Site Study Pepperell: Mill Street/Varnum Brook

About this site: Varnum Brook (1) is a tributary of the Nashua River (2). It passes through a culvert under Mill Street (3) before entering the Nashua (4). This section of Mill Street is downstream of the Pepperell Pond Dam, and to the east of the street lies the old Pepperell Paper Co. mill site (5).

Community concerns about Mill Street/Varnum Brook

The site could use public enhancement such as rain gardens.

The town looked at daylighting Varnum Brook but it's a steep drop down to the Nashua River.

This is private property. They are developing the area north of the flag. And south is in a flood zone.

This is a site worth checking on for habitat, flood issues, daylight river or culvert expansion.

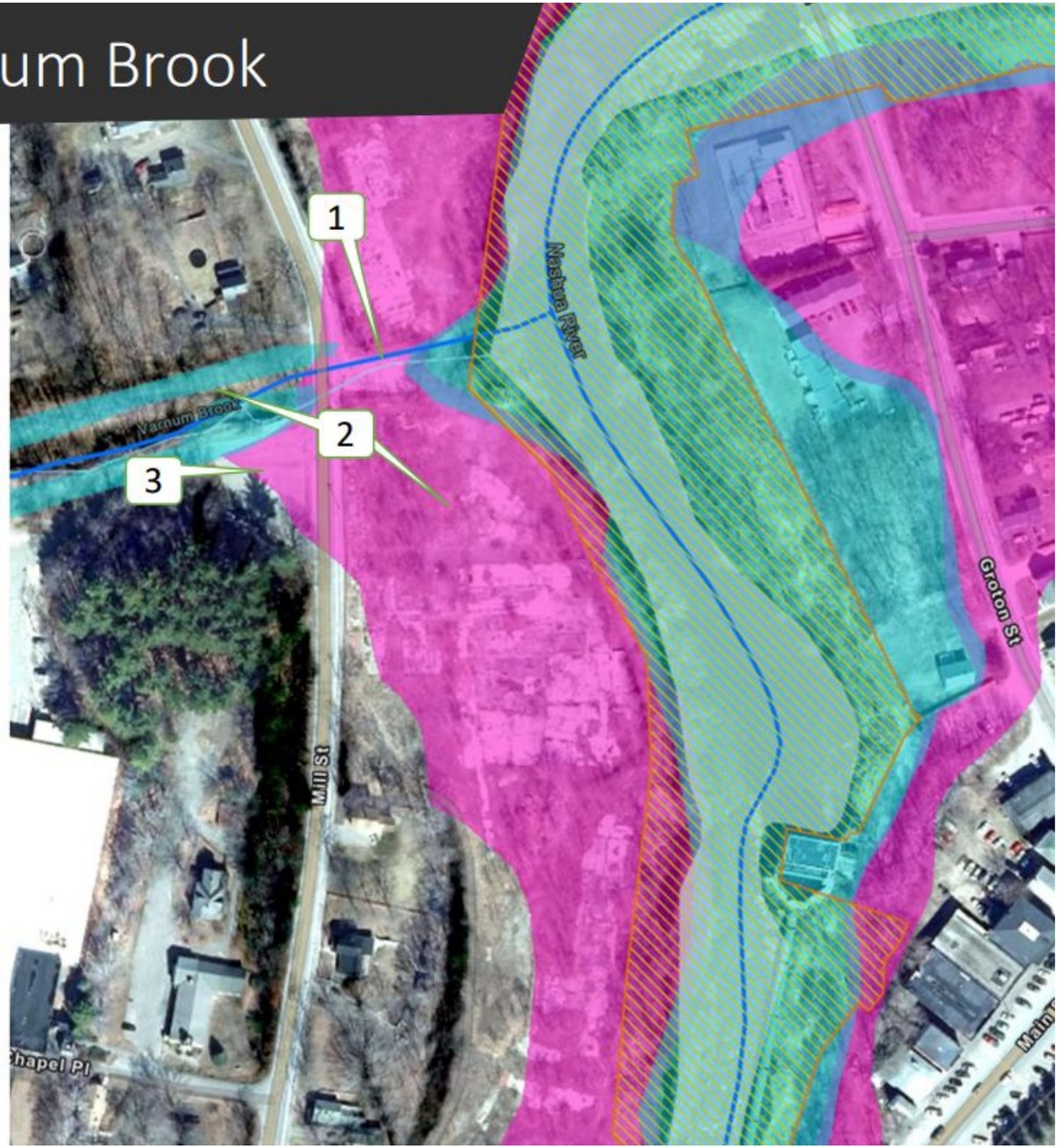
Nature-based Solutions Recommended for Pepperell: Mill Street/Varnum Brook

Mill Street/Varnum Brook

Recommended NbS
NbS #s correspond to Project Templates referenced on pages 3, 6, & 7 of Site Study

1. Varnum Brook
   - DW #12 Daylighting of stream
   - F DW #15 MSCS culvert improvement
   - DL DW #1 River/pond bank revegetation
   - B #20 Species crossing protections
2. Pavement with Floodplain
   - F DW #5 New wetland or floodplain construction/expansion
   - DL #10 Soil management or restoration
   - B DL #60 Habitat enhancements
   - B DL #58 Invasive species management
3. Mill Street Parking Lot
   - F DW #17 Pervious parking walking areas

DataViewer link:
https://arcg.is/1PS9qm



Map Key

Bright blue overlay is the FEMA 100 year floodplain

Pink overlay is FEMA 500 year floodplain

Recommended NbS Key

- F Flooding NbS
- D Drought NbS
- RT Rising temps NbS
- DW Degraded water NbS
- DL Degraded landscape NbS
- B Loss of biodiversity NbS

NbS Narrative/NbS Project Templates for Pepperell: Mill Street/Varnum Brook

NbS Recommendations

- At the site of the former Pepperell Paper Co. mill, there is a large amount of acreage covered in concrete right alongside the Nashua River. If possible, the concrete should be removed for safety reasons and the floodplain restored. It is understood that vast mill basements here were simply covered over rather than being removed, which is why the site is fenced off.
- We recommend the daylighting of Varnum Brook where it is buried under Mill Street. The brook is primarily underground so it will be challenging to daylight it.
- Tighe and Bond looked at the condition of this Varnum Brook culvert and they concluded that it will last a while.
- Within this area, there is also a need to revegetate the banks of this water body, and implement species crossing protections.
- In the area around the floodplain, there is an opportunity to expand the wetlands or floodplain.
- There is also a need for soil restoration, habitat enhancements, and invasive species removal. In the Mill Street parking lot, there should be some pervious walking areas.
- On the opposite side of the road, the area around Green's Brook (east of Kirin Crossing) is now within FEMA's flood zone and needs careful excavating. It would be good to include educational programs and outreach about flooding.
- A new flood bylaw is expected next year.

NbS Project Templates for Site Specific NbS Recommendations on previous page

Resource 1 - How to Use Templates

Resource 2 - Next Steps in Planning & Permitting

The following template numbers correspond to the NbS recommendations on the page 2 Map.

#1 River/Pond Bank Revegetation

#5 Wetland or Floodplain Construction- Expansion

#10 Soil Management-Restoration

#12 Daylighting Streams

#15 MSCS Culvert Improvements

#17 Pervious Parking- Walking Areas

#20 Species Crossing Protections

#58 Invasive Species Management

#60 Habitat Enhancements

View Pepperell Map Atlas **for maps on land covers, soil function and storage, water resources, ecological priority sites, and more.**

Soils Information for Pepperell: Mill Street/Varnum Brook

Pepperell

With a position low in the watershed, Pepperell's farmland and suburban residential lands have major potential for better management for increased soil function that would mitigate stormwater issues and benefit the several towns downstream.

Of the five focus communities, Pepperell is "lowest" in the watershed and receives stormwater impact from a vast upland land area. The Nashua River runs along the town's southeastern border and then through the center of town before continuing north. The rich alluvial soils of this riverside community are home to significant acreage of farmland with interspersed residential neighborhoods that constitute a large portion of Pepperell's "degraded soils with high regeneration potential". Compared with other focus communities like Fitchburg and Leominster, Pepperell has a low amount of "highly degraded" soil that would need intensive intervention to replicate lost soil function. The town's acreage of High Functioning soil is below the watershed-wide average, but is still significant and protection of these lands is important for watershed health. These high-functioning soils are evenly mixed with "moderate-low function" soil throughout the town.

Sites Considered for Nature-based Solutions

At least two of the sites being considered for stormwater mitigation are on soils with "high regeneration potential" and these sites could be priorities for implementing and tracking the performance of soil-regeneration measures. The Unkety Brook site has been identified as prone to flooding but is within a subbasin that is mostly in neighboring Dunstable.

Priority Actions for Protecting/Enhancing Soil Health in Pepperell

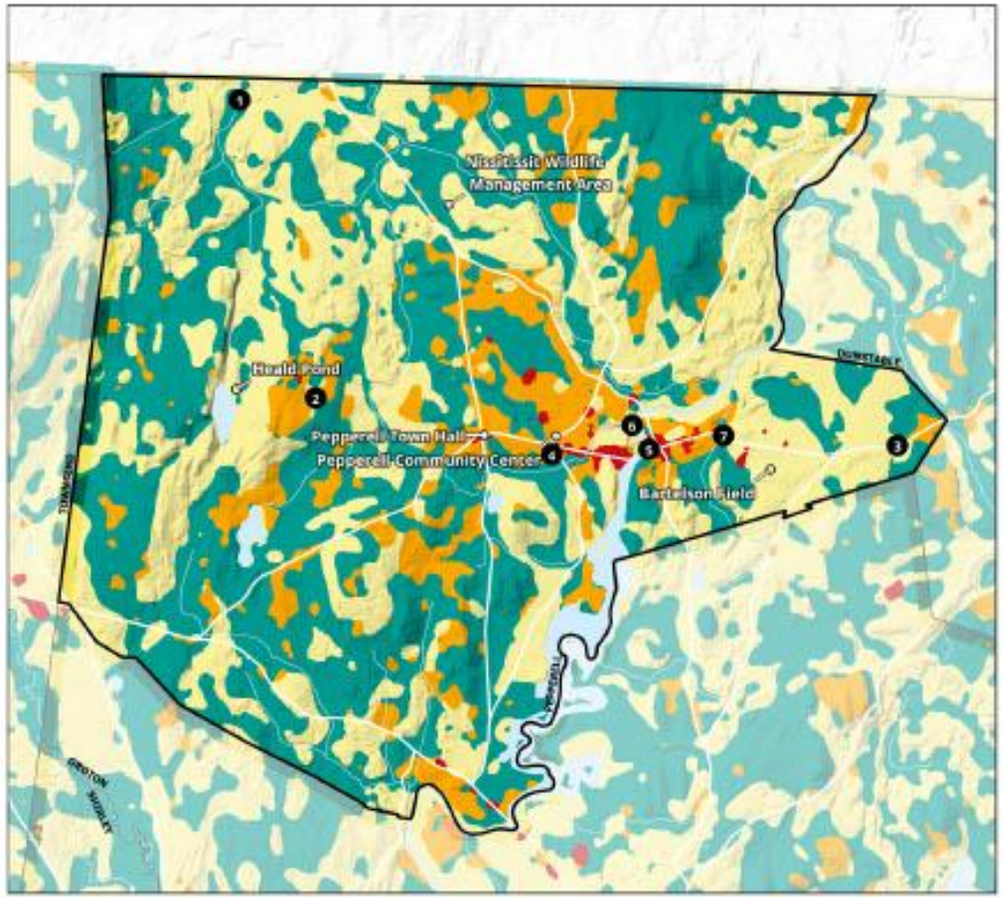
Better management of turf, lawns, gardens, and farms.

Example Nature-based Solutions:

- Education and outreach to key landowners and farmers about smart soil practices
- Pocket forests to transform biodiversity
- Planting and earthworks to restore connectivity and hydrology
- Front yard pollinator meadows
- Dual use solar
- Planning and zoning to preserve and enhance ecosystem function

#	SITE	PREDOMINANT SOIL FUNCTIONS FOR RESILIENCE			
		Highly Degraded	High Regeneration Potential	Moderate-Low Function	High Function
1	Bemis Wellhead Protection Zone/Gulf Brook		◆	◆	◆
2	Heald Orchard/Heald Pond		◆		◆
3	Unkety Brook		◆	◆	◆
4	Fitzpatrick School Parking	◆	◆		
5	Railroad Square	◆	◆		
6	Mill Street/Varnum Brook			◆	
7	Reedy Meadow off Lowell Rd.		◆	◆	◆

Soil Functions for Resilience



	Pepperell
High Performance Soils & High Carbon Soils	6,811 ac (45.9%)
Average Function Soils	6,039 ac (40.7%)
Degraded Soils with High Regeneration Potential	1,893 ac (12.8%)
Highly Degraded Soils	101 ac (0.7%)

○ Landmarks

❶ Sites Considered for Nature-based Solutions

[Read full Nashua River Watershed-wide Healthy Soils Report](#) (PDF 25MB)

Nature-based Solutions Opportunity Table Pepperell: Mill Street/Varnum Brook

Value	BEST	BETTER	GOOD
Feasibility	high	mid	low
Ownership	Commercial/Private Property		

Best Value = An improvement to a resource that provides significant lasting resiliency and strengthens or serves related resources

Better Value = Makes significant improvements to resiliency with long lasting effect

Good Value= Improves the habitat value, or resiliency of a site or feature

Feasibility is based on property ownership or technical access

NbS Template#	Nature-based Solution Description	Mill Street/ Varnum Brook
	Natural Environment Restructuring	
1	River / pond bank revegetation	**high**
2	Grassland meadow management restoration	
3	Forest / shrubland heath management or restoration	
4	Wetland management restoration	
5	New wetland or floodplain construction / expansion	**mid**
7	Stream flow alteration	
8	Pollinator hedgerow buffer	
10	Soil management or restoration	**low***
	** see Healthy Soils Report	

NbS Templat #	Nature-based Solution Description	Mill Street/ Varnum Brook
	Built Environment Restructuring	
11	Stormwater treatment wetlands	
12	Daylighting of streams	**low**
13	Upstream BMPs rain-garden, bio-swale, etc.	**mid**
14	Shade-habitat/ Infiltration tree plantings	
15	MSCS culvert improvement	**mid**
17	Pervious parking walking areas	**mid**
19	Lighting modifications / upgrades	
20	Species crossing protections	**mid**
21	Beaver deceiver / promoter	
22	High-performance soil specifications	
23	PV Parking Awnings + Rooftops	

Nature-based Solutions Opportunity Table Pepperell: Mill Street/Varnum Brook, cont'd.

Value	BEST	BETTER	GOOD
Feasibility	high	mid	low
Ownership	Commercial/Private Property		

Best Value = An improvement to a resource that provides significant lasting resiliency and strengthens or serves related resources

Better Value = Makes significant improvements to resiliency with long lasting effect

Good Value= Improves the habitat value, or resiliency of a site or feature

Feasibility is based on property ownership or technical access

NbS #Template	Nature-based Solution Description	Mill Street/ Varnum Brook
	Ecological Awareness & Access Projects	
24	Outdoor classroom/ Nature-play	
25	Food production and forage	
26	Apply Indigenous knowledge	
27	Soft trail	**low**
28	Paved pervious trail UANT	**low**
29	Soil protection-puncheon-boardwalk	
30	Pedestrian safety and bike access	
	Architectural Projects to Consider	
49	Nature-based recreational opportunities	

NbS Template#	Nature-based Solution Description	Mill Street/ Varnum Brook
	Value Added Features on Projects	
50	Analysis and study projects	
52	Educational Interpretation	
53	Furnishings / gathering space	
55	Advocacy group/ Stewards	
56	Volunteer opportunities	
58	Invasive species management	**mid**
59	Species monitoring protocol	
60	Habitat enhancements	**mid**

Varnum Brook culvert at Mill Street in Pepperell

Above: Former Pepperell Paper Co. mill site.

Left: MVP site visit to Mill Street/Varnum Brook site in Pepperell

Photos by Sherry Anders

This "Building Community Climate Resilience: Nashua River Watershed-wide Nature-based Solutions Plan" is funded by a Municipal Vulnerability Preparedness grant awarded to the City of Fitchburg by the Healey-Driscoll Administration's Municipal Vulnerability Preparedness (MVP) program, which is administered by the Executive Office of Energy and Environmental Affairs (EEA). NRWA was the lead coordinator for this project.

To view the interactive online Plan, please visit nashuariverwatershed.org/Climate Resilience