

# Shasta River Watershed Water Temperature and Dissolved Oxygen Total Maximum Daily Loads (TMDLs).

Agenda Item #18

November 15, 2006

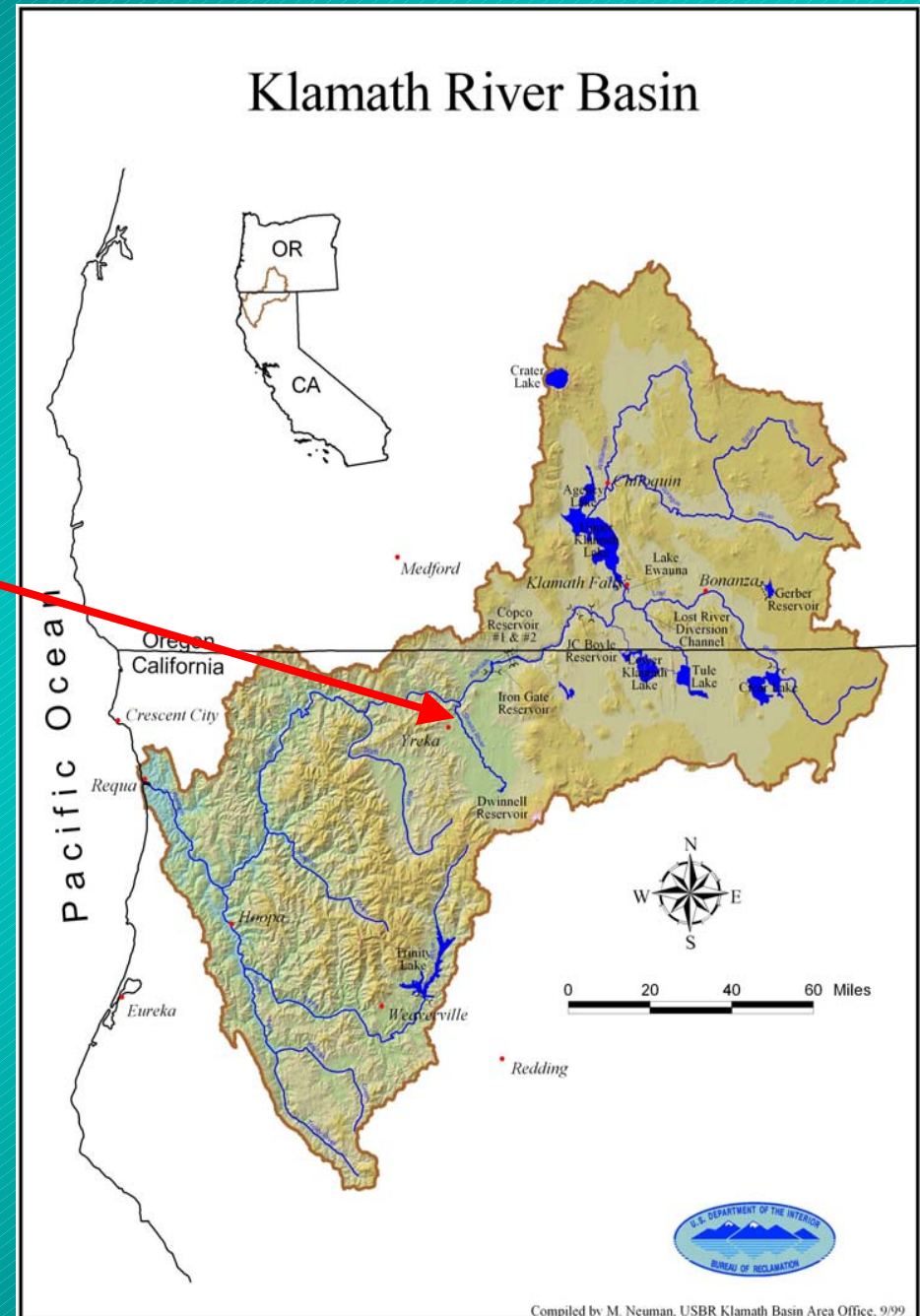
# Intro

- 303(d) Listed
  - 1992 Dissolved Oxygen (DO)
  - 1994 Temperature
- Temperature WQO
  - Narrative
- DO WQO
  - Numeric - 7.0 mg/L

# Impacted Beneficial Uses

- Cold Freshwater Habitat (COLD)
- Rare, Threatened, or Endangered Species (RARE)
- Migration of Aquatic Organisms (MIGR)
- Spawning, Reproduction, and/or Early Development (SPAWN)
- Commercial & Sport Fishing (COMM)

**Shasta is a main tributary of the Klamath**



# Factors Affecting Temperature

- Solar radiation and shade from riparian vegetation
- Irrigation tailwater return flows
- Surface water diversions
- Spring inflows
- Impoundments

# Factors Affecting Dissolved Oxygen

- Photosynthesis and respiration of aquatic plants; affected by:
  - Temperature
  - Light (shade and water clarity)
  - Nutrients
  - Substrate composition
- Sediment oxygen demand (SOD)
- Inputs of organic material (CBOD) and nutrients (N, P, & NBOD)

# Water Quality Compliance Scenario

- Increased riparian shade
- Reduced irrigation tailwater return flow temperatures
- Reduced tributary inflow temperatures
- Increased dedicated cold water instream flow
- Reduced aquatic plant biomass
- Reduced SOD rates
- Reduced NBOD input concentrations

# Temperature TMDL Allocations

## ➤ Riparian shade

- Shasta River: reach-average potential solar radiation transmittance
- Tributaries: adjusted potential effective riparian shade

## ➤ Irrigation tailwater return flows

- No net increase in receiving water temperature

## ➤ Flow

- Reductions in maximum daily temperatures:
  - 1.5°C at RM 24.1
  - 1.2°C at RM 15.5
  - 2.1°C at RM 5.6



# Dissolved Oxygen TMDL



**Decrease total daily oxygen demand by 40%**

<b>Shasta River</b>	<b>Baseline Condition</b>	<b>Water Quality Compliance / TMDL Condition</b>
<b>Total Daily Oxygen Demand (lbs/day)</b>	(20,622)	(12,353)

# Dissolved Oxygen TMDL Allocations

- Aquatic plant biomass
  - 50% reduction in respiration rates
- Sediment oxygen demand
  - 50% reductions behind minor impoundments
- NBOD concentration reductions:
  - Dwinnell Dam (67% reduction)
  - Yreka Creek (32% reduction)
  - Irrigation tailwater return flow (85% reduction)

# Framework of Action Plan

- Recognize/ support/ build upon ongoing programs
- Develop new programs through studies
- Memorialize existing programs with MOUs
- Evaluate/enforce existing Regional and State-wide Programs

# Action Plan

## -Table 4-

### Table 4 Organized By:

- Source/land use activity
- Responsible Parties
- Actions to address impairment(s)

# Conditional Waiver

- In effect until Board adopts an alternative permitting tool or for five years, whichever is first
- Conversely, parties who chose not to enlist in these programs will be required to submit a ROWD and filing fee immediately upon final approval of the TMDL by EPA.

# Action Plan

## -Actions to Address Impairments-

1. Enlist in recognized program
2. Implement recommended management measures
3. Monitor effectiveness of management measures
4. Adapt land use or management measures if monitoring indicates the need
5. Report to the North Coast Water Board on the status and effectiveness of implementation actions

# Issues

# Questions





Extra Slides Below

# 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.”

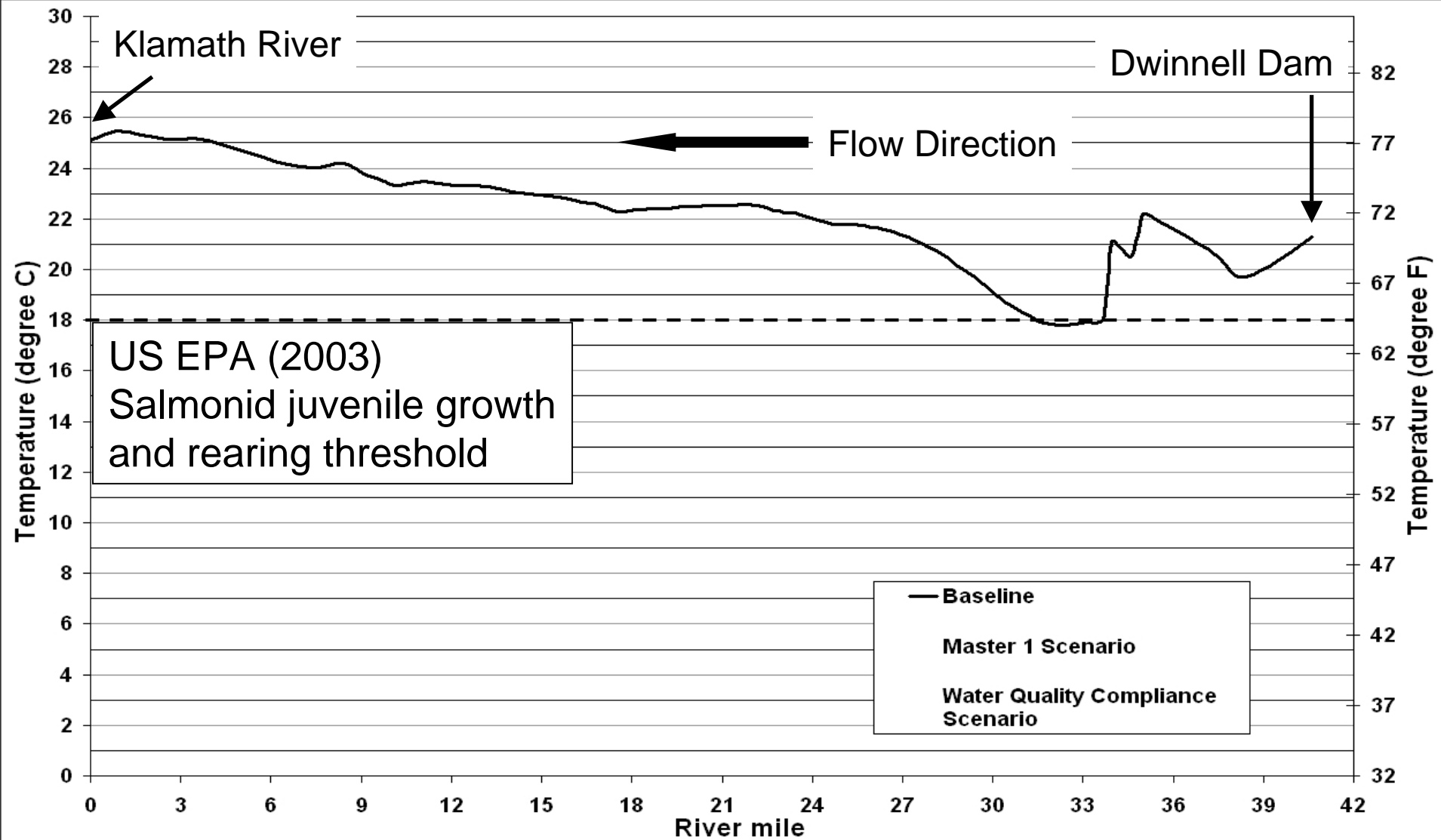
# Water Quality Objective for Temperature

No alteration of natural temperature

Or

Protect beneficial uses

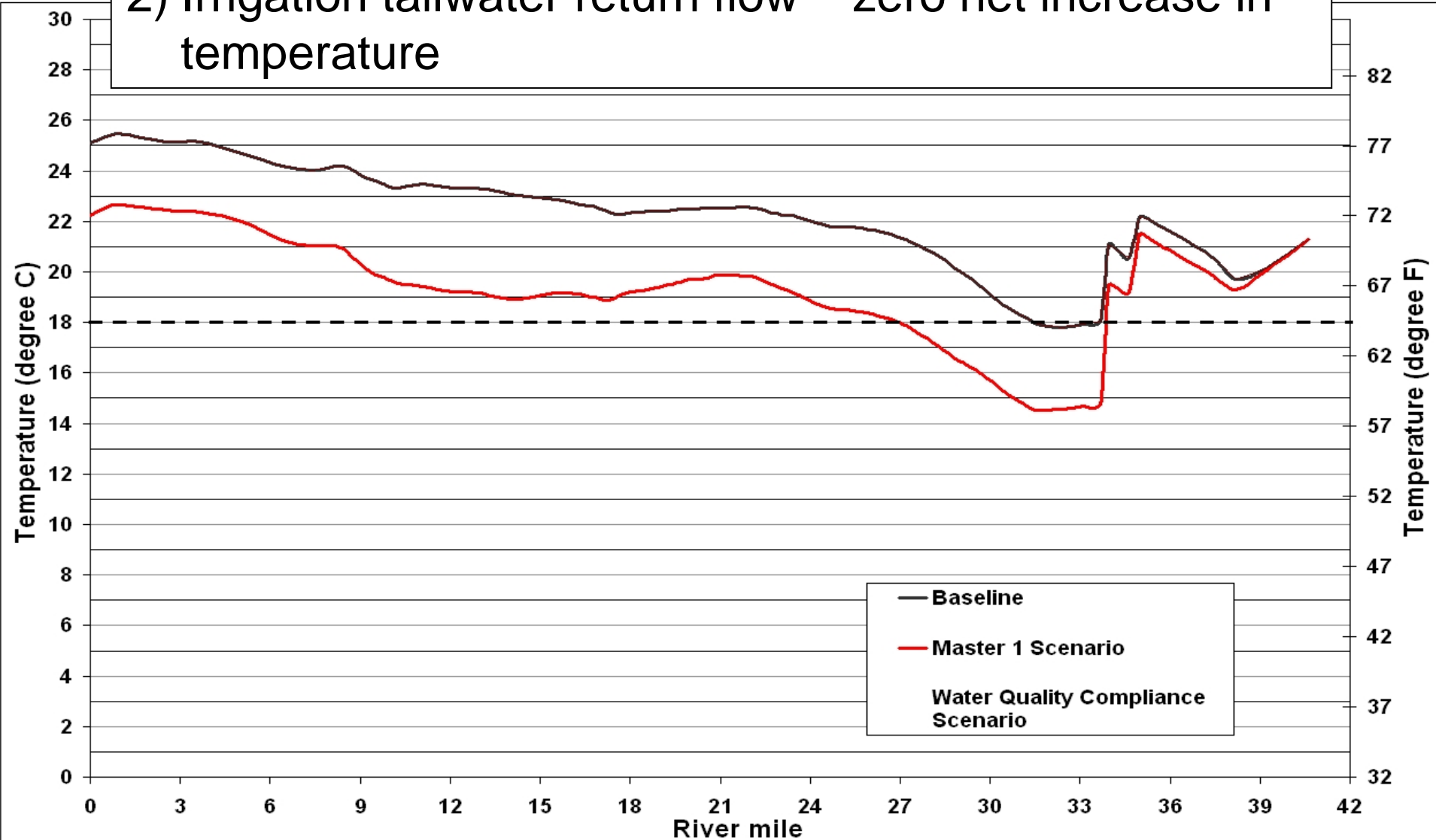
# Maximum Temperature



# Master 1 Scenario:

1) Site potential shade

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

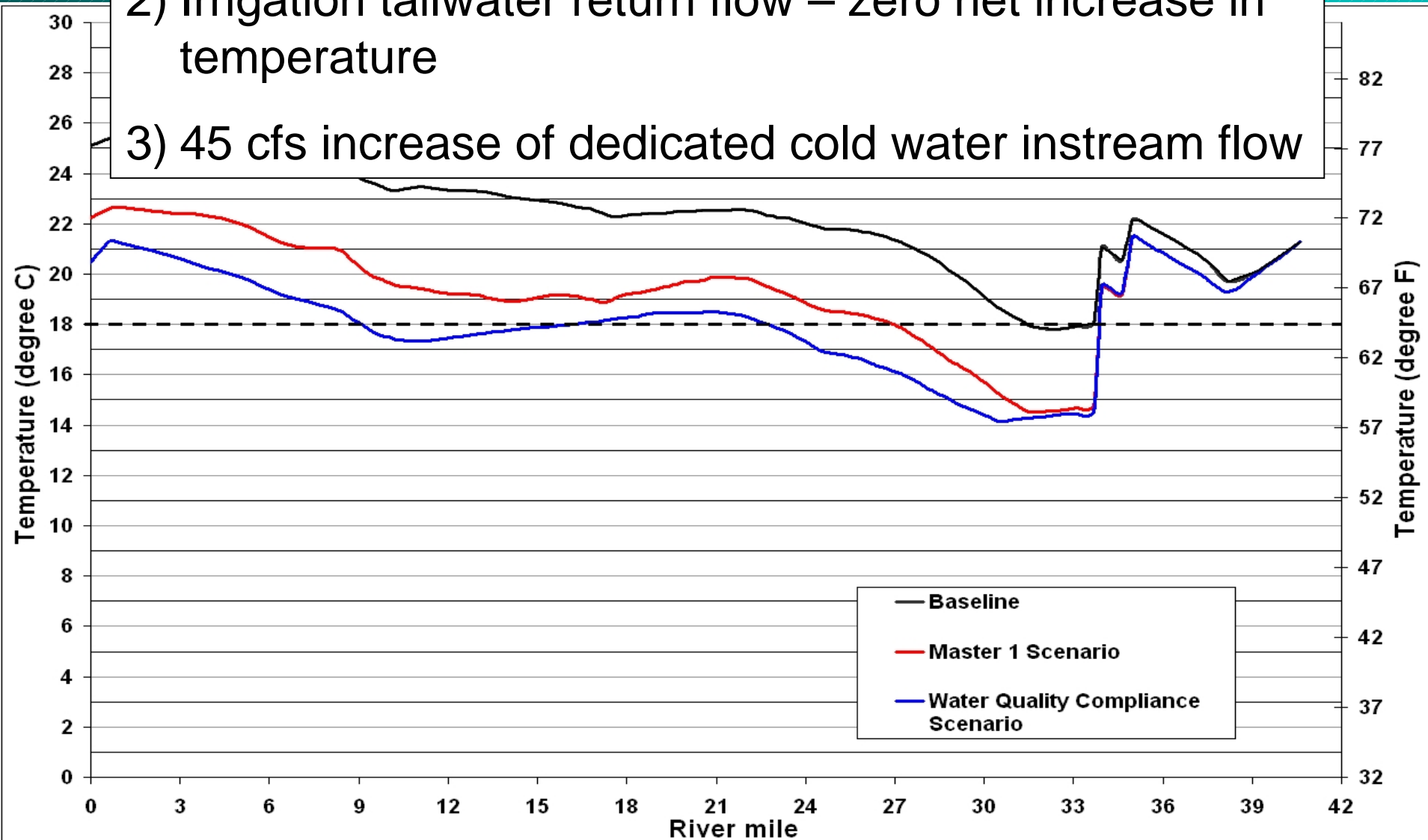


# Water Quality Compliance Scenario:

1) Site potential shade

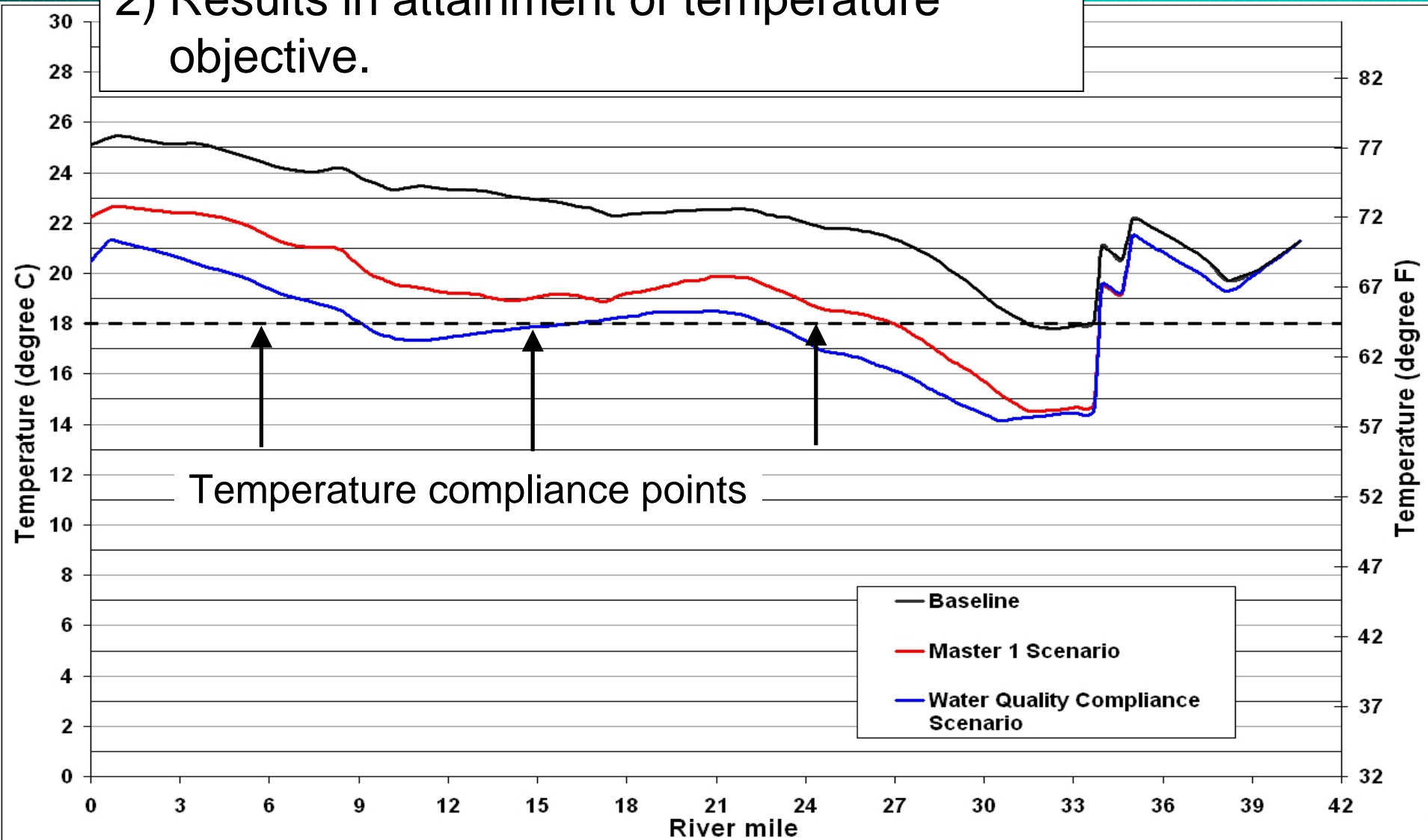
2) Irrigation tailwater return flow – zero net increase in temperature

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

<b>Factors</b>	<b>Natural Temperature</b>	<b>Altered Natural Temperature – Protect BU's</b>
<b>Shade</b>		
<b>Irrigation tailwater return flows</b>		
<b>Flow</b>		

# Compliance with Temperature Objective

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

# Compliance with Temperature Objective

<b>Factors</b>	<b>Natural Temperature</b>	<b>Altered Natural Temperature – Protect BU's</b>
<b>Shade</b>	Full site potential shade	Full site potential shade
<b>Irrigation tailwater return flows</b>	None	No net temperature increase
<b>Flow</b>	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.

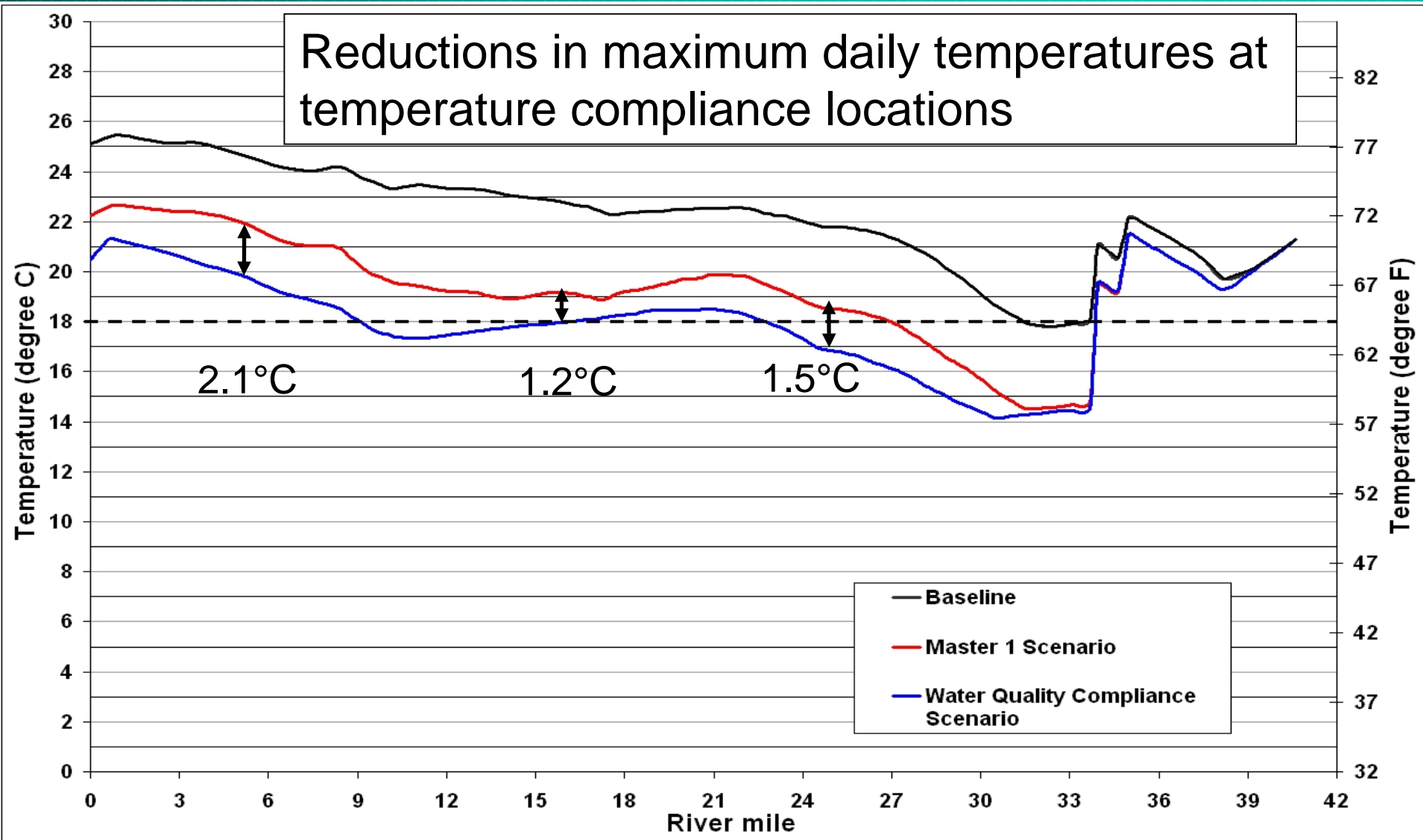
# Temperature TMDL Allocations



**Assigns temperature reductions to  
source categories:**

- Riparian shade
- Irrigation tailwater return flows
- Flow

# Flow



# Average August Flow (cfs) Shasta River Near Mouth

Unimpaired Flow <sup>1</sup>	Existing Baseline	WQ Compliance Scenario
<b>353</b>	<b>22</b>	<b>67</b>

1. CDWR (1994) Preliminary Unimpaired Flow Study

# Average Monthly Flows - Shasta River Mouth

