



NORTH COAST CYANOHAB RISK FACTORS AND WATER QUALITY MANAGEMENT STRATEGIES



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Presentation Topics

- **Identify Water Quality Risk Factors Contributing to CyanoHABs**
- **Describe Examples of North Coast CyanoHab Risk Factors**
- **Provide Examples of North Coast Water Quality Management Policies, Regulations, to Address CyanoHABs**



CyanoHAB WQ Risk Factors

Paerl and Otten, 2013

- **Climate Change / changing precipitation patterns**
- **Warm temperatures**
- **Low Turbulence/long residence time/low flow**
- **persistent stratification**
- **Nutrient over-enrichment**
- **High light/solar radiation**
- **High DOM**

Biostimulatory Conditions

- **Reduced Riparian Canopy**
- **Channel Morphology**
- **Impoundments**
- **Reduced Flows**
- **Pollutant Loading**
- **Watershed Conditions**

Biostimulatory Conditions Conceptual Model

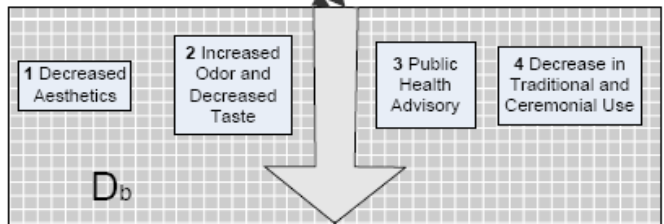
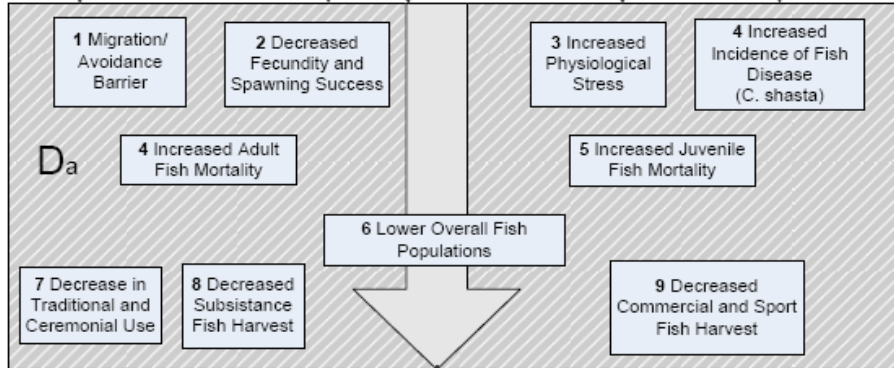
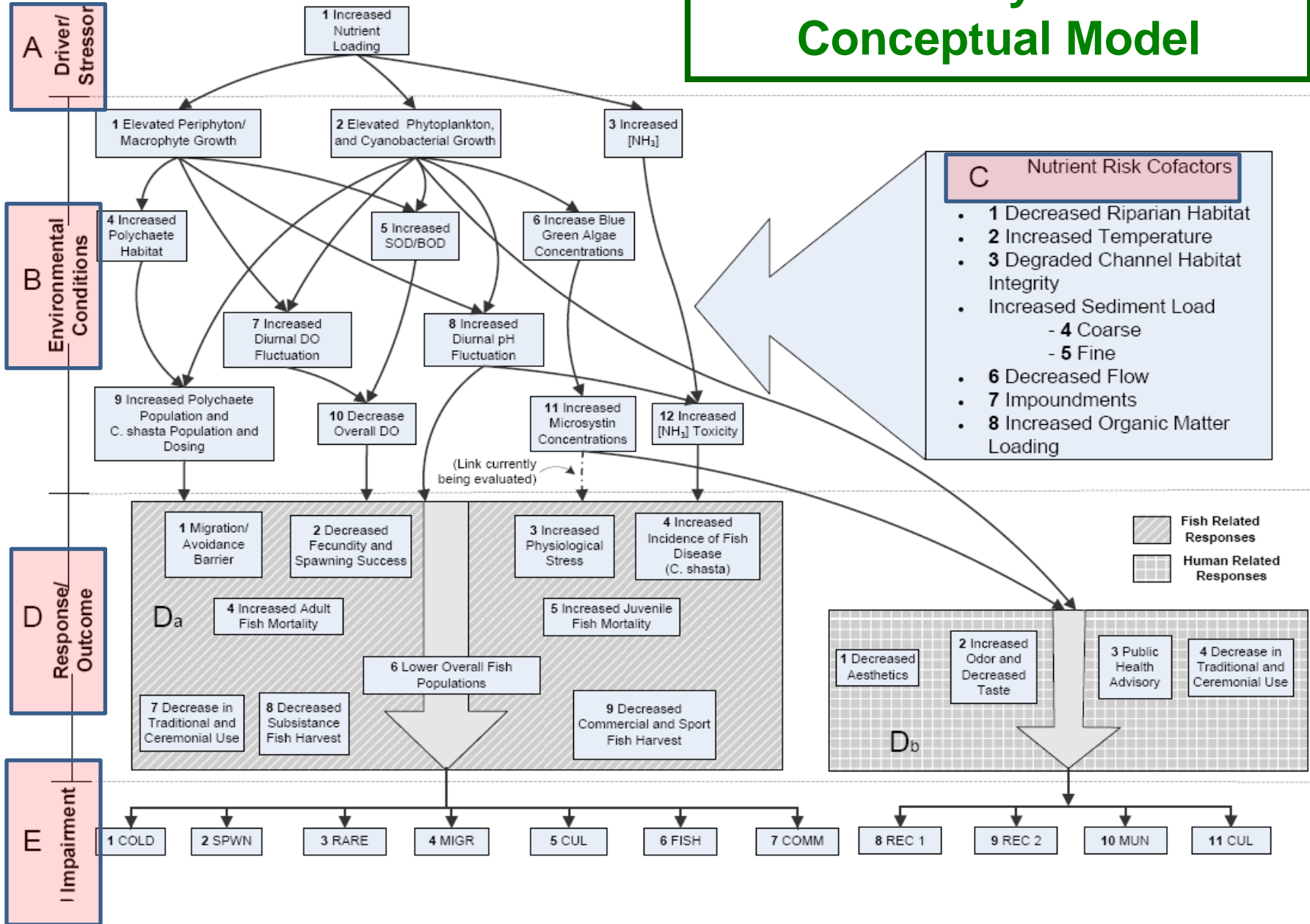
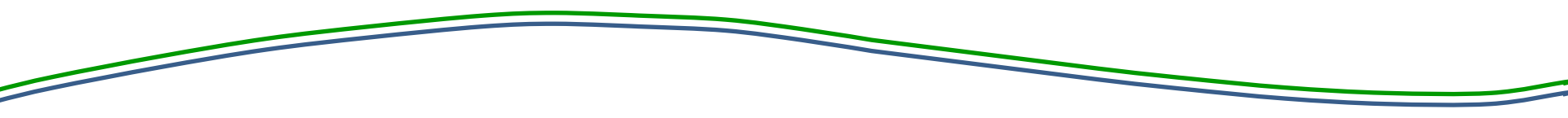


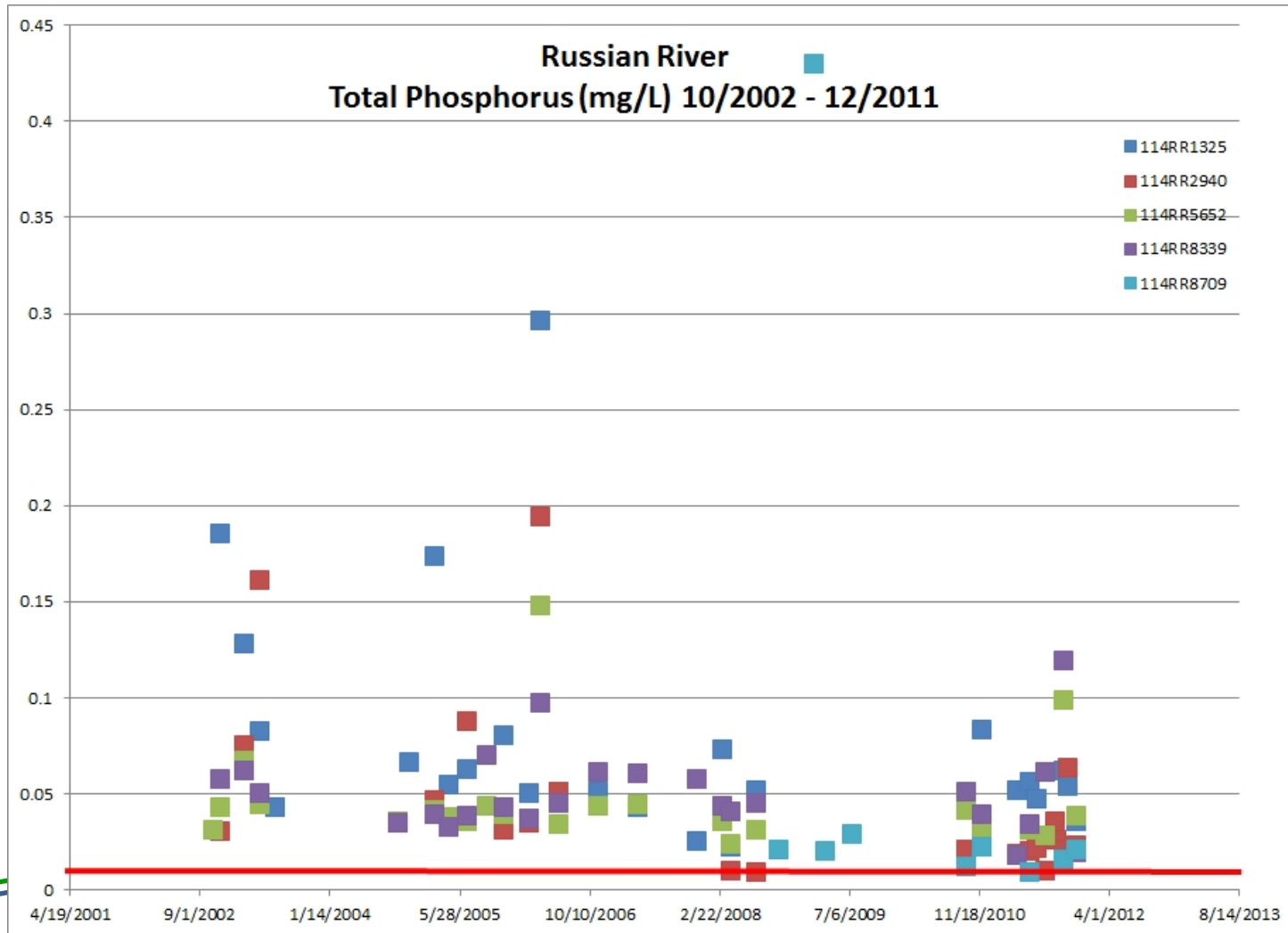


Photo Credit: Katharine Carter

Russian River: CyanoHAB Risk Factors

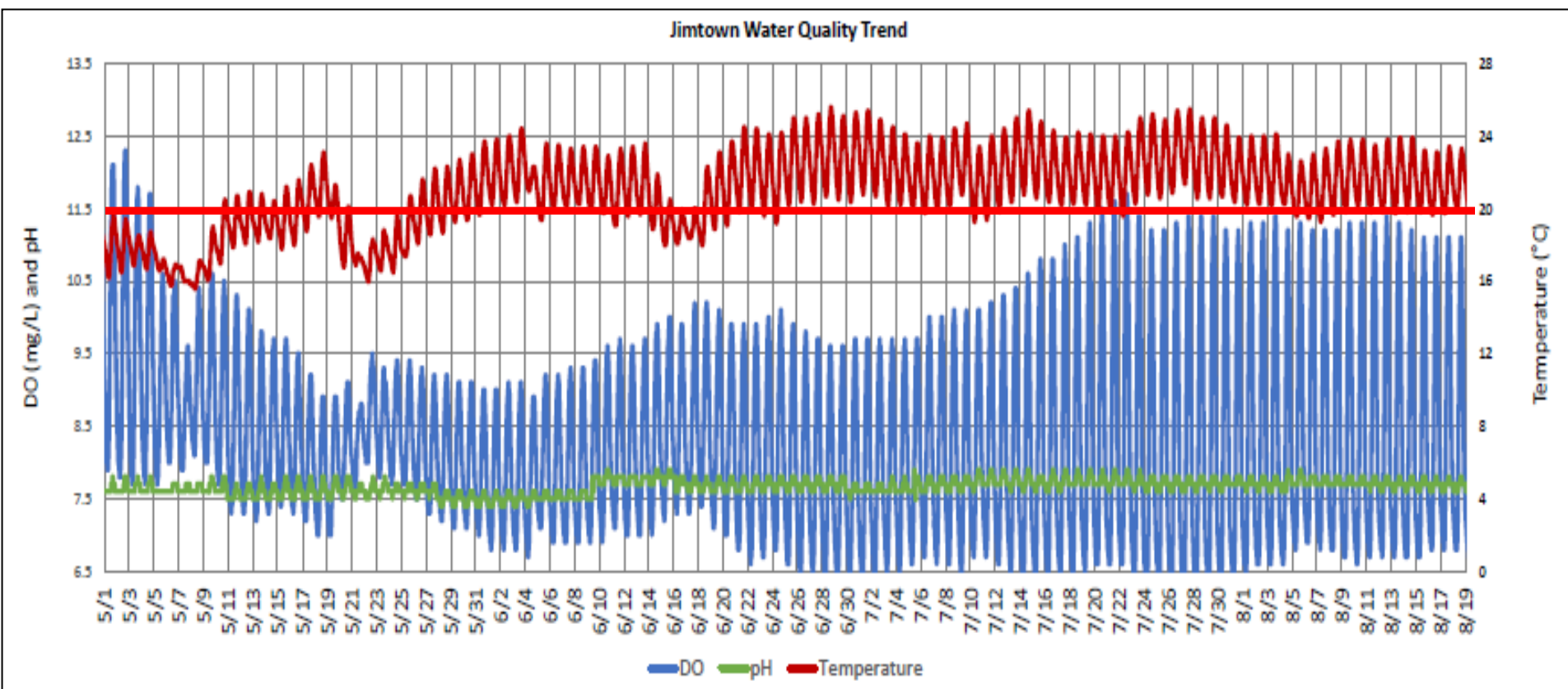


Russian River Nutrient Conditions





Russian River Temperature and Dissolved Oxygen Conditions





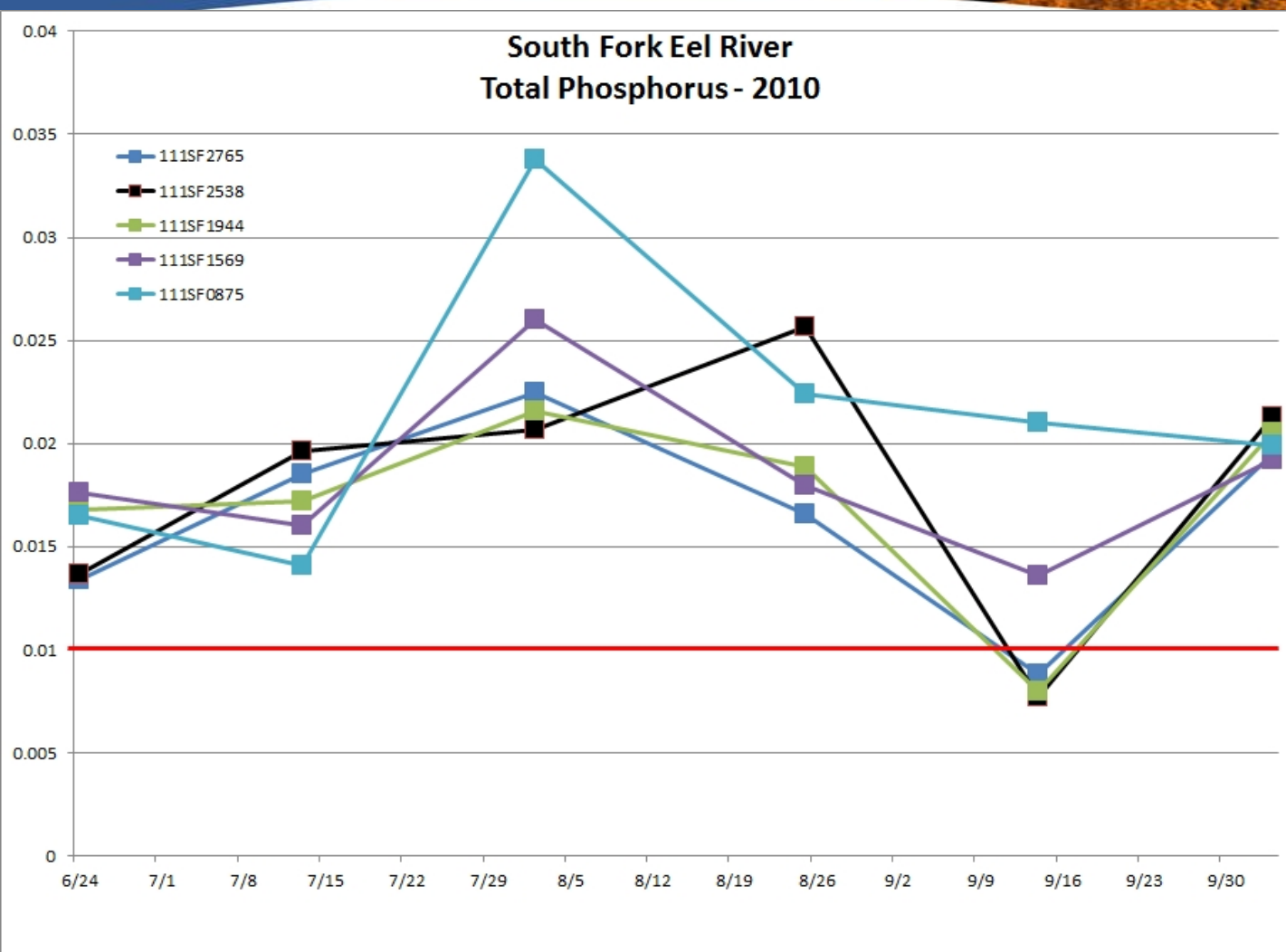
Russian River Response



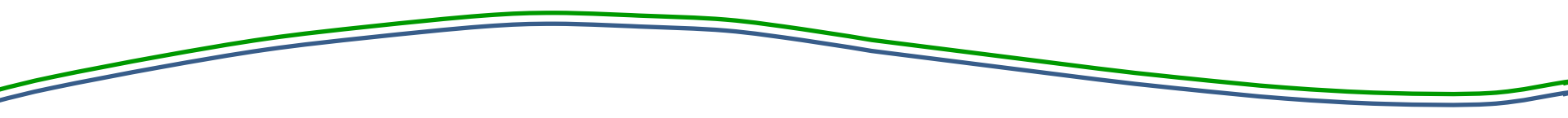


Photo Credit: Keith Bouma-Gregson

South Fork Eel River: CyanoHAB Risk Factors

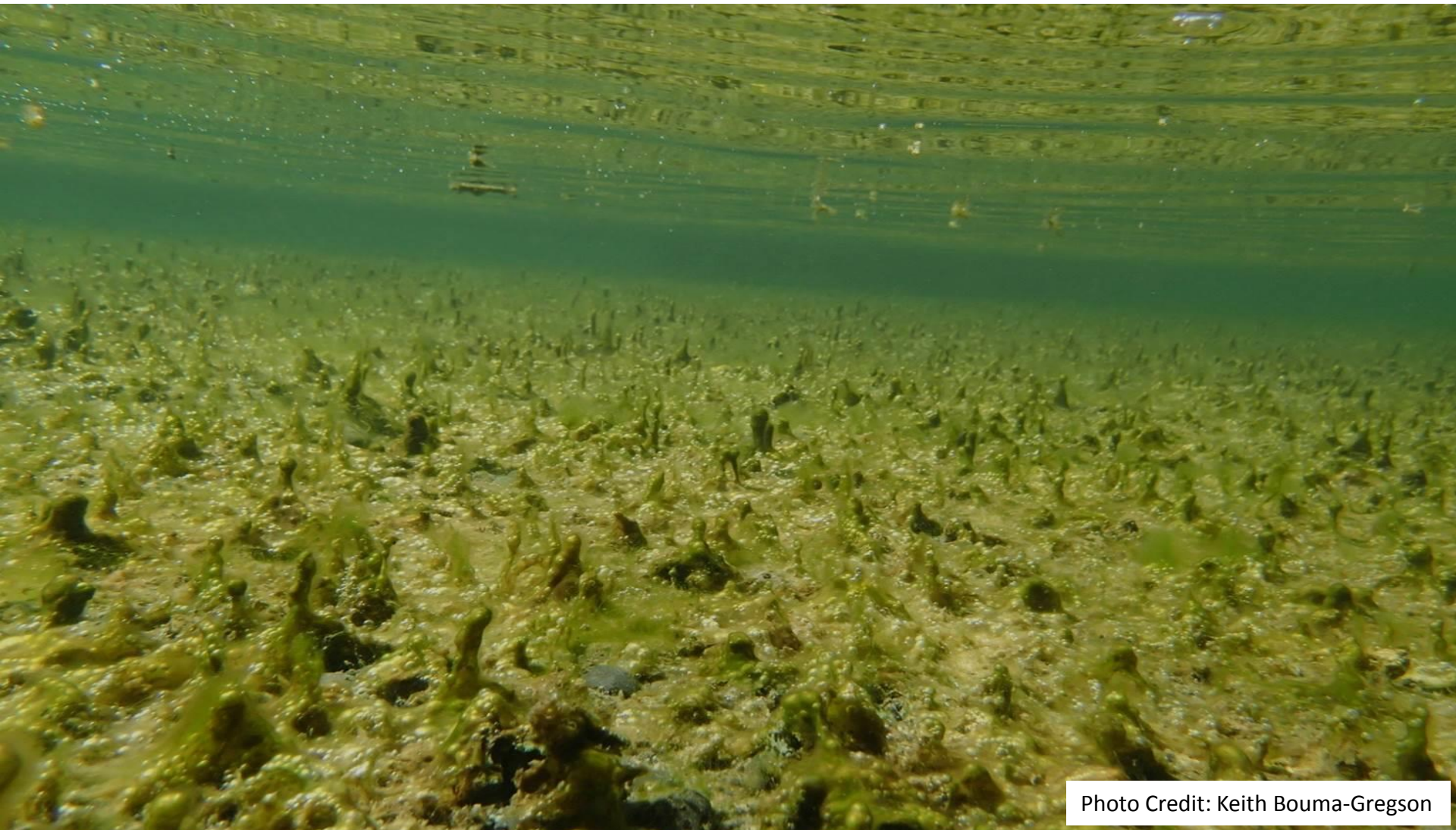


**South
Fork
Eel
Nutrient
Conditions**

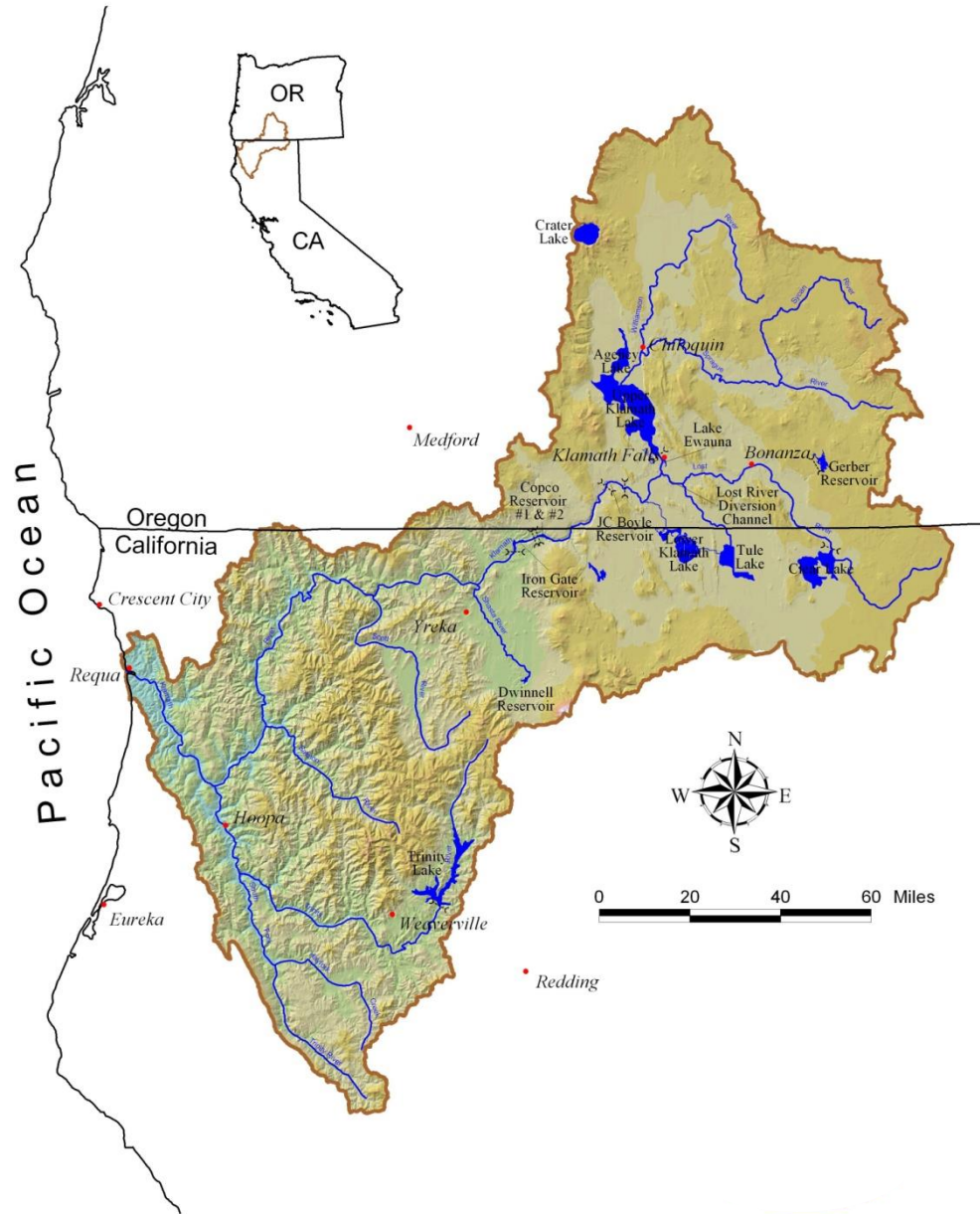




Eel River Response



Klamath River Basin



Klamath River: CyanoHAB Risk Factors & Management Actions

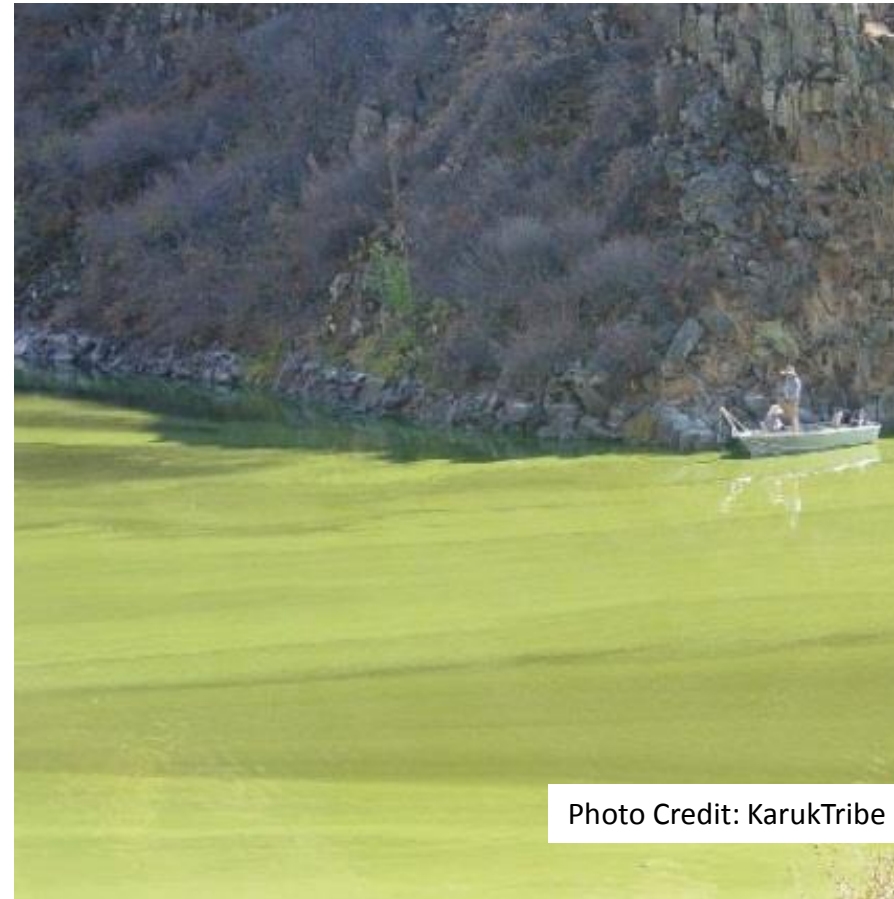
Klamath River

303(d) Listings for Microcystin

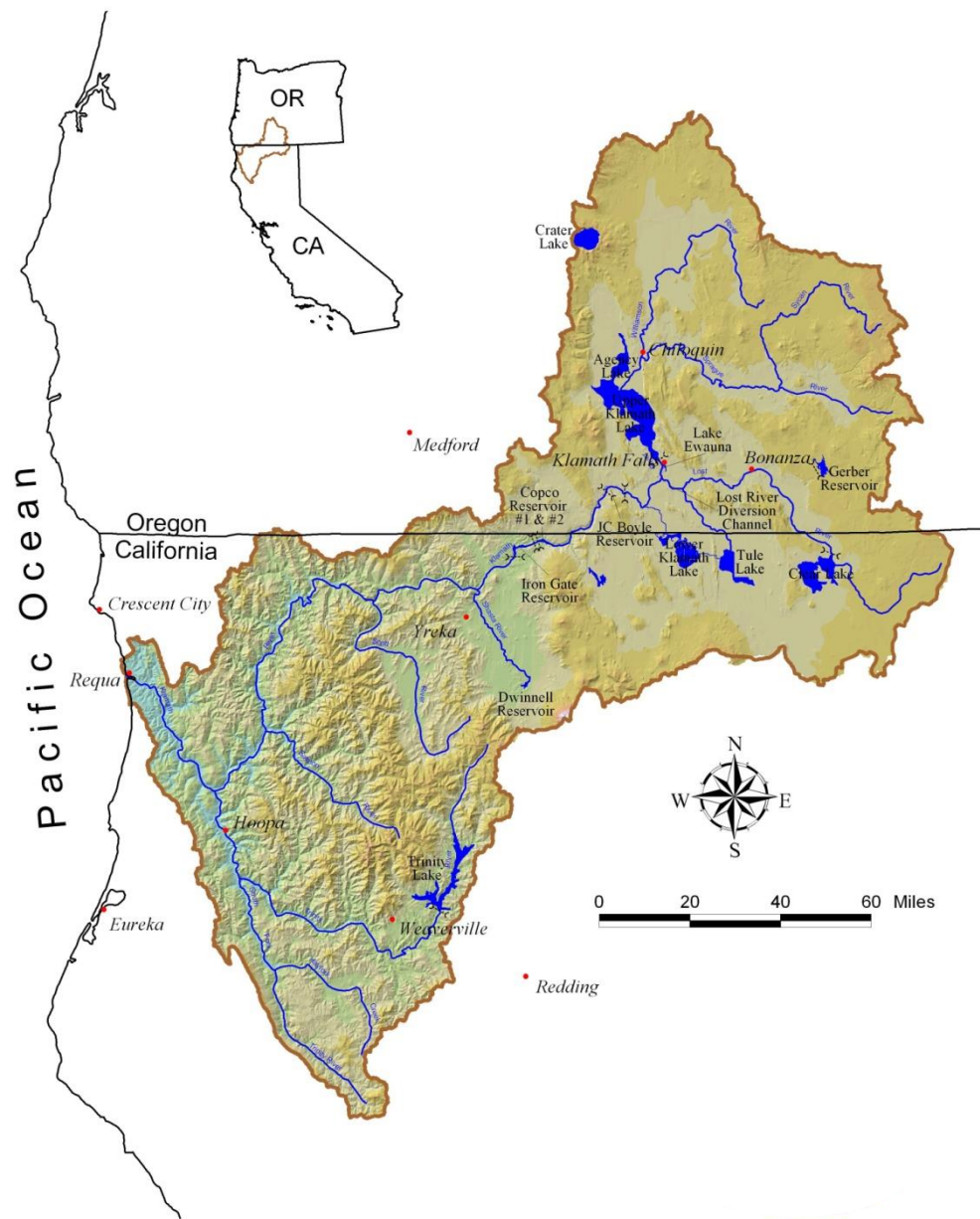
- Copco Reservoir
- Iron Gate Reservoir
- Klamath River
 - Oregon to Trinity River
(166 miles)

CA Total Maximum Daily Load (TMDL) & Action Plan

- Approved in 2010

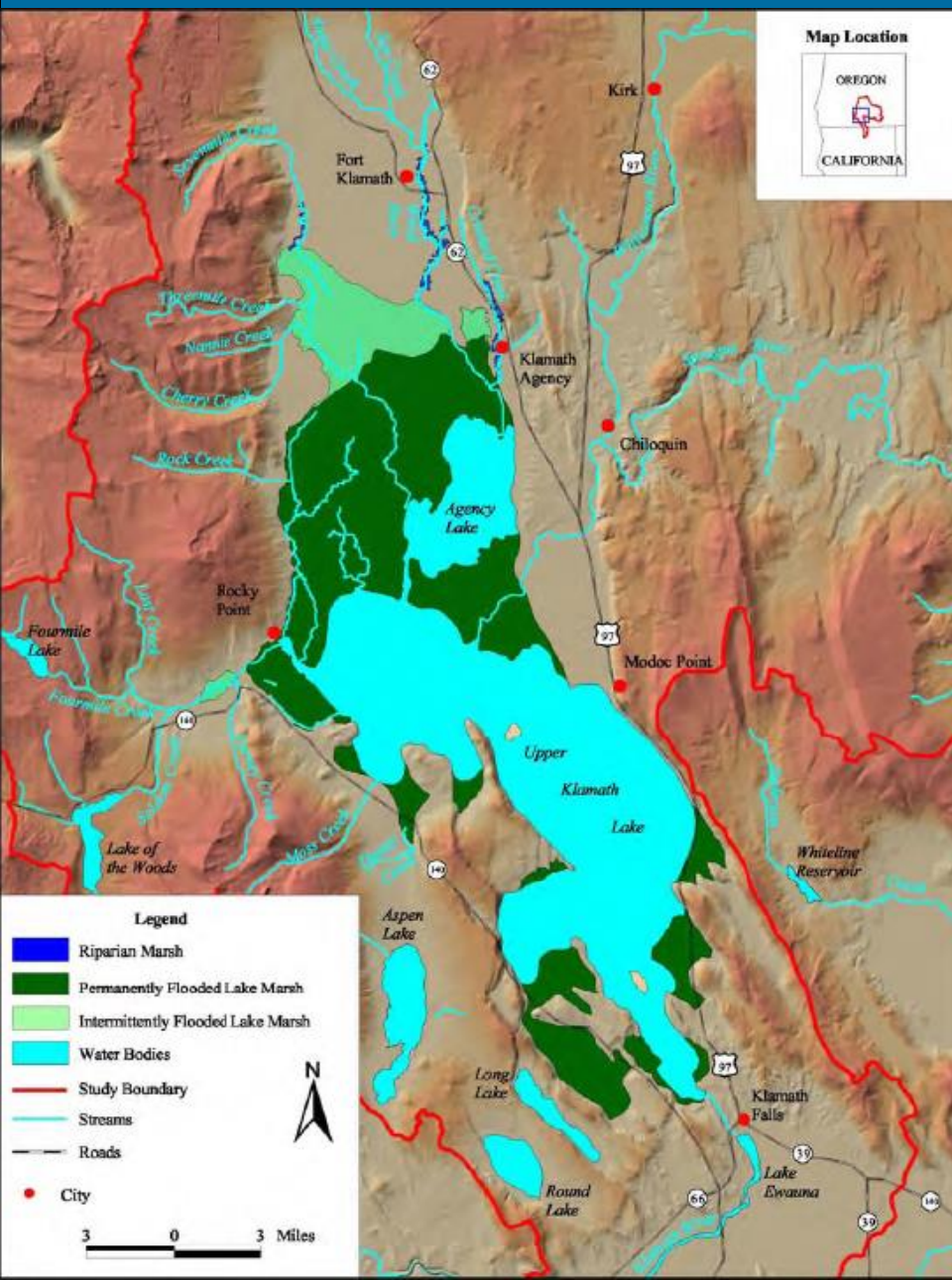


Klamath River Basin

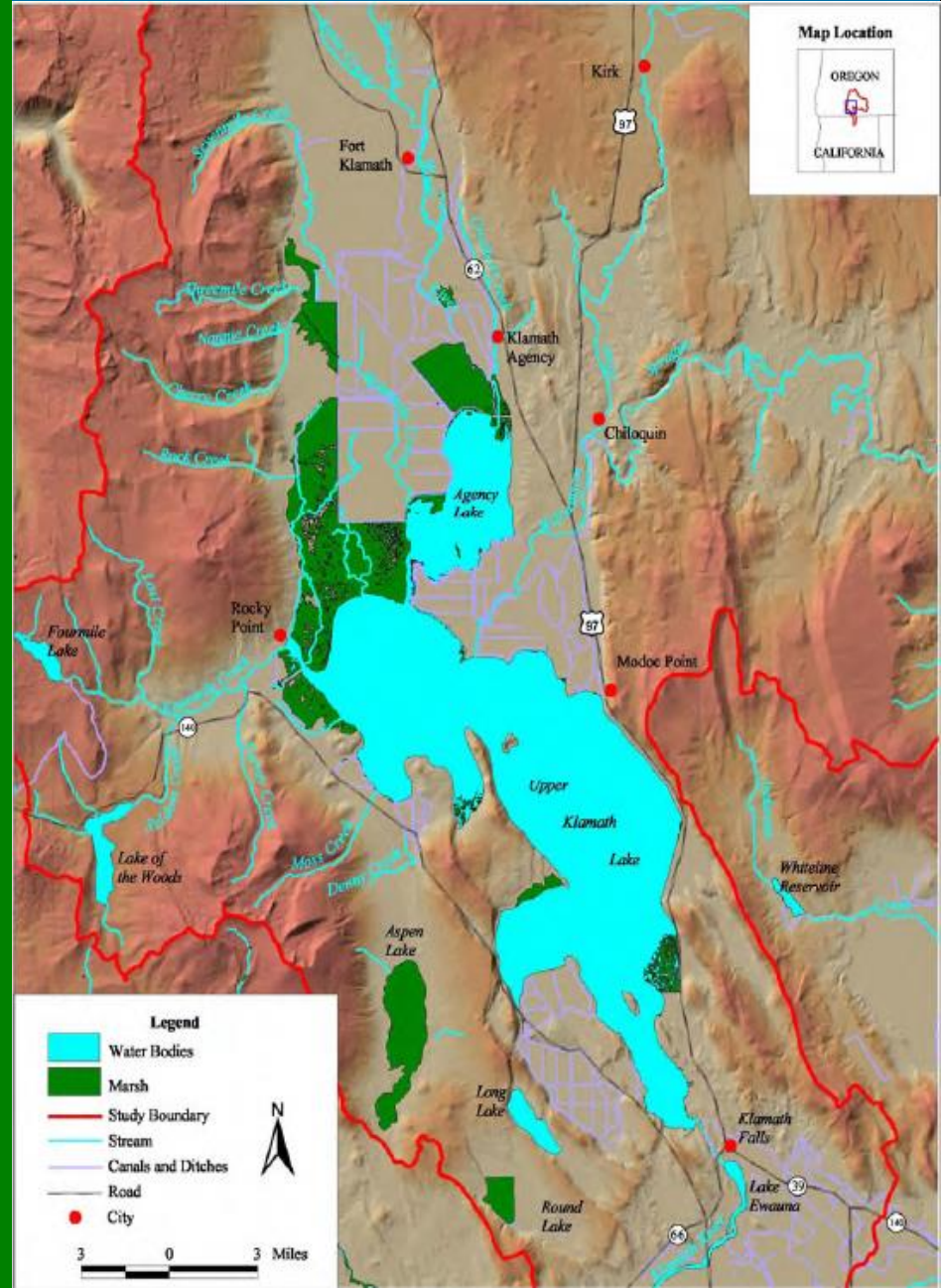


**Restoration of
the Klamath
River hinges
upon
restoration
throughout the
basin**

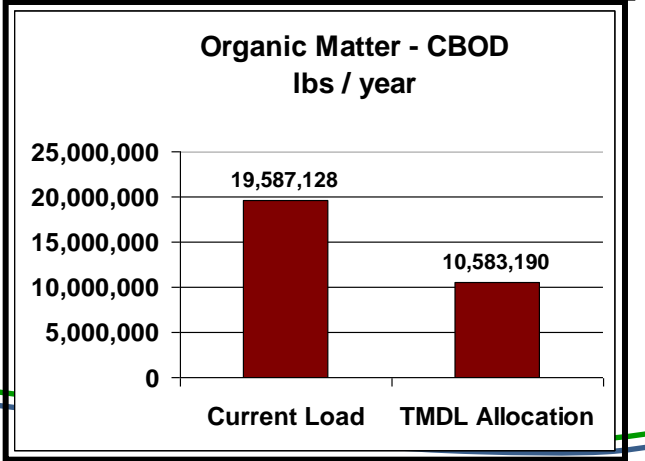
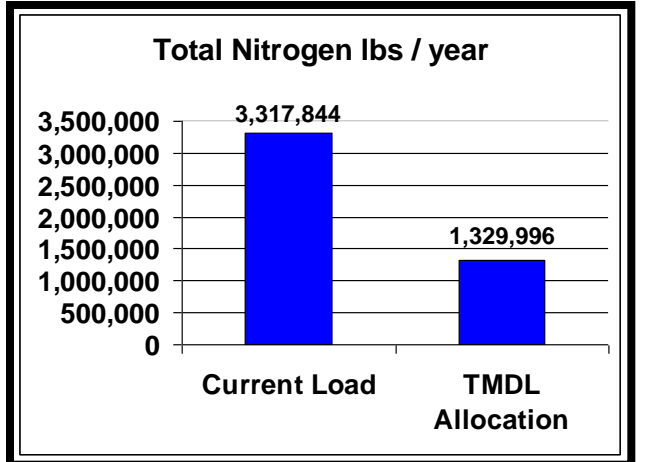
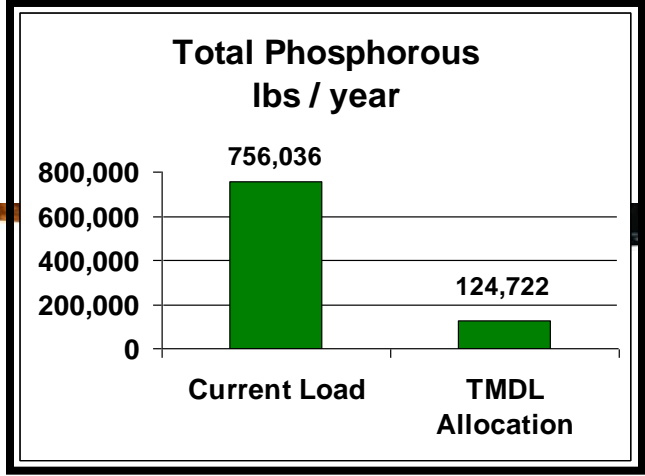
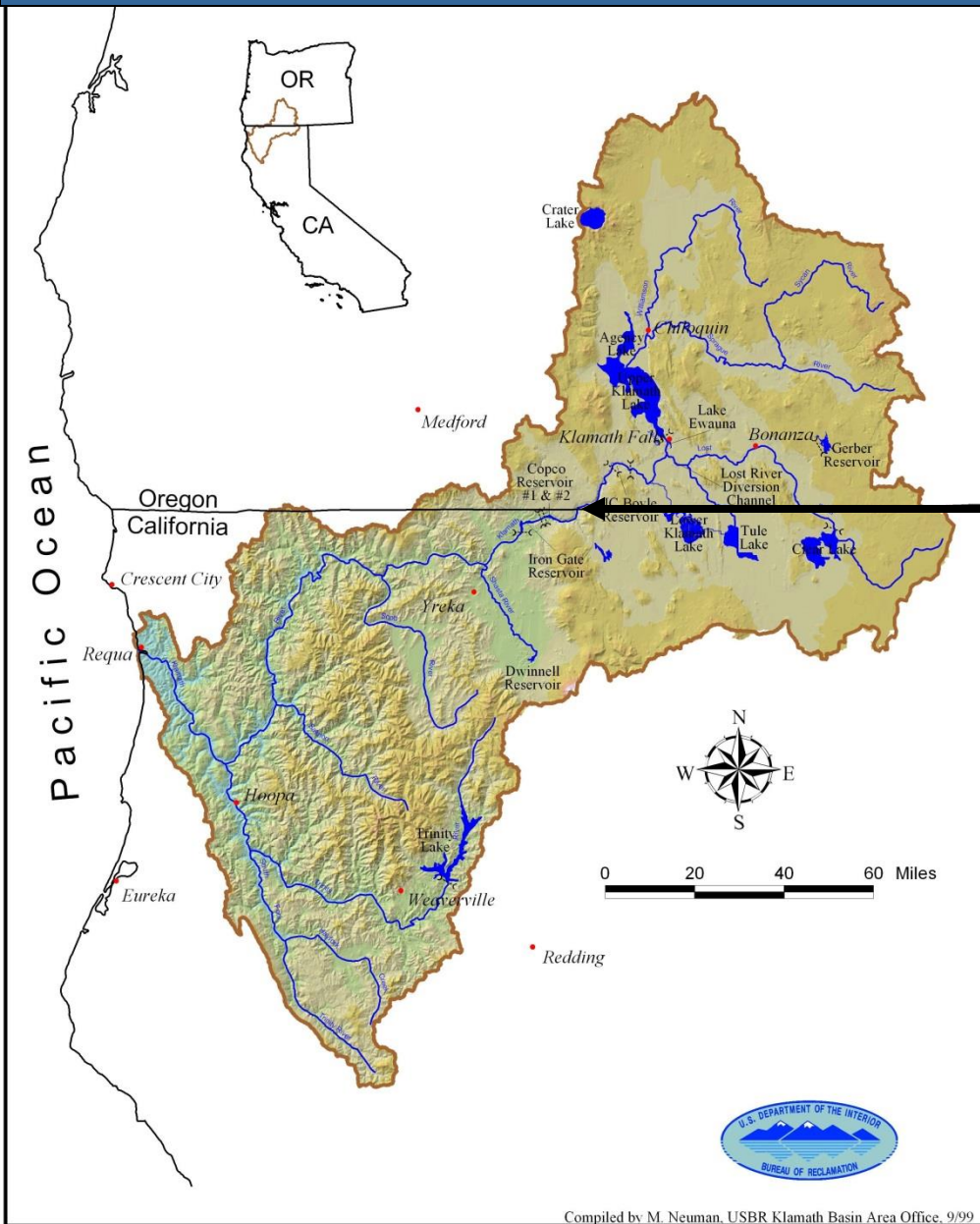
Natural Lake & Marsh Areas of UKL



Current Lake & Marsh Areas of UKL



Pollutant Loads at OR / CA Stateline



Klamath River Impoundments

Copco I & II Dams



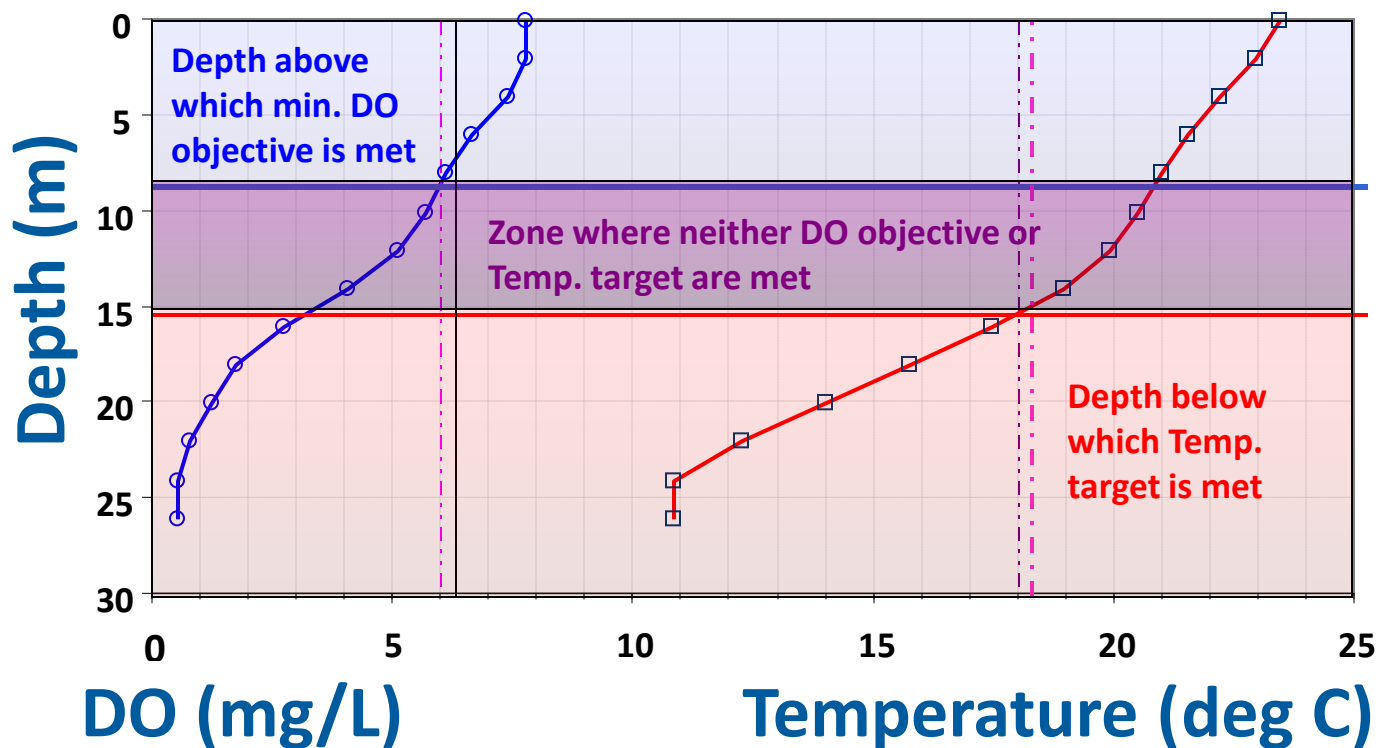
Iron Gate Dam





Reservoir Stratification

Iron Gate Reservoir – Mean for June, July, & August

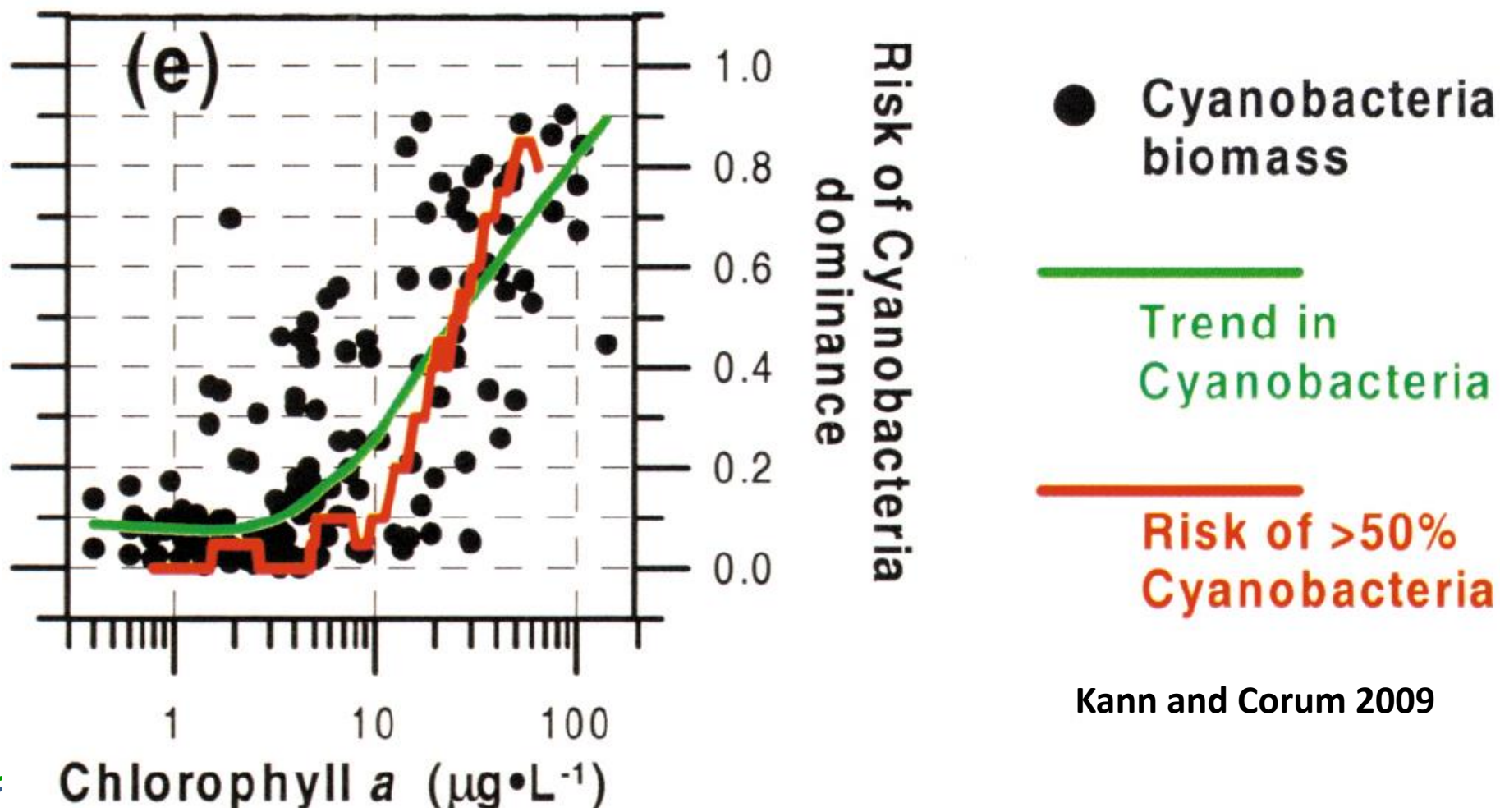


Mean DO ———

Mean Temp. ———



Algal population dynamics

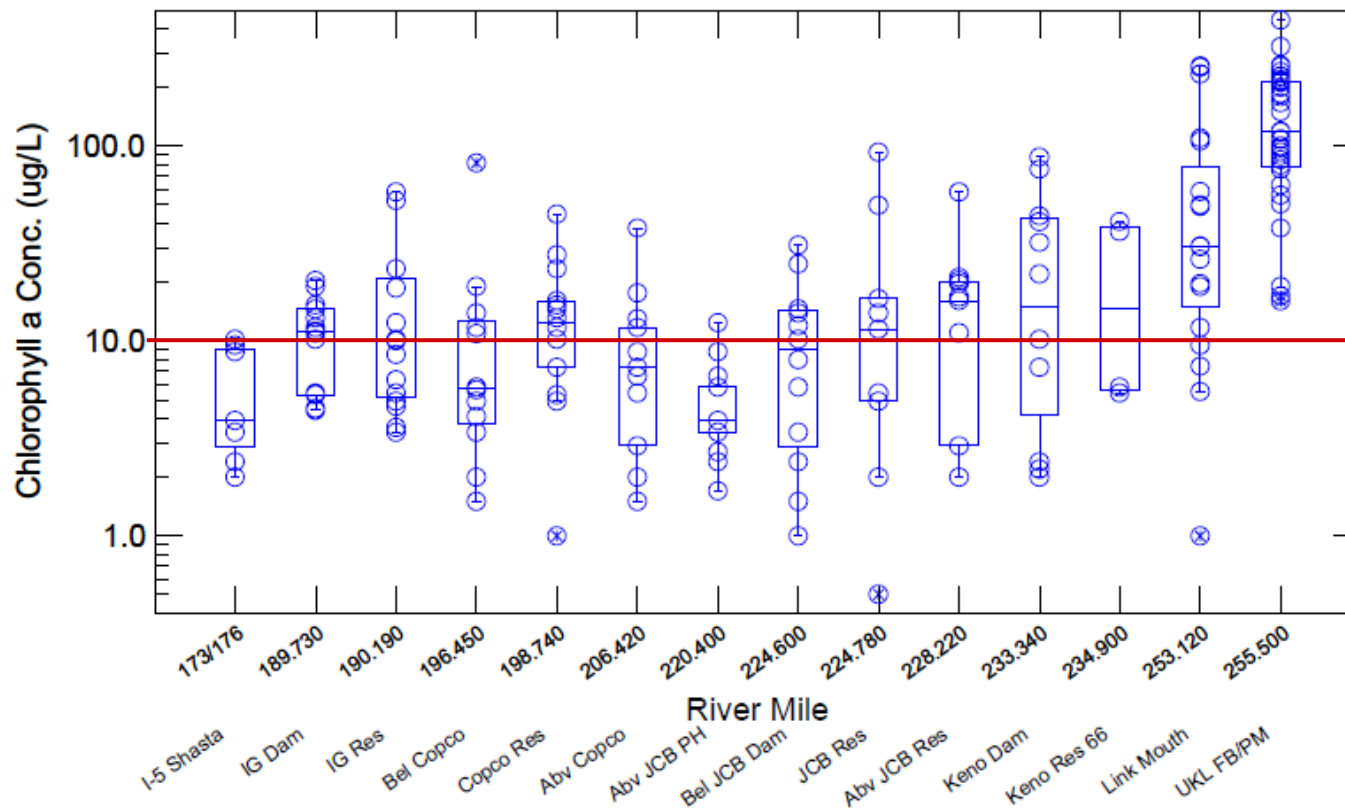


Kann and Corum 2009



Chlorophyll a

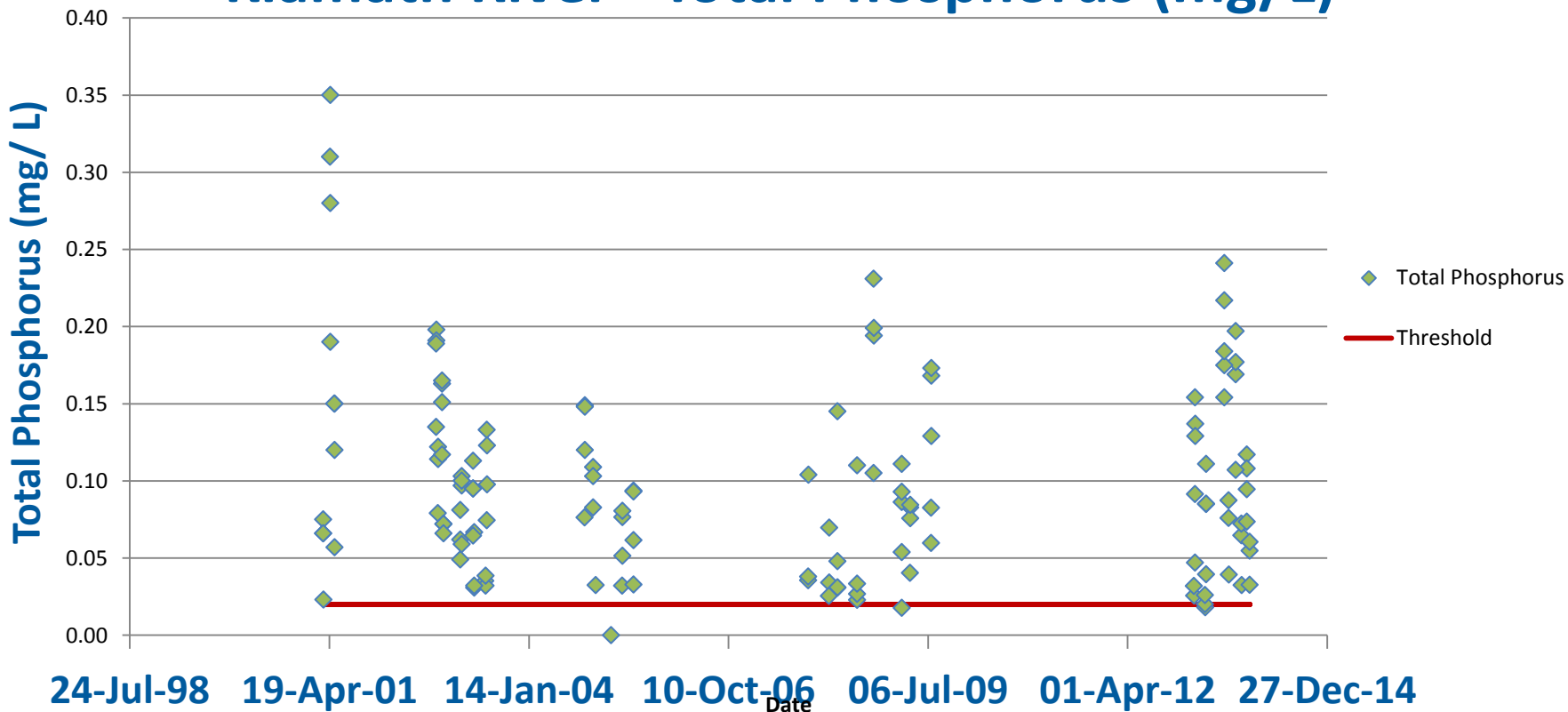
Chlorophyll a at Klamath River Sites 2001-2004, June-September



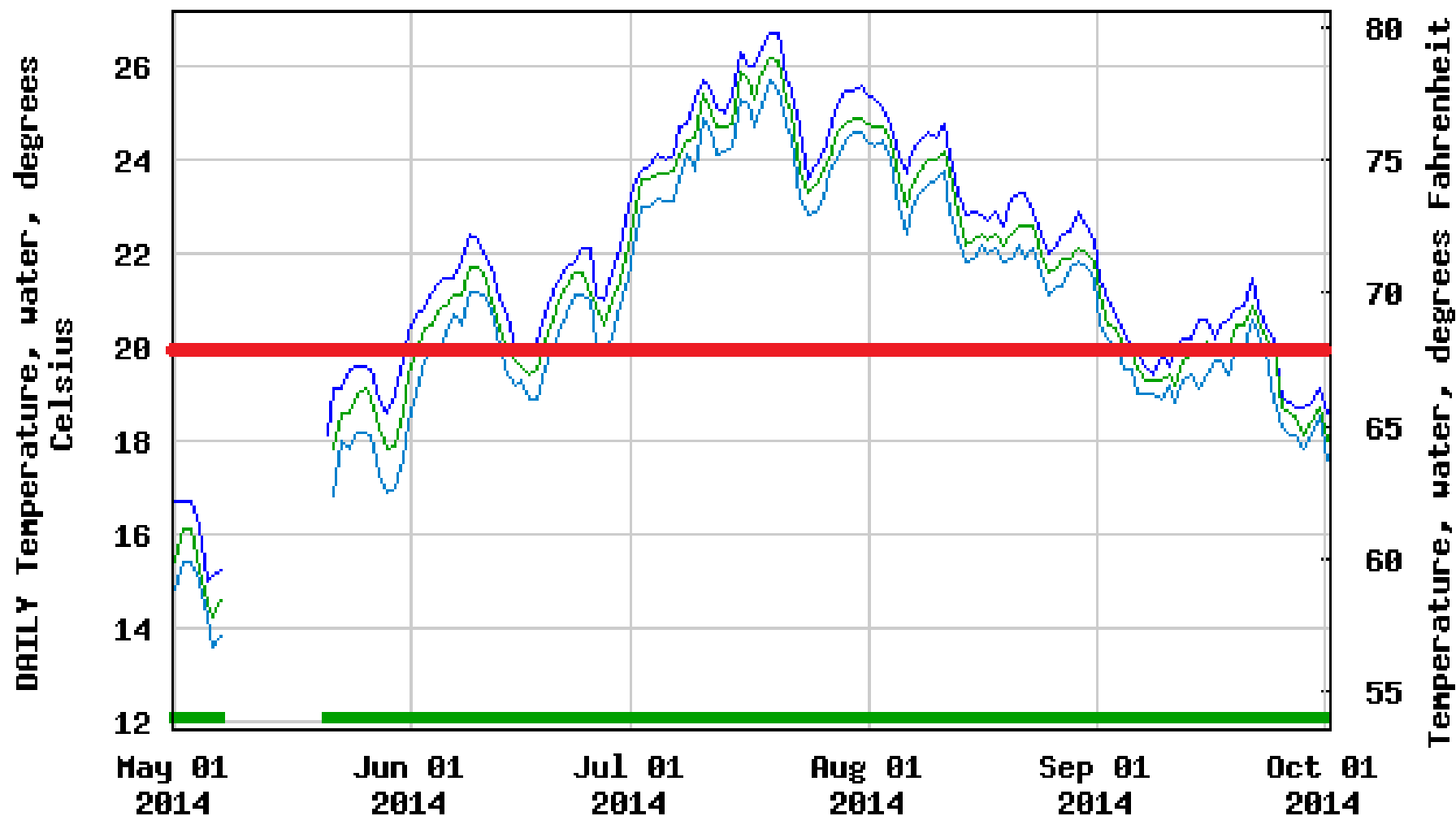


Stateline to Estuary

Klamath River - Total Phosphorus (mg/L)



USGS 11523000 KLAMATH R A ORLEANS



— Daily maximum temperature — Daily median temperature
— Daily minimum temperature █ Period of approved data

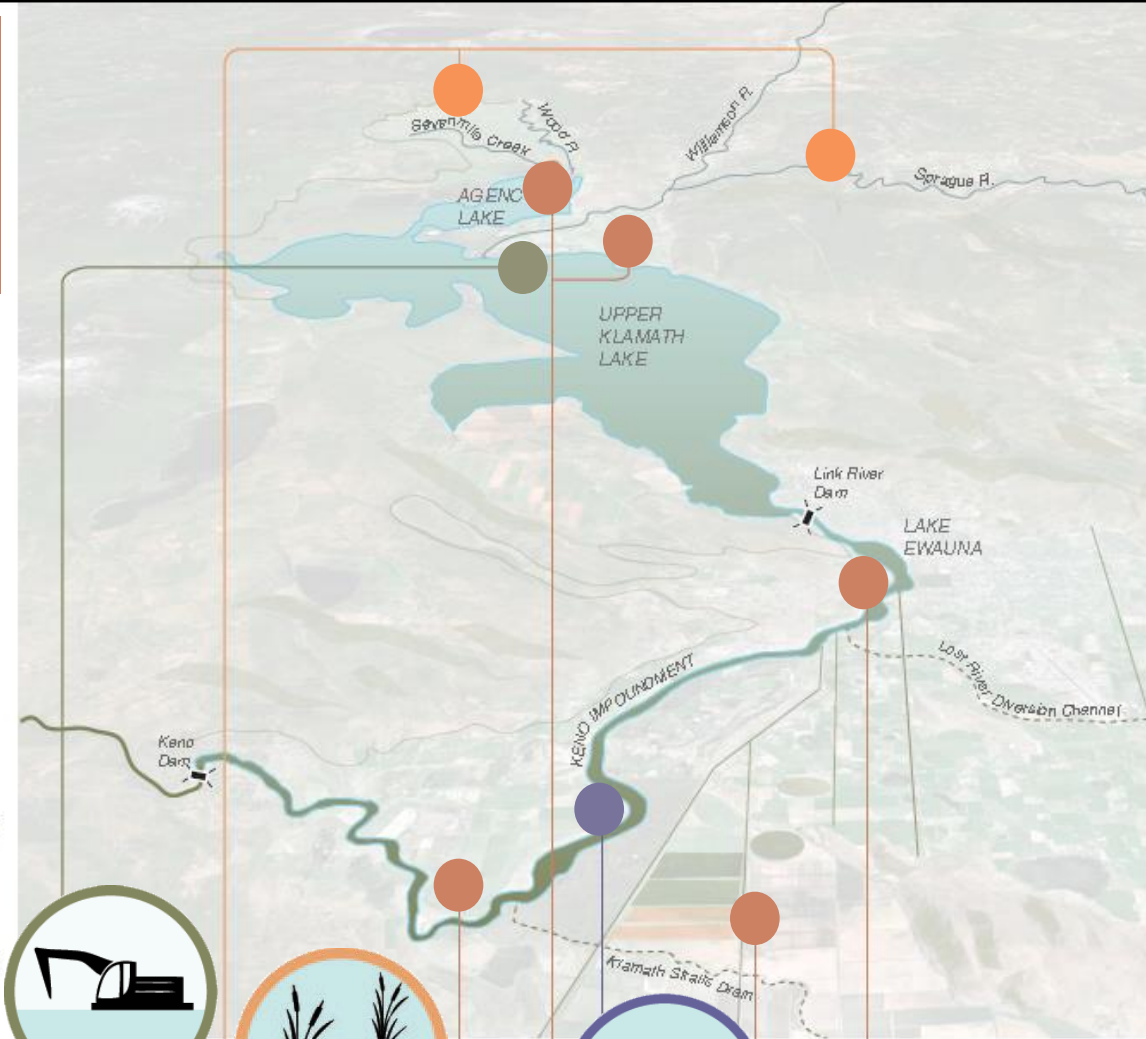
Klamath Management Actions

REHABILITATED WETLANDS ALONG UPPER KLAMATH LAKE, AGENCY LAKE, LAKE EWAUNA, KENO IMPOUNDMENT

SEDIMENT P SEQUESTRATION USING ALUM MICRO-FLOC W/AERATION/OXYGENATION

DSTWs IN WOOD AND SPRAGUE RIVER VALLEYS

TARGETED DREDGING IN UKL & AGENCY LAKE COMBINED W/IN-BASIN SEDIMENT RE-USE



Years to effective treatment: 3-5

Treatment is immediate

Years to effective treatment: 1-2

Treatment is immediate

Treats symptoms

Treats causes

Treats symptoms

Treats causes

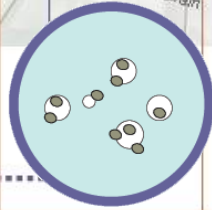
Years of effective treatment:

5-10 years

15-20 years

20-30 years

30-50 years

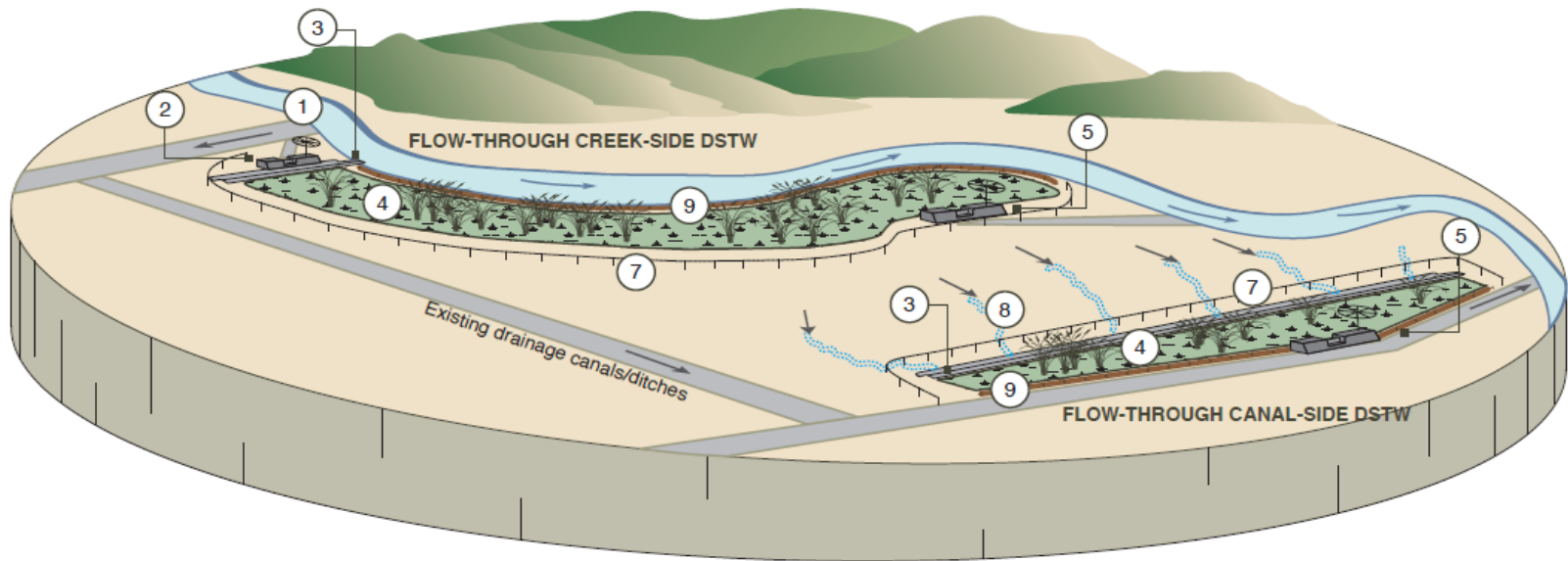




Klamath Management Actions

Diffuse Source Wetland Treatment Systems

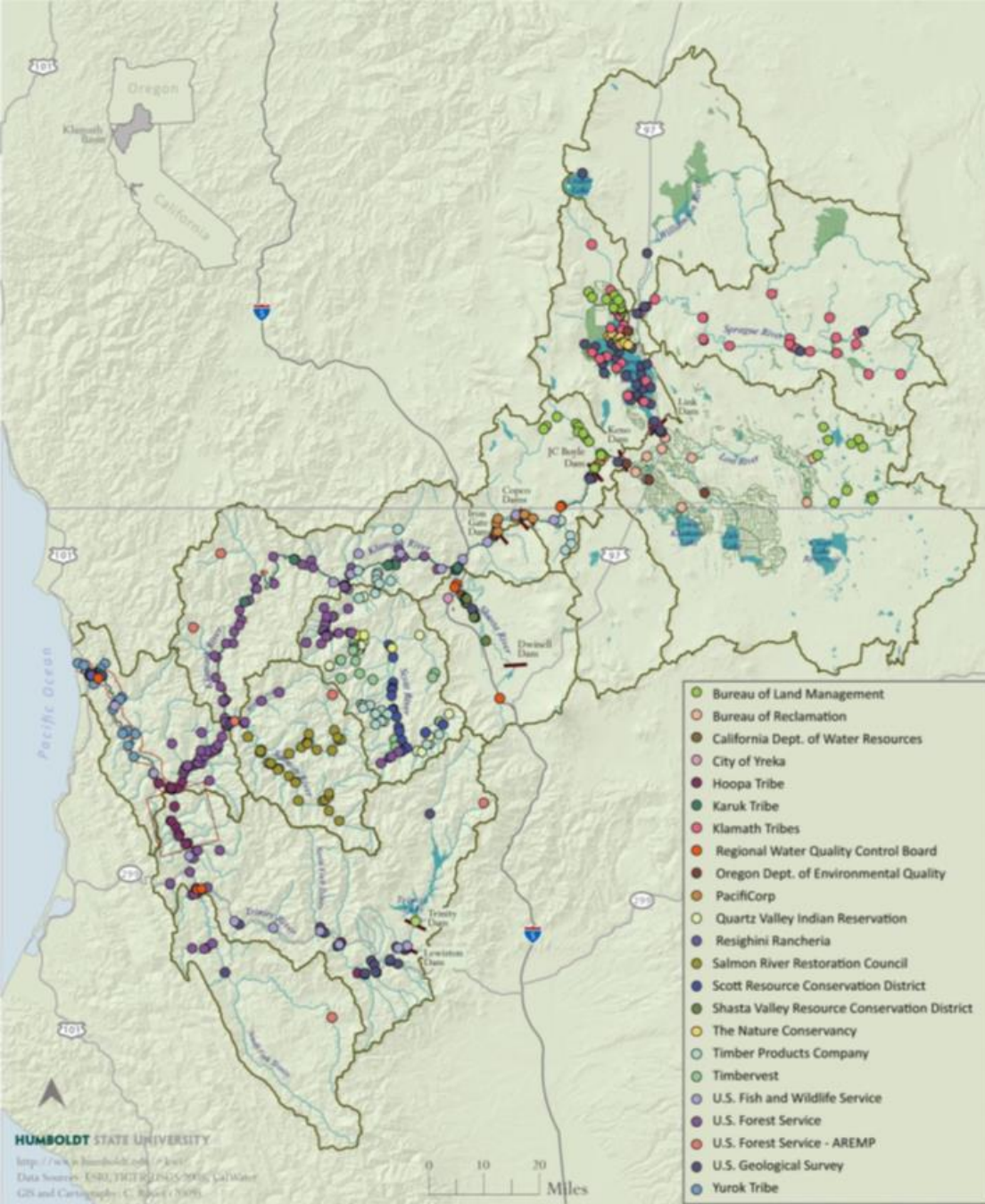
Fig. 3.7 Concept designs for flow-through creek-side and flow-through canal-side DSTWs.





Klamath Basin Monitoring Program

- Monitoring coordination
- Common analytical methods and sampling protocols
- Data management
- Membership organization
- Watershed stewardship assessment reports
- Web Information Portal (Blue-green Algae Tracker)
- www.kbmp.net





Regional Water Board Water Quality Tools

- **TMDLs = Comprehensive Assessments and Solutions to Water Quality Impairments**
- **Grant & Loan Programs**
- **Rural Roads Initiative**
- **Management of Forest Lands**
- **Cannabis Water Quality Permit Program**



Regional Water Board Water Quality Tools

- **Dredge & Fill permits -- 401 Certifications**
- **Water Quality Restoration Grants and Contracts**
- **Development of Flow Objectives – CA Water Action Plan**
- **Division of Water Rights - Water Rights Process**
- **Watershed Stewardship Partnerships**



Challenges

- So much work – so few staff
- Building partnerships takes time
- County Public/Environmental Health have varying resources and varying levels of participation
- Monitoring is expensive
- Outreach and education is pivotal