

Non-tidal Passaic River and Pompton Lake Nutrient TMDLs

Presented by
NJ Department of Environmental Protection
Division of Watershed Management

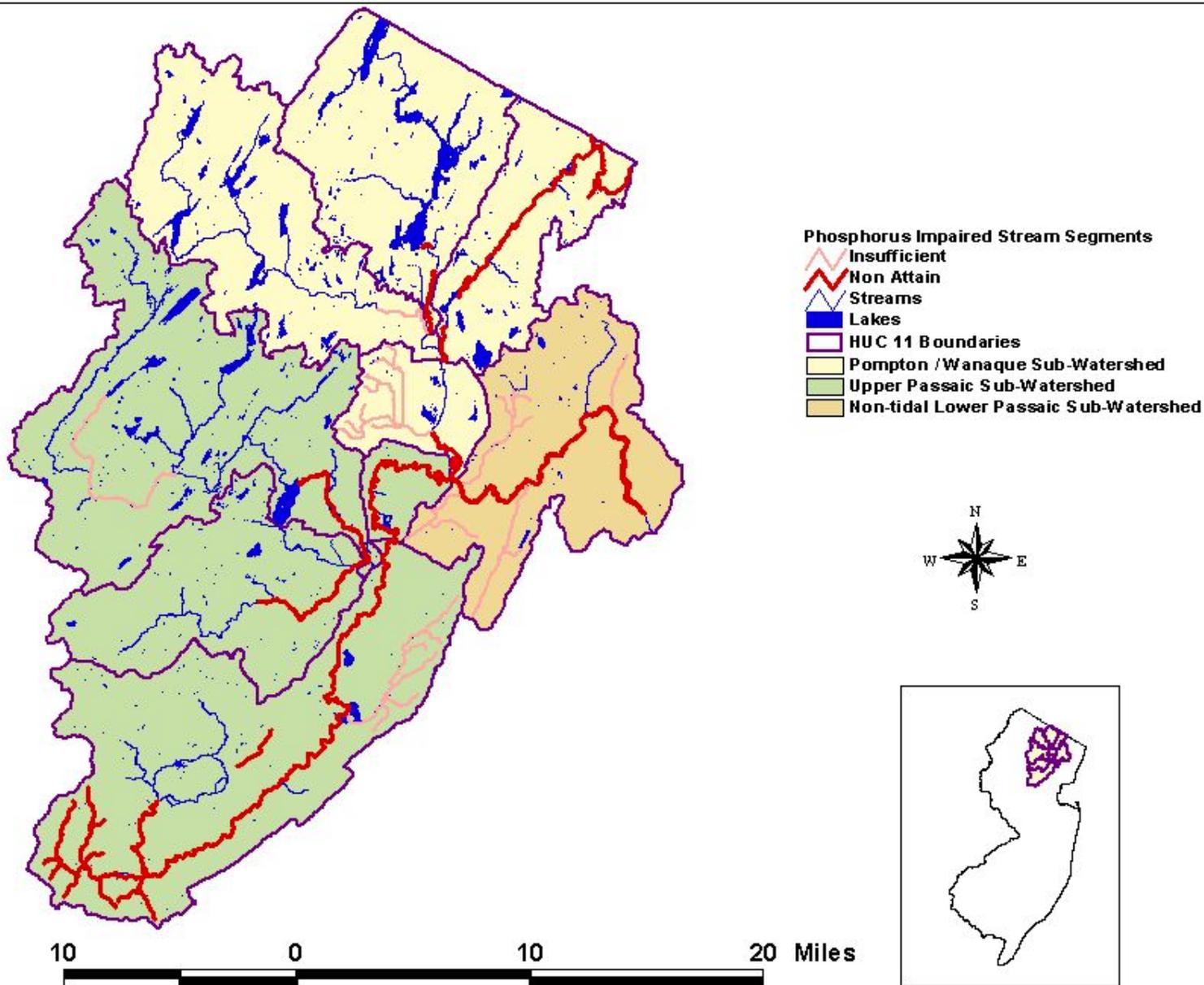
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Outline of Presentation

- Passaic Basin Overview, and Purpose of Study
- Surface Water Quality Standards (SWQS) for total phosphorus, and Watershed–Specific Criteria
- Models Summary, and Study Approach
- Model Scenarios
- Study Results
- LAs/WLAs, and effluent limits

Passaic River TMDL Subbasin Delineations Phosphorus Impaired Stream Segments



Background

- Stream reaches and HUC 14 drainage areas within the Non-tidal Passaic River Basin were listed as impaired for total phosphorus based solely on in-stream measurements of TP in excess of 0.1 mg/L
- While not listed, Phosphorus concentrations in the Wanaque Reservoir and Pompton Lake exceed the phosphorus lake criterion of 0.05 mg/L

Phosphorus Criteria

- Streams:

TP \leq 0.1 mg/l **unless** it can be demonstrated that TP is not a limiting nutrient **and**

TP will not otherwise render the waters unsuitable for designated uses

- Lakes, Ponds Reservoirs (and their tributaries & intakes)

TP \leq 0.05 mg/l

Except where watershed or site-specific criteria are developed

Nutrient Policies

N.J.A.C. 7:9B-1.5(g)2 & N.J.A.C. 7:9B-1.5(g)3

- Except as due to natural conditions, nutrients shall not be allowed in concentrations that cause objectionable algal densities, nuisance aquatic vegetation, or otherwise render the waters unsuitable for the designated uses
- Department may establish watershed or site specific criteria as necessary to protect uses

Are the Designated Uses Rendered Unsuitable Due to Phosphorus

■ Dissolved oxygen

- Does diurnal DO violate criteria?

■ Are algal densities excessive?

- Significant Water Column Algae (Phytoplankton)
- Significant Attached Algae (Periphyton)
- Significant Rooted Plants (Macrophytes)

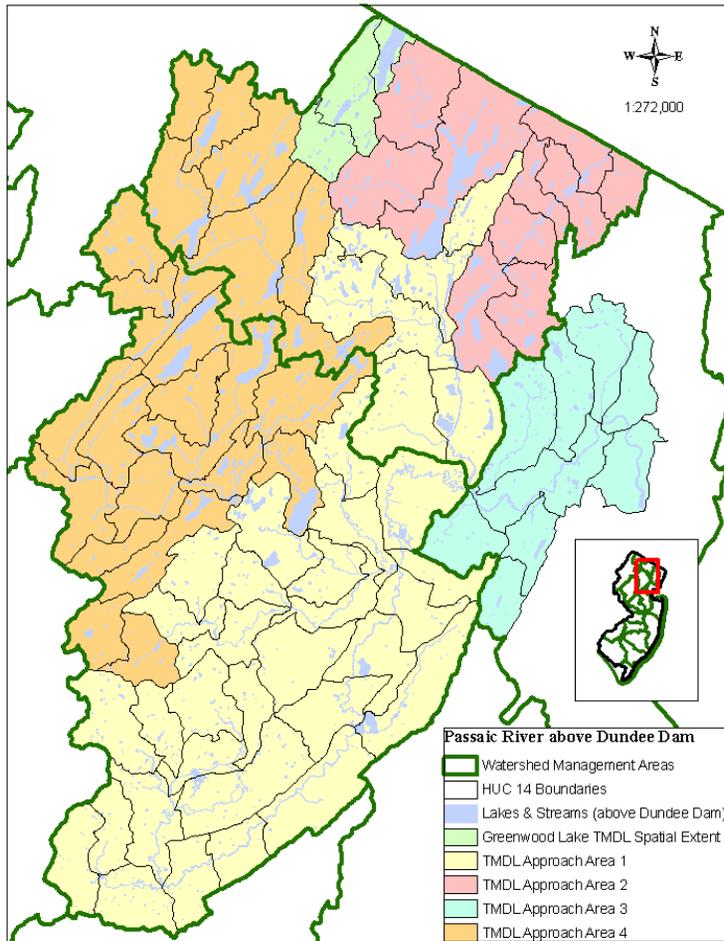
Purpose of Study

- To provide a scientifically defensible approach to establishing TMDLs for the Non-Tidal Passaic River Basin to address nutrient enrichment
- Identify critical locations and associated water quality targets
- Develop and apply comprehensive watershed models to relate nutrient sources to water quality targets at critical locations/conditions
- Calculate load and wasteload allocations to achieve water quality targets

Summary of Watershed Models

- Comprehensive watershed model to relate nutrient sources to water quality targets
 - Flow model: DA-FLOW (USGS)
 - Stream water quality model: WASP
 - Watershed Model Integration Tool: WAMIT (GIS Based)
- Reckhow and Mass-balance models provide boundary conditions to watershed model at Pompton lake
- LA-WATERS takes loads from models above and pumping scenarios to simulate water quality in Wanaque Reservoir
- Existing Greenwood Lake, Verona Park Lake TMDLs- provide boundary conditions; derived using Reckhow model

Spatial Extent of Model Approaches



Approach 1: Watershed Model above Wanaque intake

Approach 2: Mass balance loading model

Approach 3: Watershed Model below Wanaque intake

Approach 4: Boundary drainage to Watershed Model

Water Quality Data

- Sampling Program for Watershed Model
 - Data to Characterize Impairments and Calibrate Watershed Model
 - 3 high-flow events, 3 low-flow events, 8 ambient events
 - 38 stream locations
 - CBOD5, N Series, P Series, TSS, TDS
 - Diurnal dissolved oxygen, Phytoplankton, Periphyton
 - cross-sections, SOD, light intensity, plus much more!
 - Data to Characterize Nutrient Sources
 - 24 sewage treatment plants
 - 3 stormwater events at 8 locations
 - Additional Sampling to Explicitly Model Tributaries
 - Dead River, Rockaway River, Peckman River (13 locations total)
 - Other Calibration / Validation Data
 - NJDEP Diurnal DO Measurements from summer 2002
 - PVSC Historical Phytoplankton Chlorophyll-a
 - USGS Continuous DO and Temperature Measurements
 - PVWC Historical Stream Chemistry Data
 - Stream Chemistry Data from Dischargers

- Water quality data for Pompton lake, Ramapo River and Wanaque Reservoir TMDLs:
 - Ambient Surface Water Monitoring Network (NJDEP/USGS)
 - Pompton Lake Water Quality Sampling
 - PVWC Historical Stream Chemistry Data
 - NJDWSC Water Quality Sampling

General Observations and Assessment

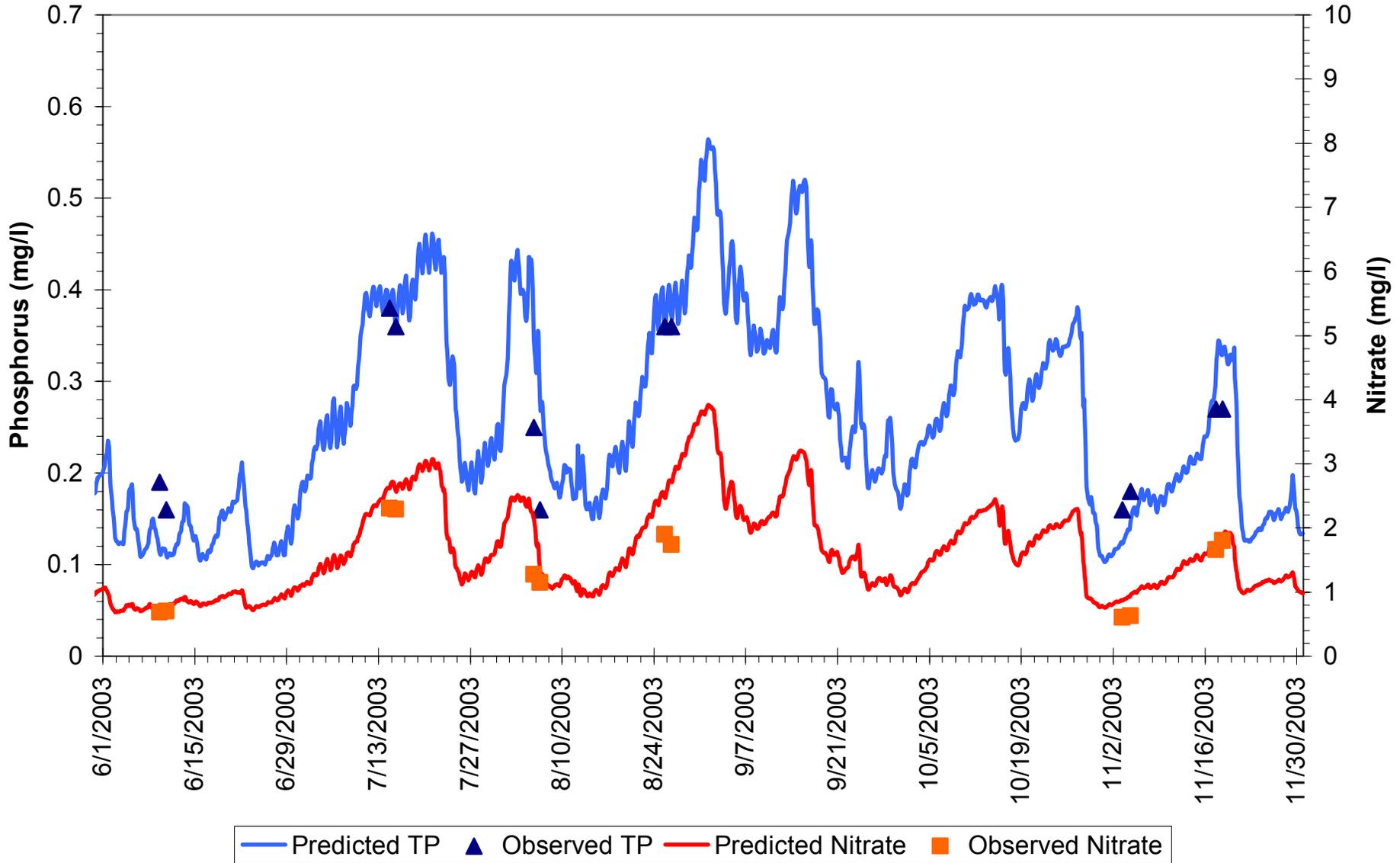
- Upper and Mid-Passaic River Watershed
 - Phosphorus is very high
 - Productivity is low
 - Few Macrophytes
 - Diurnal DO swings are generally small to none
 - Naturally low DO – productivity generally increases average DO
- Pompton River Watershed
 - Phosphorus is generally low
 - Productivity is low to moderate
 - DO is higher than Passaic
- Lower Passaic River Watershed
 - Phosphorus is very high
 - Productivity is very high under critical conditions
 - Water quality affected by excessive productivity
- Pompton lake Watershed
 - Total phosphorus concentrations exceed 0.05 mg/l criteria
 - Productivity in Pompton River is driven by boundary condition at Pompton Lake

Critical Locations

- Three critical locations are identified:
 - Wanaque Reservoir
 - Two Bridges Intake at Pompton/Passaic River Confluence
 - Pompton lakes Intake
 - Wanaque Reservoir drainage area
 - Passaic River at Dundee
 - Pompton lake

Calibration – Total Phosphorus and Nitrate

Passaic River above Dundee Dam (PA11)



Watershed Model Scenarios

dynamic 4-Year flow and water quality simulation (1999-2003)

- Existing Condition
 - Calibrated Model
- Baseline Future Condition
 - Permitted STP Flows and Concentrations
 - Existing Nonpoint Source Runoff
- Most Extreme Reduced Phosphorus Condition
 - Point sources reduced to 0.05 mg/l total phosphorus
 - Nonpoint runoff phosphorus reduced by 80% (*from developed land uses*)
- TMDL Condition

Water Quality Targets at Critical Locations

- Wanaque Reservoir
 - 10 $\mu\text{g/L}$ Chl-a as seasonal average
- Passaic River at Dundee
 - 20 $\mu\text{g/L}$ Chl-a as seasonal average
- Pompton Lake
 - Total phosphorus concentration of 0.05 mg/l

Watershed-Specific Criteria

Chlorophyll-a Criteria to Protect Designated Uses

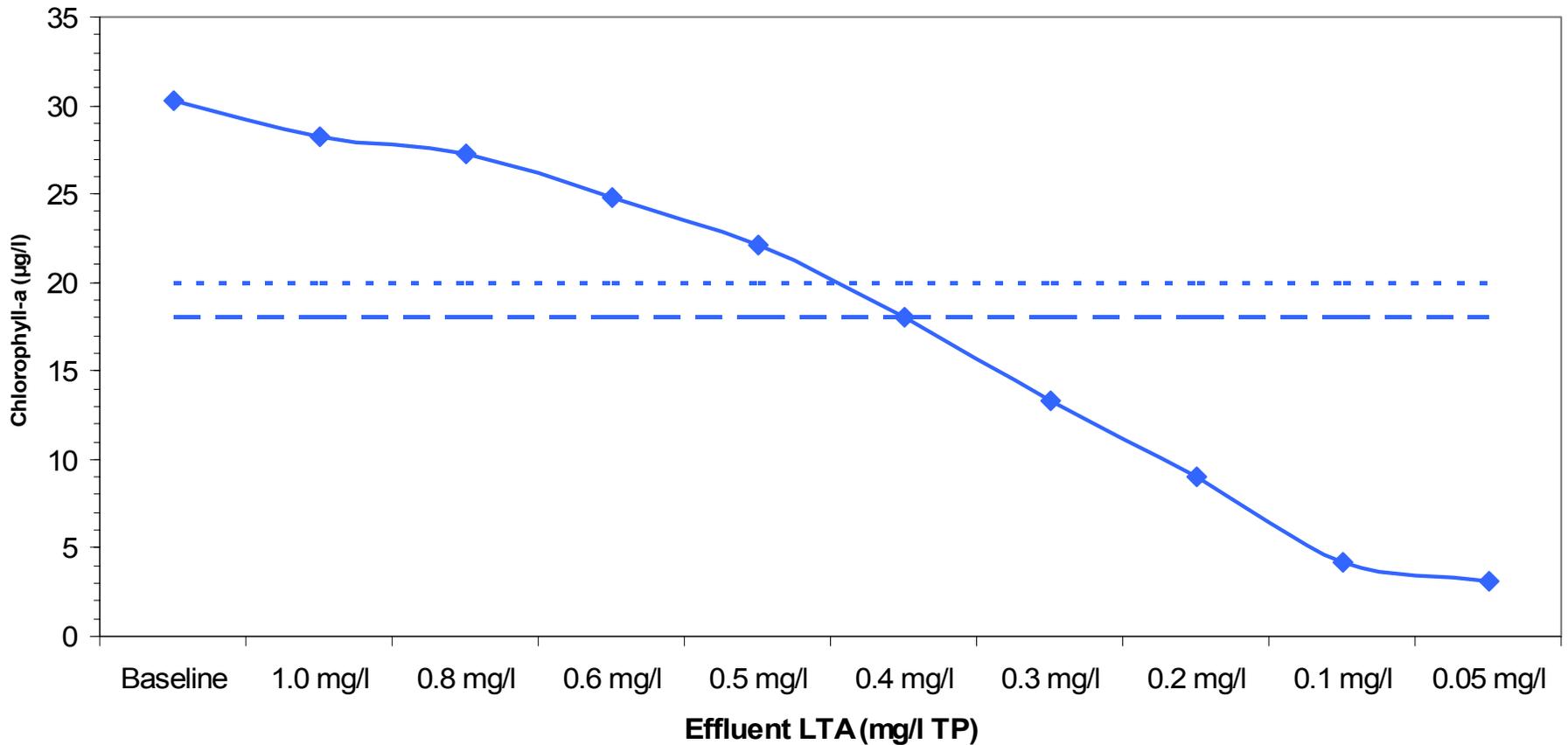
- Chlorophyll-a relates directly to the impairment of uses:
 - diurnal dissolved oxygen concentrations, which is highly depended on Chlorophyll a concentration, is the most critical parameters in the assessment of the aquatic life designated uses
 - algae blooms and its effect on taste, odor, toxicity, and water column transparency of water would impact recreational, water supply and fishery designated uses

TMDL Condition

- Point source effluent of 0.4 mg/l TP as Long-Term Average (LTA), and 60% Stormwater runoff load reduction from urban areas are required to achieve water quality targets at critical locations:
 - Wanaque Reservoir - Chl-a Endpoint = 10 $\mu\text{g}/\text{L}$ seasonal average
 - Passaic River at Dundee- Chl-a Endpoint = 20 $\mu\text{g}/\text{L}$ seasonal average
 - Pompton lake - Total phosphorus concentration of 0.05 mg/l
 - Boundary conditions at Greenwood Lake and Verona Park will be based on existing TMDLs
 - Other headwaters boundaries - existing permitted load

Impact of effluent TP concentration on phytoplankton

Passaic River at Dundee Dam (PA11)

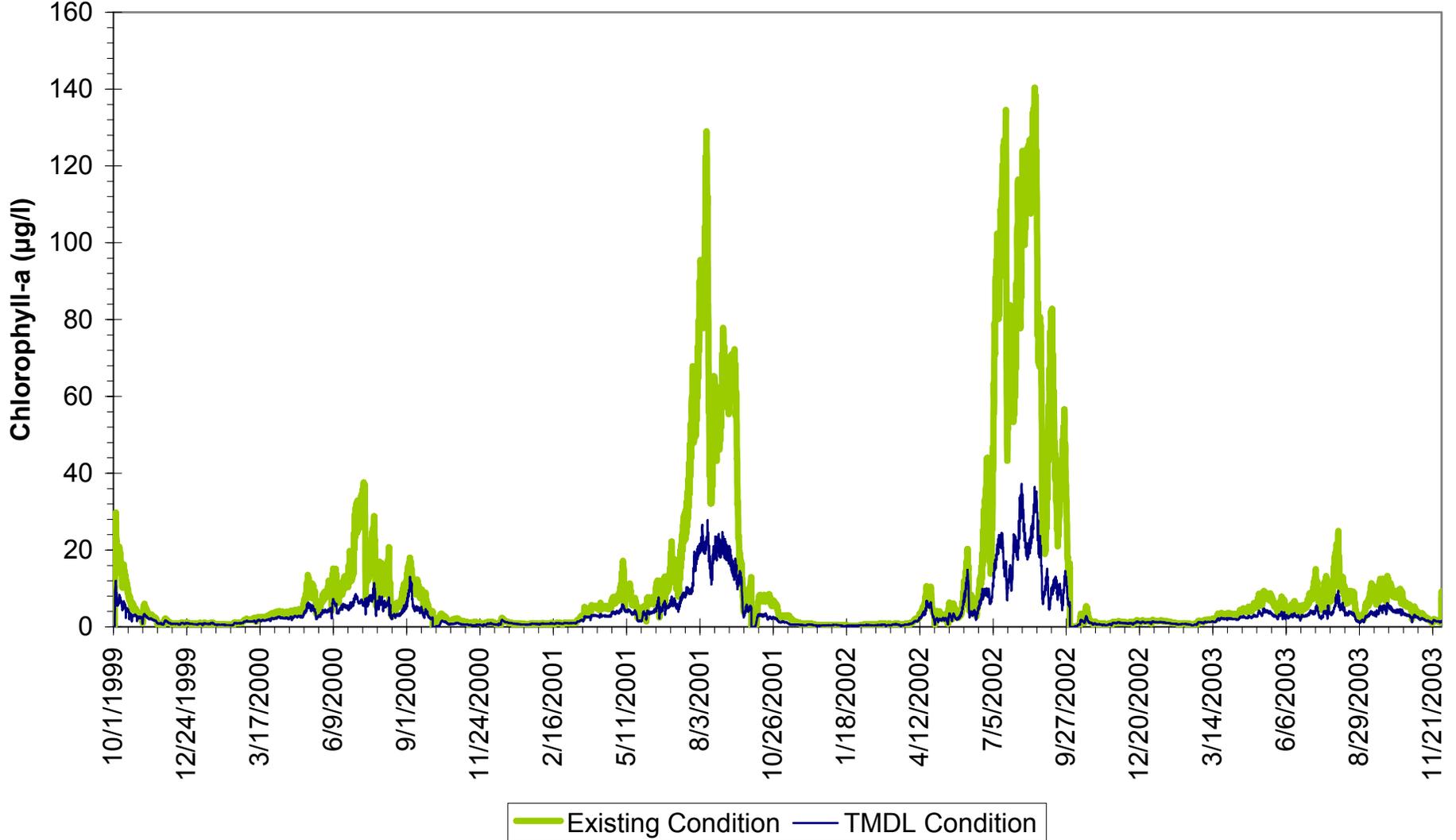


- - - Site-Specific Criterion (20 µg/l seasonal avg)

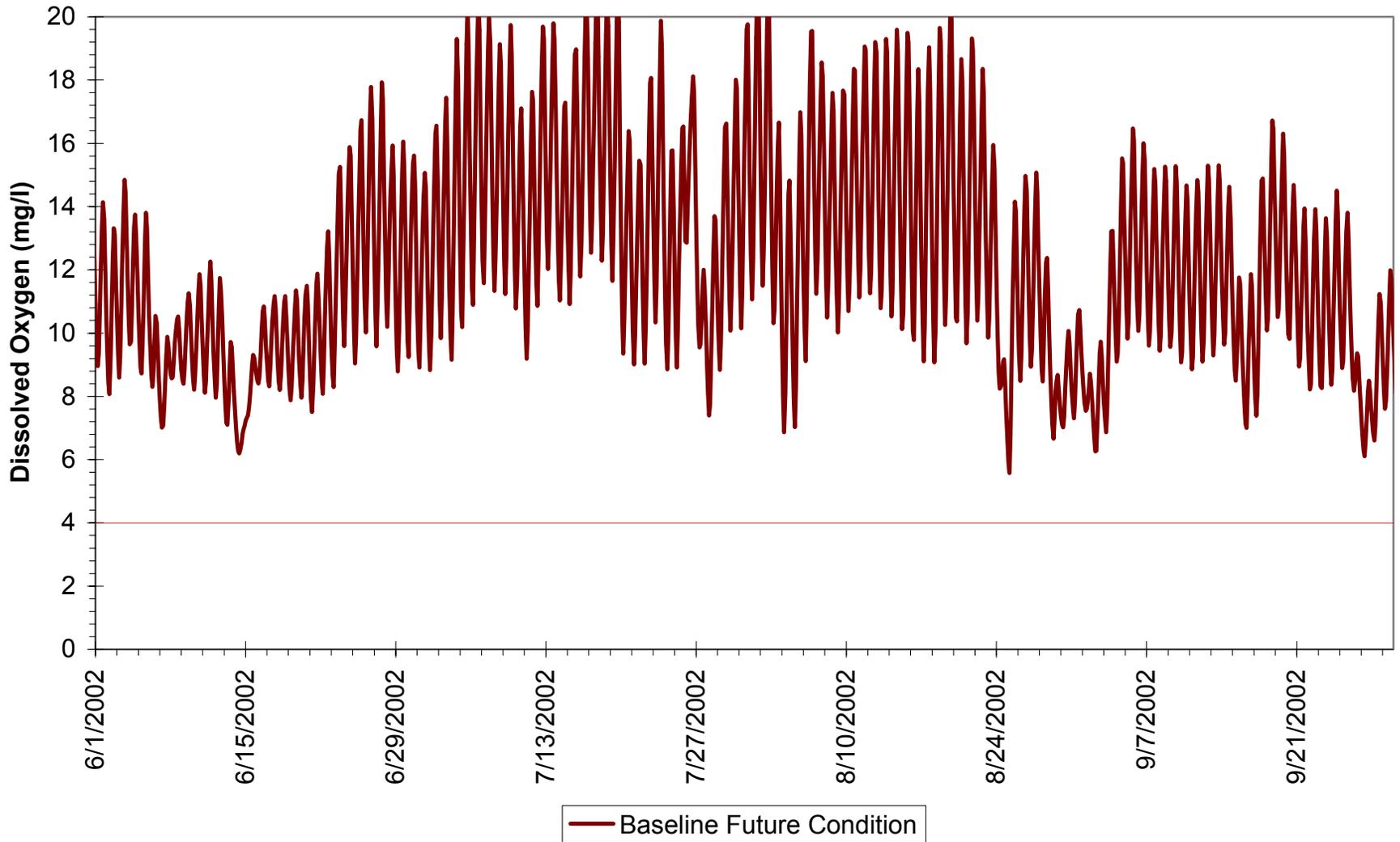
—◆— Summer Average (June 15 -August 31)

- - - Site-Specific Criterion w/ MoS (18 µg/l seasonal avg)

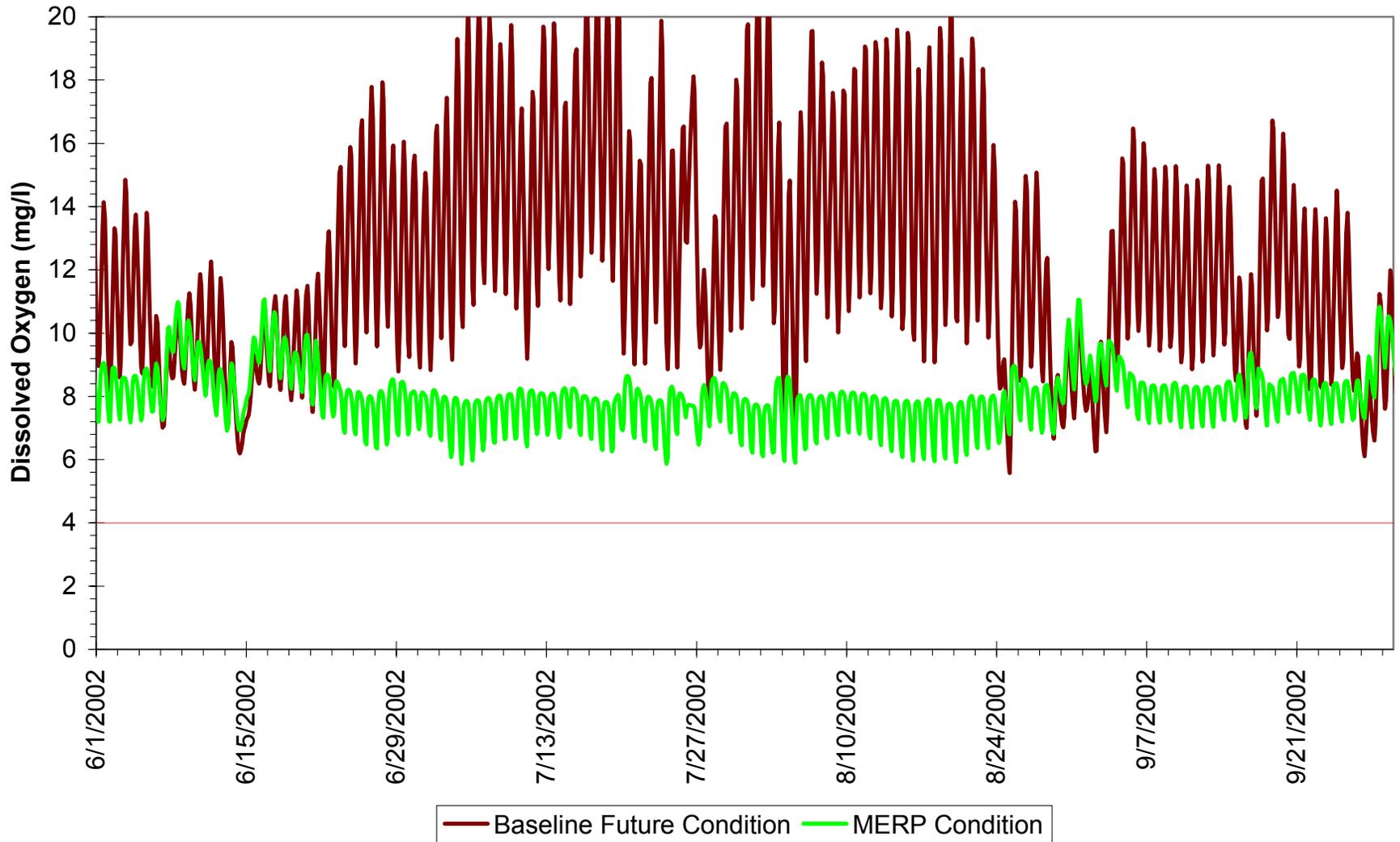
Benefits of Proposed TMDL Passaic River above Dundee Dam



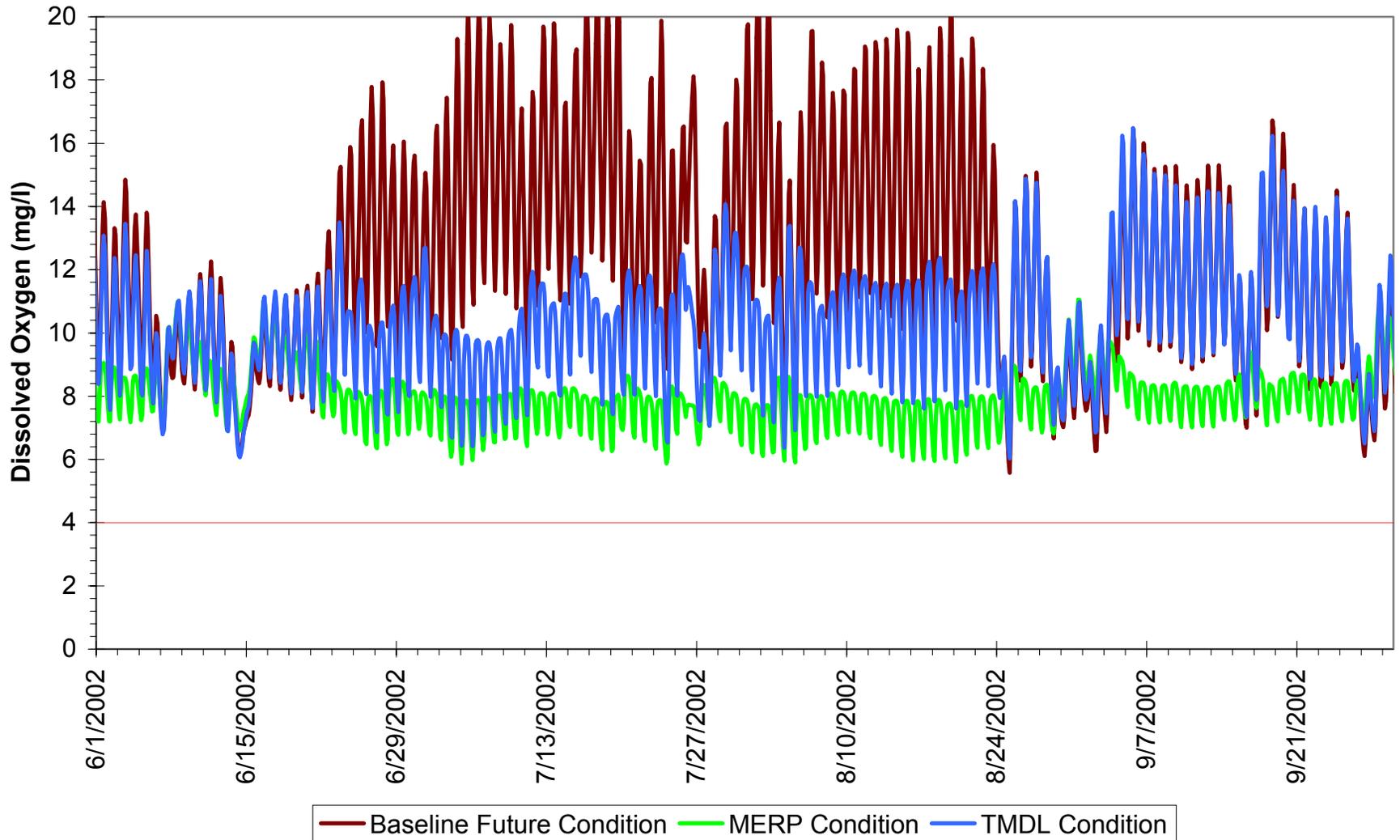
Passaic River above Dundee Dam (PA11)
(Impaired Segment: 'Passaic River at Elmwood Park, 01389880')



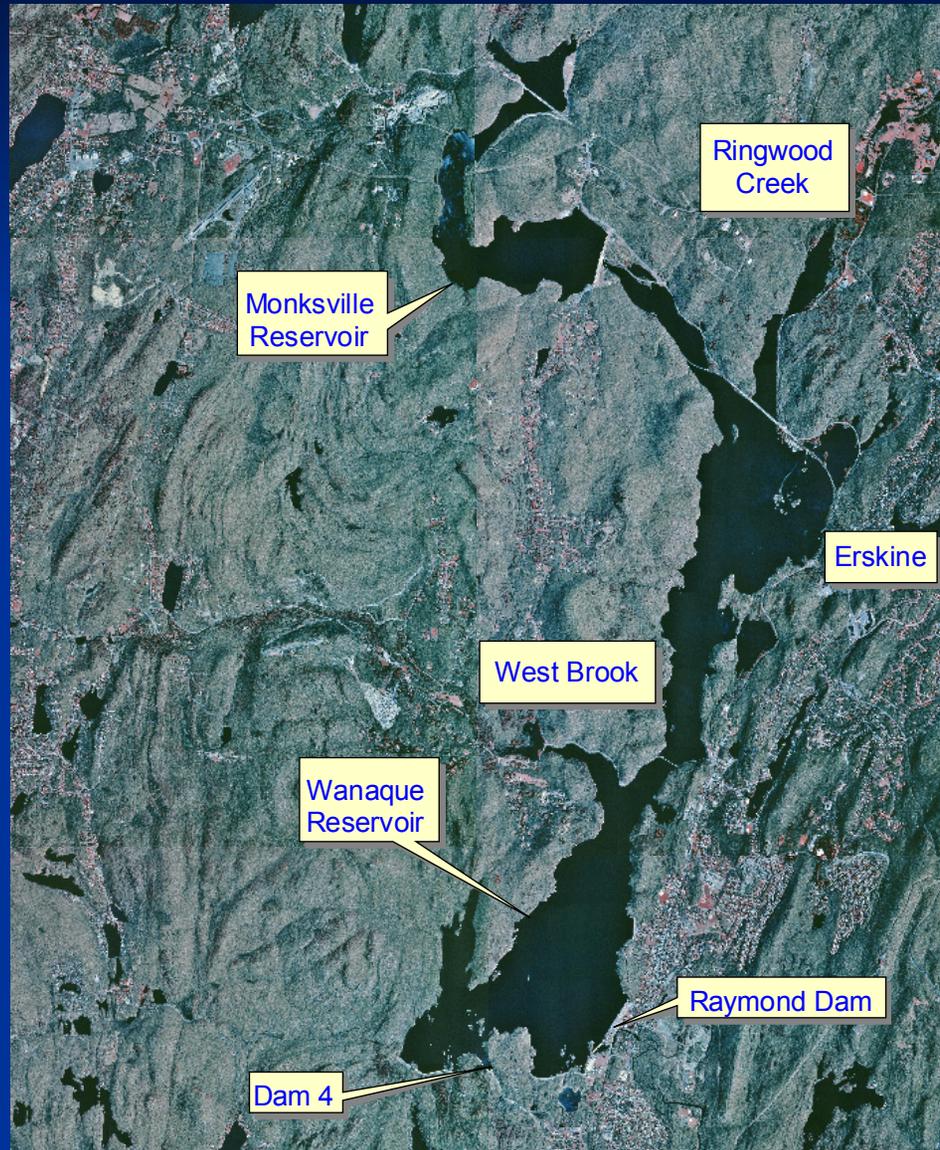
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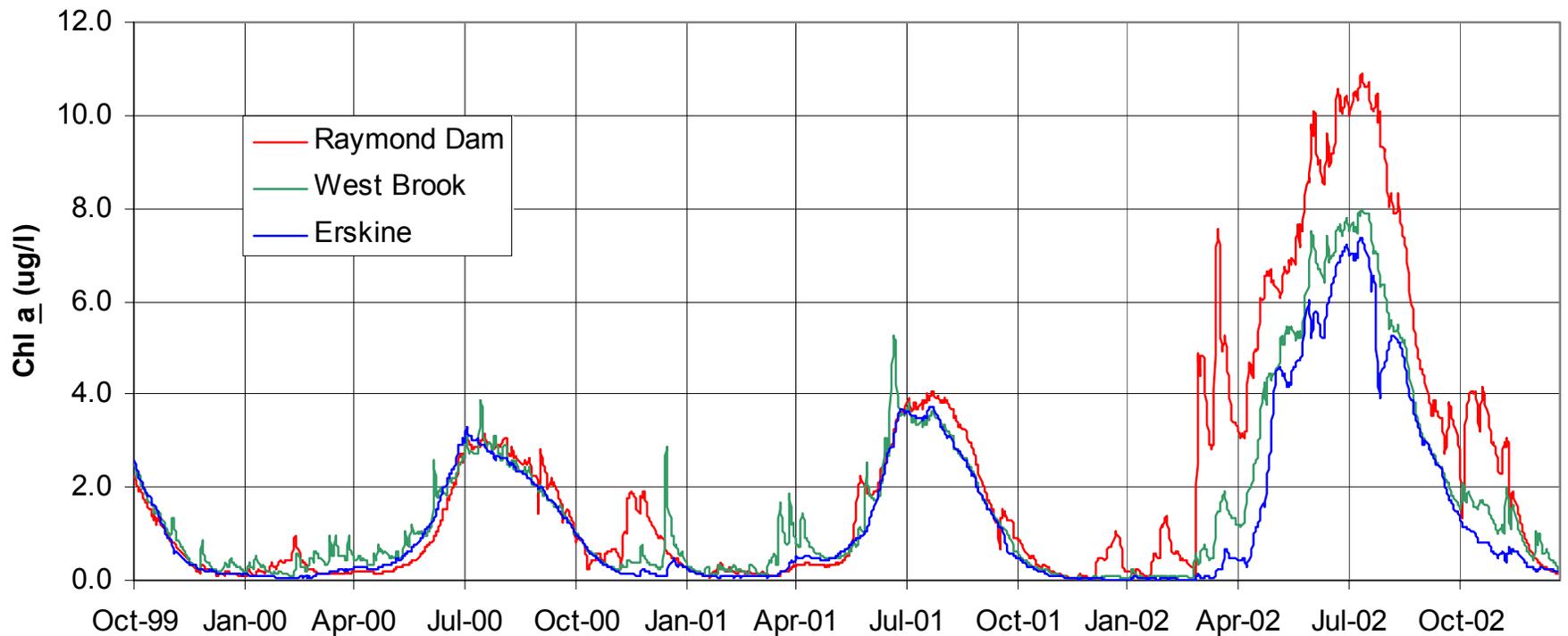


Wanaque Reservoir



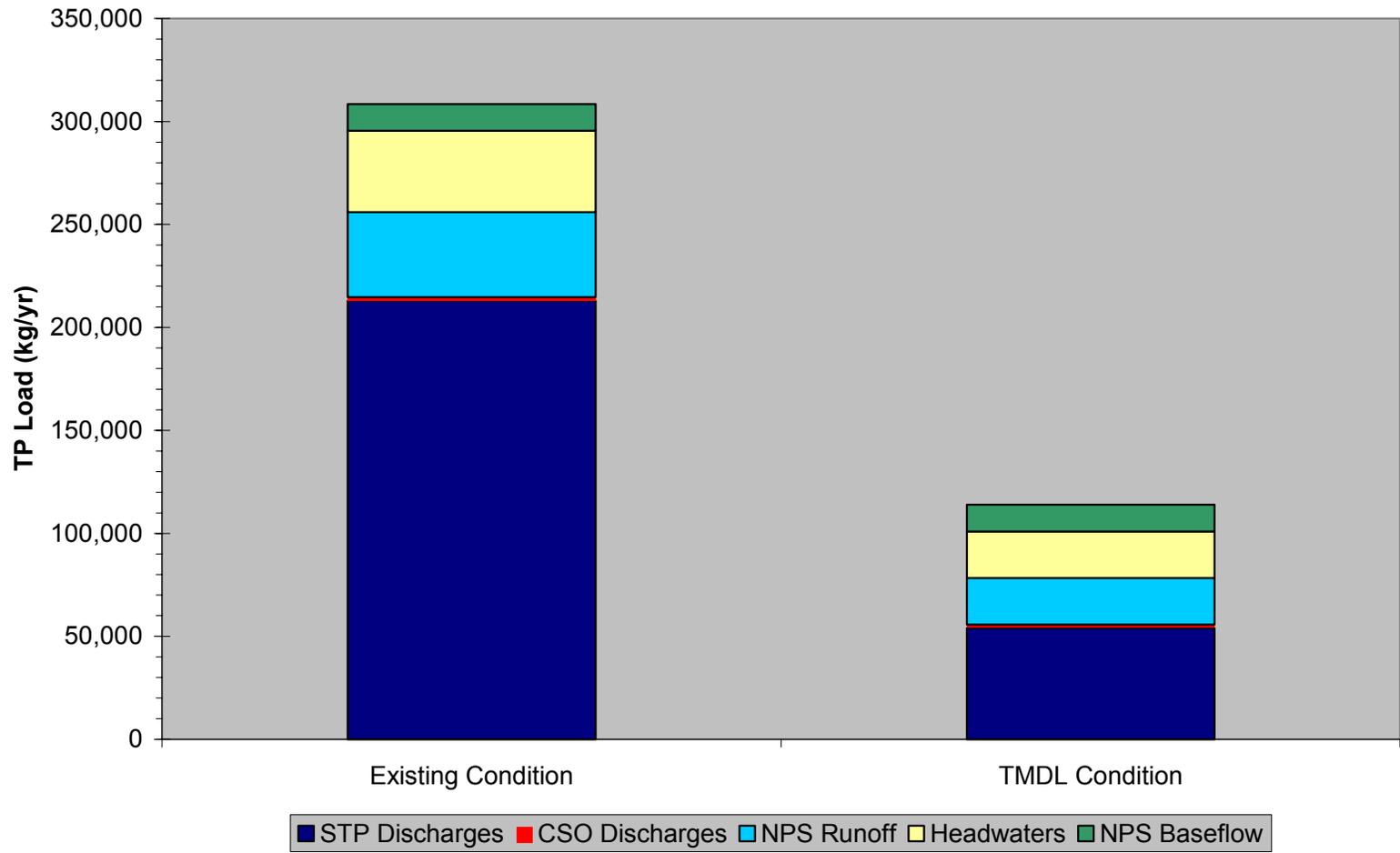
Simulated Chlorophyll a in the Wanaque Reservoir

Figure 2: Simulated Chlorophyll a in the Wanaque Reservoir
LTA = 0.4 mg/l and 60% NPS Load Allocation



TMDL Allocations

Annual Average Phosphorus Loads: Existing vs. TMDL



Nonpoint Source Reductions (LAs)

- NPS reductions vary by drainage areas
 - Greenwood Lake: 43%
 - Non-tidal Passaic model domain: 60%
 - Pompton Lake: 80%
- Reductions to be obtained primarily from urban land uses through
 - General permit measures
 - Additional measure: fertilizer ordinance

Point Source Reductions (WLA)

- EPA requires WLAs to be expressed as a mass per day per recent court decision
- In establishing effluent limits where there is an approved TMDL, the effluent limit must be consistent with the WLA; flexibility is allowed in how the effluent limit is expressed

Point Source Reductions (WLA)

- In general, within Approach areas 1 through 3: Phosphorus reduction from point sources is specified in terms of effluent Long Term Average (LTA) concentration of 0.4 mg/l
- Greenwood Lake point source reductions are based on Greenwood Lake TMDL
- Boundary condition dischargers will receive existing permitted load-based limits

(See Table 14 in the TMDL document)

Effluent Limit Calculations

- Phosphorus reduction from most point sources is specified in terms of effluent Long Term Limit (LTA) concentration of 0.4 mg/L
- Average Monthly Limits (AML) established for each point source in order to achieve 0.4 mg/L LTA while accounting for effluent variability
- Based on EPA "Technical Support Document for Water Quality Based Toxics Control, 1991 (TSD), An LTA of 0.4 mg/L would be implemented in a NJPDES permit as 0.76 mg/L AML

Acknowledgements

- Najarian & Associates
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- U.S. Geological Survey (USGS)
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Thank you