

# **Hydrologic Influences on Water Quality in Blue Cypress Marsh Conservation Area**

**Angelique M.K. Bochnak, Ph.D.**

and

**Steven J. Miller, Lawrence Keenan, Dean Dobberfuhr,  
Sue Connors**

**St. Johns River Water Management District**

**Environmental Sciences Division**

**6/4/2012**



**St. Johns River**  
Water Management District

# St Johns River Water Management District



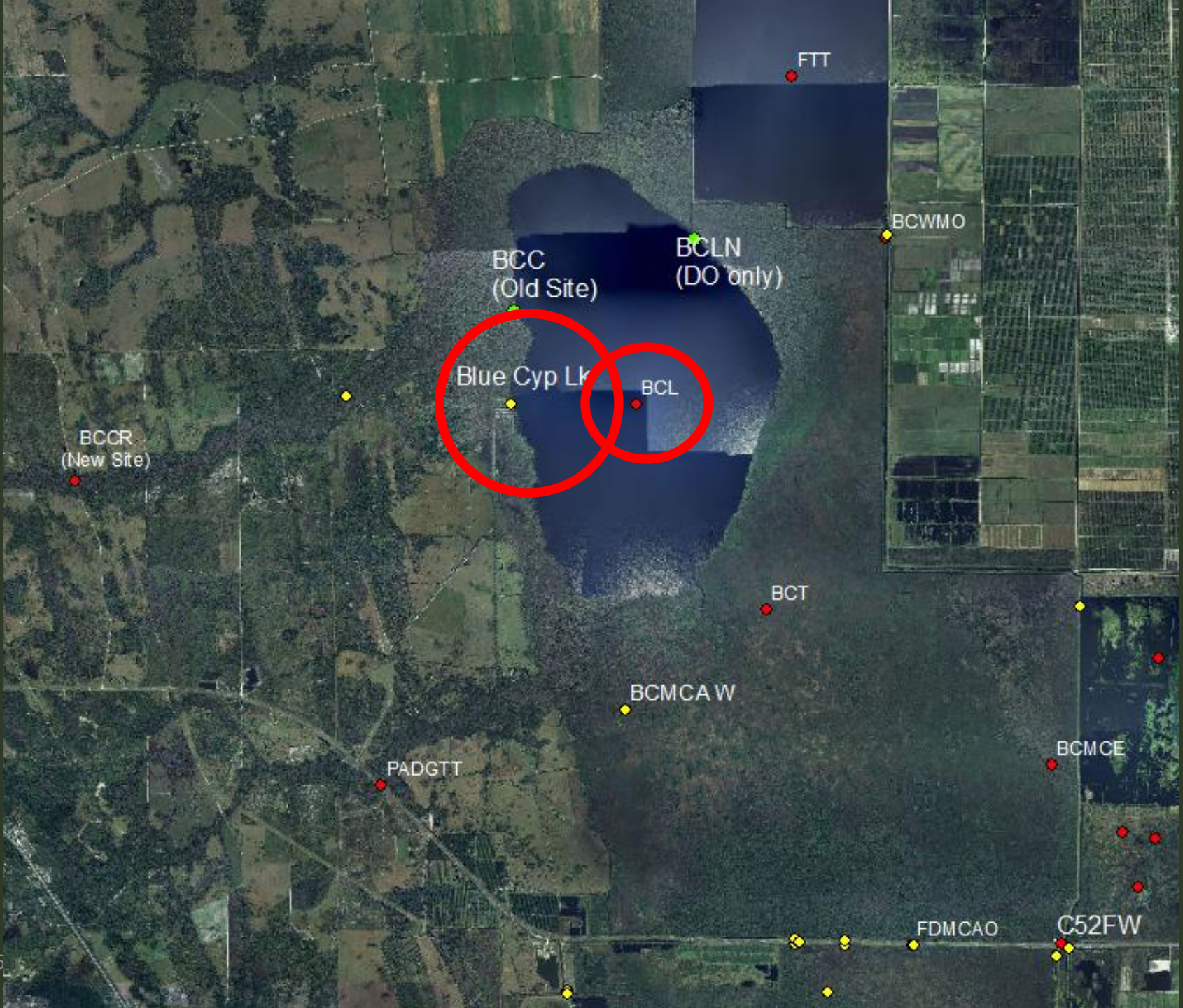
Upper SJR Basin



# Water Quality is Degrading in BC Lake?

- BCL – center lake long term WQ site
  - TSI and nutrients, with trend analysis,
  - TOC
  
- Why is it degrading?
  - Run-off?
  - Internal Loading from the marsh?





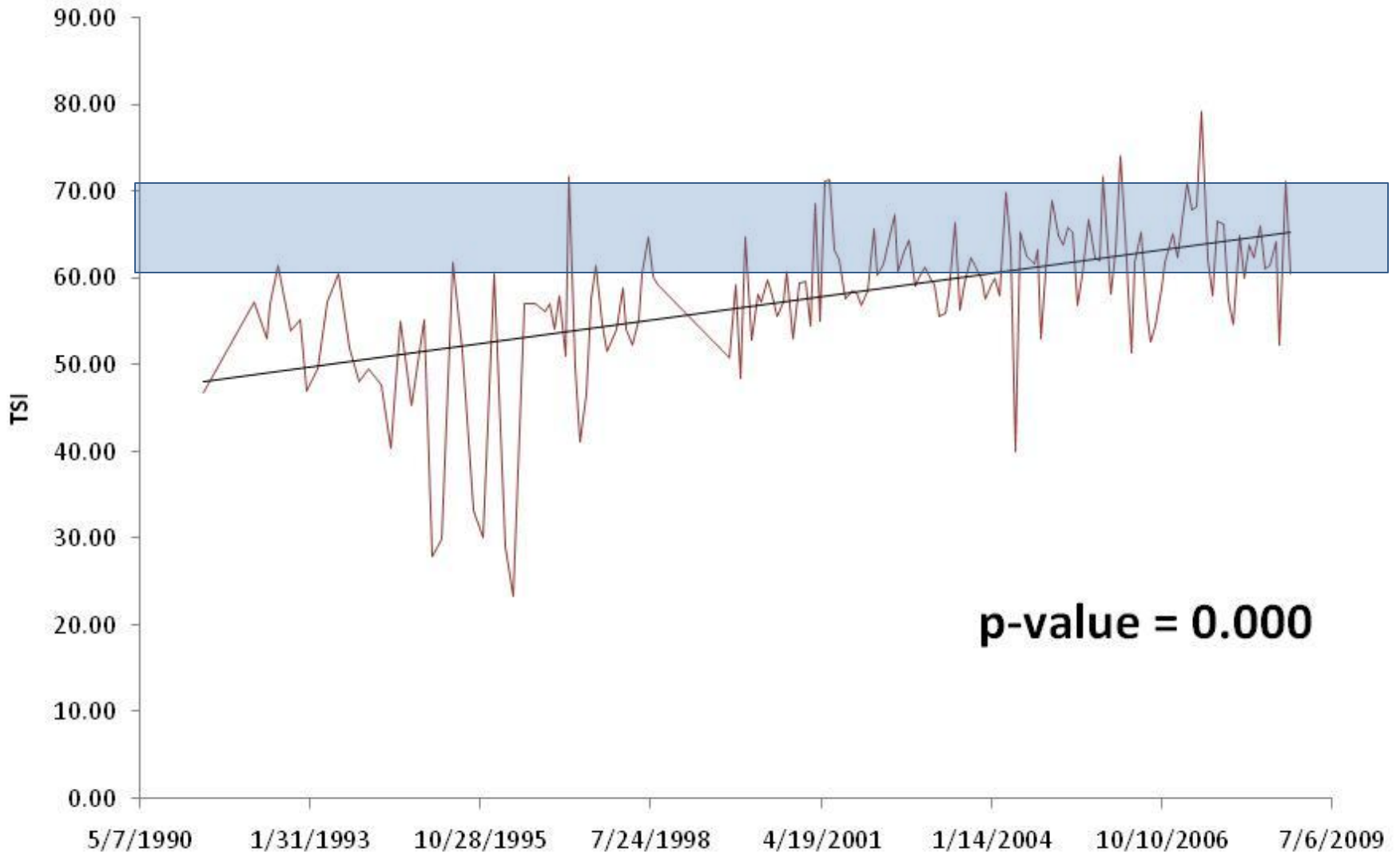




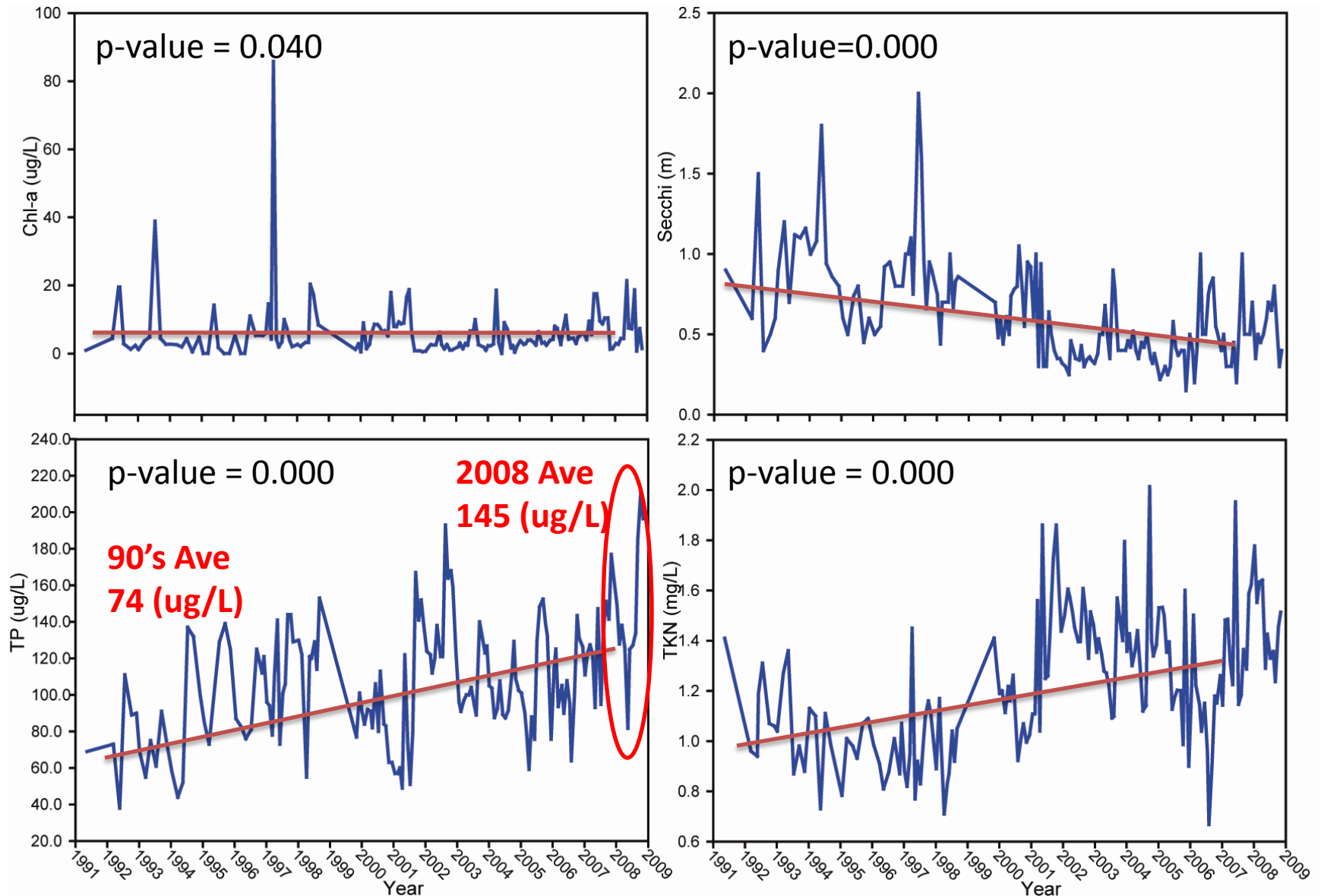




# BCL (1990-2008) - Trend Analysis

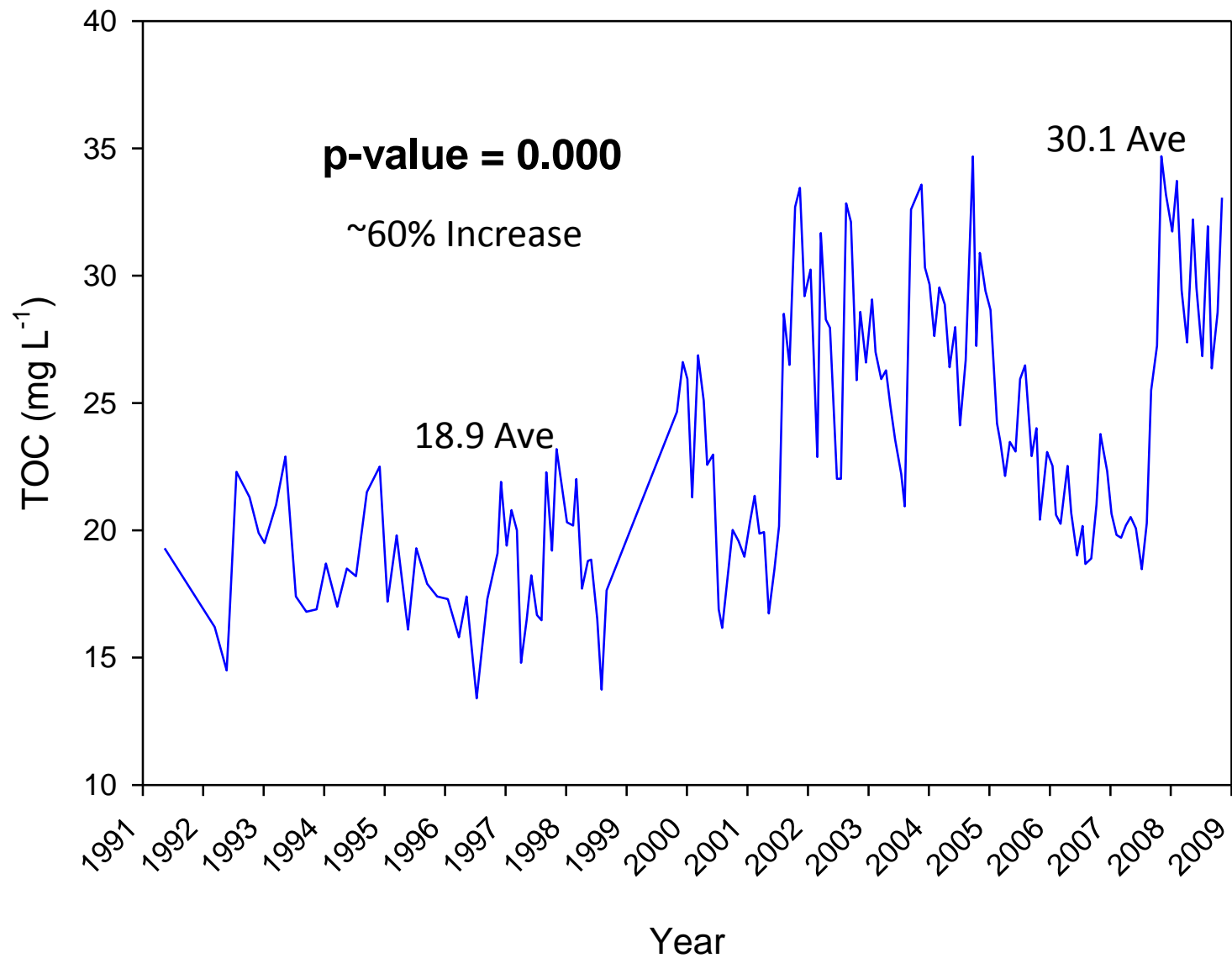


# TSI Parameters for BCL – Trend Analysis





# BCL – TOC Trend Analysis

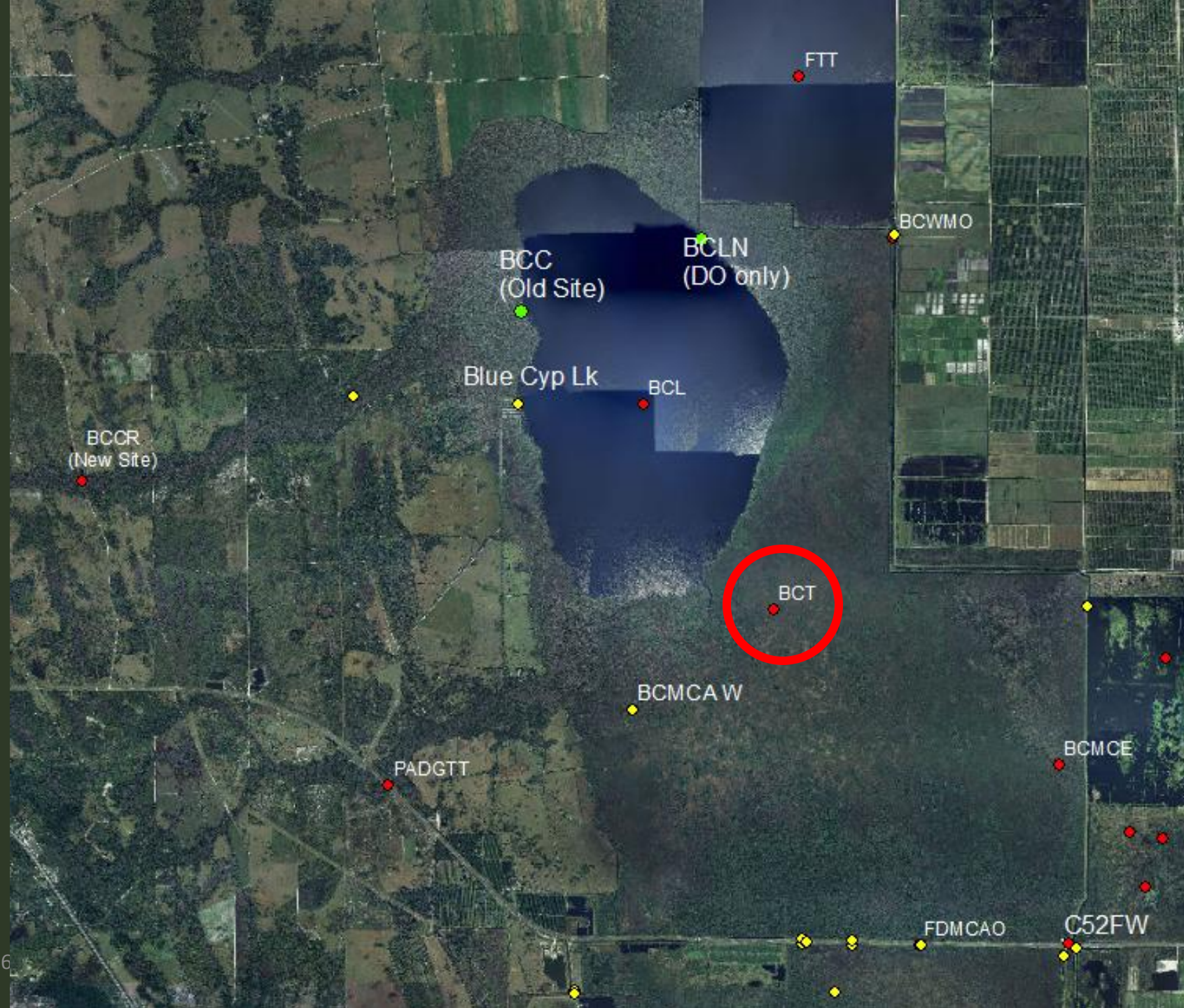


# Why is WQ degrading in BC Lake?

## Internal loading in BCMCA

- Analysis of long-term marsh sites
  - »TOC Trend
  - »Relationship between the TOC Accumulation Rate to marsh exposure
- US Army Corp Flood Control Project
- Environmental Hydrologic Criteria

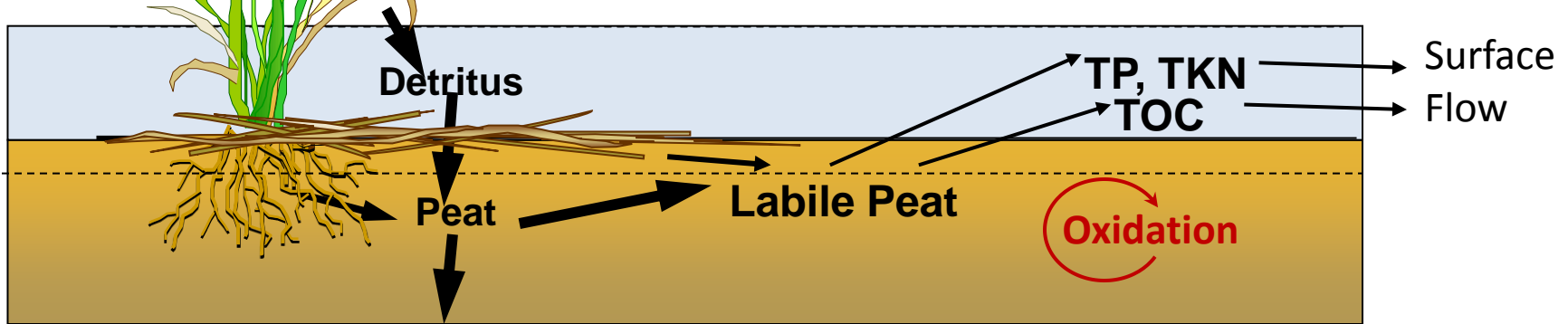




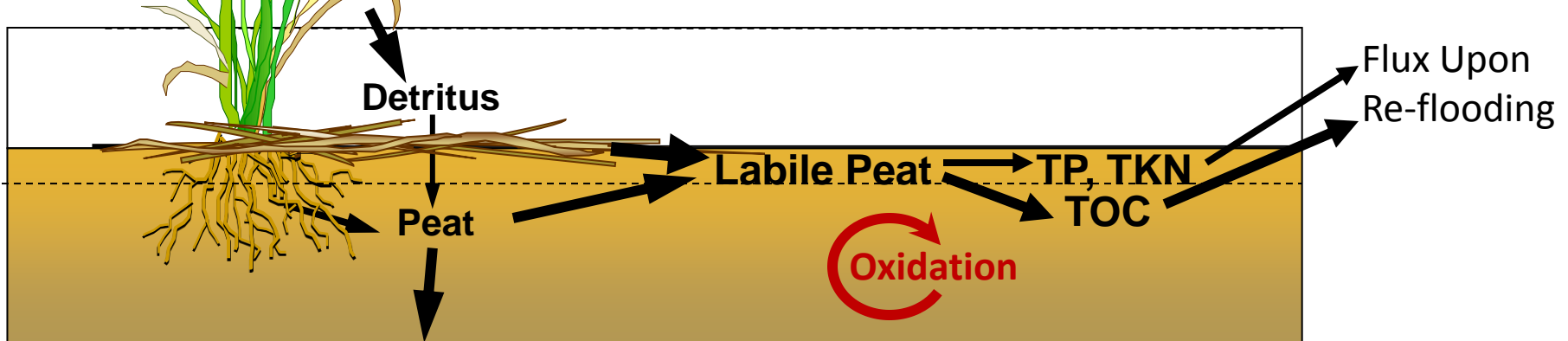
# TOC and Nutrient Flux

## Environmental Hydrologic Criteria

[Water table above soil surface]

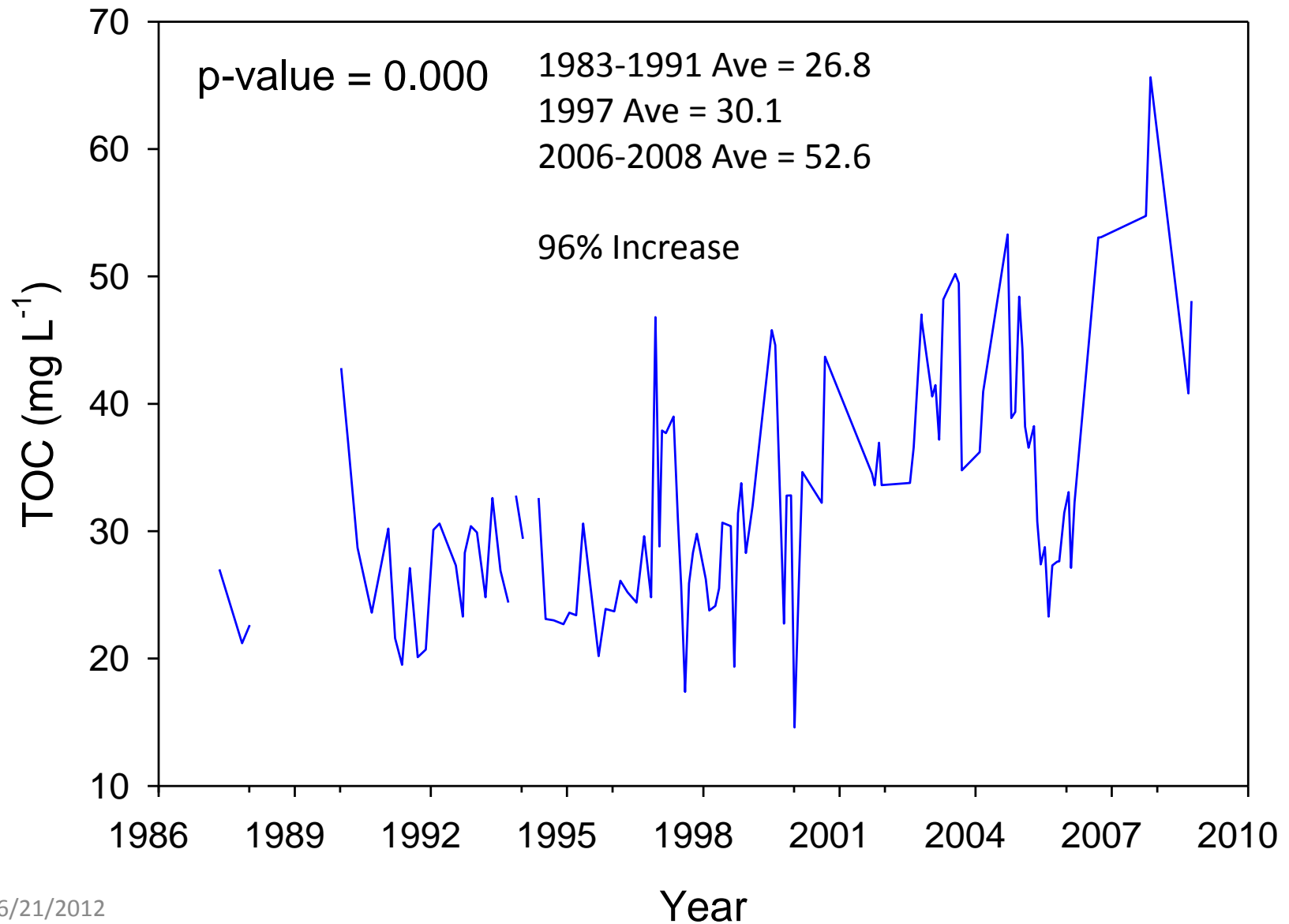


[Water table below soil surface]





# BCMCA – Marsh TOC Trend



# TOC Accumulation Rate

## Accumulation Rate

- TOC<sub>min</sub> value and date of occurrence
- TOC<sub>max</sub> value and date of occurrence

Rate (mg/L/d)=

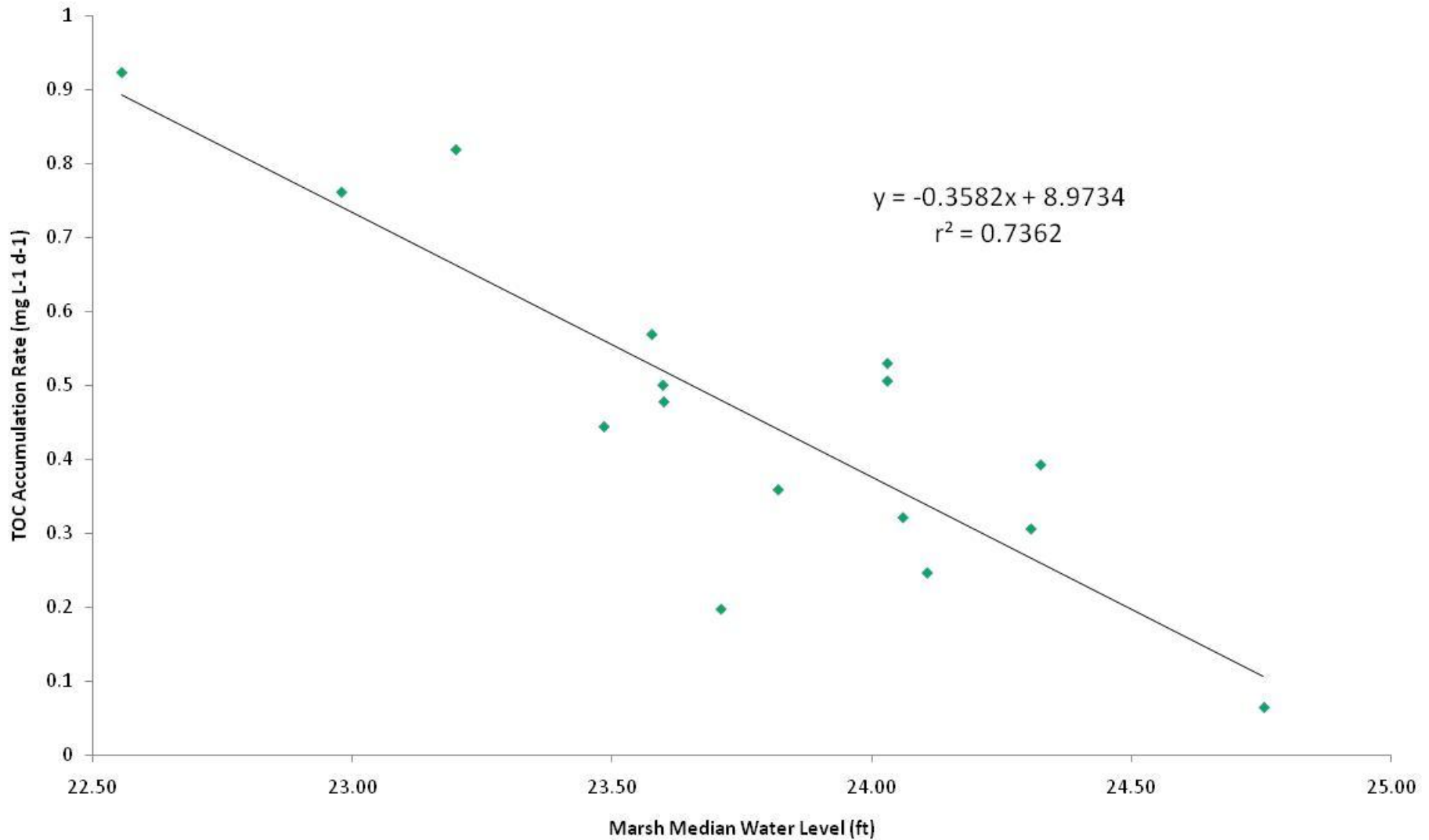
$$\frac{\text{SUM of TOC from MIN to MAX (mg/L)}}{\text{Duration (days)}}$$

## Hydrologic Index

- DAYS OF EXPOSURE below 23 ft in the MARSH 180 day prior to TOC<sub>min</sub> occurrence
- MEDIAN water level in the MARSH during the 180 days day prior to TOC<sub>min</sub> occurrence



# Lake TOC Flux with Median Water Level in Marsh (180 days prior to flux period)



# Conclusions

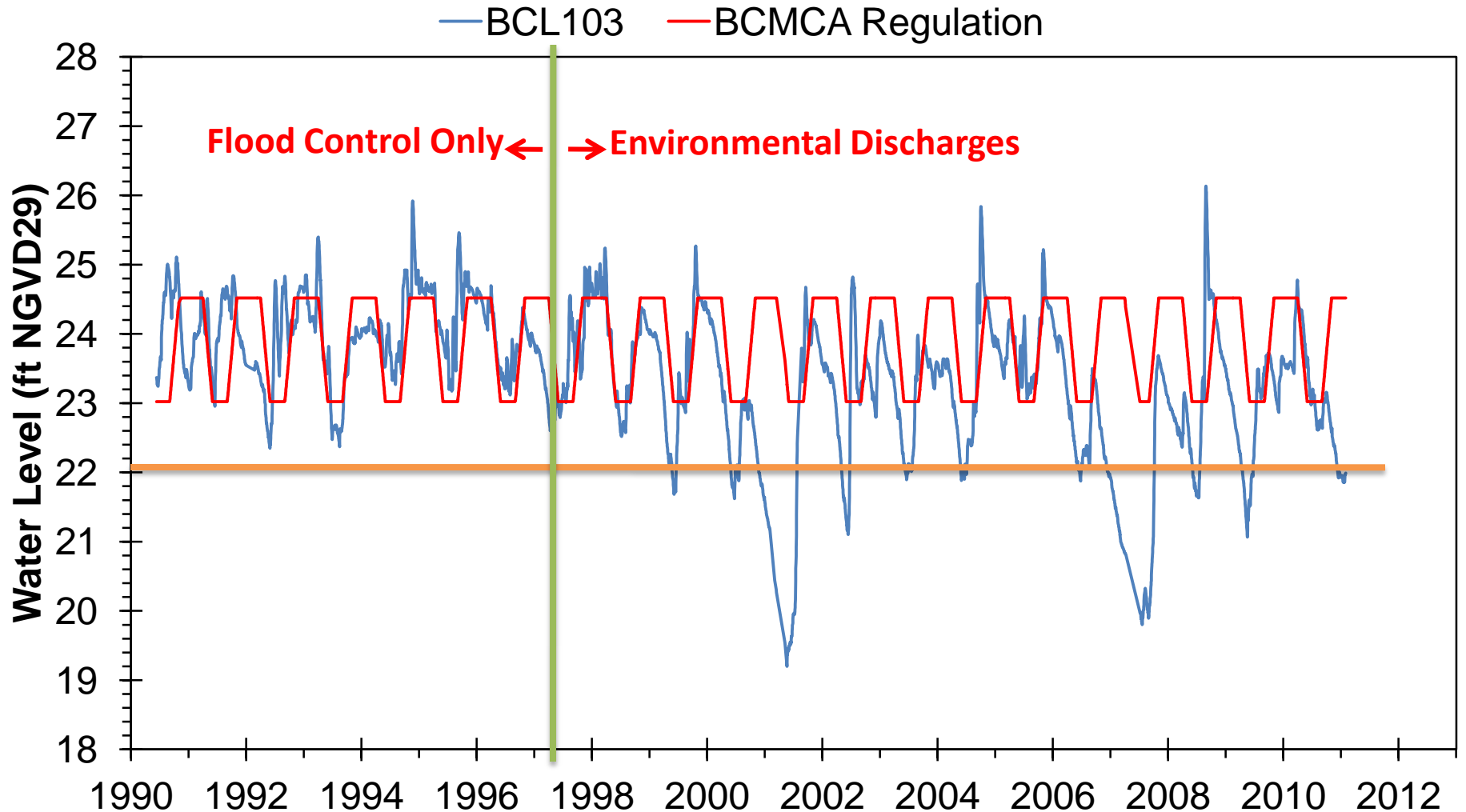
The trends observed could be a result of internal loading

– TOC Relationships

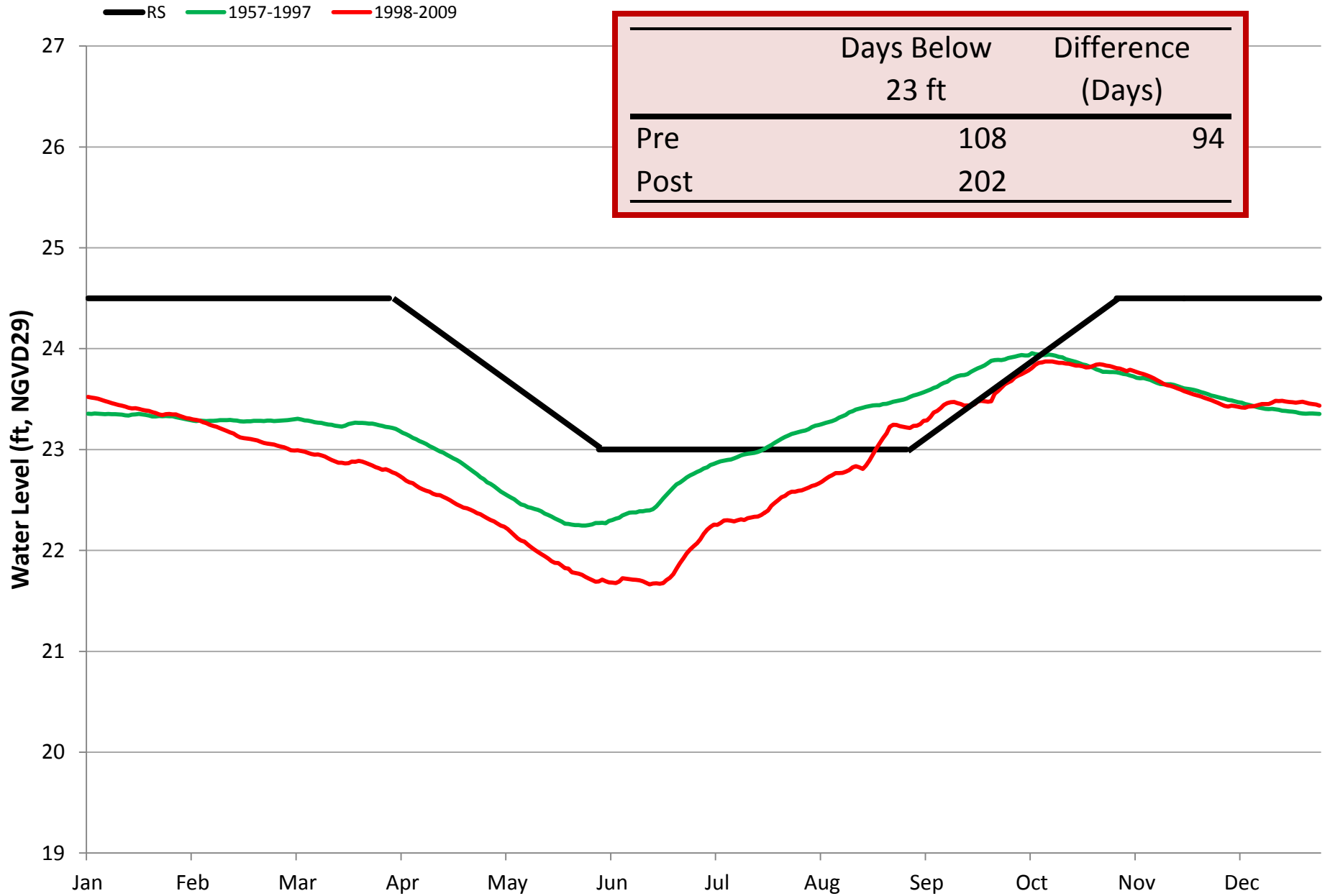
- » TOC increased by 96% from 26.8 to 52.6 mg/L compared to BCL's 30.1 mg/L average
- » Strong correlations of LAKE TOC to MARSH hydrologic Index

- The decline in water quality in BCL appears to be strongly related to the hydrologic regime in the marsh
- Re-evaluate the Environmental Hydrologic Criteria

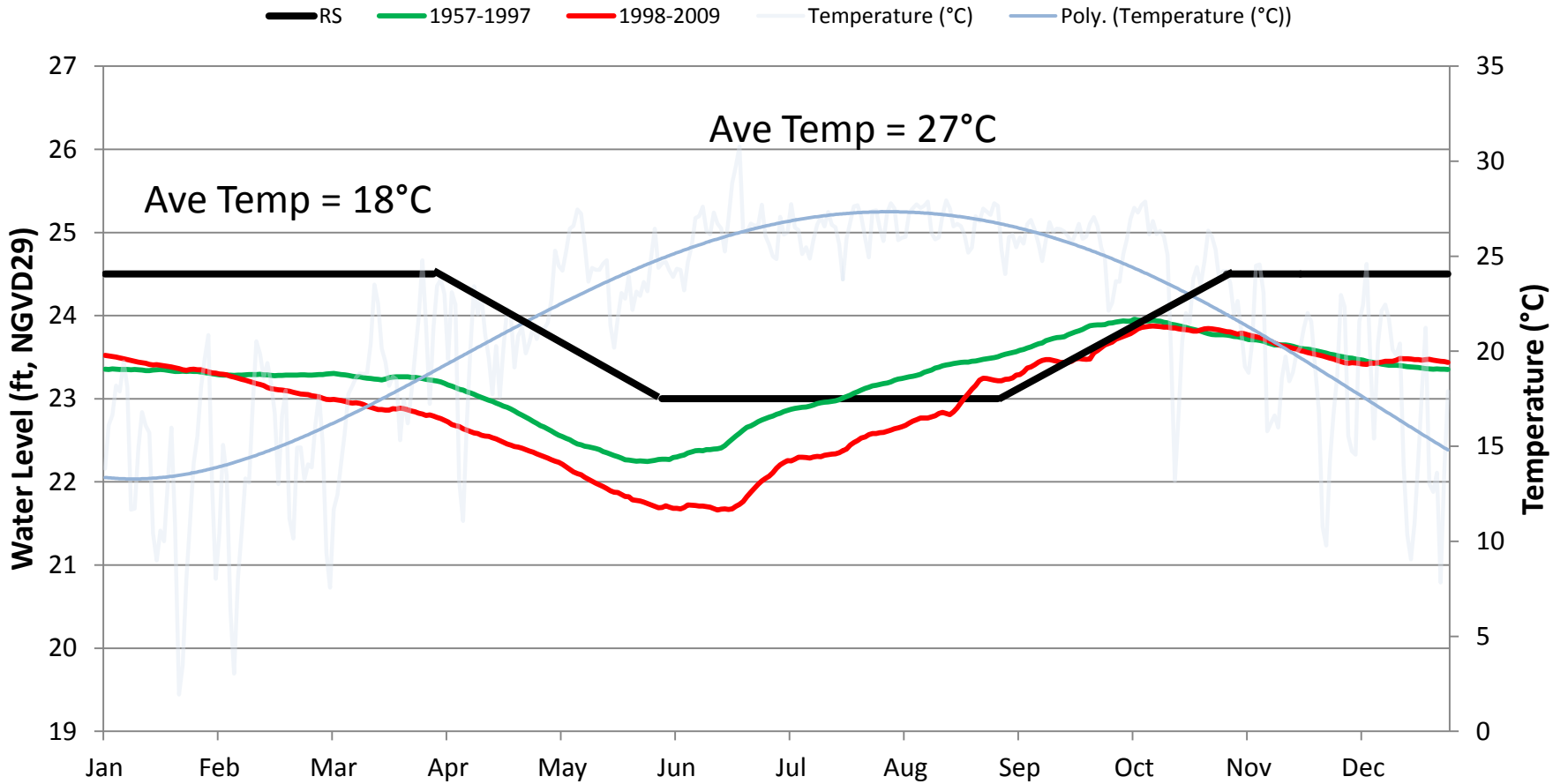
# BCL Mean Daily Stage with Regulation Schedule (1990-2011)



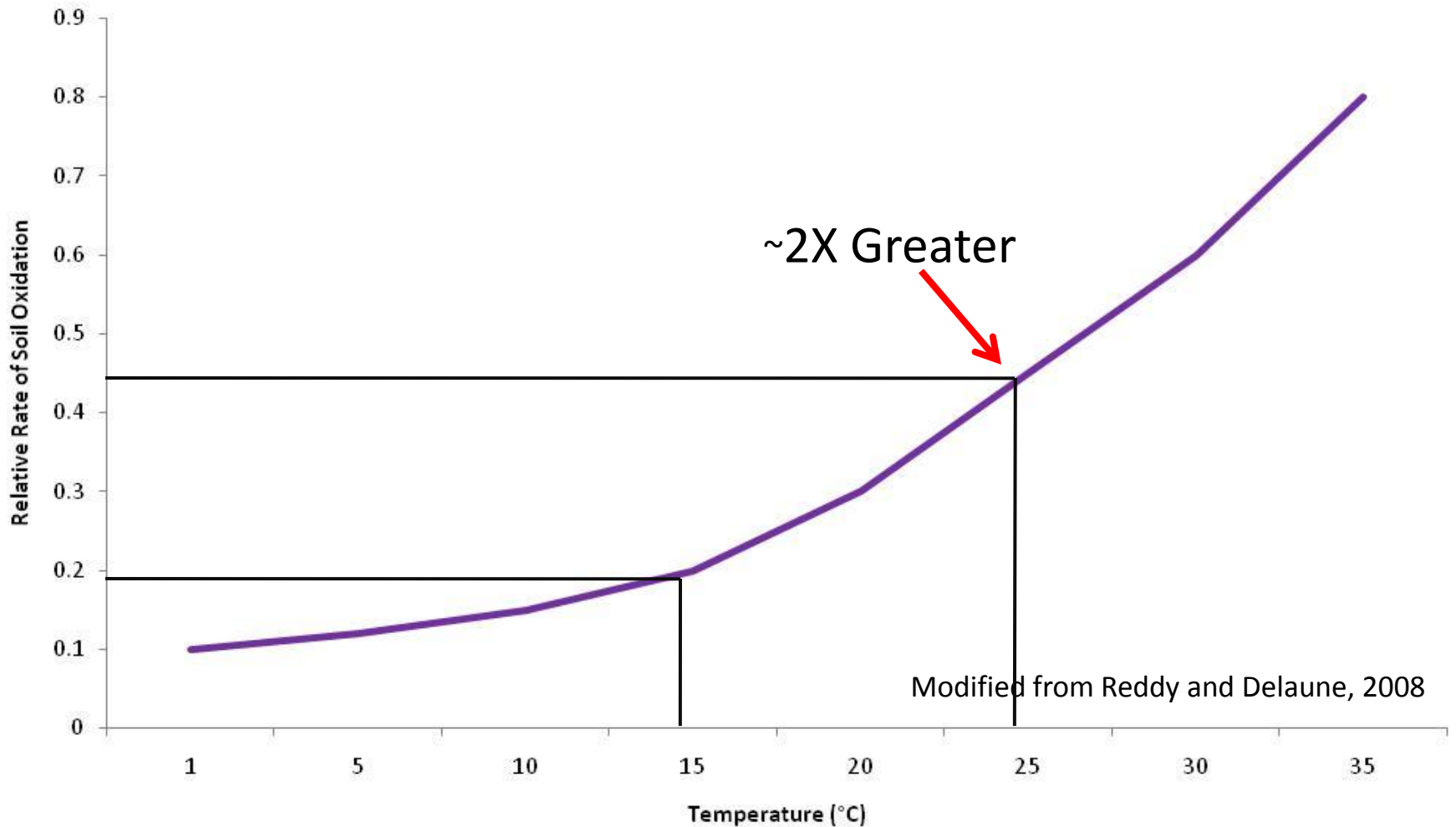




# Temperature



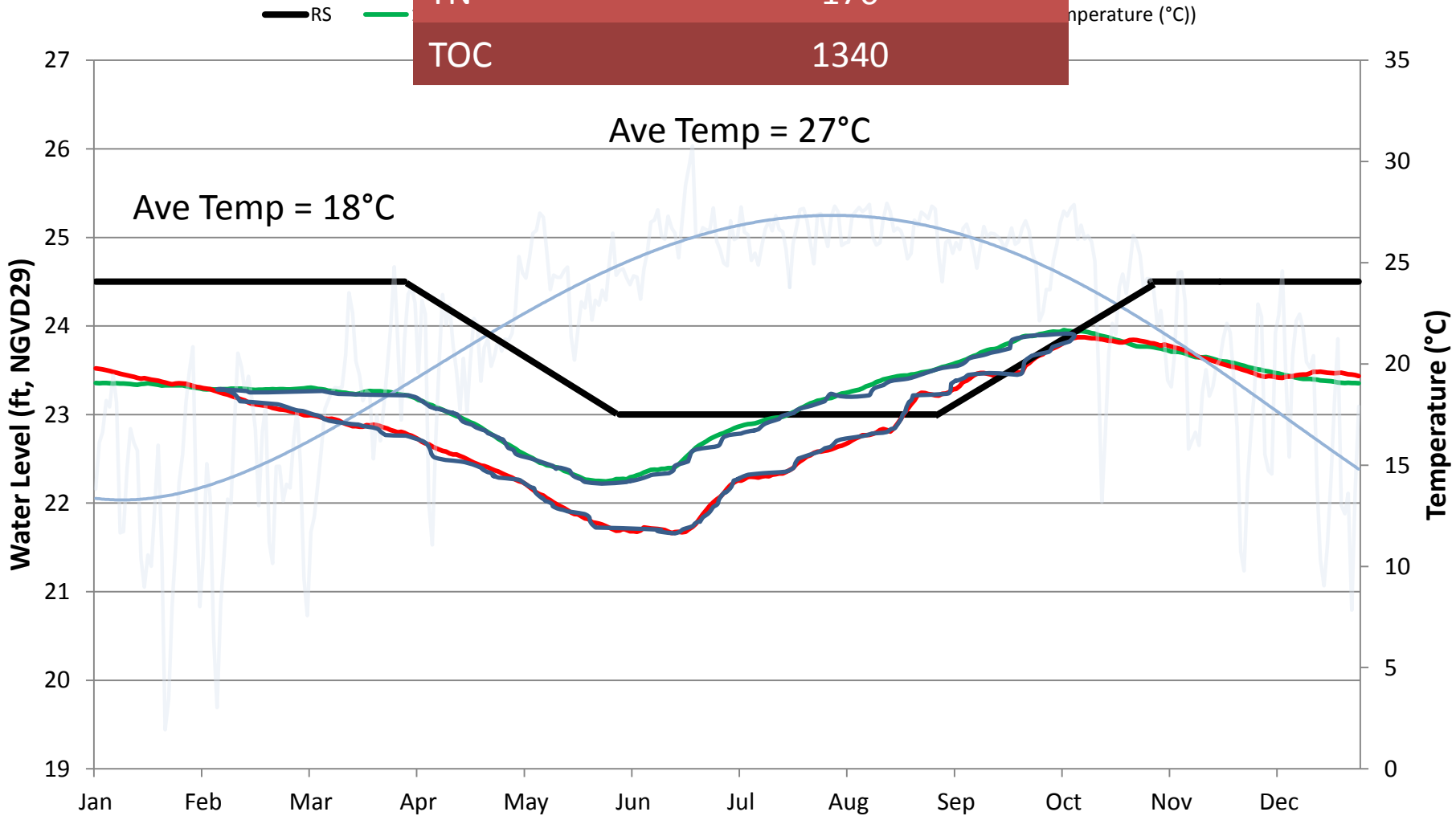
# Temperature Effects on Soil Oxidation



Modified from Reddy and Delaune, 2008



Additional Load from Soil Oxidation (mton yr-1)	
Nutrient	
TP	4.22
TN	170
TOC	1340



# Conclusions

- The hydrology of the lake strongly influences the WQ of the lake through its influences on the hydrology of the marsh
- Therefore, we expect WQ to continue to degrade under the current water management regime
- We need to revisit the environmental hydrologic criteria and reduce or stop additional discharges when below the regulation schedule
- We need to address the seasonality effects the regulation schedule has on the marsh and address this concern with the Corps.



St. Johns River  
Water Management District

ANY  
QUESTIONS???