

# Waters of the West: Utah Water Research Laboratory

Utah Water Research Laboratory  
Utah State University  
Logan, UT

# 'Water Lab' Expertise

- Drinking/waste water treatment
- Environmental quality management/remediation
- Surface/ground water quality/quantity
- Water conveyance, distribution, control
- Water resources planning/management
- Water education/technology transfer

# Hydraulics Laboratory



Two large spaces for physical modeling of hydrology/hydraulic systems



# Environmental Quality Laboratory



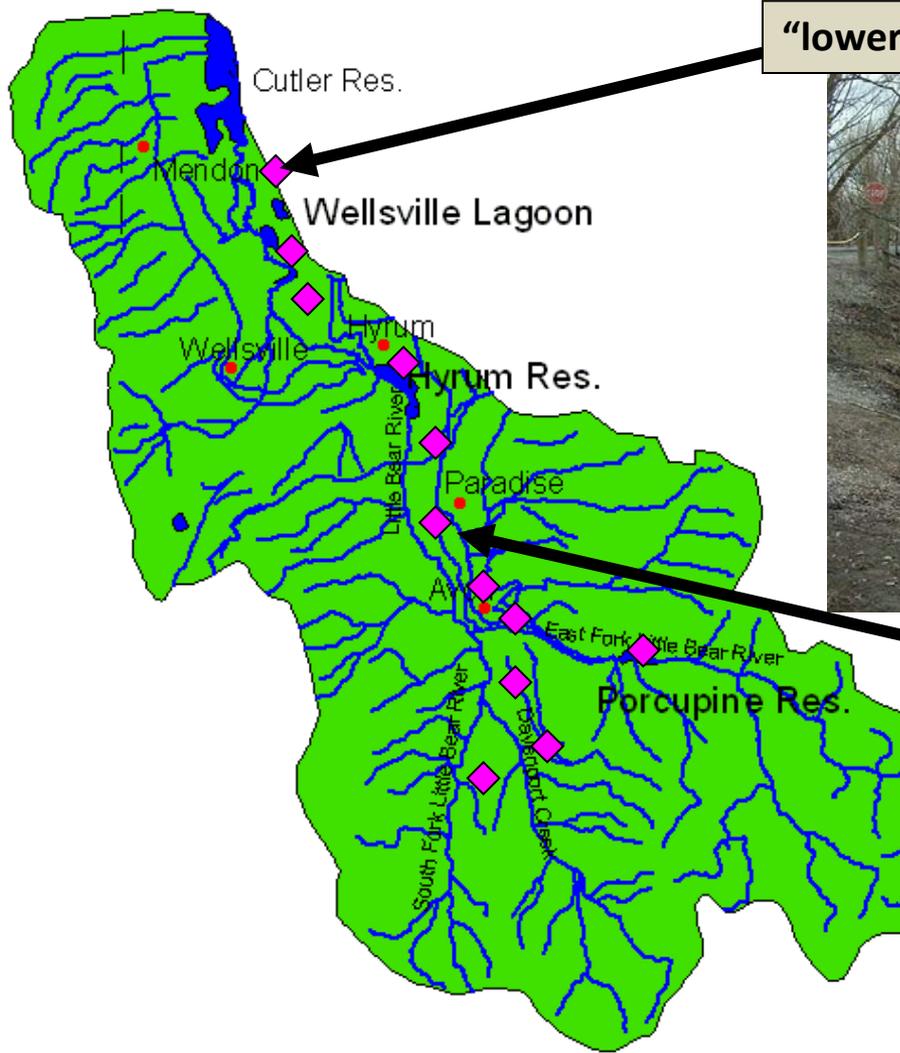
ment/Pilot Plant space  
rumentation



# Water Resources



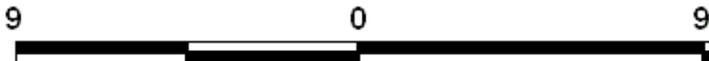
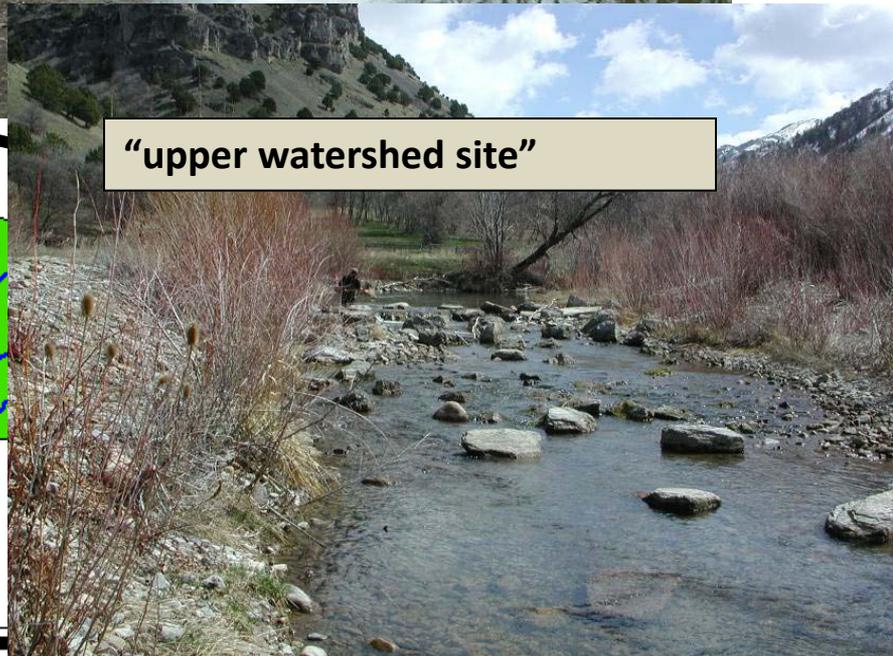
# Little Bear Watershed



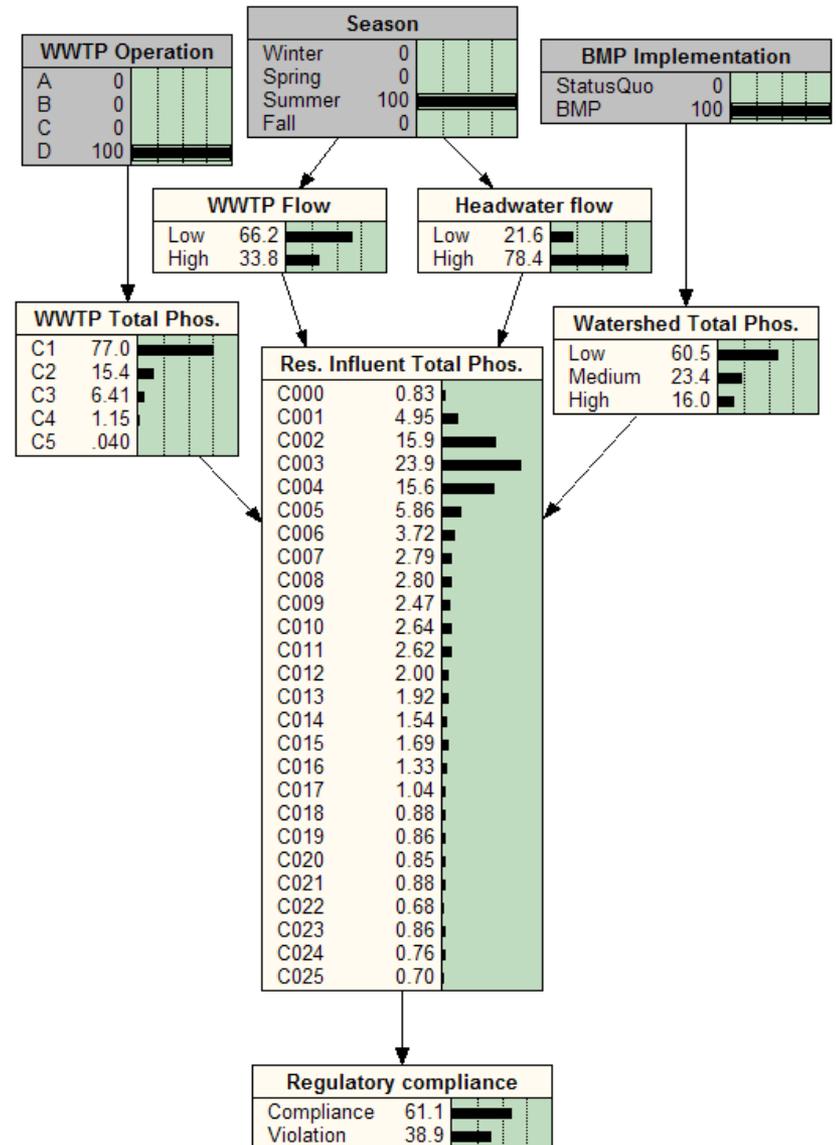
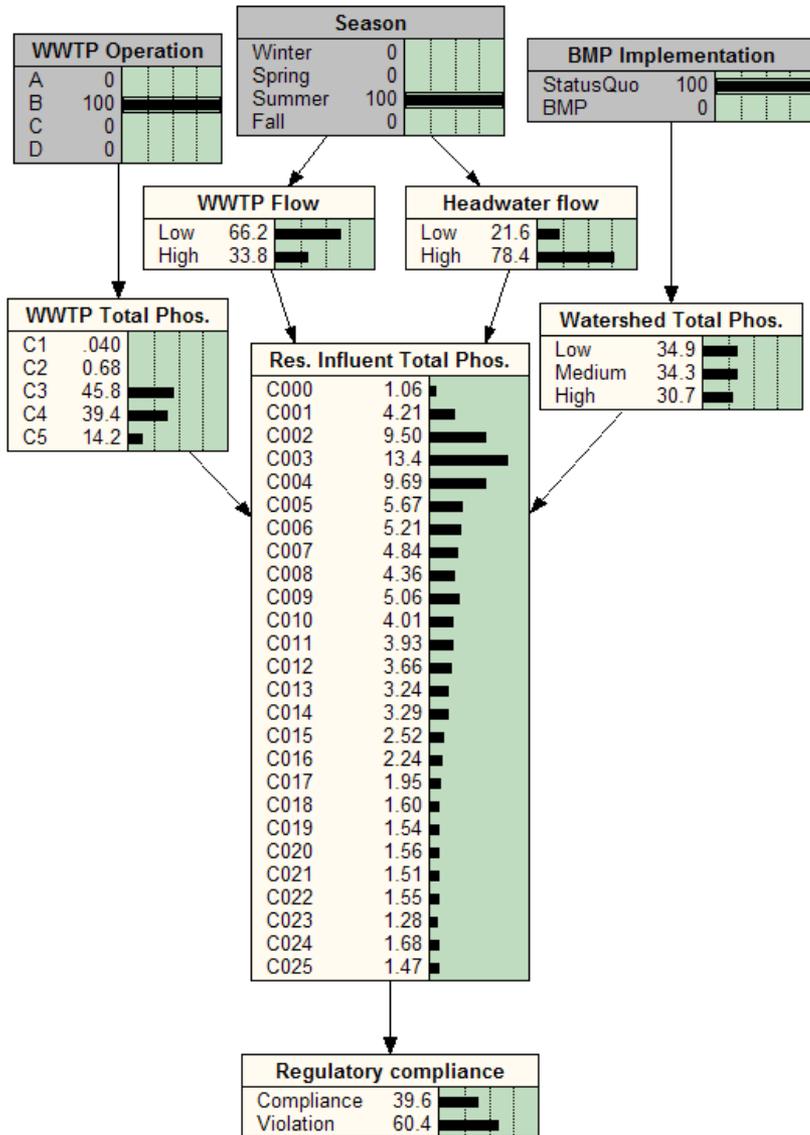
“lower watershed site”



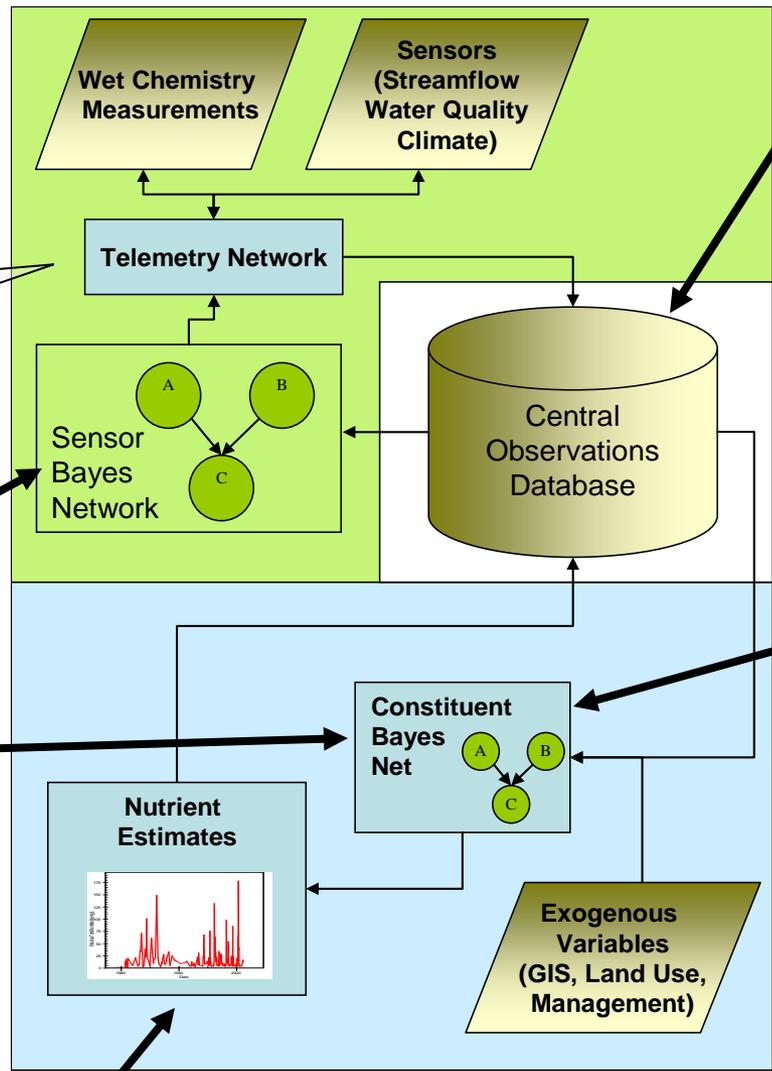
“upper watershed site”



# Pollution control assessment



# Information management infrastructure

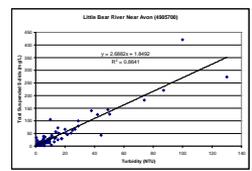
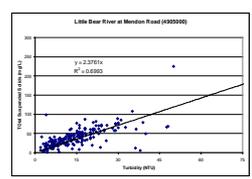


CUAHSI HIS ODM – central storage and management of observations data

Bayesian Networks to control monitoring for storm events and base flow

Bayesian Networks to construct water quality measures from surrogate sensor signals to provide high frequency estimates of water quality and loading the Little Bear river.

Correlations for TSS/TP vs. turbidity

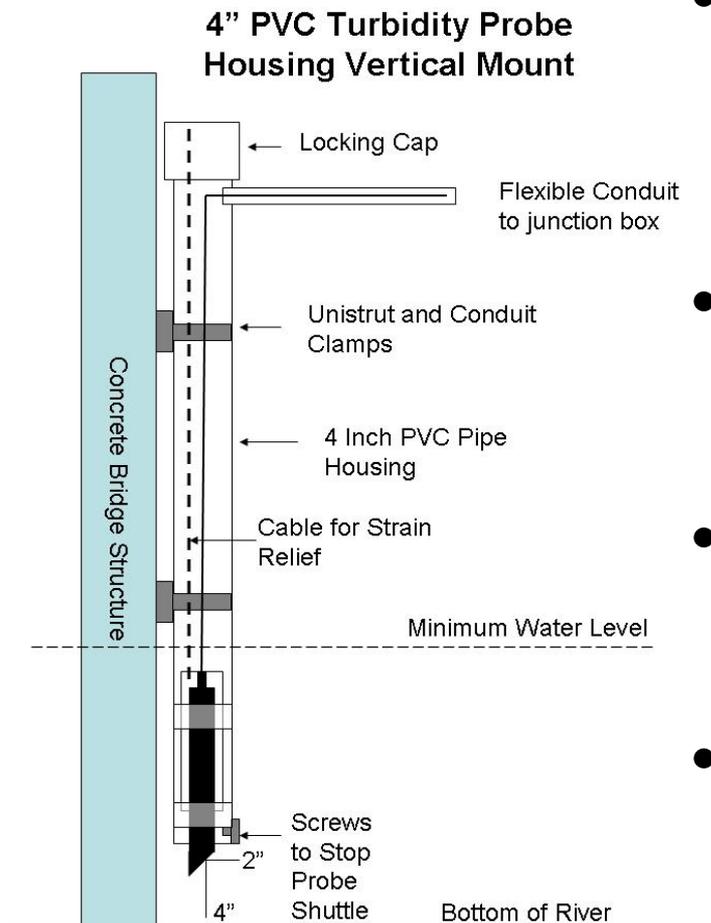


Integrated monitoring system

End result: high frequency estimates of nutrient concentrations and loadings

# Little Bear River Sampling Program

## Continuous Monitoring Equipment



- Stage recording devices to estimate discharge
- Turbidity sensors to monitor water quality
- Dataloggers and telemetry equipment
- Grab samples to correlate TP/TSS with turbidity and flow



<http://www.campbellsci.com>



<http://www.ftsinc.com/>



<http://www.campbellsci.com>

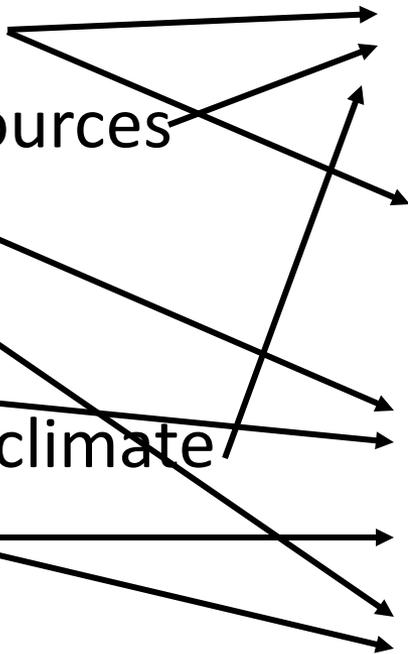
# Pollutant trading

## Disciplines

- Engineering
- Natural Resources
- Economics
- Sociology
- Plants/soils/climate
- Regulation

## Analyses

- Water/watershed interactions
- Pollutant load estimation
- Management potential
- Exceedance assessment
- Motivation



# Pollutant Trading

Cherry Creek

**Trading calculator**

Select subbasin

Receptor point: SBR6, Bear River above Cutler

Watershed: Cub River

Subbasin #: SB45, Cherry Creek

Point load:

Drainage Description: Cherry Creek

Units: U.S.

Load Units: lb x 1000, lb

Select farm/field

Farm ID:	Field ID
-1	34066 34885 34915 349
33580	34067 34886 34916 350
33581	34390 34887 34917 351
33582	34391 34890 34918 352
33584	34392 34894 34919 353
33586	34752 34895 34925 354
33587	34807 34896 34926 355
33590	34819 34897 34927 356
33591	34873 34900 34928 357
33651	34876 34905 34929 358
33652	34878 34911 34930 359
33653	34879 34912 34961 350
34064	34881 34914 34962 351

Non-point sources | Point sources | Delivery ratio viewer | Sellers/Buyers

Tradeable credits

Load by season

Winter	Spring	Summer	Fall	Annual
4,804	4,975	3,986	9,278	23,042.7

Delivered load (calculated)

Winter	Spring	Summer	Fall	Annual
4,790	4,214	2,615	9,213	20,831.3

Delivery ratio to receptor point (fraction)

Winter	Spring	Summer	Fall	Annual
0.997	0.847	0.656	0.993	0.873

Target delivered load

Winter	Spring	Summer	Fall	Annual
3,593	3,161	1,961	6,910	15,624.0

Required TMSL reduction, %

Winter	Spring	Summer	Fall	Annual
25.0	25.0	25.0	25.0	25.00

Delivered load net of BMP reduction

Winter	Spring	Summer	Fall	Annual
2,395	2,107	1,308	4,607	10,416.0

BMPs effectiveness by season, % reduction

Winter	Spring	Summer	Fall	Annual
50.0	50.0	50.0	50.0	50.00

Tradeable load (i.e. credits)

Winter	Spring	Summer	Fall	Annual
1,198	1,054	653	2,303	5,208.0

Cost information

BMP cost/ac: 20

Acres to which BMP is applied: 10

Average cost per credit (\$/unit P): 0.192

Farm and field info

Calculated loads and delivery ratios

Amount available to trade

Record to seller

# ... and two point loads

Non-point sources | Point sources | Delivery ratio viewer | **Sellers/Buyers**

Save to database | Remove row from table

Seller's tradeable credits and Buyer's allowable loads

Seller's tradeable credits

Receptor ID	Field ID	Delivery ratio	Tradeable Credits, lb	Break even price, \$/lb	Buyer's allowable load, lb	Effective Credit Price, \$/lb
▶ SBR6, Bear Ri...	Richmond La...	0.87325	4,217.00	0.178	4,830	0.155
*						

Buyer's allowable loads

Effective price for trade so both can break even

Buyer's effective credits

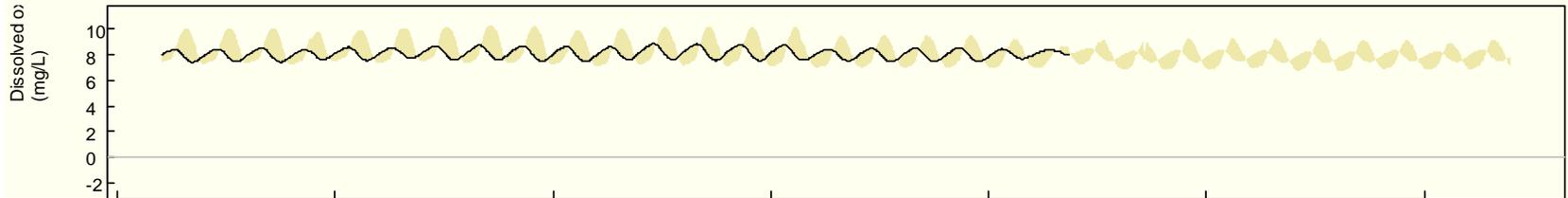
Receptor ID	Field ID	Delivery ratio	Req'd load reduction, lb	Break even price, \$/lb
▶ SBR6, Bear Ri...	Caspers Ice ...	0.873	20.9	8.95
*				

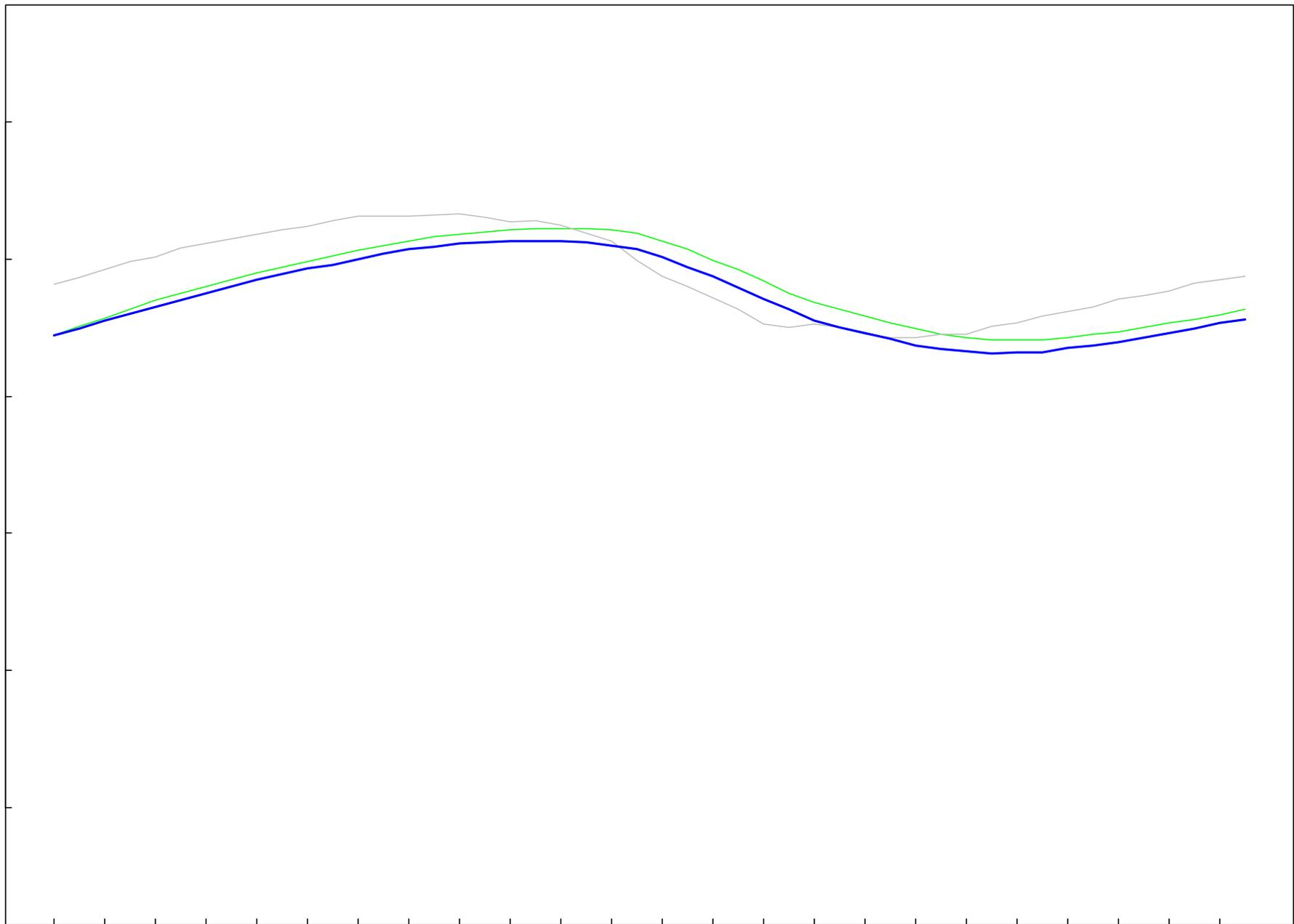
Min price needed for seller to consider trade

Max price needed for buyer to consider trade

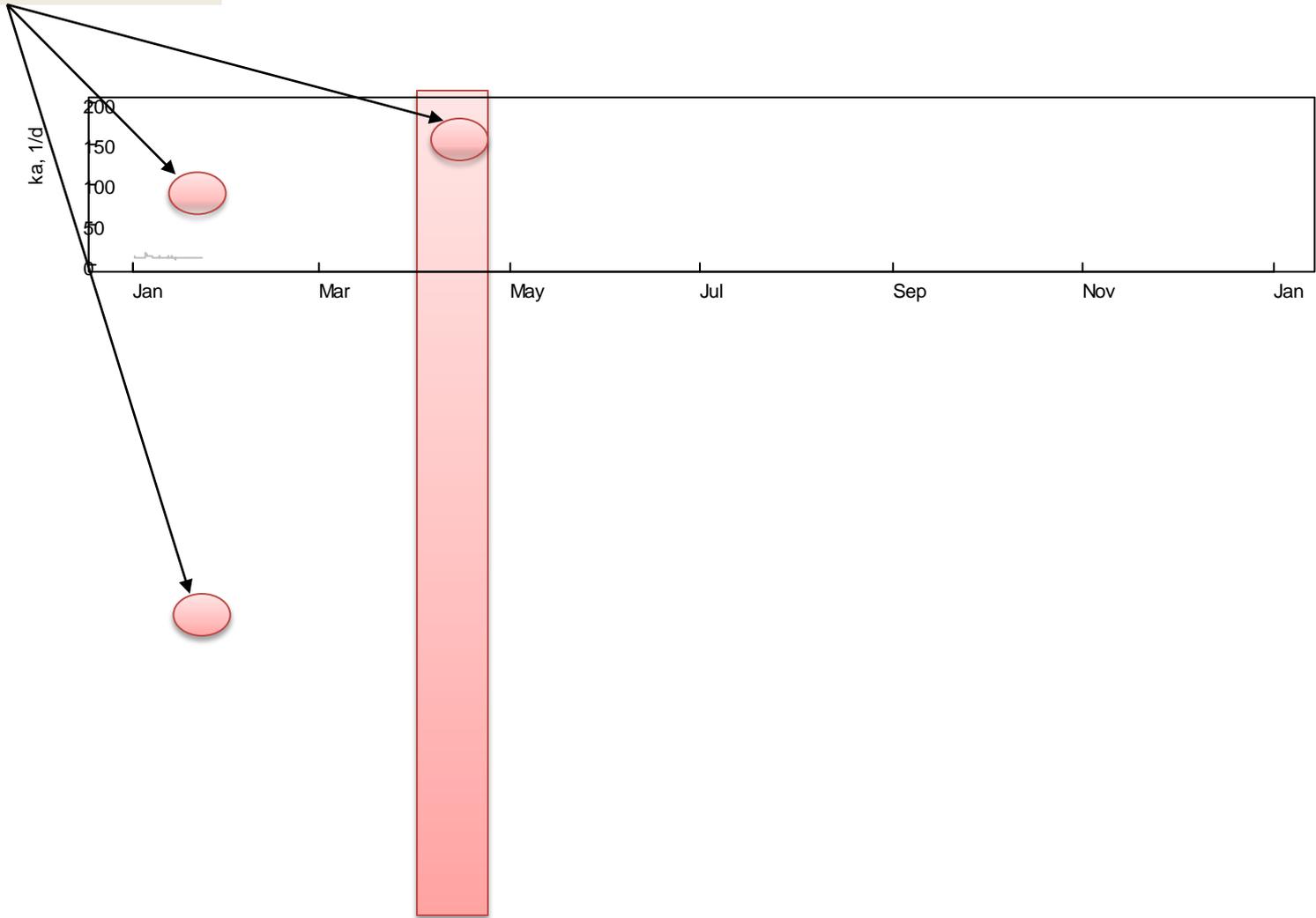


# Example data traces, LBR @ Paradise, July 2008





... a few oddball values



# UWRL Research Projects

- Drinking Water and Wastewater Treatment
- Environmental Quality Management and Remediation
- Surface and Groundwater Quality and Quantity
- Water Conveyance, Distribution, and Control
- Water Resources Planning and Management
- Water Education and Technology Transfer

# Drinking/waste water

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# Environmental Quality/Remediation



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**UtahState**  
UNIVERSITY

Utah Department of Environmental Quality

• SUIT DIOT



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# Flowthrough Columns



Mixing Chamber

Column Feed Pump

Effluent Container

OU5 GW Feed Pump

OU5 Groundwater Feed

TCE Saturated Distilled Water

TCE Feed Pump

Sup

ty

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Aurora

Utah State University Water Res... +

http://bearriverinfo.org/

Google

News feeds Janeen Anderson (4) Attorney Quick Tip: Synergy on ... New Computer R Info Running Projects

Search Up Highlight

Welcome Sign In | Contact SEARCH GO

**B R W I S**

- Watershed Description
- Outreach & Education
- Water Quality Trading
- Watershed Data
- Data Tools
- GIS and Mapping
- Digital Resources
- People, Organizations, and Projects
- Calendar
- News
- Partners/Contact

**Watershed-Friendly Tip**

Request a sprinkler system audit from your local utility, usually offered as a fee service, to determine how to water more efficiently.

**Features**

**Continuous Monitoring at the Bear Lake National Wildlife Refuge**

Access the Utah State University website for continuous monitoring data for Mud Lake at the Bear Lake National Wildlife Refuge.



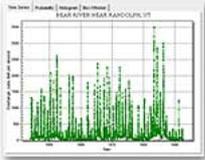
**USU Real-Time Monitoring in the Bear River Basin**

Access the [Utah State University Real-Time Water Quality Monitoring](#) page for current measurements of water quality, streamflow, and weather observations from many different locations in the Bear River Basin.



**Time Series Analyst**

The [Time Series Analyst](#) allows you to visualize and extract all of the time series data stored in the Bear River WIS observations database. These data include streamflow, water quality, climate, groundwater, and other observations from many different data sources.



**Bear River WIS Map Server**

Explore the Bear River Basin using the interactive [Bear River WIS Map Server](#). You can pinpoint water quality stations and dams, display land use and precipitation coverages, or even link to a powerful analyst tool with access to years of water quality data.



**News**

- 6/6/2009 Bear River Celebration!!!!
- 1/12/2009 Public Notice of Draft TMDL Water Quality Study
- 10/8/2008 Erosion control implemented by local rancher

**Calendar**

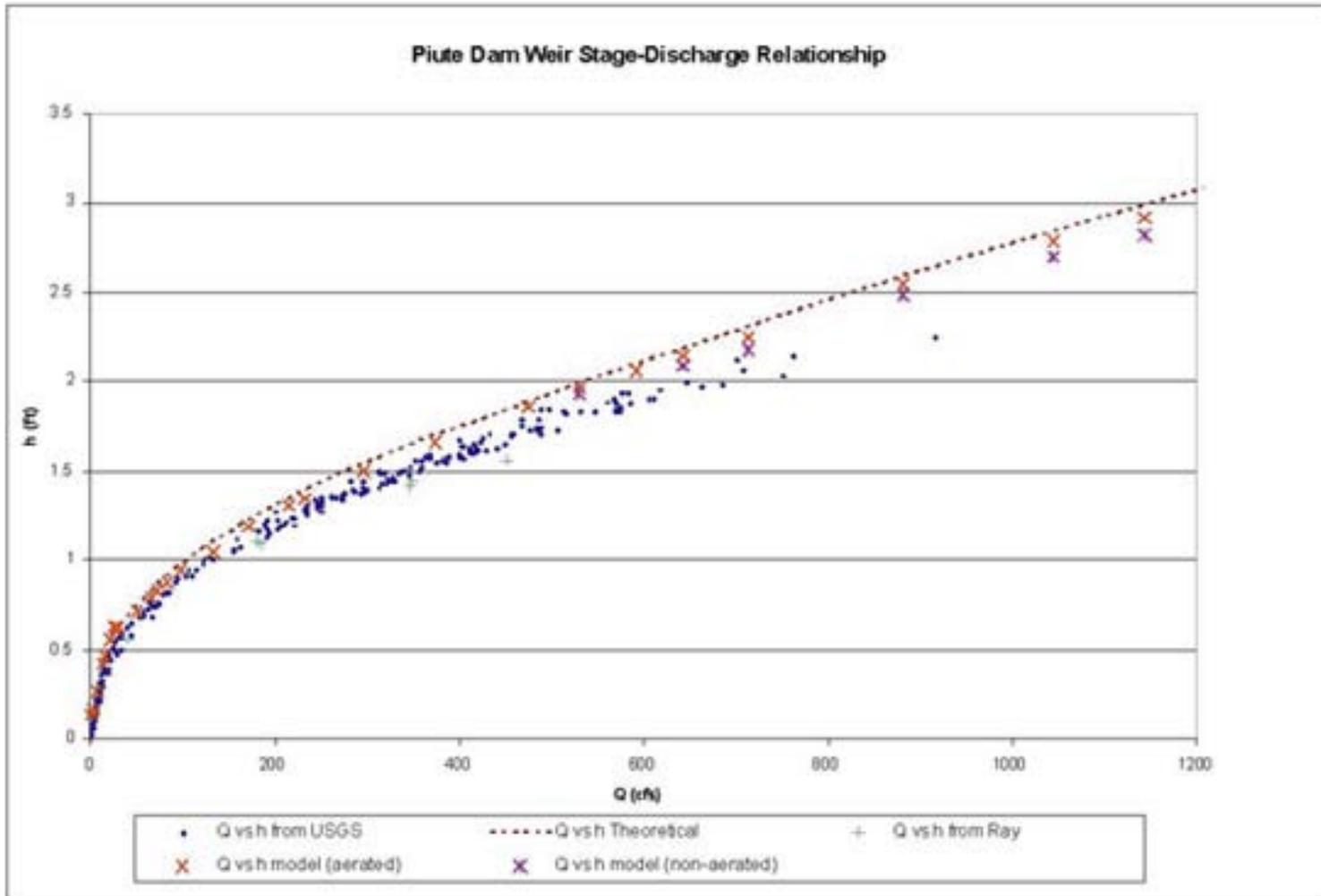
- 8/30/2011 Utah Water Quality Conference
- 11/14/2011 Water Quality Commission Meeting

Contact | Disclaimer

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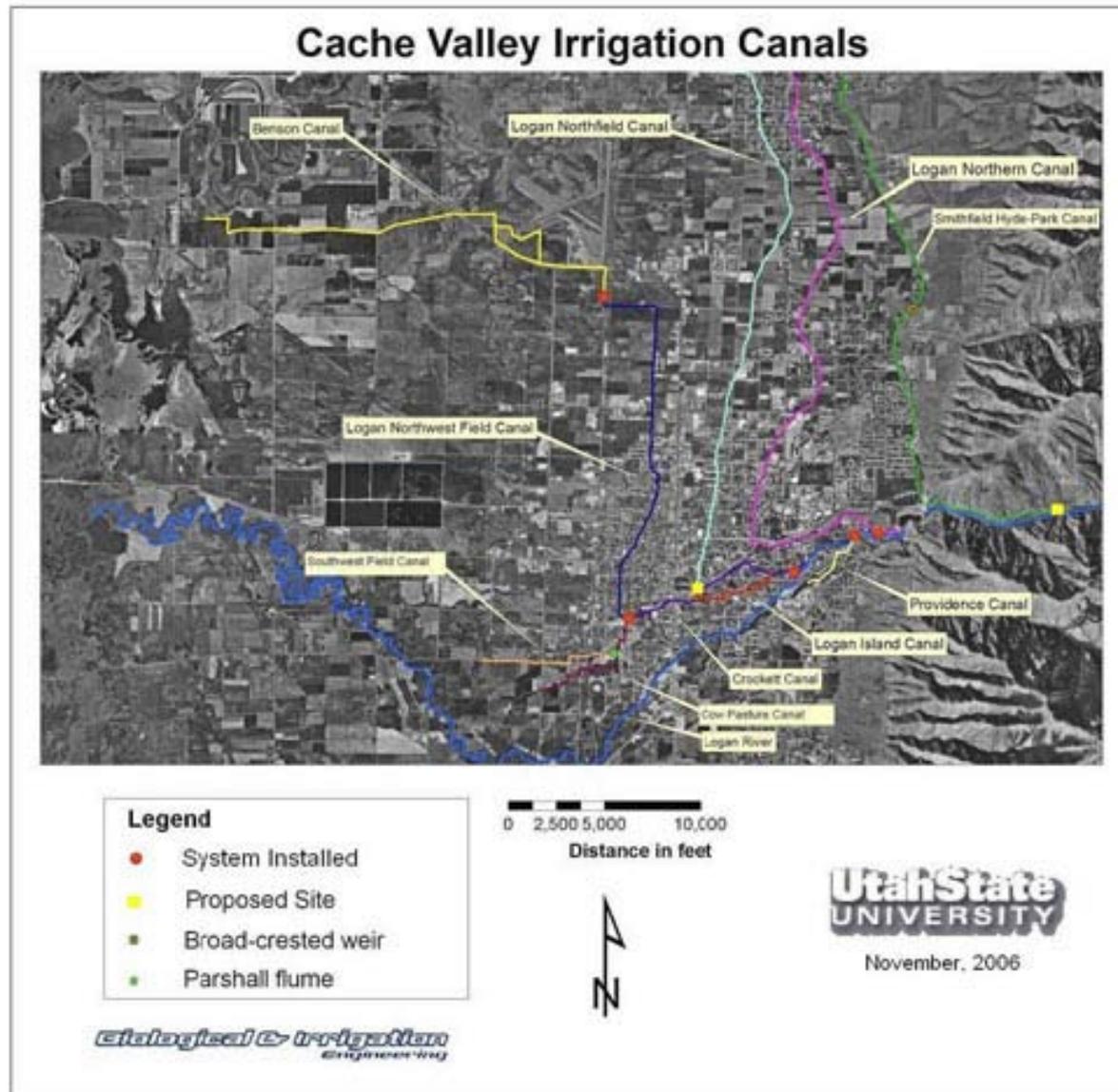
# Water Conveyance, Distribution, and Control



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# Water Resources Planning and

- Box
- Green
- Distr
- Impr
- Map
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# Water Education and Technology Transfer

