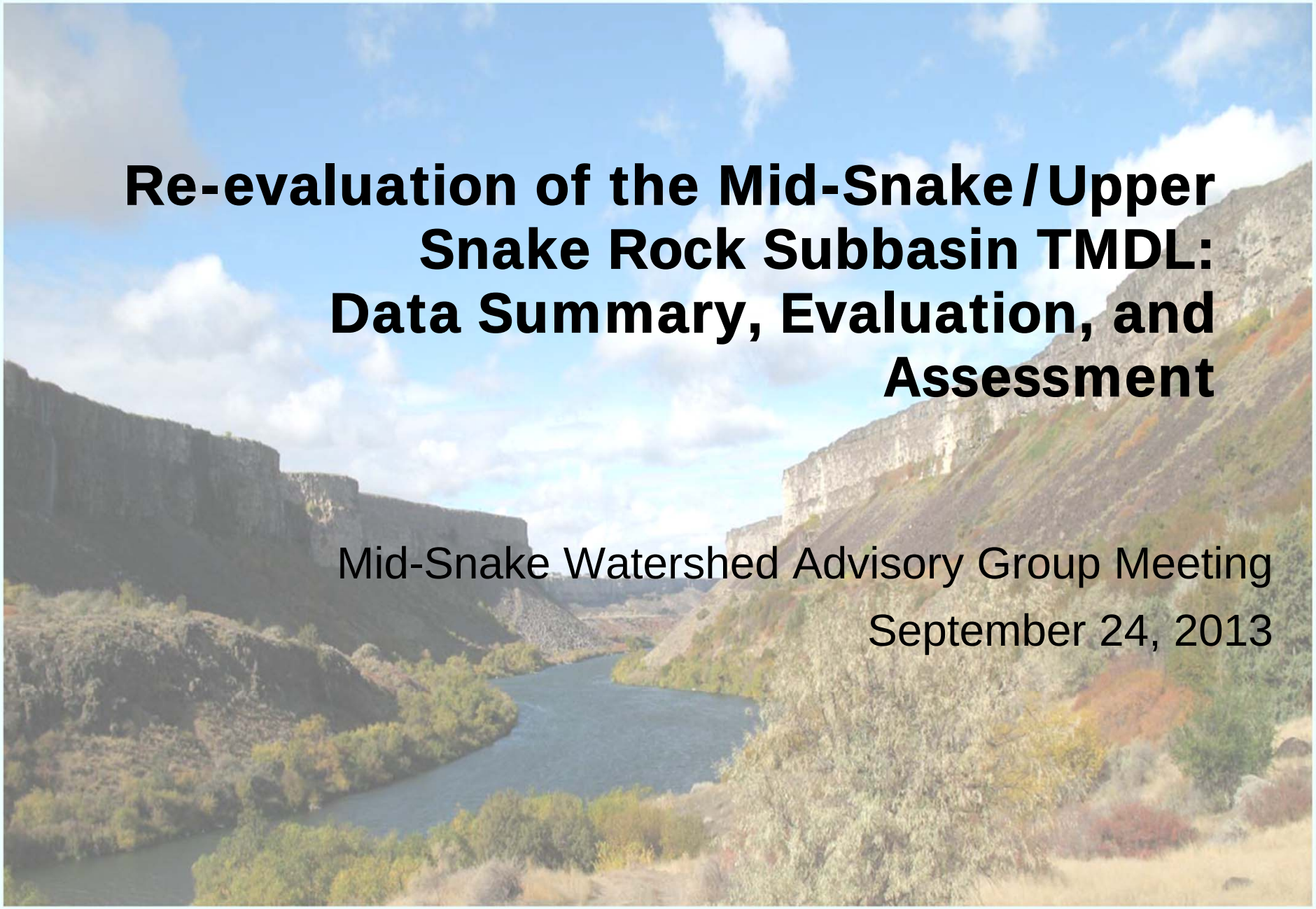


Re-evaluation of the Mid-Snake/Upper Snake Rock Subbasin TMDL: Data Summary, Evaluation, and Assessment

Mid-Snake Watershed Advisory Group Meeting

September 24, 2013

TMDL Data Assessment

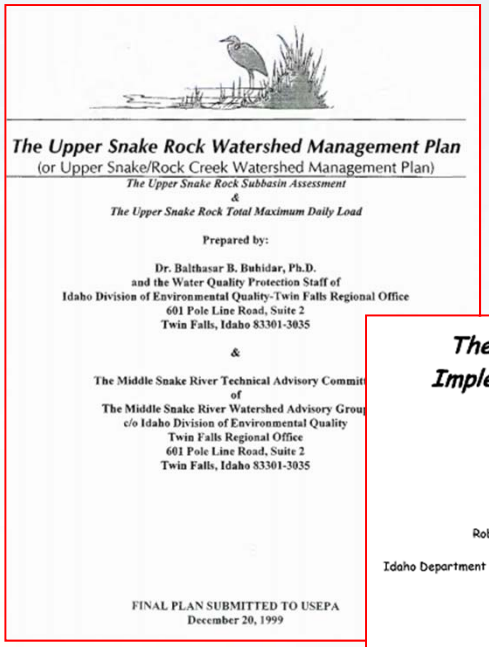
Discussion Overview

- **Mid-Snake TMDL -- Activity to Date**
- **Scope of Current Task**
- **Results Summary**
- **Key Findings**
- **Next Steps**

Mid-Snake TMDL

Activity to Date

- **Initial TMDL in 1997, *followed by …***



The Upper Snake Rock Watershed Management Plan
(or Upper Snake/Rock Creek Watershed Management Plan)
The Upper Snake Rock Subbasin Assessment
&
The Upper Snake Rock Total Maximum Daily Load

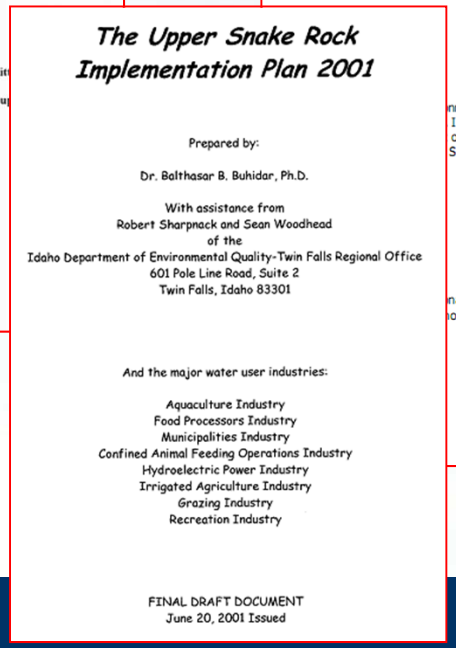
Prepared by:

Dr. Balthasar B. Buhidar, Ph.D.
and the Water Quality Protection Staff of
Idaho Division of Environmental Quality-Twin Falls Regional Office
601 Pole Line Road, Suite 2
Twin Falls, Idaho 83301-3035

&

The Middle Snake River Technical Advisory Commit
of
The Middle Snake River Watershed Advisory Grou
c/o Idaho Division of Environmental Quality
Twin Falls Regional Office
601 Pole Line Road, Suite 2
Twin Falls, Idaho 83301-3035

FINAL PLAN SUBMITTED TO USEPA
December 20, 1999



The Upper Snake Rock Implementation Plan 2001

Prepared by:

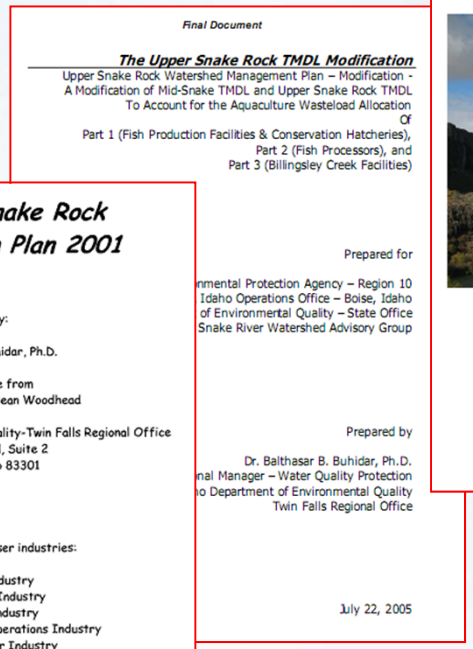
Dr. Balthasar B. Buhidar, Ph.D.

With assistance from
Robert Sharpnack and Sean Woodhead
of the
Idaho Department of Environmental Quality-Twin Falls Regional Office
601 Pole Line Road, Suite 2
Twin Falls, Idaho 83301

And the major water user industries:

Aquaculture Industry
Food Processors Industry
Municipalities Industry
Confined Animal Feeding Operations Industry
Hydroelectric Power Industry
Irrigated Agriculture Industry
Grazing Industry
Recreation Industry

FINAL DRAFT DOCUMENT
June 20, 2001 Issued



Final Document

The Upper Snake Rock TMDL Modification
Upper Snake Rock Watershed Management Plan – Modification -
A Modification of Mid-Snake TMDL and Upper Snake Rock TMDL
To Account for the Aquaculture Wasteload Allocation
Of
Part 1 (Fish Production Facilities & Conservation Hatcheries),
Part 2 (Fish Processors), and
Part 3 (Billingsley Creek Facilities)

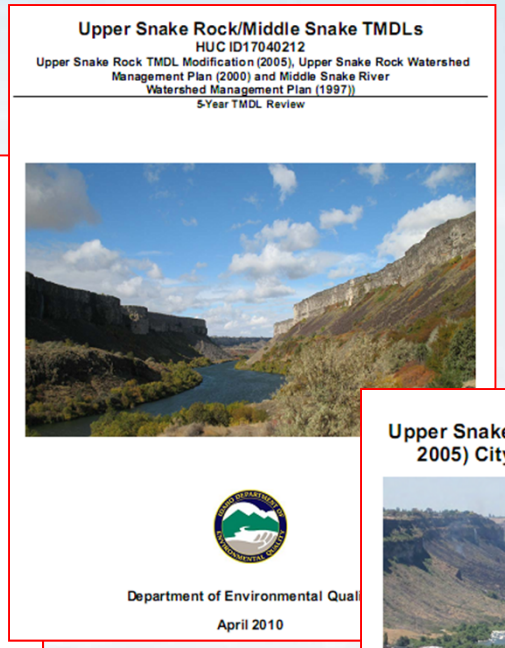
Prepared for

nmental Protection Agency – Region 10
Idaho Operations Office – Boise, Idaho
of Environmental Quality – State Office
Snake River Watershed Advisory Group

Prepared by

Dr. Balthasar B. Buhidar, Ph.D.
nal Manager – Water Quality Protection
o Department of Environmental Quality
Twin Falls Regional Office

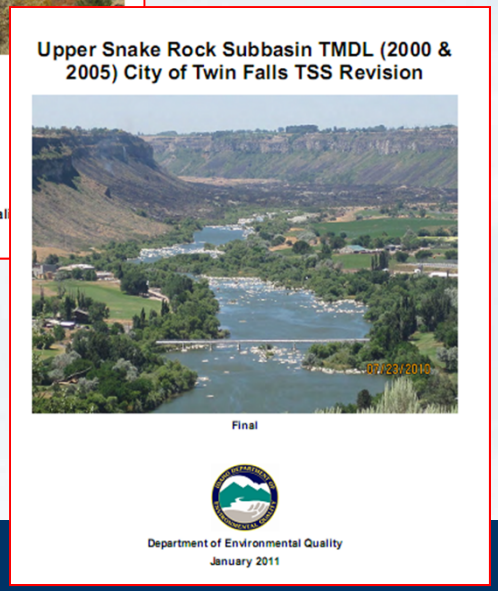
July 22, 2005



Upper Snake Rock/Middle Snake TMDLs
HUC ID17040212
Upper Snake Rock TMDL Modification (2005), Upper Snake Rock Watershed Management Plan (2000) and Middle Snake River Watershed Management Plan (1997))
5-Year TMDL Review

Department of Environmental Qual

April 2010



Upper Snake Rock Subbasin TMDL (2000 & 2005) City of Twin Falls TSS Revision

Final

Department of Environmental Quality
January 2011

Mid-Snake TMDL

Activity to Date

1997 ► Initial Phosphorus TMDL

- ***Established TP & nuisance algal growth targets***
- ***Assessed low flow, high flow, & baseline years***
- ***Industry-wide WLA established for aquaculture (970.2 pounds /day)***
- ***WLAs established for municipalities***

2000 ► Phosphorus and Total Suspended Solids (TSS) TMDL

- ***Defined six TMDL study segments***
- ***WLAs set for municipalities***
- ***Placeholder for aquaculture facilities***

Mid-Snake TMDL

Activity to Date

2005 ► Phosphorus and TSS TMDL Modification

- ***WLAs established for aquaculture facilities***
- ***WLAs set for municipalities***

2010 ► DEQ Five-year Data Review

- ***TSS & E. coli targets achieved. TP targets not met.***
- ***TMDL did not employ a low flow assumption***
- ***Past decade flows substantially lower than TMDL assumptions***

2013 ► Current Issues

- ***Aquaculture general permit expired in 2012***
- ***Population & economic growth in the area***
- ***Discussion of trading***

Data Assessment

Scope of Current Task

- **Integrated analysis of available data**
  - ***Total phosphorus conditions***
    - ***Concentrations relative to 0.075 mg/L target***
    - ***Loading patterns (sources, in-stream response)***
    - ***Attenuation & uncertainty***
  - ***Role of hydrology***
    - ***Conditions over past decade***
    - ***Effect on current TMDL***

TMDL Development

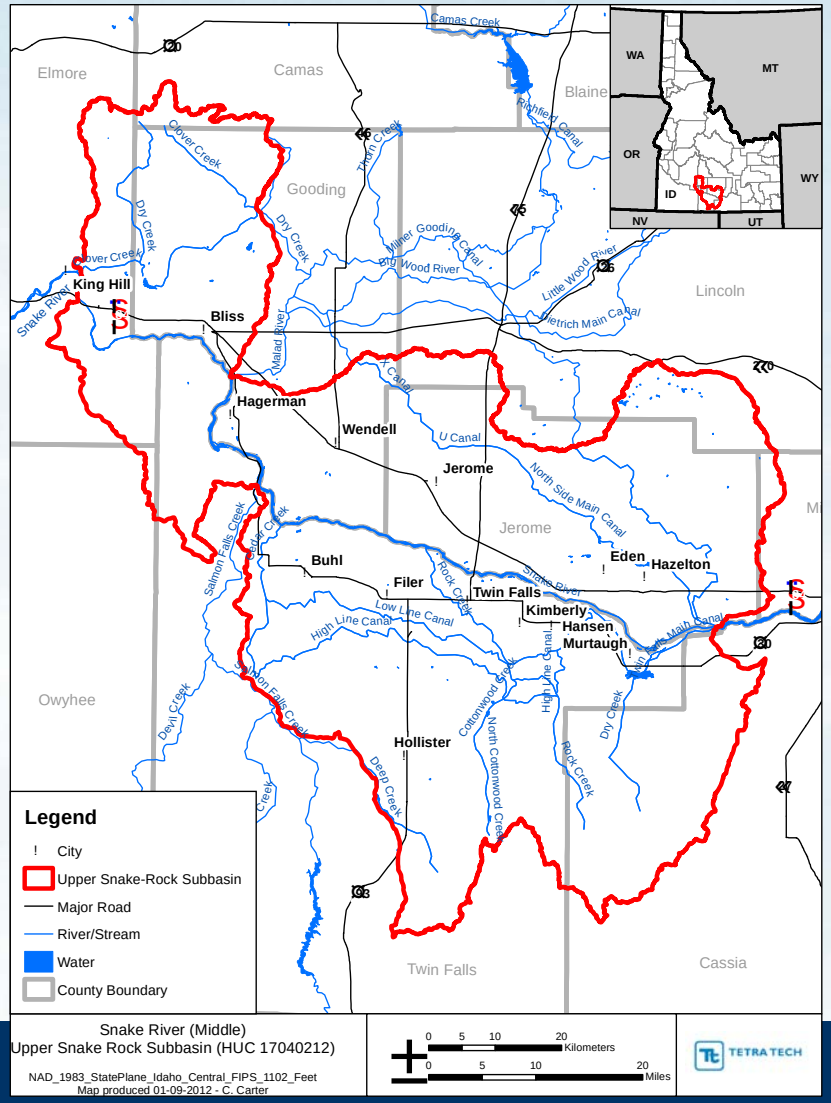
Problem Solving Framework

- **Practical approach using key questions …**
  - ***WHY*** ***the concern***
  - ***WHAT*** ***reductions are needed***
  - ***WHERE*** ***are the sources***
  - ***WHO*** ***needs to be involved***
  - ***WHEN*** ***will actions occur***

Mid-Snake TMDL

WHY the Concern

- **Excessive Algal Growth**

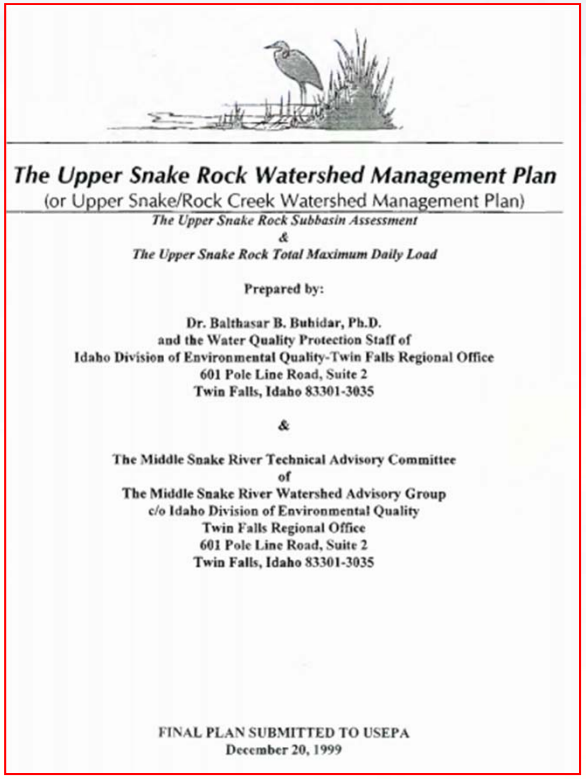


Mid-Snake TMDL

WHAT are the Targets

First TMDL established: March 1997

(EPA approval: April 1997)



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601 Pole Line Road, Suite 2
Twin Falls, Idaho 83301-3035

FINAL PLAN SUBMITTED TO USEPA
December 20, 1999

Parameter	Target	2001-2010 Average
Total Suspended Solids *(mg/L)*	52 [1]	22.6 [3,4]
Total Phosphorus *(mg/L)*	0.075 [2]	0.091 [3]

Notes:

[1] Monthly average *(Daily maximum: 80 mg/L)*

[2] 0.1 mg/L for tributaries

[3] Gridley Bridge monitoring site

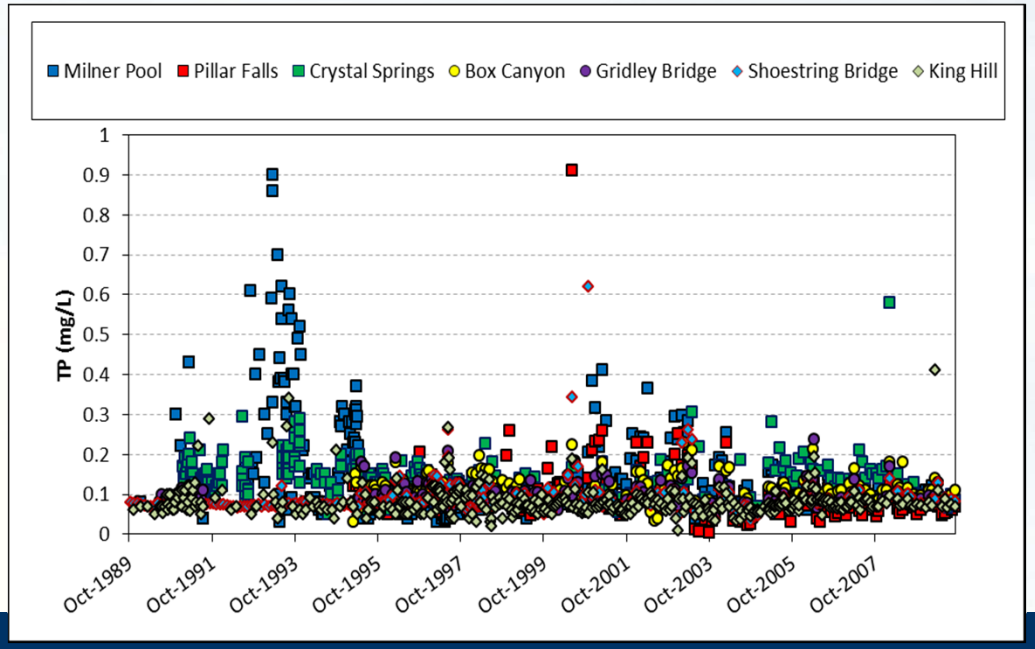
[4] Maximum monthly average *(June)*

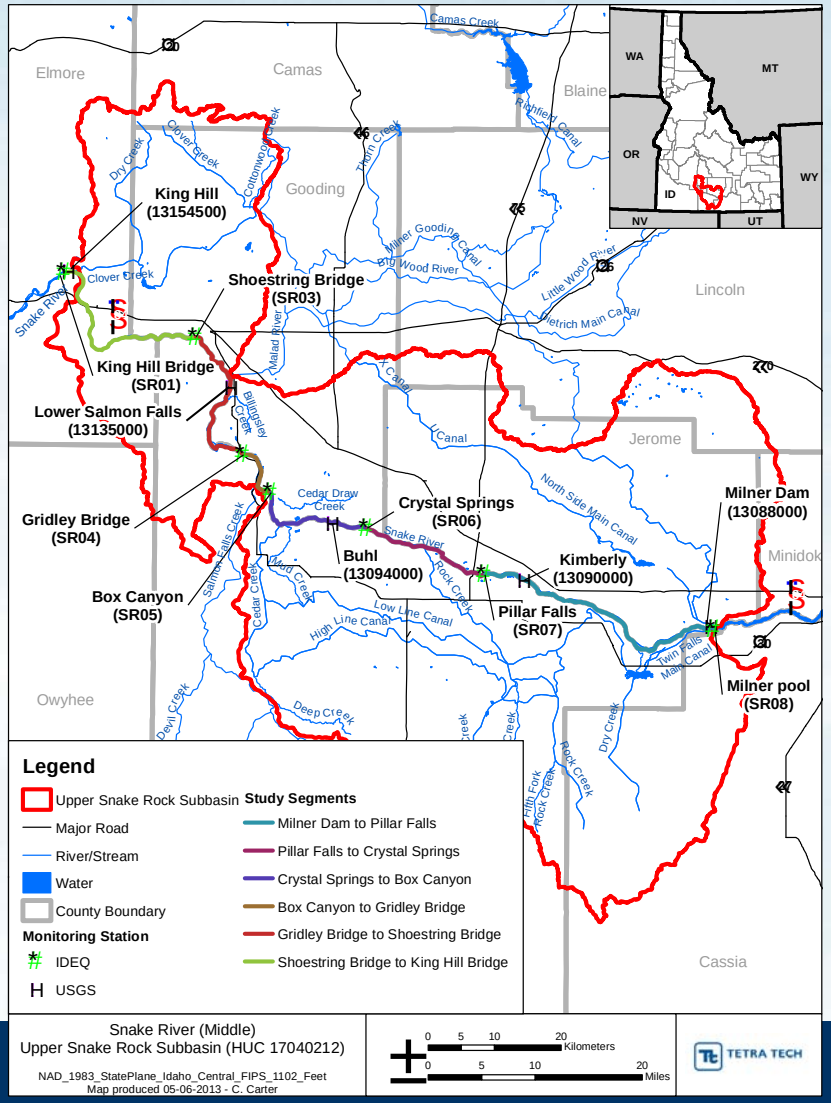
Mid-Snake TMDL

Adaptive Management

Data Driven Approach

- ***DEQ & USGS monitoring***
- ***Stakeholder sampling***

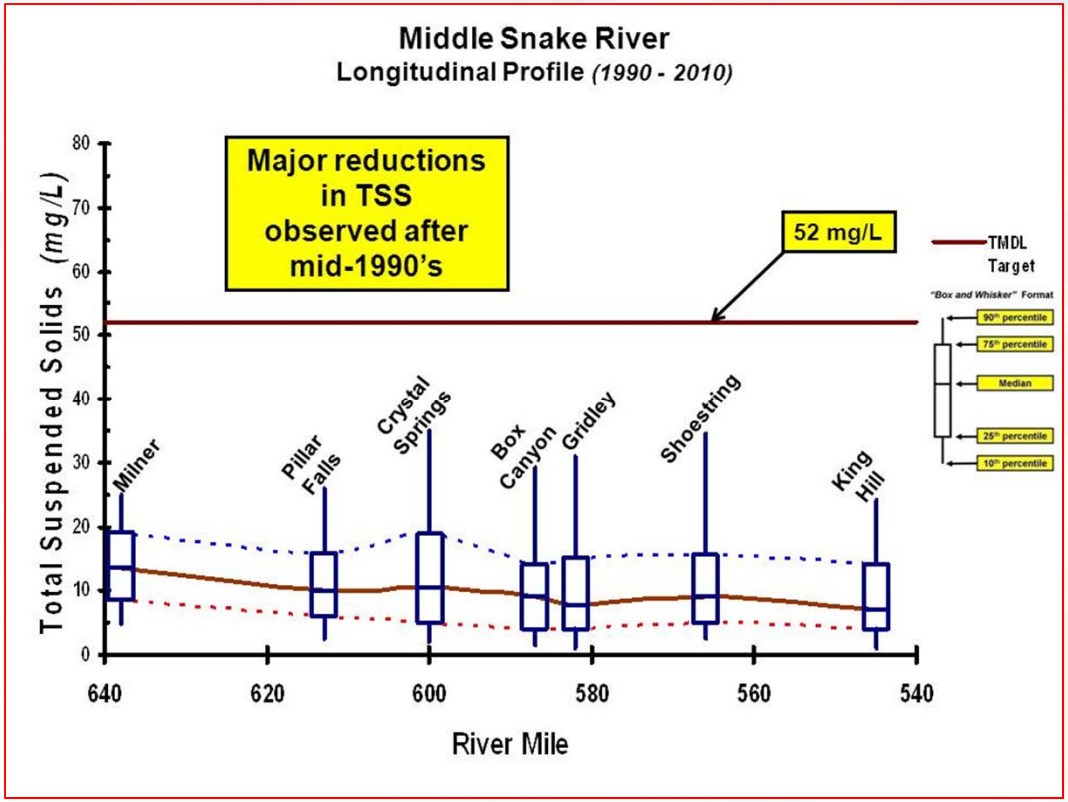


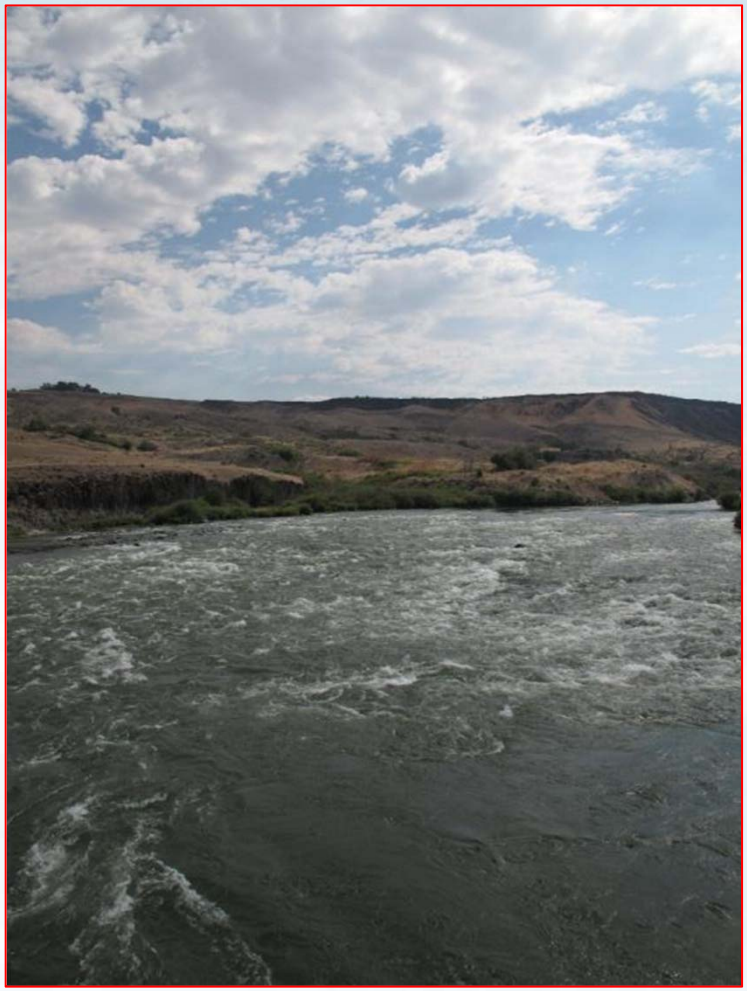


Data Driven Approach

Water Quality Patterns

Total Suspended Solids

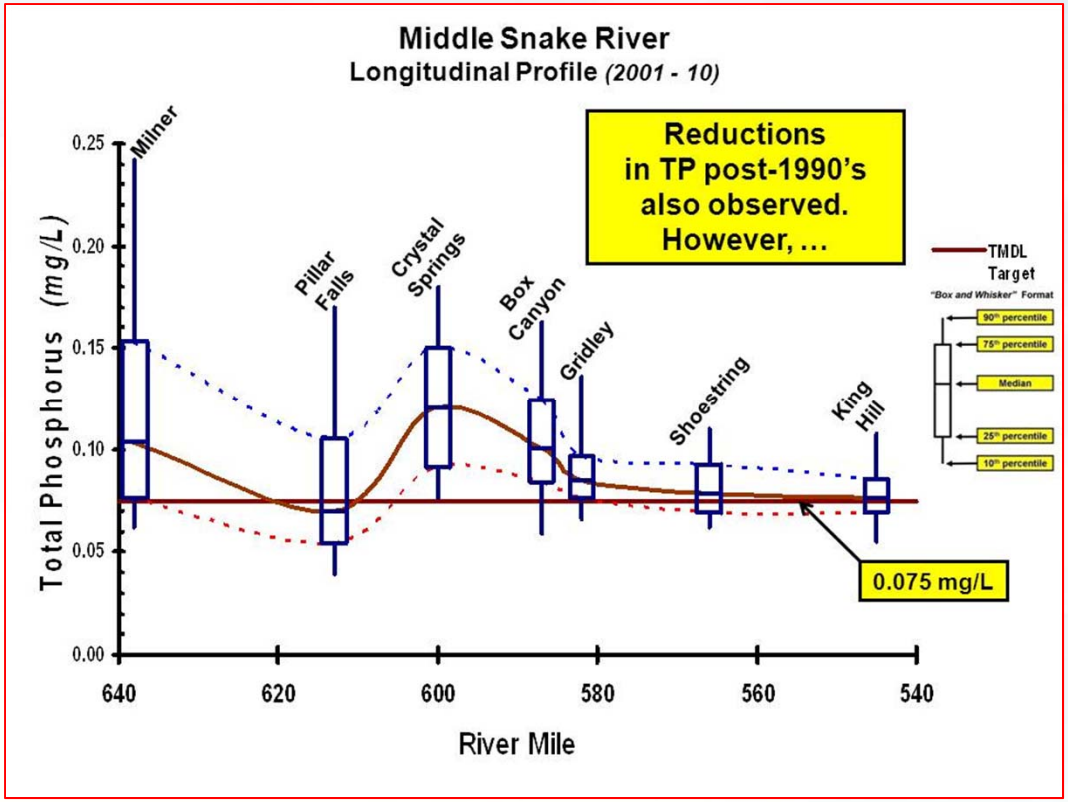


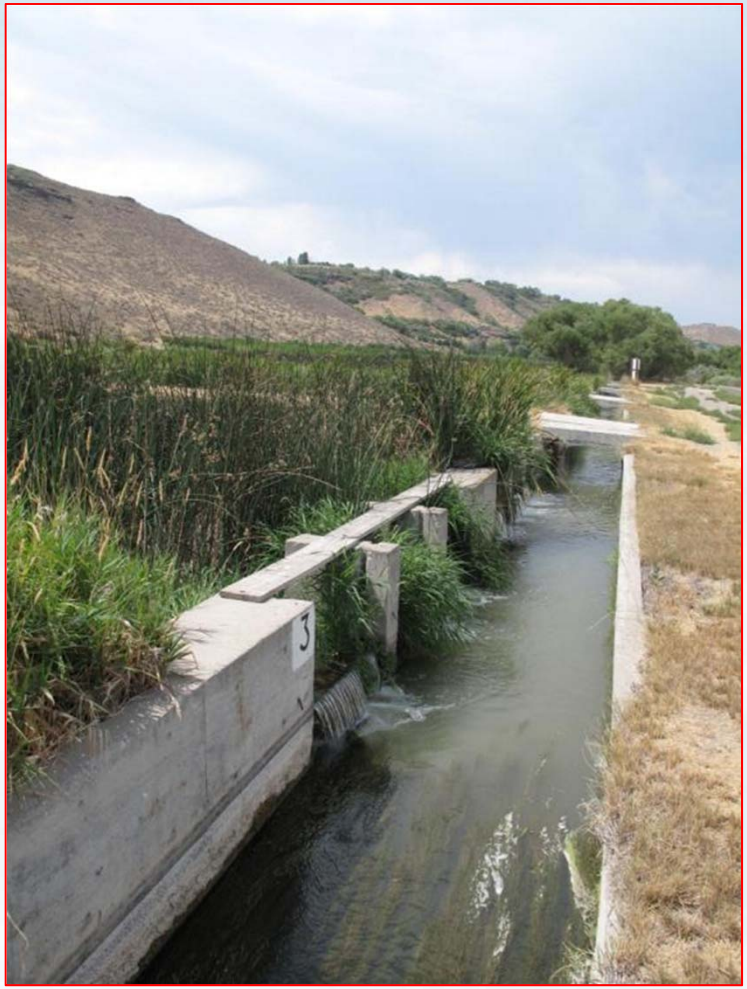


Data Driven Approach

Water Quality Patterns

Total Phosphorus

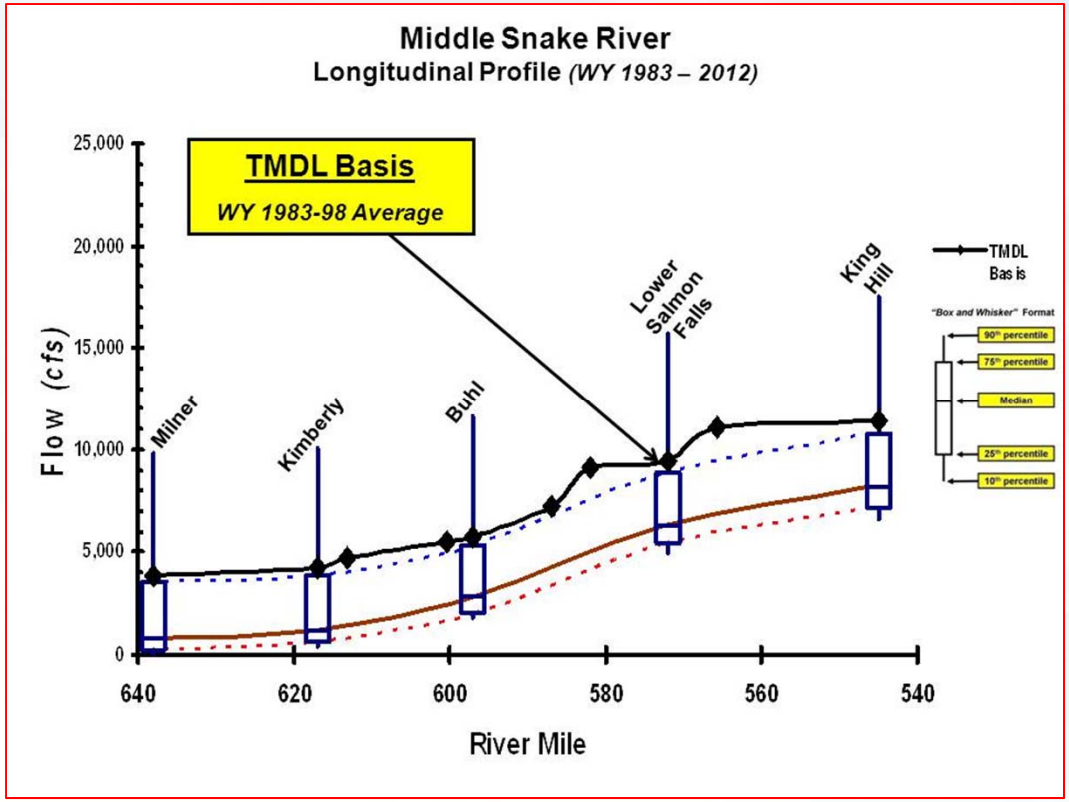


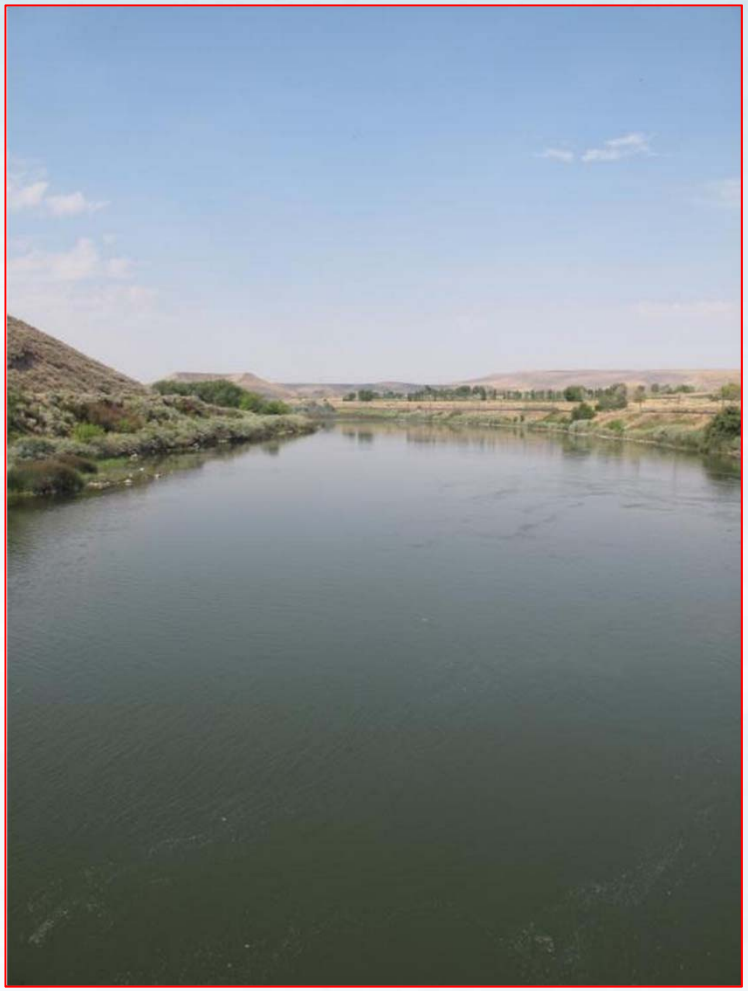


Data Driven Approach

Role of Hydrology

Flow Patterns

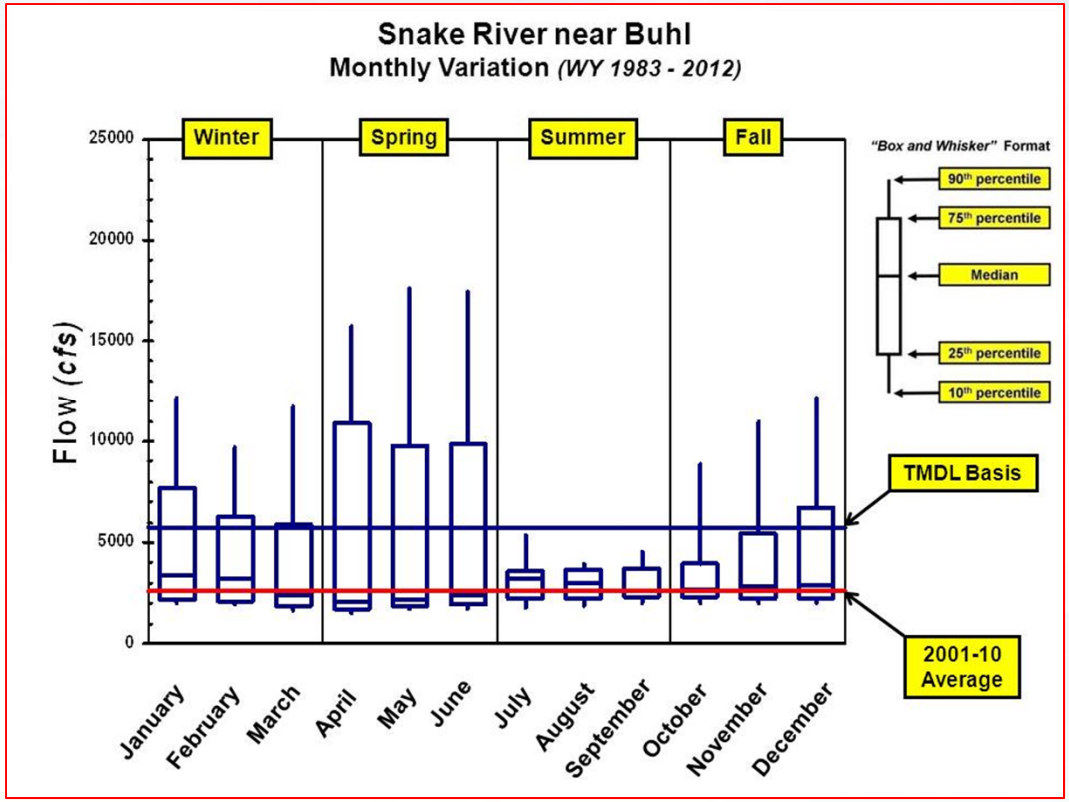




Role of Hydrology

Seasonal Patterns

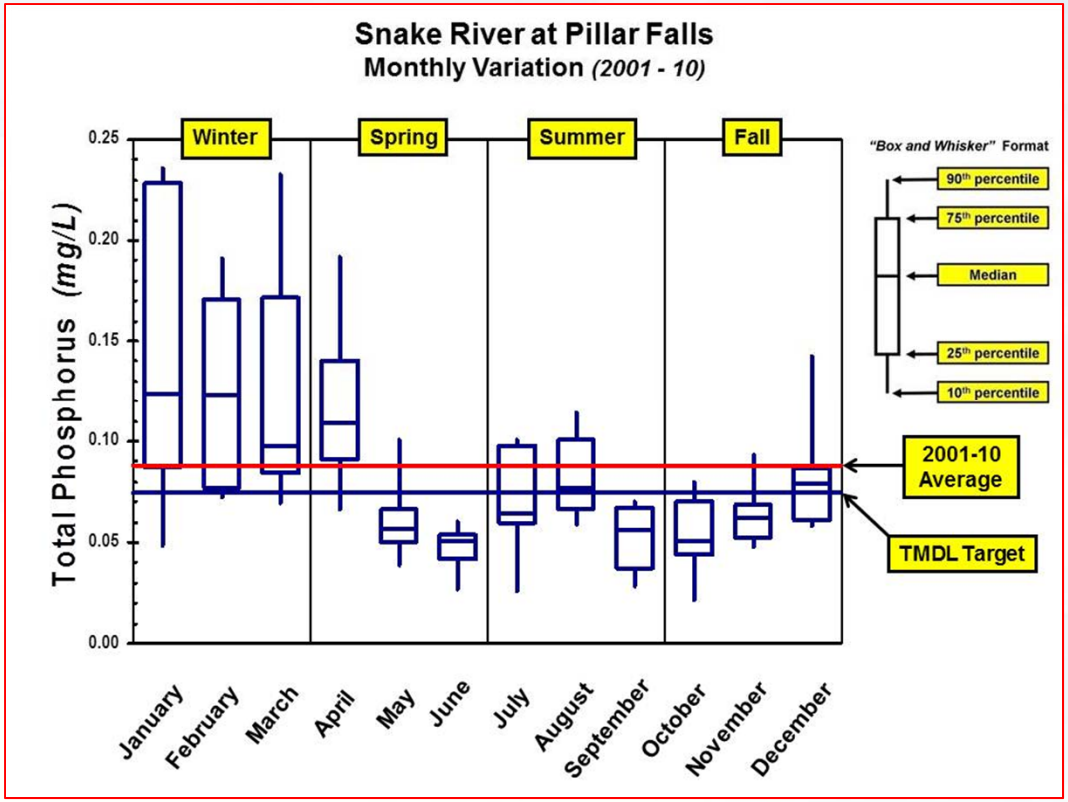
Critical Conditions



Role of Hydrology

Effect on Water Quality

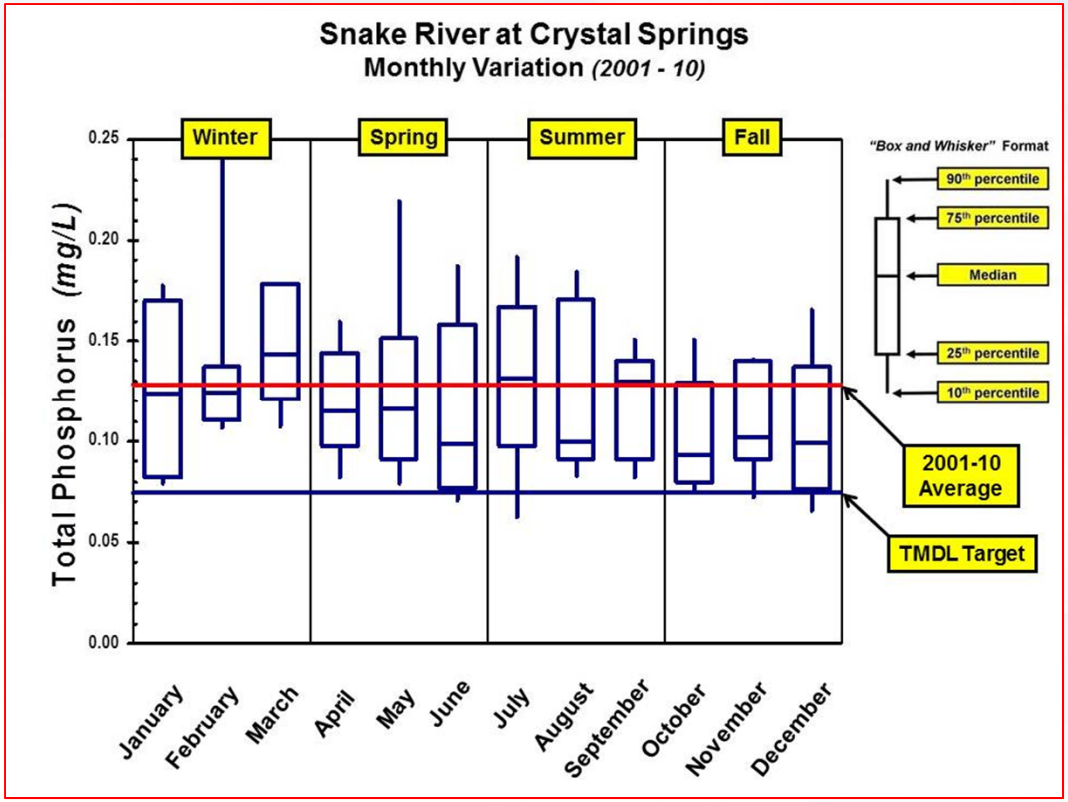
Seasonal Patterns

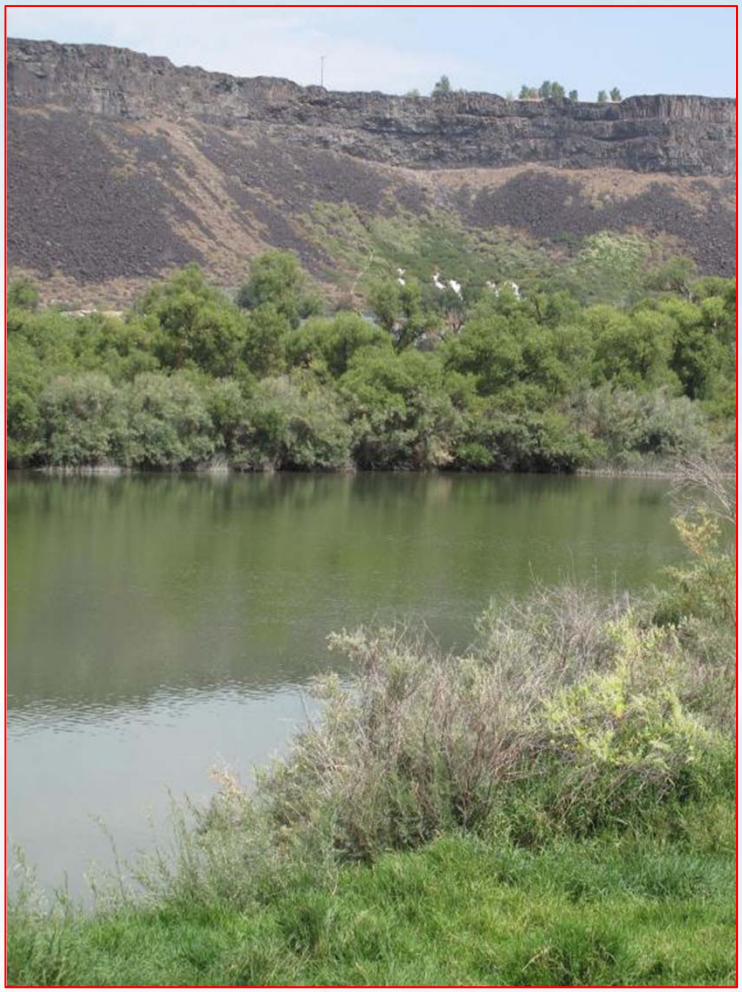


Role of Hydrology

Effect on Water Quality

Seasonal Patterns

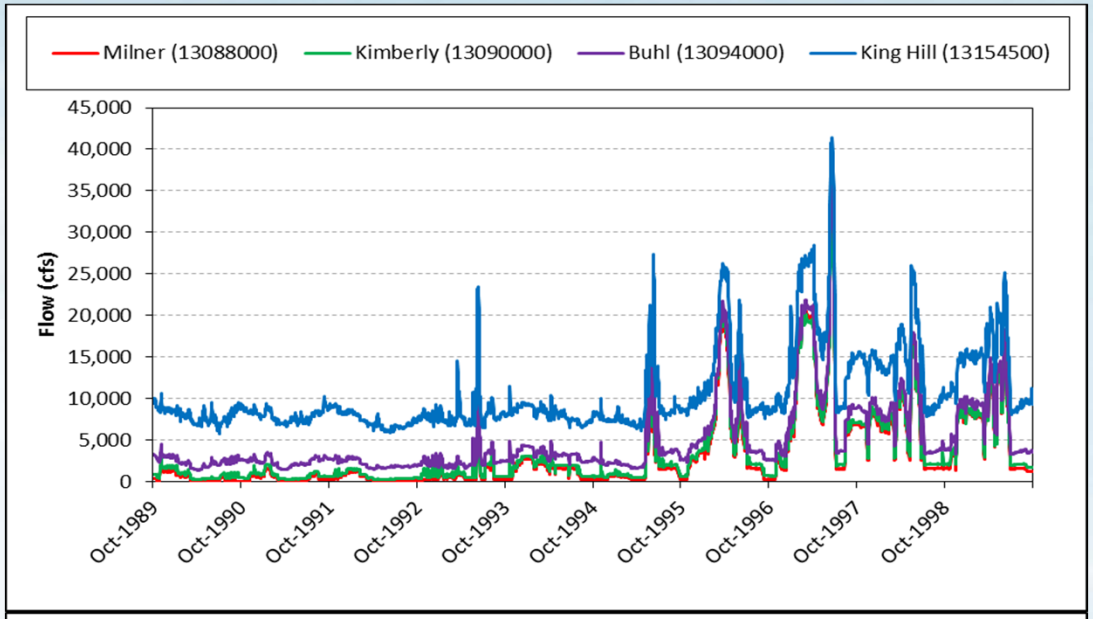




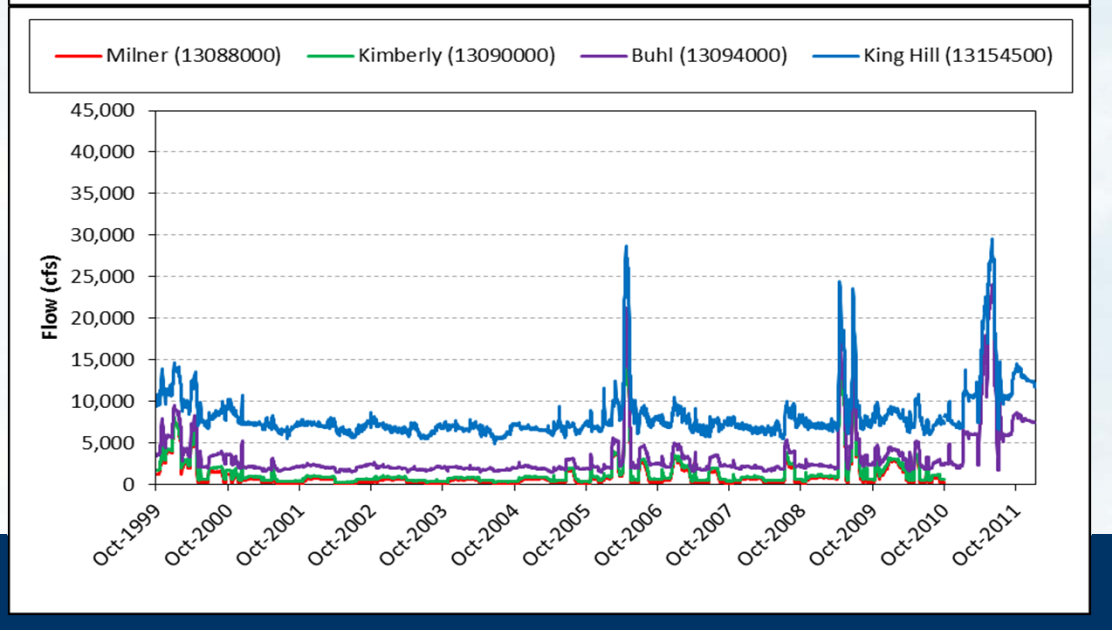
Role of Hydrology

Year-to-Year Variation

- **Average Daily Flow**
  (WY 1990 – 1999)



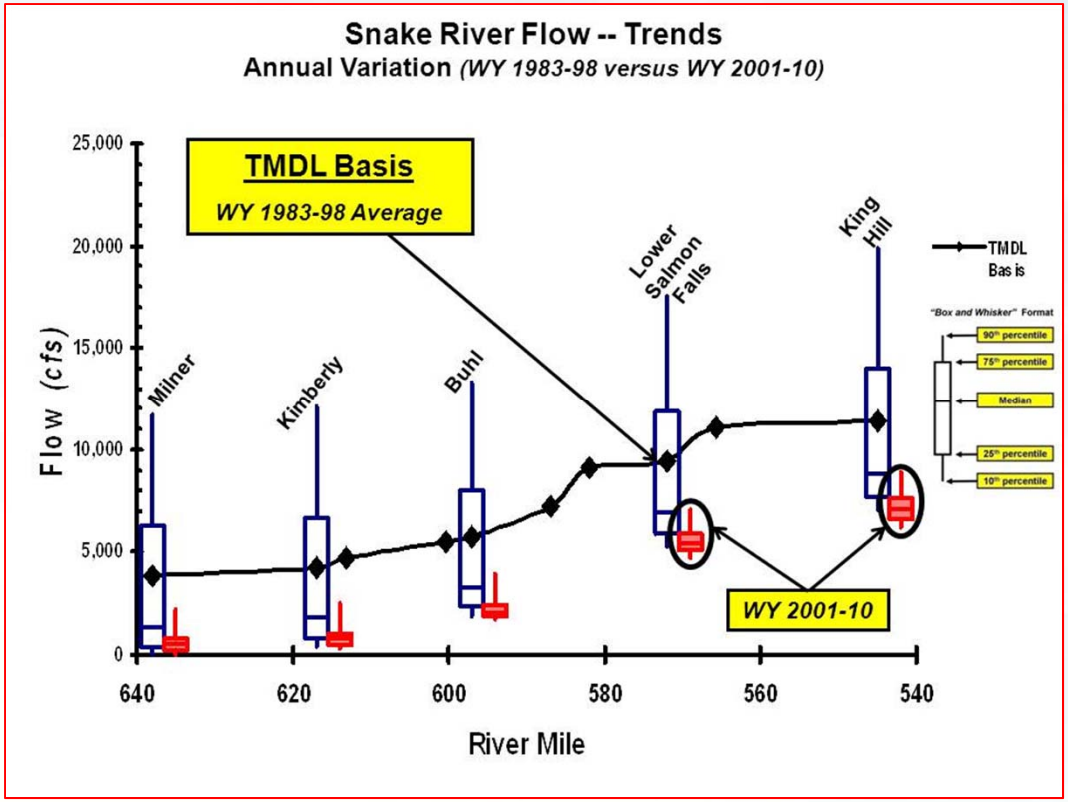
- **Average Daily Flow**
  (WY 2000 – present)



Role of Hydrology

Year-to-Year Variation

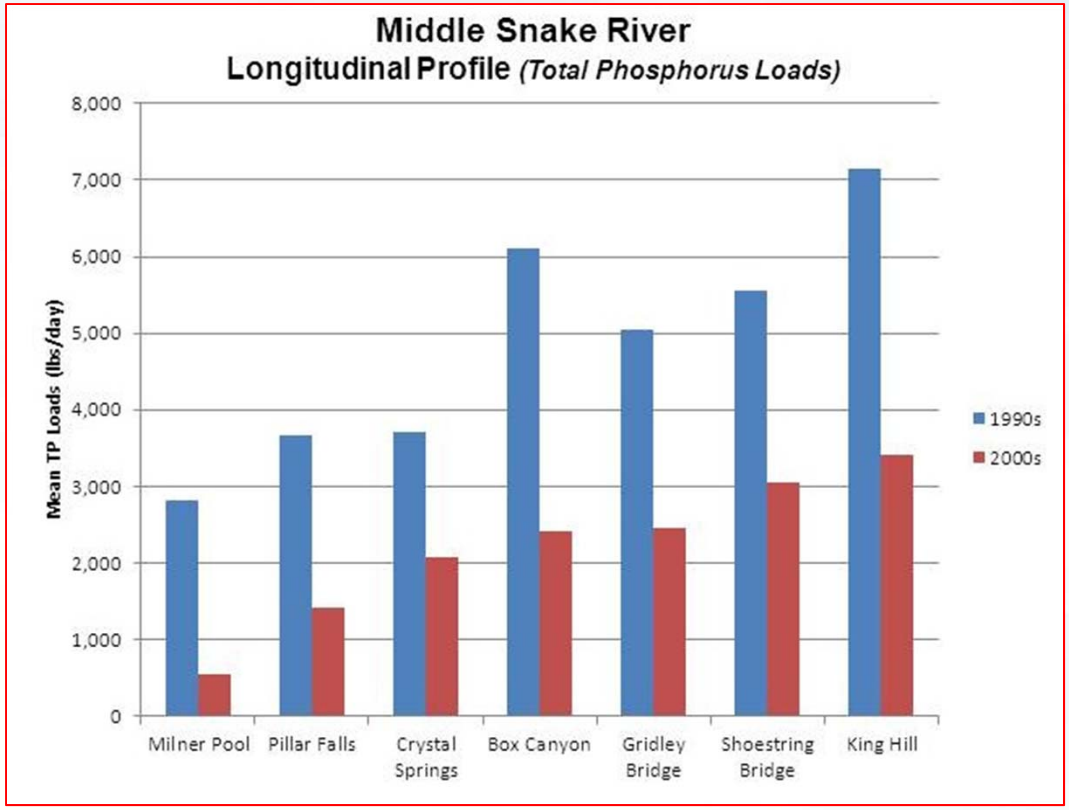
Shift over Past Decade

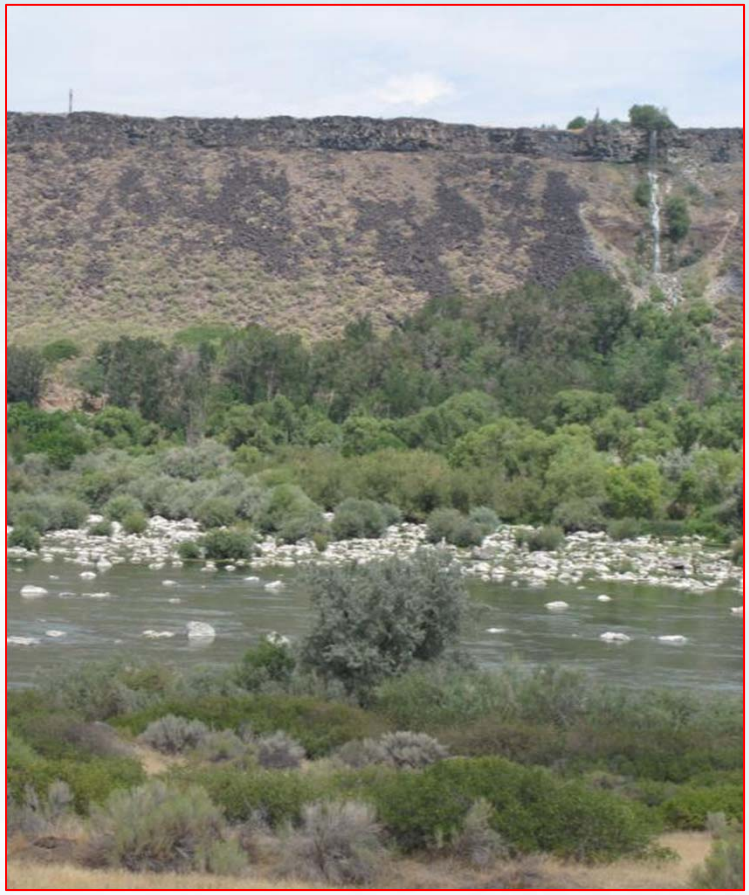


Role of Hydrology

Effect on Water Quality

- **Decrease in average daily loads as a result of reduced flows**

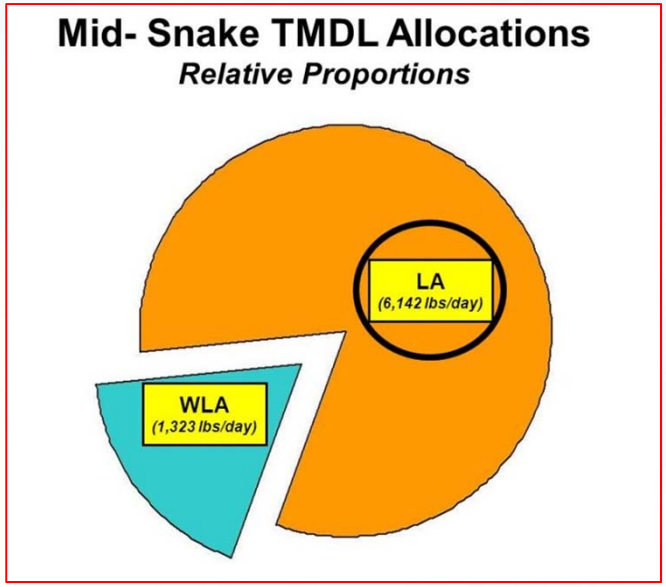




Data Assessment

Tributaries & Drains

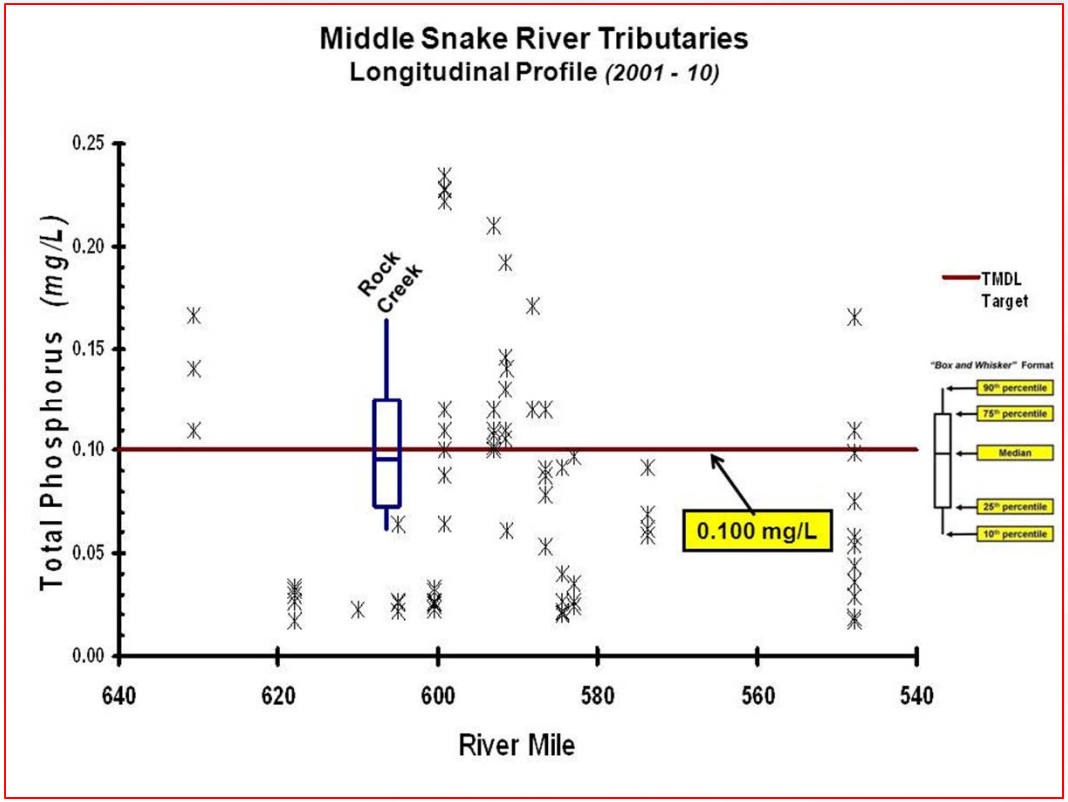
- **Limited monitoring information**
  - ***Major tributaries (Idaho DEQ)***
  - ***Drains (Irrigation Districts -- most data post-2005)***



Data Assessment

Tributaries & Drains

- **Targets not being met**

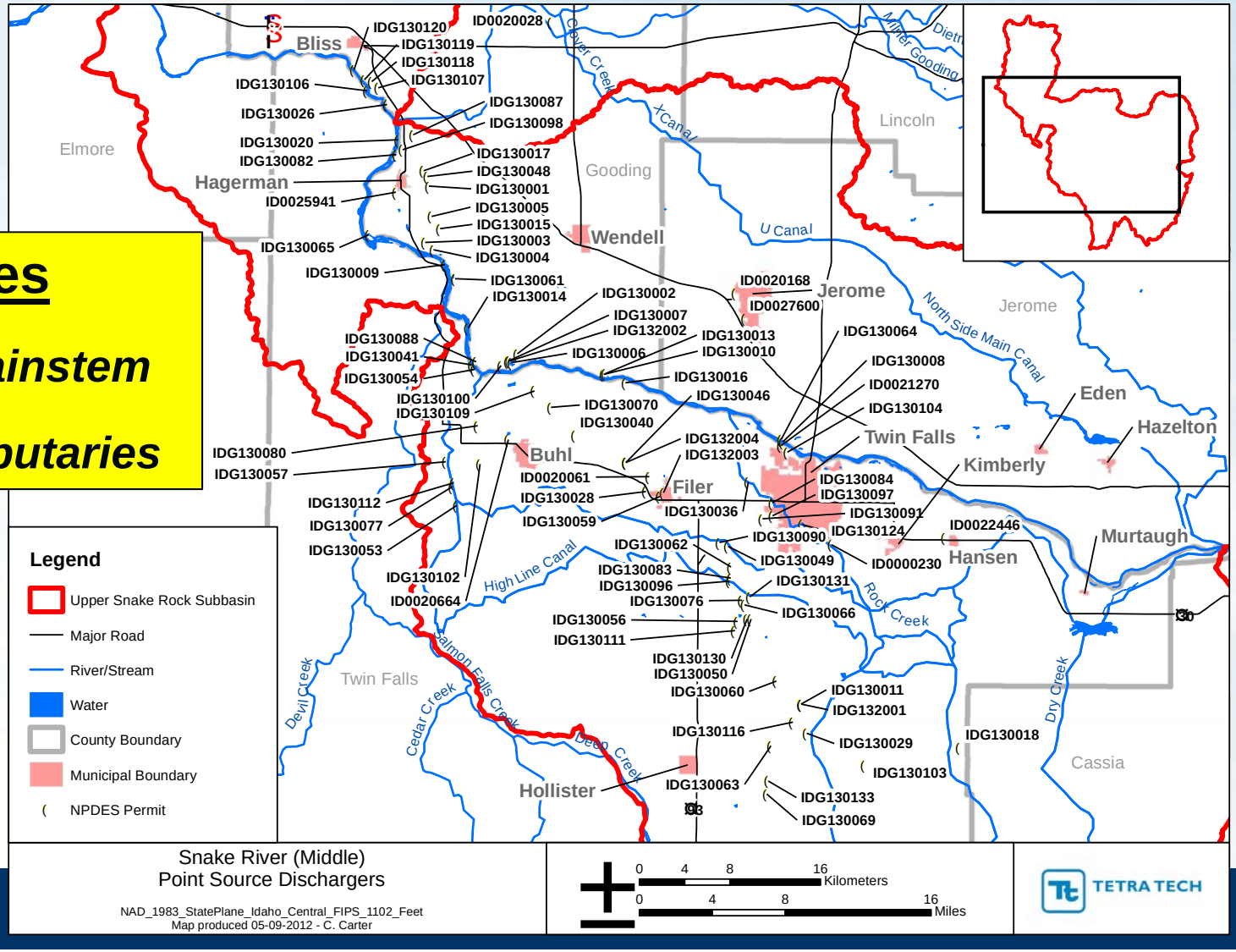


Data Assessment

Point Sources

84 facilities

- ***25 on mainstem***
- ***59 on tributaries***



Snake River (Middle)
Point Source Dischargers

NAD_1983_StatePlane_Idaho_Central_FIPS_1102_Feet
Map produced 05-09-2012 - C. Carter

0 4 8 16 Kilometers
0 4 8 16 Miles

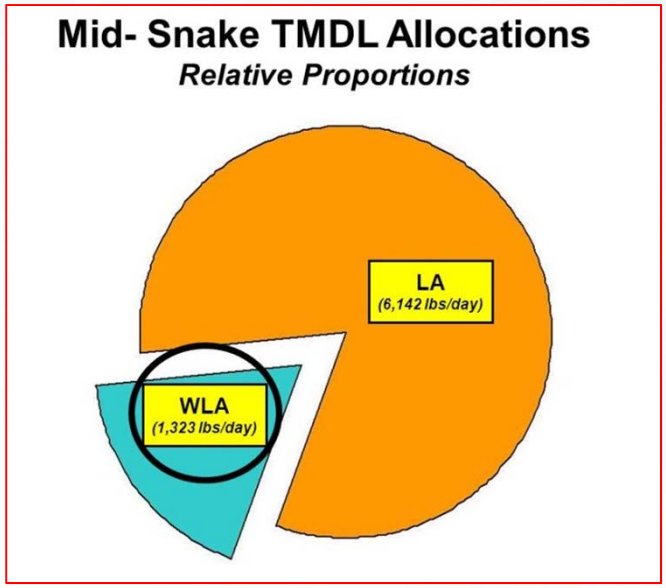
TETRA TECH

Data Assessment

Point Sources

Time frame examined: ***2001 to present***

- ***No data for 13 minor dischargers***
- ***Most facilities appear to meet WLAs***



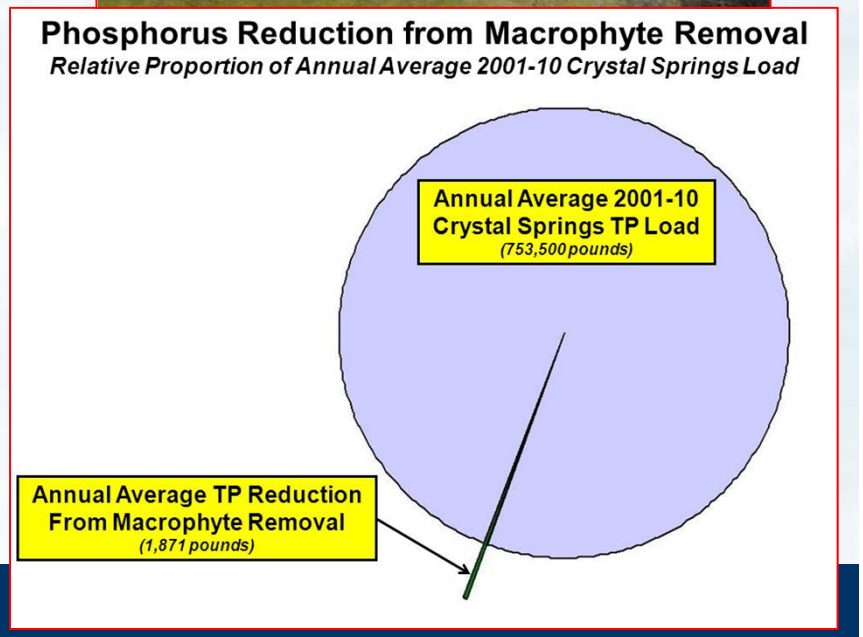
Data Assessment

Macrophytes

Harvesting represents TP loss

- ***Tracked by Idaho Power at 4 facilities (number of truckloads)***
- ***Based on TP macrophyte samples (mg/kg in aquatic vegetation)***
- ***Comparative index only !!***

Dam	Avg. Annual TP Removal *(pounds)*	Year Range
Upper Salmon "B"	1,241	1991 - 2011
Upper Salmon "A"	317	2006 - 2011
Lower Salmon	106	2007 - 2011
Bliss	207	2007 - 2011



Data Assessment

Groundwater

Considered

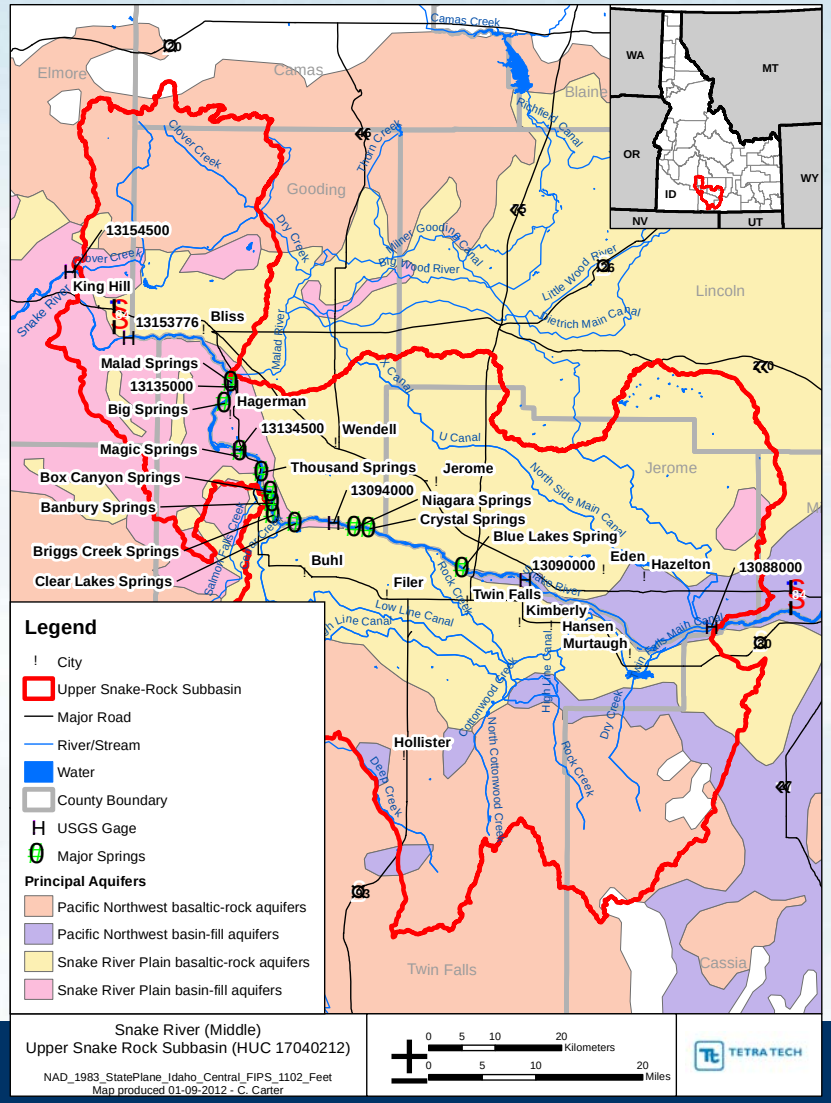
- ***Diffuse inflows***
- ***Springs***

Largest Source

- ***Snake Plain Aquifer***

Springs

- ***11 major springs (> 100 cfs)***
- ***Thousand Springs area***



Data Assessment

Groundwater Modeling

Sources reviewed

- ***Kjelstrom (2005)***
- ***USGS / Idaho Power***
  - ***(Hortness & Vidmar, 2004)***
- ***Blew & Bowling (2009)***
- ***Eastern Snake Plain Aquifer Model (IWRB)***
- ***IDWR / USGS (2013)***

Eastern Snake Plain Aquifer Model

The Eastern Snake Plain Aquifer at Thousand Springs, photo by U.S. Geological Survey

Data Assessment

Groundwater Modeling

- **Modeling indicates aquifer flows have been declining**

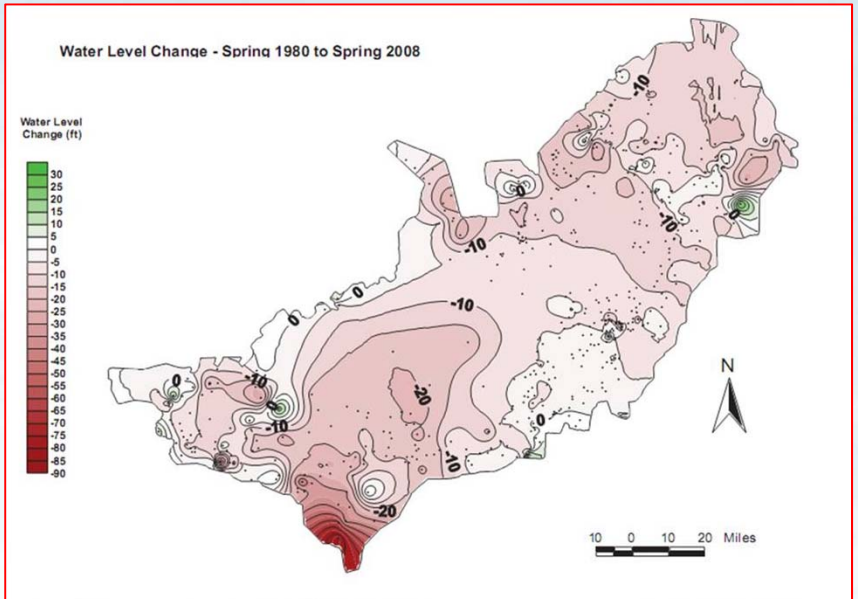


Figure 12. Water level change map, Spring 1980 - Spring 2008. *(from IDWR, 2013)*

- **Eastern Snake Plains Aquifer Plan framework is intended to stabilize aquifer levels and river flows**

Data Assessment

Attenuation

- **Defining what we mean by "Attenuation"**
  - ***Dilution***
  - ***Temporary Retention – e.g., plant uptake***
  - ***Permanent Removal – e.g., deep burial or chemical change***
- **TMDL assumptions can directly affect loading capacity and allocations**

Data Assessment

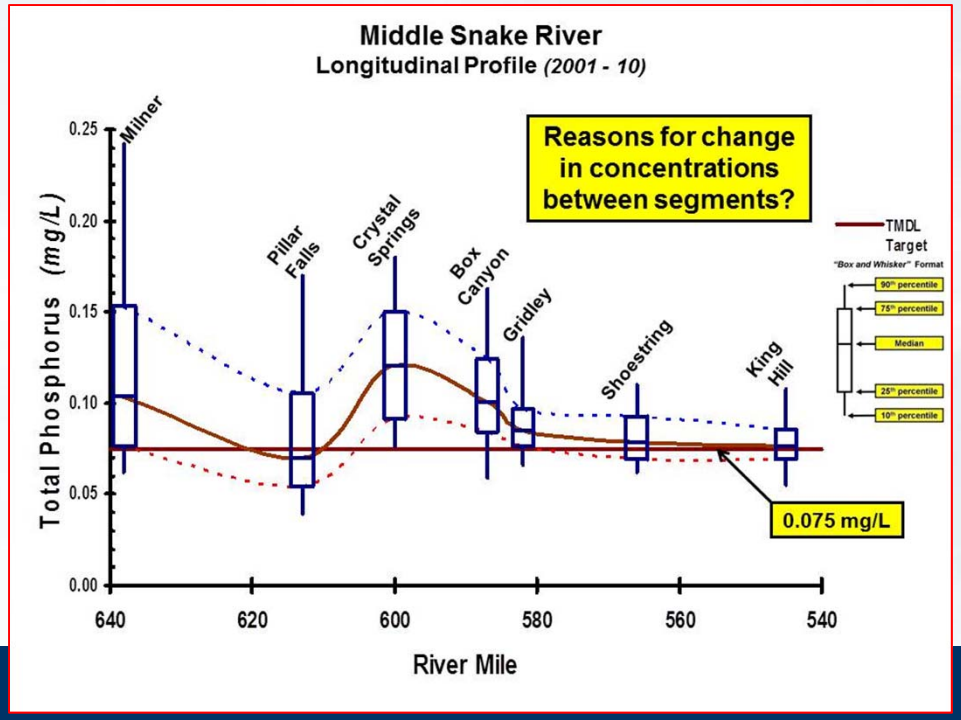
Attenuation

- **2005 TMDL assumed removal occurs**
- **2013 Assessment**
  - ***Regional SPARROW analysis suggests negligible permanent removal in large rivers***
  - ***Mass balance – removal not identifiable relative to overall uncertainty in phosphorus loading***

Mass Balance

Key Questions

- **Examine loading changes between segments**
  - ***What is the relative magnitude of source inputs?***
  - ***What are areas of uncertainty?***
  - ***What are the data gaps?***



Mass Balance

Approach

- **Source Load Estimates**
  - ***Point sources (direct & indirect)***
  - ***Gaged tributaries***
  - ***Irrigation return drains***
  - ***Gaged springs (discrete GW)***
  - ***Baseflow (diffuse GW)***

- **Assumed no attenuation**
- **Baseflow contributions did not account for potential year-to-year variability**

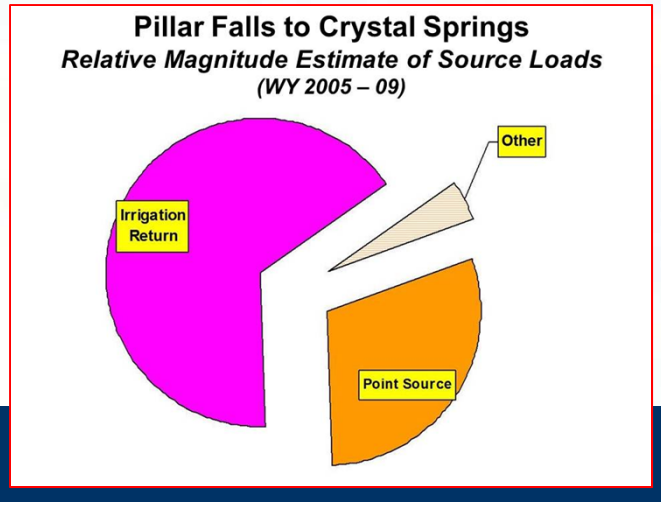
Mass Balance

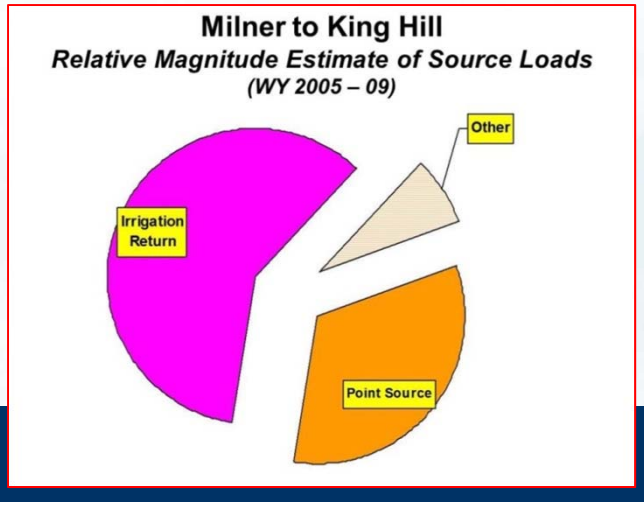
Results

Source Load Estimates

- ***Based on WY 2005 – 09 (most complete data set)***
- ***Relative magnitude comparable below Pillar Falls***

Study Segment	Point Source (lbs/day)	Irrigation Return (lbs/day)	Baseflow plus Gaged Tributaries & Springs (lbs/day)
Pillar Falls to Crystal Springs	580	1,273	78
Milner to King Hill	1,367	2,441	314

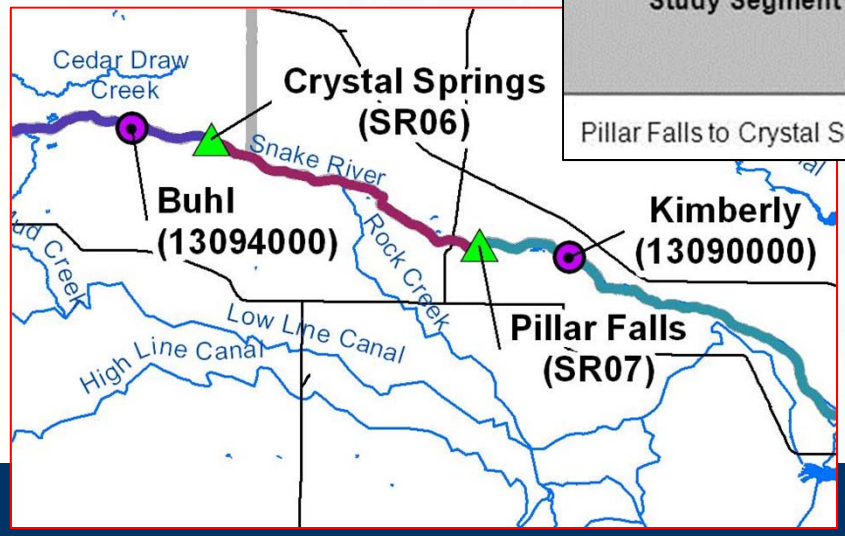




Mass Balance

Uncertainty

- **In-stream loads compared to source input estimates**
  - ***Differences may be due to:***
    - ***Uncertainty inherent in load estimates***
    - ***Loss of streamflow to groundwater***
    - ***Phosphorus removal (appears to be low)***
  - ***Example:***



Study Segment	Change in Load Between Mainstem IDEQ Stations (lbs/day)	Point Source (lbs/day)	Irrigation Return (lbs/day)	Baseflow plus Gaged Tributaries & Springs (lbs/day)	Difference (lbs/day)
Pillar Falls to Crystal Springs	1,257	580	1,273	78	-675

Data Assessment

Key Findings

- **Comparison between TMDL assumptions and 2000 – 2009 flow conditions**

Study Segment	Assumed Inflow in the TMDL (cfs)	Average Annual Inflow, 2000-2009 (cfs)	Load Capacity (lbs/day) for Inflow Only	Total Current Allocations for Inflow Sources (lbs/day)
Milner Dam to Pillar Falls	877	549	222	410
Pillar Falls to Crystal Springs	761	891	360	2,097
Crystal Springs to Box Canyon	1,714	1,403	567	1,820
Box Canyon to Gridley Bridge	1,901	742	300	1,575
Gridley Bridge to Shoestring Bridge	1,995	1,761	712	1,352
Shoestring Bridge to King Hill Bridge	290	1,228	496	210
Total	**7,538**	**6,574**	**2,657**	**7,464**

Data Assessment

Key Findings

- **Frequent exceedances of total phosphorus concentration targets** ***(mainstem & tributaries)***
- **Flow basis for TMDL exceeds average and low flow conditions**
- **Annual average flows lower over past decade**
  - ***Reduced assimilative capacity***
  - ***Allocations for inflow sources exceed reduced capacity needed to meet 0.075 mg/L target***

Mid-Snake TMDL

Next Steps

- **WAG review & input on data assessment**
  - ***Input to be reviewed by DEQ, EPA, and Tt, then incorporated as appropriate.***
- **Discuss TMDL re-evaluation**
  - ***Timeline for decision-making***
  - ***If re-evaluation pursued:***
    - ***Develop technical work plan***
    - ***Schedule***

Mid-Snake TMDL

Next Steps

- **WAG review & input on data assessment**
  - ***Provided to WAG: September 6th. Input due November 30th***
- **Send comments to:**

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