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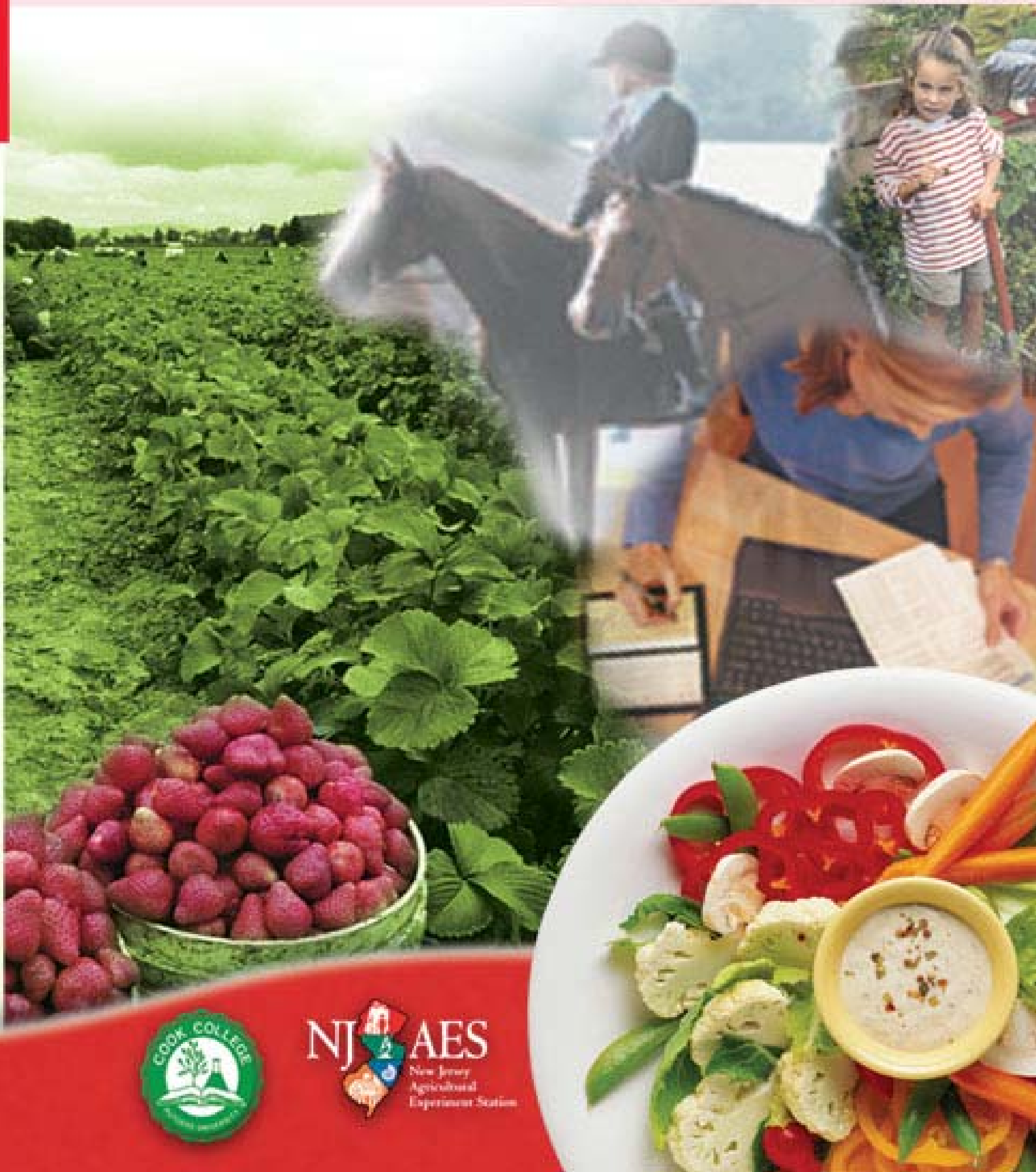
New Jersey Agricultural Experiment Station

Building on the Past – Providing Solutions for the Future

Watershed Management Through Regional Stormwater Planning: A Case Study of a Mixed Land Use Watershed



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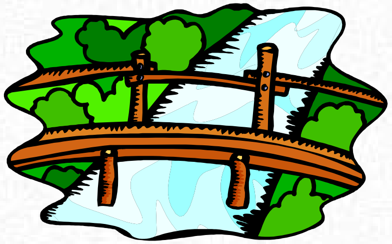
New Jersey Agricultural Experiment Station

Overview

- New Jersey Stormwater Regulations and Regional Stormwater Management Planning
  - Contrast with Watershed Restoration Plans
- Introduction to the Pompeston Creek Watershed
- Water Quality and Water Quantity
  - Existing data
  - modeling across the various land uses
- Lessons Learned



New Jersey Stormwater Rules

- Two sets of new stormwater rules were established in 2004
  - Addressing Water Quality impacts of existing and future stormwater discharges

1) Stormwater Management Rules
    - Emphasis on LID
    - Regulates “New” Development
    - Contains Design and Performance Standards
    - Allows for optional Regional Stormwater Management Plans

2) Phase II NJDES
    - Permits to MS4s
    - Municipalities and certain public complexes

New Jersey Stormwater Rules

- The goal of the Regional Stormwater Management Plans:
  - Create watershed wide recommendations to address water quality, water quantity and recharge issues.
  - Ultimately to be adopted into the Areawide Watershed Management Plan
- Not primarily a TMDL tool, but useful to begin quantification process.

The Pompeston Creek Watershed

- Approximately 10 sq. mi.
- 4 Municipalities
  (Moorestown, Cinnaminson, Delran, Riverton)
- Empties into Delaware River

The Pompeston Creek Watershed

Land Use	Area (acres)	Per Cent of Watershed
Agriculture	396.8	7.2
Barren Land	172.8	3.2
Forest	473.6	8.6
Urban	3929.6	71.2
Water	12.8	0.2
Wetlands	531.2	9.6
Total	5516.8	100

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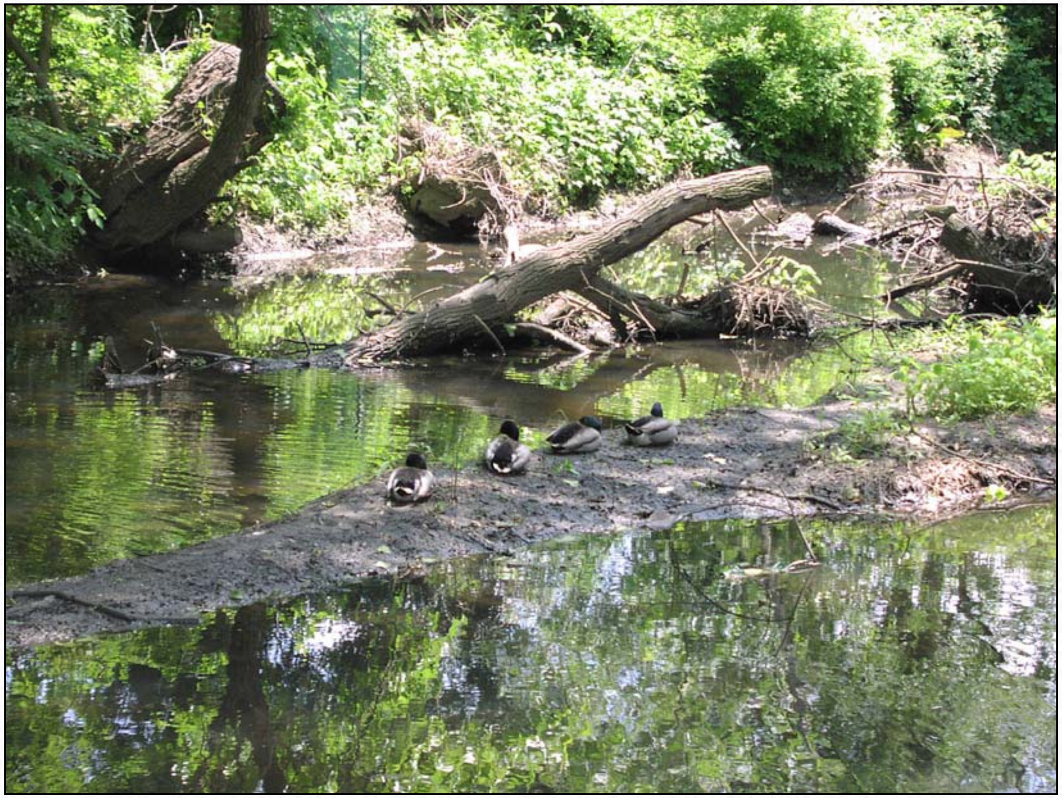
Pompeston Watershed Description

- The headwaters of the watershed are located in Moorestown Twp, New Jersey
- Several parks and other public land exist along the Pompeston Creek
- Traditional stormwater detention basins do not remove pollutants or encourage recharge
- Many stream banks show signs of significant erosion
- A lack of riparian buffers in some areas

Water Quality

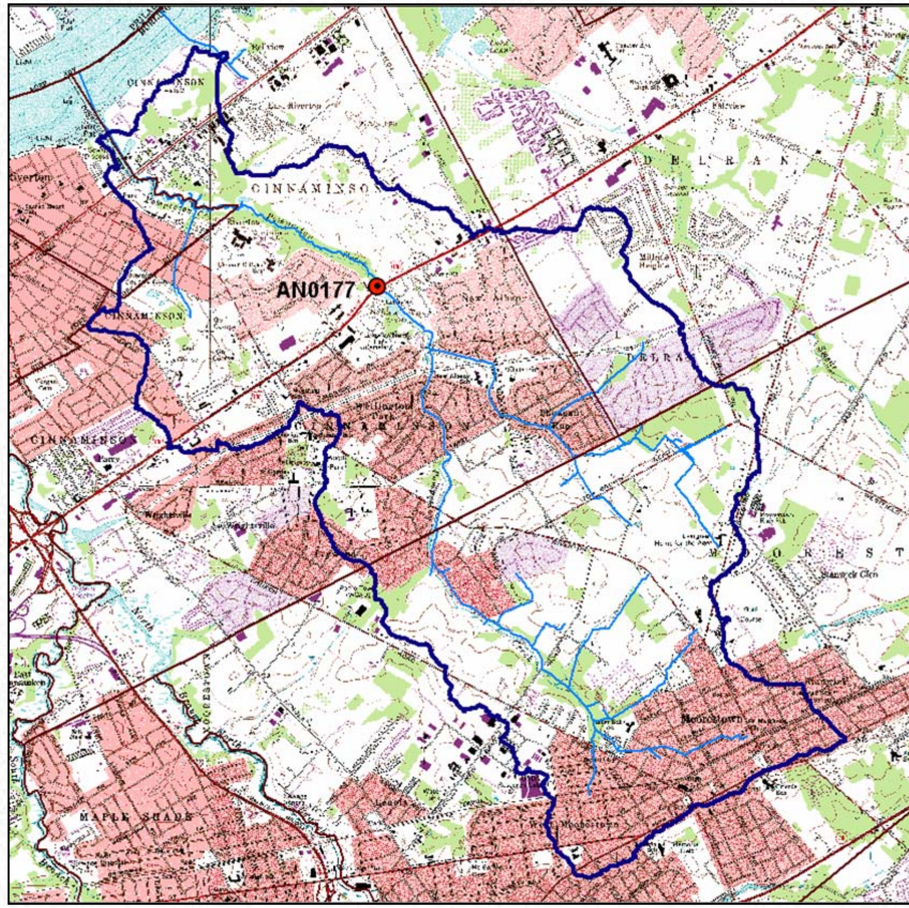
Water Quality Analysis

- Review of Impairments
- AMNET data
- Aerial Loading Analysis
- Analysis of stormwater sampling performed by the Pompeston Creek Watershed Association
- Field reconnaissance



AMNET Data

NJDEP does not have a water quality monitoring station in the watershed, but does have one ambient biomonitoring network site



Monitored 3 times in 12 years, this site was downgraded to severely impaired in 2001

Pompeston Watershed Description

- Bacterial Contamination levels are a concern.
  - No water quality monitoring station by NJDEP or USGS, but local watershed group extremely active.
  - Cooperative Extension provided support
  - Suspected sources include horse farms, geese, and human

East Branch of the Pompeston Creek

East Branch of the Pompeston Creek

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Pompeston Creek Main Stem

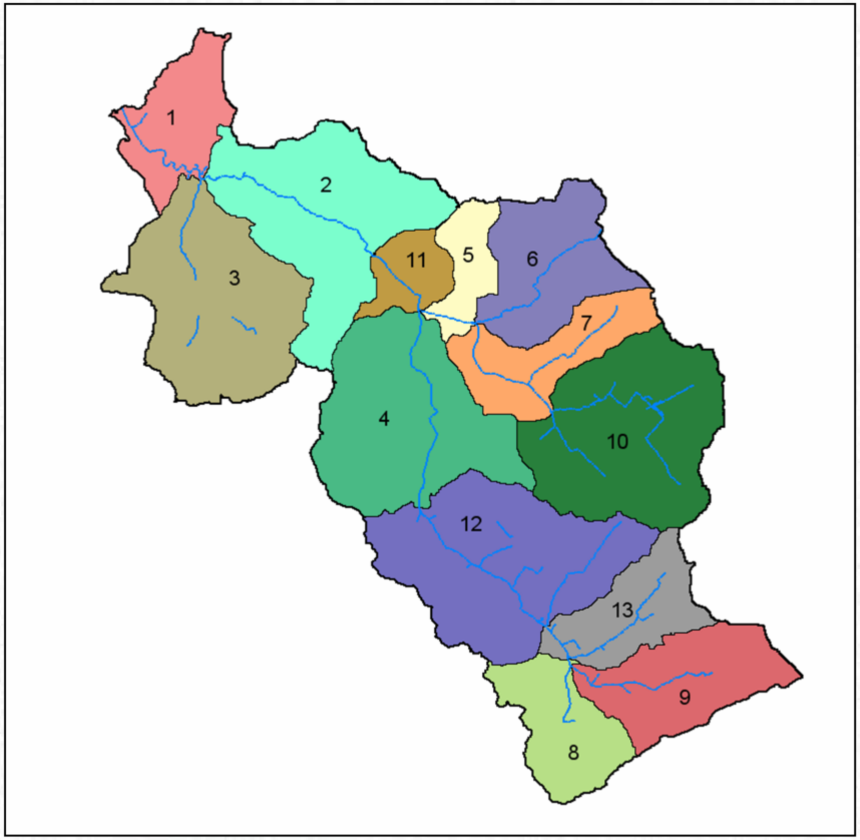
DATE	Fecal Coliform (col/100ml)	*E. coli** (CFU's/100ml)
10/19/2004	5600	5300
11/17/2004	130	200
12/1/2004	5600	9700
12/14/2004	320	310
2/15/2005	520	2200
3/22/2005	70	2
4/20/2005	150	110
5/17/2005	300	207
6/21/2005	270	283
7/20/2005	1400	740
8/9/2005	6000	24900
10/20/2005	200	140

FC:200/400

E.Coli: Geometric Mean of 126/100ml or a single sample maximum of 235/100ml

Water Quality: Aerial Loading Analysis

- HEC-GeoHMS hydrological modeling software to delineate the watershed into 13 subbasins that represent areas draining to significant tributaries or significant reaches of the stream.
- *Load = ULc* × *Area*
- Load is in units of pounds of pollutant per year (lbs/yr),
- ULc is in units of pounds per acre per year (lbs/acre/yr) for each specific land use, and
- Area is in acres for each specific land use.



Aerial Loading Analysis

	Unit Loading Coefficients				
	TP lbs/acre/yr	TN lbs/acre/yr	TSS lbs/acre/yr	NH3-N lbs/acre/yr	NO2+NO3 lbs/acre/yr
High/Med Residential	1.4	15	140	0.65	1.7
Low/Rural Residential	0.6	5	100	0.02	0.1
Commercial	2.1	22	200	1.9	3.1
Industrial	1.5	16	200	0.2	1.3
Mixed Urban	1	10	120	1.75	3.55
Agriculture	1.3	10	300	N/A	N/A
Forest, Water, Wetlands	0.1	3	40	N/A	0.3
Barren Land	0.5	5	60	N/A	N/A

N/A: Data not available from sources used.

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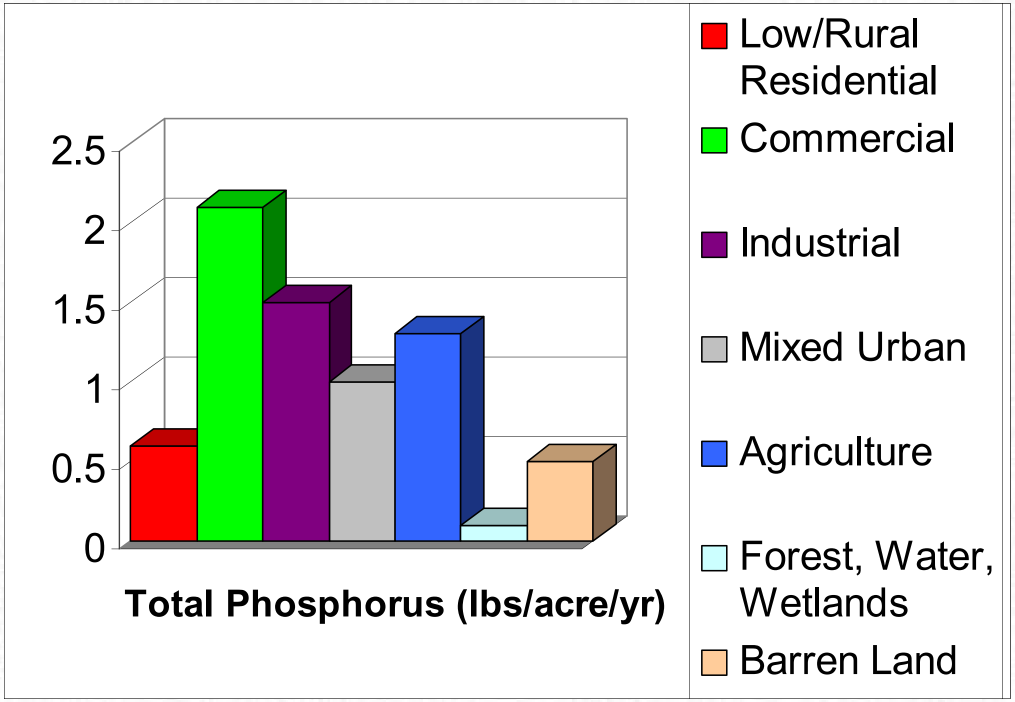
Unit Loading Coefficients

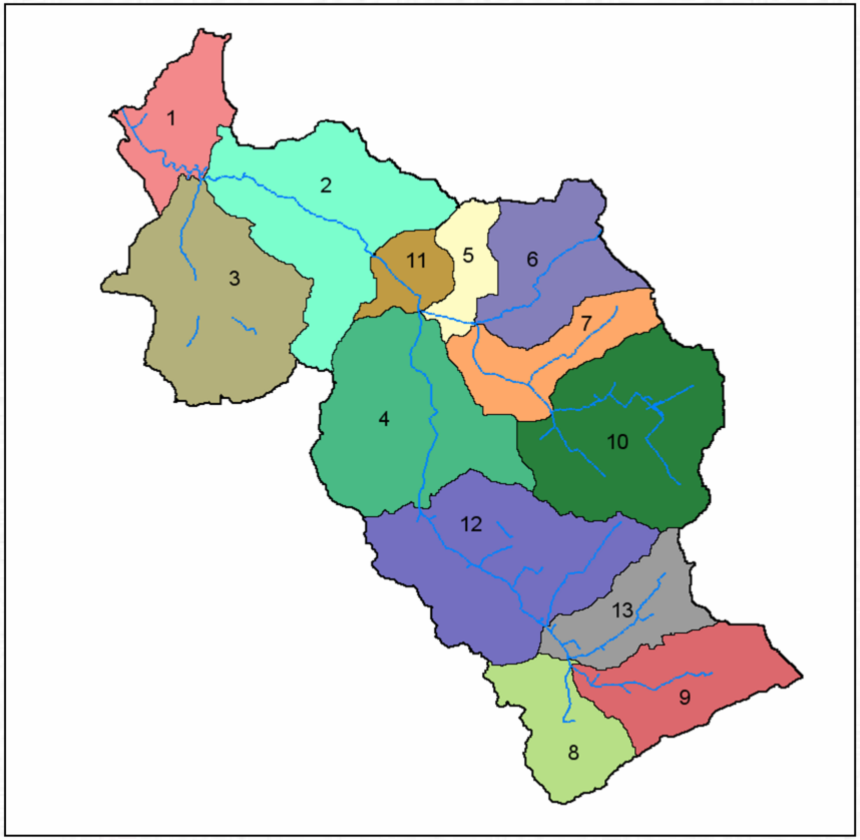
- **Where we get them from?**
- **How accurate they are?**
- **Fecal runoff coefficients?**



Aerial Loading Analysis

Summary of Aerial Loading

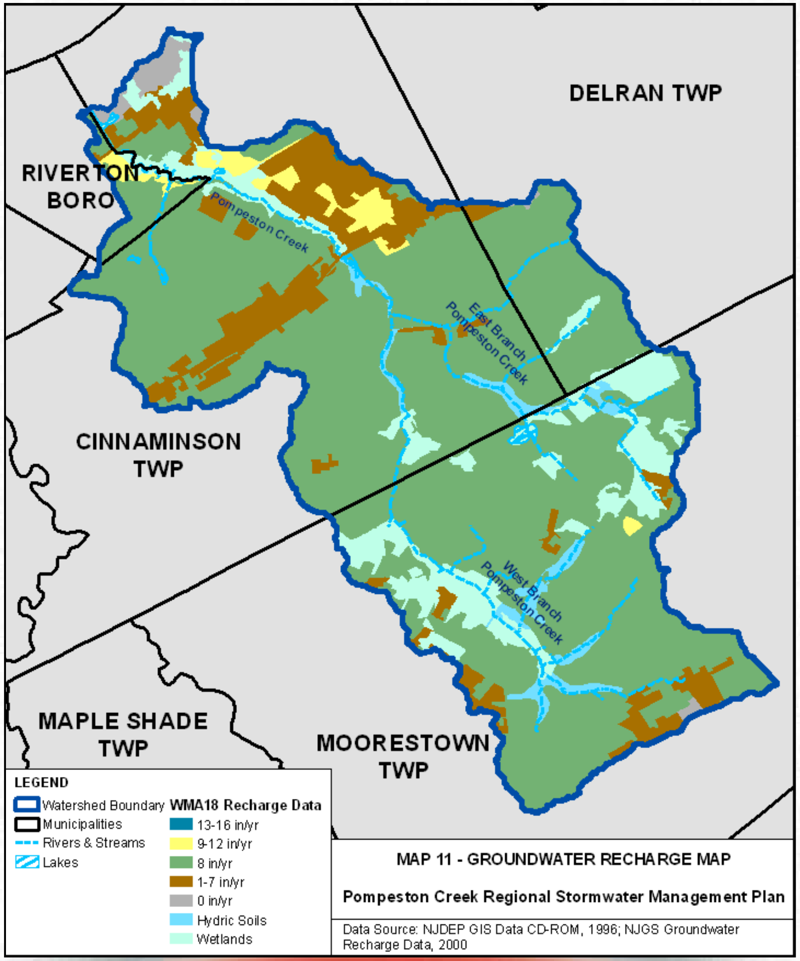
- Basins 2 & 3 high total load of NPS
- Basins 6, 8, 9 high NPS loads normalized to area (approx. 70% residential)
- Basins 2 & 3 highest metal load normalized to area (commercial and industrial)
- Basin 10, with the highest amount of agricultural use, was not ranked among the highest of concern.



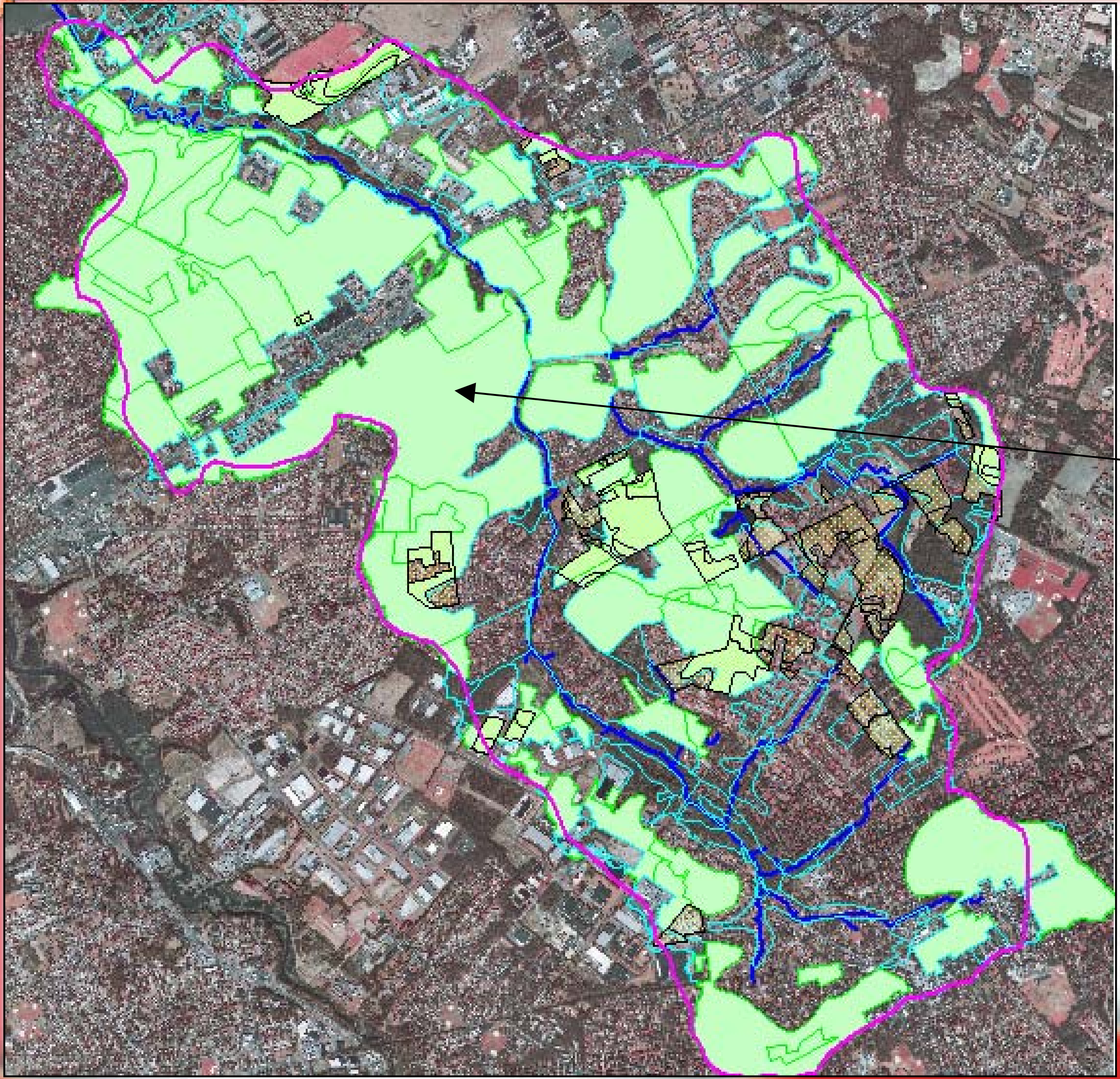
Groundwater Recharge

Groundwater Recharge Areas

- Localized high recharge 13-16in/yr
- Highest recharge 9-12in/yr eastern Cinnaminson
- Aerials were used to further analyze the areas of highest recharge and are included in the report



Pompeston Watershed Recharge



Within a sole source aquifer region

10-16 inches

Within a Water Supply Critical Area

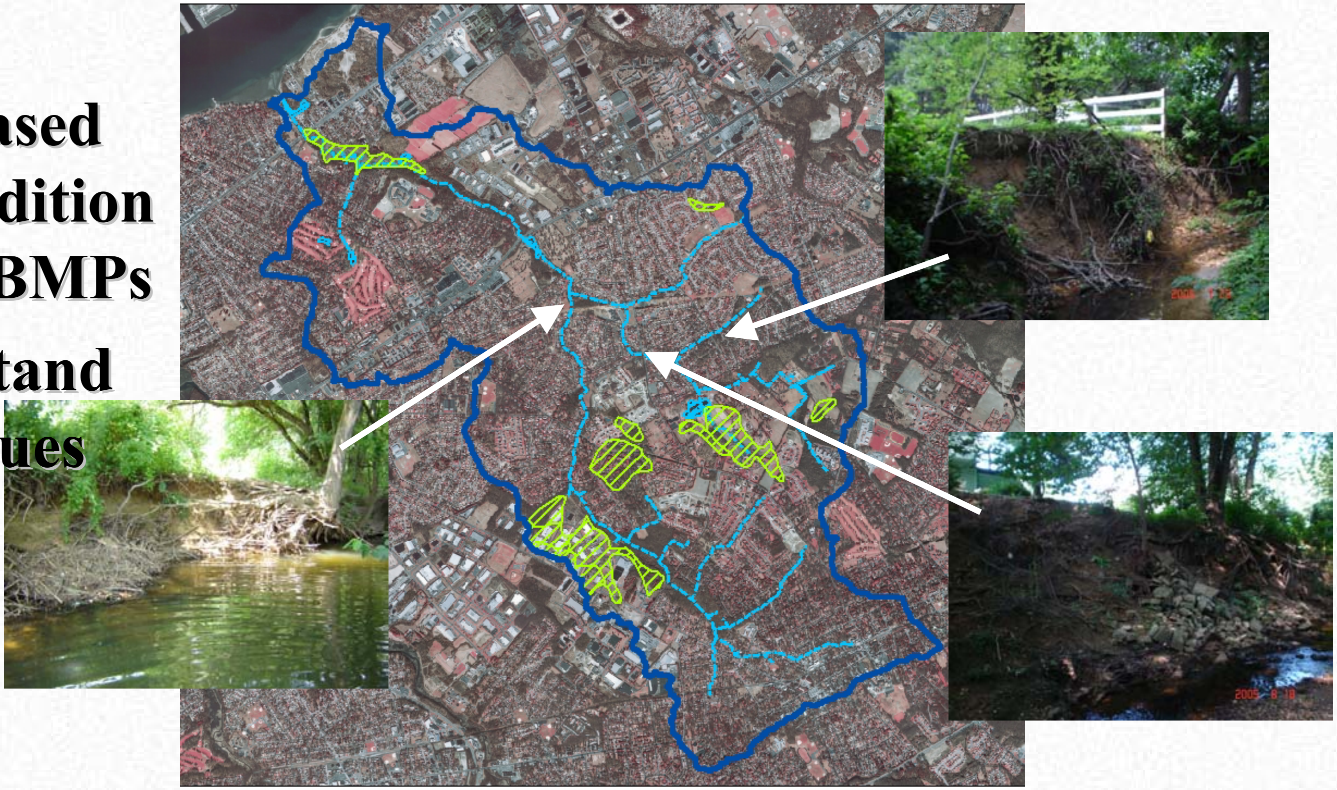
Groundwater Recharge Solutions

- Critical Best Management Practices
  - Vegetated swales
  - Rain gardens
  - Disconnection of impervious surfaces

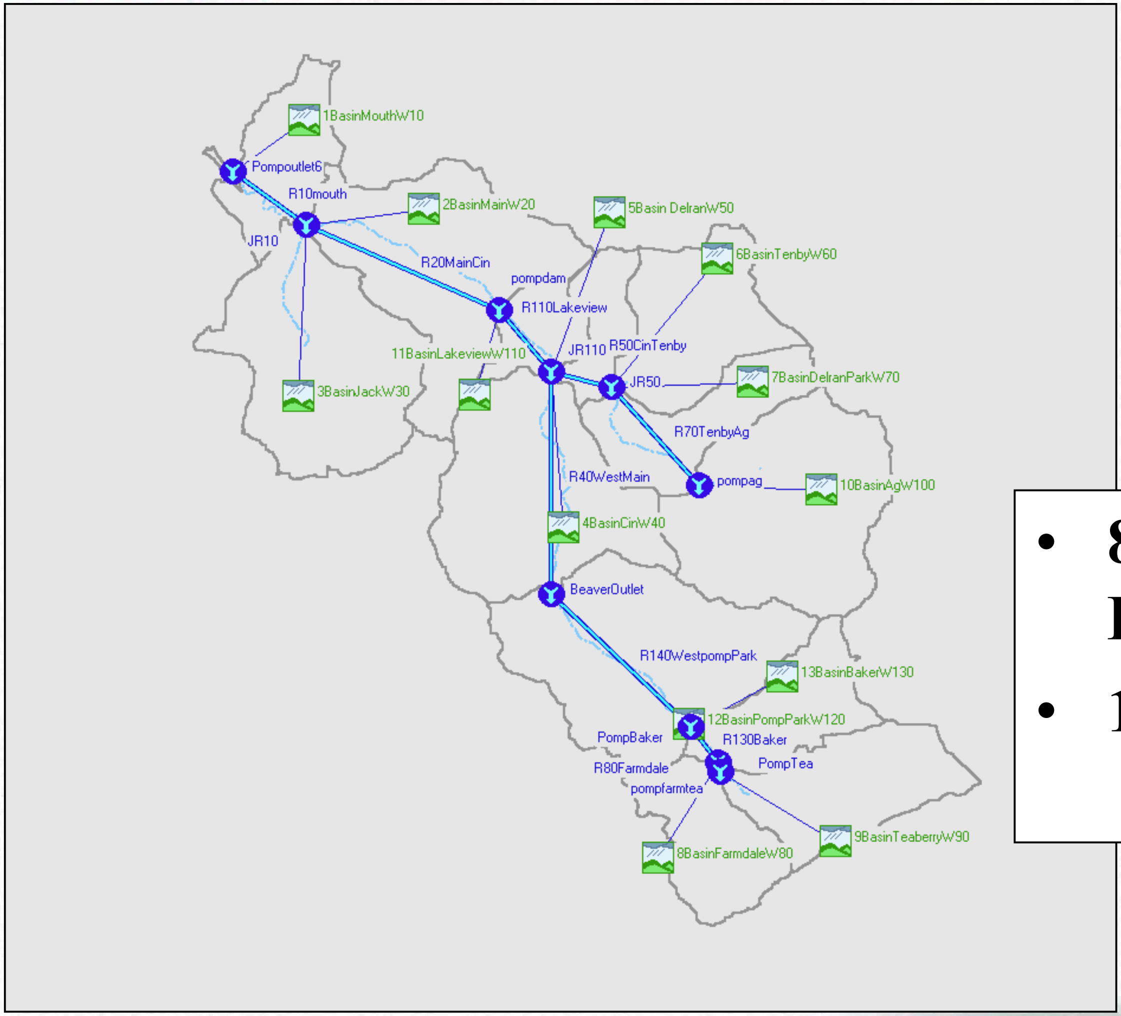
Water Quantity

Hydrologic Modeling

- **Will help us understand the effects of increased ISC and the addition of stormwater BMPs**
- **Help to understand and address issues such as these**



HEC-HMS Model

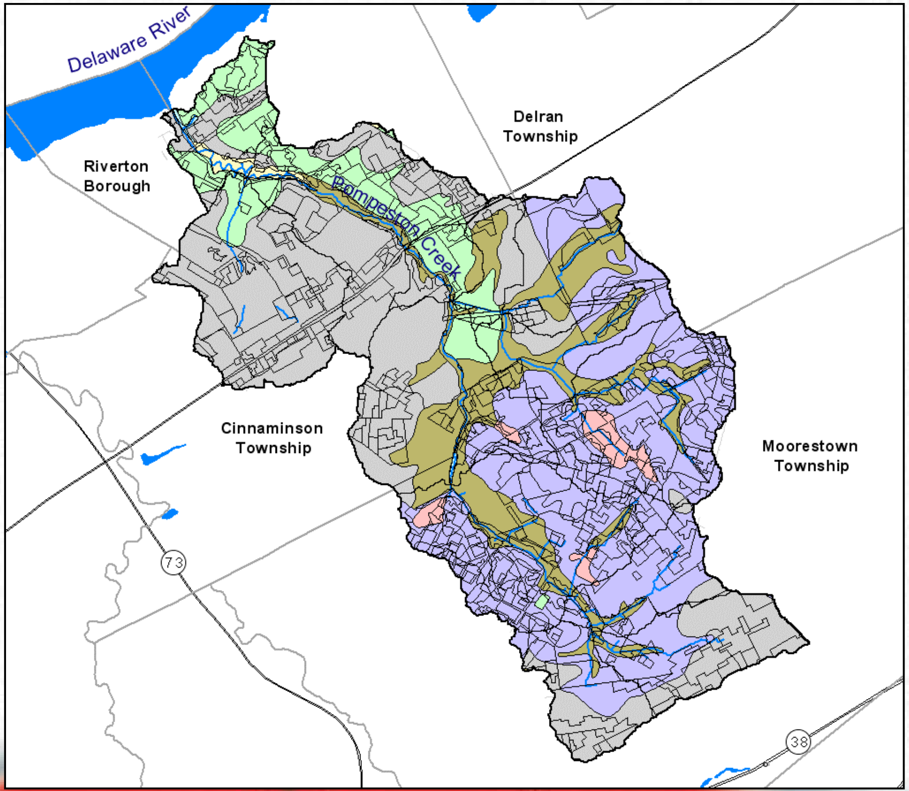


- 8.3 Square Mile Drainage Area
- 13 Sub Watersheds

General Areas and CN Table

Basin	CN	Area sq mi.
1	73.29	0.375
2	76.39	0.997
3	73.67	0.953
4	78.37	0.976
5	76.22	0.206
6	82.73	0.555
7	82.66	0.428
8	79.24	0.408
9	81.09	0.541
10	83.92	1.018
11	66.84	0.194
12	84.3	1.092
13	81.1	0.396

Area weighted curve numbers assigned to each subwatershed based on land use and soil type

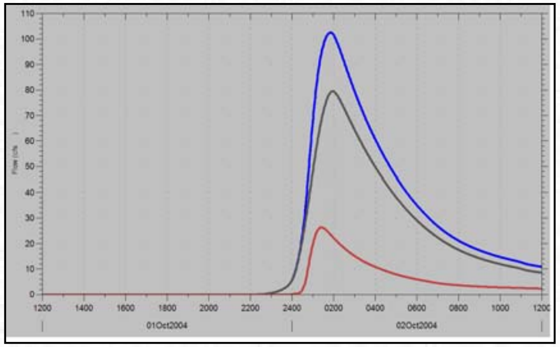


Disconnection of Impervious Areas

With limited options in a moderately developed watershed, reducing peak flows and volumes directly to the stream are of primary importance

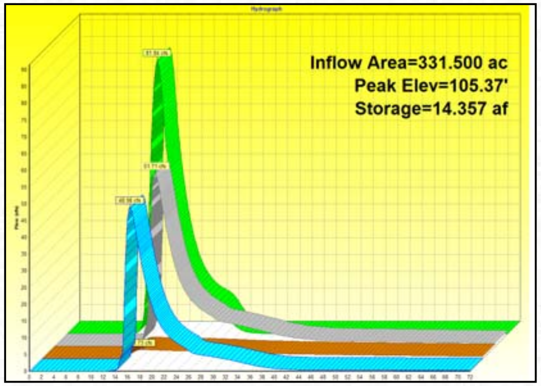
HEC-HMS

Area Weighted CN



HydroCAD

Disconnection



Disconnection Results

Subdivision	Disconnected Surface	New Volume (ft^3)	Volume Reduction (ft^3)	% Volume Reduction
Georgian Dr.	**None**	34,325	0	0%
	Rooftops	23,522	10,803	31%
	Rooftops & Driveways	16,770	17,555	51%
	Rooftops, Driveways, & Streets	1,481	32,844	96%

Volume as predicted by using the SCS method on the Water Quality (1.25 inches/2 hours) Design Storm

Lessons Learned

Research

Accurate representation by models.

Accurate quantification of water quality and quantity issues.

Extension

Watershed groups and community are essential in creating a plan that will be good!

Integration

Our graduate students learn by doing.

The community can only improve with good information.

Questions?

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