# Presentation Outline

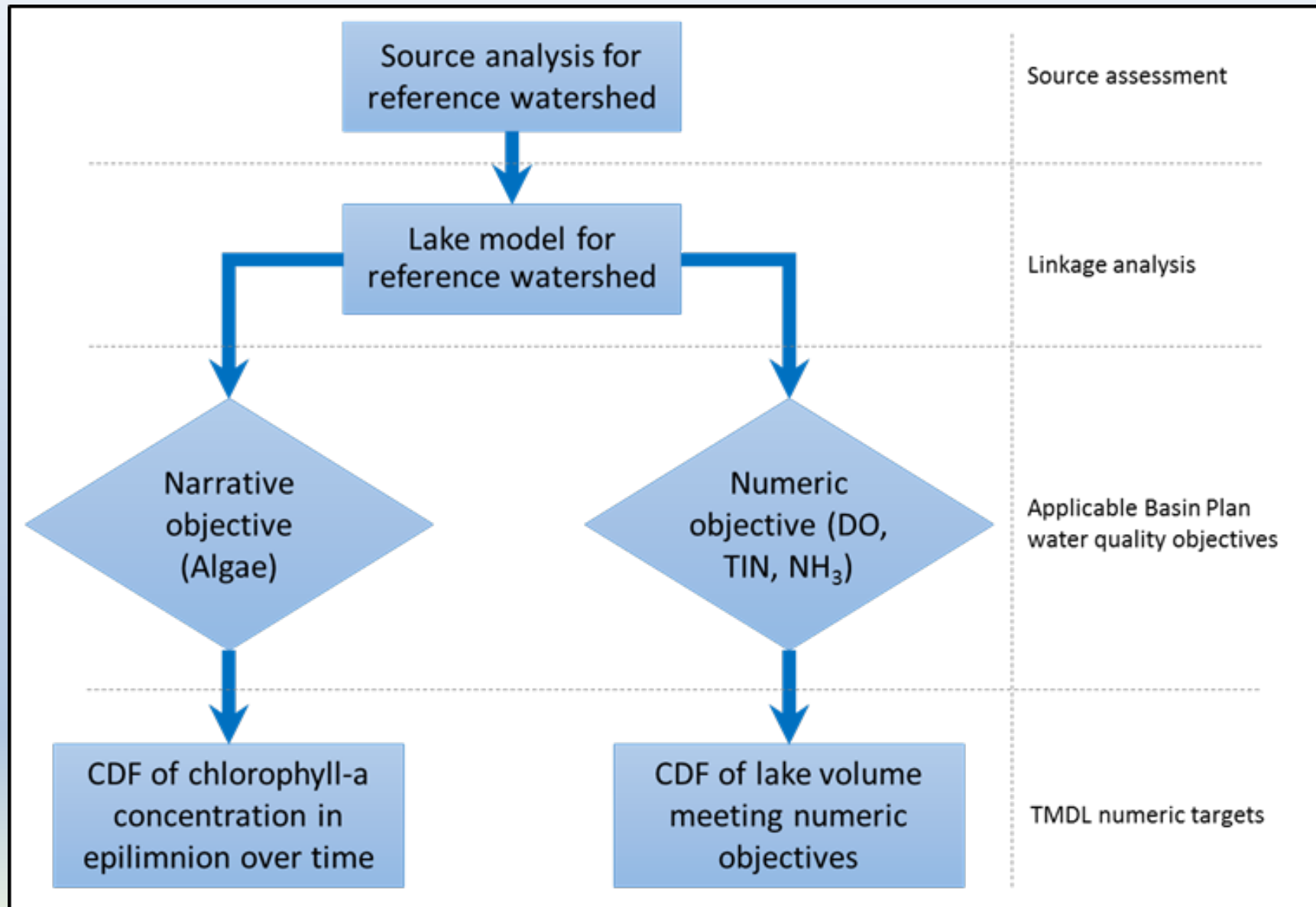- Numeric Targets
- Source Assessment

# NUMERIC TARGETS

# Numeric Targets

- Reference watershed approach
- Reference condition for Lake Elsinore and Canyon Lake
- TMDL targets

# REFERENCE WATERSHED APPROACH

# Reference Watershed Approach

# Reference Watershed Approach

- Santa Ana Basin Plan water quality objectives
  - Algae: *"Waste discharges shall not contribute to <u>excessive</u> algal growth in inland surface receiving waters"*
  - *Dissolved Oxygen: "The dissolved oxygen content of surface waters shall not be depressed below 5mg/L for waters designated WARM…, <u>as a result of controllable water quality factors</u>."*

# Reference Watershed Approach

- State Water Resources Control Board 303(d) listing policy

  - *"A water segment shall be placed on the section 303(d) list if the water segment exhibits significant degradation in biological populations and/or communities <u>as compared to reference site(s)</u> and is associated with water or sediment concentrations of pollutants including but not limited to chemical concentrations, temperature, dissolved oxygen, and trash."*

# Reference Watershed Approach

- US Environmental Protection Agency Region 9. (2000). Guidance for Developing TMDLs in California.
  - *"...It is sometimes possible to supplement instream indicators and targets with <u>hillslope targets</u> - measures of conditions within the watershed which are directly associated with waterbodies meeting their water quality standards for the pollutant(s) of concern."*

# Reference Watershed Approach

- US Environmental Protection Agency. (1997). Establishing Site-Specific Aquatic Life Criteria Equal to Natural Background. Prepared by Tudor Davies
  - *"States and Tribes may establish site specific numeric aquatic life water quality criteria by setting the <u>criteria value equal to natural background...due only to non-anthropogenic sources</u>"*
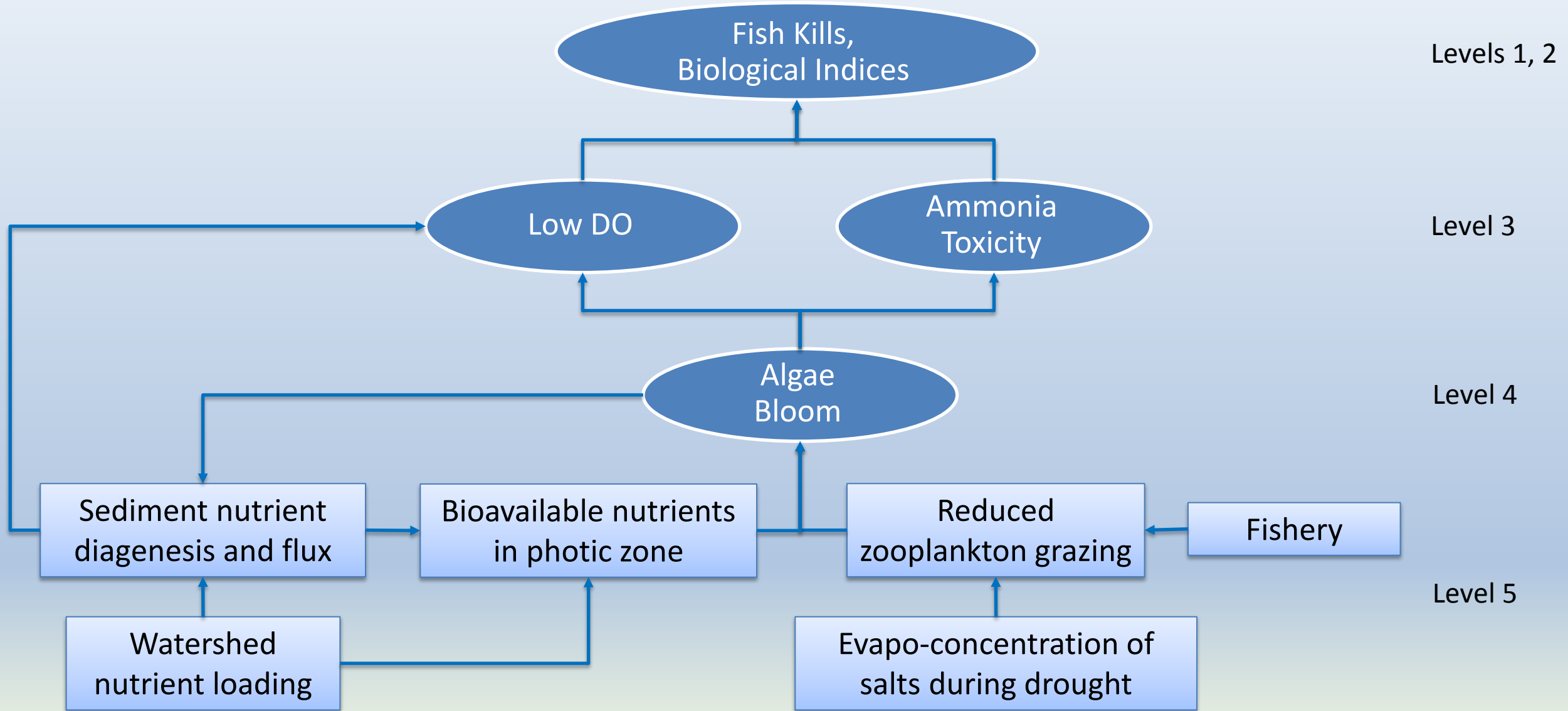
# Reference Watershed Approach

- Santa Ana Basin Plan amendment (R8-2012-0001)
  - *"Pathogen indicator concentrations shall not exceed the objectives as a result of <u>controllable</u> water quality factors... those characteristics of the discharge and/or the receiving water that can be controlled by treatment or management methods"*

- San Diego Basin Plan amendment (R9-2008-0028)
  - *"Within the context of a TMDL, the Regional Board may implement the indicator bacteria water quality objectives by using a <u>reference system and anti-degradation approach or a natural sources exclusion approach</u>... dischargers must demonstrate they have implemented all appropriate best management practices to control all anthropogenic sources of indicator bacteria"*

- Santa Monica Bay Beaches TMDL (R4-2002-004)
  - *"The allowable number of exceedance days for a shoreline monitoring site for each time period is based on the lesser of two criteria (1) <u>exceedance days in the designated reference system</u> and (2) exceedance days based on historical bacteriological data at the monitoring site"*

# Reference Watershed Approach

| Priority | Use Integrity Indicator |
|---|---|
| Level 1 | Fish kills |
| Level 2 | Biological health indices: Species richness & abundance |
| Level 3 | Water quality stressors: Cyanotoxins, dissolved oxygen, unionized ammonia, hydrogen sulfide |
| Level 4 | Algae bloom concentration and persistence |
| Level 5 | Nutrients and other controls: Nitrogen, phosphorus, TDS |

# Reference Watershed Approach

# REFERENCE WATERSHED CONDITION

# Reference Watershed Condition

- External nutrient load from runoff equal to estimated mass from reference watershed

- For Canyon Lake, assumes Railroad Canyon Dam and Hemet Dam completed

- No management actions in Canyon Lake or Lake Elsinore
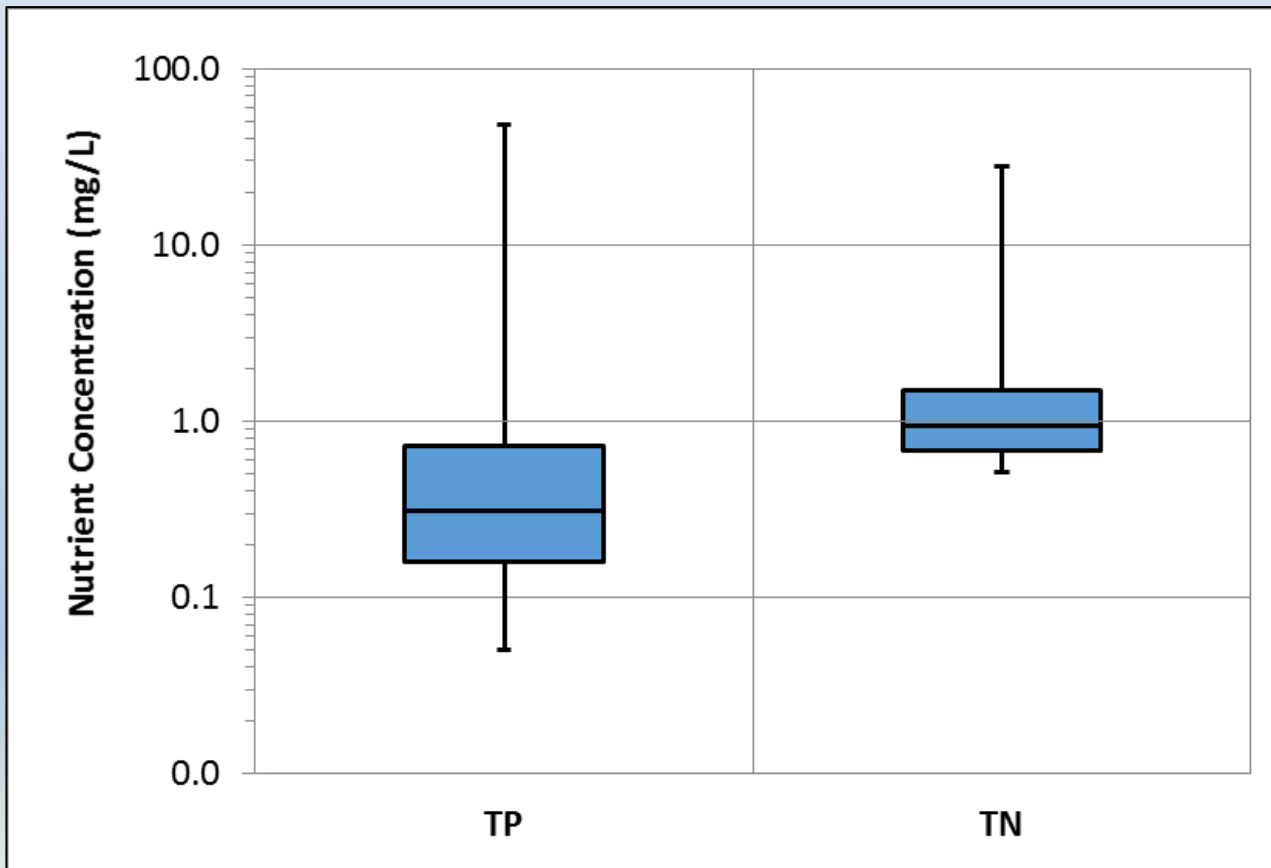  - No LEMP, LEAMS, reclaimed water in Lake Elsinore

# Reference Watershed Condition

- Model for source assessment employed to estimate runoff volume for a hypothetical zero imperviousness watershed
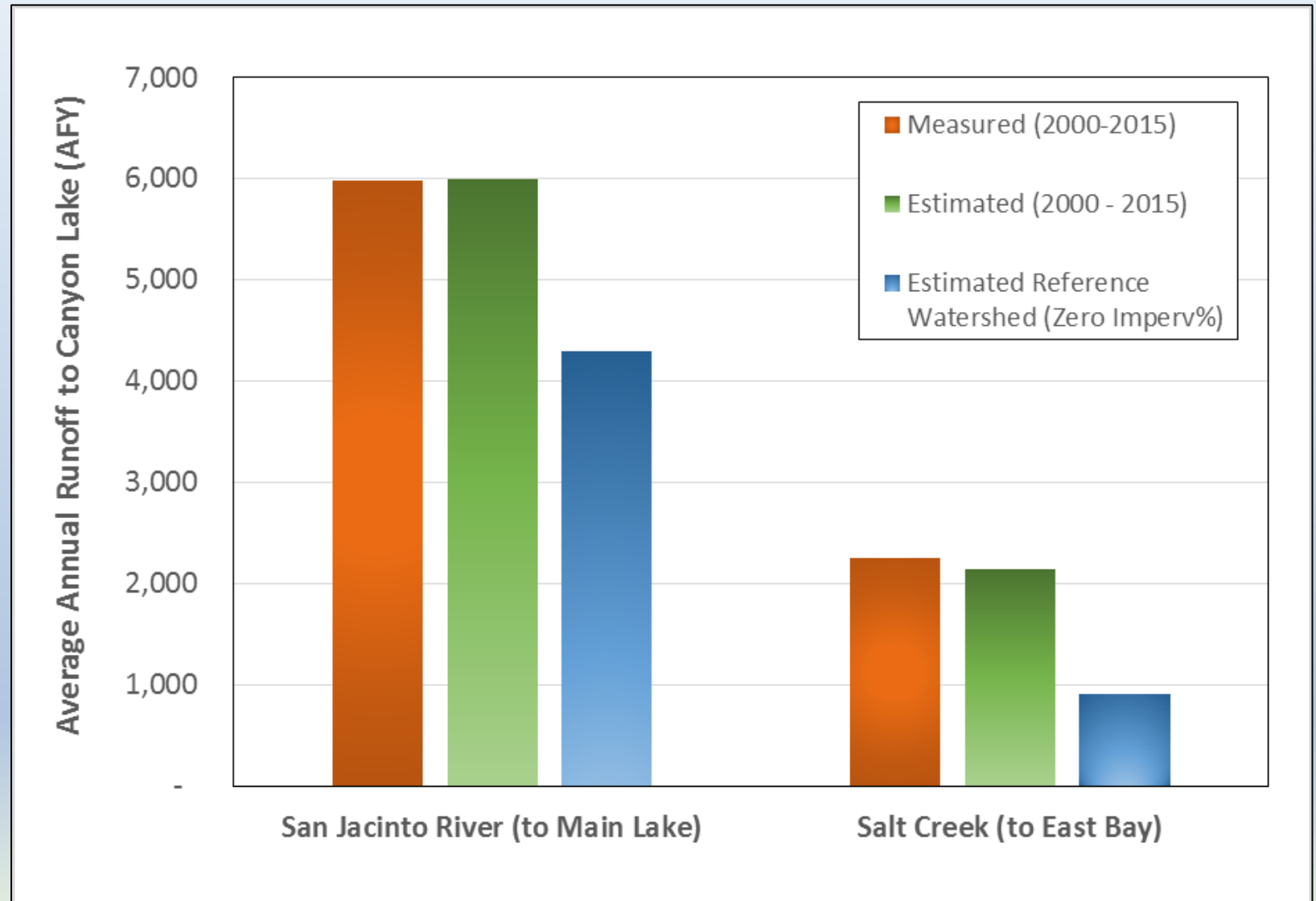
# Reference Watershed Condition

- Estimated undeveloped land nutrient washoff from monitoring data

| Date | Event Mean Concentration from Cranston Guard Station (Reference Site) | |
| --- | --- | --- |
| | TP (mg/L) | TN (mg/L) |
| 2/12/2003 | 0.13 | 0.60 |
| 2/25/2003 | 0.92 | 1.41 |
| 10/27/2004 | 4.13 | 3.80 |
| 1/12/2005 | 0.16 | 0.98 |
| 3/23/2005 | 0.11 | 0.58 |
| 1/5/2008 | 0.39 | 1.15 |
| 1/27/2008 | 1.22 | 4.00 |
| 2/4/2008 | 0.43 | 1.03 |
| 1/20/2010 | 10.13 | 7.09 |

# REVISED TMDL NUMERIC TARGETS
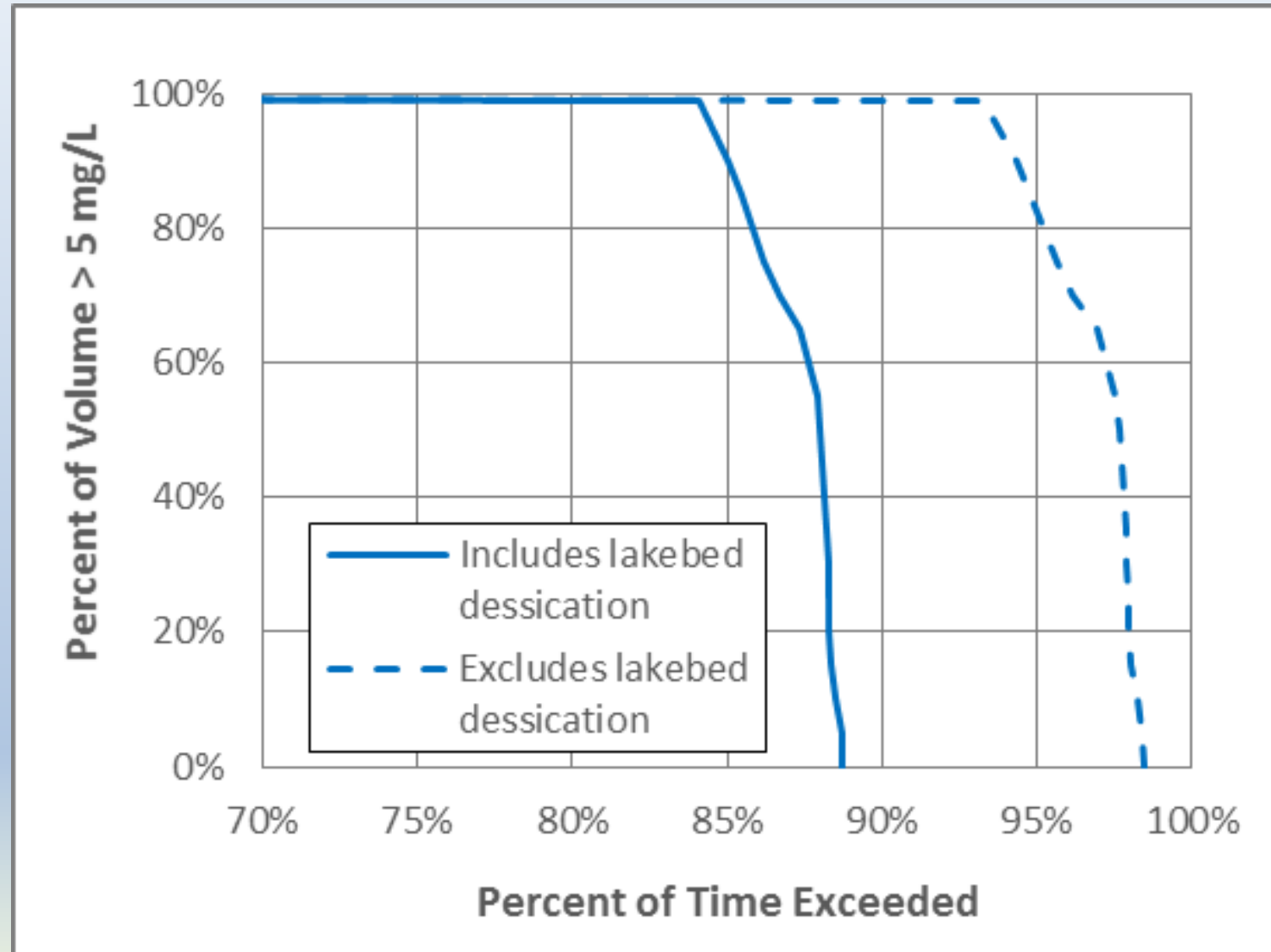
# Numeric Targets: Lake Elsinore

- Algae numeric target expressed as cumulative distribution function (CDF) of chlorophyll-a concentration
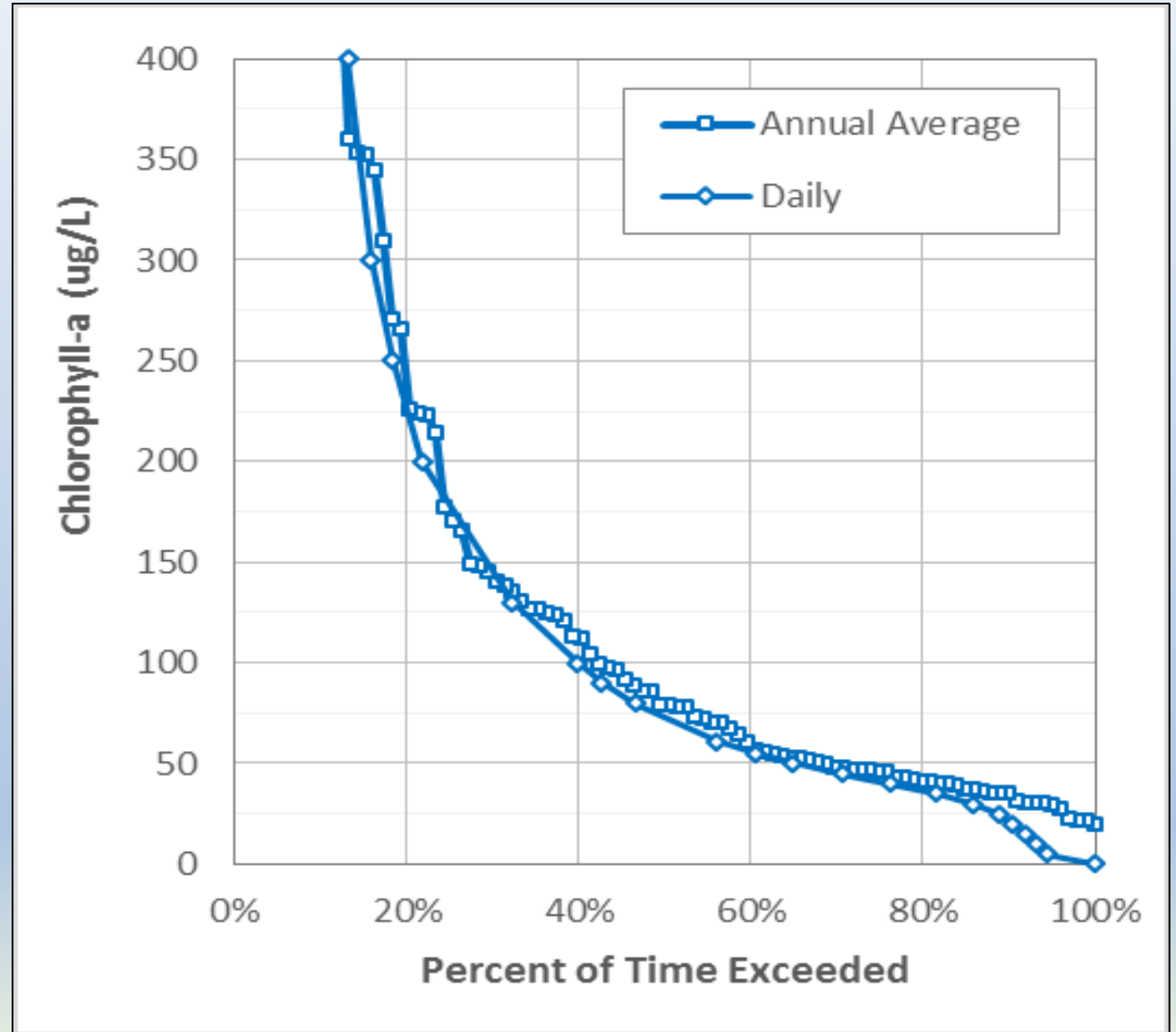
# Numeric Targets: Lake Elsinore

- Lake Elsinore DO
- CDF of volume meeting Basin Plan objective for WARM use

# Numeric Targets: Canyon Lake

- Algae numeric target expressed as CDF of chlorophyll-a concentration



Canyon Lake Main Lake (Top 1 meter)
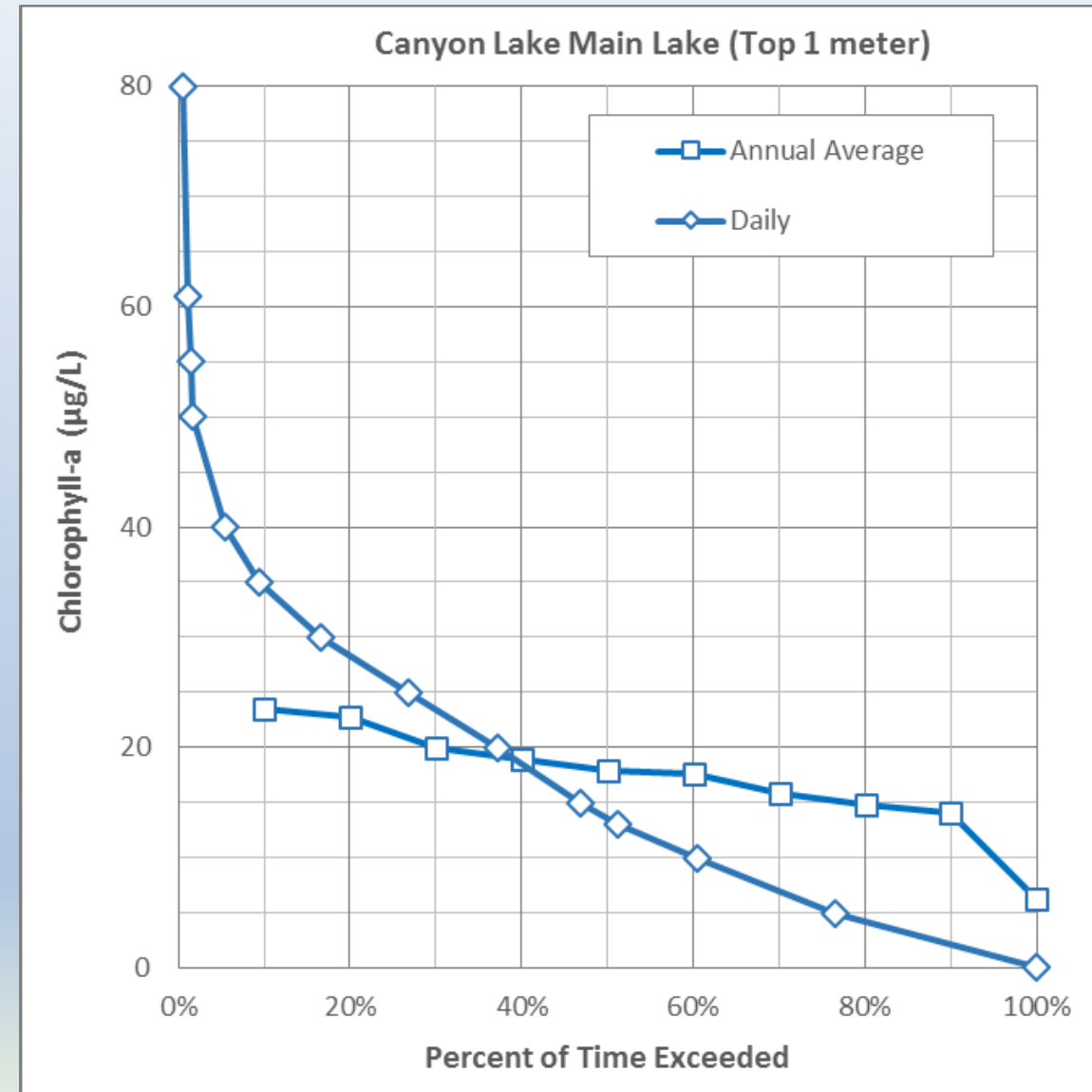
# Numeric Targets: Canyon Lake

- DO target expressed as fraction of volume meeting Basin Plan WQOs based on reference watershed loads
  - Requires revision to model reporting
  - QAQC check noted draft results were questionable

# Numeric Targets: Ammonia Toxicity

- Highly variable water quality objective

- Presume pH returned to reference levels with algae target compliance

- Assumes temperature remains at historical averages

Table 5b. Temperature and pH-Dependent Values of the CMC (Acute Criterion Magnitude) – *Oncorhynchus spp.* Absent. Temperature (°C)

| pH | 0-10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
|----|------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| 6.5 | 51 | 48 | 44 | 41 | 37 | 34 | 32 | 29 | 27 | 25 | 23 | 21 | 19 | 18 | 16 | 15 | 14 | 13 | 12 | 11 | 9.9 |
| 6.6 | 49 | 46 | 42 | 39 | 36 | 33 | 30 | 28 | 26 | 24 | 22 | 20 | 18 | 17 | 16 | 14 | 13 | 12 | 11 | 10 | 9.5 |
| 6.7 | 46 | 44 | 40 | 37 | 34 | 31 | 29 | 27 | 24 | 22 | 21 | 19 | 18 | 16 | 15 | 14 | 13 | 12 | 11 | 9.8 | 9.0 |
| 6.8 | 44 | 41 | 38 | 35 | 32 | 30 | 27 | 25 | 23 | 21 | 20 | 18 | 17 | 15 | 14 | 13 | 12 | 11 | 10 | 9.2 | 8.5 |
| 6.9 | 41 | 38 | 35 | 32 | 30 | 28 | 25 | 23 | 21 | 20 | 18 | 17 | 15 | 14 | 13 | 12 | 11 | 10 | 9.4 | 8.6 | 7.9 |
| 7.0 | 38 | 35 | 33 | 30 | 28 | 25 | 23 | 21 | 20 | 18 | 17 | 15 | 14 | 13 | 12 | 11 | 10 | 9.4 | 8.6 | 7.9 | 7.3 |
| 7.1 | 34 | 32 | 30 | 27 | 25 | 23 | 21 | 20 | 18 | 17 | 15 | 14 | 13 | 12 | 11 | 10 | 9.3 | 8.5 | 7.9 | 7.2 | 6.7 |
| 7.2 | 31 | 29 | 27 | 25 | 23 | 21 | 19 | 18 | 16 | 15 | 14 | 13 | 12 | 11 | 9.8 | 9.1 | 8.3 | 7.7 | 7.1 | 6.5 | 6.0 |
| 7.3 | 27 | 26 | 24 | 22 | 20 | 18 | 17 | 16 | 14 | 13 | 12 | 11 | 10 | 9.5 | 8.7 | 8.0 | 7.4 | 6.8 | 6.3 | 5.8 | 5.3 |
| 7.4 | 24 | 22 | 21 | 19 | 18 | 16 | 15 | 14 | 13 | 12 | 11 | 9.8 | 9.0 | 8.3 | 7.7 | 7.0 | 6.5 | 6.0 | 5.5 | 5.1 | 4.7 |
| 7.5 | 21 | 19 | 18 | 17 | 15 | 14 | 13 | 12 | 11 | 10 | 9.2 | 8.5 | 7.8 | 7.2 | 6.6 | 6.1 | 5.6 | 5.2 | 4.8 | 4.4 | 4.0 |
| 7.6 | 18 | 17 | 15 | 14 | 13 | 12 | 11 | 10 | 9.3 | 8.6 | 7.9 | 7.3 | 6.7 | 6.2 | 5.7 | 5.2 | 4.8 | 4.4 | 4.1 | 3.8 | 3.5 |
| 7.7 | 15 | 14 | 13 | 12 | 11 | 10 | 9.3 | 8.6 | 7.9 | 7.3 | 6.7 | 6.2 | 5.7 | 5.2 | 4.8 | 4.4 | 4.1 | 3.8 | 3.5 | 3.2 | 2.9 |
| 7.8 | 13 | 12 | 11 | 10 | 9.3 | 8.5 | 7.9 | 7.2 | 6.7 | 6.1 | 5.6 | 5.2 | 4.8 | 4.4 | 4.0 | 3.7 | 3.4 | 3.2 | 2.9 | 2.7 | 2.5 |
| 7.9 | 11 | 9.9 | 9.1 | 8.4 | 7.7 | 7.1 | 6.6 | 3.0 | 5.6 | 5.1 | 4.7 | 4.3 | 4.0 | 3.7 | 3.4 | 3.1 | 2.9 | 2.6 | 2.4 | 2.2 | 2.1 |
| 8.0 | 8.8 | 8.2 | 7.6 | 7.0 | 6.4 | 5.9 | 5.4 | 5.0 | 4.6 | 4.2 | 3.9 | 3.6 | 3.3 | 3.0 | 2.8 | 2.6 | 2.4 | 2.2 | 2.0 | 1.9 | 1.7 |
| 8.1 | 7.2 | 6.8 | 6.3 | 5.8 | 5.3 | 4.9 | 4.5 | 4.1 | 3.8 | 3.5 | 3.2 | 3.0 | 2.7 | 2.5 | 2.3 | 2.1 | 2.0 | 1.8 | 1.7 | 1.5 | 1.4 |
| 8.2 | 6.0 | 5.6 | 5.2 | 4.8 | 4.4 | 4.0 | 3.7 | 3.4 | 3.1 | 2.9 | 2.7 | 2.4 | 2.3 | 2.1 | 1.9 | 1.8 | 1.6 | 1.5 | 1.4 | 1.3 | 1.2 |
| 8.3 | 4.9 | 4.6 | 4.3 | 3.9 | 3.6 | 3.3 | 3.1 | 2.8 | 2.6 | 2.4 | 2.2 | 2.0 | 1.9 | 1.7 | 1.6 | 1.4 | 1.3 | 1.2 | 1.1 | 1.0 | 0.96 |
| 8.4 | 4.1 | 3.8 | 3.5 | 3.2 | 3.0 | 2.7 | 2.5 | 2.3 | 2.1 | 2.0 | 1.8 | 1.7 | 1.5 | 1.4 | 1.3 | 1.2 | 1.1 | 1.0 | 0.93 | 0.86 | 0.79 |
| 8.5 | 3.3 | 3.1 | 2.9 | 2.7 | 2.4 | 2.3 | 2.1 | 1.9 | 1.8 | 1.6 | 1.5 | 1.4 | 1.3 | 1.2 | 1.1 | 0.98 | 0.90 | 0.83 | 0.77 | 0.71 | 0.65 |
| 8.6 | 2.8 | 2.6 | 2.4 | 2.2 | 2.0 | 1.9 | 1.7 | 1.6 | 1.5 | 1.3 | 1.2 | 1.1 | 1.0 | 0.96 | 0.88 | 0.81 | 0.75 | 0.69 | 0.63 | 0.58 | 0.54 |
| 8.7 | 2.3 | 2.2 | 2.0 | 1.8 | 1.7 | 1.6 | 1.4 | 1.3 | 1.2 | 1.1 | 1.0 | 0.94 | 0.87 | 0.80 | 0.74 | 0.68 | 0.62 | 0.57 | 0.53 | 0.49 | 0.45 |
| 8.8 | 1.9 | 1.8 | 1.7 | 1.5 | 1.4 | 1.3 | 1.2 | 1.1 | 1.0 | 0.93 | 0.86 | 0.79 | 0.73 | 0.67 | 0.62 | 0.57 | 0.52 | 0.48 | 0.44 | 0.41 | 0.37 |
| 8.9 | 1.6 | 1.5 | 1.4 | 1.3 | 1.2 | 1.1 | 1.0 | 0.93 | 0.85 | 0.79 | 0.72 | 0.67 | 0.61 | 0.56 | 0.52 | 0.48 | 0.44 | 0.40 | 0.37 | 0.34 | 0.32 |
| 9.0 | 1.4 | 1.3 | 1.2 | 1.1 | 1.0 | 0.93 | 0.86 | 0.79 | 0.73 | 0.67 | 0.62 | 0.57 | 0.52 | 0.48 | 0.44 | 0.41 | 0.37 | 0.34 | 0.32 | 0.29 | 0.27 |

# SOURCE ASSESSMENT UPDATES

# Update

- Internal Loads – Sediment Nutrient Flux
- Supplemental Water
- Total Nutrient Budget

# Internal Loads

- Sediment nutrient flux – model inputs
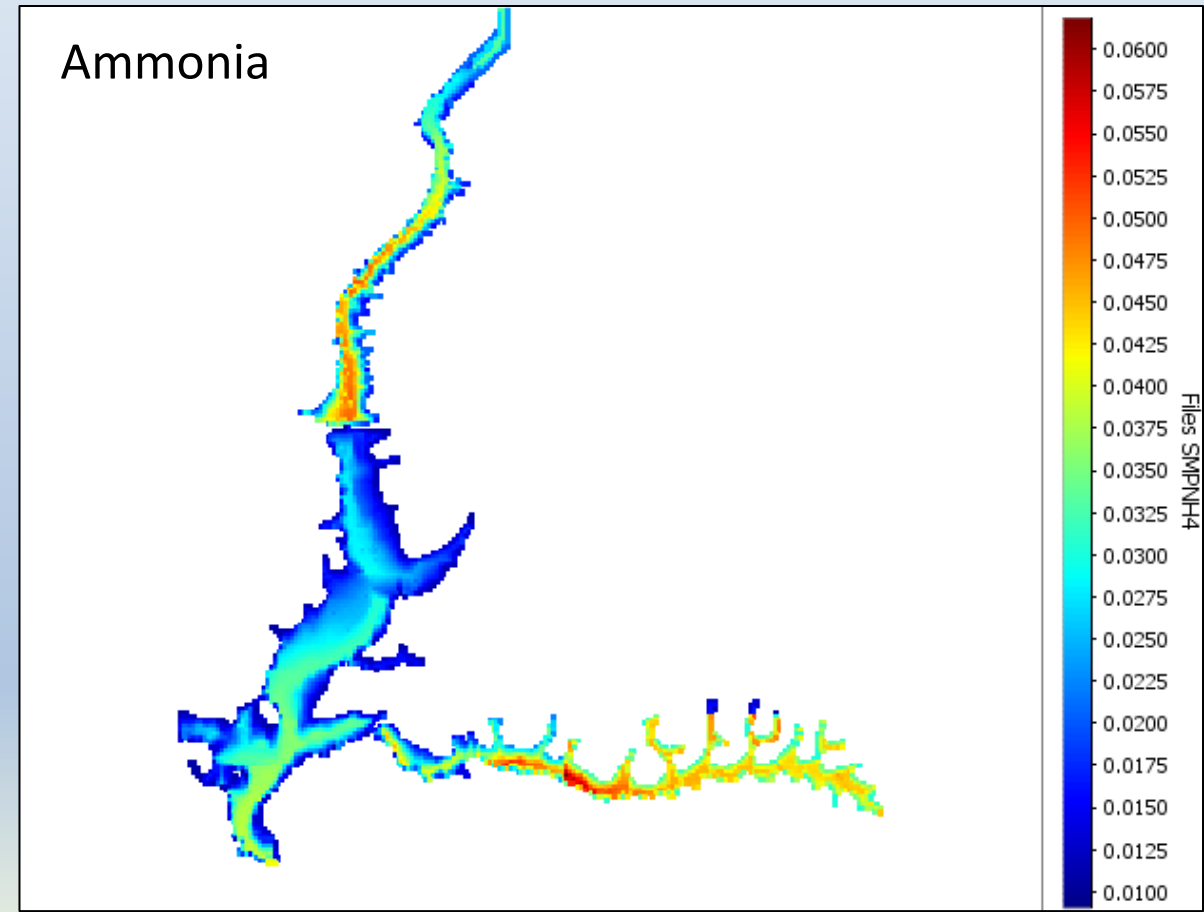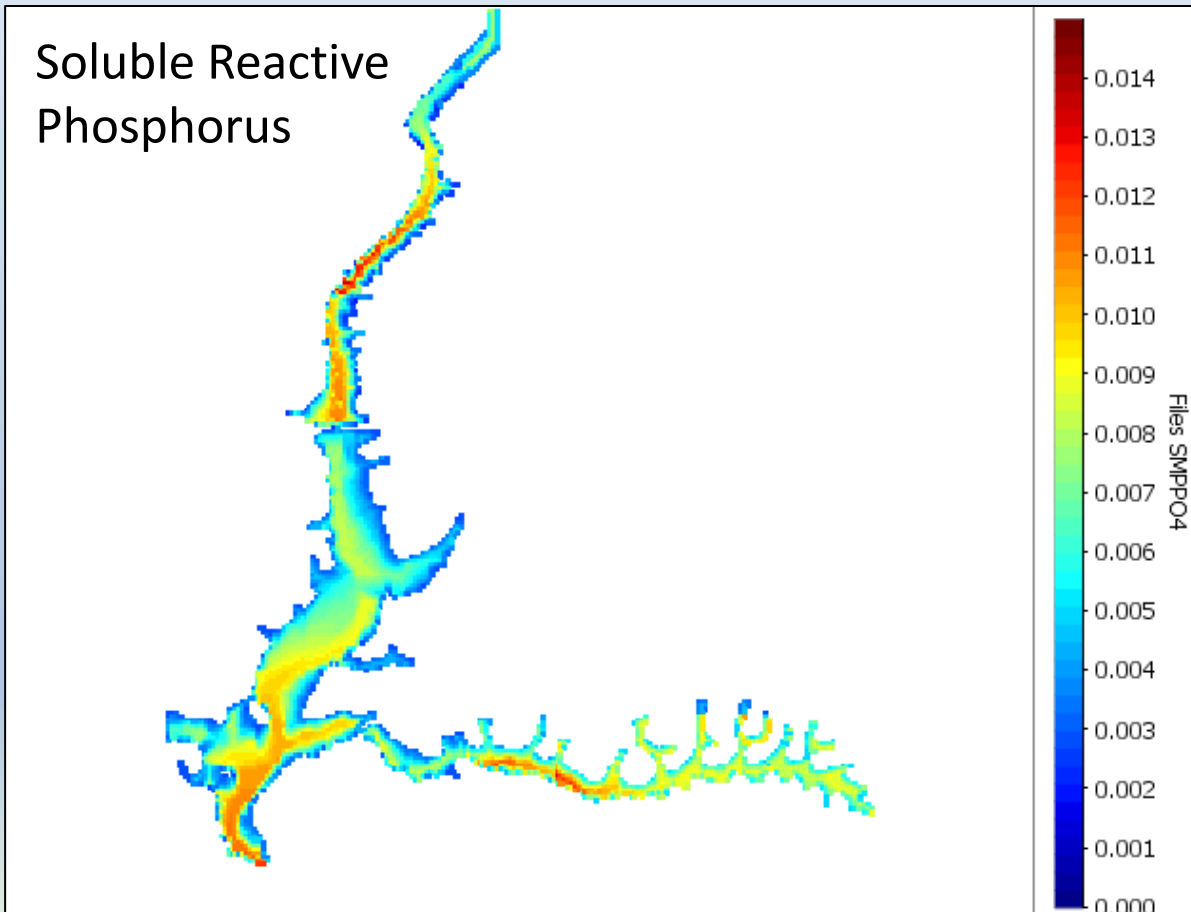
# Internal Loads

- CAEDYM simulates both diffusive flux and physical resuspension
- 2016 TMDL includes North Ski Area as part of Main Lake
- Much higher internal N load than estimated in 2004 TMDL

| Lake Segment | | 2016 TMDL Revision (CAEDYM) | 2004 TMDL (BATHTUB) |
|---|---|---|---|
| Canyon Lake Main Lake | TP (kg/yr) | 3,668 | 2,685 |
| | TN (kg/yr) | 15,237 | 8,578 |
| Canyon Lake East Bay | TP (kg/yr) | 1,056 | 1,940 |
| | TN (kg/yr) | 4,389 | 4,971 |
| Lake Elsinore | TP (kg/yr) | 35,452 | 33,160 |
| | TN (kg/yr) | 354,520 | 197,370 |

# Lake Elsinore Supplemental Water

- EVMWD reclaimed water (95% of volume)
- Island wells (5% of volume)
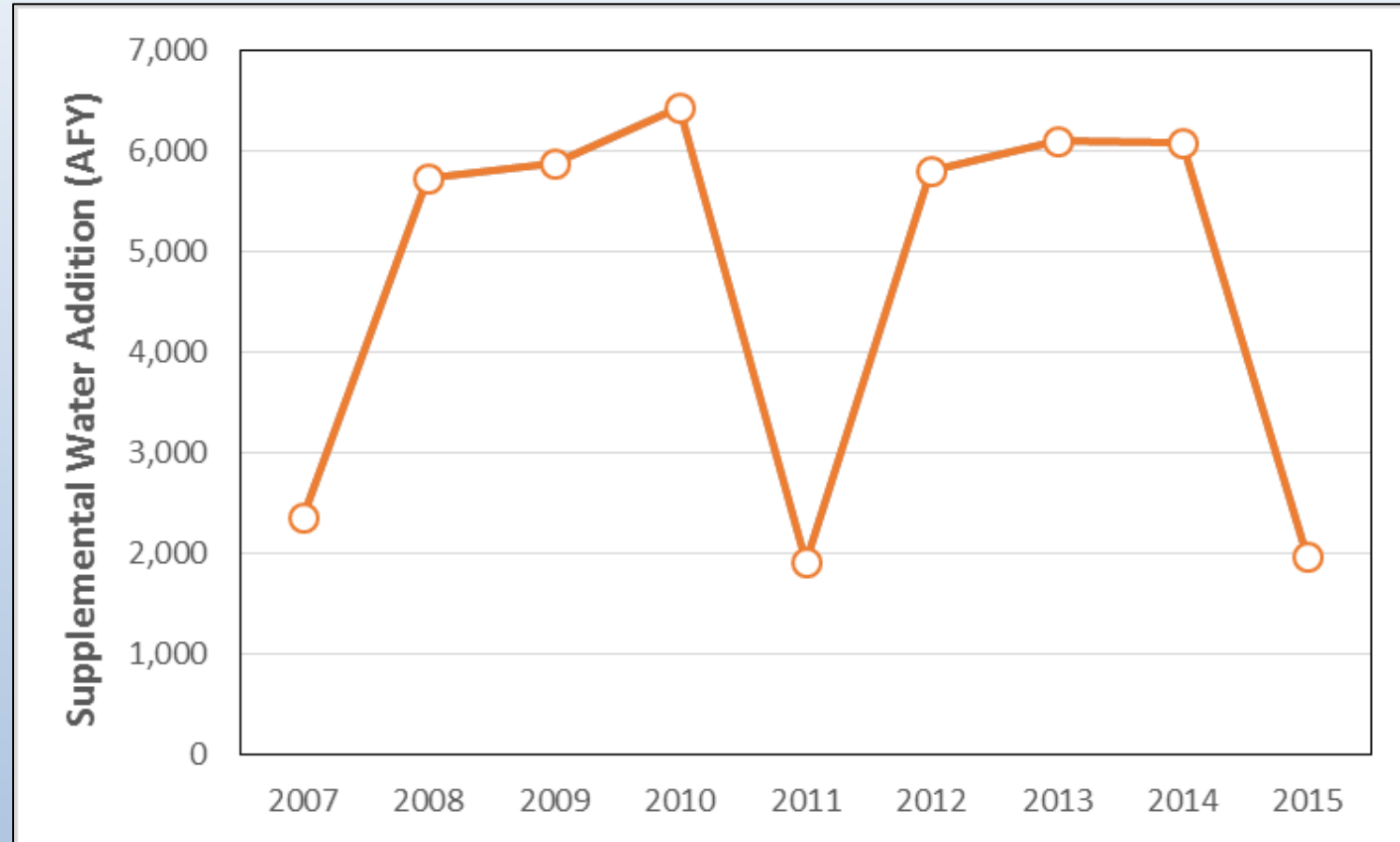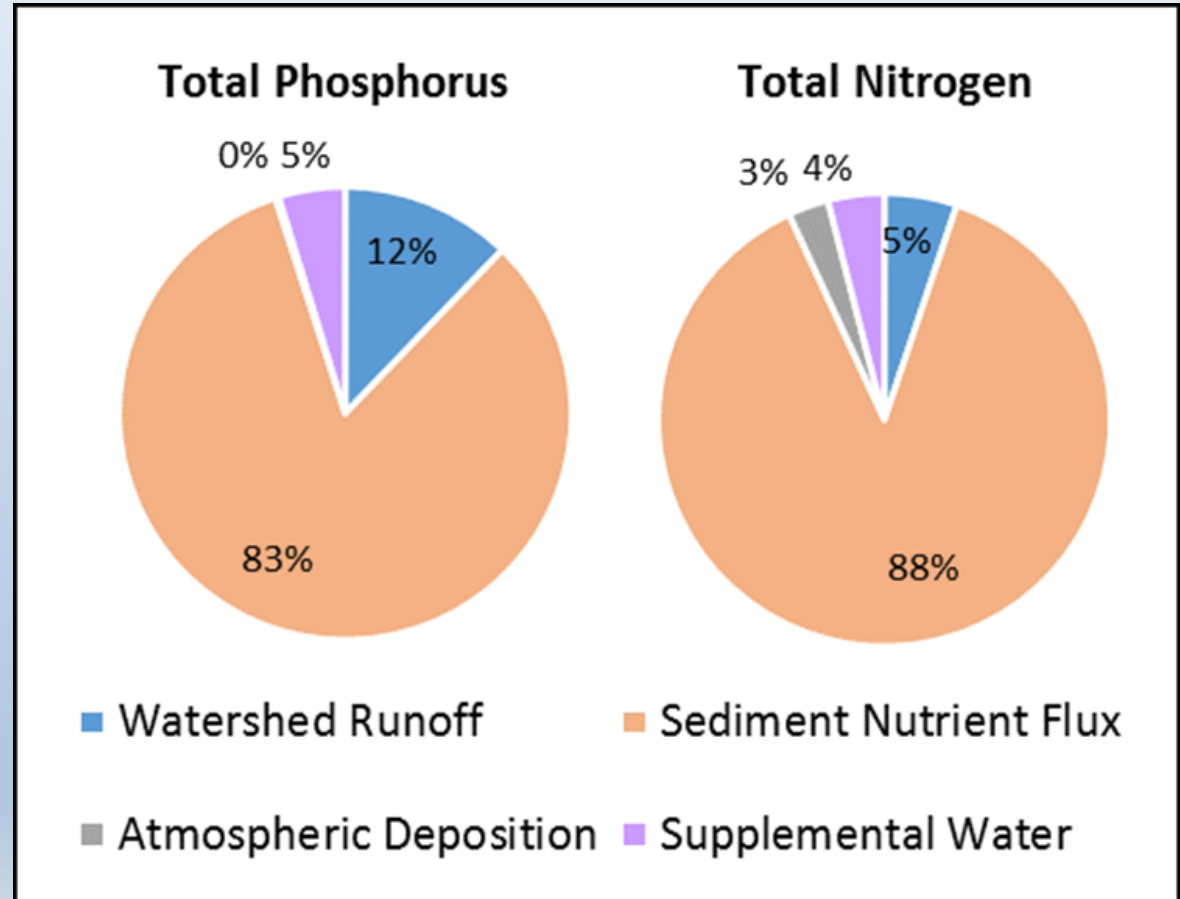
# Lake Elsinore Supplemental Water

- Estimated load from EVMWD effluent monitoring
- Average nutrient concentrations in effluent from 2014-2016
  - TP: 0.37 mg/L
  - TN: 2.83 mg/L
- State of art facility
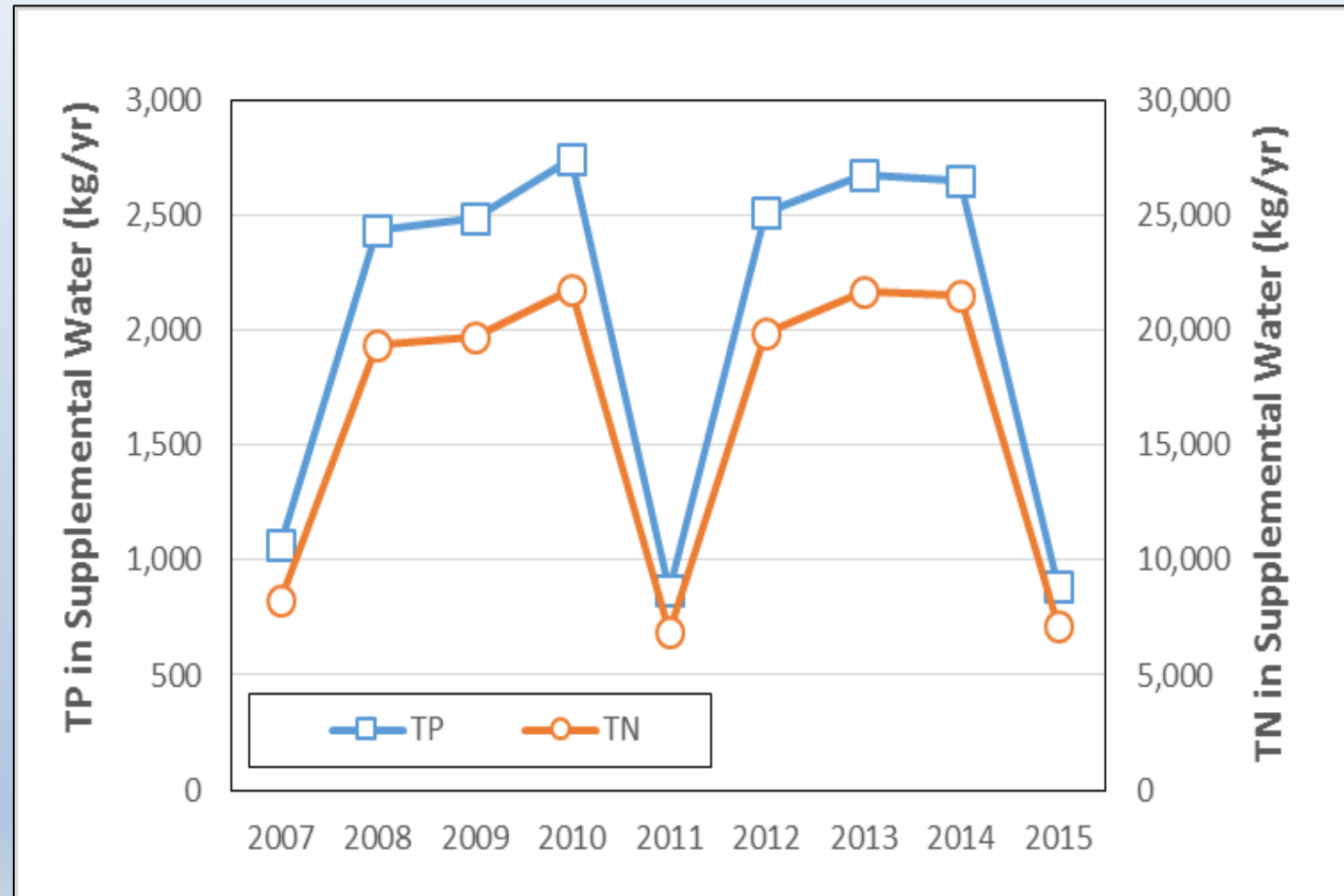
# Total Nutrient Sources

- Lake Elsinore long-term average nutrient loads
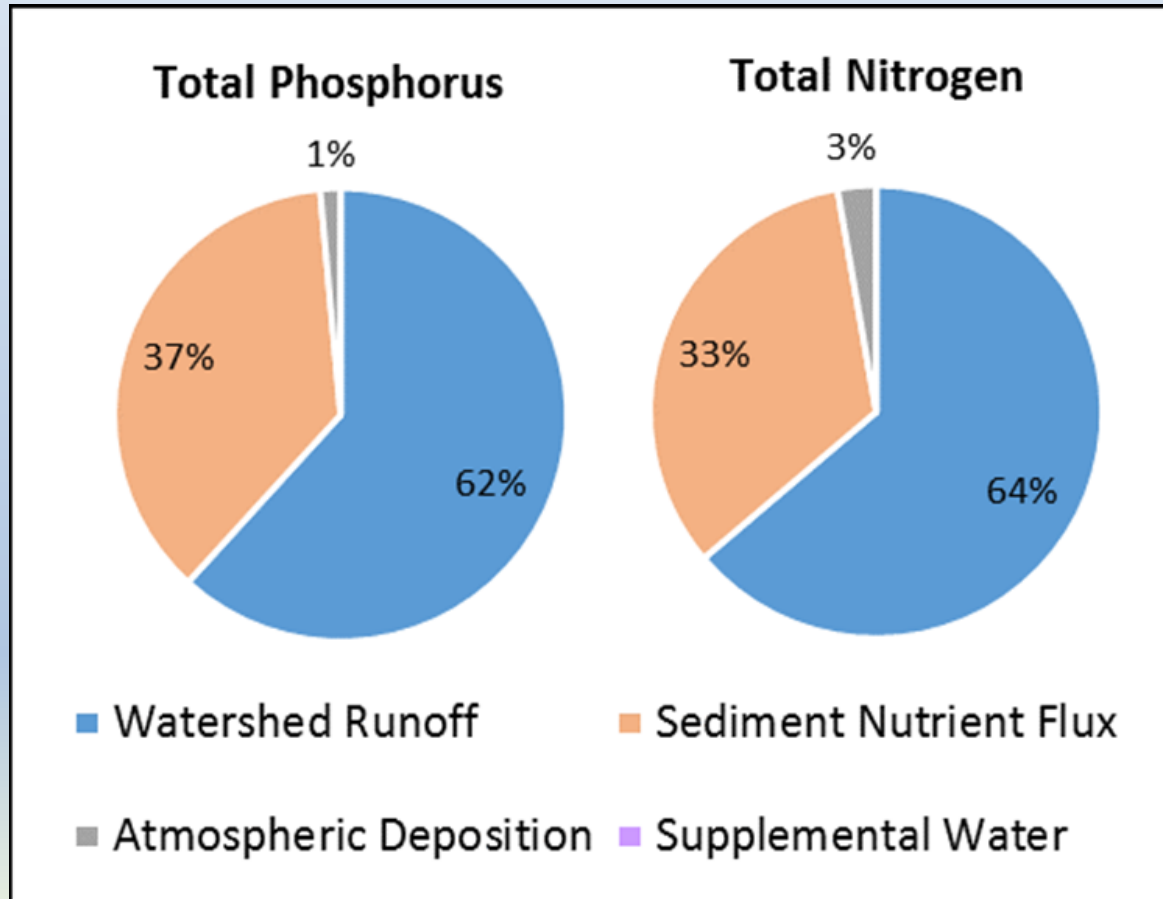- Predominantly internal load

# Total Nutrient Sources

- External loads play a more significant role in Canyon Lake

Main Lake

East Bay