Town of Hudson, NH

Robinson Pond

PREPARED FOR

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Year 5 DRAFT -JUNE 2023

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Introduction

This DRAFT Phosphorus Control Plan identifies future actions that the Town will continue to evaluate and implement as funding allows to reduce phosphorus loading to Robinson Pond to comply with the NH MS4 permit requirements. This Plan also identifies the potential loading from areas that the Town has jurisdiction over and the limitations and challenges with achieving the phosphorus load reduction target as recommended in the 2011 Robinson Pond Total Maximum Daily load (TMDL) Study.

1.1 Summary of MS4 Permit Requirements

In accordance with Section 2.1.1 of the 2017 Small NH Municipal Separate Storm Sewer System ("MS4 Permit") General Permit, municipalities which have an EPA approved lake or pond phosphorus TMDL must develop a Phosphorus Control Plan (PCP) consistent with the requirements of the MS4 Permit, Appendix F. The PCP shall identify future measures that the Town can implement to reduce stormwater related phosphorus contributions to the lake or pond and achieve the target load reduction set forth in the TMDL study to the maximum extent practicable.

Year 5 of the 2017 MS4 Permit (June 30, 2023 represents a milestone year of the Permit in that the written PCP is supposed to be finalized and the focus should shift from planning to implementation of measures to achieve phosphorus load reductions. Table 1 outlines the timeline included in Appendix F of the 2017 NH MS4 Permit for municipalities to complete next steps with respect to implementation and specifies that 20% of the recommended load reduction sufficient BMPs be achieved by June 2026 through various BMPs and the total recommended load reduction should be achieved by Permit Year 15 (June 2033). The Permit also requires at least one structural BMP be implemented by the end of year 6 or June 2024 as a demonstration project.

Section 3 of this Plan discusses the various load reduction measures that may be available and the relatively feasibility of achieving these prescribed load reduction targets.

Table 1. Summary of Phosphorus Control Plan Action Items and Timeline to Implement

Action Item	Pollutant Plan Requirements	PCP Due Date
Prep for PCP Implementation	Legal analysis	PY 2
	Funding source analysis	PY 3
Illicit Discharge Data	Evaluate illicit discharge catchment mapping	PY 4
	Illicit discharge screening/monitoring results	PY 4
Define PCP Study Area & Characteristics	Define watershed area, town jurisdiction, and land use area	PY 4
	Directly connected impervious area for the target catchment	PY 4
	Define town owned land area and impervious area	PY 4
Load Calculations	Calculate baseline or existing P load	PY 4
	Determine allowable P load based on TMDL	PY 4
	Calculate P load reduction required	PY 4
Planned Non-structural BMPs	Description of planned non-structural BMPs	PY 5
	Calculate P load reduction from planned non-structural BMPs	PY 5
Existing Structural BMPs	Identify existing structural BMPs	PY 5
	Calculate P load reduction from existing structural BMPs	PY 5
Planned Structural BMPs	Identify future potential/planned structural BMPs	PY 5
	Calculate P load reduction from future structural BMPs	PY 5
	Ranking of potential structural BMPs and/or areas for BMPs	PY 5
	Feasibility assessment of planned structural BMPs	PY 5
Implementation Planning	Develop implementation schedule for all planned BMPs	PY 5
	Estimate the cost for all planned BMPs	PY 5
	Develop O&M plan for all existing and planned structural BMPs	PY 5
Implementation	Implement identified non-structural BMPs	PY 6
	Install structural BMPs and conduct performance evaluations	Meet 20% of required reduction by **PY 8** (FY26) and full required reduction by PY 15 (FY33)

Abbreviations:

- BMP = best management practice
- MS4 = Municipal Separate Storm Sewer System
- N = nitrogen
- NSIR = nutrient source identification report
- P = phosphorus
- PCP = phosphorus control plan
- PY = permit year

1.1.1 Legal Analysis

Permit Requirement: The permittee shall conduct an analysis to identify the existing regulatory mechanisms available to the municipality such as by-laws and ordinances to minimize phosphorus loading from public and private property and describe any planned changes to these regulatory mechanisms that may be necessary to effectively implement the PCP. This may include the creation or amendment of financial and regulatory authorities. The permittee shall adopt any identified regulatory changes by the end of the permit term.

In 2020, the Town of Hudson Planning Board updated their Chapter 290 Stormwater Management regulations to require enhanced stormwater treatment for new and redevelopment projects that disturb more than 40,000 square feet area consistent with the 2017 NH MS4 Permit. This includes new residential subdivisions or newly proposed or redeveloped commercial or multifamily residential properties subject to the Site Plan and Subdivision approval.[1]

The updated regulations require new development projects that will disturb 40,000 square feet or more incorporate stormwater treatment BMPs that have rated pollutant removal efficiencies of 80% and 50% for Total Suspended Solids (TSS) and Total Phosphorus (TP), respectively, for the total post-construction impervious area. For redevelopment, these projects must treat at least 30% of the existing impervious cover and 50% of any new impervious cover with stormwater BMPs. While the new regulations are expected to require considerable treatment for new impervious area, equally as important, redevelopment projects could potentially reduce existing pollutant loads to Robinson Pond. However, with much of the developed areas in the watershed consisting of single-family residential homes, the opportunities for redevelopment projects in the watershed are likely limited.

Smaller new and redevelopment projects that are expected to disturb more than 20,000 sq. ft but less than 40,000 sq. ft. of area, are required to include Low Impact Development (LID) measures, to the maximum extent practical. The minimum lot size requirements for the various zoning districts as defined in the Town Code Article IV. Relevant zoning provisions are summarized in Table 2 below.

1 Post-Construction Stormwater Management Standards for New and Redevelopment, Town of Hudson Chapter 290 §290-5 (2020). https://ecode360.com/14425780

Table 2. Hudson Zoning Districts & Statistics

District (abbreviation)	Brief Description	Proportion of Town Area	Minimum Lot Area (sq. ft.)	
			With Water & Sewer	Without Water & Sewer
Residential – One (R-1)	Single family residential dwellings	1,622 acres (8.7%)	30,000	43,560
Residential – Two (R-2)	Single family or duplex dwellings	4,371 acres (23.5%)	43,560	60,000 (43,560 if single family)
Town Residential (TR)	Historic residential areas established prior to zoning	895 acres (4.8%)	10,000	10,000
Business (B)	General wholesale & retail commercial uses, multi-family residential dwellings	792 acres (4.3%)	30,000	43,560
Industrial (I)	Nonresidential industrial development, warehousing, business, and commercial	1,100 acres (5.9%)	30,000	43,560
General (G)	All areas not included in the Districts defined above & may allow any uses	2,717 acres (14.6%)	43,560	43,560
General One (G-1)	Same allowed uses as General but outside Circumferential Highway right-of-way	7,060 acres (37.9%)	87,120	87,120

Sources: https://ecode360.com/14358502
https://ecode360.com/attachment/HU1110/HU1110-334d%20Table%20of%20Minimum%20Dim%20Req.pdf
https://www.hudsonnh.gov/sites/default/files/fileattachments/zoning/code_enforcement/page/2061/cdd-zn-map.pdf

The New Hampshire Shoreland Water Quality Protection Act (SWQPA) establishes minimum standards for development in the protected shoreland area, which is defined as 250 feet inland of the water body reference line. The Act applies to all lakes and ponds greater than 10 acres, all 4th order and greater streams and rivers, most designated rivers which may include sections of less than 4th order, and all tidal waters. At a minimum, primary structures must be set back 50 feet from the reference line and accessory structures set back 25 feet. Municipalities throughout the state may impose more stringent rules regarding setbacks and vegetation removal within the protected shoreland area, but no municipal ordinance may be less restrictive than this Act.[2]

The Town of Hudson has established a 50-foot buffer setback through its Wetland Conservation District which applies to all wetlands and surface waters of any size.[3] Only the following uses are expressly permitted within this District are:

1. Forest management consistent with best management practices,
2. Agriculture consistent with best management practices,
3. Passive recreation such as hiking, fishing, hunting, and non-motorized boating,
4. Wildlife or fisheries management,
5. Water supply wells,
6. Rehabilitation, repair, or replacement of stormwater management facilities or other structures which lawfully existed prior to March 11, 2020.

These regulations do specifically prohibit certain activities such as salt storage, solid or hazardous waste facilities, use of lawn fertilizer, excavations, and underground tanks. However, other uses may be allowed if granted a Conditional Use Permit by the town Planning Board.

2 Shoreland Water Quality Protection Act, NH RSA ch. 483-B (1991). http://www.gencourt.state.nh.us/rsa/html/L/483-B/483-B-mrg.htm

3 Uses within Wetland Conservation District, Town of Hudson Article IX §334-36 (1995). https://ecode360.com/14358563

1.1.2 Funding Source Assessment

Permit Requirement: The permittee shall estimate the cost for implementing its PCP and describe known and anticipated funding mechanisms. The permittee shall describe the steps it will take to implement its funding plan. This may include but is not limited to: conceptual development, outreach to affected parties, and development of legal authorities to collect and administer funds.

The Town's primary source of funding to support municipal services and maintain its existing road, drainage, and facility infrastructure is through annual property taxes, except for water and sewer services which are funded through user fees assessed through dedicated enterprise funds. Maintenance of the Town's roadways and associated stormwater drainage infrastructure are funded through the Department of Public Works (DPW) annual operating budget while the Town's capital improvement plan is used to allocate funds for larger expenditures typically associated with vehicle replacement or purchases, other equipment, or major facility improvements and acquisitions.

The Town has adopted an Impact Fee Ordinance which allows the Planning Board to impose Impact Fees on major development and roadway improvement projects that will adversely impact the future capacity and usage of Town facilities and assets. The impact fee is used to fund future Town facility capacity expansions and improvements that will likely be needed because of the proposed development. These improvements typically include road widenings, additional turning lanes, and related traffic control systems such as lights or signage as well as expanding municipal service facilities or vehicle fleets. Depending on the development, impact fees can also be used to expand the capacity and improve recreation facilities.

Robinson Pond represents a major recreational asset for Town residents and is used for swimming, boating, fishing, and other water related recreational activities. The Town owns and maintains a small beach area that is frequently visited during the summer months. The watershed area is nearly at full build-out conditions with minimal available undeveloped land for future development. Additional analyses would be required to assess whether any existing recreational or transportation related impact fees could be used to enhance the capacity and useability of Robinson Pond through measures designed to improve water quality conditions.

Future control measures could also be funded through the Town's capital improvement planning process especially for planned structural improvements designed to treat stormwater runoff from Town-owned property.

The Nashua Regional Planning Commission (NRPC) provides technical assistance to the Town, especially in relation to Robinson Pond. In December 2000 the NRPC received under an EPA 604(b) Watershed Planning Grant a to develop a Water Quality Protection Plan for Robinson Pond. The goal of this plan is to identify best management practices which may improve water quality in the Pond.

Another low-cost funding source relates to the state's **Clean Water State Revolving Fund** (CWSRF) administered by the NH Department of Environmental Services (NHDES). This program provides low-interest loans with some principal forgiveness for eligible planning, design, and construction projects for stormwater and water quality improvement projects, especially those in the watersheds of impaired water bodies. The annual application process generally occurs in early spring (late March to May) and project awards are typically decided by mid to late June. In recent years, NHDES has granted principal forgiveness of up to $75,000 for most projects. Interest rates on outstanding loan balances have been at around 2 percent. This program should be strongly considered to finance future stormwater treatment project or even a public education campaign in the Robinson Pond watershed.

2

Existing Baseline Conditions

2.1 General Description

Robinson Pond is approximately 130 acres in size with a maximum depth of 29.5 feet and an average depth of 8.0 feet. Robinson Pond is a widely used recreational resource that supports swimming, boating, and fishing activities. The Town has its own recreational beach that is actively used throughout the summer. The Pond watershed area is comprised of approximately 1,250 acres and is largely contained within the Town of Hudson, although the northeastern most section of the watershed extends into the Town of Londonderry.

Robinson Pond, like many other lakes and ponds in southern New Hampshire, is classified as eutrophic, which means it is generally nutrient rich, and usually has low water transparency or clarity, abundant aquatic vegetation, and low levels of dissolved oxygen at depth. The pace of eutrophication can accelerate with increased development within the watershed. Increased development introduces other sources of nutrients such as lawn fertilizer, septic tanks, pet waste, sediment erosion, and increased delivery via stormwater runoff from impervious surfaces. As a result, phosphorus levels such as in Robinson Pond will continue to increase unless proactive measures are taken.

In the most recent 2020/2022 Section 303(d) list published by NHDES, Robinson Pond (AUID: NHLAK700061203-06-01) is included as being impaired for Primary Contact Recreation due to Chlorophyll-a (Chl-a), cyanobacteria, and *E. Coli*. The Pond is also listed as impaired for Aquatic Life Integrity due to Chl-a, dissolved oxygen saturation, non-native aquatic plants, pH, and total phosphorus. The Robinson Pond Town Beach (AUID: NHLAK700061203-06-02) is also listed due to dissolved oxygen saturation, pH, cyanobacteria, and *E. Coli*.

The impairments observed in Robinson Pond are typically the result of nutrient enrichment, specifically high levels of total phosphorus. Thus, significant reduction in the total phosphorus levels would improve conditions related to dissolved oxygen and Chl-a and would help to support the designated uses for Robinson Pond. Total phosphorus enters the lake from precipitation, storm water runoff, and ground water flow. Land use changes can affect the amount of phosphorus contributed from different areas within the watershed. The Robinson Pond watershed consists of 5 sub-watersheds that Includes Launch Brook, Howard Brook, Juniper Brook, Robinson Road Direct Drainage, and Direct Drainage and two emergent wetlands known as the Northern Cove and Southern wetlands.

Approximately 40% of the land area within the watershed area is developed, primarily as single-family homes. Approximately 75% of the watershed around the northerly, easterly, and southerly side of the lake is zoned as residential use within the General (G-1). The western side of the lake is zoned as a Residential R-1 zone. The minimum lot size in the R-1 and G-1 zones are 1 acre (43,560 sq. ft) and 2 acres (87,120 sq. ft.), respectively. According to the Town of Hudson's sewer service area, municipal wastewater utilities are not available for properties within the Robinson Pond watershed, and thus, homes must rely on private wastewater disposal systems.

2.2 2011 Robinson Pond TMDL Study

2.2.1 The MS4 Permit and Lake and Pond TMDL Requirements

The Robinson Pond Phosphorus Total Maximum Daily Load (TMDL) study is one of 16 TMDL studies that were completed in New Hampshire in 2011 and were funded by the US EPA. The intent of a TMDL is to evaluate and quantify the source contributions in lakes and ponds that show symptoms of excessive nutrient inputs, to recommend best practices that will restore water quality conditions and improve the recreational and aquatic life uses in these lakes and ponds. These TMDL studies have now become part of the 2017 NH MS4 Permit, which requires certain load reduction targets be achieved over a 15-year time frame extending out to 2033. The 2017 MS4 Permit requires that the Town adopt measures to achieve an interim 30% load reduction target by Permit Year 8 or Fiscal Year 2026.

2.2.2 Estimated Phosphorus Loads by Source

Phosphorus is contributed from various sources including atmospheric deposition (rainfall), stormwater runoff from impervious surfaces, fertilizer usage, pet waste and livestock manure, improperly sized, maintained, or sited septic systems in the near shore area, wildlife (waterfowl and beaver), and internal loading. Internal loading refers to the release of phosphorus from deposited sediments on the lake floor typically under a low dissolved oxygen or anoxic environment. The amount of internal loading that may occur depends on the length of time water in the bottom layer thermally stratifies from upper water setting up low oxygen conditions. External loading from the surrounding watershed area occurs as a result of human activities that introduce nutrient imports or land use conversions that allow more effective delivery of phosphorus to the lake via increased stormwater runoff. Wildlife, such as waterfowl and beaver, are known to be present within the Robinson Pond watershed and surrounding brooks and contribute to the annual total phosphorus load within the watershed.

2.2.3 TMDL Phosphorus Load Estimates

The 2011 Robinson Pond TMDL Study estimated the average annual phosphorus load to the Pond using the ENSR-LRM methodology, which is a model developed by AECOM and modified for New Hampshire by adding phosphorus export coefficients New Hampshire specific land uses and by including septic system loading. The Robinson Pond watershed was divided into five subwatershed areas based on tributaries and topography. Phosphorus load was then estimated for each watershed as well as atmospheric, internal, waterfowl, and septic system loading.

Table 3 provides a breakdown of the estimated total phosphorus loads by source or watershed area draining to Robinson Pond as developed by the 2011 TMDL Study, which amounts to 115.2 kg/year or 254 lbs./year. The estimated phosphorus from the watershed area accounts for 85% of the estimated annual total phosphorus load or 97.4 Kg/yr. (215 lbs./yr) that drain while another approximately 8% of the estimated load was assumed to be contributed from direct atmospheric deposition to the lake, 2% was estimated to be contributed from internal loading, of bottom sediments and 3% was estimated to be contributed from shoreline septic systems, and 2% was estimated to be contributed from wildlife.

Table 3. 2011 Robinson Pond TMDL Phosphorus Loading Summary

Estimated TP Inputs by Source/ Drainage Area	TMDL TP Load Estimates		% of Total Load
	(kg/year)	(lbs./year)	
Atmospheric	8.9	19.6	8
Internal	2.3	5.1	2
Wildlife	2.8	6.2	2
Septic System	3.8	8.4	3
Watershed Loads			
Launch Brook	30.4	67.0	26
Howard Brook	18.3	40.4	16
Direct Drainage	36.0	79.4	31
Direct Drainage near Juniper	8.5	18.7	7
Direct Drainage near Robinson Rd	3.6	7.9	3
North Wetland	0.3	0.7	<1
South Wetland	0.3	0.7	<1
Total	**115.2**	**254.0**	**100**

Source: Total Maximum Daily Load for Robinson Pond, Hudson, NH. January 2011.

Septic systems in near shore areas are generally considered to pose a greater risk of conveying phosphorus via groundwater to the pond. In New Hampshire, to minimize this risk of phosphorus contributions, many communities have adopted a setback limit of 125 feet for septic systems from the shoreline of surface waters, including tributaries. The 2011 TMDL study estimated a total phosphorus load of 8.4 lbs./yr from 21 homes identified as using septic systems within 125 feet of the Robinson Pond. This translates to approximately 0.4 lbs./yr. per home and approximately 3% of the total estimated phosphorus load.

2.2.4 VHB Phosphorus Load Estimates Using the MS4 Permit Appendix F

Using phosphorus load export rates included in Appendix F of the 2017 MS4 Permit, VHB developed a revised estimate of the average annual watershed load of approximately 170 lbs./year for Robinson Pond. This estimate is also based more recent GIS based land use data contained in the NHGRANIT data library. This revised estimate is based on a watershed area of approximately 1,256 acres and includes the estimated 80 acres located in the Town of Londonderry. The revised phosphorus load estimate is approximately 20% or 45 lbs./year less than the watershed load estimate included in the 2011 TMDL study. This may reflect differences in the inherent assumptions involved with the fate and transport of phosphorus from the various sources between the two modeling approaches.

The revised estimate also does not include the estimated 34.0 lbs./year associated with direct inputs of phosphorus to the pond from atmospheric deposition, waterfowl, near shore septic systems and internal loading from bottom sediments that were included in the 2011 TMDL Study.

Table 4 provides a breakdown of the revised pollutant load estimates for each of the major catchment areas in the watershed in comparison to those listed in the TMDL Study.

Table 4. Robinson Pond Preliminary Phosphorus Loading Estimates By Catchment Area[1]

Catchment Area	Land Area (acres)	Impervious Cover Area (acres)	Est. Phosphorus Load (lbs./year)	% of Estimated Total Load
Launch Brook	241	25.4	36.6	22%
Launch Brook (Londonderry)	80	9.0	14.2	8%
Subtotal	**321**	**34.4**	**50.8**	**30%**
Direct Drainage1	25	3.8	3.2	2%
Direct Drainage2	198	23.1	27.4	16%
Direct Drainage3	159	8.8	21.2	12%
Subtotal	**382**	**35.7**	**51.8**	**31%**
Howard Brook_	335	25.1	43.5	26%
Juniper Brook Direct Drainage	128	13.8	17.9	11%
Robinson Rd Direct Drainage	49	5.4	5.2	3%
North Wetland	21	0.00	0.3	0%
South Wetland	20	0.02	0.2	0%
Total	**1,256**	**114**	**170**	**100%**

Notes: [1] 'These P load estimates are based on preliminary data and are subject to change with new information that may be collected in future years.

2.2.5 Estimated Phosphorus Load Reduction Targets

The 2011 TMDL Study suggested that the estimated overall average annual phosphorus load would need to be reduced by approximately 40% to nearly 102.0 lbs./yr to lower the average in-lake phosphorus concentration to 12 µg/L, which represents an average in-lake concentration for New Hampshire mesotrophic lakes as opposed eutrophic lakes based on NHDES lake data. This average annual phosphorus concentration would likely result in a noticeable decrease in the nuisance algal blooms and an improvement in low dissolved oxygen conditions. Accounting for only the watershed portion of the overall estimated load developed in the TMDL study, the current estimated watershed load would need to be reduced by 48% to lower the in-lake concentration to 12 µg/L. The 2017 MS4 Permit also lists the same 48% reduction target in Table F-2 of Appendix F.

If we exclude the Londonderry portion of the watershed, since Hudson would not have any control on this part of the watershed, then Hudson's portion of the baseline watershed load estimate would likely need to be reduced by 56%, or approximately 95.2 lbs/yr. Using the revised watershed load of 155.8 lbs. P/yr to represent Hudson's portion of the watershed load and the suggested 48% reduction from the TMDL Study, then the estimated watershed load would need to be reduced by approximately 95.2 lbs./yr. This will require a wide range of nutrient reduction measures for both municipal and privately-owned properties to achieve this reduction goal.

Accounting for the MS4 Permit timeline, Table 3.1 provides a summary breakdown of the relevant phosphorus load and the target load reductions for specific milestone years.

Table 3.1. PCP Timeline of Reduction Requirements for Robinson Pond

Phosphorous Load Calculation	Load Value
Baseline P-Load, lbs/yr	170 lbs/yr[1]
Required P Reduction based on TMDL 48% Red., lbs/yr	0.56 * 170 = 95.2
Allowable P-Load from Hudson watershed, lbs/yr	155.8 – 95.2 = 60.6
Stormwater P-Load Reduction Requirement, lbs/yr	95.2

Phosphorus Load Reduction Requirement	Load Value
Year 8 Milestone: 20% of Reduction, in lbs./yr.	0.2 * 95.2 = 19.0
Year 10 Milestone: 40% of Reduction, in lbs./yr.	0.4 * 95.2 = 38.0
Year 13 Milestone: 70% of Reduction, in lbs./yr.	0.7 * 95.2 = 66.7
Year 15 Milestone: 100% of Reduction, in lbs./yr.	95.2

Notes; [1]The Baseline load is based on total watershed load of 170 lbs./yr. less Londonderry portion of 9.0 lbs./yr.

The feasibility of achieving these reduction goals will depend largely on how much of the estimated load is associated with Town-owned land and other sources can be feasibly managed avia stormwater treatment measures implemented over time. The Town has approximately 73 acres of road area plus approximately 3.0 acres associated with the town beach and boat launch area within the watershed. Assuming an estimated average phosphorus load rate of approximately 3.0 lbs./ac./yr. for roadway areas in medium residentially developed areas (based on pollutant load coefficients in Table 2.1 of Attachment 2 of Appendix F), this would result in an estimated total phosphorus load of approximately 150 lbs./year associated with town owned land within the watershed.

As a best-case scenario, even if all the town-owned land could be treated by a stormwater treatment measure with an average annual removal efficiency of approximately 50%, (generally represents the higher end for most stormwater treatment measures), at most, this would achieve a total phosphorus load reduction of 75 lbs./year, which is considerably less than the overall target load reduction of 95.2 lbs./year, as discussed above. Realistically, given the various physical and topographic constraints that are likely to be encountered, only a small fraction of the overall town-owned land is likely be able to be treated. This would result in a much lower maximum load reduction that can be feasibly achieved.

Certain land areas and phosphorus loads may be easier to treat or control more than others. An evaluation of potential phosphorus control measures will be conducted in Year 6 consistent with MS4 Permit requirements and the results of this evaluation will be included in this Report.

3

Proposed Load Reduction Measures

3.1 Stormwater Treatment Measures

Based on the 2017 NH MS4 permit requirements discussed above, the Town will need to install structural stormwater controls to treat discharges from its MS4 system and Town-owned property within the Robinson Pond watershed. VHB has conducted a preliminary field analysis to identify Structural controls may be new BMPs or retrofits to the existing drainage system.

3.1.1 Structural Measures

The following represents a list of several potential stormwater BMP retrofit locations along Town-owned roads and properties based on a very preliminary field investigation that focused on areas where stormwater drained from town-owned land.

Estimated Source Contributions			Implementation				
Source	Location/ Area to be treated (ac)	Est. Annual Phosphorus Load (lbs./yr.)[1]	Treatment Volume (ft^3)	Preliminary Assumed Treatment Measures[2]	Design Storage Volume[3]	Est. TP Removal Efficiency	Est. TP Load Reduction (lbs./yr.)
Road Runoff	**East Side of Pond**						
	Town Boat Launch / 0.6 ac	0.66	1,200	Biofiltration	0.20"/ 0.60"	25% / 44%	0.16 / 0.40
				Infiltration galley with filter media	0.20"/0.60"	33% / 73%	0.22 /0.48
	Town Beach / 2.7 ac	0.42	4,900	Perm. pavement w/ underdrain	12" / 24" Filter depth	62% / 75%	0.26 / 0.31
				Infiltration basin	0.20"/0.60"	60% / 90%	0.25 / 0.38
				Soil stabilization	-	-	-
	David Drive / 7.5 ac	1.25	13,200	Biofiltration / Rain Garden	0.20" / 0.60"	25% / 44%	0.31 / 0.55
	Kienia Rd- @ Edgewood /2.3 ac	0.46	4,200	Biofiltration / Rain Garden	0.20"/ 0.60"	25% / 44%	0.11 / 0.20
	West Side of Pond						
	Boulder Dr @ Beechwood /1.9 ac	1.1	3,500	Biofiltration / Rain Garden	0.20"/ 0.60"	25% / 44%	0.27 / 0.66
	Stoney Lane / 44.8 ac	2.2	78,500	Biofiltration / Rain Garden	0.20"/ 0.60"	25% / 44%	0.55 / 0.97
	Hazelwood Road / 15.7cac	1.0	22,300	Biofiltration / Rain Garden	0.20"/ 0.60"	25% / 44%	0.25 / 0.44
	Total	**7.1 lbs./yr**				**Low / High**	**~ 2.5 / 4.5**

To estimate the potential phosphorus load reduction that might be achieved at each of these BMPs, it was generally assumed that only enough space would be available to treat 0.2" or a maximum of 0.6" of runoff from the drainage area instead of the full 1.0-inch of runoff that is typically used for BMP design in accordance with the NH Stormwater Manual. Based on this assumption and depending on the BMP type, the potential phosphorus removal efficiency was estimated to range between 25% and 45% for flow-through type BMPs with a higher range of 73% to 90% for infiltration type BMPs based on the EPA BMP performance curves contained in Appendix F of the 2017 NH MS4 permit.

Based on these assumptions, the overall phosphorus load reduction that might be achieved if all the BMPs were constructed is estimated to range between 2.5 to 5.0 lbs./yr. depending on the actual BMP sizing and amount of area treated. An average estimated load reduction of approximately 4.0 lbs./yr. represents approximately 25% of the targeted load reduction of 16 lbs./yr. for Year 8 of the permit.

3.1.2 Non-Structural Measures

As outlined in Table 3.2 below, an additional 5.0 to 8.0 lbs. P/yr. is estimated to potentially be reduced through various good housekeeping measures including street sweeping and catch basin cleaning. These load reduction estimates are based on the calculations and methods outlined in Appendix F, Attachment 2 of the 2017 MS4 Permit (See Attached).

Planned Non-Structural BMP	Average Annual Area Managed	Average Annual P-Reduction (lbs/yr)	Anticipated Implementation Level
Street Sweeping	Town Roads (11 miles)	2 to 15%	~ 1.5 to 3.5 lbs. P/yr.
CB Cleaning	Town Roads (11 miles)	2%	~ 1.0 – 1.5 lbs. P/yr.
Enhanced Leaf Litter collection / Sweeping Program	Town roads (29.3 acres)	5%	~ 2.5 – 3.0 lbs. P/yr.
Estimated Total P Load Reduction (lbs./yr.)			**~ 5.0 -8.0 lbs. P/yr.**

Notes: Enhanced Leaf Collection / Sweeping Program consists of weekly sweeping from September 1st to Dec 1st.

3.1.3 Overall Preliminary Estimated Phosphorus Load Reductions

Based on these assumptions, a total phosphorus reduction of approximately 7.5 to 12 lbs./yr. or 50 to 75% of the targeted total watershed phosphorus load could be achieved through the combination of the structural and non-structural measures described herein. Perhaps additional phosphorus load reductions could be achieved through public education programs that focused on limiting and/or improving lawn fertilizer application techniques, increasing awareness for proper pet waste disposal and septic system maintenance. The Town has disseminated education materials on these matters annually consistent with the 2017 MS4 Permit requirements but perhaps other more rigorous and proven educational activities or materials developed elsewhere could be implemented to try have a greater impact on homeowner behavior. Encouraging homeowners to utilize measures to manage stormwater on their own property through the NHDES "Soak up the Rain" program could also provide greater load reductions. The Program is designed to assist homeowners , especially waterfront properties adjacent to sensitive water bodies.

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APPENDIX A:

MS4 Appendix F Requirements for a Phosphorus Control Plan

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III. Lake and Pond Phosphorus TMDLs

Permittees that operate regulated MS4s in the municipalities identified on Table F-2 that discharge to waterbodies listed on Table F-2 in Appendix F or their tributaries, and any other permittee that discharges to waterbodies listed on Table F-2 in Appendix F or their tributaries, shall reduce phosphorus discharges to support achievement of the WLA included in the approved TMDLs complying with EITHER Appendix F Part III.1 or Appendix F Part III.2 below.

1. The permittee shall develop a Lake Phosphorus Control Plan (LPCP) designed to reduce the amount of phosphorus in stormwater discharges from its MS4 to the impaired waterbody or its tributaries consistent with assumptions and requirements of the WLA for the phosphorous loadings published in the applicable phosphorus TMDL (see Table F-2 for TMDL names and links to applicable phosphorus TMDLs). Table F-2, Appendix F provides the percent reductions in stormwater total phosphorus load for each municipality to be consistent with the assumptions and requirements of the WLA

Table F-2: Waterbodies and Primary Municipalities subject to a Lake or Pond Phosphorus TMDL

Towns	Water Body Name	% Reduction In TP Load for all Sources	TMDL Link
Amherst; Merrimack	Baboosic Lake	44%	Baboosic TMDL
Merrimack	Horseshoe Pond	76%	Horseshoe TMDL
Manchester	Nutt Pond	71%	Nutt TMDL
Manchester	Pine Island Pond	64%	Pine Island TMDL
Hudson	Robinson Pond	48%	Robinson TMDL
Bedford	Sebbins Pond	64%	Sebbins TMDL
Sandown	Showell Pond	69%	Showell TMDL
Manchester	Stevens Pond	50%	Stevens TMDL
Derry	Hoods Pond	76%	Hoods TMDL
Kingston	Halfmoon Pond	74%	Halfmoon TMDL
Kingston	Greenwood Pond	69%	Greenwood TMDL
Hollis	Flints Pond	40%	Flints TMDL
Manchester	Dorrs Pond	62%	Dorrs TMDL
Kingston; Newton	Country Pond	52%	Country TMDL
Raymond	Governors Lake	47%	Governors TMDL
Bedford	Sandy Pond	51%	Sandy TMDL

   a. The permittee shall develop a Lake Phosphorous Control Plan (LPCP) as part of its written SWMP and update the LPCP in annual reports pursuant to Part 4.4 of

the Permit. The LPCP shall describe measures the permittee will undertake to reduce the amount of phosphorous in MS4 discharges.

b. The LPCP shall be implemented in accordance with the following schedule and contain the following elements:

i. LPCP Implementation Schedule – The permittee shall complete the implementation of its LPCP as soon as possible but no later than 15 years after the effective date of the permit.

ii. The LPCP shall be implemented in accordance with the following schedule and contain the following elements:

Number	LPCP Component and Milestones	Completion Date
1	Legal Analysis	2 years after permit effective date
2	Funding source assessment	3 years after permit effective date
3	Define LPCP scope (LPCP Area)	4 years after permit effective date
4	Calculate Baseline Phosphorus, Allowable Phosphorus Load and Phosphorus Reduction Requirement	4 years after permit effective date
5	Description of planned nonstructural and structural controls	5 years after permit effective date
6	Description of Operation and Maintenance (O&M) Program	5 years after permit effective date
7	Implementation schedule	5 years after permit effective date
8	Cost and Funding Source Assessment	5 years after permit effective date
9	Complete written LPCP	5 years after permit effective date
10	Full implementation of nonstructural controls.	6 years after permit effective date
11	Performance Evaluation.	6 and 7 years after permit effective date
12	1. Performance Evaluation. 2. Full implementation of all structural controls used to demonstrate that the total phosphorus export rate (P_{exp}) from the LPCP Area in mass/yr is equal to or less than the applicable Allowable Phosphorus Load(P_{allow}) plus the applicable Phosphorus Reduction Requirement (P_{RR}) multiplied by 0.80 $P_{exp} \leq P_{allow} + (P_{RR}\ X\ 0.80)$	8 years after permit effective date
13	Performance Evaluation	9 years after permit effective date

14	1. Performance Evaluation. 2. Update LPCP 3. Full implementation of all structural controls used to demonstrate that the total phosphorus export rate (P_{exp}) from the LPCP Area in mass/yr is equal to or less than the applicable Allowable Phosphorus Load(P_{allow}) plus the applicable Phosphorus Reduction Requirement (P_{RR}) multiplied by 0.60 $P_{exp} \leq P_{allow} + (P_{RR}\ X\ 0.60)$ OR that the permittee has reduced their phosphorus export rate by 30kg/year (whichever is greater, unless full Phosphorus Reduction Requirement has been met)	10years after permit effective date
15	Performance Evaluation	11 and 12 years after permit effective date
16	1. Performance Evaluation. 2. Full implementation of all structural controls used to demonstrate that the total phosphorus export rate (P_{exp}) from the LPCP Area in mass/yr is equal to or less than the applicable Allowable Phosphorus Load(P_{allow}) plus the applicable Phosphorus Reduction Requirement (P_{RR}) multiplied by 0.30 $P_{exp} \leq P_{allow} + (P_{RR}\ X\ 0.30)$	13years after permit effective date
17	Performance Evaluation	14 years after permit effective date
18	1. Performance Evaluation. 2. Full implementation of all structural controls used to demonstrate that the total phosphorus export rate (P_{exp}) from the LPCP Area in mass/yr is equal to or less than the applicable Allowable Phosphorus Load(P_{allow}) $P_{exp} \leq P_{allow}$	15years after permit effective date

Table F-3: LPCP components and milestones

iii. Description of LPCP Components:

Legal Analysis- The permittee shall develop and implement an analysis that identifies existing regulatory mechanisms available to the MS4 such as by-laws and ordinances and describe any changes to these regulatory mechanisms that may be necessary to effectively implement the LPCP. 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.

Scope of the LPCP (LPCP Area) - The permittee shall indicate the area in which the permittee plans to implement the LPCP, this area is known as the "LPCP Area". The permittee must choose one of the following: 1) to implement its LPCP in the entire area within its jurisdiction discharging to the impaired waterbody (for a municipality this would be the municipal boundary) or 2) to implement its LPCP in only the urbanized area portion of its jurisdiction discharging to the impaired waterbody. If the permittee chooses to implement the LPCP in its entire jurisdiction discharging to the impaired waterbody, the permittee may demonstrate compliance with the Phosphorus Reduction Requirement and Allowable Phosphorus Load requirements applicable to it through structural and non-structural controls on discharges that occur both inside and outside the urbanized area. If the permittee chooses to implement the LPCP in its urbanized area only discharging to the impaired waterbody, the permittee must demonstrate compliance with the Phosphorus Reduction Requirement and Allowable Phosphorus Load requirements applicable to it through structural and non-structural controls on discharges that occur within the urbanized area only.

Calculate Baseline Phosphorus Load (P_{base}), Phosphorus Reduction Requirement (P_{RR}) and Allowable Phosphorus Load (P_{allow}) –Permittees shall calculate their numerical Allowable Phosphorus Load and Phosphorus Reduction Requirement in mass/yr by first estimating their Baseline Phosphorus Load in mass/yr from its LPCP Area consistent with the methodology in Attachment 1 to Appendix F or the applicable TMDL, the baseline shall only be estimated using land use phosphorus export coefficients in Attachment 1 to Appendix F or the applicable TMDL methodology and not account for phosphorus reductions resulting from implemented structural BMPs completed to date. Table F-2 contains the percent phosphorus reduction required from urban stormwater consistent with the TMDL of each impaired waterbody. The permittee shall apply the applicable required percent reduction in Table F-2 to the calculated Baseline Phosphorus Load to obtain the permittee specific Phosphorus Reduction Requirement in mass/yr. The Phosphorus Reduction Requirement load shall then be subtracted from the Baseline Phosphorus Load to obtain the permittee specific Allowable Phosphorus Load..

Description of planned non-structural controls – The permittee shall describe the non-structural stormwater control measures to be implemented to support the achievement of the milestones in Table F-3. The description of non-structural controls shall include the planned measures, the areas where the measures will be implemented, and the annual phosphorus reductions that are expected to result from their implementation. Annual phosphorus reduction from non-structural BMPs shall be calculated consistent with Attachment 2 to Appendix F. The permittee shall update the description of planned non-structural controls as needed to support the achievement of the milestones in Table F-3, including an update in the updated written LPCP 10 years after the permit effective date.

Description of planned structural controls – The permittee shall develop a priority ranking of areas and infrastructure within the municipality for

potential implementation of phosphorus control practices. The ranking shall be developed through the use of available screening and monitoring results collected during the permit term either by the permittee or another entity and the mapping required pursuant to Part 2.3.4.6 of the Permit. The permittee shall also include in this prioritization a detailed assessment of site suitability for potential phosphorus control measures based on soil types and other factors. The permittee shall coordinate this activity with the requirements of Part 2.3.6.e. of the Permit. A description and the result of this priority ranking shall be included in the LPCP. The permittee shall describe the structural stormwater control measures necessary to support achievement of the milestones in Table F-3. The description of structural controls shall include the planned measures, the areas where the measures will be implemented, and the annual phosphorus reductions in units of mass/yr that are expected to result from their implementation. Structural measures to be implemented by a third party may be included in the LPCP. Annual phosphorus reduction from structural BMPs shall be calculated consistent with Attachment 3 to Appendix F. The permittee shall update the description of planned structural controls as needed to support the achievement of the milestones in Table F-3, including an update in the updated written LPCP 10 years after the permit effective date.

Description of Operation and Maintenance (O&M) Program for all planned and existing structural BMPs – The permittee shall establish an Operation and Maintenance Program for all structural BMPs being claimed for phosphorus reduction credit as part the LPCP. This includes BMPs implemented to date as well as BMPs to be implemented. The Operation and Maintenance Program shall become part of the PCP and include: (1) inspection and maintenance schedule for each BMP according to BMP design or manufacturer specification and (2) program or department responsible for BMP maintenance.

Implementation Schedule – An initial schedule for implementing the BMPs, including, as appropriate: funding, training, purchasing, construction, inspections, monitoring, O&M and other assessment and evaluation components of implementation. Implementation of planned BMPs must begin upon completion of the LPCP, and all non-structural BMPs shall be fully implemented within six years of the permit effective date. Where planned structural BMP retrofits or major drainage infrastructure projects are expected to take additional time to construct, the permittee shall within four years of the effective date of the permit have a schedule for completion of construction consistent with the reduction requirements in Table F-3. The permittee shall complete the implementation of its LPCP as soon as possible or at a minimum in accordance with the milestones set forth in Table F-3. The implementation schedule shall be updated as needed to support the achievement of the milestones in Table F-3, including an update in the updated written LPCP 10 years after the permit effective date.

Cost and funding source assessment – The permittee shall estimate the cost for implementing its LPCP and describe known and anticipated funding mechanisms. The permittee shall describe the steps it will take to implement its funding plan. This may include but is not limited to

conceptual development, outreach to affected parties, and development of legal authorities.

Complete written LPCP – The permittee must complete the written LPCP 5 years after permit effective date. The complete LPCP shall include item numbers 1-8 in Table F-3. The permittee shall make the LPCP available to the public for public comment during the LPCP development. EPA encourages the permittee to post the LPCP online to facilitate public involvement. The LPCP shall be updated as needed with an update 10 years after the permit effective date at a minimum to reflect changes in BMP implementation to support achievement of the phosphorus export milestones in Table F-3. The updated LPCP shall build upon the original LPCP and include additional or new BMPs the permittee will use to support the achievement of the milestones in Table F-3.

Performance Evaluation – The permittee shall evaluate the effectiveness of the LPCP by tracking the phosphorus reductions achieved through implementation of structural and non-structural BMPs[3] and tracking increases in phosphorus loading from the LPCP Area beginning six years after the effective date of the permit. Phosphorus reductions shall be calculated consistent with Attachment 2 (non-structural BMP performance), Attachment 3 (structural BMP performance) and Attachment 1 (reductions through land use change), to Appendix F for all BMPs implemented to date[4]. Phosphorus load increases resulting from development shall be calculated consistent with Attachment 1 to Appendix F. Phosphorus loading increases and reductions in units of mass/yr shall be added or subtracted from the calculated Baseline Phosphorus Load to estimate the yearly phosphorous export rate from the LPCP Area in mass/yr. The permittee shall also include all information required in Part III.1.c. of this Appendix in each performance evaluation.

c. Reporting. Beginning 6 years after the permit effective date, the permittee shall include the following in each annual report submitted pursuant to Part 4.4 of the Permit:
   i. All non-structural control measures implemented during the reporting year along with the phosphorus reduction in mass/yr (P_{NSred}) calculated consistent with Attachment 2 to Appendix F
   ii. Structural controls implemented during the reporting year and all previous years including:
      1. Location information of structural BMPs (GPS coordinates or street address)

[3] In meeting its phosphorus reduction requirements a permittee may quantify phosphorus reductions by actions undertaken by another entity, except where those actions are credited to another permittee identified in Appendix F Table F-2

[4] Annual phosphorus reductions from structural BMPs installed in the LPCP Area prior to the effective date of this permit shall be calculated consistent with Attachment 3 to Appendix F. Phosphorus Reduction Credit for previously installed BMPs will only be given if the Permittee demonstrates that the BMP is performing up to design specifications and certifies that the BMP is properly maintained and inspected according to manufacturer design or specifications. This certification shall be part of the annual performance evaluation during the year credit is claimed for the previously installed BMP.

2. Phosphorus reduction from all structural BMPs implemented to date in mass/yr (P_{Sred}) calculated consistent with Attachment 3 to Appendix F
3. Date of last completed maintenance for each Structural control

iii. Phosphorus load increases due to development over the previous reporting period and incurred to date (P_{DEVinc}) calculated consistent with Attachment 1 to Appendix F.

iv. Estimated yearly phosphorus export rate (P_{exp}) from the LPCP Area calculated using Equation 1. Equation 1 calculates the yearly phosphorus export rate by subtracting yearly phosphorus reductions through implemented nonstructural controls and structural controls to date from the Baseline Phosphorus Load and adding loading increases incurred through development to date. This equation shall be used to demonstrate compliance with the phosphorus reduction milestones required as part of each phase of the LPCP.

$$P_{exp}\left(\frac{mass}{yr}\right) = P_{base}\left(\frac{mass}{yr}\right) - \left(P_{Sred}\left(\frac{mass}{yr}\right) + P_{NSred}\left(\frac{mass}{yr}\right)\right) + P_{DEVinc}\left(\frac{mass}{yr}\right)$$

Equation 1. Equation used to calculate yearly phosphorus export rate from the chosen LPCP Area. P_{exp}=Current phosphorus export rate from the LPCP Area in mass/year. P_{base}=baseline phosphorus export rate from LPCP Area in mass/year. P_{Sred}= yearly phosphorus reduction from implemented structural controls in the LPCP Area in mass/year. P_{NSred}= yearly phosphorus reduction from implemented non-structural controls in the LPCP Area in mass/year. Area in mass/year. P_{DEVinc}= yearly phosphorus increase resulting from development since the year baseline loading was calculated in the LPCP Area in mass/year.

v. Certification that all structural BMPs are being inspected and maintained according to the O&M program specified as part of the PCP. The certification statement shall be:

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.

d. At any time during the permit term the permittee may be relieved of additional requirements in Appendix F Part III.1.a - b as follows.

i. The permittee is relieved of its additional requirements as of the date when the following conditions are met:
   1. The applicable TMDL has been modified or revised and EPA has approved a new TMDL applicable for the receiving water that indicates that no additional stormwater controls for the control of phosphorus are necessary for the permittee's discharge based on wasteload allocations in the newly approved TMDL

ii. When the criteria in Appendix F part III.1.d.i. are met, the permittee shall document the date of the approved TMDL in its SWMP and is relieved of

any remaining requirements of Appendix F part III.1.a.-b. as of that date and the permittee shall comply with the following:

1. The permittee shall identify in its SWMP all activities implemented in accordance with the requirements of Appendix F part III.1.a.-b. to date to reduce phosphorus in their discharges including implementation schedules for non-structural BMPs and any maintenance requirements for structural BMPs
2. The permittee shall continue to implement all requirements of Appendix F part III.1.a.-b. required to be implemented prior to the date of the newly approved TMDL, including ongoing implementation of identified non-structural BMPs and routine maintenance and replacement of all structural BMPs in accordance with manufacturer or design specifications, and the reporting requirements of Appendix F part III.1.c. remain in place.

2. The MS4 operator shall work with NHDES to develop an Alternative Phosphorus Reduction Plan consistent with the applicable TMDL. The MS4 operator shall submit a NHDES-approved Alternative Phosphorus Reduction Plan that is consistent with the TMDL Implementation Plan and includes schedules and milestones to meet applicable Waste Load Allocations consistent with the schedules and milestones contained in Appendix F part III.1 above, with their Notice of Intent (NOI) as an alternative to the requirements described in Appendix F part III.1 above.

a. The Alternative Phosphorus Reduction Plan shall be subject to EPA review and the public comment period consistent with the NOI procedures at part 1.7.4.b. of the permit.
b. The permittee shall keep the written plan (hardcopy or electronic) as part of their SWMP.
c. The permittee shall implement all operator-specific permit requirements included in the permittee's authorization letter from EPA based on the Alternative Phosphorus Reduction Plan.
d. Unless the operator-specific permit requirements related to the Alternative Phosphorus Reduction Plan are authorized by EPA, the permittee is subject to the requirements described in Appendix F part III.1 above.