

# What Does USGS Research Tell Us About Phosphorus in the Boise River?

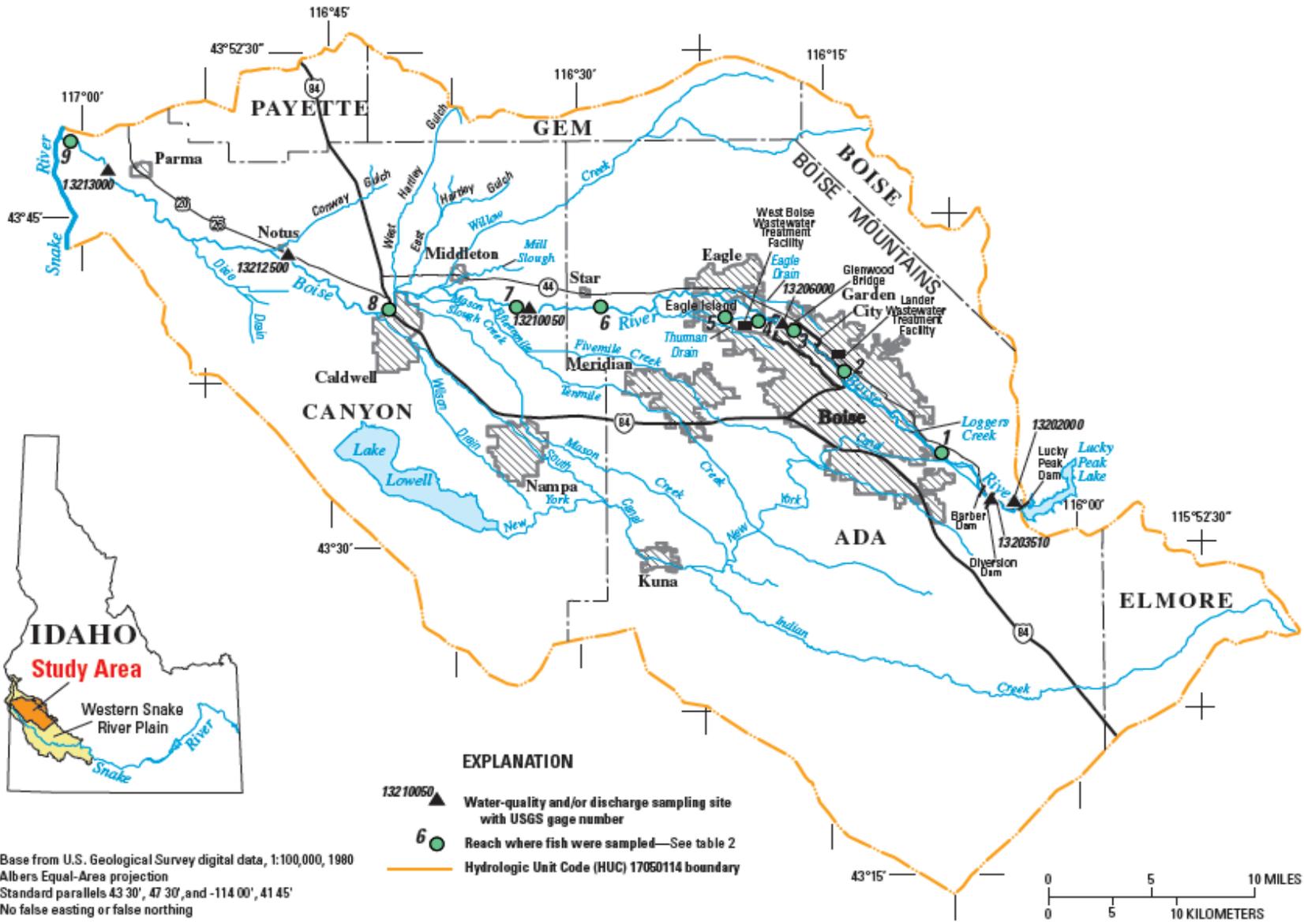
Alexandra Etheridge

April 6, 2012



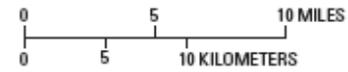
# Preview

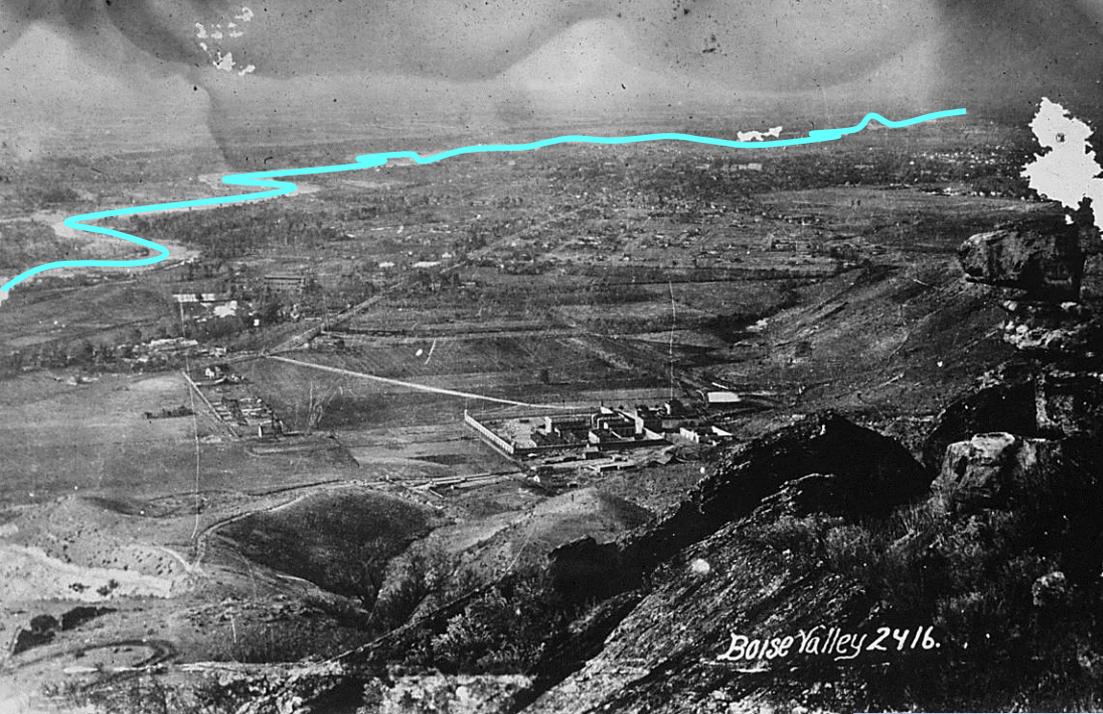
- \* Boise River history and watershed characteristics
- \* Why Phosphorus?
- \* Spatial Phosphorus Loading 1996-2005
- \* Flow-weighted Phosphorus trends 1994-2010
- \* Boise River & Snake River-Hells Canyon TMDL



Base from U.S. Geological Survey digital data, 1:100,000, 1980  
 Albers Equal-Area projection  
 Standard parallels 43°30', 47°30', and -114°00', 41°45'  
 No false easting or false northing

- EXPLANATION**
- 13210050 Water-quality and/or discharge sampling site with USGS gage number
  - 6 Reach where fish were sampled—See table 2
  - Hydrologic Unit Code (HUC) 17050114 boundary





Boise River ~1900

Boise River Today



Lucky Peak Lake

Boise River

New York Canal ~ Half the flow









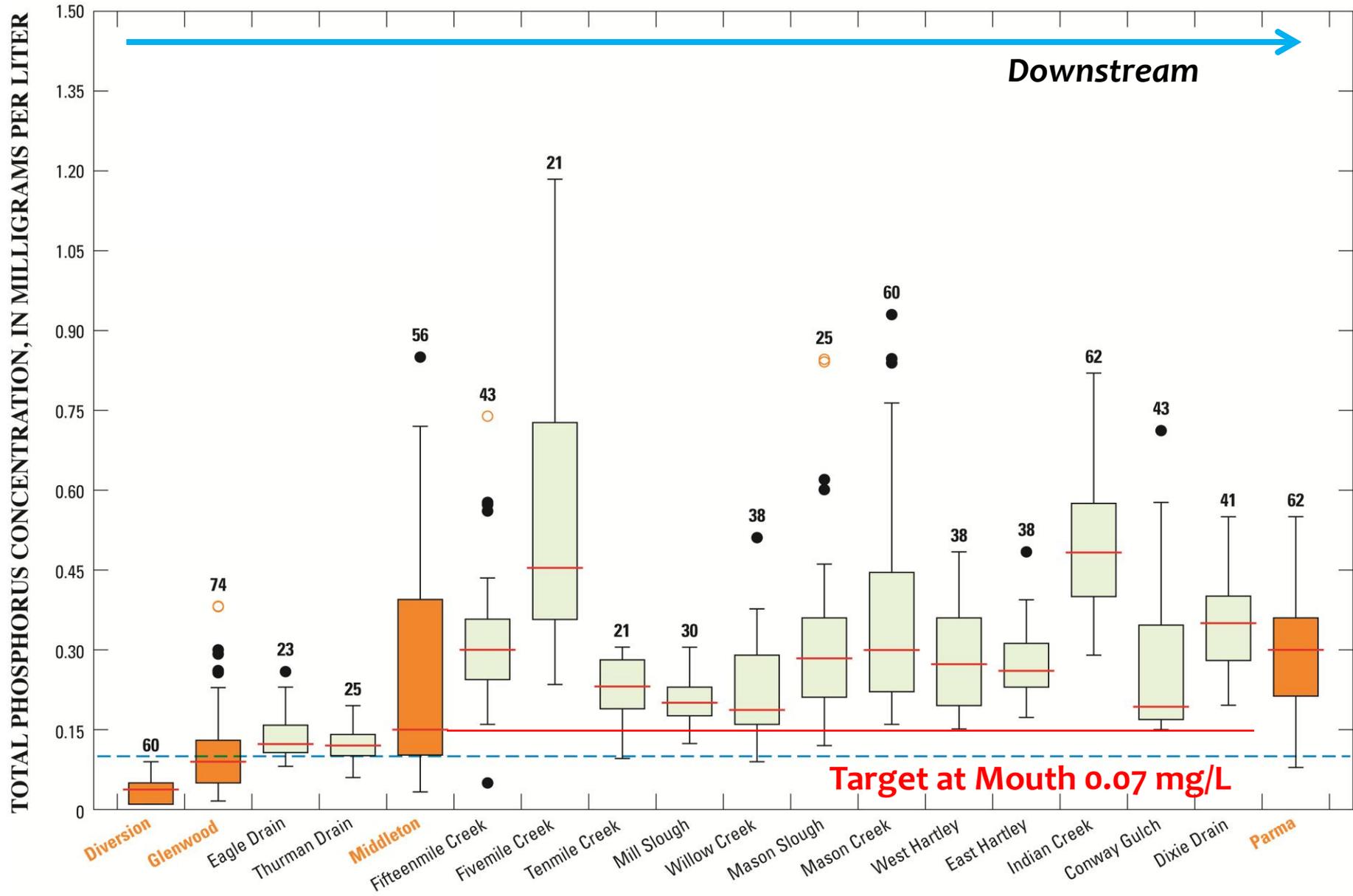


08.24.2010 12:18

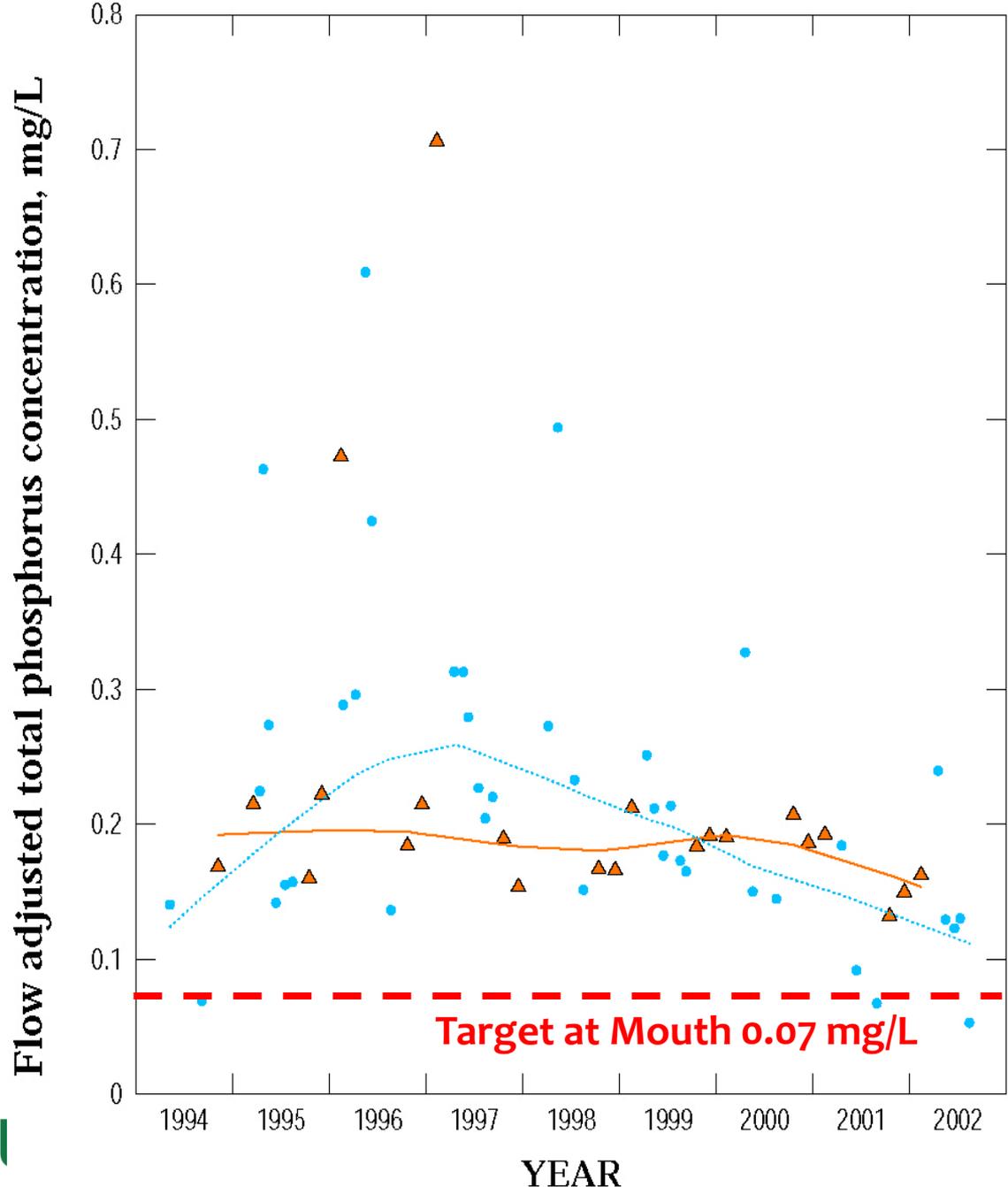
# Why Phosphorus?

- Snake River-Hells Canyon TMDL
  - Phosphorus target = 0.07 mg/L
  - Excess nutrients → excess algae → hypoxia/death
- Dissolved Phosphorus is a clear driver of Snake River algae growth
- No clear relationship between nutrients and floating algae in Boise
- Most algae in Boise River is benthic (attached to surfaces, bottom)

# Total Phosphorous Concentrations (1996-2005)



# Flow-weighted Phosphorus at Parma 1994 - 2002



### EXPLANATION

- Smoothed line, Irrigation Season
- Smoothed line, non-irrigation Season

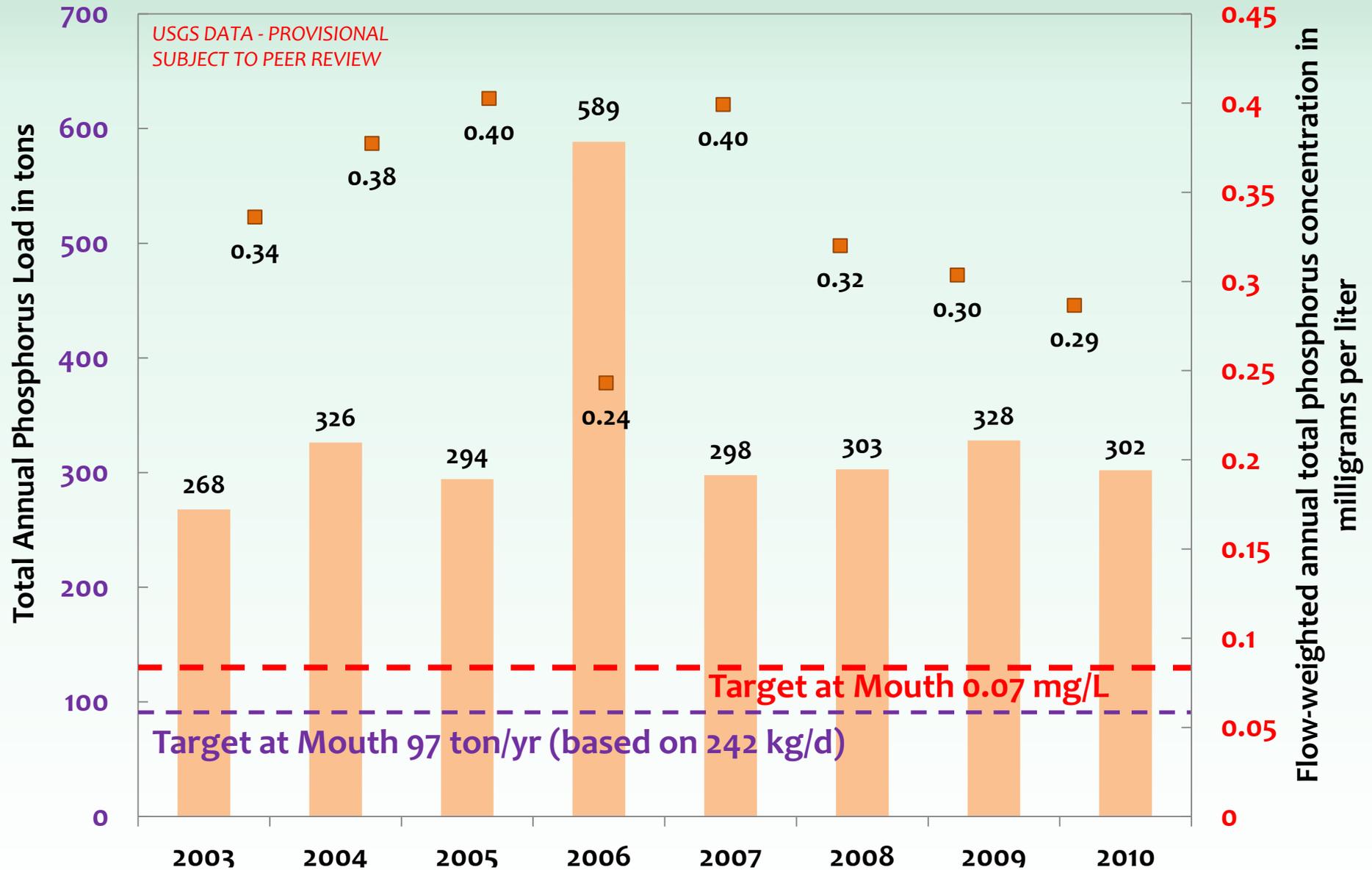
Flow-weighted = Total annual phosphorus load ÷ Total annual Q

Target at Mouth 0.07 mg/L



# Flow-Weighted Total Phosphorus At Parma

## 2003 - 2010



# Robust Data 2008-2010

## Study: What does Boise Contribute to Snake?

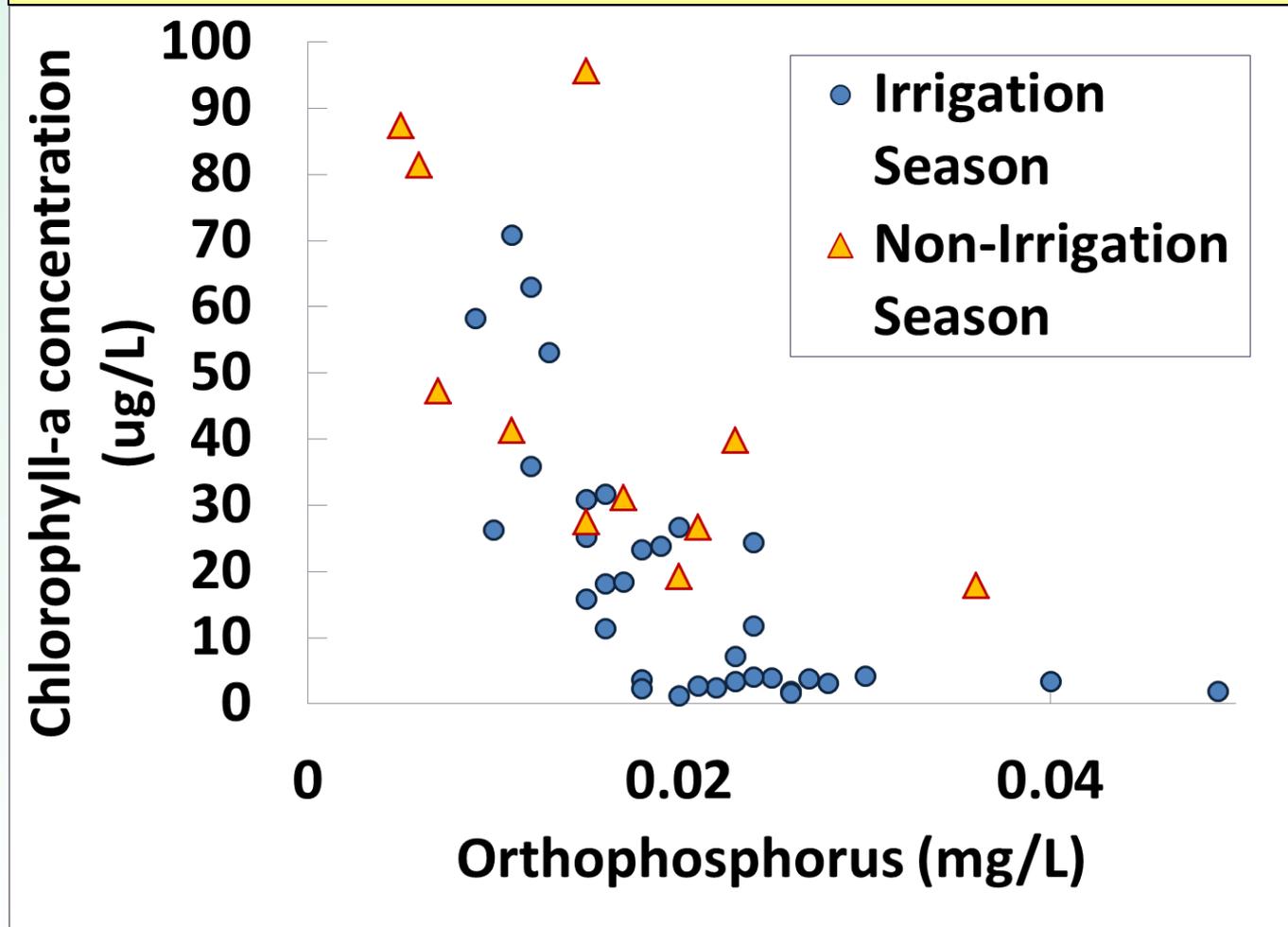
- \* Funded by municipalities and USGS
- \* TP at Parma every 49 h
- \* Weekly sampling during Irrigation season in Snake and Boise
- \* Estimated daily loads
- \* 15-minute water-quality parameters
- \* Surrogates

## What we found:

- \* Boise River contributes 30% of TP and 72% of OP in Snake
- \* Boise River has higher TP in winter
- \* Boise River more dissolved than particulate
- \* Snake River more particulate than dissolved
- \* Phosphorus drives algae growth in Snake

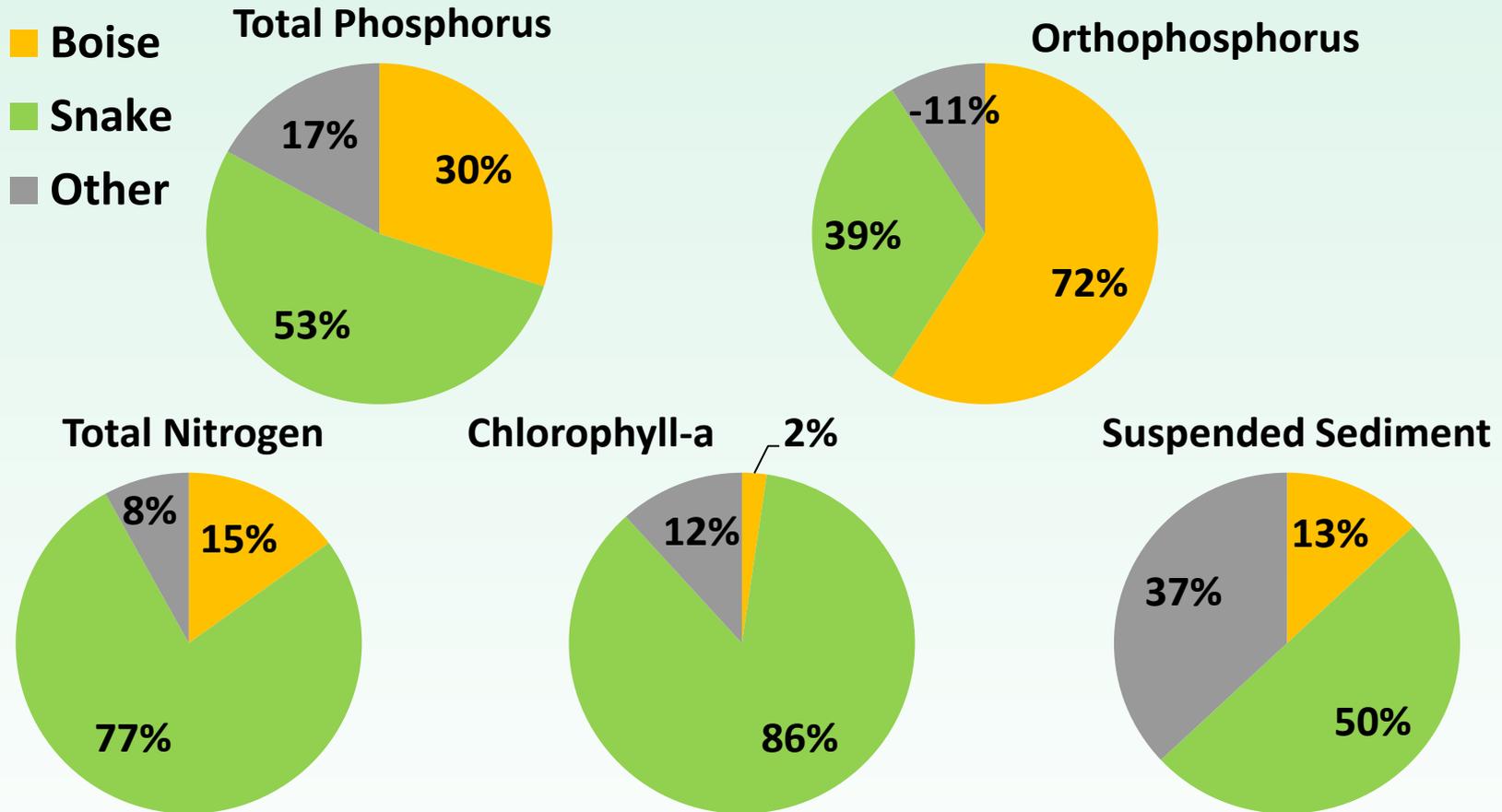
# Snake River Phosphorus & Floating Chlorophyll-a (Algae)

Overall spearman's rho =  $-0.64$



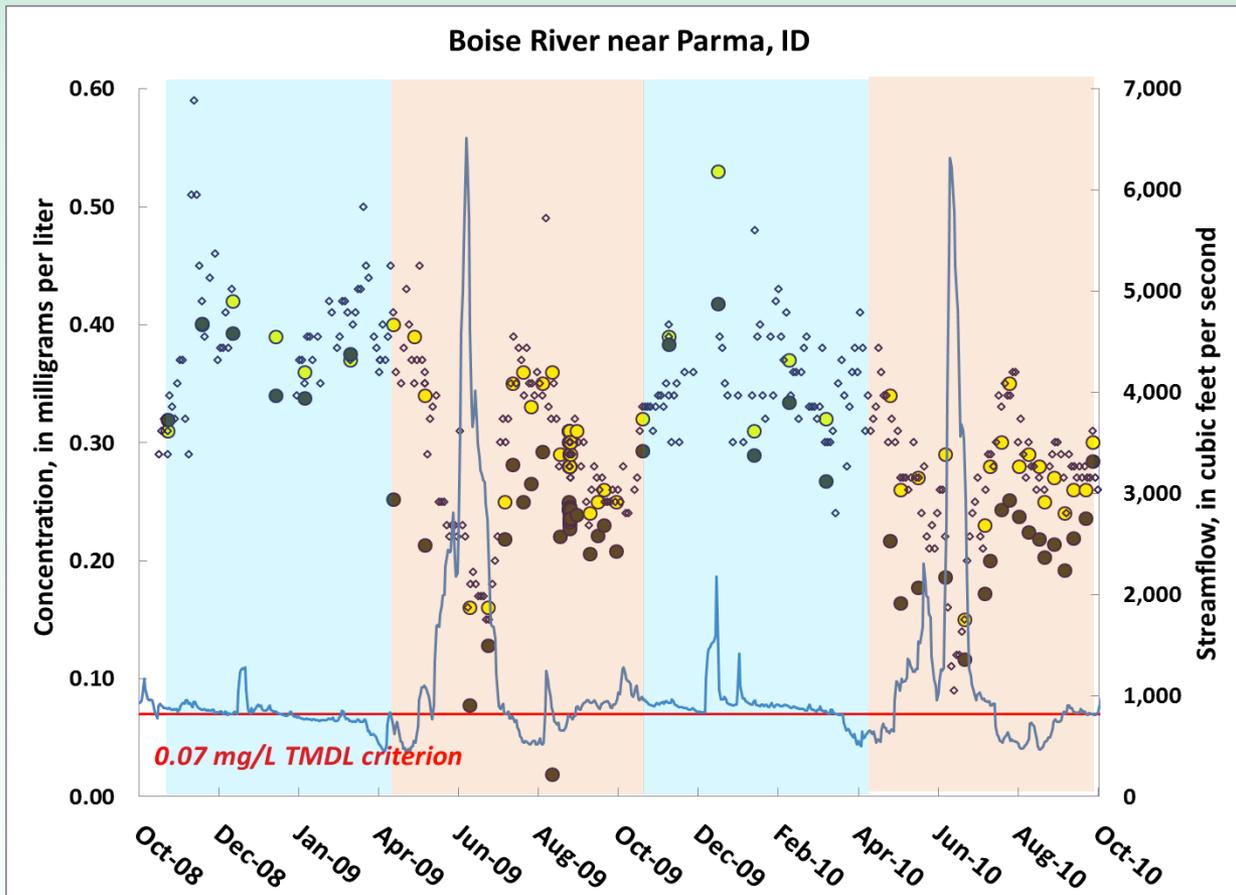
# Relative Contribution to Snake

Boise River contributes 11% of mean annual flow in Snake



*Net uptake of OP in Snake River, Owyhee River contributes ~2 – 4 % of nutrient loads measured at Nyssa*

# Total Phosphorus 2008 - 2010



- TP
- ◇ TP Autosampler
- o-PO<sub>4</sub> as P
- Daily Mean Flow

\* All measured TP concentrations in Boise River exceeded the seasonal target of 0.07 mg/L

\* At Adrian - 13% exceeded target

\* At Nyssa - 64% exceeded target

# Summary

- \* Most phosphorus in the Boise river is dissolved
- \* Phosphorus increases downstream
- \* Dissolved phosphorus delivered by the Boise River → floating algae growth in the Snake River

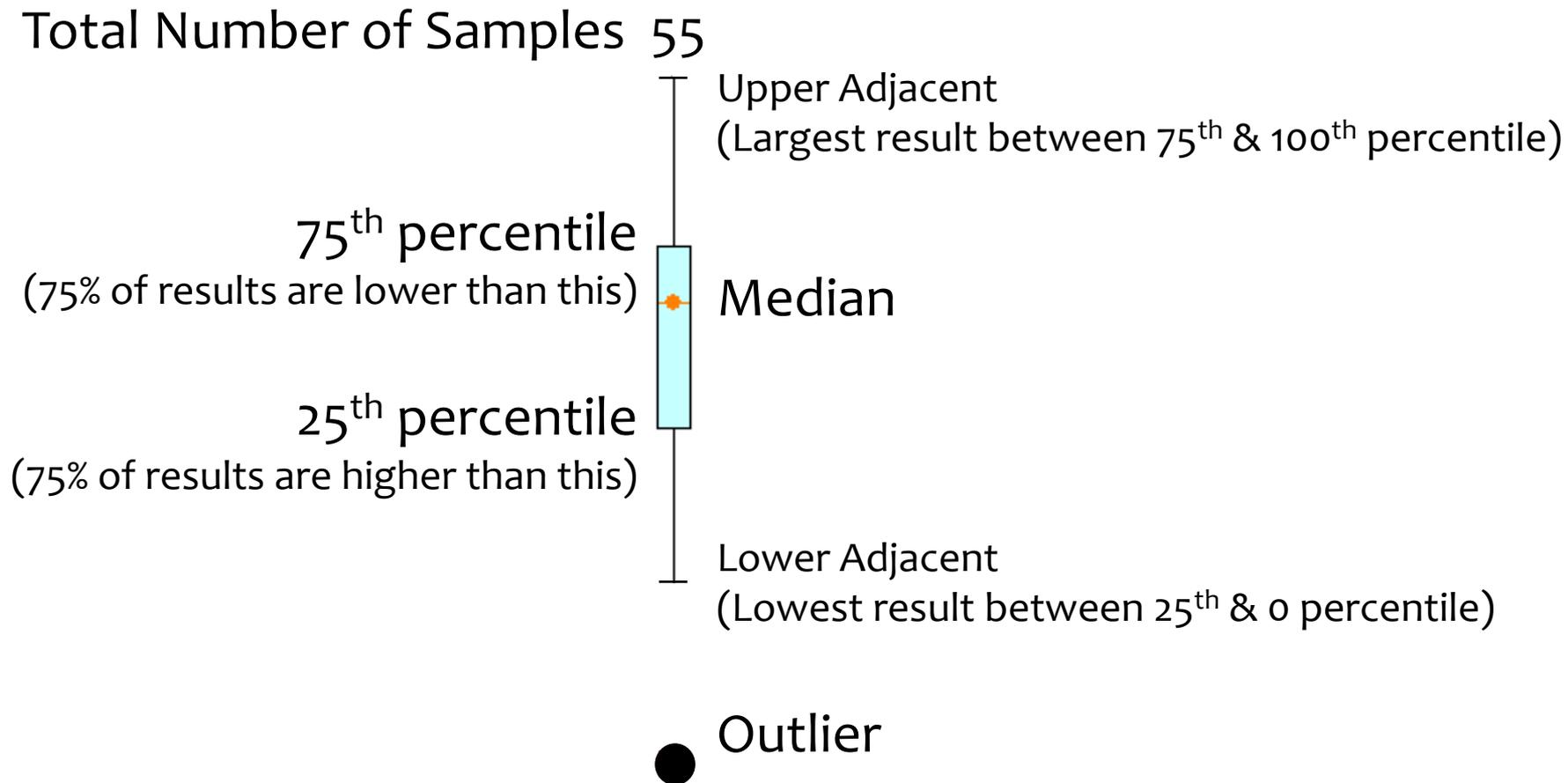
# Questions

# USGS & IDEQ Synoptic Study

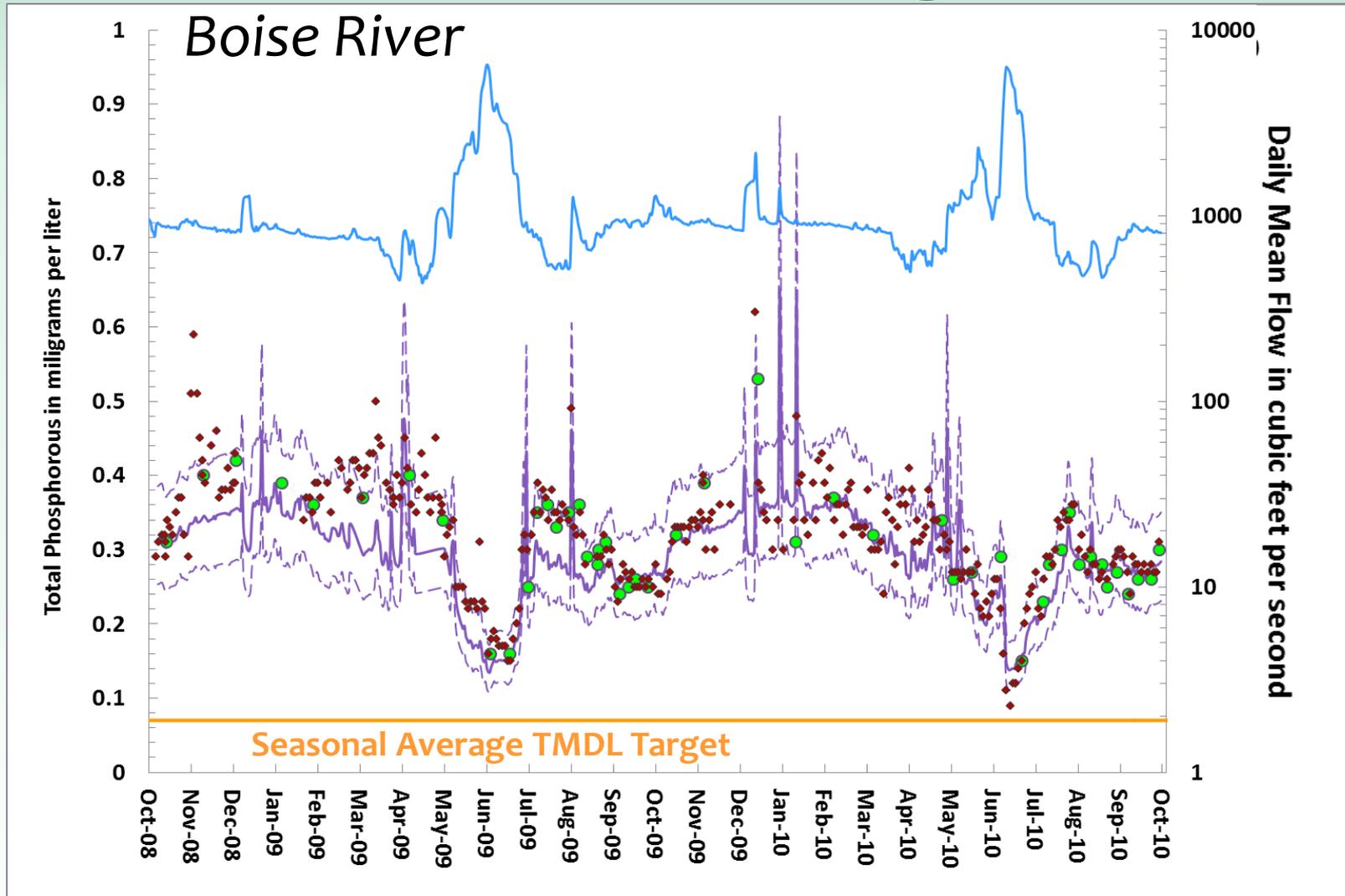
- \* 3 Synoptic sampling events
  - \* August 2012
  - \* October 2012
  - \* February 2013
- \* Up to 40 sites
  - \* 25-30 surface water
  - \* 10-15 groundwater
- \* Phosphorus mass balance model
- \* USGS Open File Report by June 30, 2013

# Phosphorus Data Summary 1994 -2005

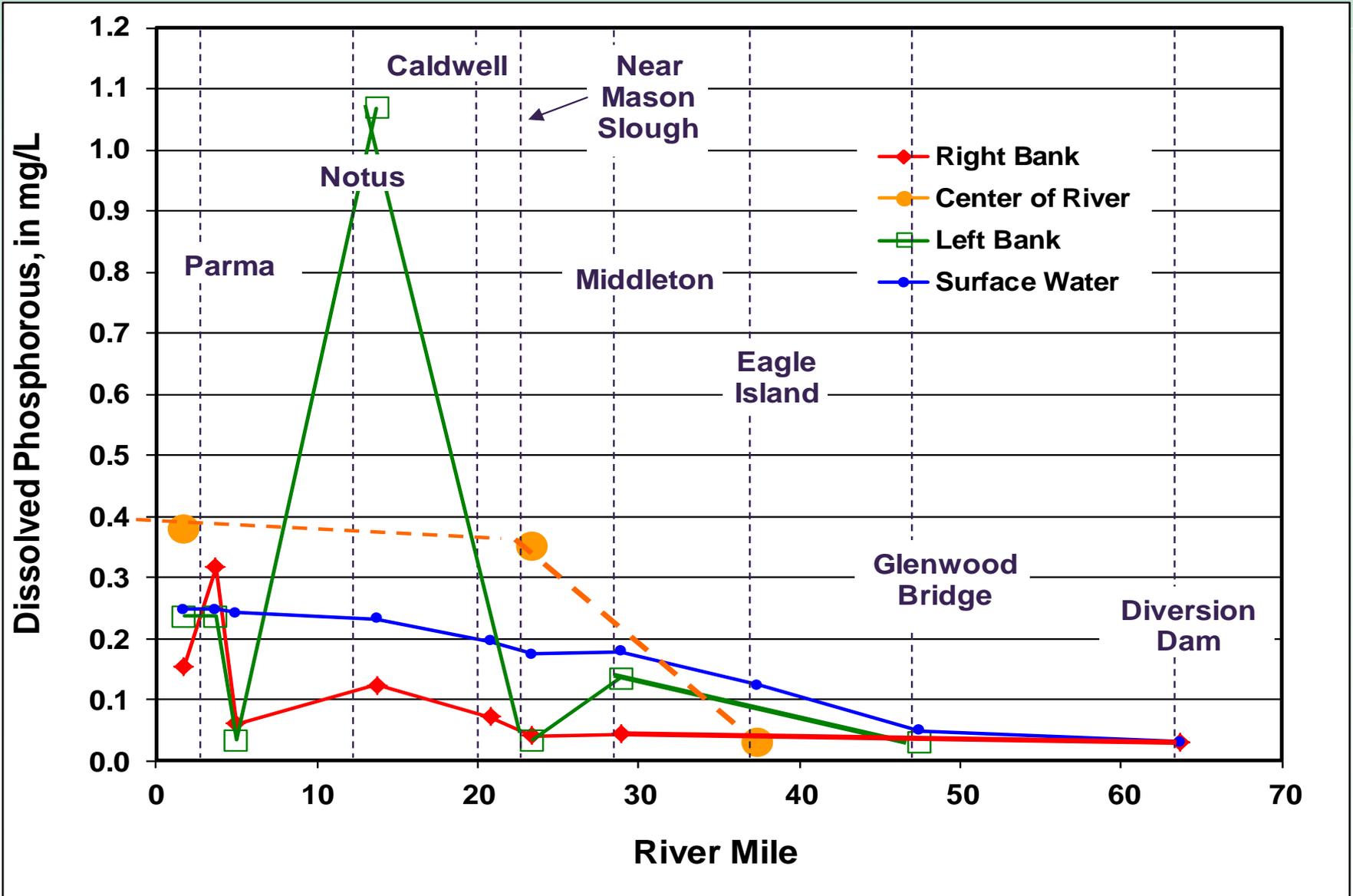
## Explanation



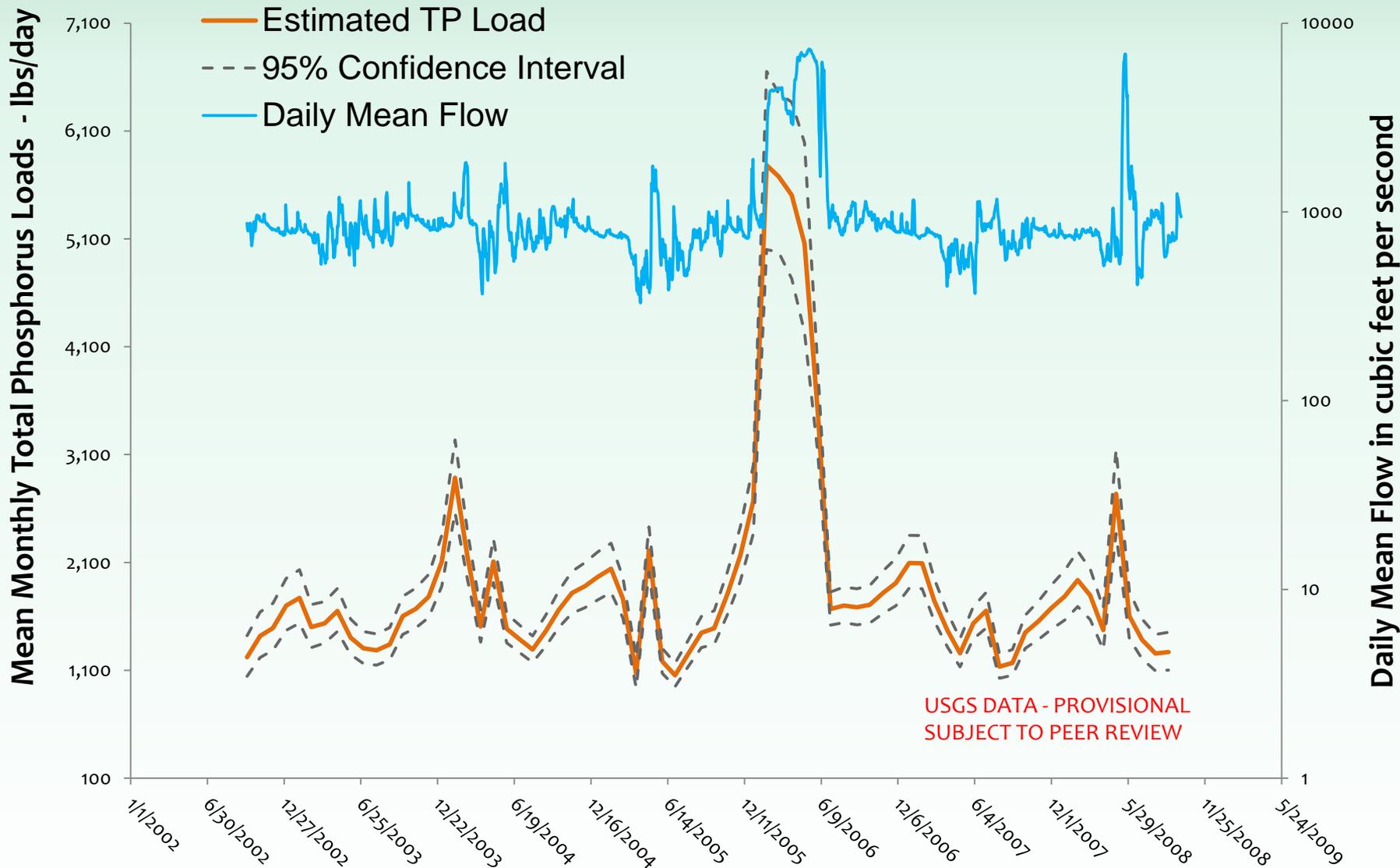
# Total Phosphorus Surrogate Model



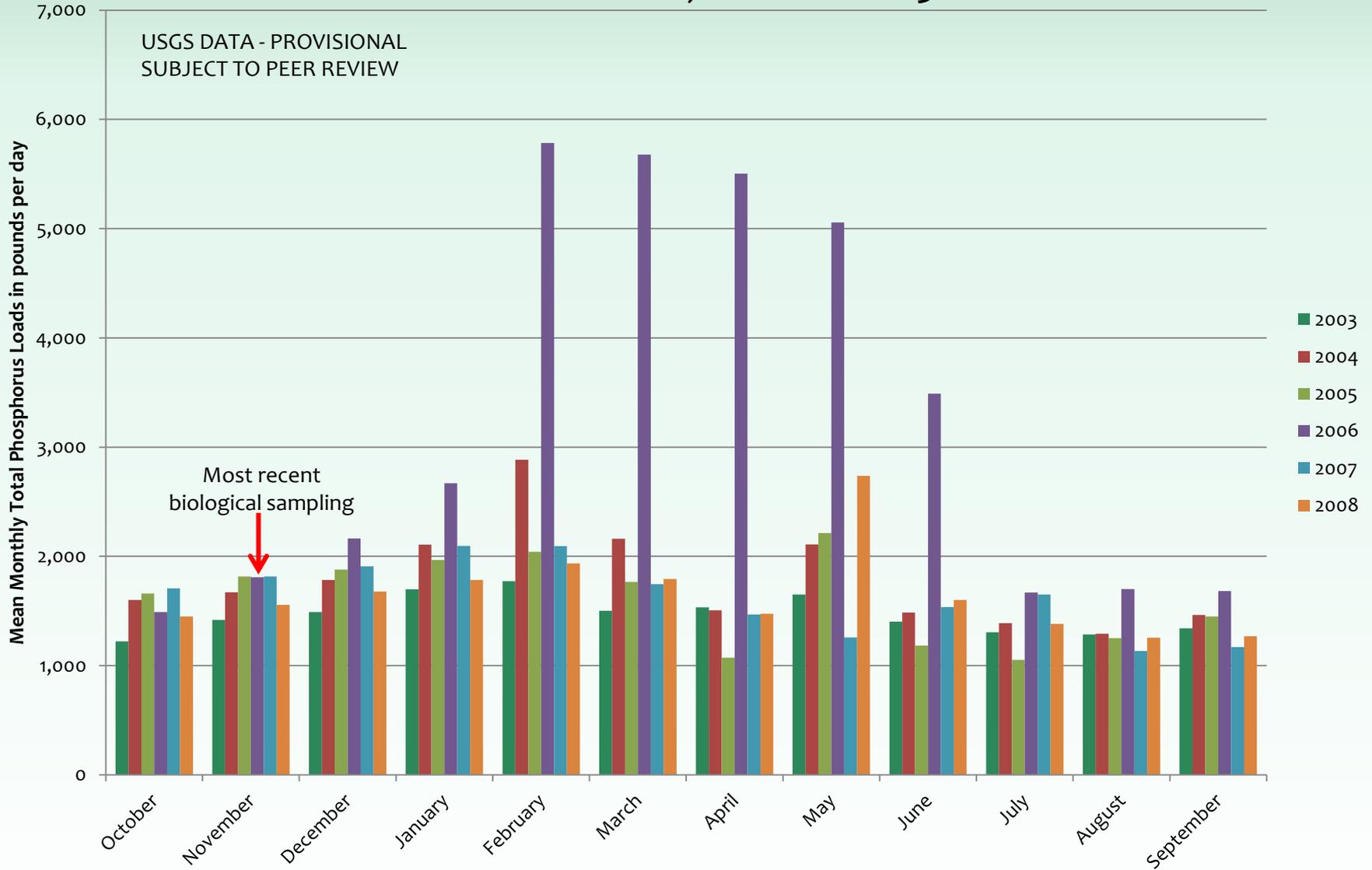
# GW source of phosphorous to lower Boise River



# Estimated Mean Monthly Total Phosphorus Loads in pounds per day Boise River Near Parma, Idaho WY2003 - WY2008



# Estimated Mean Monthly Total Phosphorus Loads Boise River Near Parma, Idaho WY2003 - WY2008



# Sediment Concentrations (1996-2005)

