

**NJDEP**  
**Bureau of Freshwater & Biological Monitoring**

**Lake Monitoring Overview**



NJ Water Monitoring  
Council Meeting  
January 25, 2012

**Victor Poretti**  
**Water Monitoring and Standards**



# **NJDEP**

## **Lake Monitoring Overview**

- **Ambient Lake Monitoring Network**  
**Overview**  
**Statewide Results**
- **Other Lake Studies**  
**National Lake Assessment (NLA)**  
**Americorp**



# Ambient Lake Monitoring Network

- The primary purpose of the Lakes Monitoring Network is to provide a statistically valid estimate of overall lake water quality in the State.
- Data collected from selected lakes statistically represents all NJ lakes meeting the design criteria.
- Estimates can be made on the Statewide condition of NJ lakes.



# **Ambient Lake Monitoring Network Design Criteria/Target Population**

- **Man-made or natural**
- **Wholly or partially within NJ's political boundaries**
- **Water supply reservoirs with active draw downs and water exchanges not included.**
- **Lake size at least two hectares (5 acres) in area.**
- **Depth of approximately one meter at the deepest point measured.**



# Probabilistic Design

- **GRTS** – **G**eneralized **R**andom **T**essellation **S**tratified design. Developed by EPA for National and Statewide assessments.
- 869 Lakes in NJ meet design criteria.
- 200 lakes targeted in a stratified random manner.
- Targeted lakes eliminated for various reasons: not accessible, do not meet design, etc...
- Result of extent estimate on final lake selection: Network lakes statistically represent 635 lakes Statewide.



# Probabilistic Design

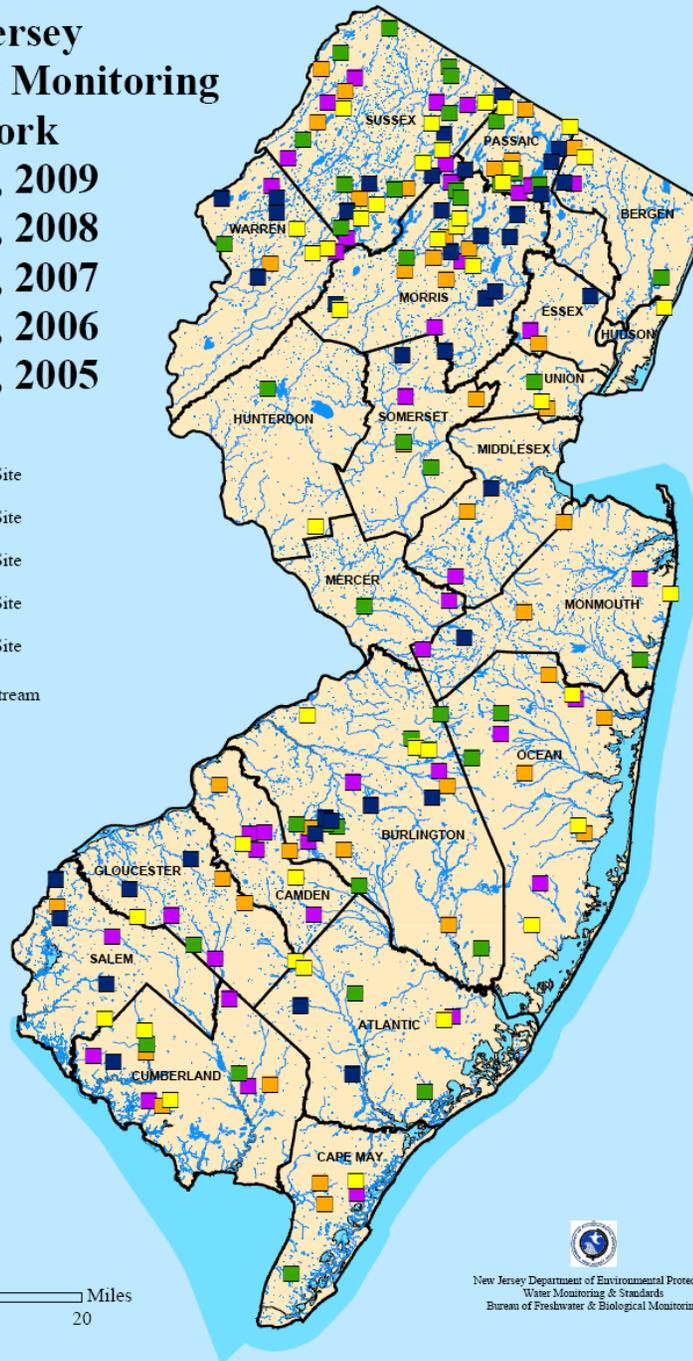
- 869 –lakes meeting design. GIS desktop.
- 200 – lakes selected, from 869.
- Factor eliminated lakes that do not meet design or not accessible.
- 635 – Statistical Universe of lakes which the Network represents.



# New Jersey Ambient Lake Monitoring Network

Panel 5, 2009  
Panel 4, 2008  
Panel 3, 2007  
Panel 2, 2006  
Panel 1, 2005

-  Panel 5 Lake Site
-  Panel 4 Lake Site
-  Panel 3 Lake Site
-  Panel 2 Lake Site
-  Panel 1 Lake Site
-  Major River/Stream
-  Lake/Pond
-  County



  
New Jersey Department of Environmental Protection  
Water Monitoring & Standards  
Bureau of Freshwater & Biological Monitoring

# Sampling Frequency

- 40 lakes sampled per year (Panel 1-5)
- Up to 3 in-lake sample sites
- Sampled in Spring, Summer, Fall

Will be revised to Growing/ Non-growing seasons.

Bracket growing season with 1 month buffers to prevent overlap.



# Sample Parameters

- **Total Phosphorus**
- Total Kjeldahl Nitrogen
- Nitrite+Nitrate Nitrogen
- Ammonia Nitrogen
- **Secchi depths**
- **Chlorophyll "a"**
- **Dissolved Oxygen**
- Temperature
- Specific Conductance
- **pH**
- Alkalinity
- Hardness
- Turbidity



**Trophic Status**

**Surface Water Quality  
Standard (SWQS)**



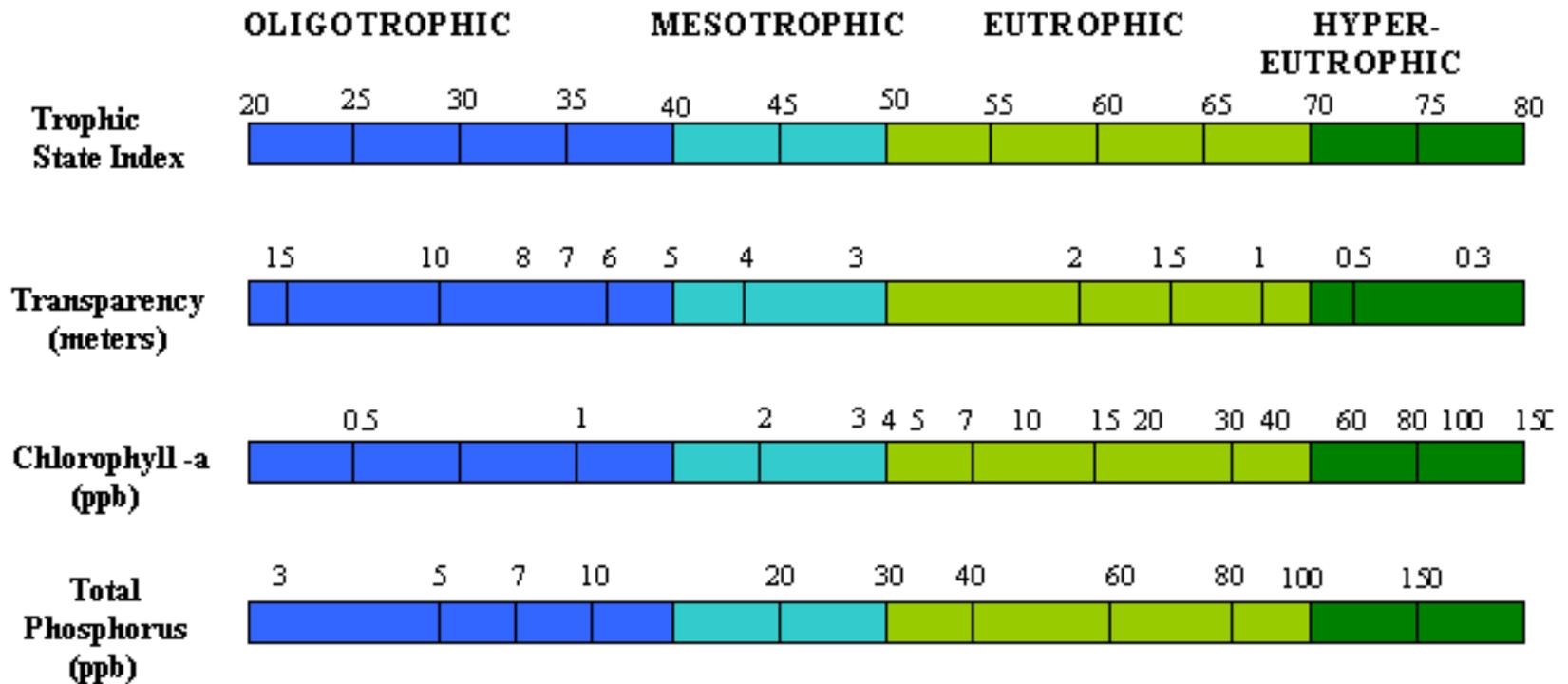
# Trophic State Assessment

- Eutrophication – Aging process of lakes moving toward increased algae & plant growth.
- Cultural eutrophication can rush lakes into eutrophic conditions in a matter of a human generation or two.



# Trophic Status Assessment

## Carlson's Trophic State Index (TSI)



# Trophic Status Assessment

## TSI parameters converted to standard units\*

- **Total Phosphorus**  
(TSIP) =  $14.12 \ln(\text{TP}) + 4.15$
- **Chlorophyll “a”**  
(TSIC) =  $9.81 \ln (\text{Chl } \underline{a}) + 30.6$
- **Secchi Disk**  
(TSIS) =  $60 - 14.41 \ln(\text{SD})$

**\*Minnesota Lake Water Quality Assessment**



# TSI Converted Values

- **Oligotrophic. < 40.**
- **Mesotrophic. 41-50.**
- **Eutrophic. 51-70.**
- **Hypereutrophic. >70.**



NJW04459-245  
 Watchung Lake  
 Watchung Boro, Somerset County



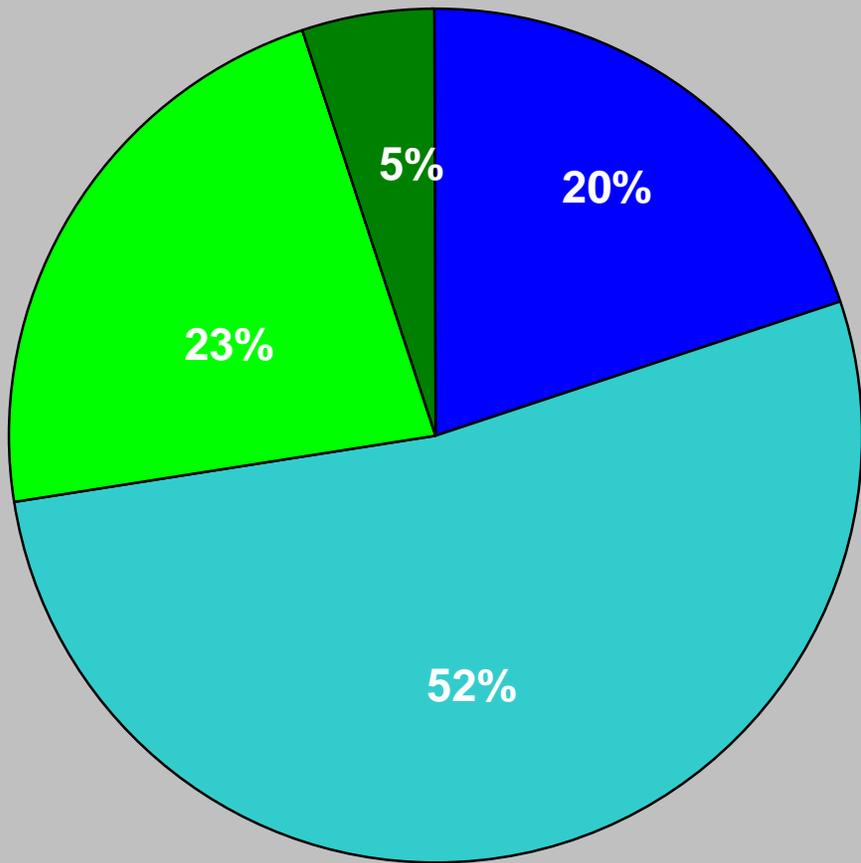
**LEGEND**

- Sampling Station
- ▲ Outfall
- ▲ Boat Launch
- Areal Extent of Aquatic Vegetation

Season	TSIP	TSIC	TSIS	TSI
Spring Station 1	32.21	58.68	58.63	49.84 Mesotrophic
Summer Station 1	65	68.94	63.22	65.72 Eutrophic
Fall Station 1	61.67	53.76	51.53	55.65 Eutrophic

# Statewide Trophic Results

## Trophic Status of Panel 5 Lakes



■ Oligotrophic  
(Lakes with  $\geq 1$   
Oligotrophic sites)

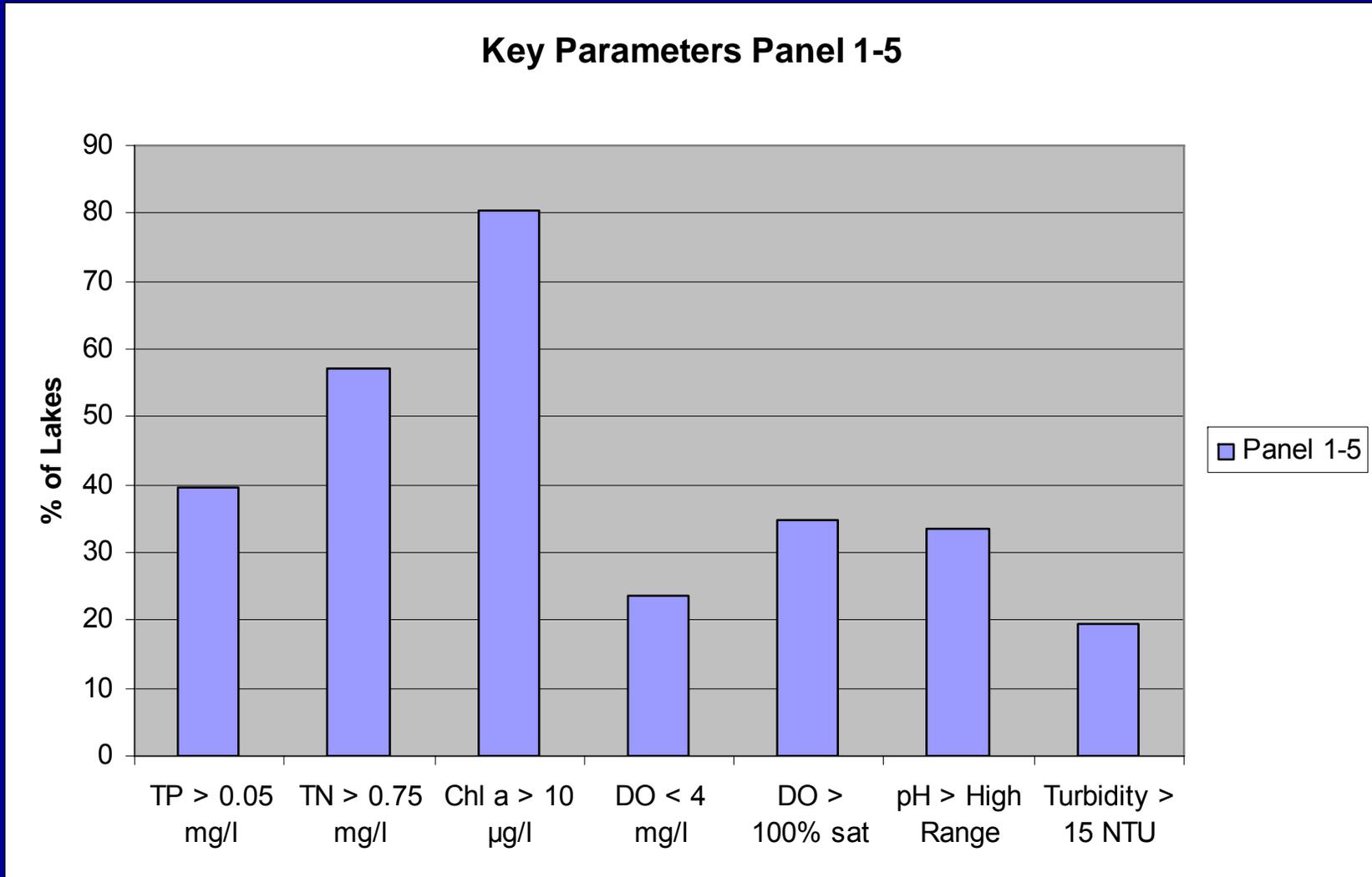
■ Mesotrophic  
(Lakes with  $\geq 1$   
Mesotrophic site  
and no Oligotrophic sites)

■ Eutrophic  
(Lakes with only Eutrophic sites)

■ Hyper-eutrophic  
(Lakes with  $\geq 1$   
Hyper-eutrophic and no Oligotrophic  
or Mesotrophic sites)



# Key Parameters Statewide Results



# Surface Water Quality Standards (SWQS)

- Two Events Required For A Violation
- **Total Phosphorus (TP) > 0.05 mg/L**
- **Dissolved Oxygen (DO) < 4.0mg/l**
- **pH 3.5 - 8.5 SU\***

\***6.5 – 8.5 SU** for lakes within waters designated as FW2 waters in the Upper Delaware, Upper Raritan, Passaic, and Walkkill River Basins.

\***4.5 - 7.5 SU** for lakes within FW2 waters in the Atlantic, Lower Delaware, and Lower Raritan River basins.

\***3.5 - 5.5 SU** for lakes designated as PL waters.



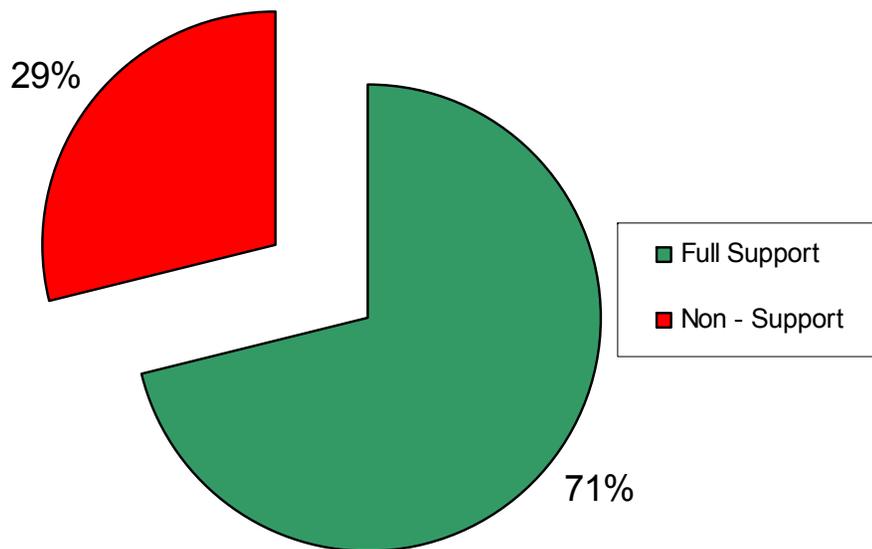
# Probabilistic Estimate of Lakes Attaining SWQS

Indicator	Category	Number of Lakes	Estimate % Lakes
Total Phosphorus Impairment	Fail	30	15.5
Total Phosphorus Impairment	Pass	169	84.5
Dissolved Oxygen Impairment	Fail	5	2.6
Dissolved Oxygen Impairment	Pass	194	97.4
pH Impairment	Fail	28	14.0
pH Impairment	Pass	171	86.0
<b>OVERALL ASSESSMENT</b>	<b>Not Support</b>	<b>57</b>	<b>29.0</b>
<b>OVERALL ASSESSMENT</b>	<b>Full Support</b>	<b>142</b>	<b>71.0</b>

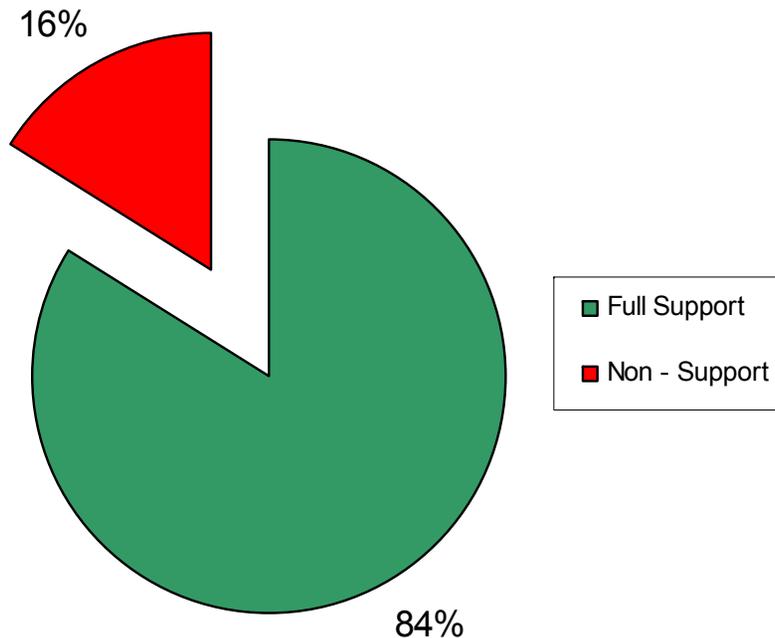


# Probabilistic Estimate of Lakes Attaining SWQS

Statewide SWQS Attainment by Lake



Statewide SWQS Attainment by Lake Acres



# Potential Stressors

- Impaired shoreline habitat.
- Storm water outfalls.
- Atmospheric precipitation and fallout from urban contaminants.
- Heavy fertilization in agricultural regions. The phosphorus content of precipitation is much higher during the active growing (summer) season.
- Release of sediment bound phosphorus.



# Lake Results and Assessment

- Raw Data
  - ✓ BFBM Website
  - ✓ EPA STORET/WQX
- Assessments
  - ✓ Ambient Lake Monitoring Network Reports
  - ✓ New Jersey Integrated Water Quality Monitoring and Assessment Reports (Integrated Reports)
  - ✓ EPA ADB (Assessment Data Base)



# In Development

- Diatom Index
  - Nutrient Correlations
  - Biological Condition
  - Reference Conditions
- Statistical Analysis
  - Size
  - Depth
  - Geographic Region
  - Parameter Relationships



# Other NJ Lake Studies

## NLA

- National Lake Assessment (NLA)
- Part of National Aquatic Resource Surveys (**NARS**)
- 2007 and 2012
- National Assessments of Lake Condition
- Not intended for individual assessments.
- Limited Staff Resources
- Partnered with DRBC, Americorp, available staff.



# NLA

## Additional Parameters

- Biological Integrity
  - Macroinvertebrate Index
  - Planktonic Index of Taxa Loss
  - Risk of cyanotoxin exposure
  - Enterococci
- Habitat Quality
  - Lakeshore Vegetation Cover
  - Littoral Quality
  - Human Shoreline Disturbance



# NLA - NJ

- 2007 – 8 NJ sites
- 2012 – 11 NJ sites
- 2012 sites will integrate some NJ Lake Network sites.



# NLA New Jersey Lakes

2007

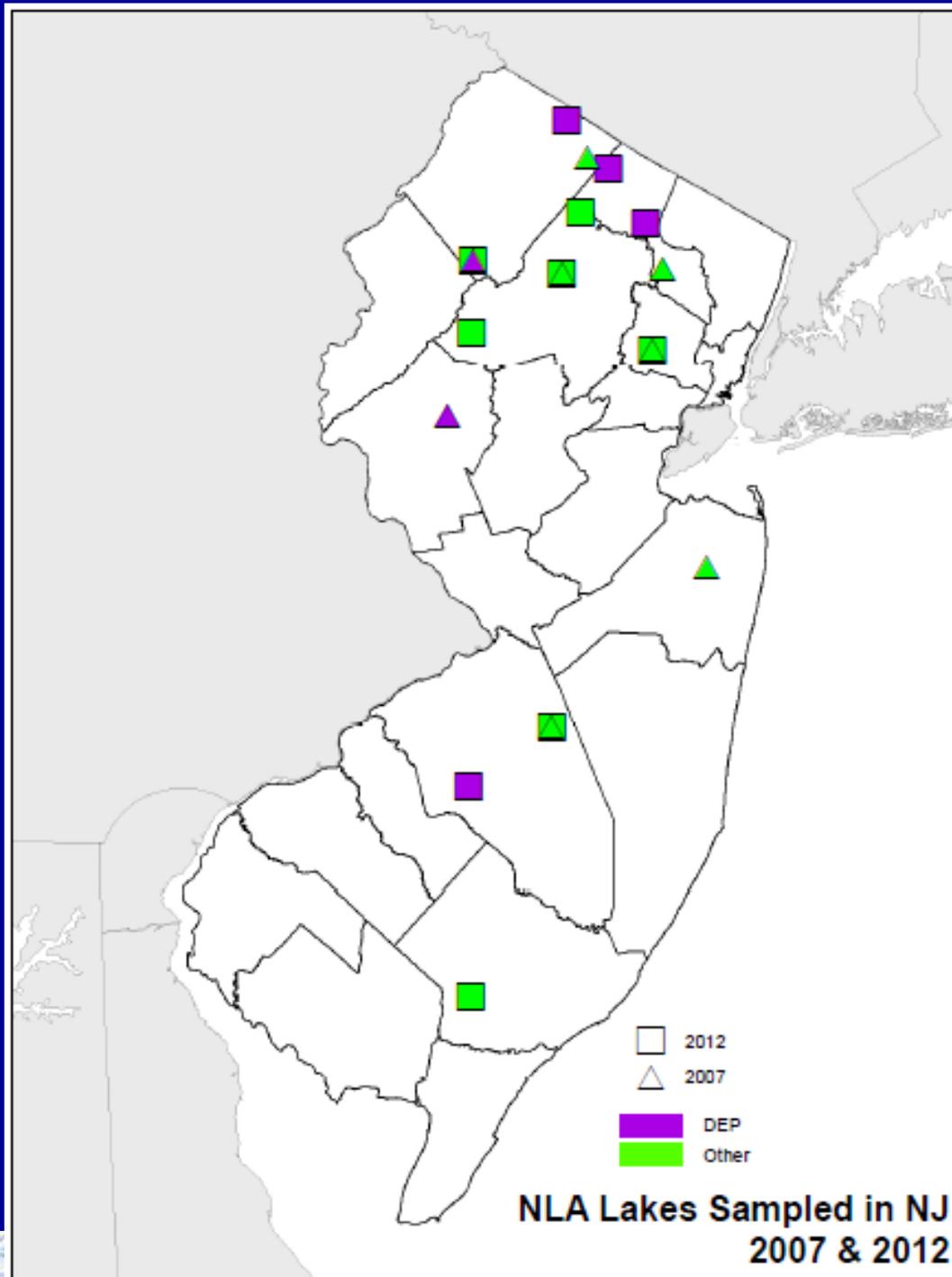
- **Round Valley Recreation Area Swimming Lake**
- **Lake Tranquility (Panel 3)**
- Highland Lake
- Mirror Lake
- Mount Hope Lake
- Orange Reservoir
- Packanack Lake
- Swimming River Reservoir
  
- **NLA parameters collected and measured by BFBM**

2012

- **Bearfort Waters (Panel 3)**
- **Washington Lake (Panel 3)**
- **Panorama Lake (Panel 3)**
- **Lake Stockwell (Panel 3)**
- George Lake (Panel 5)
- Greenwood Pond (Panel 4)
- Lake Tranquility (Panel 3)
- Maple Lake
- Mirror Lake
- Mount Hope Lake
- Orange Reservoir



# NLA New Jersey Lakes



# Volunteer Lake Monitoring Network

Sarah Helble

- Panel 6 part of the New Jersey Ambient Lake Monitoring Network
- 20 lakes were probabilistically selected by EPA for a 5-10 year trend assessment
- These 20 lakes are to be monitored annually

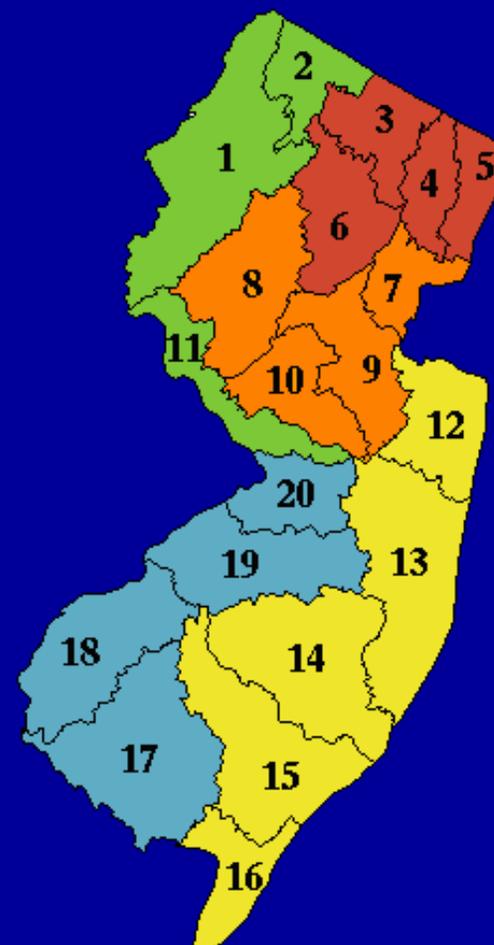


# Watershed Ambassador Program



- 20 members
- 5 lakes per member including the 20 lakes assigned by EPA mentioned above (panel 6 lakes)

**For a total of 100 lakes**



# Lake Assessment Protocol

## Visual Assessment for:

1. Designated use (human uses of lake)
2. Nutrient Assessment (algal conditions)



# **Additions to the Volunteer Assessment**

**Presence/Absence of Invasives**

**Wildlife Observations**

**Recreational Aesthetics**

**Recreational Availability**

**Water Characteristics (Turbidity, Odor,  
Surface Coating)**



**Additional information on the Ambient Lakes  
Monitoring Program can be obtained from:**

**WM&S/ Bureau of Freshwater & Biological  
Monitoring**

**609-292-0427**

**victor.poretti@dep.state.nj.us**

**[www.state.nj.us/dep/wms/bfbm](http://www.state.nj.us/dep/wms/bfbm)**

