Monitoring and Assessing Water Quality Issues For the Martis Creek Lake Dam Project

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Sacramento District
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Overview

- General Project Background
- Water Quality (WQ) Regulations & Guidance
- Historical WQ Monitoring Efforts
- Historical Operation and Dam Modification WQ Concerns and Needs
- Supplemental Baseline Monitoring
- Initial Supplemental Results

Overview

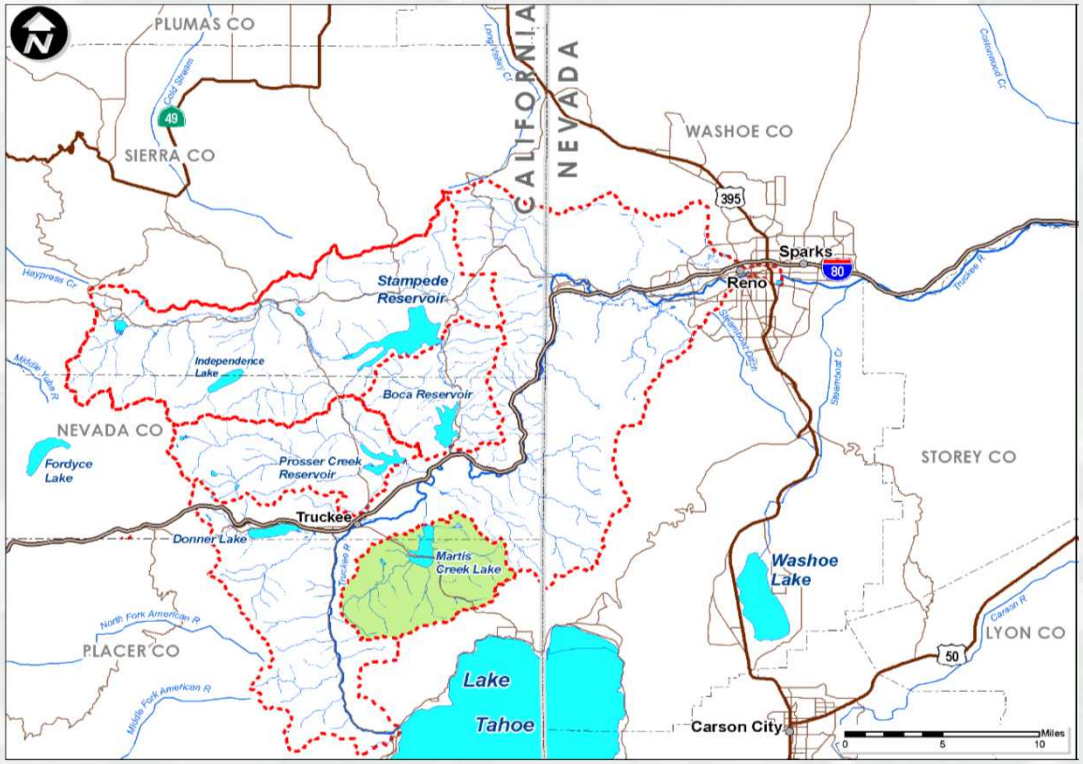
- Field Activities in FY 2011 and 2012
  - Revealed Project Concerns
  - New Monitoring Equipment and locations
- Incorporation into the Environmental Impact Statement
- Conclusions
- References

General Project Background

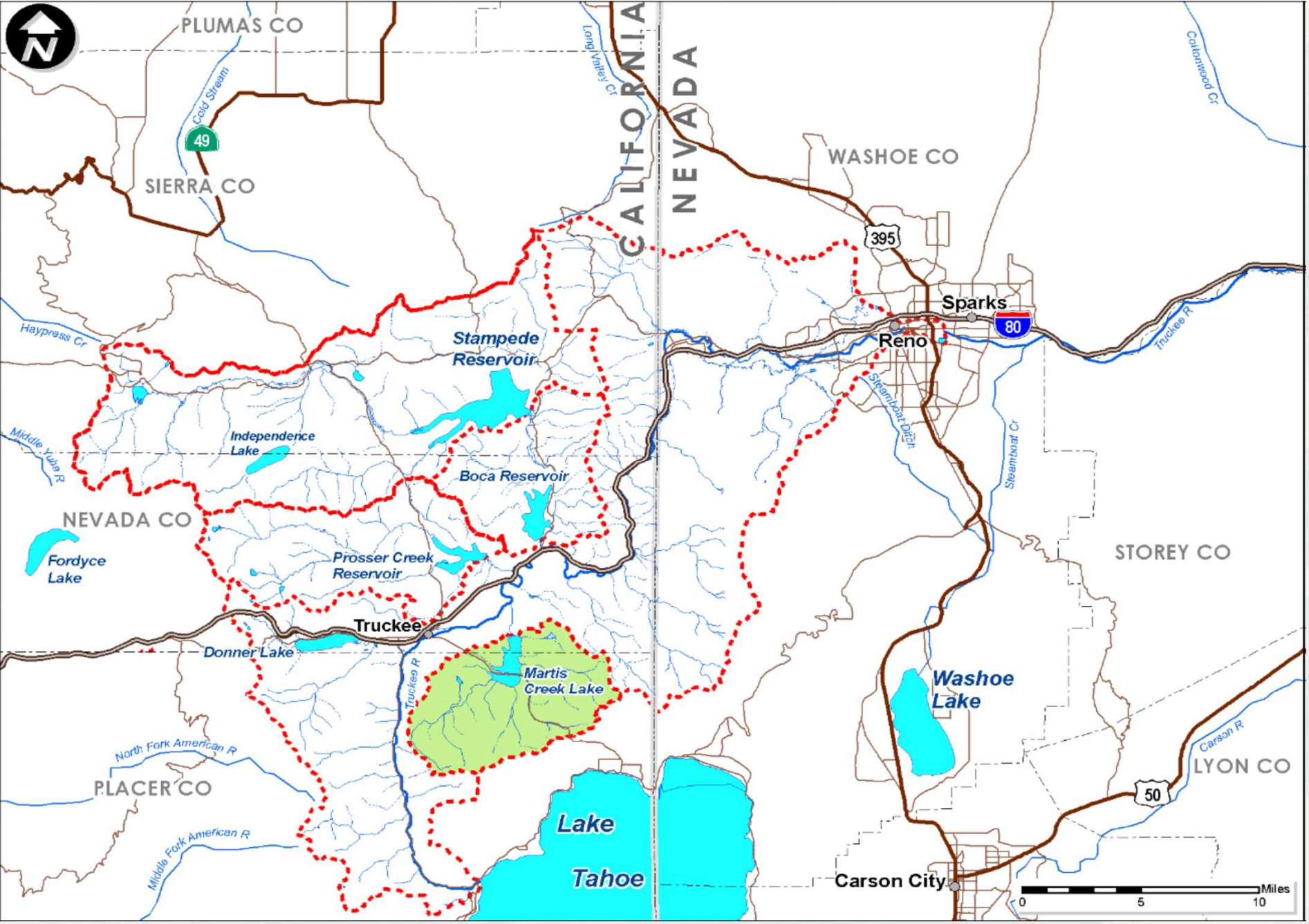
Martis Creek Dam & Lake

- Six miles southeast of Truckee, CA.
- Near Lake Tahoe, high in the Sierra Nevada mountains
- Popular recreation area – closed 11/15 to late April due to weather

General Project Background



- Dam authorized in 1962, construction completed by USACE in 1972
  - Martis Creek is a tributary of the Truckee River
  - Receives rain and snowmelt from watershed area of 39 square miles
  - Designed to contain 20,400 acre-feet, 770 acre pool surface but due to multiple areas of concern the lake is kept at minimum pool (70 acre pool area) with the gate fully open (max outflow 600 cfs).


PLUMAS CO
Cold Stream
49
SIERRA CO
Long Valley Cr
CALIFORNIA
NEVADA
WASHOE CO
Cottonwood Cr
395
Sparks
80
Reno
Truckee R
Haypress Cr
Stampede Reservoir
Steamboat Ditch
Steamboat Cr
Middle Yuba R
Independence Lake
Boca Reservoir
NEVADA CO
Fordyce Lake
Prosser Creek Reservoir
STOREY CO
Truckee
Donner Lake
Martis Creek Lake
Washoe Lake
North Fork American R
PLACER CO
Carson R
LYON CO
50
Middle Fork American R
Lake Tahoe
Carson City
Miles
0
5
10

General Project Background

- Interim Risk Reduction Measures for the reservoir are currently in place.
- An assessment in 2008 found the risk for dam failure to be Urgent and Compelling.
- Most likely failure modes are:
  - Seepage and piping at the embankment and/or foundation.
  - Hydrologic overtopping of the structures
- In response the USACE has implemented an aggressive schedule to fully evaluate potential impacts and determine project alternatives.
- Impacts are being assessed as part of the Environmental Impact Statement (EIS), including water quality conditions in and around the reservoir.

Historical Monitoring Regulations/Guidance

- Clean Water Act
- ER 1110-2-8154 Water Quality and Environmental Management for Corps Civil Works Projects.
  - ►Provides general guidance for USACE projects.
  - ►Currently under revision/expansion.
- Public Health and Safety Issues

Regional Regulatory Requirements

- Construction General NPDES Permit for the Lake Tahoe Basin – updated April 14, 2011.
- Any construction area disturbing greater than 1 acre requires a permit and must follow strict water quality management protocols.
- Bioassessments and baseline data needed prior to construction.

Regional Regulatory Requirements

- Water Quality Control Plan for the Lahontan Region (Lahontan Basin Plan) provides WQ goals at Martis Creek outflow just prior to meeting the Truckee River.
- Many parameters have set levels while others prohibit any changes (see table below).

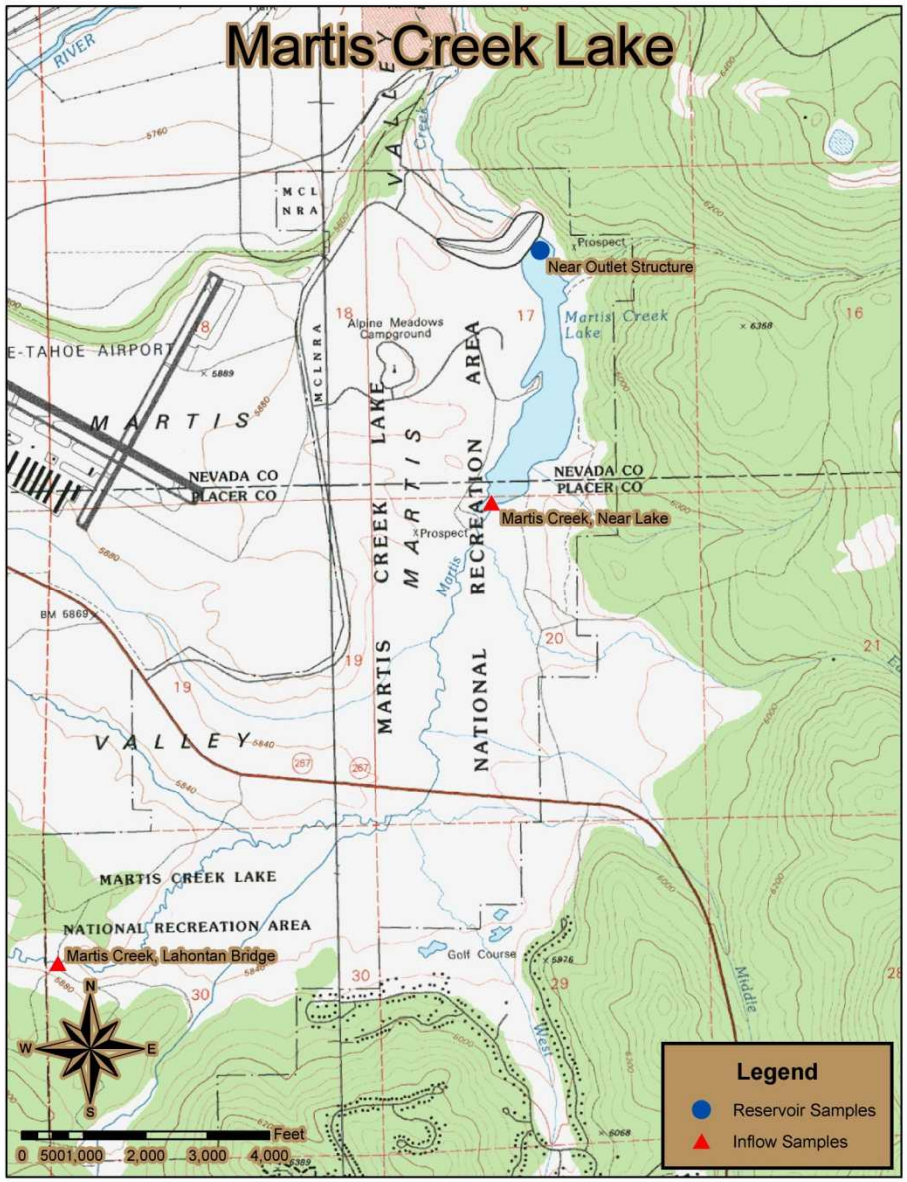
		Parameter							
	Units	TDS	Chloride	Sulfate	Phosphorus, total	NO3-N	Nitrogen, total	TKN	Fe
Martis Creek WQ Objective Limit	mg/L, unless noted	150	25	8	0.05	1	1.45	0.45	0.4
		pH	Turbidity	DO	Temperature	Color			
		> 0.5 unit change of ambient levels	> 3 NTU's above monthly mean	Most restrictive: depressed 10%, or below 80% saturation, or 7 mg/L	No Alteration of temperature permitted	> 8 PCU (monthly Mean)			

Truckee River Sediment TMDL

- A sediment Total Maximum Daily Load (TMDL) program was established for the Truckee River Watershed in 2008.
- Initial study (1996-1997) indicated that sediment loading into Martis Creek (490 tons/year) came primarily from non urban sources (> 95%).
- A sediment reduction program with stream targets was created.

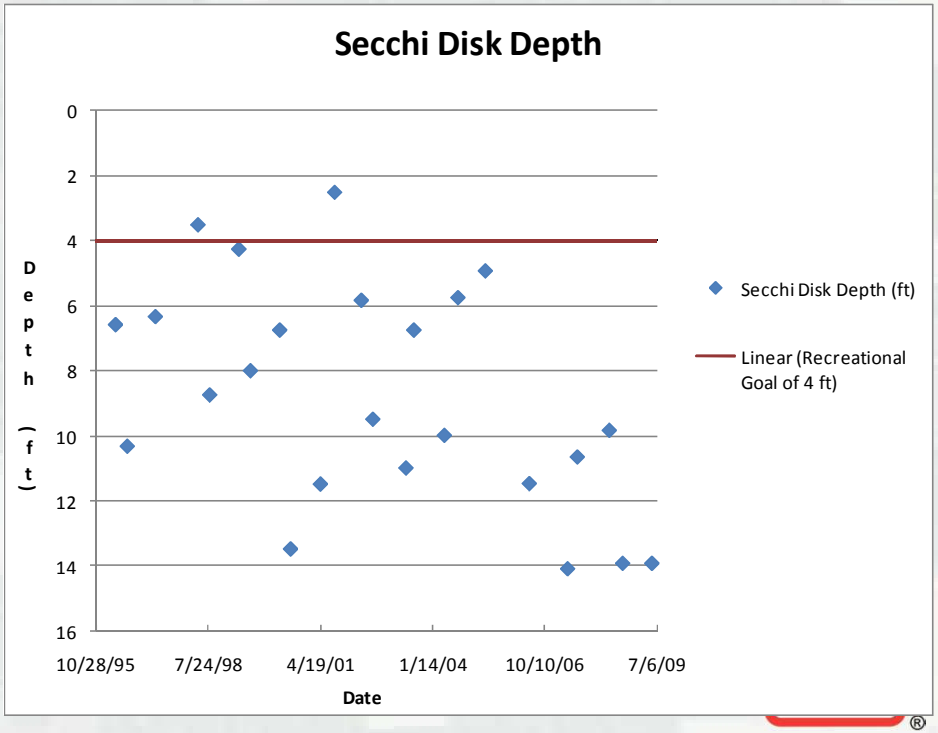
Historical Monitoring Program

- Two Monitoring events per year, generally in April/May and August/September
- Monitoring locations typically at inflow and within lake.
- Program provides “snap shot” of two days of the year at lake.



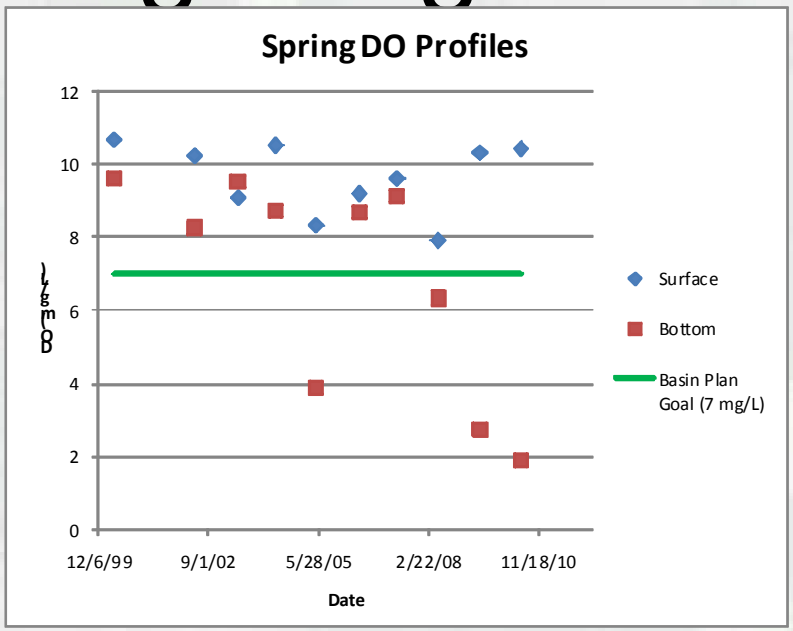
Historical Monitoring Program

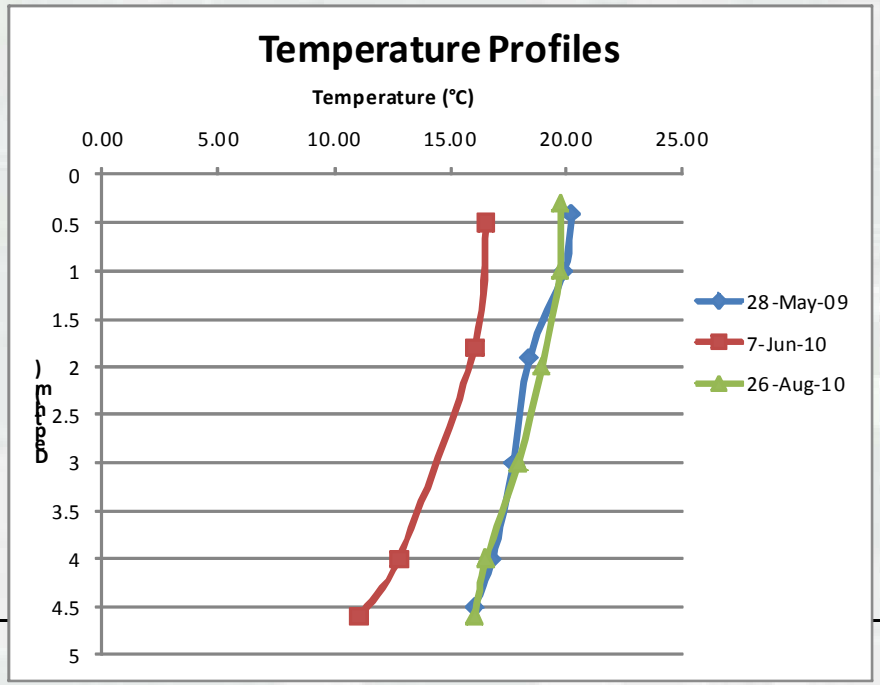
- Electronic Readings - Lake water profiles (temp, pH, turbidity, DO, conductivity) taken at deepest location.
- Secchi Disk clarity
- Wet samples collected and sent to contracted laboratory.

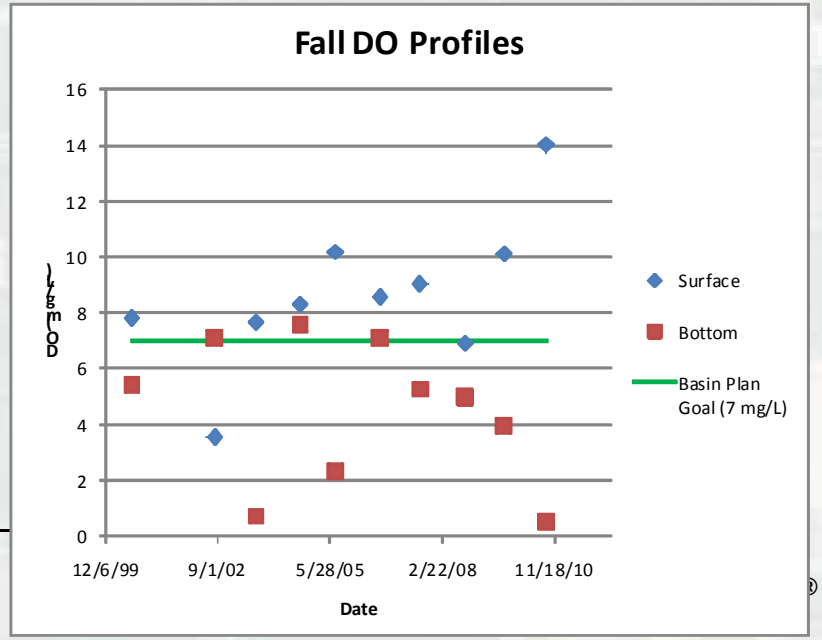


Historical Monitoring Program

- Reservoir is relatively shallow and regularly mixed by wind.
- Data collected indicates issues with downstream Martis Creek meeting water quality goals in Basin Plan.







Wet Sample Analysis Performed:

Historical Monitoring Laboratory Parameters		
Total Organic Carbon (TOC)		Arsenic (As)
Ammonia as Nitrogen		Antimony (Sb)
Nitrate as Nitrogen		Cadmium (Cd)
Kjedahl Nitrogen		Chromium (Cr)
Dissolved Orthrophosphate		Copper (Cu)
Total Phosphorus		Lead (Pb)
Total Solids (TS), Total		Manganese (Mn)
Suspended Solids (TSS),		Mercury (Hg) Unfiltered
Total Dissolved Solids (TDS)		Nickel (Ni)
Alkalinity		Selenium (Se)
Sulfate		Thallium (Tl)
Chloride		Zinc (Zn)
COD		Iron (Fe)
		Sodium (Na)
		Potassium (K)
		Calcium (Ca)
		Magnesium (Mg)

Historical Operation Issues and Concerns

- Twice a year water quality “Snap-Shot” inadequate for establishing year-round conditions.
- Historical data indicative of potential problems with meeting water quality goals downstream for any dam modifications including: DO, temp, turbidity, TDS, sulfate, etc.
- Significant changes in watershed land use since the completion of the dam.
- Reservoir now operating as a ‘clarifier’ for potential sediment coming from upstream sources.

Initial Dam Modification Water Quality Concerns

- Lower potential water pool could create significant impacts on DO, Turbidity, Nutrients, Algae Blooms

- No existing baseline data for year-round water quality conditions

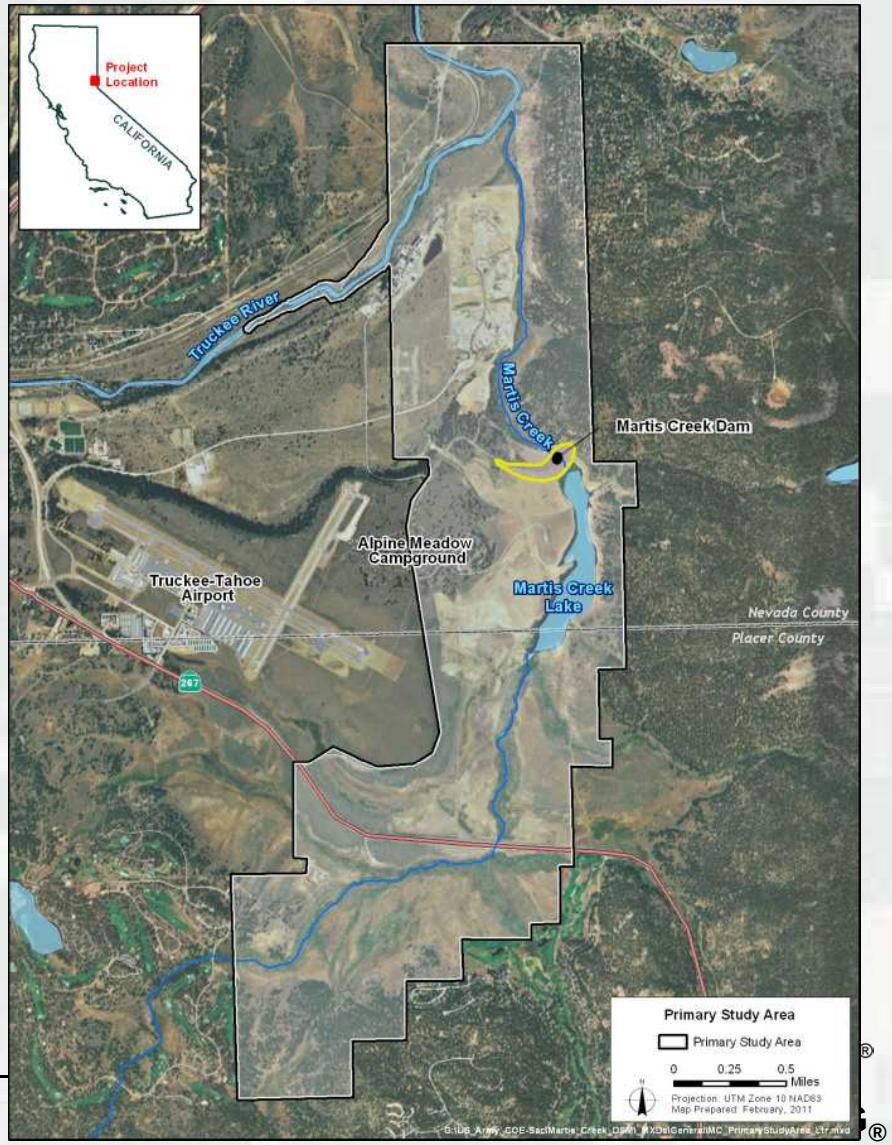
- CA State Water Resources Control Board had established limits for parameters in a Basin Plan.

- Concerns about water quality goals during construction

- Impacts of project options on upstream and downstream water quality.

Supplemental Monitoring Goals

- Develop WQ data baseline
- Year-round and/or seasonal conditions.
- Add locations to capture project run-on and run-off.
- Determine additional areas of potential water quality concern.
- Assess what additional monitoring will be needed before and during any construction activities.



Supplemental Monitoring Stations

Lake and Outflow
- Continuous monitoring stations at outflow and at deepest part of lake.
- Grab samples at more inflow stations.

Upstream monitoring
- Capture water exiting new land developments
- Assess impacts from home developments and ski resorts.

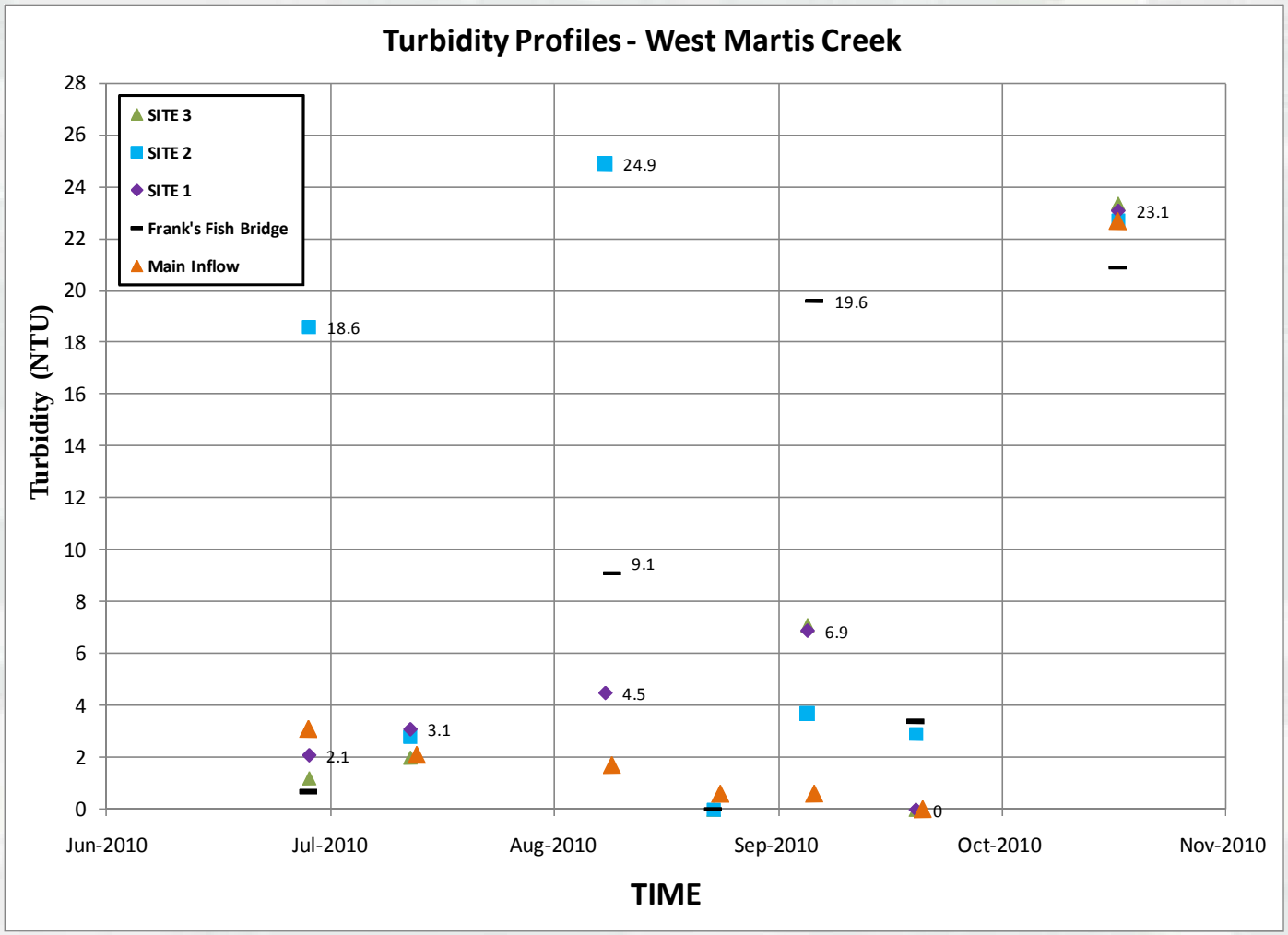
Initial Supplemental Monitoring

- Initiated additional monitoring in Summer 2010
- Ordered monitoring equipment as needed for monitoring plan.
- Grab samples taken and continuous data collection unit at outflow.
- Sampling halted during mid winter conditions and restarted in Spring.

Table 1: WQ values for Lake, Outflow, and Inflows (9 events from June - September 2010)

Location	Temperature (°C)		Conductivity (µS/cm)		pH		Turbidity (NTU)		DO (mg/L)	
	Range	Average	Range	Average	Range	Average	Range	Average	Range	Average
Lake Surface	14.5 - 22.2	19.3	101 - 139	124	7.8 - 10.3	9.2	0 - 1.4	0.3	8.9 - 14.2	10.4
Near Lake Bottom	12.5 - 16.0	14.3	132 - 182	157	6.8 - 8.0	7.3	0 - 1.6	0.6	2.13 - 8.57	6.3
Outflow	12.31 - 19.25	16.2	106 - 137	126.5	9.0 - 9.5	9.3	0 - 20	2.8	7.6 - 12.6	9.8
Main Inflow	7.9 - 18.9	13.1	123 - 147	139.4	5.8 - 8.0	7.2	0 - 22	4.4	7.2 - 11.7	8.5
Frank's Fish Bridge	8.0 - 18.5	13.5	119 - 142	135	4.9 - 8.2	7.2	0 - 21	9	8.7 - 12.1	10.2
Lahontan	7.6 - 18.2	11.7	93 - 137	118	5.7 - 8.0	7.2	0 - 23	4	8.0 - 11.4	9.4
West Martis Creek	7.6 - 16.1	11.3	91 - 194	152	5.0 - 8.4	7.2	0 - 25	7.8	7.1 - 11.6	8.9

Initial Supplemental Monitoring

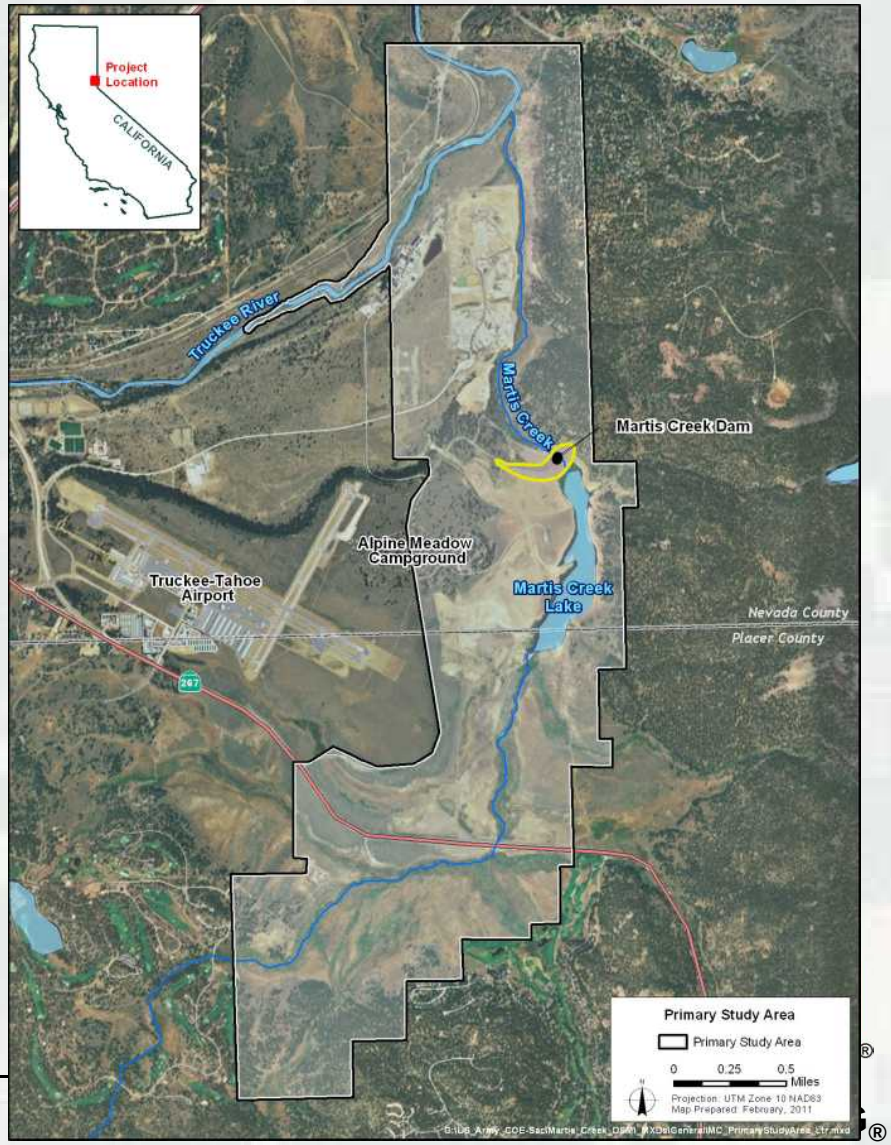


Initial Observations

- Inflow turbidity surges.
- Daily cycle in outflow values.
- Significant biofouling on outflow sonde.
- Monitoring equipment took longer to order than expected.

Revealed Project Concerns

- Potential Impacts on wastewater treatment plant further down the watershed.
- Invasive Aquatic Species.
- Amount of treatment provided by reservoir on inflowing water.
- Need for Phytoplankton and bioassessment data.
- Additional water and sediment testing based on preferred alternatives.



Current Monitoring Efforts

- Monitoring buoy to collect data (DO, turbidity, pH, temperature, conductivity), outflow, and inflow every 30 min.
- Buoy Telemetry equipped
- Exchange probe, lake profile, measure quality of all locations every 2-3 weeks.
- Wet samples collected quarterly to enhance original monitoring program.

Monitoring Buoy

Addressing WQ Issues in the EIS

- Process new WQ data and complete baseline
- Include draft Best Management Practices for alternatives in the EIS.
- Determine what additional monitoring will be needed before and during any construction activities.
- EIS for project anticipated in 2013

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Conclusions

- There are significant water quality issues associated with Martis Creek Dam project.
- Historical Monitoring provided a vital starting point to understand the system.
- Supplemental monitoring was required for EIS to ease the concern of regulatory agencies and the public.
- Water Quality issues will be a significant consideration of any final project design.

Martis Dam Monitoring Participants

- Project Manager – Adam Riley
- Planning Support – Mitch Stewart
- Field Sampling support
  - Technical Staff – Alex Kan, Daniel Holmberg, Heather Jackson, Alison Plant
  - Park Staff – Dale Verner, Jackie Zink
- Park Manager – Doug Grothe
- Tommy Waldrup – Laboratory Coordination

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