Addressing Water Resources Issues on a Municipal Level: Proactive Stormwater Management Planning in Hamilton Township, NJ

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New Jersey Agricultural Experiment Station

Water Resources Program

Hamilton
A Destination

Project Goals

- **Evaluate existing stormwater infrastructure**
- **Assess localized flooding issues**
- **Develop stormwater management strategies to address flooding and water quality issues**
- **Review Township maintenance practices for stormwater management facilities**
- **Recommend actions and strategies that will improve and protect water resources in Hamilton Township helping the community maintain compliance with NJ's Stormwater Regulations**

The Stormwater Problem

1. **Localized flooding (*QUANTITY*)**
2. **Aging infrastructure**
3. **Increased maintenance costs**
4. **Nutrients and sediment (*QUALITY*)**
5. **Failing systems & property damage**
6. **Mosquitoes**
7. **Resident waterfowl (*QUALITY*)**

The current estimate to repair the wastewater infrastructure throughout the State of NJ is $15 billion.

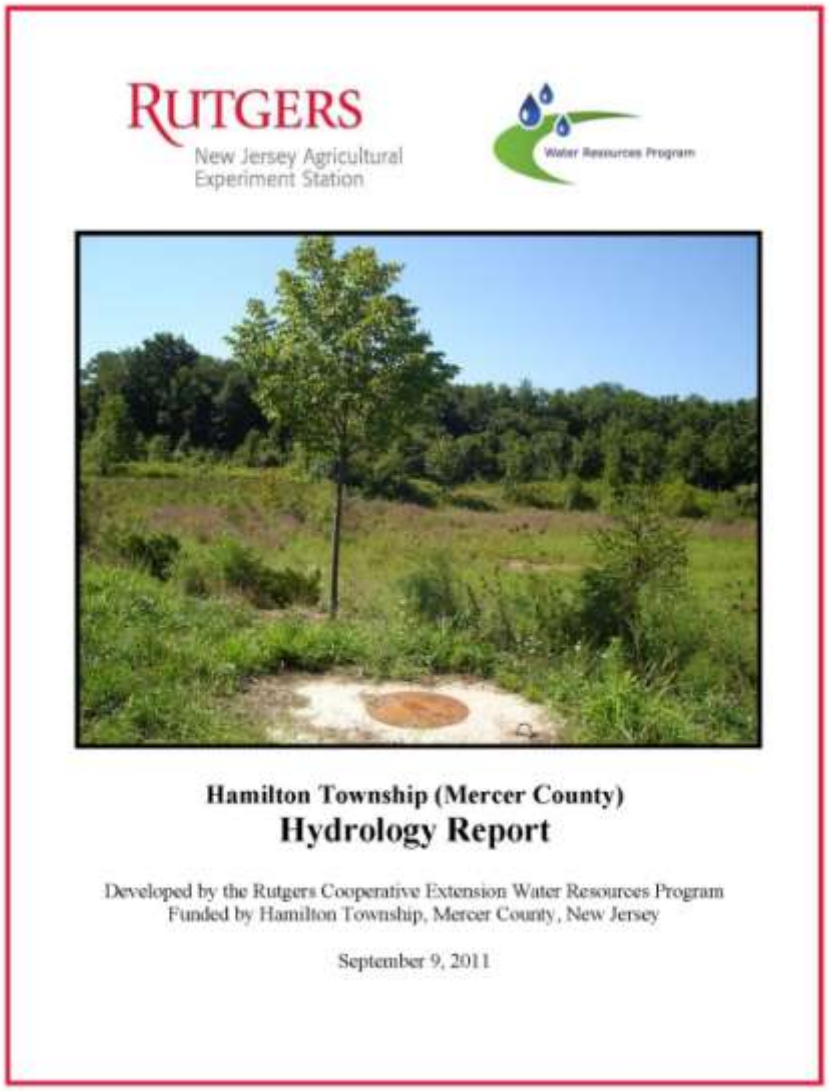
- Fiscal 2008 Budget in Brief. NJ State Office of Management and Budget, Chapter 2, pg 42, Feb 22, 2007, http://www.state.nj.us/treasury/omb

Year 1

Assessment and Developing Implementation Strategy

1st Step: Inventory and Review

- Compiled existing data
  - Stormwater infrastructure: inlets, outlets, detention basins, & pipes
  - Water resources: rivers, streams, ponds, floodplain, hydric soils, groundwater recharge areas, wellhead protection areas, riparian corridors, & wetlands
  - Surface water quality data
- Reviewed current policies and plans
- Developed mapping
- Prepared evaluation



Summary and Conclusions

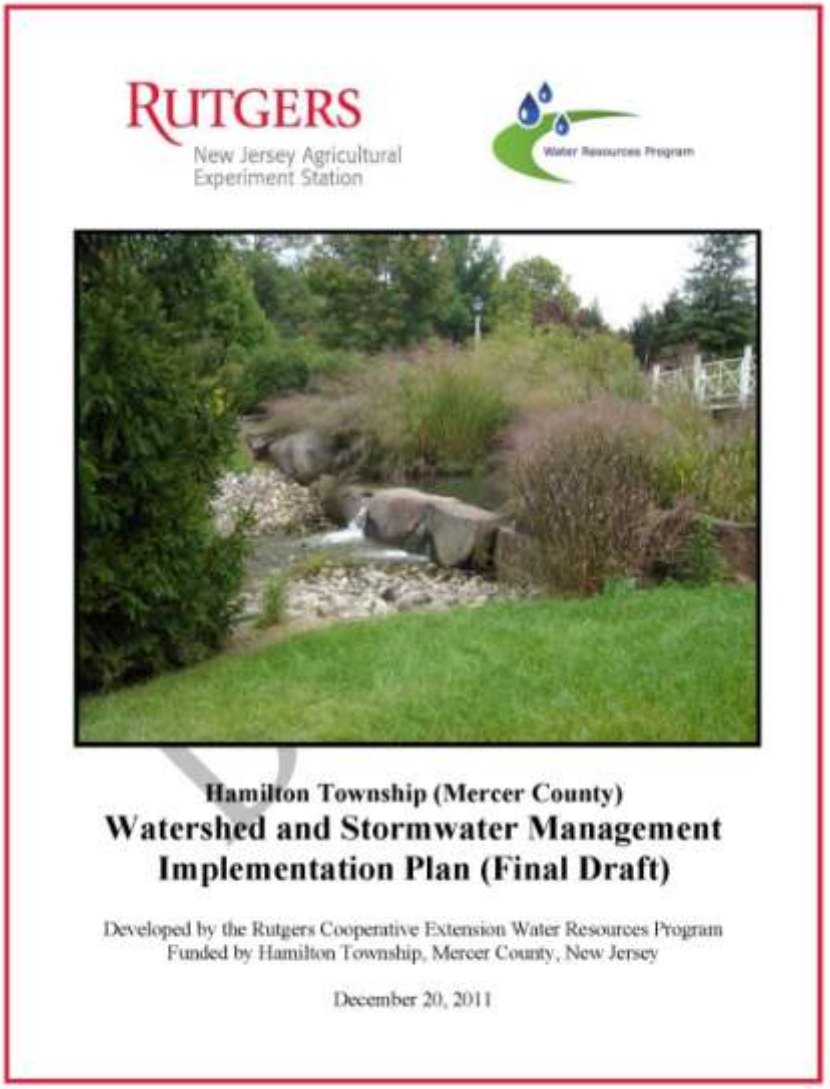
- Stormwater problems facing Hamilton Township are related to the increase in developed areas and the associated impervious cover that accompanies it
- New development areas will only exacerbate water quality problems by increasing the frequency and intensity of storm flows and flooding, while also increasing pollution

Recommendations

- Reduce the amount of impervious cover on new developments through low impact development techniques
- Disconnect existing impervious areas with green infrastructure
- Educate residents on their role in improving runoff water quality
- Retrofit existing detention basins, replace and disconnect existing impervious areas, and maintain natural lands as open spaces

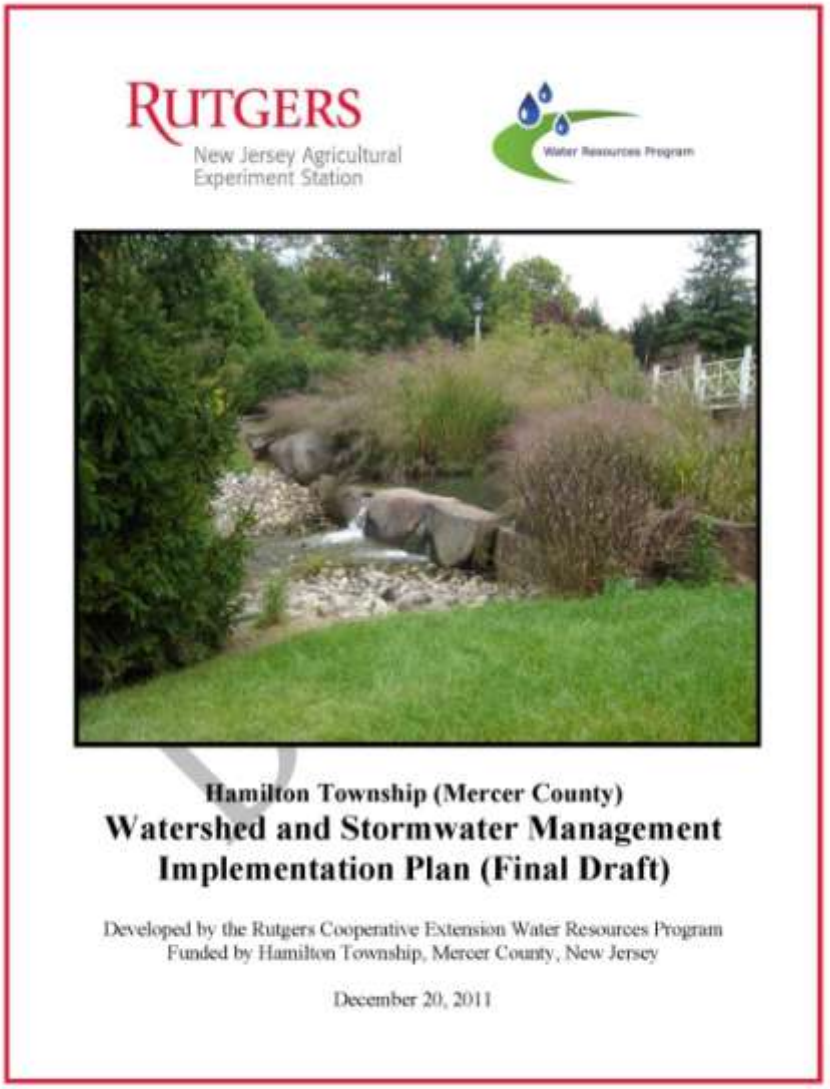
2nd Step: Develop an Implementation Plan

- Township Water Resources Goals
  - Engage the community in water resource protection
  - Manage water quality
  - Minimize localized flooding
  - Implement Phase II stormwater controls
  - Improve stormwater facility maintenance



Develop an Implementation Plan (cont'd)

- Site surveys and investigations
  - Conduct evaluation of representative detention basin facilities for function and water quality retrofits
  - Provide preliminary recommendations for corrective actions, maintenance, and enhancements
- Outline actions and opportunities



Goal 1: Engage the community in water resource protection

ACTION

- Conduct riparian area investigations
- Conduct vernal pool habitat surveys and certification
- Implement property owner education programs
- Implement rain garden and downspout disconnection demonstration projects

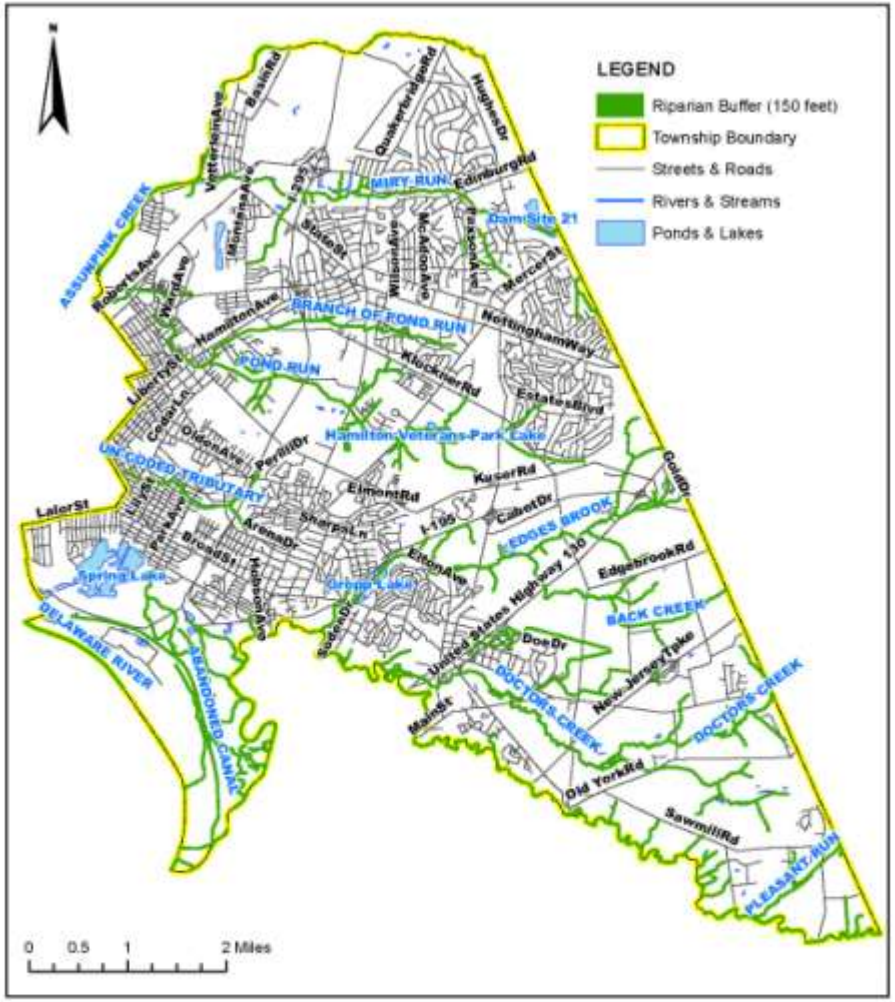


Figure 17: Riparian corridors in Hamilton Township (Mercer County).

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The community in action

Goal 2: Manage water quality

ACTION

- Develop and implement a water quality monitoring program for lakes and impoundments.

SOURCE: flickr.com by HeronThere

SOURCE: flickr.com by HeronThere

Goal 3: Minimize localized flooding

ACTION

- Develop a hydrologic model for Hamilton Township

SOURCE: trentonian.com September 2011

Goal 4: Implement Phase II stormwater controls

ACTION

- Complete impervious cover analysis and develop a community disconnection program
- Develop a ‘site suitability’ map for advanced stormwater management facilities

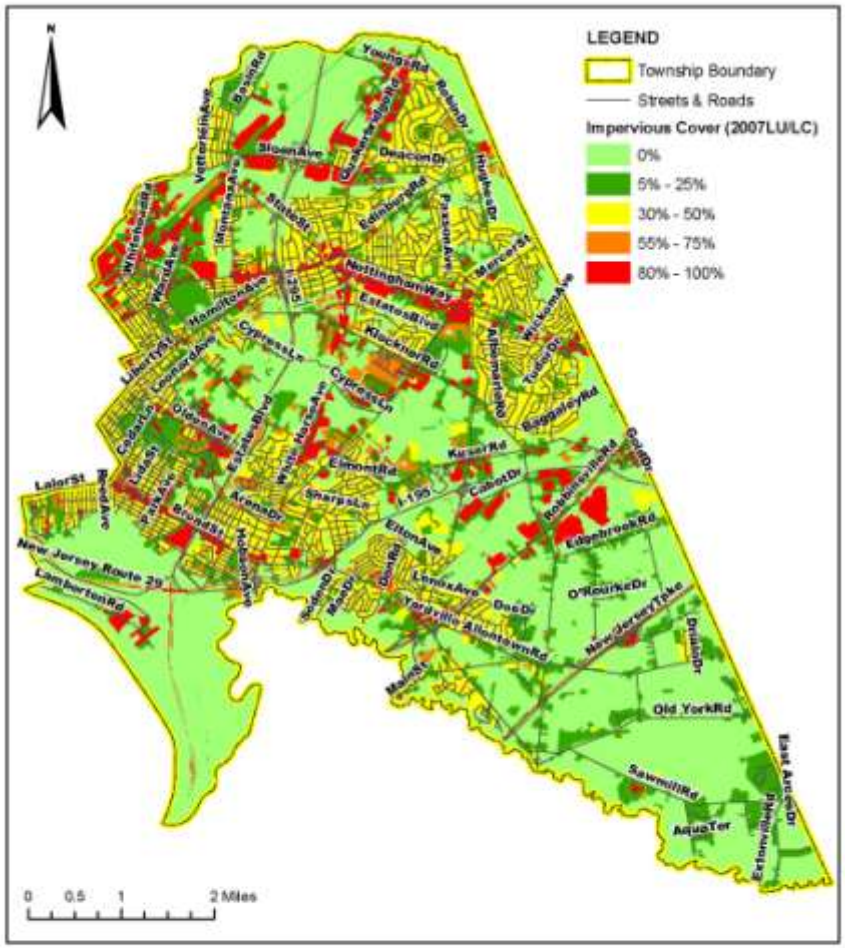

Figure 10: Percent impervious cover in Hamilton Township (Mercer County).

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Goal 5: Improve stormwater facility maintenance

ACTION

- Conduct complete inventory and assessment of stormwater management basins in Hamilton Township
- Prepare a comprehensive GIS database of stormwater infrastructure
- Implement detention basin maintenance training, inspection, and monitoring program
- Execute detention basin repair, rehabilitation, and enhancement projects

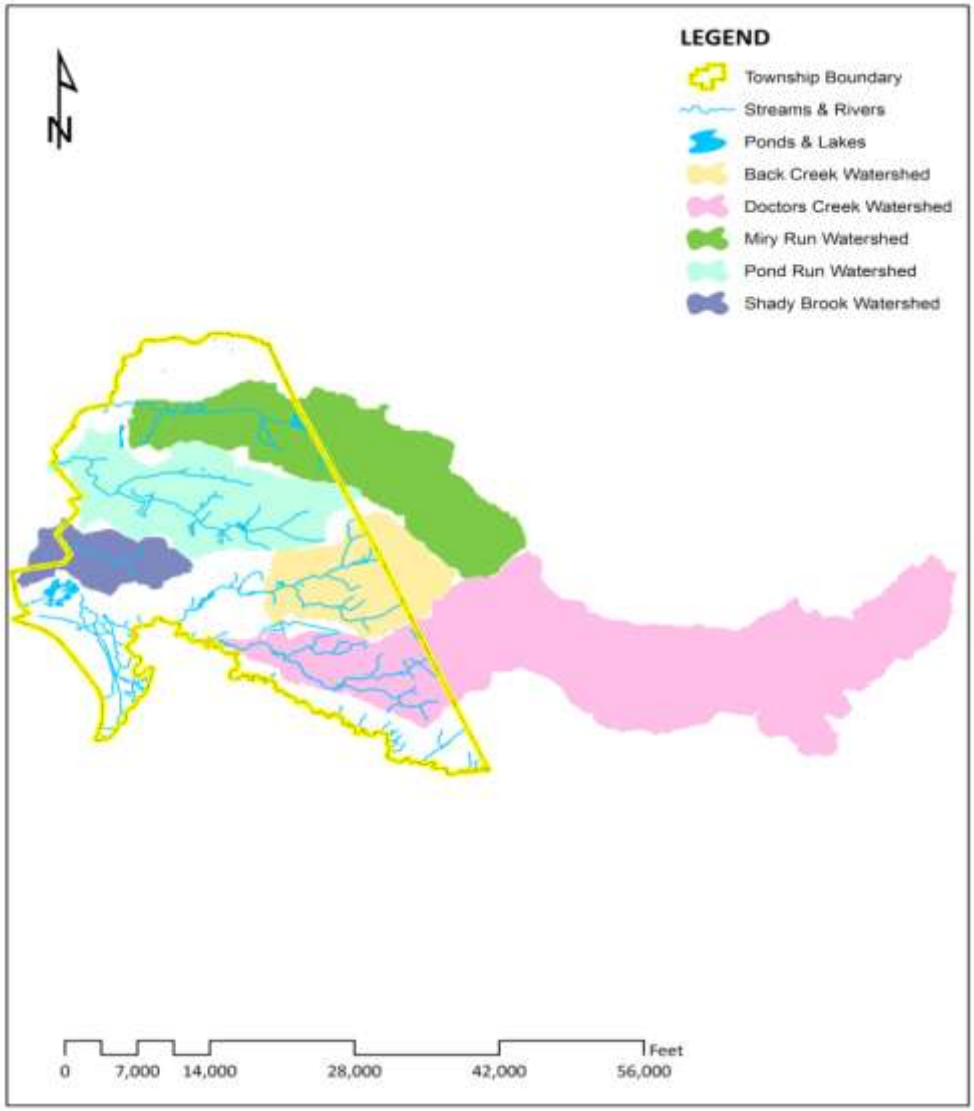
Year 2 - 3

Implementation of the Plan

HYDROLOGIC MODELING FOR THE TOWNSHIP OF HAMILTON

Hydrologic Modeling

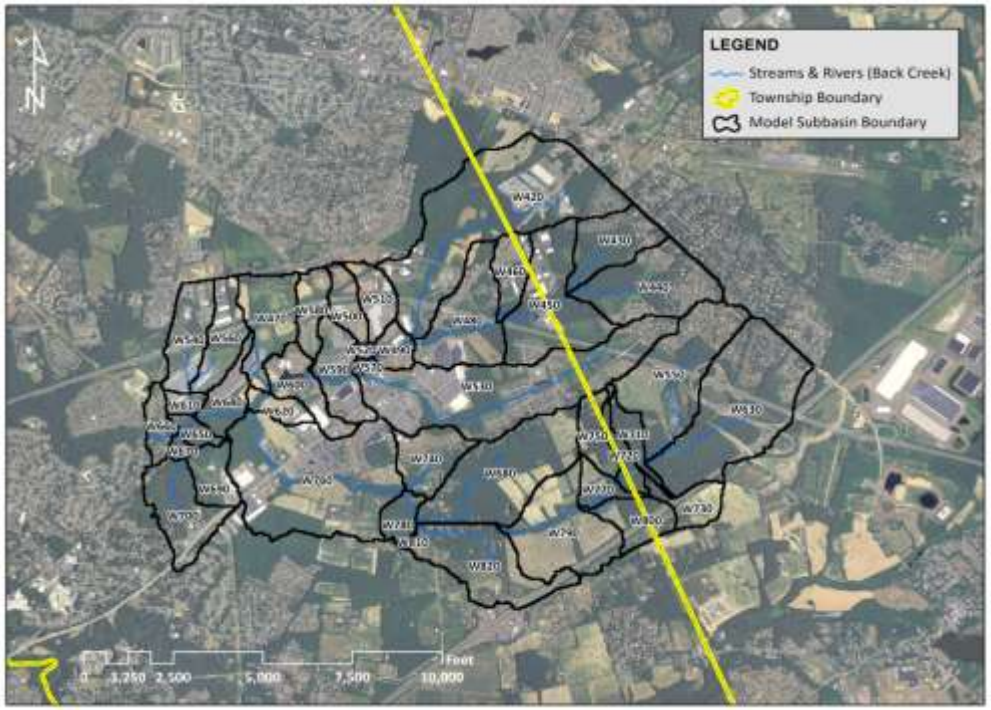
- HEC-GeoHMS was used to delineate watersheds and extract model input parameters from GIS layers.
- Input data for the model included impervious cover, soils, land use, curve number, and time of concentration.



Hydrologic Modeling

- Input parameters were then exported into HEC-HMS to simulate rainfall-runoff and routing processes through the subbasins.
- Precipitation data for the 2-year, 10-year, and 100-year storm were simulated in the hydrologic model.

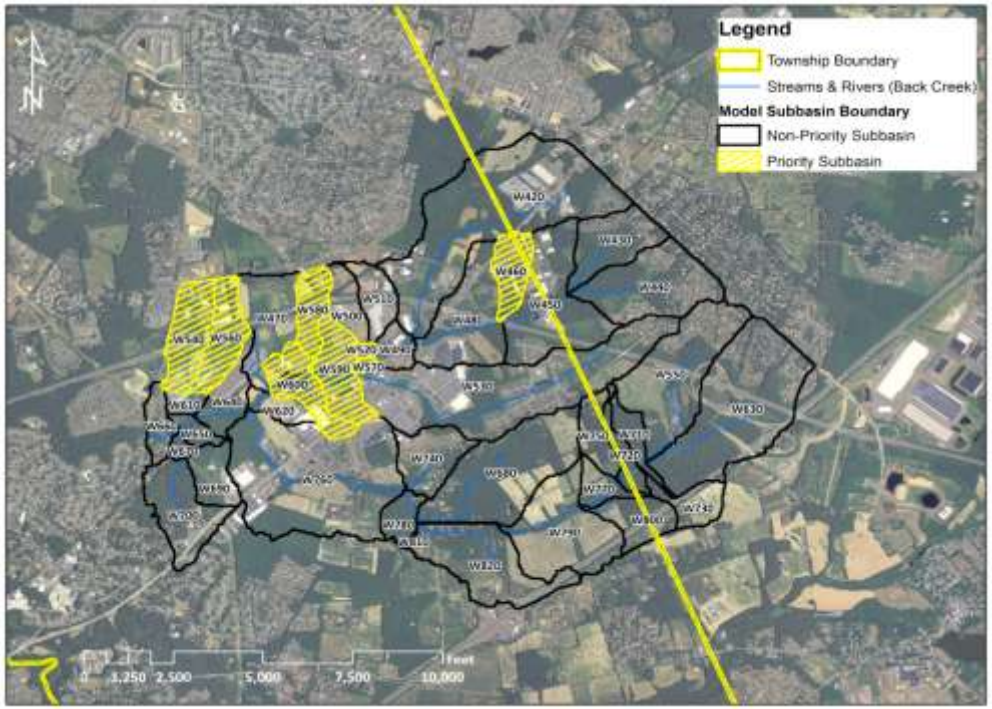
Back Creek Subbasins



Hydrologic Modeling

- Model output includes discharge volume (acre-feet), peak discharge, time of peak discharge, and stormwater runoff volume.
- Normalized direct runoff (discharge volume divided by subbasin size) used to select priority subbasins.

Back Creek Subbasins

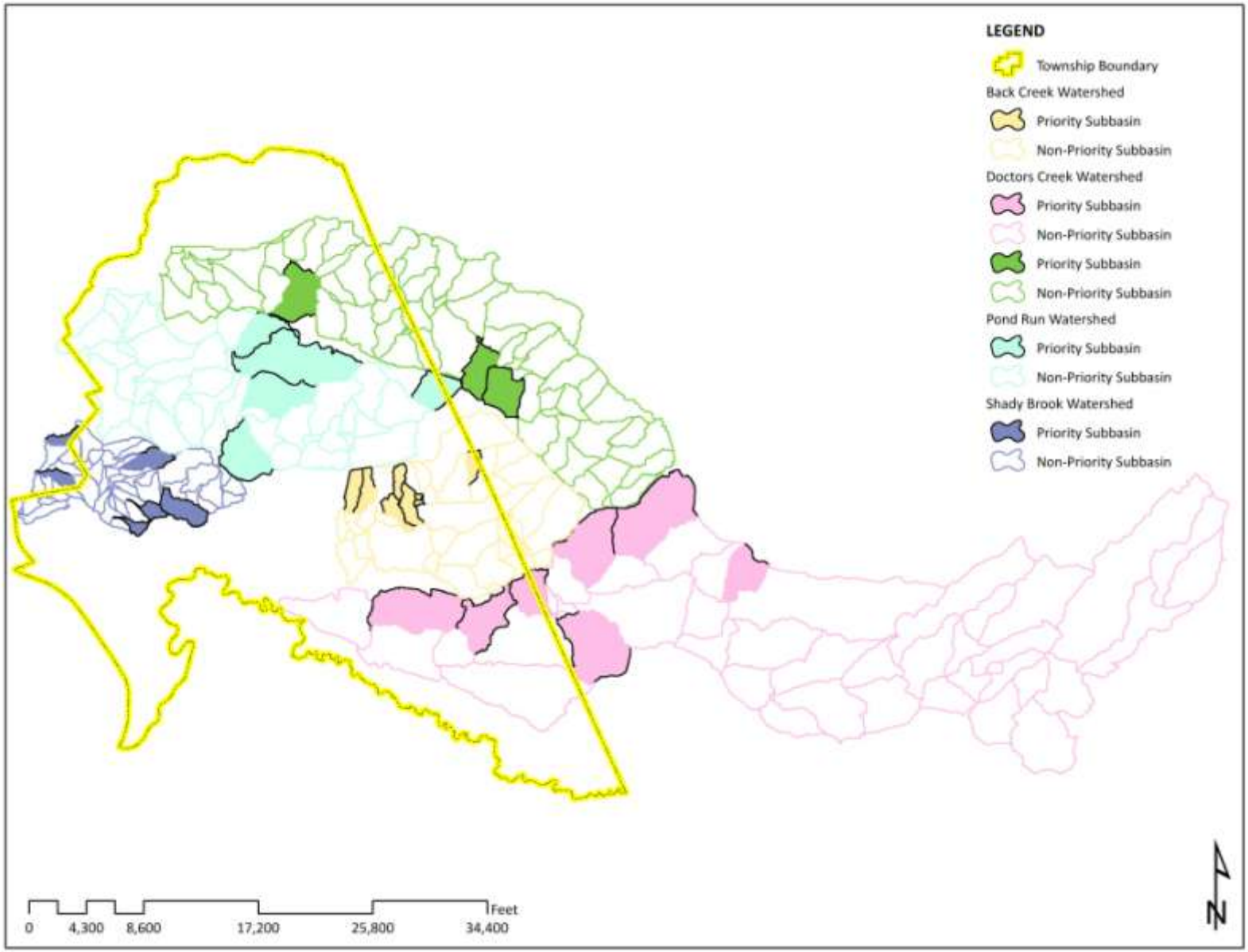


Hydrologic Modeling

Back Creek Priority Subbasins.

Critical Subbasin	Drainage Area (acres)	2-year Runoff Volume (acre-ft)	2-year Normalized Direct Runoff (acre-ft/acre)	10-year Runoff Volume (acre-ft)	10-year Normalized Direct Runoff (acre-ft/acre)	100-year Runoff Volume (acre-ft)	100-year Normalized Direct Runoff (acre-ft/acre)
W540	75.01	22.7	0.3026	37.8	0.5039	68	0.9065
W560	66.68	17.7	0.2654	30.5	0.4574	56.6	0.8488
W520	5.291	1.4	0.2646	2.4	0.4536	4.3	0.8127
W570	6.231	1.6	0.2568	3.0	0.4815	5.8	0.9309
W590	72.37	18.1	0.2501	29.7	0.4104	53	0.7323
W600	63.77	15.3	0.2399	27.2	0.4266	51.5	0.8076
W460	46.14	10.3	0.2232	17.0	0.3685	30.5	0.6611
W580	44.31	9.8	0.2212	18.6	0.4198	37.2	0.8396

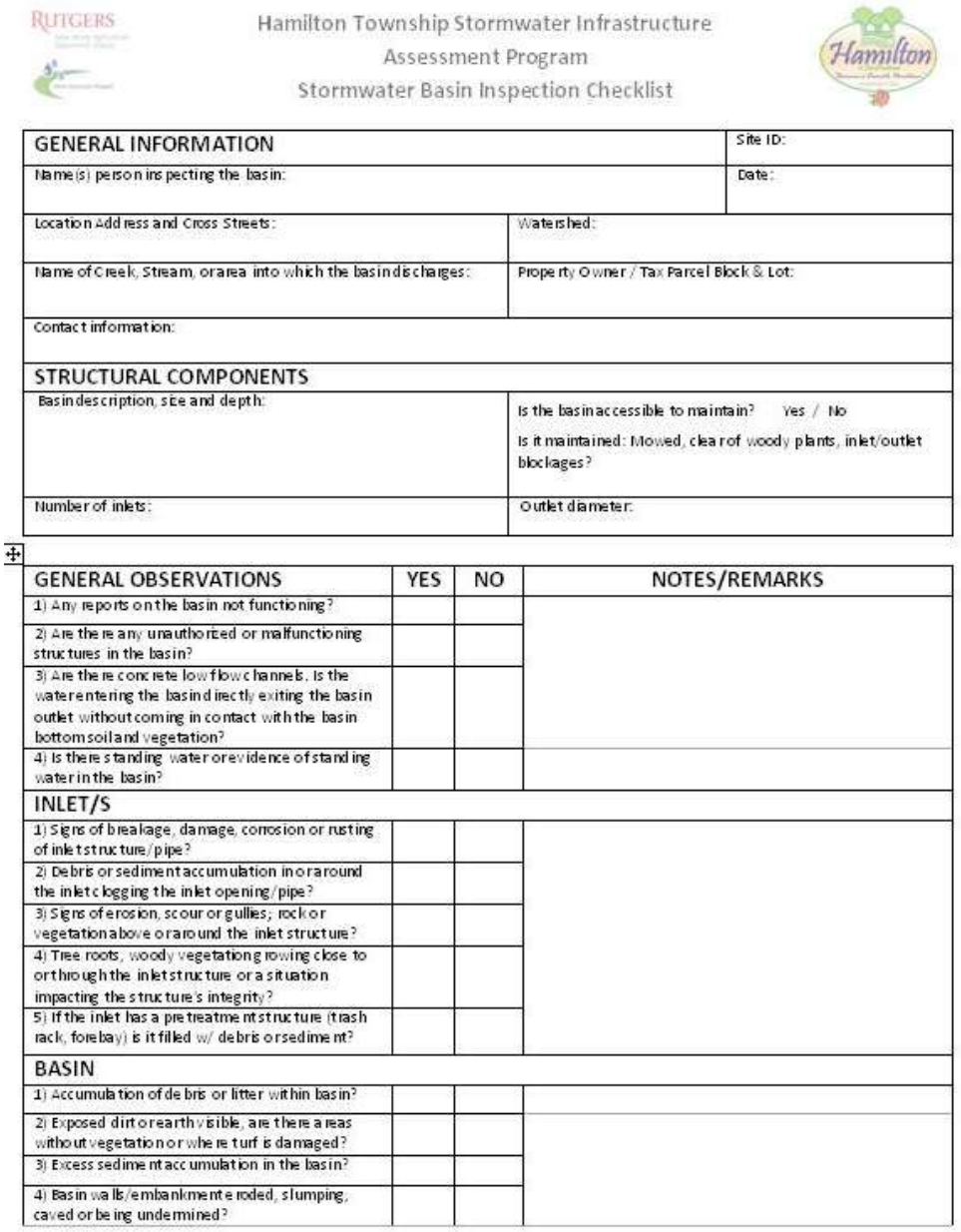
Hydrologic Modeling



STORMWATER BASIN INVENTORY & ASSESSMENT

Stormwater Basin Assessments

- A checklist was created to assess the basins
  - General Observations
  - Inlets
  - Basin
  - Outlets
  - Overflow Spillway
  - Outfall
- 100 Basins were assessed
  - Miry Run Watershed
- 75 Basins were assessed
  - Pond Run Watershed



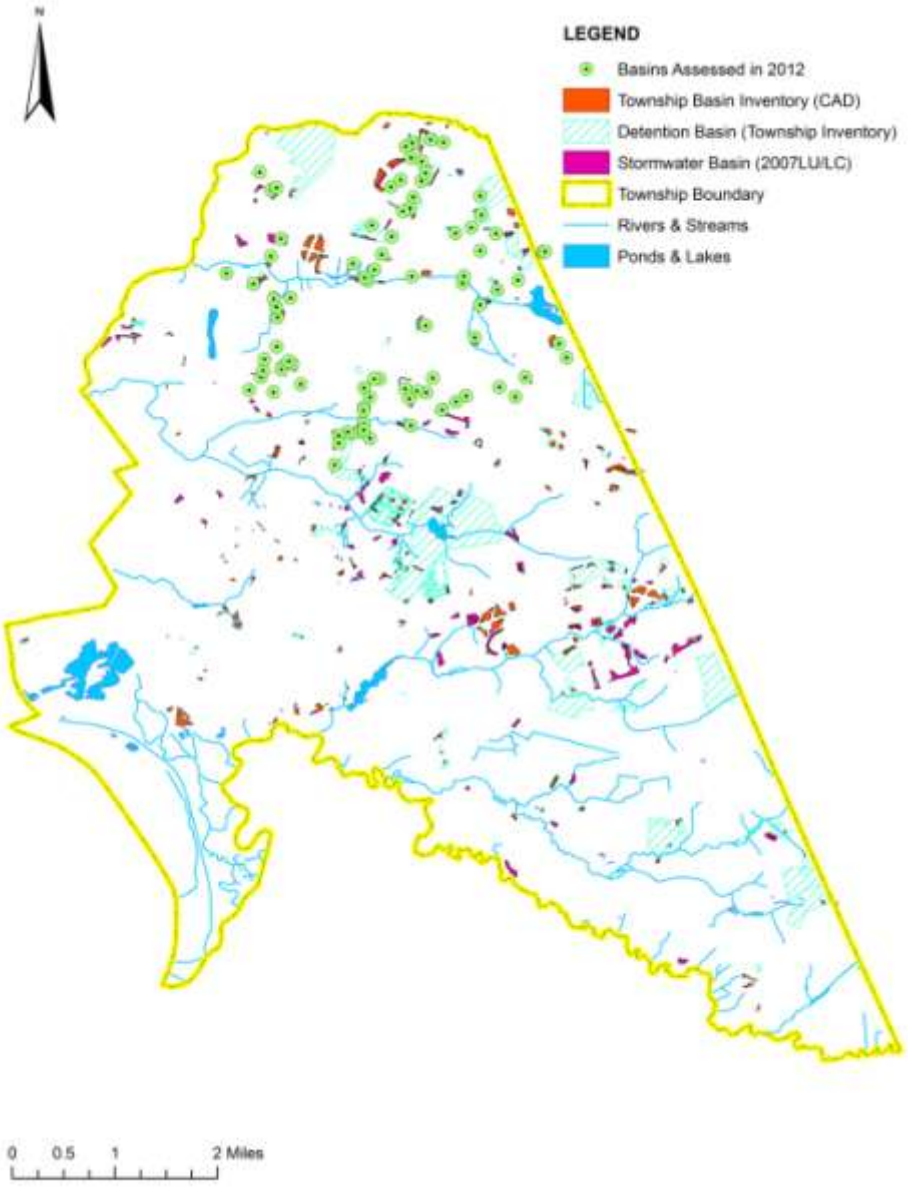
Hamilton Township Stormwater Infrastructure Assessment Program
Stormwater Basin Inspection Checklist

GENERAL INFORMATION	Site ID:
Name(s) person inspecting the basin:	Date:
Location Address and Cross Streets:	Watershed:
Name of Creek, Stream, or area into which the basin discharges:	Property Owner / Tax Parcel Block & Lot:
Contact information:	
STRUCTURAL COMPONENTS	
Basin description, size and depth:	Is the basin accessible to maintain? Yes / No Is it maintained: Mowed, clear of woody plants, inlet/outlet blockages?
Number of inlets:	Outlet diameter:

GENERAL OBSERVATIONS	YES	NO	NOTES/REMARKS
1) Any reports on the basin not functioning?			
2) Are there any unauthorized or malfunctioning structures in the basin?			
3) Are there concrete low flow channels. Is the water entering the basin directly exiting the basin outlet without coming in contact with the basin bottom soil and vegetation?			
4) Is there standing water or evidence of standing water in the basin?			
INLET/S			
1) Signs of breakage, damage, corrosion or rusting of inlet structure/pipe?			
2) Debris or sediment accumulation in or around the inlet clogging the inlet opening/pipe?			
3) Signs of erosion, scour or gullies; rock or vegetation above or around the inlet structure?			
4) Tree roots, woody vegetation growing close to or through the inlet structure or a situation impacting the structure's integrity?			
5) If the inlet has a pretreatment structure (trash rack, forebay) is it filled w/ debris or sediment?			
BASIN			
1) Accumulation of debris or litter within basin?			
2) Exposed dirt or earth visible, are there areas without vegetation or where turf is damaged?			
3) Excess sediment accumulation in the basin?			
4) Basin walls/embankment eroded, slumping, caved or being undermined?			

Stormwater Basin Assessments

- The locations of the basins were compiled into a GIS.
- An attribute table was created for each basin which listed its characteristics that were noted in the assessment sheets.
- Five maps were created based on the assessment results:
    1. Basins that require cleaning
    2. Basins that require maintenance
    3. Basins that require inlet & outlet repair
    4. Basins with standing water
    5. Priority basins (immediate attention needed)



Stormwater Basin Assessments

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Water Resources Program

Kristopher Drive Basin Prior to Cleaning (2011)

Kristopher Drive Basin After Cleaning (2012)

Hamilton Township (Mercer County)

Stormwater Basin Assessment Summary

(Year 1)

Developed by the Rutgers Cooperative Extension Water Resources Program
Funded by Hamilton Township, Mercer County, New Jersey

December 6, 2012

1

Basin assessment Summaries were complied into an easy to use hyperlinked pdf document for the DPW staff

Implementation of Solutions

1. Alternative maintenance plans were developed for basins and DPW workers were trained on implementing these plans.

2. Alternative maintenance has begun to be implemented on several basins.

3. Retrofit designs were developed for three basins and one was constructed this past summer.

CREATING A STORMWATER INFRASTRUCTURE DATABASE

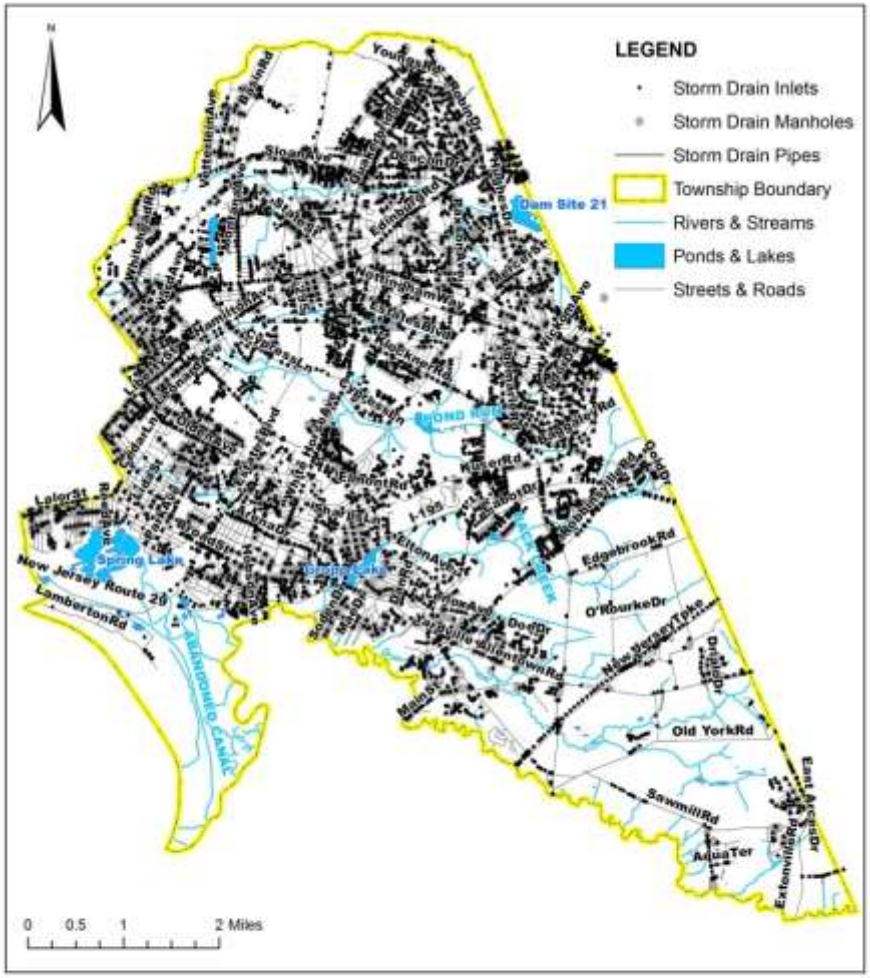

Figure 20: Stormwater infrastructure in Hamilton Township (Mercer County).

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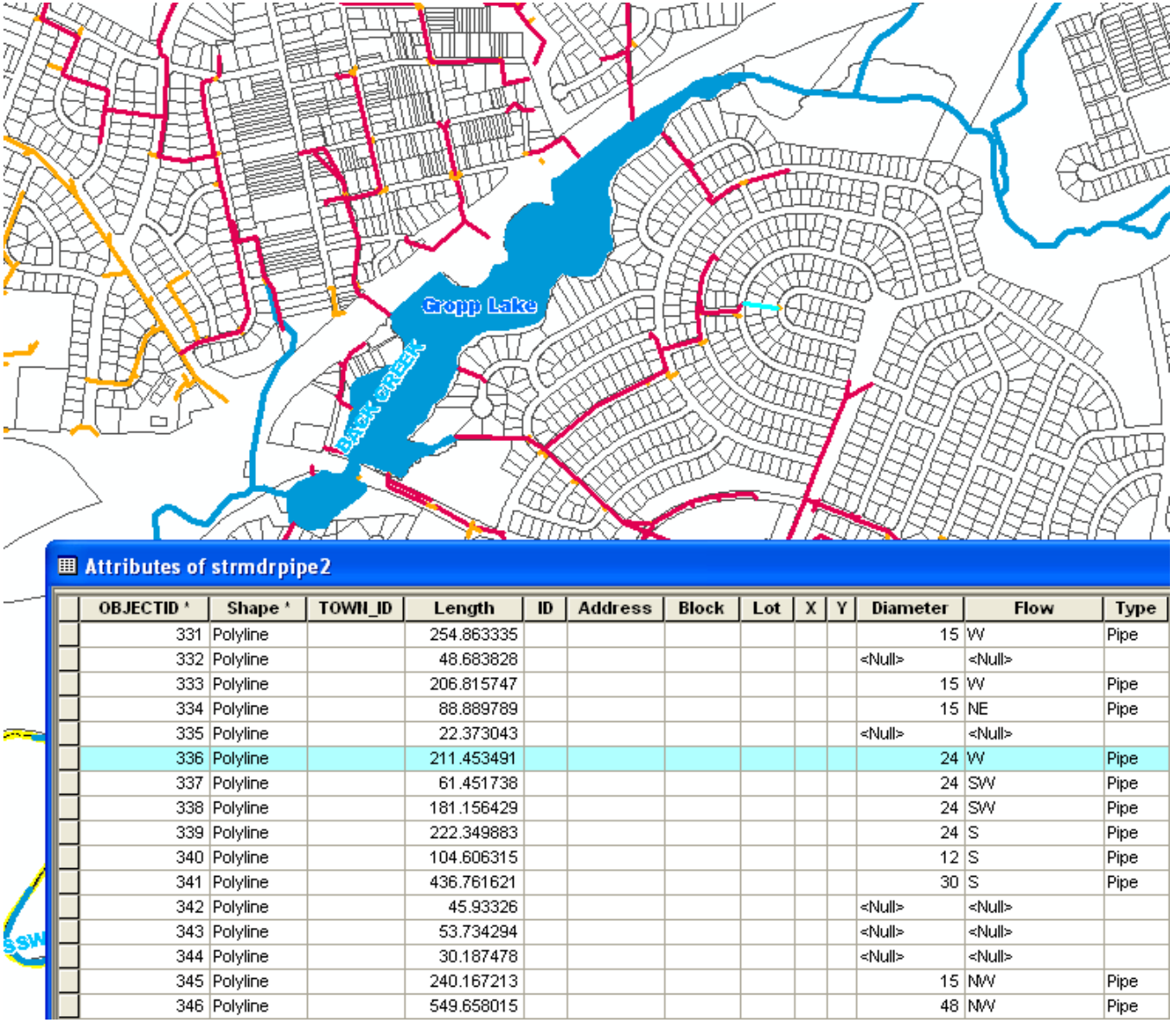
Stormwater Infrastructure Database

Manually entered database data using information provided on paper maps including:

- diameter
- flow direction
- type of structure

(pipe length is calculated by ArcMap)



OBJECTID *	Shape *	TOWN_ID	Length	ID	Address	Block	Lot	X	Y	Diameter	Flow	Type
331	Polyline		254.863335							15	W	Pipe
332	Polyline		48.683828							<Null>	<Null>	
333	Polyline		206.815747							15	W	Pipe
334	Polyline		88.889789							15	NE	Pipe
335	Polyline		22.373043							<Null>	<Null>	
336	Polyline		211.453491							24	W	Pipe
337	Polyline		61.451738							24	SW	Pipe
338	Polyline		181.156429							24	SW	Pipe
339	Polyline		222.349883							24	S	Pipe
340	Polyline		104.606315							12	S	Pipe
341	Polyline		436.761621							30	S	Pipe
342	Polyline		45.93326							<Null>	<Null>	
343	Polyline		53.734294							<Null>	<Null>	
344	Polyline		30.187478							<Null>	<Null>	
345	Polyline		240.167213							15	NW	Pipe
346	Polyline		549.658015							48	NW	Pipe

Stormwater Infrastructure Database

- Provides an easily searchable table of necessary information for MS4 and other storm structure maintenance
- Easily updatable to keep track of maintenance, changes, any problems with the structures, and notes made

ID	Length	Address	Block	Lot	Diameter	Flow	Type	Area	Maintenanc	Gen_Prob	Ac_Prob	Dr_Prob	Pipe_Prob	Rd_Prob	Out_Prob	Recommend	Notes
	139.653279				30	W	Pipe	0									
	79.572544				36	W	Pipe	0									
	49.375006				<Null>	<Null>		0									
	710.536414				30	E	Pipe	0									
	479.105264				42	S	Pipe	0									
	6.510996				24	S	Pipe	0									
	6.510997				24	S	Pipe	0									
	12.257804				24	S	Pipe	0									
	12.257804				24	S	Pipe	0									
	6.510997				24	S	Pipe	0									
	12.257805				24	S	Pipe	0									
	60.381717				<Null>	<Null>		0									
	69.9863				24	S	Pipe	0									
	237.365126				15	W	Pipe	0									
	11.70855				15	W	Pipe	0									
	41.725079				15	W	Pipe	0									
	406.042588				15	N	Pipe	0									

Database features:

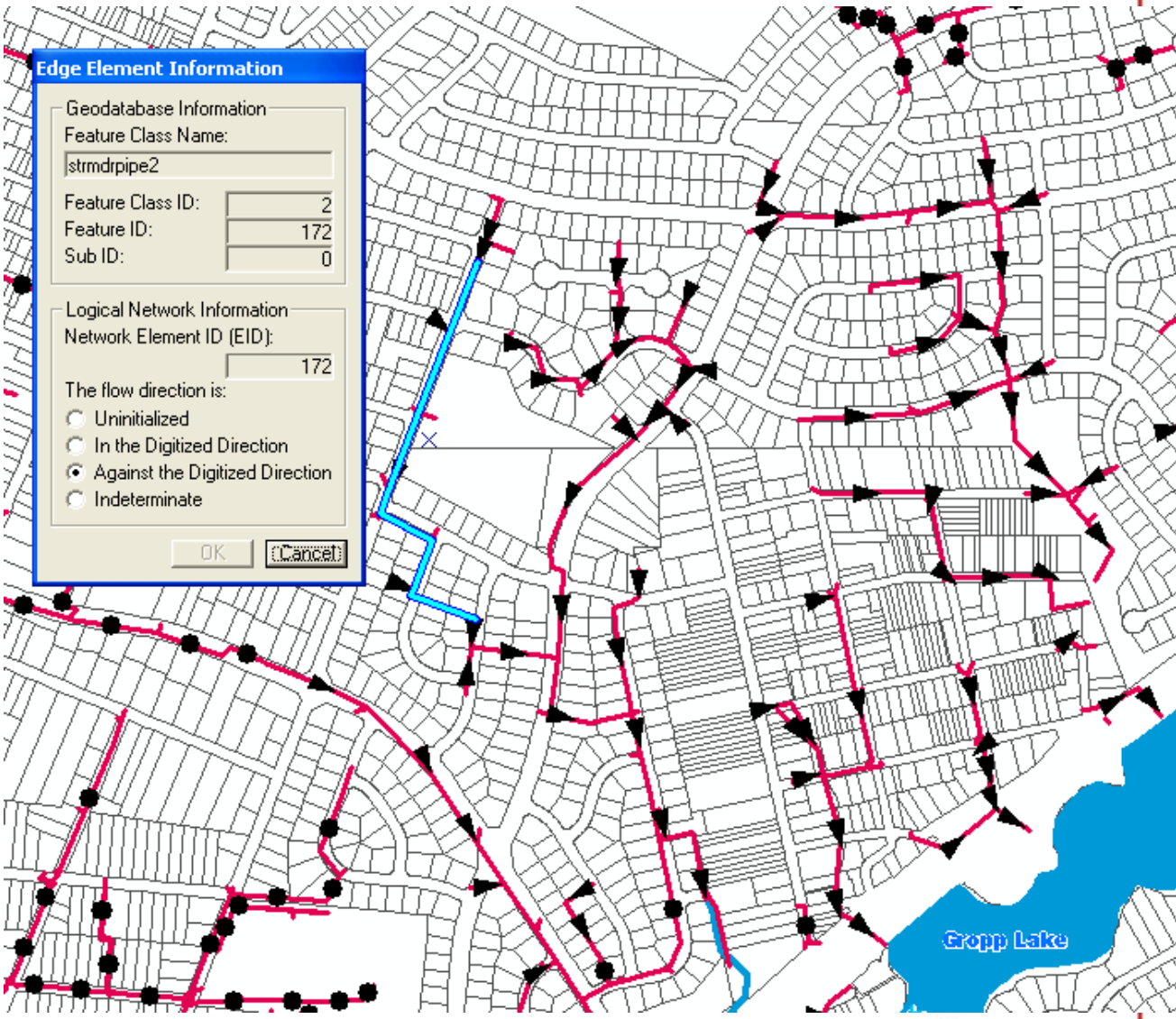
-ID
-Length
-Location
-Pipe Diameter (In)
-Flow Direction
-Type of Structure
-Area
-Maintenance Done
-General, Access, Drainage Road and Outfall Problem
-Recommendations and Notes

Stormwater Infrastructure Database

Mapping was prepared once a network geodatabase was created:

Used storm sewer digital mapping provided by Hamilton Township

Individually set flow direction according to paper maps provided.

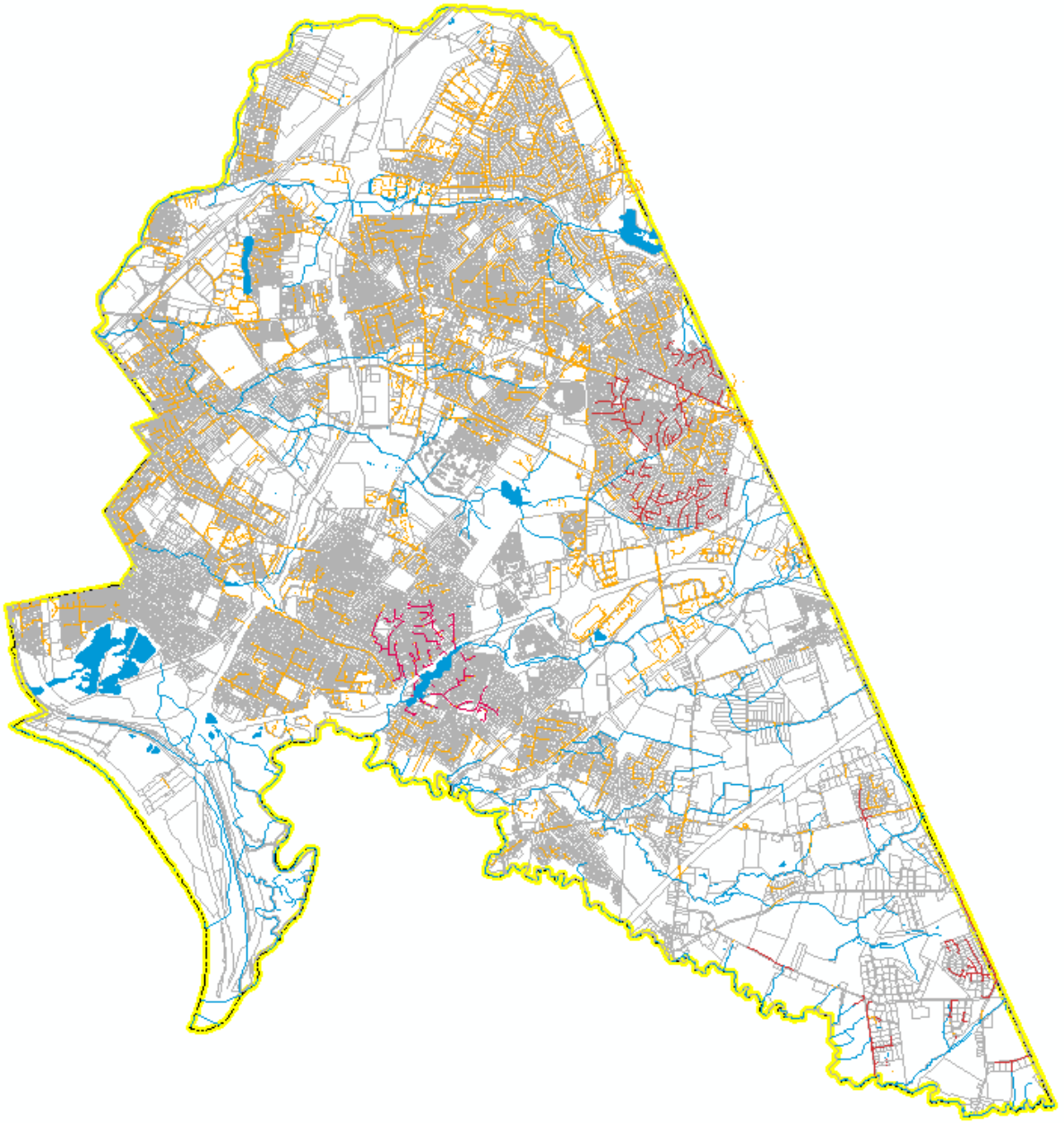


Stormwater Infrastructure Database

Progress of Data Entry completed in 2012:

731 out of 9,816 attributes have been completed (approx.7%)

- red pipes = completed
- orange = mapped but no data



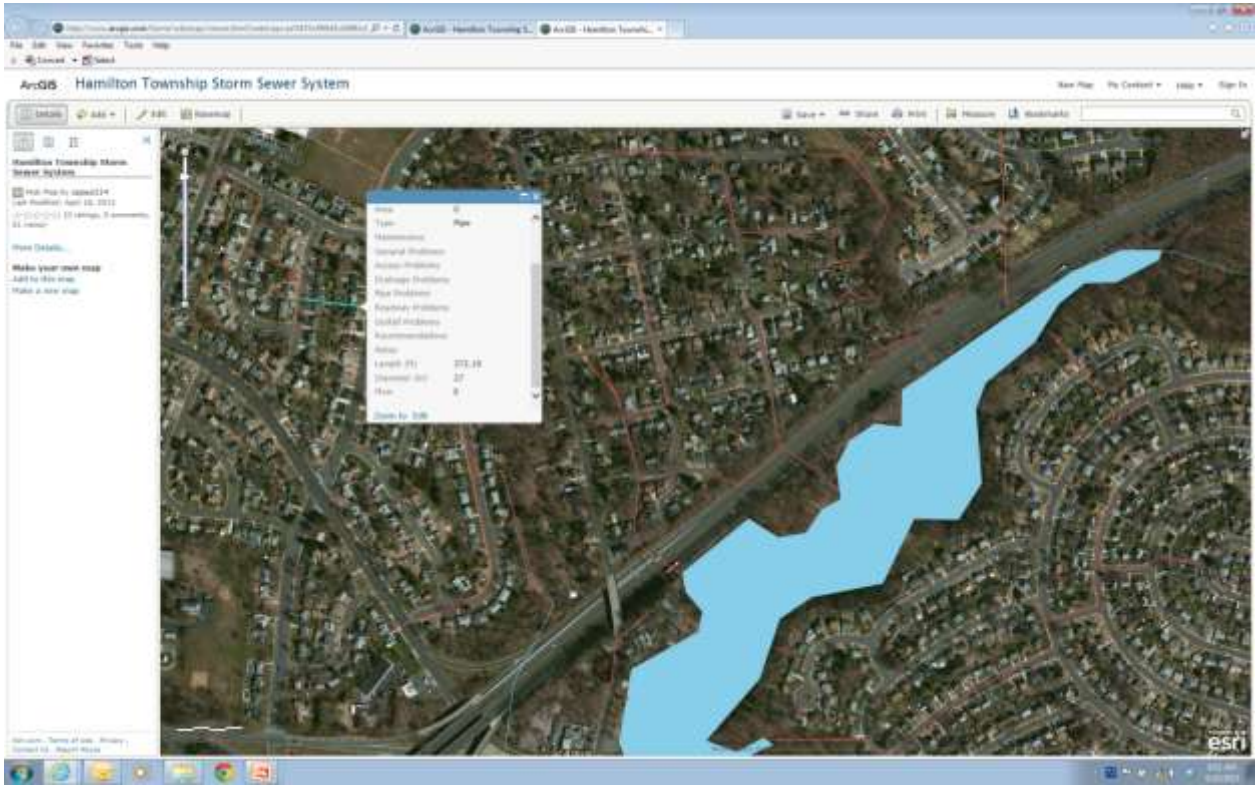
Stormwater Infrastructure Database

Database is available at: ArcGIS Online.

Stormwater Infrastructure Database

Online Database:

- Can be shared quickly and easily between multiple departments and staff.
- Can be used on mobile devices for easy access to information in the field
- Can be edited to update information quickly and easily – once updated changes are immediate.



Stormwater Infrastructure Database Summary and Next Steps

1. Solicit input from Township on database structure and content

2. Continue to build database and populate attribute tables focusing on priority areas as identified by the Township

RAIN GARDEN DEMONSTRATION PROJECT (STEINERT HIGH SCHOOL)

Your Rain Garden is composed of woody plants (trees and shrubs) and herbaceous species (flowers, grasses, and ground covers) planted in three wetness zones.

Rain Garden Demonstration Project

Proposed Rain Garden Location

- A partnership with Steinert High School was established to execute a stormwater education program and construct a demonstration rain garden.
- The project was presented to and approved by the Superintendent of Schools as well as the Board of Education.
- The educational program was coordinated with the AP Biology curriculum under the direction of Debbie Ryan
- The project and classroom instruction was completed in April 2013.

Rain Garden Demonstration Project

Excavation in partnership with Hamilton DPW (April 2, 2013)

Rain Garden Demonstration Project

Education Program and Planting with Steinert AP Biology Class April 11, 2013

On to Nottingham High School in Hamilton – TODAY!

DETENTION BASIN PILOT MANAGEMENT PROGRAM

Pilot Maintenance Program
Hamilton Township Stormwater Basins
Englewood Basin

BASIN LOCATION
Behind 125 Englewood Ave at end of street.

Legend:

- Allow basin to naturalize.
- No mow zone.
- Area to mow and keep clear.

Maintenance Notes:

- Limit monthly mowing to a 6-8 ft. perimeter area around the basin.
- Maintain 4-6 ft. clear zone around inlets and outlet on a monthly basis.
- Reduce mowing of basin bottom to once per year.

Detention Basin Pilot Management Program

- Identified 13 stormwater detention basins for a pilot program for alternative maintenance approaches.
- Rutgers staff met with Township DPW staff to outline alternative maintenance practices for water quality improvement.
- Rutgers prepared a letter to the Township informing residents about the benefits of new maintenance approaches.
- Created diagrams defining new practices and strategies in 13 basins and provided to Township DPW



Capitalizing on other opportunities . . .

Grant Opportunities

- Vernal Pool Certification funded through grant from ANJEC
- Rain Barrel Workshops funded through small grant from Sustainable Jersey

ANJEC
ASSOCIATION OF NEW JERSEY ENVIRONMENTAL COMMISSIONS

SUSTAINABLE JERSEY
CERTIFIED
A Better Tomorrow, One Community at a Time

Stormwater Education for Municipal Officials

- Provided an overview of the Stormwater Regulations for Township Officials
- Met with NJDEP representatives to discuss current issues and reviews
- Completed a 2-part seminar:
  - Sept. 27, 2012 (16 attendees)
  - Oct. 25, 2012 (16 attendees)
- NJDEP representatives attended both sessions
- Provided a process for Planning & Zoning Boards to approve Stormwater applications

Presentation Materials Available at:
www.water.rutgers.edu

Rain Barrel Workshop Program

- Planned 2 workshops to distribute 50 barrels as part of Sustainable Jersey Grant:
  - April 2, 2013 Workshop with more than 35 participants and 30 barrels distributed
  - April 25, 2013 Workshop with more than 38 participants and 33 barrels distributed
- Due to high interest, a third workshop was held on May 29, 2013:
  - Over 40 people attended and 52 barrels were distributed
- *In total over 100 Hamilton residents participated and over 100 rain barrels were distributed*

Rain Barrel Workshop Program

Workshop Date	# of Barrels Built
April 2, 2013	30
April 25, 2013	33
May 29, 2013	51

114 Rain Barrels X 1400 Gallons/year = 159,600 gallons saved per year

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Water Resources Program

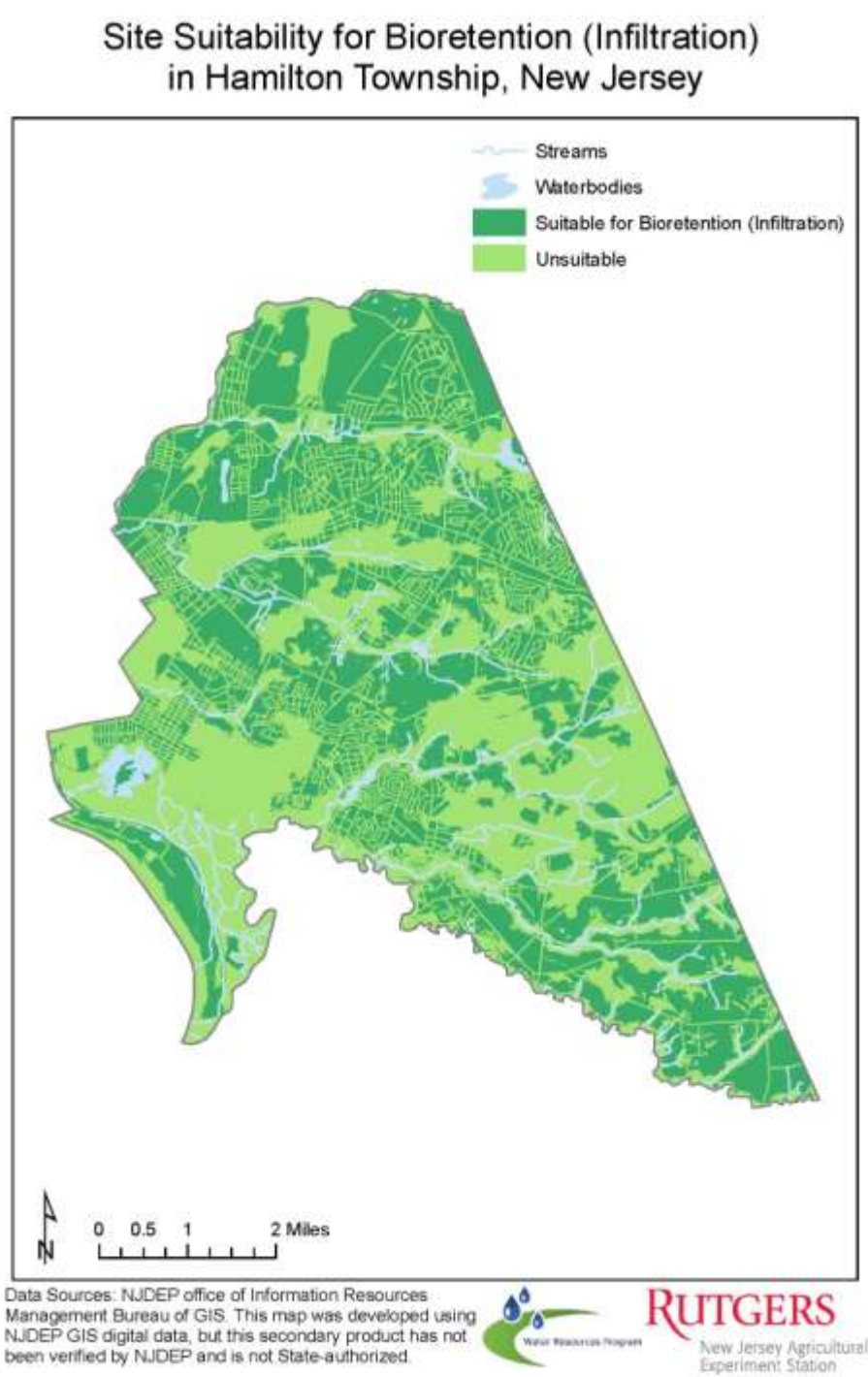


Finishing up current efforts . . .

- Continue to develop hydrologic model
- Continue inventory and assessment of stormwater basins
- Continue development of stormwater infrastructure GIS database
- Continue stormwater basin pilot maintenance program

- Finalize site suitability analysis (for stormwater BMPs)
- Finalize the impervious cover analysis
- Conduct riparian investigations with Environmental Commission
- Prepare a ***stormwater management mitigation plan***

- Develop and implement resident education program
- Implement stormwater basin retrofits and repairs



Site Suitable Mapping and Online Tool

- Grass Swales
- Sand Filters (Surface and Non-Surface)
- Infiltration Trenches
- Bioretention Areas (with and without Infiltration)
- Vegetated Filter Strips
- Porous Pavement
- Dry Ponds
- Wet Ponds
- Stormwater Wetlands

Stormwater Mitigation Plan Online Tool

Greenwood Elementary School

2069 Greenwood Avenue

Area (sq. ft.): 83,374 ; Block: 1884; Lot: 1

Impervious Cover (sq. ft.): 75, 121 ; Percent Impervious: 90%; Total Runoff from Impervious Surfaces for the 1.25" Quality Storm (gal): 58,536

Total Phosphorus Loads (lbs/yr): 4; Total Nitrogen Loads (lbs/yr): 42; Total Suspended Solids Loads (lbs/yr): 383

Recharge Potential:____; Total Suspended Solids Removal Potential:_____; Stormwater Peak Reduction Potential: _____

Suitable for: Bioretention (with underdrain system), Bioretention (infiltration), Dry Pond, Grass Swale, Infiltration Trench, Porous Pavement, Vegetated Filter Strips


QUESTIONS?