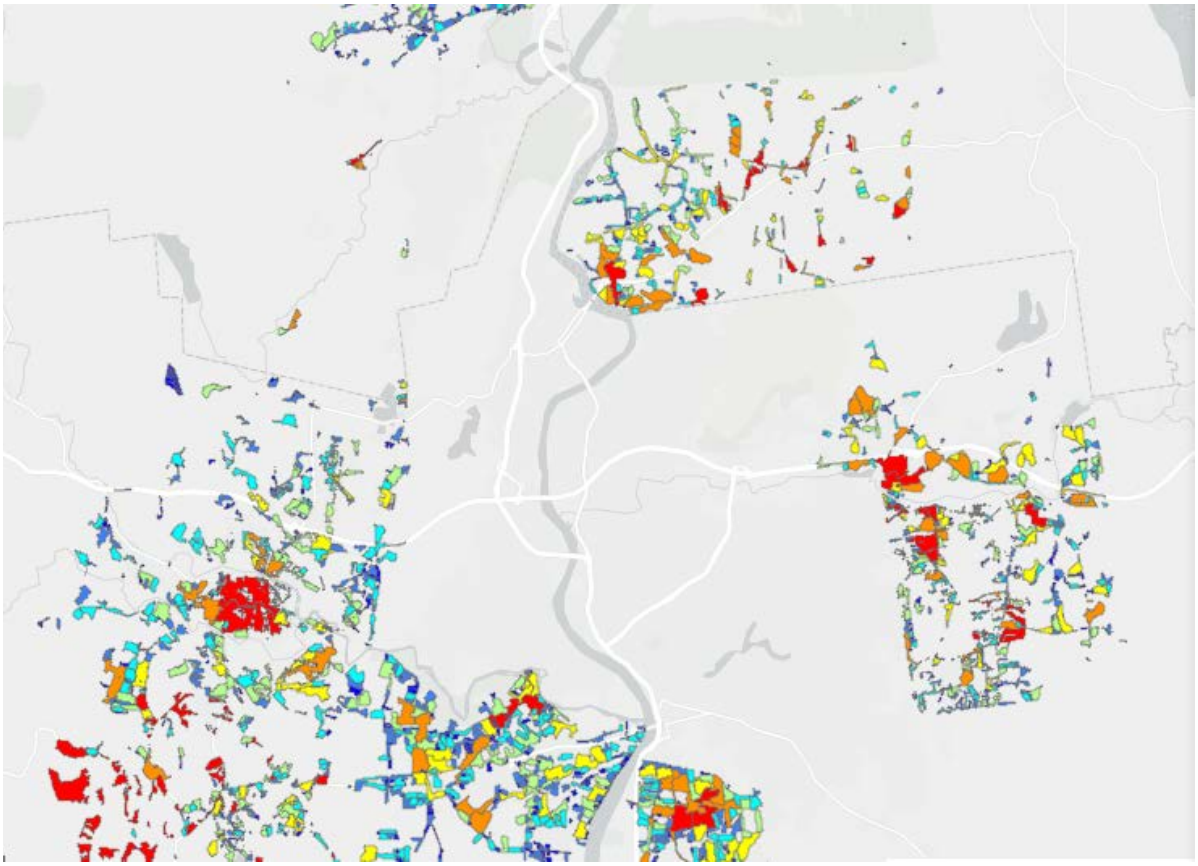
Nitrogen Source Identification Report

Town of Wilbraham



Prepared by: Pioneer Valley Planning Commission
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FINAL DRAFT

This document is a grant deliverable and is

not submitted as a regulatory compliance document.

Acknowledgements

This document is one among 20 Nutrient Source Identification Reports prepared by the Neponset River Watershed Association (NepRWA) and the Pioneer Valley Planning Commission (PVPC). These reports are meant to provide MS4 permitted municipalities with documents they can finalize and submit to U.S. EPA as part of their Year 4 reporting requirements.

This work is made possible through a grant from the MassDEP Municipal Assistance Program. Project staff from NepRWA and PVPC appreciate the conversation and feedback provided by MassDEP and U.S. EPA staff in working through methodology to prepare these reports. Aside from producing nutrient source identification reports for 20 communities, this project also resulted in the following: lake-pond phosphorous control plan Year 4 submission requirements for two communities; documentation of approach and methods for use by other MS4 permittees across MA in meeting these Year 4 requirements; and setting of the stage for upgrading existing stormwater infrastructure in key high pollutant loading catchments.

NepRWA and PVPC staff are grateful also to the partner communities who joined them in this pilot project. Following is a list of cities and towns that participated:

Agawam
Canton
Dedham
Foxborough
Granby
Longmeadow
Ludlow
Medfield
Milton
Northampton
Quincy
Randolph
Sharon
South Hadley
Southampton
Southwick
Stoughton
Westfield
Westwood
Wilbraham

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I. Introduction

Nutrients and Water Pollution

The amount of nutrients (phosphorus and nitrogen) delivered to rivers and streams increases greatly with land development and direct discharge of storm flows from certain land uses to receiving waters. In the urban environment, nitrogen and phosphorous come from a variety of sources including organic debris such as fallen leaves, animal and pet waste, lawn and agricultural fertilizers, malfunctioning sewers and septic systems, and atmospheric deposition from car exhaust, among other sources.

Some of these sources also occur in the natural environment. However, the prevalence of paved and impervious areas in the urban and suburban environment, coupled with the availability of storm drain collection systems, allows street runoff containing excess nutrient pollution to quickly move to the nearest waterbody with little or no treatment. Such flows bypass natural processes such as soil filtration and infiltration that would capture and recycle nutrients before they reach waterways in an undeveloped landscape.

As a result, nutrient enriched stormwater runoff has become a major source of water pollution. Nutrient pollution increases undesirable plant and algae growth in waterways, which can be highly toxic to humans and wildlife and reduce oxygen levels in the water. This, in turn, impedes recreation and creates chronic challenges for aquatic life, sometimes leading to fish kills. In freshwater waterways, phosphorous is generally the primary pollutant of concern, while nitrogen becomes the primary concern once freshwater rivers flow into saltwater estuaries and bays.

Regulatory Context

Under the federal and state clean water acts, the Massachusetts Department of Environmental Protection (MassDEP) is charged with establishing water quality standards and determining whether waterways meet these designated standards. MassDEP publishes its *Massachusetts Year 2016 Integrated List of Waters*, also referred to at the 303d Impaired Waters List, identifying waters that do not meet standards. These waterways are referred to as being "impaired" or "water quality limited" based on one or more causes which may include nitrogen, phosphorous, "nutrient/eutrophication biological indicators" or in some cases turbidity or transparency. MassDEP is also charged with preparing waterbody-specific cleanup plans for nutrient pollution known as Total Maximum Daily Loads or TMDLs, though these are yet to be prepared for many impaired waterways.

The Town of Wilbraham ("the Town") is subject to the requirements of the US Environmental Protection Agency's (EPA's) 2016 Massachusetts Small MS4 General Permit. One of the requirements of this permit is that Massachusetts communities located in the watershed of Long Island Sound -- which has an approved TMDL for nitrogen (Total Nitrogen) -- shall prepare a Nitrogen Source Identification Report as detailed in Appendix F of the permit. The Town has several tributaries that flow to either the Chicopee or Connecticut rivers, and all waters of which ultimately drain to Long Island Sound. There is one listing in Town for a water body indicated as having a completed TMDL in Category 4a and two listings for

Chicopee River segments as impaired in Category 5 of MassDEPs 2016 303d list. Table 1 shows the listing of these waters.

The Nitrogen Source Identification Report must be submitted with the permit year 4 annual report (year ending June 30, 2022 and report due late September 2022). Appendix F of the EPA 2016 MS4 Permit describes the following requirements for the Nitrogen Source Identification Report:

1. Calculation of total urbanized area within the permittee's jurisdiction that is within the Connecticut River Watershed, incorporating updated mapping of the MS4 and catchment delineations produced pursuant to part 2.3.4.6;
2. All screening and monitoring results pursuant to part 2.3.4.7.b., targeting the receiving water segment(s);
3. Impervious area and DCIA for the target catchment;
4. Identification, delineation and prioritization of potential catchments with high nitrogen loading;
5. Identification of potential retrofit opportunities or opportunities for the installation of structural BMPs during redevelopment.

Table 1. Impaired Receiving Waters

Category 4a - TMDL Completed					
Water Body	**Segment ID**	**Description**	**Size**	**Units**	**Impairment**
Spectacle Pond	MA36142	Wilbraham - EPA TMDL #3631	9.00	Acres	Nutrient/Eutrophication Biological Indicators
Category 5 - Requiring a TMDL					
Water Body	**Segment ID**	**Description**	**Size**	**Units**	**Impairment**
Chicopee River	MA36-22	Source, confluence of Ware River and Quaboag River, Palmer (through Red Bridge Impoundment formerly segment MA36171) to Red Bridge Impoundment Dam (NATID: MA00723), Wilbraham/Ludlow.	2.8	Miles	Escherichia Coli (E. Coli) Mercury in Fish Tissue
Chicopee River	MA36-24	Wilbraham Pumping Station (old WWTP), Wilbraham/Ludlow to Chicopee Falls Dam (NATID: MA00719), Chicopee.	8.8	Miles	Escherichia Coli (E. Coli) Fecal Coliform

II. Data Sources and Analytical Methods for Identifying Nitrogen Loading

Several existing datasets were used to complete this work. Table 2 below lists the utilized data sets and their origin.

Table 2. Data Sources

Existing Data Set	Origin	Date Published/Updated	Link
2016 Land Cover/Land Use	MassGIS	May 2019	https://docs.digital.mass.gov/dataset/massgis-data-2016-land-coverland-use
Soil Survey Geographic (SSURGO) Database for Hampden and Hampshire Counties, Massachusetts	USDA	June 2020	Downloaded through Web Soil Survey (https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm). Hydrologic soil groups extracted using Soil Data Viewer Version 6.1 (https://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/geo/?cid=nrcs142p2_053619)
Wilbraham Town Catchments	Town of South Wilbraham GIS Files With Assistance from PVPV	Current as of 3/18/21	N/A

Impervious area is the portion of the Town that is paved, covered by buildings, or otherwise rendered unable to absorb water naturally due to development. Impervious area for the town was calculated using the MassGIS 2016 Land Cover/Land Use data layer which was published in 2019. This data layer maps impervious and pervious land cover by land use type based on aerial photography and other data sources. This was overlaid with the Town's data layer for outfall catchment areas (the area draining to each town-owned stormwater discharge point) to estimate total areas and total impervious area discharging to or upstream of nutrient-impaired waterways, as well as to estimate impervious area for each stormwater outfall catchment.

Directly connected impervious area (DCIA), also referred to as "effective impervious cover," is the amount of impervious area that is directly connected to the storm drain system. Most land in

the Town was developed before the creation of modern requirements to capture, clean, slow, and recharge stormwater runoff using Stormwater Control Measures (SCMs). However, many new development and redevelopment projects constructed in recent years have required the installation or upgrade of SCMs, such that today some properties have no SCMs, some have SCMs that meet some modern standards, and some have SCMs that are fully compliant with modern standards.

Because site-specific information about the existence of specific SCMs is not available at the parcel level, an estimate of DCIA or effective impervious cover is used to approximate the average level of SCMs installed across the watershed. Estimating DCIA can yield a more specific pollutant loading estimate for a given area. DCIA was estimated based on land use categories following EPA guidance.

To estimate the pollutant loads for nitrogen and/or phosphorous in each catchment, estimated pollutant loading rates for different combinations of land use type, land cover type, and soil type were applied in accordance with guidance in the EPA 2016 MS4 Permit. The individual loading rates for these unique subsections were summed based on catchment, which produced an overall estimated catchment pollutant loading rate.

For a more detailed description of the analytical methods used for this project, please refer to the Methods document in the Appendix.

III. Total Urbanized/MS4 Regulated Area

The total area of the Town is approximately 14,293 acres, with a total of 9,343 acres located in the urbanized /MS4 regulated area. All of this MS4 regulated acreage is within the Connecticut River Watershed. The urbanized /MS4 regulated area involves 273 outfall catchment areas.

IV. Impervious Area and Directly Connected Impervious Area

Within MS4 Regulated Area

Table 3 below summarizes the total impervious area (IA) and estimated Directly Connected Impervious Area (DCIA) within the Town's MS4 regulated area.

Table 3. Summary of Impervious Area and DCIA within MS4 Regulated Area Catchments

	Acres
Total Impervious Area within MS4 Area	616
Total Estimated DCIA within MS4 Area	177

Table 4 below shows information for the 10 catchments within the MS4 regulated area with the most impervious area. The catchments are labeled using the Town's identifier for the outfall to which they drain. The table is sorted in descending order of total impervious area. A full report on impervious area and estimates of DCIA for all storm drain outfall catchments in the Town can be seen in the on-line ArcGIS data viewer at: https://tinyurl.com/MS4-NSI-PVPC

Table 4. Total Impervious Area and DCIA for the Ten Most Impervious Catchments

Catchment Identifier	Impervious Area (Acres)	Percent Impervious	DCIA (Acres)	Percent DCIA
WILBRAHAM-43	22.04	21.79%	2.43	2.41
WILBRAHAM-299	14.83	60.01%	6.86	27.75
WILBRAHAM-133	14.77	47.05%	4.66	14.84
WILBRAHAM-208	14.53	77.18%	11.17	59.35
WILBRAHAM-141	13.92	36.47%	6.00	15.72
WILBRAHAM-357	12.10	26.86%	3.40	7.55
WILBRAHAM-342	10.71	12.33%	1.27	1.46
WILBRAHAM-10	10.17	54.22%	3.65	19.47
WILBRAHAM-97	10.11	21.28%	2.46	5.17
WILBRAHAM-304	9.57	75.83%	3.37	26.66
Top 10 Catchments as % of Total	21.52%		25.58%	

V. Identification, Delineations, and Prioritization of Potential Catchments with High Nitrogen Loading

Estimated Nitrogen Loading

Using the methods described in the Appendix to this report, estimates of nitrogen loading potential were created for each of the Town's storm drain outfall catchments.

Table 5 shows the five catchments with the highest estimated nitrogen loading in the entire MS4 area. To access full reporting, showing calculated nitrogen loading estimates for all catchments in Town, see the on-line ArcGIS data viewer at: https://tinyurl.com/MS4-NSI-PVPC

Table 5. Estimated Nitrogen Loading for Five Highest-Load Catchments in MS4 Area

Catchment Identifier	Estimated N Load (Lbs/Yr)
WILBRAHAM-43	453.60
WILBRAHAM-342	287.10
WILBRAHAM-335	229.82
WILBRAHAM-141	224.92
WILBRAHAM-357	222.72
Top 5 as a % of Total Town Load	12.36%

Note these are estimated loadings based on soil type, land use and estimated DCIA (e.g. typical level of SCMs in town). Actual loading may vary considerably from site to site depending on what SCMs are actually present, and regional studies such as the Charles River Phosphorous TMDL have indicated that the default DCIA assumptions used by EPA are somewhat optimistic, such that actual loading rates may be higher. However, these estimates provide a valuable guide to help identify those areas of the Town that should be the highest priorities for interventions to begin reducing pollutant loading.

Outfall Screening Monitoring Results

As of the writing of this report, outfall screening results are not available. Once they become available, they will be included in this section and the findings shall be incorporated into the determination of the highest priority catchments with respect to nitrogen loading.

Catchment Prioritization

Since no outfall screening data are currently available to improve projections, this report is prioritizing the catchments based solely on the nitrogen loading estimates, in the order shown in Table 6 below. When outfall screening data become available, the list of catchments should be re-examined and the “Top 5” list should be updated based on these real-world data.

VI. Potential Retrofit Opportunities

Method

Building on method described within the *Pioneer Valley 2014 Regional Green Infrastructure Plan* and through subsequent pilot projects in Springfield and Agawam, PVPC has developed a screening process approach to identify public properties that might be most appropriate for green infrastructure stormwater retrofit locations.

As part of this work, PVPC developed an on-line map/data screening tool to identify potential retrofit opportunities using ESRI's application builder (referred to as *on-line ArcGIS data viewer*). The use of this interface with these layers can help immensely in facilitating decision making. The on-line ArcGIS data viewer displays municipal, state, federal, and private properties by total score of suitability for green infrastructure retrofitting and allows the end user to further explore the values associated with the suitability score for each parcel. Input values can be viewed by either clicking on a parcel to display a "pop-up box" or by viewing the master data table at the bottom of the screen.

Screening considerations, with each their own associated score, include:

- hydrologic soil group
- surface waters listed in Category 4a (TMDL completed) or 5 (Impaired/Requiring a TMDL) on the 2016 Massachusetts List of Integrated Waters, Environmental Justice Areas, size of impervious areas,
- location within the MS4 regulated area
- outfall catchment area phosphorus or nitrogen loading rate below mean value
- outfall catchment area phosphorus or nitrogen loading rate above mean value

The outfall catchment area bullet points above are the latest updates to the screening tool based on the work of this project on nutrient source identification reports. These shape files were developed in ArcMap for Destktop and displayed in the on-line viewer.

For local decision making, considerations in this screening process can be further supplemented and fine-tuned based on local priorities. For some communities, localized flooding has been an important additional consideration. PVPC has also been recommending that where possible communities add tree canopy analysis in the ranking so that investments for improved stormwater pollution control through vegetated systems might also possibly serve to cool summer temperatures in neighborhoods where there are few trees.

More information on the retrofit opportunity screening tool is provided in the Appendix on Methodology to this report.

High Priority Parcels Based on Nitrogen Loading

PVPC mapped, evaluated, and prioritized all parcels within the MS4 regulated area for Nitrogen loading. Shape files were developed in ArcMap for Destktop and displayed in the on-line viewer. While Table 6 below shows highest-priority parcels owned by the municipality, prioritization of state, federal and private parcels is available in the on-line viewer.

Table 6. High-Priority Parcels to be Considered for SCM Development for Nitrogen Loading

Address	Parloc_ID	Nitrogen BMP Score
88 STONY HILL RD	F_390652_2881987	95/95
2720 BOSTON RD	F_404747_2882077	90/95
2721 BOSTON RD	F_404713_2881377	90/95
42V MAYNARD RD	F_409793_2884015	87.5/95
16 MAIN ST	F_405091_2881284	87.5/95
All Rights-Of-Way in Priority Catchments	N/A	All

ArcGIS On-line Data Viewer

The on-line ArcGIS data viewer provides far greater capability in reviewing individual catchments and associated nitrogen loading data to facilitate analysis. From this tool, it is possible to generate analysis that includes the following:

- Impervious and DCIA Amounts for all Catchments, Sorted by Impervious Area
- Estimated Nitrogen Loading for All Catchments
- Ranking of Municipal-Owned Parcels for Nitrogen Removal

The results of this report provide a valuable starting point for the next phase of requirements in Appendix F of the 2016 MS4 Permit which are due by the end of permit year 5 (6/30/2023), which include:

1. Evaluate all properties identified as presenting retrofit opportunities or areas for structural BMP installation under permit part 2.3.6.d.ii. or identified in the Nitrogen Source Identification Report. The evaluation shall include:
    a. The next planned infrastructure, resurfacing or redevelopment activity planned for the property (if applicable) OR planned retrofit date;
    b. The estimated cost of redevelopment or retrofit BMPs; and
    c. The engineering and regulatory feasibility of redevelopment or retrofit BMPs.

2. Provide a listing of planned structural BMPs and a plan and schedule for implementation in the year 5 annual report.

To access the screening tool, see: https://tinyurl.com/MS4-NSI-PVPC