



## Regional Stormwater Management Planning for the Highlands Portion of North and South Branch Raritan River

### ***“Moving from Planning to Action”***

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# Rutgers Cooperative Extension

Rutgers Cooperative Extension (RCE) helps the diverse population of New Jersey adapt to a rapidly changing society and improves their lives through an educational process that uses science-based knowledge.



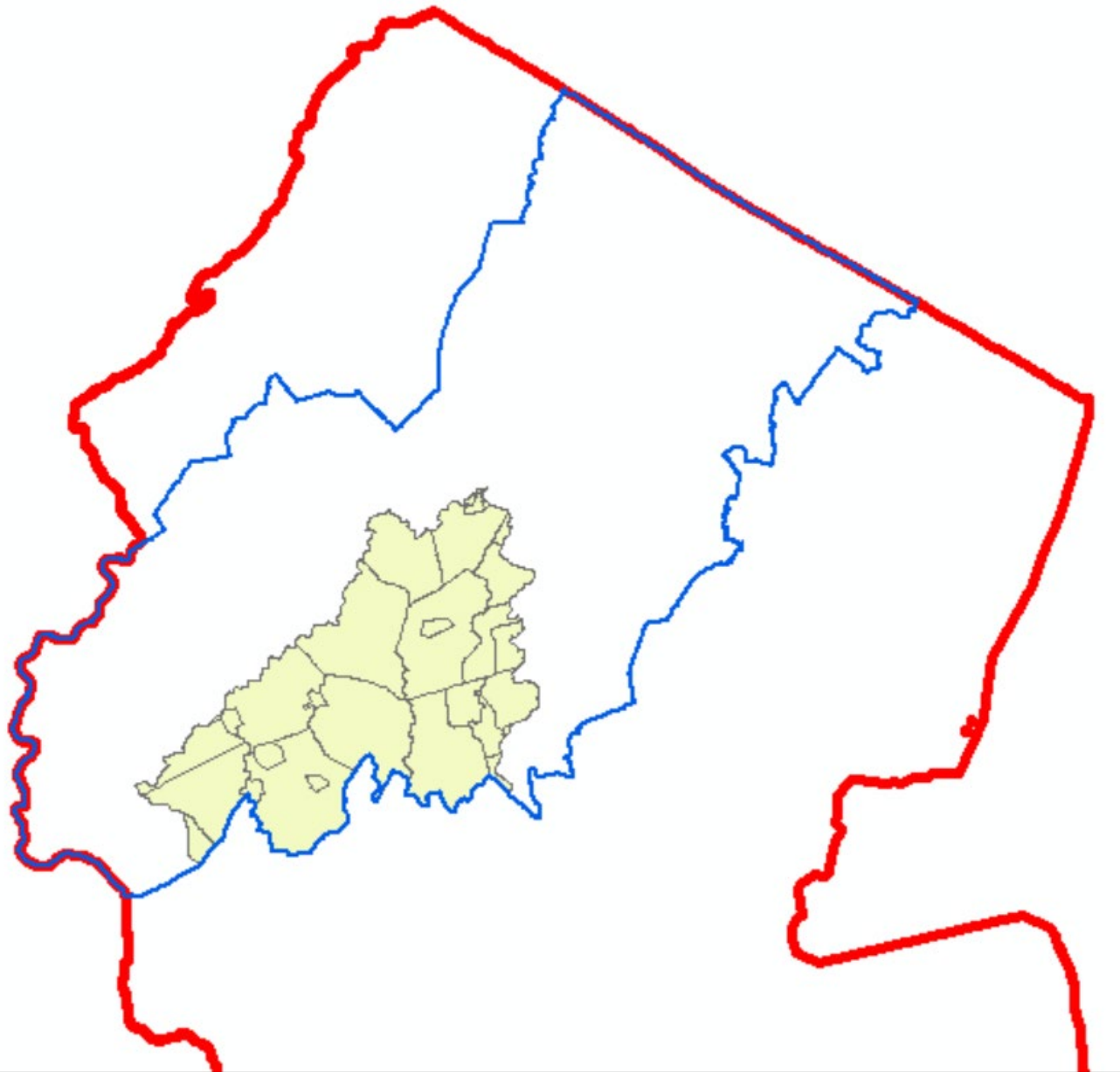


# Water Resources Program

Our mission is to identify and address water resources issues by engaging and empowering communities to employ practical science-based solutions to help create a more equitable and sustainable New Jersey.







<u>Municipality</u>	<u>County</u>
Lebanon Twp	Hunterdon
Califon Boro	Hunterdon
High Bridge Boro	Hunterdon
Tewksbury Twp	Hunterdon
Clinton Town	Hunterdon
Glen Gardner Boro	Hunterdon
Clinton Twp	Hunterdon
Union Twp	Hunterdon
Lebanon Boro	Hunterdon
Bethlehem Twp	Hunterdon
Alexandria Twp	Hunterdon
Hampton Boro	Hunterdon
Chester Twp	Morris
Chester Boro	Morris
Mendham Twp	Morris
Washington Twp	Morris
Roxbury Twp	Morris
Mount Olive Twp	Morris
Mendham Twp	Morris
Randolph Twp	Morris
Mine Hill Twp	Morris
Mount Arlington Boro	Morris
Peapack-Gladstone	Somerset
Bedminster Twp	Somerset
Far Hills Boro	Somerset
Bernardsville Boro	Somerset
Bernards Twp	Somerset



**Lebanon Boro**

**Mendham Boro**

**Roxbury Township**

**Clinton Township**

**Califon Boro**

**Chester Township**

**Lebanon Township**

**Mendham Township**

**Bernards Township**

**Bedminster Township**

**Hampton Boro**

**Union Township**

**Alexandria Township**

**Peapack-Gladstone Boro**

**Bethlehem Township**

**Bernardsville Boro**

**Mount Arlington Boro**

**Mount Olive Township**

**Chester Boro**

**Far Hills Boro**

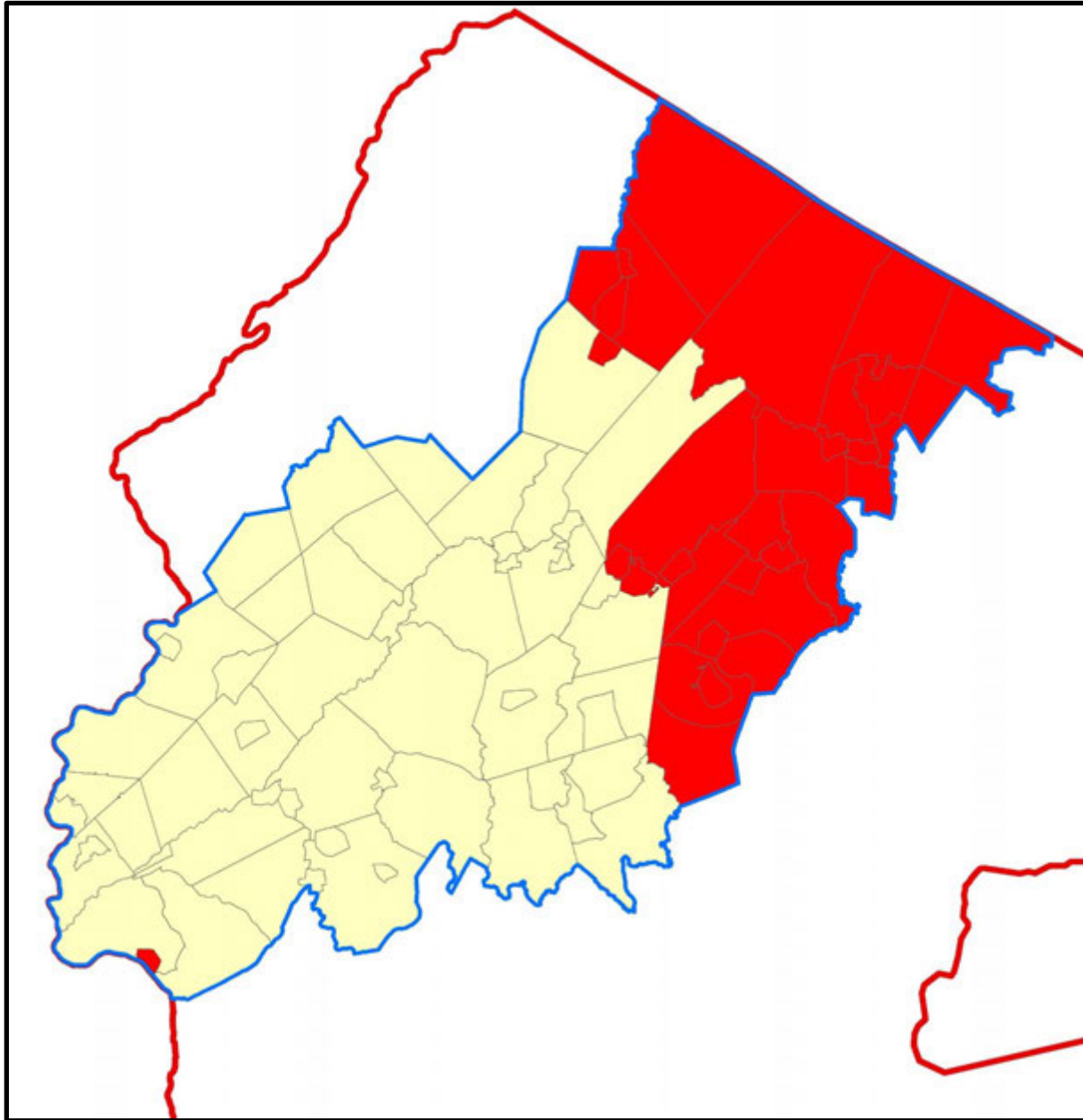
**Clinton Town**

**Mine Hill Township**

**High Bridge Boro**

**Randolph Township**

**Washington Township**



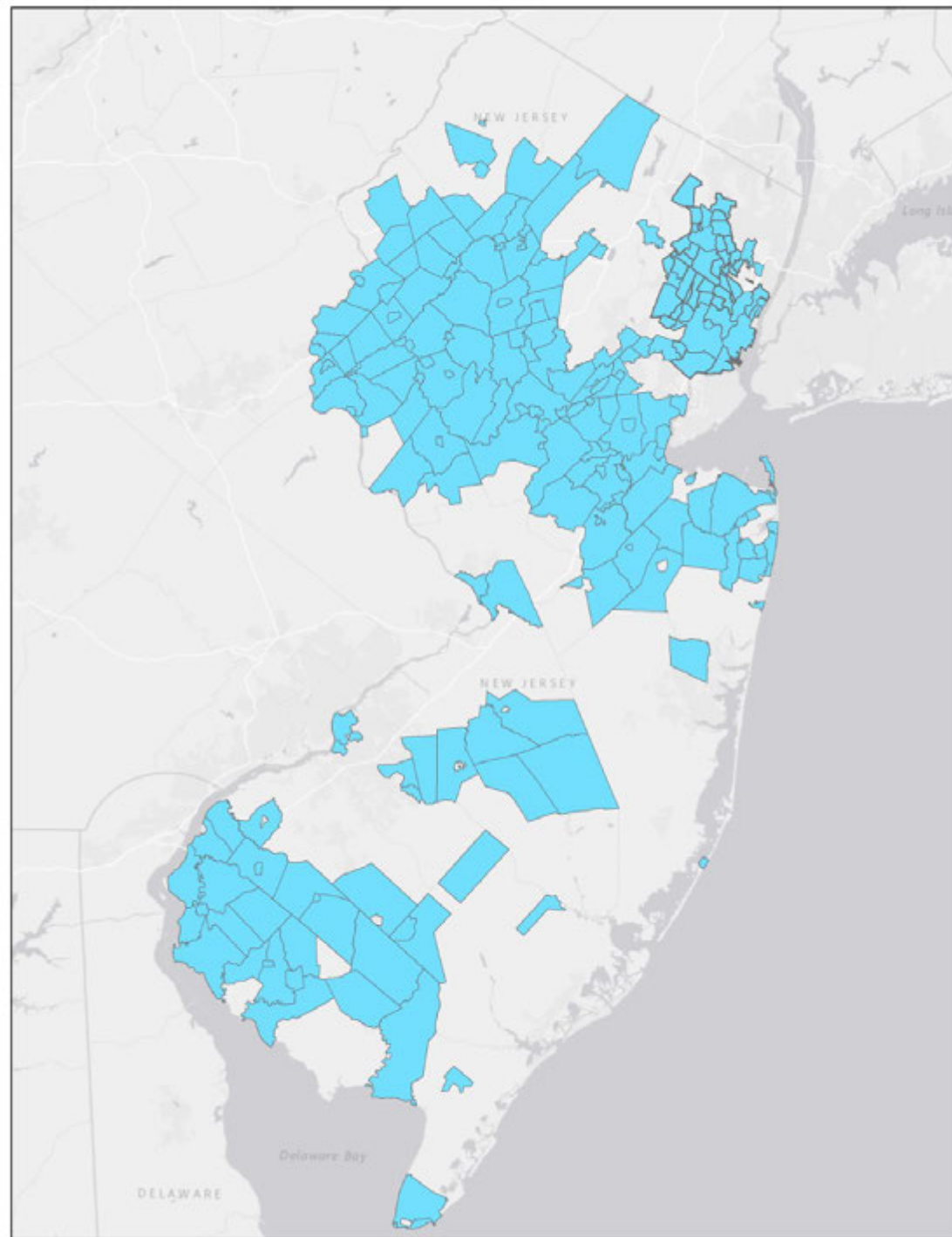
<u>Municipality</u>	<u>County</u>
Bloomsbury Boro	Hunterdon
Hampton Boro	Hunterdon
Holland Twp	Hunterdon
Jefferson Twp	Morris
Mt Arlington Boro	Morris
Mount Olive Twp	Morris
Netcong Boro	Morris
Byram Twp	Sussex
Green Twp	Sussex
Hopatcong Boro	Sussex
Sparta Twp	Sussex
Stanhope Boro	Sussex
Allamuchy Twp	Warren
Alpha Boro	Warren
Belvidere Town	Warren
Franklin Twp	Warren
Frelinghuysen Twp	Warren
Greenwich Twp	Warren
Hackettstown	Warren
Harmony Twp	Warren
Hope Twp	Warren
Independence Twp	Warren
Liberty Twp	Warren
Lopatcong Twp	Warren
Mansfield Twp	Warren
Oxford Twp	Warren
Phillipsburg Town	Warren
Pohatcong Twp	Warren
Washington Boro	Warren

<u>Municipality</u>	<u>County</u>
Washington Twp	Warren
White Twp	Warren

Green Infrastructure Plans  
in all 21 Counties

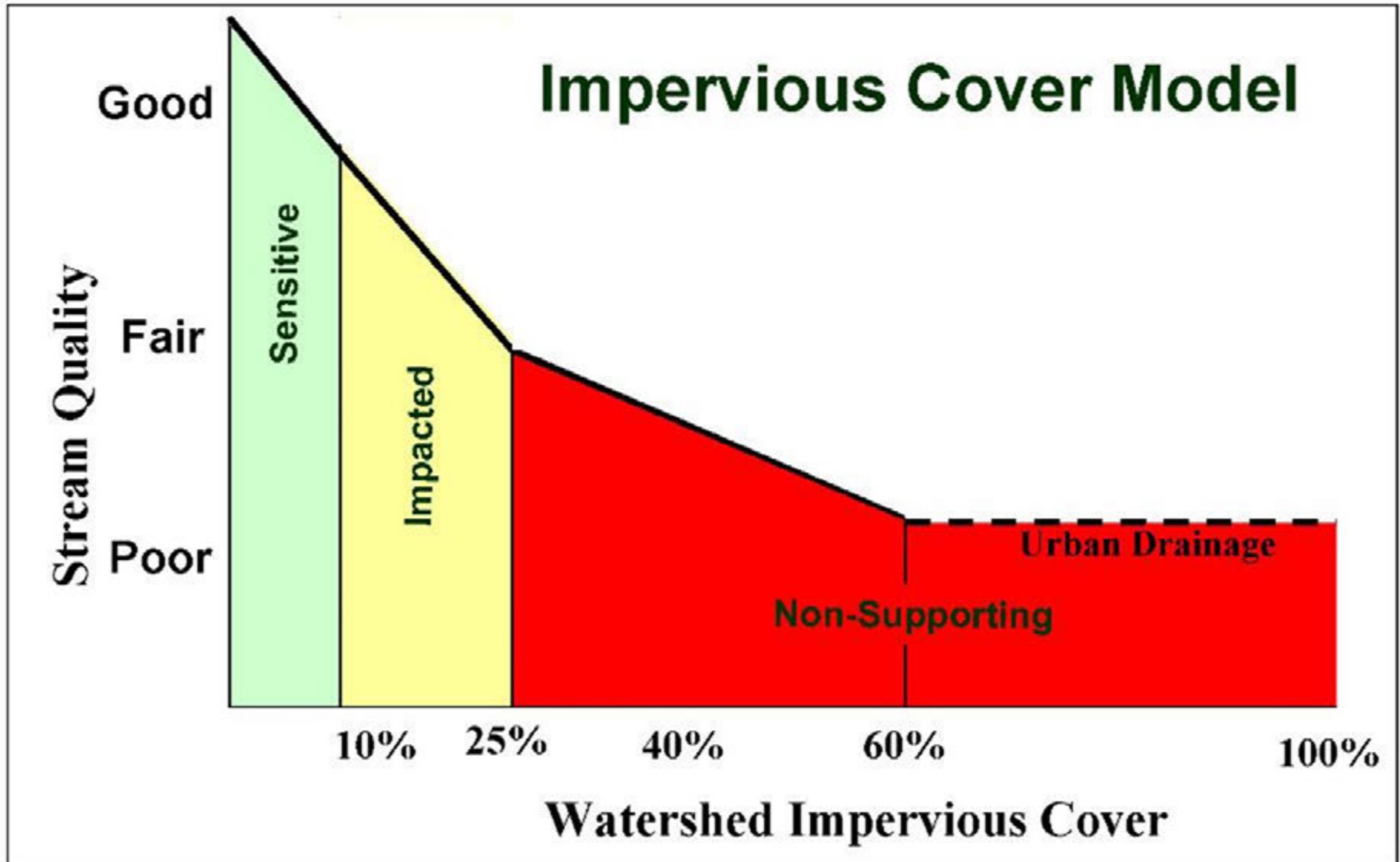
239 municipalities DONE!

326 municipalities to go.





Original ICM developed based on 200+ reports and papers



Reference: Tom Schueler and Lisa Fraley-McNeal, Symposium on Urbanization and Stream Ecology, May 23 and 24, 2008

# Green Infrastructure

...an approach to stormwater management that is cost-effective, sustainable, and environmentally friendly.

Green Infrastructure projects:

- capture,
- filter,
- absorb, and
- reuse

stormwater to maintain or mimic natural systems and treat runoff as a resource.



# Green Infrastructure Practices

- Rain Gardens/Bioretenention Systems
  - Bioswales
  - Downspout Planters
  - Stormwater Planters
  - Rainwater Harvesting
  - Permeable Pavements
  - Tree Filter Boxes
  - Dry Wells
  - Green Roofs
  - Naturalizing Detention Basins
  - Green Streets
- Infiltration Basins
  - Sand Filters





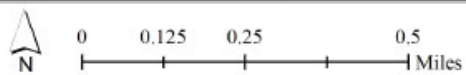
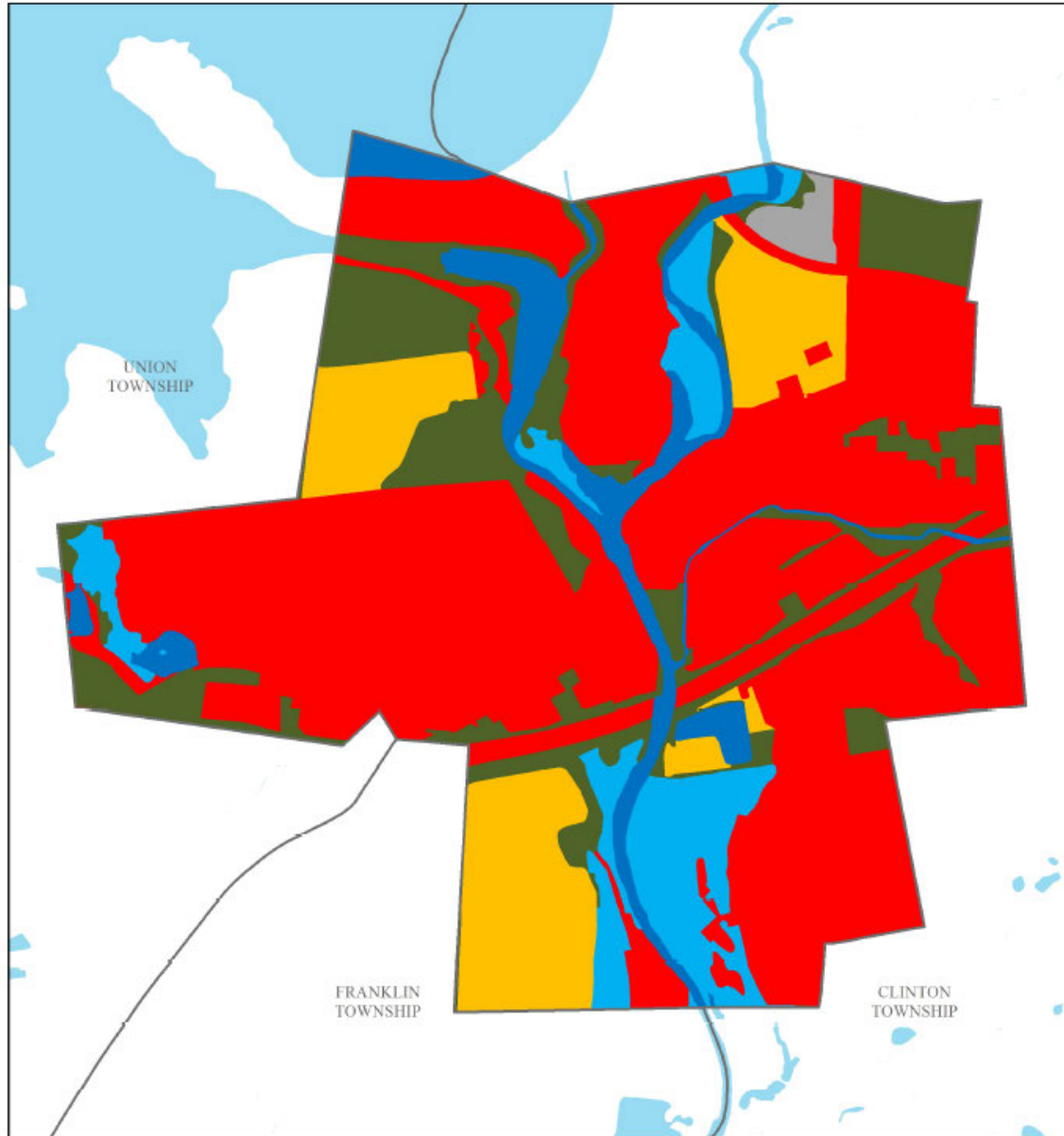
**WMA 8 - North and South Branch Raritan-Highlands**

<b>Municipality</b>	<b>County</b>	<b>Total Area (acres)</b>	<b>Impervious Cover (acres)</b>	<b>% Impervious Cover</b>
Lebanon Boro	Hunterdon	576.9	175.4	30.5%
Califon Boro	Hunterdon	636.6	70.9	11.6%
High Bridge Boro	Hunterdon	1,555.4	215.2	14.1%
Tewksbury Twp	Hunterdon	20,333.7	636.9	3.2%
Clinton Town	Hunterdon	917.9	210.2	24.6%
Glen Gardner Boro	Hunterdon	990.6	99.3	10.1%
Clinton Twp	Hunterdon	21,706.3	1,300.8	6.8%
Union Twp	Hunterdon	13,168.6	655.6	5.5%
Lebanon Boro	Hunterdon	20,249.7	583.6	2.9%
Bethlehem Twp	Hunterdon	13,288.0	412.7	3.1%
Alexandria Twp	Hunterdon	17,768.1	480.1	2.7%
Hampton Boro	Hunterdon	971.5	86.3	8.9%
Chester Boro	Morris	1,020.2	235.5	23.1%

**WMA 8 - North and South Branch Raritan-Highlands**

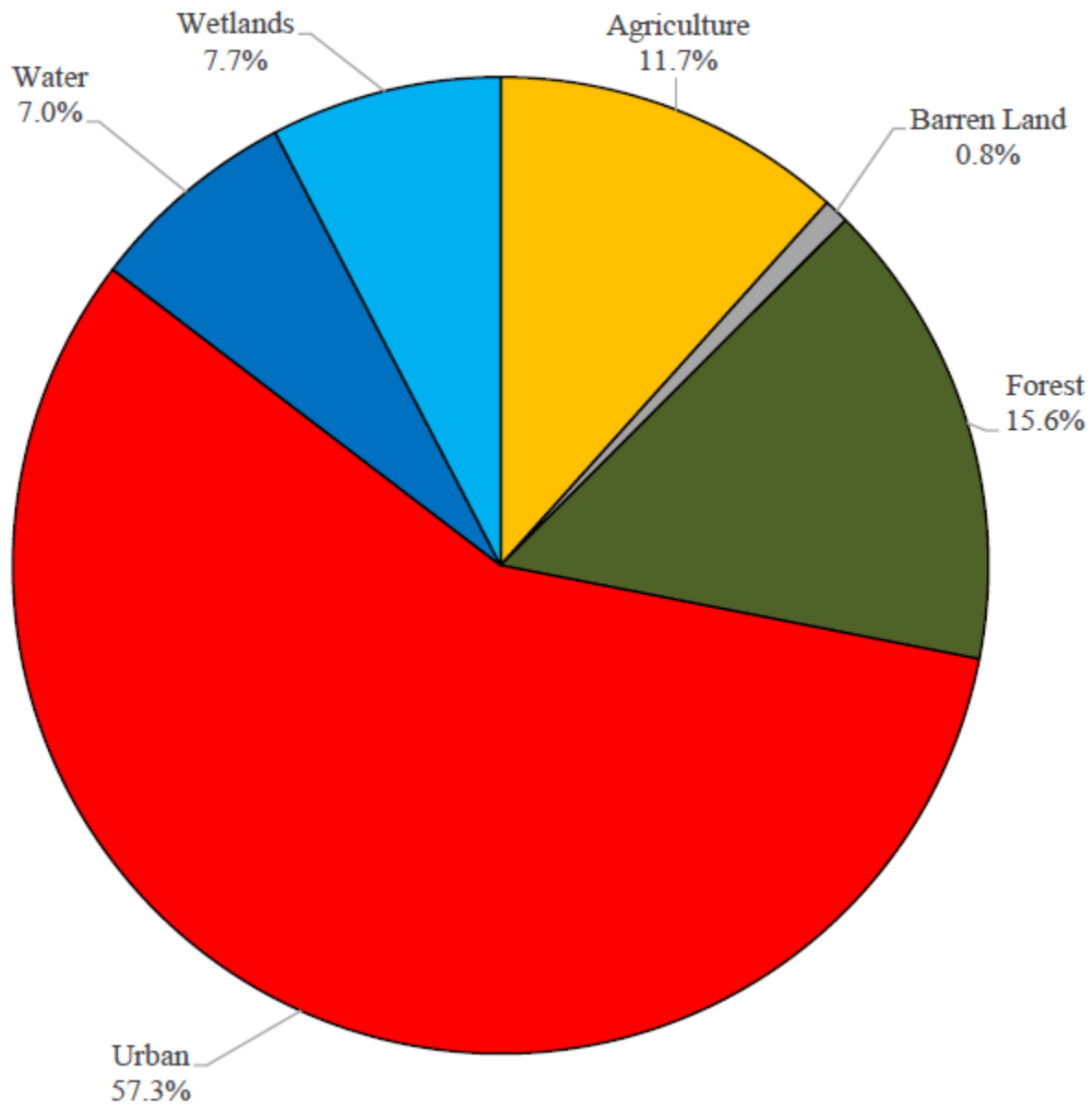
<b>Municipality</b>	<b>County</b>	<b>Total Area (acres)</b>	<b>Impervious Cover (acres)</b>	<b>% Impervious Cover</b>
Chester Twp	Morris	18,655.2	724.47	3.9%
Mendham Twp	Morris	3,826.4	407.4	10.7%
Washington Twp	Morris	12,939.3	692.0	5.4%
Roxbury Twp	Morris	14,039.8	1,819.10	13.6%
Mount Olive Twp	Morris	19,992.0	1,910.4	10.0%
Mendham Twp	Morris	11,526.7	529.6	4.7%
Randolph Twp	Morris	13,541.7	1945.1	14.5%
Mine Hill Twp	Morris	1,917.7	226.4	12.0%
Mount Arlington	Morris	1,794.7	314.2	22.7%
Peapack-Gladstone	Somerset	3,696.4	257.3	7.1%
Bedminster Twp	Somerset	16,875.5	879	5.3%
Far Hills Boro	Somerset	3,149.3	122.8	4.0%
Bernardsville Boro	Somerset	8,264.6	658.7	8.0%
Bernards Twp	Somerset	15,567.7	2,056.3	13.3%
<b>Municipal Average Impervious Cover =</b>				<b>10.5%</b>

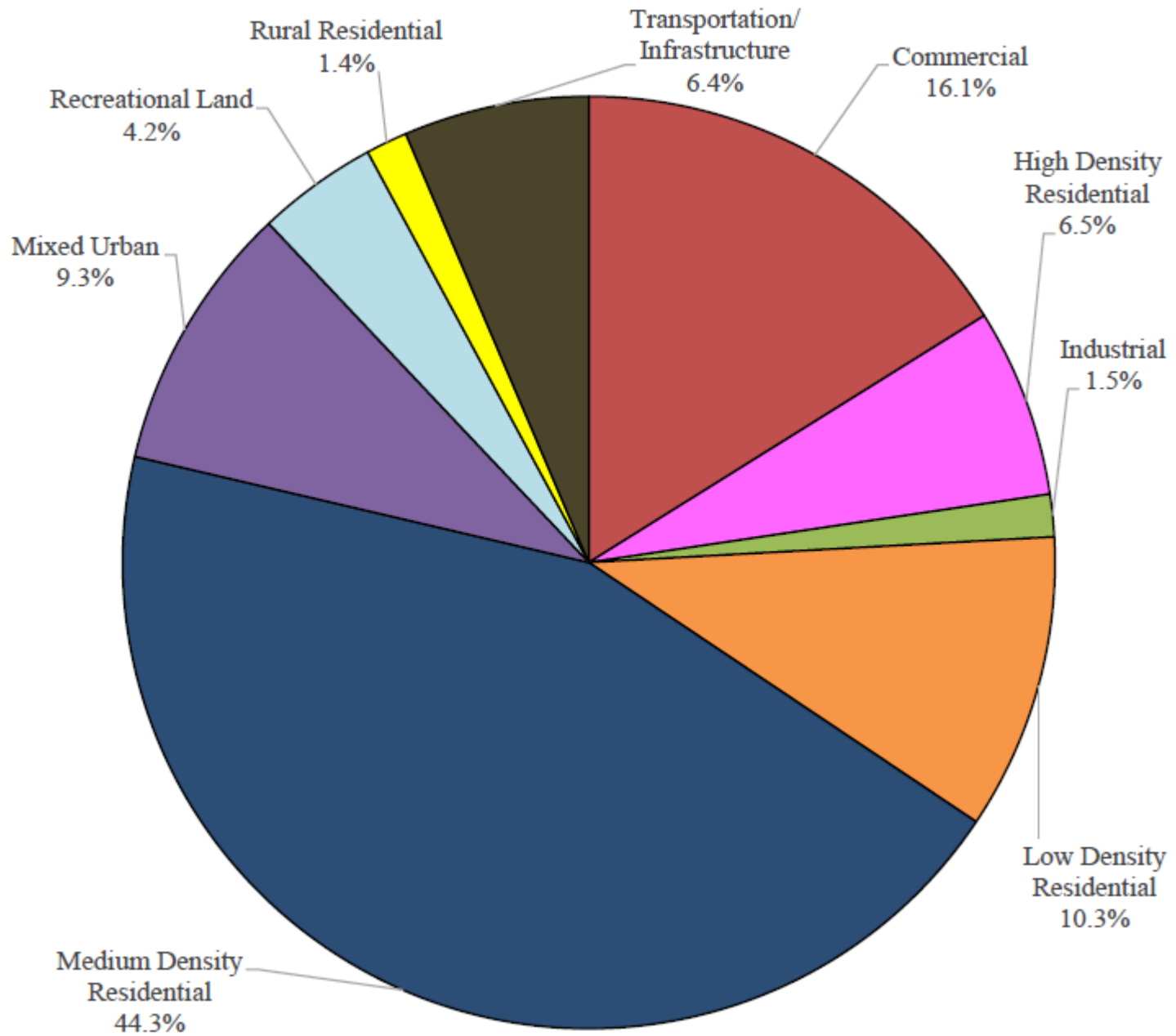
# Land Use for Clinton Town



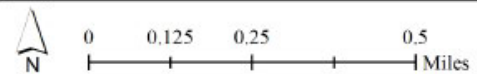
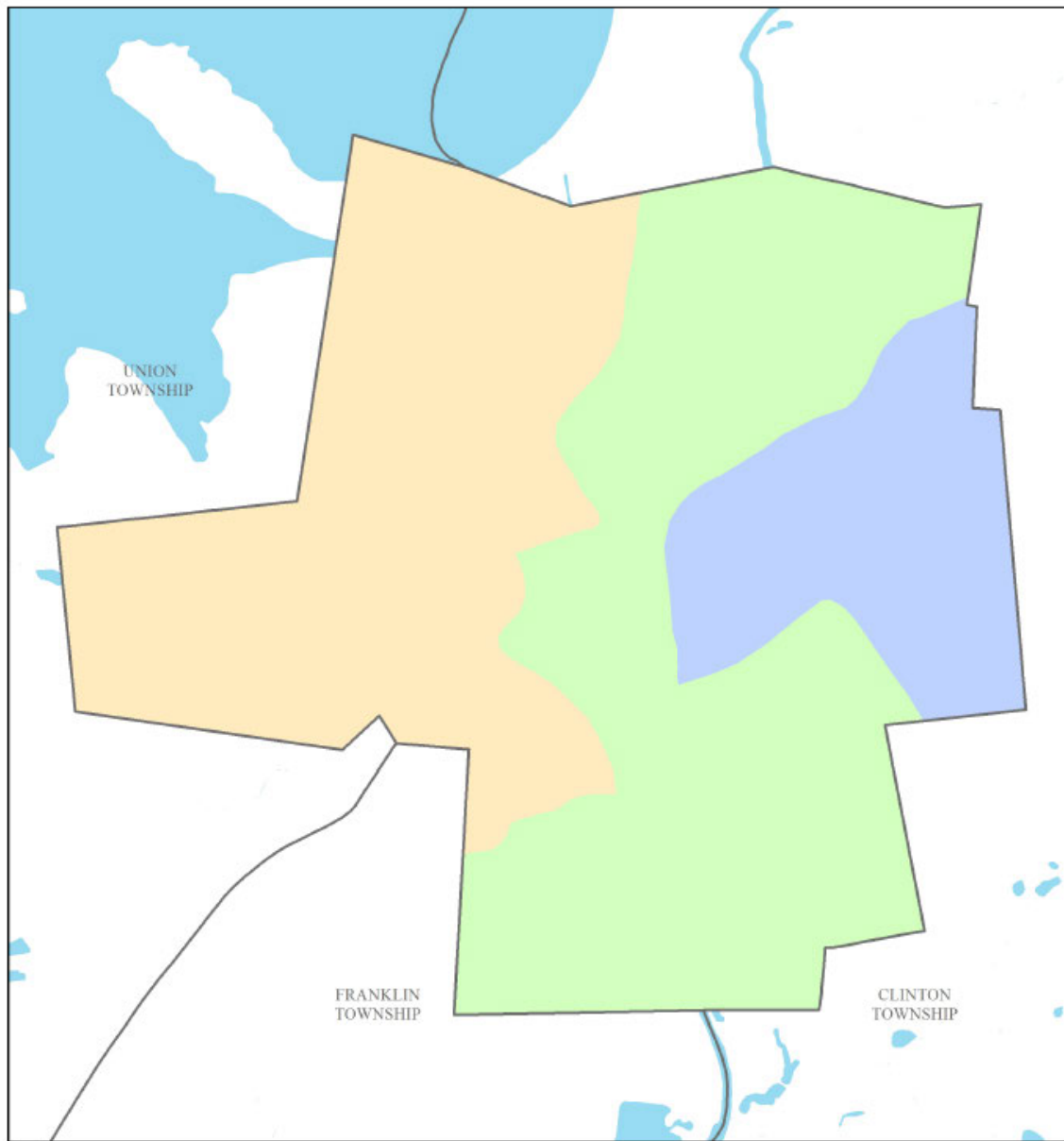
■ Agriculture ■ Barren Land ■ Forest ■ Urban ■ Water ■ Wetlands







# Subwatersheds of Clinton Town



Beaver Brook    Spruce Run Reservoir    Raritan River South Branch

<b>Watershed</b>	<b>Total Area (ac)</b>	<b>Impervious Cover (ac)</b>	<b>%</b>
<b>Beaver Brook</b>	152.3	70.8	47.4%
<b>Raritan River South Branch</b>	408.5	78.6	20.9%
<b>Spruce Run Reservoir</b>	357.1	60.7	18.5%
<b>Total</b>	917.9	210.2	24.6%

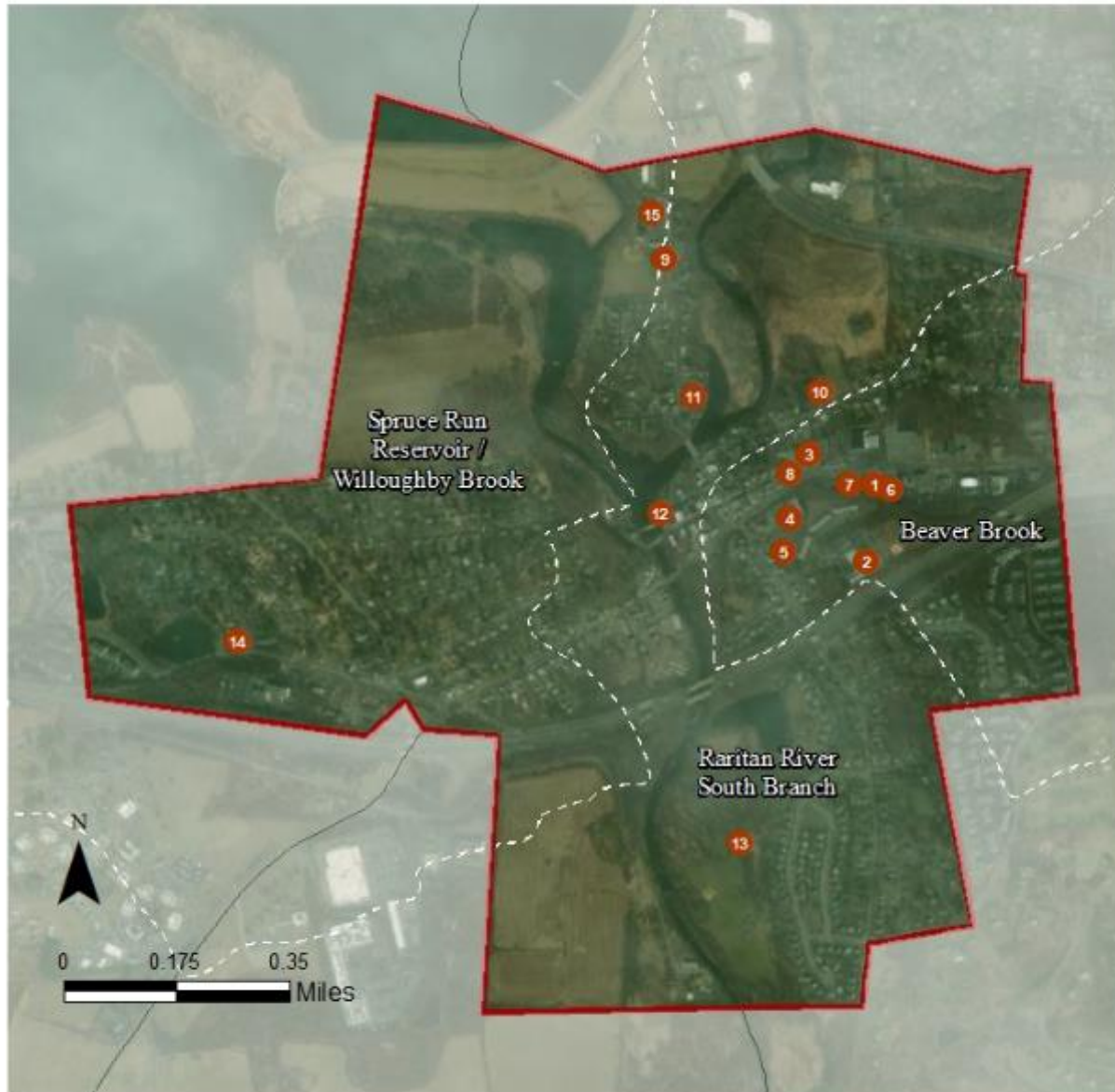


<b>Subwatershed</b>	<b>NJ Water Quality Storm (MGal)</b>	<b>Annual Rainfall of 44" (MGal)</b>	<b>2-Year Design Storm (3.38") (MGal)</b>	<b>10-Year Design Storm (5.00") (MGal)</b>	<b>100-Year Design Storm (8.03") (MGal)</b>
<b>Beaver Brook</b>	2.4	84.6	6.5	9.6	15.4
<b>Raritan River South Branch</b>	2.7	93.9	7.2	10.7	17.1
<b>Spruce Run Reservoir</b>	2.1	72.5	5.6	8.2	13.2
<b>Total</b>	7.1	251.1	19.3	28.5	45.8

# WE LOOK HERE FIRST:

- ✓ Schools
  - ✓ Places of Worship
  - ✓ Libraries
  - ✓ Municipal Building
  - ✓ Public Works
  - ✓ Firehouses
  - ✓ Post Offices
  - ✓ Elks or Moose Lodge
  - ✓ Parks/ Recreational Fields
- 20 to 40 sites are entered into a PowerPoint
  - Site visits are conducted

## TOWN OF CLINTON: GREEN INFRASTRUCTURE SITES



### SITES WITHIN THE BEAVER BROOK SUBWATERSHED

1. Basil Bandwagon
2. Clinton Elementary School
3. Clinton Fire Department
4. Clinton Municipal Offices
5. Evangel Chapel
6. Neo Sushi
7. Tirpok Cleaners
8. United States Postal Service

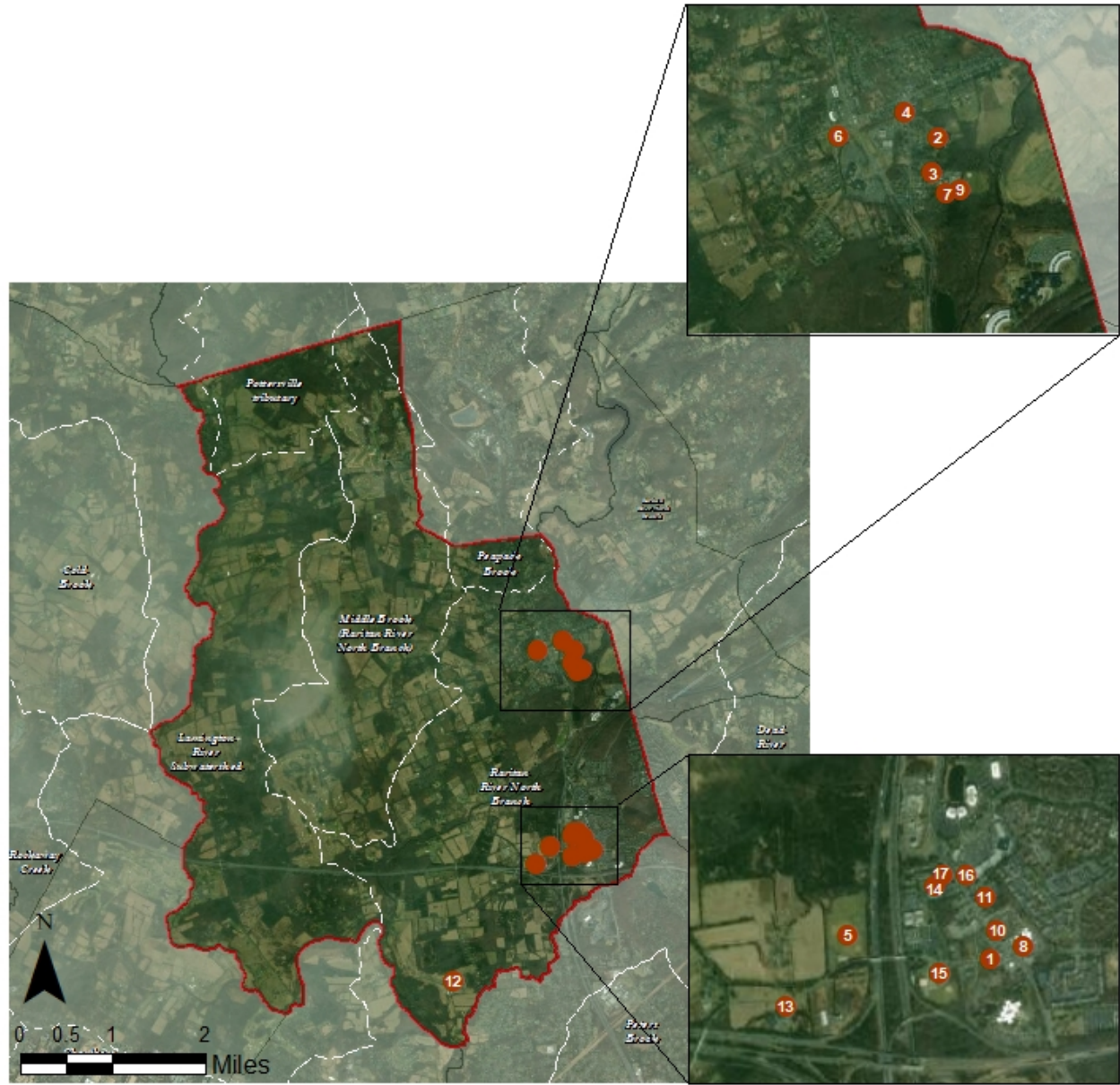
### SITES WITHIN THE RARITAN RIVER SOUTH BRANCH SUBWATERSHED

9. Clinton Community Center
10. Clinton Presbyterian Church
11. Clinton United Methodist Church
12. Hunterdon Art Museum
13. Hunts Mills Park

### SITES WITHIN THE SPRUCE RUN RESERVOIR /WILLOUGHBY BROOK SUBWATERSHED

14. Pediatric Surgical Associates
15. North County Library

# BEDMINSTER TOWNSHIP: GREEN INFRASTRUCTURE SITES

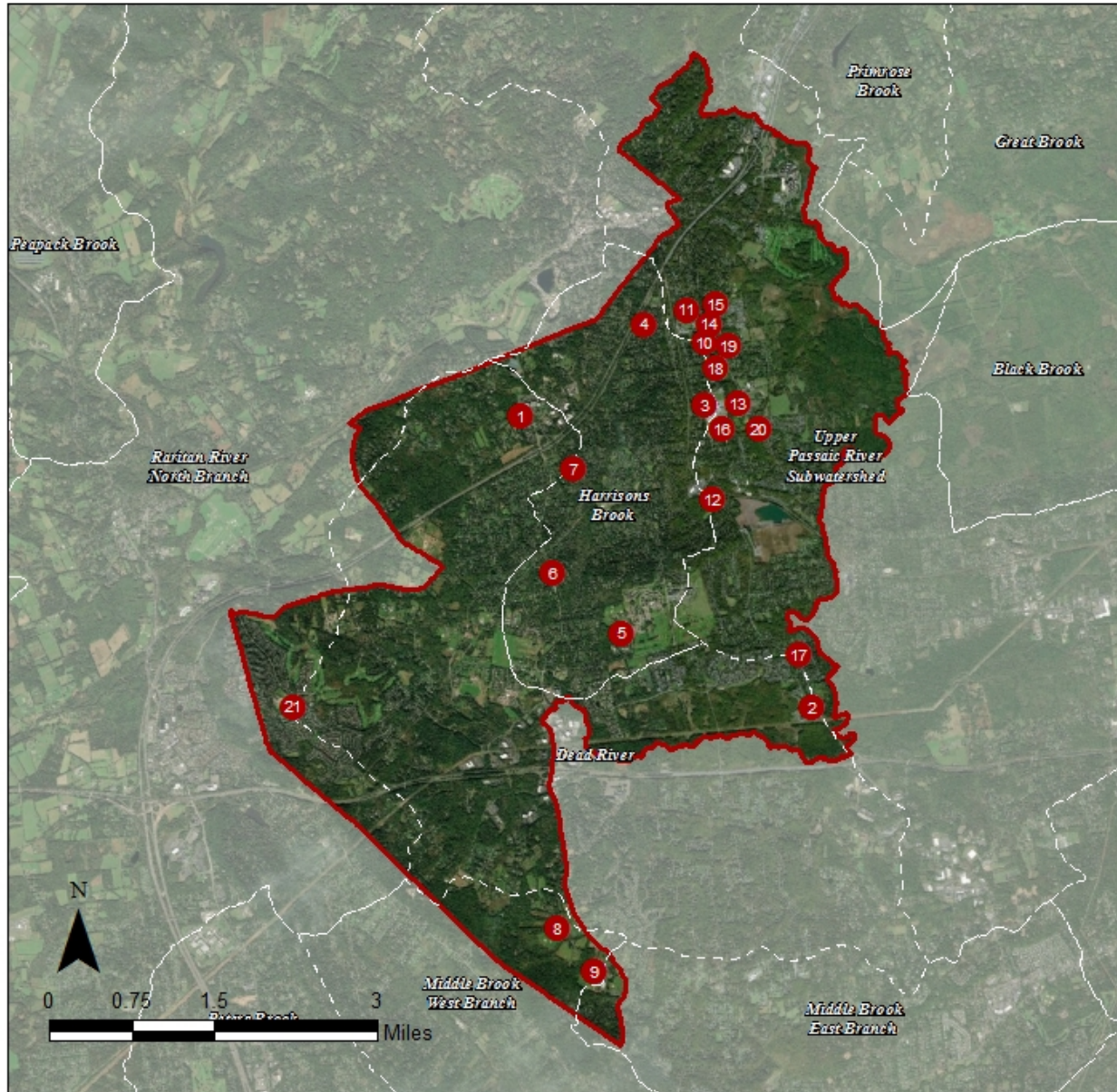


## SITES WITHIN THE RARITAN RIVER NORTH BRANCH SUBWATERSHED

1. Annie's Deli
2. Bedminster Public School
3. Bedminster Township Municipal Court
4. Bedminster USPS
5. Burnt Mills Park
6. Clarence Dillon Public Library
7. Far Hills-Bedminster Fire Department
8. Fresh Market
9. Miller Lane Park
10. Oasis Day Spa
11. Pluckemin USPS
12. Somerset Airport
13. Somerset Hills Learning Institute
14. Sordoni Construction Company
15. The Center for Contemporary Art
16. The Hills Village Center
17. The Pluckemin Inn



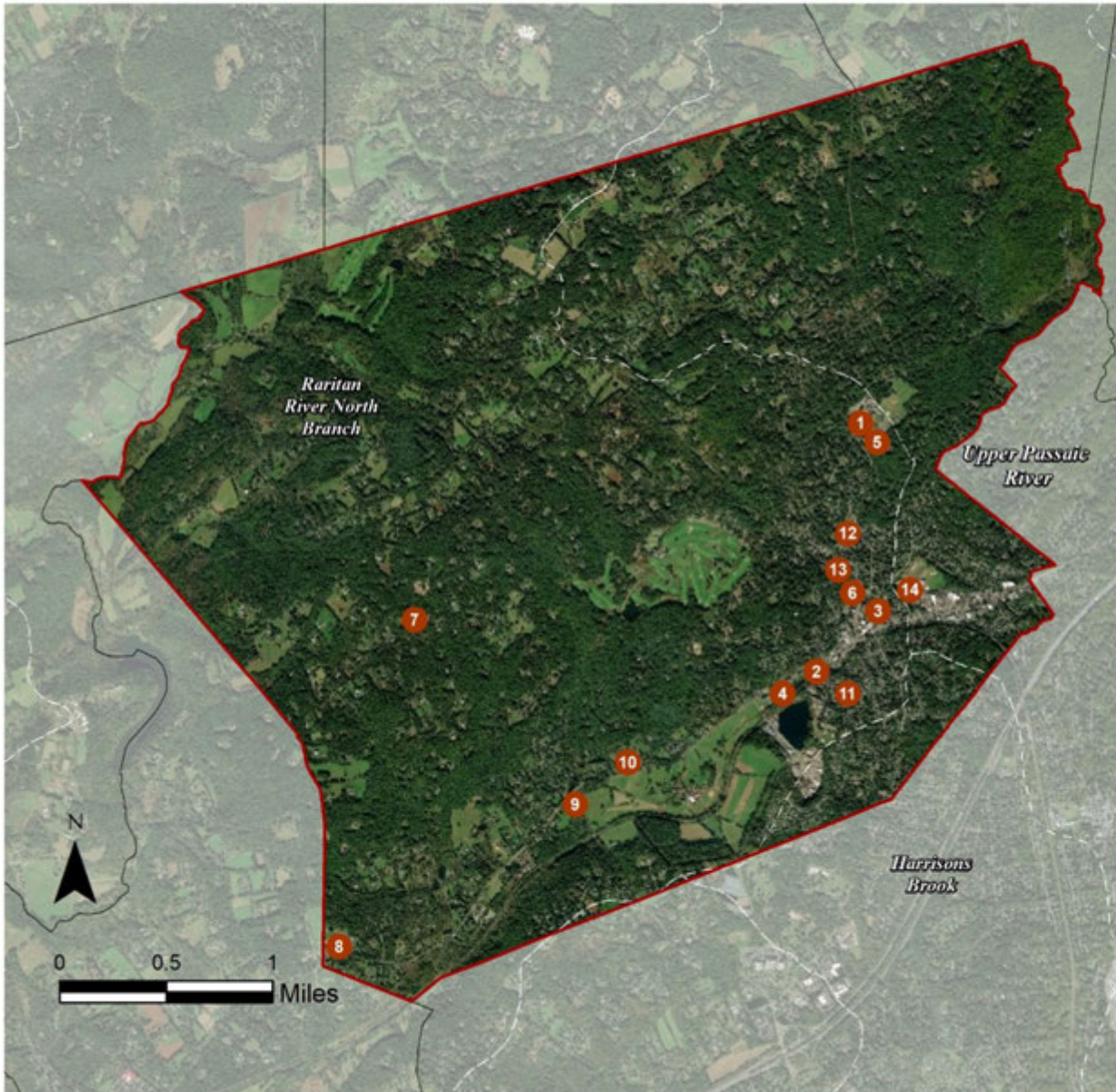
# BERNARDS TOWNSHIP: GREEN INFRASTRUCTURE SITES



- SITES WITHIN THE DEAD RIVER SUBWATERSHED
  1. King of Kings Worship Center
  2. DUNKIN'
- SITES WITHIN THE HARRISONS BROOK SUBWATERSHED
  3. Bernards Township Health Department
  4. Covenant Chapel Reformed
  5. Pleasant Valley Park
  6. Somerset Hills Baptist Church
  7. Somerset Hills Lutheran Church
- SITES WITHIN THE MIDDLE BROOK WEST BRANCH SUBWATERSHED
  8. Mountain Park Baseball and Soccer Fields
  9. The Pingry School
- SITES WITHIN THE UPPER PASSAIC RIVER SUBWATERSHED
  10. Bank of America Financial Center
  11. Basking Ridge Post Office
  12. Bernards Township Community Services
  13. Bernards Township Fire Department
  14. Bernards Township Library
  15. Bishop Janes United Methodist Church
  16. Cedar Hill Elementary School
  17. Millington Baptist Church
  18. The Church of Saint James/ Saint James School
  19. St. Mark's Episcopal Church
  20. War Memorial Field
- SITES WITHIN THE RARITAN RIVER NORTH BRANCH SUBWATERSHED
  21. Fulton Bank of New Jersey



## BERNARDSVILLE BOROUGH: GREEN INFRASTRUCTURE SITES



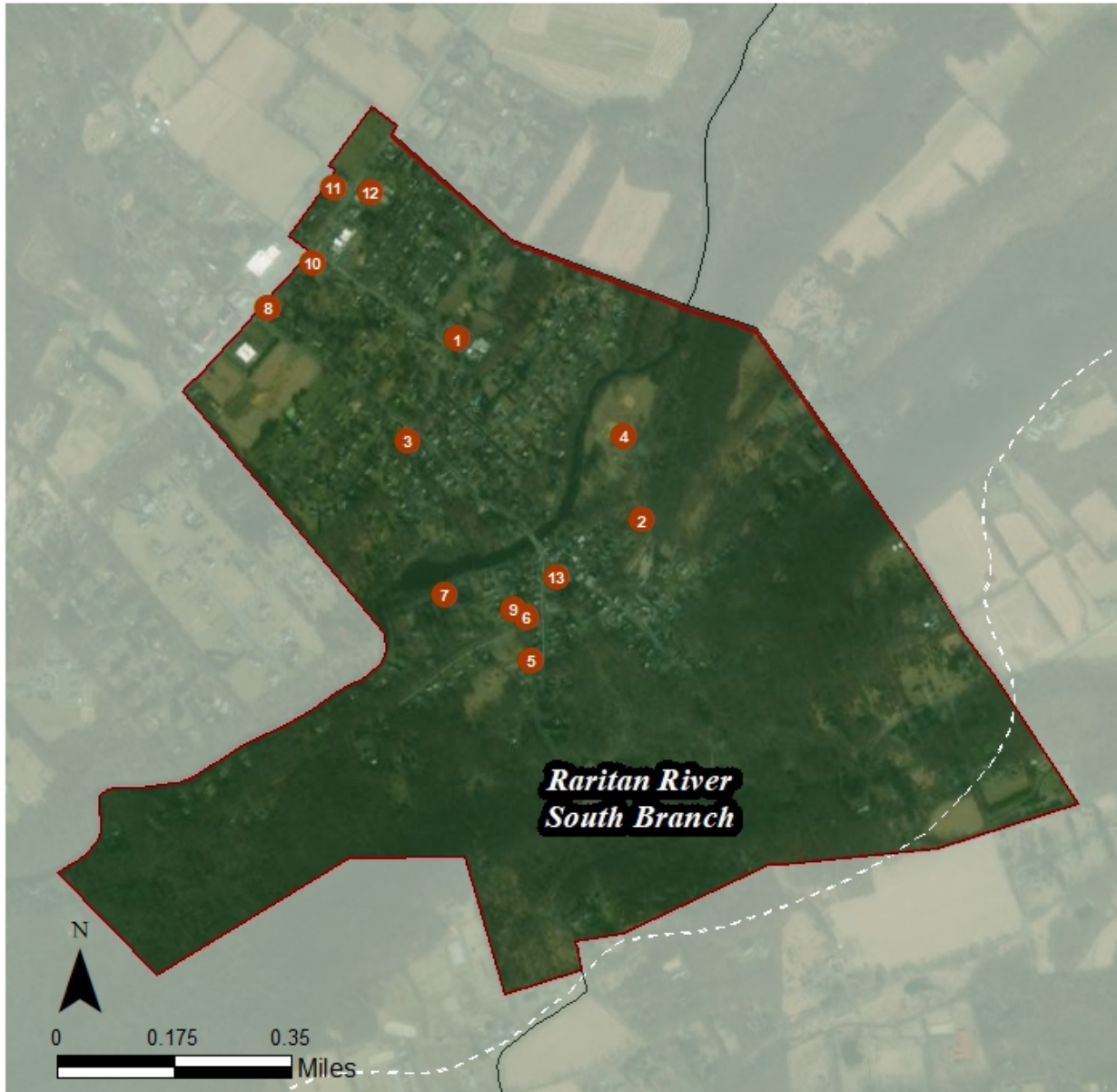
### SITES WITHIN THE RARITAN RIVER NORTH BRANCH SUBWATERSHED

1. Bedwell Elementary School
2. Bernardsville Fire Company
3. Bernardsville Library
4. Bernardsville Municipal Court & Nervine Park
5. Bernardsville Municipal Pool
6. Bernardsville School of Music
7. Church of Saint John of the Mountain
8. Far Hills Country Day School
9. First Church of Christ, Scientist
10. Good Shepherd Church
11. Sacred Heart Chapel
12. School of Saint Elizabeth
13. Saint Bernard's Church

### SITES WITHIN THE UPPER PASSAIC RIVER SUBWATERSHED

14. Bernards High School & Somerset Hills School District

## CALIFON BOROUGH: GREEN INFRASTRUCTURE SITES

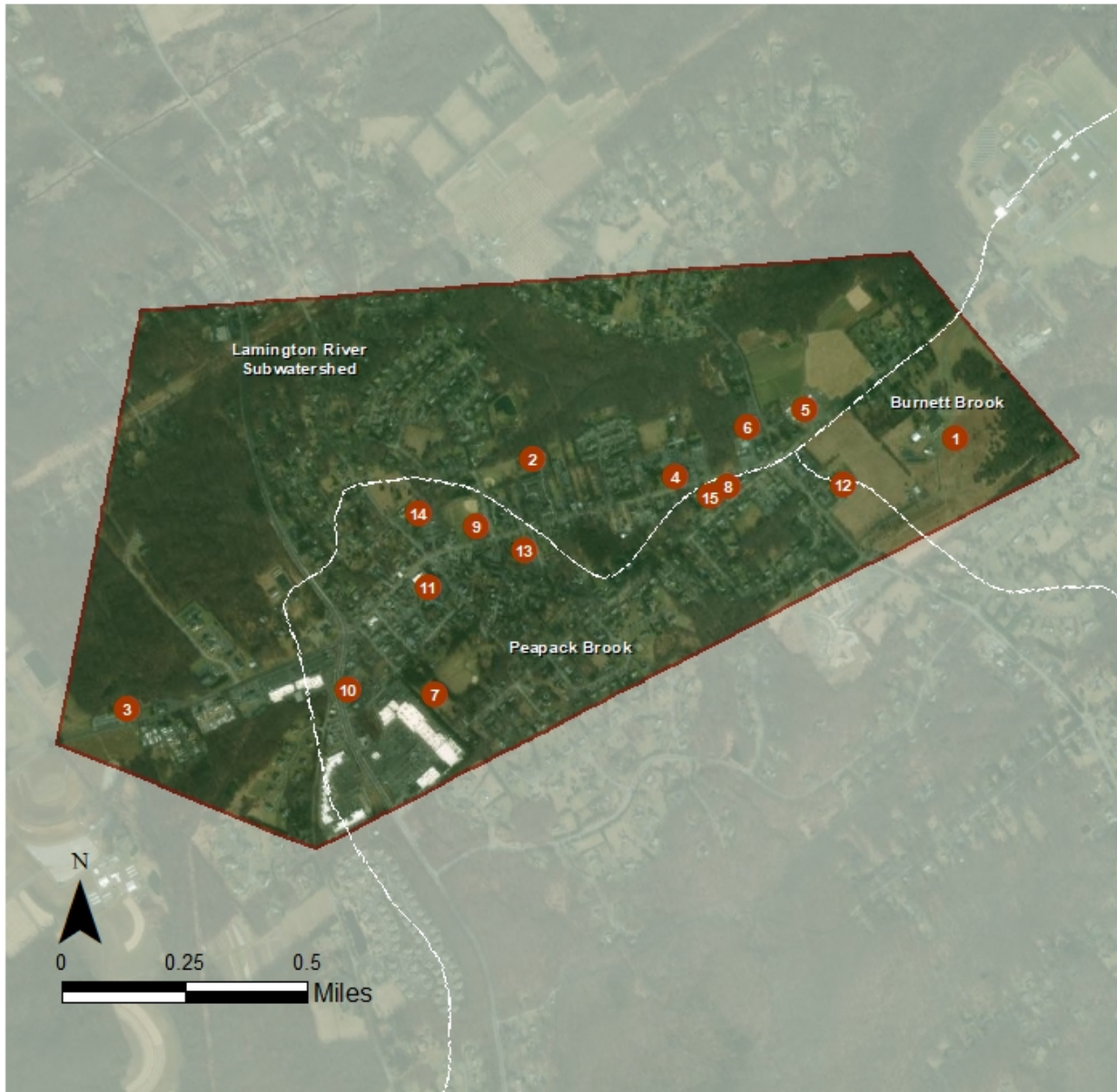


### SITES IN THE RARITAN RIVER SOUTH BRANCH WATER SHED

1. Califon Borough Elementary School
2. Califon First Aid Squad
3. Califon General Store
4. Califon Island Park
5. Califon Municipal Office
6. Califon Train Station
7. Califon United Methodist Church
8. Califon Wine and Spirits
9. Coughlin Funeral Home
10. James M Murray CPA
11. Lower Valley Presbyterian Church
12. Staianos Furniture
13. United States Postal Service



## CHESTER BOROUGH: GREEN INFRASTRUCTURE SITES



### SITES WITHIN THE BURNETT BROOK SUBWATERSHED

1. Chester Borough Office

### SITES WITHIN THE LAMINGTON RIVER SUBWATERSHED

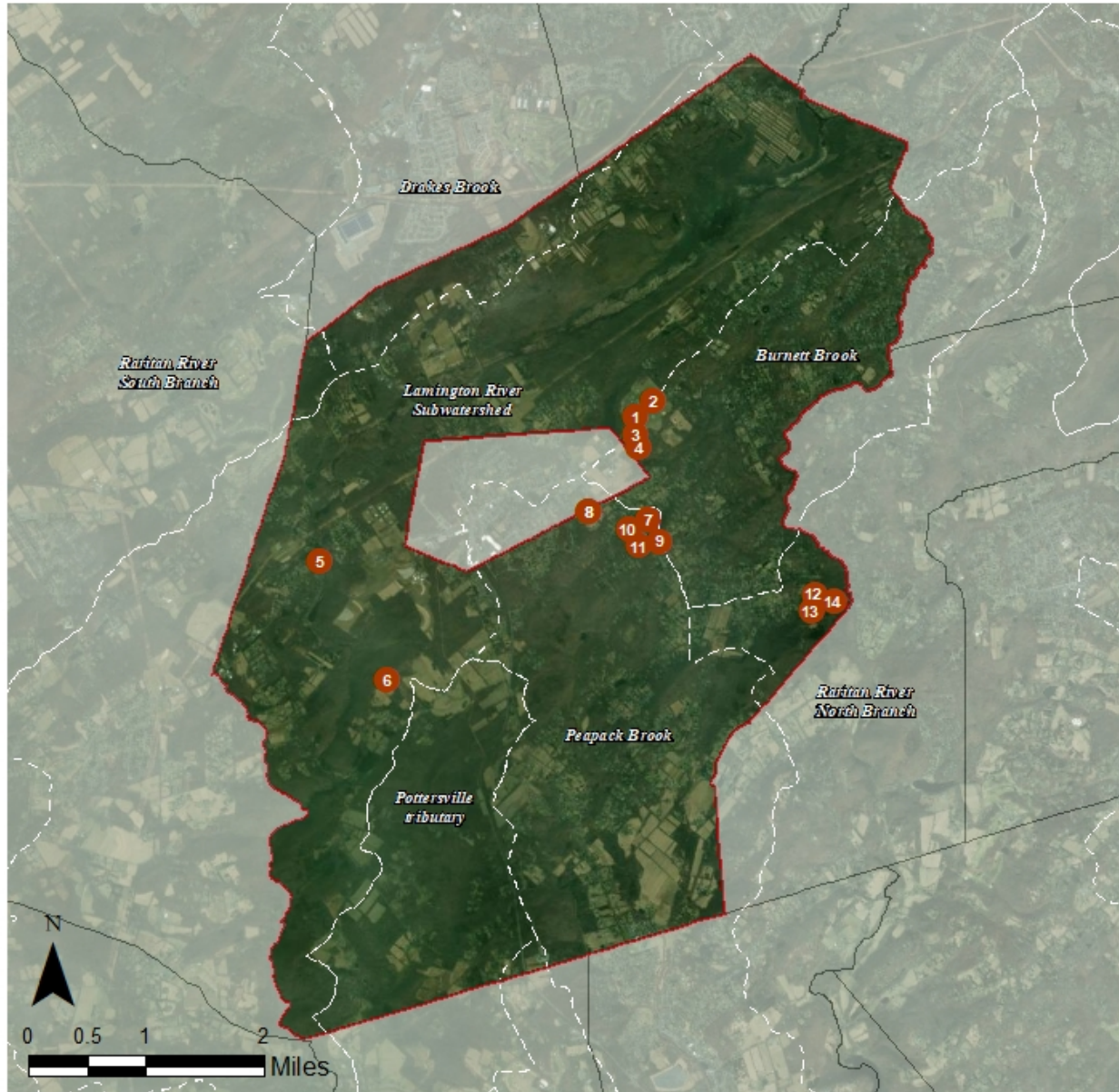
2. Chester Senior Housing
3. Chester Library
4. St. Lawrence Church
5. Stony Hill Farm Market
6. Suburban Hills School

### SITES WITHIN THE PEAPACK BROOK SUBWATERSHED

7. Borough of Chester Recreation Office
8. Chase Bank
9. Chester Borough Park
10. Chester Diner
11. Chester Fire Company
12. Chester Tennis Club
13. Community Presbyterian Church
14. First Congregational Church
15. United States Postal Service



## CHESTER TOWNSHIP: GREEN INFRASTRUCTURE SITES



### SITES WITHIN THE BURNETT BROOK SUBWATERSHED

1. Black River Middle School
2. Black River Recreation
3. Highlands Ridge Park
4. New Jersey Highlands Council

### SITES WITHIN THE LAMINGTON RIVER SUBWATERSHED

5. Chester Township Municipal Building
6. Kay Environmental Education Center

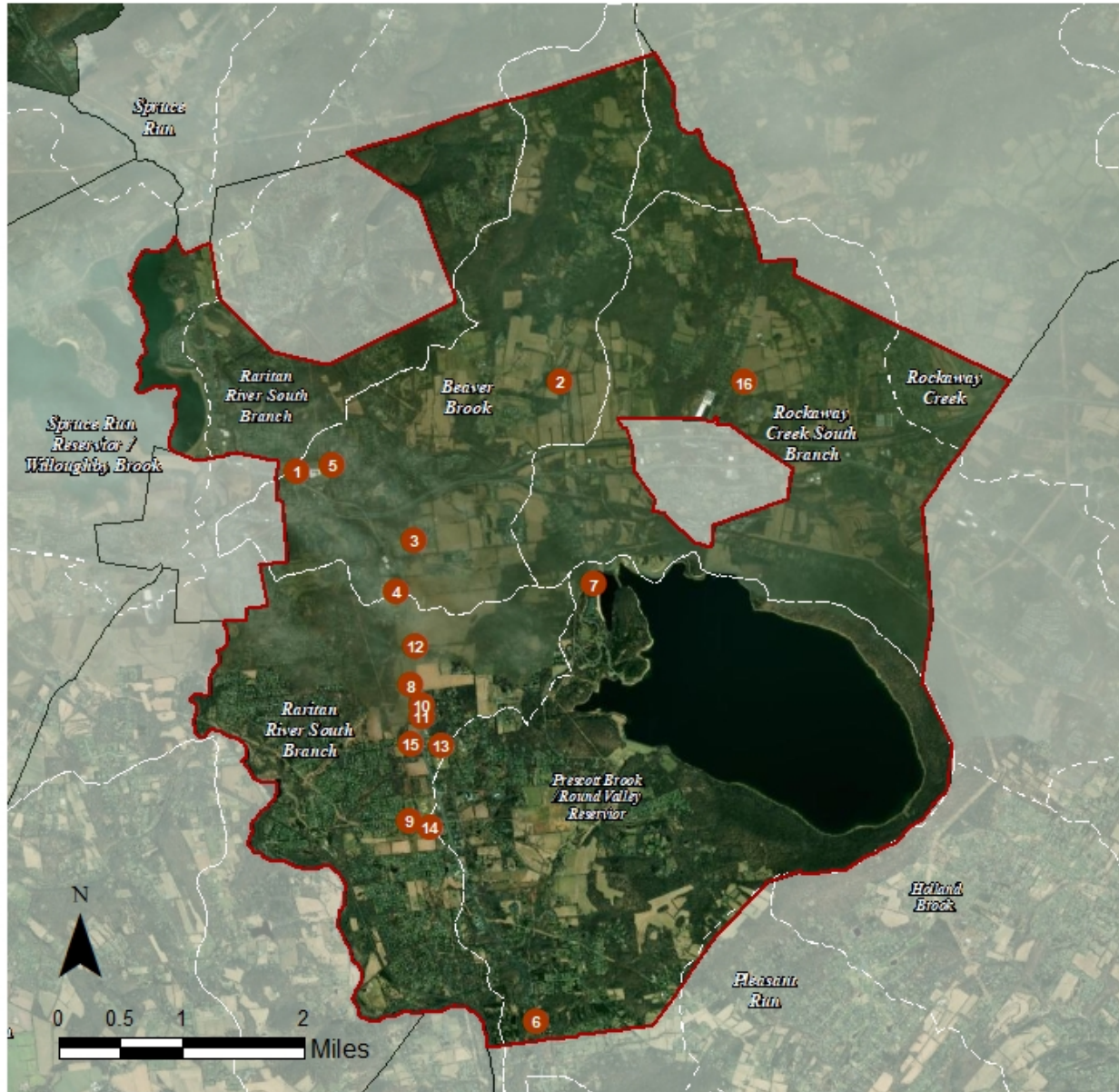
### SITES WITHIN THE PEAPACK BROOK SUBWATERSHED

7. American Legion Post 342
8. Dickerson School & Bragg School
9. Hudson City Savings Bank
10. landoli & Edens Attorneys at Law
11. Pizza & Bagel 24

### SITES WITHIN THE RARITAN RIVER NORTH SUBWATERSHED

12. Mendham Animal Hospital
13. Mendham Hills Community Church
14. Westmont Montessori School

# CLINTON TOWNSHIP: GREEN INFRASTRUCTURE SITES



## SITES WITHIN THE BEAVER BROOK SUBWATERSHED

1. Clinton Township Middle School
2. Hunterdon Preparatory School
3. Immaculate Conception Church
4. North Hunterdon Regional High School
5. Spruce Run School

## SITES WITHIN THE PRESCOTT BROOK/ROUND VALLEY RESERVOIR

6. Hunterdon County Arboretum
7. Round Valley Reservoir

## SITES WITHIN THE RARITAN RIVER SOUTH BRANCH SUBWATERSHED

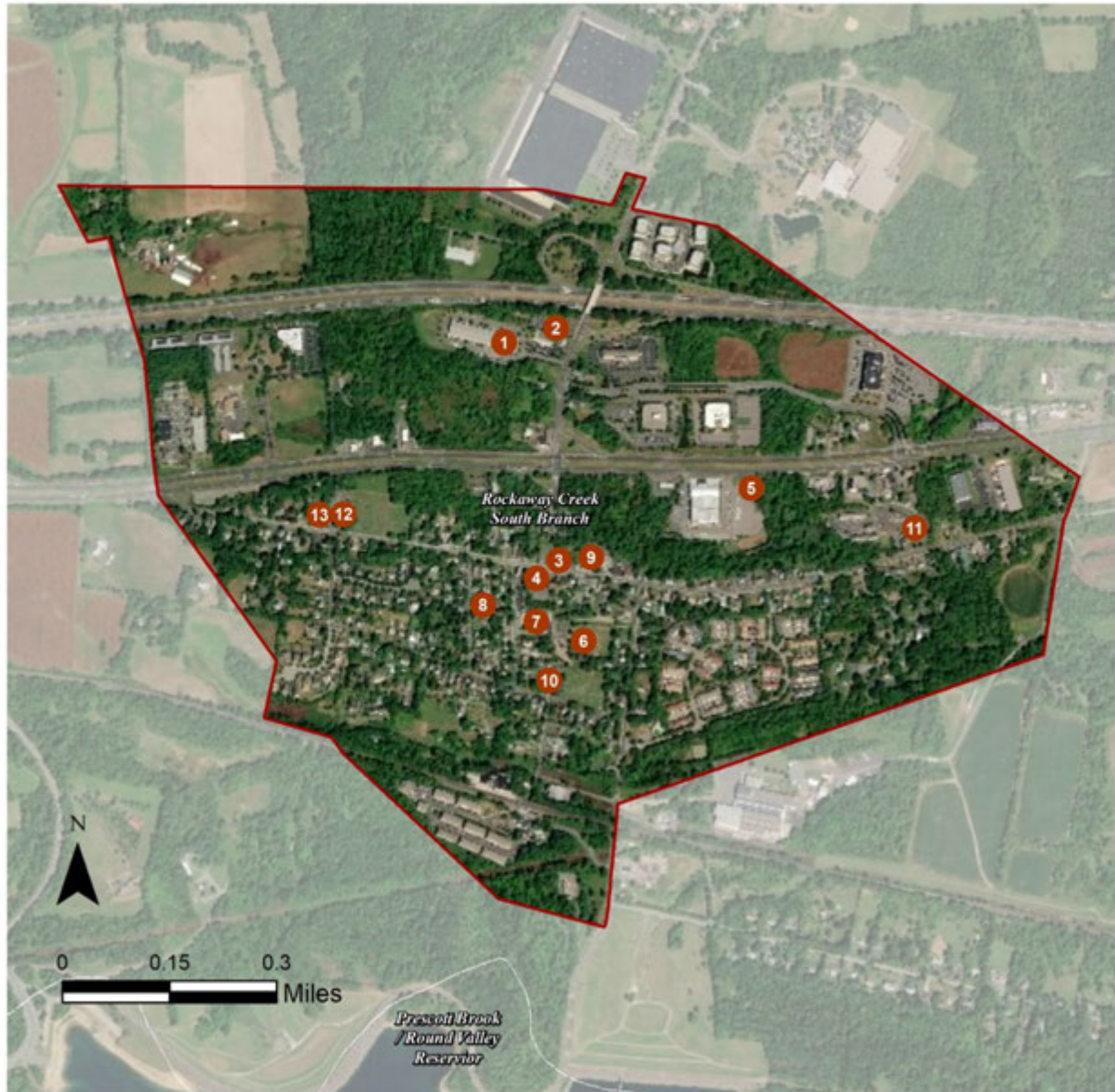
8. All Trades Contracting, Inc.
9. Bundt Park
10. Gebhardt & Kiefer, P. C.
11. Harper's Table
12. North Hunterdon Municipal Court
13. Patrick McGaheran School
14. The Church of Jesus Christ of Latter-day Saints

## SITES WITHIN THE ROCKAWAY CREEK SUBWATERSHED

15. Union Community Bible Church
16. Round Valley School



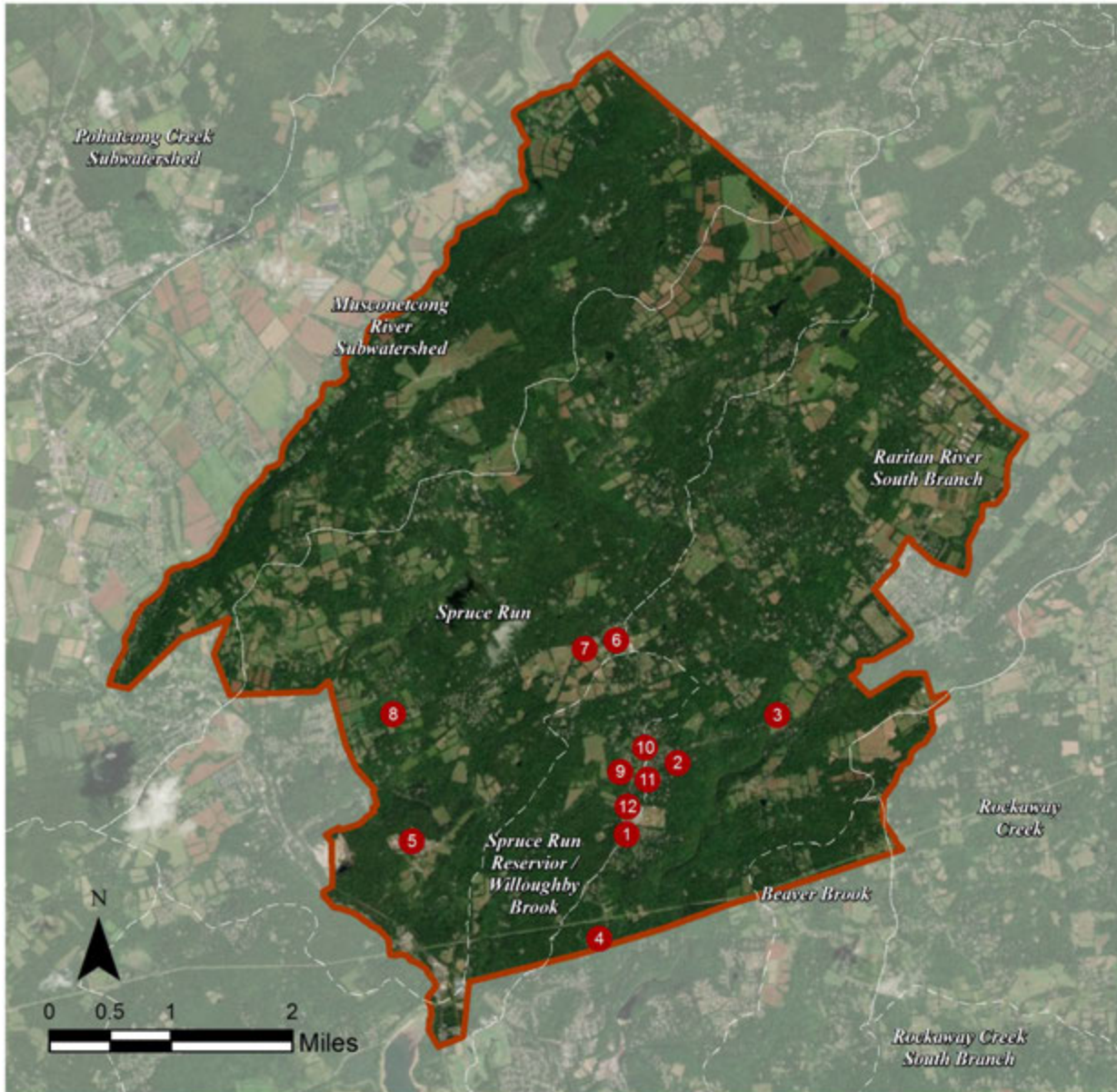
## LEBANON BOROUGH: GREEN INFRASTRUCTURE SITES



### SITES WITHIN THE ROCKAWAY CREEK SOUTH BRANCH SUBWATERSHED

1. Cokesbury Road Industrial Park
2. Cutshaw Construction
3. Dairy Technomics
4. Fox & Hound Tavern
5. Healthy Balance
6. Holjes-Sheppard Memorial Park
7. Lebanon Borough Elementary School
8. Lebanon Borough Municipal Office
9. Lebanon Fire Department
10. Lebanon Reformed Church
11. Oasis Commons
12. Round Valley United Methodist Church
13. Scarponi-Bright Funeral Home

## LEBANON TOWNSHIP: GREEN INFRASTRUCTURE SITES



### SITES WITHIN THE RARITAN RIVER SOUTH BRANCH SUBWATERSHED

1. Body of Christ Ministries
2. Groendyke Associates
3. Oldwick Village Auto Body
4. Voorhees Residential Community Home

### SITES WITHIN THE SPRUCE RUN SUBWATERSHED

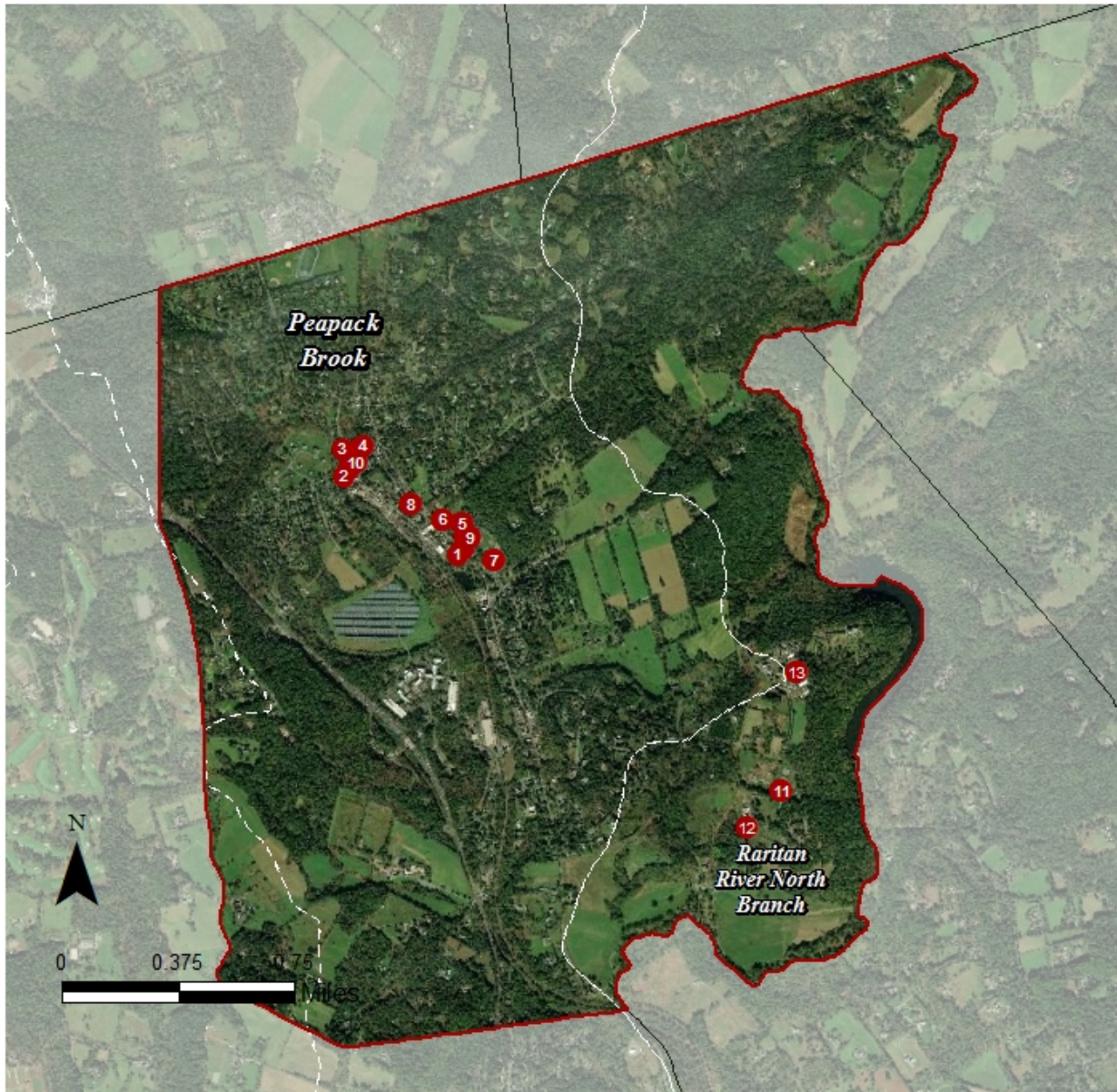
5. Freedom House
6. Lebanon Township Municipal Building
7. Lebanon Township Volunteer Fire Department – Station 3
8. Spruce Run Lutheran Church

### SITES WITHIN THE SPRUCE RUN RESERVOIR / WILLOUGHBY BROOK SUBWATERSHED

9. Bunnvale Assembly of God
10. Bunnvale Library
11. Ono Rosa Restaurant
12. Voorhees High School



## PEAPACK-GLADSTONE: GREEN INFRASTRUCTURE SITES



### SITES WITHIN THE PEAPACK BROOK SUBWATERSHED

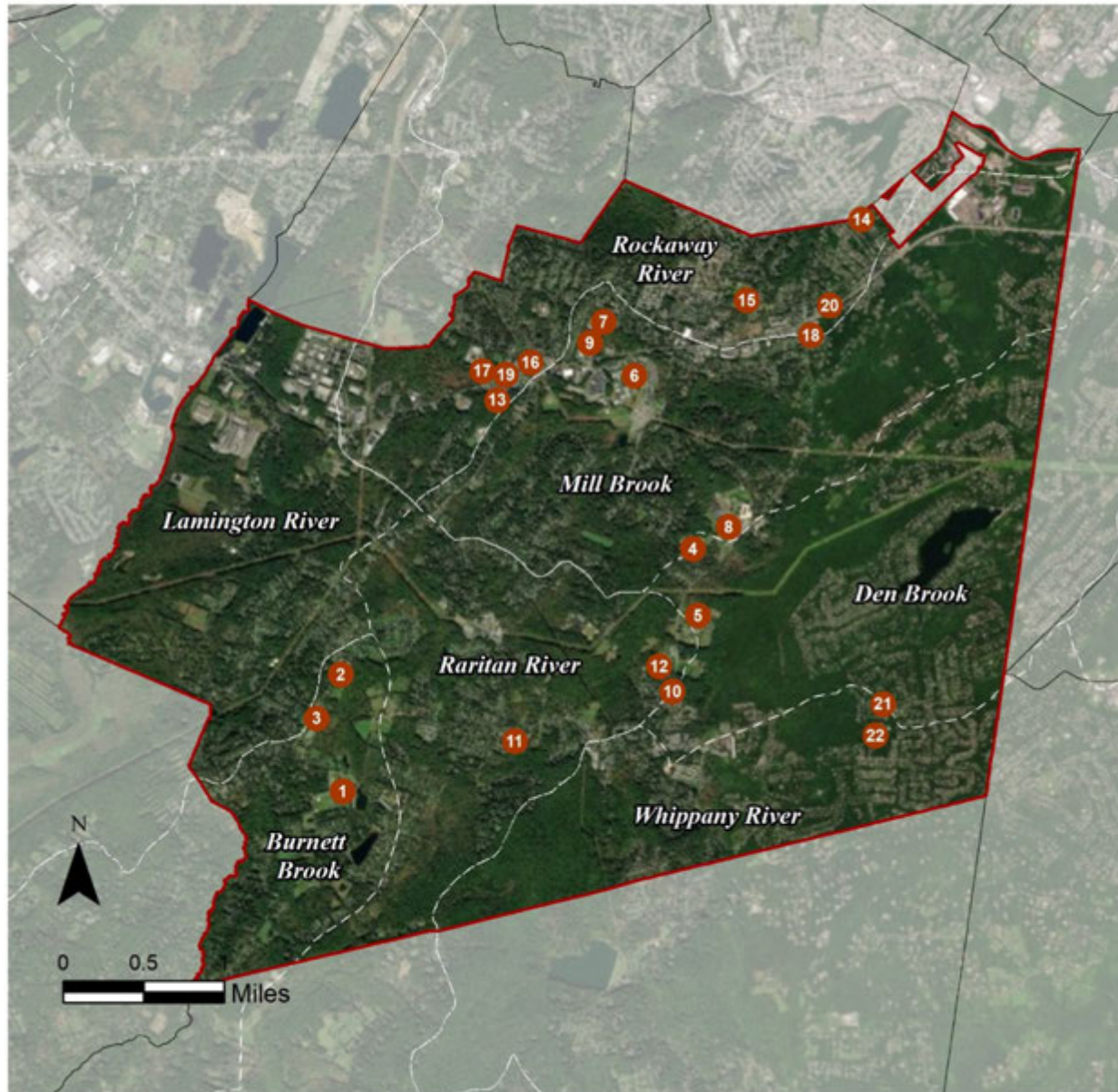
1. Bailey Funeral Home
2. Gladstone Tavern
3. Murphy Capital Management
4. Peapack & Gladstone Fire Department
5. Peapack-Gladstone First Aid & Rescue Squad
6. Peapack-Gladstone Bank
7. Peapack & Gladstone Library
8. Peapack Reformed Church
9. Saint Luke's Episcopal Church
10. USPS

### SITES WITHIN THE RARITAN RIVER NORTH BRANCH SUBWATERSHED

11. Cooking School at Natirar
12. Natirar Park
13. The Matheny School



## RANDOLPH TOWNSHIP: GREEN INFRASTRUCTURE SITES



### SITES WITHIN THE BURNETT BROOK SUBWATERSHED

1. Heistein Park
2. Ironia Elementary School
3. Randolph Township Fire Department Company #4

### SITES WITHIN THE DEN BROOK SUBWATERSHED

4. Center Grove Elementary School
5. Freedom Park

### SITES WITHIN THE MILL BROOK SUBWATERSHED

6. County College of Morris
7. Iglesia Alianza
8. Randolph High School
9. The Connect Church: Randolph

### SITES WITHIN THE RARITAN RIVER SUBWATERSHED

10. Randolph Township Fire Department Company #3
11. Randolph Township Library & Community Center
12. Resurrection Parish

### SITES WITHIN THE ROCKAWAY RIVER SUBWATERSHED

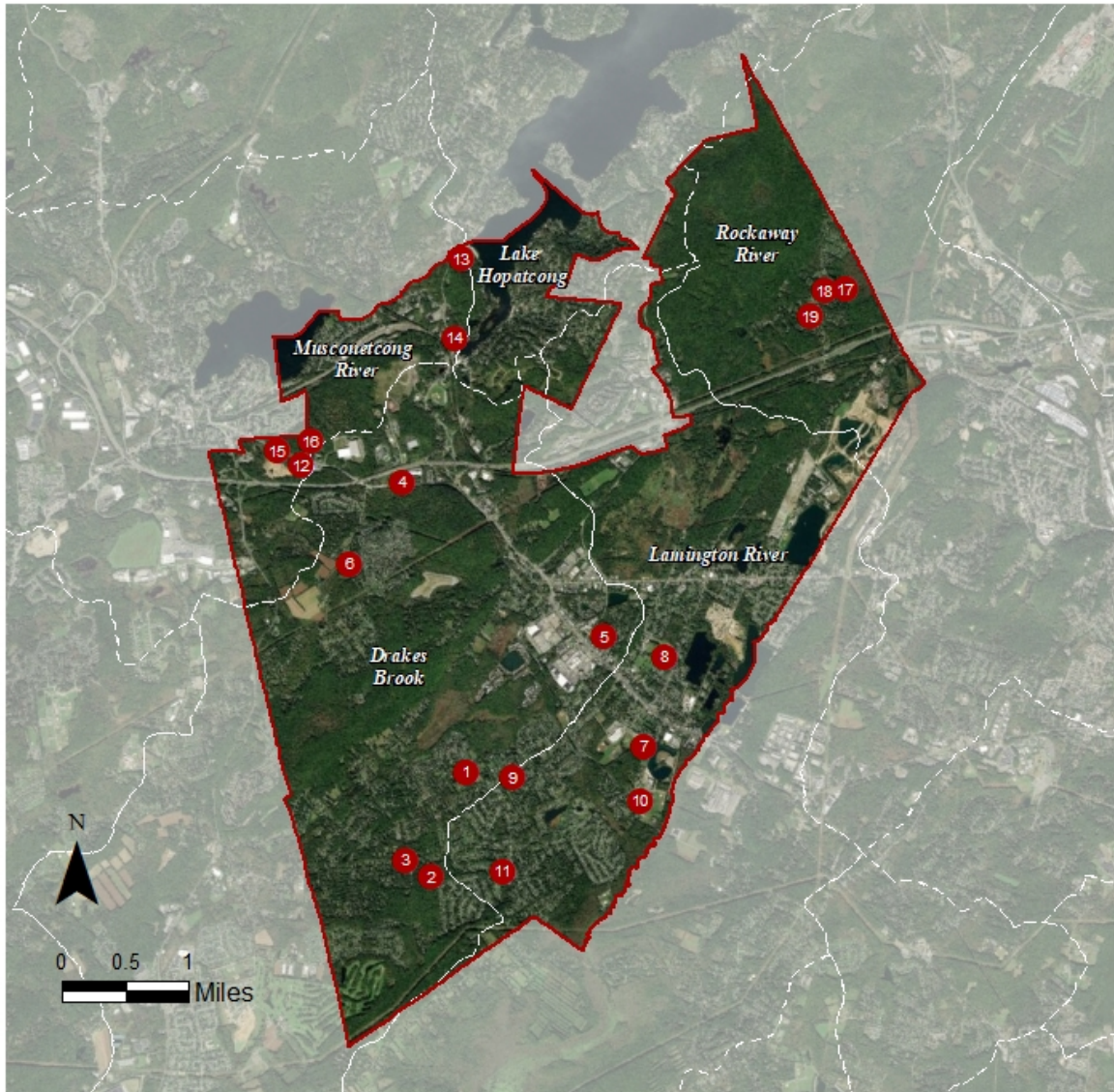
13. Bible Church International
14. Christadelphian Chapel
15. Fernbrook Elementary School
16. Grace Church Bethlehem Campus
17. Mar Thoma Church of New Jersey
18. Millbrook United Methodist Church
19. Randolph Rescue Squad

### SITES WITHIN THE WHIPPANY RIVER SUBWATERSHED

20. Randolph Township Fire Department Company #2
21. Randolph Township Fire Department Company #5
22. Shongum Elementary School



## ROXBURY TOWNSHIP: GREEN INFRASTRUCTURE SITES



### SITES WITHIN THE DRAKES BROOK SUBWATERSHED

1. Jefferson Elementary School
2. Kiwanis Park
3. Roxbury Community Garden
4. Roxbury Township Court Clerk
5. Saint Therese Church
6. The Church of Jesus Christ of Latter-day Saints

### SITES WITHIN THE LAMINGTON RIVER SUBWATERSHED

7. Eisenhower Middle School & Roxbury High School
8. Franklin Elementary School & Lincoln Roosevelt School
9. Hillside Lutheran Brethren Church
10. Horseshoe Lake Recreation Complex
11. Kennedy Elementary School

### SITES WITHIN THE MUSCONETCONG RIVER SUBWATERSHED

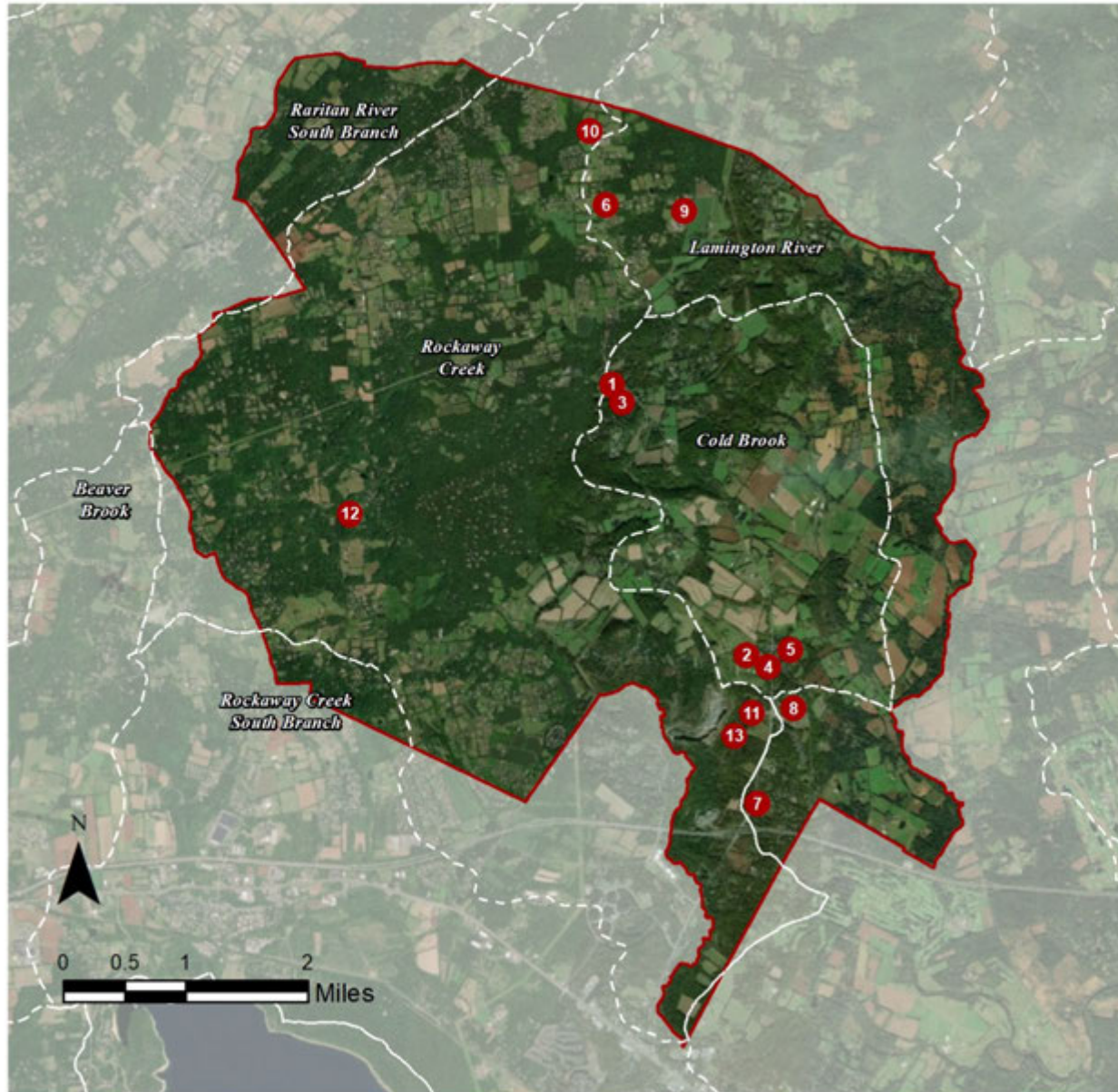
12. Grace Church on the Mount
13. Lake Hopatcong Historical Museum and State Park
14. Landing Post Office
15. Saint Hubert's Animal Welfare Center Noah's Ark
16. The Animal Hospital of Roxbury

### SITES WITHIN THE ROCKAWAY RIVER SUBWATERSHED

17. Berkshire Valley Park
18. Roxbury Fire Company 3
19. United Methodist Church



## TEWKSBURY TOWNSHIP: GREEN INFRASTRUCTURE SITES



### SITES WITHIN THE COLD BROOK SUBWATERSHED

1. Old Turnpike Middle School
2. Oldwick Park
3. Tewksbury First Aid & Rescue, Administration/Police, and Municipal Complex
4. Tewksbury Township Library
5. Zion Lutheran Church

### SITES WITHIN THE LAMINGTON RIVER SUBWATERSHED

6. Fairmount United Methodist Church
7. Oldwick Animal Hospital
8. Oldwick Post Office
9. Tewksbury Elementary School

### SITES WITHIN THE ROCKAWAY CREEK SUBWATERSHED

10. Haytown Nursery School
11. Oldwick Fire Company Social Hall
12. Tewksbury Historical Society
13. The Meadows At Oldwick

# PEDIATRIC SURGICAL ASSOCIATES



**Subwatershed:** Spruce Run  
Reservoir/Willoughby  
Brook

**Site Area:** 27,148 sq. ft.

**Address:** 122 West Main Street  
Clinton, NJ 08809

**Block and Lot:** Block 1, Lot 1



A proposed rain garden can be installed in the front of the building to aid in infiltration of stormwater from the roof top. A downspout planter box can be installed at the northwestern corner of the building to prevent rooftop stormwater from flowing across the pavement. A preliminary soil assessment suggests that more soil testing would be required before determining the soil's suitability for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
69	18,661	0.9	9.4	85.7	0.015	0.51






Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention system	0.016	3	1,200	0.05	155	\$775
Planter box	n/a	1	n/a	n/a	1 (box)	\$1,000



# GREEN INFRASTRUCTURE RECOMMENDATIONS



## Pediatric Surgical Associates

-  planter box
-  bioretention system
-  drainage area
-  property line
-  2015 Aerial: NJOIT, OGIS





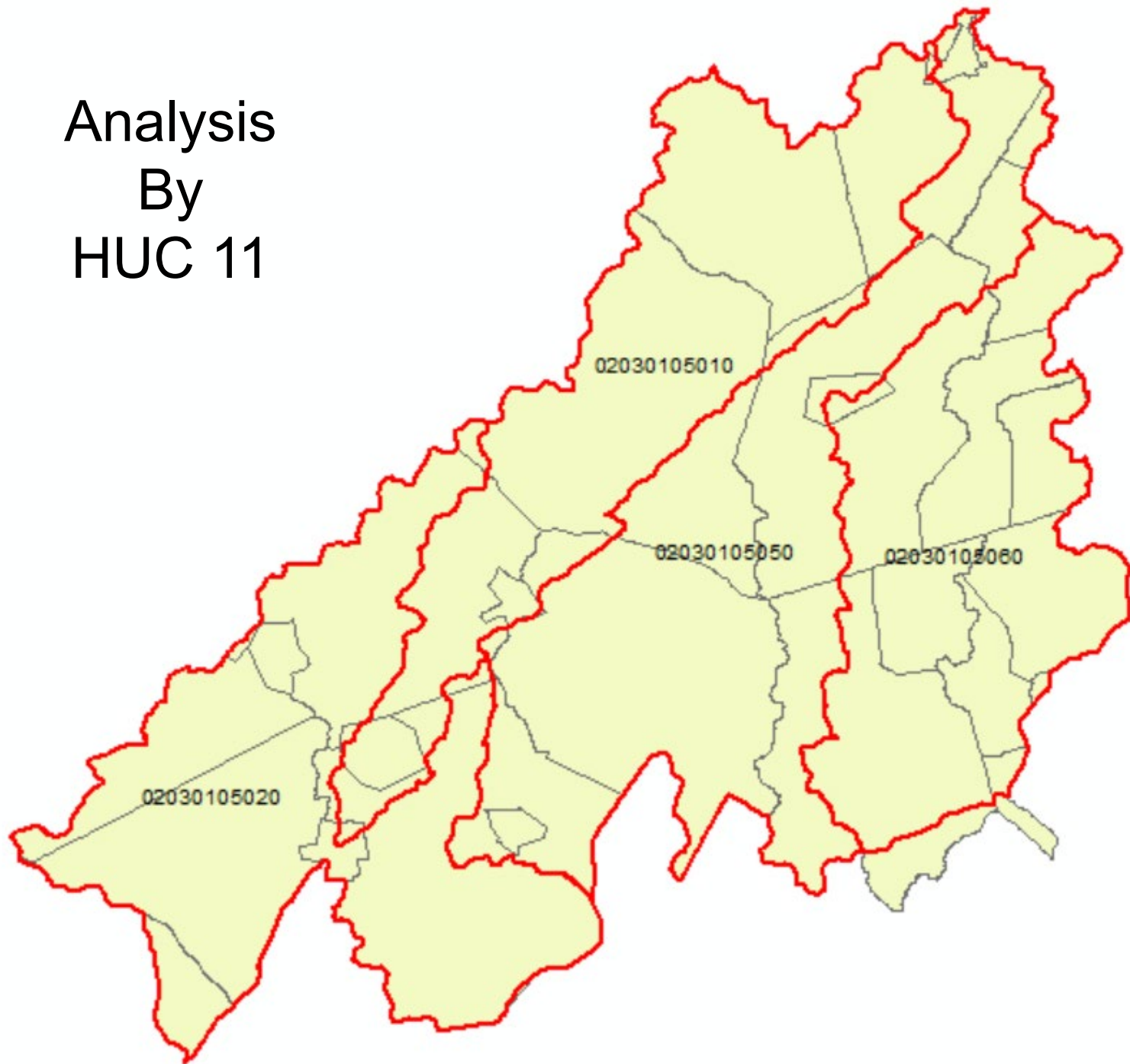
**Before**



**After**



Analysis  
By  
HUC 11



<b>HUC 11</b>	<b>Impervious Cover (%)</b>			
	<b>2002</b>	<b>2007</b>	<b>2012</b>	<b>2015</b>
2030105010	7.68	8.06	7.73	11.34
2030105020	4.85	5.11	4.93	7.86
2030105050	4.95	5.28	5.76	8.93
2030105060	6.34	6.63	6.58	10.55

Land Use Type	HUC 010				
	% Land Use Type	% Impervious Cover	Runoff Volumes From Impervious Cover		
			Water Quality Storm (1.25" over 2 hours) (Mgal)	2-Year Storm (Mgal)	Annual (Mgal)
High, Medium Density Residential	5.5%	21.5%	37.4	98.6	1314.8
Low Density, Rural Residential	21.2%	41.8%	72.5	191.5	2553.6
Commercial	2.1%	12.7%	22.1	58.3	777.4
Industrial	1.1%	7.4%	12.8	33.8	451.1
Urban, Mixed Urban, Other Urban	4.9%	5.0%	8.7	22.9	305.9
Agriculture	10.9%	3.3%	5.7	15.1	200.7
Forest, Water, Wetlands	53.8%	7.4%	12.8	33.8	451.3
Barrenland/ Transitional Area	0.6%	0.9%	1.6	4.3	57.5



Land Use Type	HUC 020				
	% Land Use Type	% Impervious Cover	Runoff Volumes From Impervious Cover		
			Water Quality Storm (1.25" over 2 hours) (Mgal)	2-Year Storm (Mgal)	Annual (Mgal)
High, Medium Density Residential	1.4%	8.2%	10.6	27.9	371.7
Low Density, Rural Residential	17.1%	44.2%	56.8	149.8	1997.7
Commercial	1.6%	12.7%	16.4	43.2	576.3
Industrial	1.3%	11.4%	14.7	38.8	516.9
Urban, Mixed Urban, Other Urban	4.4%	6.9%	8.8	23.3	311.2
Agriculture	19.2%	7.1%	9.1	24.1	321.4
Forest, Water, Wetlands	54.7%	8.9%	11.4	30.0	400.4
Barrenland/ Transitional Area	0.4%	0.6%	0.8	2.1	27.5

Land Use Type	HUC 050				
	% Land Use Type	% Impervious Cover	Runoff Volumes From Impervious Cover		
			Water Quality Storm (1.25" over 2 hours) (Mgal)	2-Year Storm (Mgal)	Annual (Mgal)
High, Medium Density Residential	2.8%	14.1%	23.6	62.3	830.7
Low Density, Rural Residential	17.3%	39.6%	66.5	175.7	2342.1
Commercial	1.7%	12.8%	21.5	56.7	756.4
Industrial	1.4%	11.6%	19.5	51.4	684.7
Urban, Mixed Urban, Other Urban	4.6%	5.3%	8.9	23.6	314.1
Agriculture	20.4%	7.5%	12.6	33.2	442.4
Forest, Water, Wetlands	50.9%	8.6%	14.5	38.2	509.4
Barrenland/ Transitional Area	0.9%	0.5%	0.8	2.2	29.6

Land Use Type	HUC 060				
	% Land Use Type	% Impervious Cover	Runoff Volumes From Impervious Cover		
			Water Quality Storm (1.25" over 2 hours) (Mgal)	2-Year Storm (Mgal)	Annual (Mgal)
High, Medium Density Residential	2.4%	11.2%	16.4	43.2	575.7
Low Density, Rural Residential	25.3%	50.2%	73.6	194.2	2589.2
Commercial	1.8%	11.8%	17.2	45.5	606.4
Industrial	0.8%	6.0%	8.8	23.2	309.9
Urban, Mixed Urban, Other Urban	6.3%	6.4%	9.4	24.8	330.9
Agriculture	15.6%	5.1%	7.5	19.9	264.8
Forest, Water, Wetlands	47.7%	9.2%	13.5	35.8	477.0
Barrenland/ Transitional Area	0.1%	0.1%	0.1	0.3	4.1



# Potential Reduction in Impervious Cover based upon Proposed Green Infrastructure Projects

Land Use (LU) Type	% Impervious Cover Reduction
High, Medium Density Residential	17.1%
Low Density, Rural Residential	15.9%
Commercial	21.4%
Industrial	13.2%
Urban, Mixed Urban, Other Urban	38.7%

# Potential Stormwater Volume Reduction

Land Use (LU) Type	% Reduction	Volume Reduction							
		HUC 010		HUC 020		HUC 050		HUC 060	
		WQS (Mgal)	2-Year (Mgal)	WQS (Mgal)	2-Year (Mgal)	WQS (Mgal)	2-Year (Mgal)	WQS (Mgal)	2-Year (Mgal)
High, Medium Density Residential	17.1%	6.4	16.9	1.8	4.8	4.0	10.7	2.8	7.4
Low Density, Rural Residential	15.9%	11.5	30.4	9.0	23.8	10.6	27.9	11.7	30.8
Commercial	21.4%	4.7	12.5	3.5	9.2	4.6	12.1	3.7	9.7
Industrial	13.2%	1.7	4.5	1.9	5.1	2.6	6.8	1.2	3.1
Urban, Mixed Urban, Other Urban	38.7%	3.4	8.9	3.4	9.0	3.5	9.1	3.6	9.6

## Washington Township Library

The Washington Township Library was funded by Pfizer, the Leavens Foundation, the New Jersey Corporate Wetland Restoration Partnership, the Morris County Utilities Authority, and the Garden Club of Long Valley. Approximately ten Raritan Highlands Compact members were present for the installation of the rain garden in the fall of 2007. Additional in-kind support was provided by staff from the Rutgers Cooperative Extension Water Resources Program and the Master Gardeners of Morris County. The rain garden itself was installed to serve as a demonstration rain garden to educate homeowners, business owners, and government facilities on how rain gardens can minimize impacts to nearby waterways.



During Installation



Ten Months Later





# Municipal Buildings







WOODTOWN BOROUGH HALL

WOODTOWN BOROUGH CLERK  
OFFICE  
COURT REPORTERS  
PUBLIC ACCESS



# Schools













# Public Libraries







Water Retention Program



# Parks





# Social Clubs





# Senior Centers





# YMCAs





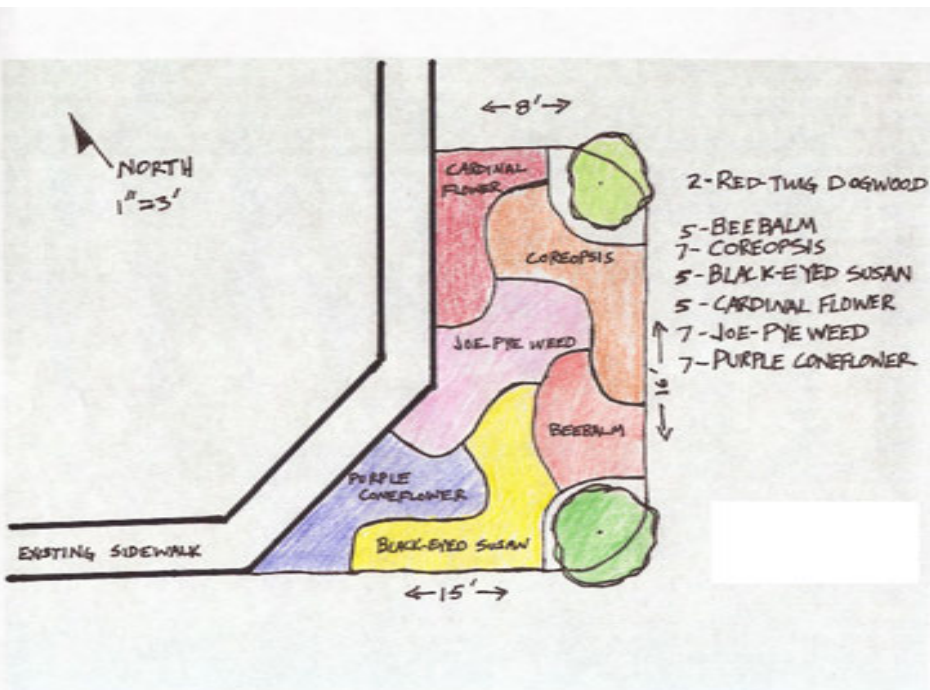
# Houses of Worship





# Homeowner Rain Gardens

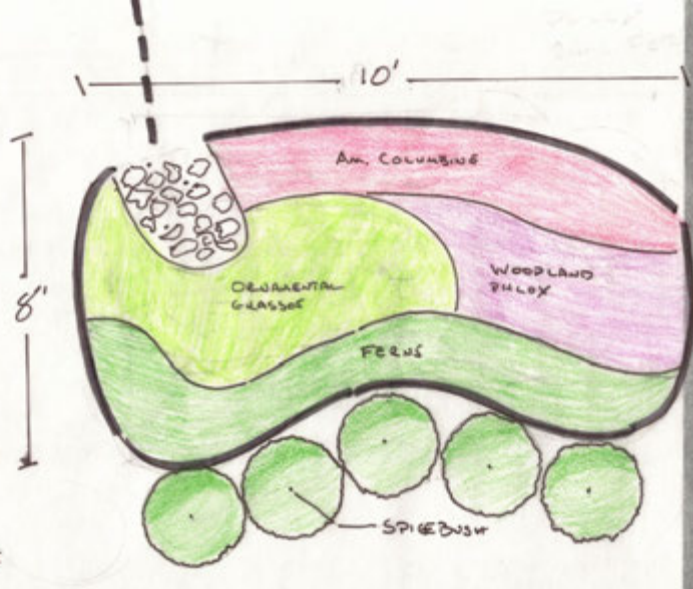
## Design



## Installed Rain Garden







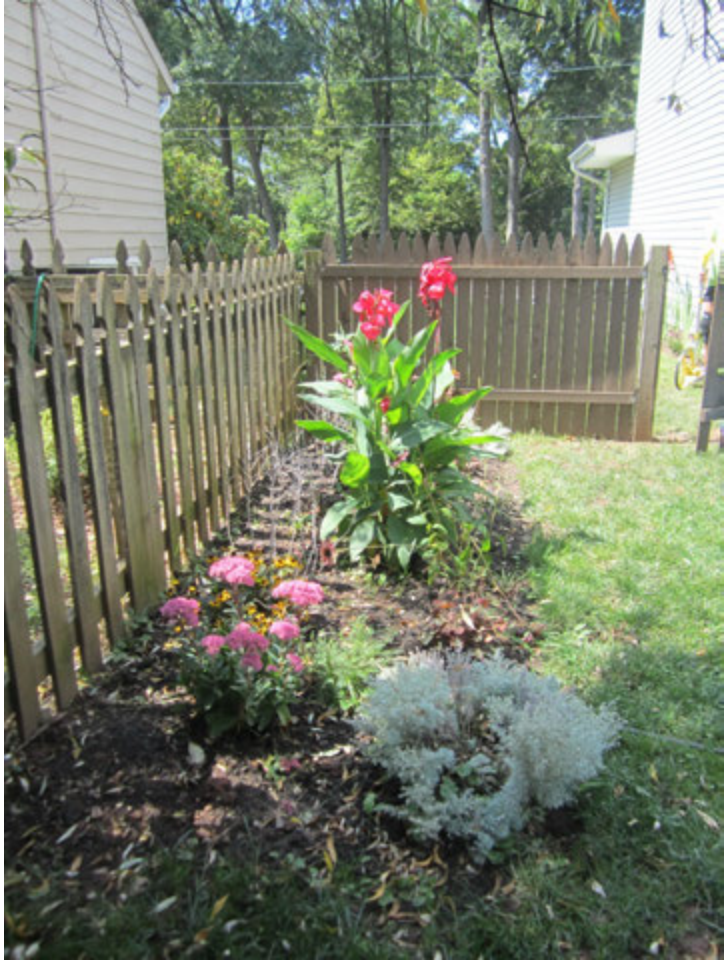
- 5- WOODLAND THYLOX
- 7- AMERICAN COLUMBINE
- 7- FERNS
- 3- ORNAMENTAL GRASSES - CEWA SEDGE
- 5- SPIREBUSH

**Design**

**Installed Rain Garden**











## 1244 Briarcliff



# What's Next?



- Engage municipalities - Keep the conversation going
- Encourage municipalities to partner with the Highlands Council and Rutgers to move forward
- Extend analysis to the rest of the Highlands Management Area

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