# Non-Tidal Passaic River Basin Water Quality Trading Project

A Collaboration of
Rutgers and Cornell Universities
*USEPA Targeted Watershed Grant Program*

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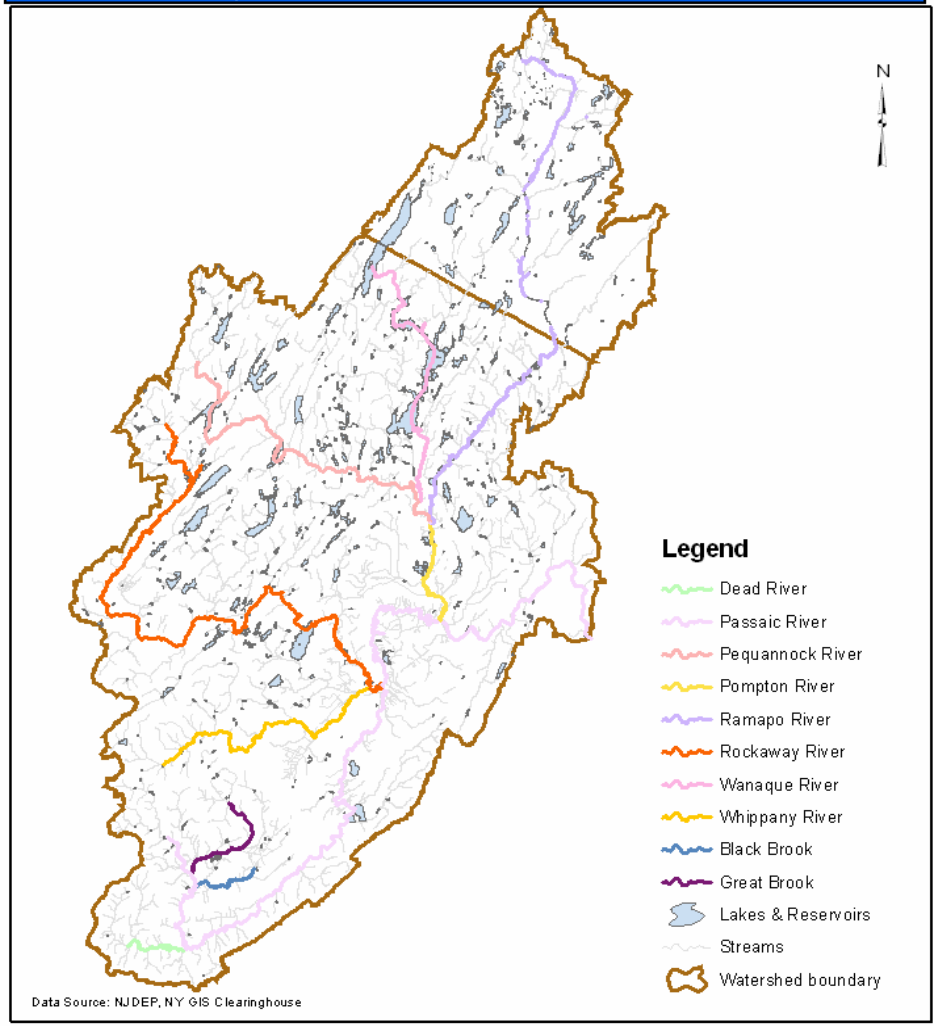
THE STATE UNIVERSITY OF NEW JERSEY

Cornell University

# NY, NJ Surface Water Bodies

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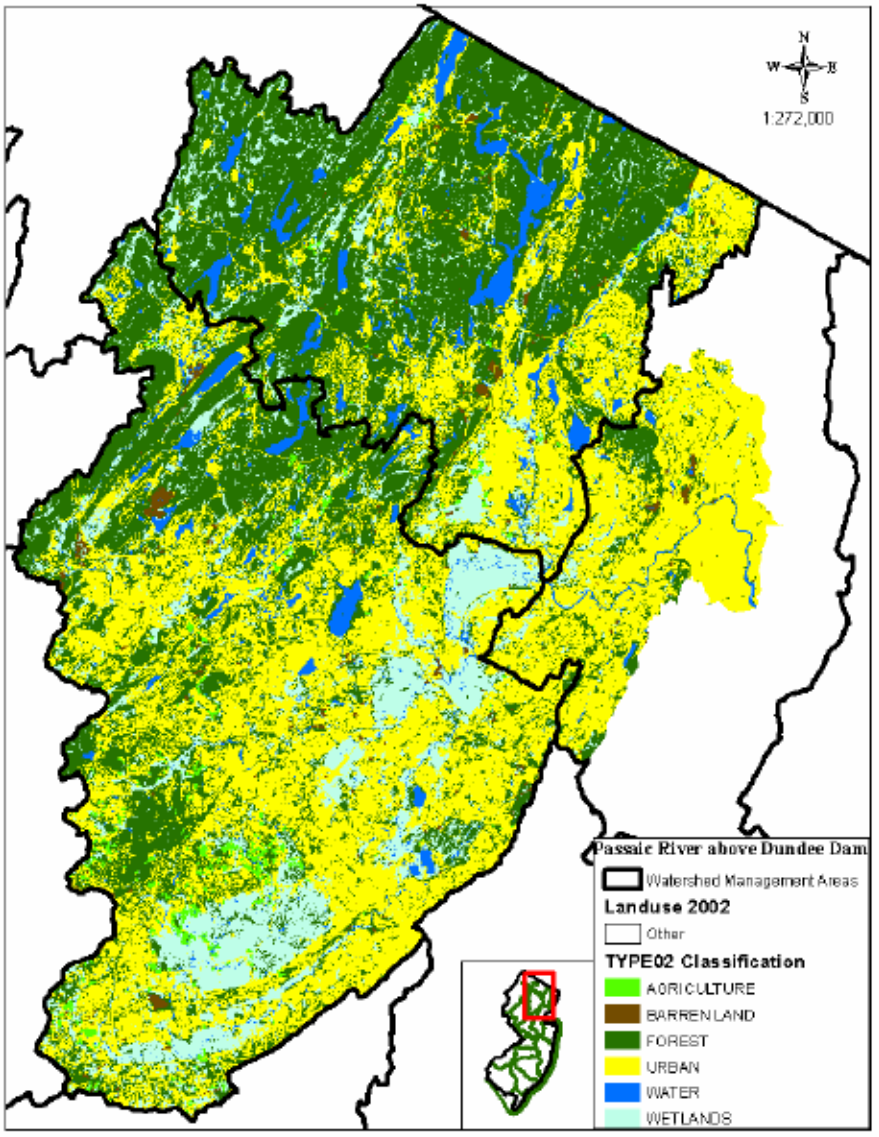
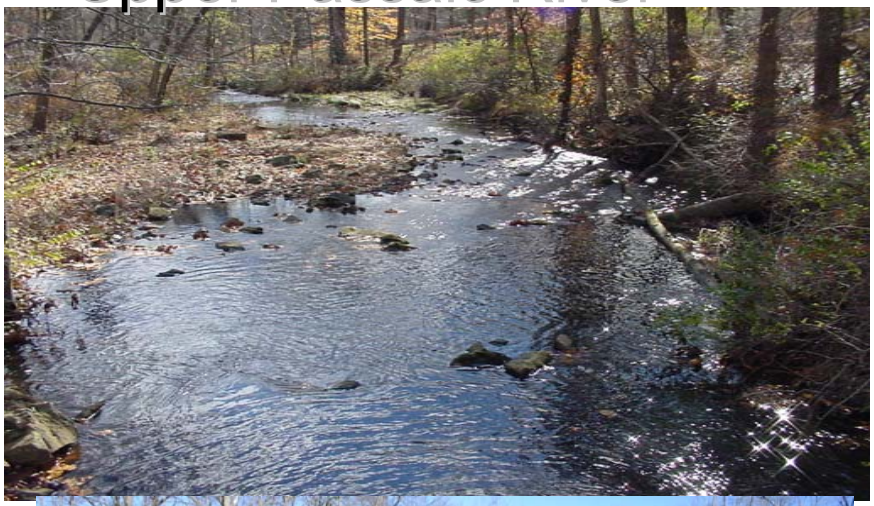
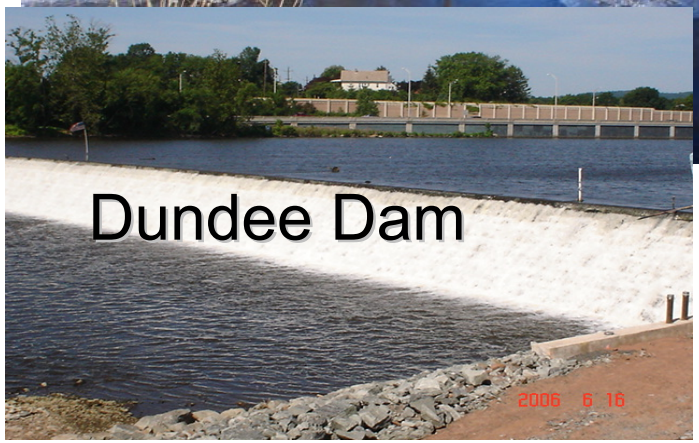


Upper Passaic River






Confluence of Passaic and Pompton Rivers
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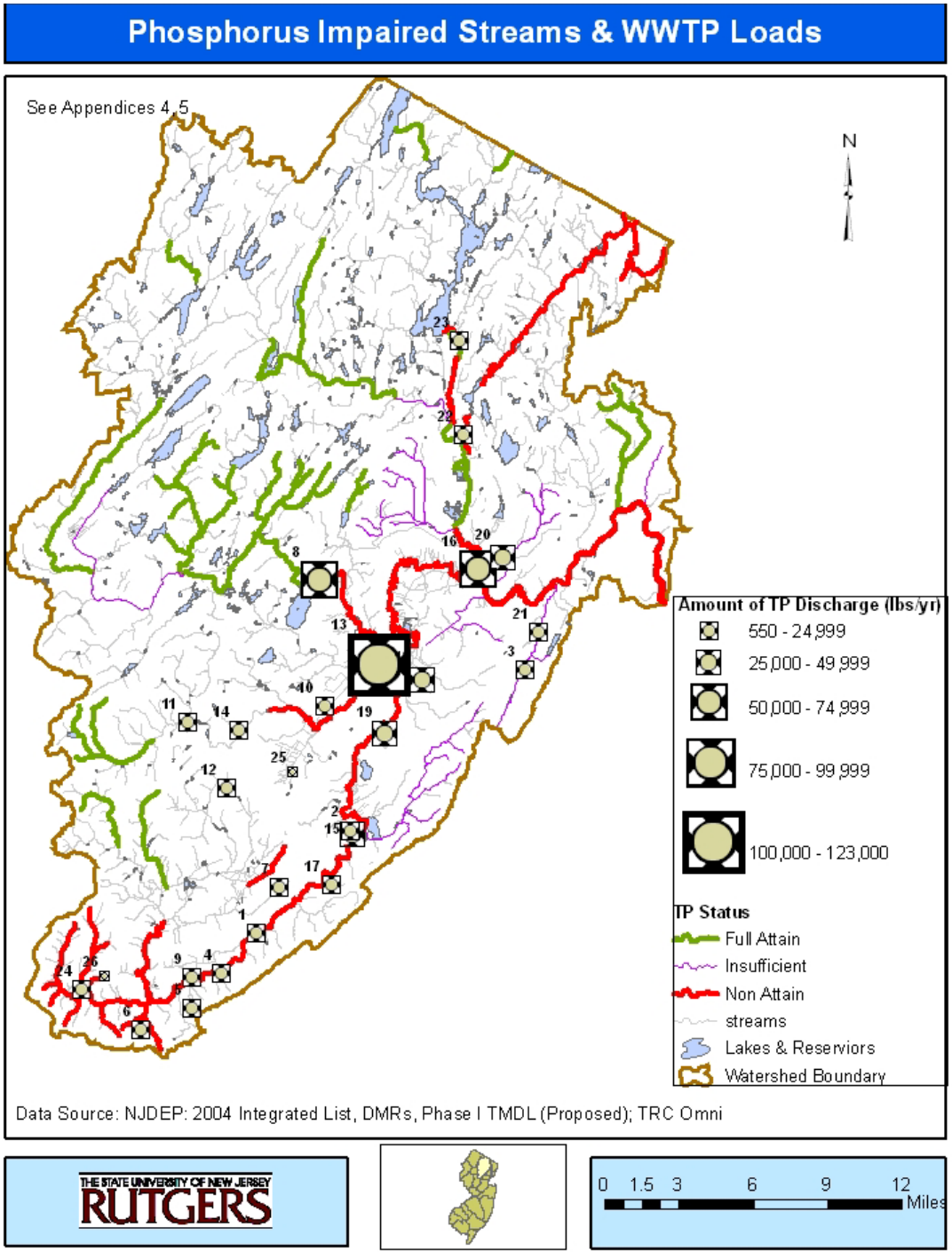
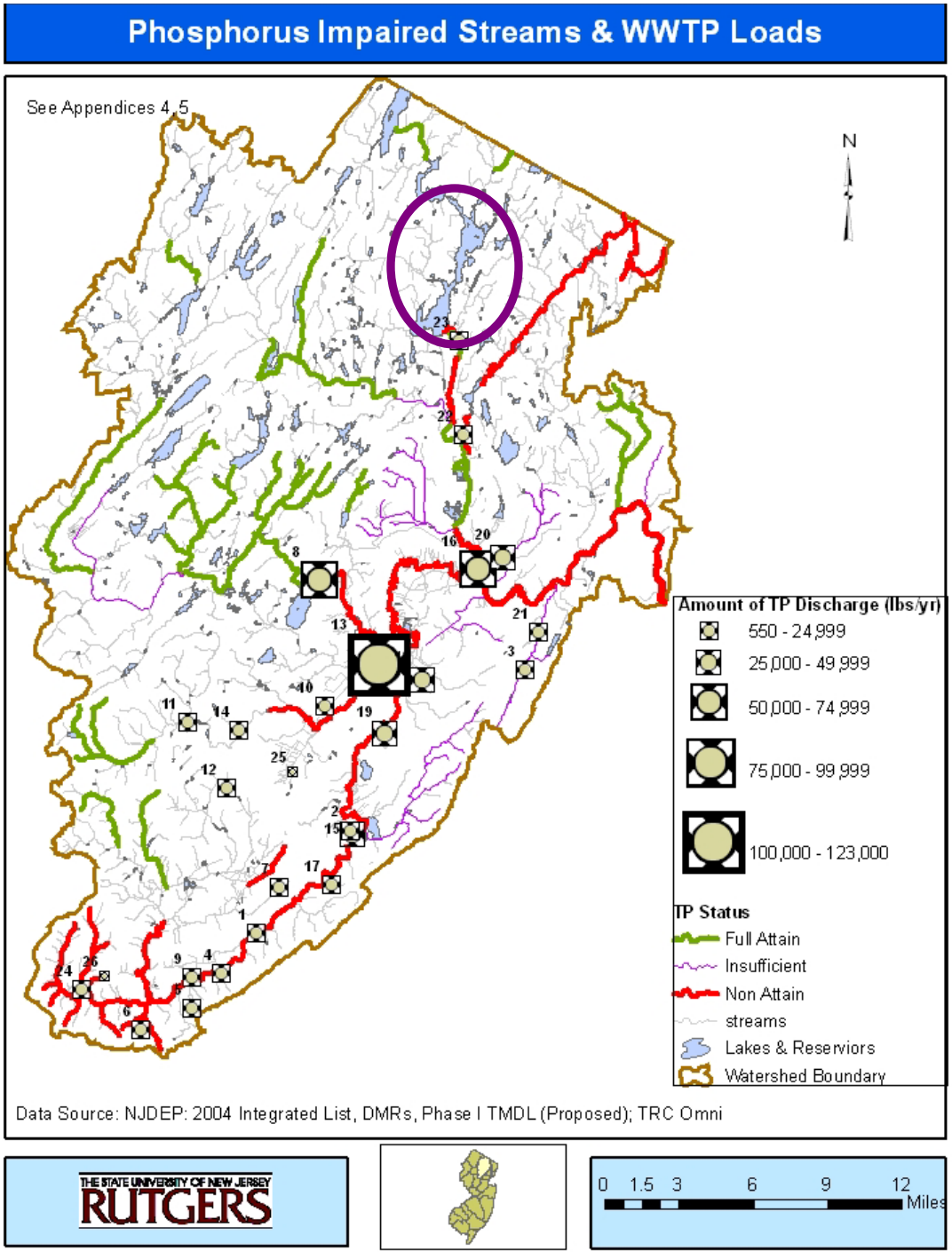



- 22 WWTPs with capacity > 0.1 MGD
- Contribute > 60% phosphorus load to Wanaque Reservoir and Dundee Lake
- Phosphorus loading is point source dominated




## Wanaque Reservoir

- 29.6 BG capacity
- 173 MGD long term safe yield
- Supplies drinking water to ~ 2 million people
- Wanaque South Intake pumps surface water from Pompton and/or Passaic Rivers to Wanaque Reservoir
- 64% of phosphorus load to reservoir is from Wanaque South Intake diversion

# Passaic TMDL

- Passaic TMDL proposed May 7, 2007
  - Supercedes NJSWQS for total phosphorus with site-specific ecological criteria
  - Seasonal average criteria for chl-*a* at **two** endpoints
    - Wanaque Reservoir: 10 μg/l
    - Dundee Lake: 20 μg/l
  - TMDL allocations based on water quality modeling
  - WWTP allocation: 0.4 mg/l long-term average (LTA) total phosphorus effluent
    - WWTPs currently discharging 0.2 to 3.3 mg/l LTA

# Passaic Trading Project

Rutgers received EPA grant to develop, implement, and evaluate a Water Quality Trading program for Non-tidal Passaic River Watershed that:

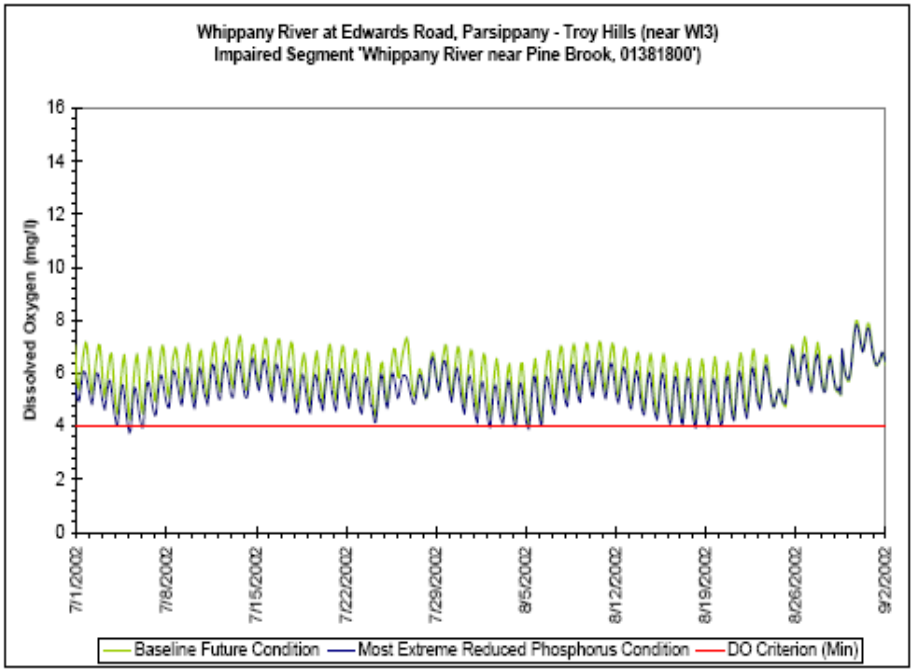
- *Adheres to USEPA policy on Water Quality Trading*
- *Meets NJDEP requirements*
- *Implements TMDL*
- *Reduces cost of compliance with Clean Water Act*
- *Establishes incentives for voluntary reductions that could also achieve ancillary environmental benefits such as expedited load reductions*

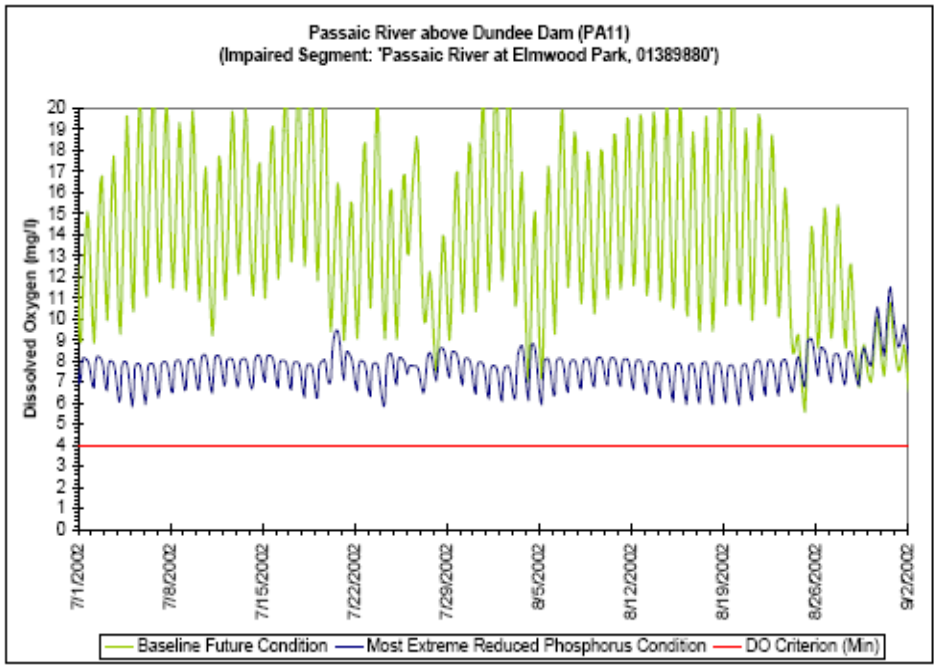
# Trading Framework

- What are the restrictions on trading necessary to protect and improve water quality?
- Framework must:
  - Ensure hot spot avoidance
  - Address watershed-specific features (i.e., diversions, protect **both** TMDL endpoints)
  - Minimize transaction costs
  - Maximize cost-effectiveness

# Trading Framework

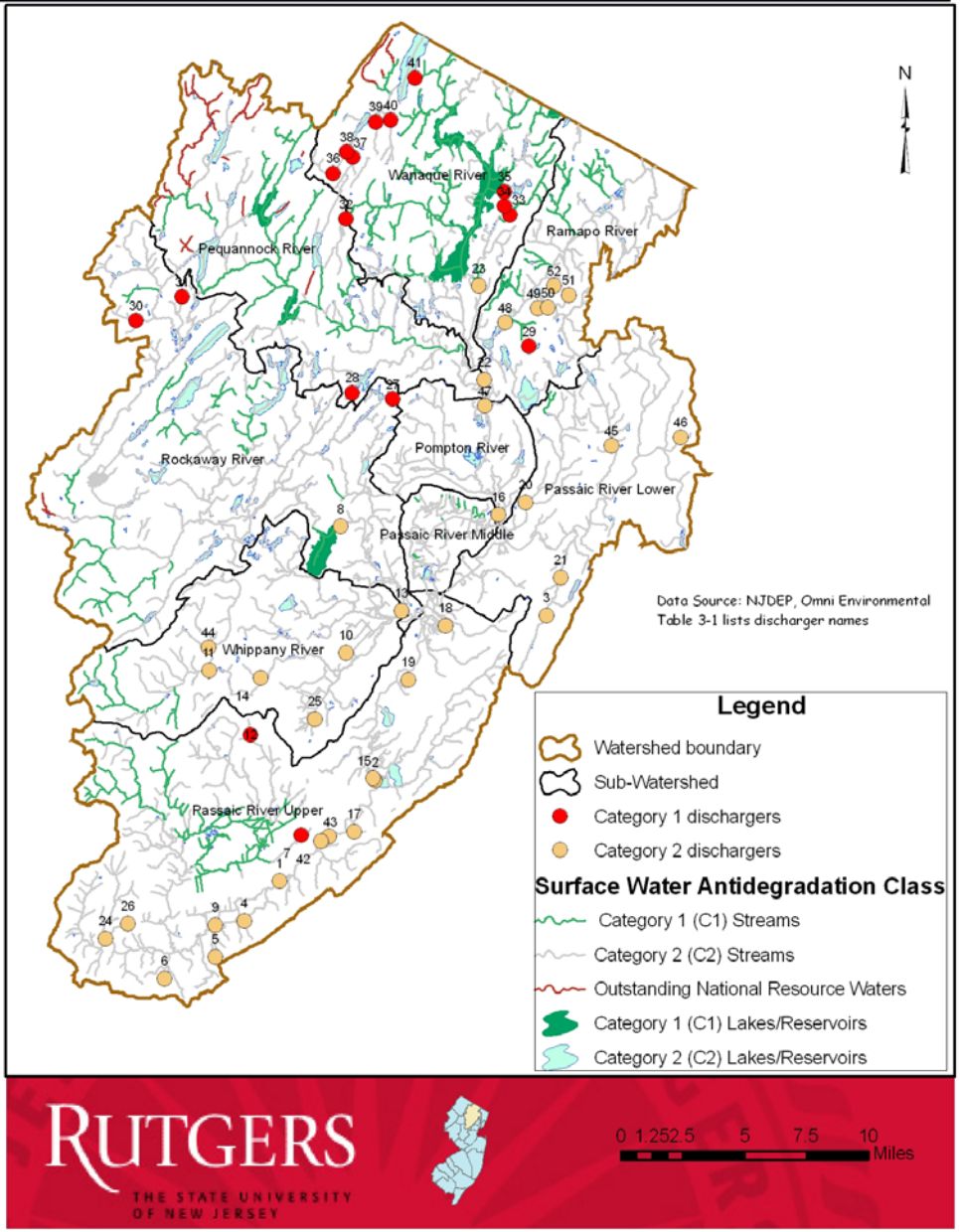
- Identifying potential hot spots: modeling has demonstrated excessive P is only a water quality concern at the two TMDL endpoints



- Identify dischargers as “Category 1” or “Category 2”
  - Category 1 dischargers are *naturally* upstream of Category 1 waters. May only sell allowances.
  - Category 2 dischargers are *not naturally* upstream of Category 1 waters. May buy or sell allowances.

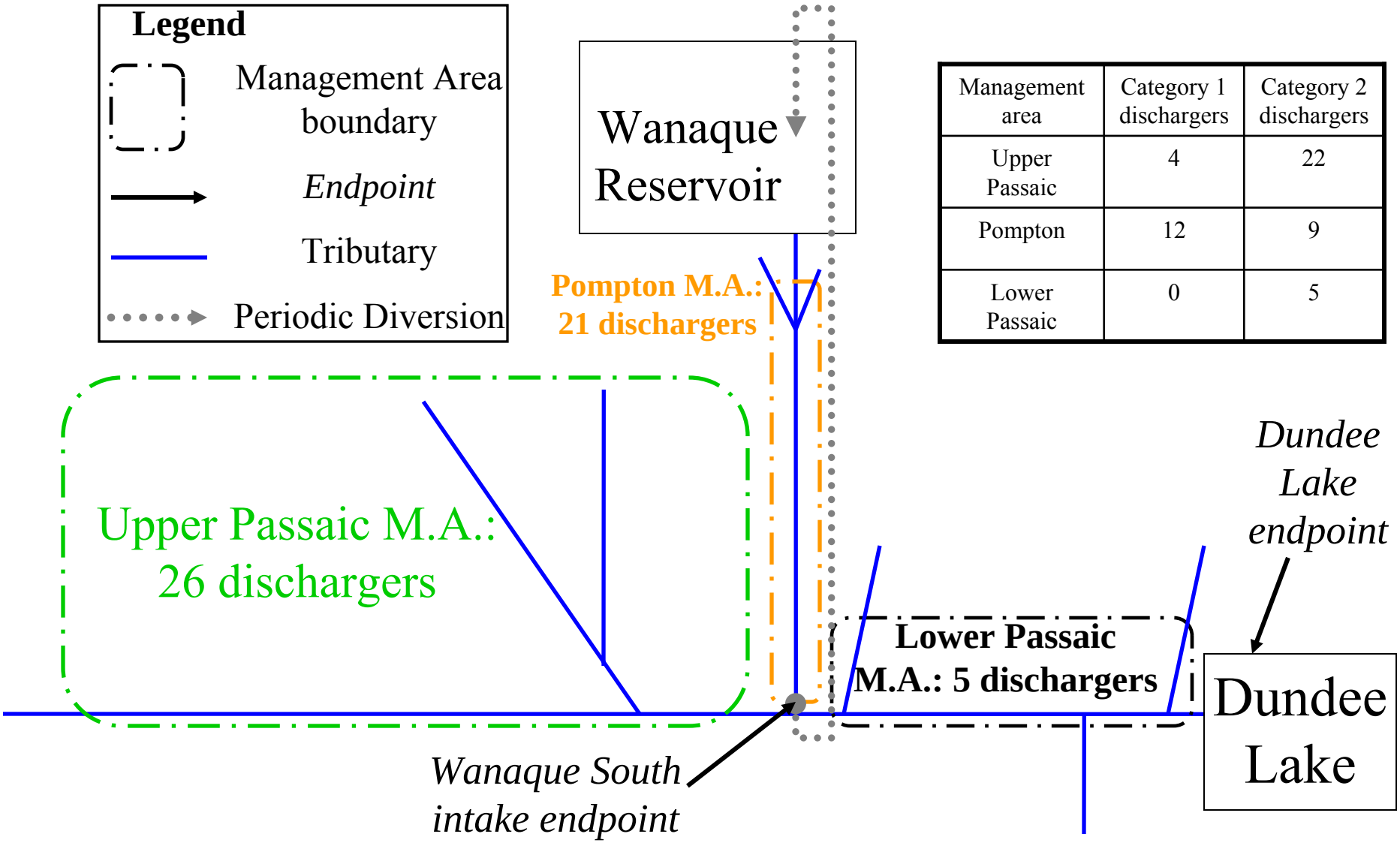
**Figure 4-1 Category 1 and Category 2 Dischargers**



# Trading Framework

- Group WWTPs into “management areas”.
- Management area is bounded by a TMDL endpoint.
  - **Management area is designed to protect TMDL endpoints**.
  - *Within the management area, buyers and sellers can trade bi-directionally. For trades between management areas, seller must be upstream of shared TMDL endpoint.*
  - Apply trading ratio

# Passaic Trading Framework




| Management area | Category 1 dischargers | Category 2 dischargers |
|---|---|---|
| Upper Passaic | 4 | 22 |
| Pompton | 12 | 9 |
| Lower Passaic | 0 | 5 |

# Passaic Trading Framework: *Three* Management Areas Protecting *Two* Endpoints

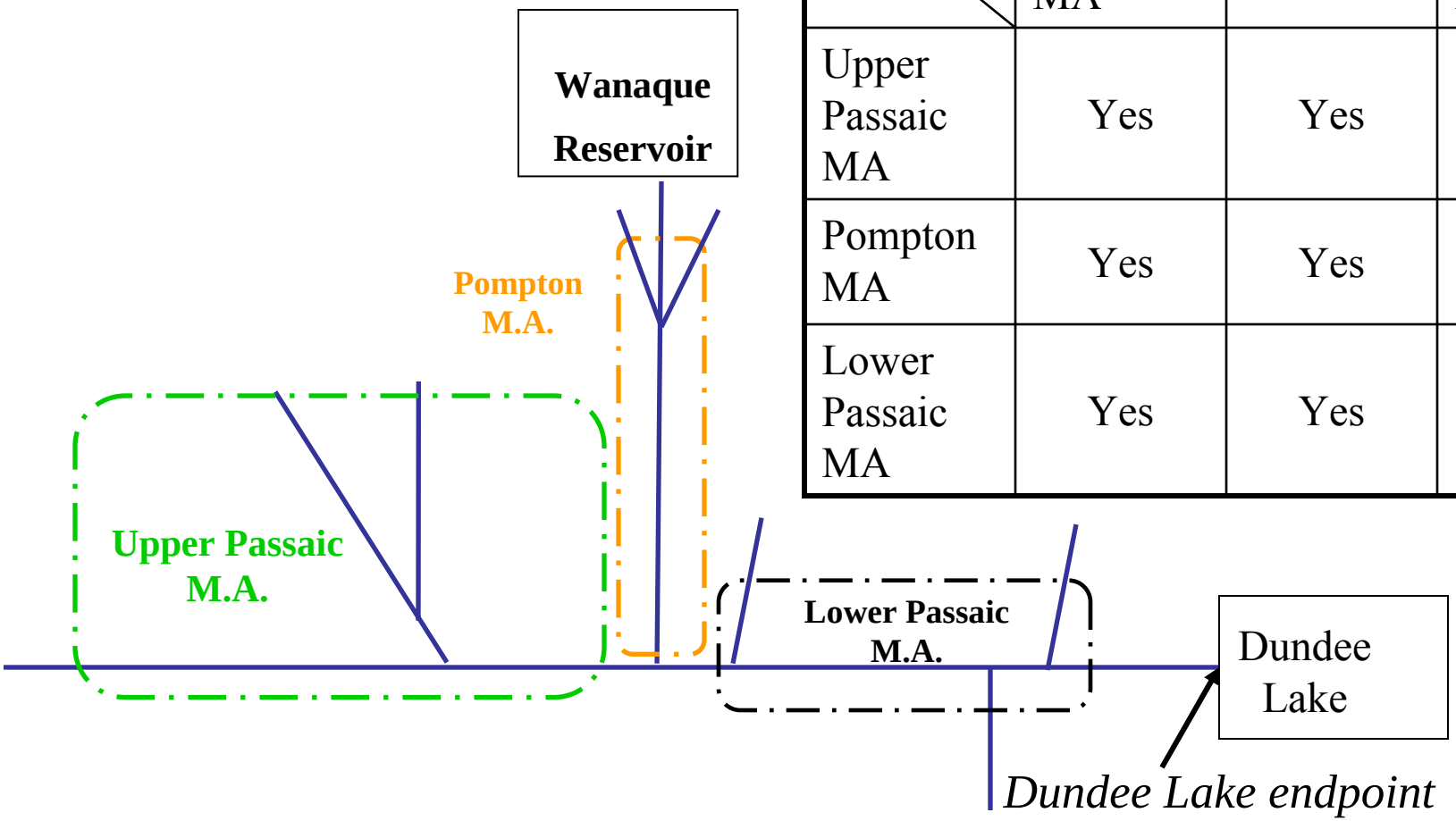
| Seller \ Buyer | Upper Passaic MA | Pompton MA | Lower Passaic MA |
|---|---|---|---|
| Upper Passaic MA | Yes | No | Yes |
| Pompton MA | Yes | Yes | Yes |
| Lower Passaic MA | No | No | Yes |

# Passaic Trading Table

- How was the trading table developed?
  - Analyzed 3 scenarios: No Diversion, Diversion, Extreme Diversion
  - Selected most conservative options from each scenario to create the final table
  - Trading table is protective of water quality under **all** scenarios

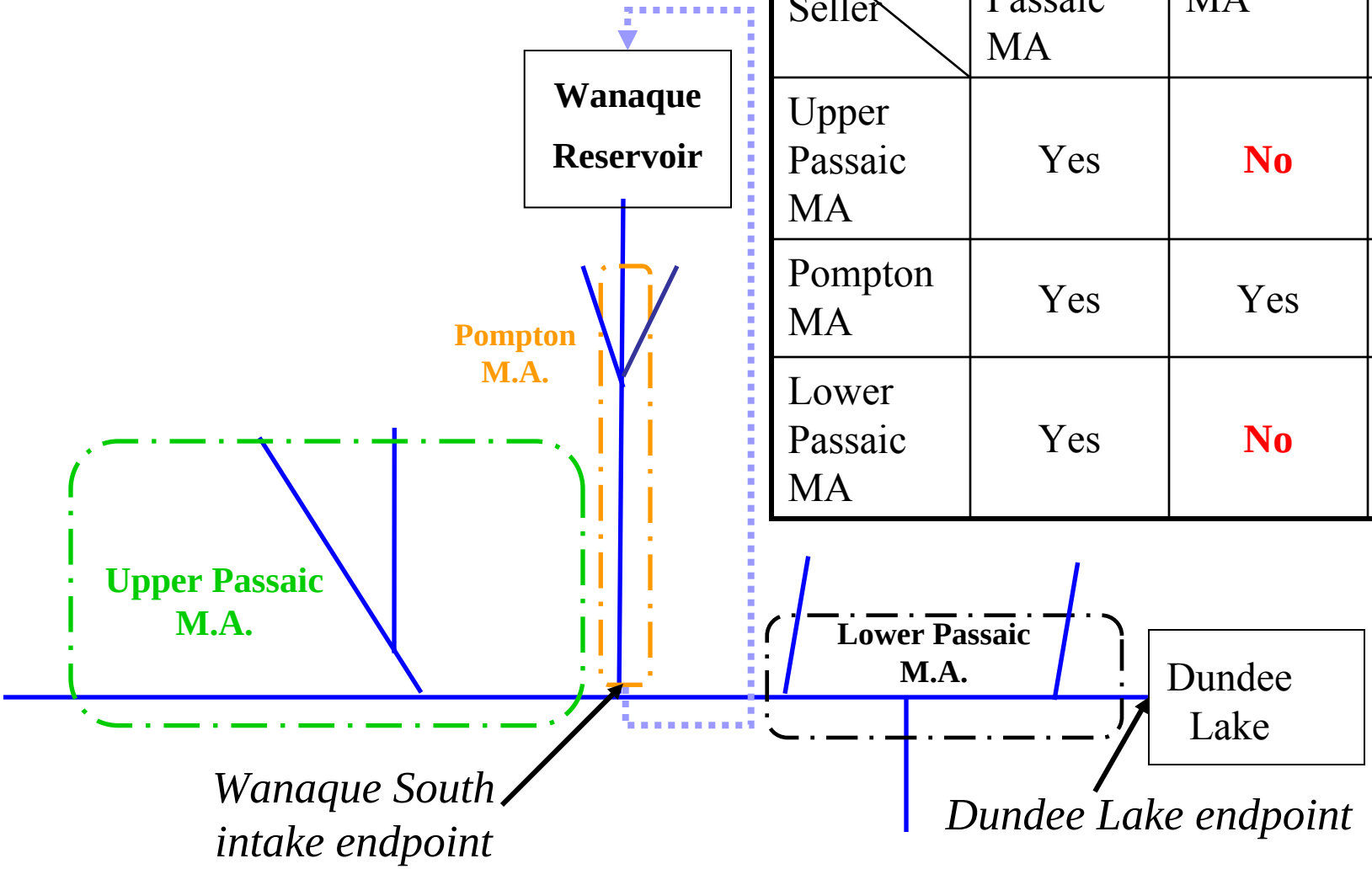
# Passaic Trading Table: No Diversion Scenario

| Seller \ Buyer | Upper Passaic MA | Pompton MA | Lower Passaic MA |
|---|---|---|---|
| Upper Passaic MA | Yes | Yes | Yes |
| Pompton MA | Yes | Yes | Yes |
| Lower Passaic MA | Yes | Yes | Yes |



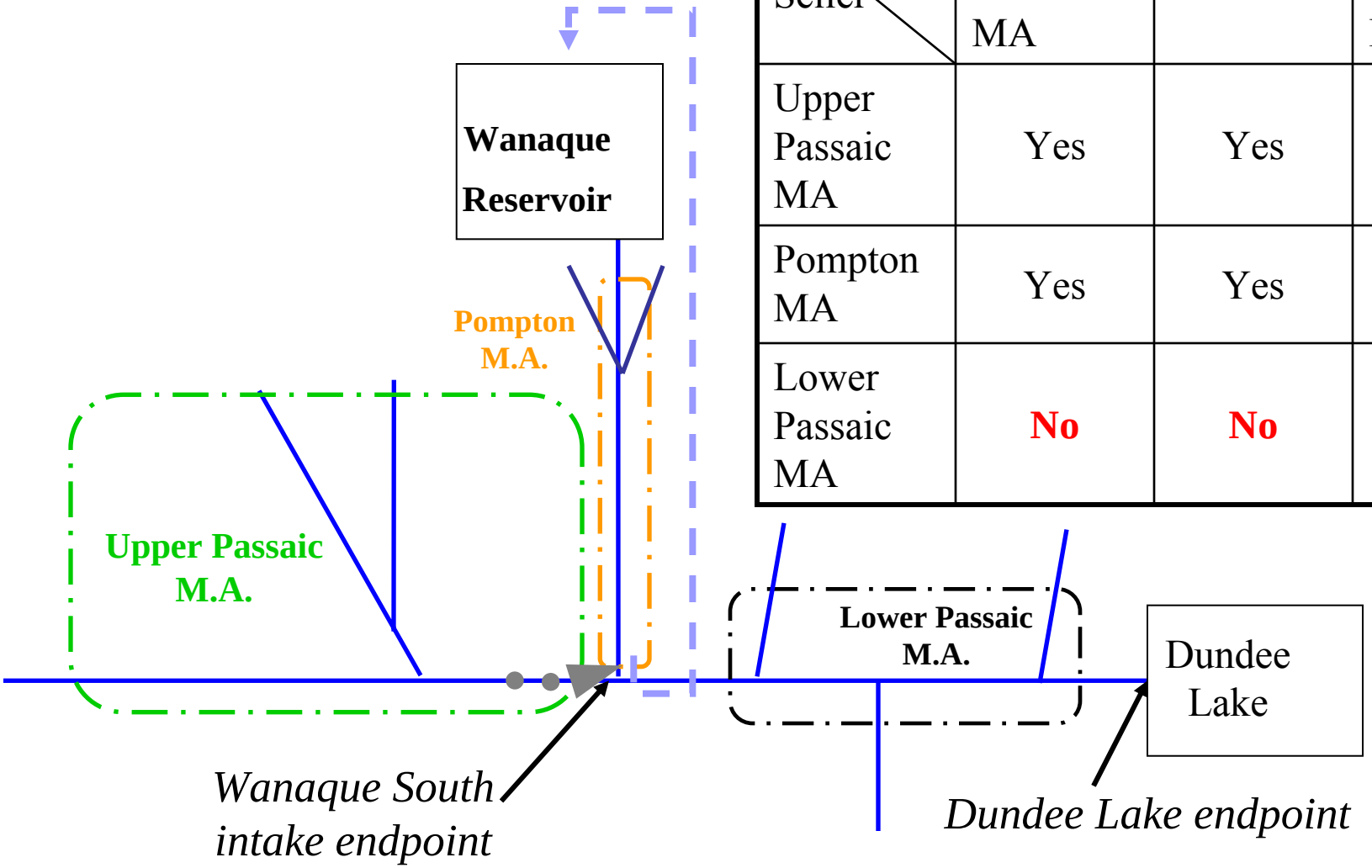
# Passaic Trading Table: Diversion Scenario

| Seller \ Buyer | Upper Passaic MA | Pompton MA | Lower Passaic MA |
|---|---|---|---|
| Upper Passaic MA | Yes | **No** | Yes |
| Pompton MA | Yes | Yes | Yes |
| Lower Passaic MA | Yes | **No** | Yes |



# Passaic Trading Table: Extreme Diversion Scenario

| Seller \ Buyer | Upper Passaic MA | Pompton MA | Lower Passaic MA |
|---|---|---|---|
| Upper Passaic MA | Yes | Yes | Yes |
| Pompton MA | Yes | Yes | Yes |
| Lower Passaic MA | **No** | **No** | Yes |



# Passaic Trading Framework: *Three* Management Areas Protecting *Two* Endpoints

| Seller \ Buyer | Upper Passaic MA | Pompton MA | Lower Passaic MA |
|---|---|---|---|
| Upper Passaic MA | Yes | No | Yes |
| Pompton MA | Yes | Yes | Yes |
| Lower Passaic MA | No | No | Yes |

# Formula for trading

- NJDEP guidance
  - The trading program should be based on attaining 0.4 mg/l long term avg (LTA) from each WWTP on an annual basis.
    - →*Trades should offset concentration, rather than load*
    - →Best way to do this: base the trading allocation on WWTP actual flow, rather than permitted flow
- Recommended formula
  1. **Allocation** = [(0.4 mg/l LTA * Anticipated Actual Discharger Flow)
     - Note: Actual LTA to be determined on an annual basis. Anticipated Actual Discharger Flow based on average of 2005-2007 actual flow from facility.
  2. **Balance** = [(0.4 mg/l LTA * Anticipated Actual discharger flow) – (Actual LTA * Actual discharger flow)]

     - Actual kg sold + Equalized kg purchased

     - Equalized kg = (Actual kg * Trading ratio)

# Formula for trading (cont.)

[(0.4 mg/l LTA * Anticipated *Actual flow*) –
(Actual LTA * *Actual flow*)]

- Actual kg sold + Equalized kg purchased

- What if allocation is based on permitted flow?
  - Seller can take credit for more pounds than it has really removed; risk to stream

# Formula for trading (cont.)

[(0.4 mg/l LTA * Anticipated Actual flow) – (Actual LTA * Actual flow)]

- Actual kg sold + Equalized kg purchased

- Equalized pounds = (Actual pounds * Trading ratio)

– Actual kg sold
  - Kg below allocation that seller has removed from effluent and sold
– Equalized kg purchased
  - Uses trading ratio to account for attenuation of TP between buyer and seller; all diversion conditions accounted for
  - Trading ratio table developed to guide all dischargers

**Balance** =

[ Allocation – (Actual LTA * Actual Discharger flow)]

- Actual kg sold + Equalized kg purchased

# Example of trading ratio table

(Based on **No Diversion**, **Diversion**, **Extreme Diversion** Scenarios)

| Seller \ Buyer | Dead Zone (UP MA) | Upper Passaic Zone 2 (UP MA) | Lower Passaic Zone 1 (LP MA) |
|---|---|---|---|
| Upper Passaic Zone 1 (UP MA) | **0.90** | **0.78** | **0.57** |
| Whippany Zone (UP MA) | **0.82** | **0.77** | **0.52** |
| Pompton Headwater Zone (Pompton MA) | **0.49** | **0.43** | **0.29** |
| Lower Passaic Zone 2 (LP MA) | | | **0.87** |

# Derivation of trading ratios

- Consultant performed attenuation coefficient analysis using calibrated model
- Considered “no diversion”, “diversion”, and “extreme diversion” scenarios
- Calculated attenuation of TP load from each zone as load moves downstream
- Result: “Zonal attenuation coefficient” or ZAC for each zone

# Derivation of trading ratios (cont.)

- Trading ratio = (Seller ZAC/Buyer ZAC), relative to common endpoint.
  - Some ratios have 2 common endpoints; choose the endpoint which yields the lower ratio.
- Calculate trading ratio for each scenario,and select lowest ratio; max protection for WQ
  - Ratios further reduced by 10% as margin of safety

# Derivation of trading ratios: Example inter-MA trade, Pompton selling to Upper Passaic

- Seller: Two Bridges SA (Two Bridges Zone)
  - ZAC at Dundee Lake = 0.93, no diversion
  - ZAC at Dundee Lake = 0.47, diversion
  - ZAC at Dundee Lake = 0.25, extreme diversion
  - ZAC at Wanaque South = 1.00, extreme diversion
- Buyer: Warren Twp SA – Stage 5 (Dead Zone)
  - ZAC at Dundee Lake = 0.77, no diversion
  - ZAC at Dundee Lake = 0.62, diversion
  - ZAC at Dundee Lake = 0.37, extreme diversion
  - ZAC at Wanaque South = 0.13, extreme diversion
- Trading ratio = (Seller ZAC/Buyer ZAC)
  - No diversion, trading ratio = 1.21 = (0.93/0.77)
  - Diversion, trading ratio = 0.76 = (0.47/0.62)
  - Extreme diversion, trading ratio = 0.68 = min (0.25/0.37 , 1.0/0.13)
  - **Select 0.90*0.68 as trading ratio = <u>0.61</u>**

# Example Trade
# Inter-MA trade, Pompton selling to Upper Passaic

- Buyer: Hanover SA STP (located in Whippany Zone)
  - Actual LTA = 1.0 mg/l**;** Actual Discharger Flow = 2.10 MGD (hypothetical)
  - Anticipated Actual Discharger Flow = 2.07 MGD; (average of 2005-2007 Discharger flow, Table 5-4)
  - Allocation = 0.4 mg/l * Anticipated Actual Discharger Flow = 1144 kg/yr (Table 5-4)
  - **Balance** = Allocation – (1.0 mg/l * 2.10 MGD) = **- 1758 kg**
- Seller: Two Bridges SA (located in Two Bridges Zone)
  - Actual LTA = 0.1 mg/l**;** Actual Discharger Flow = 5.90 MGD (hypothetical)
  - Anticipated Actual Discharger Flow = 5.79 MGD; (average of 2005-2007 Discharger flow, Table 5-4)
  - Allocation = 0.4 mg/l * Anticipated Actual Discharger Flow = 3200 kg/yr (Table 5-4)
  - **Balance** = Allocation – (0.10 mg/l * 5.90 MGD) = **2385 kg**
- **Trading ratio = 0.63 (Table 5-7)**
- **Hanover needs to buy 1758 kg**
- **Two Bridges can sell 0.63 *2385 kg = 1502 *equalized* kg**
- **Two Bridges new balance = 2385 kg – 2385 kg = 0 kg**
- **Hanover new balance = -1758 kg + 1502 kg = - 256 kg**
  - **Hanover must still buy 256 kg from other sellers**
- Note: Buyer must always be Category 2 discharger

# Passaic trading made simple

1. Are you a Category 1 or Category 2 discharger? (Check Table 5-4)
   - ❖ Only Category 2 dischargers are eligible to buy phosphorus allowances.
2. Which management area are you in? Check the Passaic Trading Framework to find out which management areas you can trade with.
3. Which point source zone are you in?
   - ❖ If you're in the Lower Passaic Zone 1 or 2, or trading with either of those zones, then trades are made on a seasonal basis (May-Oct, Nov-Apr)
   - ❖ Otherwise, trades are made on an annual basis (Jan – Dec)
4. What is your allocation? (Check Table 5-4)
5. How many kg/yr of TP do you expect to discharge? Is that number greater or less than your allocation?
6. Who do you want to trade with?
7. What is the trading ratio between you and the facility you want to trade with? (Check Table 5-7)
8. Apply the trading ratio (choose the ratio of seller to buyer in Table 5-7) to convert the *actual* TP sold into *equalized* kg bought
9. What balance will you have after trading? (Apply the trading formula on next slide)
10. *See Examples in Appendix 2*

# New Topics in WQT

- Trading with a water purveyor
- Trading unused capacity
- Accounting for surface water diversions
- Protecting more than one endpoint
- Trading with MS4s
- Trading sewage sludge and disposal capacity
- Effect of model uncertainty on water quality trading
- Achieving environmental justice

# Remaining steps

- Adopt the TMDL
- Publicize trading framework and trading ratios

http://www.water.rutgers.edu/Projects/trading/WQTrading.htm


## Water Quality Trading Program



***What is water quality trading?***

Water quality trading represents a market based approach to achieving better water quality at lower cost. It is an alternative to traditional command and control regulation. Not only does it hold the potential of reduced costs for point sources (factories, wastewater treatment plants, etc.) to comply with water quality standards, it may be the best way to encourage reduction of rampant non point source pollution such as agriculture and urban land use, which are not regulated by the Clean Water Act. Water quality trading is multi-disciplinary and integrates science, engineering, policy, and economics. Stakeholders in a trading program can include industries, wastewater treatment plants, local businesses, farmers, municipalities, environmental NGOs, government officials, and citizen groups.

Trading is based on the fact that sources in a watershed can face very different costs to control the same pollutant. A trading program allots a certain number of pollution credits to sources collocated in the same watershed. The sources can choose to pollute under their limit and sell their credits, or pollute over their limit and purchase credits. If the limits and credits are properly allocated, such as with a TMDL, the net effect will improve water quality in the watershed, at lower cost than making each individual pollutant source upgrade their equipment to comply. Trading can occur among point sources and nonpoint sources. Depending on the structure of the program, sources can trade directly or indirectly with each other. Several water quality trading programs are underway nationwide, and some have been very successful, including nitrogen trading in Long Island Sound, and nutrient trading in the North Carolina Tar-Pamlico River Basin. These programs are saving hundreds of millions of dollars while significantly reducing water pollution.

These are just some of the key issues which are important to making a successful trading program:

- Presence of a regulatory driver, such as a TMDL
- Presence of market drivers that make trading financially attractive
- Establishing a framework that reduces transaction costs and simplifies the trading process, while still being transparent and compliant with the Clean Water Act and state/local laws
- Avoiding hot spots of higher pollutant concentration and ensuring equity for lower income residents

***Source:*** US EPA Water Quality Trading Assessment Handbook (2004), available at http://www.epa.gov/owow/watershed/trading/handbook/

***What is the Passaic Water Quality Trading Project?***

Done

# Acknowledgements


- Passaic Project Team Faculty
- USEPA Region 2
- NJDEP
- Passaic River Basin Alliance
- Omni Environmental Inc.