

# Surface Water Quality and Pollutant Loadings in the Raritan Basin

Presentation for  
the Raritan Basin Watershed Management Project by  
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New Jersey Water Supply Authority

# Acknowledgements

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- Robert Reiser, USGS
  - WQ Status, Loadings, Statistics
- Jim Cosgrove, TRC-Omni Environmental
  - Point Source Loads
- Denise Zambrowski, formerly NJWSA
  - Report

# The Raritan Basin



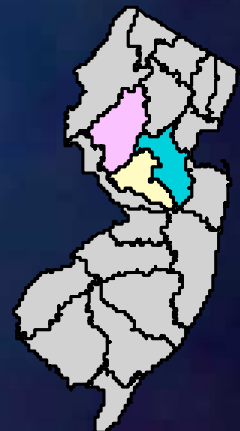
North and South  
Branch Raritan



Millstone



Lower  
Raritan



# Raritan Basin Statistics

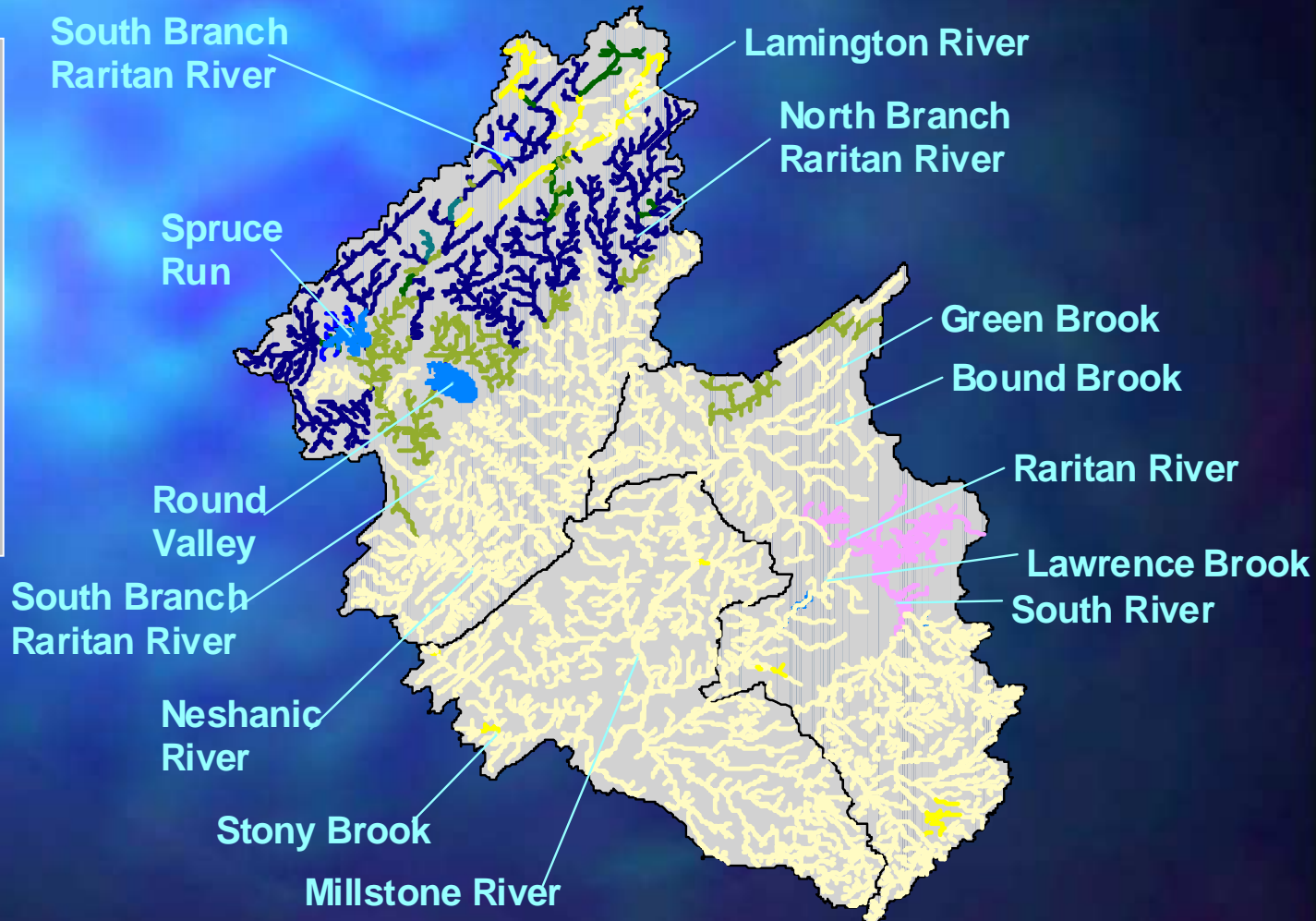
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- 1,100 square miles
- Largest drainage basin located only in NJ
- 900 billion gallons of water annually from rainfall
- 1.2 million persons (2000 Census)
- 1,995 miles of mapped streams
- 21 square miles of mapped surface water (lakes, rivers, and streams)

# Surface Water Classifications

## LEGEND:

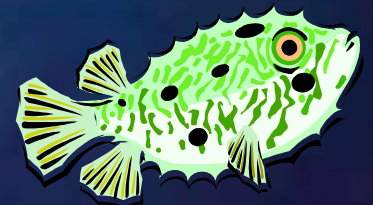
- FW1-TP
- FW2-NT
- FW2-NTC1
- FW2-TM
- FW2-TMC1
- FW2-TP
- FW2-TPC1
- SE1



# Purposes of Water Quality Characterization & Assessment

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- Which surface water bodies have problems?
- What causes the problems in the surface water bodies?
- How often do those problems occur?
- Are sources of pollutants from point or non-point sources?



# Indicators of Impairment

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- Compliance with Water Quality Standards
- Ecological Health
- Physical Conditions



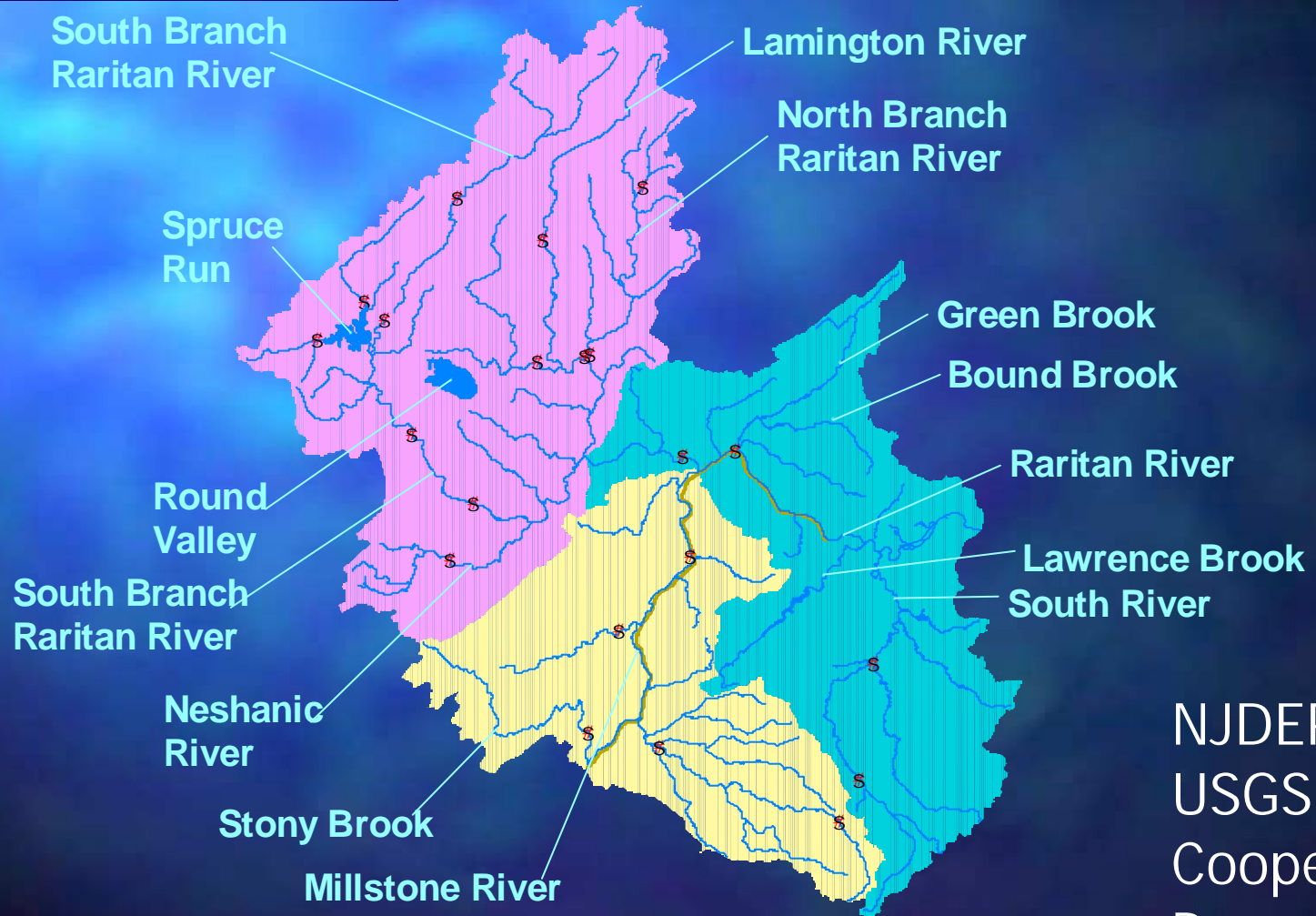
# Water Quality Characterization

- 17 Water Quality Constituents
  - Conventional (Temp., pH, TDS, TSS, DO, BOD)
  - Nutrients (Nitrogen and Phosphorus Compounds)
  - Others (Organic Carbon, Chloride, Sodium, Sulfate, Fecal Coliform)
- Pesticides (analyzed for 85)
- Volatile Organic Compounds (analyzed for 86)
- Bed Sediment Analyses
- Stream Flow Analyses



Data through 1997 evaluated.

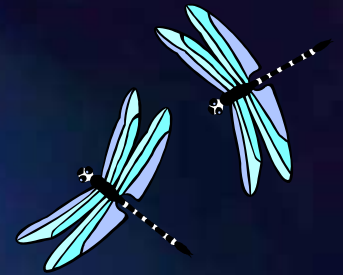
# Ambient Stream Monitoring Sites



NJDEP and  
USGS  
Cooperative  
Program

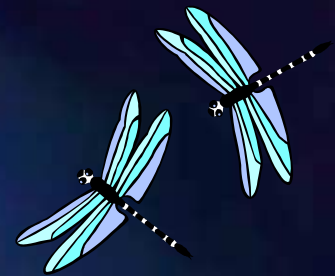
# Water Quality Status

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- All 21 stations had at least one instance of non-compliance with a water quality standard.
- Most common constituents not in compliance were Total Phosphorus and Fecal Coliform.
- Upper Raritan WMA had the best water quality.

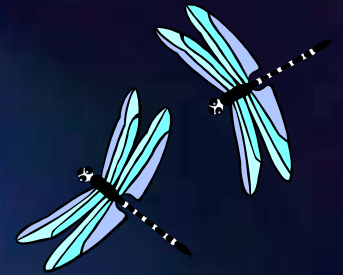
# Water Quality Status- Non-Trout Waters



- Fecal Coliform – 31% exceeded WQS
- pH –
  - 8.9% too low (Coastal Province)
  - 11% too high (Piedmont/NE Province)
- Phosphorus –
  - 42% exceeded stream WQS of 0.1 mg/L
  - 74% exceeded 0.05 mg/L
- Sodium – 6.5% exceeded DWQS

# Water Quality Status- Trout Waters

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- Fecal Coliform – 27% exceeded WQS
- pH – 11.6% above range (Piedmont)
- Phosphorus
  - 10.6% exceeded stream WQS of 0.1 mg/L
  - 41.7% exceeded 0.05 mg/L
- Temperature – 12% exceeded 20°C
- Sodium – 2.4% exceeded DWQS

# Volatile Organic Compounds Detected\*

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- MTBE (gasoline additive)
- Chloroform (solvent)
- Carbon disulfide (process chemical for manufacture of rayon and cellophane)
- Acetone (solvent)

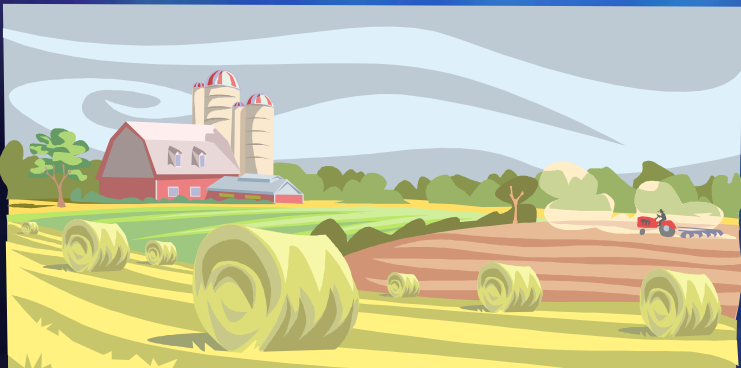
\* No Violations of WQ Criteria

Data through 1997 evaluated.



# Pesticides Detected Above Water Quality Criteria

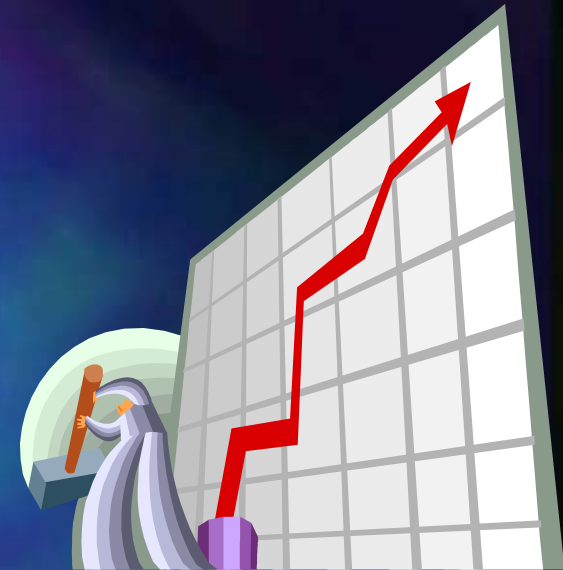
- Atrazine (agricultural herbicide)
- Alachlor (agricultural herbicide)
- Cyanazine (agricultural herbicide)
- Dieldrin (insecticide – no longer produced in the US - bioaccumulates)



Data through 1997 evaluated.

# Water Quality Trends

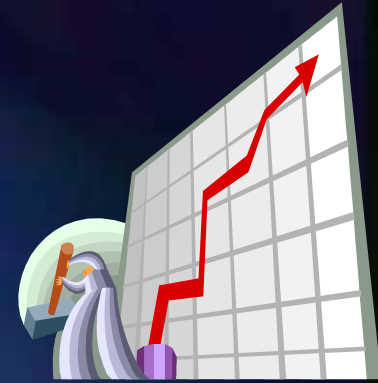
- Ammonia concentrations have decreased with time.
- Organic Nitrogen concentrations have decreased with time at 17 sites.
- Nitrite and Nitrate concentrations have increased (4 sites) or remained the same.



21 sites were investigated.

# Water Quality Trends

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- Total Phosphorus concentrations have decreased (11 sites). No increases at other sites.
- Watersheds with higher percentages of forested land have better water quality.
- Total Suspended Solids increase with increasing flow.

21 sites were investigated.

# Seasonal WQ Trends



- Higher Concentrations during growing season

- TKN (NH<sub>3</sub>+organic N)
- Un-ionized Ammonia
- Fecal Coliform
- pH
- Total Phosphorus
- Pesticides\*

- Higher Concentrations during non-growing season

- Chloride
- Total Dissolved Solids
- NO<sub>2</sub>+NO<sub>3</sub>

# Trends of Future Concern

- Total Dissolved Solids
- Chloride
- Sodium



# Raritan Basin Water Quality Ratings

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## ■ Most Desirable

- Mulhockaway Creek
- Spruce Run
- Lamington River at Pottersville
- Millstone River at Manalapan
- Manalapan Brook



## ■ Least Desireable

- Millstone River at Blackwells Mills
- Millstone River at Grover's Mill
- Matchaponix Brook
- Raritan River at Bound Brook
- Neshanic River



# Pollutant Loadings from Baseflow

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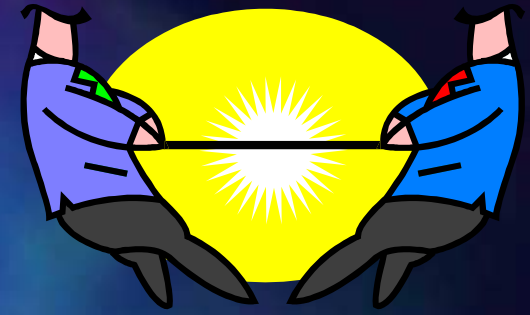


- Baseflow is between 38-75% of average annual flow. (Higher in NE and Coastal Provinces)
- Baseflow contributes majority of mean annual instream load of TDS and TKN (basin wide).
- Chloride loads from baseflow are small in North and South Branch and larger in Millstone.
- $\text{NO}_2 + \text{NO}_3$  loads from baseflow in NS Branch are about  $1/2$ , while in Millstone it's  $3/4$ .

Percentages based on average flow conditions.

# Pollutant Loadings – NPS vs. PS

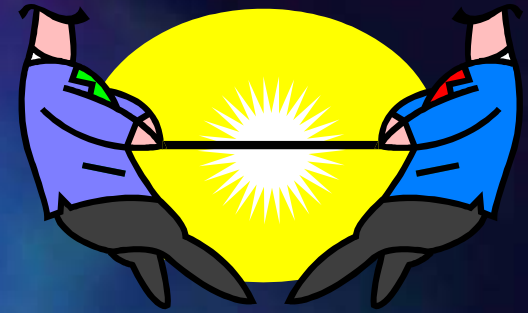
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- Majority of TSS load from NPS, generally more than 2/3 of load.
- Majority of TDS load from NPS except under very low flow conditions.
- Majority of NO<sub>2</sub>+NO<sub>3</sub> load from PS except under high flow conditions.
- At low flow, more than 60% of TP loads are from point sources.

# Pollutant Loadings – NPS vs. PS - Low Flow

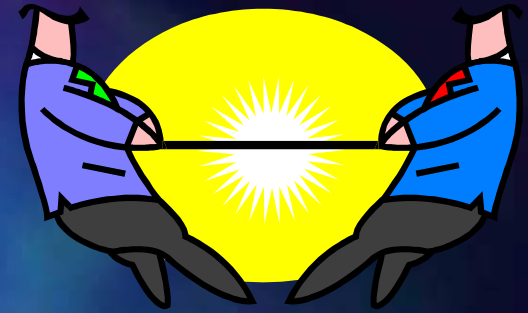
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- Over 80% of TKN Load from PS at NB Raritan, Rockaway Creek, Raritan at Bound Brook.
- Over 60% of TDS load from PS at NB Raritan, Lamington River, and Raritan at Chester.
- Over 75% of NO<sub>2</sub>+NO<sub>3</sub> load from PS at 8 of 21 sites. Highest yield from Matchaponix.
- Over 50% of TP load from PS at 10 of 21 sites (5 sites with 100% from PS).

# Pollutant Loadings – NPS vs. PS - High Flow

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- Greater than 85% of TKN load from NPS. High yields at Millstone sites, Stony Brook, and Raritan at Bound Brook.
- TP yields higher in Coastal Plain than New England Province.
- TDS yields highest from SB Raritan.

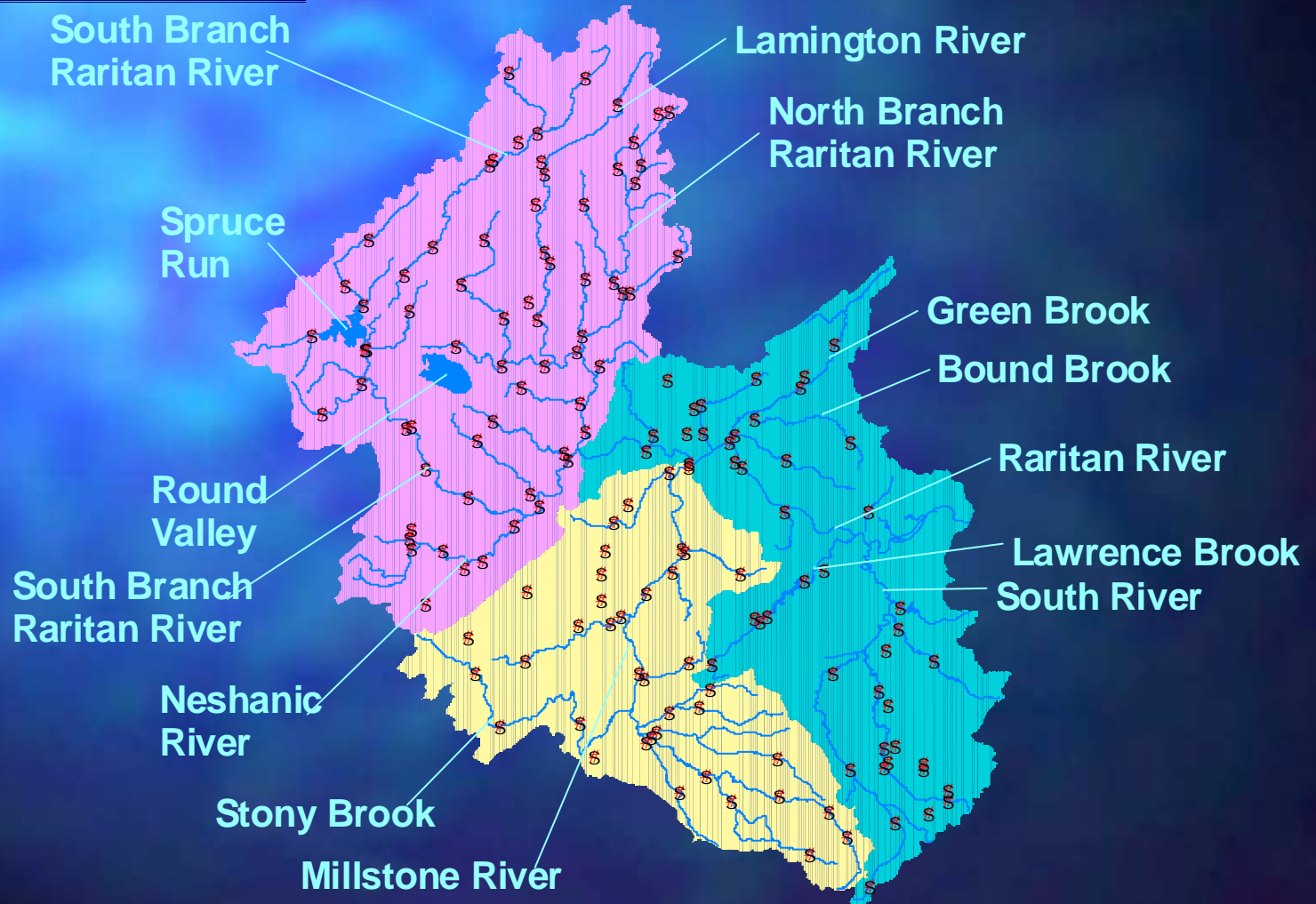


# Non-Point Source Yields

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- NPS TDS yields higher in areas with greater septic system densities.
- NPS NO<sub>2</sub>+NO<sub>3</sub> yields higher in areas with high septic system densities.
- NPS TKN, TSS, and TP yields higher in Coastal Plain areas.
- NPS TP yield at high flow correlated to higher percentages of forested land.

# AMNET Biological Monitoring Stations



# Ecological Status/ Bioassessment

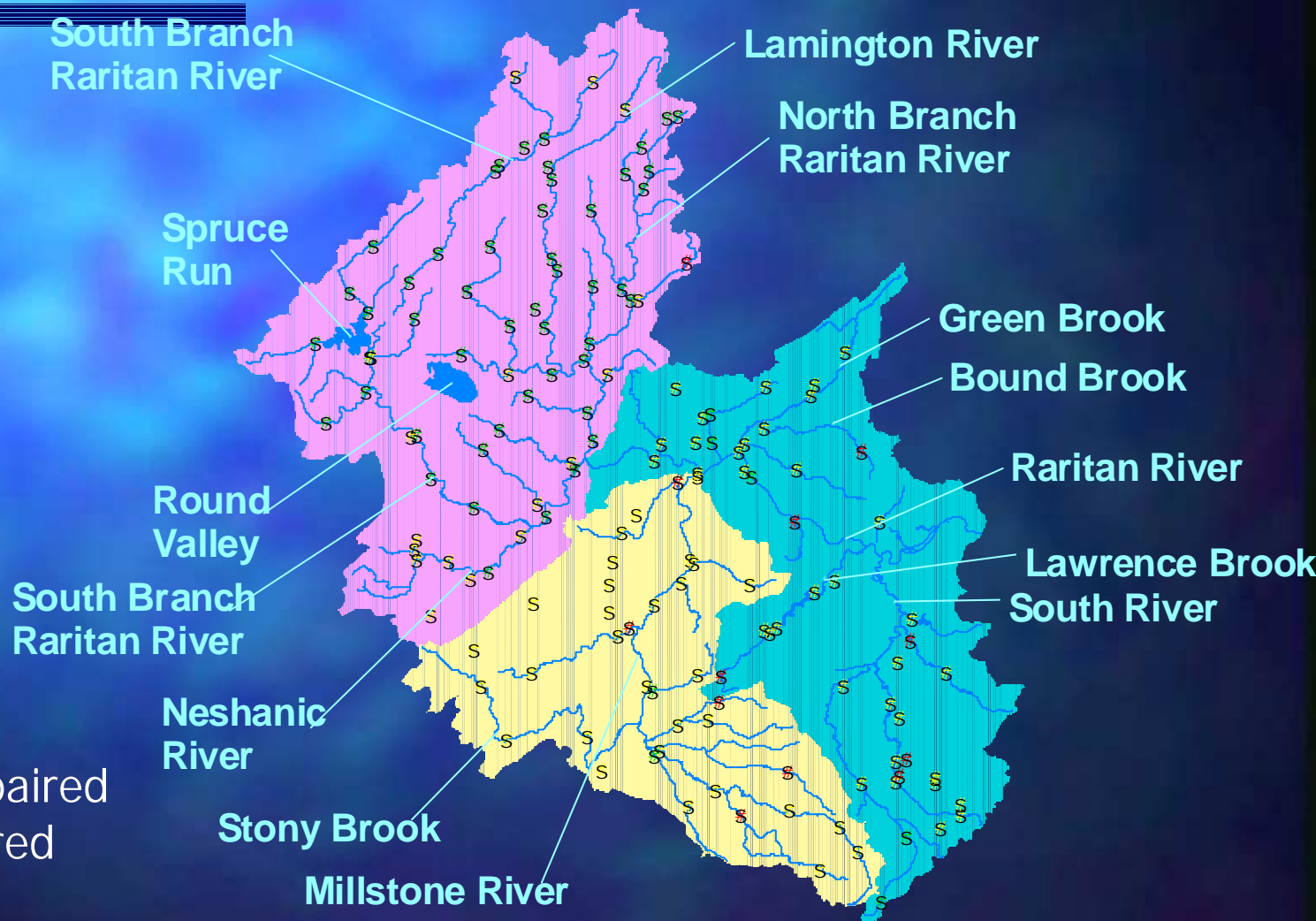
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- Bioassessment Trend
  - Non-impaired - North and West
  - Impaired - East and South
  - Severely Impaired – Urban Streams
- Habitat Trend
  - Decreasing scores from west to east
  - Range from Optimal to Sub-optimal



# Bioassessment Ratings at AMNET Stations



## LEGEND

- Not Impaired
- Moderately Impaired
- Severely Impaired

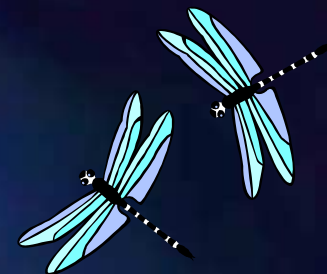
# 303(d) Lists

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- **Sub-List 1:** waters having known water quality impairment
- **Sub-List 2A:** waters having known use impairment
- **Sub-List 2B:** waters with water quality problems but more information is required

# Number of 303(d) Surface Waters by WMA



Sub-List/ WMA	North South Branch	Lower Raritan	Millstone
<b>1</b>	9	4	5
<b>2A</b>	0	7	3
<b>2B</b>	18	36	18

# Likely Surface Water Control Plans (TMDLs)

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- Total Phosphorus
- Fecal Coliform
- Temperature
- pH



# Additional Concerns

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- Metals (awaiting “clean methods” data)
- Pesticides (localized areas)
- Total Dissolved Solids
- Chloride
- Sodium (water treatment)



