Florida Department of Environmental Protection

Division of Environmental Assessment and Restoration

Lake Jesup BMAP Technical Meeting

Lake Jesup Models Review

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June 22, 2016





Agenda

- Welcome and Introductions.
- Background and Project Overview.
- Lake Jesup Model Updates.
  - HSPF Model Results.
  - EFDC/WASP Models Results.
    - Lake Water Quality.
- General Allocation Approach.
- Next Steps.

Background

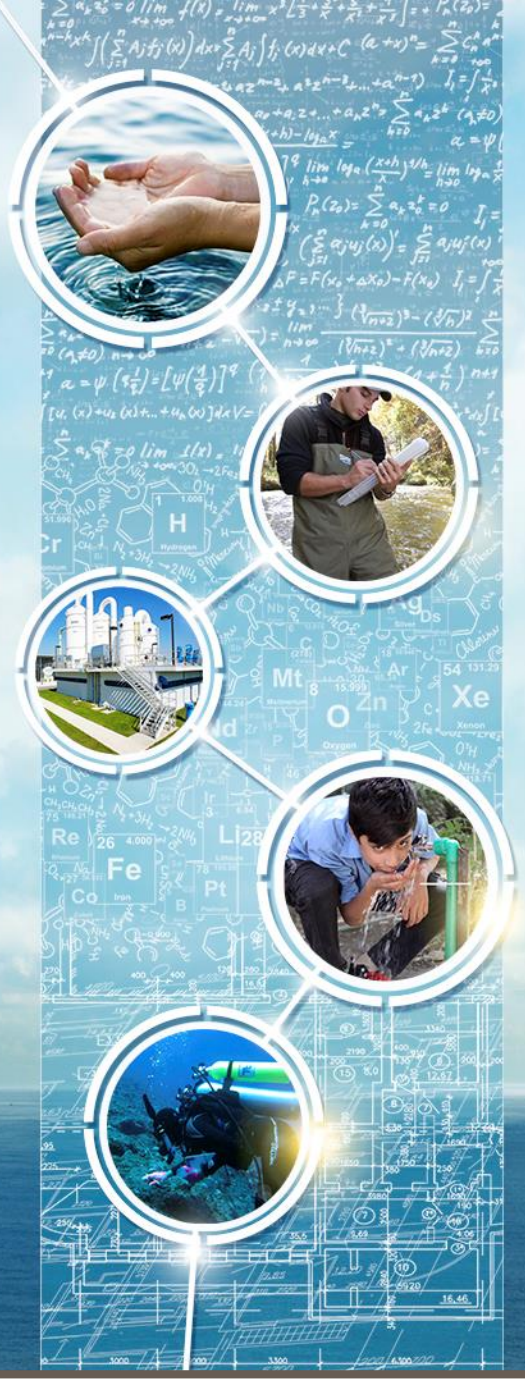
- April 2006.
  - Total maximum daily loads (TMDLs) adopted for total phosphorus (TP) and total nitrogen (TN).
- May 2010.
  - Basin Management Action Plan (BMAP) adopted.
  - Required reductions were split into three, five-year time periods.
    - The first iteration of the BMAP adopted to implement the TP TMDL.
    - TN load reductions would be included in the second iteration of the BMAP.
- During BMAP development, the stakeholders had concerns about the model used for the TMDLs.
  - The department and SJRWMD committed to developing a new model during the first BMAP iteration.

Project Overview

- SJRWMD developed 3 models for their Lake Jesup Pollutant Load Reduction Goal (PLRG).
  - Hydrologic Simulation Program – Fortran (HSPF).
  - Environmental Fluid Dynamic Code (EFDC).
  - Water Quality Analysis Simulation Program (WASP).
- The TMDLs and BMAP allocations require a different level of detail in the models than what was needed for the PLRG.
- Tetra Tech and AMEC were contracted by the department to evaluate and revise, as needed, SJRWMD's models.
- Project goals are to update the models for use in
  - Revising the TMDLs, as/if needed.
  - Updating BMAP allocations for future iterations.
- Revise models provide
  - More detailed watershed loading.
  - Updated land use coverage.
  - Updated urban best management practices (BMPs) coverage.
  - In-lake water quality dynamics.

Project Overview

- Task 1. Evaluate the Revision and Recalibration Needs for the Existing HSPF, EFDC, and WASP Model.
  - Completed.
    - October 2015.
      - Task 1 Memo made available to stakeholders.
- Task 2. Revise and Recalibrate the HSPF Model.
  - Completed.
    - May 2016.
      - Final Memo and updated model files available on ftp site.
- Task 3. Model Background Simulation and Model Output Format That Meets the Needs of BMAP Load Allocation.
  - Completed.
    - May 2016.
    - June 2016 – discuss general allocation approach.
- Task 4. Revise and Recalibrate the Receiving Water Models.
  - In progress.
    - June 2016.
      - Revised Draft Task 4 Memo and Revised Lake Jesup WASP/EFDC files available to stakeholders for comments and review.
        - Stakeholder comments/review to DEP by **July 11, 2016.**
      - DEP to approve final results.



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Lake Jesup Modeling Support – Model Results Updates

June 22, 2016

Brian Watson, PE, PH, D.WRE

Marcy Frick, REM

Presentation Overview

- Task 2 – Revise and Recalibrate the Hydrologic Simulation Program – FORTRAN (HSPF) Model
  - Updated watershed water quality results.
- Task 4 – Revise and Recalibrate the Receiving Water Models
  - Environmental Fluid Dynamics Code (EFDC) model hydrodynamic results.
  - Water Quality Analysis Simulation Program (WASP) water quality results and sediment diagenesis modeling.
- Task 3 – Model Background Simulation and Model Output Format That Meets the Needs of BMAP Load Allocation
  - GIS allocation file.
  - General allocation approach.

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Task 2 HSPF Model Results

Reminder - Task 2 Goals

- Extend the model simulation period through 2014.
- Redelineate subwatersheds.
- Incorporate revisions identified in the Task 1 memo.
  - Includes modifications to address stakeholder comments.
- Calibration was revised to focus on improving the statistics.

Water Quality Statistics Evaluation

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- The department requested that Tetra Tech use the general calibration/validation targets or tolerances for the HSPF model from Donigian (2002) and McCutcheon et al. (1990) to evaluate the model results.

Category	Water Quality/DO	Nutrients/Chlorophyll-a
Very Good	<15%	<30%
Good	15%-25%	30%-45%
Fair	25%-35%	45%-60%
Poor	>35%	>60%

Water Quality Error Statistics – Lakes

Waterbody	TN % Difference in Medians	TP % Difference in Medians
North Lake Triplet/ Prairie Lake (subwatershed 10)**	13%	-7%
	Very Good	Very Good
Fairy Lake (subwatershed 12)**	-11%	19%
	Very Good	Very Good
Greenwood Lake (subwatershed 17)	-51%	19%
	Fair	Very Good
Bear Gully Lake (subwatershed 42)	-22%	-2%
	Very Good	Very Good
Lake Burkett (subwatershed 44)**	-24%	25%
	Very Good	Very Good
Lake Howell (subwatershed 46)	-11%	11%
	Very Good	Very Good
Lake Waumpi (subwatershed 49)**	-2%	-1%
	Very Good	Very Good
Lake Gem (subwatershed 53)	9%	-25%
	Very Good	Very Good
Lake Sue (subwatershed 61)	-41%	7%
	Good	Very Good
Lake Rowena (subwatershed 63)**	-28%	24%
	Very Good	Very Good
Lake Adair (subwatershed 75)	-1%	-10%
	Very Good	Very Good
Lake Tuskawilla (subwatershed 91)	-4%	-19%
	Very Good	Very Good
Lake Alma (subwatershed 93)	-20%	2%
	Very Good	Very Good
Lake Searcy (subwatershed 94)	2%	-21%
	Very Good	Very Good

** BMAP monitoring stations

Water Quality Error Statistics – Streams

Waterbody	TN % Difference in Medians	TP % Difference in Medians
Gee Creek (subwatershed 15) **	-15%	17%
	Very Good	Very Good
Soldiers Creek (subwatershed 18) **	-25%	23%
	Very Good	Very Good
Navy Canal (subwatershed 27) **	4%	23%
	Very Good	Very Good
Ditch at Cameron Ave. (subwatershed 30) **	34%	6%
	Good	Very Good
Solary Canal/ Sweetwater Creek (subwatershed 38) **	8%	-58%
	Very Good	Fair
Bear Gully Creek (subwatershed 41)	48%	-44%
	Fair	Good
Howell Creek (subwatershed 45)	22%	-5%
	Very Good	Very Good
Weir at Howell Branch (subwatershed 51) **	25%	-17%
	Very Good	Very Good
Minnehaha (subwatershed 52)	-26%	25%
	Very Good	Very Good
Chub Creek (subwatershed 96) **	12%	-8%
	Very Good	Very Good
Salt Creek (subwatershed 98) **	-30%	-23%
	Good	Very Good

** BMAP monitoring stations

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Task 4 EFDC and WASP Model Results

Task 4 Goals

- Extend the model simulation period for both models (EFDC and WASP) through 2014.

- Incorporate revisions identified in the Task 1 memo.
  - Includes modifications to address stakeholder comments.

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EFDC Model Results

EFDC Model Structure

- Model inputs:
  - HSPF model flows, ground water seepage, and rainfall on lake surface.
    - All used as model flow boundaries.
  - USGS gage water surface elevation at lake outlet.
    - Used as lake elevation boundary.

- Hydrodynamic constituents:
  - Water surface elevation.
  - Flows.
  - Temperature.
  - Salinity.

EFDC Model Summary of Changes

- Converted to the public domain version of the model.
- Simulated temperature in EFDC.
- Revised the representation of ground water flows.
  - Added as a set of 10 discrete flow sources to the model grid to represent the ground water inputs using time series of flow, temperature, and salinity.
- Revised the watershed runoff salinities to 0 and made the river and ground water the sources of salinity.
- Updated the atmospheric files using nearby weather records.
- Revised the roughness coefficients to more realistic values.
- Forced the model with hourly values of water surface elevations available at USGS 02234435.

EFDC Model Results

- EFDC model results were reviewed in detail during the last meeting.

- Model well calibrated:
  - Good flow statistics.

USGS Station	Error in 5th Percentile	Error in Median	Error in 95th Percentile
02334425	-0.6%	5.1%	-2.1%
	Very Good	Very Good	Very Good

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WASP Model Results

WASP Model Structure

- Model inputs:
  - HSPF model watershed loads.
  - Ground water loads.
  - St. Johns River nutrient loads.
  - EFDC hydrodynamic results.
  - Nitrogen fixation loads.

- Water quality constituents:
  - Sediment diagenesis.
  - Dissolved oxygen.
  - Biochemical oxygen demand (BOD).
  - TP.
  - TN.
  - Chlorophyll-a.

WASP Model Summary of Changes

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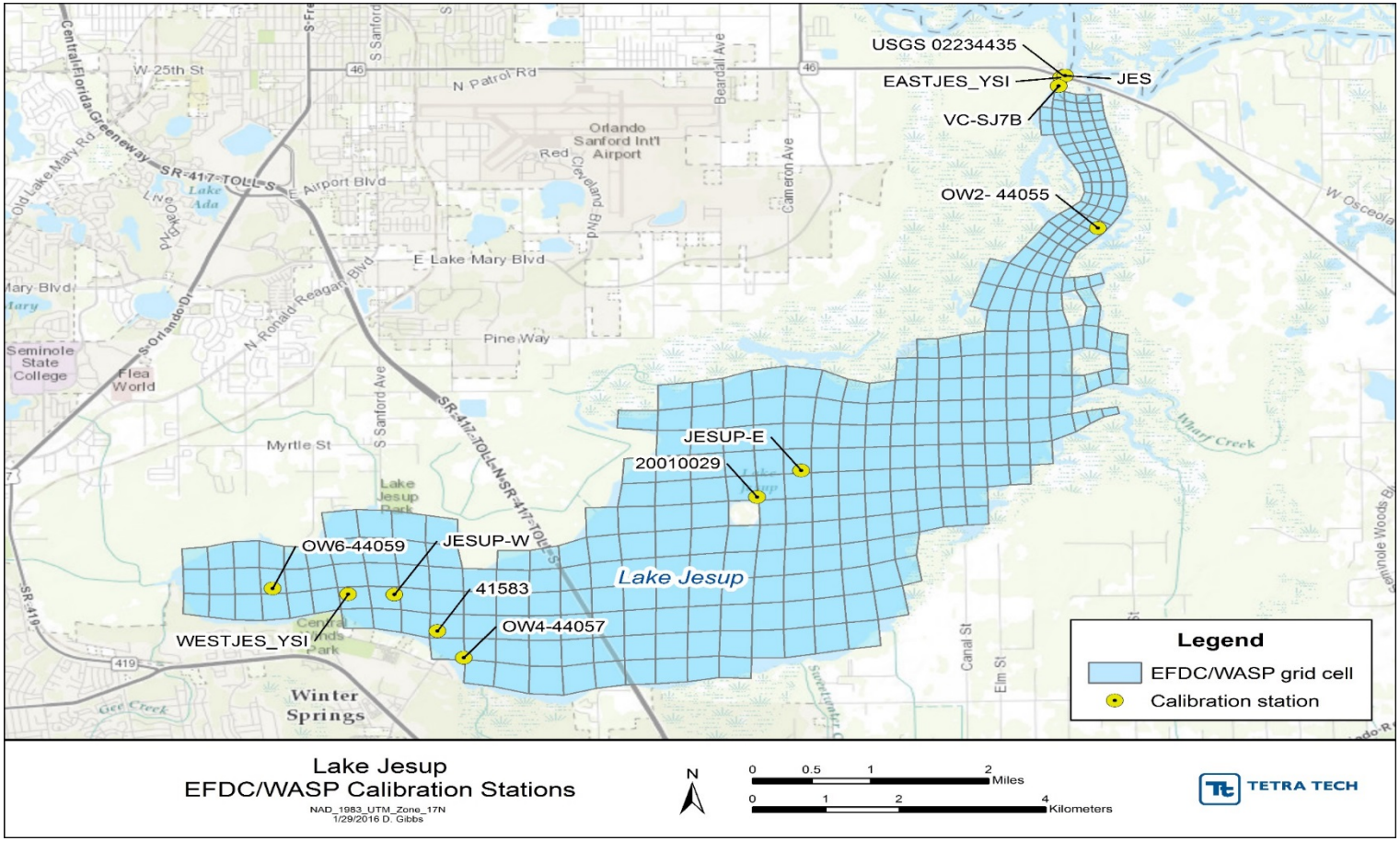
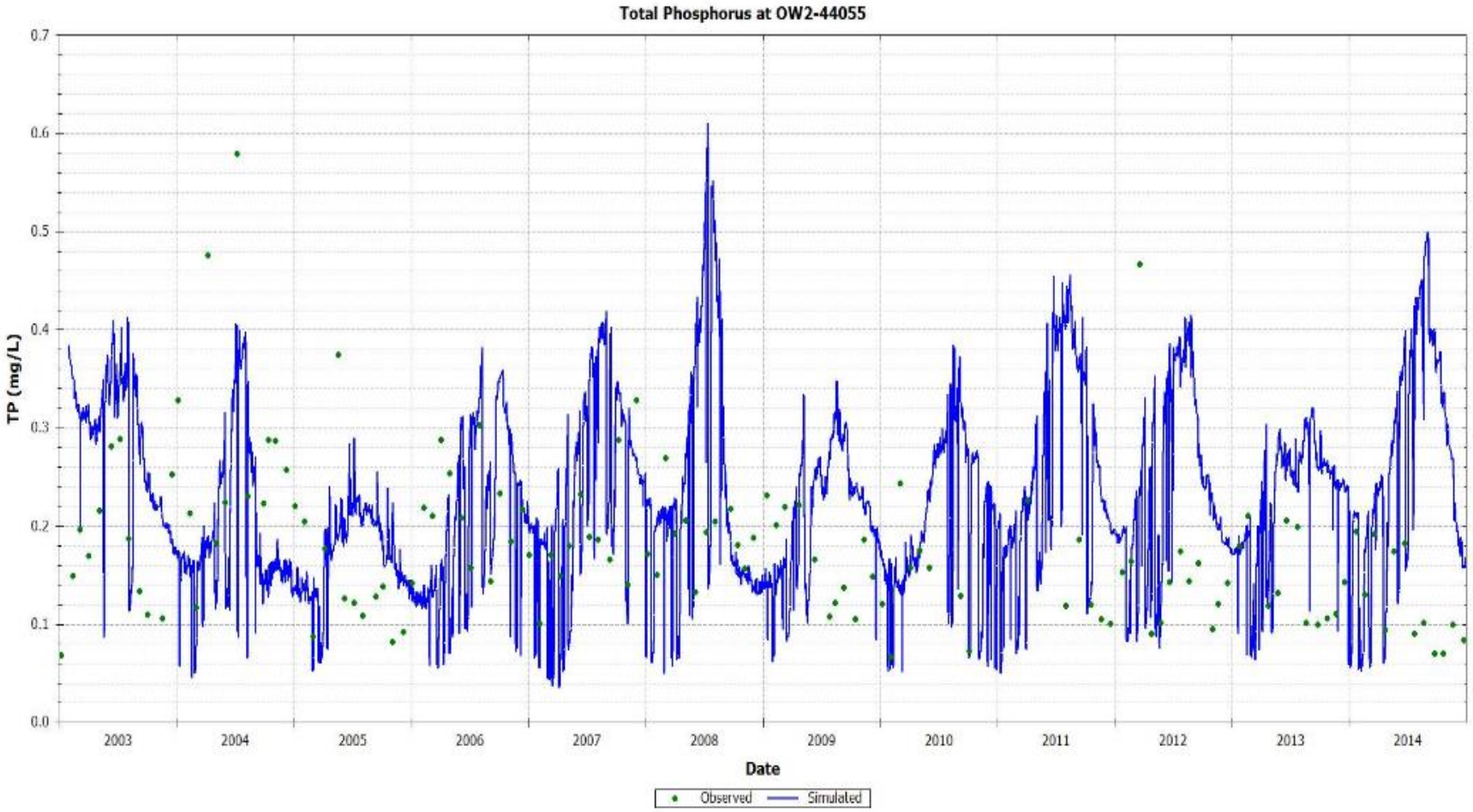
- Updated the model to latest version (WASP 7.5.2).
- Activated sediment diagenesis in the model.
  - Using this to determine SOD and nutrient fluxes in the lake.
- Included model comparisons to available records for additional monitoring stations.

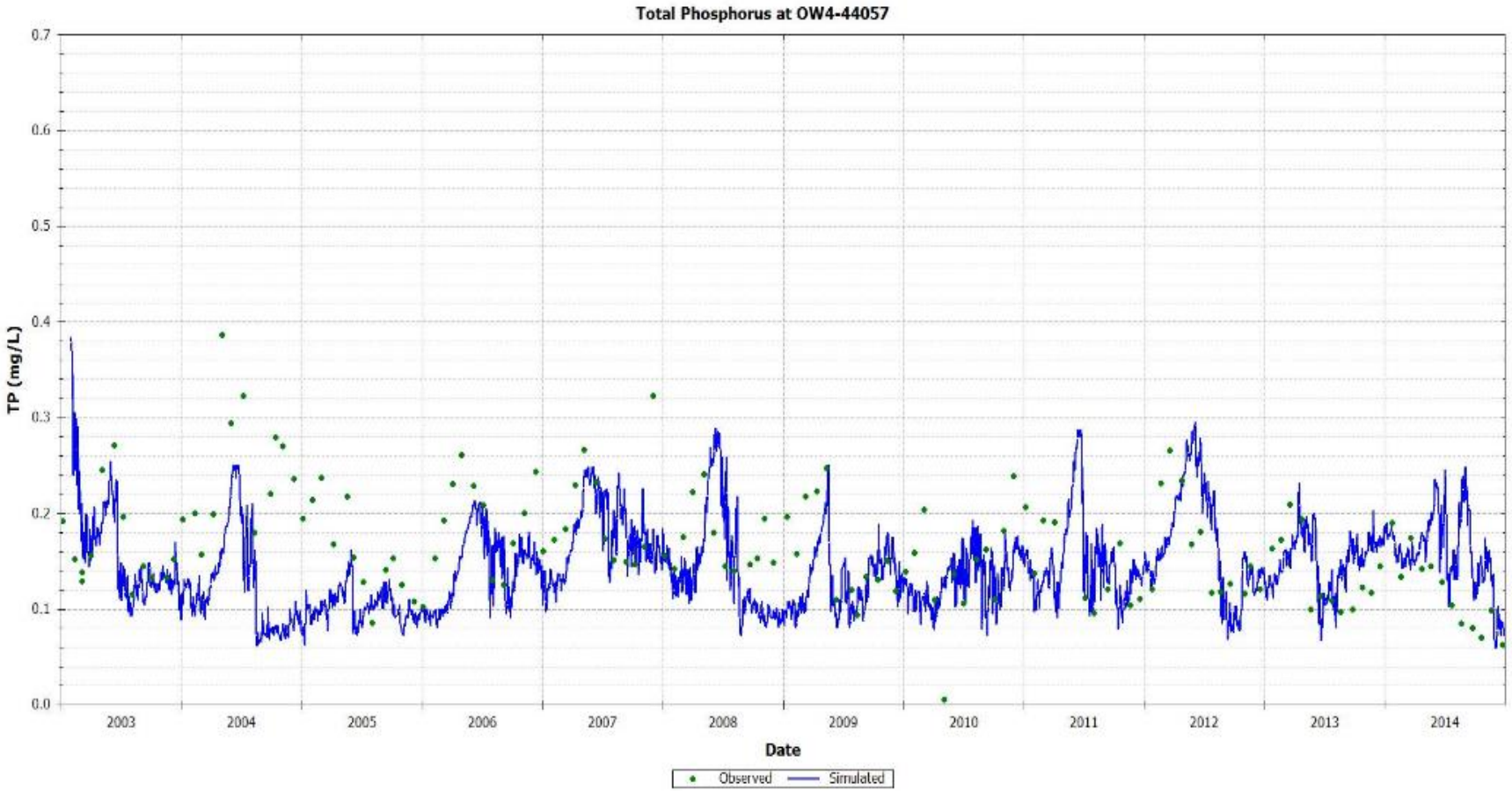
WASP Station Location Map



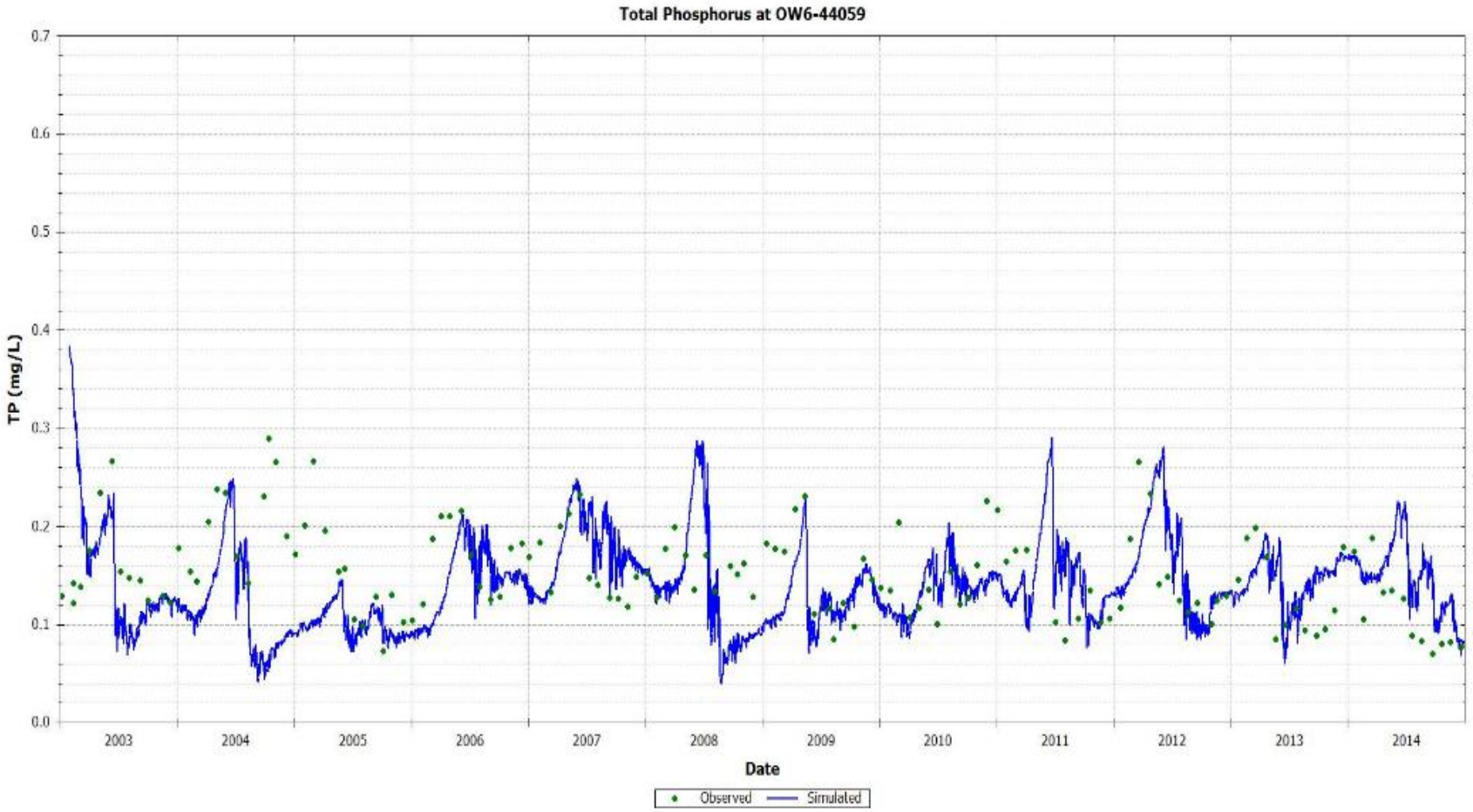
TP Results Station OW2, 44055



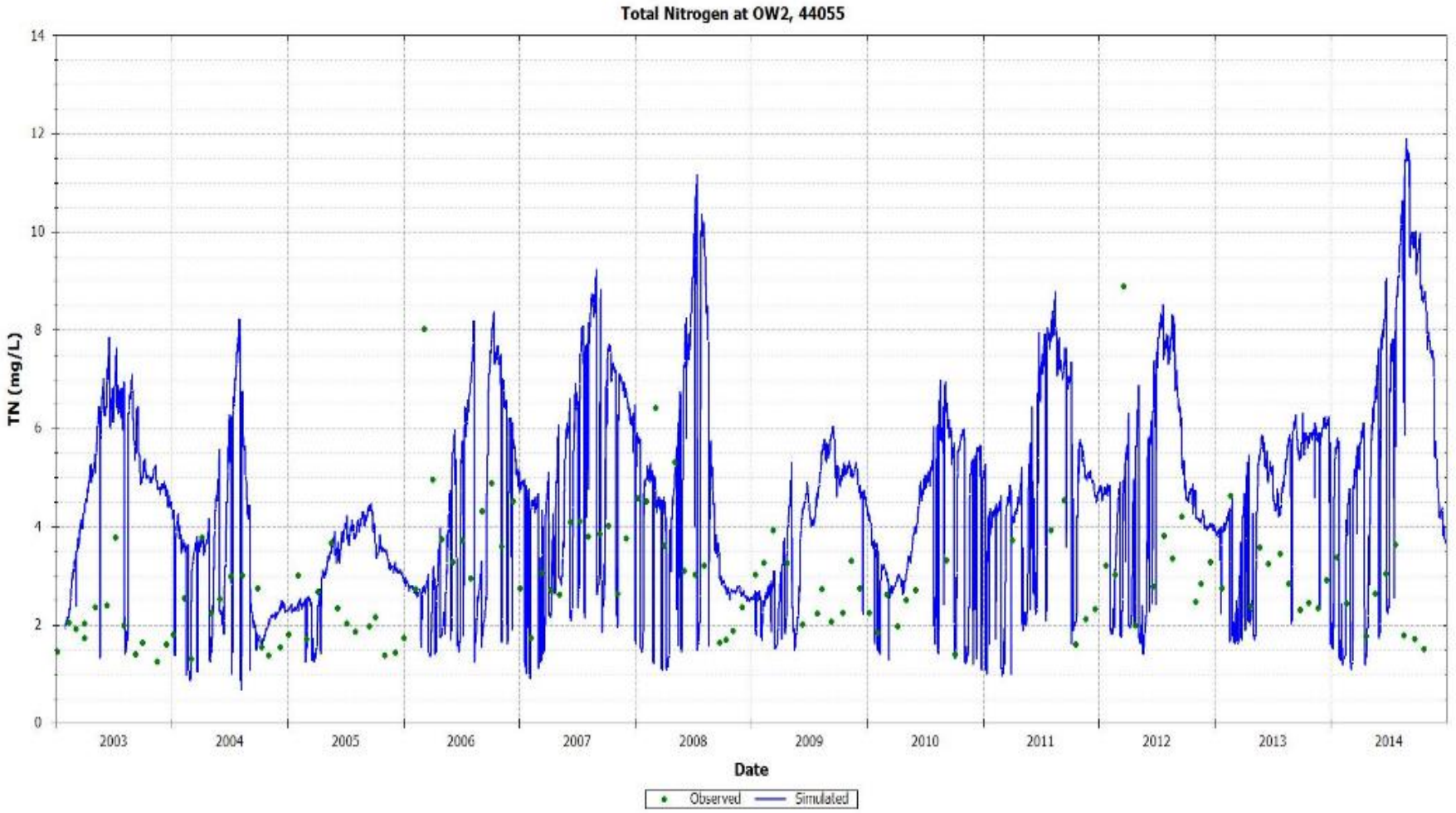
TP Results Station OW4, 44057



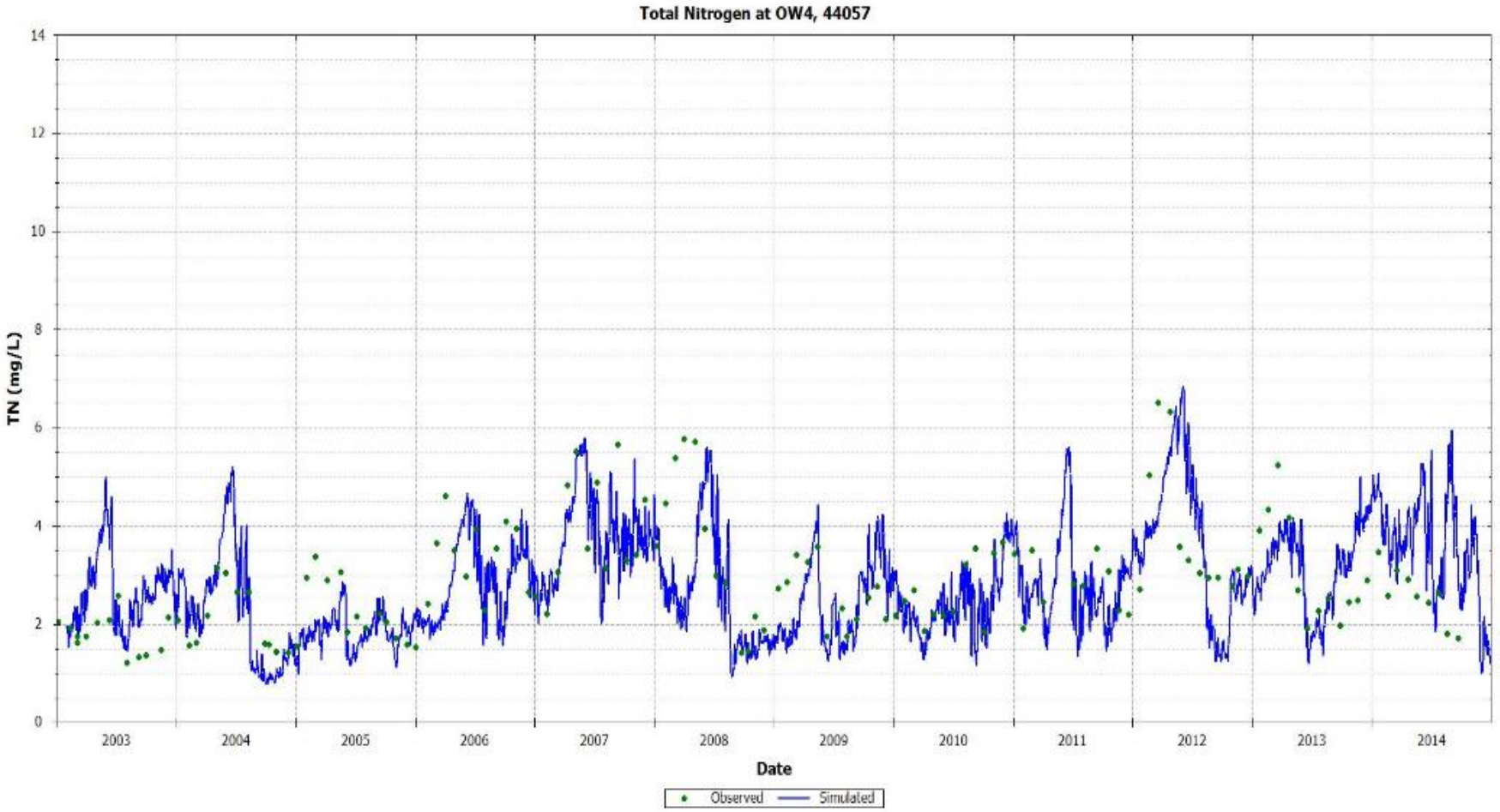
TP Results Station OW6, 44059



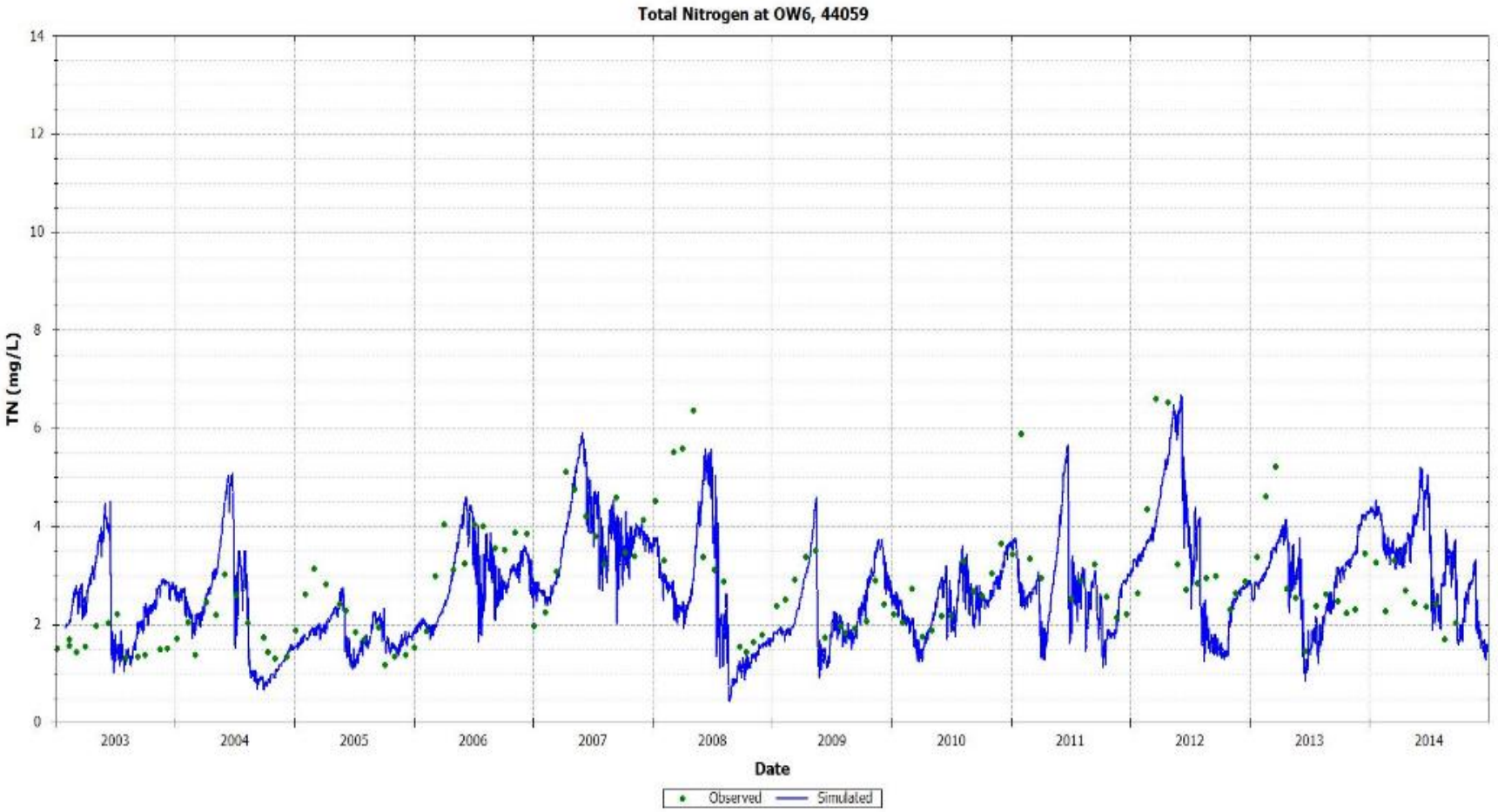
TN Results Station OW2, 44055



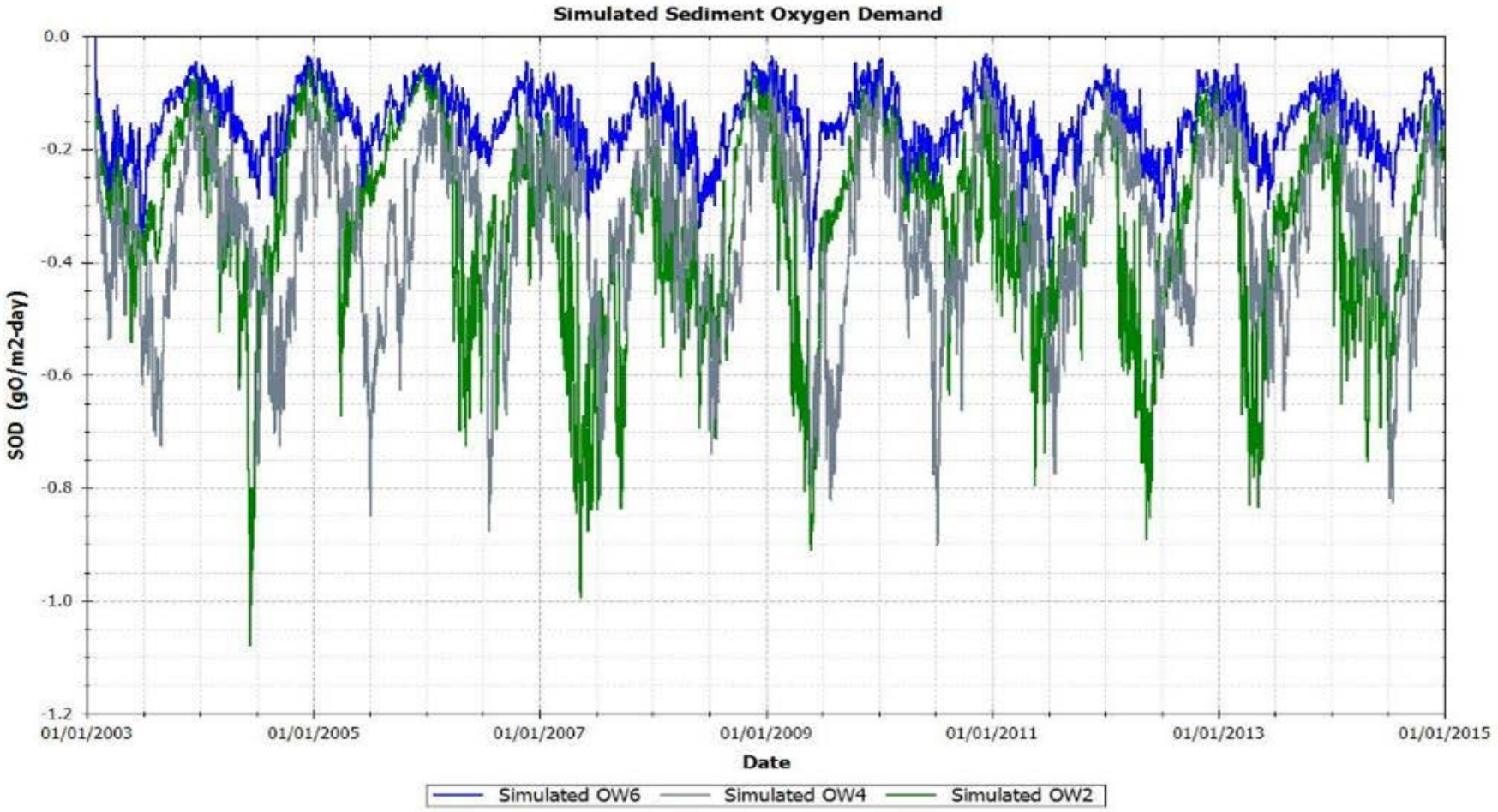
TN Results Station OW4, 44057



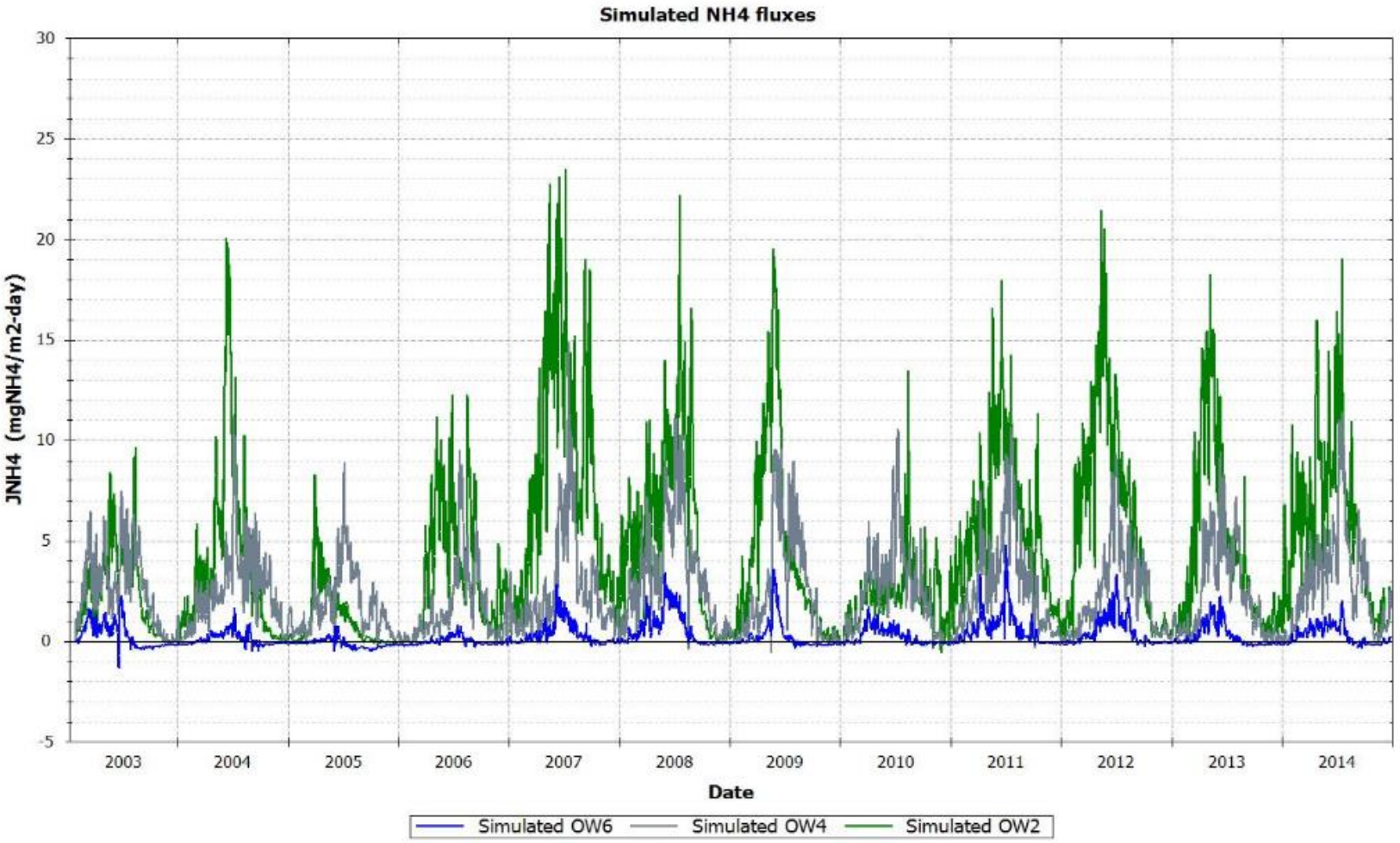
TN Results Station OW6, 44059



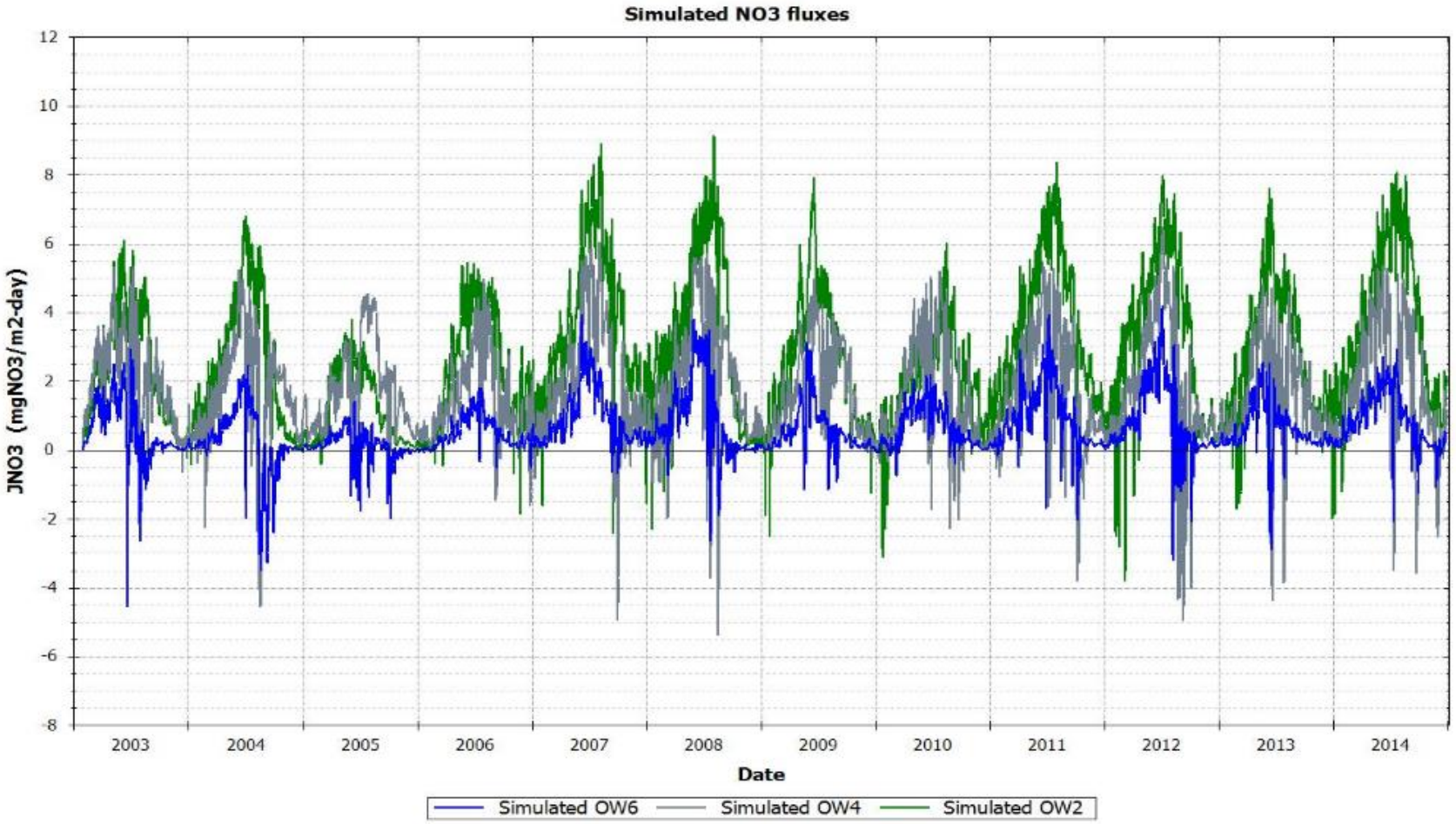
Sediment Oxygen Demand (SOD)



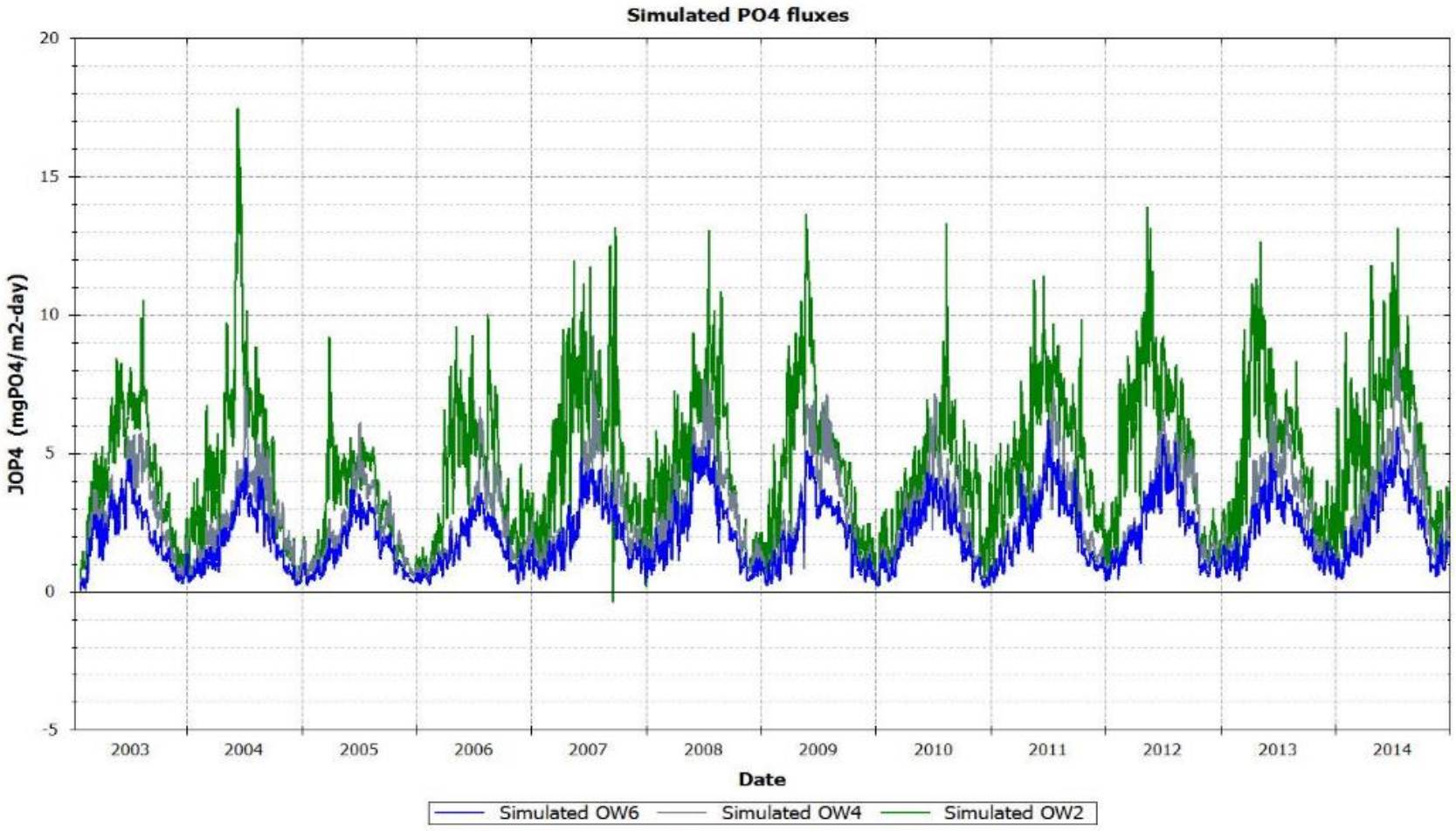
Nutrient Fluxes – NH_4



Nutrient Fluxes – NO_3



Nutrient Fluxes – PO_4



Summary of Loading by Source

Parameter	Watershed Load (lbs/yr)	Atmospheric Deposition Load (lbs/yr)	Ground Water Seepage Load (lbs/yr)	Sediment Flux Load (lbs/yr)
TN	328,745	78,000	73,696	43,480
TP	24,352	6,200	8,844	61,820

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Task 3 – Allocation GIS File

Task 3 – GIS Allocation File

- HSPF model output was used to create a GIS file of watershed loading.
- Includes TN loading, TP loading, and attenuation factors from model.
  - Total loading to lake is the sum of the attenuated loading.
- GIS file will be used to develop allocations:
  - Stakeholder jurisdictional boundaries will be clipped to the watershed model to determine starting loads for responsible area.
  - Project treated areas can also be overlaid with the GIS file to determine the total load treated.

Proposed Allocation Approach

- In-lake target concentrations are still reasonable.
- Start with current TMDL percent reductions to determine if those reductions are enough or need to be adjusted.
- Stakeholders will not be responsible for making reductions to atmospheric deposition or natural lands loading.
  - These loads will be kept constant.
- Stakeholders will be assigned reductions for the watershed loading.
- Process to address in-lake nutrient reductions will be identified.

Next Steps
BMAP 2nd Iteration

- 2016.
  - 3rd Quarter.
    - Determine allocations.
    - New project identification.
    - Update jurisdictional boundaries.
    - Update project calculations from the first BMAP (if needed).
    - Stakeholder meetings to develop the second BMAP iteration.
    - Update the monitoring plan (if needed).
    - Develop 2nd BMAP Iteration.
  - 4th Quarter.
    - Adopt 2nd BMAP Iteration.


Questions?
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