Addressing Instream Flow in the Shasta River Temperature TMDL

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North Coast RWQCB

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Item 18

Summary

- Temperature objective not achieved without increasing dedicated cold water instream flow
- 45 cfs goal based on sensitivity analysis (Staff Report Sections 6.2.4 and 6.4.1)
- Shasta River watershed characterized by constant source of cold water

Summary

- 60-year average August unimpaired flow at mouth = 353 cfs (CDWR 1994)
- 60-year average August impaired flow at mouth = 39 cfs (USGS)
- Spring flows contribute > 130 cfs near-constant flow
- 45 cfs goal can be achieved by available and existing management strategies and does not alter or reallocate water rights.

Water Quality Objective for Temperature

"The natural receiving water temperature of intrastate waters shall not be altered unless it can be demonstrated to the satisfaction of the Regional Water Board that such alteration in temperature does not adversely affect beneficial uses."

Water Quality Objective for Temperature

No alteration of natural temperature

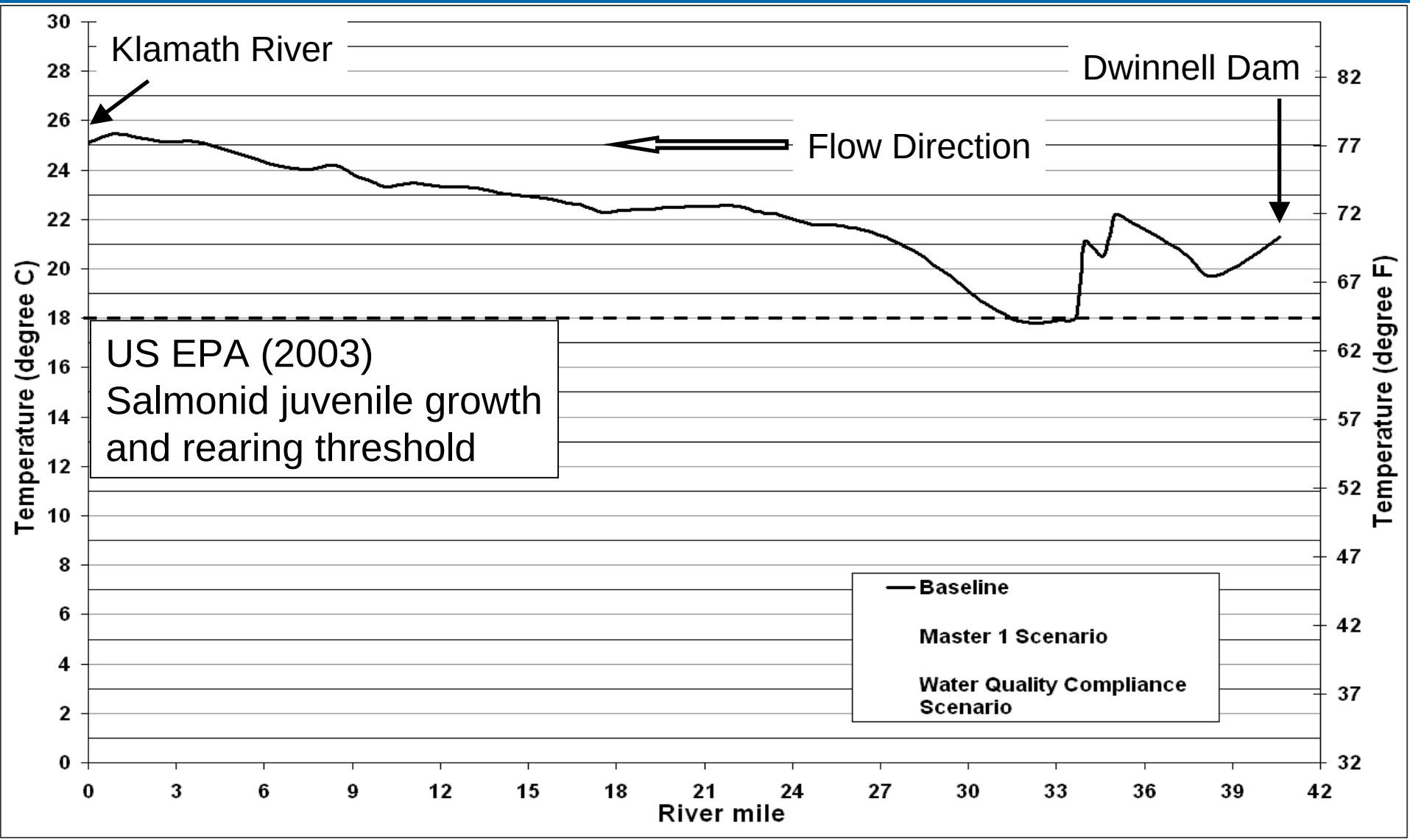
Or

Protect beneficial uses

Water Quality Compliance Scenario

- Increased riparian shade
- Reduced irrigation tailwater return flow temperatures
- Reduced tributary inflow temperatures
- **Increased dedicated cold water instream flow**

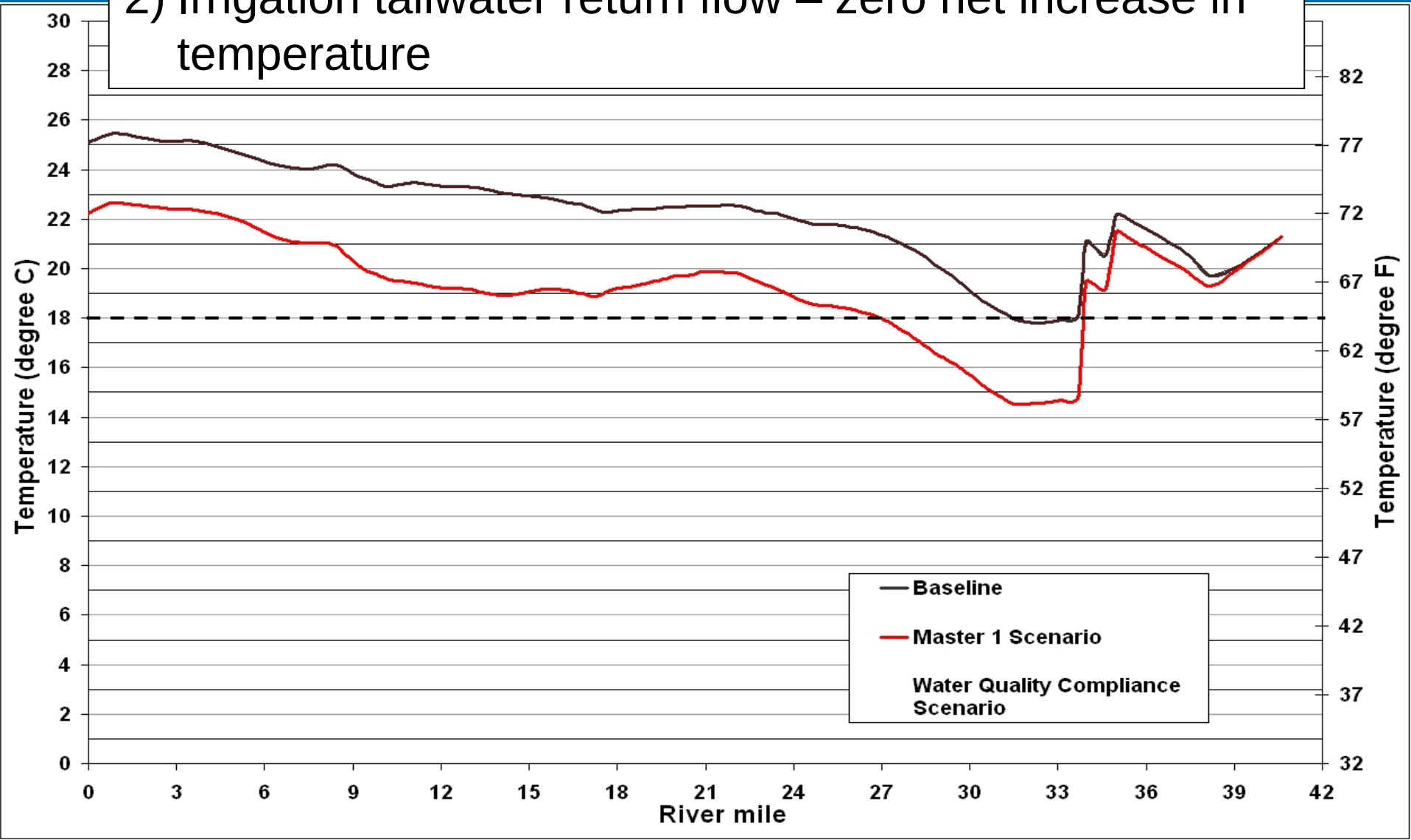
Maximum Temperature



Master 1 Scenario:

1) Site potential shade

2) Irrigation tailwater return flow – zero net increase in temperature

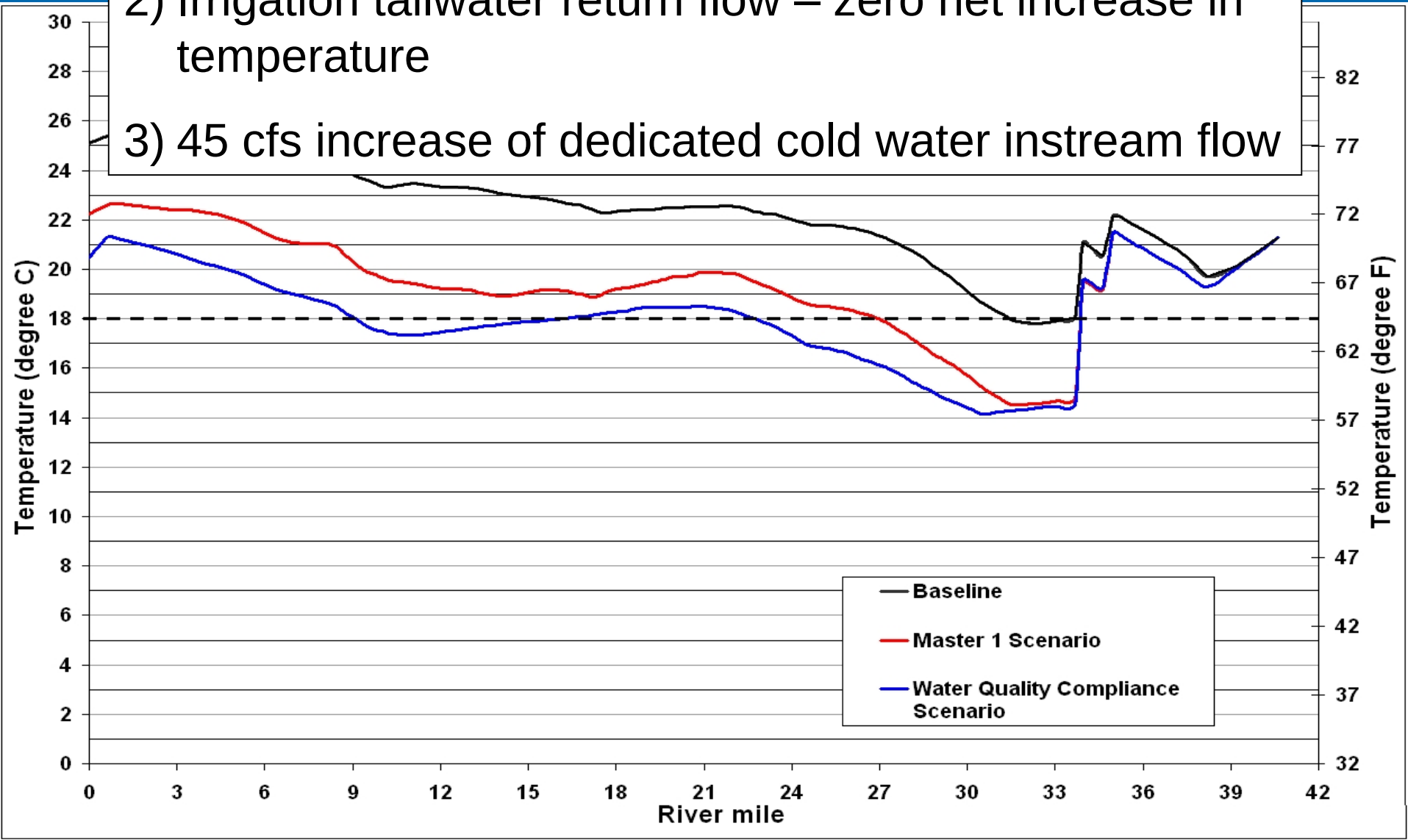


Water Quality Compliance Scenario:

1) Site potential shade

2) Irrigation tailwater return flow – zero net increase in temperature

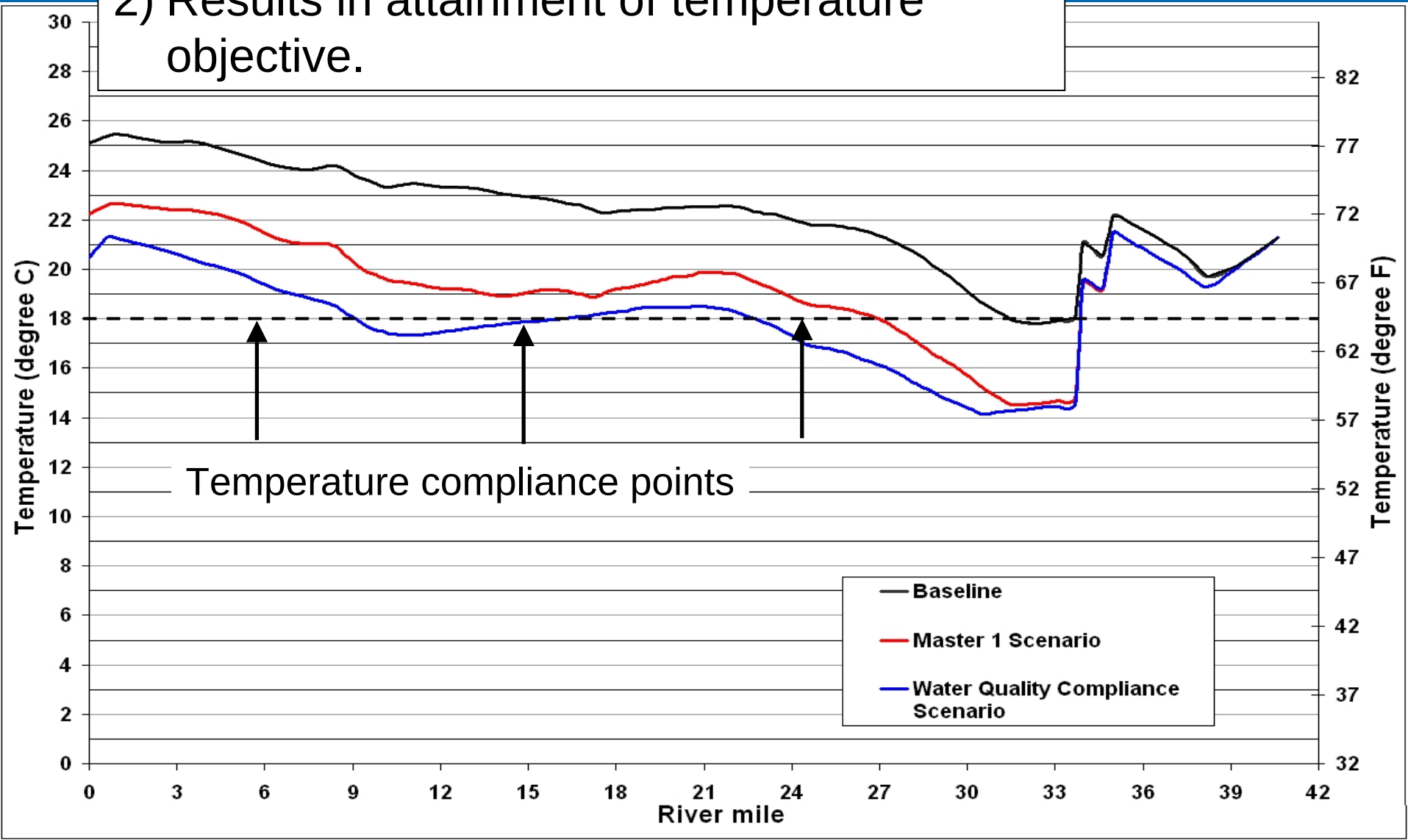
3) 45 cfs increase of dedicated cold water instream flow



Water Quality Compliance scenario:

1) Does not adversely affect BU's, and

2) Results in attainment of temperature objective.



Compliance with Temperature Objective

Factors	Natural Temperature	Altered Natural Temperature – Protect BU's
Shade		
Irrigation tailwater return flows		
Flow		

Compliance with Temperature Objective

Factors	Natural Temperature	Altered Natural Temperature – Protect BU's
Shade	Full site potential shade	
Irrigation tailwater return flows	None	
Flow	Full natural flow	

Compliance with Temperature Objective

Factors	Natural Temperature	Altered Natural Temperature – Protect BU's
Shade	Full site potential shade	Full site potential shade
Irrigation tailwater return flows	None	No net temperature increase
Flow	Full natural flow	+ 45 cfs of dedicated cold instream flow

[40 CFR 130.7(c)]

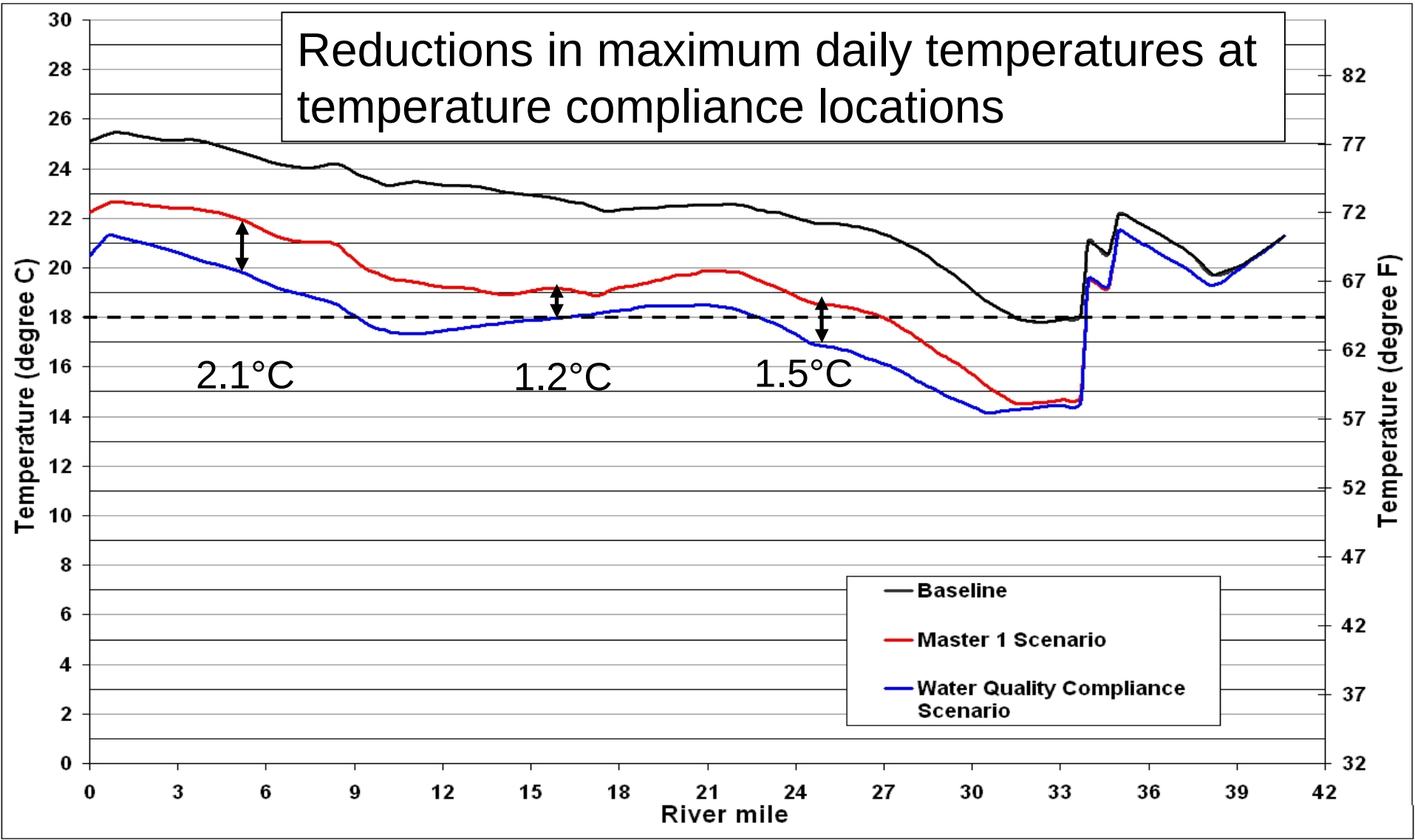
TMDLs must result in attainment of water quality standards throughout the year, including under critical conditions.

Temperature TMDL Allocations

Assigns temperature reductions to source categories:

- Riparian shade
- Irrigation tailwater return flows
- Flow

Flow

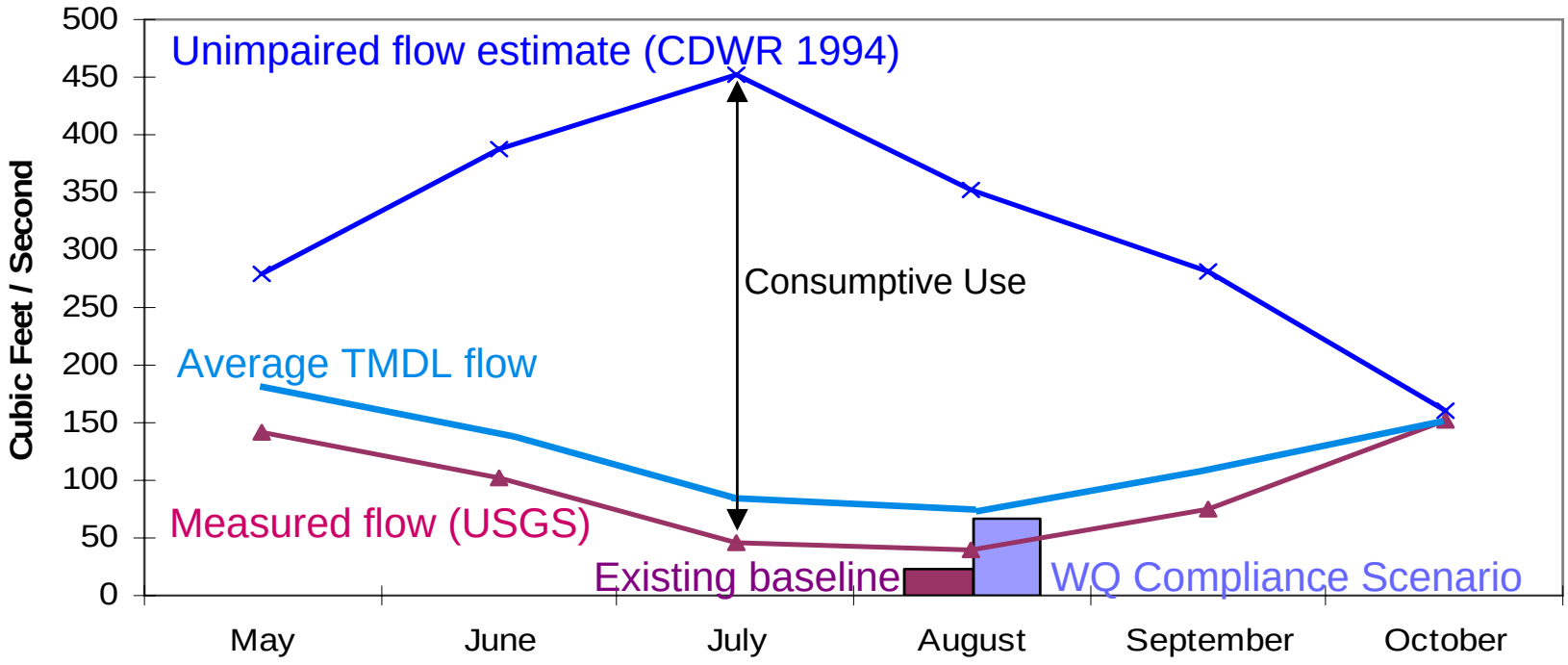

Reductions in maximum daily temperatures at temperature compliance locations
2.1°C
1.2°C
1.5°C
Temperature (degree C)
Temperature (degree F)
River mile
Baseline
Master 1 Scenario
Water Quality Compliance Scenario

Average August Flow (cfs) Shasta River Near Mouth

Unimpaired Flow[1]	Existing Baseline	WQ Compliance Scenario
353	**22**	**67**

1. CDWR (1994) Preliminary Unimpaired Flow Study

Average Monthly Flows - Shasta River Mouth



Attributes of Shasta River

- Mt. Shasta, Eddy Mountains, Cascade Range
  - Provide constant source of cold spring and snow melt stream flows
  - Water temperatures at the source of springs remain fairly constant year-round from about 11-13 degrees Celsius
- Largely volcanic soils
  - Naturally high nutrient concentrations
- Agricultural economy
  - Irrigated pasture & alfalfa, hay, cow-calf
- Low rainfall, high desert environment
  - Irrigation; mostly flood irrigation at present

What is the basis for 45 cfs goal?

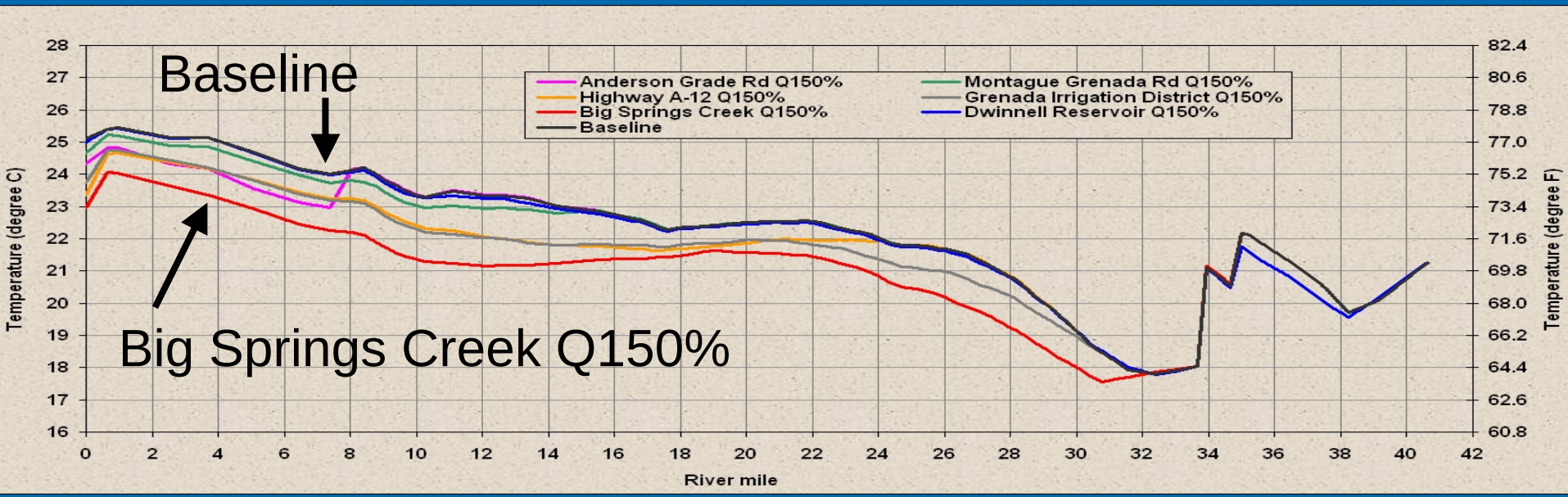
Flow Sensitivity Analysis

Purpose:

To evaluate the effect of dedicated cold water flow increase on Shasta River temperature.

- Increased baseline flows by 50% at six select locations – one location for each simulation
- Baseline temperature maintained
- Flow maintained to the mouth

Flow analysis – maximum temperature results



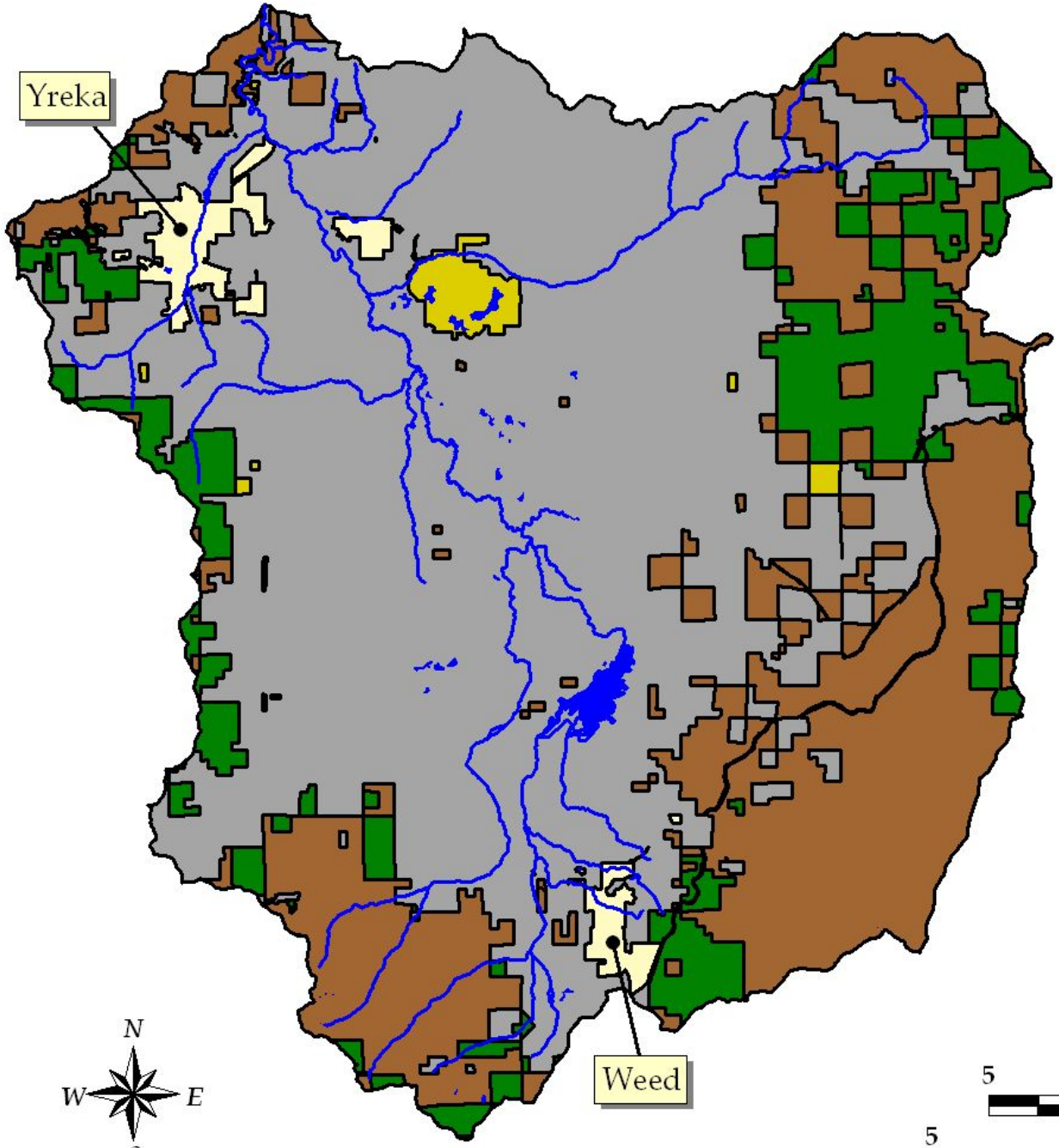
- 50% flow increase downstream of Big Springs Creek has largest affect on Shasta River temperatures;
  = 45 cfs increase

Action Plan

- Water diverters should employ water management practices and activities that result in increased **dedicated cold water instream flow** in the Shasta River and its tributaries.
- **Goal**: Increase the dedicated cold water instream flow in the Shasta River by 45 cfs or alternative flow regime that achieves the same temperature reductions

Shasta River Watershed

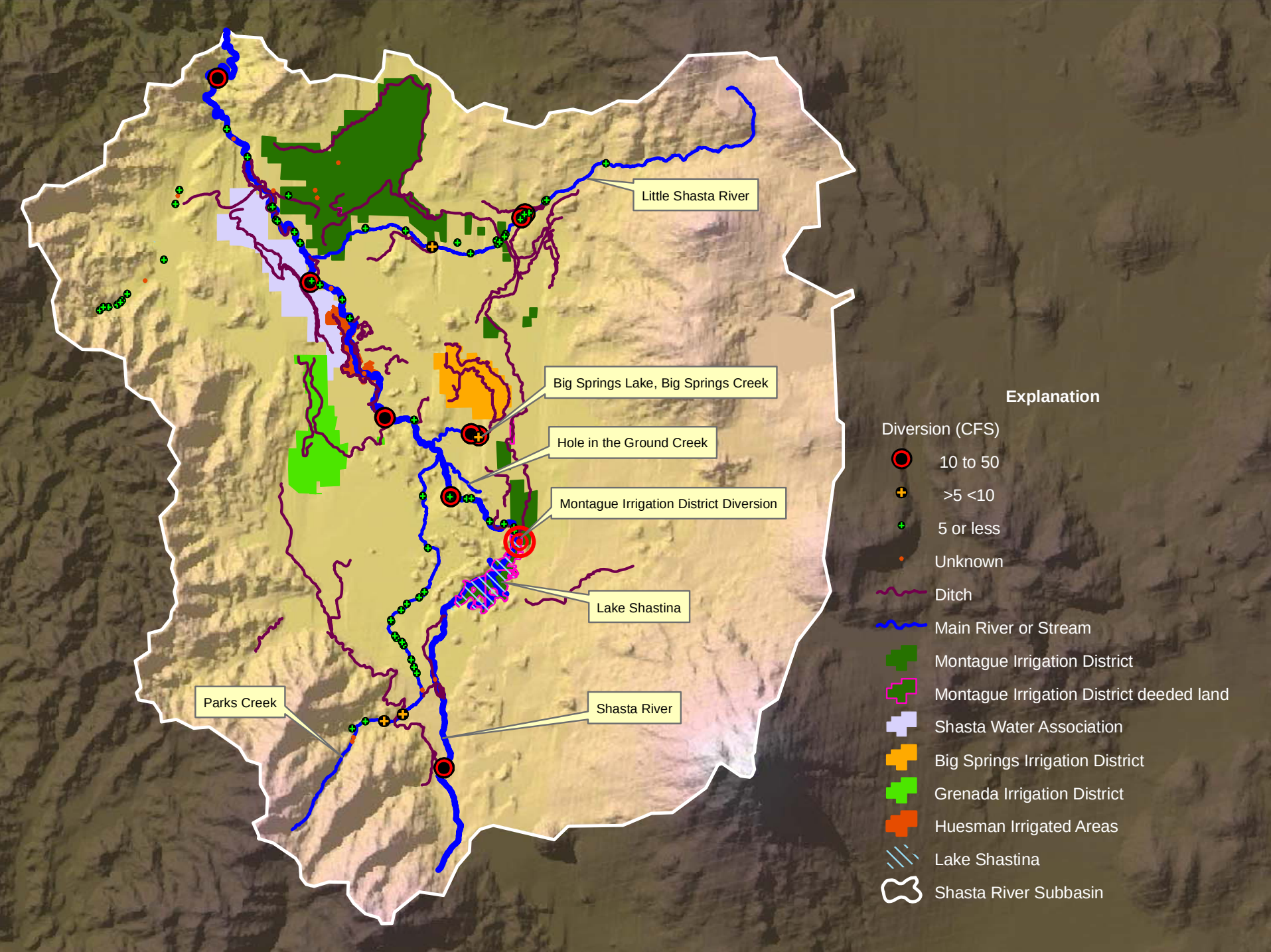
Property Ownership Distribution



- **Federal Lands** ~ *208 sq mi*
- **State Lands** ~ *9 sq mi*
- **City Boundary** ~ *17 sq mi*
- **Private - Timber** ~ *81 sq mi*
- **Private - Other** ~ *474 sq mi*
- **Reservoirs / Lakes**
- **Major streams**

5 0 5 10 15 20 Kilometers

5 0 5 10 15 Mile


Little Shasta River
Big Springs Lake, Big Springs Creek
Hole in the Ground Creek
Montague Irrigation District Diversion
Lake Shastina
Parks Creek
Shasta River
Explanation
Diversion (CFS)
10 to 50
>5 <10
5 or less
Unknown
Ditch
Main River or Stream
Montague Irrigation District
Montague Irrigation District deeded land
Shasta Water Association
Big Springs Irrigation District
Grenada Irrigation District
Huesman Irrigated Areas
Lake Shastina
Shasta River Subbasin

Management Strategies

- Water Use Efficiency
- System Reoperation
- Agricultural Lands Stewardship
- Groundwater Storage/ Conjunctive Management
- Municipal Water Reuse
- Ecosystem Restoration
- Economic Incentives
- Water Transfers/Water Trust

-CA Dept Water Resources, Water Plan Update 2005

Water Use Efficiency

- Ag production per unit of applied water for 32 important CA crops increased 38% from 1980 to 2000.
- Hardware and infrastructure upgrades
  - Data acquisition and control systems
  - Changes in irrigation method
  - Lining of ditches and canals
  - Tailwater recovery
- Water Management
  - Integrated monitoring and management
  - Water to meet crop requirements

System Reoperation

- Change time or volume of reservoir releases
- Temperature control devices
- Groundwater banking
- Coordinate and interconnect storage, conveyance, and delivery systems
- Risk management
- Change points of diversion
- Pulse flows
- Off-stream storage

Agricultural Lands Stewardship

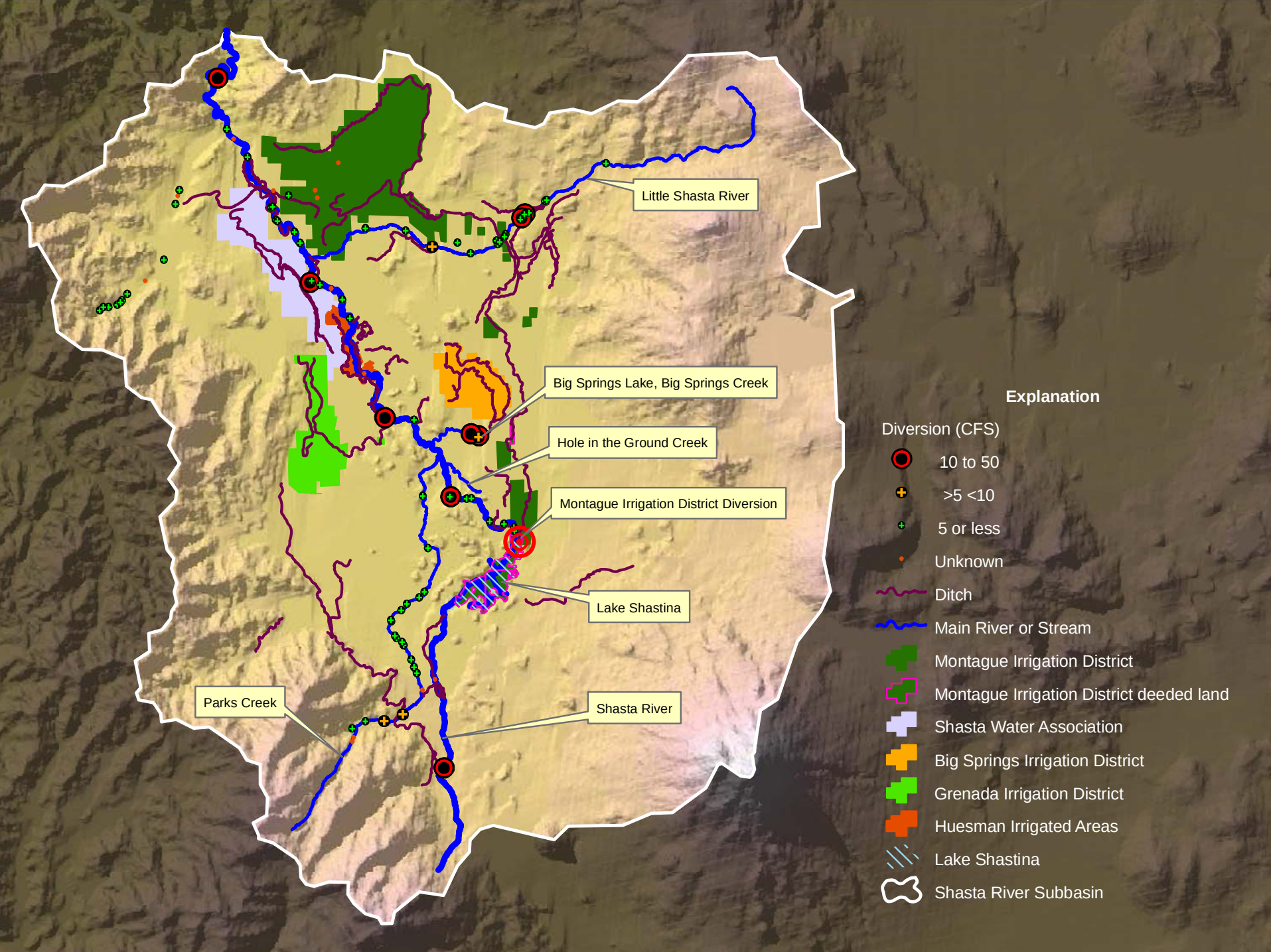
- Irrigation tailwater recycle/reuse
- Crop shifting
- Crop idling

Economic Incentives

- Low-cost loans
- Grants, e.g., CA proposition programs
- Subsidies
- Water audits, rebates
- Water pricing, rate structures
- Water purchase

Water Transfers/Water Trust

- Change in point of diversion, place of use, purpose of use
- Temporary or long-term
- Water is made available through means such as water use efficiency, crop idling, crop shifting, return flow reductions, conveyance loss reductions, groundwater conjunctive use
- In 2001, 1,250,000 ac-ft, 20% long-term.
- Environmental programs: 200,000 ac-ft/yr 1995-2001
- Scott Valley exploring water trust idea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Are these just big ideas or are they real?

Strategy	Scott	Shasta	California
Water use efficiency	Yes	Yes	Yes
Economic incentives	Yes	Yes	Yes
System reoperation	Possible	Possible	Yes
Ag. land stewardship	Yes	Yes	Yes
Water transfers	Proposed	Possible	Yes
GW/SW conjunctive	Yes	Possible?	Yes
Municipal water reuse	Possible?	Montague	Yes
Ecosystem restoration	Yes	Yes	Yes

Win-Win

- Plenty of tools in the tool box
- Solutions do not require reopening adjudications
- All irrigators have the potential to contribute