



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

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April 15, 2021



Rutgers Cooperative Extension

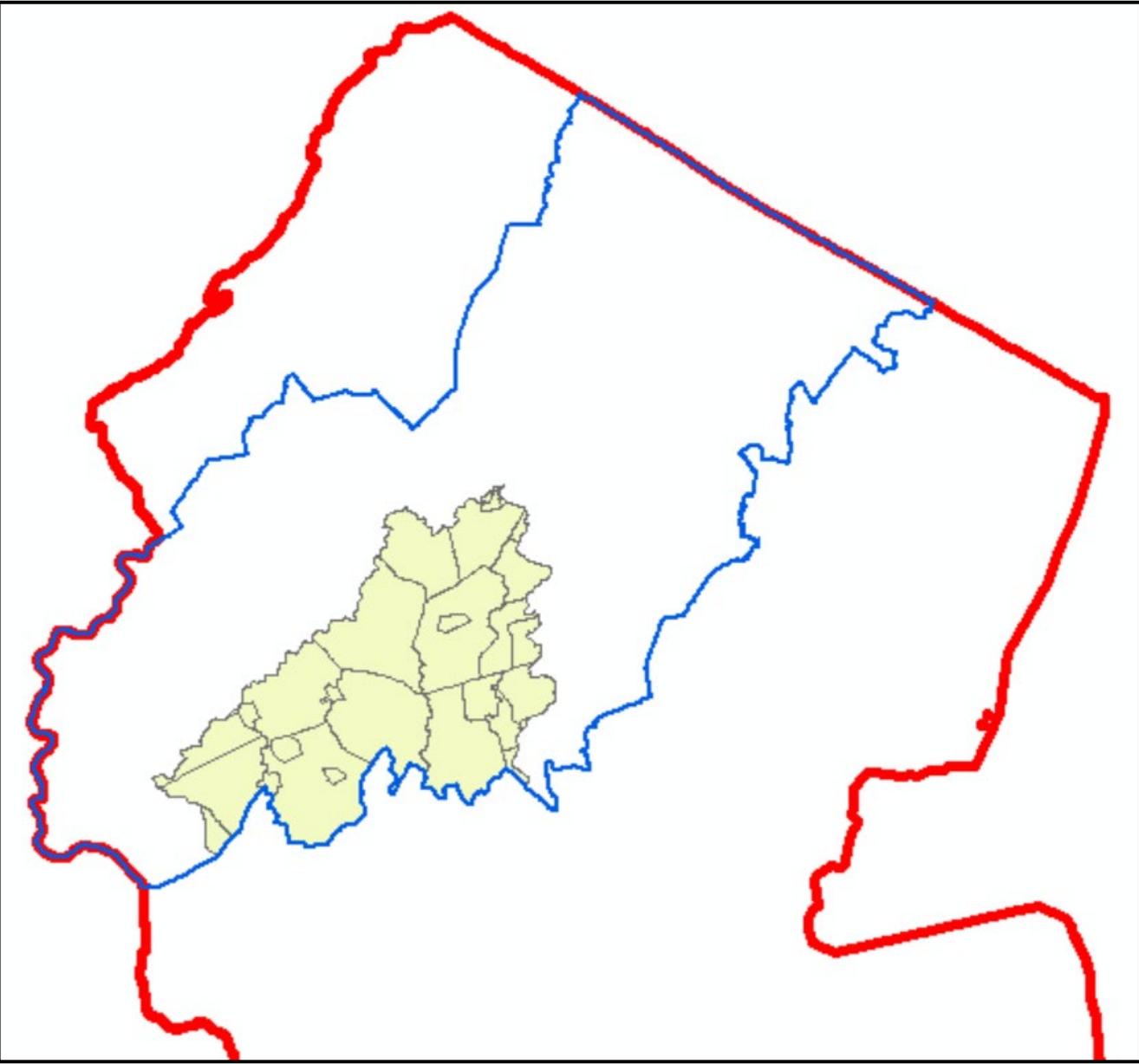
Rutgers Cooperative Extension (RCE) helps the diverse population of New Jersey adapt to a rapidly changing society and improves their lives through an educational process that uses science-based knowledge.



Water Resources Program

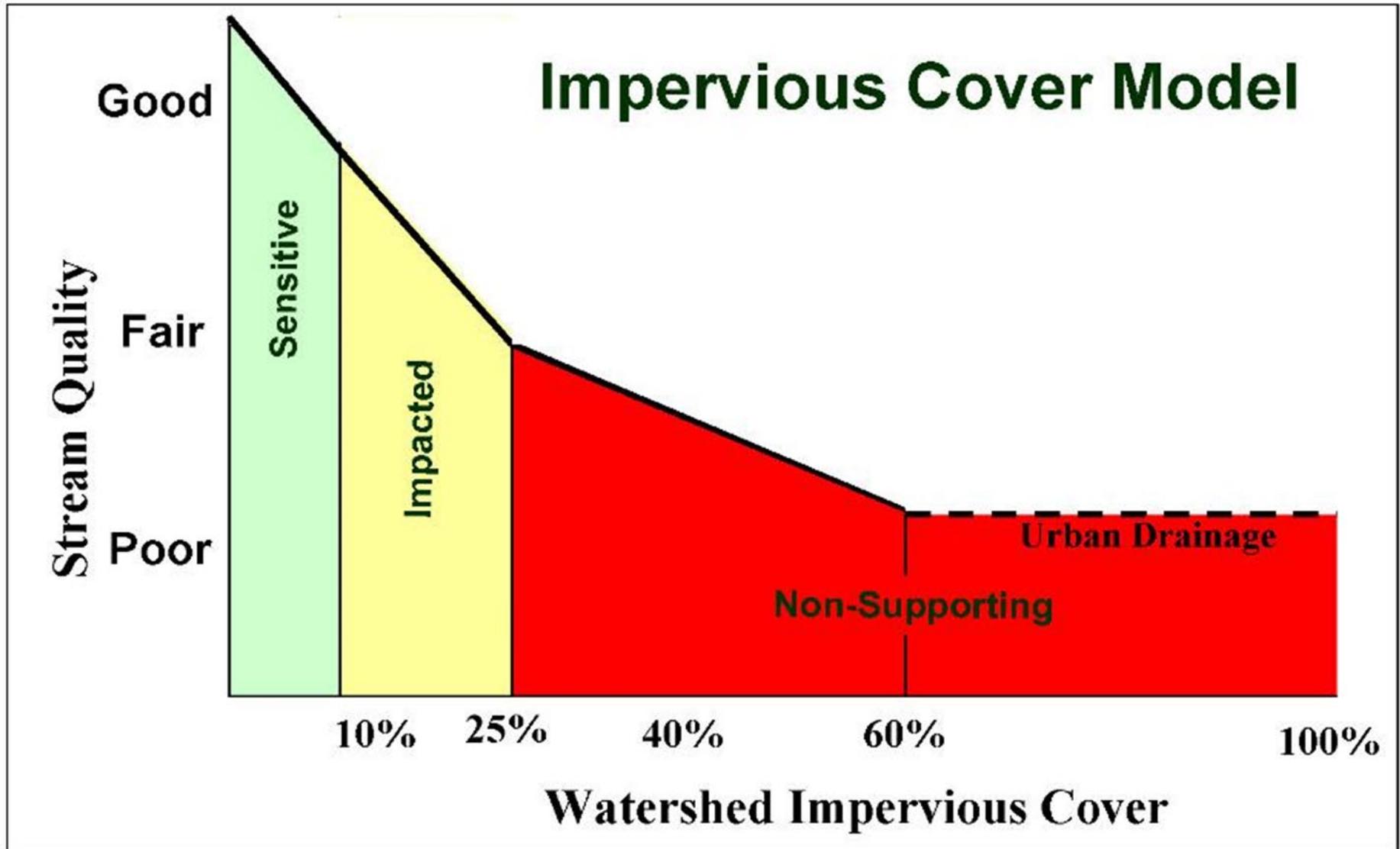


Our mission is to identify and address water resources issues by engaging and empowering communities to employ practical science-based solutions to help create a more equitable and sustainable New Jersey.



Municipality	County
Lebanon Boro	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

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/Bioretention 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



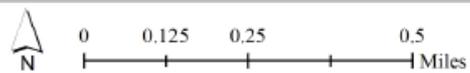
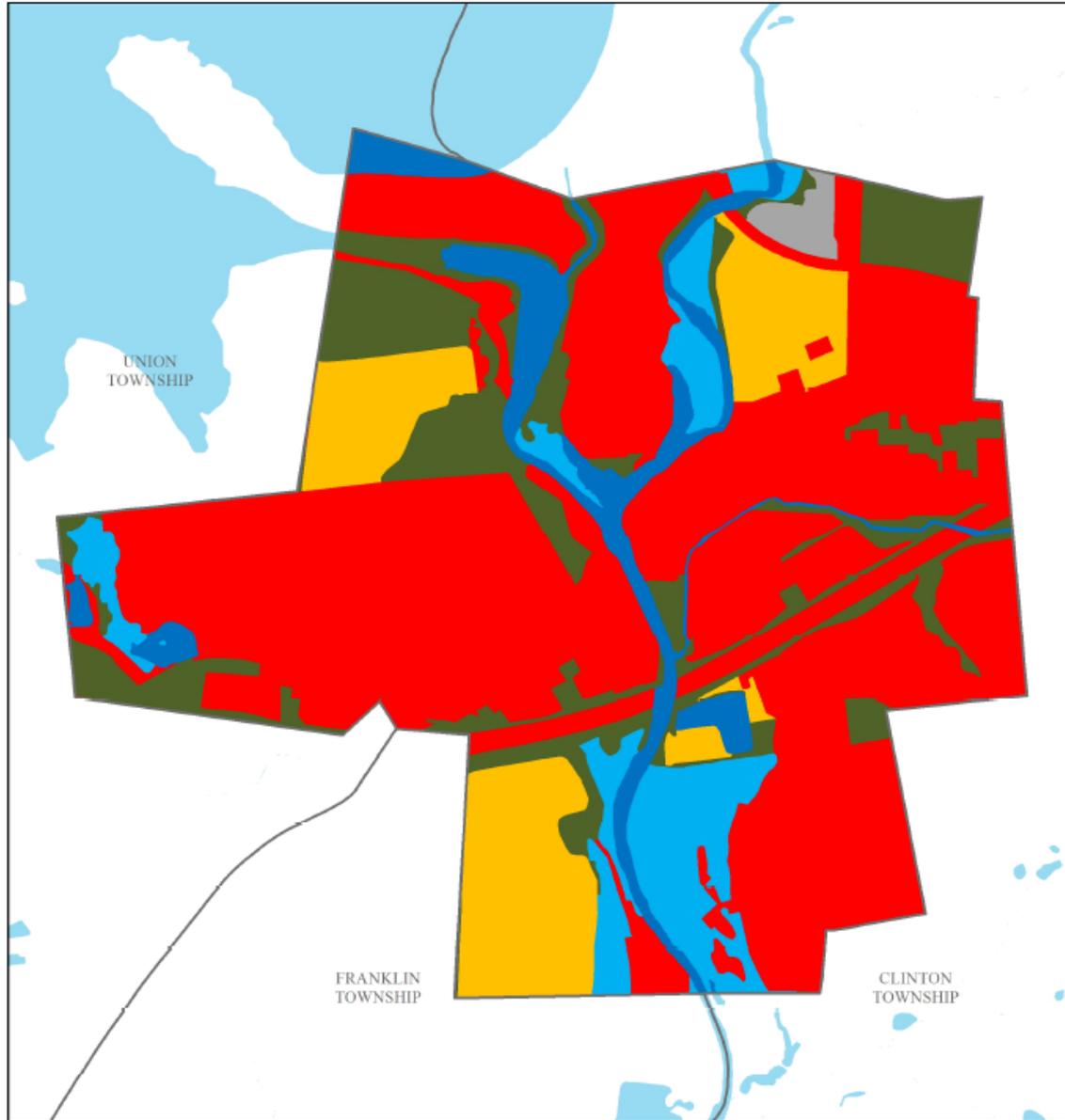
WMA 8 - North and South Branch Raritan-Highlands

Municipality	County	Total Area (acres)	Impervious Cover (acres)	% Impervious Cover
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%

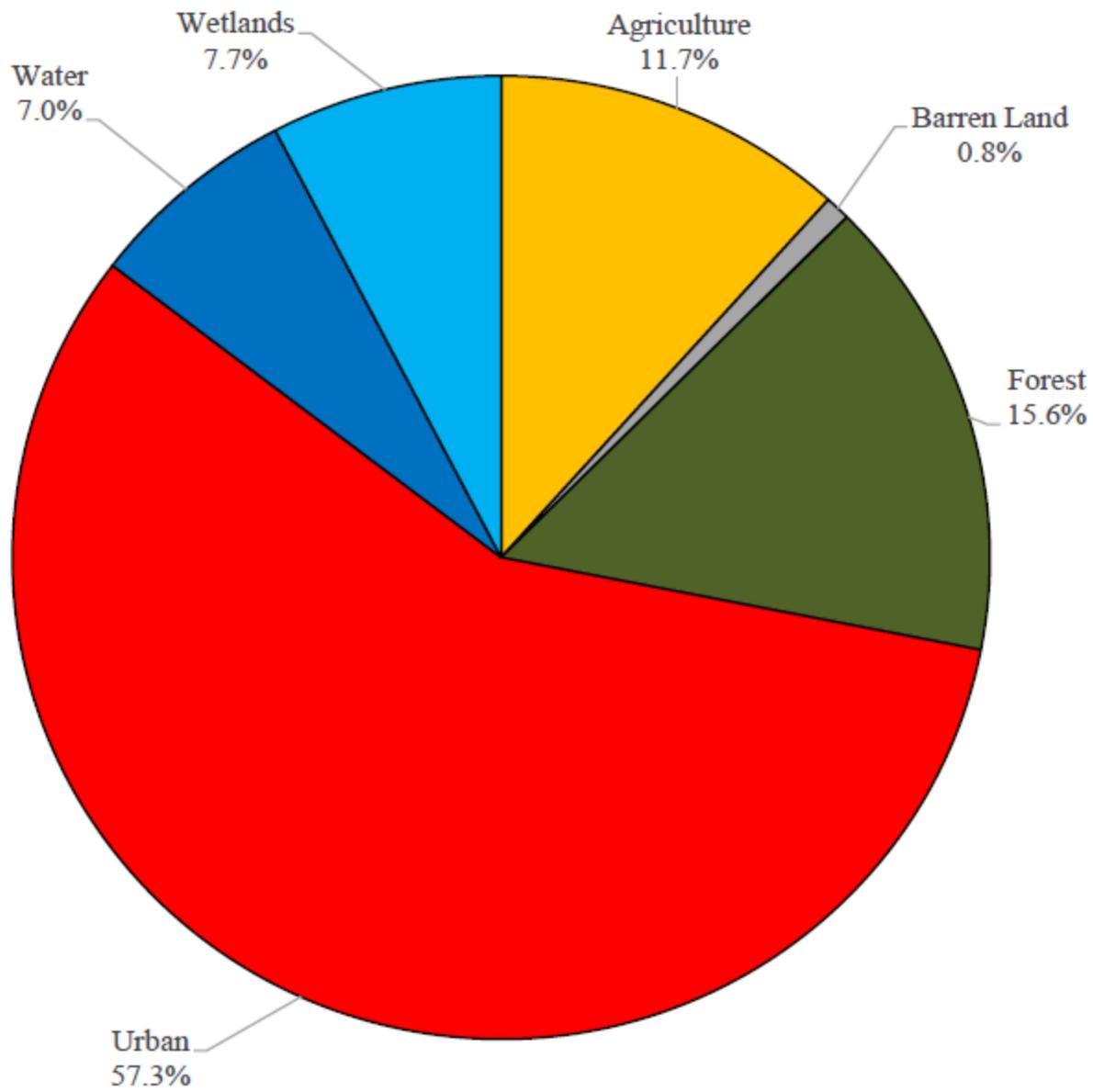
WMA 8 - North and South Branch Raritan-Highlands

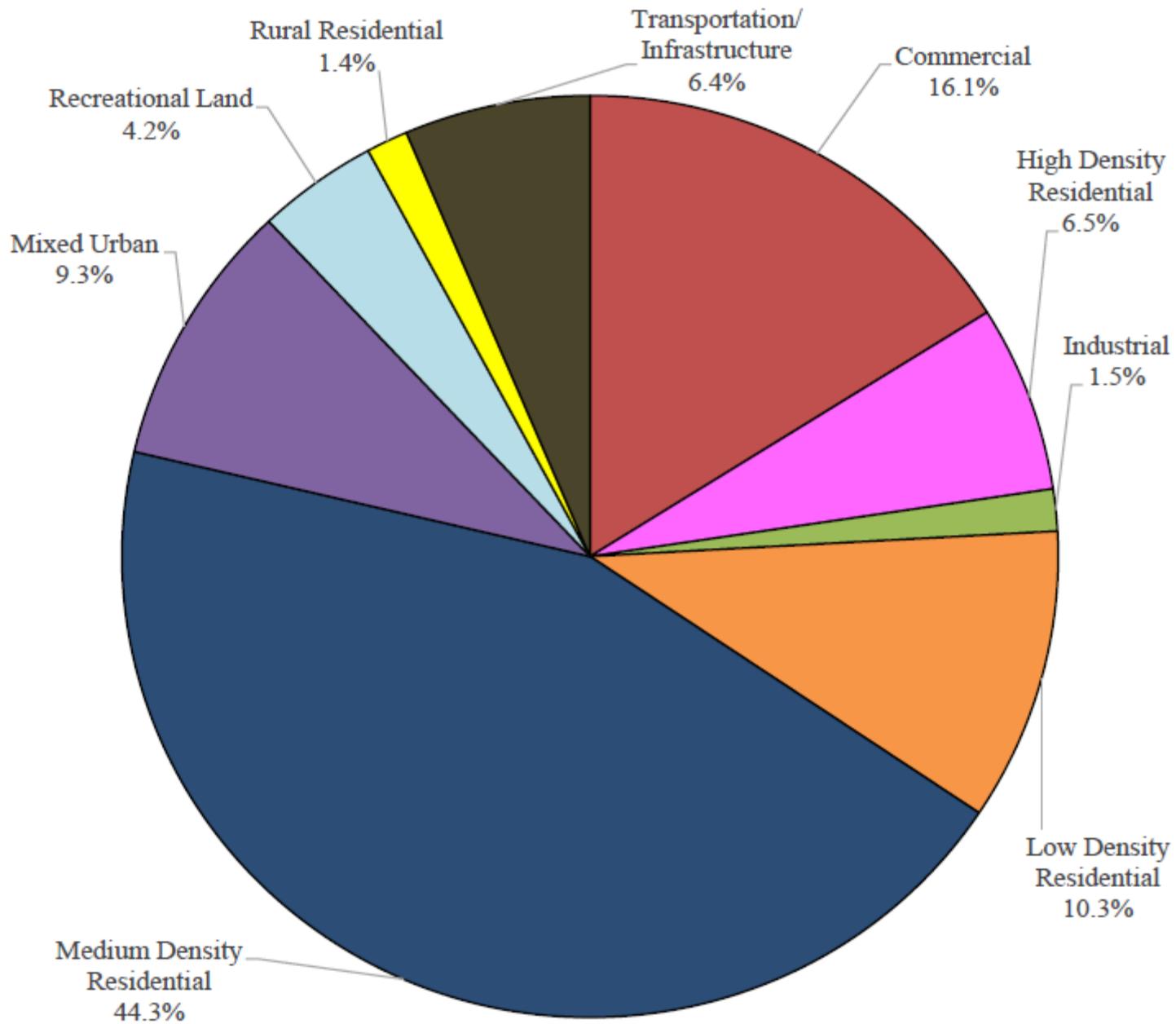
Municipality	County	Total Area (acres)	Impervious Cover (acres)	% Impervious Cover
Chester Twp	Morris	18,655.2	724.47	3.9%
Mendham Twp	Morris	3,826.4	407.4	10.7%
Washington Twp	Morris	12,939.3	692.0	5.4%
Roxbury Twp	Morris	14,039.8	1,819.10	13.6%
Mount Olive Twp	Morris	19,992.0	1,910.4	10.0%
Mendham 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%
Municipal Average Impervious Cover =				10.5%

Land Use for Clinton Town

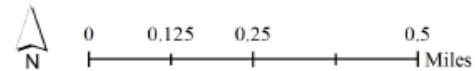
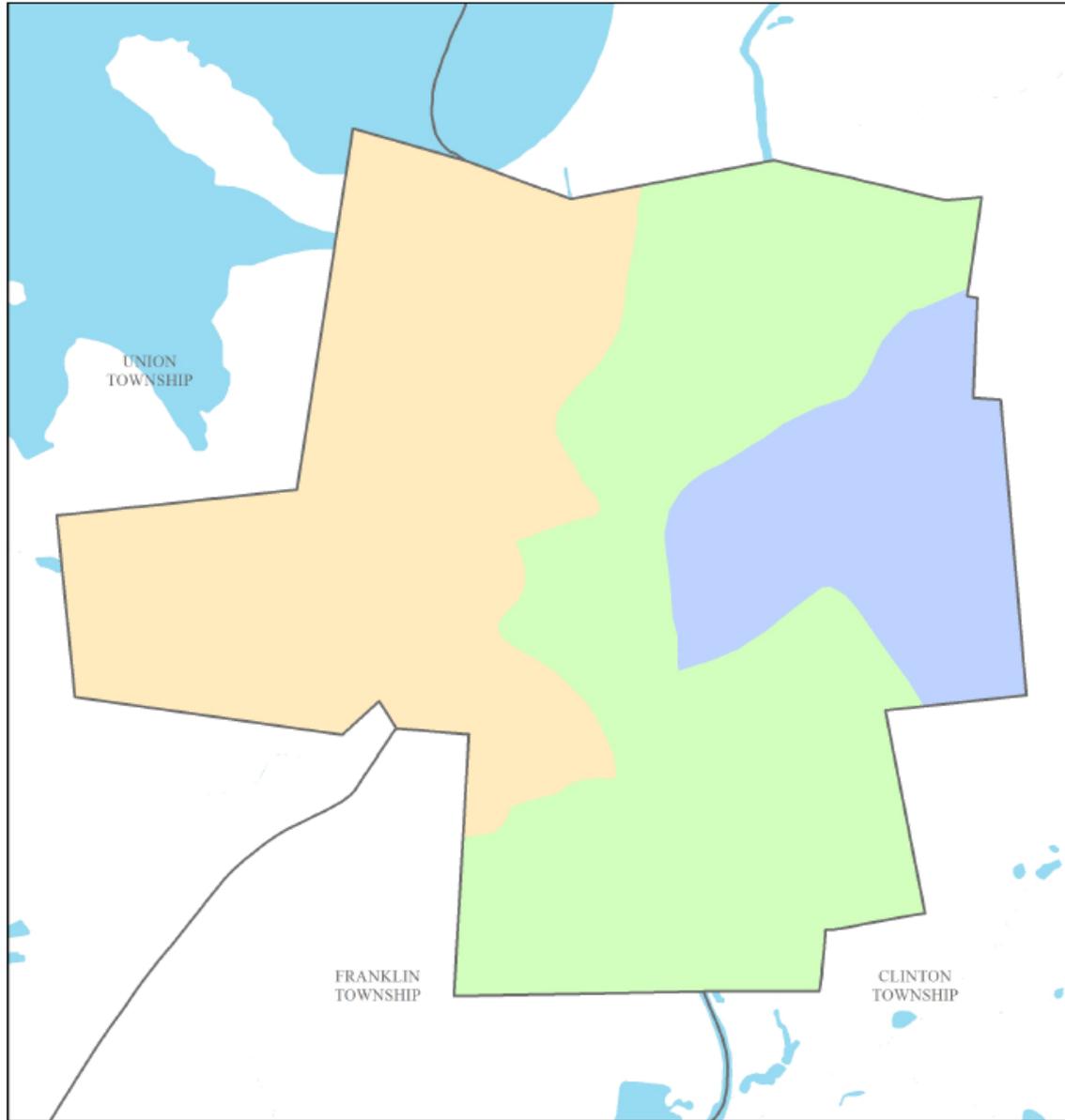


■ Agriculture ■ Barren Land ■ Forest ■ Urban ■ Water ■ Wetlands





Subwatersheds of Clinton Town



Beaver Brook Spruce Run Reservoir Raritan River South Branch

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

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

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



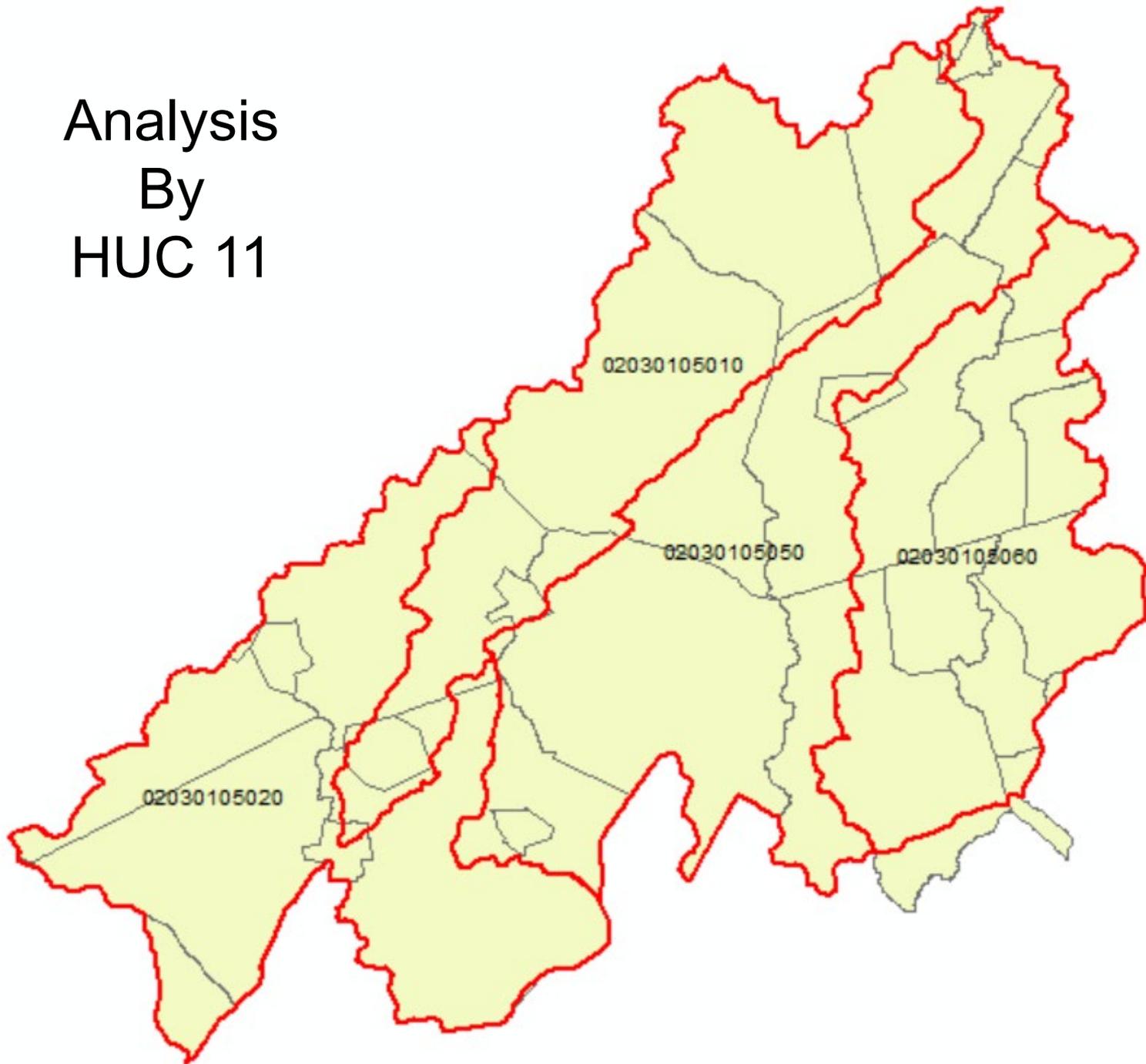
Before



After



Analysis
By
HUC 11



HUC 11	Impervious Cover (%)			
	2002	2007	2012	2015
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



What's Next?



- Continue to present these plans to the municipalities
- Encourage municipalities to partner with the Highland Council and Rutgers to move forward
- Extend analysis to the rest of the Highlands Management Area

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