

Surface Water Quality and Pollutant Loadings in the Raritan Basin

Presentation for
the Raritan Basin Watershed Management Project by
Amy Lynne Shallcross, P.E.
New Jersey Water Supply Authority

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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



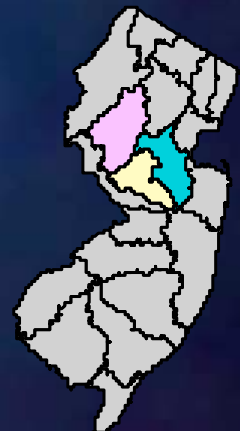
North and South
Branch Raritan



Millstone



Lower
Raritan











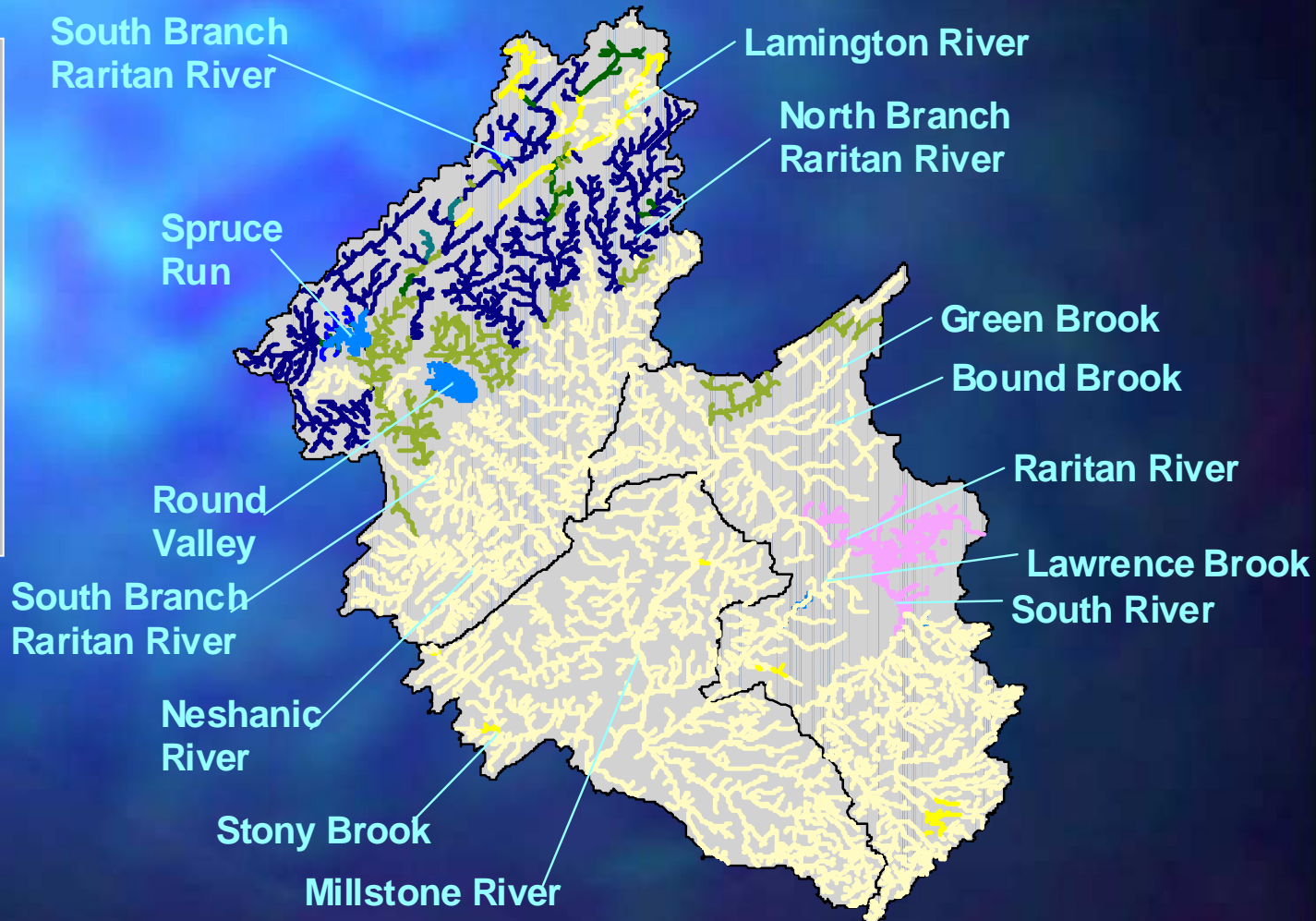
Raritan Basin Statistics

- 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

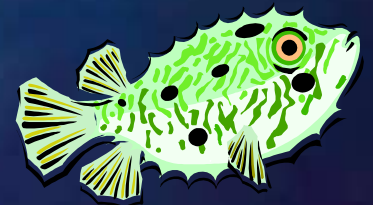
LEGEND:

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



Purposes of Water Quality Characterization & Assessment

- 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

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



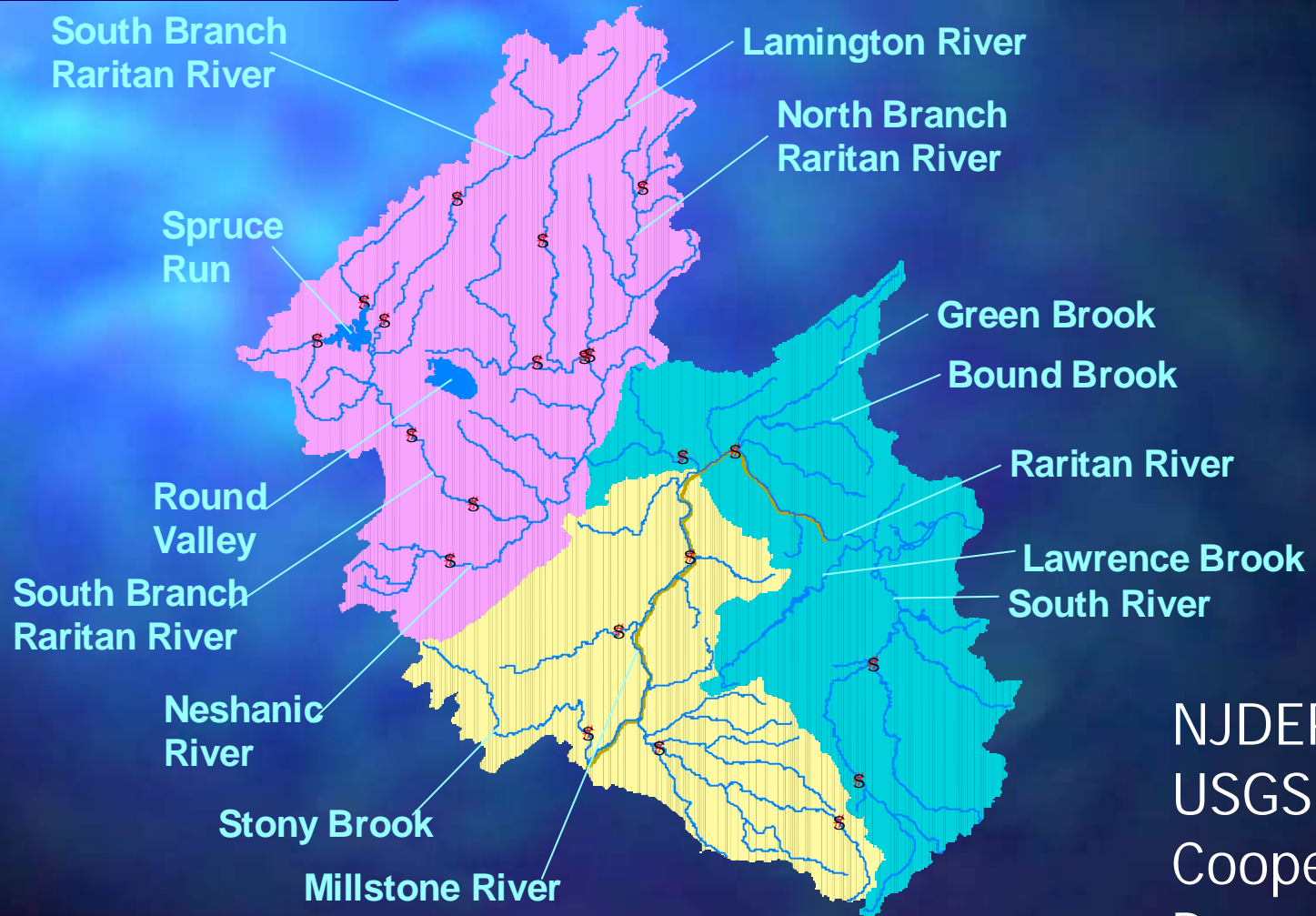
Water Quality Characterization

- 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



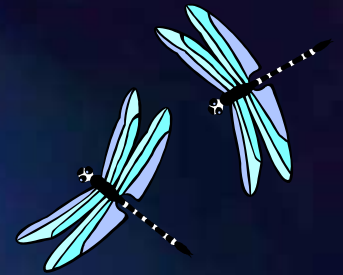
Data through 1997 evaluated.

Ambient Stream Monitoring Sites



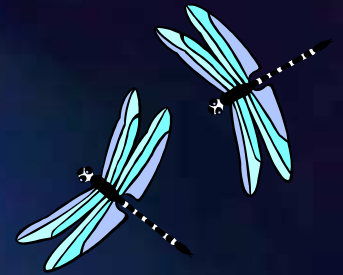
NJDEP and
USGS
Cooperative
Program

Water Quality Status



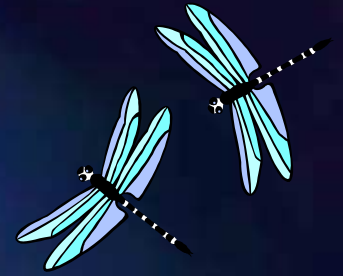
- All 21 stations had at least one instance of non-compliance with a water quality standard.
- Most common constituents not in compliance were Total Phosphorus and Fecal Coliform.
- Upper Raritan WMA had the best water quality.

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



- 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*

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

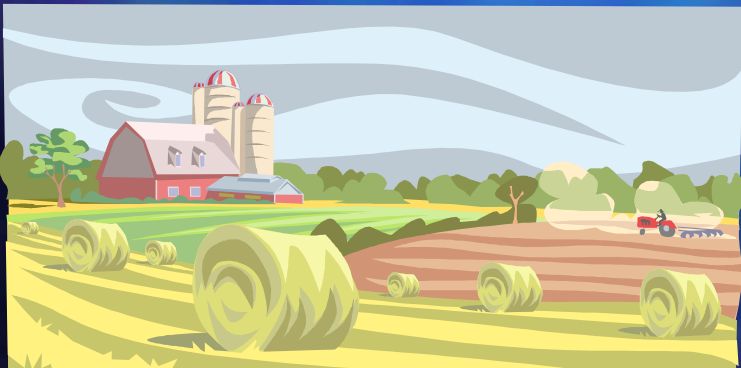
* No Violations of WQ Criteria

Data through 1997 evaluated.



Pesticides Detected Above Water Quality Criteria

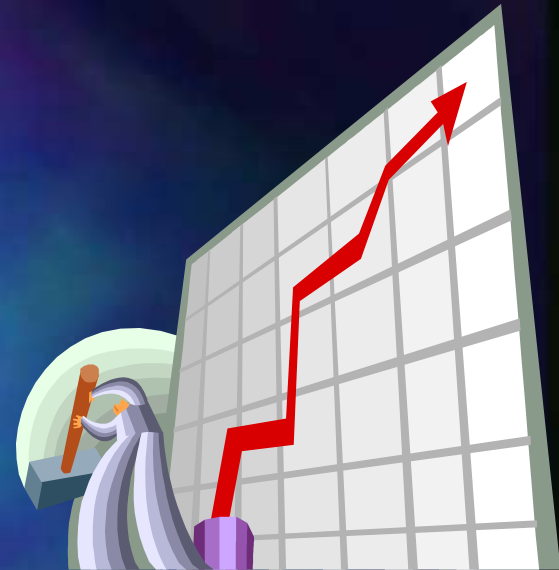
- Atrazine (agricultural herbicide)
- Alachlor (agricultural herbicide)
- Cyanazine (agricultural herbicide)
- Dieldrin (insecticide – no longer produced in the US - bioaccumulates)



Data through 1997 evaluated.

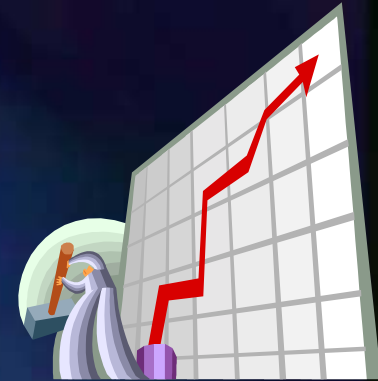
Water Quality Trends

- 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



- 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 (NH₃+organic N)
- Un-ionized Ammonia
- Fecal Coliform
- pH
- Total Phosphorus
- Pesticides*

- Higher Concentrations during non-growing season

- Chloride
- Total Dissolved Solids
- NO₂+NO₃

Trends of Future Concern

- Total Dissolved Solids
- Chloride
- Sodium



Raritan Basin Water Quality Ratings

■ 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



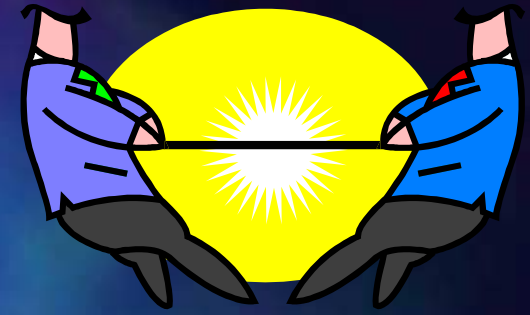
Pollutant Loadings from Baseflow



- 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 $3/4$.

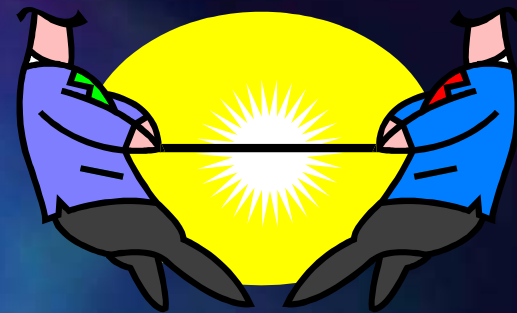
Percentages based on average flow conditions.

Pollutant Loadings – NPS vs. PS



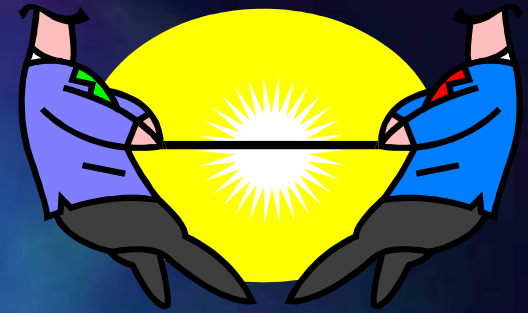
- Majority of TSS load from NPS, generally more than 2/3 of load.
- Majority of TDS load from NPS except under very low flow conditions.
- Majority of NO₂+NO₃ load from PS except under high flow conditions.
- At low flow, more than 60% of TP loads are from point sources.

Pollutant Loadings – NPS vs. PS - Low Flow



- 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 NO₂+NO₃ 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



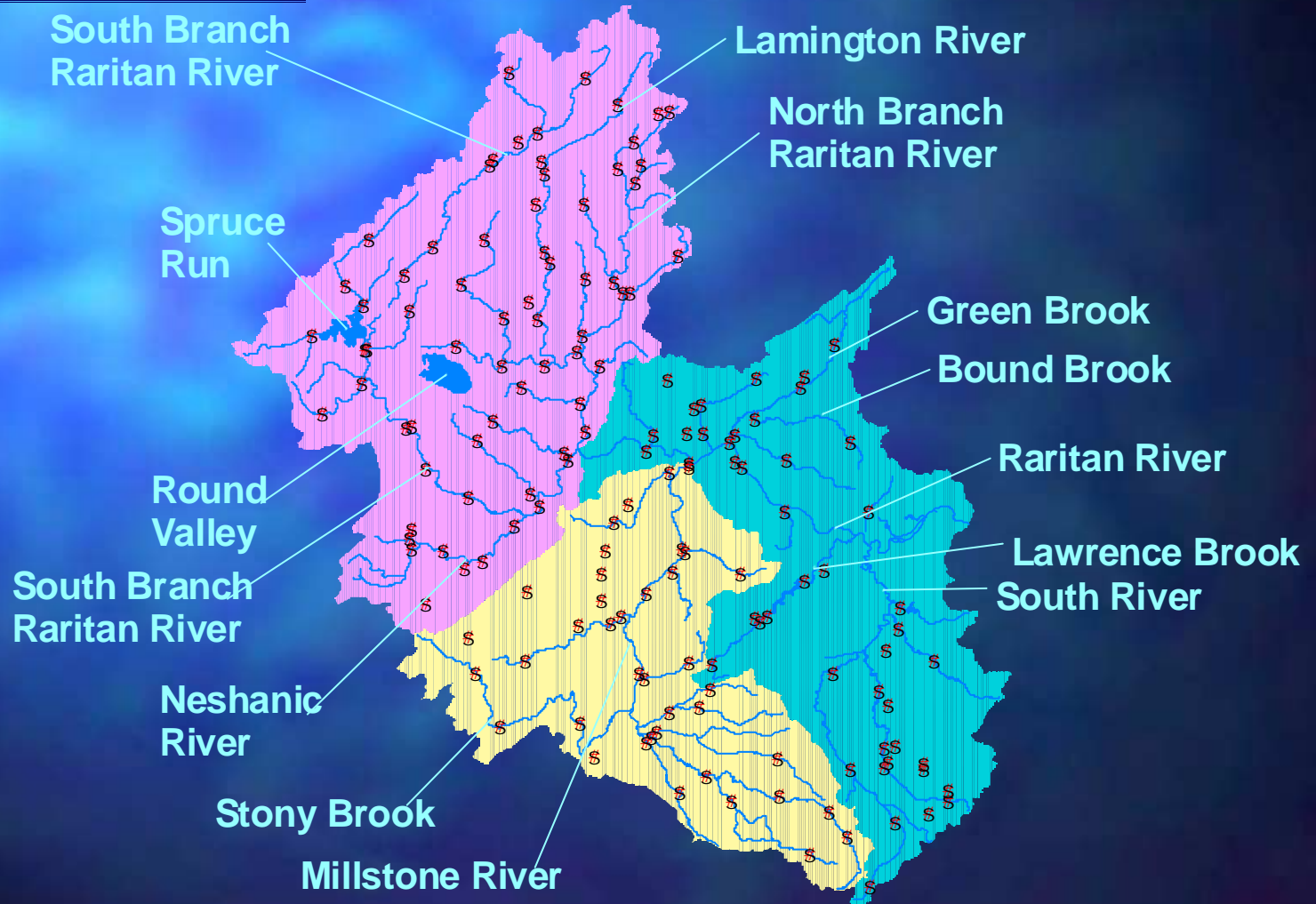
- Greater than 85% of TKN load from NPS. High yields at Millstone sites, Stony Brook, and Raritan at Bound Brook.
- TP yields higher in Coastal Plain than New England Province.
- TDS yields highest from SB Raritan.



Non-Point Source Yields

- NPS TDS yields higher in areas with greater septic system densities.
- NPS NO₂+NO₃ 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



■ Bioassessment Trend

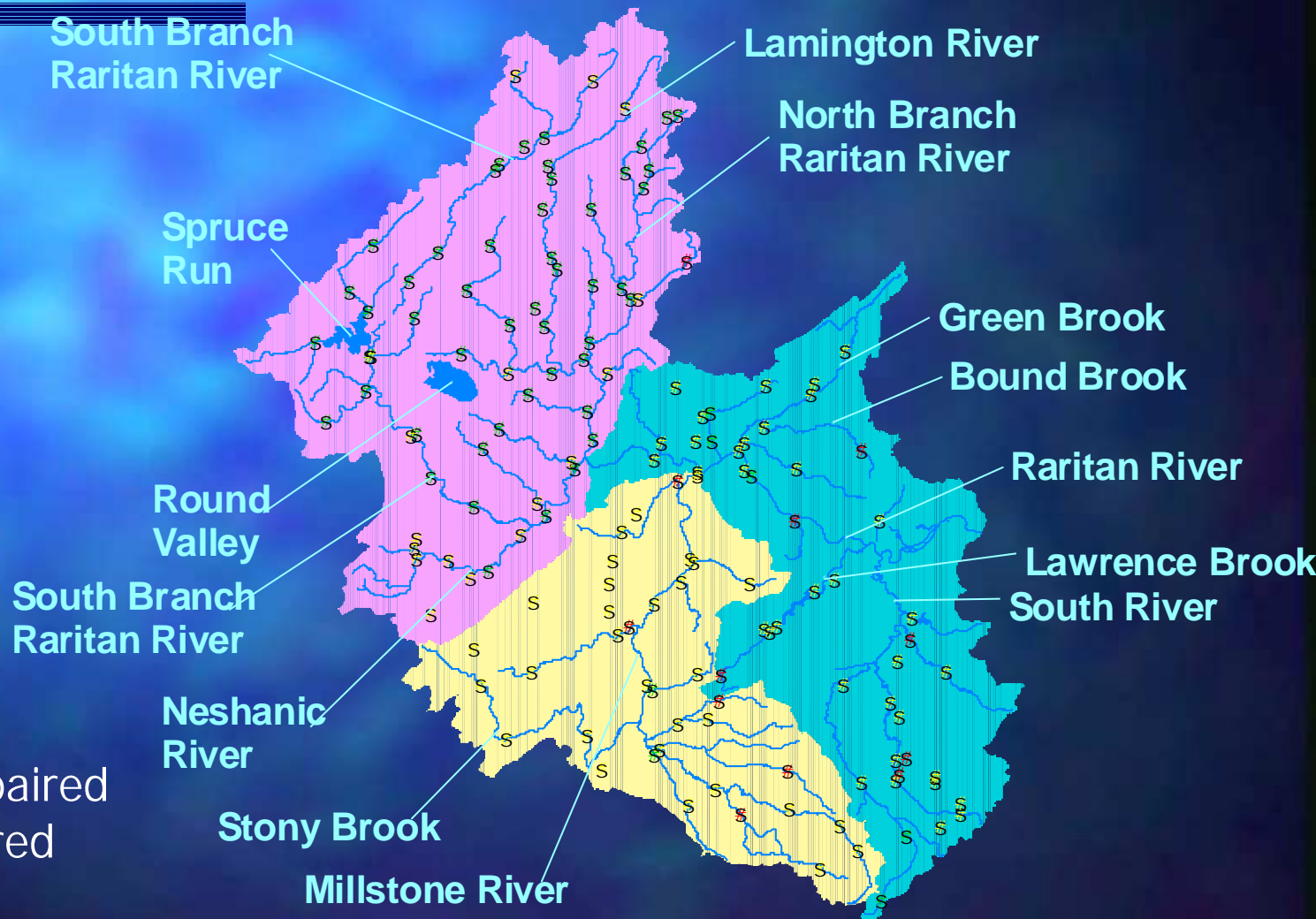
- Non-impaired - North and West
- Impaired - East and South
- Severely Impaired – Urban Streams

■ Habitat Trend

- Decreasing scores from west to east
- Range from Optimal to Sub-optimal



Bioassessment Ratings at AMNET Stations



LEGEND

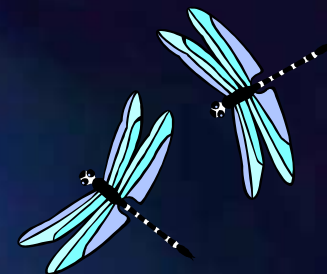
- Not Impaired
- Moderately Impaired
- Severely Impaired

303(d) Lists



- **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
1	9	4	5
2A	0	7	3
2B	18	36	18

Likely Surface Water Control Plans (TMDLs)

- Total Phosphorus
- Fecal Coliform
- Temperature
- pH



Additional Concerns

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



