tmosca@newtonma.gov		Closed	-	-	758.62	758.62

Department totals: $ 1,423.05 $ 4,750.23 $ 6,361.43 $ 12,534.71

Grand totals: $ 1,423.05 $ 4,750.23 $ 6,361.43 $ 12,534.71

Maintenance Summary

Newton, MA

Date Range: 01/01/2022 - 12/31/2022

Department: SUSTAINABLE MATERIALS

Veh Id	Year/Make/Model	Date	Service	Service Request	Repair Description	Repair Category	Status	Labor ($)	Parts ($)	3rd ($)	Total ($)
146	2017 Elgin Pelican	02/17/2023	Repair	GPS inop	install new GPS unit	Interior/GPS	Closed	116.11	-	-	116.11
146	2017 Elgin Pelican	12/05/2022	Repair	Tow crafts to CNWood		/	Closed	-	-	600.00	600.00
146	2017 Elgin Pelican	11/30/2022	Repair	LH broom lift cyl leaking	replaced L/H broom cylinder	Equipment Attachments/Hydraulic Systems	Closed	129.77	225.92	-	355.69
146	2017 Elgin Pelican	11/30/2022	Repair	side broom hose damaged	replaced two hydraulic lines for L/H side broom		Closed	109.28	200.66	-	309.94
146	2017 Elgin Pelican	11/29/2022	Repair	Replace wiper blades	Replace both wipers	Exterior Body/Wiper Repairs	Closed	20.49	257.18	-	277.67
146	2017 Elgin Pelican	11/29/2022	Repair	Straighten headlamp	straighten R/H headlight bracket and reattach	Electrical/Lighting System	Closed	54.64	-	-	54.64
146	2017 Elgin Pelican	11/29/2022	Repair	Air filter cap broken	replace broken air filter housing cap	Engine/Motor/Air Intake System	Closed	13.66	171.57	-	185.23
146	2017 Elgin Pelican	11/29/2022	Repair	RH side latch broken	replace broken body cover latch	Exterior Body/Fenders & Flaps	Closed	27.32	96.25	-	123.57
146	2017 Elgin Pelican	11/28/2022	PM	PM-A		/	Closed	-	217.69	1,564.29	1,781.98
146	2017 Elgin Pelican	11/28/2022	Repair	Conveyor chain broken	Replace conveyor chain and gears	Sweepers/Conveyor System	Closed	-	264.21	0.00	264.21
146	2017 Elgin Pelican	10/19/2022	Repair	Main broom weight brackets bent	Straighten main broom weight damage.		Closed	26.19	-	-	26.19
146	2017 Elgin Pelican	10/05/2022	Repair	A/C blowing warm air	A/C breaker tripped-Evacuate/recharge A/C	Interior/HVAC	Closed	106.08	-	-	106.08
146	2017 Elgin Pelican	10/04/2022	Repair	Relocate license plate	Move license plate	Exterior Body/Body	Closed	86.19	-	-	86.19
146	2017 Elgin Pelican	09/28/2022	Repair	Overheated, belt snapped off	Serpentine belt, A/C compressor	Engine/Motor/Power Plant	Closed	278.46	1,009.73	-	1,288.19
146	2017 Elgin Pelican	09/26/2022	PM	PM-A		/	Closed	125.97	424.53	-	550.50
146	2017 Elgin Pelican	08/09/2022	Repair	Replace operator manual			Closed	-	93.33	-	93.33
146	2017 Elgin Pelican	08/09/2022	Repair	Road call, blown hyd hose	Replace blown hyd hoses and main broom.	Equipment Attachments/Hydraulic Systems	Closed	878.40	344.24	-	1,222.64
146	2017 Elgin Pelican	07/28/2022	Repair	Tree branch damage to RH wiper arm	Replace wiper trans and arms.	Exterior Body/Wiper Repairs	Closed	137.25	1,733.42	-	1,870.67
146	2017 Elgin Pelican	07/28/2022	Repair	Right mirror broken	Replace RH mirror.	Exterior Body/Mirrors & Brackets	Closed	27.45	64.86	-	92.31

Maintenance Summary

Newton, MA

Date Range: 01/01/2022 - 12/31/2022

Department: SUSTAINABLE MATERIALS

Veh Id	Year/Make/Model	Date	Service	Service Request	Repair Description	Repair Category	Status	Labor ($)	Parts ($)	3rd ($)	Total ($)
146	2017 Elgin Pelican	07/28/2022	Repair	Check lights	(Electrical) Lighting System	Electrical/Lighting System	Closed	27.45	253.87	-	281.32
146	2017 Elgin Pelican	07/28/2022	Repair	Broken grease line	Replace headlamp.		Closed	27.45	-	-	27.45
146	2017 Elgin Pelican	07/12/2022	Repair	A/C not effective in hot weather	Tighten loose hose at compressor and replace high side schrader valve.	Interior/HVAC	Closed	119.34	13.43	-	132.77
146	2017 Elgin Pelican	07/07/2022	Repair	RR tire flat	Replace RR rim and tire.	Chassis/Tires, Tubes, Liners & Valves	Closed	26.52	1,024.96	-	1,051.48
146	2017 Elgin Pelican	07/01/2022	PM	PM-A		/	Closed	119.34	185.43	-	304.77
146	2017 Elgin Pelican	07/01/2022	Repair	Check left side gutter broom for play	Replaced both towbars	Sweepers/Gutter Broom	Closed	477.36	3,701.78	-	4,179.14
146	2017 Elgin Pelican	07/01/2022	Repair	Check A/C charge	Check charge	Interior/HVAC	Closed	26.52	-	-	26.52
146	2017 Elgin Pelican	07/01/2022	Repair	Back up alarm inop.	Replaced back up alarm	Electrical/Other	Closed	0.00	0.00	-	0.00
146	2017 Elgin Pelican	07/01/2022	Repair	Check lower vents. No air flow	Removed blockage	Interior/HVAC	Closed	119.34	-	-	119.34
146	2017 Elgin Pelican	06/03/2022	Repair	Conveyor INOP	Replaced conveyor belt and conveyor chain and dirt shoe	Sweepers/Conveyor System	Closed	494.10	5,466.28	-	5,960.38
146	2017 Elgin Pelican	05/18/2022	Repair	Hub cap broken off	Replaced hub cab	Chassis/Wheels, Rims, Hubs & Bearings	Closed	39.78	50.70	-	90.48
146	2017 Elgin Pelican	05/18/2022	Repair	Check mirrors	Replaced mirror	Exterior Body/Mirrors & Brackets	Closed	26.52	0.00	-	26.52
146	2017 Elgin Pelican	05/10/2022	Repair	Replace hopper mirrors	Replace hopper mirrors.		Closed	13.26	64.69	-	77.95
146	2017 Elgin Pelican	05/10/2022	Repair	LH gutter broom light damaged	Replace light head.	Electrical/Lighting System	Closed	26.52	-	-	26.52
146	2017 Elgin Pelican	05/10/2022	Repair	Replace LH west coast mirror	Replace mirror.	Exterior Body/Mirrors & Brackets	Closed	13.26	-	-	13.26
146	2017 Elgin Pelican	04/11/2022	Repair	Main broom bushings worn		/	Closed	-	-	2,482.78	2,482.78
146	2017 Elgin Pelican	04/04/2022	Repair	Steering wheel hub grease fitting line broken	Replaced steering grease fitting and bottom pin grease fitting	Chassis/Wheels, Rims, Hubs & Bearings	Closed	119.34	0.00	-	119.34
146	2017 Elgin Pelican	03/23/2022	Repair	Hopper very bouncy	Parts giving to Perry. He was going to have his guys put the pads on	/	Closed	-	480.80	-	480.80

Maintenance Summary

Newton, MA

Date Range: 01/01/2022 - 12/31/2022

Department: SUSTAINABLE MATERIALS

Veh Id	Year/Make/Model	Date	Service	Service Request	Repair Description	Repair Category	Status	Labor ($)	Parts ($)	3rd ($)	Total ($)
146	2017 Elgin Pelican	03/16/2022	PM	PM-A,PM-B,PM-C			Closed	192.15	925.91	0.00	1,118.06
146	2017 Elgin Pelican	03/16/2022	Repair	Check tires	Install new tire	Chassis/Tires, Tubes, Liners & Valves	Closed	27.45	239.99	-	267.44
146	2017 Elgin Pelican	03/16/2022	Repair	Check conveyor chain	Replaced chain and sprockets	Sweepers/Conveyor System	Closed	109.80	276.63	-	386.43

Department totals:	$ 4,142.76	$ 17,788.06	$ 4,647.07	$ 26,577.89

Grand totals:	$ 4,142.76	$ 17,788.06	$ 4,647.07	$ 26,577.89

Maintenance Summary

Newton, MA

Date Range: 01/01/2022 - 12/31/2022

Department: SUSTAINABLE MATERIALS

Veh Id	Year/Make/Model	Date	Service	Service Request	Repair Description	Repair Category	Status	Labor ($)	Parts ($)	3rd ($)	Total ($)
147	2021 Elgin Pelican	10/14/2022	Repair	Repair hopper damage	Repair LF hopper door damage.	Exterior Body/Body	Closed	96.03	-	-	96.03
147	2021 Elgin Pelican	10/13/2022	PM	PM-A		/	Closed	86.19	266.60	-	352.79
147	2021 Elgin Pelican	08/17/2022	Repair	Cypress gps not responding	Swap in new cypress gps unit.	Interior/GPS	Closed	26.52	40.07	-	66.59
147	2021 Elgin Pelican	08/17/2022	Repair	Drive belt noise	Replace belt, tensioner and idler.	Engine/Motor/Power Plant	Closed	79.56	471.23	-	550.79
147	2021 Elgin Pelican	08/01/2022	PM	PM-A		/	Closed	-	175.36	-	175.36
147	2021 Elgin Pelican	08/01/2022	Repair	Belt chrip	Replace belt.	Engine/Motor/Power Plant	Closed	53.04	277.31	-	330.35
147	2021 Elgin Pelican	05/24/2022	Repair	Main broom LH hub bolts broken	Removed broken bolts from main broom mount	Sweepers/Main Broom	Closed	212.16	10.88	-	223.04
147	2021 Elgin Pelican	04/11/2022	PM	PM-A,PM-B,PM-C		/	Closed	212.16	498.71	0.00	710.87
147	2021 Elgin Pelican	04/11/2022	Repair	Broken latch on one of the side covers	Replace broken RH latch.	Exterior Body/Trim & Miscellaneous Hardware	Closed	39.78	0.00	-	39.78
147	2021 Elgin Pelican	04/11/2022	Repair	Conveyor chain loose	Replace conveyor chain setup.	Sweepers/Conveyor System	Closed	53.04	268.52	-	321.56
147	2021 Elgin Pelican	04/06/2022	St Insp	Result: Pass		/	Closed	0.00	0.00	-	0.00

Department totals:	$ 858.48	$ 2,008.68	$ 0.00	$ 2,867.16
Grand totals:	$ 858.48	$ 2,008.68	$ 0.00	$ 2,867.16

Maintenance Summary

Newton, MA

Date Range: 01/01/2022 - 12/31/2022

Department: SUSTAINABLE MATERIALS

Veh Id	Year/Make/Model	Date	Service	Service Request	Repair Description	Repair Category	Status	Labor ($)	Parts ($)	3rd ($)	Total ($)
149	2018 Freightliner / Elgin M2-106	08/11/2022	PM	PM-A		/	Closed	225.42	548.75	-	774.17
149	2018 Freightliner / Elgin M2-106	06/27/2022	Repair	Water filter clogged	tmosca@newtonma.gov		Closed	-	99.49	-	99.49
149	2018 Freightliner / Elgin M2-106	05/23/2022	Repair	Water leak	Replaced water valve on pressure hose side	Sweepers/Conveyor System	Closed	27.45	0.00	-	27.45
149	2018 Freightliner / Elgin M2-106	05/10/2022	Repair	Check suction nozzle rubbers	Replaced rubbers	Sweepers/Gutter Broom	Closed	92.82	207.06	-	299.88
149	2018 Freightliner / Elgin M2-106	03/30/2022	Repair	Seat belt INOP	Repair seat belt jammed.	Interior/Safety Restraint Systems	Closed	34.92	-	-	34.92
149	2018 Freightliner / Elgin M2-106	03/30/2022	St Insp	Result: Pass		/	Closed	0.00	0.00	-	0.00
						Department totals:		$ 380.61	$ 855.30	-	$ 1,235.91
						Grand totals:		$ 380.61	$ 855.30	-	$ 1,235.91

Maintenance Summary

Newton, MA

Date Range: 01/01/2020 - 12/31/2020

Department: DRAIN

Veh Id	Year/Make/Model	Date	Service	Service Request	Repair Description	Repair Category	Status	Labor ($)	Parts ($)	3rd ($)	Total ($)
330	2014 Freightliner 108SD	12/16/2020	Repair	PTO cuts in and out occasionally	No issue found	Equipment Attachments/Other	Closed	32.44	-	-	32.44
330	2014 Freightliner 108SD	12/11/2020	Repair	Throttle up switch on crane INOP	tmosca@newtonma.gov	/	Closed	-	6,627.82	1,000.00	7,627.82
330	2014 Freightliner 108SD	12/11/2020	Repair	Water in fuel light on	Replaced filter and switch	Engine/Motor/Fuel System	Closed	29.74	144.53	-	174.27
330	2014 Freightliner 108SD	12/11/2020	Repair	No back up alarm	Replaced back up alarm	Electrical/Other	Closed	44.61	74.43	-	119.04
330	2014 Freightliner 108SD	12/11/2020	Repair	Check dump body lights	Replaced marker light	Electrical/Lighting System	Closed	14.87	6.30	-	21.17
330	2014 Freightliner 108SD	12/03/2020	Repair	Top off DEF	tmosca@newtonma.gov	/	Closed	-	10.85	-	10.85
330	2014 Freightliner 108SD	11/19/2020	PM	PM-A,PM-B			Closed	-	-	265.74	265.74
330	2014 Freightliner 108SD	11/19/2020	Repair	Rear brakes	tmosca@newtonma.gov		Closed	-	-	2,500.00	2,500.00
330	2014 Freightliner 108SD	11/19/2020	Repair	CEL on	tmosca@newtonma.gov		Closed	-	-	3,500.00	3,500.00
330	2014 Freightliner 108SD	11/19/2020	Repair	Coolant in the exhaust	tmosca@newtonma.gov		Closed	-	-	0.00	0.00
330	2014 Freightliner 108SD	07/30/2020	Repair	Exhaust stack loose	Replace exhaust stack.	Engine/Motor/Exhaust System	Closed	110.36	820.31	-	930.67
330	2014 Freightliner 108SD	07/06/2020	Repair	Oil leak from drain plug area	Replace oil pan. SS not available yet.	Engine/Motor/Power Plant	Closed	178.44	38.38	-	216.82
330	2014 Freightliner 108SD	06/24/2020	Repair	A/C inop	Diag no a/c. power issue. Replace a/c compressor twice. Freightliner found starter wired wrong from 2 weeks prior. Oops.	Interior/HVAC	Closed	183.80	2,140.98	435.00	2,759.78
330	2014 Freightliner 108SD	06/10/2020	Repair	Starter?	Replace starter.	Electrical/Cranking System	Closed	178.44	321.30	-	499.74
330	2014 Freightliner 108SD	06/08/2020	PM	PM-C		/	Closed	-	-	477.50	477.50
330	2014 Freightliner 108SD	05/18/2020	Repair	Hydraulic leaking on the hydraulic tank	Replace hyd cap and gasket.	Equipment Attachments/Hydraulic Systems	Closed	31.53	24.74	-	56.27
330	2014 Freightliner 108SD	05/07/2020	PM	PM-A		/	Closed	252.24	354.76	-	607.00
330	2014 Freightliner 108SD	05/06/2020	St Insp	Result: Pass			Closed	0.00	0.00	-	0.00

Maintenance Summary

Newton, MA

Date Range: 01/01/2020 - 12/31/2020

Department: DRAIN

Veh Id	Year/Make/Model	Date	Service	Service Request	Repair Description	Repair Category	Status	Labor ($)	Parts ($)	3rd ($)	Total ($)
330	2014 Freightliner 108SD	01/15/2020	Repair	Issue wiper blades	rgately@newtonma.gov		Closed	-	12.84	-	12.84
330	2014 Freightliner 108SD	01/10/2020	Repair	Check lights	Repair wiring and replace light.	Electrical/Lighting System	Closed	75.75	12.60	-	88.35
							Department totals:	$ 1,132.22	$ 10,589.84	$ 8,178.24	$ 19,900.30
							Grand totals:	$ 1,132.22	$ 10,589.84	$ 8,178.24	$ 19,900.30

Maintenance Summary

Newton, MA

Date Range: 01/01/2021 - 12/31/2021

Department: DRAIN

Veh Id	Year/Make/Model	Date	Service	Service Request	Repair Description	Repair Category	Status	Labor ($)	Parts ($)	3rd ($)	Total ($)
330	2014 Freightliner 108SD	12/28/2021	Repair	Plow doesn't work while driving?	Boston freightliner reprogrammed computer	Equipment Attachments/Plow	Closed	12.22	-	-	12.22
330	2014 Freightliner 108SD	12/22/2021	Repair	Throttle switch in rear INOP	No issues found	Electrical/Modules, Relays, Switches	Closed	12.22	-	-	12.22
330	2014 Freightliner 108SD	12/22/2021	Repair	No dump body alarm	No issues found		Closed	12.22	-	-	12.22
330	2014 Freightliner 108SD	10/26/2021	Repair	Check engine light	Engine light was because of the low voltage	Electrical/Charging System	Closed	31.53	-	-	31.53
330	2014 Freightliner 108SD	10/25/2021	Repair	Washer fluid rotted off/INOP	Replaced washer fluid tank, pump and heat shield	Exterior Body/Wiper Repairs	Closed	94.59	450.98	-	545.57
330	2014 Freightliner 108SD	10/25/2021	Repair	Not charging?	Replaced alternator	Electrical/Charging System	Closed	94.59	252.72	-	347.31
330	2014 Freightliner 108SD	09/27/2021	Repair	Bolts holding crane onto frame loose	Replaced bolts that hold crane onto truck	Equipment Attachments/Other	Closed	175.29	460.68	-	635.97
330	2014 Freightliner 108SD	09/08/2021	Repair	Replace wipers	tmosca@newtonma.gov	/	Closed	-	12.68	-	12.68
330	2014 Freightliner 108SD	08/05/2021	PM	PM-C			Closed	-	497.96	0.00	497.96
330	2014 Freightliner 108SD	07/06/2021	Repair	Death wobble at 30mph	Replaced right outer tie rod	Chassis/Steering	Closed	126.12	79.38	-	205.50
330	2014 Freightliner 108SD	07/06/2021	Repair	Boom extend cylinder leaking	No issue found	Equipment Attachments/Hydraulic Systems	Closed	23.48	-	-	23.48
330	2014 Freightliner 108SD	06/07/2021	Repair	Blower motor INOP	Replaced blower motor	Interior/HVAC	Closed	11.74	152.30	-	164.04
330	2014 Freightliner 108SD	06/07/2021	Repair	Check A/C	Recharged A/C		Closed	11.74	-	-	11.74
330	2014 Freightliner 108SD	06/07/2021	Repair	Check Brakes	Adjusted brakes	Chassis/Brakes	Closed	11.74	-	-	11.74
330	2014 Freightliner 108SD	05/18/2021	St Insp	Result: Pass		/	Closed	0.00	0.00	-	0.00
330	2014 Freightliner 108SD	04/08/2021	PM	PM-A,PM-B			Closed	-	-	74.93	74.93
330	2014 Freightliner 108SD	04/08/2021	Repair	Coolant leak			Closed	-	-	1,000.00	1,000.00
330	2014 Freightliner 108SD	04/08/2021	Repair	Front end repairs	tmosca@newtonma.gov		Closed	-	-	1,000.00	1,000.00
330	2014 Freightliner 108SD	02/06/2021	Repair	Repairs to crane	csilva@newtonma.gov		Closed	0.00	0.00	4,831.75	4,831.75

Maintenance Summary

Newton, MA

Date Range: 01/01/2021 - 12/31/2021

Department: DRAIN

Veh Id	Year/Make/Model	Date	Service	Service Request	Repair Description	Repair Category	Status	Labor ($)	Parts ($)	3rd ($)	Total ($)
						Department totals:		$ 617.48	$ 1,906.70	$ 6,906.68	$ 9,430.86
						Grand totals:		$ 617.48	$ 1,906.70	$ 6,906.68	$ 9,430.86

Maintenance Summary

Newton, MA

Date Range: 01/01/2022 - 12/31/2022

Department: DRAIN

Veh Id	Year/Make/Model	Date	Service	Service Request	Repair Description	Repair Category	Status	Labor ($)	Parts ($)	3rd ($)	Total ($)
330	2014 Freightliner 108SD	06/15/2022	Repair	No start	Operator error	/	Closed	-	-	-	0.00
330	2014 Freightliner 108SD	05/31/2022	St Insp	Result: Pass			Closed	0.00	0.00	-	0.00
						Department totals:		$ 0.00	$ 0.00	-	$ 0.00
						Grand totals:		$ 0.00	$ 0.00	-	$ 0.00

APPENDIX H: IMPLEMENTATION SCHEDULE

Implementation Schedule Memorandum

- Attachment 1: Base Schedule Estimates Memorandum
- Attachment 2: Prioritized Parcel Opportunity Schedule Report Sheet
- Attachment 3: Prioritized Roadway Opportunity Schedule Report Sheets

Permit Timeline Schedule

Constraints Schedule

Implementation Schedule Memorandum

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MEMORANDUM

PROJECT: Newton, MA Phosphorus Control Plan

PROJECT NUMBER: 0233351.00

DATE: June 2023

SUBJECT: Implementation Schedule Memorandum

1.1 Executive Summary: Phase 1 Implementation Schedule

The MS4 General Permit includes a requirement for creation of a Phase 1 Plan implementation schedule. The creation of the schedule involved evaluating the Permit load reduction requirement and then evaluating both existing and planned control measures. The baseline phosphorus reduction Permit requirement of 5,679.4 pounds (lbs) is outlined in Section 3 of the Phase 1 PCP Plan. The Phase 1 implementation requires a reduction of 20% by Permit Year 8 (2026) and 25% by year 10 (2028). This equates to an annual phosphorus load reduction target of 1,135.9 lbs and 1,419.9 lbs respectively.

The City then evaluated existing controls and planned controls which could be implemented to meet the Permit load reductions. The existing stormwater controls are separated by non-structural and structural practices which are discussed in Section 4 of Phase 1 PCP Plan. The city currently implements non-structural controls such as street sweeping, catch basin cleaning, and leaf litter collection. These currently implemented non-structural controls will continue to be accounted for in the implementation schedule as existing and planned non-structural measures, resulting in an on-going reduction of 50.1 pounds per year (lbs/year) throughout the Phase 1 implementation period. Existing municipal structural stormwater control measures (SCMs), outlined in Section 4, are estimated to contribute a reduction of 25.9 lbs/year. The city also routinely executes roadway improvement and traffic calming projects annually. An existing 1.4 lbs/yr has been identified in association with roadway projects currently in design and / or construction. These projects will continue to be executed throughout Phase 1 with an approximate load reduction accrual of 1 lbs/year. The City Private controls are tracked through Major stormwater permits. During Phase 1 Major stormwater permits are anticipated to accrue a reduction of 40 lbs. per year. The City's current Major stormwater permit rules & regulations were adopted in the spring of 2022. To allow for a construction period as well as a 1-year period post-construction at which time inspection and maintenance reporting is required these load reductions are included in the implementation of the Phase 1 Plan starting in Permit Year 6 (2024). This results in a reduction of 120 lbs/year by Permit Year 8 (2026), with another 80 lbs/year accruing between 2026-2028 for a total of 200 lbs/year in Permit Year 10 (2028). Due to the consistent, on-going nature of these controls, they are reflected in the implementation schedule separately from planned controls for the City's implementation.

Planned structural control measures include the stormwater control measures which are considered for implementation at City municipal properties and within right of ways. These SCMs would be implemented during Phase 1 by retrofitting the existing City stormwater infrastructure for phosphorus removal. Planned stormwater controls are further discussed in

Section 5 and Appendix E of Phase 1 PCP Plan. With existing non-structural and structural control measures accounted for, the remainder of load reduction for Phase 1 outlined in Section 4 of the Phase 1 PCP Plan is to be achieved through the Planned Stormwater Controls City's municipal properties. Planned Stormwater Controls are outlined in Section 5 and Appendix E of the Phase 1 PCP Plan.

The permit requirements in conjunction with existing and planned control measures for the City of Newton were evaluated and the creation of two implementation schedules was completed. The first Phase 1 Plan schedule utilizes ongoing existing control measures and the prioritized planned control measures in compliance with the Permit Phase 1 timeline. This schedule is defined as the "Permit Timeline Schedule". Evaluating the Permit Timeline Schedule for constraints such as overall number and complexity of control measure projects to be executed, existing City capitol project planning, community impact, costs, and funding indicate that execution of the Permit Timeline Schedule may not be reasonably achievable. Therefore, a second schedule, defined as the "Constraints Schedule" was developed, which encompasses considerations of the aforementioned constraints.

The schedules included with this Appendix each represent one of many possible ways in which the Phase 1 implementation requirements may be achieved. The Permit Timeline Schedule and Constraints schedule are planning level schedules that are subject to change as feasibility & design planning, funding, regulatory changes and other considerations of Phase 1 implementation evolve.

The following sections discuss the factors and approaches considered in the development of the two Phase 1 implementation schedules.

1.2 Permit Timeline Schedule

The Phase 1 Permit Timeline Schedule includes the implementation of existing control measures and the completion of all planned strucural controls within the Permit yearly timeline. The Permit Timeline Schedule can be found in Appendix H.

1.2.1 Permit Timeline Schedule: Background

To comply with the Phase 1 PCP Plan, the City of Newton must implement planned structural control measures in a 5-year window to account for the 1,343.9 lbs/year Phase 1 phosphorus load reduction gap. Phase 1 Plan implementation begins in Permit Year 6 (2024), meeting a 20% reduction in Permit Year 8 (2026) and ending at Permit Year 10 (2028) with a 25% reduction. Approximately 68 projects of varying size and complexity are anticipated to be necessary to achieve this goal. 63 structural control measure projects are to be completed in a span of 3 years to meet the Permit Year 8 (2026) reduction gap. The five remaining projects are implemented in Permit Years 9 and 10 (2027 and 2028). To plan the Permit Timeline Schedule implementation for Phase 1, each planned structural control measure project was reviewed for the criteria discussed in the following section.

1.2.2 Permit Timeline Schedule: Base Schedule Estimates

In order to develop a schedule, these projects were first evaluated for standard project phases which would be necessary to implement any planned structural SCM project. Those phases are listed below.

- Design Proposal & Procurement
- Feasibility & Planning
- Design Phase
- Permitting
- Construction Bidding
- Construction

Each of these were included to account for the associated required duration in schedule development. The Design Proposal & Procurement phase includes time for the City to procure design services and execute design contracting. Feasibility & Planning, and the Design phases are when further information required to inform and then complete designs to a construction level will be gathered and executed. The Permitting phase represents the steps a project must progress through after design to acquire necessary permits prior to construction. The Construction Bidding and Construction phases are the periods when a SCM project will evaluate construction bids, execute contracting and then construction.

During this Phase 1 Plan, each of the planned structural SCM projects were separated into small, medium, large, and extra-large project sizes. Projects were classified in these size groupings by evaluating a project's total load reduction, the area of each SCM footprint, and complexity. Complexity was reviewed using GIS for utility information, elevation data, resource areas, and existing City plan records. Time frames were then developed for each size and applied to each planned SCM. A breakdown of project phases, typical phase considerations, and time frames based on project size can be found in Appendix H as Attachment 1.

1.2.3 Permit Timeline Schedule: Project Types

Planned structural SCMs projects to be implemented during Phase 1 were separated into project types. The municipal projects were then grouped and evaluated for planning based on the use of the municipal property. These uses are school properties, parks / recreational area, roadways, and other municipal properties such as parking lots, Department of Public Works, library, recycling center, police headquarters or senior centers. These property types are represented by different highlights shown on the Permit Timeline Schedule.

1.2.4 Permit Timeline Schedule: Schedule Planning

Planning for implementation of the Permit Timeline Schedule included reviewing the list of planned structural SCMs for those which aligned with the City of Newton's Capital Improvement Plan (CIP). SCM projects which were located on a municipal lot with proposed CIP work were aligned in the Permit Timeline Schedule and the CIP.

Following review of the CIP, the different project types were planned in the Permit Timeline Schedule to meet the Phase 1 load reduction requirements. The first type of projects to be planned were school properties. The school projects were planned so that their construction phases would overlap with school summer break months to the maximum extent practicable. Next the remaining project types were planned in a manner which placed the construction time frames within typical construction months of April through November. Parks / recreational area project types were planned to prevent the simultaneous closing of municipal amenities, to the extent feasible. This Permit Timeline Schedule represents one of many possible ways in which the Phase 1 implementation requirements may be achieved. The Permit Timeline Schedule is a planning level schedule that is subject to change as feasibility & design planning, funding, regulatory changes, and other considerations of Phase 1 implementation evolve.

Holistically the 20% load reduction requirement of Permit Year 8 (2026) results in the majority of the projects implemented in the 3-years between 2023 and 2026. To execute the implementation of the Permit Year 8 (2026) reduction requirement, the completion of the projects was planned for construction ending during the latter half of the 3-year window. This was planned to create an early time window for the City to evaluate funding and execution strategies for the substantial list of projects.

1.2.5 Permit Timeline Schedule: Feasibility

The Permit Timeline Schedule presents feasibility challenges which are most notably, number and complexity of concurrent projects, community impact, and cost. These challenges are discussed below.

To meet the Permit Year 10 (2028) reduction a total of 68 projects are to be completed in 5 years between 2023 and 2028. Permit Year 8 (2026) represents the largest number of projects to be implemented concurrently to meet the large load reduction. The peak number of projects concurrently in the SCM Design phase is 31 projects in the month of October 2025. The peak number of projects concurrently in construction is 37 projects in the months of May and June 2026. The capacity of the City of Newton's municipal offices and departments to execute projects will be exceeded by the large number of projects to be implemented.

The majority of municipal parcels where planned structural SCMs have been identified are Park / recreational area project types. During the years of 2025 and 2026 the scheduling constraints result in over 30 park / recreational areas undergoing construction concurrently and present significant challenges for public use of these vital municipal properties.

The total cost to implement (design and construct) the planned prioritized structural control measures by Permit Year 10 (2028) is $111.98M. EPA cost estimates were used for determining project cost estimates and are further described in Report Appendix G Section 1. As further described in Report Section 9 Funding Source Assessment, the current Fiscal Year 2024 City of Newton budget available to utilize towards execution of the planned structural SCMs is approximately $2M annually.

Evaluating the Permit Timeline Schedule for constraints such as overall number and complexity of control measure projects to be executed, existing City capitol project planning, community impact, costs, and funding indicate that execution of the Permit Timeline Schedule may not be

reasonably achievable. Therefore, a second schedule, defined as the "Constraints Schedule" was developed, which encompasses considerations of the aforementioned constraints.

1.3 Constraints Schedule

The Phase 1 Constraints Schedule only includes the implementation of prioritized structural control measures identified to meet the Phase 1 load reduction gap. These prioritized projects are scheduled in a sequence which meets City of Newton constraints as of the development of this Plan (2023). These constraints include the number of projects the City can support simultaneously in design and construction, budgetary constraints, and project type. What is presented here is one of multiple ways projects could be aligned within the Constraints Schedule. The purpose of this schedule is to depict the significant variation in timelines between what is required by the Permit, the 5-year Permit Timeline Schedule and what the City of Newton may achieve based on constraints further identified below, the Constraints Schedule. The Constraints Schedule depicts an implementation timeline of approximately 55 years. The Constraints Schedule can be found in Appendix H.

1.3.1 Constraints Schedule: Background

The development of the Constraints Schedule is based upon the infeasibility to concurrently execute the number and complexity of projects, adverse community impact and total cost required to implement Phase 1 planned structural control measures by 2028. The Constraints Schedule was created to present a schedule timeline which reflects the City's constraints.

The number of projects in design and construction concurrently is a constraint that has been considered in this schedule. The existing capacity of the City of Newton's municipal offices and departments to execute projects is approximately 3 projects in design and 3 projects in construction concurrently.

Another constraint used was the City's available funding for planned structural control measures of $2M annually and an initial assumed amount of $3.6M available. It should be noted that the Constraints Schedule is based on all City stormwater budget being used toward phosphorus control measures and does not consider other stormwater infrastructure improvements projects, such as flood mitigation, which are vital to the City.

Lastly, consideration was made to balance the number of project types and distribute the grouping of yearly implemented project types. The projects were selected to balance school properties, parks / recreational area, roadways and other municipal properties.

1.3.2 Constraints Schedule: Planning

To support this schedule development, EPA design phases (soft costs) and construction phase costs were used. EPA cost estimates are further described in Report Section 7. As noted in this Memo Section 1.2.2, design phases include Design Proposal & Procurement, Feasibility & Planning, Design Phase, and Permitting. Construction phases include Construction Bidding, and Construction. The average project completion for design through construction is 1.5 years. For schedule cost and budget planning it was assumed that design phases of a project would take place over one year and the construction phases taking one more additional year in the schedule.

One consideration in developing the Constraint Schedule, in scheduling work between 2023 to 2028 was any overlap with the City of Newton CIP. These projects were paired in the schedule to prevent repeat disturbances to municipal properties, to minimize community impact. These CIP overlapping projects were scheduled to meet the number of projects in design and construction as well as available annual budget.

Development of the schdule was planned to maintain the maximum of 3 projects in design and 3 projects in construction concurrently.

The remainder of the schedule was developed by selecting projects for earlier execution which have the best (lowest) cost-benefit ratio. This cost-benefit is the EPA total project cost divided by total load reduction in pounds per year. Projects were organized in the schedule to maximize the annual $2M budget available while also balancing number of projects in design and in construction. The $3.6M budget reserve the City has accrued was also factored into the schedule development.

Many of the largest projects in total load reduction have construction costs which exceed the City available $2M annual budget. The design of these projects were scheduled when budget was available with construction often deferred 2 to 6 six years. This would allow for the ongoing execution of small and medium-sized projects while accruing the budget required for construction of the large projects. The largest projects were selected by first pairing with the CIP and then prioritizing those with the best cost-benefit.

Using the project planning methodology outlined above, the required Permit Year 10 load gap reduction for planned structural control measures is achieved in 2077, or approximately 55 years.

Attachments

Attachment 1: Base Schedule Estimates; Planned Structural Controls

Attachment 2: Prioritized Parcel Opportunity Schedule Report Sheets

Attachment 3: Prioritized Roadway Opportunity Schedule Report Sheets

Attachment 1: Base Schedule Estimates Memorandum

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MEMORANDUM

PROJECT: Phase 1 Newton, MA Phosphorus Control Plan

PROJECT NUMBER: 0233351.00

DATE: May 2023

SUBJECT: Base Schedule Estimates; Planned Structural Controls

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This memorandum is intended to document notes and considerations associated with time frames utilized to support development of the Permit Timeline Schedule for planned structural control projects at city owned parcels and roadways prioritized for Phase 1 implementation.

Base Schedule Estimates

Design Proposals & Procurement

- City preparation & request for proposals
- Timeline: Municipal Parcels and Roadways
    a. 3 mo. for all projects for RFP to design contract

Feasibility & Planning

- Collect data
    - Resource area (2 mo. if present)
        - Delineation by wetland scientist – 1 mo.
        - Survey after delineation – 1 mo.
    - Field Survey (2-3 mo. total)
        - Proposal, schedule, mobilize – 1 mo.
        - Field survey, process & turnaround plan – 1-2 mo.
    - Soil Testing / Geotech, as needed
    - Roadway Specific
        - Initial utility coordination & obtain record plans
- Timelines: Municipal Parcels
    - Small / Medium – 3 mo.
    - Large / Extra-Large – 4mo.
- Timelines: Roadways
    - Small / Medium – 4 mo.
    - Large / Extra-Large – 5 mo.

Woodard & Curran

Design Phase

- SCM Engineering Design
  - Concept SCM Design
    - Conceptual SCM layout
    - Load Reduction Confirmation
    - City / Design Engineer Cost Benefit Review
    - Go / No Go
- SCM 100% Engineering Design
  - Design Elements
    - SCM Type (Chamber, basin, gravel wetland, etc)
    - Erosion control / temporary controls
    - Grading
    - Drainage
    - Hydrology, as applicable
    - Hydraulics, as applicable
    - Downstream studies, as applicable (know flood issue areas)
    - Ground water mounding, as applicable
    - Utility redesign, if applicable
    - Landscape / Restoration
    - Specifications
  - 100% Plans & Specifications
- Timelines: Municipal Parcels
  - Small - 3 month
  - Med - 4 month
  - Large - 5 month
  - Extra-Large - 6 month
- Timelines: Roadways
  - Small - 4 month
  - Med - 5 month
  - Large - 6 month

Permitting

- 1 month
  - Small projects
  - City Stormwater Permit
- 2 months
  - Recreational / park areas requiring public outreach
- 3 months
  - Conservation Commission permitting / projects near resource areas

Construction Bidding

- 2 months all projects
  - Advertisement (1 week)
  - Request for bids (4 weeks)
  - Bid review / questions / addendums (1 week)
  - Project award / Notice to Proceed (2 weeks)

Construction

- Based on project size with modifiers for unique elements, constraints, as applicable
- Construction elements – variable by project size, average element time noted
    - Pre-mobilization & procurement
        - Shop drawings / submittals
        - Material procurement (long lead items as applicable: chambers, custom diversion structures, etc.)
    - Site Preparation – 1 week
        - Set out environmental controls Mobilization – 1 week
    - Earthwork - 2 weeks
    - SCM construction - 1 month+/- (4-5 weeks)
    - Diversion structure(s) and conveyance piping – 1 week
    - Utility modification to facilitate diversion or SCM (gas, water) – 1 week
    - Fine grading & seeding - 1 week
    - Specialized elements – 2 weeks
        - Repair or re-build recreational facility
        - Significant relocation of existing utilities
        - Parking lot restoration
- Roadway Specific
    - Phasing for Utility relocations
    - Traffic management
- Timelines: Municipal Parcels and Roadways
    - Small - 2 month
    - Med - 3 month
    - Large - 4 month
    - Extra-Large - 5 month

Attachment 2: Prioritized Parcel Opportunity Schedule Report Sheet

Davis Playground

Infiltration Chamber

Project Reference Number	1
Parcel ID	31016 0017
Address/Location	EDEN AVE
Property Description	Davis Playground

Additional Municipal Parcels Treated
33034 0049, 31021 0050A, 33034 0009

Invert Depth at Intercepted Pipe (ft)	Unk
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	77.1
Total Contributing Area (ac.)	156.4
Generated TP Load from Total Area (lb/yr)	164.0
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	39,764.00
Treatment Depth (in.)	0.3
Reduction Efficiency	68%
SCM Volume (CF)	87,285
Total Load Reduction (lb/y) :	**111.5**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	4 months
Design - SCM Design Phase	5 months
Design - Permitting	2 months
Total Design, Feasibility, & Permitting	**14 months**
Construction - Bidding	2 months
Construction	5 months
Total Bidding & Construction	**7 months**
Total Duration Months	**21 months**

Schedule Notes	Project Scale = X-LARGE Large underground system in baseball field (40,000 sf underground) Recreation Facility re-design elements Design around sewer / water crossing conflicts at sw main diversion Drain line easement Waltham St to SCM Permitting: Drain Easement Permitting: Public interaction for recreation facilities Construction estimate does not include breaks for winter Construction phasing due to full lot construction Construction estimate does not include phasing or drawn out schedule for full grass regrowth / cover re-establishment

Elliot St DPW Yard

Infiltration Chamber

Project Reference Number	2
Parcel ID	51029 0037
Address/Location	60 ELLIOT ST
Property Description	Elliot St DPW Yard

Additional Municipal Parcels Treated
51015 00170, 51015 0018, 51015 0019, 51015 0020, 51019 0002, 51019 0003, 51019 0004, 51019 0005, 51029 0039, 51029 0037A

Invert Depth at Intercepted Pipe (ft)	2 (along pipe, not at a MH)
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	71.6
Total Contributing Area (ac.)	148.3
Generated TP Load from Total Area (lb/yr)	149.6
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	44,027.00
Treatment Depth (in.)	0.35
Reduction Efficiency	75%
SCM Volume (CF)	96,670
Total Load Reduction (lb/y) :	**111.5**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	4 months
Design - SCM Design Phase	5 months
Design - Permitting	1 months
Total Design, Feasibility, & Permitting	**13 months**

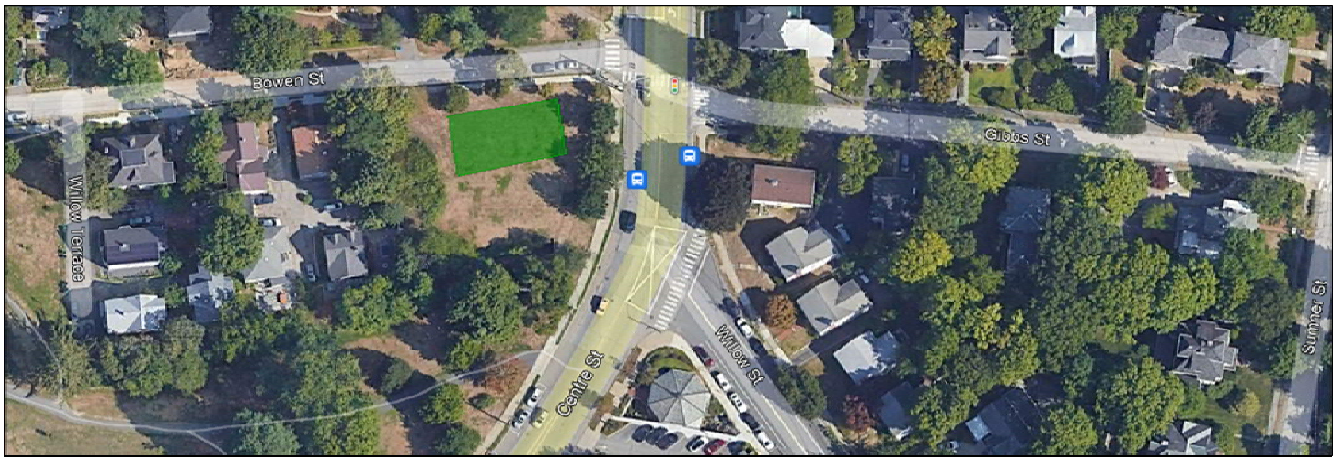
Construction - Bidding	2 months
Construction	5 months
Total Bidding & Construction	**7 months**

Total Duration Months	**20 months**

Schedule Notes	Project Scale = X-LARGE Large underground system (46,000 sf underground) Located in DPW materials yard SCM chamber to accommodate heavy equipment/materials storage Re-route of ex drain mainline Permitting estimate assumes low impact, project contained to DPW lot Construction estimate does not include breaks for winter

Newton Center Playground

Infiltration Basin



Project Reference Number	3A
Parcel ID	64032 0001 (1)
Address/Location	TYLER TER
Property Description	Newton Center Playground

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	7
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	3.9
Total Contributing Area (ac.)	7.5
Generated TP Load from Total Area (lb/yr)	8.0
Dimensions (Length x Width)	80x45
SCM Footprint (SF)	3,600.00
Treatment Depth (in.)	1
Reduction Efficiency	98%
SCM Volume (CF)	14,400
Total Load Reduction (lb/y) :	**7.8**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	3 months
Design - SCM Design Phase	3 months
Design - Permitting	3 months
Total Design, Feasibility, & Permitting	**12 months**

Construction - Bidding	2 months
Construction	2 months
Total Bidding & Construction	**4 months**

Total Duration Months	**16 months**

Schedule Notes	Project Scale = SMALL Infiltration basin (3,600 sf underground) Possible relocation of stream outfall Permitting: CON COM - Hammond Brook

Newton Center Playground

Infiltration Chamber

Project Reference Number	3B
Parcel ID	64032 0001 (2)
Address/Location	TYLER TER
Property Description	Newton Center Playground

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	4
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	77.6
Total Contributing Area (ac.)	157.2
Generated TP Load from Total Area (lb/yr)	163.8
Dimensions (Length x Width)	160x250
SCM Footprint (SF)	40,050.00
Treatment Depth (in.)	0.3
Reduction Efficiency	45%
SCM Volume (CF)	87,932
Total Load Reduction (lb/y) :	**73.7**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	4 months
Design - SCM Design Phase	5 months
Design - Permitting	3 months
Total Design, Feasibility, & Permitting	**15 months**

Construction - Bidding	2 months
Construction	5 months
Total Bidding & Construction	**7 months**

Total Duration Months	**22 months**

Schedule Notes	Project Scale = X-LARGE Large underground system adjacent to or in baseball field (40,000 sf underground) Diversion of stormwater from drain line or sw swale for treatment *NO IN STREAM WORK ACCOUNTED FOR* Recreation Facility design elements Permitting: Public interaction for recreation facilities Permitting: CON COM - Hammond Brook Construction estimate does not include breaks for winter Construction estimate does not include phasing or drawn out schedule for full grass regrowth / cover re-establishment

Pellegrini Park

Infiltration Chamber

Project Reference Number	4
Parcel ID	14016 0033
Address/Location	11 HAWTHORN ST
Property Description	Pellegrini Park

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	Unk, (~3 at Hawthorn)
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	39.3
Total Contributing Area (ac.)	63.3
Generated TP Load from Total Area (lb/yr)	80.8
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	65,147.00
Treatment Depth (in.)	1
Reduction Efficiency	98%
SCM Volume (CF)	143,302
Total Load Reduction (lb/y) :	**79.2**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	4 months
Design - SCM Design Phase	5 months
Design - Permitting	2 months
Total Design, Feasibility, & Permitting	**14 months**
Construction - Bidding	2 months
Construction	5 months
Total Bidding & Construction	**7 months**
Total Duration Months	**21 months**

Schedule Notes	Project Scale = X-LARGE Large underground system (65,000 sf underground) Multiple storm drain line diversions & re-locations Recreation facility re-design elements Permitting: Public interaction for recreation facilities Construction estimate does not include breaks for winter Construction phasing due to full lot construction Construction estimate does not include phasing or drawn out schedule for full grass regrowth / cover re-establishment

Cabot Park

Infiltration Chamber

Project Reference Number	5
Parcel ID	13001 0001
Address/Location	101 EAST SIDE PKWY
Property Description	Cabot Park

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	Unk (N&S)
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	27.3
Total Contributing Area (ac.)	63.1
Generated TP Load from Total Area (lb/yr)	61.3
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	45,842.00
Treatment Depth (in.)	1
Reduction Efficiency	98%
SCM Volume (CF)	99,100
Total Load Reduction (lb/y) :	**60.1**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	4 months
Design - SCM Design Phase	5 months
Design - Permitting	2 months
Total Design, Feasibility, & Permitting	**14 months**

Construction - Bidding	2 months
Construction	5 months
Total Bidding & Construction	**7 months**

Total Duration Months	**21 months**

Schedule Notes	Project Scale = X-LARGE Large underground system in baseball field (45,000 sf underground) Re-route north sw main around underground Large 36 dia sw main diversion Permitting: Public interaction for recreation facilities Construction estimate does not include breaks for winter Construction estimate does not include phasing or drawn out schedule for full grass regrowth / cover re-establishment

Peirce School

Infiltration Chamber

Project Reference Number	6
Parcel ID	32021 0006
Address/Location	BERKELEY ST
Property Description	Peirce School

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	3
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	27.8
Total Contributing Area (ac.)	83.6
Generated TP Load from Total Area (lb/yr)	60.6
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	46,523.00
Treatment Depth (in.)	1
Reduction Efficiency	98%
SCM Volume (CF)	102,178
Total Load Reduction (lb/y) :	**59.4**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	4 months
Design - SCM Design Phase	5 months
Design - Permitting	2 months
Total Design, Feasibility, & Permitting	**14 months**
Construction - Bidding	2 months
Construction	5 months
Total Bidding & Construction	**7 months**
Total Duration Months	**21 months**

Schedule Notes	Project Scale = X-LARGE Large underground system in baseball field (46,000 sf underground) Large 36 dia sw main diversion Design around sewer / water crossing conflicts at sw main diversion Permitting: Public interaction for recreation facilities Construction estimate does not include breaks for winter Construction estimate does not include phasing or drawn out schedule for full grass regrowth / cover re-establishment

Stearns Park

Infiltration Chamber

Project Reference Number	7
Parcel ID	11010 0007
Address/Location	54 JASSET ST
Property Description	Stearns Park

Additional Municipal Parcels Treated
14012 0022

Invert Depth at Intercepted Pipe (ft)	6 (Jasset), 3 (Allison)
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	30.8
Total Contributing Area (ac.)	44.7
Generated TP Load from Total Area (lb/yr)	64.5
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	18,977.00
Treatment Depth (in.)	0.35
Reduction Efficiency	75%
SCM Volume (CF)	41,286
Total Load Reduction (lb/y) :	**48.0**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	4 months
Design - SCM Design Phase	5 months
Design - Permitting	3 months
Total Design, Feasibility, & Permitting	**15 months**
Construction - Bidding	2 months
Construction	4 months
Total Bidding & Construction	**6 months**
Total Duration Months	**21 months**

Schedule Notes	Project Scale =LARGE Split underground system in rec. field (19,000 sf underground) Water/sewer splitting system drain line diversion locations Large 42 dia sw main diversion south of water/sewer, need to be able to connect to north chamber field Permitting: Public interaction for recreation facilities Construction estimate does not include breaks for winter Construction estimate does not include phasing or drawn out schedule for full grass regrowth / cover re-establishment

Ward Park

Infiltration Chamber

Project Reference Number	8
Parcel ID	73016 0022
Address/Location	MONTROSE ST
Property Description	Ward Park

Additional Municipal Parcels Treated
73016 0021, 63005 0002

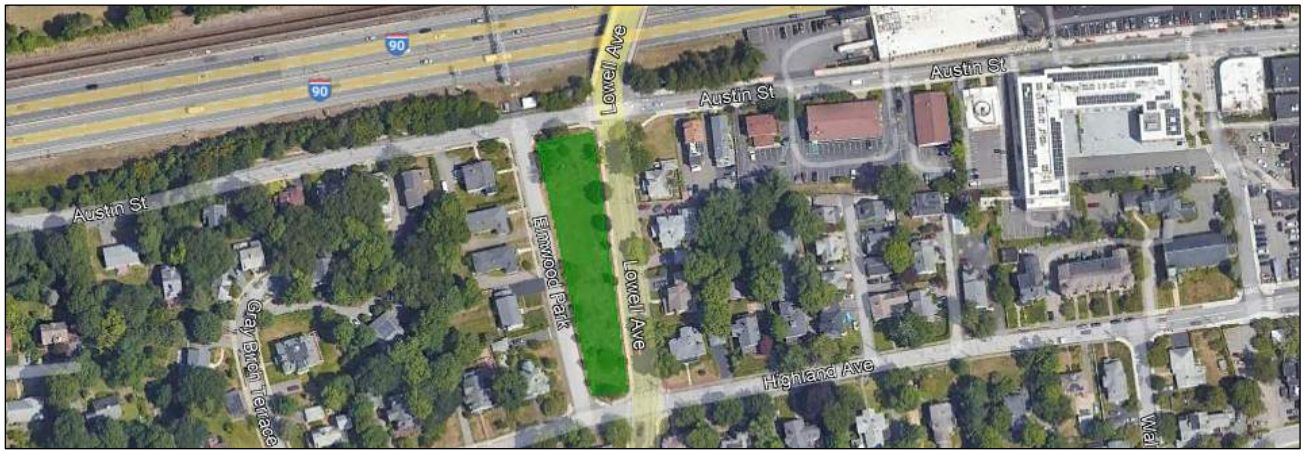
Invert Depth at Intercepted Pipe (ft)	6 (Montrose), 7 (Fellesmere), 6 (Lot), Unk (Woodchester)
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	23.2
Total Contributing Area (ac.)	52.0
Generated TP Load from Total Area (lb/yr)	51.2
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	39,125.00
Treatment Depth (in.)	1
Reduction Efficiency	90%
SCM Volume (CF)	85,660
Total Load Reduction (lb/y) :	**46.1**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	4 months
Design - SCM Design Phase	5 months
Design - Permitting	2 months
Total Design, Feasibility, & Permitting	**14 months**
Construction - Bidding	2 months
Construction	4 months
Total Bidding & Construction	**6 months**
Total Duration Months	**20 months**

Schedule Notes	Project Scale =LARGE Split underground system in rec. field (40,000 sf underground) Woodchester Dr. diversion down into park Design around existing sw mainlines Design around sewer lines crossing park Permitting: Public interaction for recreation facilities Construction estimate does not include breaks for winter Construction estimate does not include phasing or drawn out schedule for full grass regrowth / cover re-establishment

Elmwood Park

Infiltration Chamber



Project Reference Number	9
Parcel ID	24008 0001
Address/Location	LOWELL AVE
Property Description	Elmwood Park

Additional Municipal Parcels Treated
24006 0016, 24006 0017, 24009 0004

Invert Depth at Intercepted Pipe (ft)	8 (Austin), 10 (Highland)
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	44.0
Total Contributing Area (ac.)	114.8
Generated TP Load from Total Area (lb/yr)	97.1
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	23,970.00
Treatment Depth (in.)	0.3
Reduction Efficiency	45%
SCM Volume (CF)	52,467
Total Load Reduction (lb/y) :	**43.7**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	4 months
Design - SCM Design Phase	5 months
Design - Permitting	2 months
Total Design, Feasibility, & Permitting	**14 months**
Construction - Bidding	2 months
Construction	3 months
Total Bidding & Construction	**5 months**
Total Duration Months	**19 months**

Schedule Notes	Project Scale = MED-LARGE Large underground system in park (25,000 sf underground) Design around sewer Permitting: Public interaction for recreation facilities Construction estimate does not include breaks for winter Construction estimate does not include phasing or drawn out schedule for full grass regrowth / cover re-establishment

Albemarle Park/Halloran Sports Complex

Infiltration Chamber

Project Reference Number	10
Parcel ID	21022 0001
Address/Location	250 ALBEMARLE RD
Property Description	Albemarle Park/Halloran Sports Complex

Additional Municipal Parcels Treated
21022 0002, 21023 0019A, 23003 0001, 23004 0010

Invert Depth at Intercepted Pipe (ft)	Unk
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	21.4
Total Contributing Area (ac.)	50.5
Generated TP Load from Total Area (lb/yr)	46.1
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	35,489.00
Treatment Depth (in.)	1
Reduction Efficiency	90%
SCM Volume (CF)	77,900
Total Load Reduction (lb/y) :	**41.5**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	4 months
Design - SCM Design Phase	5 months
Design - Permitting	3 months
Total Design, Feasibility, & Permitting	**15 months**
Construction - Bidding	2 months
Construction	4 months
Total Bidding & Construction	**6 months**
Total Duration Months	**21 months**

Schedule Notes	Project Scale = LARGE Large underground system in rec. field (36,000 sf underground) Design around sewer Large 30 dia sw main diversion Permitting: CON COM - Cheese Cake Brook Construction estimate does not include breaks for winter Construction estimate does not include phasing or drawn out schedule for full grass regrowth / cover re-establishment

Wellington Playground

Infiltration Chamber

Project Reference Number	11
Parcel ID	33030 0020
Address/Location	HENSHAW PL OFF
Property Description	Wellington Playground

Additional Municipal Parcels Treated
34026 0002A

Invert Depth at Intercepted Pipe (ft)	8 (North), 9 (South)
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	18.0
Total Contributing Area (ac.)	35.2
Generated TP Load from Total Area (lb/yr)	38.3
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	33,085.00
Treatment Depth (in.)	1
Reduction Efficiency	98%
SCM Volume (CF)	72,560
Total Load Reduction (lb/y) :	**37.5**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	4 months
Design - SCM Design Phase	5 months
Design - Permitting	2 months
Total Design, Feasibility, & Permitting	**14 months**

Construction - Bidding	2 months
Construction	4 months
Total Bidding & Construction	**6 months**

Total Duration Months	**20 months**

Schedule Notes	Project Scale = LARGE Large underground SPLIT system in park field (33,000 sf underground) Park re-design elements Design around sewer / water crossing conflicts at sw main diversion Permitting: Public interaction for recreation facilities Construction estimate does not include breaks for winter Construction estimate does not include phasing or drawn out schedule for full grass regrowth / cover re-establishment

Cold Spring Park

Gravel/Constructed Wetland

Project Reference Number	12
Parcel ID	54021 0002
Address/Location	170 R PLYMOUTH RD
Property Description	Cold Spring Park

Additional Municipal Parcels Treated
54021 0001, 54017 0013, 54027 0001, 54030 0010, 54030 0017, 54031 0006

Invert Depth at Intercepted Pipe (ft)	Unk
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	26.9
Total Contributing Area (ac.)	85.1
Generated TP Load from Total Area (lb/yr)	59.4
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	33,000.00
Treatment Depth (in.)	0.65
Reduction Efficiency	53%
SCM Volume (CF)	66,000
Total Load Reduction (lb/y) :	**31.2**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	4 months
Design - SCM Design Phase	5 months
Design - Permitting	3 months
Total Design, Feasibility, & Permitting	**15 months**

Construction - Bidding	2 months
Construction	5 months
Total Bidding & Construction	**7 months**

Total Duration Months	**22 months**

Schedule Notes	Project Scale = LARGE Constructed Wetland (33,000 sf) Stream diversion into / through wetland SCM Park re-design elements SCM planting and wetland design elements Permitting: CON COM - Cold Spring Brook Construction estimate does not include breaks for winter Construction: 1 Month added for wetland creation

Oak Hill Middle School Parking

Infiltration Chamber

Project Reference Number	13
Parcel ID	81006 0001
Address/Location	WHEELER RD
Property Description	Oak Hill Middle School Parking

Additional Municipal Parcels Treated
81005 0011

Invert Depth at Intercepted Pipe (ft)	Unk
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	18.3
Total Contributing Area (ac.)	37.2
Generated TP Load from Total Area (lb/yr)	37.8
Dimensions (Length x Width)	200x115
SCM Footprint (SF)	23,000.00
Treatment Depth (in.)	0.65
Reduction Efficiency	76%
SCM Volume (CF)	46,000
Total Load Reduction (lb/y) :	**28.5**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	4 months
Design - SCM Design Phase	5 months
Design - Permitting	2 months
Total Design, Feasibility, & Permitting	**14 months**

Construction - Bidding	2 months
Construction	3 months
Total Bidding & Construction	**5 months**

Total Duration Months	**19 months**

Schedule Notes	Project Scale =MED-LARGE Underground system in parking lot (23,000 sf underground) Design around existing sw mainlines Construction estimate does not include breaks for winter

Richard McGrath Park

Infiltration Chamber

Project Reference Number	14
Parcel ID	32024 0006A
Address/Location	WASHINGTON ST
Property Description	Richard McGrath Park

Additional Municipal Parcels Treated
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Invert Depth at Intercepted Pipe (ft)	8
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	13.1
Total Contributing Area (ac.)	23.7
Generated TP Load from Total Area (lb/yr)	27.6
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	12,000.00
Treatment Depth (in.)	0.5
Reduction Efficiency	86%
SCM Volume (CF)	24,000
Total Load Reduction (lb/y) :	**23.7**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	3 months
Design - SCM Design Phase	4 months
Design - Permitting	2 months
Total Design, Feasibility, & Permitting	**12 months**

Construction - Bidding	2 months
Construction	2 months
Total Bidding & Construction	**4 months**

Total Duration Months	**16 months**

Schedule Notes	Project Scale = MED Large underground system in grassed area (11,800 sf underground) Design of two systems Permitting: Public interaction for recreation facilities & Warren House which is a preserved building Construction estimate does not include breaks for winter Construction estimate does not include phasing or drawn out schedule for full grass regrowth / cover re-establishment Construction time estimate SMALL

Richardson Playground

Infiltration Chamber

Project Reference Number	15
Parcel ID	53016 0007
Address/Location	ALLEN AVE
Property Description	Richardson Playground

Additional Municipal Parcels Treated
53016 0002, 53022 0009, 54012 0010

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	10.7
Total Contributing Area (ac.)	36.0
Generated TP Load from Total Area (lb/yr)	23.5
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	19,500.00
Treatment Depth (in.)	1
Reduction Efficiency	98%
SCM Volume (CF)	39,000
Total Load Reduction (lb/y) :	**23.0**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	3 months
Design - SCM Design Phase	4 months
Design - Permitting	3 months
Total Design, Feasibility, & Permitting	**13 months**

Construction - Bidding	2 months
Construction	3 months
Total Bidding & Construction	**5 months**

Total Duration Months	**18 months**

Schedule Notes	Project Scale = MED Underground system in grassed area (20,500 sf underground) Waterline crossing north system Design of two systems Permitting: Public interaction for recreation facilities Construction estimate does not include breaks for winter Construction estimate does not include phasing or drawn out schedule for full grass regrowth / cover re-establishment

Auburndale and Lyons Parks

Gravel/Constructed Wetland

Project Reference Number	16
Parcel ID	41022 0001
Address/Location	COMMONWEALTH AVE
Property Description	Auburndale and Lyons Parks

Additional Municipal Parcels Treated
41013 0012, 41013 0013, 43031 0002, 43031 0003

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	30.3
Total Contributing Area (ac.)	65.5
Generated TP Load from Total Area (lb/yr)	63.8
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	19,000.00
Treatment Depth (in.)	0.3
Reduction Efficiency	34%
SCM Volume (CF)	38,000
Total Load Reduction (lb/y) :	**21.4**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	4 months
Design - SCM Design Phase	6 months
Design - Permitting	4 months
Total Design, Feasibility, & Permitting	**17 months**

Construction - Bidding	2 months
Construction	4 months
Total Bidding & Construction	**6 months**

Total Duration Months	**23 months**

Schedule Notes	Project Scale = LARGE Constructed Wetland (20,000 sf) Possible of other park improvements Permitting: CON COM - wetlands, Charles river in 500 yr. flood plain Construction estimate does not include breaks for winter

Mason-Rice School

Infiltration Basin

Project Reference Number	17A
Parcel ID	64032 0005 (1)
Address/Location	149 PLEASANT ST CTR
Property Description	Mason-Rice School

Additional Municipal Parcels Treated
64032 0006

Invert Depth at Intercepted Pipe (ft)	Unk
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	13.1
Total Contributing Area (ac.)	26.9
Generated TP Load from Total Area (lb/yr)	27.6
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	3,200.00
Treatment Depth (in.)	0.25
Reduction Efficiency	72%
SCM Volume (CF)	12,800
Total Load Reduction (lb/y) :	**19.9**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	3 months
Design - SCM Design Phase	3 months
Design - Permitting	3 months
Total Design, Feasibility, & Permitting	**12 months**
Construction - Bidding	2 months
Construction	2 months
Total Bidding & Construction	**4 months**
Total Duration Months	**16 months**

Schedule Notes	Project Scale = SMALL - MED Infiltration basin in grassed area Design of sw main diversion and discharge back to drain or Hammond brook Design diversion around sewer crossing Permitting: CON COM - Hammond Brook Construction estimate does not include breaks for winter Construction: Summer construction window for school

Mason-Rice School

Porous Pavement

Project Reference Number	17B
Parcel ID	64032 0005 (2)
Address/Location	149 PLEASANT ST CTR
Property Description	Mason-Rice School

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	0.5
Total Contributing Area (ac.)	0.5
Generated TP Load from Total Area (lb/yr)	0.9
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	23,000
Treatment Depth (in.)	1.00
Reduction Efficiency	62%
SCM Volume (CF)	20,700
Total Load Reduction (lb/y) :	**0.6**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	3 months
Design - SCM Design Phase	4 months
Design - Permitting	3 months
Total Design, Feasibility, & Permitting	**13 months**

Construction - Bidding	2 months
Construction	3 months
Total Bidding & Construction	**5 months**

Total Duration Months	**18 months**

Schedule Notes	Project Scale =MED Porous pavement on school parking lot Permitting: CON COM - Hammond Brook Construction: Summer construction window for school

West Pine St Parking lot

Infiltration Chamber

Project Reference Number	18
Parcel ID	41031 0037
Address/Location	WEST PINE ST
Property Description	West Pine St Parking lot

Additional Municipal Parcels Treated
41031 0036A

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	9.0
Total Contributing Area (ac.)	20.3
Generated TP Load from Total Area (lb/yr)	18.9
Dimensions (Length x Width)	164x100
SCM Footprint (SF)	16,400.00
Treatment Depth (in.)	1
Reduction Efficiency	98%
SCM Volume (CF)	32,800
Total Load Reduction (lb/y) :	**18.5**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	3 months
Design - SCM Design Phase	4 months
Design - Permitting	2 months
Total Design, Feasibility, & Permitting	**12 months**
Construction - Bidding	2 months
Construction	3 months
Total Bidding & Construction	**5 months**
Total Duration Months	**17 months**

Schedule Notes	Project Scale = MED Underground system in paved parking lot (16,500 sf underground) Possible unknown easement crossing parking lot Permitting: Public interaction for recreation facilities Construction estimate does not include breaks for winter

Franklin Elementary School

Infiltration Chamber

Project Reference Number	19
Parcel ID	34037 0021
Address/Location	125 DERBY ST
Property Description	Franklin Elementary School

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	C
Impervious Drainage Area (ac.)	9.1
Total Contributing Area (ac.)	18.0
Generated TP Load from Total Area (lb/yr)	20.0
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	17,000.00
Treatment Depth (in.)	1
Reduction Efficiency	92%
SCM Volume (CF)	34,000
Total Load Reduction (lb/y) :	**18.4**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	4 months
Design - SCM Design Phase	4 months
Design - Permitting	2 months
Total Design, Feasibility, & Permitting	**13 months**

Construction - Bidding	2 months
Construction	3 months
Total Bidding & Construction	**5 months**

Total Duration Months	**18 months**

Schedule Notes	Project Scale = MED - LARGE Underground SPLIT system in park field (16,000 sf underground) MED SCM design Design of two sw main diversion and reconnection to main Design around sewer line crossing in field and the north chamber field Permitting: Public interaction for recreation facilities Construction estimate does not include phasing or drawn out schedule for full grass regrowth / cover re-establishment

Countryside School

Infiltration Basin

Project Reference Number	20A
Parcel ID	83006 0011 (1)
Address/Location	191 DEDHAM ST
Property Description	Countryside School

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	1.7
Total Contributing Area (ac.)	3.2
Generated TP Load from Total Area (lb/yr)	3.5
Dimensions (Length x Width)	40x40
SCM Footprint (SF)	1,600
Treatment Depth (in.)	1.00
Reduction Efficiency	92%
SCM Volume (CF)	6,400
Total Load Reduction (lb/y) :	**3.2**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	3 months
Design - SCM Design Phase	4 months
Design - Permitting	3 months
Total Design, Feasibility, & Permitting	**13 months**

Construction - Bidding	2 months
Construction	2 months
Total Bidding & Construction	**4 months**

Total Duration Months	**17 months**

Schedule Notes	Project Scale =MED Infiltration basin grass/LA area Small-MED SCM design Design of sw main diversion and discharge back to drain or S. Meadow brook Permitting: CON COM - South Meadow Brook, FEMA 500 yr. flood plain Construction: Possible school year implications

Countryside School

Infiltration Chamber

Project Reference Number	20B
Parcel ID	83006 0011 (2)
Address/Location	191 DEDHAM ST
Property Description	Countryside School

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	8.1
Total Contributing Area (ac.)	17.1
Generated TP Load from Total Area (lb/yr)	16.8
Dimensions (Length x Width)	148x100
SCM Footprint (SF)	14,800.00
Treatment Depth (in.)	1
Reduction Efficiency	90%
SCM Volume (CF)	29,600
Total Load Reduction (lb/y) :	**15.1**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	4 months
Design - SCM Design Phase	4 months
Design - Permitting	3 months
Total Design, Feasibility, & Permitting	**14 months**

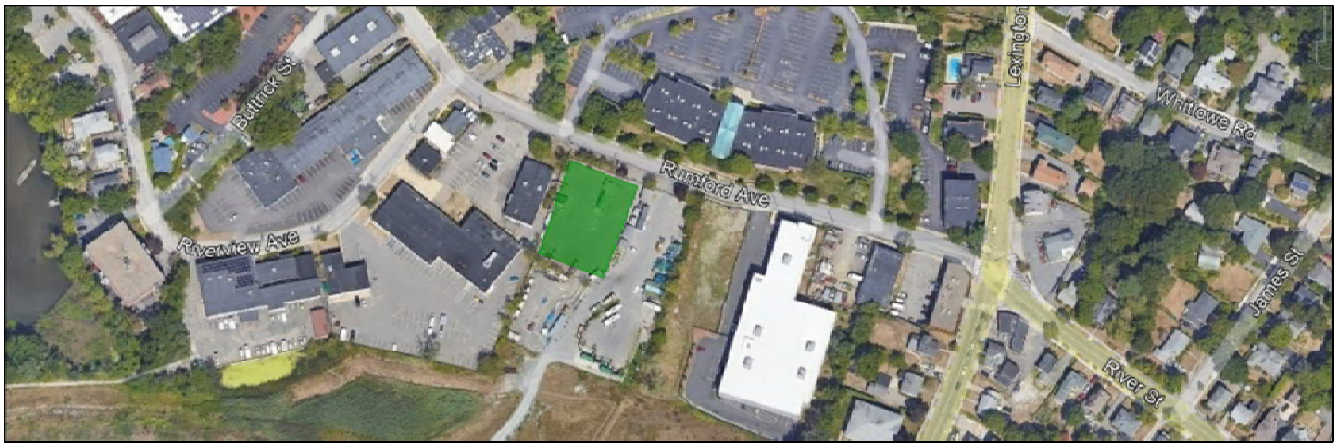
Construction - Bidding	2 months
Construction	3 months
Total Bidding & Construction	**5 months**

Total Duration Months	**19 months**

Schedule Notes	Project Scale = MED-LARGE Medium underground school rec. field (15,000 sf underground) Design around possible storm, sewer / water crossing conflicts at sw main diversion Permitting: CON COM - South Meadow Brook, FEMA 500 yr. flow plain Construction estimate does not include breaks for winter Construction estimate does not include phasing or drawn out schedule for full grass regrowth / cover re-establishment

Resource Recovery Center

Infiltration Chamber



Project Reference Number	21
Parcel ID	41031 0043
Address/Location	211 LEXINGTON ST
Property Description	Resource Recovery Center

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	Unk
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	24.9
Total Contributing Area (ac.)	60.8
Generated TP Load from Total Area (lb/yr)	54.3
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	18,213.00
Treatment Depth (in.)	0.2
Reduction Efficiency	33%
SCM Volume (CF)	18,213
Total Load Reduction (lb/y) :	**17.9**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	3 months
Design - SCM Design Phase	4 months
Design - Permitting	1 months
Total Design, Feasibility, & Permitting	**11 months**

Construction - Bidding	2 months
Construction	3 months
Total Bidding & Construction	**5 months**

Total Duration Months	**16 months**

Schedule Notes	Project Scale = MED-LARGE Infiltration chambers in Paved City recycle center (19,500sf underground) Med SCM Design, recycle center re-build Permitting: 1 month for municipal lot Construction: Re-pave, med time frame

Boyd Park

Infiltration Chamber

Project Reference Number	22
Parcel ID	11020 0002
Address/Location	44 JACKSON RD
Property Description	Boyd Park

Additional Municipal Parcels Treated
12004 0033

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	8.9
Total Contributing Area (ac.)	14.8
Generated TP Load from Total Area (lb/yr)	19.2
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	16,300.00
Treatment Depth (in.)	1
Reduction Efficiency	90%
SCM Volume (CF)	32,600
Total Load Reduction (lb/y) :	**17.3**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	4 months
Design - SCM Design Phase	5 months
Design - Permitting	3 months
Total Design, Feasibility, & Permitting	**15 months**
Construction - Bidding	2 months
Construction	4 months
Total Bidding & Construction	**6 months**
Total Duration Months	**21 months**

Schedule Notes	Project Scale = LARGE Med-Large underground system in school/ park area (16,000 sf underground) Significant disturbance to school parking, grounds, park, rec. areas for chamber install Inclusion of other city park design elements Permitting: Public interaction for recreation facilities Construction: Held Large time frame Construction estimate does not include phasing or drawn out schedule for full grass regrowth / cover re-establishment Construction: Possible school year implications

DPW Yard

Infiltration Chamber

Project Reference Number	23A
Parcel ID	23015 0027 (1)
Address/Location	90 CRAFTS ST
Property Description	DPW Yard

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	6.3
Total Contributing Area (ac.)	9.4
Generated TP Load from Total Area (lb/yr)	13.2
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	11,400.00
Treatment Depth (in.)	1
Reduction Efficiency	90%
SCM Volume (CF)	22,800
Total Load Reduction (lb/y) :	**11.9**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	4 months
Design - SCM Design Phase	4 months
Design - Permitting	1 months
Total Design, Feasibility, & Permitting	**12 months**

Construction - Bidding	2 months
Construction	3 months
Total Bidding & Construction	**5 months**

Total Duration Months	**17 months**

Schedule Notes	Project Scale = MED-LARGE Med underground (12,000 sf underground) Design chambers in ex DPW parking lot, significant disturbance to parking lot Permitting: assumed low impact on DPW lot Construction: phasing / re-build of parking lot

DPW Yard

Infiltration Chamber

Project Reference Number	23B
Parcel ID	23015 0027 (2)
Address/Location	90 CRAFTS ST
Property Description	DPW Yard

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	2.5
Total Contributing Area (ac.)	3.2
Generated TP Load from Total Area (lb/yr)	4.5
Dimensions (Length x Width)	50x90
SCM Footprint (SF)	4,500
Treatment Depth (in.)	1.00
Reduction Efficiency	90%
SCM Volume (CF)	9,000
Total Load Reduction (lb/y) :	**4.1**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	3 months
Design - SCM Design Phase	4 months
Design - Permitting	1 months
Total Design, Feasibility, & Permitting	**11 months**

Construction - Bidding	2 months
Construction	2 months
Total Bidding & Construction	**4 months**

Total Duration Months	**15 months**

Schedule Notes	Project Scale = Small - MED Underground system (4,500 sf underground) Design chambers in ex DPW paved lot Design: SCM chamber to accommodate heavy equipment / materials storage yard Design: Re-route of ex drain mainline, avoid ex sewer Permitting: assumed low impact on DPW lot Construction: phasing / re-build of paved lot Construction: Reduced 1 month for working in DPW lot

Hunnewell Playground

Infiltration Basin

Project Reference Number	24
Parcel ID	71026 0024
Address/Location	GRASMERE ST
Property Description	Hunnewell Playground

Additional Municipal Parcels Treated
71026 0023

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	7.7
Total Contributing Area (ac.)	18.0
Generated TP Load from Total Area (lb/yr)	17.6
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	6,600.00
Treatment Depth (in.)	0.9
Reduction Efficiency	90%
SCM Volume (CF)	26,400
Total Load Reduction (lb/y) :	**15.8**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	3 months
Design - SCM Design Phase	4 months
Design - Permitting	2 months
Total Design, Feasibility, & Permitting	**12 months**

Construction - Bidding	2 months
Construction	3 months
Total Bidding & Construction	**5 months**

Total Duration Months	**17 months**

Schedule Notes	Project MED 6,600 sf inf. Basin Design: diversion from drain line down hill to park Permitting: Public interaction for recreation facilities (2 month) Construction: medium

E. Side Parkway Grassed Median

Infiltration Chamber

Project Reference Number	25
Parcel ID	13001 0002
Address/Location	EAST SIDE PKWY
Property Description	E. Side Parkway Grassed Median

Additional Municipal Parcels Treated
13001 0001, 13001 0002

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	10.2
Total Contributing Area (ac.)	22.8
Generated TP Load from Total Area (lb/yr)	22.7
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	4,800.00
Treatment Depth (in.)	0.25
Reduction Efficiency	62%
SCM Volume (CF)	9,600
Total Load Reduction (lb/y) :	**14.0**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	3 months
Design - SCM Design Phase	3 months
Design - Permitting	1 months
Total Design, Feasibility, & Permitting	**10 months**
Construction - Bidding	2 months
Construction	2 months
Total Bidding & Construction	**4 months**
Total Duration Months	**14 months**

Schedule Notes	Project SMALL 1,770sf inf chamber Design: drain line adjustment Permitting: 1 month, grassed median Construction: small

Newton Commonwealth Golf Course

Infiltration Chamber

Project Reference Number	26A
Parcel ID	72039 0017 (1)
Address/Location	KENRICK ST OFF
Property Description	Newton Commonwealth Golf Course

Additional Municipal Parcels Treated
72039 0018

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	5.2
Total Contributing Area (ac.)	16.8
Generated TP Load from Total Area (lb/yr)	13.5
Dimensions (Length x Width)	50x200
SCM Footprint (SF)	10,000.00
Treatment Depth (in.)	1
Reduction Efficiency	98%
SCM Volume (CF)	20,000
Total Load Reduction (lb/y) :	**13.2**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	3 months
Design - SCM Design Phase	3 months
Design - Permitting	1 months
Total Design, Feasibility, & Permitting	**10 months**

Construction - Bidding	2 months
Construction	3 months
Total Bidding & Construction	**5 months**

Total Duration Months	**15 months**

Schedule Notes	Project Scale = SMALL Design: infiltration chambers under golf course, sloping surface Permitting: assume 1 month, on municipal land Construction estimate does not include phasing or drawn out schedule for full grass regrowth / cover re-establishment

Newton Commonwealth Golf Course

Infiltration Trench

Project Reference Number	26B
Parcel ID	72039 0017 (2)
Address/Location	KENRICK ST OFF
Property Description	Newton Commonwealth Golf Course

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	0.5
Total Contributing Area (ac.)	0.8
Generated TP Load from Total Area (lb/yr)	0.8
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	800
Treatment Depth (in.)	0.50
Reduction Efficiency	65%
SCM Volume (CF)	960
Total Load Reduction (lb/y) :	**0.5**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	3 months
Design - SCM Design Phase	3 months
Design - Permitting	3 months
Total Design, Feasibility, & Permitting	**12 months**

Construction - Bidding	2 months
Construction	2 months
Total Bidding & Construction	**4 months**

Total Duration Months	**16 months**

Schedule Notes	Project Scale = Small Design infiltration trenches along driveways and impervious areas Permitting: Assuming CON-COM for golf course water/wetland Construction: Small timeline reduced for low impact construction of SCM

Hyde Playground and Park

Infiltration Chamber

Project Reference Number	27
Parcel ID	52041 0001
Address/Location	100 LINCOLN ST
Property Description	Hyde Playground and Park

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	6.3
Total Contributing Area (ac.)	17.4
Generated TP Load from Total Area (lb/yr)	13.9
Dimensions (Length x Width)	125x92
SCM Footprint (SF)	11,500.00
Treatment Depth (in.)	1
Reduction Efficiency	98%
SCM Volume (CF)	23,000
Total Load Reduction (lb/y) :	**13.6**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	3 months
Design - SCM Design Phase	5 months
Design - Permitting	2 months
Total Design, Feasibility, & Permitting	**13 months**
Construction - Bidding	2 months
Construction	3 months
Total Bidding & Construction	**5 months**
Total Duration Months	**18 months**

Schedule Notes	Project Scale = MED Infiltration chambers in landscaped Park (11,500sf underground) Design: add 1 month for park restoration Permitting: Public interaction for park Construction: medium

Newton Police Headquarters Parking Lot

Infiltration Chamber

Project Reference Number	28
Parcel ID	33011 0001
Address/Location	1321 WASHINGTON ST
Property Description	Newton Police Headquarters Parking Lot

Additional Municipal Parcels Treated
33011 0011

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	6.2
Total Contributing Area (ac.)	9.3
Generated TP Load from Total Area (lb/yr)	12.8
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	7,900.00
Treatment Depth (in.)	0.7
Reduction Efficiency	94%
SCM Volume (CF)	15,800
Total Load Reduction (lb/y) :	**12.0**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	3 months
Design - SCM Design Phase	4 months
Design - Permitting	2 months
Total Design, Feasibility, & Permitting	**12 months**
Construction - Bidding	2 months
Construction	3 months
Total Bidding & Construction	**5 months**
Total Duration Months	**17 months**

Schedule Notes	Project Scale = Small - MED Design underground inf. system (8,000 sf underground) Medium SCM design Design diversion in Cherry St. to divert water to SCM first, then brook culvert Design around sewer line & connect onsite impervious to an inf SCM Permitting: add 1 month for roadway coordination Construction: Medium timeframe

Bigelow Middle School

Infiltration Chamber

Project Reference Number	29
Parcel ID	72010 0001
Address/Location	42 VERNON ST
Property Description	Bigelow Middle School

Additional Municipal Parcels Treated
72009 0003

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	5.7
Total Contributing Area (ac.)	13.9
Generated TP Load from Total Area (lb/yr)	13.0
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	10,400.00
Treatment Depth (in.)	1
Reduction Efficiency	90%
SCM Volume (CF)	20,800
Total Load Reduction (lb/y) :	**11.7**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	3 months
Design - SCM Design Phase	4 months
Design - Permitting	2 months
Total Design, Feasibility, & Permitting	**12 months**

Construction - Bidding	2 months
Construction	3 months
Total Bidding & Construction	**5 months**

Total Duration Months	**17 months**

Schedule Notes	Project MED 10,400sf inf chamber Permitting: Public interaction for recreation facilities Construction: medium Construction estimate does not include phasing or drawn out schedule for full grass regrowth / cover re-establishment

Spears Park

Infiltration Chamber

Project Reference Number	30
Parcel ID	12003 0001
Address/Location	WALNUT PK
Property Description	Spears Park

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	6.3
Total Contributing Area (ac.)	10.7
Generated TP Load from Total Area (lb/yr)	14.0
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	8,000.00
Treatment Depth (in.)	0.65
Reduction Efficiency	76%
SCM Volume (CF)	16,000
Total Load Reduction (lb/y) :	**10.6**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	3 months
Design - SCM Design Phase	4 months
Design - Permitting	2 months
Total Design, Feasibility, & Permitting	**12 months**
Construction - Bidding	2 months
Construction	3 months
Total Bidding & Construction	**5 months**
Total Duration Months	**17 months**

Schedule Notes	Project Scale = MED Infiltration chambers in grassed area (7,000sf underground) Diversion of stormwater line into chambers, sewer/water utilites crossings Permitting: Public interaction for recreation facilities Construction estimate does not include phasing or drawn out schedule for full grass regrowth / cover re-establishment

Cold Spring Park

Gravel/Constructed Wetland

Project Reference Number	31
Parcel ID	54022 0049B
Address/Location	BEACON ST REAR
Property Description	Cold Spring Park

Additional Municipal Parcels Treated
54022 0051A, 54022 0057, 54022 0052A, 54022 0050A, 62004 0015

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	B/D
Impervious Drainage Area (ac.)	26.2
Total Contributing Area (ac.)	55.5
Generated TP Load from Total Area (lb/yr)	55.0
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	4,800.00
Treatment Depth (in.)	0.1
Reduction Efficiency	19%
SCM Volume (CF)	9,600
Total Load Reduction (lb/y) :	**10.5**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	3 months
Design - SCM Design Phase	4 months
Design - Permitting	3 months
Total Design, Feasibility, & Permitting	**13 months**

Construction - Bidding	2 months
Construction	3 months
Total Bidding & Construction	**5 months**

Total Duration Months	**18 months**

Schedule Notes	Project Scale - MED Gravel Wetland in corner of field Design diversion off drain line past brook Permitting: Con Com = brook Construction: Medium, constructed wetland

Newton Commonwealth Golf Course

Infiltration Chamber

Project Reference Number	32
Parcel ID	72039 0021
Address/Location	MAGNOLIA AVE
Property Description	Newton Commonwealth Golf Course

Additional Municipal Parcels Treated
73009 0019

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	D
Impervious Drainage Area (ac.)	5.8
Total Contributing Area (ac.)	20.8
Generated TP Load from Total Area (lb/yr)	14.3
Dimensions (Length x Width)	125x80
SCM Footprint (SF)	6,600.00
Treatment Depth (in.)	0.6
Reduction Efficiency	73%
SCM Volume (CF)	13,200
Total Load Reduction (lb/y) :	**10.4**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	3 months
Design - SCM Design Phase	4 months
Design - Permitting	2 months
Total Design, Feasibility, & Permitting	**12 months**
Construction - Bidding	2 months
Construction	3 months
Total Bidding & Construction	**5 months**
Total Duration Months	**17 months**

Schedule Notes	Project MED infiltration chambers Design underground chambers in sloping golf course Permitting: Public interaction for recreation facilities (2 month) Construction: medium Construction estimate does not include phasing or drawn out schedule for full grass regrowth / cover re-establishment

Brown Middle School

Infiltration Chamber

Project Reference Number	33
Parcel ID	81005 0011
Address/Location	125 MEADOWBROOK RD
Property Description	Brown Middle School

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	5.4
Total Contributing Area (ac.)	14.9
Generated TP Load from Total Area (lb/yr)	11.5
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	9,800.00
Treatment Depth (in.)	1
Reduction Efficiency	90%
SCM Volume (CF)	19,600
Total Load Reduction (lb/y) :	**10.4**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	3 months
Design - SCM Design Phase	4 months
Design - Permitting	2 months
Total Design, Feasibility, & Permitting	**12 months**
Construction - Bidding	2 months
Construction	3 months
Total Bidding & Construction	**5 months**
Total Duration Months	**17 months**

Schedule Notes	Project Scale = MED Infiltration chambers in grassed area (10,000sf underground) Recreation facility re-design Permitting: Public interaction for recreation facilities Construction estimate does not include phasing or drawn out schedule for full grass regrowth / cover re-establishment Construction: Possible school year implications

Newton South High School

Infiltration Chamber

Project Reference Number	34A
Parcel ID	81051 0047 (1)
Address/Location	140 BRANDEIS RD
Property Description	Newton South High School

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	3.9
Total Contributing Area (ac.)	4.8
Generated TP Load from Total Area (lb/yr)	7.2
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	7,200
Treatment Depth (in.)	1.00
Reduction Efficiency	90%
SCM Volume (CF)	14,400
Total Load Reduction (lb/y) :	**6.5**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	4 months
Design - SCM Design Phase	5 months
Design - Permitting	3 months
Total Design, Feasibility, & Permitting	**15 months**

Construction - Bidding	2 months
Construction	4 months
Total Bidding & Construction	**6 months**

Total Duration Months	**21 months**

Schedule Notes	Project Scale = Med - Large (7,200sf underground) Infiltration chambers under synthetic turf field Drain line re-routing Recreation facility re-design Permitting: Public interaction for recreation facilities Construction: Possible school year implications

Newton South High School

Infiltration Chamber

Project Reference Number	34B
Parcel ID	81051 0047 (2)
Address/Location	140 BRANDEIS RD
Property Description	Newton South High School

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	1.5
Total Contributing Area (ac.)	2.1
Generated TP Load from Total Area (lb/yr)	2.9
Dimensions (Length x Width)	50x28
SCM Footprint (SF)	2,300
Treatment Depth (in.)	0.80
Reduction Efficiency	83%
SCM Volume (CF)	4,600
Total Load Reduction (lb/y) :	**2.4**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	3 months
Design - SCM Design Phase	3 months
Design - Permitting	2 months
Total Design, Feasibility, & Permitting	**11 months**

Construction - Bidding	2 months
Construction	2 months
Total Bidding & Construction	**4 months**

Total Duration Months	**15 months**

Schedule Notes	Project Scale = Small Inf chambers (1,500 sf underground) Permitting: Public interaction for recreation facilities Construction: Possible school year implications

Lowell Park

Infiltration Chamber

Project Reference Number	35
Parcel ID	23013 0001
Address/Location	WATERTOWN ST
Property Description	Lowell Park

Additional Municipal Parcels Treated
23008 0001

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	4.2
Total Contributing Area (ac.)	6.8
Generated TP Load from Total Area (lb/yr)	8.5
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	4,200.00
Treatment Depth (in.)	0.55
Reduction Efficiency	89%
SCM Volume (CF)	8,400
Total Load Reduction (lb/y) :	**7.6**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	3 months
Design - SCM Design Phase	3 months
Design - Permitting	2 months
Total Design, Feasibility, & Permitting	**11 months**
Construction - Bidding	2 months
Construction	2 months
Total Bidding & Construction	**4 months**
Total Duration Months	**15 months**

Schedule Notes	Project SMALL 4,200sf inf chamber Design: small Permitting: Public interaction for recreation facilities Construction: small Construction estimate does not include phasing or drawn out schedule for full grass regrowth / cover re-establishment

Reverend Ford Playground

Infiltration Chamber

Project Reference Number	36
Parcel ID	33006 0061
Address/Location	70 CRESCENT ST
Property Description	Reverend Ford Playground

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	13.5
Total Contributing Area (ac.)	26.1
Generated TP Load from Total Area (lb/yr)	28.6
Dimensions (Length x Width)	50x80
SCM Footprint (SF)	4,000.00
Treatment Depth (in.)	0.15
Reduction Efficiency	26%
SCM Volume (CF)	8,000
Total Load Reduction (lb/y) :	**7.3**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	4 months
Design - SCM Design Phase	5 months
Design - Permitting	2 months
Total Design, Feasibility, & Permitting	**14 months**
Construction - Bidding	2 months
Construction	3 months
Total Bidding & Construction	**5 months**
Total Duration Months	**19 months**

Schedule Notes	Project Scale = Med - Large (4,200sf underground) Infiltration chambers under grass park / playground Intricate drain line line diversion re-routing Recreation facility re-design Permitting: Public interaction for recreation facilities Construction estimate does not include phasing or drawn out schedule for full grass regrowth / cover re-establishment

Bobby Braceland Playground

Infiltration Chamber

Project Reference Number	37
Parcel ID	51045 0003
Address/Location	PENNSYLVANIA AVE
Property Description	Bobby Braceland Playground

Additional Municipal Parcels Treated
51045 0004

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	3.3
Total Contributing Area (ac.)	7.3
Generated TP Load from Total Area (lb/yr)	7.2
Dimensions (Length x Width)	60x100
SCM Footprint (SF)	6,000.00
Treatment Depth (in.)	1
Reduction Efficiency	90%
SCM Volume (CF)	12,000
Total Load Reduction (lb/y) :	**6.5**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	3 months
Design - SCM Design Phase	4 months
Design - Permitting	2 months
Total Design, Feasibility, & Permitting	**12 months**
Construction - Bidding	2 months
Construction	3 months
Total Bidding & Construction	**5 months**
Total Duration Months	**17 months**

Schedule Notes	Project Scale = MEDIUM Infiltration chambers in parking lot (6,000sf underground) Medium SCM design, sewer/water/other utilites crossings for diversion Permitting: Public interaction for recreation facilities MED construction window

Emerson Playground

Infiltration Chamber

Project Reference Number	38
Parcel ID	51008 0001A1
Address/Location	51 I PETTEE ST
Property Description	Emerson Playground

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	2.1
Total Contributing Area (ac.)	4.7
Generated TP Load from Total Area (lb/yr)	4.6
Dimensions (Length x Width)	50x78
SCM Footprint (SF)	3,900.00
Treatment Depth (in.)	1
Reduction Efficiency	98%
SCM Volume (CF)	7,800
Total Load Reduction (lb/y) :	**4.5**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	3 months
Design - SCM Design Phase	2 months
Design - Permitting	2 months
Total Design, Feasibility, & Permitting	**10 months**

Construction - Bidding	2 months
Construction	3 months
Total Bidding & Construction	**5 months**

Total Duration Months	**15 months**

Schedule Notes	Project Scale = Small - MED Infiltration chambers in rec. field/ school field (4,000sf underground) Permitting: Public interaction for recreation facilities Construction: Possible school year implications Construction estimate does not include phasing or drawn out schedule for full grass regrowth / cover re-establishment

Memorial-Spaulding School

Infiltration Chamber

Project Reference Number	39
Parcel ID	82021 0001
Address/Location	250 BROOKLINE ST
Property Description	Memorial-Spaulding School

Additional Municipal Parcels Treated
--

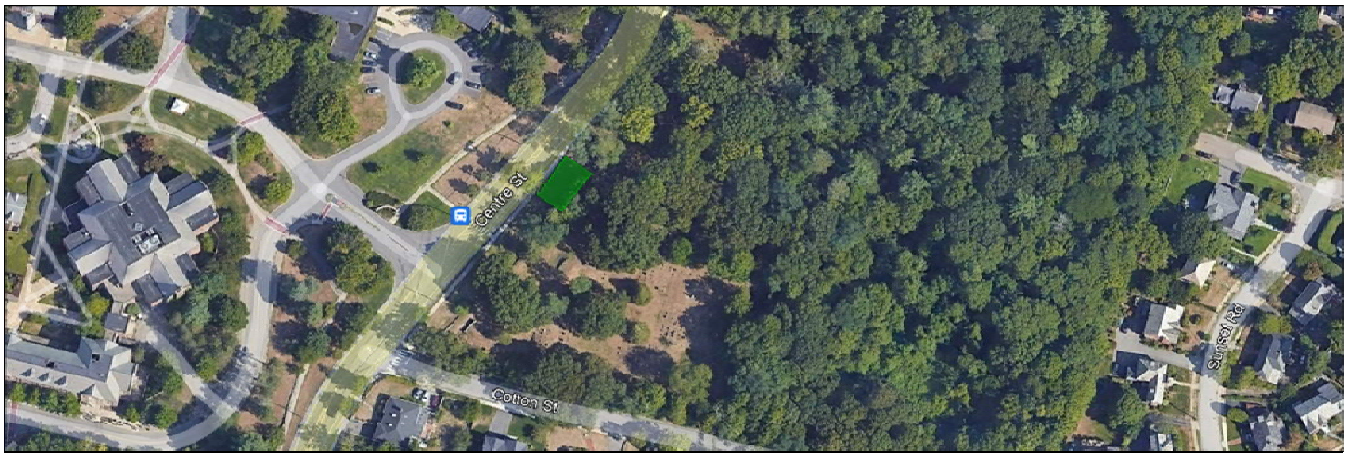
Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	2.5
Total Contributing Area (ac.)	4.4
Generated TP Load from Total Area (lb/yr)	5.0
Dimensions (Length x Width)	92x50
SCM Footprint (SF)	4,600.00
Treatment Depth (in.)	1
Reduction Efficiency	90%
SCM Volume (CF)	9,200
Total Load Reduction (lb/y) :	**4.5**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	3 months
Design - SCM Design Phase	4 months
Design - Permitting	2 months
Total Design, Feasibility, & Permitting	**12 months**
Construction - Bidding	2 months
Construction	3 months
Total Bidding & Construction	**5 months**
Total Duration Months	**17 months**

Schedule Notes	Project Scale = Small - MED Infiltration chambers in rec. field / school field (4,000sf underground) Sewer / other utilites crossings SCM to be located ex grassed area Permitting: Public interaction for recreation facilities Construction estimate does not include phasing or drawn out schedule for full grass regrowth / cover re-establishment

Loring Park

Infiltration Basin



Project Reference Number	40
Parcel ID	73001 0019
Address/Location	CENTRE ST
Property Description	Loring Park

Additional Municipal Parcels Treated
73001 0018

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	2.1
Total Contributing Area (ac.)	4.8
Generated TP Load from Total Area (lb/yr)	4.3
Dimensions (Length x Width)	50x40
SCM Footprint (SF)	2,000.00
Treatment Depth (in.)	1
Reduction Efficiency	98%
SCM Volume (CF)	8,000
Total Load Reduction (lb/y) :	**4.2**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	3 months
Design - SCM Design Phase	3 months
Design - Permitting	1 months
Total Design, Feasibility, & Permitting	**10 months**
Construction - Bidding	2 months
Construction	2 months
Total Bidding & Construction	**4 months**
Total Duration Months	**14 months**

Schedule Notes	Project Scale = Small Infiltration basin (2,000 sf) Small SCM design, diversion design of sw line into SCM area Permitting: assumed no Con Com Construction estimate does not include phasing or drawn out schedule for full grass regrowth / cover re-establishment

Edmands Park (North)

Infiltration Basin

Project Reference Number	41
Parcel ID	13020 0001
Address/Location	70 BLAKE ST
Property Description	Edmands Park (North)

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	1.4
Total Contributing Area (ac.)	6.8
Generated TP Load from Total Area (lb/yr)	3.5
Dimensions (Length x Width)	50x26
SCM Footprint (SF)	1,300.00
Treatment Depth (in.)	1
Reduction Efficiency	98%
SCM Volume (CF)	5,200
Total Load Reduction (lb/y) :	**3.4**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	3 months
Design - SCM Design Phase	4 months
Design - Permitting	3 months
Total Design, Feasibility, & Permitting	**13 months**
Construction - Bidding	2 months
Construction	3 months
Total Bidding & Construction	**5 months**
Total Duration Months	**18 months**

Schedule Notes	Project Scale = Small - MED Infiltration basin (1,500 sf) Design of extended drain line for diversions Permitting: Recreation area +1 month for conservation are overlay Permitting: Public interaction for recreation facilities Construction estimate does not include phasing or drawn out schedule for full grass regrowth / cover re-establishment

Crystal Lake Park

Infiltration Chamber

Project Reference Number	42
Parcel ID	62001 0002
Address/Location	20 ROGERS ST
Property Description	Crystal Lake Park

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	1.6
Total Contributing Area (ac.)	3.3
Generated TP Load from Total Area (lb/yr)	3.4
Dimensions (Length x Width)	75x40
SCM Footprint (SF)	3,000.00
Treatment Depth (in.)	1
Reduction Efficiency	98%
SCM Volume (CF)	6,000
Total Load Reduction (lb/y) :	**3.4**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	3 months
Design - SCM Design Phase	3 months
Design - Permitting	3 months
Total Design, Feasibility, & Permitting	**12 months**
Construction - Bidding	2 months
Construction	2 months
Total Bidding & Construction	**4 months**
Total Duration Months	**16 months**

Schedule Notes	Project Scale = Small - MED Infiltration chamber (3,000 sf Small SCM design Permitting: Recreation area +1 month for possible Con Com: Crystal Lake Permitting: Public interaction for recreation facilities Construction estimate does not include phasing or drawn out schedule for full grass regrowth / cover re-establishment

Senior Center

Infiltration Chamber

Project Reference Number	43
Parcel ID	24010 0001
Address/Location	345 WALNUT ST
Property Description	Senior Center

Additional Municipal Parcels Treated
--

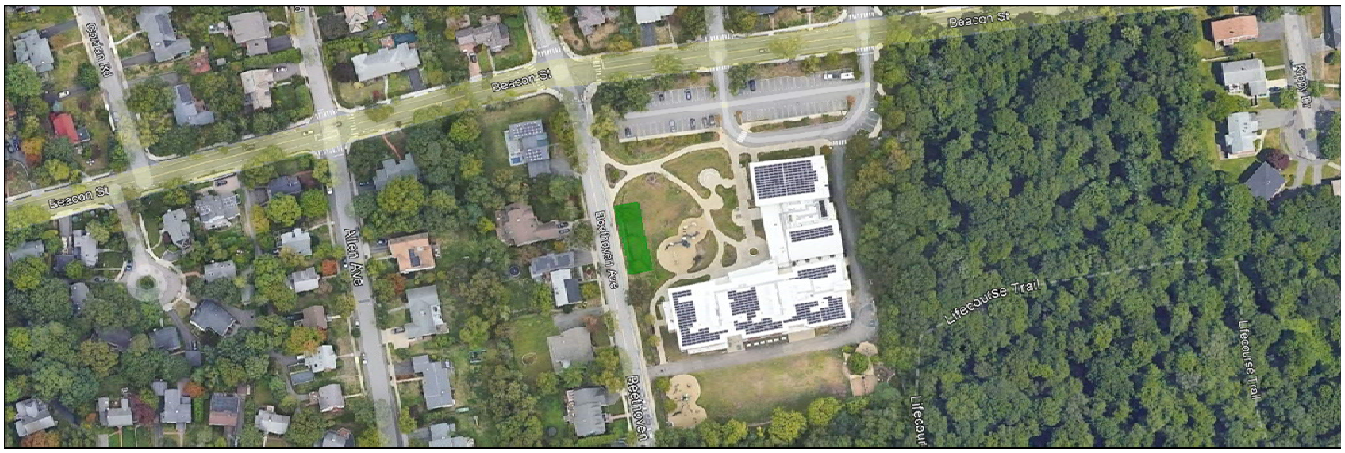
Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	1.7
Total Contributing Area (ac.)	2.7
Generated TP Load from Total Area (lb/yr)	3.7
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	3,200.00
Treatment Depth (in.)	1
Reduction Efficiency	90%
SCM Volume (CF)	6,400
Total Load Reduction (lb/y) :	**3.3**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	3 months
Design - SCM Design Phase	4 months
Design - Permitting	3 months
Total Design, Feasibility, & Permitting	**13 months**
Construction - Bidding	2 months
Construction	3 months
Total Bidding & Construction	**5 months**
Total Duration Months	**18 months**

Schedule Notes	Project Scale = MED Infiltration chambers in parking lot (5,300sf underground) Medium SCM design Possible re-design of parking lot & sidewalk Sewer/water/ other utilites crossings Permitting: 3 months Construction: Medium, re-build Senior Center parking

Frank Zervas Elementary School

Infiltration Chamber



Project Reference Number	44
Parcel ID	54013 0003
Address/Location	30 BEETHOVEN AVE
Property Description	Frank Zervas Elementary School

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	1.7
Total Contributing Area (ac.)	2.3
Generated TP Load from Total Area (lb/yr)	3.3
Dimensions (Length x Width)	16x100
SCM Footprint (SF)	3,100.00
Treatment Depth (in.)	1
Reduction Efficiency	90%
SCM Volume (CF)	6,200
Total Load Reduction (lb/y) :	**2.9**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	3 months
Design - SCM Design Phase	3 months
Design - Permitting	2 months
Total Design, Feasibility, & Permitting	**11 months**

Construction - Bidding	2 months
Construction	2 months
Total Bidding & Construction	**4 months**

Total Duration Months	**15 months**

Schedule Notes	Project SMALL 1,600sf inf chamber Permitting: Public interaction for recreation facilities Construction: small, school lot Construction estimate does not include phasing or drawn out schedule for full grass regrowth / cover re-establishment

Adams St Parking Lot

Infiltration Chamber

Project Reference Number	45
Parcel ID	14008 0003
Address/Location	ADAMS ST
Property Description	Adams St Parking Lot

Additional Municipal Parcels Treated
--

Invert Depth at Intercepted Pipe (ft)	--
HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	1.6
Total Contributing Area (ac.)	2.1
Generated TP Load from Total Area (lb/yr)	3.1
Dimensions (Length x Width)	75x40
SCM Footprint (SF)	3,000.00
Treatment Depth (in.)	1
Reduction Efficiency	90%
SCM Volume (CF)	6,000
Total Load Reduction (lb/y) :	**2.8**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	3 months
Design - SCM Design Phase	3 months
Design - Permitting	2 months
Total Design, Feasibility, & Permitting	**11 months**
Construction - Bidding	2 months
Construction	2 months
Total Bidding & Construction	**4 months**
Total Duration Months	**15 months**

Schedule Notes	Project Scale = Small - MED Infiltration chamber (3,000 sf) Under public paved parking lot Small - Medium SCM design Construction: Small timeframe

Cold Spring Park

Infiltration Trench

Project Reference Number	46
Parcel ID	54022 0058
Address/Location	BEACON ST
Property Description	Cold Spring Park

HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	0.9
Total Contributing Area (ac.)	2.0
Generated TP Load from Total Area (lb/yr)	1.6
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	2,650
Treatment Depth (in.)	1.00
Reduction Efficiency	98%
SCM Volume (CF)	3,180
Total Load Reduction (lb/y) :	**1.6**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	3 months
Design - SCM Design Phase	2 months
Design - Permitting	2 months
Total Design, Feasibility, & Permitting	**10 months**

Construction - Bidding	2 months
Construction	1 months
Total Bidding & Construction	**3 months**

Total Duration Months	**13 months**

Schedule Notes	Project SMALL Design: sport court perimeter inf trenches (reduced 1 month) Permitting: Public interaction for recreation facilities Construction: small (reduced 1 month)

Forte Park

Infiltration Basin

Project Reference Number	47
Parcel ID	11004 0013
Address/Location	229 R CALIFORNIA ST
Property Description	Forte Park

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	0.5
Total Contributing Area (ac.)	2.0
Generated TP Load from Total Area (lb/yr)	1.2
Dimensions (Length x Width)	9x50
SCM Footprint (SF)	450
Treatment Depth (in.)	1.00
Reduction Efficiency	92%
SCM Volume (CF)	1,800
Total Load Reduction (lb/y) :	**1.1**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	3 months
Design - SCM Design Phase	3 months
Design - Permitting	1 months
Total Design, Feasibility, & Permitting	**10 months**

Construction - Bidding	2 months
Construction	2 months
Total Bidding & Construction	**4 months**

Total Duration Months	**14 months**

Schedule Notes	Project Scale = Small Infiltration basin (450 sf) Permitting: use base 1 month Construction: Small timeframe

Underwood School

Infiltration Chamber

Project Reference Number	48
Parcel ID	72002 0003
Address/Location	101 VERNON ST
Property Description	Underwood School

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	0.6
Total Contributing Area (ac.)	0.6
Generated TP Load from Total Area (lb/yr)	1.1
Dimensions (Length x Width)	50x22
SCM Footprint (SF)	1,100
Treatment Depth (in.)	1.00
Reduction Efficiency	90%
SCM Volume (CF)	2,200
Total Load Reduction (lb/y) :	**0.9**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	3 months
Design - SCM Design Phase	3 months
Design - Permitting	2 months
Total Design, Feasibility, & Permitting	**11 months**

Construction - Bidding	2 months
Construction	2 months
Total Bidding & Construction	**4 months**

Total Duration Months	**15 months**

Schedule Notes	Project Scale = Small Infiltration chamber (1,200 sf) Permitting: base + 1 month for historic district Construction: small timeframe

Angier School

Infiltration Trench

Project Reference Number	49
Parcel ID	55010 0049
Address/Location	1697 R BEACON ST
Property Description	Angier School

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	0.4
Total Contributing Area (ac.)	0.8
Generated TP Load from Total Area (lb/yr)	0.6
Dimensions (Length x Width)	4x300
SCM Footprint (SF)	1,200
Treatment Depth (in.)	1.00
Reduction Efficiency	90%
SCM Volume (CF)	1,440
Total Load Reduction (lb/y) :	**0.6**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	3 months
Design - SCM Design Phase	2 months
Design - Permitting	1 months
Total Design, Feasibility, & Permitting	**9 months**

Construction - Bidding	2 months
Construction	2 months
Total Bidding & Construction	**4 months**

Total Duration Months	**13 months**

Schedule Notes	Project Scale = Small Infiltration trench (1,200 sf) Small design, reduced 1 Month Base permitting time frame Construction: small timeframe reduced 1 month

Peirce Elementary School

Bio-Filtration

Project Reference Number	50
Parcel ID	32021 0005
Address/Location	170 TEMPLE ST
Property Description	Peirce Elementary School

HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	0.6
Total Contributing Area (ac.)	0.6
Generated TP Load from Total Area (lb/yr)	1.0
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	1,400
Treatment Depth (in.)	1.00
Reduction Efficiency	53%
SCM Volume (CF)	2,170
Total Load Reduction (lb/y) :	**0.5**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	3 months
Design - SCM Design Phase	3 months
Design - Permitting	2 months
Total Design, Feasibility, & Permitting	**11 months**

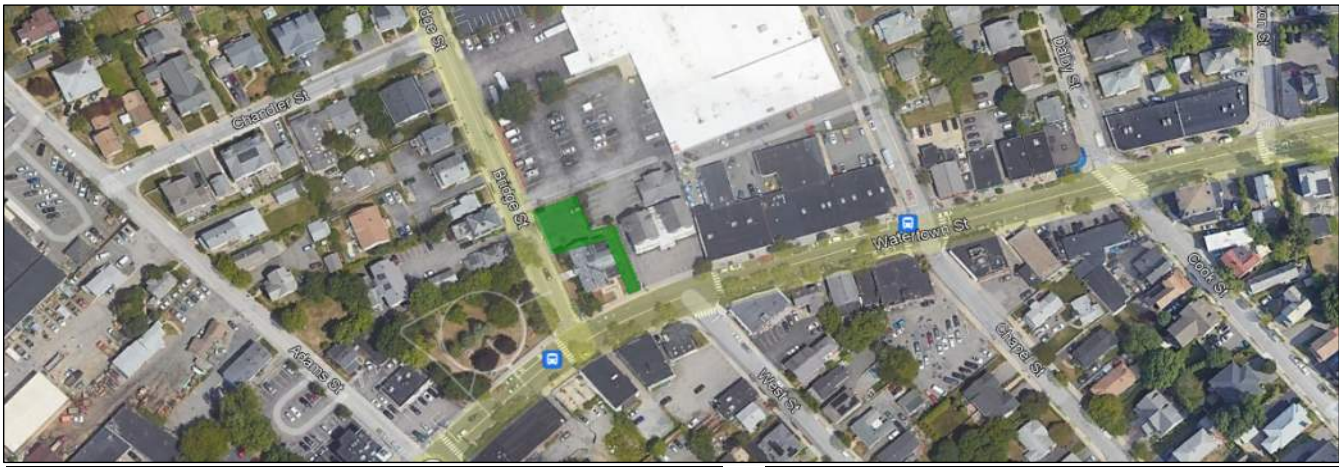
Construction - Bidding	2 months
Construction	2 months
Total Bidding & Construction	**4 months**

Total Duration Months	**15 months**

Schedule Notes	Project Scale = Small Bio filters @ roof downspouts (1,700 sf) Small Permitting: 2 months for work at school lot Construction: small timeframe reduced 1 month

Newton Free Library

Porous Pavement



Project Reference Number	51
Parcel ID	14001 0004
Address/Location	144 BRIDGE ST
Property Description	Newton Free Library

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	0.1
Total Contributing Area (ac.)	0.1
Generated TP Load from Total Area (lb/yr)	0.2
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	5,000
Treatment Depth (in.)	1.00
Reduction Efficiency	62%
SCM Volume (CF)	4,500
Total Load Reduction (lb/y) :	**0.1**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	3 months
Design - SCM Design Phase	3 months
Design - Permitting	2 months
Total Design, Feasibility, & Permitting	**11 months**

Construction - Bidding	2 months
Construction	2 months
Total Bidding & Construction	**4 months**

Total Duration Months	**15 months**

Schedule Notes	Project Scale = Small Porous Pavement - Library Permitting: 2 months for library lot Construction: small timeframe reduced 1 month

Newton Center Playground

Infiltration Trench

Project Reference Number	52
Parcel ID	64032 0003
Address/Location	TYLER TER
Property Description	Newton Center Playground

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	0.1
Total Contributing Area (ac.)	0.3
Generated TP Load from Total Area (lb/yr)	0.1
Dimensions (Length x Width)	5x40
SCM Footprint (SF)	200
Treatment Depth (in.)	1.00
Reduction Efficiency	90%
SCM Volume (CF)	240
Total Load Reduction (lb/y) :	**0.1**

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	3 months
Design - SCM Design Phase	2 months
Design - Permitting	1 months
Total Design, Feasibility, & Permitting	**9 months**

Construction - Bidding	2 months
Construction	2 months
Total Bidding & Construction	**4 months**

Total Duration Months	**13 months**

Schedule Notes	Project Scale = Small Infiltration trench (200 sf) Small design, reduced 1 month Base permitting time frame Construction: small timeframe reduced 1 month

Attachment 3: Prioritized Roadway Opportunity Schedule Report Sheets

Nevada St

Infiltration Chamber

Project Reference Number	1
Roadway Name	Nevada St
Location Description	Nevada @ Village

HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	10.5
Total Contributing Area (ac.)	22.8
Generated TP Load from Total Area (lb/yr)	21.5
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	5,400
Treatment Depth (in.)	0.25
Reduction Efficiency	62%
SCM Volume (CF)	10,800

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	4 months
Design - SCM Design Phase	5 months
Design - Permitting	2 months
Total Design, Feasibility, & Permitting	**14 months**

Construction - Bidding	2 months
Construction	4 months
Total Bidding & Construction	**6 months**

Total Duration Months	**20 months**

Total Load Reduction (lb/y) :	**13.2**

Schedule Notes	Medium-Large SCM Underground inf. chambers Design: Large design for multiple underground systems Utilities: Coordinate for record plans, location & possible relocations Permitting: 2 months for utility coordination Construction: Large, possible utility relocation & phasing

Brandeis Rd

Infiltration Chamber

Project Reference Number	2
Roadway Name	Brandeis Rd
Location Description	Greenwood @ Brandeis

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	21.7
Total Contributing Area (ac.)	50.9
Generated TP Load from Total Area (lb/yr)	45.5
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	7,500
Treatment Depth (in.)	0.15
Reduction Efficiency	26%
SCM Volume (CF)	15,000

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	4 months
Design - SCM Design Phase	5 months
Design - Permitting	3 months
Total Design, Feasibility, & Permitting	**15 months**

Construction - Bidding	2 months
Construction	3 months
Total Bidding & Construction	**5 months**

Total Duration Months	**20 months**

Total Load Reduction (lb/y) :	**11.6**

Schedule Notes	Medium SCM Underground inf. chambers Design: Med design Utilities: Coordinate for record plans, location & possible relocations Permitting: Con Com = adjacent brook / wetland Construction: Med, possible utility relocation & phasing

Waban Ave

Infiltration Chamber

Project Reference Number	3
Roadway Name	Waban Ave
Location Description	Waban @ Quinobequin

HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	5.5
Total Contributing Area (ac.)	18.5
Generated TP Load from Total Area (lb/yr)	12.2
Dimensions (Length x Width)	105x40
SCM Footprint (SF)	2,800
Treatment Depth (in.)	0.25
Reduction Efficiency	62%
SCM Volume (CF)	5,600

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	4 months
Design - SCM Design Phase	4 months
Design - Permitting	2 months
Total Design, Feasibility, & Permitting	**13 months**

Construction - Bidding	2 months
Construction	2 months
Total Bidding & Construction	**4 months**

Total Duration Months	**17 months**

Total Load Reduction (lb/y) :	**7.5**

Schedule Notes	Small SCM Underground inf. chambers Design: Med design Utilities: Coordinate for record plans, location & possible relocations Permitting: 2 months, public interaction for park Construction: Small, possible utility relocation & phasing

Albemarle Rd

Bio-Filtration

Project Reference Number	4
Roadway Name	Albemarle Rd
Location Description	Crafts to the Charles

HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	5.7
Total Contributing Area (ac.)	12.1
Generated TP Load from Total Area (lb/yr)	11.6
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	11,100
Treatment Depth (in.)	0.8
Reduction Efficiency	48%
SCM Volume (CF)	17,205

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	4 months
Design - SCM Design Phase	6 months
Design - Permitting	3 months
Total Design, Feasibility, & Permitting	**16 months**

Construction - Bidding	2 months
Construction	4 months
Total Bidding & Construction	**6 months**

Total Duration Months	**22 months**

Total Load Reduction (lb/y) :	**5.6**

Schedule Notes	Large SCM Bio-filters lining 3,000 of roadway Design: multiple SCM areas for design Utilities: Coordinate for record plans, location Permitting: Con-Com = adjacent brook Construction: Large

Beacon St

Infiltration Chamber

Project Reference Number	5
Roadway Name	Beacon St
Location Description	Beacon @ Glen

HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	4.9
Total Contributing Area (ac.)	17.1
Generated TP Load from Total Area (lb/yr)	11.2
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	1,500
Treatment Depth (in.)	0.15
Reduction Efficiency	44%
SCM Volume (CF)	3,000

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	4 months
Design - SCM Design Phase	6 months
Design - Permitting	2 months
Total Design, Feasibility, & Permitting	**15 months**

Construction - Bidding	2 months
Construction	3 months
Total Bidding & Construction	**5 months**

Total Duration Months	**20 months**

Total Load Reduction (lb/y) :	**4.9**

Schedule Notes	Medium SCM 1,500 sf underground inf. chambers Design: Med design (+1 Month for utility design) Utilities: Coordinate for record plans, location & possible relocations Permitting: 2 months, utility coordination Construction: Med, possible utility relocation & phasing

Valentine St

Infiltration Chamber

Project Reference Number	6
Roadway Name	Valentine St
Location Description	Valentine @ Fountain

HSG Soil Type at SCM	C
Impervious Drainage Area (ac.)	5.6
Total Contributing Area (ac.)	20.3
Generated TP Load from Total Area (lb/yr)	12.6
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	2,100
Treatment Depth (in.)	0.2
Reduction Efficiency	37%
SCM Volume (CF)	4,200

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	4 months
Design - SCM Design Phase	4 months
Design - Permitting	2 months
Total Design, Feasibility, & Permitting	**13 months**

Construction - Bidding	2 months
Construction	2 months
Total Bidding & Construction	**4 months**

Total Duration Months	**17 months**

Total Load Reduction (lb/y) :	**4.7**

Schedule Notes	Small SCM 2,100 sf underground inf. chambers Design: Small design Utilities: Coordinate for record plans, location & possible relocations Permitting: 2 months, utility coordination Construction: Small, possible utility relocation & phasing

Albemarle Rd

Bio-Filtration

Project Reference Number	7A
Roadway Name	Albemarle Rd
Location Description	Watertown to Crafts

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	5.8
Total Contributing Area (ac.)	11.2
Generated TP Load from Total Area (lb/yr)	13.1
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	2,625
Treatment Depth (in.)	0.15
Reduction Efficiency	20%
SCM Volume (CF)	4,069

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	4 months
Design - SCM Design Phase	6 months
Design - Permitting	3 months
Total Design, Feasibility, & Permitting	**16 months**

Construction - Bidding	2 months
Construction	4 months
Total Bidding & Construction	**6 months**

Total Duration Months	**22 months**

Total Load Reduction (lb/y) :	**2.6**

Schedule Notes	Large SCM Bio-filters lining roadway Design: multiple SCM areas for design Utilities: Coordinate for record plans, location Permitting: Con-Com = adjacent brook Construction: Large

Albemarle Rd

Porous Pavement

Project Reference Number	7B
Roadway Name	Albemarle Rd
Location Description	Watertown to Crafts

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	0.3
Total Contributing Area (ac.)	0.3
Generated TP Load from Total Area (lb/yr)	0.7
Dimensions (Length x Width)	Multiple
SCM Footprint (SF)	14,990
Treatment Depth (in.)	1
Reduction Efficiency	62%
SCM Volume (CF)	13,491

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	4 months
Design - SCM Design Phase	6 months
Design - Permitting	3 months
Total Design, Feasibility, & Permitting	**16 months**

Construction - Bidding	2 months
Construction	4 months
Total Bidding & Construction	**6 months**

Total Duration Months	**22 months**

Total Load Reduction (lb/y) :	**0.4**

Schedule Notes	Large SCM Porous Pavement roadway shoulders Design: multiple SCM areas for design Utilities: Coordinate for record plans, location Permitting: Con-Com = adjacent brook Construction: Large

Crystal St
Infiltration Chamber

Project Reference Number	8
Roadway Name	Crystal St
Location Description	Crystal @ Lake

HSG Soil Type at SCM	A
Impervious Drainage Area (ac.)	4.2
Total Contributing Area (ac.)	4.7
Generated TP Load from Total Area (lb/yr)	8.3
Dimensions (Length x Width)	Polygon
SCM Footprint (SF)	925
Treatment Depth (in.)	0.1
Reduction Efficiency	33%
SCM Volume (CF)	1,850

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	4 months
Design - SCM Design Phase	5 months
Design - Permitting	2 months
Total Design, Feasibility, & Permitting	**14 months**

Construction - Bidding	2 months
Construction	3 months
Total Bidding & Construction	**5 months**

Total Duration Months	**19 months**

Total Load Reduction (lb/y) :	**2.7**

Schedule Notes	Medium SC 1,000 sf underground inf. chambers Design: Med design, utility re-locations Utilities: Coordinate for record plans, location & possible relocations Permitting: 2 months, utility coordination Construction: Med, possible utility relocation & phasing

Grove St

Infiltration Chamber

Project Reference Number	9
Roadway Name	Grove St
Location Description	Grove Public Parking

HSG Soil Type at SCM	Not Rated
Impervious Drainage Area (ac.)	0.4
Total Contributing Area (ac.)	0.8
Generated TP Load from Total Area (lb/yr)	0.8
Dimensions (Length x Width)	25x30
SCM Footprint (SF)	750
Treatment Depth (in.)	1
Reduction Efficiency	90%
SCM Volume (CF)	1,500

Design - Proposal & Procurement	3 months
Design - Feasibility & Planning	3 months
Design - SCM Design Phase	3 months
Design - Permitting	1 months
Total Design, Feasibility, & Permitting	**10 months**

Construction - Bidding	2 months
Construction	2 months
Total Bidding & Construction	**4 months**

Total Duration Months	**14 months**

Total Load Reduction (lb/y) :	**0.8**

Schedule Notes	Small SCM 950 sf underground inf. chambers Design: Small design Utilities: Coordinate for record plans, location & possible relocations Permitting: 1 months, no utility relocation anticipated Construction: Small

Permit Timeline Schedule

City of Newton Phase 1 Phosphorus Control Plan

Permit Timeline Schedule

Woodard & Curran

Legend - Highlights

Project Type	Project Phase
Park / Recreation Area	Design - Proposal & Procurement
School Property	Design - Feasibility & Planning
Other (Parking Lot, Property)	Design - SCM Design Phase
Roadway	Design - Permitting
	Construction - Bidding
	Construction

Stormwater Control Element	Total Load Reductio n (lb/yr)	Fiscal Year 2024	Fiscal Year 2025	Fiscal Year 2026	PERMIT YR 8	Fiscal Year 2027	Fiscal Year 2028	PERMIT YR 10
Non-Structural Controls	50.1	50.1 lb/year	50.1 lb/year	50.1 lb/year		50.1 lb/year	50.1 lb/year	
Existing Municipal Structural Controls	25.9	25.9 lb/year	25.9 lb/year	25.9 lb/year		25.9 lb/year	25.9 lb/year	
Existing & On-Going Municipal Transportation Controls	see right	1.4 lb/yr existing + 1 lb/yr accrual =2.4 lb/year total	1.4 lb/yr existing + 1 lb/yr accrual (2 yrs) =3.4 lb/year total	1.4 lb/yr existing + 1 lb/yr accrual (3 yrs) =4.4 lb/year total		1.4 lb/yr existing + 1 lb/yr accrual (4 yrs) =5.4 lb/year total	1.4 lb/yr existing + 1 lb/yr accrual (5 yrs) =6.4 lb/year total	
Major Stormwater Permits	see right	40 lb/yr accrual = 40 lb/year total	40 lb/yr accrual = 80 lb/year total	40 lb/yr accrual = 120 lb/year total		40 lb/yr accrual = 160 lb/year total	40 lb/yr acirvue = 200 lb/year total	

Planned Structural Controls (Municipal Parcels+Roadways)

| Project Reference Number | Parcel ID | Address/Location | Property Description | SCM Description | Total Load Reductio n (lb/yr) | School summer break | | |

Constraints Schedule

City of Newton Phase 1 Phosphorus Control Plan

Constraints Schedule

Woodard & Curran

Legend - Highlights

Project Type	Capitol Improvement Plan
Park / Recreation Area	Schedule Paired
School Property	
Other (Parking Lot, Property)	
Roadway	

Project Phase Stages	Yearly Spending Phase
Design - Proposal & Procurement	Design
Design - Feasibility & Planning	
Design - SCM Design Phase	
Design - Permitting	
Construction - Bidding	Construction
Construction	

Project Reference Number	Parcel ID	Address/Location	Property Description	SCM Description	2023 EPA Adj Soft Cost (35%)	Design Year	2023 EPA Adj. Const Cost Estimate	Construction Year	2023 EPA Total Cost Estimate	EPA Cost/Benefit ($/lb/y)	Total Load Reduction (lb/yr)	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077
1	31016 0017	EDEN AVE	Davis Playground	Large underground system in baseball field (+/-40,000 sf underground)	$1,558,200	2035	$4,452,000	2038	$6,010,200	$53,897	111.5													$1,558,200			$4,452,000																																									
2	51029 0037	60 ELLIOT ST	Elliot St DPW Yard	Large underground system (+/-46,000 sf underground) Located in DPW materials yard	$1,725,850	2039	$4,931,000	2043	$6,656,850	$59,710	111.5																		$1,725,850					$4,931,000																																			
3A	64032 0001 (1)	TYLER TER	Newton Center Playground	Infiltration basin (+/-3,800 sf underground)	$75,600	2023	$216,000	2024	$291,600	$37,335	7.8	$75,600	$216,000																																																													
3B	64032 0001 (2)	TYLER TER	Newton Center Playground	SCM adjacent to or in baseball field (+/-40,000 sf underground)	$1,569,750	2023	$4,485,000	2025	$6,054,750	$82,136	73.7	$1,569,750		$4,485,000																																																										
4	14016 0033	11 HAWTHORN ST	Pellegrini Park	Large SCM system (+/-65,000 sf underground) Multi-drain line re-locations	$2,558,150	2028	$7,309,000	2034	$9,867,150	$124,609	79.2						$2,558,150						$7,309,000																																															
5	13001 0001	101 EAST SIDE PKWY	Cabot Park	Large underground system in baseball field (+/-45,000 sf underground)	$1,769,250	2051	$5,055,000	2056	$6,824,250	$113,544	60.1																														$1,769,250					$5,055,000																				
6	32021 0006	BERKELEY ST	Peirce School	Large underground system in baseball field (+/-46,000 sf underground)	$1,824,200	2057	$5,212,000	2062	$7,036,200	$118,394	59.4																																			$1,824,200							$5,212,000													
7	11010 0007	54 IASSET ST	Stearns Park	Split underground system in rec. field (+/-19,000 sf underground)	$737,100	2043	$2,106,000	2044	$2,843,100	$59,206	48.0																							$737,100	$2,106,000																																			
8	73016 0022	MONTROSE ST	Ward Park	Split underground system in rec. field (+/-40,000 sf underground) sewer splitting systems	$1,529,150	2064	$4,369,000	2069	$5,898,150	$128,062	46.1																																																										
9	24008 0001	LOWELL AVE	Elmwood Park	Underground system in park (+/-25,000 sf underground)	$936,600	2045	$2,676,000	2046	$3,612,600	$82,639	43.7																																																										
10	21022 0001	250 ALBEMARLE RD	Albemarle Park/Halloran Sports Complex	Large underground system in rec. field (+/-36,000 sf underground)	$1,390,550	2070	$3,973,000	2072	$5,363,550	$129,170	41.5																																																											
11	33030 0020	HENSHAW PL OFF	Wellington Playground	Large underground SPLIT system in park field (+/-33,000 sf underground)	$1,295,350	2074	$3,701,000	2077	$4,996,350	$133,219	37.5																																																								
12	54021 0002	170 R PLYMOUTH RD	Cold Spring Park	Constructed Wetland (+/-33,000 sf)	$485,100	2026	$1,386,000	2027	$1,871,100	$59,952	31.2				$485,100	$1,386,000																																																							
13	83006 0001	WHEELER RD	Oak Hill Middle School Parking	Underground system in parking lot (+/-23,000 sf underground)	$821,100	2047	$2,346,000	2049	$3,167,100	$111,026	28.5																																																								
14	32024 0006A	WASHINGTON ST	Richard McGrath Park	Infiltration basin in grass/LA area	$428,400	2023	$1,224,000	2024	$1,652,400	$69,656	23.7	$428,400	$1,224,000																																																									
15	53016 0007	ALLEN AVE	Richardson Playground	Infiltration basin in grass rec. area	$696,150	2051	$1,989,000	2052	$2,685,150	$116,509	23.0																														$696,150	$1,989,000																								
16	41022 0001	COMMONWEALTH AVE	Auburndale and Lyons Parks	Constructed Wetland (+/-20,000 sf)	$279,300	2037	$798,000	2039	$1,077,300	$50,386	21.4															$279,300		$798,000																																							
17A	64032 0005 (1)	149 PLEASANT ST CTR	Mason-Rice School	Infiltration basin in grass/LA area	$67,200	2031	$192,000	2032	$259,200	$13,024	19.9									$67,200	$192,000																																																		
17B	64032 0005 (2)	150 PLEASANT ST CTR	Mason-Rice School	Permeable parking - School parking lot	$304,500	2031	$870,000	2032	$1,174,500	$2,015,586	0.6									$304,500	$870,000																																																		
18	41031 0037	WEST PINE ST	West Pine Parking lot	Underground system in paved parking lot (+/-16,500 sf underground)	$585,550	2062	$1,673,000	2063	$2,258,550	$122,179	18.5																																																									
19	34037 0021	125 DERBY ST	Franklin Elementary School	Split underground system in park field (+/-16,000 sf underground)	$606,900	2072	$1,734,000	2073	$2,340,900	$127,279	18.4																																																								
20A	83006 0011 (1)	191 DEDHAM ST	Countryside School	Infiltration basin or Gravel Wetland in grass/LA area	$33,600	2065	$96,000	2066	$129,600	$40,729	3.2																																																							
20B	83006 0011 (2)	192 DEDHAM ST	Countryside School	Underground system in school rec. field (+/-15,000 sf underground)	$528,500	2065	$1,510,000	2066	$2,038,500	$135,112	15.1																																																							
21	41031 0043	211 LEXINGTON ST	Resource Recovery Center	Beneath recycle center pave. Infiltration chambers (+/-19,300 sf underground)	$325,150	2054	$929,000	2055	$1,254,150	$69,943	17.9																																																							
22	13020 0002	44 JACKSON RD	Boyde Park	Underground sys, in school/ park area (+/-16,000 sf underground) -sig. disturbance to hardscape	$582,050	2074	$1,663,000	2075	$2,245,050	$129,668	17.3																																																								
23A	23015 0027 (1)	90 CRAFTS ST	DPW Yard	underground in school rec. field (+/-12,000 sf underground)	$407,050	2067	$1,163,000	2068	$1,570,050	$131,830	11.9																																																						
23B	23015 0027 (2)	90 CRAFTS ST	DPW Yard	Underground system (+/-4,500 sf underground) Located in DPW yard	$160,650	2067	$459,000	2068	$619,650	$152,942	4.1																																																						
24	71026 0024	GRASMERE ST	Hunnewell Playground	Infiltration basin (+/-6,600 sf)	$138,600	2032	$396,000	2033	$534,600	$33,835	15.8										$138,600	$396,000																																												
25	13001 0002	EAST SIDE PKWY	E. Side Parkway Grassed median	Infiltration chambers (+/-1,760 sf underground)	$171,500	2033	$490,000	2034	$661,500	$47,389	14.0												$171,500	$490,000																																										
26A	72039 0017 (1)	KENRICK ST OFF	Newton Commonwealth Golf Course	Underground system in golf course (+/-10,000 sf)	$357,000	2049	$1,020,000	2050	$1,377,000	$103,929	13.2																													$357,000	$1,020,000																								
26B	72039 0017 (2)	KENRICK ST OFF	Newton Commonwealth Golf Course	Infiltration trench along driveways and impervious areas (+/-800 sf)	$9,800	2049	$28,000	2050	$37,800	$69,077	0.5																													$9,800	$28,000																								
27	52041 0001	100 LINCOLN ST	Hyde Playground and Park	Infiltration chambers (+/-11,500 sf underground)	$410,550	2064	$1,173,000	2065	$1,583,550	$116,654	13.6																																																							
28	33011 0001	1321 WASHINGTON ST	Newton Police Headquarters Parking Lot	Underground system (+/-8,000 sf underground) Located in Police Station Lot	$282,100	2027	$806,000	2028	$1,088,100	$90,698	12.0					$282,100	$806,000																																																			
29	72010 0001	42 VERNON ST	Bigelow Middle School	Infiltration chambers (+/-10,400 sf underground)	$371,350	2046	$1,061,000	2047	$1,432,350	$122,501	11.7																																																							
30	12003 0001	WALNUT PK	Spears Park	Infiltration chambers in grassed area (+/-7,000 sf underground)	$285,600	2052	$816,000	2053	$1,101,600	$104,204	10.6																																																					
31	54022 0049B	BEACON ST REAR	Cold Spring Park	Constructed/Gravel Wetland (+/-4,800 sf)	$70,700	2029	$202,000	2030	$272,700	$26,094	10.5								$70,700	$202,000																																																	
32	72039 0021	MAGNOLIA AVE	Newton Commonwealth Golf Course	Infiltration chambers (+/-6,600 sf underground)	$235,900	2057	$674,000	2058	$909,900	$87,098	10.4																																																						
33	81005 0011	125 MEADOWBROOK RD	Brown Middle School	Infiltration chambers in grassed area (+/-10,000 sf underground)	$350,000	2060	$1,000,000	2061	$1,350,000	$130,219	10.4																																																						
34A	81051 0047 (1)	140 BRANDEIS RD	Newton South High School	Infiltration chambers under synthetic turf field (+/-7,200 sf underground)	$257,250	2059	$735,000	2060	$992,250	$153,295	6.5																																																						
34B	81051 0047 (2)	141 BRANDEIS RD	Newton South High School	Infiltration chambers (+/-1,500 sf underground)	$82,250	2059	$235,000	2060	$317,250	$132,970	2.4																																																						
35	23013 0001	WATERTOWN ST	Lowell Park	Infiltration chambers (+/-4,200 sf underground)	$150,150	2035	$429,000	2036	$579,150	$76,589	7.6														$150,150	$429,000																																									
36	33006 0061	70 CRESCENT ST	Reverend Ford Playground	Infiltration chambers under grass park / playground (+/-4,200 sf underground)	$142,800	2024	$408,000	2025	$550,800	$75,587	7.3		$142,800	$408,000																																																						
37	51045 0003	PENNSYLVANIA AVE	Bobby Braceland Playground	Infiltration chambers in rec. parking lot (+/-6,000 sf underground)	$214,200	2058	$612,000	2059	$826,200	$128,085	6.5																																																							
38	51008 0001A1	51 I PETTEE ST	Emerson Playground	Infiltration chambers in rec. field/ school field (+/-4,000 sf underground)	$139,300	2044	$398,000	2045	$537,300	$119,598	4.5																																																							
39	82021 0001	250 BROOKLINE ST	Memorial-Spaulding School and fields	Infiltration chambers in rec. field/ school field (+/-4,000 sf underground)	$164,500	2039	$470,000	2040	$634,500	$141,858	4.5																																																					
40	73001 0019	CENTRE ST	Loring Park	Infiltration basin (+/-2,000 sf)	$42,000	2030	$120,000	2031	$162,000	$38,395	4.2								$42,000	$120,000																																													
41	13020 0001	70 BLAKE ST	Edmands Park (North)	Infiltration basin (+/-1,500 sf)	$27,300	2024	$78,000	2026	$105,300	$30,640	3.4		$27,300		$78,000																																																	
42	62001 0002	20 ROGERS ST	Crystal Lake Park	Infiltration chambers (+/-3,000 sf)	$107,100	2028	$306,000	2029	$413,100	$122,639	3.4						$107,100	$306,000																																																
43	24010 0001	345 WALNUT ST	Senior center	Infiltration chambers in parking lot (+/-5,300 sf underground)	$114,450	2026	$327,000	2027	$441,450	$132,872	3.3				$114,450	$327,000																																																		
44	54013 0003	30 BEETHOVEN AVE	Frank Zervas Elementary School	Infiltration chambers (+/-1,600 sf)	$110,950	2047	$317,000	2048	$427,950	$145,713	2.9																																																							
45	14008 0003	ADAMS ST	Adams St Parking Lot	Infiltration chamber (+/-3,000 sf) under public paved parking lot	$107,100	2026	$306,000	2027	$413,100	$146,187	2.8				$107,100	$306,000																																																
46	54022 0058	BEACON ST	Cold Spring Park	sport court perimeter inf trench's	$32,550	2041	$93,000	2042	$125,550	$78,587	1.6																																																						
47	11004 0013	229 R CALIFORNIA ST	Forte Park	Infiltration basin (+/-450 sf)	$9,450	2029	$27,000	2030	$36,450	$33,837	1.1								$9,450	$27,000																																													
48	72002 0003	101 VERNON ST	Underwood School	Infiltration chamber (+/-1,200 sf)	$39,550	2055	$113,000	2056	$152,550	$161,261	0.9																																																						
49	55010 0049	1697 R BEACON ST	Angier School	Infiltration trench (+/-1,200 sf)	$14,700	2034	$42,000	2035	$56,700	$99,534	0.6													$14,700	$42,000																																								
50	32021 0005	170 TEMPLE ST	Peirce Elementary School	Bio filters @ roof downspouts (+/-1,700 sf)	$27,650	2039	$79,000	2040	$106,650	$195,137	0.5																														$27,650	$79,000																								
51	14001 0004	144 BRIDGE ST	Newton Free Library	Porous Pavement - Library	$66,150	2027	$189,000	2029	$255,150	$2,014,196	0.1					$66,150	$189,000																																																	
52	64032 0003	TYLER TER	Newton Center Playground	Infiltration trench (+/-200 sf)	$2,450	2025	$7,000	2028	$9,450	$75,012	0.1			$2,450			$7,000																																																	
1		Nevada St	Nevada @ Village	Infiltration chamber (+/-5,400 sf)	$192,850	2030	$551,000	2031	$743,850	$56,158	13.2									$192,850	$551,000																																												
2		Brandeis Rd	Greenwood @ Brandeis	Infiltration chamber (+/-7,500 sf)	$267,750	2040	$765,000	2041	$1,032,750	$89,098	11.6																														$267,750	$765,000																								
3		Waban Ave	Waban @ Quinobequin	Infiltration chamber (+/-2,800 sf)	$100,100	2032	$286,000	2033	$386,100	$51,504	7.5											$100,100	$286,000																																										
4		Albemarle	Crafts to the Charles	Bio filters at road edges (+/- 2,900 lf roadway)	$217,000	2048	$620,000	2049	$837,000	$150,513	5.6																																																					
5		Beacon St	Beacon @ Glen	Infiltration chamber (+/-1,500 sf)	$53,550	2038	$153,000	2039	$206,550	$41,929	4.9																													$53,550	$153,000																								
6		Valentine St	Valentine @ Fountain	Infiltration chamber (+/-2,100 sf)	$75,250	2050	$215,000	2051	$290,250	$62,179	4.7																																																						
7A		Albemarle	Watertown to Crafts	Bio filters at road edges (+/- 4,000 lf roadway)	$51,450	2063	$147,000	2064	$198,450	$77,454	2.6																																																					
7B		Albemarle	Watertown to Crafts	Porous Pavement - Roadway Shoulders (+/- 2,800 lf roadway)	$198,450	2063	$567,000	2064	$765,450	$1,830,439	0.4																																																					
8		Crystal St	Crystal @ Lake	Infiltration chamber (+/-925 sf)	$33,250	2024	$95,000	2025	$128,250	$46,688	2.7		$33,250	$95,000																																																		
9		GROVE ST	Grove Public Parking	Infiltration chamber (+/-750 sf)	$26,950	2053	$77,000	2054	$103,950	$135,922	0.8																																																					

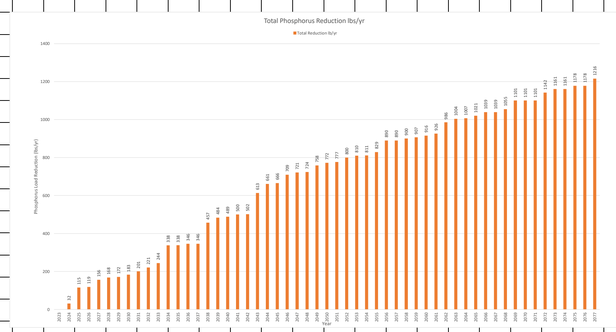


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Figure Created: June 2023

APPENDIX I: LEGAL ANALYSIS

Legal Analysis Memorandum Dated February 2020

City of Newton Stormwater Management Ordinance

City of Newton Stormwater Management and Erosion Control Rules & Regulations

Legal Analysis Memorandum Dated February 2020

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DRIVE RESULTS

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MEMORANDUM

TO: Ted Jerdee and Maria Rose, City of Newton Utilities Department

FROM: Zach Henderson and Rich Niles

DATE: February 21, 2020

RE: Phosphorus Control Plan Preliminary Legal Analysis

Included in the scope of services in our Agreement for the Crystal Lake Watershed Assessment and Phosphorus Control Plan, was to consider the City's obligations under the MS4 General Permit regarding Phosphorus Control Plan requirements for the Charles River, including a preliminary legal analysis.
This memorandum provides a preliminary legal analysis to support the City's Phosphorus Control Plan (PCP), as required by the MS4 General Permit. We would anticipate the need for a meeting with you to discuss and review recommendations and perhaps a broader conversation with other City leadership and/or economic development interests to discuss broader public-private partnerships. We will identify a date to get together with you.

Background

The Crystal Lake Management Plan was completed by Woodard & Curran in January 2020. The work completed to develop the Crystal Lake Management Plan provides an example case study to assist in developing the City-wide PCP to begin evaluating management actions and regulatory mechanisms that may be needed for implementation of controls to reduce total phosphorus loads. It is anticipated that this memorandum will be the preliminary step toward identification of recommended legal and/or policy guidance as those recommended actions must be implemented within the Permit Term.

Crystal Lake

As discussed in the report titled "Nutrient Loading Analysis and Management Review for Crystal Lake" prepared by Water Resource Services, Inc. dated January 17, 2020, the current average annual phosphorus load is estimated at 45 lb/year. A target total phosphorus load reduction of 20% through watershed management actions, in addition to internal nutrient inactivation, is anticipated to yield an average phosphorus concentration <11 µg/L and provide acceptable conditions with regard to algae during the primary use season. The recommended management actions in the Crystal Lake Management Plan are projected to result in approximately 30% reduction in total phosphorus load through several targeted structural and non-structural watershed nutrient management strategies and provide a basis for projection of the cost of structural retrofits within the municipal right-of-way (ROW) City-wide.

The preliminary cost projections for Crystal Lake indicate non-structural BMPs may cost around $50,000 per year and over $600,000 (capital) in structural controls to reach a 30% reduction in total phosphorus nutrient load annually (approximately 23 lbs/year). It is evident that publicly funded nutrient control city-wide, to meet the obligations of the MS4 General Permit, will be exceedingly expensive, may not be achievable on only municipal property, and that alternative strategies to nutrient management will likely be necessary.

This memorandum and the preliminary legal analysis focus on the external watershed nutrient management strategies, which are available strategies defined by the EPA in the 2016 MS4 General Permit, and include the following:

- Non-Structural Best Management Practices
  - Catch Basin Cleaning
  - Street Sweeping

    - Organic Waste Management
    - Turf and Landscape Management
- Structural Best Management Practices
    - Infiltration Trenches
    - Infiltration Chambers
    - Infiltration Basins

MS4 General Permit

The MS4 General Permit (effective July 1, 2018) requires the City of Newton to develop a phosphorus Control Plan (PCP) to meet a Town-wide Total phosphorus (TP) reduction of 50% or 4,279 pounds per year to address the Total Maximum Daily Load (TMDL) studies for the Charles River Watershed.

Appendix F of the MS4 General Permit details the requirements of the PCP that includes the following steps to create Phase 1 of a 3-phase plan by the end of the 5-year permit term (June 30, 2023):

1. Legal Analysis *(June 30, 2020)*
2. Funding Source Assessment *(June 30, 2021)*
3. Define Scope of PCP (PCP Area) Baseline phosphorus Load and phosphorus Reduction Requirement and Allowable phosphorus Load *(June 30, 2022)*
4. Description of Phase 1 Planned Nonstructural Controls *(June 30, 2023)*
5. Description of Phase 1 Planned Structural Controls *(June 30, 2023)*
6. Description of Operation and Maintenance Program for Structural Controls *(June 30, 2023)*
7. Phase 1 Implementation Schedule *(June 30, 2023)*
8. Estimated Cost for Implementing Phase 1 of the PCP *(June 30, 2023)*
9. Complete Written Phase 1 PCP *(June 30, 2023)*

The scope of the legal analysis is described in the MS4 General Permit as follows: *"The permittee shall develop and implement an analysis that identifies existing regulatory mechanisms available to the MS4 such as by-laws and ordinances and describes any changes to regulatory mechanisms that may be necessary to effectively implement the entire PCP. This may include the creation or amendment of financial and regulatory authorities. The permittee shall adopt necessary regulatory changes by the end of the permit term."*

EPA recognizes that implementation of a PCP will be challenging to address the TP load from existing developed properties that are not currently regulated by a stormwater permit (existing private dischargers); however, very little guidance is offered for the Charles River Watershed communities to implement requirements to address this gap in jurisdiction. The City of Newton, therefore, is responsible for performing an initial legal analysis based on the stormwater controls that are anticipated to be included in the PCP.

Studies Relevant to Legal Analysis

A number of studies have been completed within the Charles River Watershed and throughout New England that provide some insight related to watershed management and regulatory frameworks to encourage and require stormwater management. Several of these reports and other programs are listed below and summarized in **Attachment 1** as they relate to the preliminary legal analysis for the PCP. Note that some of these reports discuss programs that may be useful to model as additional legal authority is further considered for implementation.

A. Draft 2010 Residual Designation Authority (RDA) Permit for "Designated Discharges in the Charles River Watershed within the Municipalities of Bellingham, Franklin, and Milford, Massachusetts"

B. Sustainable Stormwater Funding Evaluation for the Upper Charles River Communities of Bellingham, Franklin, and Milford, MA. September 30, 2011.
C. Long Creek Watershed Management District (LCWMD), Maine
D. Philadelphia, PA Stormwater Grant Program
E. Bristol, CT Storm Water Control Trust
F. Upper Charles River Regional Stormwater Finance Phase II Feasibility Study. June 2018
G. Guide for Developing an Off-site Stormwater Compliance Program for Redevelopment Projects in Massachusetts. June 2018
H. Establishing a Stormwater Volume Credit Trading Program, a Practical Guide for Stormwater Practitioners. September 2019

Preliminary Legal Analysis and Recommendations

Implementation of watershed-based stormwater controls in the Crystal Lake Watershed are similar to those that the City will likely identify and implement City-wide under the PCP to meet the MS4 Permit, until additional management options are outlined/adopted by EPA. The challenges to implement certain types of controls, although similar, may warrant a slightly different approach on a City-wide basis across 18 square miles versus 55 acres for the Crystal Lake Watershed.

This preliminary legal analysis is intended to provide guidance for the City of Newton to consider how to best manage stormwater across the public and private sectors to meet the MS4 Permit total phosphorus reduction requirements. The specific actions to develop new programs, policies, or ordinances will likely be informed as the PCP is developed by the end of the MS4 Permit term.

Non-Structural Best Management Practices (BMPs)

The City of Newton currently implements non-structural BMPs, such as catch basin cleaning, street sweeping and leaf litter collection that support total phosphorus management goals. In general, enhancing these activities (e.g., increased frequency, improved and more effective equipment) can be achieved with additional funding and within the existing regulatory framework for the operation and maintenance of public streets and properties. No additional legal authority is required to obtain credit across total phosphorus nutrient reduction.

The City does not regulate these activities on private property unless it is incorporated into a current stormwater permit under the City's Stormwater Ordinance No. Z-45 30-5(c) and/or the Massachusetts Wetlands Protection Act. These regulations include enforcement mechanisms to ensure routine operation and maintenance is performed. These permits, however, may not include provisions for enhanced non-structural BMPs and only recent development and redevelopment projects are subject to these requirements. The City does not currently have the authority to require non-structural BMPs for existing properties that are not already subject to stormwater requirements.

Considerations for Non-Structural BMPs: The City may wish to consider the following options to enhance and expand implementation of non-structural BMPs to reduce phosphorus loads associated with private properties.

a) Increase the level of funding within the stormwater enterprise fund to support a more aggressive municipal leaf litter collection program and, if necessary, offer an incentive such as a user-fee credit for participating properties. Private landowners may welcome a municipal leaf litter collection program without credit as many commercial facilities already fund these efforts.
b) Provide technical support and/or facilitate service contracts for non-structural BMPs that private property owners can access at a discounted cost (see Long Creek Watershed Management District example in Attachment 1).

c) Develop a stormwater operation and maintenance program for collection of fees for the municipality to perform maintenance of structural or non-structural BMPs (see the Storm Water Control Trust example in Bristol, CT in Attachment 1).
d) Amend or adopt an ordinance to require non-structural BMPs on private property. This could be based on certain thresholds and property types, such as impervious cover or commercial/industrial uses.

Structural BMPs

The City of Newton developed a Complete Streets Policy and Street Design Guide to follow for public projects within the right-of-way. Implementation of this policy and guide will support better stormwater management as streets are rehabilitated or reconstructed. Structural BMPs that target total phosphorus reduction on public properties and along the public right-of-way can be implemented with additional funding and within the current regulatory framework.

The City's Stormwater Ordinance No. Z-45 30-5(c) has project review thresholds for relatively small increases in impervious surface and land alteration. Additionally, the City has drafted a new stormwater ordinance to meet the MS4 Permit requirements. This will capture most new development and redevelopment activities, but the City does not have the authority to require structural BMPs for existing properties that are not already subject to stormwater requirements.

Considerations for Structural BMPs: The City may wish to consider the following options to encourage or require structural BMPs to reduce phosphorus loads associated with private properties.

a) Finalize the draft stormwater ordinance to meet the MS4 Permit requirements and include future amendments to incorporate an off-site stormwater compliance program for redevelopment projects (see Attachment 1) that only meet the design standards to the maximum extent practicable.
b) Develop a policy and guide to encourage Public Private Partnerships (see Long Creek Watershed Management District example in Attachment 1).
c) Develop a Stormwater Grant Program to provide funding for non-residential property owners to design and construct stormwater retrofits (see Philadelphia, PA Stormwater Grant Program example in Attachment 1).
d) Pursue stormwater management easements along the public right-of-way.

Summary

The City of Newton faces a significant challenge to reduce City-wide phosphorus loads by 50% or 4,279 pounds per year by 2038. Further evaluation of the cost-benefit of non-structural and structural stormwater best management practices will help shape the City's strategy and basis for the Phosphorus Control Plan (PCP) required by the MS4 General Permit. This preliminary legal analysis is a first step of the PCP development to evaluate whether the City has the legal authority to implement the PCP. Although the recommended control measures have yet to be developed, below is a summary of the City's current options and existing legal authority. Note that the City should consult legal counsel for a final determination and recommended next steps.

	Best Management Practice	Existing Legal Authority
Non-Structural	a) Leaf Litter Collection – increase effort City-wide	Yes, possible through stormwater enterprise fund
	b) Provide Technical Support and Facilitate Service Contracts – discounted costs for private sector	Yes, possible through stormwater enterprise fund
	c) Develop Stormwater O&M Program for Private Property – performed by City	No, requires further review for legal and liability concerns
	d) Amend or Adopt Ordinance to Require Non-Structural BMPs on Private Property	No, but feasible (e.g., amend Ordinance No. Z-45 30-5(c))

Structural	a) Amend Ordinance No. Z-45 30-5(c) to Include an Off-Site Stormwater Compliance Program	No, but feasible
	b) Develop a Policy for Public Private Partnerships	No (not required if policy only)
	c) Develop a Stormwater Grant Program for Private Property Retrofits	Unclear, possibly through stormwater enterprise fund
	d) Pursue Stormwater Management Easements Along ROW	Yes

Attachment 1 – Studies Relevant to Legal Analysis

A. Draft 2010 Residual Designation Authority (RDA) Permit for "Designated Discharges in the Charles River Watershed within the municipalities of Bellingham, Franklin, and Milford, Massachusetts"

On April 20, 2010 the US EPA published a notice of the availability of the draft RDA Permit in the Federal Register. The RDA Permit targeted properties with two or more acres of impervious surfaces located in the three upper watershed communities and required the development and implementation of a Phosphorous Reduction Plan, among other requirements, to achieve a 65% TP reduction. The draft RDA Permit was an attempt to implement stormwater management requirements under the EPA's "Residual Designation" Authority pursuant to the Clean Water Act §402(p) and 40 CFR §122.26(9)(i)(C) and (D). The draft RDA Permit was met with significant resistance from the potentially regulated community and the permit was never finalized by EPA.

Relevance: Although there are many similarities in the draft RDA Permit to the current MS4 Permit and PCP requirements, the draft RDA Permit does not provide any germane information to support the Legal Analysis required by the 2018 MS4 Permit. Regardless of its perception and potential economic implications, future implementation of a similar version to this RDA Permit at the Federal level could be an effective tool for communities to meet the TP reduction requirements by requiring existing developed, private properties to reduce TP loads.

B. Sustainable Stormwater Funding Evaluation for the Upper Charles River Communities of Bellingham, Franklin, and Milford, MA. September 30, 2011.

This study was commissioned by the US EPA following issuance of the draft 2010 MS4 General Permit and the above referenced draft 2010 RDA Permit". The study aimed to evaluate the costs and funding approach to implement the recommendations of the October 17, 2007 TMDL for the Charles River Basin and requirements of the draft 2010 MS4 General Permit and RDA Permit. The study also included a review of "Existing Legislation and Legal Considerations" to identify what options appear to exist in Massachusetts to implement a regional or multi-municipal governance structure and options for fees and financing.

Relevance: This study provides a summary of relevant legislation, identifies gaps that require further evaluation, and provides context for a potential regional stormwater management program to address the Charles River TMDL. Although it does not directly support the Legal Analysis under the PCP, it highlights the challenges that communities face and emphasizes the need for a regulatory framework that is beyond the reach of individual communities.

C. Long Creek Watershed Management District (LCWMD), Maine

In 2009 the US EPA exercised the Residual Designation Authority (RDA) provisions to require a stormwater permit for designated discharges in the Long Creek Watershed. The resulting permit requires properties with one or more acres of impervious cover (designated discharges) to obtain a Maine Pollutant Discharge Elimination System (MPDES) and through a collaborative effort, the LCWMD was formed to implement the General Permit for Post Construction Discharge of Stormwater in the Long Creek Watershed on behalf of the designated dischargers under a Participating Landowner Agreement. Implementation of the General Permit follows the Long Creek Watershed Management Plan and the costs for capital improvement projects and other expenses are paid by fees collected by the LCWMD.

The LCWMD was an intense but collaborative effort across 89 private properties, municipalities, state entities, and one quasi-municipal entity. It serves as a unique example to manage stormwater across private and public boundaries and required new legislation at the state level. The Long Creek Watershed is approximately 3.5 square miles compared to the Charles River Watershed at 308 square miles. As discussed previously,

the 2010 attempt to implement an RDA Permit in the Upper Charles River Watershed was met with resistance indicating that a watershed-wide approach will be very challenging.

Relevance: The Legal Analysis under the PCP is intended to focus on local requirements, but the LCWMD is an example of watershed-based stormwater management approach that may be more feasible in the short term for smaller sub-watersheds within the Charles River Basin. The *Participating Landowner Agreement*, landowner workshops, landowner operation and maintenance forms and other resources may be worth considering as future elements or phases of the PCP are developed. Additionally, the multi-jurisdictional efforts of the LCWMD may also be a model for the broader watershed-wide discussion by the City of Newton and the remaining Charles River communities.

D. Philadelphia, PA Stormwater Grant Program

As part of the stormwater fees charged to non-residential properties in the City, the Philadelphia Water Department (PWD) offers a grant program to pay for the design and construction of stormwater retrofit projects. The grant program is built into the stormwater fees for all properties, which provides a continuous revenue stream each year for retrofit projects. In addition to PWD covering the project cost, once completed, the property owner qualifies for lower stormwater charges on their monthly bill. The projects must manage at least the first 1.5" of rainfall, obtain all applicable licenses and permits, and meet the City's loading ratios for subsurface infiltration systems. PWD partners with the Philadelphia Industrial Development Corporation to award millions in stormwater grants every year. It is an attractive program for non-residential property owners since the grants cover the costs for design and construction, but also provide an opportunity to add landscaping, fix drainage problems, and improve the appearance of their property. It should be noted that certain types of grant programs may have tax implications.

Relevance: The PWD stormwater grant program is a cost-effective way to implement stormwater retrofits on existing developed properties where the City has no jurisdiction and needs to meet City-wide water quality goals. This grant program serves as an effective model for other cities, such as Newton, to consider incorporating into their stormwater fees in order to support the PCP and meet the MS4 General Permit requirements.

E. Bristol, CT Storm Water Control Trust

The City of Bristol, CT Code of Ordinances, Chapter 22, Article V establishes the Bristol Storm Water Control Trust to receive endowment funds to cover the future costs of care and management for long term storm water controls. The owners of the land where the storm water controls are required must submit to the City Council a plan for the control and perpetual management and an endowment plan. The Board of Trustees is responsible for managing the inventory of storm water controls, annual inspections, and performing maintenance as needed. The Storm Water Control Trust provides a mechanism for the City to ensure that maintenance is performed, prioritizes maintenance activities, and maximizes efficiency with a better economy of scale on a city-wide basis, it is also an additional source of revenue that, depending on fee structure, may be a cost-effective (break-even) program.

Relevance: The Bristol Storm Water Control Trust is an example program for the City of Newton to consider that supports more effective and timely maintenance of privately-owned stormwater BMPs. This will become more important as the City evaluates the benefits of existing and proposed BMPs to support the PCP implementation since ongoing maintenance is a challenge in nearly all communities. Under the MS4 General Permit it is implied that private facility structural controls will require active O&M to obtain TP credit, but the level of scrutiny by EPA on active private O&M of controls for full crediting is unknown.

F. Upper Charles River Regional Stormwater Finance Phase II Feasibility Study. June 2018.

This project built upon the efforts of the 2011 *Sustainable Stormwater Funding Evaluation for the Upper Charles River Communities Study*. The Phase II Feasibility Study focused on two key challenges to implementing a regional stormwater management and funding program: 1) lack of public support; and 2) lack of understanding of legal frameworks to implement such a program. The study included an evaluation of a "Preliminary Legal Framework for a Preferred Regional Stormwater Management Approach".

The legal analysis was performed to identify and evaluate ways that towns could work together in a manner that conformed to Massachusetts laws and municipal regulations. The legal options for implementing various types of regional stormwater management activities were evaluated between municipalities, but the analysis did not include the private sector other than Public Private Partnerships (P3s) for which there is currently no regulatory framework.

> Relevance: While this study does not directly support the Legal Analysis under the PCP, it provides useful information for the City of Newton to consider as part of its overall PCP strategy to work with neighboring communities. The participating communities agreed that an Inter-Municipal Agreement (IMA) was the most appropriate legal mechanism for regional stormwater management activities and a draft IMA was developed during the study.

G. Guide for Developing an Off-site Stormwater Compliance Program for Redevelopment Projects in Massachusetts. June 2018.

The MS4 General Permit establishes flexibility for meeting the redevelopment performance standard in Part 2.3.6.a.ii.4(c) of the MS4 General Permit: *Stormwater management on redevelopment sites may utilize off-site mitigation within the same USGS HUC 10 watershed for the developer to meet the equivalent retention or pollutant removal requirements of the redevelopment site*. This guidance document provides definitions, details, and resources for MS4s that wish to establish an off-site approach for redevelopment sites. This approach is referred to as "off-site compliance" and this document is intended to assist and guide MS4s in integrating an off-site mitigation program within their stormwater permit review process for redevelopment projects. The guidance document outlines the steps to build the program, including establishment of the regulatory framework in a local ordinance, including model language.

An off-site stormwater compliance program may result in a higher level of stormwater management to meet design standards off-site where the current regulatory framework only requires redevelopment projects to meet the design standards to the maximum extent practicable, for example. This is the case for redevelopment projects under the Massachusetts Stormwater Management Standard No. 7.

> Relevance: This guidance document addresses an important aspect of the MS4 Permit related to redevelopment projects with an option to improve stormwater management. In terms of the Legal Analysis under the PCP, this document offers guidance on a future credit trading program that the City may wish to consider under the current draft ordinance or as future elements of the PCP are developed.

H. Establishing a Stormwater Volume Credit Trading Program, a Practical Guide for Stormwater Practitioners. September 2019.

This document describes the history and fundamentals of stormwater volume credit trading, primarily through the lens of the design for a proposed trading program in Grand Rapids, Michigan. The goal was to provide an understanding of key issues that other municipalities and stormwater agencies may consider when evaluating a stormwater credit trading approach, and to provide a rough 'road map' for determining whether such an approach is well suited to meet local needs. The concepts discussed in this document reference similar programs in place in Chattanooga, TN and Washington, D.C.

The document focuses on stormwater volume credit trading for meeting post-construction stormwater management requirements at new development and redevelopment sites. Credit trading or payment in lieu programs have the potential to distribute resources more efficiently or to areas where stormwater management needs are higher. Similar to the off-site mitigation program discussed in the Guide for Developing an Off-site Stormwater Compliance Program for Redevelopment Projects in Massachusetts, a credit trading program may result in a higher level of stormwater management to meet design standards off-site.

Relevance: Credit trading program administration and implementation are discussed in this document; however, such a program would require modification to local ordinances. In terms of the Legal Analysis under the PCP, this document offers guidance on a future credit trading program that the City may wish to consider as future elements of the PCP are developed.

City of Newton Stormwater Management Ordinance

#111-22

CITY OF NEWTON

IN CITY COUNCIL

ORDINANCE NO. C-8

May 2, 2022

BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF NEWTON that the Revised Ordinances of Newton, Massachusetts, 2017, as amended, be and are hereby further amended with respect to **Chapter 17 Fees for Licensing and Permits; and Civil Fines Generally** and **Chapter 29 Water, Sewers and Drains** as follows:

I. **INSERT** after **subsection (k) Water service to turn/on/off fee** where it appears in **Sec. 17-16. Fees to be paid to the Department of Public Works** a new **subsection (l)** as follows:

(l) Stormwater management and erosion control permits (Sec. 29-150)

Land Disturbance (only) Permit fee.....$50

Minor Stormwater Permit fee.....$100

Major Stormwater Permit fee:

1-4 family dwellings.....$300

All other properties.....$1,000

II. **INSERT** in **Subsection (f) DEPARTMENT OF PUBLIC WORKS** in **Sec. 17-23. Enforcing persons and revised ordinances subject to civil fine.** the following:

Sec. 29-153(b). Penalties for violations of the storm water ordinance.
( ) Any offense.....$300.00

III. **INSERT** in **Chapter 29. WATER, SEWERS AND DRAINS** a new **Art. VIII.** as follows:

Article VIII.
STORMWATER MANAGEMENT AND EROSION CONTROL

§29-148 General provisions

(a) Purpose

The purpose of this ordinance is to protect, maintain, and enhance public safety, environmental health, and general public welfare by controlling the volume and rate of stormwater runoff resulting from land disturbing activities (during and after such activities), managing stormwater at its source and directing it into the ground rather than sending it into a system of storm drain pipes and channels.

This ordinance establishes a permit system to ensure that all applicable projects are reviewed and comply with established standards, the city's legal authority to ensure compliance with the provisions of this ordinance through inspection, monitoring and enforcement and a mechanism by which the City can meet the requirements of its National Pollutant Discharge Elimination System (NPDES) general permit.

(b) Definitions. For the purposes of this ordinance the following words and phrases shall have the meanings respectively ascribed to them by this section:

Alter or alteration: Any activity on an area of land that changes the water quality, or the force, quantity, direction, timing, or location of runoff flowing from the area. Such changes include change from distributed runoff to confined, discrete discharge; change in the volume of runoff from the area; change in the peak rate of runoff from the area; and change in the recharge to groundwater on the area. Alter may also be referred to as "alteration of drainage characteristics," and "conducting land disturbance activities."

Best management practice (BMP): A structural or nonstructural activity, procedure, restraint, or structural improvement that helps to reduce the quantity of or improve the quality of stormwater runoff. A structural stormwater best management practice may include a basin, discharge outlet, swale, rain garden, filter, or other stormwater treatment practice or measure either alone or in combination, including without limitation any overflow pipe, conduit, weir control structure that: (a) is not naturally occurring; (b) is not designed as a wetland replication area; and (c) has been designed, constructed, and installed for the purpose of conveying, collecting, storing, discharging, recharging, or treating stormwater. Nonstructural stormwater best management practices may include source control and pollution prevention measures.

Conveyance: Any structure or device, including, but not limited to, pipes, drains, culverts, curb breaks, paved swales and man-made swales, natural and man-made channels, and ditches, designed or utilized to move or direct stormwater runoff or existing water flow; any impervious

surface/sheet flow utilized to remove rainfall (for example, a parking lot) which drains directly onto a vegetated surface or public road without any curbing or stormwater system to intercept the flow.

Erosion and sedimentation control plan: A document containing a narrative, drawings and details developed by a registered professional civil engineer (PE) or a registered professional land surveyor (PLS), which includes best management practices, or equivalent measures designed to control surface runoff, erosion and sedimentation during pre-construction and construction related land disturbance activities.

Impervious Surface or Area: Any material or structure in, on or above the ground that prevents water from infiltrating through the underlying soil. Impervious surface is defined to include, without limitation: paved surfaces (parking lots, sidewalks, driveways, etc.), roof tops, swimming pools, stone patios/pavers, gravel, and compacted dirt surfaces such as driveways and roads.

Land disturbance: Any activity that causes a change in the position or location of soil, sand, rock, gravel, or similar earth material. Examples include, but are not limited to, demolition, construction (of buildings or retaining walls), site preparation, grading, paving, tree cutting, and earth moving.

Low impact development (LID): A site design strategy for managing stormwater by maintaining or replicating the predevelopment hydrologic functions using design techniques to create a functionally equivalent hydrologic landscape.

Municipal Storm Drain System or Municipal Separate Storm Sewer System (MS4): The system of conveyances designed or used for collecting or conveying stormwater, including any road with a stormwater management system, street, gutter, curb, inlet, piped storm drain, pumping facility, retention or detention basin, natural or man-made or altered drainage channel, reservoir, or other drainage structure(s) that together comprise the storm drainage system owned or operated by the city.

Person Aggrieved: all record owners of the subject property or an owner of property directly abutting the subject property.

Stormwater Management and Erosion Control Permit: A permit issued by the Engineering Division of the Department of Public Works, after review of an application, plans, calculations, and other supporting documents, in accordance with the provisions of this ordinance.

Stormwater Management Certificate of Compliance (SMCC): A document issued by the Engineering Division after all construction activities have been completed which states that all conditions of an issued Stormwater Management and Erosion Control Permit (SMP) have been met and that a project has been completed in compliance with the conditions set forth in a SMP.

Stormwater management plan: A plan submitted as part of an application for a stormwater management and erosion control permit, as required by Section 29-150(A) of this ordinance. A document containing narrative, drawings and details prepared by a registered professional civil engineer (PE), which includes structural and non-structural best management practices to manage and treat stormwater runoff generated from regulated development activity. A stormwater management plan also includes an operation and maintenance plan describing the maintenance requirements for structural best management practices.

Stormwater management system: the collective system for conveying, collecting, storing, discharging, recharging, or treating stormwater on-site, including stormwater best management practices, and any pipes and outlets intended to transport and discharge stormwater to the groundwater, a surface water, or a municipal separate storm sewer system.

(c) Applicability

This ordinance shall apply to all land-disturbing activities over the thresholds below, within the jurisdiction of the city. A stormwater management and erosion control permit shall be required prior to undertaking any alteration or land disturbing activity as follows:

(1) Land disturbance

(a) Projects that will or could disturb over 5,000 square feet (SF) of land.

(2) Minor stormwater management

(a) Any residential development or redevelopment with four or fewer units, provided the land disturbance is less than 0.5-acre (or 21,780 SF) .

(b) Any residential, commercial, industrial, institutional, or municipal alteration, development or redevelopment creating 401 to 1,000 SF of new impervious area.

(c) The construction of any new retaining wall required due to proposed changes in grade, unless already approved by Special Permit (per Chapter 30 Section. 5.4.2).

(d) Trench excavation requiring dewatering.

(3) Major stormwater management

(a) Any alteration, disturbance, development, or redevelopment exceeding the thresholds listed in § 29-148(C)(1) and (2) above.

(d) Exemptions

The commissioner of public works may establish exemptions from the requirements of this ordinance, which exemptions shall be set forth in the city of Newton stormwater management and erosion control rules and regulations.

§29-149 Administration

(a) Administration

The commissioner of public works or his or her designee shall administer, implement, and enforce this ordinance.

(b) Rules and regulations

The commissioner of public works shall adopt, and periodically amend as deemed necessary, rules and regulations relating to the detailed requirements, procedures, and administration of this ordinance.

§29-150 Permit procedures

(a) Permit required

No alteration and/or land disturbing activity that meets the criteria specified in Section 29-148(c) may commence prior to the issuance of a stormwater management and erosion control permit as set forth in this ordinance.

(b) Procedures and Requirements

The commissioner of public works shall set forth the application procedures and requirements - including but not limited to content of applications, stormwater management plan and operations and maintenance plan contents, technical requirements, inspections, and project closeout process in the rules and regulations promulgated under Section §29-149(b) of this ordinance.

The fees for stormwater management and erosion control permits shall be as follows:

Land Disturbance (only) Permit fee.....$50

Minor Stormwater Permit fee.....$100

Major Stormwater Permit fee:

1-4 family dwellings.....$300

All other properties.....$1,000

(c) Deadline for Action

Failure of the commissioner of public works or his or her designee to take action within sixty (60) days of receipt of a complete stormwater management and erosion control permit shall be deemed approval of said application, unless extension of the sixty (60) days is agreed upon, in writing, by the applicant.

§29-151 Entry, inspections and close-out

To the extent permitted by law, the commissioner of public works or his or her designee may enter upon privately owned property for the purpose of performing their duties under this ordinance and may make or cause to be made such examinations, surveys or sampling as the commissioner of public works or his or her designee deems reasonably necessary to determine compliance with the permit

§29-152 Final report and certificate of compliance

Upon completion of the work done pursuant to a permit issued for a minor or major stormwater land disturbing activity, the permittee shall request a final inspection and submit the following: (Note: Land disturbance only permits do not require a certificate of compliance)

(1) Certified as-built construction plans from a Massachusetts Registered Professional Engineer (P.E.) and/or Registered Professional Land Surveyor (P.L.S) depicting all final grade changes, water, sewer and stormwater utilities and any BMPs installed.

(2.) A note on the As-built plan from the Engineer of Record indicating that the stormwater management system(s) have been constructed in accordance with, and meet the requirements of, the Stormwater Management Permit. Any discrepancies between the approved plan and the as-built plan shall be noted.

(3.) Proof of recording the Operations and Maintenance Plan at the South Middlesex County Registry of Deeds.

The city engineer will issue a stormwater management certificate of compliance upon receipt of these items and upon determination that all work of the permit has been satisfactorily completed and is in conformance with this ordinance. The commissioner of inspectional services shall not issue a certificate of occupancy for any property subject to this Section 29 prior to receipt of such certificate of compliance.

§29-153 Enforcement

The commissioner of public works shall have authority to enforce this ordinance and the associated rules and regulations; issue orders, violation notices, and enforcement orders as necessary; and may pursue all available civil and criminal remedies for such violations.

(a) Violation notices and enforcement orders

(1) The commissioner of public works may issue a written order to enforce the provisions of

the stormwater management and erosion control ordinance or the rules and regulations, which may include demands to:

(a) Cease and desist from further alterations or land disturbance activity until there is compliance with the stormwater management and erosion control ordinance and/or the stormwater management and erosion control permit.

(b) Maintain, install or perform additional erosion and sedimentation control measures.

(c) Remediate erosion and sedimentation resulting directly or indirectly from land-disturbing activity.

(d) Remediate adverse impacts resulting directly or indirectly from malfunction of the stormwater management system.

(e) Eliminate discharges, directly or indirectly, into a watercourse or into the waters of the Commonwealth.

(2) If the commissioner of public works determines that abatement or remediation of adverse impacts is required, the order shall set forth a deadline by which such abatement or remediation must be completed.

(3) If a person violates the provisions of this ordinance, regulations, permit, notice, or order issued thereunder, the commissioner of public works may seek injunctive relief in a court of competent jurisdiction restraining the person from activities which would create further violations or compelling the person to perform abatement or remediation of the violation.

(b) Penalties

Pursuant to Section 17-21 of the City Ordinances, any person who violates any provision of the Stormwater Management and Erosion Control Ordinance, or order or permit issued thereunder, may be ordered to correct the violation and/or shall be punished by a fine of not more than $300.00 per violation, excluding the cost of damages. Each day or part thereof that such violation occurs or continues shall constitute a separate violation.

(C) Non-Criminal Disposition

As an alternative to criminal prosecution, the commissioner of public works may elect to utilize the non-criminal disposition procedure set forth in M.G.L. c. 40, § 21D.

(D) Appeals

Judicial review. Any person aggrieved by the grant or denial of a permit may seek relief therefrom by a civil action in any court of competent jurisdiction as provided by the laws of the Commonwealth of Massachusetts.

§29-154 Severability

Any finding of the invalidity of any section, provision, paragraph, sentence, or clause of this ordinance shall not invalidate any other section, provision, sentence, or clause thereof, nor shall it invalidate any permit or determination that has been previously issued under this ordinance.

Approved as to legal form and character:

Alissa O. Giuliani
ALISSA O. GIULIANI
City Solicitor

Under Suspension of Rules
Readings Waived and Adopted
21 yeas 0 nays 2 absent (Councilors Grossman and Noel) 1 recused (Councilor Downs)

EXECUTIVE DEPARTMENT
Approved:

(SGD) CAROL MOORE
City Clerk

Ruthanne Fuller
(SGD) RUTHANNE FULLER
Mayor

6/1/2022

City of Newton Stormwater Management and Erosion Control Rules & Regulations

CITY OF NEWTON
Stormwater Management and Erosion Control Rules & Regulations
4/15/22

SECTION 1: AUTHORITY

A. These Rules and Regulations have been adopted by the Commissioner of the Department of Public Works in accordance with Chapter 29 of the Revised Ordinances of the City of Newton, Massachusetts, and will be administered by the City Engineer through the Engineering Division.

B. Nothing in these Rules and Regulations is intended to replace or be in derogation of the requirements of the City of Newton's Floodplain/Watershed Ordinance (Ch. 22, Article II Sec. 22), the City of Newton's Zoning Ordinance (Ch. 30), or any other ordinance adopted by the City of the Newton. Any project or activity subject to the provisions of the above-cited Ordinances or related Rules and Regulations must comply with the specifications of each.

C. These Rules and Regulations may be periodically amended by the Commissioner of the Department of Public Works in accordance with the procedures outlined in Ch. 29-149 of Newton's Stormwater Management and Erosion Control Ordinance, hereinafter referenced as the Stormwater Management Ordinance.

D. Waivers. The Commissioner of Public Works, as delegated to the City Engineer may waive strict compliance with any of the requirements of the City of Newton Stormwater Management and Erosion Control Rules and Regulations (hereinafter referenced as the Stormwater Management Rules and Regulations), if it finds that strict application of some of the requirements is unnecessary or impracticable because of the size or character of the development project or because of the natural conditions at the site. Waivers may only be granted for projects disturbing less than 1 acre of land. Any applicant requesting a waiver must submit a written request for such a waiver. Such a request shall be accompanied by an explanation and documentation supporting the waiver request.

SECTION 2: PURPOSE

A. The City's stormwater management system is strained by increased volumes of runoff from more frequent and higher intensity storms. Compounding the issue is a trend of increasing impervious areas and elevated grades around new structures limiting natural infiltration. Further, stormwater runoff from impervious surfaces is the greatest source of pollution to Newton's ponds, lake, and waterways. Development proposals provide an inconsistent level of detail, making review and analysis challenging.

B. The purpose of these regulations is to clarify administration of Newton's Stormwater Management Ordinance, in order to achieve its objectives to:

1. Limit land clearing and alteration of natural topography prior to (re)development.
2. Prevent soil erosion and sedimentation resulting from construction.
3. Promote filtration, infiltration, and the recharge of groundwater, and limit additional stormwater flow into the City's drainage system.
4. Minimize flooding.
5. Improve water quality.
6. Prevent alteration or destruction of aquatic resources and wildlife habitat.
7. Prevent clogging and pollution entering municipal catch basins and storm drainage systems.
8. Establish a mechanism by which the City can meet the requirements of its National Pollutant Discharge Elimination System (NPDES) Municipal Separate Storm Sewer (Drainage) System (MS4) permit.

SECTION 3: DEFINITIONS

A. All definitions are provided in Appendix A of these Rules and Regulations.

B. These definitions apply to the Stormwater Management Ordinance and these Rules and Regulations.

C. Terms not defined in the Stormwater Management Ordinance or Appendix A of these Rules and Regulations shall be construed according to their customary and usual meaning unless the context indicates a special or technical meaning.

SECTION 4: APPLICABILITY

These Rules and Regulations apply to all projects or activities subject to Ch. 29-148(c) the Applicability Section of the Stormwater Management Ordinance. All projects or activities referenced in Ch. 29-148 and not falling under an exception listed in Ch 29-148(d) shall require a Stormwater Management Permit in accordance with the Stormwater Management Ordinance.

Projects and/or activities within the jurisdiction of the Stormwater Management Ordinance must obtain a Stormwater Management Permit (SMP) from the City Engineer in accordance with the permit procedures and requirements defined in Sections 5 through 9 of these Rules and Regulations.

No work on a project within the jurisdiction of the City's Stormwater Management Ordinance may commence without a SMP or waiver from the City Engineer. Work commenced without an approved permit or waiver can result in an enforcement action and/or fines.

A. Exemptions. Notwithstanding Section 4.B, no SMP shall be required by the City Engineer for:

1) Normal maintenance and improvement of land for the primary purpose of agriculture, horticulture, floriculture, or viticulture, or the use, expansion, or reconstruction of existing structures for the primary purpose of agriculture, horticulture, floriculture, or viticulture, to the extent protected under the Zoning Act, M.G.L Chapter 40A, Section 3.

2) Normal maintenance of existing landscaping, gardens, or lawn areas.

3) Milling, excavating and replacement, including widening less than a single lane, adding shoulders, and correcting substandard intersections of existing pavement.

4) Overlaying of existing pavement, with no increase in impervious area.

5) Construction of a fence that does not alter the existing terrain or drainage patterns.

6) Drain connections declared necessary by the Commissioner of Public Works to remove groundwater and stormwater inflow from the sanitary sewer.

7) Emergency activities necessary for the protection of the health and safety of the public, provided that: (a) the work is to be performed by or has been ordered by an agency of the Commonwealth of Massachusetts or a political subdivision thereof, (b) advance notice, oral or written, has been given to the Commissioner of Public Works prior to commencement of work or within 24 hours after commencement, (c) the Commissioner certifies the work as an emergency activity, and (d) the work is performed only for the time and place certified by the Commissioner of Public Works for the limited purposes necessary to abate the emergency.

8) Maintenance, repair or replacement of an existing and lawfully located structure or facility used in the service of the public to provide electric, gas, water, sewer, drainage, telephone, telegraph or other telecommunication services, provided that applicable permits are obtained.

9) Maintenance, repair or replacement of existing stormwater infrastructure or stormwater Best Management Practices (BMPs) provided that: (a) there is no alteration of the existing terrain or drainage patterns; (b) there is no increase in the size or capacity of over 25%; (c) there is no change in the drainage area contributing to the system; and (d) best practical measures are utilized to avoid any negative impacts on stormwater quality or runoff rate or volume.

10) Normal maintenance of City-owned public land, rights-of-way, public utilities, and appurtenances, including roadway reconstruction.

11) Any work or projects for which all necessary approvals and permits, including building permits, have been issued before the effective date of the City of Newton's Stormwater Management Ordinance.

12) Activities that are temporary in nature, have negligible impacts, and are necessary for planning and design purposes (e.g., installation of monitoring wells, exploratory borings, sediment sampling, surveying and percolation tests).

B. A **Land Disturbance** Stormwater Management Permit is required for the following activity, as stated in Ch. 29-148(c).

1. Projects that will or could disturb over 5,000 square feet (SF) of land (i.e., the limit of work line encompasses over 5,000 SF of land).

C. A **Minor** Stormwater Management Permit is required for any one or more of the following activities, as stated in Ch.29-148(c):

1. Any residential development or redevelopment up to 4 units, provided the land disturbance is less than 0.5-acre.

2. Any residential, commercial, industrial, institutional, or municipal alteration, development or redevelopment creating 401 to 1,000 SF of new impervious area.

3. The construction of a new retaining wall, unless already approved by Special Permit (per Zoning Sec. 5.4.2).

4. Trench excavation that requires dewatering.

D. A **Major** Stormwater Management Permit is required for any alteration, disturbance, development, or redevelopment exceeding the thresholds listed above for Land Disturbance or Minor Stormwater, as stated in Ch. 29-148(c).

SECTION 5: DESIGN STANDARDS

A. All SMP applications must clearly illustrate compliance with the following standards.

1. Calculate and depict prominently on the plans: the existing and proposed impervious surface areas. This information shall be included as a table with other zoning information.

2. Grading. Topographic contours shall be shown at 1-foot intervals on plans. Changes in grading of the land must demonstrate to the City Engineer's satisfaction that there will be no net increase in stormwater runoff to abutting properties or the City's stormwater drainage system. Changes to landforms (i.e., ledge removal, blasting) shall be avoided and where necessary conducted to minimize land disturbance and avoid negative impacts to adjacent properties.

3. Retaining walls. In order to prevent potential flooding caused by the construction of a retaining wall, any proposed retaining wall shall be designed and constructed so as not to block or exacerbate any existing stormwater or groundwater flow patterns to or from abutting properties, as well as to or from the city's right of way.

4. Tree removal. Preserving healthy trees is encouraged due to the many benefits trees provide. Existing condition plans shall identify and note the sizes of all trees eight (8) inches dbh and larger on the subject property. Trees 8 inches dbh and larger that are proposed for cutting shall be clearly identified as such on a plan sheet. A clearly illustrated replacement planting plan shall be provided on a proposed condition plan sheet. Protected trees shall be replaced with an appropriate quantity of trees equaling the caliper inches lost due to development, in accordance with the City's Tree Preservation Ordinance[1], unless the project is exempt from compliance with the Tree Ordinance. If unable to meet this replacement policy the applicant may contribute to the City's tree fund.

5. Groundwater Intrusion: The bottom (underside) of the basement slab must be 1-foot above the seasonal high groundwater elevation as determined by a Soil Evaluator licensed in Massachusetts or determine the seasonal high groundwater table using Frimpter Method[2].

6. Erosion and Sedimentation Control. Sediment that washes off construction sites and into the City's catch basins, ponds, lake, and wetlands has considerable cost and ecological implications for the City. Runoff, erosion, and sediment control are important at every phase of the construction process. Implementing and maintaining the right control practice saves money, time and the environment. The application will be evaluated on the following criteria.

    a) Minimize disturbance of natural vegetation wherever possible. This is the best and most economical control measure.

    b) Control stormwater runoff and minimize soil erosion potential during construction. Divert flows around exposed soils, material stockpiles and slow down stormwater flows.

    c) Control soil movement and retain sediment within the 'limits of work' during and after construction. These measures may include but are not limited to perimeter controls such as straw wattles and silt fence, stabilized construction entrances/exits, sediment basins, catch basin silt sacks, proper dewatering practices (as needed).

    d) Stabilize disturbed soils, particularly unvegetated slopes, during any lapse in construction and immediately post-construction.

    e) Include a note (on the plans) for the contractor to regularly inspect and maintain the erosion and sediment controls measures. See additional note requirement in Section 6.B.

    f) Construction phasing or sequencing is encouraged for larger projects (e.g., ≥ 2 acres).

B. Minor Stormwater Management Permits. In addition to Section 5.A above, all projects subject to a Minor Stormwater Management Permit shall be designed to the following standards.

1. Stormwater management systems for new development and redevelopment sites shall be designed to retain the volume of runoff equivalent to, or greater than, two (2) inches multiplied by the *net increase* in impervious surface area on the site, except for projects that propose to tear

[1] Newton's Tree Preservation Ordinance

[2] Frimpter Method: https://www.usgs.gov/centers/new-england-water/science/updating-a-method-estimate-probable-high-groundwater-levels?qt-science_center_objects=0#qt-science_center_objects

down, dismantle, or remove a primary structure from its existing location such that a majority of the structural elements are replaced, in which case retaining two inches of runoff for the total of all impervious surfaces is required (not the net).

2. There must be a minimum two-foot separation between the bottom of any stormwater management system and seasonal high groundwater.

3. Stormwater infiltration systems shall be design with the following setbacks:

   a) A minimum of 10 feet from any building.
   b) A minimum of 50 feet from any slope greater than 15%. A variance may be allowed if an impermeable barrier is installed.

4. Proposals must analyze, propose, and implement Low Impact Development (LID) Best Management Practices (BMPs), unless proven in writing to the satisfaction of the City Engineer to be infeasible. See Appendix B for LID BMPs. If infeasible, Applicants shall demonstrate reasons why LID BMPs are infeasible and demonstrate compliance with design standards through generally accepted methods.

5. Soils tests must be conducted by a Soil Evaluator licensed in Massachusetts and must be performed within 25 feet of the location of every proposed infiltration BMPs and LID technique, to clearly identify soil descriptions, depth to estimated seasonal high groundwater, depth to bedrock, and soil texture. Any soil test conducted between the months of June and February must also be accompanied by a determination of the seasonal high groundwater table using Frimpter Method[3].

6. Drainage Design: Drainage calculations shall be performed for existing site conditions (pre-development) and proposed site conditions (post-development) based on proposed site plans. Storms of 2, 10, 25, and 100-year frequency events shall be analyzed to demonstrate no net increase in stormwater runoff volume or peak flow for any storm event. The rainfall amounts used shall be based on the 1998 Cornell University Study, NOAA Atlas 14 Volume 10 Point Precipitation Frequency Estimates for Newton.

   Note: the 100-year design storm is based on 8.78 inches of precipitation in 24 hours. For purposes of choosing a Runoff Curve Number, all pervious lands on the Site shall be assumed prior to development to be in "good" hydrologic condition regardless of conditions existing at the time of computation. All drainage calculations shall be stamped by a Registered Professional Civil Engineer.

7. Infiltration systems shall be designed to drain fully within 72 hours.

8. Plan submission requirements are detailed in Section 6 – Application Requirements and Procedures.

C. Major Stormwater Management Permits. **In addition to Section 5.A. and 5.B., above**, all projects subject to a Major Stormwater Management Permit shall be designed to meet the following additional standards.

1. All projects triggering the thresholds for a Major Stormwater Permit must meet the minimum pollutant removal requirements and on-site stormwater volume retention requirements identified

[3] Frimpter Method: https://www.usgs.gov/centers/new-england-water/science/updating-a-method-estimate-probable-high-groundwater-levels?qt-science_center_objects=0#qt-science_center_objects

in C.3 and C.4 below; if due to site conditions this is technically infeasible, then the Applicant may request a waiver (waivers are only applicable for projects less than 1 acre).

2. Projects shall comply with the Stormwater Standards of the most recent version of Massachusetts Stormwater Management Handbook (Handbook)[4], and the City of Newton General Construction Detail Book and Streets Design Guide. Where an inconsistency exists between the Handbook and these Regulations, the stricter shall apply.

3. Stormwater management systems on **new development** sites shall be designed to:

   a) Retain the volume of runoff equivalent to, or greater than, two (2) inches multiplied by the total post-construction impervious surface area on the site; and

   b) Remove 90% of the average annual load of Total Suspended Solids generated from the total post-construction impervious area on the site; and

   c) Calculate the existing and proposed average annual Total Phosphorus (TP) load based on the land use(s) and demonstrate 60% reduction of the TP load generated from the total post-construction impervious surface area on the site: and

   d) Whenever feasible exceed the above minimum phosphorus removal[5] requirement. Infiltration BMPs, bioretention areas, constructed stormwater wetlands, and filter systems are recommended ways to reduce phosphorus in stormwater discharges.

4. Stormwater management systems on **redevelopment** sites shall be designed to improve existing conditions by:

   a) Retain the volume of runoff equivalent to, or greater than, two (2) inches multiplied by the total post-construction impervious surface area on the site; and

   b) Remove 80% of the average annual load of Total Suspended Solids generated from the total post-construction impervious area on the site; and

   c) Calculate the existing and proposed average annual Total Phosphorus load based on the land use(s) and demonstrate 50% reduction of the average annual TP load generated from the total post-construction impervious surface area on the site: and

   d) Whenever feasible exceed the minimum total phosphorus removal[2] requirement. Infiltration BMPs, bioretention areas, constructed stormwater wetlands, and filter systems are recommended ways to reduce phosphorus in stormwater discharges.

5. To support compliance with the City's MS4 Permit, all new stormwater management BMPs located on commercial and industrial property shall incorporate shutdown and containment in the

[4] Massachusetts Stormwater Handbook, as most recently updated.
http://www.mass.gov/eea/agencies/massdep/water/regulations/massachusetts-stormwater-handbook.html

[5] The required removal percentages are not required for each storm, it is the average removal over a year that is required. Pollutant removal shall be calculated consistent with EPA Region 1's Opti-Tool found here; https://www.epa.gov/tmdl/opti-tool-epa-region-1s-stormwater-management-optimization-tool, Or use the performance curves in the MS4 Permit, Appendix F, Attachment 3, found here: https://www3.epa.gov/region1/npdes/stormwater/ma/2016fpd/appendix-f-attach-3-2016-ma-sms4-gp-mod.pdf.

design to isolate the drainage system in the event of an emergency spill or other unexpected event.

6. To support the City's efforts to remove illicit sewer connections and discharges to our drainage system, the applicant shall confirm no illicit connections / discharges are present for projects where the sewer and storm drain infrastructure remain on site.

SECTION 6: APPLICATION REQUIREMENTS AND PROCEDURES FOR STORMWATER MANAGEMENT PERMITS

A. All Stormwater Management Permits (SMP) Applications

1. One (1) completed Stormwater Management Permit Application Form with the following:

   a) Name, contact information, and original signatures of owner(s), Applicant(s), and, if applicable, representative.

   b) Address of property and parcel ID.

   c) Project description.

   d) Site plan reference(s).

   e) Signature of Applicant, property owner (if different), and representative, if applicable.

   f) Payment of the Application fee.

2. Supporting engineering plans for a SMP shall include the materials as specified in this section.

B. Land Disturbance Permit Submission Requirements

1. In addition to the signed, completed application, the Applicant shall provide a brief narrative explaining the purpose of the proposed land disturbance.

2. A Site Plan denoting property lines, existing buildings, existing and proposed trees (clearly noting any trees to be cut), existing and proposed edge of lawn and ground cover materials and existing and proposed topographic contours. This plan shall be stamped and signed by a Professional Civil Engineer (PE) licensed in the Commonwealth of Massachusetts and/or Professional Land Surveyor (PLS).

3. Methods to minimize the potential for soil erosion and control soil / sediment from leaving the property shall be depicted on the Site Plan.

C. Minor Permit Submission Requirements

1. In addition to the signed, completed permit application, the Applicant shall provide: one (1) set of full-size plans, stapled, and rolled; plus, an electronic copy (pdf) provided on a flash drive. Additional copies may be requested by the City Engineer.

2. A Stormwater Management Site Plan that may be prepared by drafting or hand sketching. depending on project size and complexity, at the discretion of the City Engineer, to include:

   a) General Information:

(1) Sheet size: Sheets shall have a maximum dimension of 24” x 36” and formatted for landscape layout. Large plans should be rolled rather than folded. If more than one sheet is needed to describe the proposed work, a key sheet is required showing a general composite of all work proposed.

(2) Scale: Not more than 1” = 40' (the Engineering Division routinely accepts plans at 1” =20' or 1” =40'). If project sites are large, an overall site plan at 1” = 100' is acceptable, but detailed plans must be at or less than 1” = 40'. Include graphical scales on all plans. Coordinate system shall be 1983 North American Datum, Massachusetts State Plane, feet, and North American Vertical Datum (NAVD) of 1988.

(3) Title Block: A title block shall be included on all plans, located at the lower right-hand corner, oriented to be read from the bottom when bound at the left margin. Include:

(a) Plan title.
(b) Original date plus additional space to reference the title and dates of all plan revisions.
(c) Name and address of record owner and engineer and/or surveyor.
(d) Address of property, Assessor Map and Parcel ID.

(4) Legend: Include legend identifying line types and symbols used in plan set

(5) Locus Map.

b) An Existing Conditions Plan containing the following:

(1) Property lines.

(2) The existing zoning, and land use at the site and abutting properties.

(3) The location(s) of existing easements.

(4) The location of existing utilities.

(5) Existing contours at 1-foot minimum vertical increments.

(6) Existing landscaping and vegetation including all existing trees within 25 feet of the work area that are over 8 inches in diameter breast height (dbh) and major vegetative cover types, including wooded areas defined by tree line drip line, shrub communities, limits of lawn, and edge of tree canopy.

(7) Locations of existing structures, pipes, swales, and detention ponds.

(8) Locations of bodies of water, including wetlands.

(9) A delineation of FEMA Special Flood Hazard areas and calculation of FEMA flood elevation, if applicable. Floodplain elevation data shall be based on 1988 NAVD (North American Vertical Datum) and reference the appropriate National Flood Insurance Rate Map and/or Flood Study.

(10) Location of existing septic systems, monitoring and private wells, if present.

(11) The location(s) of soil tests and description of soil from test pits performed at the location of proposed stormwater management facilities, including but not limited to soil description, depth to seasonal high groundwater table (SHGWT), depth to bedrock, and

percolation rates. Soils and the SHGWT elevation shall be based on site test pits logged by a Soil Evaluator licensed in Massachusetts.

(12) The existing vegetation (e.g., lawn area, mature trees, etc.) and ground surfaces with runoff coefficients for each.

(13) Stamp and signature of a Professional Civil Engineer (PE) licensed in the Commonwealth of Massachusetts and/or Professional Land Surveyor (PLS).

c) A Proposed Conditions Plan containing the following:

(1) Property lines, building envelope restrictions and/or easement areas, including areas affected by conservation restrictions, if applicable.

(2) Proposed improvements including location of buildings or other structures, utilities, easements, etc., if applicable, and impervious surfaces. For single family homes plans shall show, at a minimum, house footprint, decks, garages, sheds, roof drainage and stormwater drainage structures, as applicable) and all areas of existing and proposed impervious areas: including tennis courts, patios, and driveways, etc.

(3) **Proposed total impervious surface areas in square feet,** shown as a table with comparison to existing impervious surface area conditions.

(4) FEMA Flood Hazard areas and Newton Floodplain Ordinance areas, if applicable.

(5) Limit of work.

(6) Proposed grading for work area. Proposed contours at 1-foot vertical increments.

(7) Locations for storage of materials, equipment, soil, snow, and other potential pollutants.

(8) A note on the plan indicating the Contractor shall sequence construction activities to avoid stockpiling materials and soil compaction where proposed stormwater BMPs will be located.

(9) Location(s) and description of existing stormwater conveyances, impoundments, wetlands, drinking water resource areas, or other critical environmental resource areas on or adjacent to the site or into which stormwater flows.

(10) Proposed drainage facilities (plan view and details) including drawings of all components of the proposed stormwater management system including:

1. Locations, cross sections, and profiles of all brooks, streams, drainage swales and their method of stabilization.

2. All measures for the detention, retention, or infiltration of water.

3. All measures for the protection of water quality.

4. For engineered systems designed to provide drainage or stormwater management including, but not limited to, culverts, drainage outfalls, catch basins and pervious pavement ‘systems’; provide an appropriate plan detail with notes on drawings specifying materials to be used, and construction specifications.

5. Notes indicating the required inspections for the site and the stormwater drainage facilities during construction.

(11) Proposed landscaping, vegetation, and ground surfaces. When trees 8-inches dbh and larger are proposed for cutting, a clearly illustrated planting plan shall be provided. The replacement planting plan shall comply with the City's Tree Preservation Ordinance (see footnote 1). If it is not feasible to plant the required number of trees, an applicant may propose a combination of trees and shrubs for approval.

(12) Locations where stormwater discharges to surface water (include all roads, drains and other structures that could carry stormwater to a wetland or other water body, on or offsite).

(13) A general construction note stating the Engineering Division Inspector shall be notified 48 hours prior to any site work in accordance with project permits.

(14) Stamp and signature of a Professional Civil Engineer (PE) licensed in the Commonwealth of Massachusetts to certify that the Stormwater Management Plan is in accordance with the criteria established in the Stormwater Regulations; a stamp and signature of a Professional Land Surveyor (PLS) is acceptable if no drainage facilities are proposed and they have the experience and capability to prepare the required Site Plan and to provide the required existing and proposed grading and erosion control provisions.

4. The Erosion and Sediment Control Plan shall demonstrate that erosion will be minimized, and sediment contained. The plan shall include, at a minimum, the following:

a) Estimates of the total area expected to be disturbed by excavation, grading, or other construction activities, including dedicated off-site borrow and fill areas.

b) Location and design of all proposed soil erosion and sediment control measures.

c) Pollution control measures to be implemented during construction to mitigate pollutants from entering the public right of way and storm drains. Consider construction and waste materials expected to be stored on-site, describe source control and storage methods to minimize exposure of the materials to stormwater.

d) Location of anti-tracking area at each construction entrance or other means to minimize off-site tracking of soil and sediment onto paved surfaces.

e) Means to protect all existing drainage infrastructure (i.e., catch basins) and proposed drainage infrastructure from clogging during construction. For projects anticipated to encounter or manage groundwater, show proposed dewatering operations, including proposed locations of discharge and related details.

f) Location of proposed construction stockpiling areas with appropriate erosion and sediment control measures.

g) The intended sequence and timing of activities that disturb soils at the site and the general sequence during the construction process in which the erosion and sediment control measures will be implemented. Or include this note on the plan: "The contractor shall sequence construction activities to minimize the potential for soil, stone or sediment to migrate off-site; divert flows around bare soils, to the maximum extent practicable; stabilize unvegetated areas as soon as practical and prevent pollutants from entering the City's storm drainage system."

h) Measures to control wastes, including discarded building materials, concrete truck wash-out, chemicals, litter, and sanitary wastes during construction and prevent the discharge of these and any solid material to Newton's MS4 or waters of the United States, unless authorized by a permit issued under Section 404 of the Clean Water Act.

i) Where a site is located in whole or in part within the floodplain, a Floodplain Contingency Plan shall be included with the Erosion and Sediment Control Plan. This Plan shall describe the steps necessary to stabilize the site during construction in the event of a possible flood. A possible flood shall be defined as period when a flood watch is declared for the Charles River by the National Weather Service.

5. A Stormwater Management Report shall be prepared in conformance with the Design Standards contained in Section 5 and contain the following elements:

   a) The existing site hydrology.

   b) A drainage area map showing pre- and post-construction watershed boundaries, drainage area and stormwater time of concentration (Tc) flow paths, including drainage system flows.

   c) Hydrologic and hydraulic design calculations for the pre-development and post-development conditions for the design storms specified in this Regulation. Such calculations shall include:

      (i) Description of the design storm frequency, intensity, and duration.

      (ii) Time of concentration.

      (iii) Soil Runoff Curve Number (CN) based on land use and soil hydrologic group.

      (iv) Peak runoff rates and total runoff volumes for each watershed area.

      (v) Infiltration rates, where applicable.

      (vi) Culvert capacities, where applicable.

      (vii) Flow velocities.

      (viii) Data on the rate and volume of runoff for the specified design storms.

      (ix) Documentation of sources for all computation methods and field test results.

   d) If a project requires a Stormwater Pollution Prevention Plan (SWPPP) per the NPDES General Permit for Storm Water Discharges from Construction Activities (applicable to construction sites that disturb one or more acres of land), then the Applicant is required to submit a complete copy of the SWPPP (including the signed Notice of Intent and approval letter) as part of its Application for a SMP.

6. Post Construction Operation and Maintenance Plan (O&M)

   a) The Post-Construction O&M Plan shall be designed to ensure compliance with the SMP, the Stormwater Management Ordinance and these Rules and Regulations and that the Massachusetts Surface Water Quality Standards, 314, CMR 4.00 are met in all seasons and throughout the life of the system. The O&M Plan shall be a stand-alone document and shall remain on file with the Engineering Division and shall be an ongoing requirement.

   b) The Post-Construction O&M Plan shall include, at a minimum:

i. The name(s) of the owner(s) for all components of the system and emergency contact information.

ii. The signature(s) of the owner(s).

iii. The names and addresses of the person(s) currently responsible for O&M.

iv. An Inspection and Maintenance Schedule for all stormwater management facilities including routine and non-routine maintenance tasks to be performed.

v. A reduced size plan or map clearly showing the location of the systems and facilities including easements, catch basins, manholes/access lids, main, and stormwater devices.

vi. If applicable, a list of easements necessary for the construction and O&M of the stormwater system, with the purpose and location of each. Easements shall be recorded with the South Middlesex County Registry of Deeds prior to issuance of a Stormwater Management Certificate of Compliance by the Engineering Division.

vii. O&M inspection schedule and log form.

viii. Provisions for the, City Engineer or his/her designee to enter the property at reasonable times and in a reasonable manner for the purpose of inspection.

D. Major Permit Submission Requirements

In addition to all the requirements for a Minor Stormwater Permit, provide:

1. A Project Narrative that includes a description of the proposed project and a description of how and where stormwater will be controlled and erosion and sedimentation controls implemented, and an explanation of how the proposed project:

   a) Meets the Design Standards enumerated in Section 5C.

   b) Meets the Stormwater Standards outlined in the Massachusetts Stormwater Handbook[6];

   c) Attempt to reproduce natural hydrologic conditions with respect to groundwater and surface water.[7]

   d) Include square footage summaries indicating square footage of work area as well as existing, proposed, and net changes in impervious surface areas.

SECTION 7: ADMINISTRATION

A. Administration of Rules and Regulations**.** The City Engineer through its Engineering Division shall administer, implement, and enforce these Rules and Regulations.

B. Stormwater Management Permit Application Approval Process.

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[6] Massachusetts Stormwater Handbook, as most recently updated. http://www.mass.gov/eea/agencies/massdep/water/regulations/massachusetts-stormwater-handbook.html

[7]Guidance on these practices is provided in Appendix C of these Regulations and the MA Stormwater Management Handbook.

Actions by the City Engineer / Engineering Division:

1. Determination of Completeness: The City Engineer shall review the Stormwater Management Permit Application for completeness with the requirements and standards of Sections 5 through 8 within fifteen (15) business days of receipt.

2. Incomplete Applications: If the City Engineer determines the Application is incomplete, including, but not limited to, insufficient information to describe the site, the work, or the effect that work has on water quality and runoff volume, the Engineering Division may reject the application, require the submission of additional information, or deny the Permit.

3. Complete Applications. Each Application for a Stormwater Management Permit Application that is determined to be a complete Application shall be reviewed by the City Engineer. The Application shall be acted upon within fifteen (15) business days of the date that the Engineering Division determines that the Application is complete unless such Application has been withdrawn from consideration. The Engineering Division may:

   a) Approve the Permit Application upon finding that the proposed project will meet the objectives of the Stormwater Management Ordinance and the Design Standards.

   b) Approve the Permit Application with conditions, modifications and/or restrictions that are required to ensure that the project will protect water resources and meets the objectives of the Stormwater Management Ordinance and the Design Standards.

   c) Deny the Permit Application due to non-compliance with Design Standards (in Section 5) or insufficient information to make a determination.

C. Plan Changes.

The Applicant must notify the City Engineer, in writing, of any proposed change to or alteration of the site plans and details authorized in any Stormwater Management Permit before any change or alteration is made. Proposed changes are only considered approved by the Engineering Division if the changes are *noted in writing by the Engineering Division and/or revised plans / documents are stamped approved by the Engineering Division*. If the Engineering Division determines that a proposed change or alteration is significant, based on the Design Standards in Section 5 of these Rules and Regulations and accepted construction practices, it may require an amended Application be filed.

D. Expiration of Permits and Permit Extensions.

1. Should a land-disturbing project or activity associated with an approved plan in accordance with this City Ordinance not begin within one (1) year following permit issuance, the permit shall lapse and should the Applicant wish to continue with the previously approved plan, the Applicant must re-apply for a new permit.

2. If the project associated with an approved Stormwater Management Permit granted under the Ordinance has not been completed within three (3) years of permit issuance, a new permit or a permit extension will be required by the Engineering Division. The Engineering Division may require revisions to the project to comply with current regulations and standards as a condition of the permit extension.

3. Applicants may request permit extensions in one (1) year increments.

E. Project Completion. A Stormwater Management Certificate of Compliance (SMCC) is required for completion of all Minor and Major Stormwater Management Permits. Upon request by the permittee and following review and approval that all work of the permit has been satisfactorily completed in

conformance with the Stormwater Management Ordinance and Permit, the Engineering Division will issue a Stormwater Management Certificate of Compliance. (See Section 10 for details.)

SECTION 8: PRE-CONSTRUCTION NOTICE and CONSTRUCTION INSPECTIONS

A. Pre-Construction Meetings and Site Inspections.

1. Pre-Construction Meeting: Once a permit has been approved, the Engineering Division may require a pre-construction meeting prior to starting any clearing, excavation, construction, or land-disturbing activity by the Applicant. The Applicant's technical representative, the general contractor, or any other person with authority to make changes to the project, shall meet with the Engineering Division or its representative to review construction sequencing and the permitted plans and their implementation.

2. Notice of Construction Commencement: The Applicant must notify the Engineering Division City Engineer two (2) business days prior to the commencement of any construction or land disturbance activities. In addition, the Applicant must notify the assigned Engineering Division inspector two business (2) days prior to construction of any stormwater management structural Best Management Practices (BMPs).

3. Initial Site Inspection: An inspection may be made of erosion and sedimentation controls prior to any land-disturbance to assess overall effectiveness and functioning to protect resources

B. Construction-Period Inspections**.**

1. Upon issuance of any Stormwater Management Permit, and until issuance of a SMCC, representatives from the Engineering Division and their designees shall be granted the right to enter the property at reasonable times and in a reasonable manner for the purpose of inspection.

2. The Engineering Division may, at a minimum, inspect the project site at the following stages:

   a) Prior to any vegetation clearing and upon installation of all soil erosion and sediment control measures. Periodic inspections will be made thereafter to ensure the durability and function of these measures.

   b) Stormwater Management System Excavation Inspection: The Engineer of Record shall inspect the excavation of the stormwater management system(s) to ensure adequate separation of the stormwater system from ground water. This is required for Major Stormwater Permits and highly encouraged for Minor Stormwater Permits.

   c) Stormwater Management System Inspection: An inspection will be made prior to backfilling of any underground drainage or stormwater conveyance structures and management.

   d) The City Engineer may require the submission of periodic inspections and reporting by the Applicant as dictated by site conditions. Inspections must be completed by qualified persons approved by the Engineering Division.

C. Post-Construction Inspection. The Engineering Division shall inspect the site and all stormwater infrastructure / BMPs to confirm its "as-built" features and full compliance with all approved plans and permit conditions, including final site stabilization.

SECTION 8: STANDARD CONDITIONS

A. A copy of the approved and signed plans and permits shall always be kept on the construction site.

B. Notes indicating the required inspections must appear on the final approved Site Plan(s).

C. Post-Construction Annual Reporting on O&M of Stormwater Management System for Major Stormwater Permits only. Annual stormwater management systems inspection reports shall be submitted to the Engineering Division by January 15th of the following year. Inspection reports *including photographs or videos* (as appropriate) for stormwater management systems shall include:

1. The date of inspection.
2. Name of inspector.
3. The condition of each BMP including components such as:
    a) Pretreatment devices.
    b) Vegetation or filter media.
    c) Spillways, valves, or other control structures.
    d) Embankments and slopes.
    e) Inlet and outlet channels and structures.
    f) Underground drainage.
    g) Sediment and debris accumulation in storage and forebay areas (including catch basins).
    h) Any nonstructural practices.
    i) Any other item that could affect the proper function of the stormwater management system.
4. Description of the need for maintenance.
5. Observations of any physical changes to system in comparison with the approved as-built plan.

SECTION 9: STORMWATER MANAGEMENT CERTIFICATE OF COMPLIANCE (SMCC)

A. Upon completion of the work done under any minor or major stormwater management activity, the permittee shall request a final inspection and submit the following: Note: Land disturbance only permits do not require a certificate of compliance.

The permittee shall submit:

1. A written request for a Stormwater Management Certificate of Compliance from the Engineering Division.
2. As-built plans detailing all aspects of the construction project including the stormwater management systems, structures, and devices, as installed. As-built plans shall be stamped by a Registered Professional Engineer.
3. A letter from the Engineer of Record indicating that the constructed facility(s) have been constructed in accordance with, and meet the requirements of, the Stormwater Management

Permit, including compliance with performance standards for Best Management Practices (BMPs) as noted in manufacturer's literature and/or EPA's performance curves in the NPDES Small MS4 Permit.

4. Proof of recording the Operations and Maintenance Plan at the South Middlesex Registry of Deeds.

B. After receipt of a written request for a Stormwater Management Certificate of Compliance, as-built plans, and a letter from the Engineer of Record, the Engineering Division shall inspect the stormwater management system to confirm its "as-built" features, determine if the site has been stabilized and determine whether to issue a Stormwater Management Certificate of Compliance.

1. The Engineering Division shall issue a Stormwater Management Certificate of Compliance upon finding that the permit and all its conditions have been complied with.

2. The Engineering Division shall not issue a Stormwater Management Certificate of Compliance upon physical evidence of operational failure, even though it was built as called for the Engineering Plans. In such a case, the Engineering Division shall have the right to require corrections or improvements to the "as-built" system before issuing a Stormwater Management Certificate of Compliance.

SECTION 10: SECURITY

A. As part of any Minor or Major Stormwater Management Permit issued, in addition to any security required by another municipal or state board, agency or official, the Engineering Division may require that the performance and observance of the conditions imposed hereunder be secured wholly or in part by a proper bond or deposit of money or negotiable securities or the undertaking of financial responsibility sufficient in the opinion of the Engineering Division, to be released in whole or in part upon issuance of a SMCC for work performed pursuant to the Permit.

SECTION 12: SEVERABILITY

The invalidity of any section, provision, paragraph, sentence, or clause of these Rules and Regulations shall not invalidate any other section, provision, paragraph, sentence, or clause thereof, nor shall it invalidate any permit or determination that previously has been issued.

END OF NEWTON'S STORMWATER MANAGEMENT ORDINANCE RULES AND REGULATIONS

APPENDICES FOLLOW

APPENDIX A: DEFINITIONS

For the purposes of these rules and regulations, which supplement the ordinance, the following words and phrases shall have the meanings respectively ascribed to them by this section:

Abutter: Any property owner whose land directly abuts the land upon which work is being proposed.

Applicant*:* Any "person", as defined in the ordinance, who has filed an application for a Stormwater Management and Erosion Control Permit.

Engineer of Record*:* The registered professional civil engineer (P.E.) who seals/stamps drawings, reports, or documents for a project on behalf of the owner/developer. The seal/stamp shall acknowledge that the professional engineer prepared, coordinated, or had subordinates prepare under the direct supervision of the professional engineer, drawings, reports, or documents for a project, all in accordance with the standards of the civil engineering profession.

Estimated seasonal high groundwater**:** The shallowest depth to free groundwater that stands in an unlined borehole or test pit.

Erosion and sediment control*:* The prevention or reduction of the movement of soil particles or rock fragments.

Existing lawn*:* Grass area which has been maintained and mowed in the previous two years.

Fill*:* The placement or deposit of any material that raises, either temporarily or permanently, the elevation of any area subject to the Ordinance, and rules and regulations.

Flooding*:* A local and temporary inundation or a rise in the surface of a body of water, such that it covers land not usually under water.

General construction detail book: The latest version of general construction details promulgated by the City of Newton's Department of Public Works, which is available from the Engineering Division.

Groundwater*:* All water beneath any land surface including water in the soil and bedrock beneath water bodies.

Hooded catch basin*:* A catch basin that is fitted with an inverted elbow over its outlet pipe or similar structure that is designed to retain oils and other floatables (solids or liquids) within the catch basin sump and prevent them from flowing into the drainage system.

***New development**:* Any construction or disturbance of land that is currently in a natural vegetated state. New development also includes any disturbance beyond existing impervious and disturbed areas that is contiguous to redevelopment projects.

Pervious material: Soil Types that are listed as Class I, II and III soils as defined in 310 CMR 15.243 and 15.244 based upon the general soil classification used by the U.S. Department of Agriculture and depicted in the Soil Textural Triangle.

Point source: Any discernible, confined, and discrete conveyance, including but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, or container from which pollutants are or may be discharged.

***Redevelopment**:* Any construction, land alteration, demolition or improvement of impervious surfaces that does not meet the definition of new development. The following activity is excluded from this definition: Maintenance and improvement of existing roadways, including widening less than a single lane, adding shoulders, and correcting substandard intersections and drainage, repaving, and adding sidewalks and curbing.

Resource area: Any area protected under including without limitation: the Massachusetts Wetlands Protection Act, Massachusetts Rivers Act, or City of Newton General Wetlands Protection Ordinance.

***Sedimentation**:* A process of depositing material that has been suspended and transported in water.

***Slope**:* The incline of a ground surface expressed as a ratio of horizontal distance to vertical distance (*e.g.,* a 4h:1v slope). It can also be expressed as a percentage of the vertical rise divided by the horizontal distance (*e.g.,* a twenty-five (25) percent slope).

***Total phosphorus** (TP):* Phosphorus is a nutrient commonly contaminating stormwater, derived from the natural decay of plant material and human activities. Total phosphorus is a measure of all forms of phosphorus, dissolved and suspended particulate found in a sample.

***Total suspended solids** (TSS)*: Total Suspended Solids. Material, including but not limited to trash, debris, and sand suspended in stormwater runoff.

APPENDIX B: LOW IMPACT DEVELOPMENT PRACTICES

Low Impact Development (LID) strategies use careful site design and decentralized stormwater management to reduce the environmental footprint of new growth and redevelopment. This approach improves water quality, minimizes the need for expensive pipe and pond stormwater systems, and creates more attractive developments. The following are LID strategies and various benefits of implementation.

1. Bioretention cells, commonly known as rain gardens, are small-scale, landscaped depressions containing plants and a soil mixture that absorbs and filters runoff.

   Management Objectives:
   - Provide quality treatment.
   - Remove suspended solids, metals, nutrients.
   - Increase groundwater recharge through infiltration.
   - Reduce peak discharge rates and total runoff volume.

2. Permeable and porous pavements allow water to soak through the paved surface into the ground beneath. Permeable pavement encompasses a variety of mediums including porous concrete and asphalt, plastic grid systems and interlocking paving bricks.

   Management Objectives:
   - Reduce stormwater runoff volume from paved surfaces.
   - Reduce peak discharge through infiltration.
   - Reduce pollutant transport through direct infiltration.
   - Improve site landscaping benefits (grass pavers).

3. Grass swales are broad, open channels sown with erosion resistant and flood tolerant grasses.

   Management Objectives:
   - Provide water quality treatment; remove suspended solids; heavy metals, trash.
   - Reduce peak discharge rate and total runoff volume.
   - Infiltrate water into the ground.
   - Provide a location for snow storage.

4. Infiltration Trenches and Dry Wells These are standard stormwater management structures that store water in the void space between crushed stone or gravel; the water slowly percolates downward into the subsoil.

   Management Objectives:
   - Remove suspended solids, heavy metals trash, oil, and grease.
   - Reduce peak discharge rate and total runoff volume.
   - Provide modest infiltration and recharge.
   - Provide snow storage areas.

5. Grass Filter Strips are low-angle vegetated slopes designed to treat sheet flow runoff from adjacent impervious areas.

   Management Objectives:
   - Remove suspended solids, heavy metals, trash, oil, and grease.

- Reduce peak discharge rate and total runoff volume.
- Provide modest infiltration and recharge.
- Provide snow storage areas.

6. Roadway and Parking Lot Design:

   Management Objectives:
   - Remove suspended solids, heavy metals trash, oil, and grease.
   - Reduce peak discharge rate and total runoff volume.
   - Provide modest infiltration and recharge.
   - Provide snow storage areas.

7. Cisterns and rain barrels harvest and store rainwater collected from roofs [Note: not to be used as part of measures to meet minimum recharge volumes]:

   Management Objectives:
   - Storing and diverting runoff.
   - Reduce flooding and erosion caused by stormwater runoff.
   - They contain no salts or sediment which provides "soft" chemical-free water for garden or lawn irrigation, reducing water bills and conserving municipal water supplies.

8. Other LID Implementations:

   - Shared Driveways
   - Green Roofs
   - Blue Roofs
   - Tree box filters
   - Eliminating curbs and gutters or minimizing in new construction.
   - Soil Amendments.
   - Creating long flow paths over landscaped areas.
   - Creating terraces and check dams.
   - Pervious pavers.
   - Infiltration, Filtration
     - Rain gardens.
     - Disconnected downspouts (not on hills).
     - Filter Mitts.

9. Low Impact Landscaping:

   - Native, drought tolerant species.
   - Turf area conversion (shrubs, etc.).
   - Encouraging longer grass length.
   - Planting wildflower meadows rather than turf along medians.

Conservation Development

Like LID, Conservation Development tries to mitigate the effects of urbanization, but it places additional emphasis on protecting aquatic habitat and other natural resources. Conservation Development subdivisions are characterized by compact clustered lots surrounding a common open space.

Conservation Development's goal is to disturb as little land area as possible while simultaneously allowing for the maximum number of residences permitted under zoning laws.

Prior to new construction, conservation developers evaluate natural topography, natural drainage patterns, soils, and vegetation. They deploy stormwater Best Management Practices to help prevent flooding and protect natural hydrology. By maintaining natural hydrological processes, Conservation Development creates conditions that slow, absorb, and filter stormwater runoff onsite.

Because future development threatens valuable natural features, Conservation Development provides specific provisions for long-term and permanent resource protection. Conservation easements, transfer of development rights, and other "in perpetuity" mechanisms ensure that protective measures are more than just temporary.

Effective Site Design

The goals of Effective (or Better) Site Design are to reduce impervious cover, preserve natural lands, and capture stormwater onsite. To meet these goals, designers employ a variety of methods. To reduce impervious cover, they narrow streets and sidewalks, minimize cul-de-sacs, tighten parking spaces, and reduce the size of driveways and housing lots.

To reduce stormwater runoff, designers preserve natural lands, using them as buffer zones along streams, wetlands, and steep slopes. They employ landscaping techniques that flatten slopes and preserve native vegetation and clusters of trees. They create bio-retention areas - open channels, filter strips and vegetated swales - to increase stormwater infiltration, helping to protect streams, lakes, and wetlands.

APPENDIX J: FUNDING SOURCE ASSESSMENT

Funding Source Assessment Memorandum Dated June 2023

Funding Source Assessment Memorandum Dated June 2021

Funding Source Assessment Memorandum Dated June 2023

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MEMORANDUM

PROJECT: Newton, MA Phosphorus Control Plan

PROJECT NUMBER: 0233351.00

DATE: June 2023

SUBJECT: PCP Funding Source Memorandum - Revised 2023

The City of Newton, MA (City) maintains coverage under the General Permit for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems (MS4) in Massachusetts (MS4 General Permit, Permit). As a permittee, the City is subject to specific phosphorus reduction goals because waterbodies located within the City are listed in the 2016 Massachusetts Impaired Waters List as being impaired or having total maximum daily loads (TMDLs) established for phosphorus related impacts, and specifically the Charles River watershed.

> The purpose of this memorandum is to update to the previously prepared memorandum dated June 22, 2021, providing an overview of existing and potential future funding programs that may be available to the City to assist with implementation of phosphorus load reductions required by the MS4 General Permit. The funding opportunities presented in this memorandum provide a basis to evaluate eligibility of potentially applicable funding mechanisms.

The City will continue to assess the funding mechanisms described below, and other relevant funding mechanisms that may become available during implementation of Phase 1 of the PCP, to reduce stormwater related phosphorus impacts from their MS4 to waterbodies located within the City

Department of Public Works Funding Sources

Newton Department of Public Works Stormwater Fund

The primary funding mechanism currently available to the City to support implementation of Phase 1 PCP measures is revenue generated from Ordinance Chapter 29, Section 120, which established a stormwater fee to be paid by various developed properties within the City of Newton.

Stormwater fees generated by developed lands within the City of Newton may be used for the following:

- Engineering and design, debt service and related financing expenses, construction costs for new infrastructure (including costs for contracted services) and enlargement or improvement of existing stormwater infrastructure;
- Operation and maintenance of the stormwater system, including catch basin cleaning, stream bank stabilization, maintaining open channels / floodways, lake and pond

management, street sweeping, pipe repairs, and stormwater best management practices (BMPs) repairs;

- Capital investments including design, permitting and construction of new stormwater BMPs and related components (e.g., purchase of plants, soils, and other amenities to support stormwater management alternatives utilizing vegetation); and
- Retrofitting developed areas for enhanced pollution control.

Funds generated through the stormwater user fees can also be leveraged as payment on principal and interest on debt obligations that may be incurred through obtaining grants where a matching fund or low interest rate loan is obtained to fund phosphorus reduction related projects, as described below.

The FY24 budget is $4,540,823 for the City's Stormwater Fund. The purpose of this fund is to manage and operate the MS4 system, including water quality implementation projects; execute MS4 Permit compliance work and PCP Phase 1 implementation, reporting and planning. The following is a current breakdown of budget categories in this fund.

- Stormwater system maintenance $1,918,005
- Bond maturities and interest $493,846
- Capital projects, budget reserves & fringe benefits $ 2,128,973

The monetary values associated with each item are a sample budget summary from this fiscal year and may not reflect future budget values. The Department of Public Works (DPW) manages the stormwater program and all the elements associated with the MS4 Permit.

Sustainable Materials Management Division – Street Cleaning

The FY24 street cleaning budget is $921,101. The purpose of this budget is to manage and operate the street sweeping program which provides regular sweeping and leaf-litter collection throughout the city; this cleaning program reduces phosphorus loading as documented in the Phase 1 PCP. As previously noted, the monetary value is a sample budget from this fiscal year and may not reflect future budget value.

Additional Phosphorus Control Planning Funding Sources

The additional funding mechanisms listed below were previously identified as potential funding support sources for PCP implementation in the city. These additional funding sources were reviewed in 2023 for continued applicability, as possible additional funding mechanisms to support Phase 1 implementation.

These programs are typically rolled out on an annual basis so the opportunity to apply will be available within the same timeframe in future years. A summary of funding mechanisms is provided in the table below and an expanded discussion of each program follows. The following represent typical funding programs for stormwater activities, but other grant or innovative loan programs may be used for municipal infrastructure improvement programs.

Funding Program	Funding Type	Funded Activities
Clean Water State Revolving Loan Fund	Low interest loans	Structural and non-structural stormwater projects
Coastal Pollutant Remediation Grant	• Annual total grant awards: $500,000 • Municipal match: At least 25% of the total project cost	• Nonpoint source pollutant assessments • Design and permitting activities • Regulatory program development, technical assistance, and online tools/resources
MS4 Municipal Assistance Grant Program	• Grants range from $50,000 - $300,000 • Matching funds encouraged but not required	Activities to meet MS4 General Permit requirements
Section 604(b) Water Quality Management Program	• Grants range from $30,000 - $50,000 • Matching funds not required but strongly recommended	Nonpoint source assessment and planning projects
Section 319 Water Quality Management Planning Grant Program	• Grants range from $10,000 - $500,000 • 40% non-federal match required	• BMPs in impaired waters watersheds • Outreach and education
Massachusetts Municipal Vulnerability Preparedness Grant	• Grant awards expected to range from $25,000 to $2,000,000, with regional awards up to $5,000,000 • 25% cash, in-kind, or combination required	• Planning, assessments, capacity-building, and regulatory updates • Design and permitting • Construction and on-the-ground implementation

Clean Water State Revolving Fund Loan

The Massachusetts Clean Water State Revolving Fund (SRF) loan program provides low-interest loans to finance projects that help communities meet water quality standards and provide public health benefits. Projects are selected annually using a priority ranking system called the Intended Use Plan (IUP). IUP ranking is based upon protection of the public health and improved compliance together with affordability. In CY2021, MassDEP had approximately $600 million to finance clean water projects.

Funding is available for the planning and construction of structural projects (funding for design is excluded) including:

- Infiltration/Inflow correction
- Stormwater conveyance infrastructure improvements
- Measures to manage, reduce, treat, or recapture stormwater and surface drainage water;
- Stormwater Management Planning projects that help communities comply with the April 2016 NPDES MS4 permit;
- Development and implementation of conservation and management plans; and
- Nonpoint source pollution abatement projects such as: landfill capping, community programs for upgrading septic systems (Title 5), Brownfield remediation, pollution prevention, and stormwater treatment systems.

Funding is also available for non-structural projects, such as:

- Green infrastructure planning projects for nonpoint source problems which are consistent with MassDEP's Nonpoint Source Management Plan and that identify pollution sources and suggest potential remediation strategies.
- Wastewater nutrient management projects to manage, reduce, treat or recapture stormwater and surface drainage water.

CY2023 Terms are as follows:

Loan Type	Permanent Financing	Interim Financing
Standard SRF Loan	2% (20 years or less) 2.4% - 2.9% (30 years)	0%
Housing Choice Loan Rate	1.5% (20 years)	0%
Nutrient Enrichment Reduction Loan	0%	0%
Maximum Term	30 years	3 years
Administrative Fee	0.15%	0%
Loan Origination Fee	$5.50 per $1,000	$0

Anticipated Timeline (annual process for CY2024 Clean Water Intended Use Plans)**:**

- Project Evaluation Forms (PEFs) due mid-August 2023
- Intended Use Plan issued in January 2024
- Local Borrowing Authorization by end of June 2024
- SRF Application for Financial Assistance due mid-October 2024

For more information, click here.

Coastal Pollutant Remediation Grant

The Massachusetts Office of Coast Zone Management (CZM) administers the Coastal Pollutant Remediation (CPR) Grant Program to provide funding for communities to identify and improve water quality impaired by nonpoint source pollution. For FY2022, approximately $500,000 is available. Eligible applicants are the municipalities located within the boundaries of the Massachusetts coastal watershed, which encompasses 220 cities and Cities in eastern Massachusetts. Eligible projects must fall into one of the following categories:

- Assessment, identification, and characterization of stormwater or commercial boat waste pollution. Assessment efforts must focus on the investigation of nonpoint source (NPS) discharges to impaired waterbodies (e.g., physical evaluation of drainage areas; land-use characterization; water quality testing at in-stream and outfall locations; and the development of recommendations for NPS management (structural and nonstructural), as well as the investigation of the appropriate type and placement of stormwater best management practices (BMPs) or boat pump out facilities).
- Design, permitting or implementation of:
    - BMPs to remediate runoff from paved or unpaved roads, bridges, and municipal parking lots. Target contaminants include, but are not limited to, sediment, bacteria and nutrients.
    - Commercial boat waste pump out facilities to reduce or eliminate pollution discharged from vessel holding tanks.
- Capacity-building activities for planning, engineering, and repair of stormwater BMPs or boatyard pump out facilities:
    - Development, amendment, or implementation of local stormwater or low impact development bylaws, ordinances, standards or other management measures.
    - Technical assistance including green infrastructure operations and maintenance trainings for municipal staff, guidance documents, case studies of successful projects, and demonstration projects.
    - Development of publicly available online tools or resources that support municipal assessment, planning, design, and implementation activities for stormwater and boat waste pump out infrastructure.

Recent annual historic funding totals $500,000. A match of at least 25% of the total project cost is required. In 2022 two application rounds (spring and fall) were accepted.

Newton Eligibility

As a community located in the Massachusetts Coastal Watershed, Newton is eligible to apply. Because Newton is only partially located within a coastal watershed (Charles River watershed), the City must provide additional information to prove that the proposed project lies within the Massachusetts coastal watershed.

MS4 Municipal Assistance Grant Program

The Massachusetts Department of Environmental Protection administers the MS4 Municipal Assistance Grant Program for innovative projects that will assist multiple communities in meeting the requirements of the 2016 Small MS4 General Permit. The funding is to enable groups of Massachusetts municipalities to expand their efforts to meet 2016 MS4 permit requirements and reduce stormwater pollution through coordinated partnerships that emphasize resource sharing. For FY2021, a total of $300,000 was available. Eligible applicants are groups of two or more Massachusetts municipalities that are subject to the 2016 Small MS4 General Permit, Regional Planning Agencies acting on behalf of two or more municipalities that are subject to the 2016 Small MS4 General Permit; Massachusetts stormwater coalitions representing two or more municipalities that are subject to the 2016 Small MS4 General Permit; or non-profit organizations acting on behalf of two or more municipalities that are subject to the 2016 Small MS4 General Permit.

Eligible projects will result in tools or approaches that will help multiple municipalities meet one or more specific requirement(s) of the 2016 Small MS4 General Permit, and must:

1. Provide a shared benefit to multiple communities, including environmental justice communities, and;
2. Not duplicate work already done by any stormwater coalition or where a previously funded project delivery is applied to another region. Previously funded projects can be found here.

Examples of potentially eligible, MS4-focused projects include, but are not limited to:

- Assessment tool for identifying retrofit sites;
- Data intake and field-certification tool for Best Management Practices (BMP) operation and maintenance programs;
- Formation of new regional MS4 coalitions in areas where none exist;
- MS4 capital investments, including equipment and electronic resources;
- Outreach and education services, materials, and/or strategies for public engagement or establishment of stormwater enterprise funds or stormwater utilities;
- Survey research to identify needs of smaller MS4 municipalities;
- Municipal code review with a focus on/analysis of how street design and parking lot design requirements impact the creation of impervious area; and whether these or other, related municipal requirements negatively impact the implementation of Low Impact Development Practices; and/or

MS4 related job training opportunities benefitting environmental justice populationsBoth current and proposed projects are eligible for this grant program that will support any phase(s) of the project, from initial project planning through project implementation. Preference is given to projects that assist the greatest number of municipalities, including environmental justice communities. FY2022, awards may have ranged from $50,000 to $300,000 per applicant, with matching funds encouraged, but not required. The total funding available in FY2022 was $300,000. FY 2022 applications were due in September. Similar funding and timing can be anticipated in the future..

Newton Eligibility

Newton would need to partner with at least one other municipality subject to the 2016 Small MS4 General Permit.

Section 604(b) Water Quality Management Planning Grant Program

The Massachusetts Department of Environmental Protection administers the Section 604(b) Water Quality Management Planning Grant Program. Slightly over $200,000 has been available in past years; similar funding is anticipated to continue.. Eligible entities include regional planning agencies, council of governments, counties, conservation districts, and cities. Eligible projects are nonpoint source assessment and planning projects that result in the following:

- Development of Watershed-based Plans for local watershed planning and to support future 319 grant implementation projects
- Development of preliminary designs and implementation plans that will address water quality impairments in impaired watersheds
- Development of Watershed-based Plans for 319 Healthy Waterbody Projects to be used to guide watershed protection and management activities, including:

    - Streams: Geomorphology and Habitat Improvement
    - Streams: Nutrient, Sediment, and Pathogen Pollution Reduction
- Determination of the nature, extent, and causes of water quality problems and determination of pollutant load reductions necessary to meet water quality standards; or
- Development of green infrastructure projects that manage wet weather events to maintain and restore natural hydrology

Projects can be located in MS4 areas; however, projects to implement specific requirements of the NPDES stormwater permits are ineligible. Grant awards typically range between $30,000 to $50,000 range. A match is not required; however, is highly recommended. **FY2022 applications were due August 2022; a similar timeframe is anticipated for upcoming years.**

Section 319 Water Quality Management Planning Grant Program

The Massachusetts Department of Environmental Protection administers the Section 319 Nonpoint Source Competitive Grants Program to fund projects that address prevention, control, and abatement of nonpoint source (NPS) pollution, and that attain environmental results by restoring beneficial uses and/ or meeting or maintaining state water quality standards. For Fall Federal FY 2022, approximately $1.6 million was available, of which approximately $1.1 million is benchmarked for implementation projects that addresses water quality impairments listed in Categories 4a, 4c, and 5 of the Massachusetts 2016 Integrated List of Waters. Eligible applicants are any public or private organization in Massachusetts. Projects from all watersheds are eligible and encouraged, excluding work covered under NPDES stormwater permits. Eligible projects are defined by the following categories:

- Implementation Projects in Impaired Waters: The most competitive projects will pursue a watershed-based strategy to implement a combination of structural and non-structural Best Management Practices (BMPs) addressing all impairments and leading to restoration of impaired waters.
- Healthy Watersheds and Protection of High-Quality Waters: Implementation projects for climate change adaptation and resiliency projects that protect non-impaired and high-quality waters from the effects of nonpoint source pollution. Projects with a substantial land conservation component as part of NPS prevention and remediation work are also eligible.
- Outreach and Education: Projects that propose specific outreach and education activities and products and will develop and implement an evaluation method to gauge the effectiveness of these activities. Projects should have regional or statewide relevance.

Funding availability for NPDES Stormwater regulated/ MS4 areas:

- Implementation projects remain eligible for funding in NPDES regulated areas. 319 funds cannot be used for work that addresses NPDES permit requirements. Work that will meet new NPDES permit requirements may be undertaken using 319 funds only if the work is completed prior to the time it will be required under the new NPDES permit timetable.
- All other types of projects are eligible in regulated or mixed regulated/unregulated areas, provided the work proposed is not required under the current or pending NPDES

stormwater permit, nor used to meet permit application requirements such as mapping stormwater systems, identifying illicit connections, characterizing stormwater discharges, or monitoring required by permits.

- EPA guidelines require termination of funding agreements for work that becomes regulated under NPDES permits, even where a project is partially completed. Therefore, the most competitive projects in regulated areas will provide assurances that the work is not required, nor is it anticipated that it would become required, during the life of a 319 contract.
- Work in unregulated areas, and in unregulated portions of partially regulated communities, remains fully eligible.

A 40% non-federal match is required. **Fall Federal FY 2022 applications were due in December 2022.**

Massachusetts Municipal Vulnerability Preparedness Grant Program

The Massachusetts Office of Energy and Environmental Affairs (EEA) administers the Municipal Vulnerability Preparedness (MVP) Grant Program's MVP Action Grants to provide financial and technical assistance to designated "MVP Communities" to implement priority adaptation actions identified through the MVP planning process, or similar climate change vulnerability assessment and action planning that has led to MVP designation. Approximately $10 million is available for FY2022. Eligible applicants are municipalities who have completed the Community Resilience Building process and received "MVP Community" designation from EEA. Applications from regional partnerships of multiple municipalities are eligible provided that the lead applicant is an MVP designated community.

Eligible projects must address one (or more) priority implementation actions within the municipality's MVP plan/report and use best available techniques and climate projections. The most applicable project types include:

- Nature-Based Flood Protection, Drought Prevention, Water Quality, and Water Infiltration Techniques: Green infrastructure projects that utilize natural resources and pervious surfaces to manage coastal and inland flooding, erosion, and other storm damage, such as stormwater wetlands (i.e., constructed wetlands for pollutant removal) and bio-retention systems, and other Smart Growth and Low Impact Development techniques.
- Community Outreach and Education: Projects that increase public understanding of climate change impacts within and beyond the community and foster effective partnerships to develop support.

Local Bylaws, Ordinances, Plans, and other Management Measures: Projects to develop, amend, and implement local ordinances, bylaws, standards, plans, and other management measures to reduce risk and damages from extreme weather, heat, flooding, and other climate change impacts.

To be competitive for MVP funding, projects will need to embody and reflect the MVP program's core principles. Eligible projects will fit into one of the following three types:

1. Planning, Assessments, Capacity-Building, and Regulatory Updates. Projects must meet the MVP program's core principles and may include the following:
    - Identifying, assessing, and prioritizing people, places, resources, and/or critical facilities or infrastructure that may be impacted by climate change to plan for and implement resiliency strategies.

- Assessing the feasibility of a specific climate adaptation strategy.
- Developing and/or formally adopting planning documents and regulations that encourage climate change adaptation.
- Undertaking capacity-building activities that will increase social resiliency. These activities may involve municipal staff, community leaders, local business owners, residents, and/or community organizations.

2. Design and Permitting. Projects must meet the MVP program's core principles and may include the following:
    - Creating design plans for site preparation, installation, and project monitoring and maintenance.
    - Preparing and filing federal, state, and local permit applications for proposed activities.
3. Construction and On-the-ground Implementation. Projects must meet the MVP program's core principles and may include the following:
    - Preparing the project site, constructing/installing adaptation options, and developing/implementing appropriate monitoring protocols.
    - Installing or implementing tangible energy resilience projects like solar plus storage systems at critical facilities, energy efficiency measures at critical facilities, relocation of building utilities outside flood-prone locations, and other innovative pilot projects.
    - Acquiring land or property to achieve climate resiliency goals.
    - Implementing other "on-the-ground" adaptation projects (e.g., tree planting, pilot projects, etc.).

Grant awards are expected to range from $25,000 to $2,000,000, with regional awards up to $5,000,000. A 25% cash, in-kind, or combination is required. Applications are typically accepted once per year, usually in the May/June timeframe.

Funding Source Assessment Memorandum Dated June 2021

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MEMORANDUM

TO: Ted Jerdee, Director of Utilities

CC: Maria Rose, Environmental Engineer

FROM: Zach Henderson, Technical Manager
Stephanie Kaiser, Project Manager

DATE: June 22, 2021

RE: MS4 General Permit Phosphorus Funding Source Assessment – Newton, MA

The City of Newton, MA (City) currently maintains coverage under the General Permit for Stormwater Discharges from Small Municipal Separate Storm Sewer Systems (MS4) in Massachusetts (MS4 General Permit, Permit). As a permittee, the City is subject to specific phosphorus reduction goals because waterbodies located within the City are listed in the 2016 Massachusetts Impaired Waters List as being impaired or having total maximum daily loads (TMDLs) established for phosphorus related impacts, and specifically the Charles River watershed.

The purpose of this memorandum is to provide an overview of existing and potential future funding programs that may be available to the City to assist with phosphorus reduction goals required by the MS4 General Permit. The funding opportunities presented in this memorandum provide a starting point to evaluate eligibility and provide a basis for the "Funding Source Assessment" required in Part 2.2.1 and Appendix F, Part A.1.a.3 which require, in part, the development of a Phosphorus Control Plan (PCP) to reduce the amount of phosphorus in stormwater discharges from the MS4 to the Charles River. This funding source assessment is a required element of the PCP and shall include:

> "…Known and anticipated funding mechanisms (e.g., general funding, enterprise funding, stormwater utilities) that will be used to fund PCP implementation. The permittee shall describe the steps that it will take to implement this funding plan. This may include but is not limited to conceptual development, outreach to affected parties, and development of legal authorities".

The City will assess the funding mechanisms described below, and other relevant funding mechanisms that may become available during implementation of the PCP, to reduce stormwater related phosphorus impacts from their MS4 to waterbodies located within the City

Newton Department of Public Works Stormwater Utility

The primary funding mechanism available to the City to support implementation of the PCP will be revenue generated from Ordinance Chapter 29, Section 120, which established a stormwater fee to be paid by various developed properties within the City of Newton.

Stormwater fees generated by developed lands within the City of Newton may be used for the following:

- Engineering and design, debt service and related financing expenses, construction costs for new infrastructure (including costs for contracted services) and enlargement or improvement of existing stormwater infrastructure;
- Operation and maintenance of the stormwater system, including catch basin cleaning, stream bank stabilization, maintaining open channels / floodways, lake and pond management, street sweeping, pipe repairs, and stormwater best management practices (BMPs) repairs;

- Capital investments including design, permitting and construction of new stormwater BMPs and related components (e.g., purchase of plants, soils, and other amenities to support stormwater management alternatives utilizing vegetation); and
- Retrofitting developed areas for enhanced pollution control.

Funds generated through the stormwater user fees can also be leveraged as payment on principal and interest on debt obligations that may be incurred through obtaining grants where a matching fund or low interest rate loan is obtained to fund phosphorus reduction related projects, as described below.

Department of Public Works Stormwater Enterprise Fund

The FY22 budget is $3,795,000 for the City's Stormwater Enterprise Fund. The purpose of this fund is to manage and operate the MS4 system, including water quality implementation projects, such as Crystal Lake and City Hall ponds; execute MS4 Permit compliance work and PCP planning and implementation. The following is a current breakdown of budget categories in this fund.

- Stormwater system maintenance $1,861,311
- Bond maturities and interest $414,037
- Budget reserves & fringe benefits $ 1,519,652

The monetary values associated with each item are a sample budget summary from this fiscal year and may not reflect future budget values. The Department of Public Works (DPW) manages the stormwater program and all the elements associated with the MS4 Permit.

Additional Phosphorus Control Planning Funding Sources

The additional funding mechanisms listed below have been identified as potential funding support sources for PCP implementation in the City. In some cases, the deadline for application submittal is approaching or has passed; however, these programs are rolled out on an annual basis so the opportunity to apply will be available within the same timeframe in 2022. A summary of funding mechanisms is provided in the table below and an expanded discussion of each program follows. The following represent typical funding programs for stormwater activities, but myriad other grant or innovative loan programs may be used for municipal infrastructure improvement programs.

Funding Program	Funding Type	Funded Activities
Clean Water State Revolving Loan Fund	Low interest loans	Structural and non-structural stormwater projects
Coastal Pollutant Remediation Grant	• Maximum grant award: $175,000 • Municipal match: At least 25% of the total project cost	• Nonpoint source pollutant assessments • Design and permitting activities • Regulatory program development, technical assistance, and online tools/resources

MS4 Municipal Assistance Grant Program	• Grants range from $50,000 - $300,000 • Matching funds encouraged but not required	Activities to meet MS4 General Permit requirements
Section 604(b) Water Quality Management Program	• Grants range from $30,000 - $50,000 • Matching funds encouraged but strongly recommended	Nonpoint source assessment and planning projects
Section 319 Water Quality Management Planning Grant Program	• $2.8 million benchmarked in FFY2022; $1.6 million benchmarked for Categories 4a, 4c, and 5 MA Integrated Waters • 40% non-federal match required	• BMPs in impaired waters watersheds • Outreach and education
Massachusetts Municipal Vulnerability Preparedness Grant	• Grant awards expected to range from $25,000 to $2,000,000, with regional awards up to $5,000,000 • 25% cash, in-kind, or combination required	• Planning, assessments, capacity-building, and regulatory updates • Design and permitting • Construction and on-the-ground implementation

Clean Water State Revolving Fund Loan

The Massachusetts Clean Water State Revolving Fund (SRF) loan program provides low-interest loans to finance projects that help communities meet water quality standards and provide public health benefits. Projects are selected annually using a priority ranking system called the Intended Use Plan (IUP). IUP ranking is based upon protection of the public health and improved compliance together with affordability. In CY2021, MassDEP had approximately $600 million to finance clean water projects.

Funding is available for the planning and construction of structural projects including:

- CSO mitigation
- New wastewater treatment facilities and upgrades of existing facilities
- Infiltration/Inflow correction
- Wastewater collection systems
- Stormwater conveyance infrastructure improvements
- Nonpoint source pollution abatement projects such as: landfill capping, community programs for upgrading septic systems (Title 5), Brownfield remediation, pollution prevention, and stormwater treatment systems

Funding is also available for non-structural projects, such as:

- Green infrastructure planning projects for nonpoint source problems which are consistent with MassDEP's Nonpoint Source Management Plan and that identify pollution sources and suggest potential remediation strategies.
- Wastewater nutrient management projects to manage, reduce, treat or recapture stormwater and surface drainage water.

CY2021 Terms are as follows:

Loan Type	Permanent Financing	Interim Financing
Standard SRF Loan	2% (20 years or less) 2.4% - 2.9% (>20 years)	0%
Housing Choice Loan Rate	1.5% (20 years)	0%
Nutrient Enrichment Reduction Loan	0%	0%
Maximum Term	30 years	3 years
Administrative Fee	0.15%	0%
Loan Origination Fee	~$5.00 per $1,000	$0
Effective Loan Rate	2.15% (20 years)	0%

Anticipated Timeline (annual process for CY2022 Clean Water and Drinking Water Intended Use Plans)**:**

- Project Evaluation Forms (PEFs) due mid-August 2021
- Intended Use Plan issued in January 2022
- Local Borrowing Authorization by end of June 2022
- SRF Application for Financial Assistance due mid-October 2022

For more information, click here.

Coastal Pollutant Remediation Grant

The Massachusetts Office of Coast Zone Management (CZM) administers the Coastal Pollutant Remediation (CPR) Grant Program to provide funding for communities to identify and improve water quality impaired by nonpoint source pollution. For FY2022, approximately $500,000 is available. Eligible applicants are the municipalities located within the boundaries of the Massachusetts coastal watershed, which encompasses 220 cities and Cities in eastern Massachusetts. Eligible projects must fall into one of the following categories:

- Assessment, identification, and characterization of stormwater or commercial boat waste pollution. Assessment efforts must focus on the investigation of nonpoint source (NPS) discharges to impaired waterbodies (e.g., physical evaluation of drainage areas; land-use characterization; water quality testing at in-stream and outfall locations; and the development of recommendations for NPS management (structural and nonstructural), as well as the investigation of the appropriate type and placement of stormwater best management practices (BMPs) or boat pump out facilities).
- Design, permitting or implementation of:
    - BMPs to remediate runoff from paved or unpaved roads, bridges, and municipal parking lots. Target contaminants include, but are not limited to, sediment, bacteria and nutrients.
    - Commercial boat waste pump out facilities to reduce or eliminate pollution discharged from vessel holding tanks.
- Capacity-building activities for planning, engineering, and repair of stormwater BMPs or boatyard pump out facilities:
    - Development, amendment, or implementation of local stormwater or low impact development bylaws, ordinances, standards or other management measures.
    - Technical assistance including green infrastructure operations and maintenance trainings for municipal staff, guidance documents, case studies of successful projects, and demonstration projects.

- Development of publicly available online tools or resources that support municipal assessment, planning, design, and implementation activities for stormwater and boat waste pump out infrastructure.

For FY2022, the maximum grant award is $175,000 and a match of at least 25% of the total project cost is required. Applications are due June 11, 2021. For more information, click here.

Newton Eligibility

As a community located in the Massachusetts Coastal Watershed, Newton is eligible to apply. Because Newton is only partially located within a coastal watershed (Charles River watershed), the City must provide additional information to prove that the proposed project lies within the Massachusetts coastal watershed.

MS4 Municipal Assistance Grant Program

The Massachusetts Department of Environmental Protection administers the MS4 Municipal Assistance Grant Program for innovative projects that will assist multiple communities in meeting the requirements of the 2016 Small MS4 General Permit. The funding is to enable groups of Massachusetts municipalities to expand their efforts to meet 2016 MS4 permit requirements and reduce stormwater pollution through coordinated partnerships that emphasize resource sharing. For FY2021, a total of $300,000 was available. Eligible applicants are groups of two or more Massachusetts municipalities that are subject to the 2016 Small MS4 General Permit, Regional Planning Agencies acting on behalf of two or more municipalities that are subject to the 2016 Small MS4 General Permit; Massachusetts stormwater coalitions representing two or more municipalities that are subject to the 2016 Small MS4 General Permit; or non-profit organizations acting on behalf of two or more municipalities that are subject to the 2016 Small MS4 General Permit.

Eligible projects will result in tools or approaches that will help multiple municipalities meet one or more specific requirement(s) of the 2016 Small MS4 General Permit, and must:

1. Provide a shared benefit to multiple communities, including environmental justice communities, and;
2. Not duplicate work already done by any stormwater coalition or where a previously funded project delivery is applied to another region. Previously funded projects can be found here.

Examples of potentially eligible, MS4-focused projects include, but are not limited to:

- Assessment tool for prioritizing retrofit sites
- Tracking tool for regional stormwater retrofits
- Review of retrofit applications for different stormwater management applications
- Review of Stormwater Enterprise Fund implementation issues, costs, successes, challenges, and opportunities for crediting
- Templates for active and completed construction site inspection checklists
- Formation of new regional MS4 coalitions in areas where none exist
- MS4 Capital Investments, including equipment and electronic resources
- Outreach and Education services, materials, and/or strategies for public engagement
- Development of standard operating procedures or templates
- Training to meet MS4 permit requirements
- Survey research to identify needs of smaller MS4 municipalities
- Best Management Practices for improvement to stormwater management; and/or
- MS4-related job training opportunities within environmental justice communities

Both current and proposed projects are eligible for this grant program that will support any phases(s) of the project, from initial project planning through project implementation. Preference is given to projects that assist the greatest number of municipalities, including environmental justice communities. For FY2021, awards may have ranged from $50,000 to $300,000 per applicant, with matching funds encouraged, but not required. The FY2022 request for responses is anticipated to be announced later in 2021. For more information, click here.

Newton Eligibility

Newton would need to partner with at least one other municipality subject to the 2016 Small MS4 General Permit.

Section 604(b) Water Quality Management Planning Grant Program

The Massachusetts Department of Environmental Protection administers the Section 604(b) Water Quality Management Planning Grant Program. For FY 2021, approximately $220,000 will be available. Eligible entities include regional planning agencies, council of governments, counties, conservation districts, and cities. Eligible projects are nonpoint source assessment and planning projects that result in the following:

- Development of Watershed-based Plans for local watershed planning and to support future 319 grant implementation projects
- Development of preliminary designs and implementation plans that will address water quality impairments in impaired watersheds
- Development of Watershed-based Plans for 319 Healthy Waterbody Projects to be used to guide watershed protection and management activities, including:
    - Streams: Geomorphology and Habitat Improvement
    - Streams: Nutrient, Sediment, and Pathogen Pollution Reduction
- Determination of the nature, extent, and causes of water quality problems and determination of pollutant load reductions necessary to meet water quality standards; or
- Development of green infrastructure projects that manage wet weather events to maintain and restore natural hydrology

Projects can be located in MS4 areas; however, projects to implement specific requirements of the NPDES stormwater permits are ineligible. Grant awards typically range between $30,000 to $50,000 range. A match is not required; however, is highly recommended. **FY2022 applications were due April 14, 2021; however, a new grant cycle for FY2023 will open in a similar timeframe in 2022.** For more information, click here.

Section 319 Water Quality Management Planning Grant Program

The Massachusetts Department of Environmental Protection administers the Section 319 Nonpoint Source Competitive Grants Program to fund projects that address prevention, control, and abatement of nonpoint source (NPS) pollution, and that attain environmental results by restoring beneficial uses and/ or meeting or maintaining state water quality standards. For FY 2022, approximately $2.8 million was available, of which approximately $1.6 million is benchmarked for implementation projects that addresses water quality impairments listed in Categories 4a, 4c, and 5 of the Massachusetts 2016 Integrated List of Waters. Eligible applicants are any public or private organization in Massachusetts. Projects from all watersheds are eligible and encouraged, excluding work covered under NPDES stormwater permits. Eligible projects are defined by the following categories:

- Implementation Projects in Impaired Waters: The most competitive projects will pursue a watershed-based strategy to implement a combination of structural and non-structural Best Management Practices (BMPs) addressing all impairments and leading to restoration of impaired waters.
- Healthy Watersheds and Protection of High-Quality Waters: Implementation projects for climate change adaptation and resiliency projects that protect non-impaired and high-quality waters from the effects of nonpoint source pollution. Projects with a substantial land conservation component as part of NPS prevention and remediation work are also eligible.
- Outreach and Education: Projects that propose specific outreach and education activities and products and will develop and implement an evaluation method to gauge the effectiveness of these activities. Projects should have regional or statewide relevance.

Funding availability for NPDES Stormwater regulated/ MS4 areas:

- Implementation projects remain eligible for funding in NPDES regulated areas. 319 funds cannot be used for work that addresses NPDES permit requirements. Work that will meet new NPDES permit requirements may be undertaken using 319 funds only if the work is completed prior to the time it will be required under the new NPDES permit timetable.
- All other types of projects are eligible in regulated or mixed regulated/unregulated areas, provided the work proposed is not required under the current or pending NPDES stormwater permit, nor used to meet permit application requirements such as mapping stormwater systems, identifying illicit connections, characterizing stormwater discharges, or monitoring required by permits.
- EPA guidelines require termination of funding agreements for work that becomes regulated under NPDES permits, even where a project is partially completed. Therefore, the most competitive projects in regulated areas will provide assurances that the work is not required, nor is it anticipated that it would become required, during the life of a 319 contract.
- Work in unregulated areas, and in unregulated portions of partially regulated communities, remains fully eligible.

A 40% non-federal match is required. **FY2022 applications are due June 30, 2021.** For more information, click here.

Massachusetts Municipal Vulnerability Preparedness Grant Program

The Massachusetts Office of Energy and Environmental Affairs (EEA) administers the Municipal Vulnerability Preparedness (MVP) Grant Program's MVP Action Grants to provide financial and technical assistance to designated "MVP Communities" to implement priority adaptation actions identified through the MVP planning process, or similar climate change vulnerability assessment and action planning that has led to MVP designation. Approximately $10 million is available for FY2022. Eligible applicants are municipalities who have completed the Community Resilience Building process and received "MVP Community" designation from EEA. Applications from regional partnerships of multiple municipalities are eligible provided that the lead applicant is an MVP designated community. To be competitive for MVP funding, projects will need to embody and reflect the MVP program's core principles. Eligible projects will fit into one of the following three types:

1. Planning, Assessments, Capacity-Building, and Regulatory Updates. Projects must meet the MVP program's core principles and may include the following:
    - Identifying, assessing, and prioritizing people, places, resources, and/or critical facilities or infrastructure that may be impacted by climate change to plan for and implement resiliency strategies.
    - Assessing the feasibility of a specific climate adaptation strategy.

- Developing and/or formally adopting planning documents and regulations that encourage climate change adaptation.
- Undertaking capacity-building activities that will increase social resiliency. These activities may involve municipal staff, community leaders, local business owners, residents, and/or community organizations.

2. Design and Permitting. Projects must meet the MVP program's core principles and may include the following:
    - Creating design plans for site preparation, installation, and project monitoring and maintenance.
    - Preparing and filing federal, state, and local permit applications for proposed activities.
3. Construction and On-the-ground Implementation. Projects must meet the MVP program's core principles and may include the following:
    - Preparing the project site, constructing/installing adaptation options, and developing/implementing appropriate monitoring protocols.
    - Installing or implementing tangible energy resilience projects like solar plus storage systems at critical facilities, energy efficiency measures at critical facilities, relocation of building utilities outside flood-prone locations, and other innovative pilot projects.
    - Acquiring land or property to achieve climate resiliency goals.
    - Implementing other "on-the-ground" adaptation projects (e.g., tree planting, pilot projects, etc.).

Grant awards are expected to range from $25,000 to $2,000,000, with regional awards up to $5,000,000. A 25% cash, in-kind, or combination is required. **FY2022 applications are due May 7, 2021.** For more information, click here.

As a Key Client of Woodard & Curran, you have access to the W&C Strategic Funding Service Team. The Strategic Funding Services group specializes in securing state, federal, and private funding for our Key Clients and has a track record of capturing this money through competitive grant and loan processes. Over the last 5 years, Woodard & Curran has applied for $1.8 billion in grants and loans totaling roughly $3 billion in project costs. Approximately $1.4 billion dollars in grants/loans were awarded to our Clients. We look forward to partnering with you to strategically fund and finance your community needs.

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