Update to Lake Elsinore and Canyon Lake Nutrient TMDL Task Force

Lake model migration updates, supplemental lake water quality model scenarios, alum application decision guidance

Steven Wolosoff, CDM Smith
Dr. Paula Kulis, CDM Smith
Dr. Michael Anderson

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CDM Smith

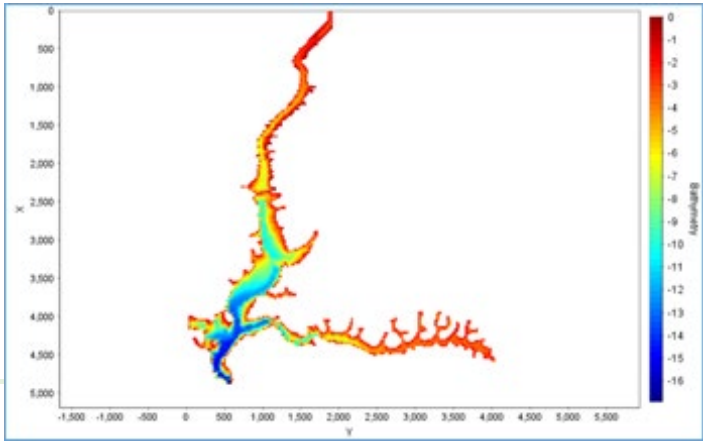
Outline

- Lake model migration updates
  - GLM
  - AEM3D
- Supplemental lake water quality model scenarios
  - Alternative reference scenario
  - Sensitivity analysis
- Alum application decision guidance
  - Mobilization thresholds based on in-lake TP results

Lake Model Migration Updates

AEM3D: Canyon Lake

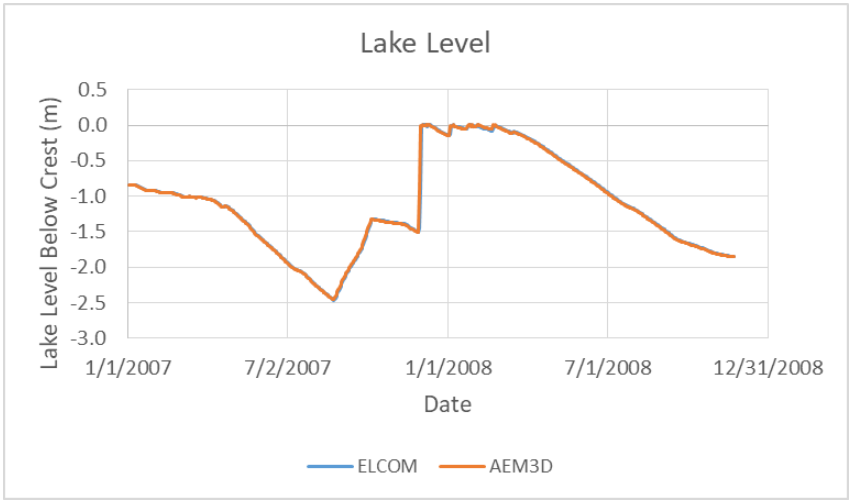
- AEM3D is a 3-D hydrodynamic-water model developed to replace ELCOM-CAEDYM
- Several of the original contributors to ELCOM-CAEDYM have assisted with the revisions to the code
- Input files from ELCOM-CAEDYM calibration simulation have been migrated over to AEM3D
- Comparision with prior ELCOM-CAEDYM results conducted

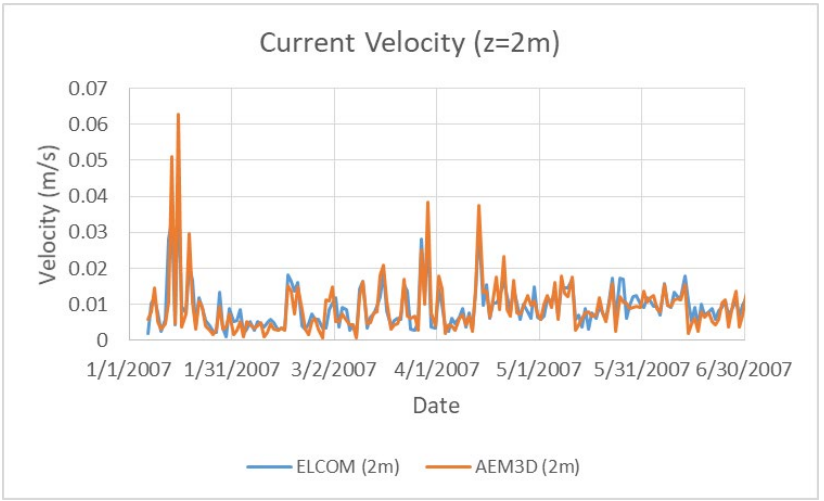


Model grid: 4712 lateral cells (20x20 m), up to 57 vertical layers (0.3 m each)

AEM3D: Canyon Lake

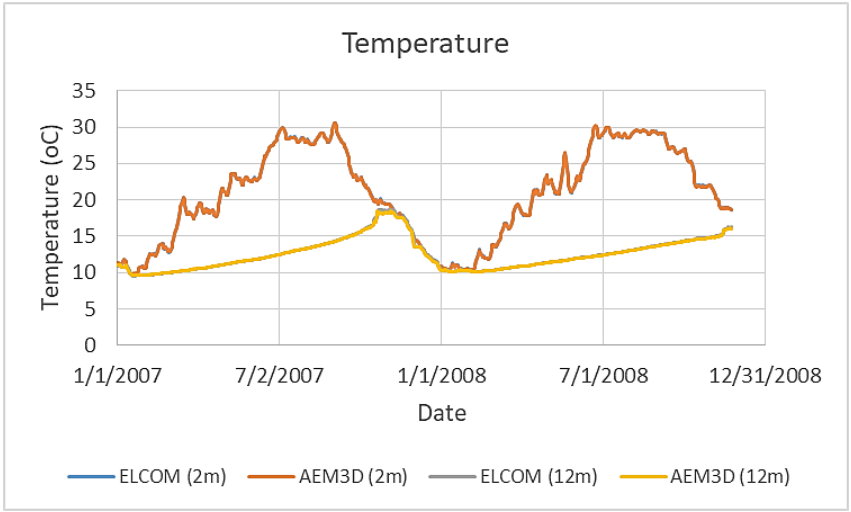
- Comparison shown for 2007-2008 period
- AEM3D reproduced lake levels almost exactly, and also predicted very similar current velocities (M1 station, 2 m)

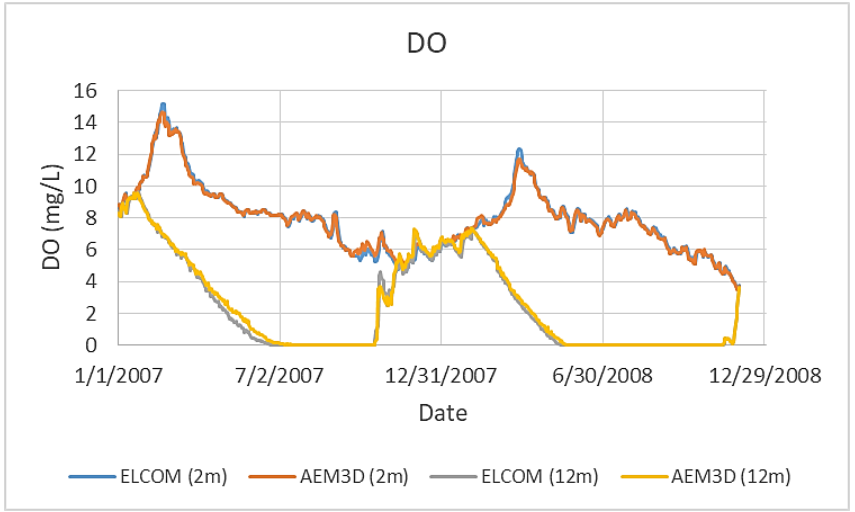




AEM3D: Canyon Lake

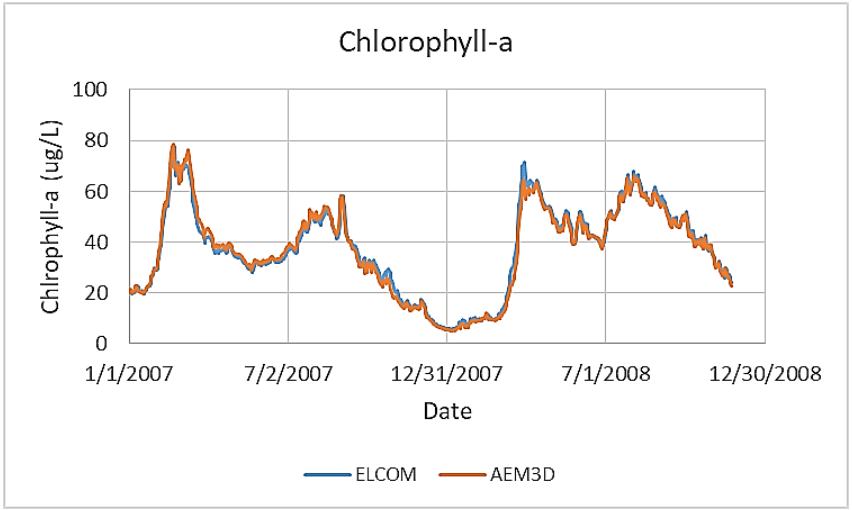
- AEM3D also reproduced temperatures almost exactly, and very closely depicted DO concentrations (M1 station, 2 m & 12 m depths shown)

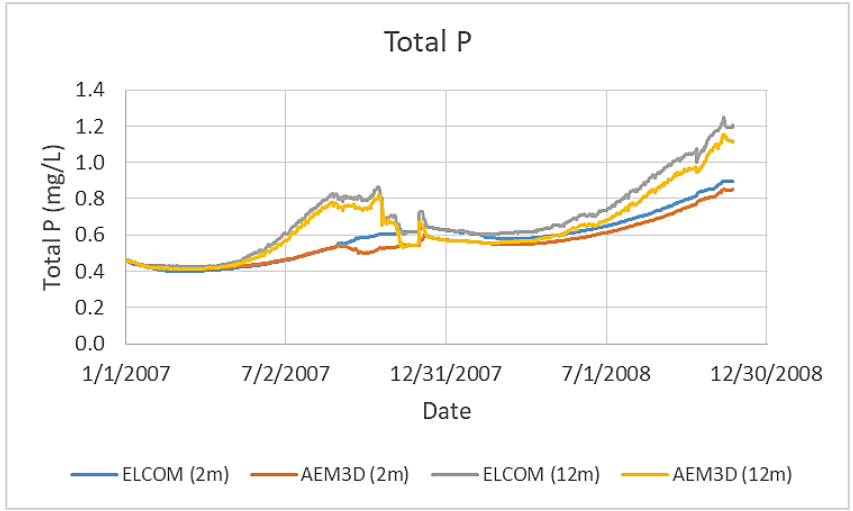




AEM3D: Canyon Lake

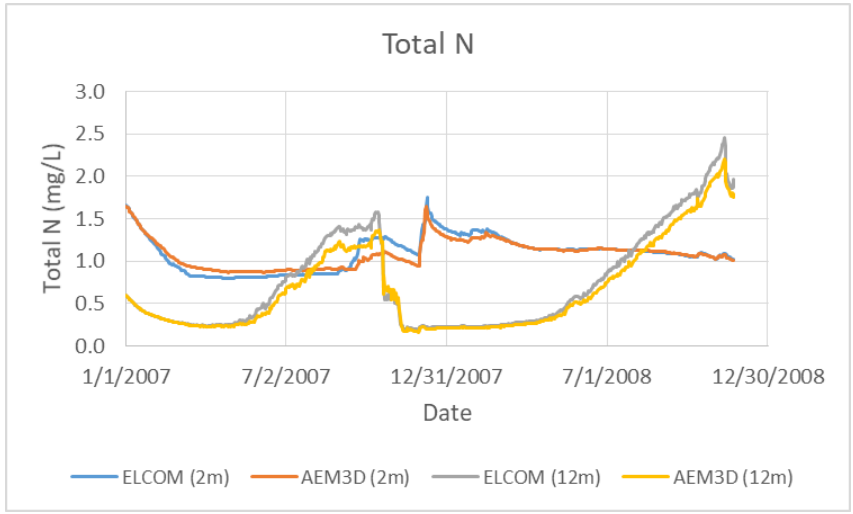
- AEM3D also predicted chlorophyll-a very closely, while total P concentrations varied slightly between the 2 models





AEM3D: Canyon Lake

- AEM3D also reproduced total N at 2m and NH_4-N at 12 m depths well
- Statistics provided in Table



Parameter	Depth (m)	MAD	RMAD (%)
Level	-	0.013 m	1.6 %
Temperature	2	0.04 °C	0.2 %
	12	0.07 °C	0.5 %
DO	2	0.17 mg/L	2.2 %
	12	0.17 mg/L	6.8 %
Chlorophyll-a	2	1.7 ug/L	4.5 %
Total P	2	0.033 mg/L	5.6 %
	12	0.046 mg/L	6.8 %
Total N	2	0.053 mg/L	4.3 %
NH_4-N (mg/L)	12	0.082 mg/L	9.0 %

MAD = mean absolute difference; RMAD = (MAD/Average Parameter Value)*100

AEM3D: Canyon Lake

- AEM3D reproduced ELCOM-CAEDYM results very well
  - lake level and thermal stratification reproduced almost exactly
  - DO, chlorophyll-a and nutrient concentrations reproduced closely
- Model simulation times remain very long (about 1 day/year simulated)
- AEM3D does seem to be more prone to numerical instabilities compared with ELCOM-CAEDYM

Supplemental Lake Modeling

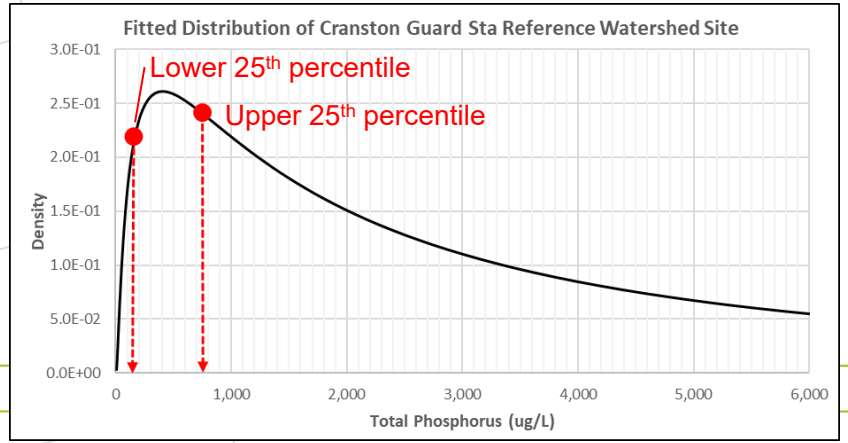
Supplemental Modeling Scope

- Regional Board needs these model scenarios to be conducted to continue with adoption process
- Modernized models ready to conduct supplemental scenarios

Scenario	Canyon Lake	Lake Elsinore	Number of Simulations
1. Alternative reference condition: 25th percentile of Cranston Guard Sta nutrient concentration, add levee to Lake Elsinore	AEM3D 2001-2016	GLM 1916-2016	2
2a. Sensitivity for sediment flux parameter for NH4 and SRP	AEM3D 2007-2011	GLM 1916-2016	4
2b. Sensitivity for hydrologic inflows	AEM3D 2007-2011	GLM 1964-2016	2

More Conservative Reference Nutrient Concentrations

- Cranston Guard Sta watershed is 92.4% forested land use
- Presumption is that a reference watershed results in reference conditions in downstream waters
- San Jacinto has uniquely high TP from forested canyons – a key observation from peer review



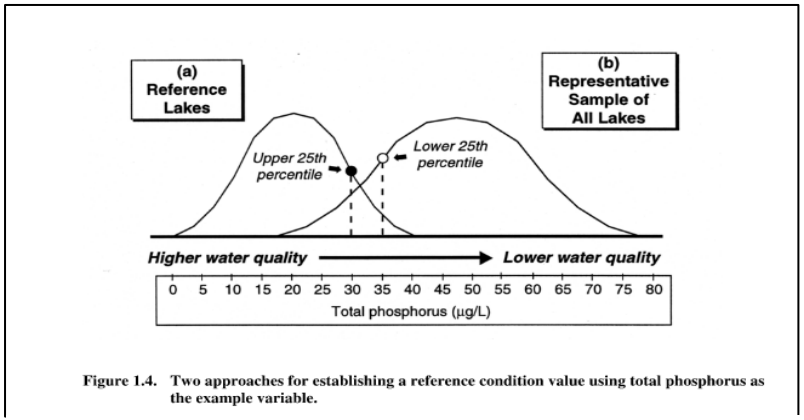


Figure 1.4. Two approaches for establishing a reference condition value using total phosphorus as the example variable.

https://www.epa.gov/sites/production/files/2018-10/documents/nutrient-criteria-manual-lakes-reservoirs.pdf

Presence of Levee in Reference Condition

- Policy decision through Task Force to not include the levee in reference condition
  - Represents pre-LEMP condition
  - Levee project was implemented to improve water quality
- Alternative scenario to include levee – essentially restoring current physical basin to reference WQ

Sediment Nutrient Flux Parameter

- Significant spatial and temporal variability in core-flux measurements
- Calibration of models employed the sediment flux parameter, adjusted within range of measurements
- Sensitivity analysis will evaluate how much this variability may contributes to model uncertainty in reference condition

Runoff Retention Impacts to Lake Water Quality

- TMDL revision used measured flow volumes (reflective of the developed condition) to set allowable loads for a reference (zero impervious area) watershed
  - Increased volume provides for a deeper lake and dilution of ambient TDS, which support a healthier aquatic ecosystem
  - Increased volume does also bring more nutrient load, even at reference concentration
- Sensitivity analysis will evaluate how these pros and cons net out over long-term in Lake Elsinore? 1964-2016

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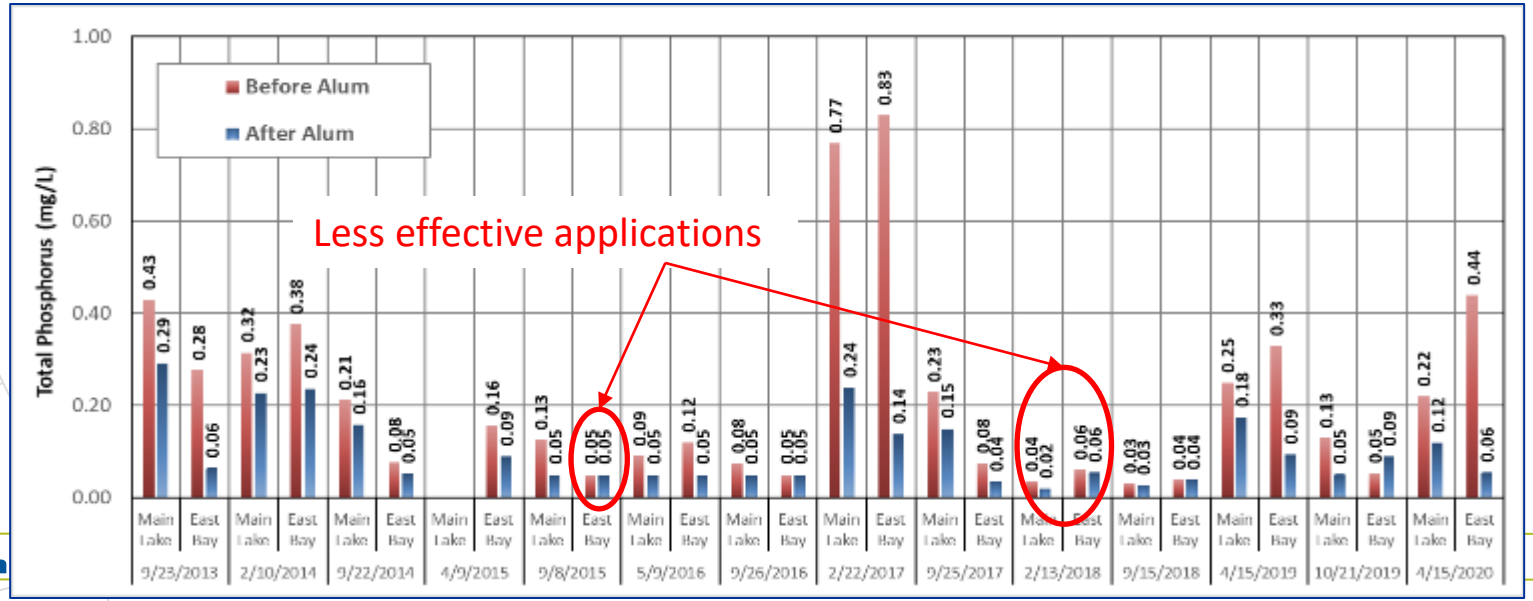
Supplemental Modeling Scope

- Timing is important - We will deliver results in March and finalize a draft tech memo in 90 days from start so that adoption can occur in 2021
- Communication is important- We added six bi-weekly science collaboration calls with Regional Board staff to make sure they can stand behind the final product
- Results may provide insights that require a change to numeric targets and/or allocations in the revised TMDL

Alum Application Guidance

Alum Application Decision Tree

- Most effective alum applications are in Feb-Apr following above average wet seasons and within the Main Lake prior to fall turnover



Alum Application Decision Tree

- Process to make decisions whether or not to apply alum lake-wide in spring season in within East Bay during fall season
- February 2021 sample result will be important to review