



# **Surface Water and Riparian Areas of the Raritan Basin:**

**A Technical Report for the  
Raritan Basin  
Watershed Management Project**

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**NJ Water Supply Authority**

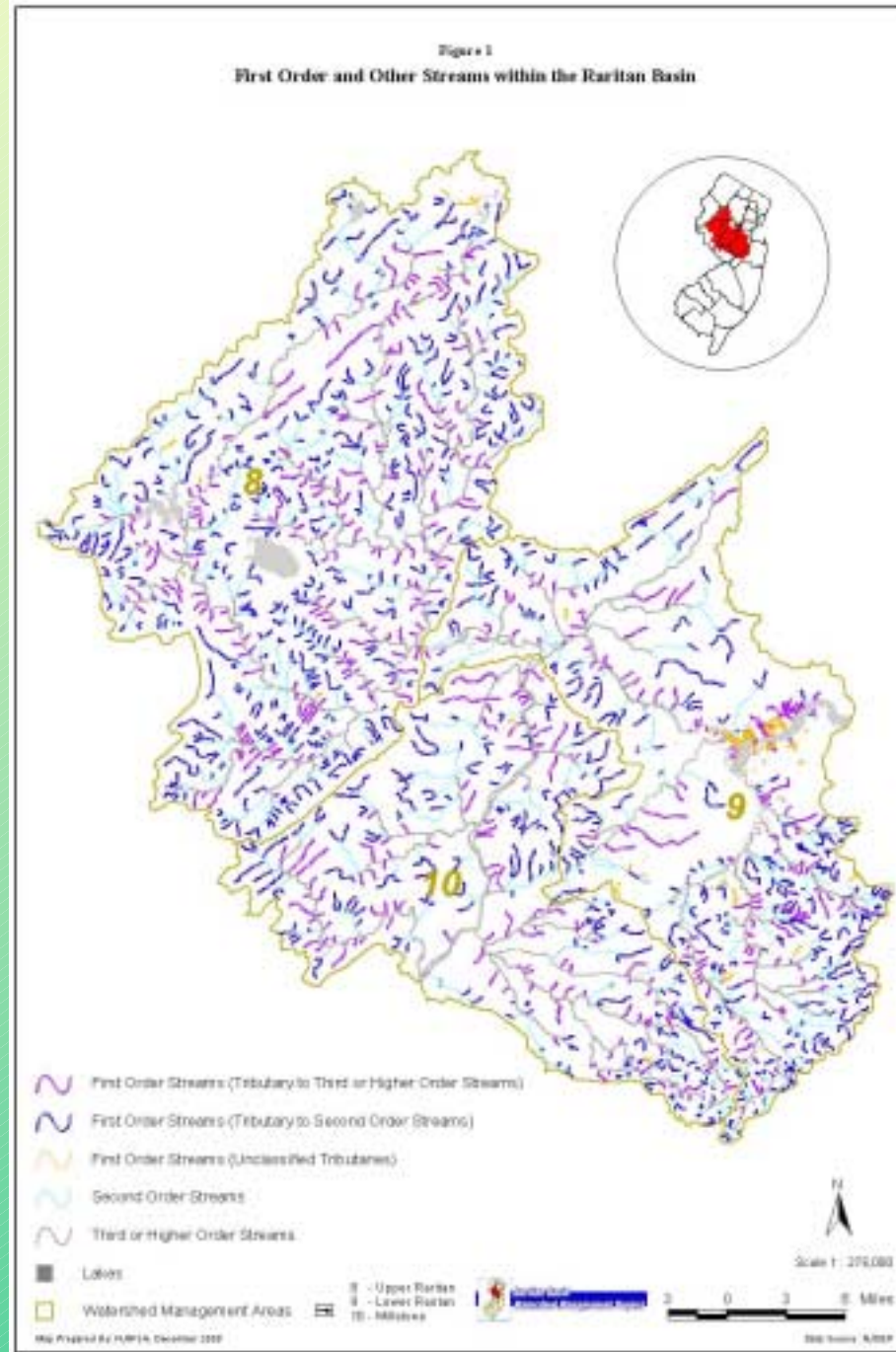
**Photo of Beden Brook – Millstone Watershed Management Area**

# Overview of Report

- Focuses on Ecological Health of the Surface Waters and Riparian Areas of the Basin
- Provides summary of existing regulations and plans that protect surface waters and riparian areas
- Recommendations for further study (critical needs)

# 1st Order Streams

- Smallest streams without tributaries – majority of streams in the Basin
- “Upper” 1<sup>st</sup> order streams – join to form a 2<sup>nd</sup> order stream
- “ Lower” 1<sup>st</sup> order – flow directly into other streams such as 3<sup>rd</sup> order & above.
- 1<sup>st</sup> order streams ~52% of Basin stream miles
- “Upper” 1<sup>st</sup> order ~34% of Basin stream miles



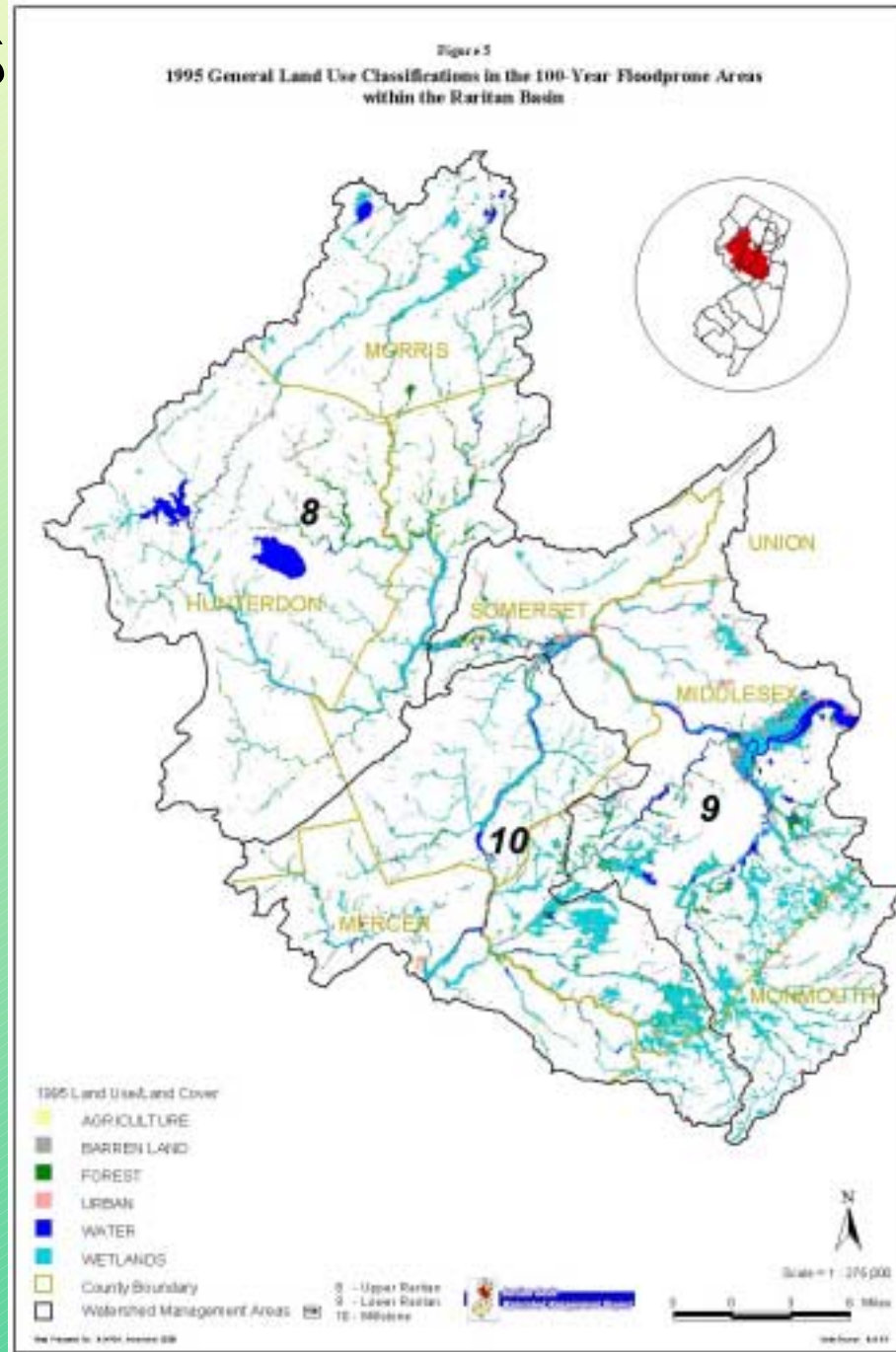
# Low Flows in the Basin

- 7-Day 10-Year (MA7CD10) Low Flow Data through 1993
- Many MA7CD10 reflective of 1960's drought
- USGS has proposal to NJDEP to update low flow data (2-3 yr project)
- Some low flows based on geology, others based on human impact
- Difficult to assess trends
- For Final Report – Look at Geology, Compare Flows with Minimum Passing Flows for Gauging Stations.



# Flood Prone Areas

- FEMA & NJDEP 100-year Flood Prone Areas (associated with frequent flood events)
- FP Areas do not extend much beyond wetland boundaries
- Significant areas prone to flooding include: mainstem of the Raritan River, tidal portions of the Raritan R., and areas in the Lower Raritan and Millstone WMAs.
- Existing Land Uses Within Flood Prone Areas



# Ecological Health – Surface Waters

- **NJDEP Ambient Biomonitoring Network (AMNET) Data**
  - 1993-94 Results (144 sites):
    - 37.5% non-impaired
    - 56.9% moderately impaired
    - 5.6% severely impaired
  - 1999 Results (150 sites):
    - 37.3% non-impaired
    - 54.7% moderately impaired
    - 8.0% severely impaired
  - Comparison shows:
    - Significant improvement at 7 sites, significant decline at 3 sites in the Lower Raritan WMA.
    - Significant improvement at 3 sites, significant decline at 6 sites in the Millstone WMA.

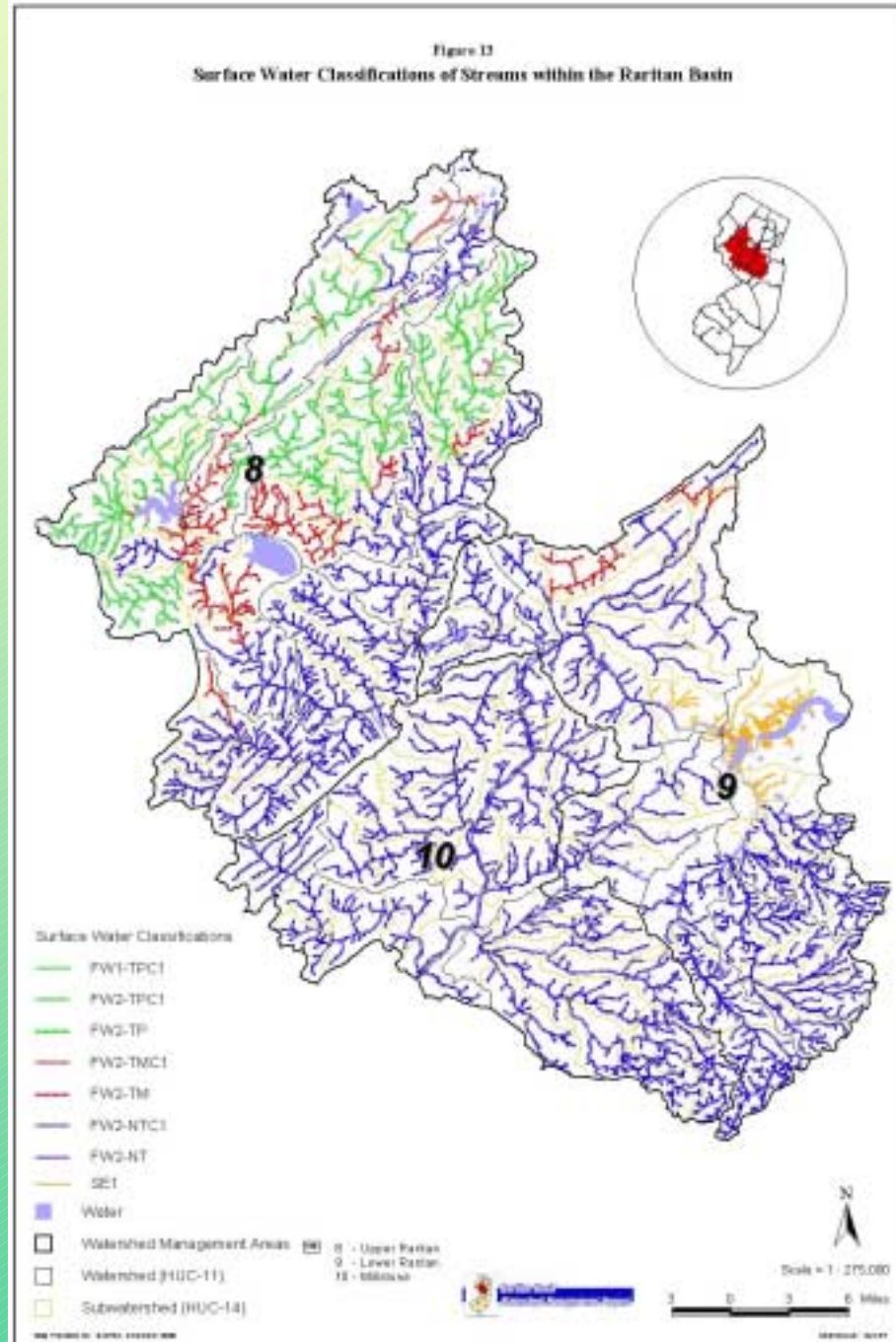


# Ecological Health – Surface Waters cont.

- Stony Brook-Millstone Watershed Association
  - Sampling program established 1996
  - Monitor 8 sites along tribs to the Millstone R.
  - 1999 – 2 Non. sites, 4 Mod. Sites, 1 Sev. site
  - 2000 – 1 Non. sites, 5 Mod. sites, 1 Sev. site
- Upper Raritan Watershed Association
  - Sampling program established 1999
  - Monitor 16 sites along the So. Branch Rockaway Creek
  - 1999 – 13 Non. sites, 3 Mod. Sites
  - 2000 – 10 Non. sites, 6 Mod. Sites
- Declines in health between 1999 and 2000 attributed to 1999 drought, then flood

# Stream Classifications

- NJDEP Surface Water Classifications (provide basis for water quality and uses of surface waters)
- Upper Raritan WMA – Trout Maintenance, Trout Production and Nontrout
- Lower Raritan WMA – Trout Maintenance Nontrout Saline Estuarine
- Millstone WMA – Nontrout

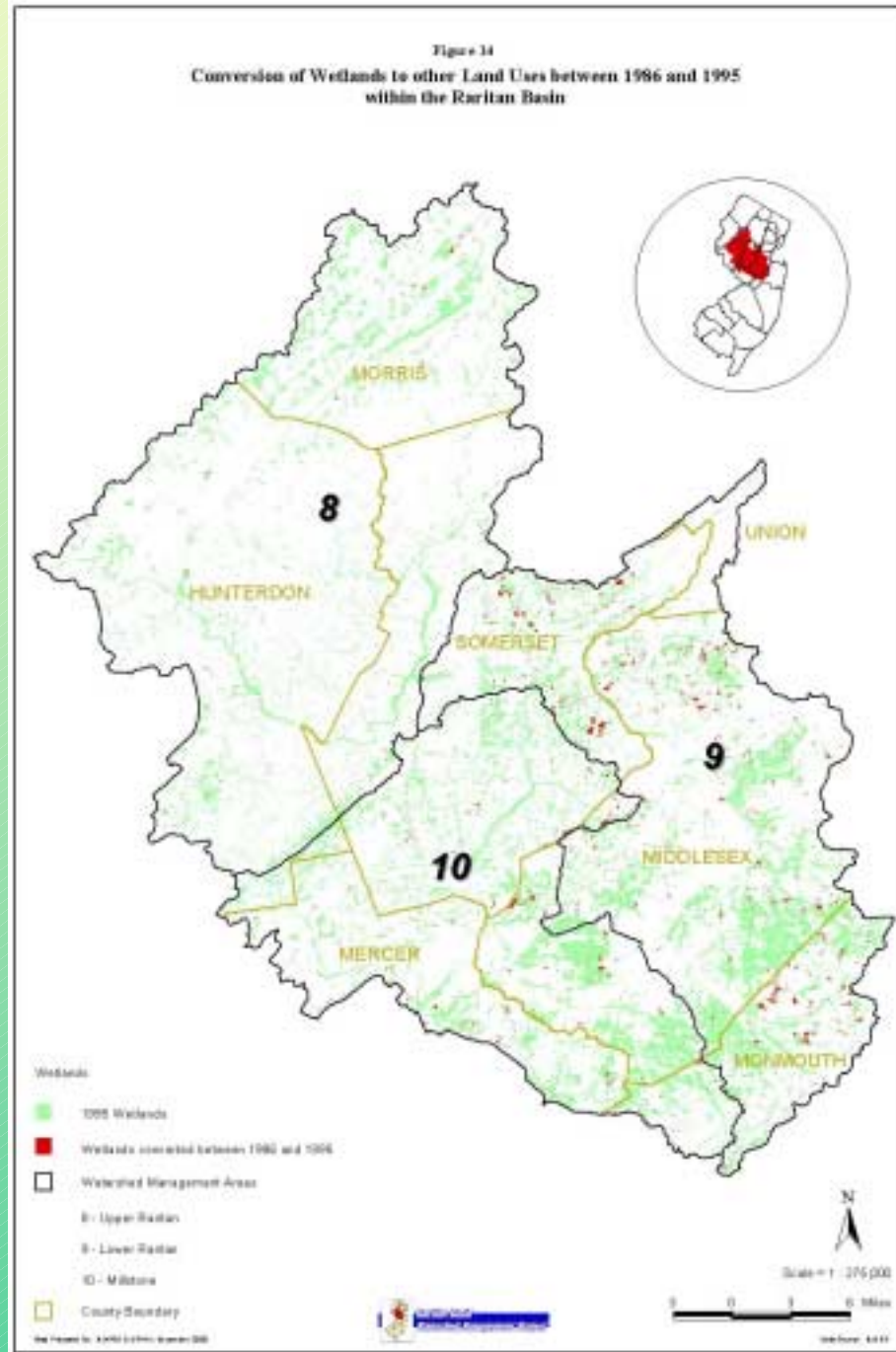


# Eutrophication

- Excessive nutrients (phosphorus, nitrates) in a stream that lead to an overgrowth of algae and aquatic plants
- Problems in the Basin:
  - Lower Raritan River and Raritan Bay
  - Millstone River (Plainsboro & Carnegie Lake)
  - Stretches of Beden Br, Rock Br & Pike Run)
  - Pockets along the So. & No. Branches Raritan River
  - South River near Route 535
  - Spruce Run Reservoir

# Conversion of Wetlands to Other Land Uses

- Conversions of wetlands to urban, water, barren land, agriculture and forest 1986 - 1995
- Basin-wide:
  - 4,400 acres (92.7%) converted to urban
  - 36 acres (0.8%) converted to agricultural land



# Hydrologic Unit Map of the Basin

- Way of identifying sub-watersheds of the Basin by USGS hydrologic units (14-digit codes)
- For use with Riparian Area figures of the report



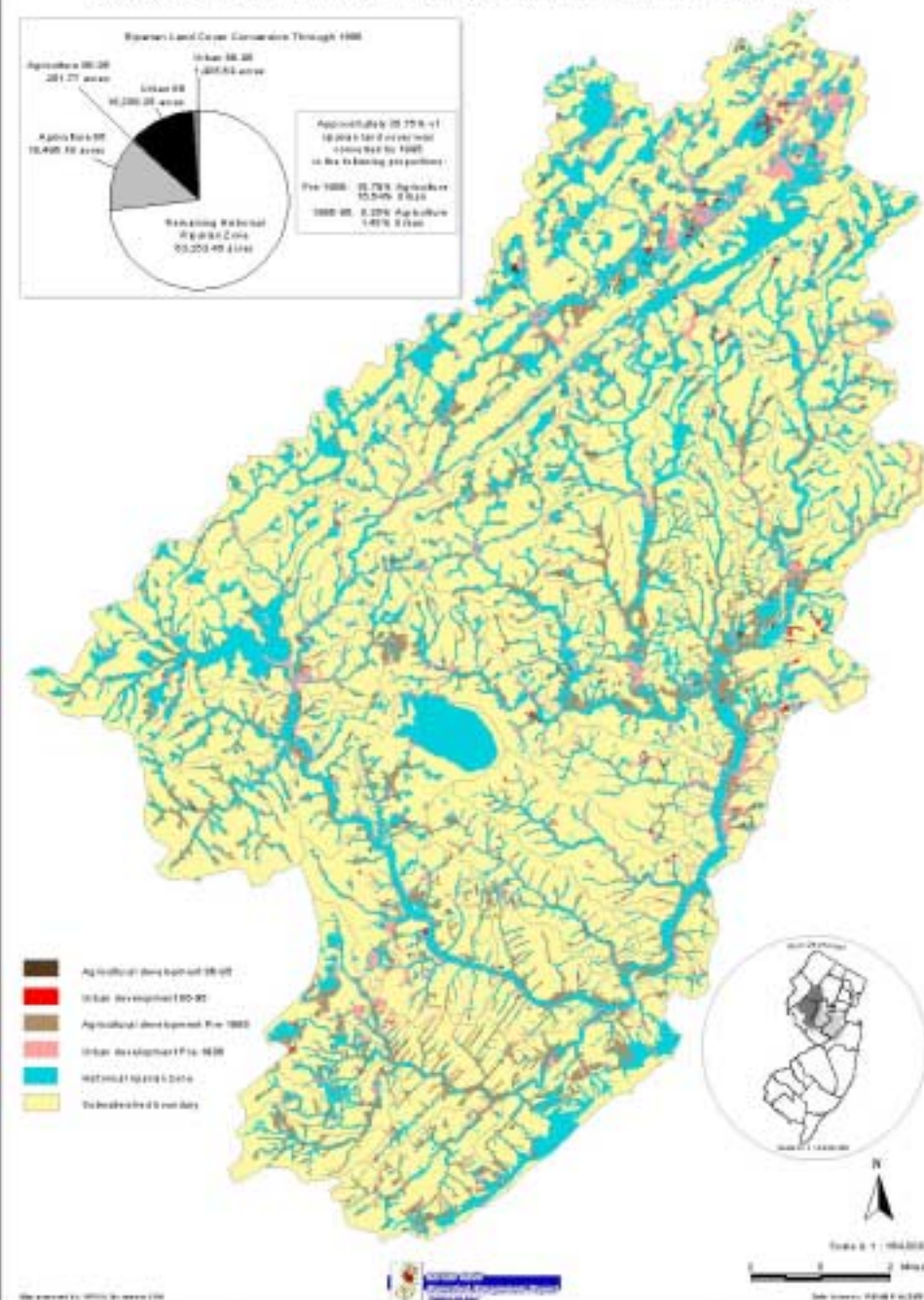
# Riparian Areas of the Basin

- Used Methodology developed by Raritan Basin Characterization Committee (June 2000) – 100-yr FP Areas, Soils w/ SHWT within 18 inches, streamside wetlands and wetland transition areas, 150 ft or 300 ft wildlife passage corridor
- Report looks at conversion of Riparian Areas in the Basin to other land cover types historically and between 1986-1995
- Maps by WMA and Basin
- Tables in Appendix lists percentages by Sub-watershed (HUC-14)

# Riparian Area Conversion in the Upper Raritan WMA

- Represents what historical riparian area may have looked like
- Historical Conversion:
  - 18.8% to Ag
  - 16.5% to Urban
- Between 1986-95:
  - 0.25% to Ag
  - 1.4% to Urban

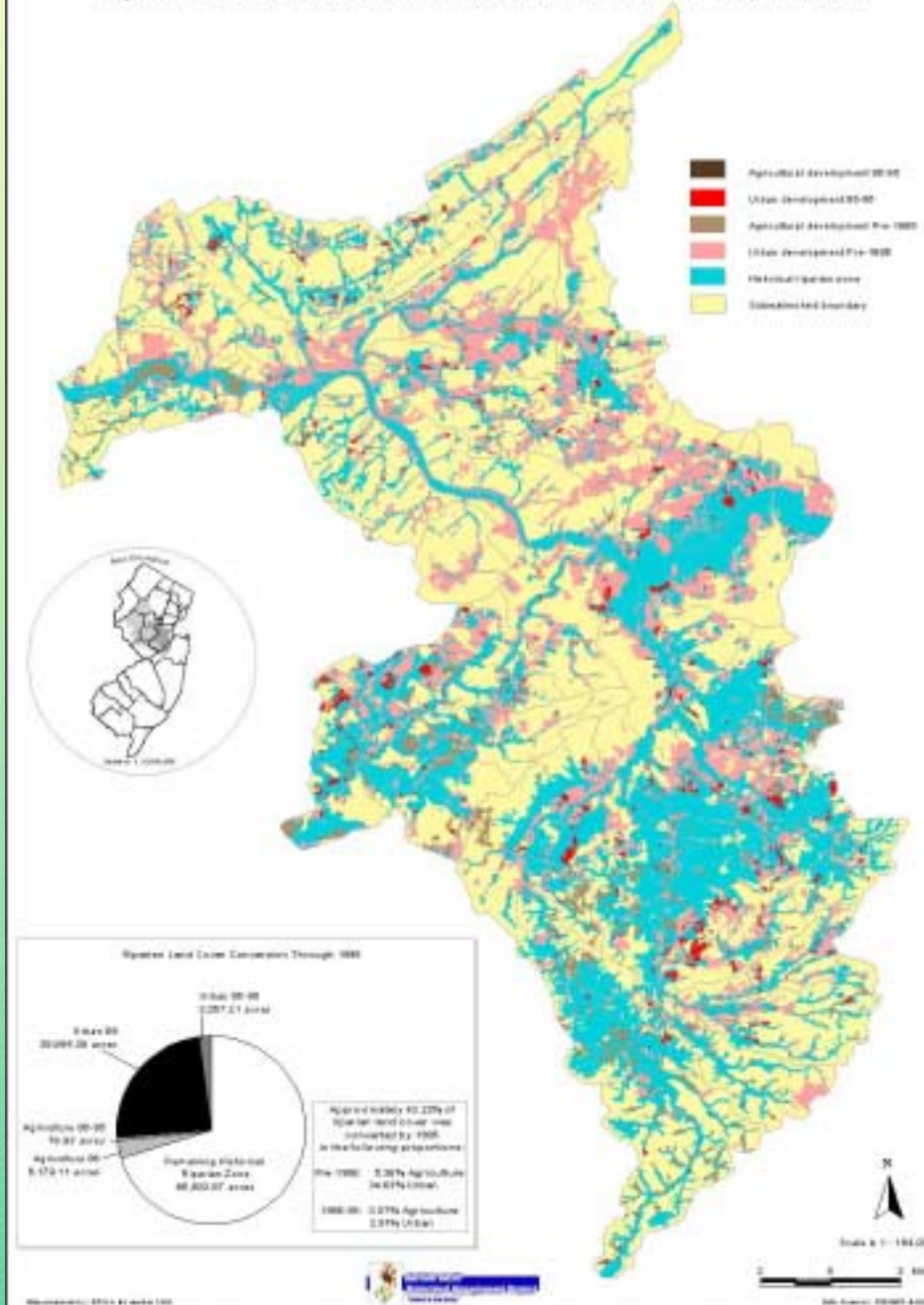
Figure 16  
Riparian Land Cover Conversion In The Upper Raritan Watershed Management Area



# Riparian Area Conversion in the Lower Raritan WMA

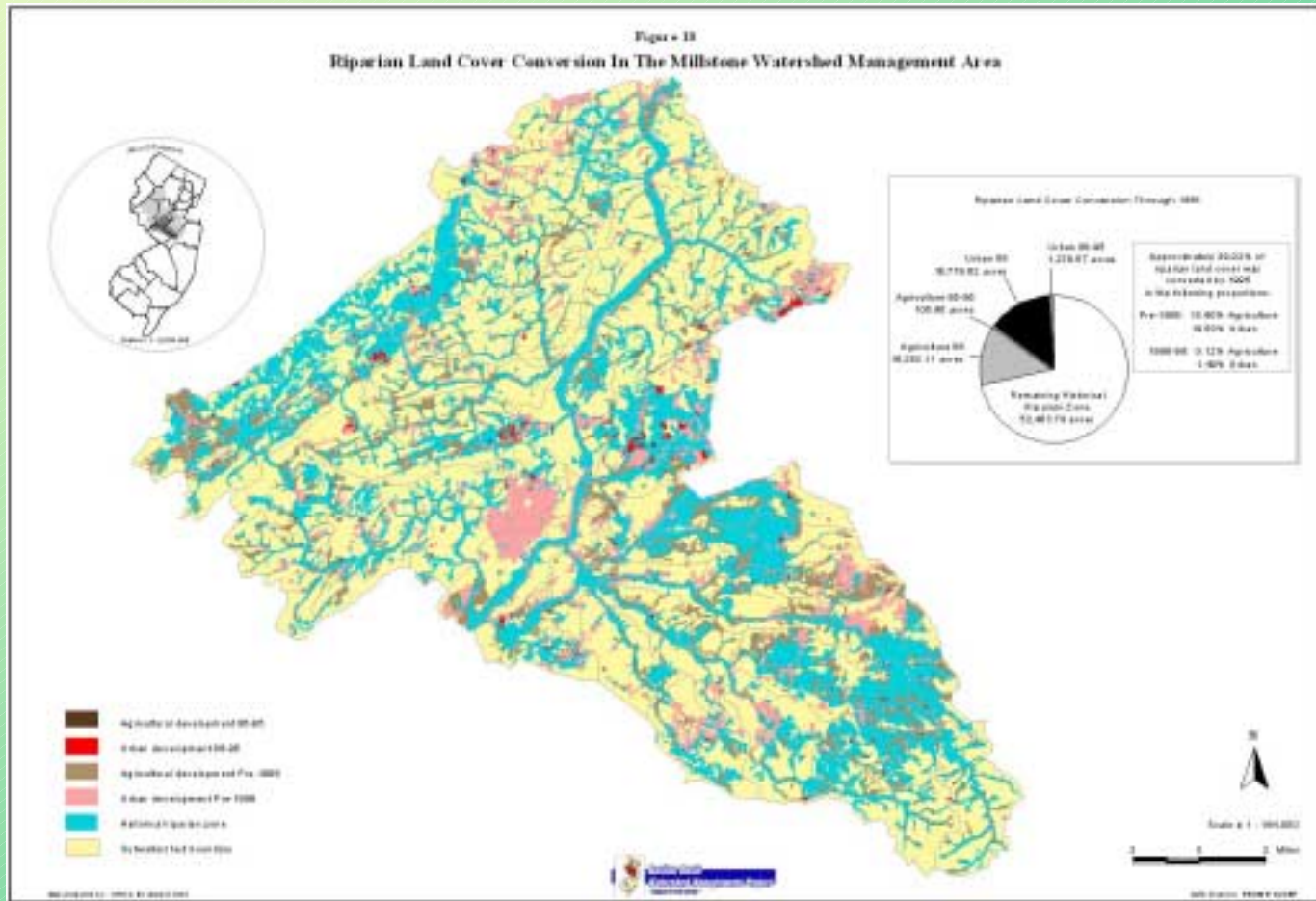
- Historical Conversion:  
5.4% to Ag  
34.6% to Urban
- Between 1986-95:  
0.07% to Ag  
2.9% to Urban

Figure 17  
Riparian Land Cover Conversion In The Lower Raritan Watershed Management Area



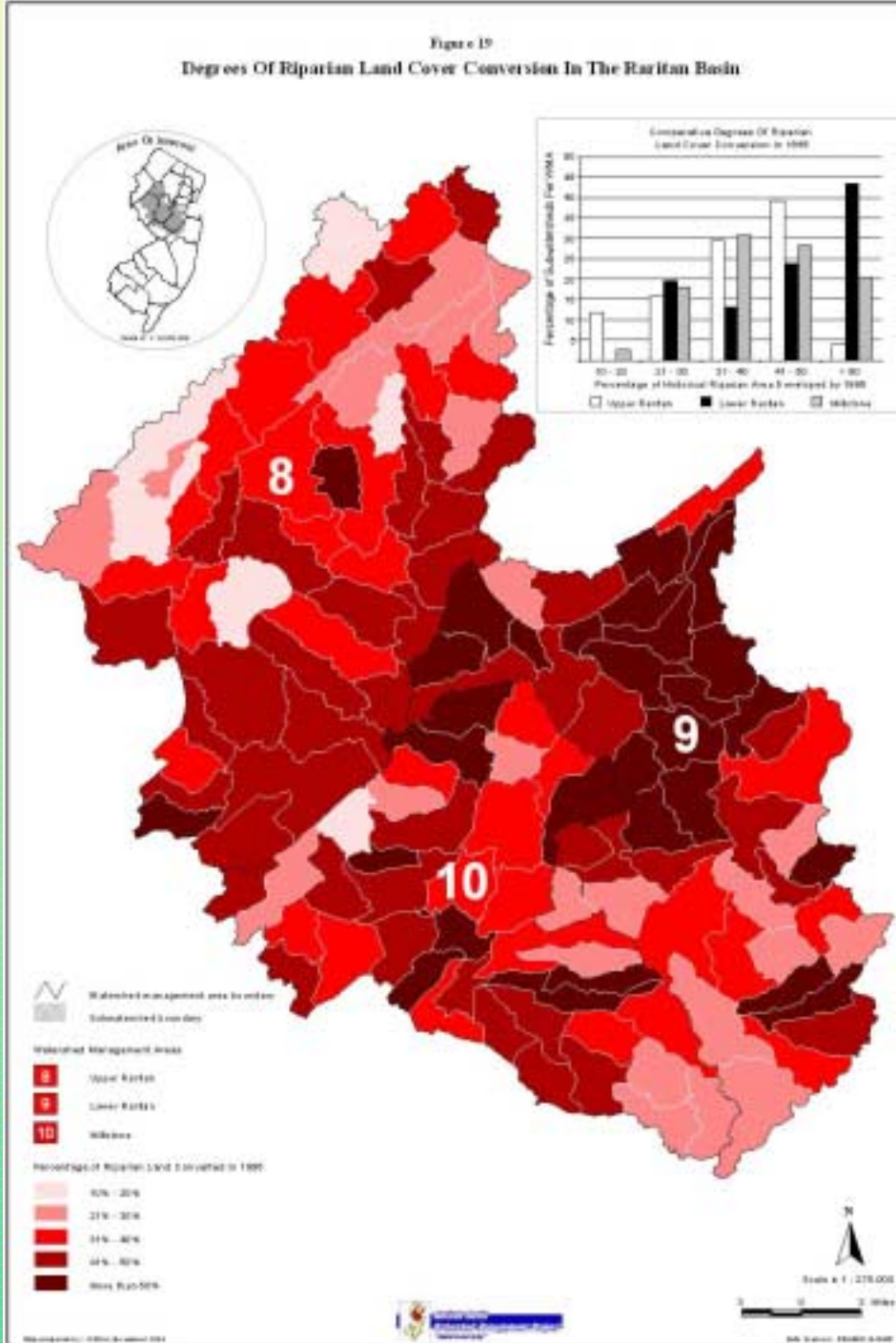
# Riparian Area Conversion in the Millstone WMA

- Historical Conversion:  
18.9% to Ag  
19.5% to Urban
- Between 1986-95:  
0.12% to Ag  
1.5% to Urban



# Riparian Area Conversions in the Basin

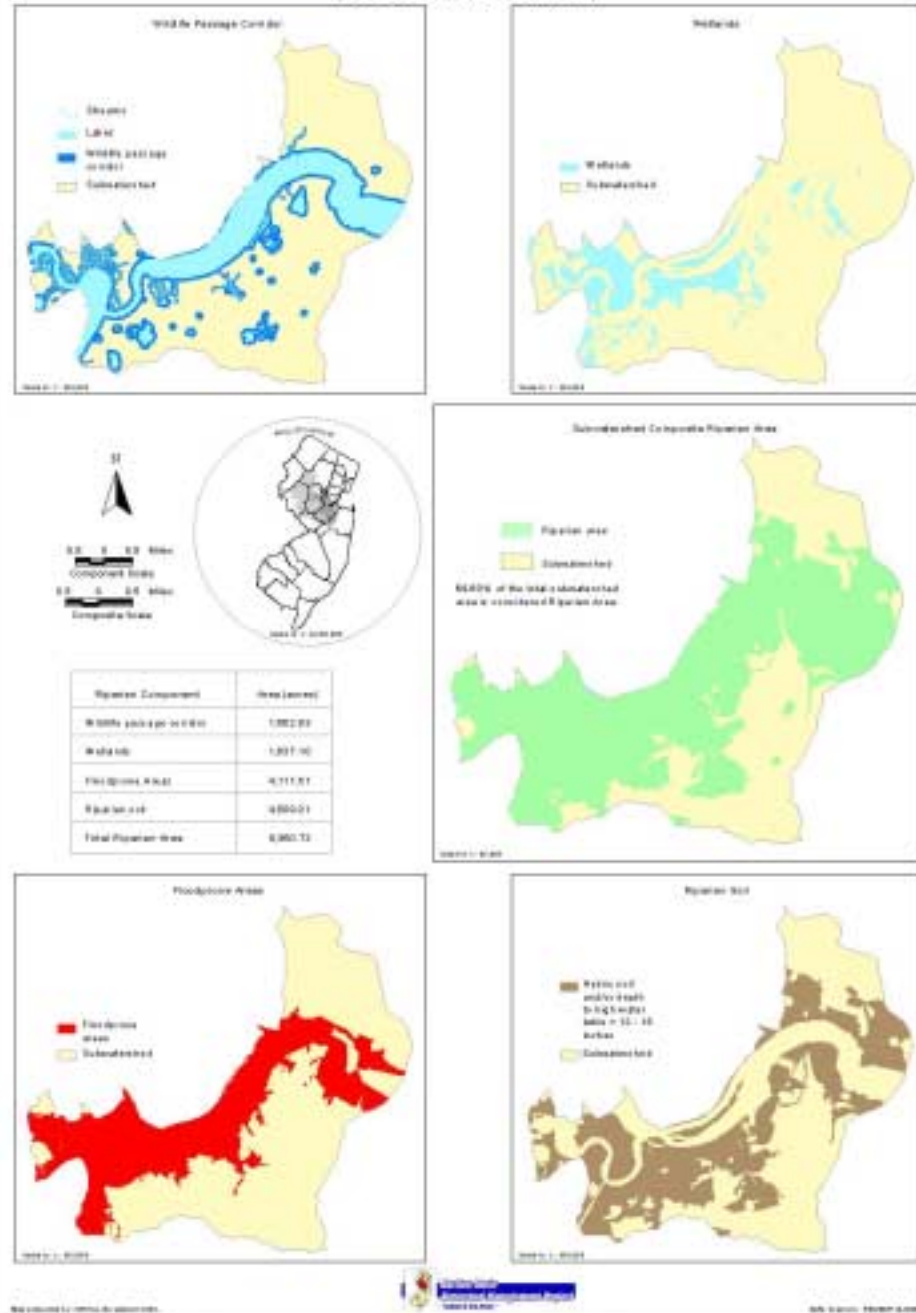
- Bar chart – Compares sub-watershed status by Management Area
- Lighter color; less conversion
- Areas with greatest conversion:
  - Tewksbury Twp.
  - Neshanic R.
  - Bridgewater area
  - New Brunswick/Edison
  - Marlboro Twp.
  - Hillsborough Twp
  - Cranbury/Plainsboro Twp



# Riparian Area Components in a Subwatershed of the Lower Raritan WMA

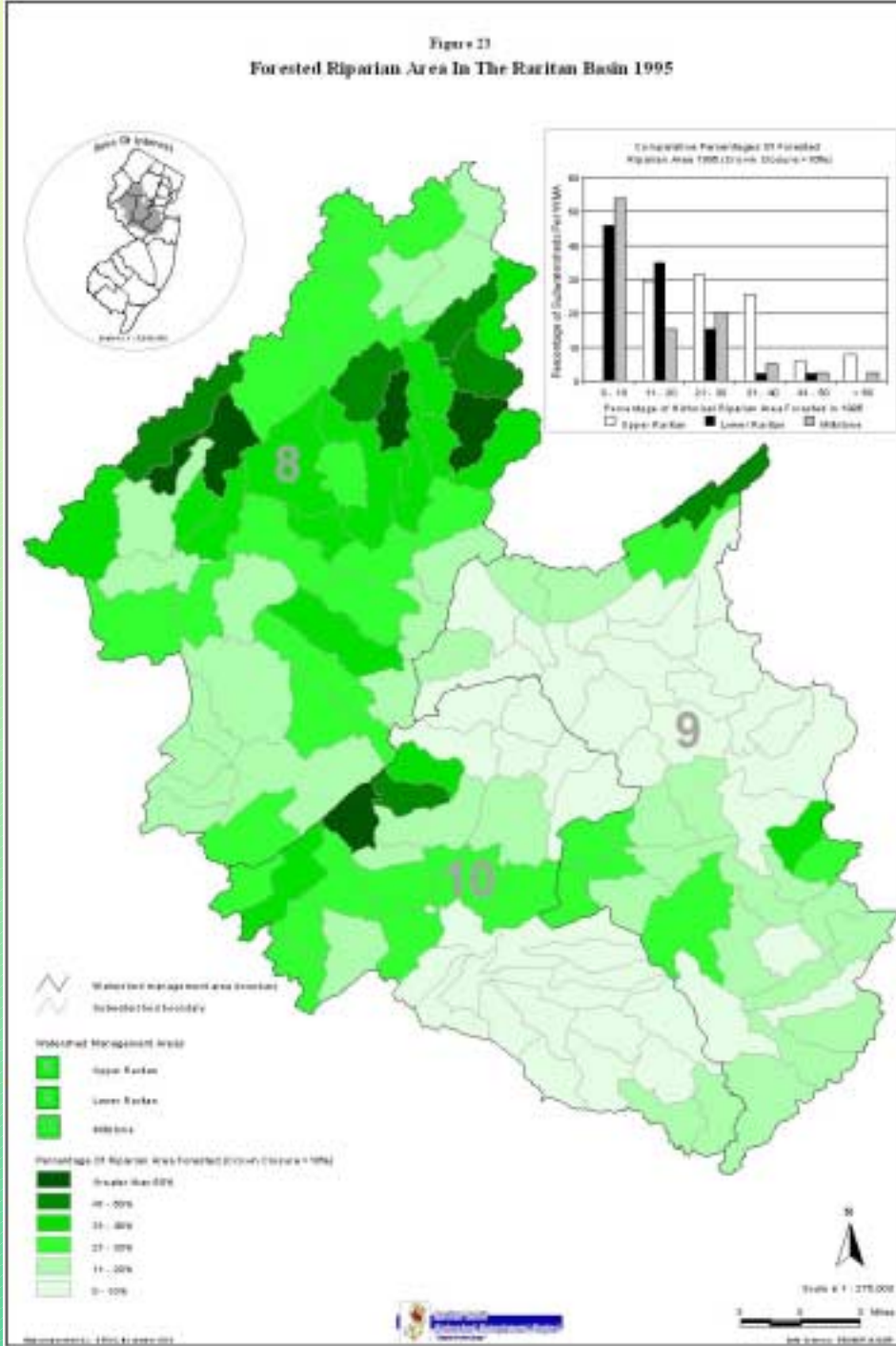
- Assessment must consider how much of HUC originally consisted of riparian area.
- Approximately 64% of this sub-watershed was historic riparian land
- Another sub-watershed (in the Upper Raritan WMA) was only 24% historic riparian land

Figure 21  
Riparian Area Components In A Subwatershed Of The Lower Raritan Watershed Management Area (HUC14 No. 02030105160100)



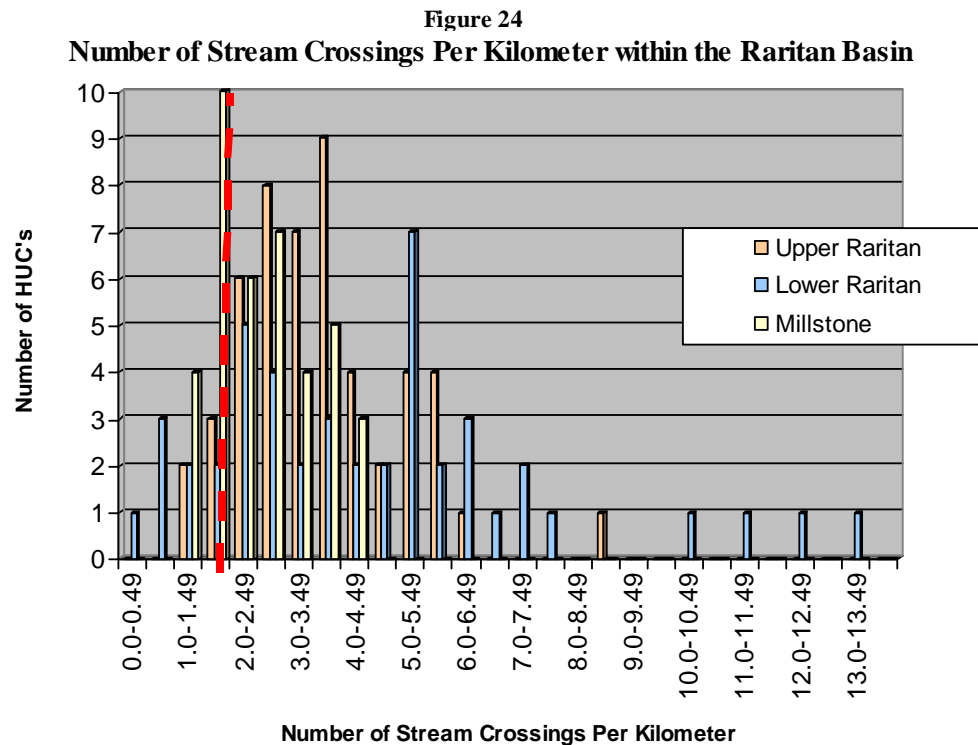
# Forested Riparian Area in 1995 (% Crown Closure)

- Percentage of forested area within the riparian area by sub-watershed
- Areas with crown closure greater than 10%
- Darker colors; areas with greater % crown closure



# Stream Crossings Per Km in the Basin

- Recommended 2 crossings/km to maintain a nearly continuous riparian corridor
- Lower Raritan WMA (13) has greatest # of crossings/km, followed by Upper Raritan WMA (9) and then Lower Raritan WMA (5)



# Critical Needs

## For the Next Revision of this Report:

- Photographs of stream morphological characteristics
- Comparison of low flow data with minimum passing flows for gaging stations of the Basin
- Comparison of benthic macroinvertebrate data with conversion of riparian areas to other land cover types
- Results of the “Great Raritan Flood Project” prepared by the Rutgers University Geography Department

# Critical Needs

## In Time For the Management Plan:

- Updated Low Flow Data
- Determination of stream behavior and channel conditions in the Basin
- Mapping of Flood-flooded areas
- Revised FEMA maps
- Effects of Pre and Post-Development on Floods
- Effects of impervious surfaces on watersheds of the Basin
- Updated Surface Water Quality Inventory Results for 2000 - 305b Report

# Conclusions

- Need a better assessment of the impacts of the 256 dams in the Basin.
- Slight decline in the # of non-impaired sites; increase in the # of severely impaired sites b/t 1994 and 1999.
- Overall decline between 1999 and 2000; due to drought then flood.
- Need to establish base trends.

# Conclusions cont.

- Eutrophication problems – determine causes.
- Approximately 40% of the Basin's historical riparian areas converted to other land cover.
- Evidence that existing regulations are not enough to protect areas.
- Need more stringent regulations and/or better planning to guide future growth.