Lake Wister 2017: Progress & Prospects

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Acknowledgements:

- Thad Scott, Baylor University
- Brian Haggard, University of Arkansas
- Choctaw Nation of Oklahoma
- City of Poteau
- AES
- US Geological Survey
- Oklahoma Conservation Commission
“we don’t want to get to be as bad as Lake Wister…”
Lake Wister Water Quality Modeling in Support of Nutrient and Sediment TMDL Development

Prepared for:

Poteau Valley Improvement Authority

and

Oklahoma Department of Environmental Quality

Prepared by:

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and

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Bio x Design

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**Graph 1:**
- 5-year Average Chlorophyll-a (ug/L)
- External P only
- +90% Int P Reduction
- \( y = -0.1246x + 19.636 \)
- \( R^2 = 0.9992 \)

**Graph 2:**
- Annual Average Chlorophyll-a (ug/L)
- Data points for 10%, 25%, 50%, 75%, 100%, 150%, 200% Ext P and Int P x Ext
- \( y = 134.51x + 6.663 \)
- \( R^2 = 0.9165 \)
Learning from Recent Modeling Projects

Shanon Phillips- OCC
Steve Patterson- BioXDesign
OCLWA April 5-6, 2017
Lake Wister, August 1998
Lake Wister Annual Average Turbidity

- NTU
- 1992 to 2012
- Turbidity
- State Threshold (25 NTU)
“model simulations indicate that water quality impairments in the lake are not the result of short-term watershed loadings but are the result of accumulated nutrients/solids that cause [internal] sediment nutrient fluxes…”

“In general, a [watershed area:lake surface area] ratio of greater than 50:1 indicates that…watershed [processes] are likely to dominate lake water quality. Obviously, Lake Wister is not one of these “normal” lakes.”
“The model *underestimates* annual total P to the lake by as much as 42%” (ODEQ 2010: 11).

The period selected for [lake] model calibration was **May 1, 2001 to October 31, 2001**  
(AMEC & Dynamic Solutions 2008:13)

There was no validation of the model.

No sediment P flux data was used in calibration.

Benthic sediment P fluxes were *“increased...until the best calibration results were obtained”*  
(AMEC & Dynamic Solutions 2008:25).
Sediment phosphorus flux in an Oklahoma reservoir suggests reconsideration of watershed management planning

B. E. Haggard a, J. T. Scott b & S. Patterson c
The importance of good data

**Lake Wister Loads 2011-2015**

<table>
<thead>
<tr>
<th>Year</th>
<th>Total P Load (kg/yr)</th>
<th>Total Suspended Solids Load (kg/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>199,048</td>
<td>131,745,019</td>
</tr>
<tr>
<td>2012</td>
<td>97,279</td>
<td>50,955,204</td>
</tr>
<tr>
<td>2013</td>
<td>209,387</td>
<td>128,828,296</td>
</tr>
<tr>
<td>2014</td>
<td>110,410</td>
<td>62,713,491</td>
</tr>
<tr>
<td>2015</td>
<td>492,813</td>
<td>338,558,256</td>
</tr>
<tr>
<td>Average</td>
<td>221,787</td>
<td>142,560,053</td>
</tr>
</tbody>
</table>
Lake model results:

• Watershed processes dominate in-lake processes
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- Watershed processes dominate in-lake processes
  - e.g., for Total Phosphorus, about 3:1
  - and, for Total Suspended Solids, about 2.3:1
What was happening in 1998?

- 1996 – Permanent conservation pool elevation raised 5.4 ‘
  - Killed 3,254 acres of seasonally flooded forest


- Followed by:
  - Summer 1998 – extreme drought
Recommendations:

- Data – accept no substitute
  - Take the time, collect the data
  - Stop trying to use models in the absence of adequate data

- Create multidisciplinary teams
  - In particular, include limnologists and ecologists who know something
    - (1) about how lakes function and
    - (2) about the lake or other system being modeled