DRAFT TMDL SUMMARY

No Name Brook

WATERSHED DESCRIPTION

This **TMDL** applies to a 10.02 mile section of No Name Brook, located in the City of Lewiston. The impaired segment begins in the northern corner of the watershed in a forested area and flows south crossing Lane Road, Old Greene Road, and No Name Pond Road before flowing into No Name Pond. At the outlet of the pond, No Name Brook continues south through a wetland, crossing Sabattus Street and Grove Street. The stream continues through a forest with sparse development, crossing Randall Road, power lines, Old Webster Road, I-95, Crowley Road, Foss Road, and Jordan Road. The stream then skirts multiple residential developments, crosses under Littlefield Road, and converges with the Sabattus River. The No Name Brook watershed covers an area of 15.42 square miles. The majority of the watershed is located within the City of Lewiston, however, small portions of the watershed lie within the surrounding towns of Greene, Sabattus, and Lisbon.

- Runoff from agricultural land located throughout the northeastern portion of the watershed, especially along Town Farm Road, is likely the largest source of **nonpoint source (NPS) pollution** to No Name Brook. Runoff from cultivated lands, active hay lands, and pasture can transport nitrogen and phosphorus to the nearest section of the stream.
- The No Name Brook watershed is predominately non-developed (83%). Forested areas (61.9%) within the watershed absorb and filter pollutants helping protect both water quality in the stream and stream channel stability. Wetlands (7%) may also help filter nutrients.
- Non-forested areas within the watershed are predominantly agricultural (13.7%) and developed (17%) and are located throughout the watershed.
- Developed areas (17%) with impervious surfaces in close proximity to the steam may impact water quality.
- No Name Brook is on Maine's 303(d) list of Impaired Streams (Maine DEP, 2012).

Definitions

- ***Total Maximum Daily Load (TMDL)*** *represents the total amount of pollutants that a waterbody can receive and still meet water quality standards.*
- **Nonpoint Source Pollution** *refers to pollution that comes from many diffuse sources across the landscape, and are typically transported by rain or snowmelt runoff.*

Waterbody Facts

Segment ID: ME0104000210_418R02

City: Lewiston, ME

County: Androscoggin

Impaired Segment Length: 10.02 miles

Classification: Class C

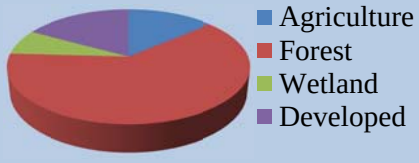
Direct Watershed: 15.42 mi^2 (9,869 acres)

Impairment Listing Cause: Dissolved Oxygen

Watershed Agricultural Land Use: 13.68%

Major Drainage Basin: Androscoggin River

Watershed Land Uses



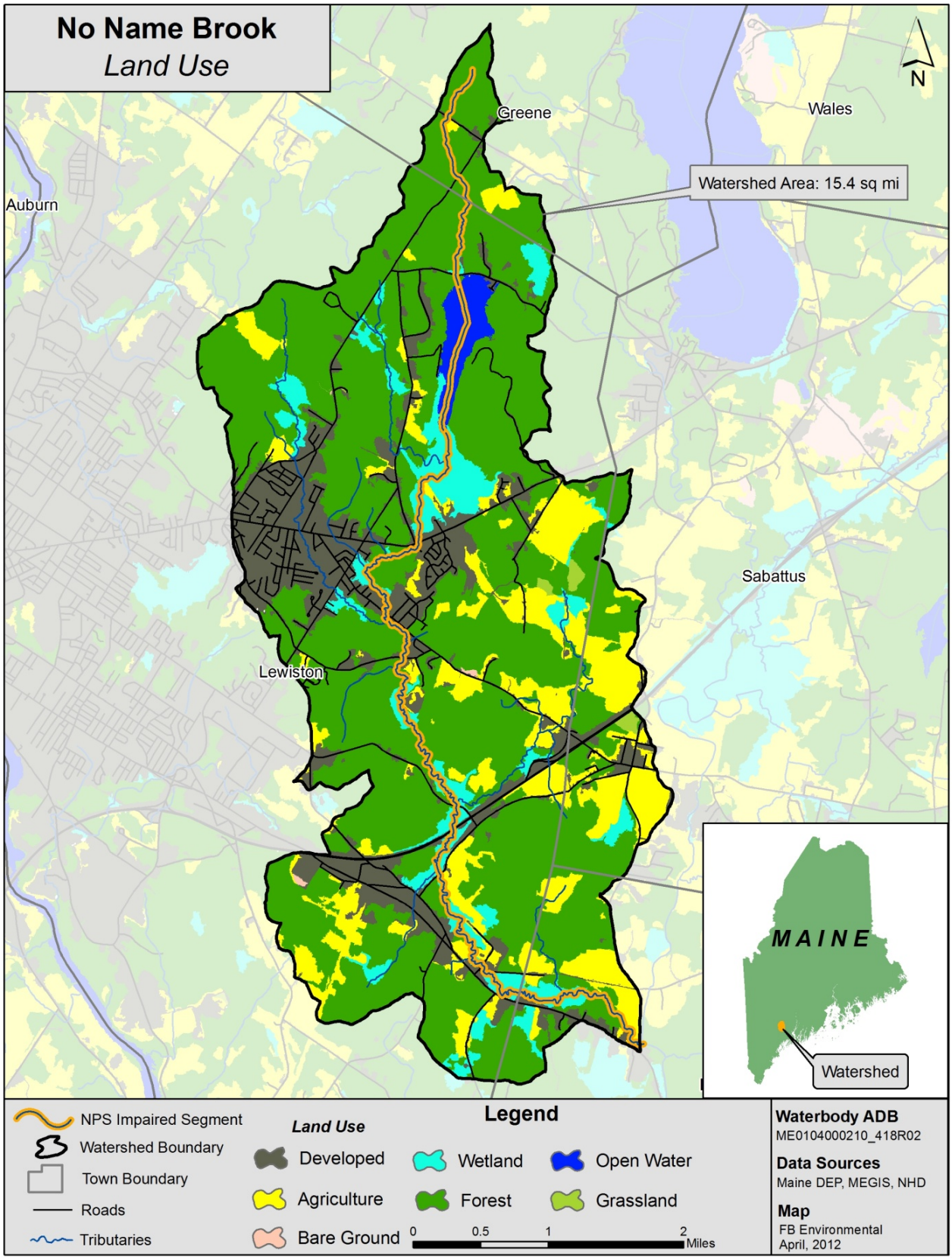


Figure 1: Land Use in the No Name Brook Watershed

WHY IS A TMDL ASSESSMENT NEEDED?

No Name Brook, a Class C freshwater stream, has been assessed by Maine DEP as not meeting water quality standards for the designated use of aquatic life, and placed on the 303(d) list of impaired waters under the Clean Water Act. The Clean Water Act requires that all 303(d)-listed waters undergo a TMDL assessment that describes the impairments and establishes a target to guide the measures needed to restore water quality. The goal is for all waterbodies to comply with state water quality standards.

No Name Brook *near Mill Road crossing. Photo: FB Environmental*

Agriculture in the No Name Brook watershed makes up about 14% of the total watershed area. This is slightly less than the area of developed land at 17% of the watershed. Runoff from impervious surfaces in developed areas as well as agriculture, may be the largest contributors of sediment and nutrient enrichment to the stream, especially along Jordan Road (Town Farm Road). The close proximity of agricultural lands to the stream further increases the likelihood that nutrients from disturbed soils, manure, and fertilizers will reach the stream. Other potential contributors to of nonpoint source pollution included a landscaping/auto repair facility off Lisbon Road and undersized culverts causing sedimentation in the stream. The No Name Brook wetland also has naturally low dissolved oxygen concentrations and may be effecting the concentrations within the stream.

WATER QUALITY DATA ANALYSIS

Maine DEP uses a variety of data types to measure the ability of a stream to adequately support aquatic life, including; dissolved oxygen, benthic macroinvertebrates, and periphyton (algae). The aquatic life impairment in No Name Brook is based on historic data. Additionally, dissolved oxygen data collected from 2009-2011 also found low values at many sampling stations.

TMDL ASSESSMENT APPROACH: NUTRIENT MODELING OF IMPAIRED AND ATTAINMENT STREAMS

NPS pollution is difficult to measure directly, because it comes from many diffuse sources spread across the landscape. For this reason, a nutrient loading model, MapShed, was used to estimate the sources of pollution based on well-established hydrological equations; detailed maps of soil, land use, and slope; many years of daily weather data; and direct observations of agriculture and other land uses within the watershed.

The nutrient loading estimates for the impaired stream were compared to similar estimates for five non-impaired (attainment) streams of similar watershed land uses across the state. The TMDL for the impaired stream was set as the mean nutrient loading estimate of these attainment stream watersheds, and units of mass per unit watershed area per year (kg/ha/year) were used. The difference in loading estimates between the impaired and attainment watersheds represents the percent reduction in nutrient loading required under this TMDL. The attainment streams, nutrient loading estimates, and TMDL are presented below in Table 1.

Table 1: Numeric Targets for Pollutant Loading Based on MapShed Model Outputs for Attainment Streams

Attainment Streams	**Town**	**TP load (kg/ha/yr)**	**TN load (kg/ha/yr)**	**Sediment load (1000 kg/ha/yr)**
Martin Stream	Fairfield	0.14	3.4	0.008
Footman Brook	Exeter	0.33	6.4	0.058
Upper Kenduskeag Stream	Corinth	0.29	5.6	0.047
Upper Pleasant River	Gray	0.22	4.6	0.016
Moose Brook	Houlton	0.25	5.9	0.022
Total Maximum Daily Load		**0.24**	**5.2**	**0.030**

RAPID WATERSHED ASSESSMENT

Habitat Assessment

A Habitat Assessment survey was conducted on both the impaired and attainment streams. The assessment approach is based on the *Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers* (Barbour et al., 1999), which integrates various parameters relating to the structure of physical habitat. The habitat assessments include a general description of the site, physical characterization and visual assessment of in-stream and riparian habitat quality.

Based on Rapid Bioassessment protocols for low gradient streams, No Name Brook received a score of 147 out of a total 200 for quality of habitat. Higher scores indicate better habitat. The range of habitat assessment scores for attainment streams was 155 to 179.

Habitat assessments were conducted on a relatively short sample reach (about 100-200 meters for a typical small stream) near the most downstream Maine DEP sample station in the watershed. For both impaired and attainment streams, the assessment location was usually near a road crossing for ease of access. In the No Name Brook watershed, the downstream sample station was located just upstream on the Foss Road crossing in Lewiston. Pathway Vineyard Church with a large surrounding parking area is nearby to the north of the sample reach. The sample reach was surrounded by a forested buffer through the majority of the reach area. However, a minimal buffer was documented near the Foss Road culvert and the Vineyard Church parking lot.

Figure 2 (right) shows the range of habitat assessment scores for all attainment and impaired streams, as well as for No Name Brook. Though these scores show that habitat is clearly an issue in the impairment of No Name Brook, it is important to look for other potential sources within the watershed leading to impairment. Consideration should be given to major "hot spots" in the No Name Brook watershed as potential sources of NPS pollution contributing to the water quality impairment.

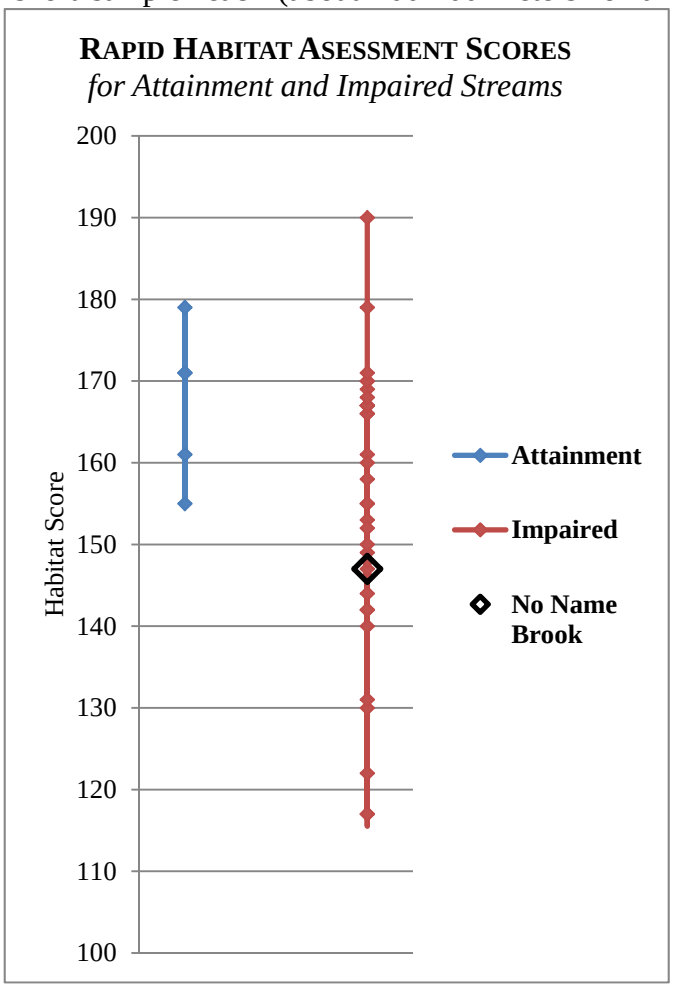


Figure 2: Habitat Assessment Scores

Pollution Source Identification

Pollution source identification assessments were conducted for both No Name Brook (impaired) and all attainment streams. The source identification work is based on an abbreviated version of the Center for Watershed Protection's Unified Subwatershed and Site Reconnaissance method (Wright, et al., 2005). The abbreviated method includes both a desktop and field component. The desktop assessment consists of generating and reviewing maps of the watershed boundary, roads, land use and satellite imagery, and then identifying potential NPS pollution locations, such as road crossings, agricultural fields, and large areas of bare soil. When available, multiple sources of satellite imagery were reviewed. Occasionally, the high resolution of the imagery allowed for observations of livestock, row crops, eroding stream banks, sediment laden water, junkyards, and other potential NPS concerns that could affect stream quality. As many potential pollution sources as possible were visited, assessed and documented in the field. Field visits were limited to NPS sites that were visible from roads or a short walk from a roadway. Neighborhoods were assessed for NPS pollution at the whole neighborhood level including streets and storm drains (where applicable). The assessment does not include a scoring component, but does include a detailed summary of findings and a map indicating documented NPS sites throughout the watershed.

The watershed source assessment for No Name Brook was completed on June 28, 2012. In-field observations of erosion, lack of vegetated stream buffer, extensive impervious surfaces, high-density neighborhoods and agricultural activities were documented throughout the watershed (Table 2, Figure 3).

Table 2: Pollution Source ID Assessment for the No Name Brook Watershed

Potential Source			Notes
ID#	**Location**	**Type**	
16	Jordan Road (Town Farm Road)	Agriculture	• Active Row crops. • Evidence of manure/fertilizing application. • Bare soil observed in some areas.
24	Grove Street	Road Crossing	• A Culvert on Grove Street has recently been replaced, yet high flow and flooding was evident from the significant sediment deposition on the south side (downstream) end of the culvert, and heavy accumulation of large woody debris deposited high up on the riprap almost to the road. • Woody debris considered possible result of collapse of beaver activity upstream due to flooding. • The local landowner told of recent flooding since the replacement of the culvert and that water overtopped the roadway. • Two (2) unknown pipes were documented emerging from the riprap into the stream. • A narrow buffer was documented between the stream and adjacent lawns.
26	Sabattus Street & Golder Road	Road Crossings/ Residential	• Multiple stream crossings indicate potential stormwater impacts to the stream. • Rooted emergent vegetation was documented growing immediately downstream toward Golder Road crossing. • Water flowing in from the storm drains appeared slightly turbid.
32	Old Webster Road	Road Crossing	• Undersized culvert resulting in widening of the stream. • Small area of erosion observed off roadway due to storm water runoff.
38	Lisbon Road	Commercial Development	• Lewis Auto Sales. • Potential hot spot. • Many junked vehicles on property.
39	Lisbon Road	Commercial Development	• Landscape/truck repair business. • Oil barrels, sand, and mulch piles located behind building. • Large waste oil tank without secondary containment. • Trash observed throughout area. • A white hose was seen running to adjacent tributary. Pumping or draining activity unknown.
40	South Lisbon Road	Town Sewage Station/Road Crossing	• Road crossing with south west tributary to No Name Brook. • Sewage pump station located nearby road crossing. • Strong septic odor at road crossing.
42	Lisbon Road	Agriculture	• 2 Horses observed grazing. Hayfields surrounding. Fields do not look active.
43	Lisbon Road	Commercial Development	• Glamour Pools and Spas. • Quite close to No Name Brook. Large parking lot and building. • Possible chemical runoff from pool chemicals.

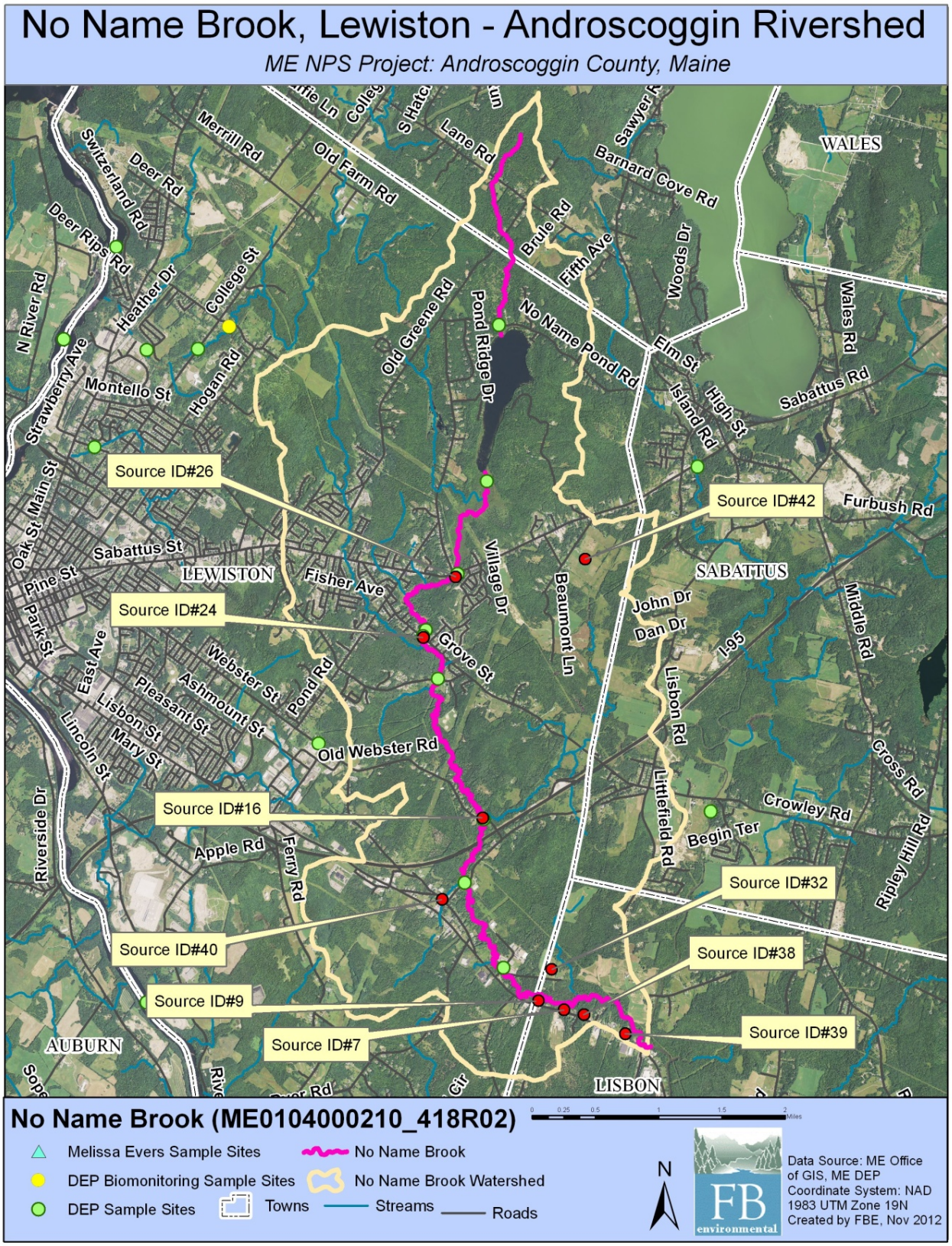


Figure 3: Aerial Photo of Source ID locations in the No Name Brook Watershed

NUTRIENT LOADING – MAPSHED ANALYSIS

The MapShed model was used to estimate stream loading of sediment, total nitrogen and total phosphorus in No Name Brook (impaired), plus five attainment watersheds throughout the state. The model estimated nutrient loads over a 15-year period (1990-2004), which was determined by the available weather data provided within MapShed. This extended period captures a wide range of hydrologic conditions to account for variations in nutrient and sediment loading over time.

Many quality assured and regionally calibrated input parameters are provided with MapShed. Additional input parameters were manually entered into the model based on desktop research and field observations, as described in the section on Habitat Assessment and Pollution Source Identification. These manually adjusted parameters included estimates of livestock animal units, agricultural stream miles with intact vegetative buffer, Best Management Practices (BMPs), and estimated wetland retention and/or drainage areas.

Livestock Estimates

Livestock waste contains nutrients which can cause water quality impairment. The nutrient loading model considers numbers and types of animals. Table 3 (right) provides estimates of livestock (numbers of animals) in the watershed, based on direct observations made in the watershed, plus other publicly available data.

The No Name Brook watershed is predominantly forested, with substantial amount of development and some agriculture. Agricultural land use is dominated by active hay fields, though some row crops were observed. Only 2 horses were observed grazing in a pasture off of Old Chadbourn Road.

Table 3: Livestock Estimates in the No Name Brook Watershed

Type	No Name Brook
Dairy Cows	
Beef Cows	
Broilers	
Layers	
Hogs/Swine	
Sheep	
Horses	2
Turkeys	
Other	
Total	**2**

Vegetated Stream Buffer in Agricultural Areas

Vegetated stream buffers are areas of trees, shrubs, and/or grasses adjacent to streams, lakes, ponds or wetlands which provide nutrient loading attenuation (Evans & Corradini, 2012). MapShed considers natural vegetated stream buffers within agricultural areas as providing nutrient load attenuation. The width of buffer strips is not defined within the MapShed manual, and was considered to be 75 feet for this analysis. Geographic Information System (GIS) analysis of recent aerial photos along with field reconnaissance observations were used to estimate the number of agricultural stream miles with and without vegetative buffers, and these estimates were directly entered into the model.

Table 4: Summary of Vegetated Buffers in Agricultural Areas

No Name Brook
• 13.7 stream miles in watershed (includes ephemeral streams) • 2.7 stream miles in agricultural areas • **48%** of agricultural stream miles have a vegetated buffer

No Name Brook is a 10.0 mile-long impaired segment as listed by Maine DEP. As modeled, the total stream miles (including tributaries) within the watershed was calculated as 13.7 miles. Of this total, 2.7 stream miles are located within agricultural areas and 1.3 miles or 48% of the stream shows a 75 foot or greater vegetated buffer (Table 4, Fig. 4). By contrast, agricultural stream miles (as modeled) with a 75 foot vegetated buffer in the attainment stream watersheds ranged from 34% to 92%, with an average of 61%.

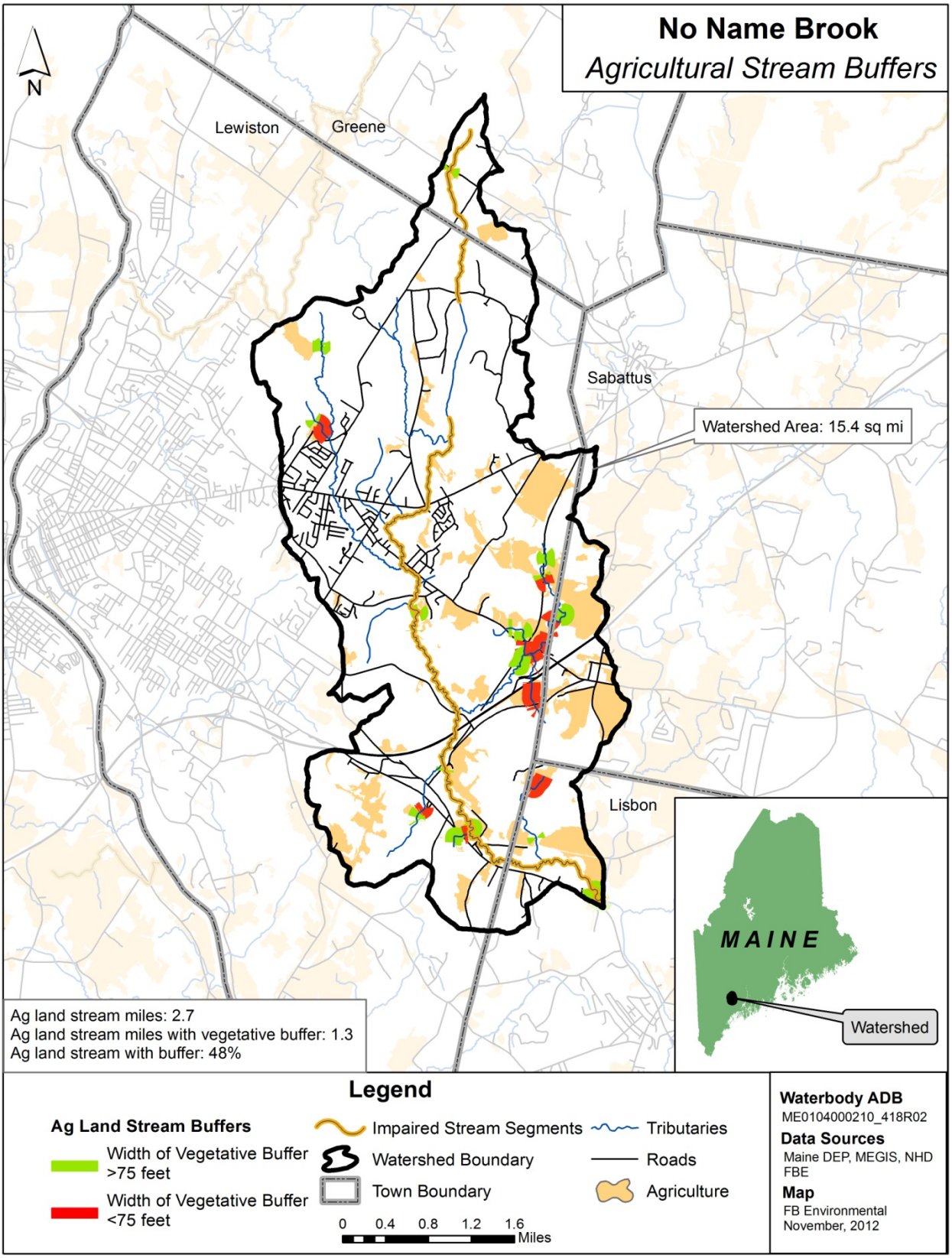


Figure 4: Buffered Agricultural Stream Miles in the No Name Brook Watershed

Best Management Practices (BMPs)

For this modeling effort, four commonly used BMPs were entered based on literature values. These estimates were applied equally to impaired and attainment stream watersheds. More localized data on agricultural practices would improve this component of the model.

- *Cover Crops:* Cover crops are the use of annual or perennial crops to protect soil from erosion during time periods between harvesting and planting of the primary crop. The percent of agricultural acres cover crops used within the model is estimated at 4%. This figure is based on information from the 2007 USDA Census stating that 4.1% of cropland acres is left idle or used for cover crops or soil improvement activity, and not pastured or grazed (USDA, 2007b).
- *Conservation Tillage:* Conservation tillage is any kind of system that leaves at least 30% of the soil surface covered with crop residue after planting. This reduces soil erosion and runoff and is one of the most commonly used BMPs. This BMP was assumed to occur in 42% of agricultural land. This figure is based on a number given by the Conservation Tillage Information Center's 2008 Crop Residue Management Survey stating that 41.5% of U.S. acres are currently in conservation tillage (CTIC, 2000).
- *Strip Cropping / Contour Farming:* This BMP involves tilling, planting and harvesting perpendicular to the gradient of a hill or slope using high levels of plant residue to reduce soil erosion from runoff. This BMP was assumed to occur in 38% of agricultural lands, based on a study done at the University of Maryland (Lichtenberg, 1996).
- *Grazing Land Management:* This BMP consists of ensuring adequate vegetation cover on grazed lands to prevent soil erosion from overgrazing or other forms of over-use. This usually employs a rotational grazing system where hays or legumes are planted for feed and livestock is rotated through several fenced pastures. In this TMDL, a figure of 75% of hay and pasture land is assumed to utilize grazing land management. This figure is based on a study by Farm Environmental Management Systems of farming operations in Canada (Rothwell, 2005).

Pollutant Load Attenuation by Lakes, Ponds and Wetlands

Depositional environments such as ponds and wetlands can attenuate watershed sediment loading. This information is entered into the nutrient loading model by a simple percentage of watershed area draining to a pond or a wetland. The No Name Brook watershed is 7% wetland and 1.5% open water. No Name Pond, located in the northern portion of the watershed, and the large wetland complex to its south drain about 25% of the land area in the northern most portion of the watershed. Percent of watershed draining to a wetland in the attainment watersheds ranged from 15% to 60%, with an average of 35%.

NUTRIENT MODELING RESULTS

The MapShed model simulates surface runoff using daily weather inputs of rainfall and temperature. Erosion and sediment yields are estimated using monthly erosion calculations and land use/soil composition values for each source area. Below, selected results from the watershed loading model are presented. The TMDL itself is expressed in units of kilograms per hectare per year. The additional results shown below assist in better understanding the likely sources of pollution. The model results for No Name Brook indicate a minor reduction in nitrogen is needed to improve water quality and no reduction of sediment and phosphorus are needed. Below, loading for sediment, nitrogen and phosphorus are discussed individually.

Sediment

Sediment loading in the No Name Brook watershed is mainly derived from mixed development which accounts for 50% of the total sediment load. Combined agricultural sources also contribute a significant portion of the load at 34%, respectively (Table 5 and Figure 5). Total loads by mass cannot be directly compared between watersheds due to differences in watershed area. See section *TMDL: Target Nutrient Levels for No Name Brook* (below) for loading estimates that have been normalized by watershed area.

Table 5: Total Sediment Load by Source

No Name Brook	**Sediment (1000kg/year)**	**Sediment (%)**
Source Load		
Hay/Pasture	7.79	14%
Crop land	11.37	20%
Forest	8.66	16%
Wetland	0.11	0%
Disturbed Land	0	0%
Low Density Mixed	9.31	17%
Medium Density Mixed	0	0%
High Density Mixed	18.33	33%
Low Density Residential	0.04	0%
Medium Density Residential	0	0%
High Density Residential	0	0%
Farm Animals	0	0%
Septic Systems	0	0%
Source Load Total:	**55.61**	**100%**
Pathway Load		
Stream Banks	30.76	-
Subsurface / Groundwater	0	-
Total Watershed Mass Load:	**86.37**	

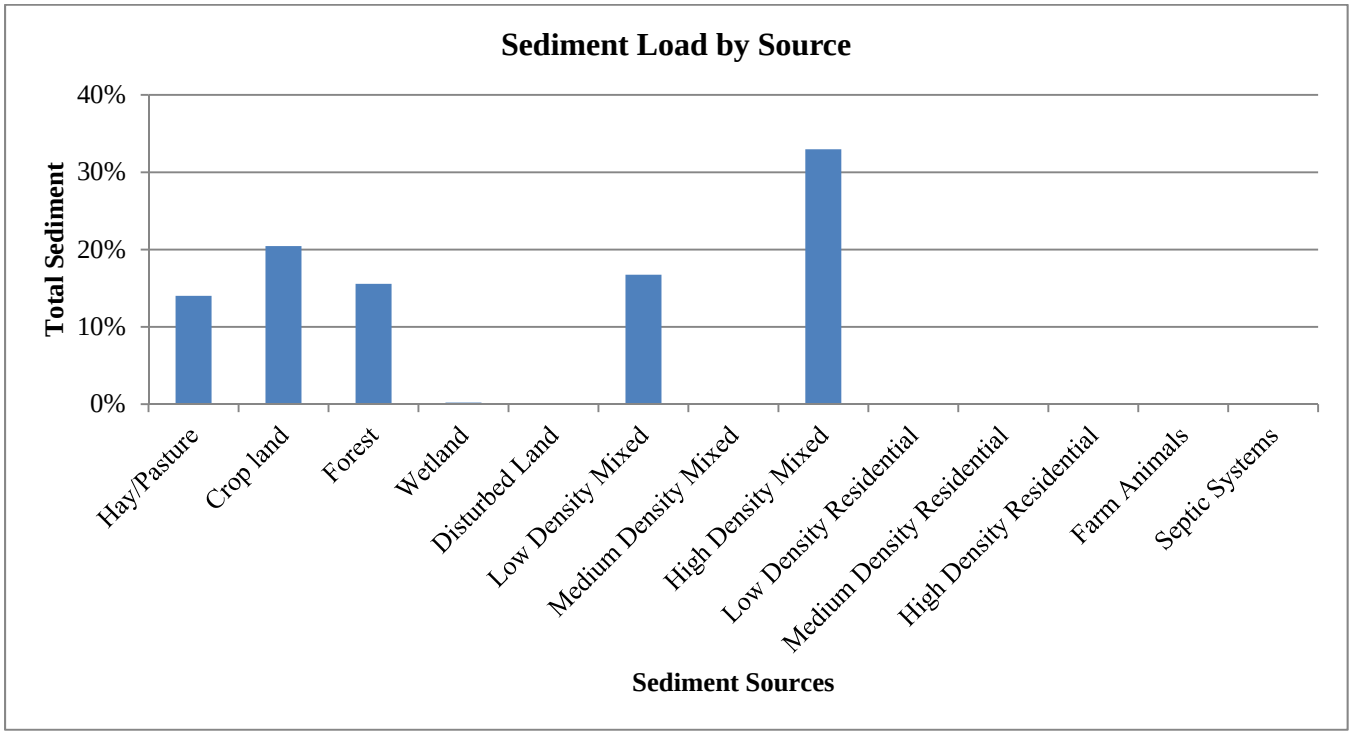


Figure 5: Total Sediment Loads by Source in the No Name Brook Watershed

Total Nitrogen

Nitrogen loading is attributed to mixed development which contributes 34% of the total load to No Name Brook. Septic Systems are also a significant source of nitrogen and account for 25% of the total load. Combined agricultural sources make up 24% of the nitrogen load with cropland at 16%, respectively. Table 6 and Figure 6 (below) shows estimated total nitrogen load in terms of mass and percent of total, and by source, in No Name Brook. Total loads by mass cannot be directly compared between watersheds due to differences in watershed area. See section *TMDL: Target Nutrient Levels for No Name Brook* (below) for loading estimates that have been normalized by watershed area.

Table 6: Total Nitrogen Loads by Source

No Name Brook	Total N (kg/year)	Total N (%)
Source Load		
Hay/Pasture	287.4	8%
Crop land	560.6	16%
Forest	482.9	14%
Wetland	128.7	4%
Disturbed Land	0	0%
Low Density Mixed	306.8	9%
Medium Density Mixed	0	0%
High Density Mixed	874.5	25%
Low Density Residential	1.4	0%
Medium Density Residential	0	0%
High Density Residential	0	0%
Farm Animals	7.6	0%
Septic Systems	896.1	25%
Source Load Total:	**3545.9**	**100%**
Pathway Load		
Stream Banks	23.3	-
Subsurface / Groundwater	18865.6	-
Total Watershed Mass Load:	**22434.7**	

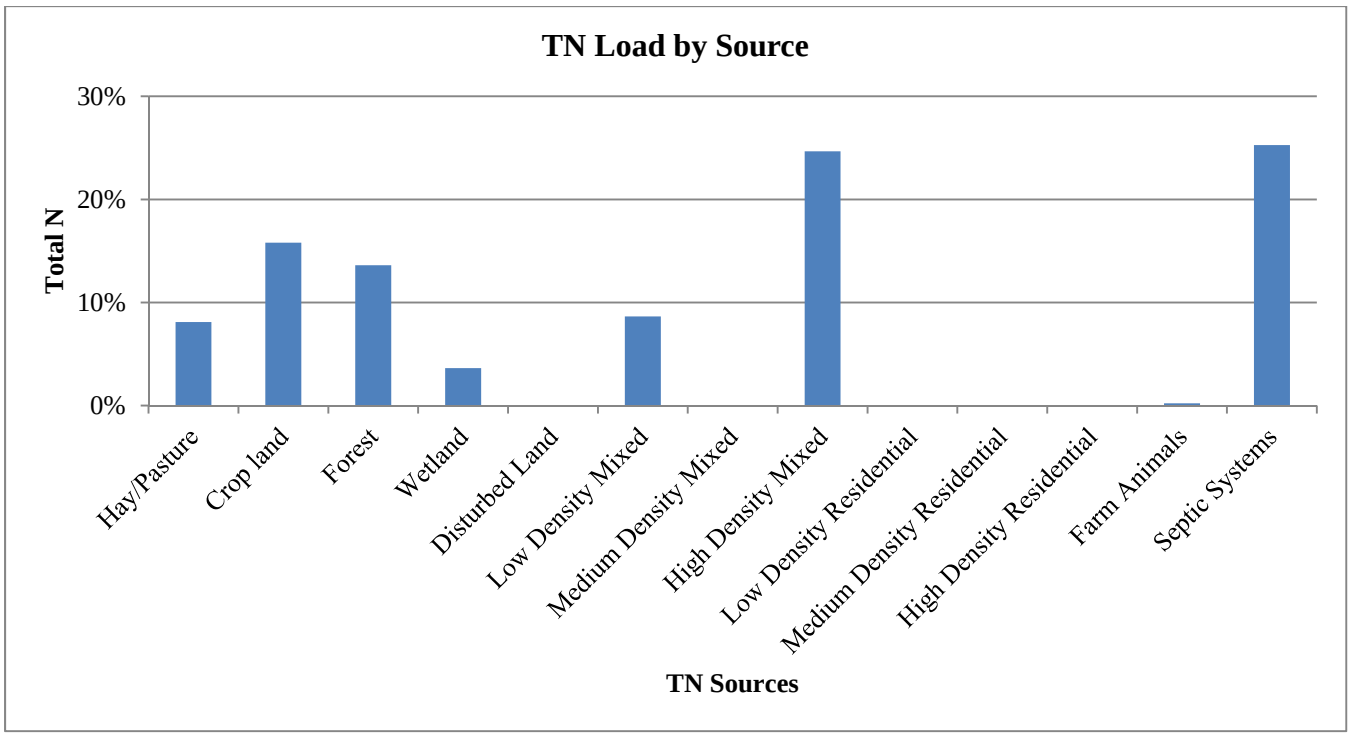


Figure 6: Total Nitrogen Loads by Source in the No Name Brook Watershed

Total Phosphorus

Phosphorus loading within the watershed is attributed primarily to agricultural sources and mixed development. Combined agricultural sources account for over 45% of the phosphorus load in No Name Brook. Mixed development is also a significant source of phosphorus and makes up 36% of the total load. Phosphorus loads are presented in Table 7 and Figure 7. Total loads by mass cannot be directly compared between watersheds due to differences in watershed area. See section *TMDL: Target Nutrient Levels for No Name Brook* (below) for loading estimates that have been normalized by watershed area.

Table 7: Total Phosphorus Loads by Source

No Name Brook	Total P (kg/year)	Total P (%)
Source Load		
Hay/Pasture	98.7	29%
Crop land	53.7	16%
Forest	30.2	9%
Wetland	6.6	2%
Disturbed Land	0	0%
Low Density Mixed	33.1	10%
Medium Density Mixed	0	0%
High Density Mixed	87.7	26%
Low Density Residential	0.2	0%
Medium Density Residential	0	0%
High Density Residential	0	0%
Farm Animals	1.9	1%
Septic Systems	24.9	7%
Source Load Total:	**336.9**	**100%**
Pathway Load		
Stream Banks	7.4	-
Subsurface / Groundwater	356.8	-
Total Watershed Mass Load:	**701.2**	

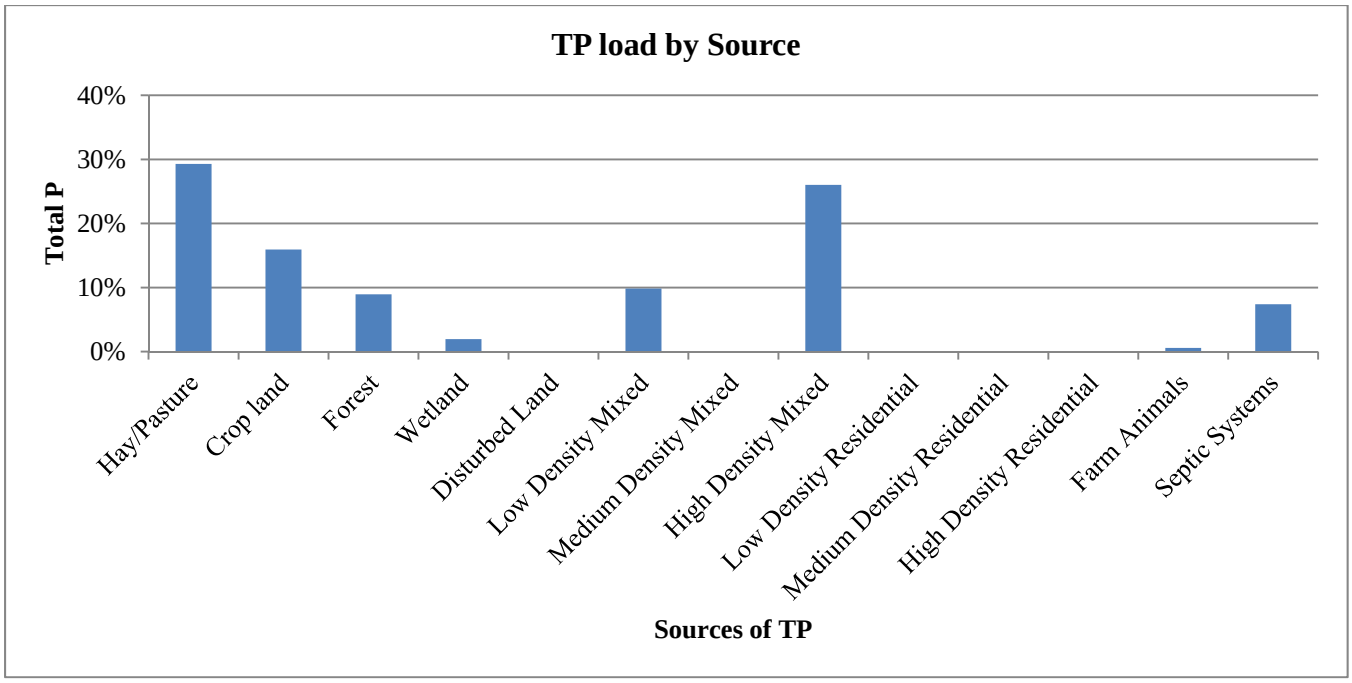


Figure 7: Total Phosphorus Loads by Source in the No Name Brook Watershed

TMDL: TARGET NUTRIENT LEVELS FOR NO NAME BROOK

The existing loads for nutrients and sediments in the impaired segment of No Name Brook are listed in Table 8. Table 9 presents a more detailed view of the modeling results and calculations used in Table 8 to define TMDL reductions, and compares the existing nutrient and sediment loads in No Name Brook to TMDL endpoints derived from the attainment waterbodies. An annual time frame provides a mechanism to address the daily and seasonal variability associated with nonpoint source loads.

Table 8: TMDL Targets Compared to No Name Brook Pollutant Loading

TMDL POLLUTANT LOADS Annual Loads per Unit Area	**Estimated Loads No Name Brook**	**Total Maximum Daily Load**	**TMDL % REDUCTIONS No Name Brook**
Sediment Load *(1000 kg/ha/year)*	**0.022**	**0.030**	**No Reduction Needed**
Nitrogen Load *(kg/ha/year)*	**5.65**	**5.2**	**8%**
Phosphorus Load *(kg/ha/year)*	**0.18**	**0.24**	**No Reduction Needed**

Future Loading

The prescribed reduction in pollutants discussed in this TMDL reflects reduction from estimated existing conditions. Expansion of agricultural and development activities have the potential to increase runoff and associated pollutant loads to the (Impaired stream name). To ensure that the TMDL targets are attained, future agriculture or development activities will need to meet the TMDL targets. Future growth from population increases is a moderate threat in the (Impaired stream name) watershed because Androscoggin County has increasing population trends, with a 3% increase between 2000 and 2008 (USM MSAC, 2009). The growth in agricultural lands is also increasing, with a 13% increase in the total number of farms in Androscoggin County between 2002 and 2007. However, a decrease of 9% was seen in the land (acres) in farms between 2002 and 2007, and a 19% decrease occurred in the average farm size in this time period as well (USDA, 2007a). Future activities and BMPs that achieve TMDL reductions are addressed below.

Next Steps

The use of agricultural and developed area Best Management Practices (BMP's) can reduce sources of polluted runoff in No Name Brook. It is recommended that municipal officials, landowners, and conservation stakeholders in Lewiston work together to develop a watershed management plan to:

- Encourage greater citizen involvement through the development of a watershed coalition to ensure the long term protection of No Name Brook;
- Address <u>existing</u> nonpoint source problems in the No Name Brook watershed by instituting BMPs where necessary; and
- Prevent <u>future</u> degradation of No Name Brook through the development and/or strengthening of local Nutrient Management Ordinance.

Table 9: Modeling Results Calculations for Derived Numeric Targets and Reduction Loads for No Name Brook

No Name Brook				
	Area ha	**Sediment 1000kg/yr**	**TN kg/yr**	**TP kg/yr**
Land Uses				
Hay/Pasture	410	7.8	287.4	98.7
Crop land	140	11.4	560.6	53.7
Forest	2462	8.7	482.9	30.2
Wetland	279	0.1	128.7	6.6
Disturbed Land	0	0.0	0.0	0.0
Low Density Mixed	453	9.3	306.8	33.1
High Density Mixed	222	18.3	874.5	87.7
Low Density Residential	2	0.0	1.4	0.2
Other Sources				
Farm Animals			7.6	1.9
Septic Systems			896.1	24.9
Pathway Loads				
Stream Banks		30.8	23.3	7.4
Groundwater			18865.6	356.8
Total Annual Load		86 x 1000 kg	22435 kg	701 kg
Total Area	3968 ha			
Total Maximum Daily Load		**0.022 1000kg/ha/year**	**5.65 kg/ha/year**	**0.18 kg/ha/year**

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