NDEP Bureau of Water Quality Planning

Review of Lahontan Reservoir Water Quality Standards

Focus Group Meeting #3

Nutrient Criteria

December 11, 2013

Focus Group Activities

- Beneficial Uses
- Other Criteria
- Antidegradation Criteria (RMHQs)
  - *After some consideration, decided there is insufficient data to revise any RMHQs*
- Nutrient Criteria

Current Nutrient WQS

Parameter	RMHQs	Beneficial Use Criteria	Most Restrictive Beneficial Use
Total Phosphates (aka total phosphorus)	None	SV: ≤ 0.06 mg/l	Aquatic life; contact recreation
Total Nitrogen	AA: 1.3 mg/l SV: 1.7 mg/l	None	Not applicable
Nitrate	None	SV: ≤ 10.0 mg/l	Municipal or domestic supply
Nitrite	None	SV: ≤ 1.0 mg/l	Municipal or domestic supply

History of Nutrient WQS

- Total Phosphorus: SV ≤ 0.06 mg/
  - Established in 1984 based upon DRI study
    - Concluded phosphorus loading was major contributor to eutrophic conditions
    - Set to limit algae levels (chlorophyll-a) to 10 µg/l
      - Need to question the appropriateness of this threshold for Lahontan Reservoir
    - Based upon relationship between P and chl-a derived from data for manmade lakes in SE U.S.

      "Care should be taken in applying the model in dissimilar regions other than as a first approximation of the expected conditions in a warm water fishery."

Figure 1. Grieb et al. Predictive Relationship for "Nutrient Limited" Waters

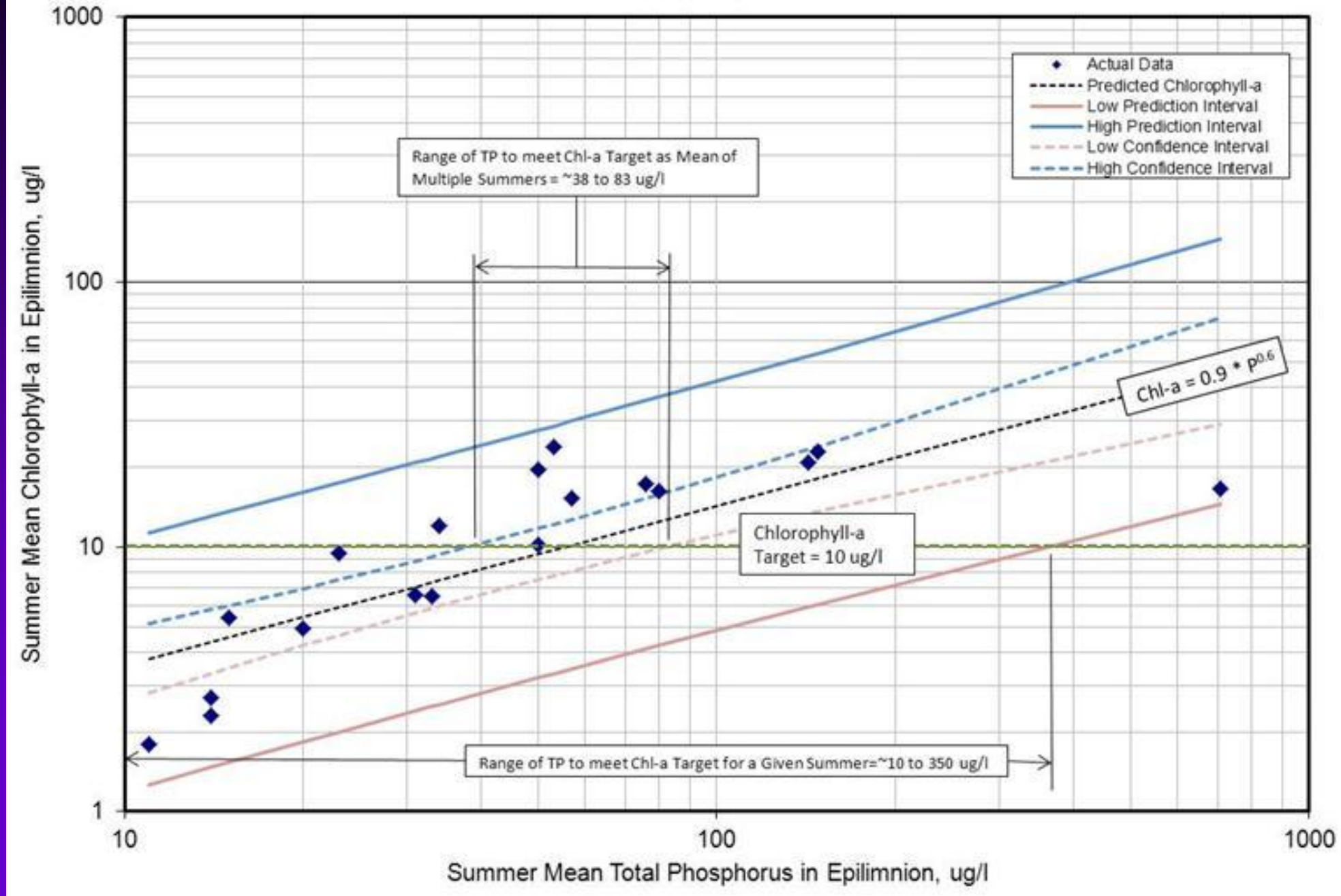
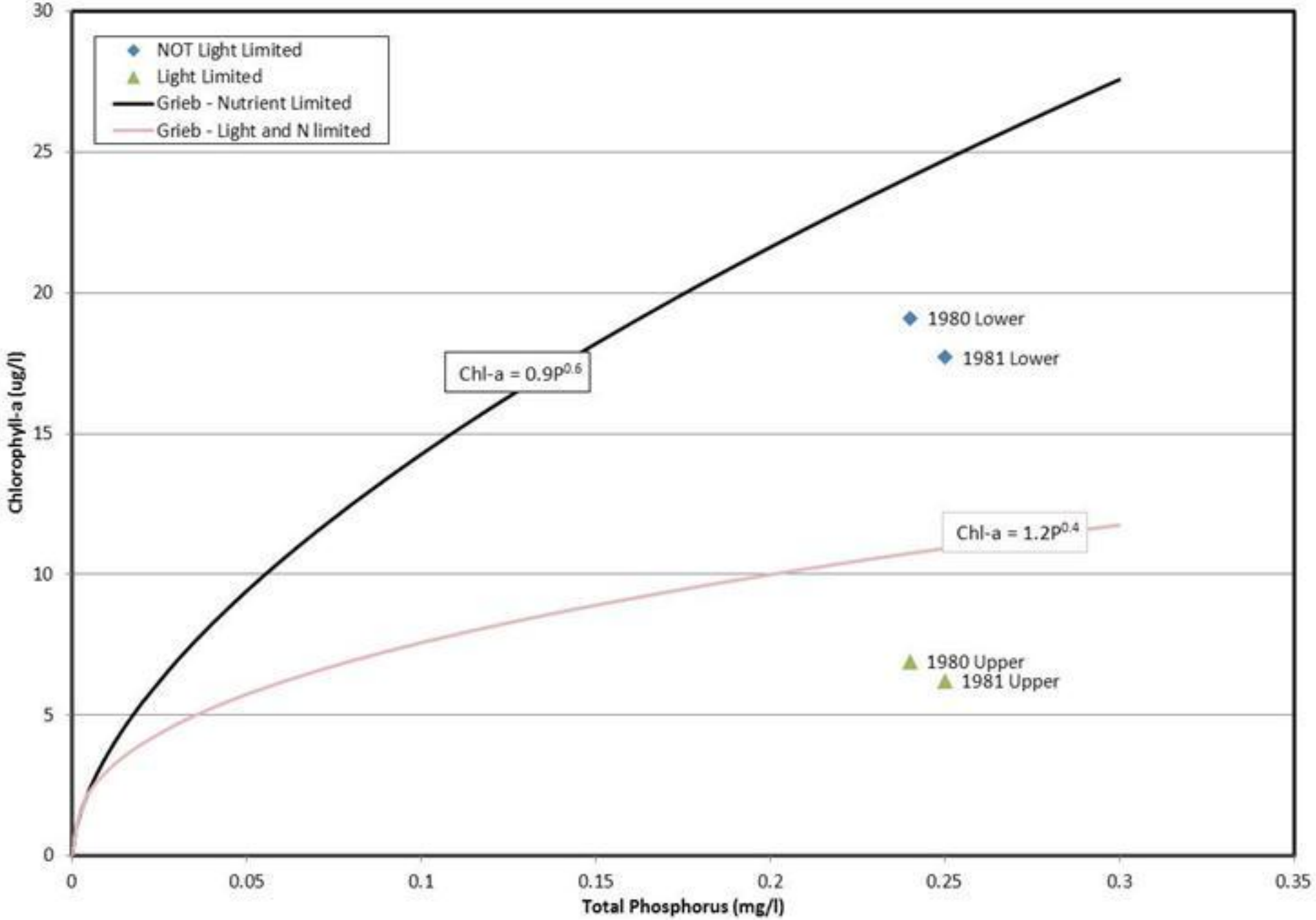


Figure 2. 1980-81 Data Compared to Grieb Predictions



History of Nutrient WQS (cont'd)

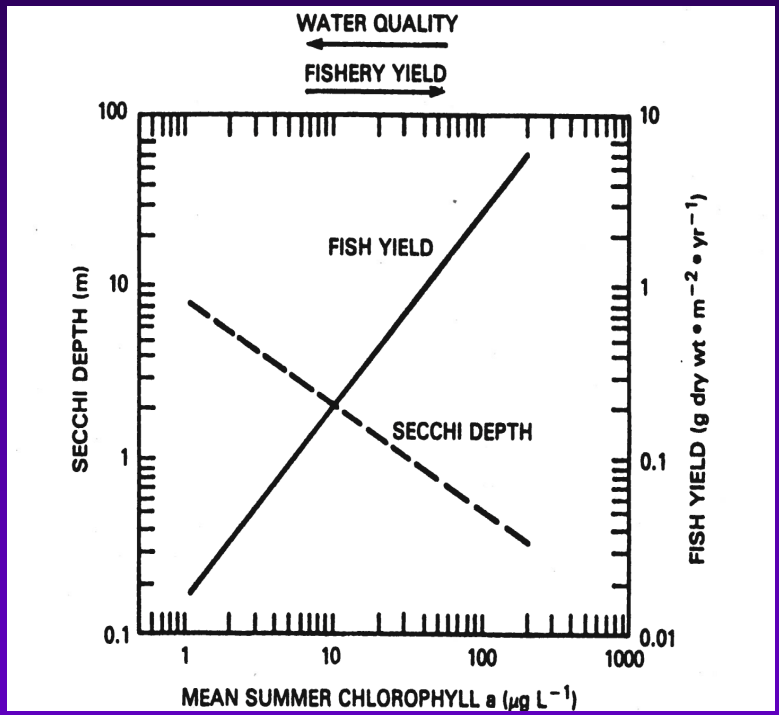
- Total Nitrogen
  - No beneficial use WQS set
    - DRI concluded phosphorus loading was major contributor to eutrophic conditions. No nitrogen standard recommended
      - The control of nitrogen levels beyond existing levels was not thought to impact algae levels
        - Relied on RMHQs for control
- Nitrate: SV ≤ 10 mg/l; Nitrite: SV ≤ 1 mg/l
  - Set in 1984 based upon EPA recommendation for drinking water

Select Appropriate Chlorophyll-a Target

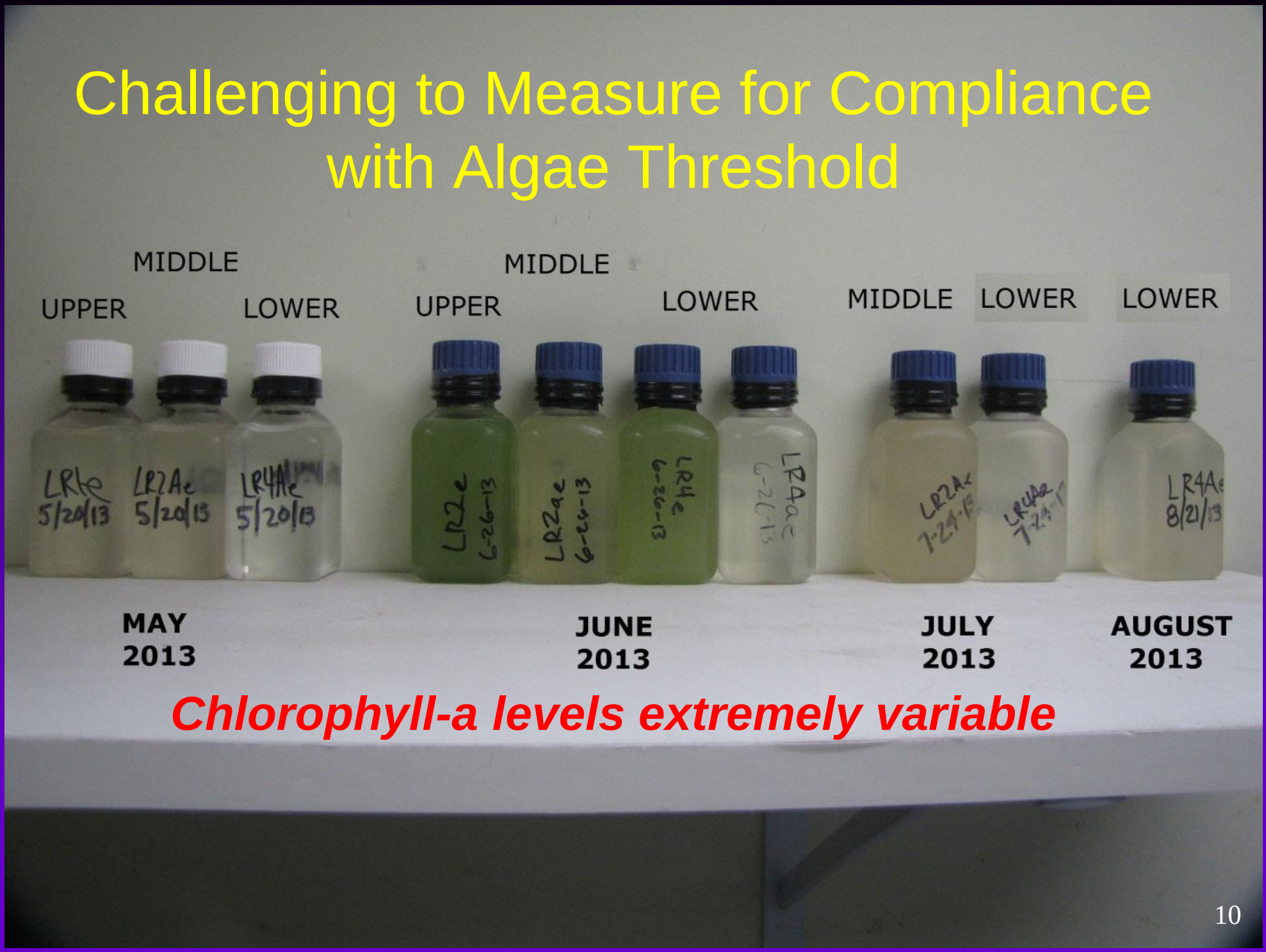
- Current WQS based upon desired trophic conditions between mesotrophic and eutrophic conditions – 10 µg/l
  - Trophic state is a general concept
    - No precise definition
    - No single set of agreed upon algae thresholds for classification
- Protection of beneficial uses is foundation of WQS
  - Contact and non-contact recreation; aquatic life; drinking water
  - No EPA recommendations
  - Review of literature and other states' regulations
    - Wide range of values

Challenges in Selecting Algae Threshold

- Great variability in values in literature, state regs, etc.
- Recreation uses and fishery uses may be at odds
  - Users prefer better water quality
    - Varies from region to region
  - Warmwater fish prefer higher algae levels
- Temporal scale
  - Summer mean
  - Annual mean
- Spatial scale
  - At any point
  - Reservoir-wide average
  - Entire water column
  - Top 1-meter



Challenging to Measure for Compliance with Algae Threshold



Chlorophyll-a levels extremely variable

Chlorophyll-a Thresholds - Recreation

Source	Comment	Waterbody Type	Chlorophyll-a (µg/l)
Minnesota regulations	Based upon user perception surveys; Summer mean for water column	Northern trout waters	3 - 6
		Southern Minnesota waters	22
Vermont regulations	Based upon user perception surveys; May-Oct. mean for euphotic zone	Class A1	5
		Class B	16
Arizona regulations (pending approval)	Growing season mean	Shallow (< 4 m) and deep (>18 m) lakes	10 – 15
		Other lakes	20 - 30
Suggested Threshold			15 - 20

Chlorophyll-a Thresholds – Aquatic Life

Use	State Regs	Comments	Chlorophyll-a (µg/l)
Coolwater fish	Virginia	Apr.-Oct. 90th percentile at 1 meter or less	25
Coolwater/warmwater fish	Minnesota	Summer mean for water column	9 (northern region) – 22 (southern region)
Warmwater fish	Colorado, W. Virginia	Summer mean for water column (Colo.); Avg. of 4 or more samples collected May-Oct. (W.Virg.)	20
	Virginia	Apr.-Oct. 90th percentile at 1 meter or less	35
Suggested Threshold			20 - 25

Chlorophyll-a Thresholds – Drinking Water

- Algae can lead to:
  - Taste and odor problems
  - Toxins
  - Trihalomethanes – disinfection byproduct
- Some literature suggest 5 – 10 µg/l where water piped or pumped directly from lake/reservoir or nearby downstream location to water treatment plant
  - Others have suggested higher values (10 – 20 µg/l)
- Lahontan Reservoir
  - Water not directly removed for drinking use near reservoir
  - Recharges aquifers for domestic use downstream
  - Filtered through groundwater
  - Unnecessary to consider chlorophyll-a threshold

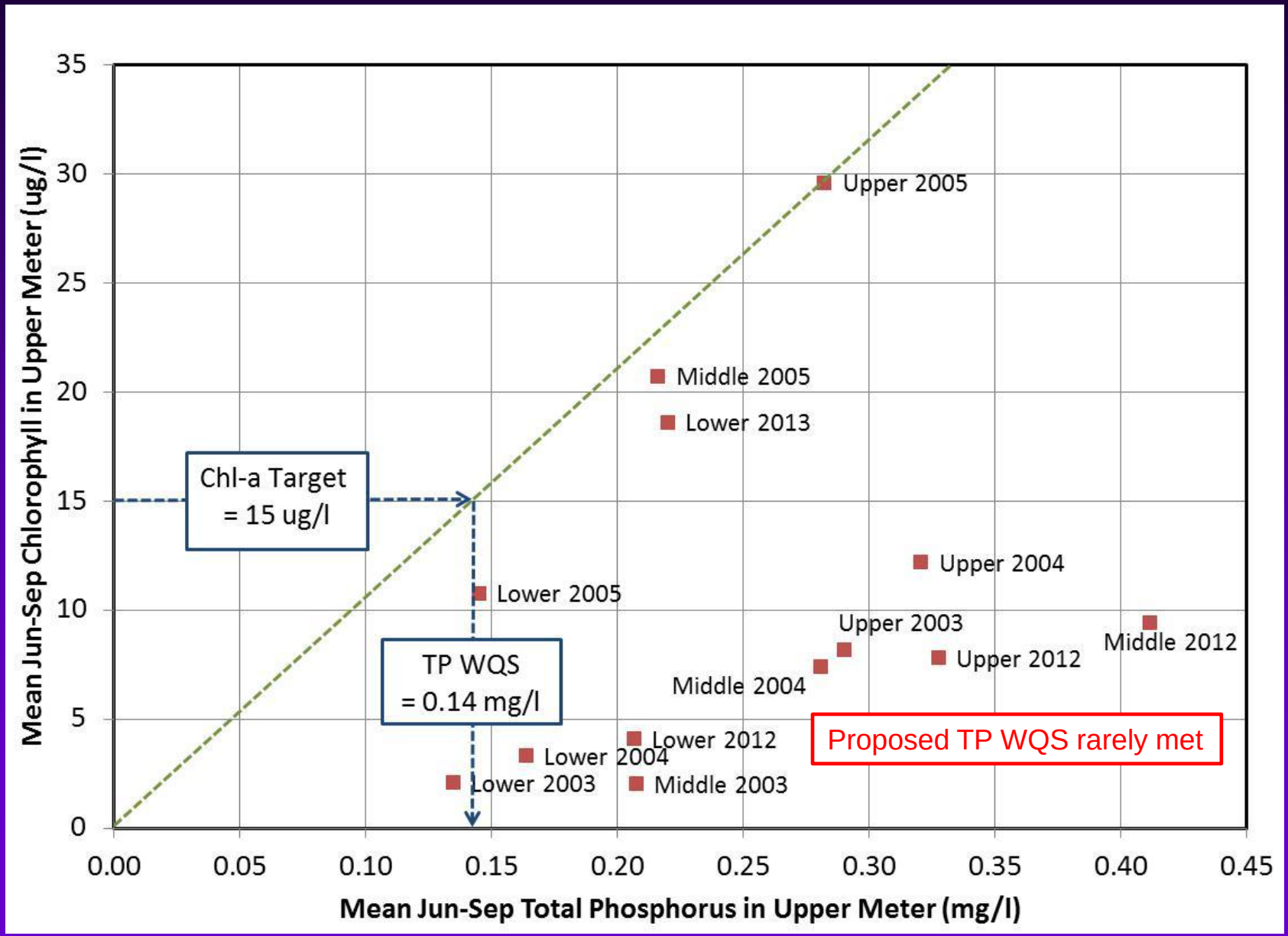
Summary of Chlorophyll-a Thresholds

Beneficial Use	Chlorophyll-a (µg/l)
Contact and noncontact Recreation	15 – 20
Aquatic Life (warmwater fishery)	20 – 25
Municipal or domestic supply	None
Recommended Threshold	15

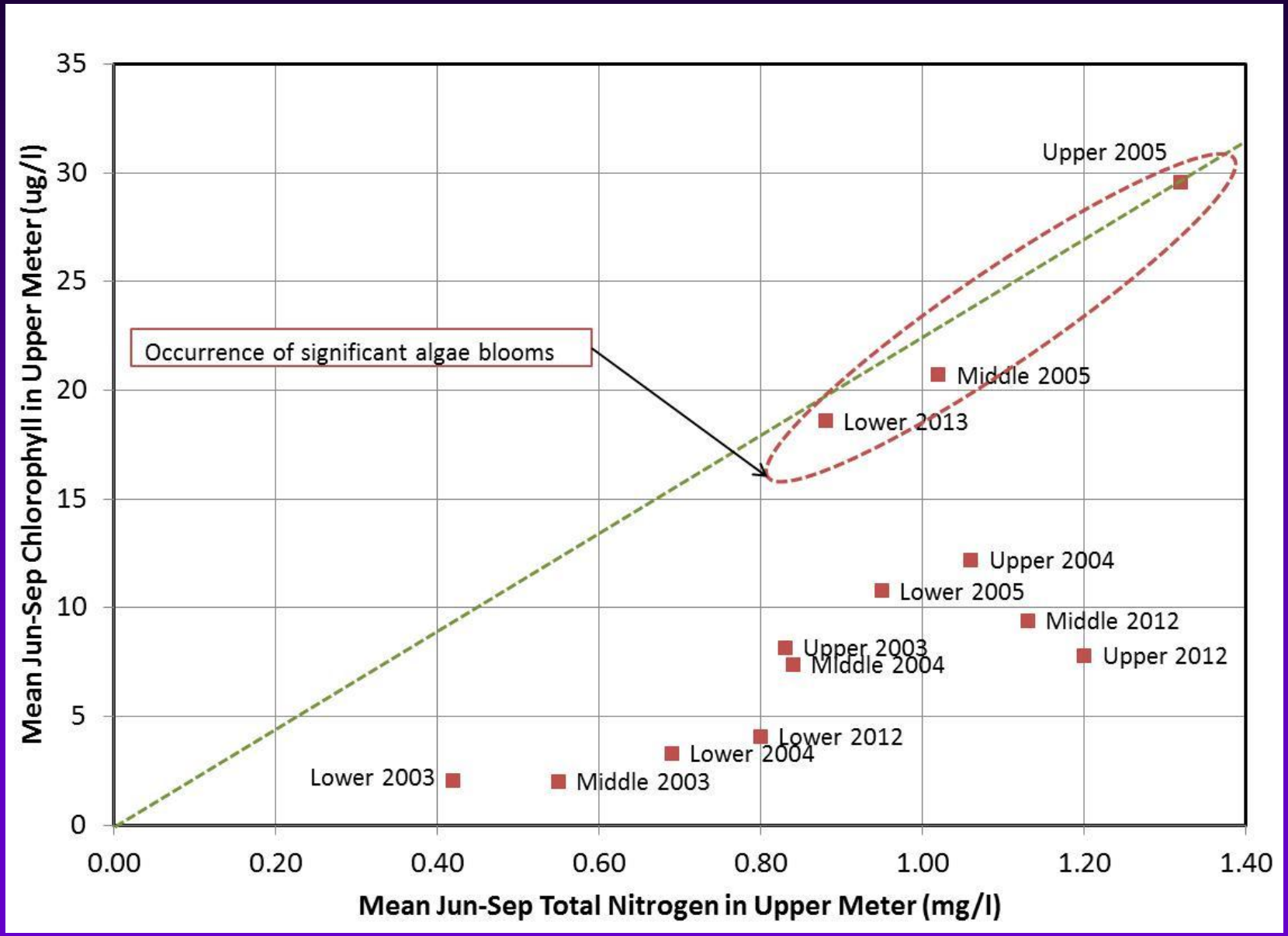
Scale for Chlorophyll-a Threshold and Nutrient WQS

- Temporal Scale Options
  - Annual mean
  - Summer mean
  - June – Sept mean ← Recommended
  - May – October mean
- Spatial Scale Options
  - Areal
    - Mean of all sites in reservoir
    - Mean of all sites in a segment (basin) ← Recommended
    - Each monitoring sites separately
  - Water column
    - Mean in entire water column
    - Mean in epilimnion
    - Mean in upper meter ← Recommended
    - Mean in euphotic zone

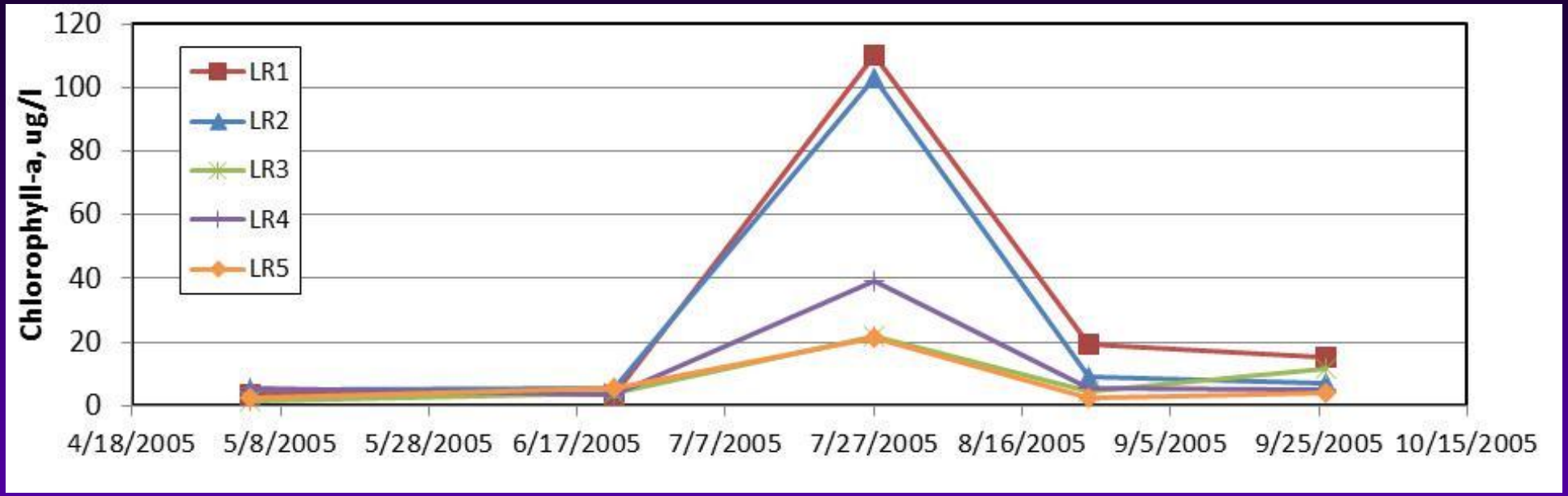
Total P vs. Chlorophyll-a

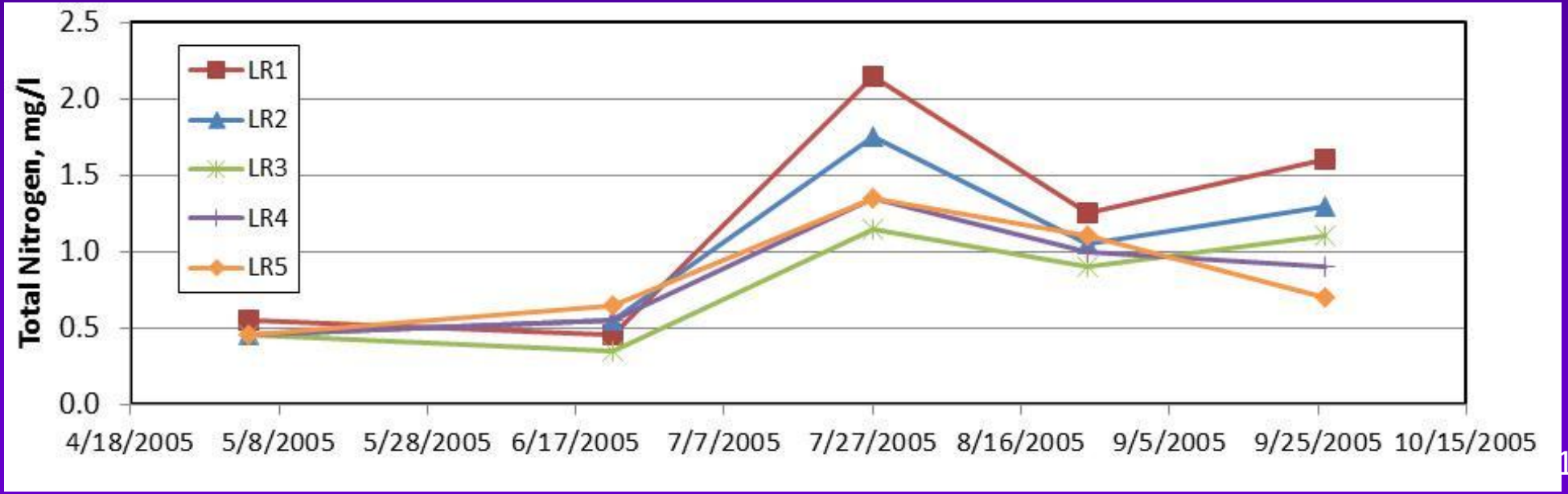


Total N vs. Chlorophyll-a



TN - Chlorophyll-a: Cause or Response?





TN WQS?

- Some have concluded that lake eutrophication cannot be controlled by TN controls, and that only TP WQS are necessary
  - Significant disagreement
  - EPA recommends setting both N and P criteria
- NDEP recognizes the need to control both N and P
  - Available data insufficient to set N WQS for the control of algae
    - Rely on RMHQs
      - SV = 1.7 mg/l
      - AA = 1.3 mg/l
      - Insufficient data exists to re-evaluate existing RMHQs

Nitrate and Nitrite Recommendations

- Nitrate: SV ≤ 10 mg/l
  - Set in 1984 based upon EPA recommendation for drinking water
    - EPA recommendation is unchanged
    - No change is proposed
- Nitrite: SV ≤ 1 mg/l
  - Set in 1984 based upon EPA recommendation for drinking water
    - EPA recommendation is unchanged
    - No change is proposed

Next Steps

- Still waiting for initial comments from EPA
- Late January 2014 – finalize draft Rationale/Petition
- February 2014 – public workshop
- March 2014 – comments due
- June 2014 – State Environmental Commission

Thank You

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