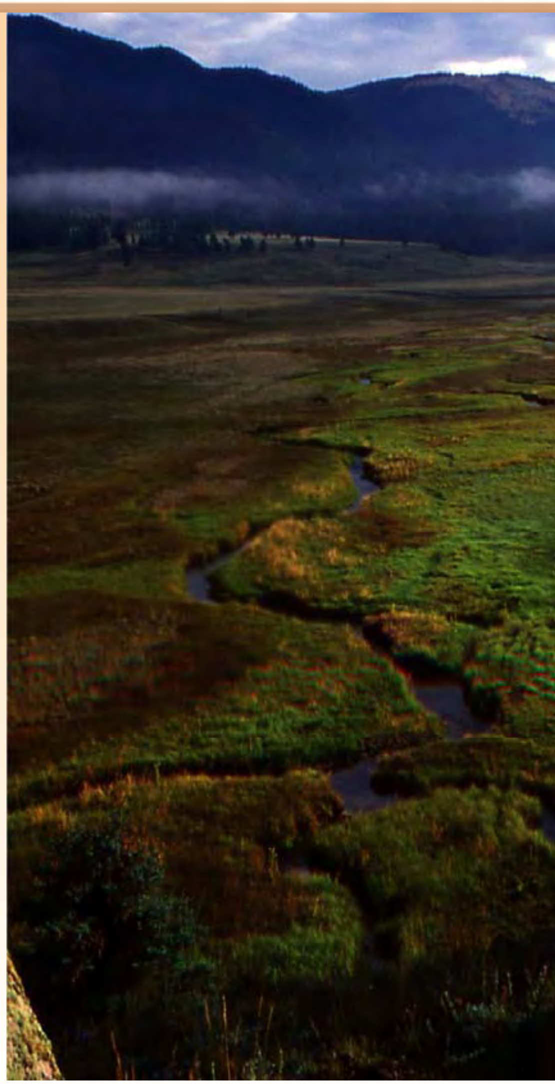


Tackling the Water Quality Challenge in the New Millenium: Using New Technology to Track Geologic Salinity Sources to Surface and Ground Water

Laura Crossey, UNM

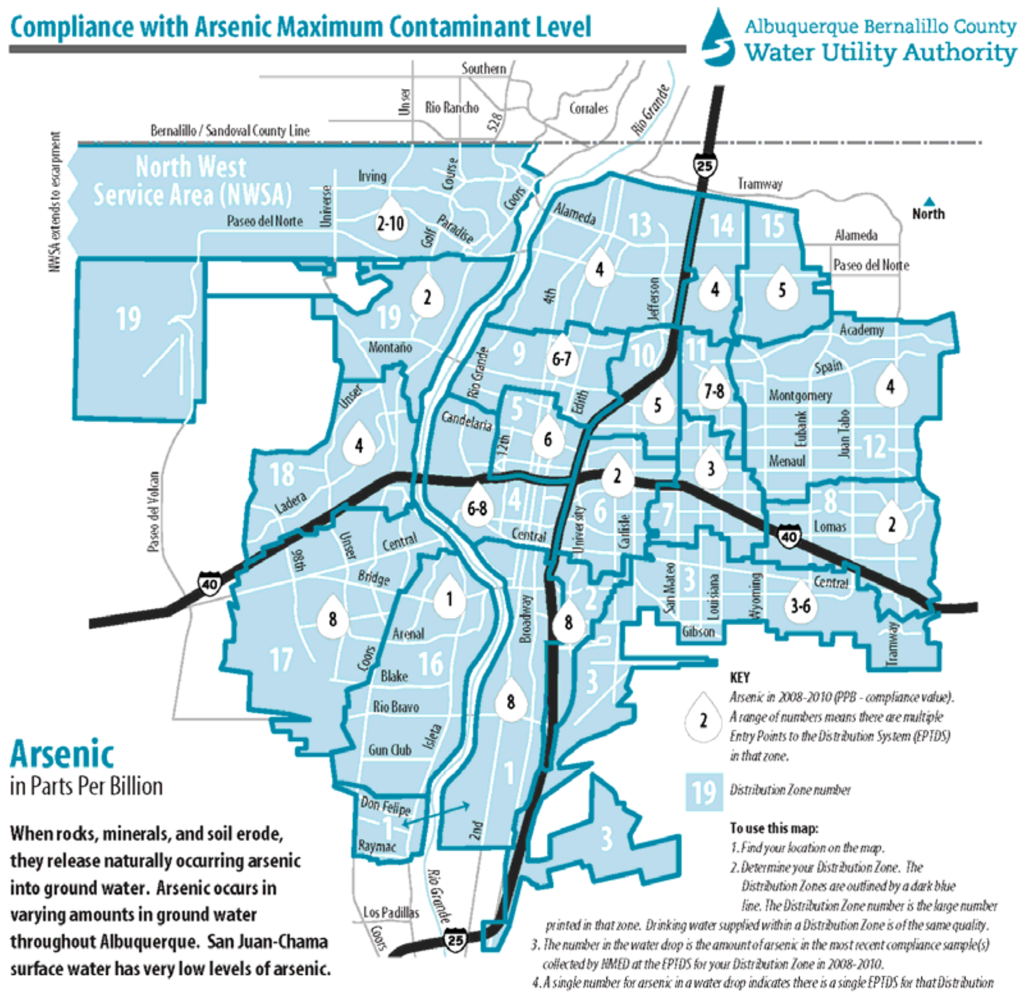
with contributions from:

Lauren Sherson[1], Andy Jochems[1], Jevon Harding[2], Emily Woolsley[2], Karl Karlstrom[1], John Wilson[2] and Cliff Dahm[1]

[1]Dept. of Earth & Planetary Sciences, University of New Mexico, ABQ NM

[2]Dept. of Earth & Environmental Sciences, New Mexcio Tech., Socorro, NM

Arsenic- a regional water quality issue



Information about your drinking water

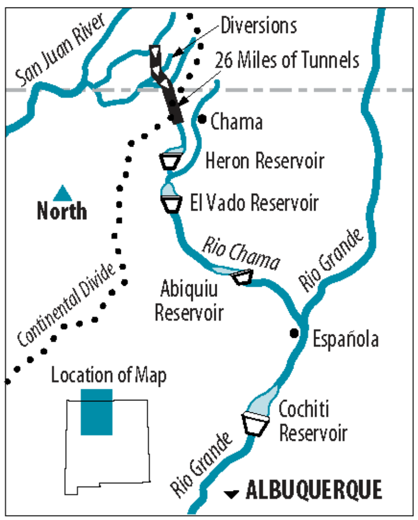
2010 Water Quality Report

Drinking Water Sources

Albuquerque Bernalillo County
Water Utility Authority

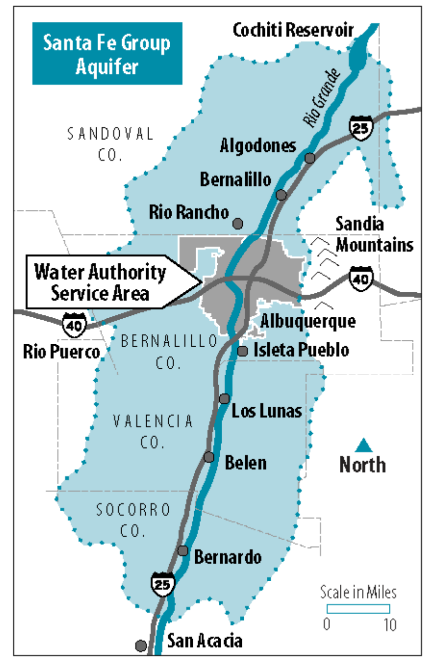
The Albuquerque area relies on two sources for its drinking water: ground water from the Santa Fe Group Aquifer and San Juan-Chama surface water diverted from the Rio Grande via the San Juan-Chama Drinking Water Project.

In 2010: 14.2 billion gallons from SJ-C surface water



The San Juan-Chama Drinking Water Project: Water from the Colorado River Basin makes its way to Albuquerque via a series of diversions, reservoirs, and rivers.

In 2010: 19.6 billion gallons (192 wells) of ground water



The Santa Fe Group Aquifer stretches from Cochiti Reservoir on the north to San Acacia on the south and from the Sandia Mountains on the east to (and beyond) the Rio Puerco on the west.

Saline Waters: no dilution = pollution

Coupled hydrologic and hydrochemical monitoring and modeling needed to adequately address predictions of climate change on water quality, and develop management strategies that factor in salinization.

1 'campaign'

2 autonomous sensors

3 Temp as a proxy

Three sets of data are presented to demonstrate how degradation of water quality can be integrated with climate change scenarios.

- Traditional ‘campaign’ water sampling over the 2006-2011 water years along a 40 km reach of the Jemez river show that in times of low flow, the salinity, sulfate concentration and arsenic concentration all exceed designated use limits.

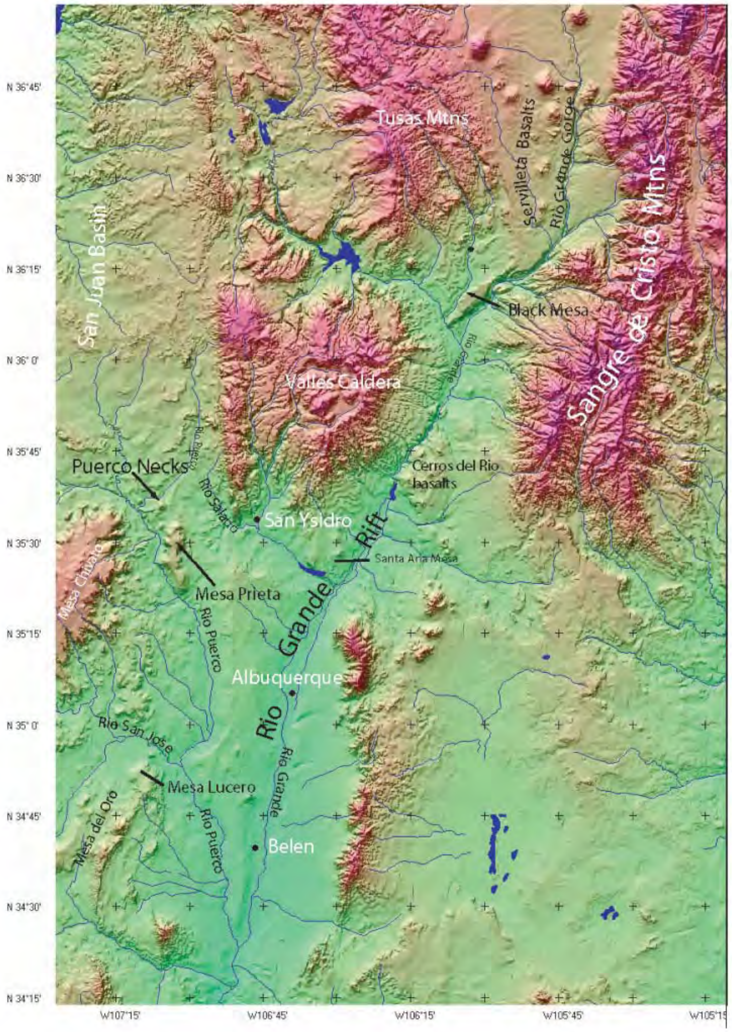
- The deployment of continuous sensors for temperature, conductance (salinity), pH, and dissolved oxygen in the Jemez river in 2010-2011 provide information on coupling of discharge, temperature, dissolved oxygen, pH and specific conductance at highly resolved timescales- with implications for aquatic systems.

- Preliminary results from a 2-km Distributed Temperature Sensor (DTS) deployment in the Rio Salado across the Nacimiento fault indicate a diffuse leakage from the fault system into the shallow alluvial aquifer, as well as recharging to regional groundwater systems.

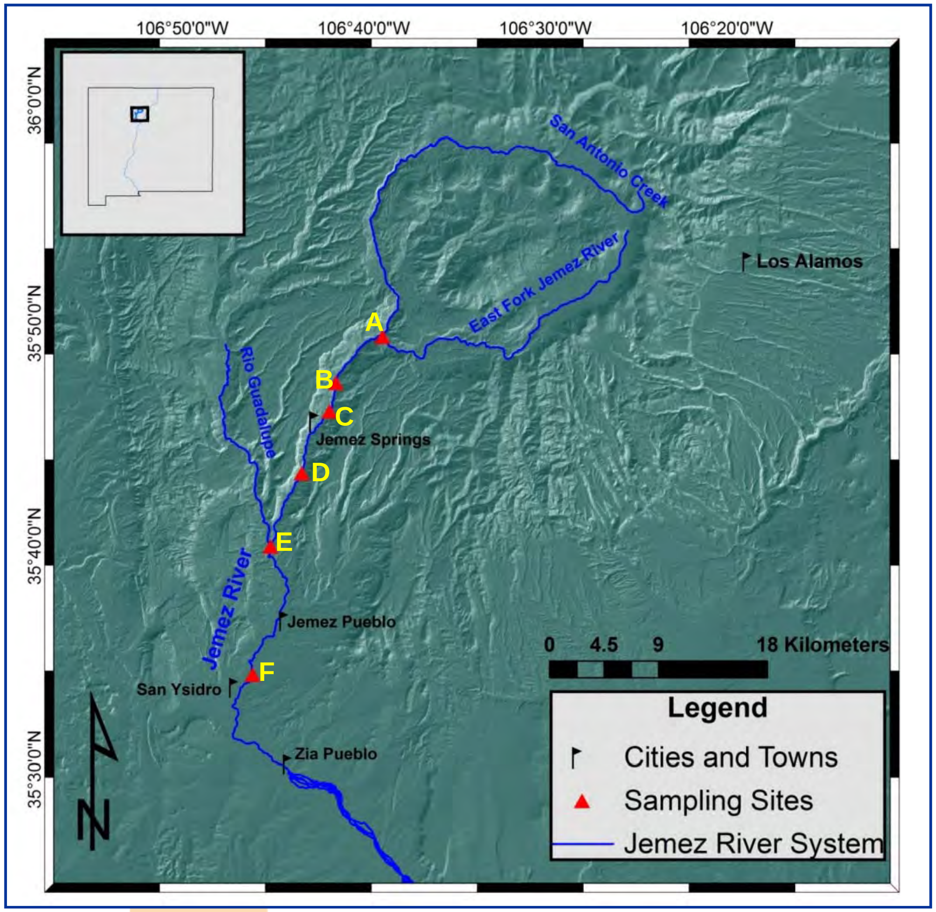
Jemez River & Rio Salado systems

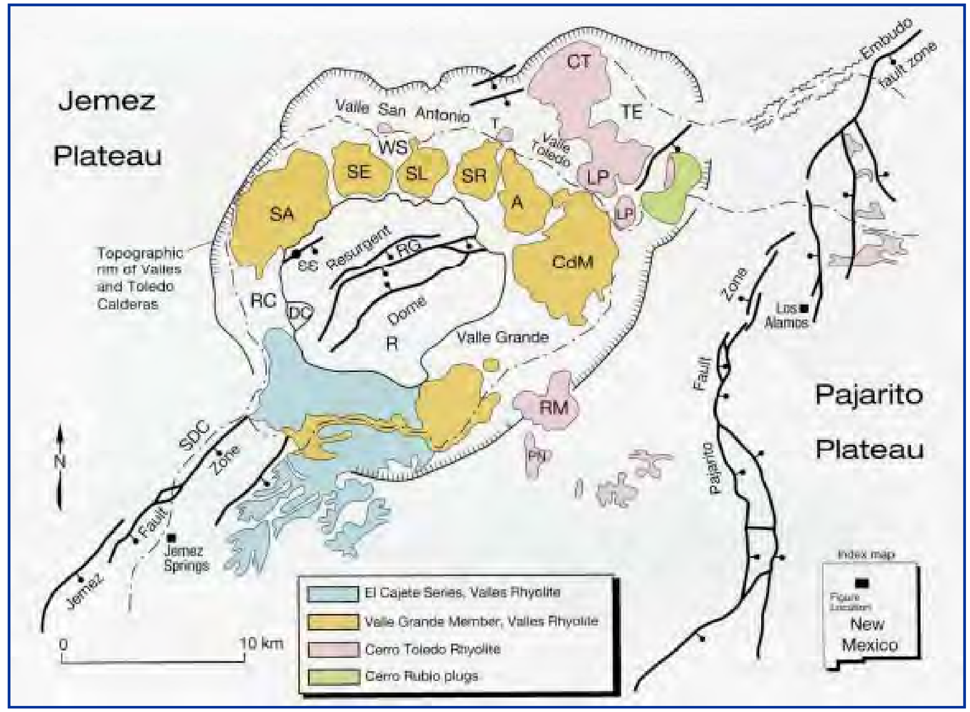
In arid regions, saline surface water and brackish groundwater pose particular problems for water management. The Jemez and Rio Salado in northern New Mexico are classic examples of arid-region salinization due to geologic inputs.

These hydrologic systems are important to local stakeholders (including a mix of private, tribal and public lands), as direct contributors to the surface waters of the Rio Grande, and as recharge components to Sandoval county and the northwestern part of the Albuquerque basin



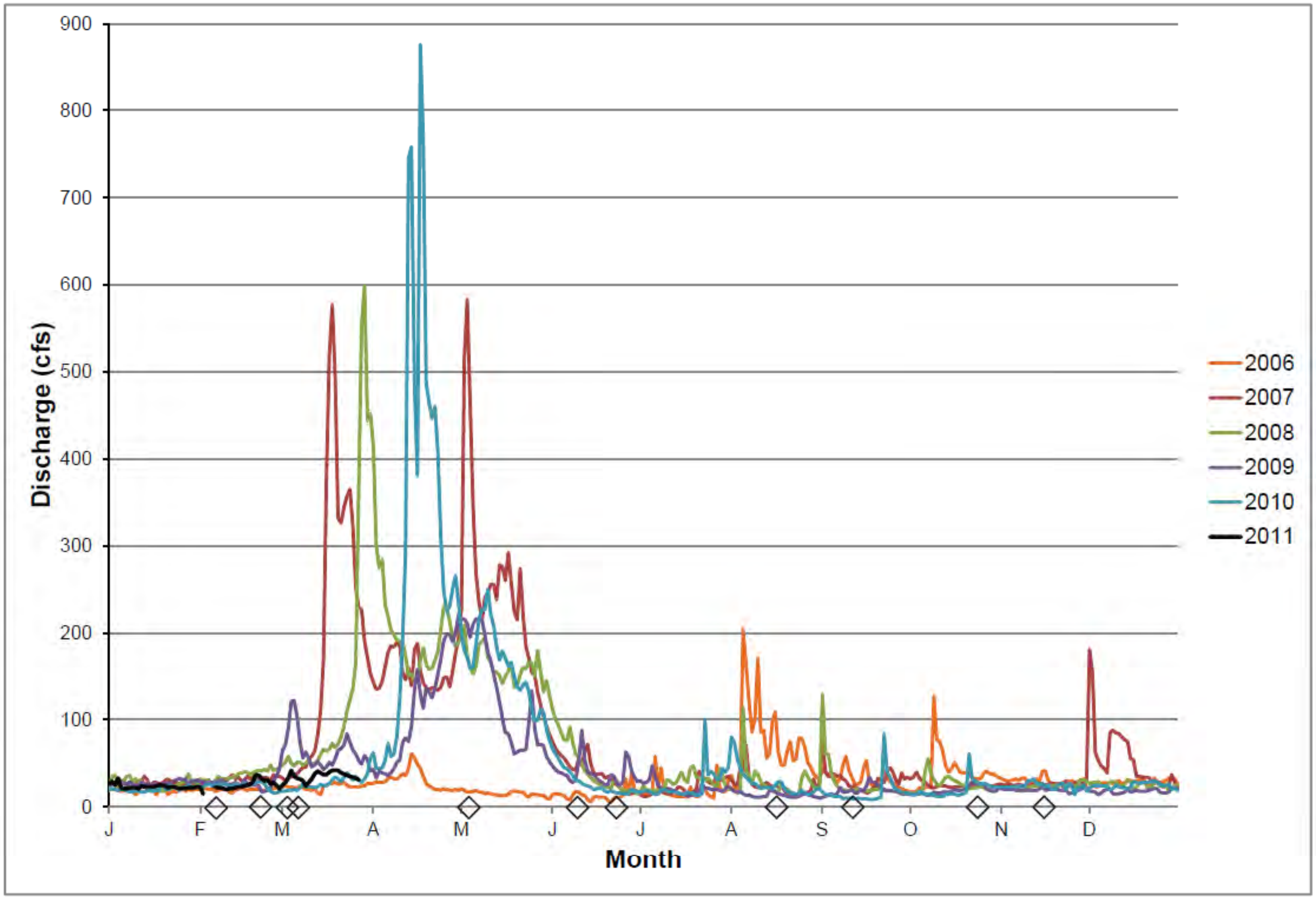
Jemez River - Geologic Setting



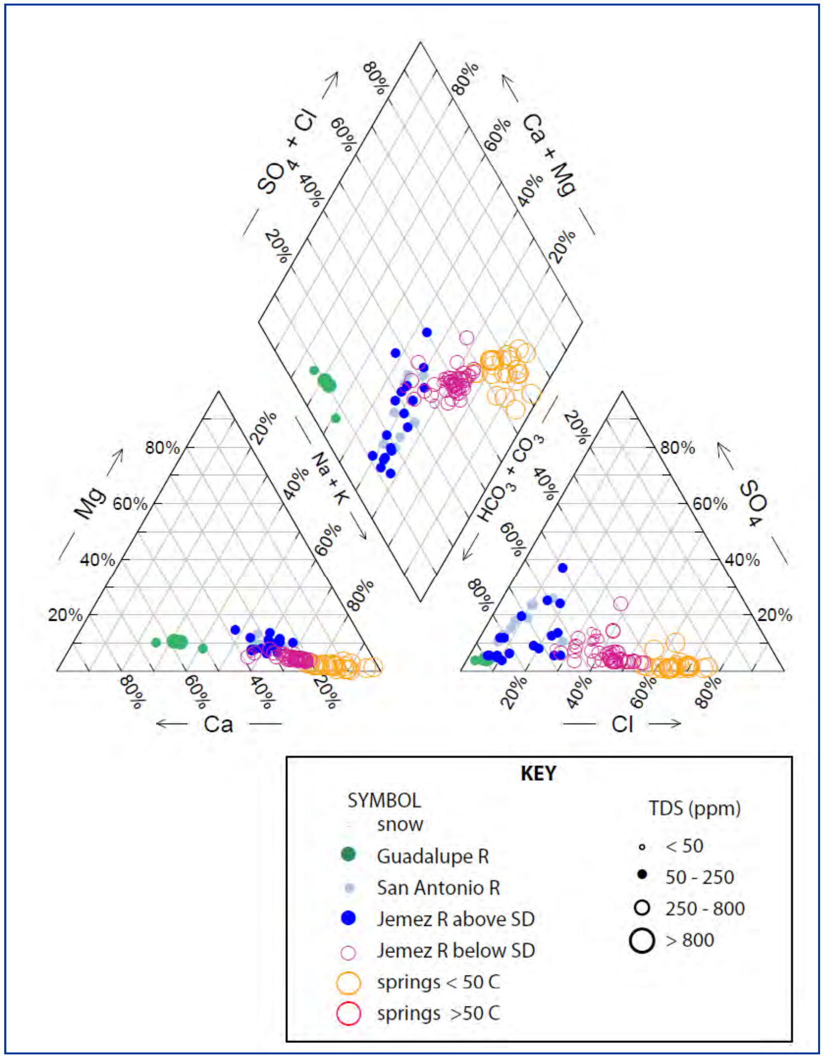


Deep fluid inputs along faults degrade WQ

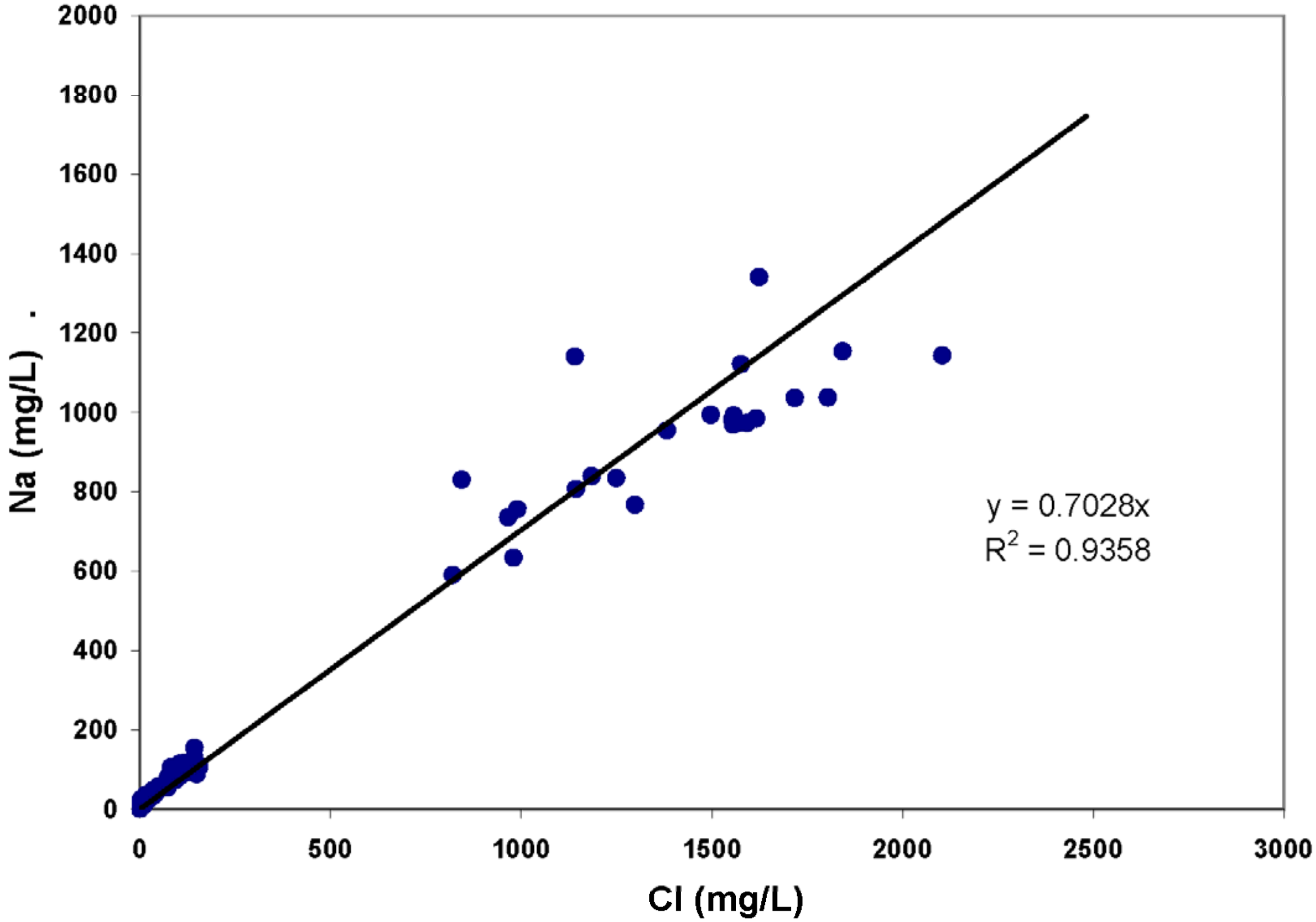
Jemez River - Hydrochemistry is linked to Discharge



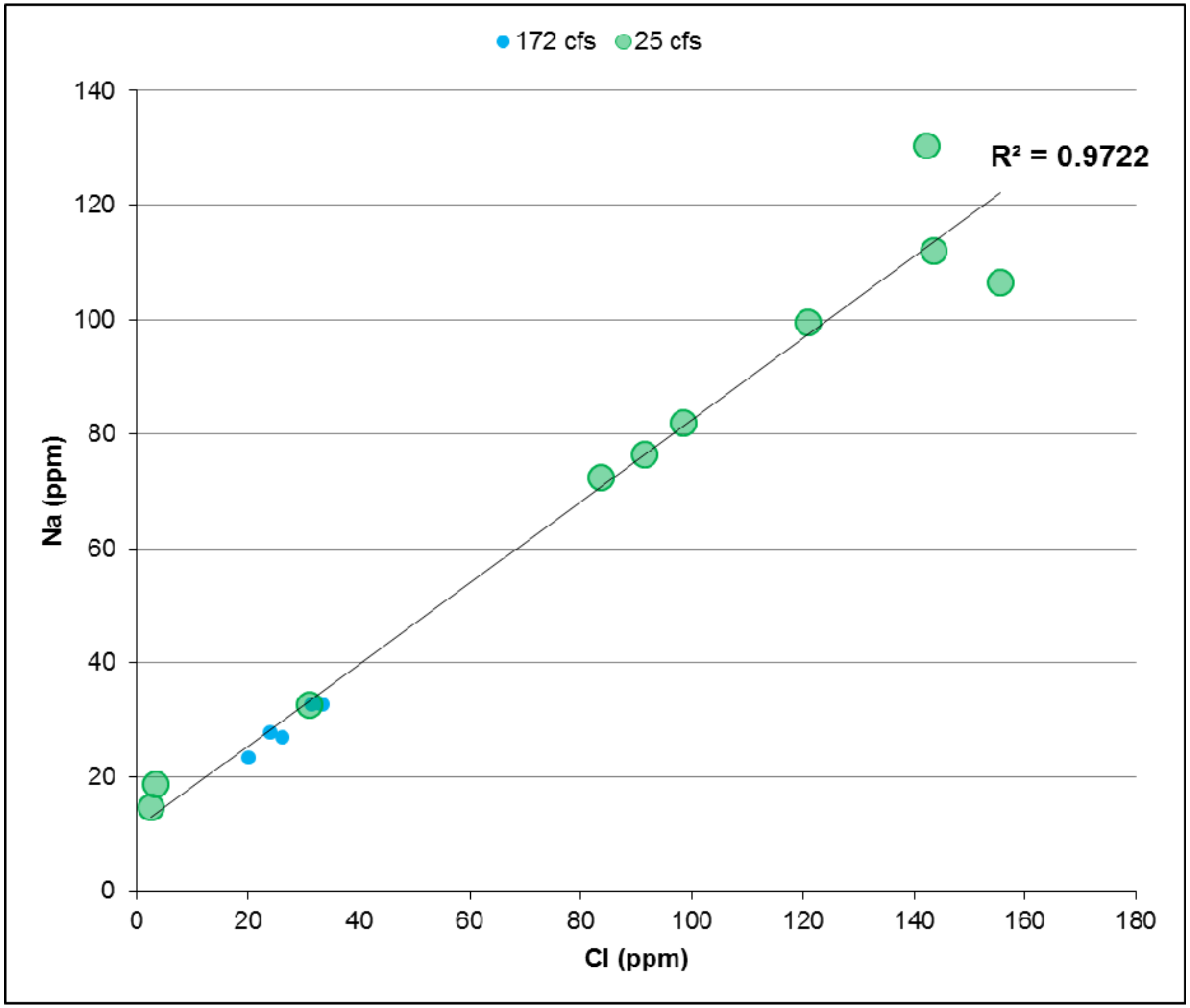
Jemez River - Hydrochemistry



Simple Mixing Model for salinity

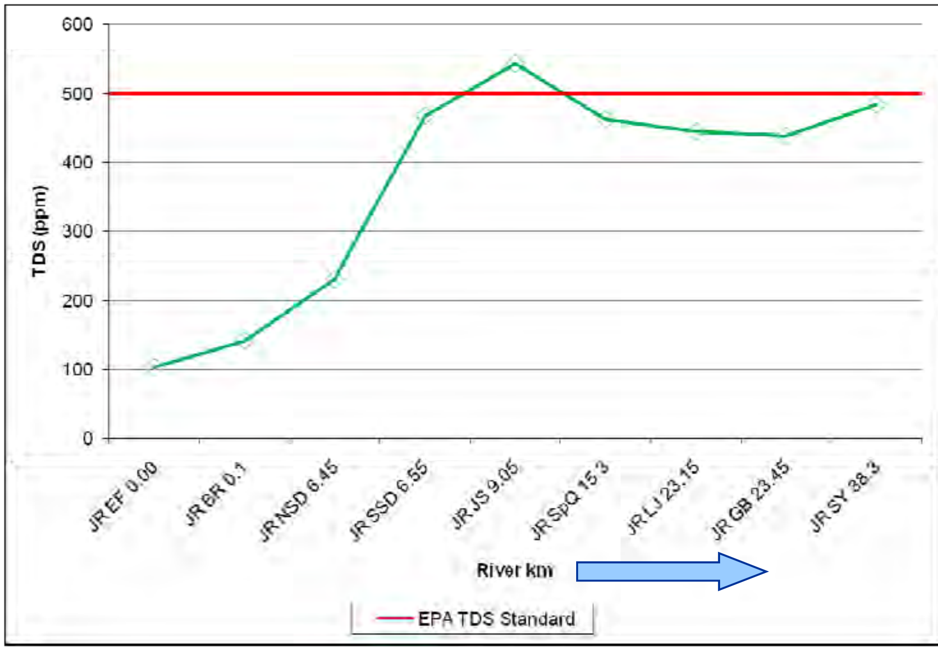


Same trend: Discharge, downstream gains in salinity

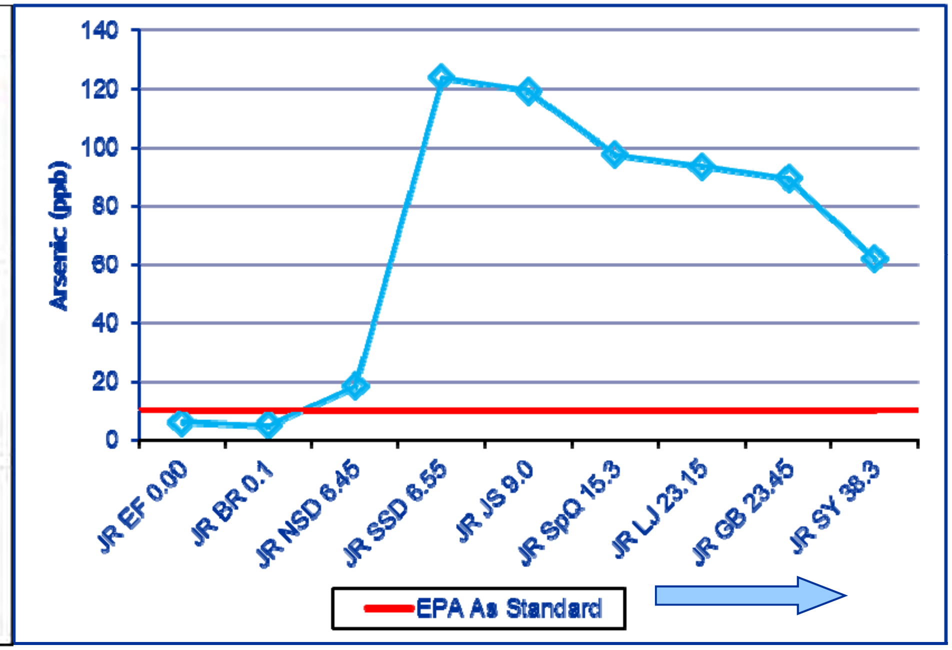


Jemez River - Hydrochemistry

salinity

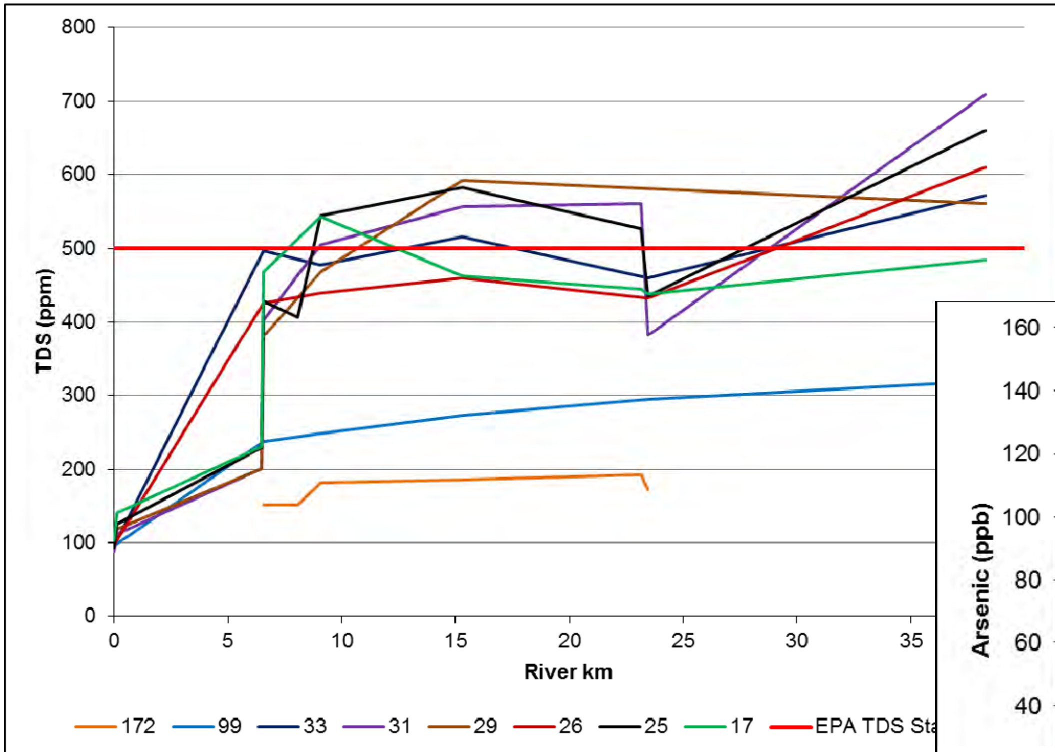


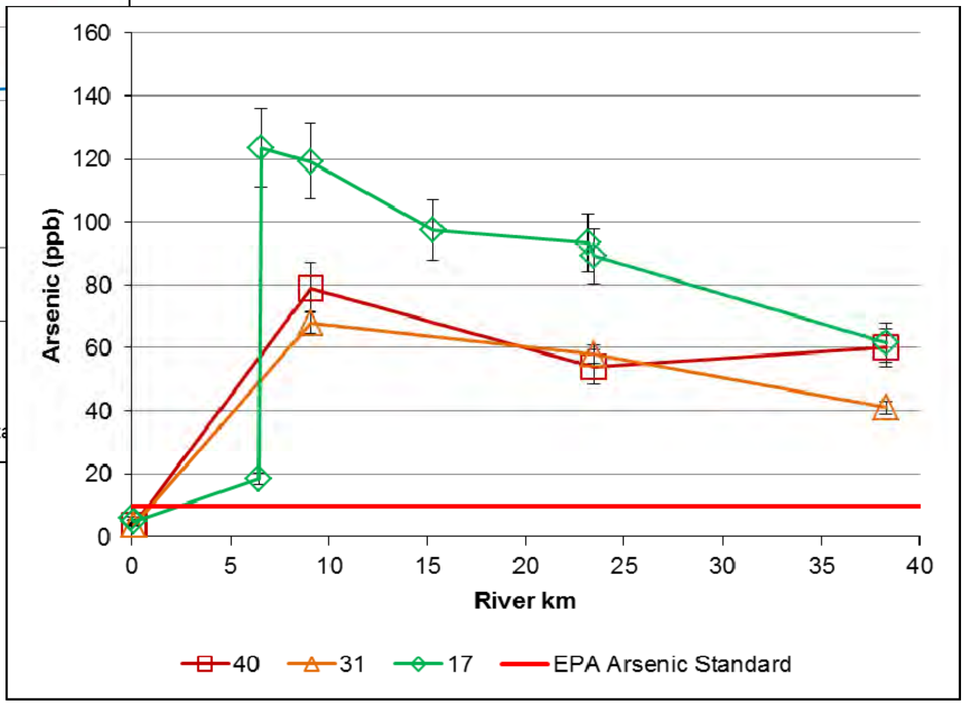
arsenic



At 17 cfs: a river PAST risk…

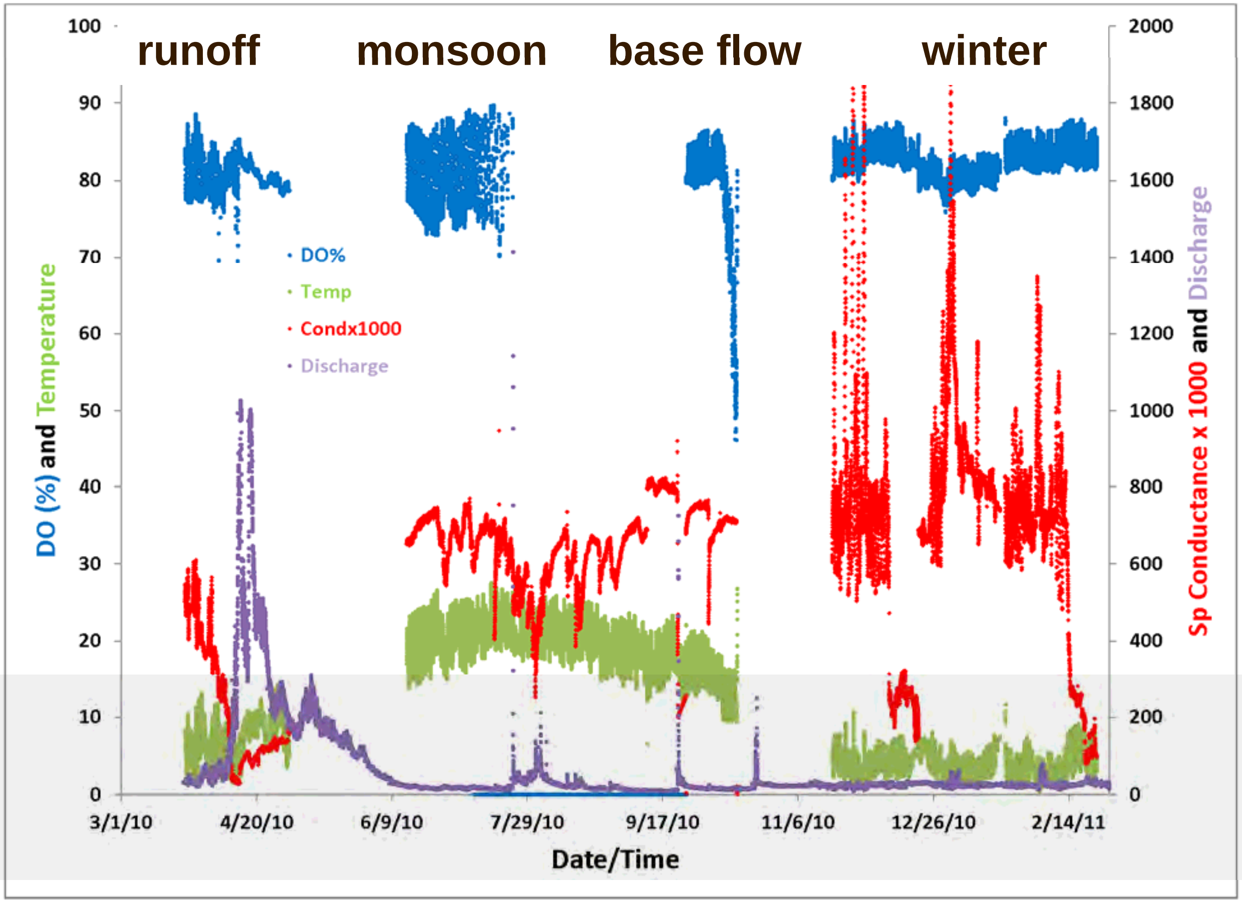
Downstream trends as f(discharge): salinity/arsenic



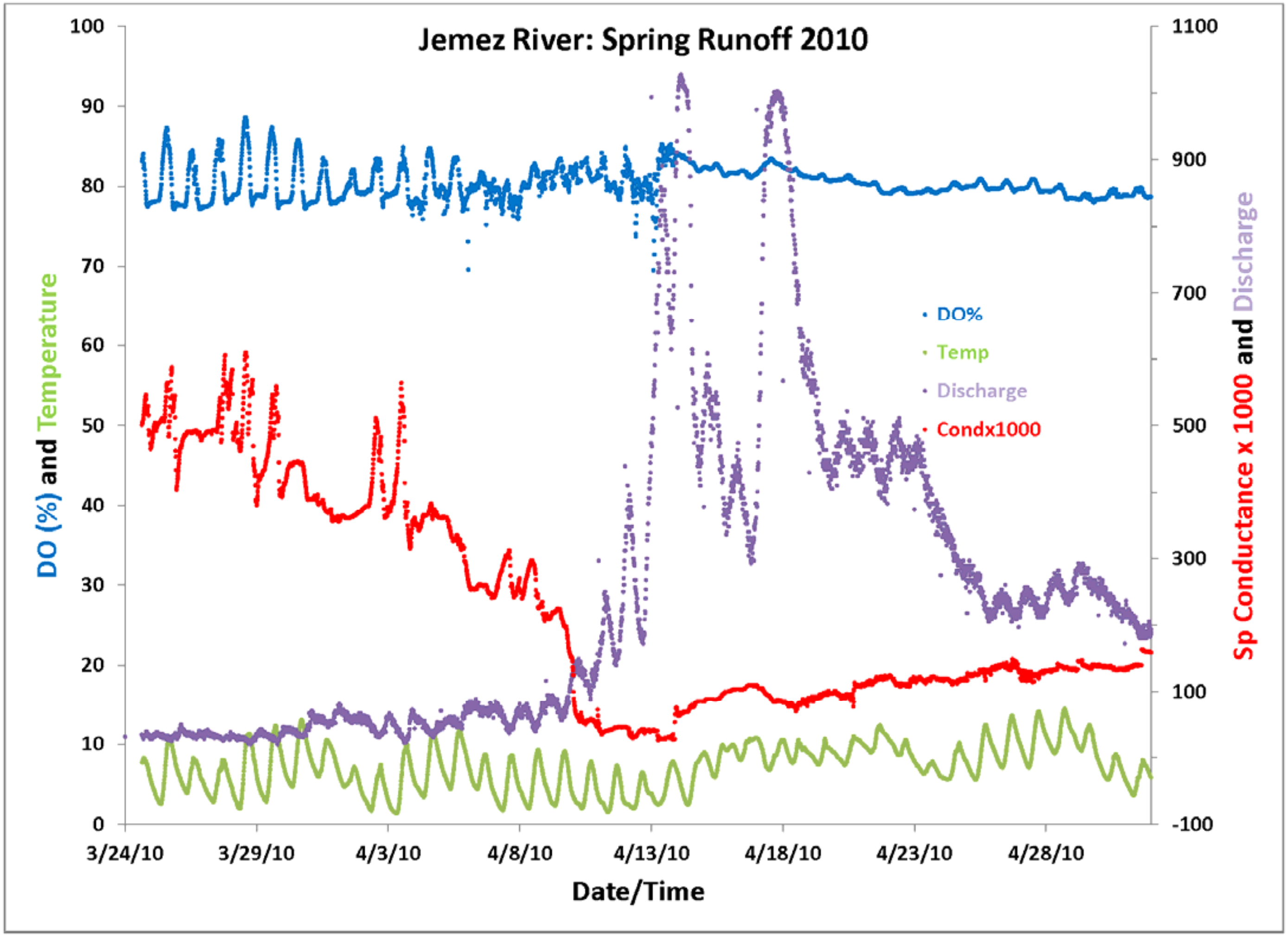


Jemez River – a discharge-sensitive system

Autonomous sensors: T, pH DO, cond…

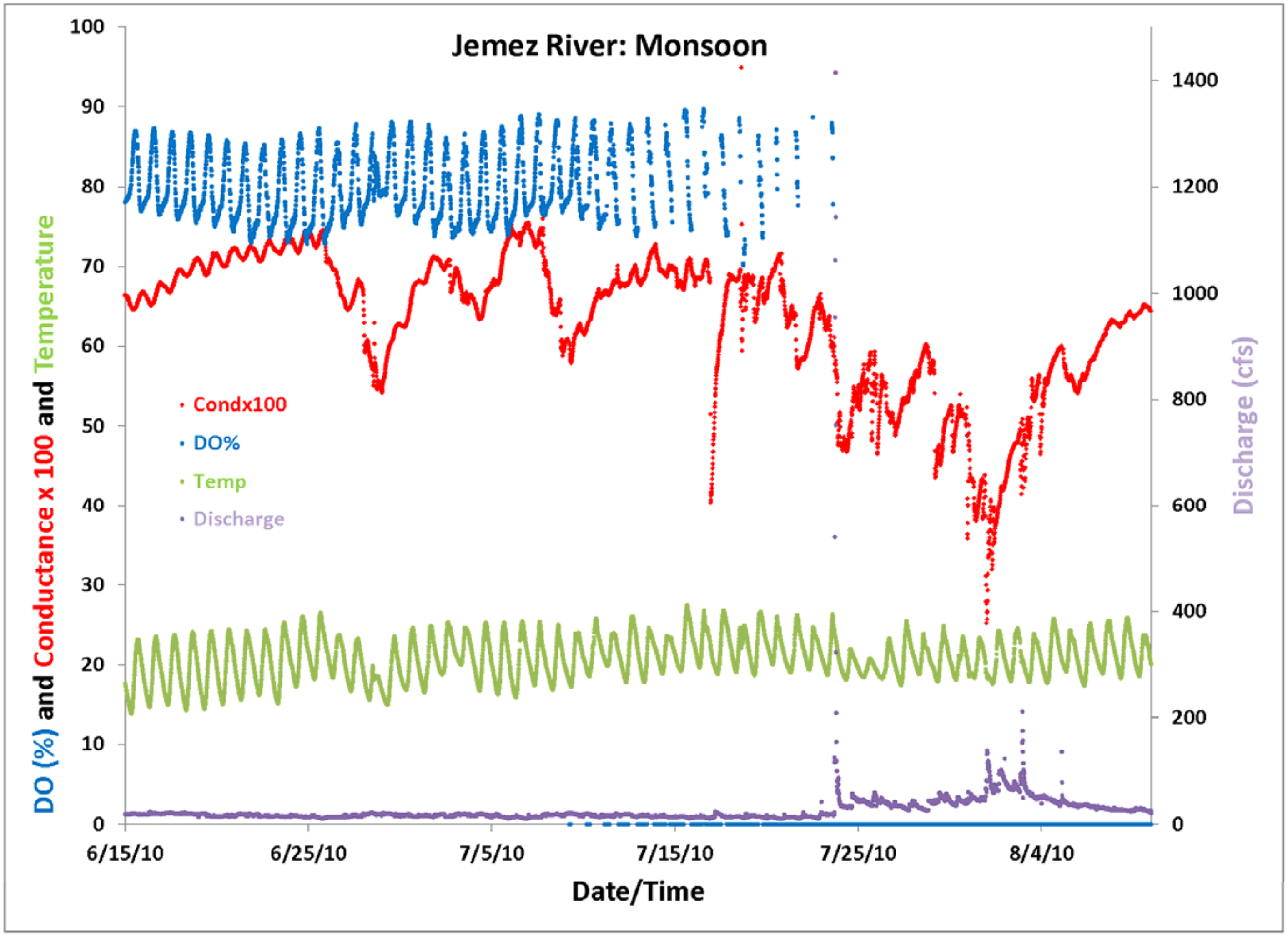


Runoff



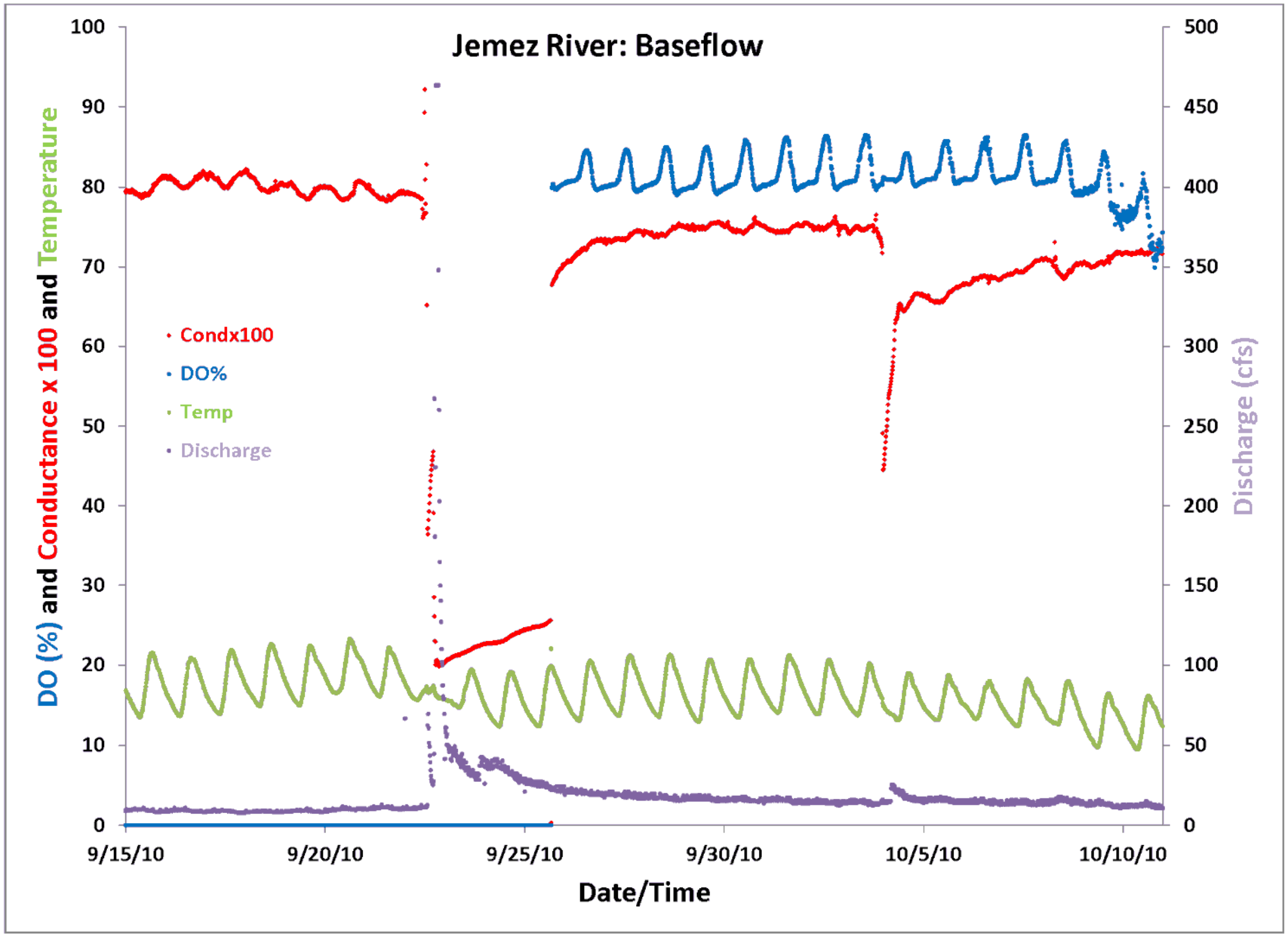
Jemez River: Spring Runoff 2010
DO (%) and Temperature
Sp Conductance x 1000 and Discharge
Date/Time
DO%
Temp
Discharge
Condx1000
100
90
80
70
60
50
40
30
20
10
0
1100
900
700
500
300
100
-100
3/24/10
3/29/10
4/3/10
4/8/10
4/13/10
4/18/10
4/23/10
4/28/10

Monsoon



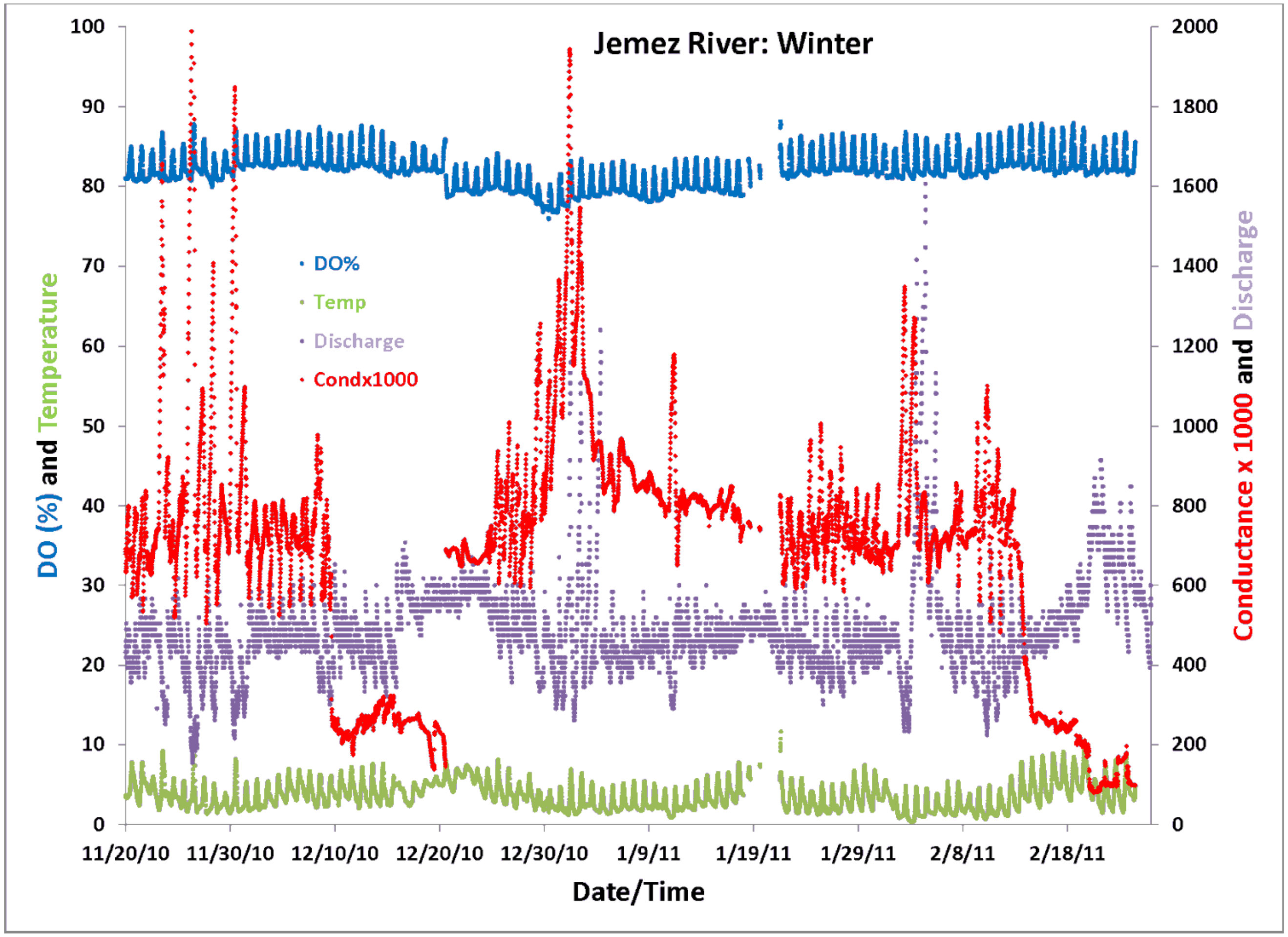
Jemez River: Monsoon
DO (%) and Conductance x 100 and Temperature
Discharge (cfs)
Date/Time
Condx100
DO%
Temp
Discharge
100
90
80
70
60
50
40
30
20
10
0
1400
1200
1000
800
600
400
200
0
6/15/10
6/25/10
7/5/10
7/15/10
7/25/10
8/4/10

Baseflow



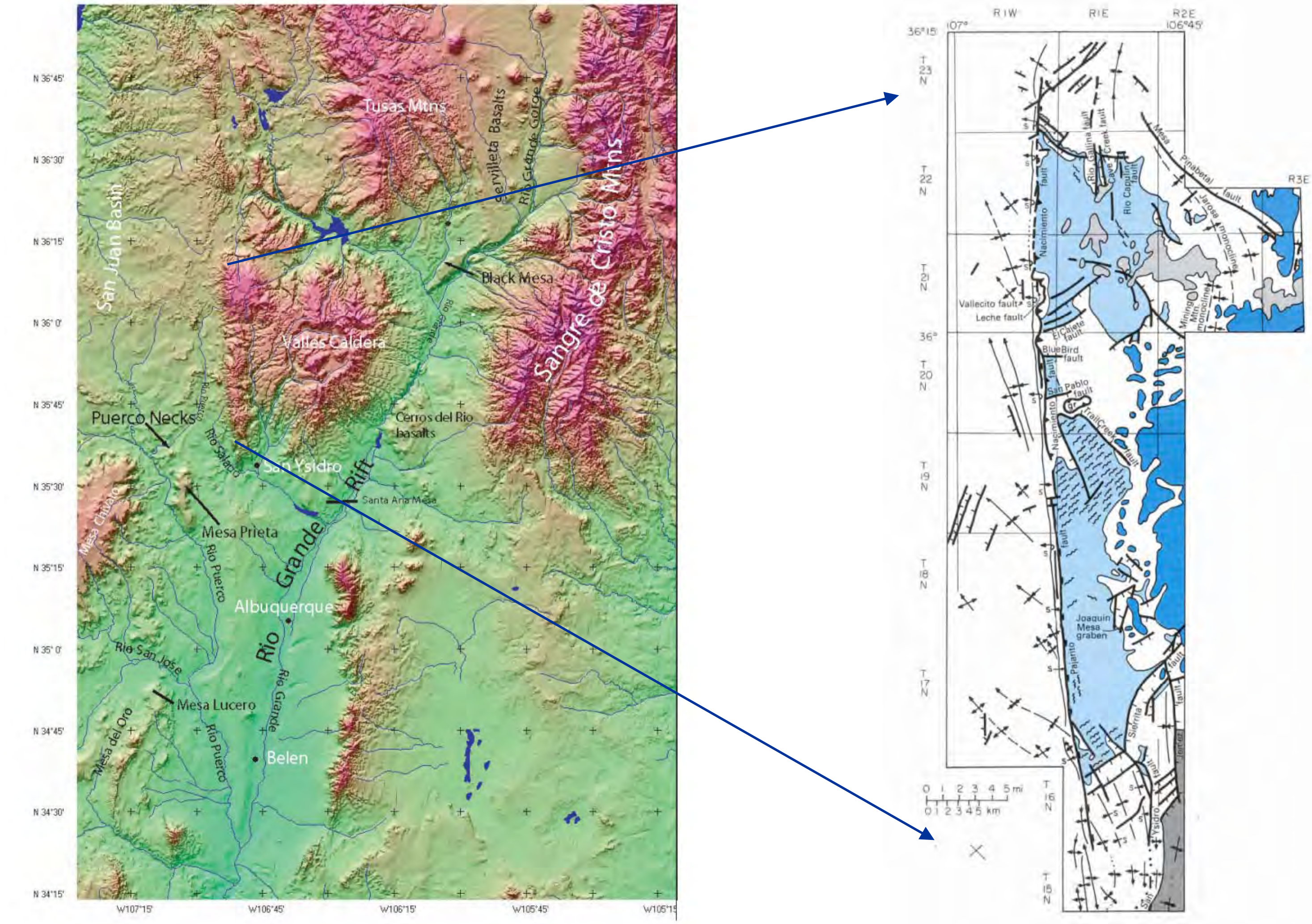
Jemez River: Baseflow
DO (%) and Conductance x 100 and Temperature
Discharge (cfs)
Date/Time
Condx100
DO%
Temp
Discharge
100
90
80
70
60
50
40
30
20
10
0
500
450
400
350
300
250
200
150
100
50
0
9/15/10
9/20/10
9/25/10
9/30/10
10/5/10
10/10/10

Winter



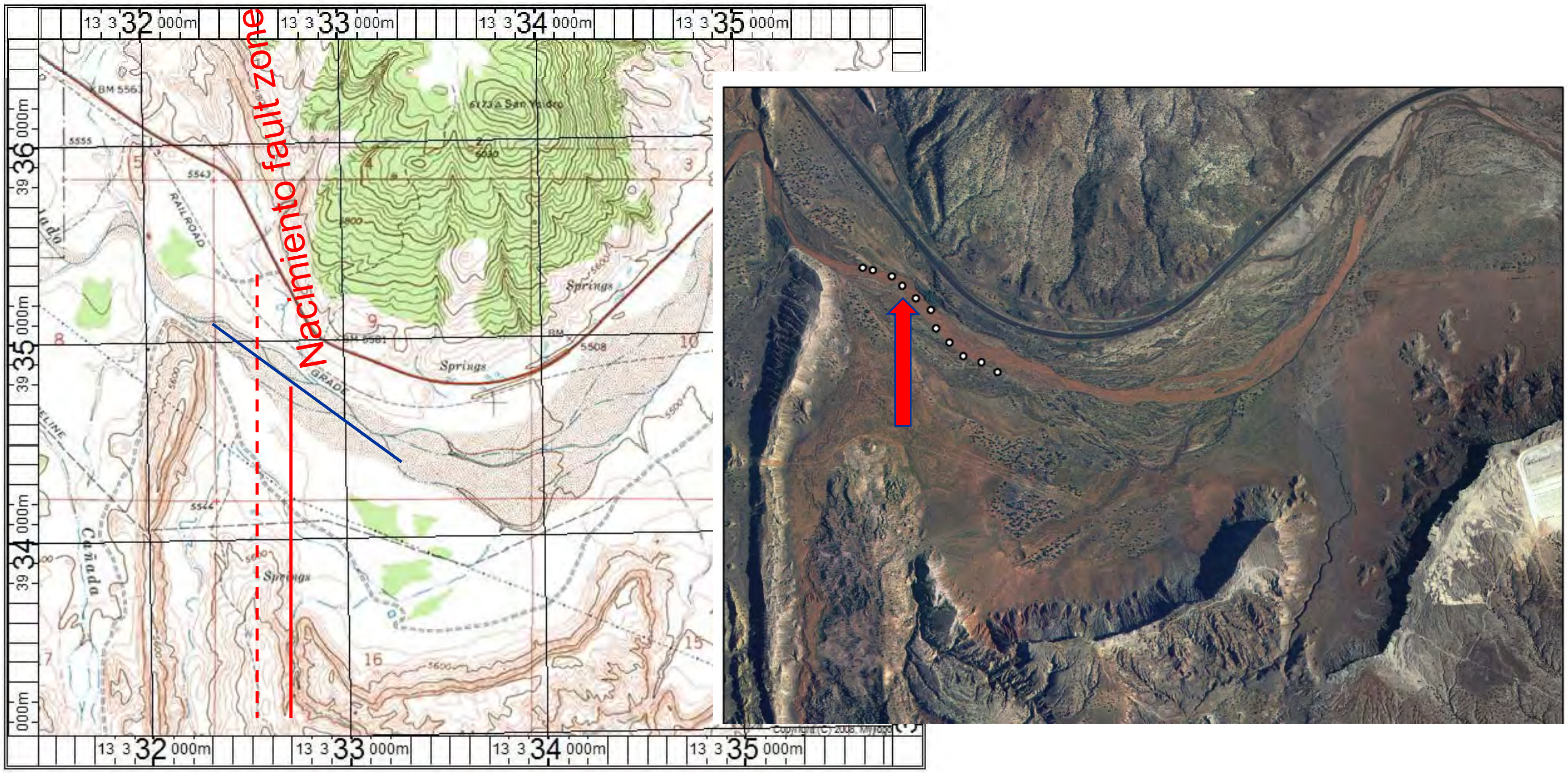
Jemez River: Winter
DO%
Temp
Discharge
Condx1000
DO (%) and Temperature
Conductance x 1000 and Discharge
Date/Time
100
90
80
70
60
50
40
30
20
10
0
2000
1800
1600
1400
1200
1000
800
600
400
200
0
11/20/10
11/30/10
12/10/10
12/20/10
12/30/10
1/9/11
1/19/11
1/29/11
2/8/11
2/18/11

Fluid upwelling on the Nacimiento fault

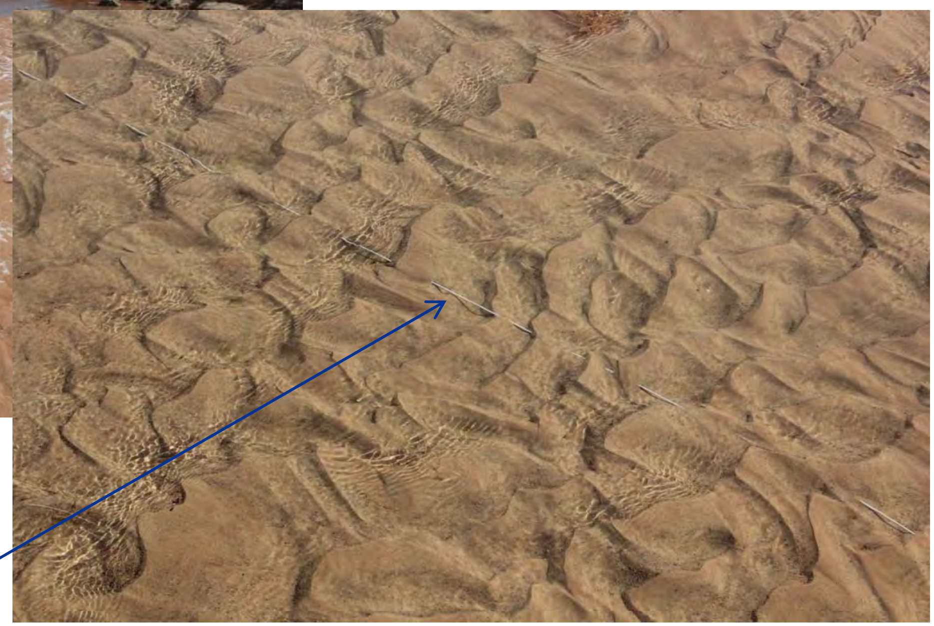


Fluid upwelling on the Nacimiento fault

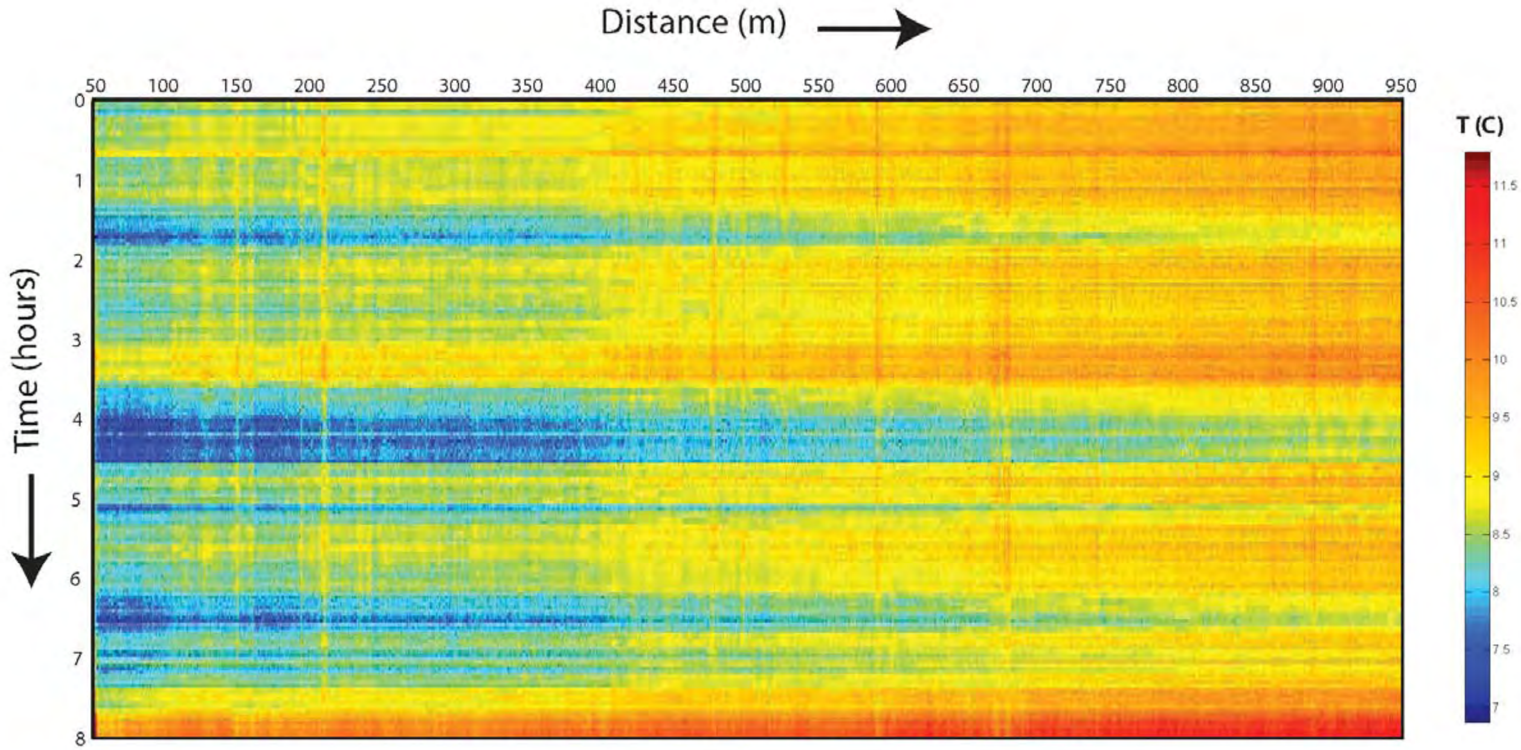
3) Rio Salado - Fault-sourced fluids…DTS



3) Rio Salado - Fault-sourced fluids...DTS



Rio Salado -DTS results



predicted position of fault

Influx along fault

Bottom line: based on T and assuming simple end members of 10 & 25 C, 3 deg. Shift corresponds to a 20% influx of GW into the alluvial aquifer along the fault.

Summary: monitoring technology for WQ

- A necessary complement to existing ‘campaign’ style sampling
- Imperative to establish baselines for key hydrologic systems (rivers, springs and groundwaters)
- Provides quantitative data for modeling water quality issues such as salinity, DO ‘sags’, etc.
- Can readily be coupled with climate-based discharge models
- Offers an exciting mix of field and analytical skill development for student training
- An engaging outreach tool that brings the water chemistry ‘to life’