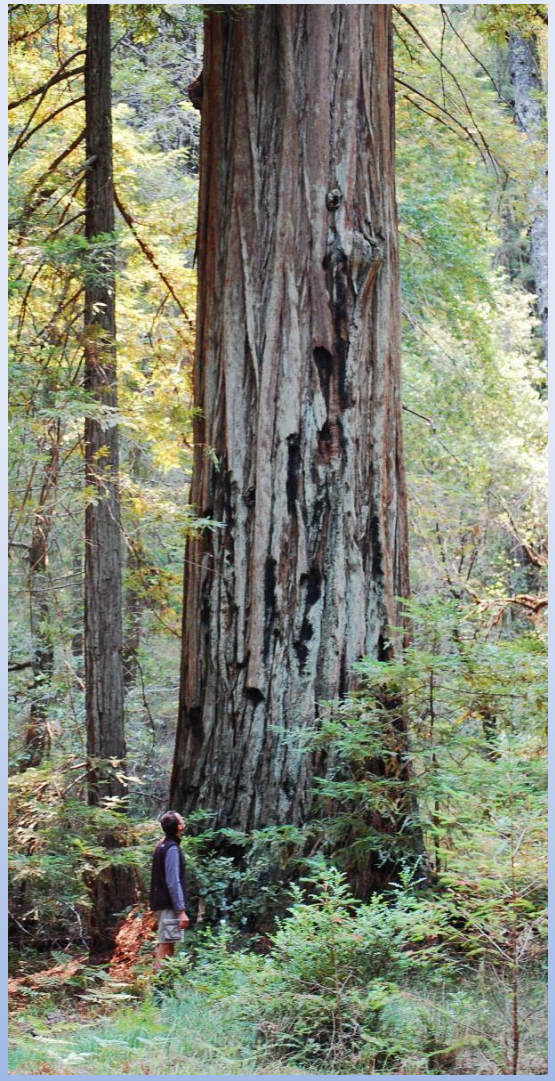
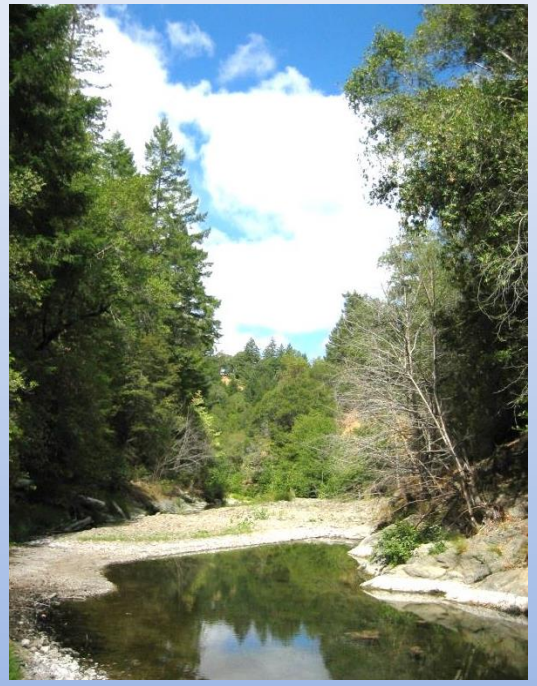
Healthy watersheds. Effective regulation.
Strong partnerships.





Consideration of Flow in the Water Quality Regulatory Process

Item No. 1

March 11, 2015

Santa Rosa, California

Bryan McFadin

North Coast Regional Water Quality Control Board

CALIFORNIA Water Boards

Purpose of Workshop

- To Inform the Board and Public:
  - ✓North Coast flow Conditions
  - ✓Legal Framework
  - ✓Flow Criteria Methodologies

- To Promote Discussion About Options to Address low flows in north Coast Streams

Overview

- Regional Strategic Direction
- Surface Flow Conditions in the Region
- Efforts to Address Low Flow Conditions in the Region
- Speakers:
  - ✓ Legal Topics
  - ✓ Water Quality/Quantity Big Picture
  - ✓ Development of Flow Objectives
  - ✓ Steve Moore, State Board Member
- Board Member Questions and Comments
- Public Comments
- Board Discussion

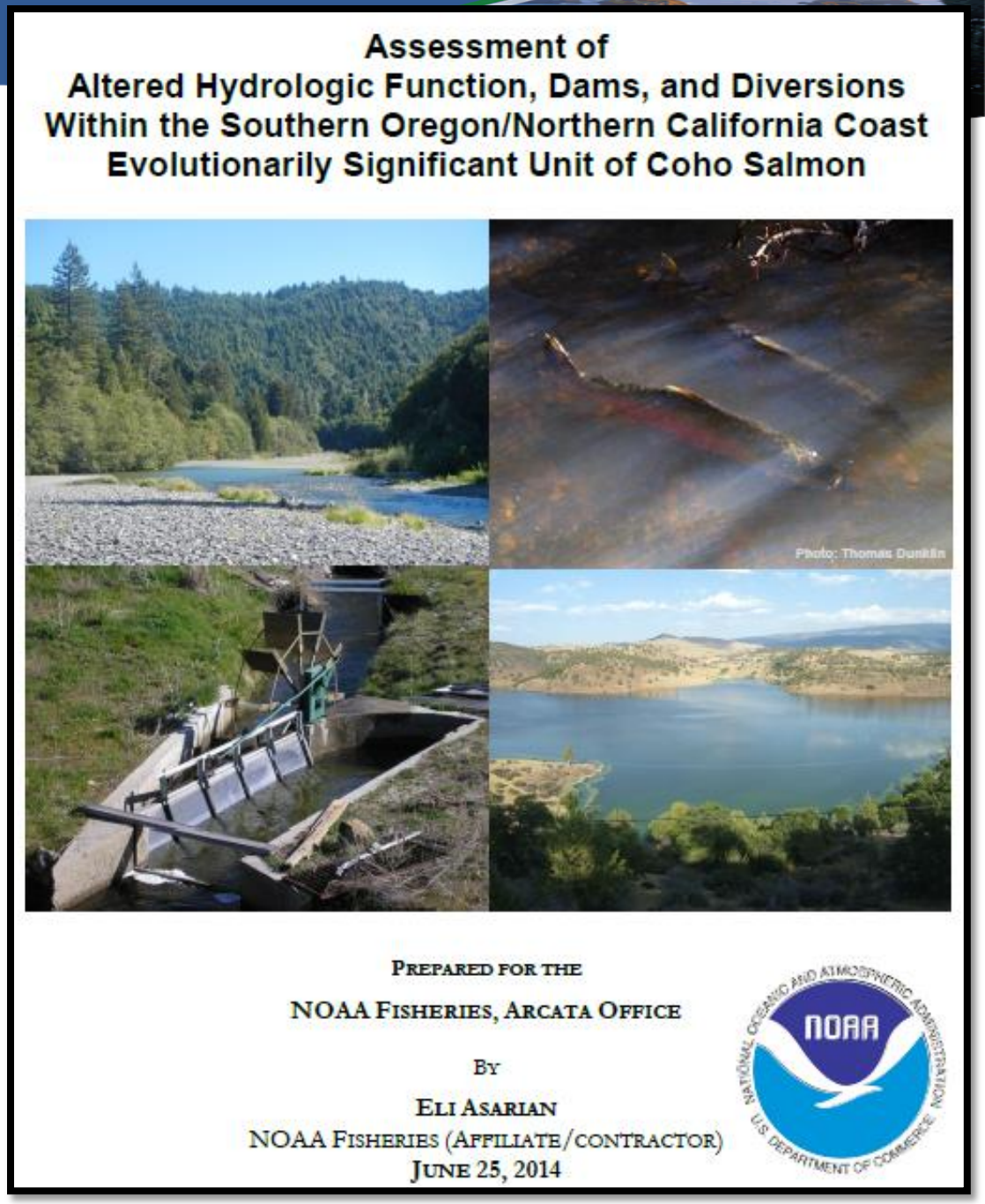
Strategic Direction: Addressing the Impacts of Reduced Surface Water Flows on Water Quality and Beneficial Uses

- An outcome of the staff visioning process
- Consistent with Triennial Review
- Identified by staff as the most pressing water quality issue
- Strong partnerships are recognized as being critical

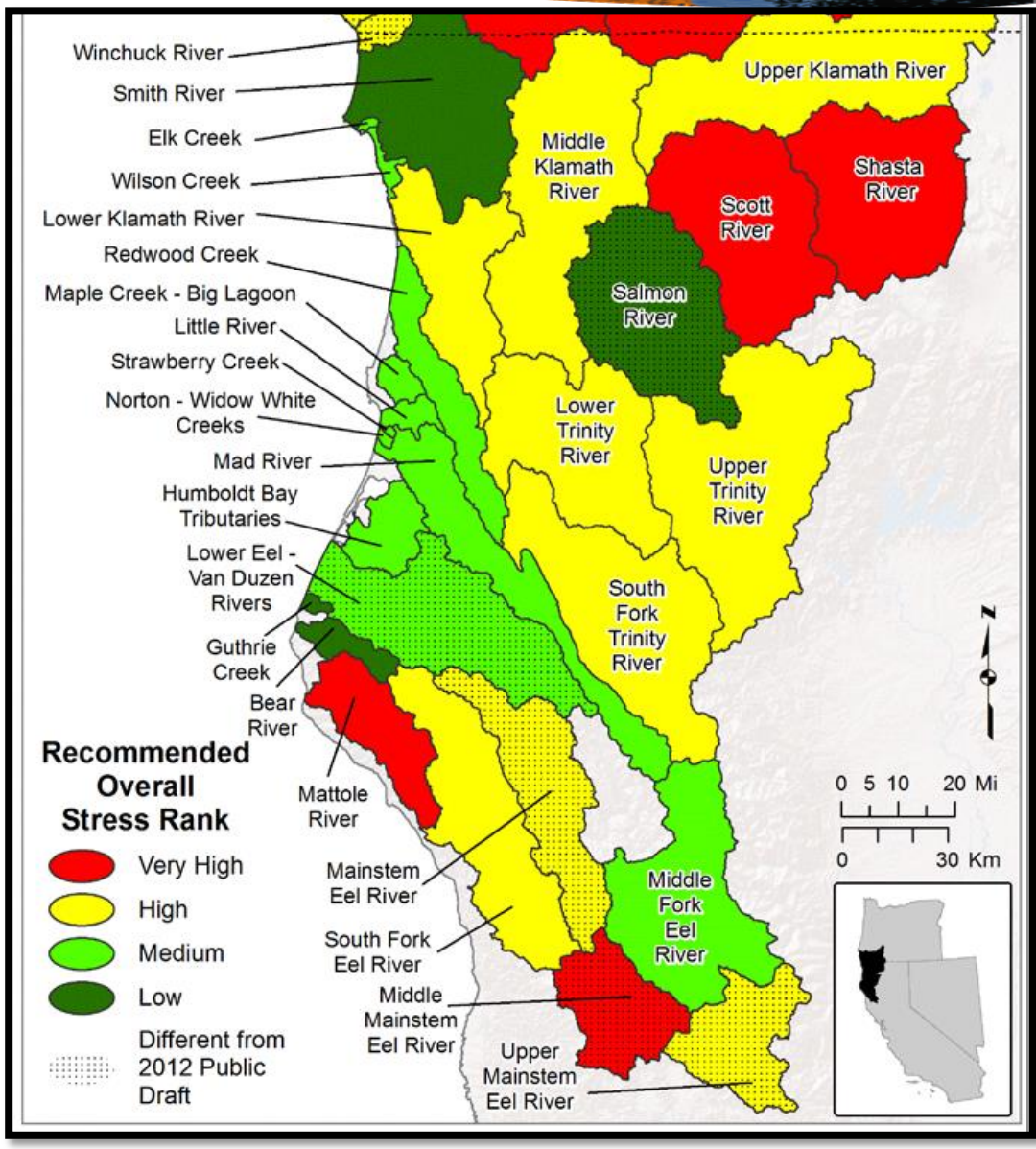
Opportunities to Address Low Flows

- Encourage and streamline recycled water use
- Participate in groundwater management planning efforts
- Leverage partnerships
- Support flow restoration and water conservation projects
- Pursue regulatory mechanisms
  - ✓ Manage storm water as a resource
  - ✓ Consider augmenting streamflow with highly treated waste water
  - ✓ Use permits to promote water conservation
  - ✓ Develop flow objectives, when appropriate

Flow Conditions in the North Coast Region

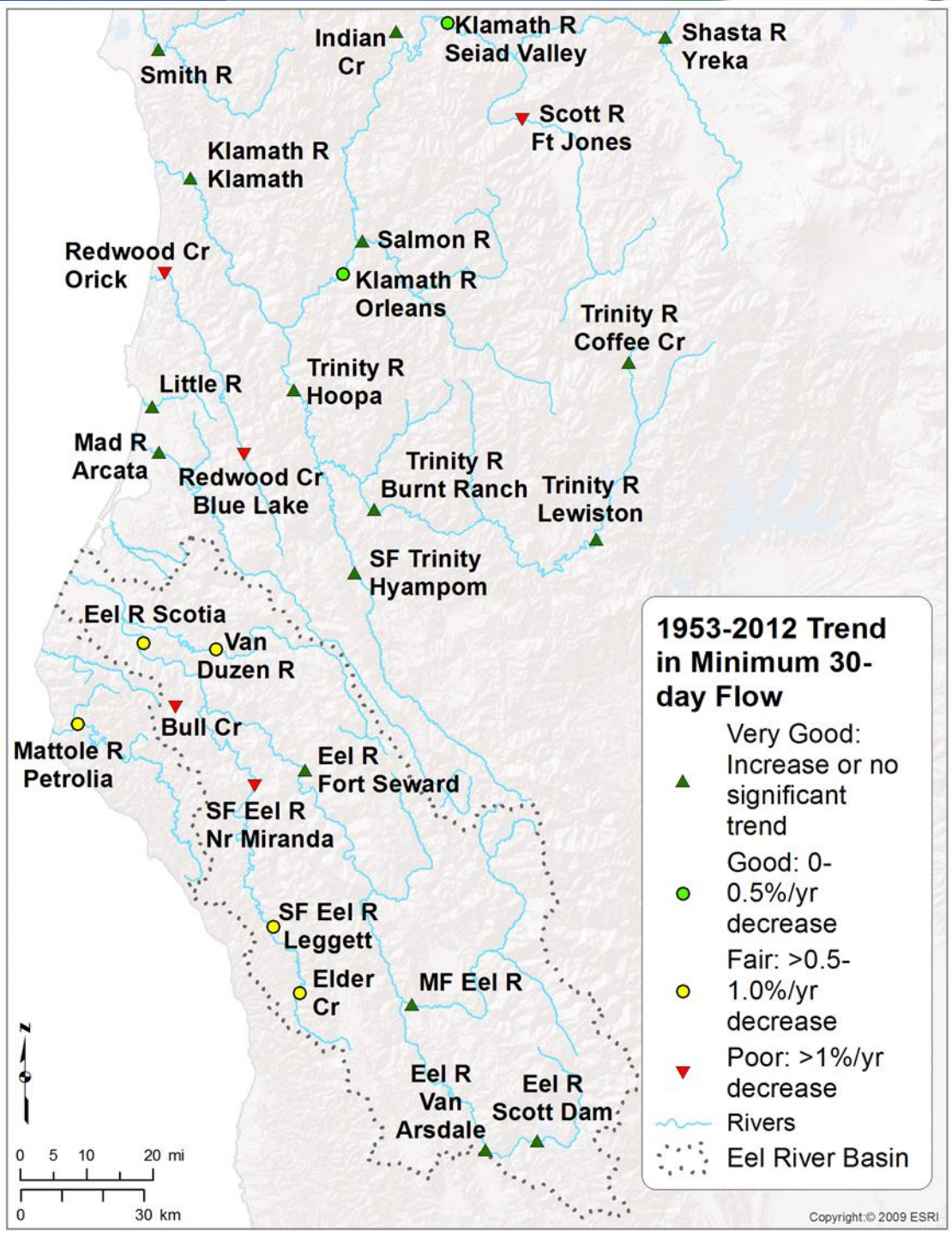


Flow Conditions in the North Coast Region



Source: Asarian, 2014

North Coast low flow trends over the past 60 years



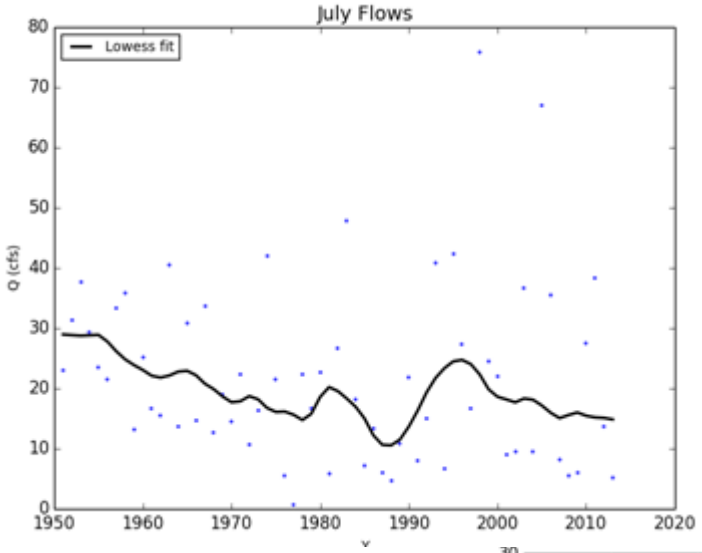
p<0.10; Source: Asarian, 2014

Decreasing Monthly Flow Trends*, 1953-2012

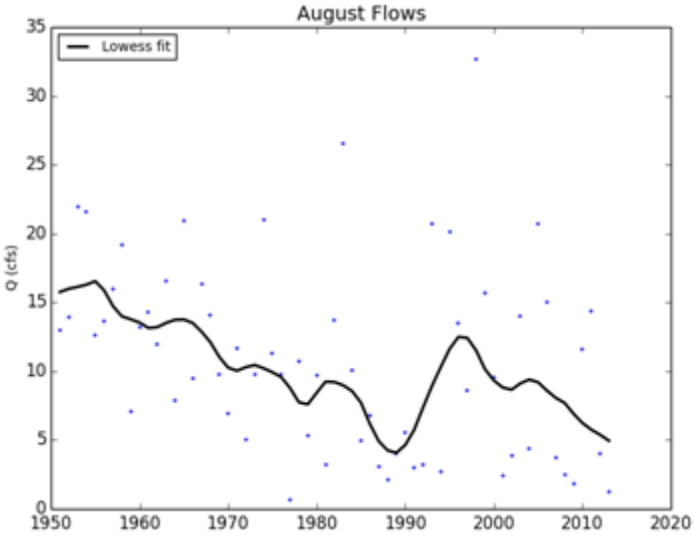
Watershed	Time period
Redwood Creek	August-November
Mattole River	August-September
Lower Eel River	September
Van Duzen River	August- September
SF Eel River	August-September
Bull Creek	August-November
Elder Creek	September
MF Eel	August
Lower Klamath	February
Mid Klamath	February, September-November
Upper Klamath (at Seiad)	Annual
Scott River	February, August-November
Shasta River	Feb., Sept., Nov., Dec.

*Statistically significant at $p<0.05$ Source: Asarian, 2014

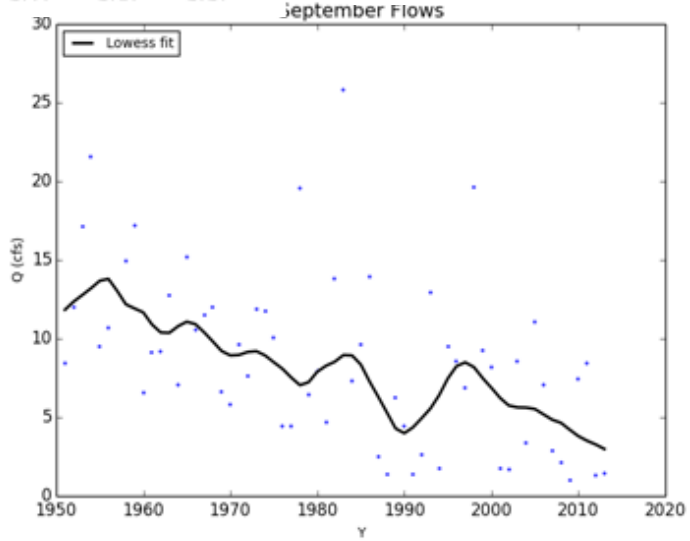
Flow Conditions in the Navarro River



Significant at p=0.107



Significant at p=0.001



Significant at p<0.001

Source: Tetra Tech, 2015

Flow and Related Conditions in the North Coast Region

- Monitored streams changing from perennial to intermittent flows (Eel River Restoration Program)
- Cyanobacteria blooms increasing (Humboldt County Health Dept.)

Efforts to Address Low Flows in the North Coast Region

Storage and Forbearance Efforts:

- Upper Mattole (Sanctuary Forest)
- Salmon Creek (Gold Ridge RCD)
- Wine, Grape, and Dutch Bill Creeks (Russian River Coho Water Resource Partnership)
- South Fork Eel (Salmonid Restoration Federation)
- Navarro (Mendocino RCD & The Nature Conservancy)

Efforts to Address Low Flows in the North Coast Region

Instream Flow Dedications (Wat. Code §1707):

- **Scott River & tributaries (Scott River Water Trust)**
- **Shasta River (The Nature Conservancy, Montague Water Conservation District)**
- **Indian Creek, Trinity River tributary (J. Letton)**
- **Russian River (Beckstoffer Vineyards)**
- **Fall Creek, Klamath tributary (Pacificorp)**

***Mad River, Humboldt Bay Municipal Water District**

North Coast Instream Flow Studies

In progress:

- Scott River (CDFW)
- Shasta River (CDFW)
- Sproul Creek (Cal Trout)
- Navarro River (NCRWQCB)

Previously completed:

- Shasta Canyon (McBain & Trush and HSU, 2014)
- Big Springs (McBain & Trush and HSU, 2012)
- Upper Mattole (McBain & Trush, 2012)
- Trinity River (USFWS & Hoopa Valley Tribe, 1999)
- Klamath River (Utah State University, 2001)

Presenters

Background

Instream Flows and the Legal Nexus Between Water Quality and Quantity
Samantha Olson, SWRCB Office of Chief Counsel

Consideration of Flow in the Water Quality Regulation: Opportunities and Hurdles
Vicky Whitney, SWRCB Division of Water Quality

Flow Criteria

Quantifying Flow Criteria for Fish and Wildlife and Their Habitats
Robert Holmes, CDFW Instream Flow Coordinator

Method to Develop Flow Criteria for Priority Tributaries
Dan Schultz, SWRCB Division of Water Rights

Development of a Regionally Appropriate Flow Criteria Methodology
Darren Mierau, Cal Trout

Additional Remarks

Steve Moore, SWRCB Board Member

Matt St. John, NCRWQCB Executive Officer

Presenters

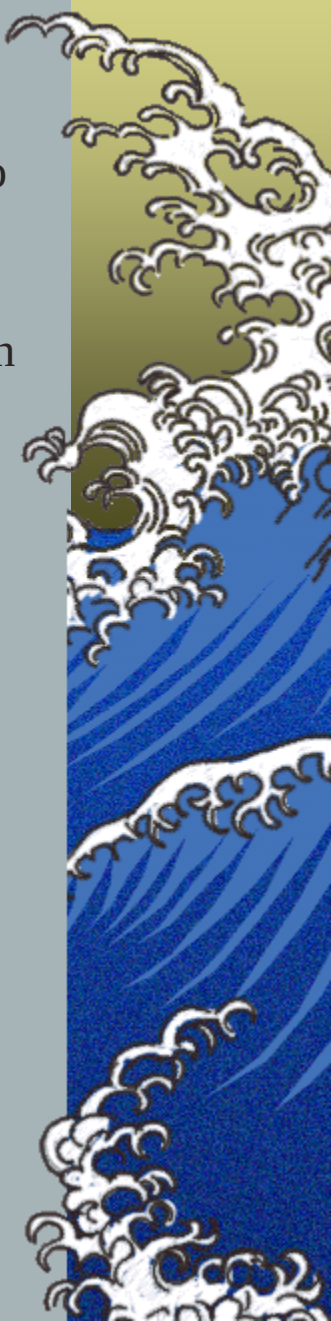
Samantha K. Olson
Senior Staff Counsel
North Coast Regional Water Quality Control Board

Instream Flows and the Legal Nexus between Water Quality and Quantity

Samantha K. Olson, Senior Staff Counsel
North Coast Regional Water Quality Control Board

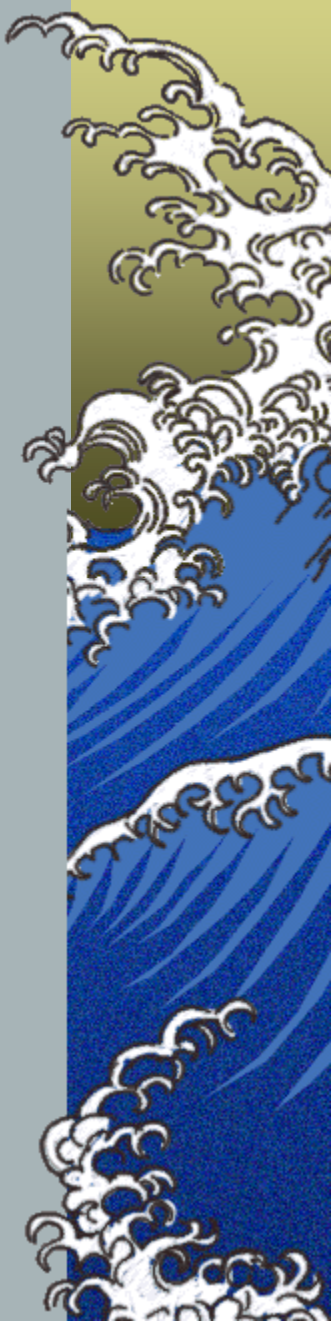
Administration

- 1967: State Water Rights Board and State Water Quality Board combined into one body, the State Water Resources Control Board (SWRCB)
- 1969: Porter-Cologne Water Quality Control Act adopted (Water Code section 13000 *et seq*.)
- Water quality control system administered by nine regional water boards coordinated by a state board
- State Water Board:
  - Water rights jurisdiction
  - Authority to set state policy for water quality control
    - Binding on Regional Boards
    - Appellate body
- Regional Water Boards:
  - Authority over water quality in its region
  - Regulations (basin plans), discharge permits, enforcement

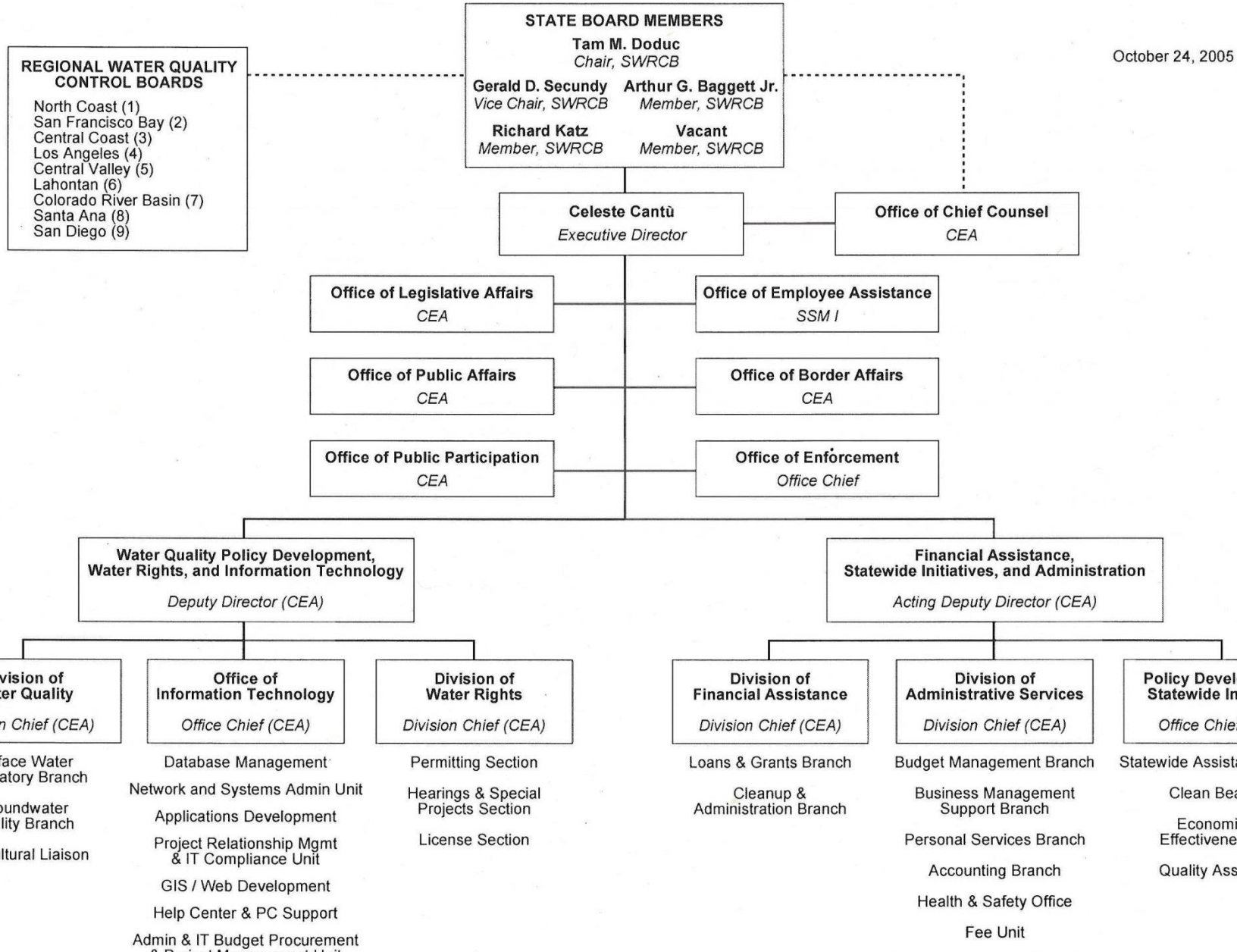


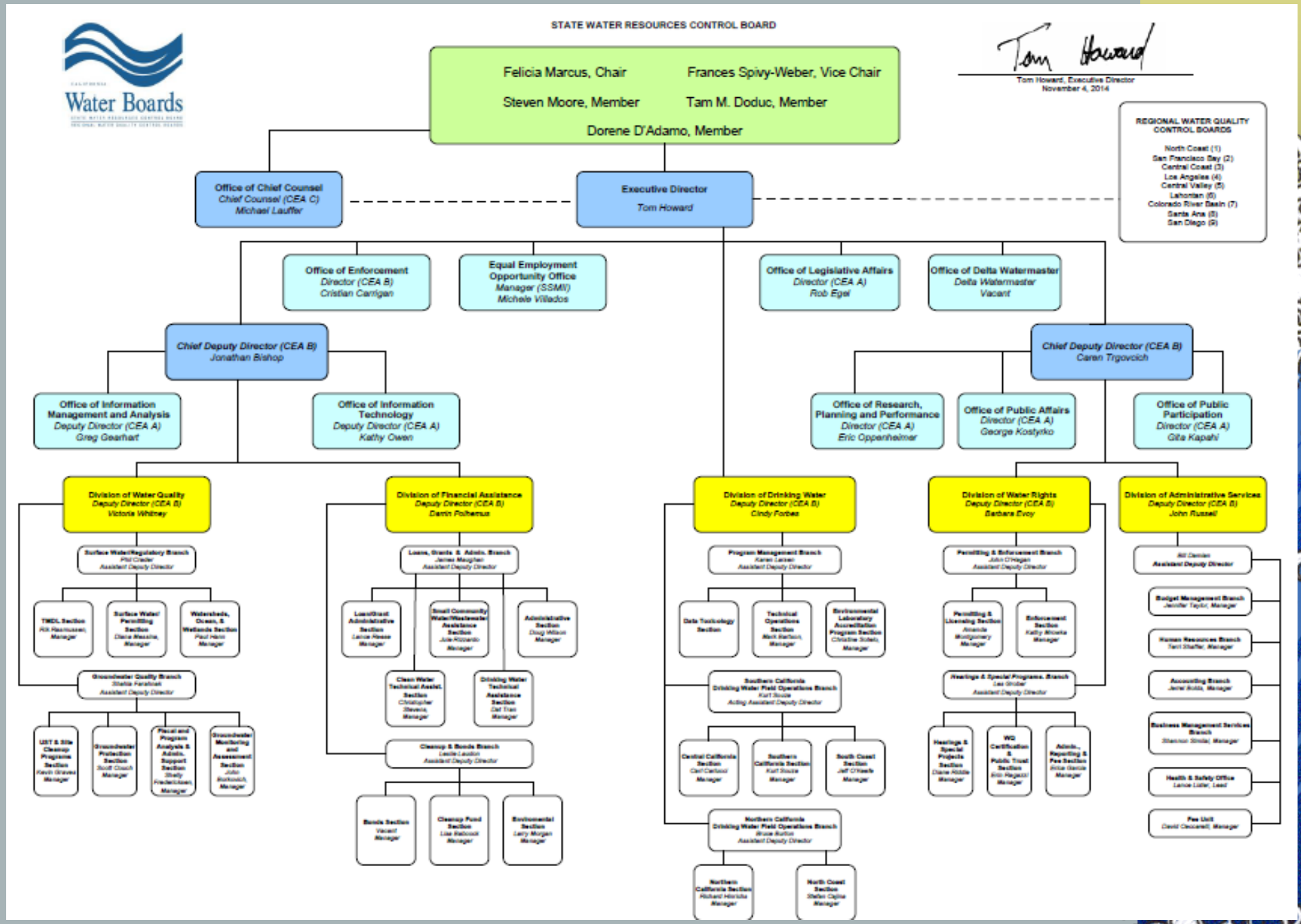
Quality/Quantity

- Lack of water is a form of pollution, a term defined by the Clean Water Act as the "man-induced alteration of the chemical, physical, biological, and radiological integrity of water." Water quality includes water quantity and no artificial distinction can be made between them.
- California combines water rights and water quality functions of the state government into one agency for this very reason. Jurisdiction over the administration of water rights lies with the Division of Water Rights and the State Water Board, however, the Regional Water Board may address low flows in its Basin Plan for the Division of Water Rights' and State Water Board's consideration.



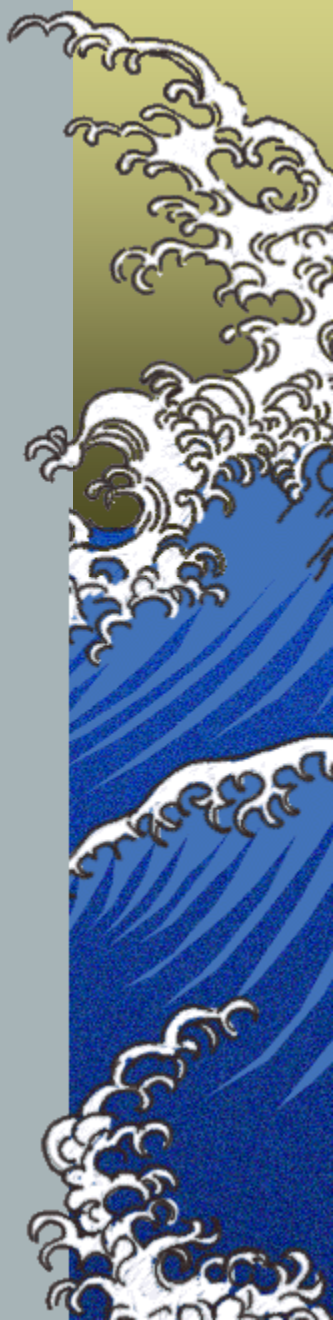
STATE WATER RESOURCES CONTROL BOARD



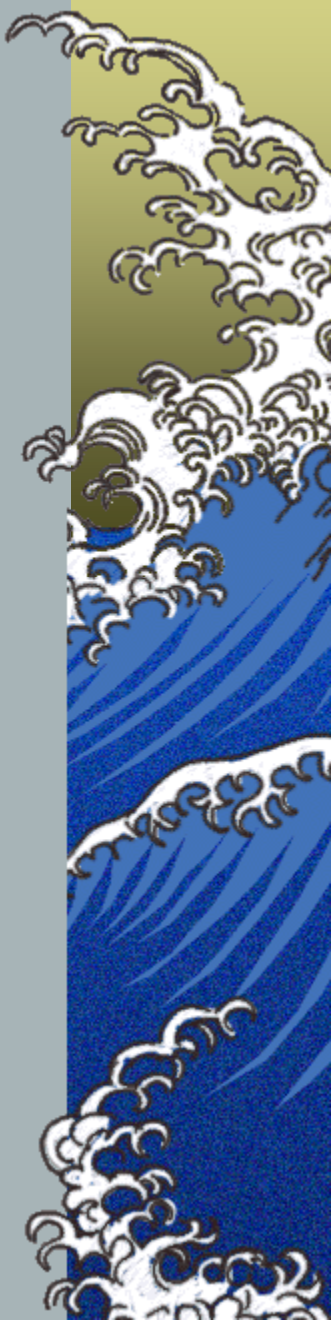

STATE WATER RESOURCES CONTROL BOARD
Water Boards
Felicia Marcus, Chair
Frances Spivy-Weber, Vice Chair
Steven Moore, Member
Tam M. Doduc, Member
Dorene D'Adamo, Member
Tom Howard
Tom Howard, Executive Director
November 4, 2014
REGIONAL WATER QUALITY CONTROL BOARDS
North Coast (1)
San Francisco Bay (2)
Central Coast (3)
Los Angeles (4)
Central Valley (5)
Lahontan (6)
Colorado River Basin (7)
Santa Ana (8)
San Diego (9)
Office of Chief Counsel
Chief Counsel (CEA C)
Michael Lauffer
Executive Director
Tom Howard
Office of Enforcement
Director (CEA B)
Cristian Carrigan
Equal Employment Opportunity Office
Manager (SSM I)
Michele Villados
Office of Legislative Affairs
Director (CEA A)
Rob Egel
Office of Delta Watermaster
Delta Watermaster
Vacant
Chief Deputy Director (CEA B)
Jonathan Bishop
Chief Deputy Director (CEA B)
Caren Trgovcich
Office of Information Management and Analysis
Deputy Director (CEA A)
Greg Gearhart
Office of Information Technology
Deputy Director (CEA A)
Kathy Owen
Office of Research, Planning and Performance
Director (CEA A)
Eric Oppenheimer
Office of Public Affairs
Director (CEA A)
George Kostyrko
Office of Public Participation
Director (CEA A)
Gita Kapahi
Division of Water Quality
Deputy Director (CEA B)
Victoria Whitney
Division of Financial Assistance
Deputy Director (CEA B)
Darrin Polhemus
Division of Drinking Water
Deputy Director (CEA B)
Cindy Forbes
Division of Water Rights
Deputy Director (CEA B)
Barbara Evoy
Division of Administrative Services
Deputy Director (CEA B)
John Russell

Types of Water Rights

- *Appropriative*
  - *Pre-1914*
  - *Post-1914*
- *Riparian*
- *Percolating Groundwater*
- *Federal Reserved Rights*
- *Unauthorized Use*

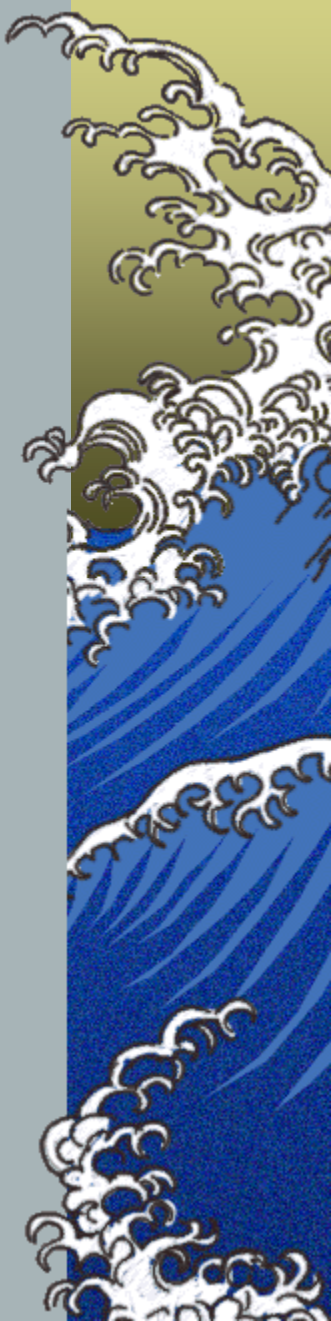


- *In California, water rights law is administered by the Division of Water Rights under the State Water Resources Control Board. The SWRCB is the only agency with authority to administer water rights in California. Local governments, water districts, DFW and the RWQCB do not administer water rights. The State Water Board shares the authority to enforce water right laws with the state courts.*



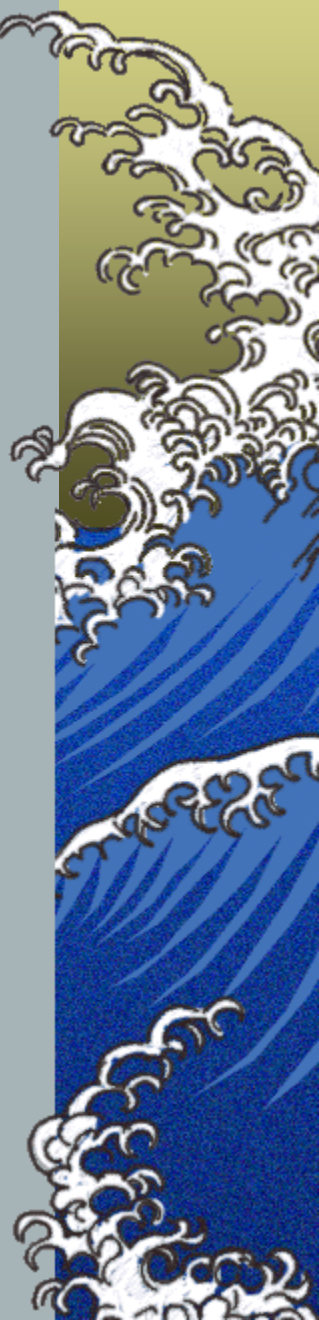
Division of Water Rights Jurisdiction

- Permits after 1914
  - New Applications
  - Change Petitions
  - Reopeners
- FERC 401 Certifications
- Public Trust Doctrine
- Waste and Unreasonable Use
- Statutory adjudications/court reference
- Enforcement



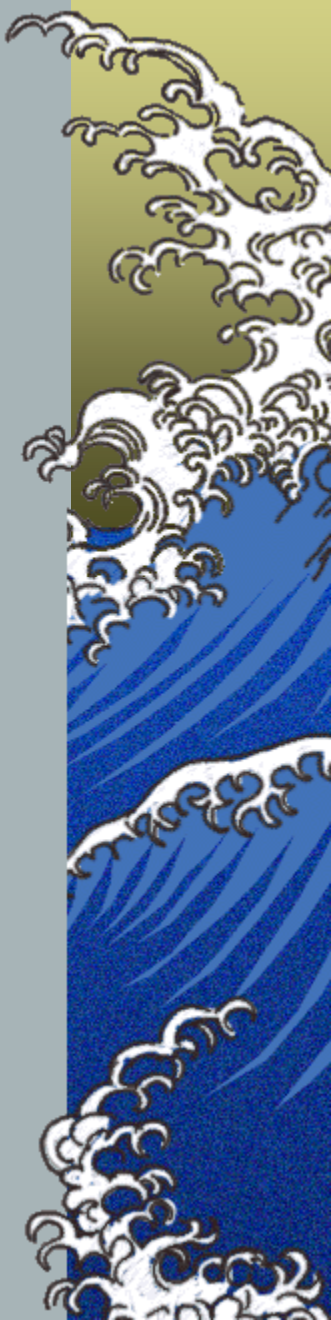
SWRCB Policy, Regulation and Planning

- *Water Code section 13140 (Policy)*
  - *AB2121-North Coast Instream Flow Policy*
- *Water Code section 1058 (Regulation)*
  - *Frost Protection Regs*
  - *Emergency Drought Regs*
- *Water Code section 13170 (Planning)*
  - *Bay/Delta*

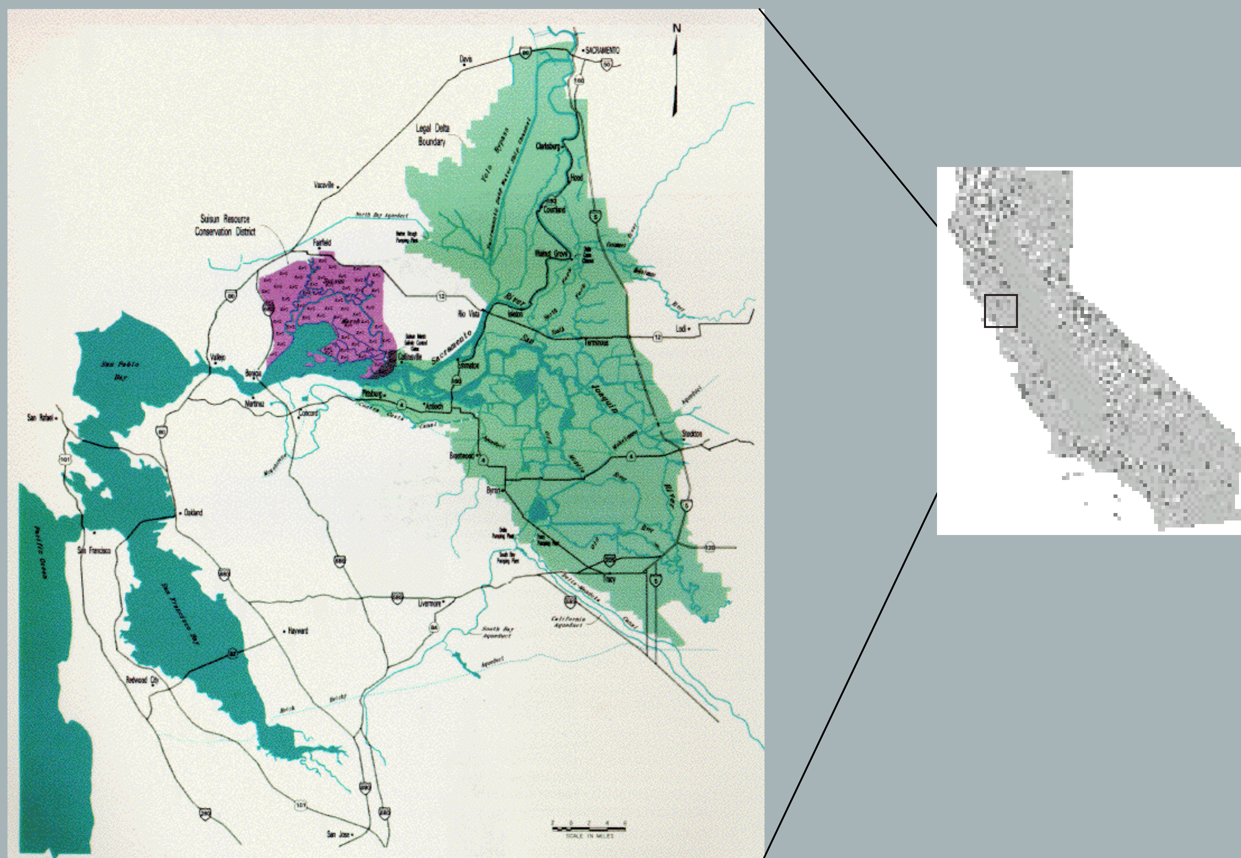


Porter-Cologne Basin Plan

- Water quality control plans for each region
- Establish Water Quality Standards
  - Beneficial uses
  - Water quality objectives
  - Antidegradation
- Program of Implementation



Bay/Delta

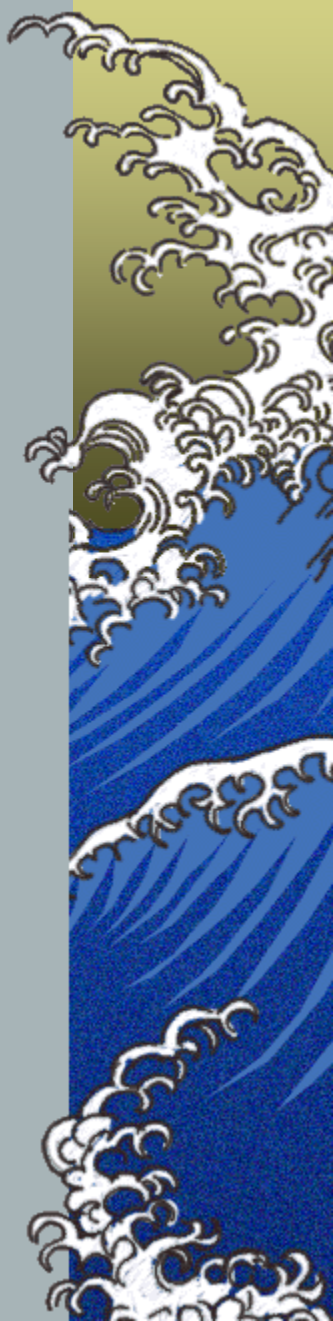

N
SACRAMENTO
Davis
Legal Delta Boundary
Vacaville
Suisun Resource Conservation District
North Bay Aqueduct
Fairfield
Clarksburg
Hood
Courtland
Walnut Grove
Rio Vista
Isleton
Lodi
Terminous
Collinsville
Vallejo
Benicia
Martinez
Concord
Pittsburg
Antioch
Sacramento River
San Joaquin
Yolo Bypass

terminology

- "Flow-dependent objectives"—all objectives that could be met by the flow of water or by changes in the operations of [diversion] facilities, notwithstanding that such objectives also could be met entirely or partially through other means, such as management measures and waste discharge requirements.

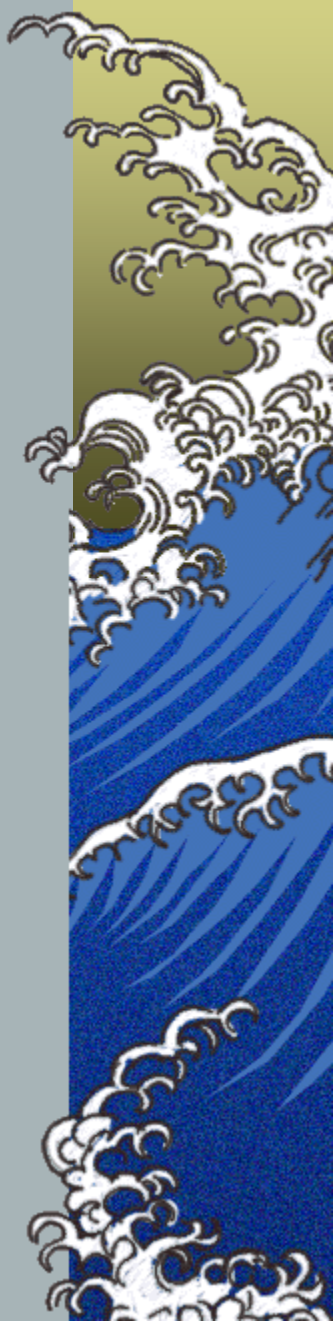
- "Flow objective"—water quality based objective based on the amount of water (measured in cfs) flowing in a watercourse at a given time.

- "Flow criteria" – technical assessment.



1995: SWRCB adopts the Bay-Delta Water Quality Control Plan

- Objectives
  - Salinity objectives
  - Delta outflow objective
  - Vernalis flow objectives (minimum monthly average flow rates, and a "pulse" flow)
  - Narrative salmon doubling objective
- Implementation
  - "Initiate a water rights proceeding to address the water-supply-related objectives through the amendment of water rights…. The water right decision will allocate responsibility for meeting objectives among water right holders…and establish terms and conditions in appropriate water rights."



1999: SWRCB adopts Decision 1641

- Allocated responsibility to meet flow-dependent water quality objectives among the various water right holders.

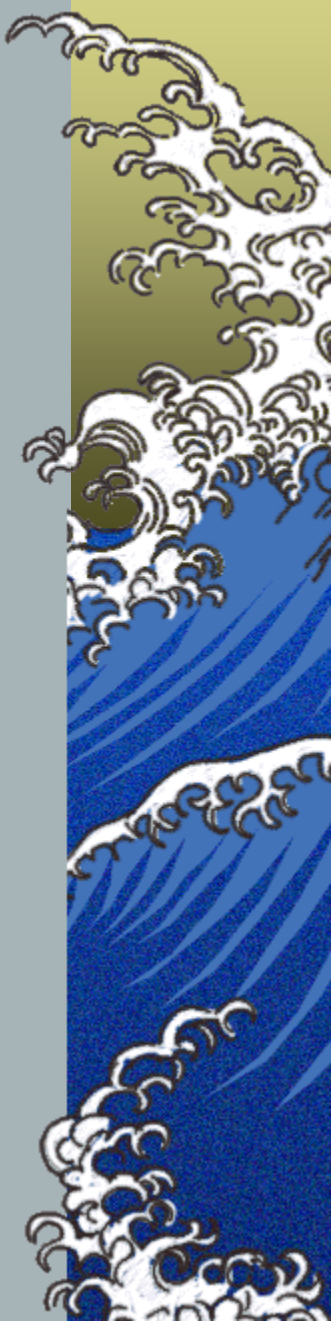
- Implements the 1995 WQCP, with certain exceptions:

  - Implements the Vernalis Adaptive Management Plan (study of effects of flow and pumping on juvenile chinook salmon) during April/May instead of Vernalis pulse flow.

  - FN 5: Ag. Salinity objective from .7 to 1.0 EC if permanent barriers constructed.

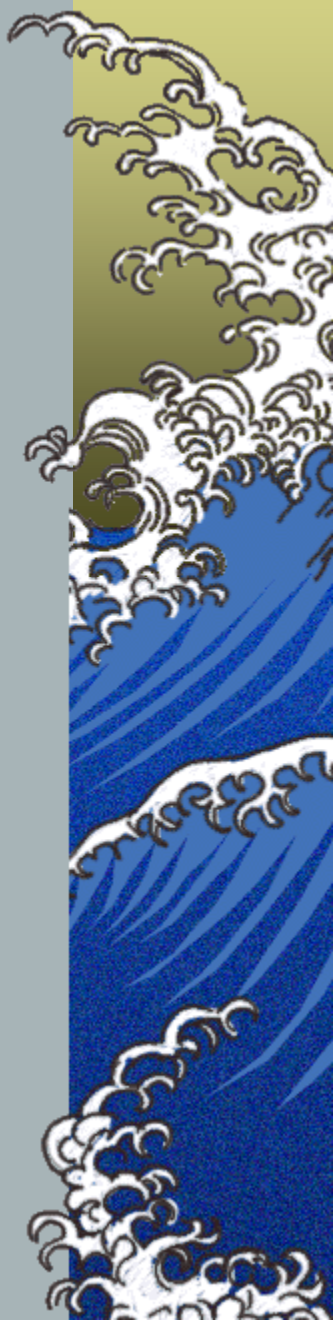
Third Appellate District review of D1641 (Judge Ron Robie)

- SWRCB not entitled to implement alternate flows agreed to by interested parties in lieu of flow objectives actually provided for in 1995 WQCP.
- SWRCB failed to fully implement certain salinity objectives in the 1995 WQCP.
- SWRCB failed to implement minimum flows necessary to achieve the narrative objective for salmon protection in the 1995 WQCP.



Bay/Delta Plan Update

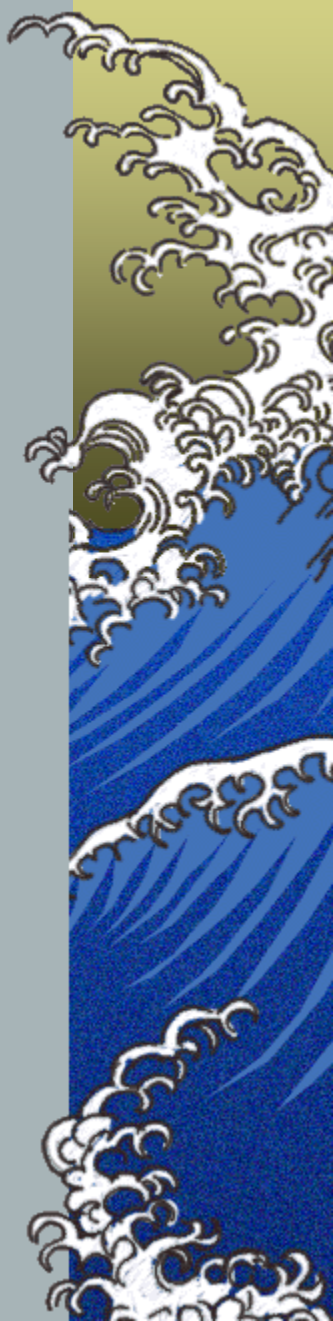
- *Phased Approach:*
  - *Phase 1 - San Joaquin River flows and Southern Delta salinity*
  - *Phase 2 – Other Updates*
  - *Phase 3 – Implementation of Phase 1 & 2*
  - *Phase 4 - developing and implementing flow objectives for priority tributaries*
- *Phase 4:*
  - *Propose to develop separate policies for water quality control for each tributary*
  - *Will develop flow criteria to protect beneficial use*
  - *Flow criteria will be used to develop flow objectives*



Points of authority for considering the Basin Plan in water right proceedings:

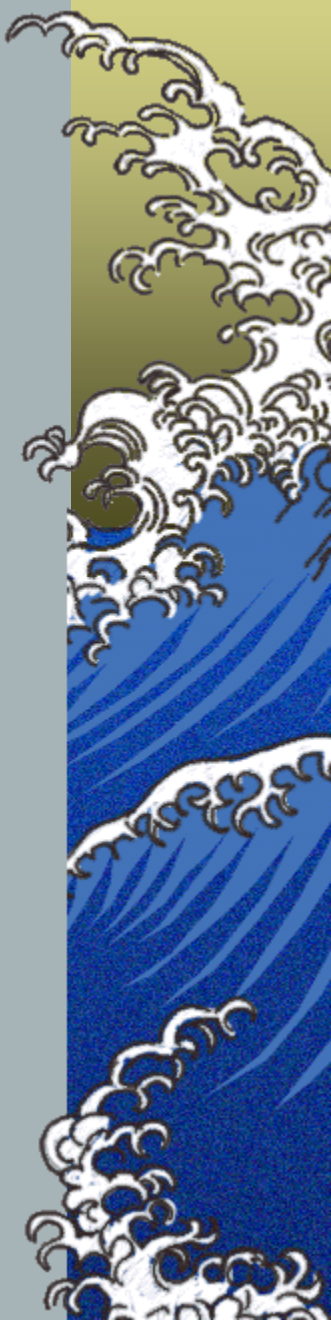
- Water Code section 13247 provides: "State offices, departments, and boards, in carrying out activities which may affect water quality, shall comply with water quality control plans approved or adopted by the state board unless otherwise directed or authorized by statute, in which case they shall indicate to the regional board in writing their authority for not complying with such plans."

- Water Code section 1258 provides: "In acting upon applications to appropriate water, the board shall consider water quality control plans…and may subject such appropriations to such terms and conditions as it finds are necessary to carry out such plans."



Points of authority for considering flows in Basin Plan:

- "Water Quality Control" means the regulation **of any activity or factor** which may affect the quality of the waters of the state…." (Wat. Code, §13050(i).)
- **Lack of water is a form of pollution**, a term defined by the Clean Water Act as the "man-induced alteration of the chemical, physical, biological, and radiological integrity of water." Water quality includes water quantity and no artificial distinction can be made between them. *(PUD #1 of Jefferson County v, Wash. Dep't of Ecology* (1994) 511 U.S 700.)
- Regional Board shall establish objectives to ensure the reasonable protection of beneficial uses and prevent nuisance. Consider WQ conditions that could be reasonably achieved through the **coordinated control of all factors which affect water quality** in the area. (Wat. Code, §13241.)
- Regional duty to consider the effect of its actions on the California Water Plan or other coordinated governmental plan looking toward the development, utilization or conservation of the water resources of the state. Wat. Code, §13225, subd. (i).)

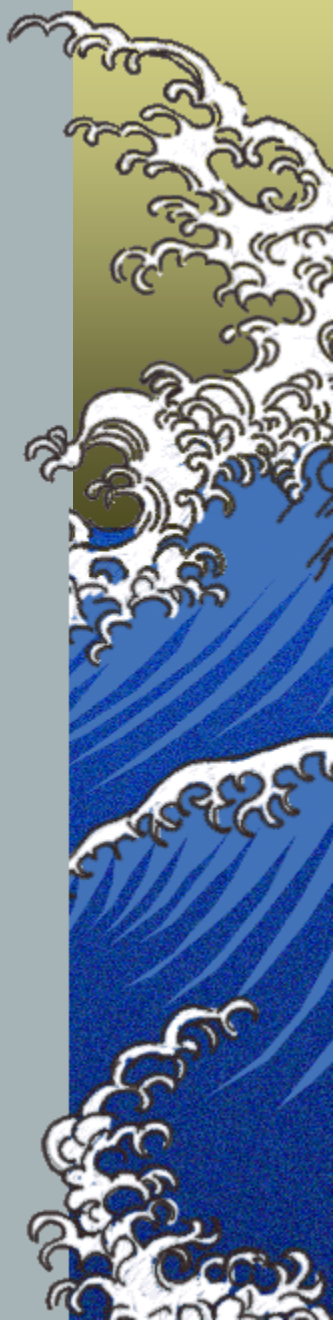


Policy Reasons for Considering Flows in Basin Plan:

- *Water quality determinations are inherently flow-related—(ppm)*
- *Law is comprehensive*
- *May be no other way to achieve objectives*
- *Fairness*

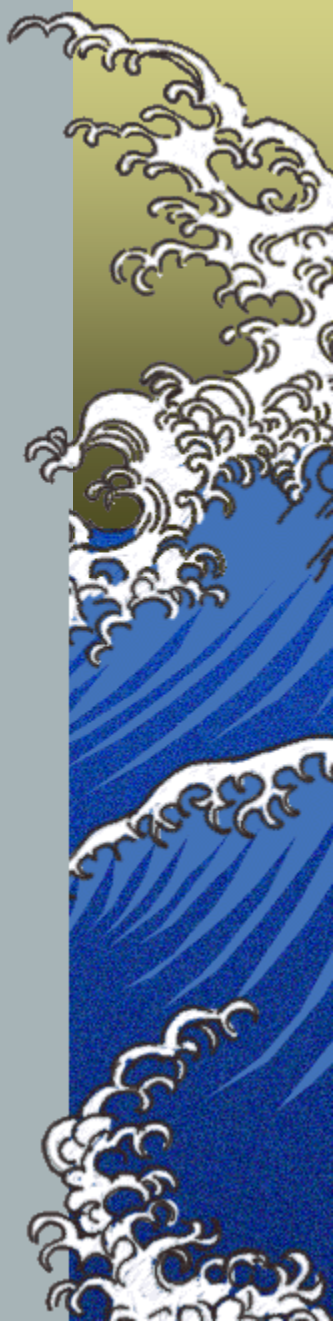
Procedural Reasons for Considering Flows in Basin Plan:

- *Develop flow criteria/objectives in separate process from WR implementation*
- *Standard of Review*
- *Reduce the Number of Issues in WR Hearing*



Regional Board Implementation—Discharge Dependent

- *Report of Waste Discharge: "Any person discharging waste, or proposing to discharge waste…."*
- *Waste Discharge Requirements (WDRs), Waiver of WDRs, and Prohibition*
- *Water Quality Certification*
- *Investigation of Water Quality*
- *Clean Up and Abatement and other Enforcement Orders*

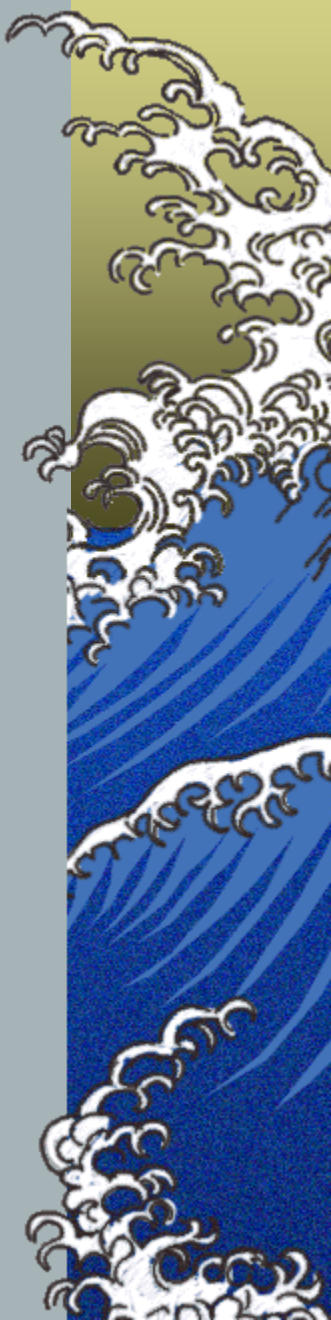


Discharge from a Dam

- *Lake Madrone-Clean Up Order (discharge of sediment from tailrace includes in definition of "waste")*

- *"Waste includes sewage and any and all other waste substances, liquid, solid, gaseous, or radioactive, associated with human habitation, or from any producing , manufacturing, or processing operation…."*

- *Discharge means "to relieve of a charge, load, or burden. Pour forth, EMIT." This is consistent with Legislatures directive that "water quality control" means "the regulation of any activity or factor which may affect the quality of the waters of the state."*

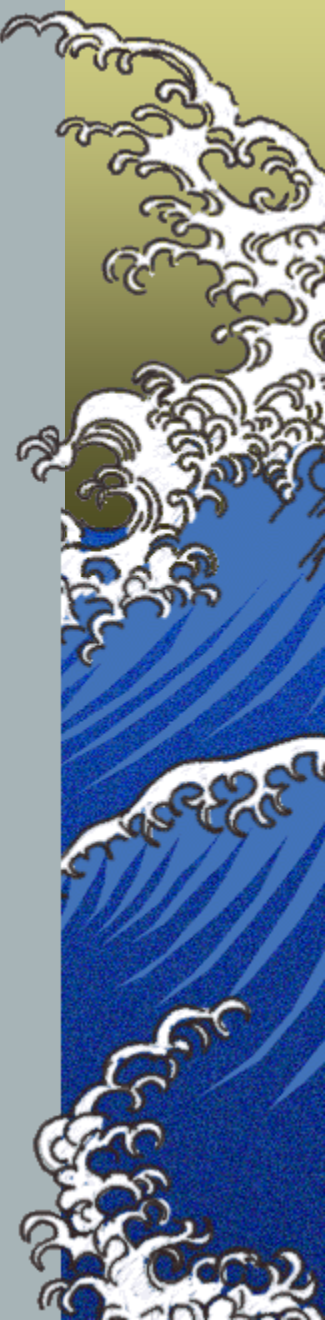


Shasta Dam

- *Regional Board Order*
- *State Board asserts jurisdiction*
- *Order No. WQ 89-18*

Regional Water Board Efforts

- ***Temp Policy-****Identifies activities with the potential to reduce instream flows or reduce sources of cold water, including cold water refugia as a factor to attain and maintain temperature objective.*
- ***Klamath TMDL***
  - *Compliance Lens-Load Allocation to be implemented in FERC certification*
- ***Shasta TMDL***
  - *Flow recommendations*
  - *Tailwater Management*



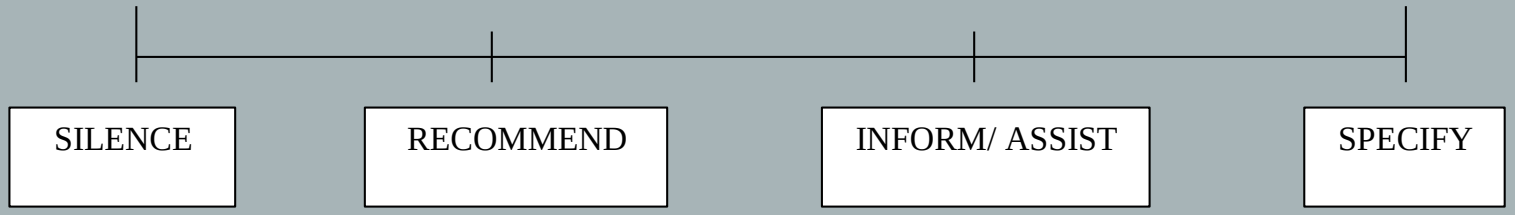
Shasta TMDL Flow Recommendation

- ***Water Diverter(s) Actions:***

  *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 in relation to the **45 cfs goal** or alternative flow regime that achieves the same temperature reductions **from May 15 to October 15**.*

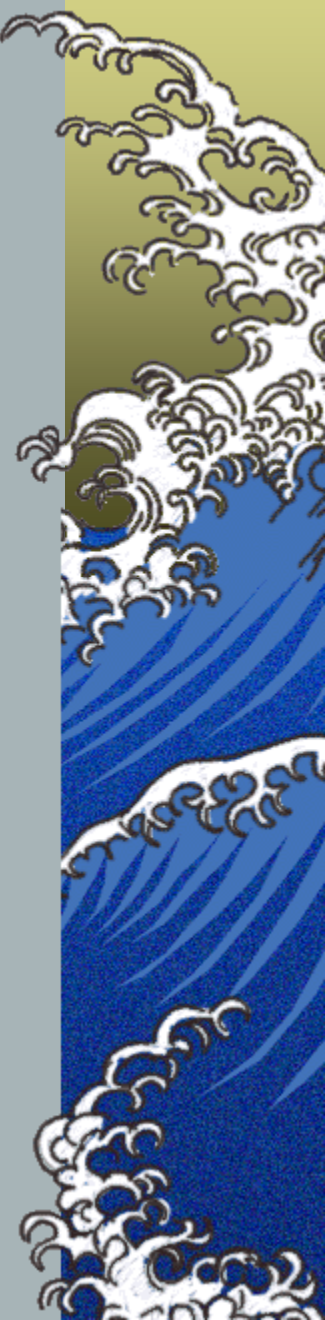
- ***State Water Board Actions:*** *If after five years, the Regional Water Board's Executive Officer finds that the above-measures have failed to be implemented or are otherwise ineffective, the Regional Water Board may recommend that the State Water Board consider seeking modifications to the decree (In re Waters of Shasta River and its Tributaries, No. 7035 (Super. Ct. Siskiyou County Dec.29, 1932)), conducting proceedings under the public trust doctrine, and/or conducting proceedings under the waste and unreasonable use provisions of the California Constitution and the California Water Code.*

Range of Force and Effect of Flow Criteria or Objectives



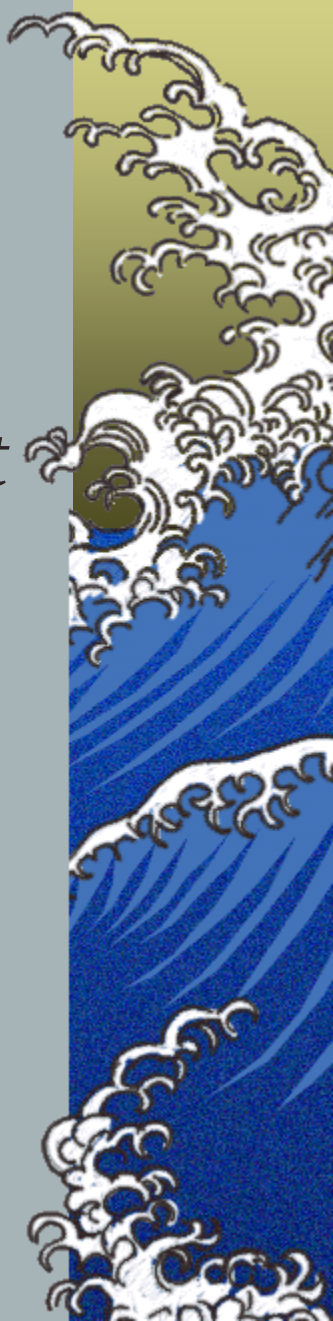
Shasta TMDL Flow Recommendation

- *Allows flexibility for other flow measures that will achieve temperature reductions*
- *All water users contribute to low flow problems and therefore should participate in solutions, not just those subject to the decree*
- *Collaborative nature of the programs will allow for more efficient results without procedural burdens.*
- *Allows parties to generate and implement the solution in a more creative way, assuming that parties take advantage of the opportunity*



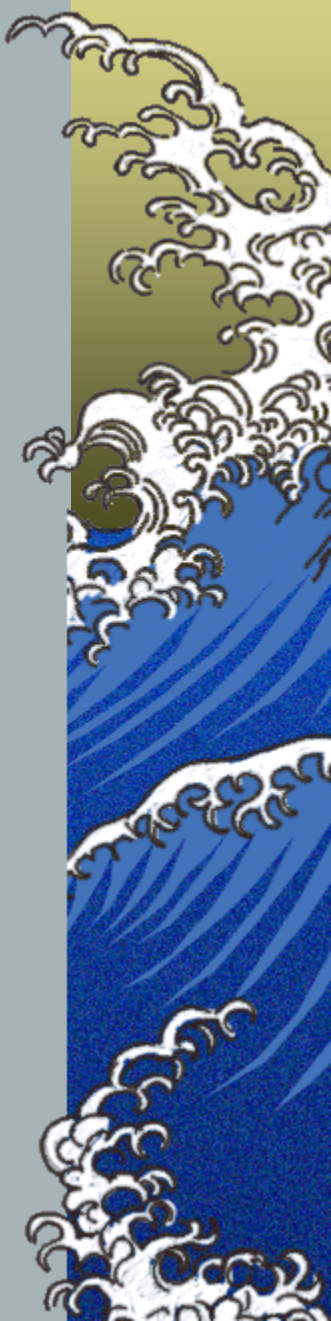
Shasta TMDL Flow Recommendation Disclaimer

- *This recommended flow measure does not alter or reallocate water rights in the Shasta River watershed, nor bind the State Water Board, Division of Water Rights in any water right decision.*



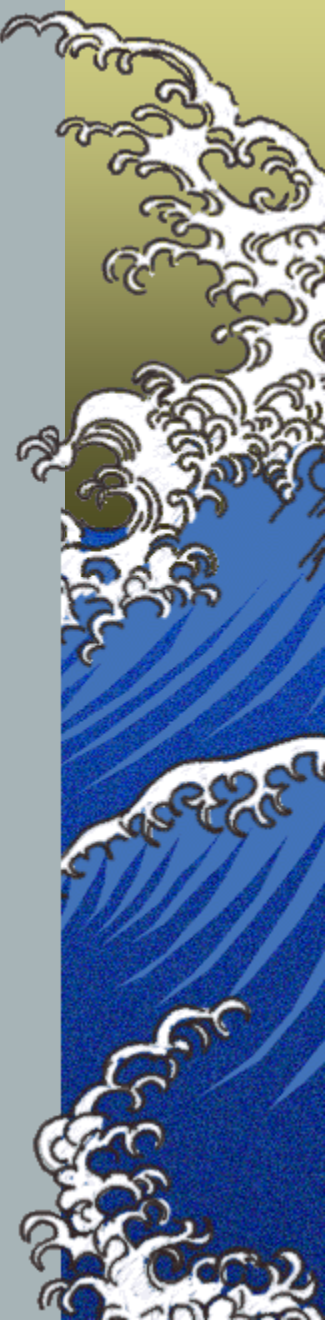
Promulgating Flow Objectives

- *EPA/Clean Water Act § 101(g)*
- *Water Quality aligns with Public Trust and Waste and Unreasonable Use*
- *Program of Implementation*
  - *Actions necessary to achieve objectives, including recommendations for appropriate action by any entity, public or private;*
  - *Time schedule;*
  - *Monitoring to determine compliance.*



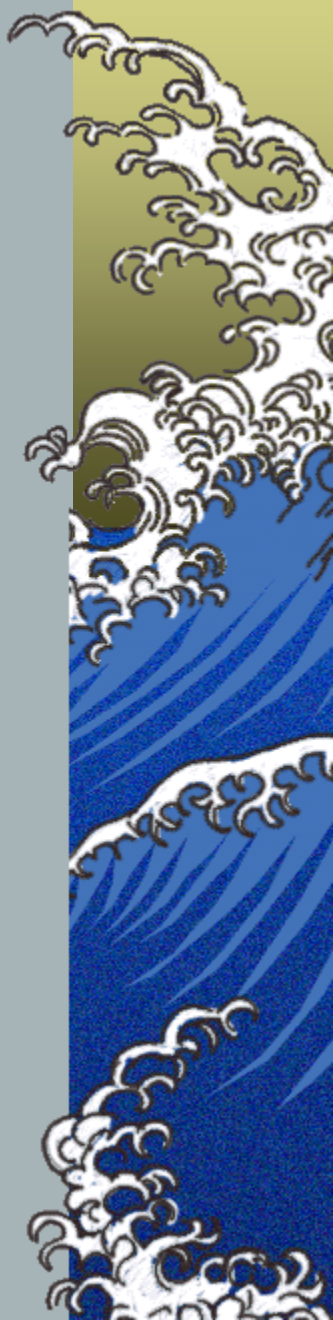
Implementing Flow Objectives

- *Do Nothing (not an option if other measures will not achieve compliance)*
- *Recommendation to State Water Board (without flow number)*
- *Recommendation to State Water Board (with flow number)*
- *Incentive Based--Link to discharge prohibition/waiver/WDR (invites pollution trading)*
- *Direction to State Water Board to hold a water right hearing*



Factors to Consider

- *Comity*
- *Practicality*
- *Division of Water Rights' needs*
- *Ability of Flows to Help*



Victoria Whitney, PE
Deputy Director for Water Quality

Consideration of Flow in Water Quality Regulation: Opportunities and Hurdles

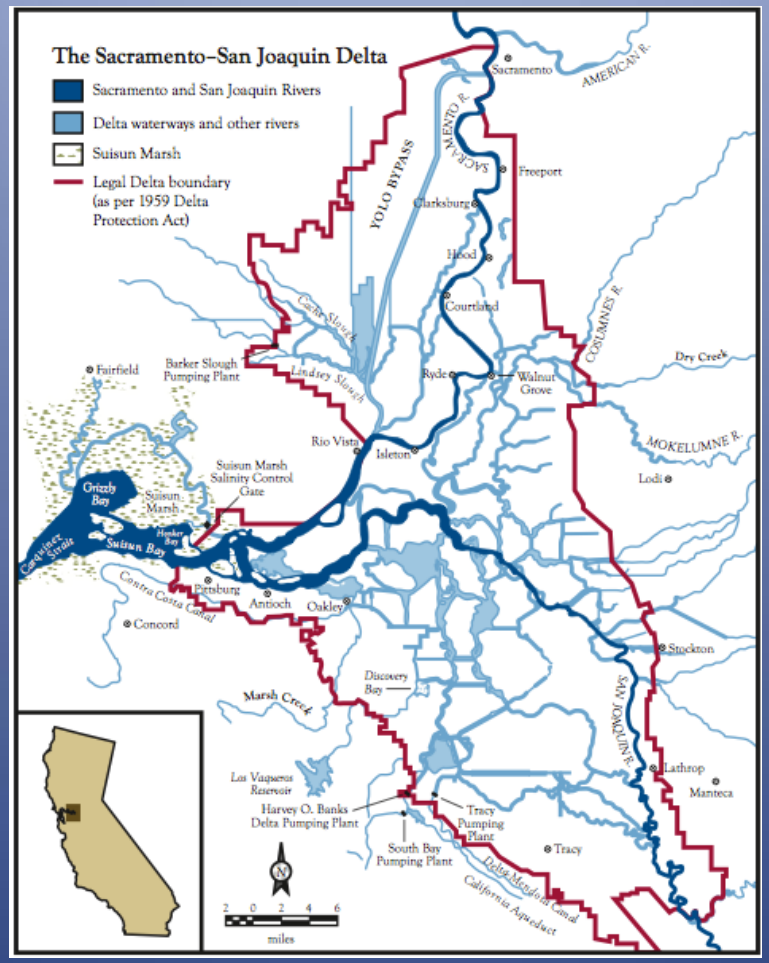
Victoria Whitney, PE
Deputy Director for Water Quality
State Water Resources Control Board

Victoria Whitney, PE
Deputy Director for Water Quality

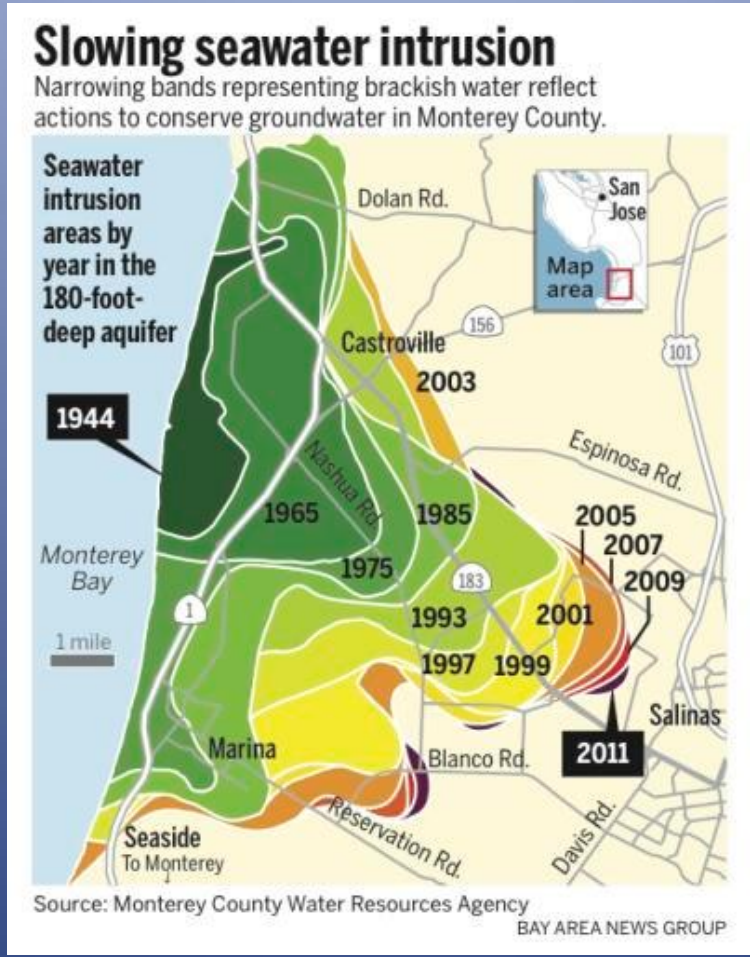
- 1982-1984: Staff Engineer-Colorado River Regional Water Quality Control Board
- 1984-2010: Division of Water Rights
  - 1984-1989: Staff Engineer (Complaints)
  - 1989-1995: Senior Engineer (WR Adjudications and Water Right Adjudicatory Hearings)
  - 1995-2002: Senior/Supervising Engineer (Bay-Delta Program)
- 2002-2003: Principal Engineer/Assistant Division Chief, Water Rights
- 2003-2010: Deputy Director for Water Rights
- 2010-present: Deputy Director for Water Quality

- 1985-present: Married to Assistant Executive Officer, Central Valley Regional Water Quality Control Board.

Practical Reasons for Including flows in Basin Plans



Practical Reasons for Including flows in Basin Plans

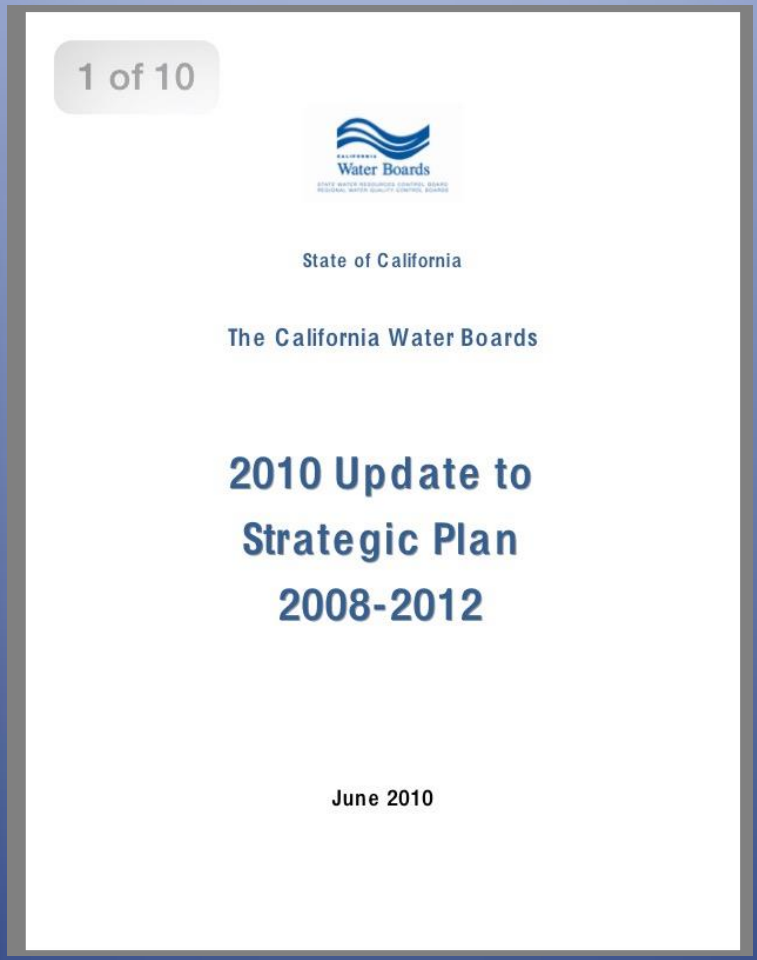


Practical Reasons for Including flows in Basin Plans

Practical Reasons for including flows in Basin Plans

- California v other states
  - Public Trust Doctrine
  - Integrated Water Management Planning

State Water Board's Strategic Plan



http://www.waterboards.ca.gov/water_issues/hot_topics/strategic_plan/docs/final_draft_strategic_plan_update_090208.pdf

“Long Range Approaches to Managing the Problem”

- Address point source discharges.
- Develop a standard, comprehensive TMDL implementation plan with stakeholder involvement that simplifies overlapping strategies for multiple pollutants…
- Address non-point source discharges.
- “In instances where actions to control point and non-point sources of pollution fail to result in achieving water quality standards due to insufficient assimilative capacity of the water body, the State Water Board will consider whether it is in the public interest to exercise its water rights authority to augment stream flows. The Water Boards may also consider if it is appropriate to conduct a use attainability analysis to determine if any water quality standard should be revised.”

Hurdles: Dilution is not the solution to pollution

- California Constitution, Article X, §2: It is hereby declared that because of the conditions prevailing in this State the general welfare requires that the water resources of the State be put to beneficial use to the fullest extent of which they are capable, and that the waste or unreasonable use or unreasonable method of use of water be prevented, and that the conservation of such waters is to be exercised with a view to the reasonable and beneficial use thereof in the interest of the people and for the public welfare. The right to water or to the use or flow of water in or from any natural stream or water course in this State is and shall be limited to such water as shall be reasonably required for the beneficial use to be served, and such right does not and shall not extend to the waste or unreasonable use or unreasonable method of use or unreasonable method of diversion of water. Riparian rights in a stream or water course attach to, but to no more than so much of the flow thereof as may be required or used consistently with this section, for the purposes for which such lands are, or may be made adaptable, in view of such reasonable and beneficial uses; provided, however, that nothing herein contained shall be construed as depriving any riparian owner of the reasonable use of water of the stream to which the owner's land is riparian under reasonable methods of diversion and use, or as depriving any appropriator of water to which the appropriator is lawfully entitled. This section shall be self-executing, and the Legislature may also enact laws in the furtherance of the policy in this section contained.
- Water Code §§ 100 and 275
- Water Code § 106: It is hereby declared to be the established policy of this state that the use of water for domestic purposes is the highest use of water and that the next highest use is for irrigation.

Hurdles: Flows are not easy to determine

- Necessary flows are difficult to determine with certainty
  - Flows for resident fish
  - Flows for anadromous fish migration and spawning
  - Flows for other aquatic species (frogs, toads and salamanders)
  - Channel forming flows (gravel recruitment and other sediment, benthic organisms)

Hurdles: Implementation

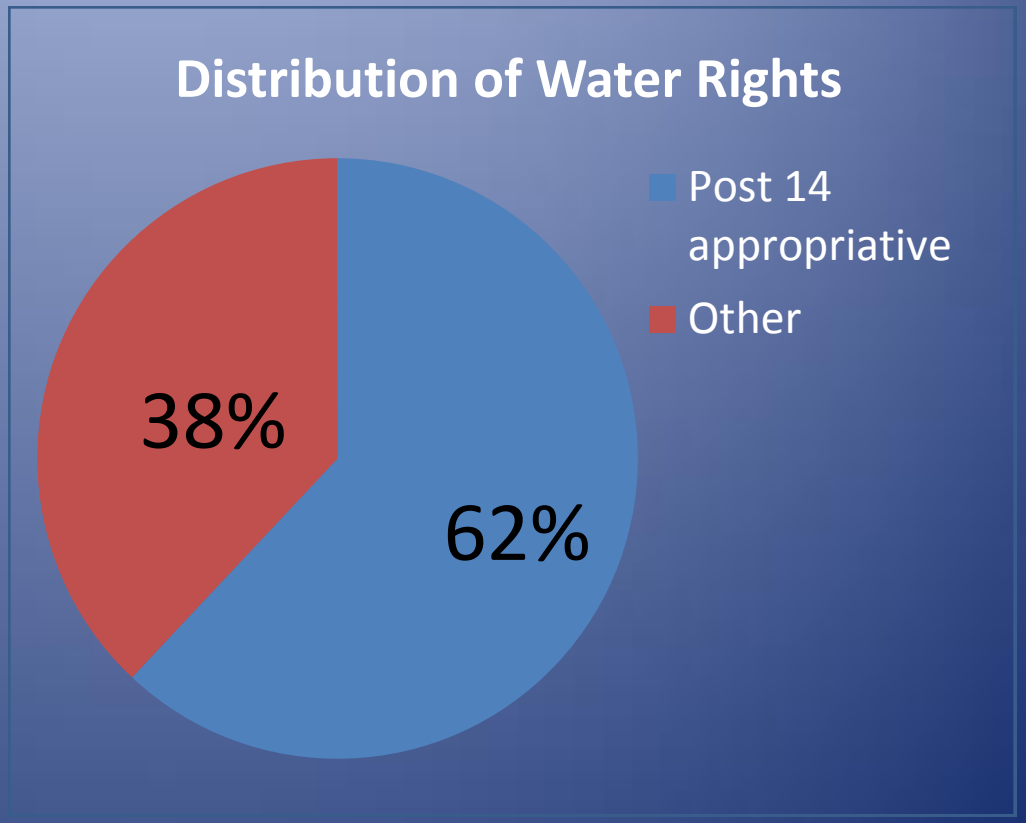
- Implementation
  - The implementation action must follow the program of implementation in the Basin Plan.
  - The POI said that the Board would implement the flow objectives through a water right hearing
    - Instead of the SJR flow objectives, the SWRCB implemented a flow/export experiment for the San Joaquin River for a 30 day period from April to May
    - The VAMP was not part of the Plan's Program of Implementation
  - The Board lost on this issue

Hurdles: Implementation

- A water right allocation is different than a flow TMDL.
  - Priority: the right to precedence over others in obtaining, buying or doing something (Webster's New World College Dictionary).
  - Allocations of flow responsibility generally must be done consistent with the water right priority system.
    - EID v. SWRCB (2006): The SWRCB cannot assign responsibility for meeting water quality objectives in a manner that undermines water right priority without substantial justification for doing so.

What were those types of California Surface Water Rights again?

- Pueblo
- Federal Reserved
- Riparian
- Appropriative
  - Pre-1914
  - Post-1914
- Prescriptive



Hurdles: Binding dispensable parties

- Location matters: compliance location and location of right holders (diversion and use)
- Post 1914 are "easy," except
  - Municipal preference
  - Settlement agreements
  - Multiple rights
- Pre-1914s are hard
  - How much? Doctrine of Prior Appropriation
- Riparians are harder
  - Natural flow
  - Watershed requirement
  - Chain of title

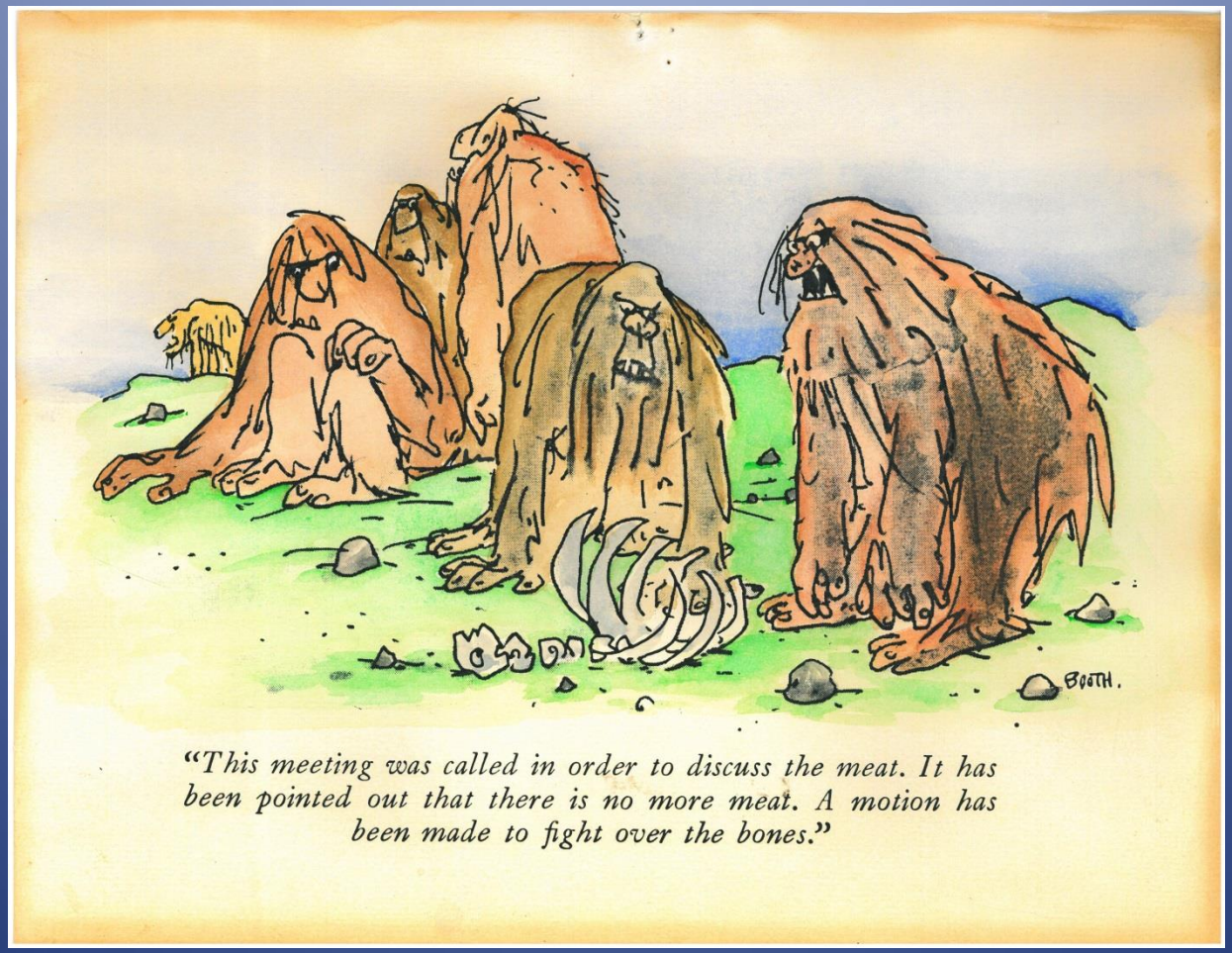
Hurdles: Other Factors

- The Water Boards may not be able to initiate a stream system adjudication
  - Parties to a water right claim must pay
- Cost recovery is in arrears
  - $500 per party to file a proof of claim
- A water right is a property right unlike a water quality permit.
- Litigation…litigation…litigation

Hurdles: Time Frames

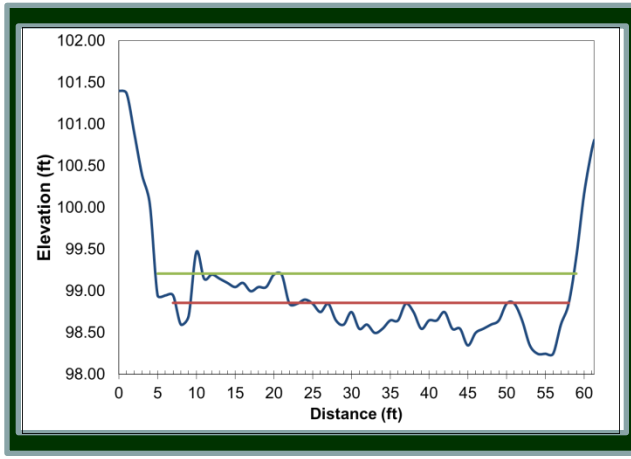
- Mono Lake, 1994 (43 days of Board hearing/1000 page staff report/4000 written comments, 1 water right holder.)
- San Gregorio Water Rights Adjudication, 1991 (60 days of Court Hearings, Redwood City, following two separate board hearings in the 1980s, ≈50 sq miles, and ≈ 350 claimants).
- Bay-Delta Hearings, 1998-2000 (80 days of Board Hearing, followed by trial court and appellate court hearings, 50 file boxes of documents, EIR w/2000 comment letters, about 14,000 water right holders, but only 250 hold rights to about 95% of the water).

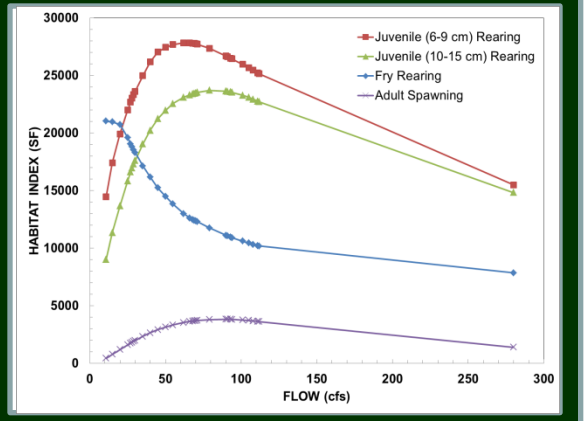
Questions??


BOOTH.
"This meeting was called in order to discuss the meat. It has been pointed out that there is no more meat. A motion has been made to fight over the bones."

Robert Holmes
Statewide Instream Flow Coordinator
California Department of Fish and Wildlife

Quantifying Flow Criteria for Fish and Wildlife and Their Habitats



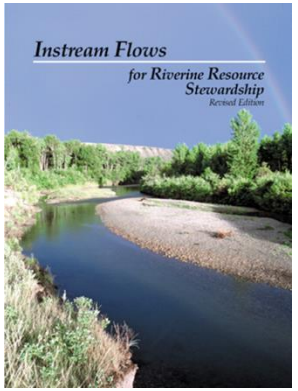


Robert Holmes
Statewide Instream Flow Coordinator
California Department of Fish and Wildlife

North Coast Regional Water Quality Control Board
Instream Flows Workshop
March 11, 2014

Outcome

- General understanding of common methods available to quantify flow criteria for fish and wildlife.

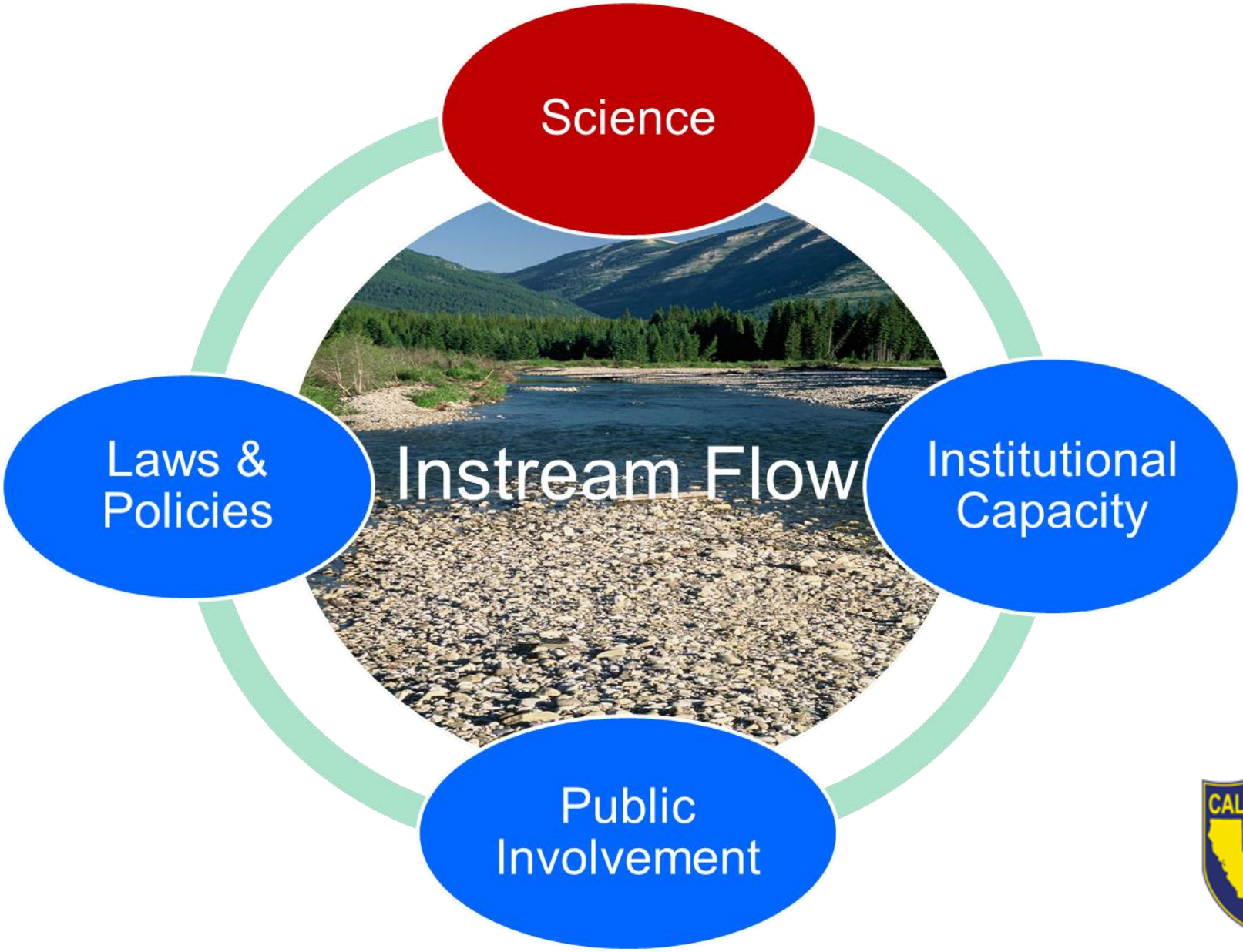


- Considerations when selecting such methods.

- There are a large number of proven, acceptable methods to chose from for quantifying flow needs.

- No single best method or flow (*think flow regimes*)…

Information in this presentation is from publications and policies of the Instream Flow Council. Tom Annear (Wyoming Game and Fish) also provided information.


Science
Laws & Policies
Instream Flow
Institutional Capacity
Public Involvement

Methods Evolution

- 1960's – Water Quality
- 1970's – Hydrologic Statistics
- 1980's - Quantitative Biology Models
- 1990's - Ecosystem Processes
- 2000's – Holistic Methods

Models - What Can They Tell Us?

- A considerable amount about individual habitat elements such as:
  - Short-term survival of organisms
  - Long-term persistence of habitat
  - Long-term persistence of organisms

Models help with the decision making process..

Precision vs Accuracy of Models

Do you need to know the PRECISE effect or result?

"*Exactly how many fish will result from a particular flow level?*"

- Few situations where field studies can consistently provide such precision.
- Precise answers are unrealistic since we are modeling ecosystem processes.

Or just ACCURATELY predict trends?

- If used properly, available models and knowledge of ecological processes does allow scientists to predict trends associated with different flow regimes with reasonable accuracy.

Habitat Modeling Caveats

- Models manage uncertainty – not eliminate it.
- No model tells us everything we need to know.
- Relationship between flow and habitat is not linear.
- A flow that's good for one species may be detrimental to others.
- There is not a single best flow – think flow regimes.

Traditional Approach

- *One species*
- *One method / tool*
- *One flow (minimum)*
- *"Flat-lining" flow regime*

Flow Quantification Method Categories

Standard-setting methods (segments or regions)

- Single minimum threshold (bottom up)
- Presumptive standard (top down)

Incremental Methods

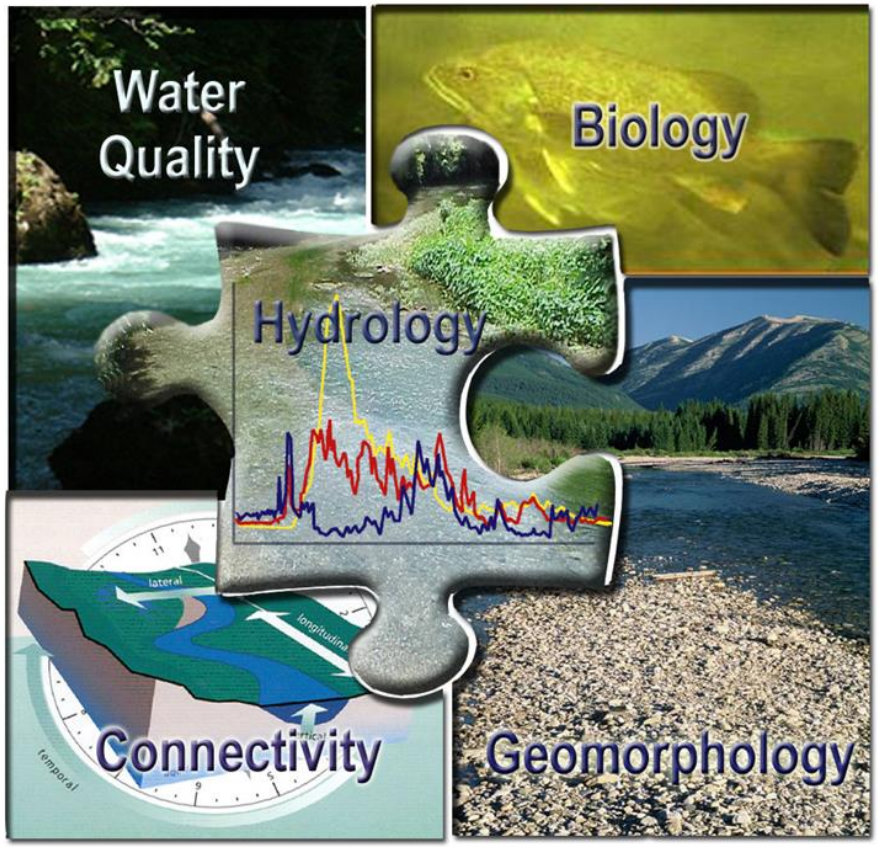
- Evaluate habitat vs. flow relationships
- Relate to a single riverine element at a time

Multiple component (holistic) methods

- The next generation (environmental flows)
- Integrates more than one component at a time

Core Riverine Components

- Biology
- Connectivity
- Geomorphology
- Hydrology
- Water Quality



Understanding the importance and addressing the inter-relations of the 5 riverine components is critical in any flow regime quantification exercise.

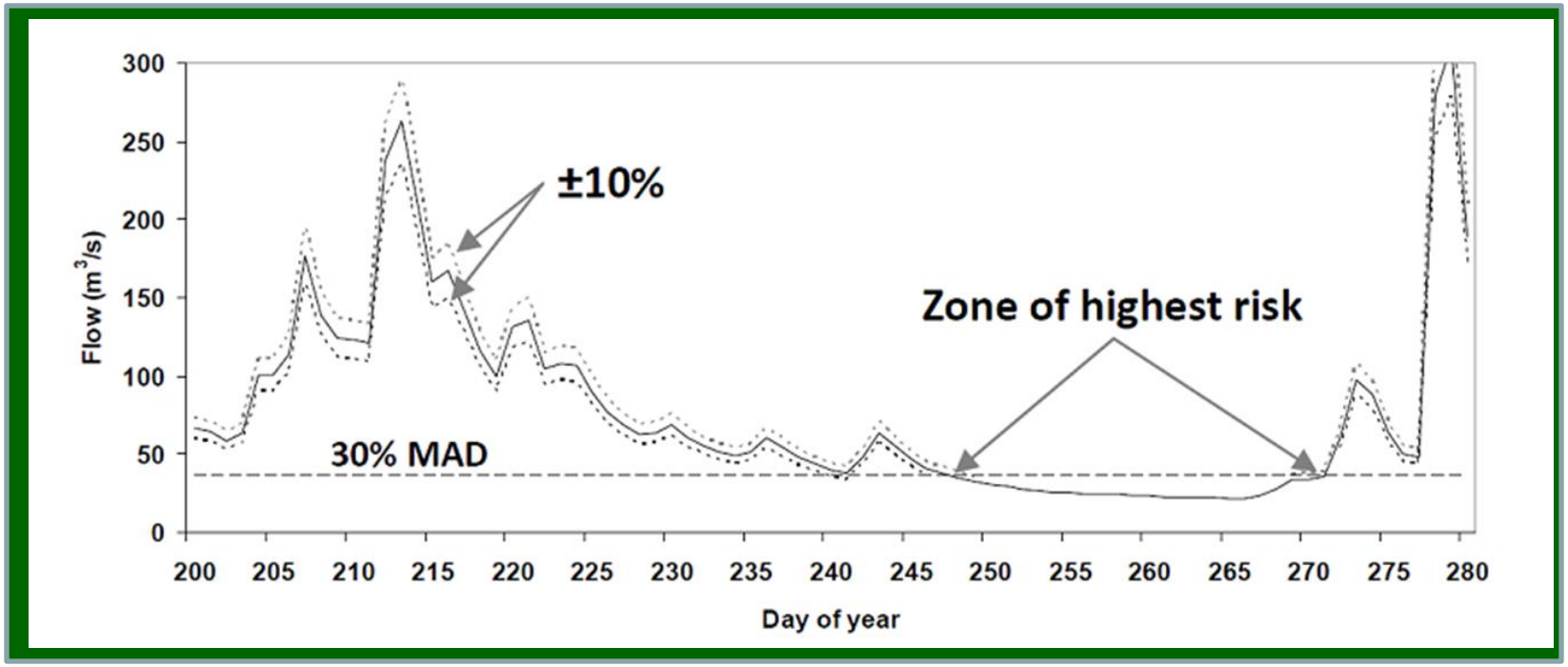
Hydrology Methods

- Indicators of Hydraulic Alteration (IHA)
- Range of Variability Approach (RVA)
- Flow duration curves (Q_{98})
- Alberta desk top method (protect % of flow)
- Richter presumptive standard

Of those shown here, the IHA model is the most widely used tool among IFC member agencies.

Presumptive Standard Approach

Depiction of Zone of Highest Risk
(Instantaneous Discharges < 30% (MAD) Mean Annual Discharge)



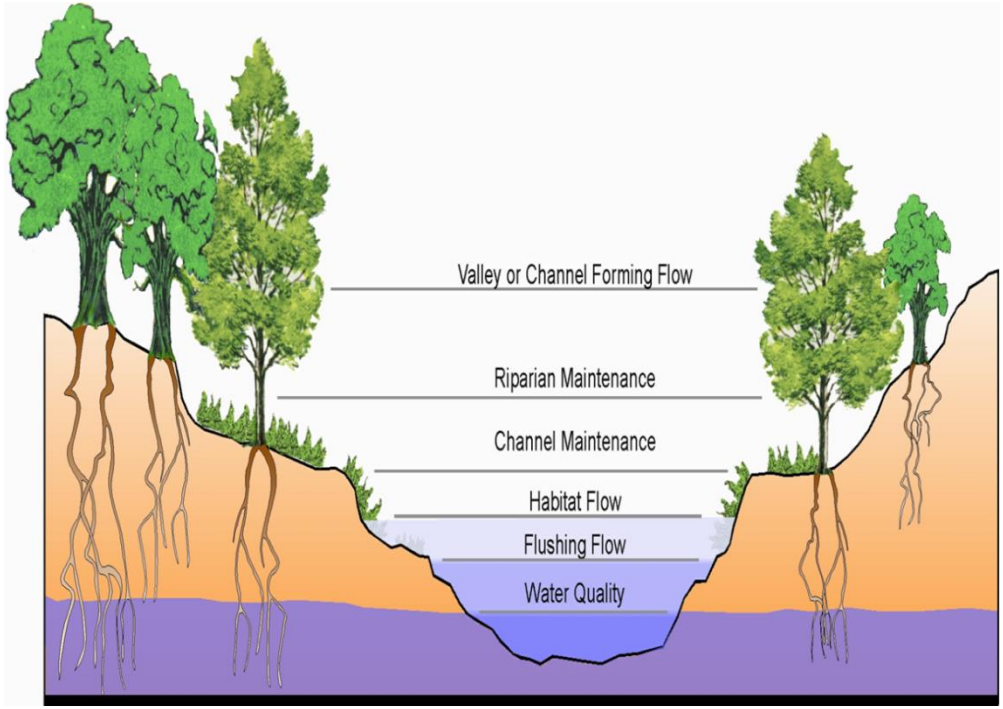
Source:

Fisheries and Oceans Canada | Pêches et Océans Canada
Science | Sciences
National Capital Region

Canadian Science Advisory Secretariat
Science Advisory Report 2013/017

FRAMEWORK FOR ASSESSING THE ECOLOGICAL FLOW REQUIREMENTS TO SUPPORT FISHERIES IN CANADA

Flow Protection



- Upside Down Instream Flow

This group of models (hydrology) typically used to identify how much water to leave – not necessarily to restore.
Note: If hydrologic patterns have been altered, the flows derived may be artificially lower.

Hydrology Model Considerations

- Long history of use (for some) – acceptance
- Good for describing hydrology (planning)
- Need long-term gage data
- Low to moderate effort
- Assumes relationship with biology
- May have different relationships with biology on different streams
- Need other tools to assess needs for other riverine elements or specific needs

Biology

- Single Transect Methods
- Tennant Method (and variations)
- Physical Habitat Simulation (PHABSIM)
- Two Dimensional Models (River 2D)

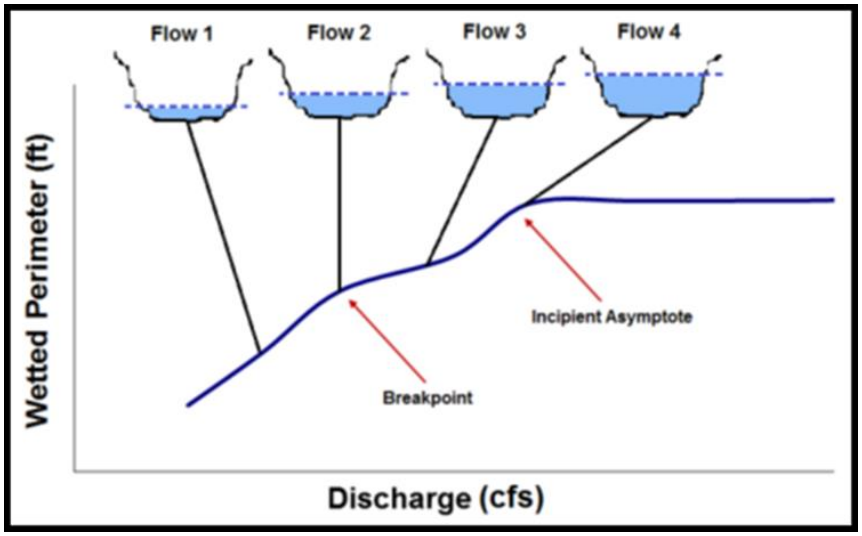
By far, the majority of instream flow quantification methods are based on some aspect of biology.

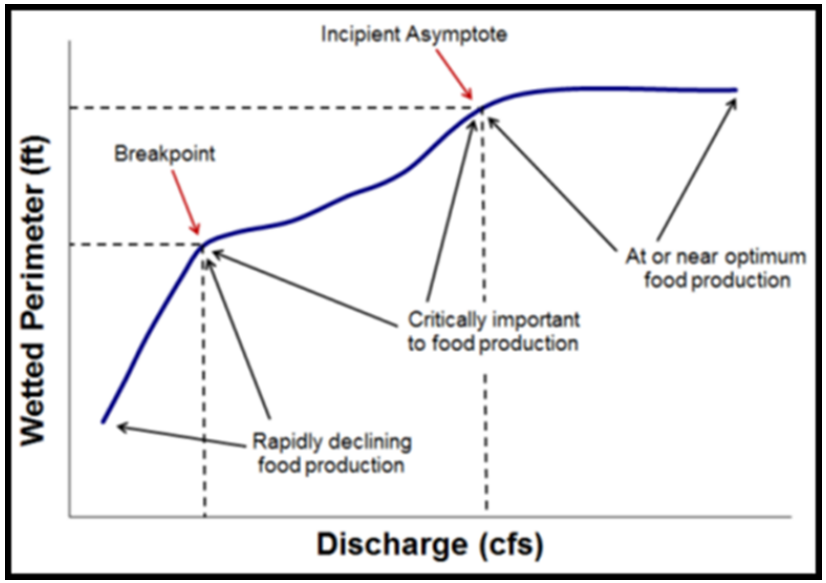
Single Transect Methods

Primarily used to estimate hydraulic characteristics over a range of flows (average depth, average velocity, wetted perimeter, and hydraulic radius).

Wetted Perimeter:

Lower and Upper (Incipient Asymptote*) Breakpoints





* Term “Incipient Asymptote” coined by Dr. Rob Titus (CDFW)

Single Transect Methods (Wetted Perimeter)

- Low to moderate effort
- Long history of use
- Only useful for setting threshold flows
- Limited ability to identify trade-offs
- Doesn’t address flow variability needs
- Need other tools to assess needs for other riverine elements

Tennant Method

Narrative Description of Flow	April to September	October to March
Flushing or maximum flow	200% from 48 to 72 hours	
Optimum range of flow	60-100%	60-100%
Outstanding habitat	60%	40%
Excellent habitat	50%	30%
Good habitat	40%	20%
Fair or degrading habitat	30%	10%
Poor or minimum habitat	10%	10%
Severe degradation	<10%	<10%

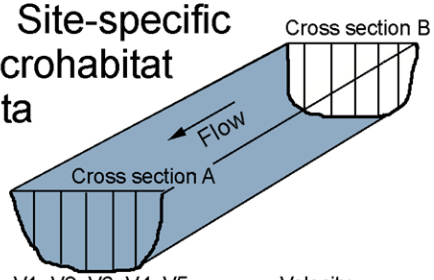
Many people think of Tennant as an office based, single-flow setting tool. The fact is that Tennant never intended this method to be used that way. Rather, any flow set using the technique should be validated in the field and the tool should be used to establish a range of flows.

Tennant Method

- Can set threshold flows or regimes
- Need long-term gage data
- Limited ability to identify trade-offs
- Majority of challenges have been successfully defended (widely accepted method)
- Need other tools to assess needs for other riverine elements

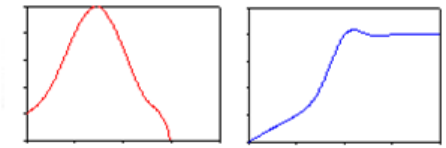
Physical Habitat Simulation (PHABSIM)

A. Site-specific microhabitat data

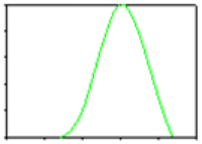


V1, V2, V3, V4, V5 -------- Velocity
D1,D2,D3,D4,D5 --------- Depth
C1,C2,C3,C4,C5 --------- Cover
A1, A2, A3, A4, A5 -------- Area

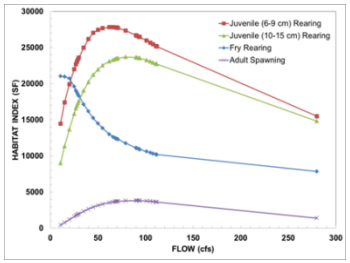
B



Habitat suitability criteria



C. Seasonal relationship between discharge and microhabitat for each life stage

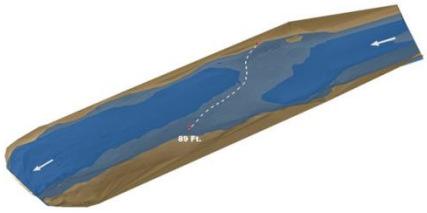


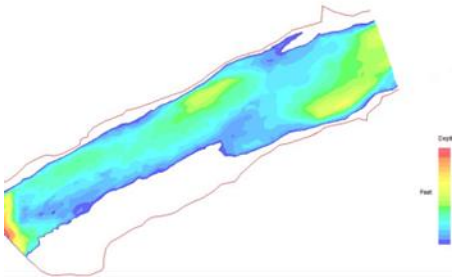
PHABSIM Concerns

- 1D hydraulic models simplify the channel
- Physical habitat suitability isn't the same as habitat
- Unknown relationship between WUA and fish biomass
- Need other models to quantify needs for other riverine purposes

2D Hydraulic Habitat Models

- Total Station and prism used to survey bed topography and physical features
- Establish vertical benchmarks and tying vertical benchmarks together
- Measuring stage of zero flow
- Collecting water surface elevations at range of flows

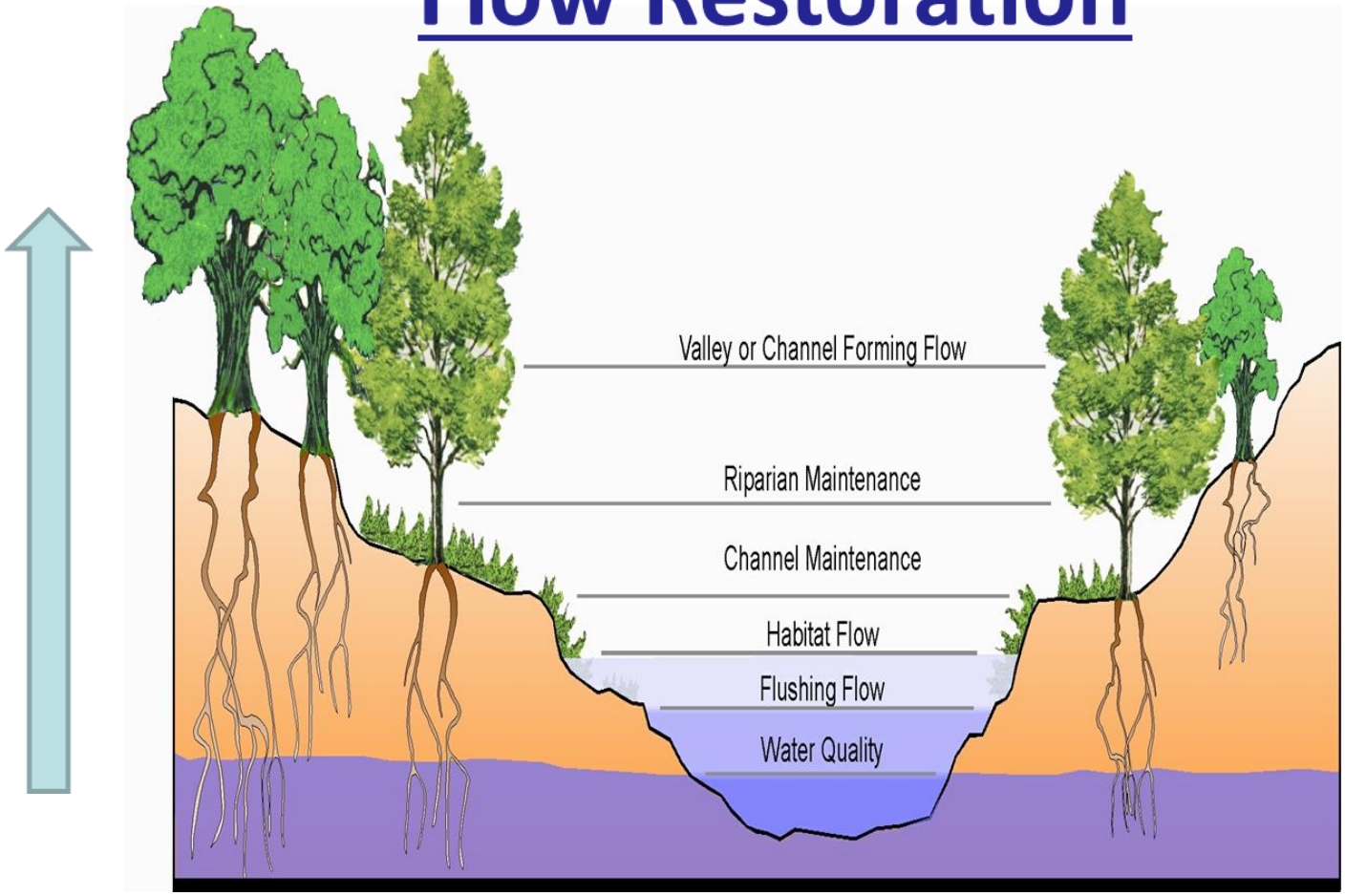




General 2D Model Considerations

- Different models available
- Focus on survival or habitat suitability
- Flow / habitat relationship may differ in different streams or stream segments
- Some address trade-offs
- Need other tools to assess needs for other riverine elements

Flow Restoration



- Bottom Up Instream Flow

This group of models (biology) is more effective for identifying how much water is needed to restore a fishery – and also to quantify mitigation needs.

Geomorphology

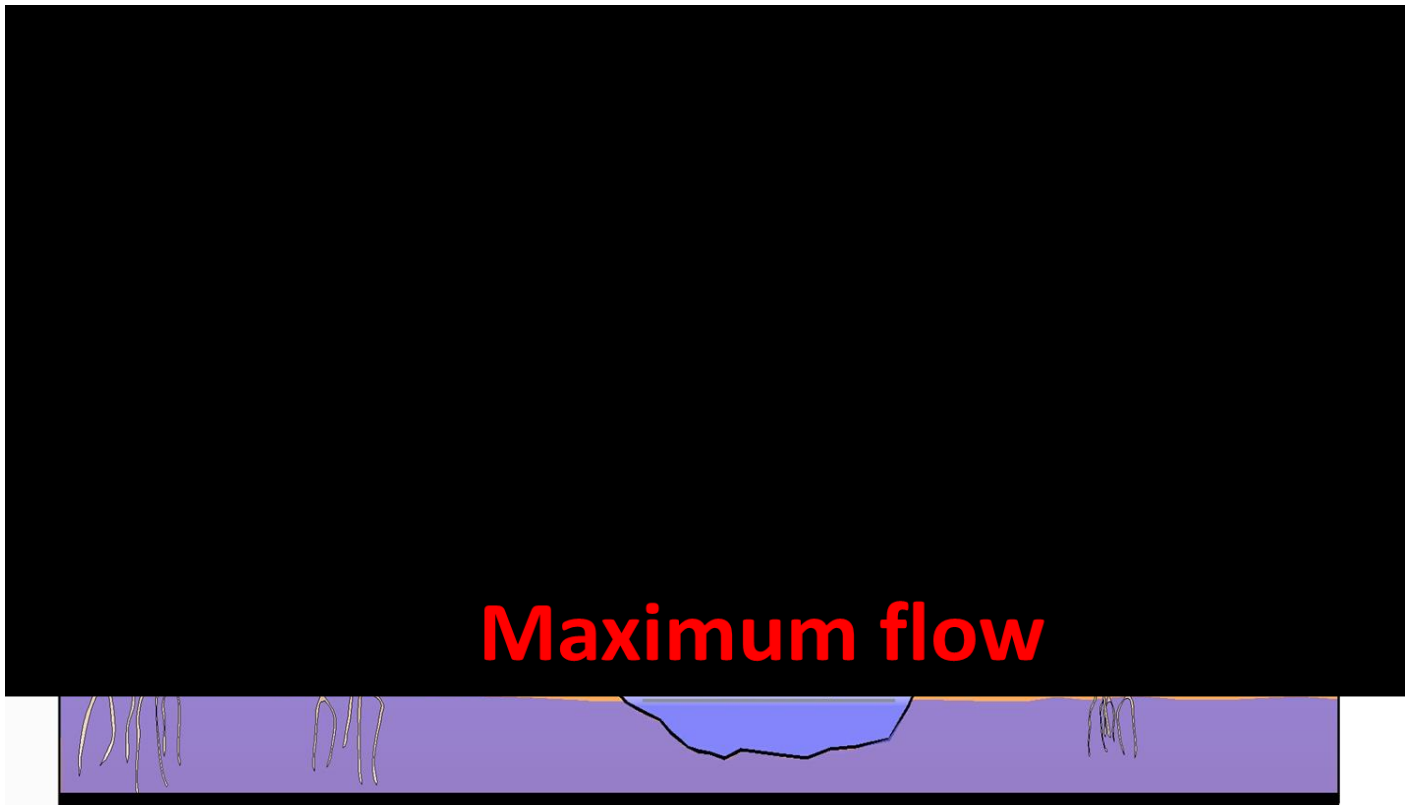
- Channel maintenance in gravel-bed streams
- Flushing flows
  - Empirical or office based
- Geomorphic classifications (Rosgen)
- HEC-6 and HEC-RAS

Considerations:

- Address long-term physical habitat (not tied to one species)
- Need specific timing, duration, ramping
- Need other tools to assess needs for other riverine elements

Water Quality

- Stream System Temperature (SSTEMP)
- Stream Network Temperature (SNTEMP)
- 7Q10
  - Often used as basis for setting instream flows in eastern and southern U.S.
  - Not an instream flow method with any value for protecting or restoring biological aspects of rivers.
  - Strictly a method that relates to maintaining established water quality standards.



- *Water quality models typically relate to minimum flows…*
- *Sometimes minimum flows become <u>maximum</u> flows..*
- *To provide meaningful, long-term ecological protection, it essential to talk in terms of flow <u>regimes</u> for multiple purposes whether achievable in the short-term or not.*

Connectivity Methods

Empirical Riverine Methods

- Critical Riffle Analysis can address connectivity at riffle sites

Hydraulic Habitat Models

- Two dimensional (2D) models can address connectivity at the site or segment level

Estuary Methods

- Salinity-based inflow method
- Tidal distributary method

Regional Fish Passage Formula

- SWRCB North Coast Streams Policy (2014)

$$Q_{fp} = 19.3\, Q_m\, D_{min}^{2.1}\, DA^{-0.71}$$

Visual Inspection

Connectivity

- Specify which of 4 dimensions you're using (lateral, vertical, longitudinal, time)
- Identify which elements are of interest (organisms, chemistry, bedload, energy)
- Specify time and duration when needed
- Need other tools to assess needs for other riverine elements and processes

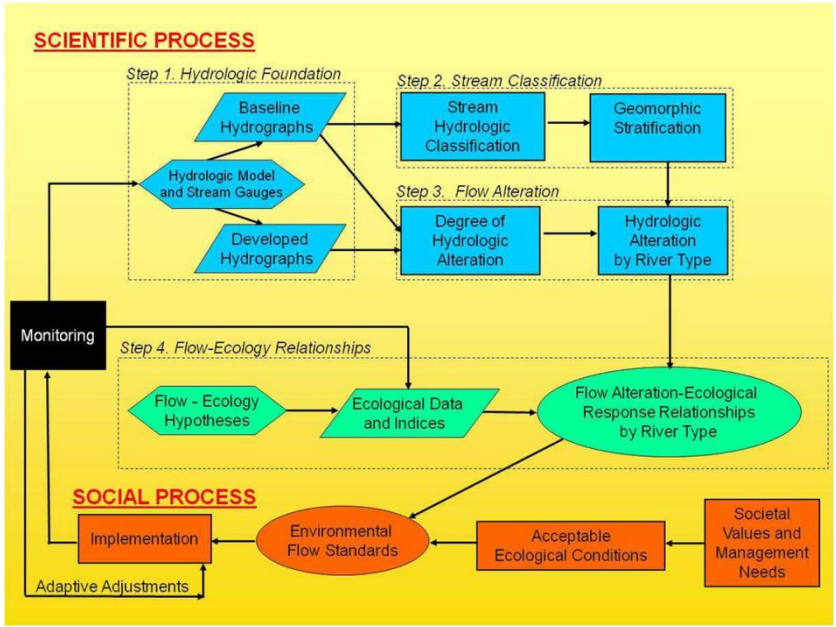
Holistic Methodologies

- Ecological Limits of Hydrologic Alteration (ELOHA)
- Bayesian Decision Models
- Demonstration Flow Assessments (DFA)

In the past decade or so, several tools have evolved to begin to address flow needs from a more holistic, community-based perspective. It seems likely that this trend will continue.

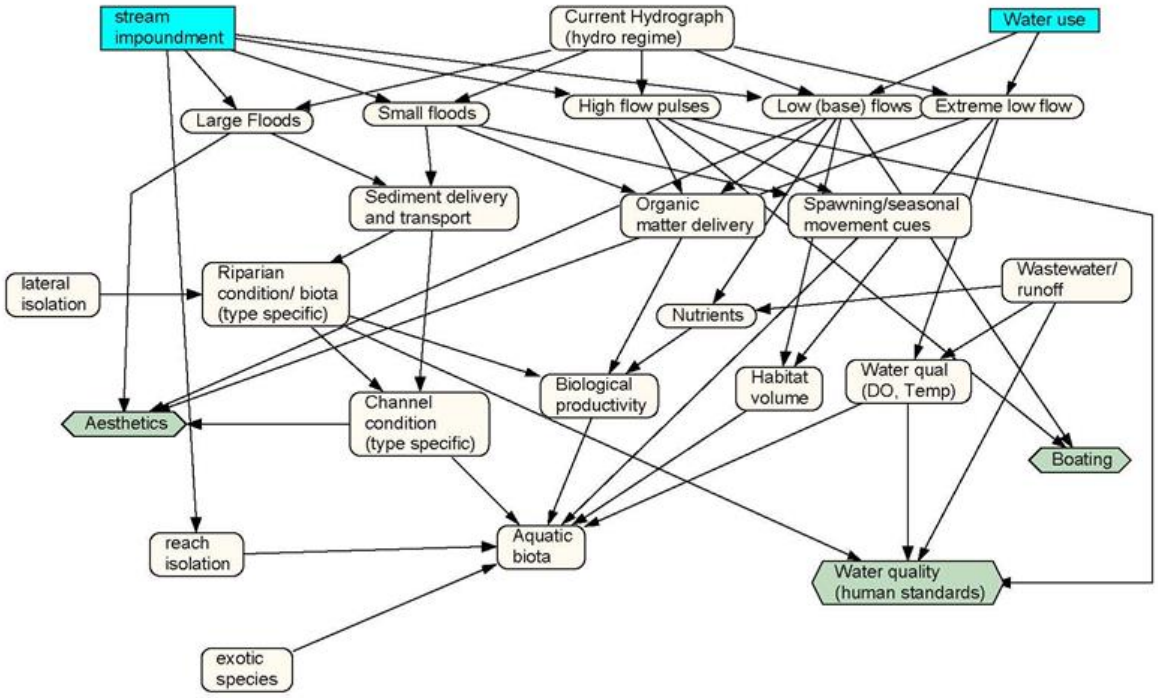
Ecological Limits of Hydrologic Alteration (ELOHA)

- Links hydrological alteration (IHA) with ecology
  - Requires good hydrological data
  - Requires information about ecological processes



ELOHA provides a decision-making process rather than representing a discrete replicable model.

Bayesian Decision Models



Bayesian Decision Models are essentially probability assessment tools.

Demonstration Flow Assessment (DFA)

Can and should be a scientifically controlled and repeatable exercise.

What about professional judgment?

None of the technical methods described here or used anywhere in the world is capable of making decisions of flow in the absence of objective interpretations.

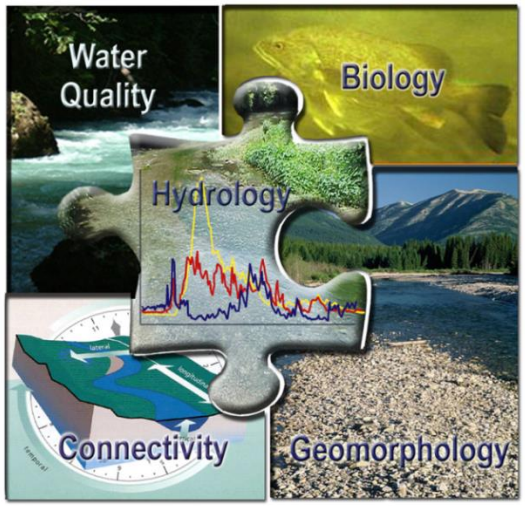
Stream Flow Gages

Most important monitoring information needed is always “more gage data”.

Putting it all together

The fact is there are a large number of proven, acceptable methods to chose from for quantifying flow needs.

The challenge is to use the right tool to provide the needed information.

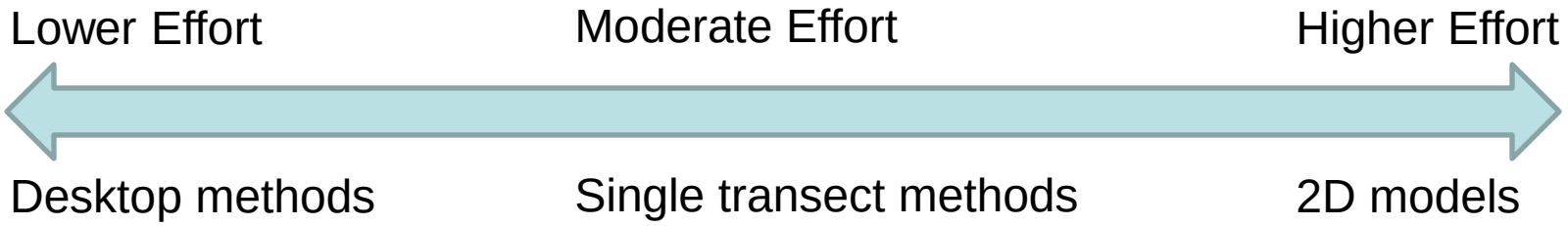


- *No single best method.*
- *Every situation is different so each has a unique solution.*
- *Good approach is to assess flow needs using a suite of methods to address specific flow components at specific times of the year (flow regimes).*

Coordination with CDFW

- CDFW Water Branch - technical oversight and review.
- Public Resources Code (PRC) §10000-10005 studies.
- 2015 Water Bond/Water Action Plan studies.
- Other studies (grants, bypass flows, restoration, etc.).

Flow Studies:



CDFW Instream Flow QA Program – *QA/QC links data collection with decision making.*

Planning Flow Studies?

See CDFW Instream Flow QA Program for Guidance Documents, Checklists, Templates…

CALIFORNIA DEPARTMENT OF FISH and WILDLIFE

INSTREAM FLOW PROGRAM

INSTREAM FLOW STUDY
RESULTS CHECKLIST

The California Department of Fish and Wildlife (CDFW) is mandated to identify stream flow requirements for protection of fish and wildlife. The CDFW Instream Flow Program (IFP) may use study reports and data from internal or external sources to support development of flow requirements. Study reports and data from external sources are an essential source of information and allow the CDFW IFP to leverage funds and extend limited resources. To ensure the credibility, comparability, coordination and scientific defensibility of information on which the CDFW IFP relies, we review study plans and supporting information described in this checklist, as well as any other information that may be relevant for a particular study. Coordination with the CDFW IFP during project planning, study implementation and project reporting will help identify specific information needs. We ask that study proponents include the following categories of supporting information when submitting reports and/or data to the CDFW IFP:

☑ **Copy of the original instream flow study plan for the project, including goals and objectives, as previously approved by CDFW IFP.** The study plan template can be found online at: http://www.dfg.ca.gov/water/instream_flow.html.

☑ **A full description of the study design and methodology, including any modifications taken from the initial, approved instream flow study plan. Detail justifications for any and all modifications taken from the original approved study plan during the course of the project. Modifications can include, but are not limited to, changes in:**

- Study design
- Site selection and transect location strategy
- Frequency of sampling
- Timing of sampling
- Target assessment flows

☑ **Study site documentation, including:**

- Detailed map(s) of the study area, indicating site locations and names
- Pictures documenting each sampling site, including flow levels at each site during sampling

☑ **Reach delineation and habitat mapping results:**

- Inventory of habitat types present by reach

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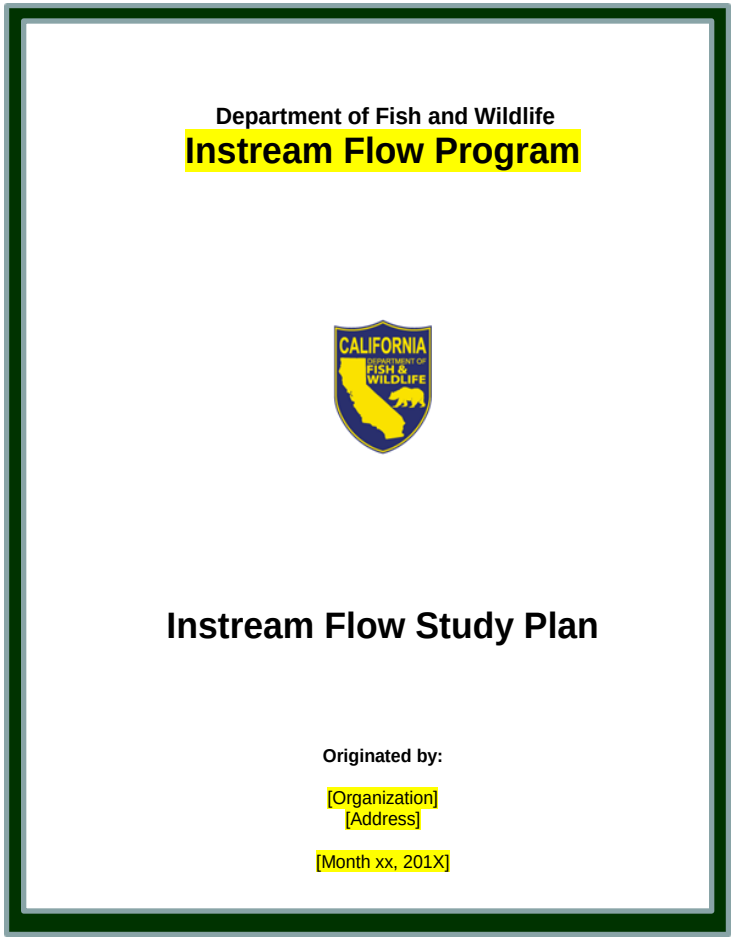


Department of Fish and Wildlife

Instream Flow Program

Instream Flow Study Plan

Originated by:

[Organization]
[Address]

[Month xx, 201X]

http://www.dfg.ca.gov/water/instream_flow.html

For more information contact:

Robert Holmes
CDFW Statewide Instream Flow Coordinator
Director Instream Flow Council Western Region
Water Branch
830 S Street
Sacramento, CA 95811
Robert.Holmes@wildlife.ca.gov

DFG Instream Flow Program information at:
http://www.dfg.ca.gov/water/instream_flow.html

Instream Flow Council
http://www.instreamflowcouncil.org/

Daniel Schultz
Senior Environmental Scientist
State Water Resources Control Board
Division of Water Rights

Method to Develop Flow Criteria for Priority Tributaries

Dan Schultz
Division of Water Rights
March 11, 2015

CALIFORNIA
Water Boards
STATE WATER RESOURCES CONTROL BOARD
REGIONAL WATER QUALITY CONTROL BOARDS

Presentation Outline

- Definitions
- Phase 4 Overview – Flow Objectives for Priority Tributaries (Sacramento River focus)
- Ecological Objectives to Consider when Developing Instream Flow Requirements
- Next Steps
- California Water Action Plan & Possibility for New Instream Flow Work

DEFINITIONS

Flow Criteria

Flow Objective

Public Trust Doctrine

Flow Criteria vs Flow Objectives

Flow Criteria

-No regulatory effect

-Identifies range of instream flows for aquatic dependent species viability

Other Beneficial Uses

Flow Objectives

-Have regulatory effect

-Balances public trust resources and other beneficial uses

-The quantity of instream flow required to maintain ecologically sustainable watersheds

-Tributary-specific flow objectives will be developed as a component of tributary-specific regulations or policies

Public Trust

- The State Water Board is responsible for the protection of public trust uses, including commerce, navigation, recreation, and habitat for fish and wildlife, which are held in trust for the public.

- The State Water Board must consider these responsibilities when planning and allocating water resources, and protect public trust uses whenever feasible.

Phase 4 of Bay-Delta Effort

State Water Board Bay-Delta Activities

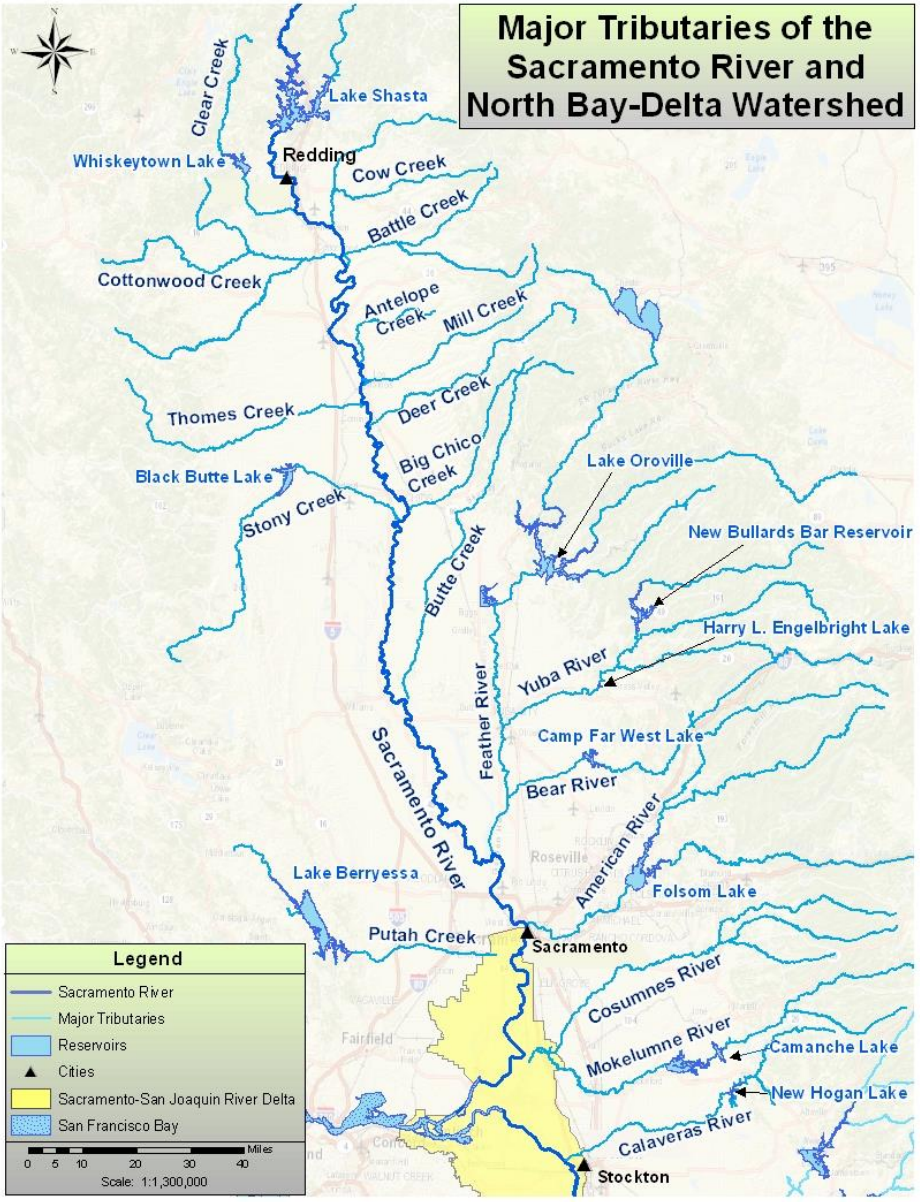
- Phase 1: Bay-Delta Plan review and update of the **San Joaquin River** flow and southern Delta salinity objectives and program of implementation
- Phase 2: Comprehensive review and update of other components of the Bay-Delta Plan and program of implementation
- Phase 3: Amendment of water rights and other measures to implement changes to the Bay-Delta Plan resulting from Phases 1 and 2
- **Phase 4: Development and implementation of flow criteria and flow objectives for priority tributaries to the Sacramento-San Joaquin Delta watershed, with a focus on the Sacramento River watershed**

Phase 4 Process

1. Development of non-binding flow criteria
2. Development of flow objectives and implementation plans
3. Development of regulations or policies for water quality control
4. Implementation of regulations or policies through conditioning of water rights and other measures as appropriate

Phase 4 Goals

- Focus on Sacramento River watershed
- Develop policies or regulations that establish flow objectives for 4-5 priority tributaries in the Bay-Delta watershed by 2018
- Work to continue on remaining priority tributaries thereafter



Flow Criteria Methodology

Flow Criteria Method Goals

- Leverage limited resources available to conduct needed studies over large geographic area
- Applicable to bulk of each tributary's watershed
- Address multiple species or life stages and fluvial processes
- Responsive to critical and time-sensitive need to address flow-related impacts contributing to the decline of threatened and endangered species

Flow Criteria Development (to date)

- July 2013: State Water Board submitted *Request for Recommendation of Method to Develop Flow Criteria for Priority Tributaries to the Sacramento-San Joaquin Delta* to the Delta Science Program (DSP)
  - Scientifically Defensible
  - Cost-effective
  - Applicable to the bulk of each tributary's watershed
  - Can be implemented in a timely fashion

Flow Criteria Development (to date)

- February 2014: Delta Science Program transmitted the report developed by an independent review committee - *Recommendations for Determining Regional Instream Flow Criteria for Priority Tributaries to the Sacramento-San Joaquin Delta*
- March 2014: State Water Board workshop on the Delta Science Program's recommendation.

DSP Panel Recommendation: Use of a Hybrid Approach

1. Stream and river classification based on geomorphic, hydrologic, geographic, and/or faunal characteristics
2. Hydrologic analyses that separate the hydrograph into flow regimes (blocks) and examine historical changes
3. Assessment of whether any site-specific field work is required in the catchment or river reach to address specific information gaps
4. Extrapolation of understanding of flow-ecology relationships from other sites to the study catchment or segment
5. Production of an environmental flow regime that meets the needs of species and ecosystem processes in the system
6. Assuring clear and transparent dialogue and interaction between scientists and stakeholders
7. Designing an effective adaptive management protocol with robust implementation measurements to support the decision-making process

Flow Criteria Method Objectives

- Prepare a Manual with procedures and steps to guide the flow criteria development process
  - Applicable Statewide
  - Incorporates existing information, studies, and data
  - Flexibility in Regional Application
  - Can be implemented by a range of practitioners

Ecological Objectives to Consider when Developing Instream Flow Requirements

Ecological Objectives

- Achieve characteristics of a natural hydrograph
  - Maintain inter-annual variability
  - Maintain intra-annual events
- Restore natural high flow recession rates
  - Prevent juvenile salmonid stranding
  - Promote riparian seed dispersal
  - Trigger natural species reproduction patterns

Ecological Objectives

- Restore natural geomorphic processes, to maintain channel habitat
  - Floodplain and side channel inundation
    - Rainfall runoff
    - Annual peak spring snowmelt period
  - Channel flushing flows
    - 1st annual significant fall or early winter event
  - Channel maintenance flows
    - 1.5-3 year return interval
  - Channel forming flows
    - 5, 10, and 15 year return interval

Ecological Objectives

- Restore self-sustaining resilient populations of anadromous salmonids and other native species by:
  - Addressing flow-related salmonid passage impediments
  - Increasing the quantity and quality of salmonid spawning and rearing habitat
  - Reducing water temperature
  - Restoring natural aquatic habitat connectivity

Implementation Objectives

- Preserve existing beneficial uses of water to the maximum extent possible
- Minimize impacts to water right holders
  - Provide a reliable water supply
  - Promote off-season deliveries and storage
  - Promote water conservation

Next Steps

Phase 4 Next Steps

- Develop *Strategy for Establishing Flows for Tributaries to the Bay-Delta* (Phase 4 Strategy); Anticipate Strategy will contain:
  - Goals and objectives of Phase 4 effort
  - Overview of process
  - Flow criteria methodology
  - Priority Tributaries

  - Timeframe: Draft Strategy anticipated for release for public comment in early 2015

California Water Action Plan & Possibility of New Instream Flow Work

California Water Action Plan

- Developed at direction of Governor Brown by:
  - California Department of Food and Agriculture
  - California Environmental Protection Agency
  - California Natural Resources Agency
- Plan will guide state efforts to:
  - Enhance water supply reliability
  - Restore damaged and destroyed ecosystems
  - Improve resilience of California's infrastructure
- Outlines California's near- and long-term water priorities, including drought

California Water Action Plan (cont.)

- Action 4 – Protect and Restore Important Ecosystems
  - Sub-action: Enhance Water Flows in Stream Systems Statewide
    - State Water Board and Department of Fish and Wildlife (DFW) to implement suite of efforts to enhance flows statewide in at least five stream systems to support critical habitat for anadromous fish
    - Includes development of defensible, cost-effective, and time-sensitive approaches to establish instream flows using sound science and transparent public process
    - State Water Board and DFW directed to consider public trust responsibility and existing statutory authorities

BCP - Enhanced Flows Purpose

- Contribute to implementation of Action 4 of California Water Action Plan
- Collaborative effort between State Water Board and DFW
- Target five stream systems to enhance flows that balance the needs of people and environment
  - Mark West Creek (Russian River)
  - Mill Creek (Sacramento River)
  - Shasta River
  - South Fork Eel River
  - Ventura River

BCP - Enhanced Flows
State Water Board's Work

- Instream flow development and implementation
- Enforcement
- Permitting

With support from the Office of Chief Counsel


Questions?

Darren Mierau
Northern Coast Director
CalTrout

Regional Guidelines for Allocating Instream Flows in California's North Coast Watersheds

Darren Mierau
CalTrout
March 11, 2015

CALIFORNIA TROUT

CalTrout

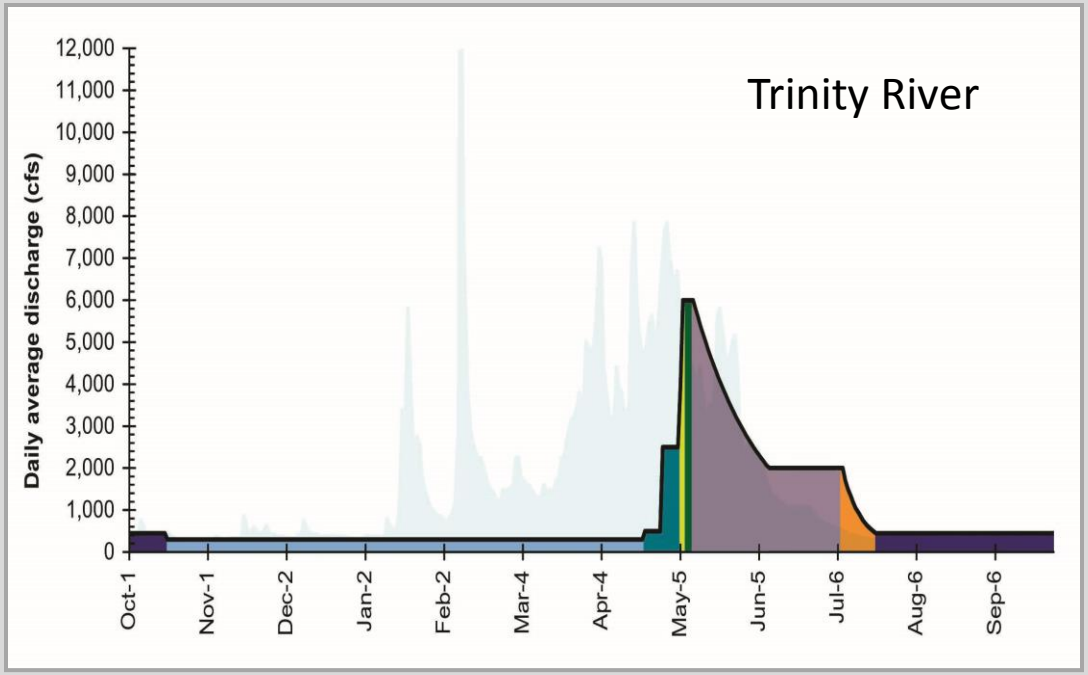
Trout Unlimited

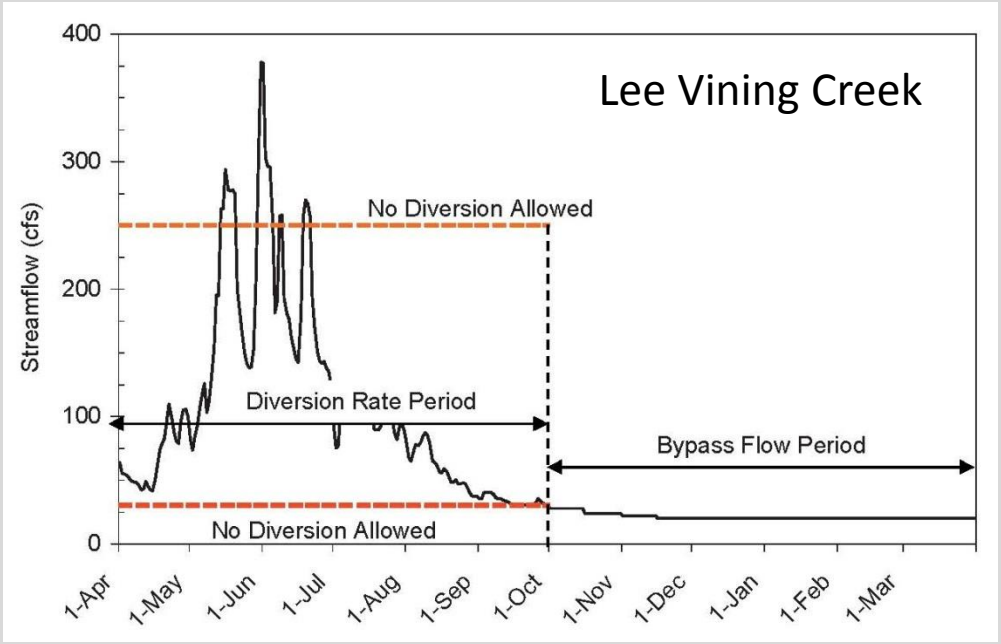
The Nature Conservancy

HSU River Institute

CEMAR

McBain Associates





- Trinity River Flow Evaluation Study
- The Mono Basin Synthesis Report
- Shasta River Big Springs and Shasta Canyon Instream Flow Studies
- Alameda Creek Flow Study
- Upper Tuolumne River Flow Study
- The Upper Mattole River Flow Study
- The State Water Board's North Coast Instream Flow Policy
- Navarro River and Sproul Creek (ongoing)

Today's Take-Away Messages:

1. We need to adopt a regional approach to identify flow objectives that precludes the need for time-consuming and expensive site-specific studies in most watersheds.
2. A "Percent of Flow" approach is more ecologically protective than a traditional bypass strategy.
3. We offer a methodology for allocating streamflow that meets protective criteria and provides reasonable consumptive needs.

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Two General Approaches to Develop Flow Objectives:

- ❑ Conduct Site Specific Instream Flow Studies

- ❑ Develop Regional Criteria, Objectives, and Diversion Guidelines

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Target Region is California's North Coast Watersheds:

Five ESUs or DPSs of salmon and steelhead listed as threatened or endangered, including:

- threatened SONCC coho salmon
- threatened NCC steelhead
- threatened CC Chinook salmon
- endangered CCC coho salmon
- threatened CCC steelhead.

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SWRCB 2010

- Provides a prioritized schedule and estimate of costs to complete instream flow studies
- Schedule 2 Priority 1 includes rivers and streams that serve as habitat for either Coho Salmon, or Southern California Steelhead

Instream Flow Studies for the Protection of Public Trust Resources:

A Prioritized Schedule and Estimate of Costs

Submitted In Accordance with the Requirements of Water Code Section 85087

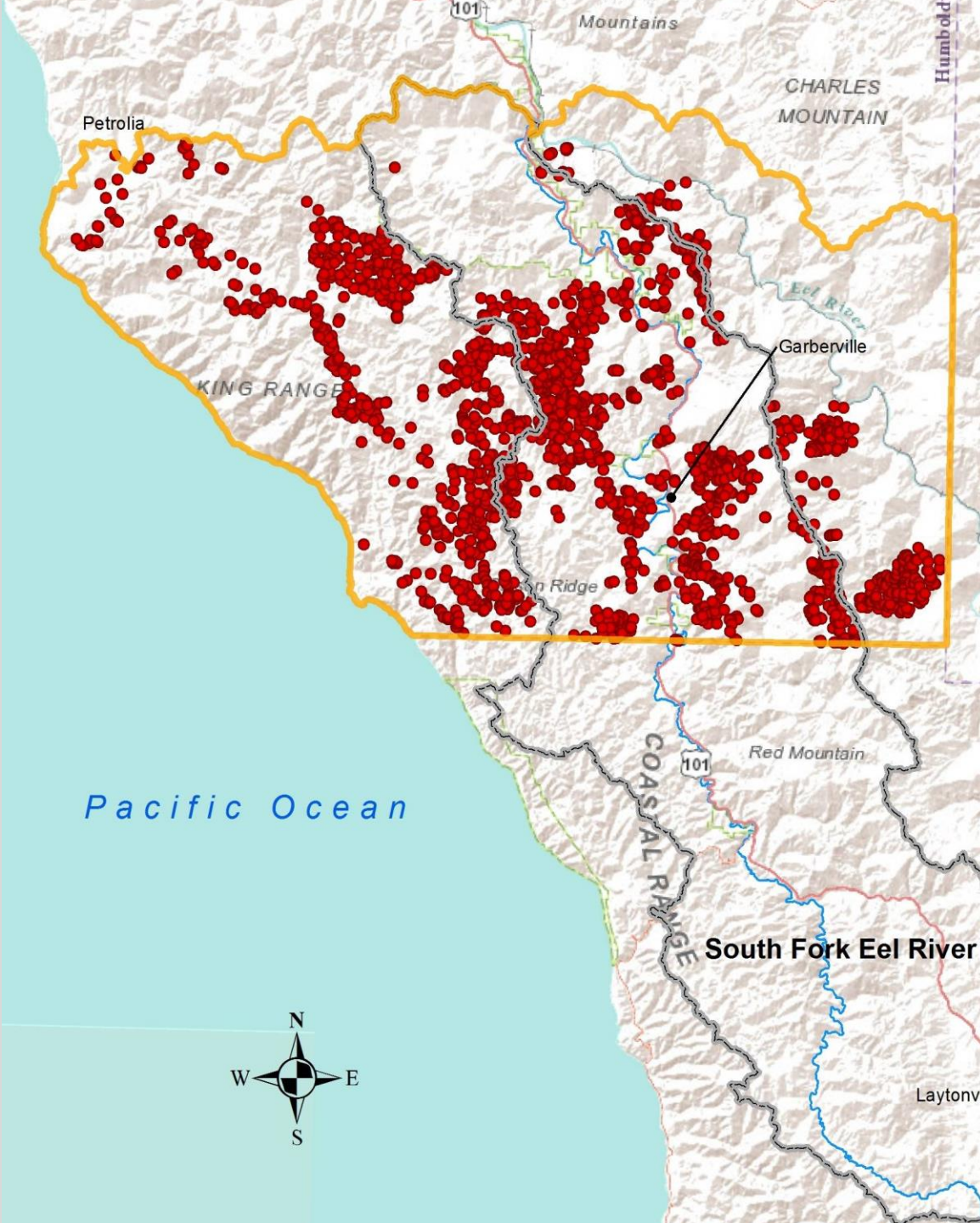
December 2010

CALIFORNIA Water Boards
STATE WATER RESOURCES CONTROL BOARD
REGIONAL WATER QUALITY CONTROL BOARDS

Schedule 2 (Table C) **High Priority Rivers and Streams that Support Anadromous Species**			
Priority Group 1	$10.39 million	$60.8 million	$71.19 million
Priority Group 2	$2.36 million	$13.2 million	$15.56 million
		Total Estimated Costs for Schedule 2	**$86.75 million**

Regional Flow Objectives

- ❑ Must be conservative, err on the side of resource protection
- ❑ Must apply year-round
- ❑ Must acknowledge existing and proposed water rights and diversions
- ❑ Must be practical, implementable
- ❑ Protect streamflow variability (low flows and high flows)



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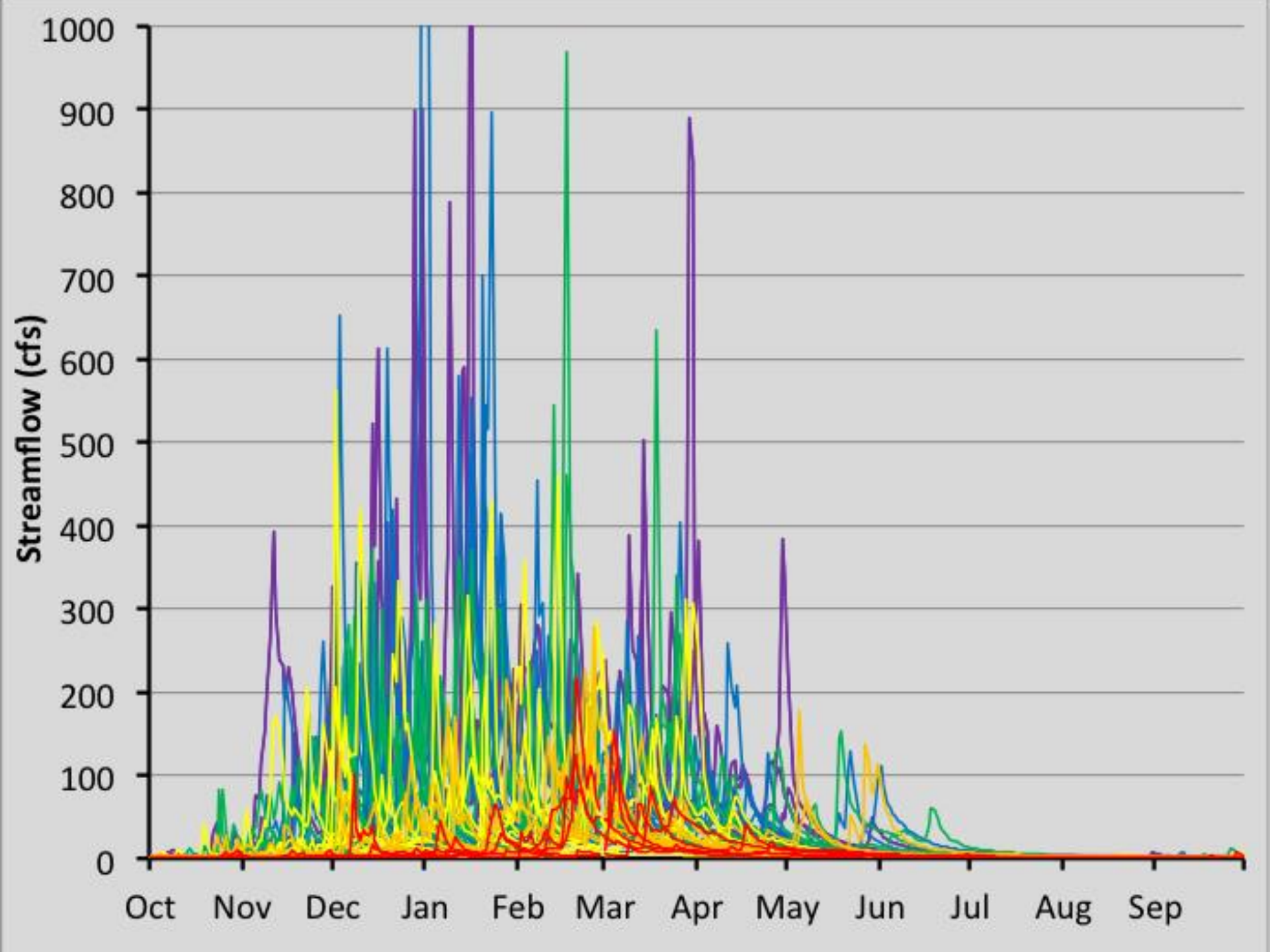
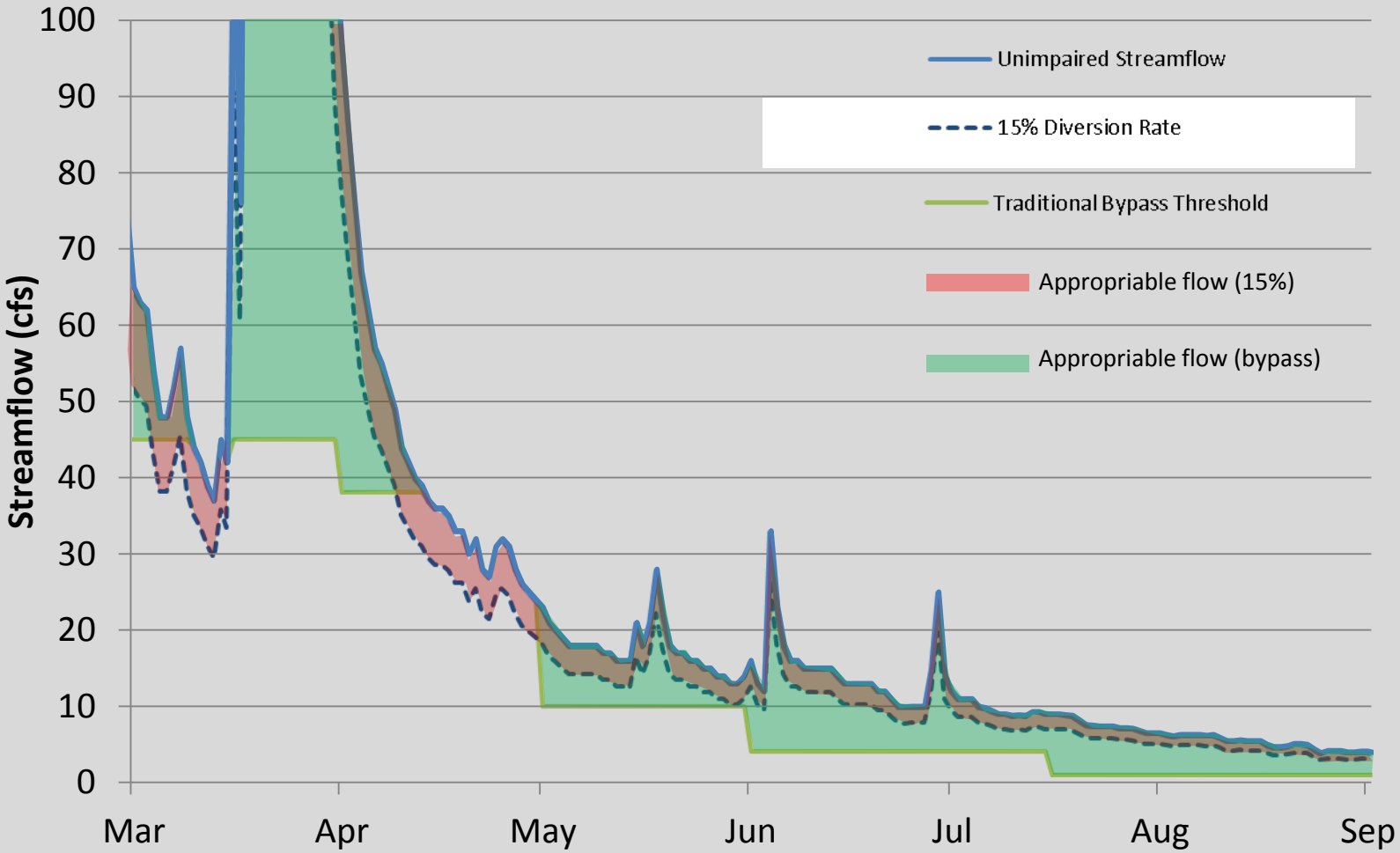
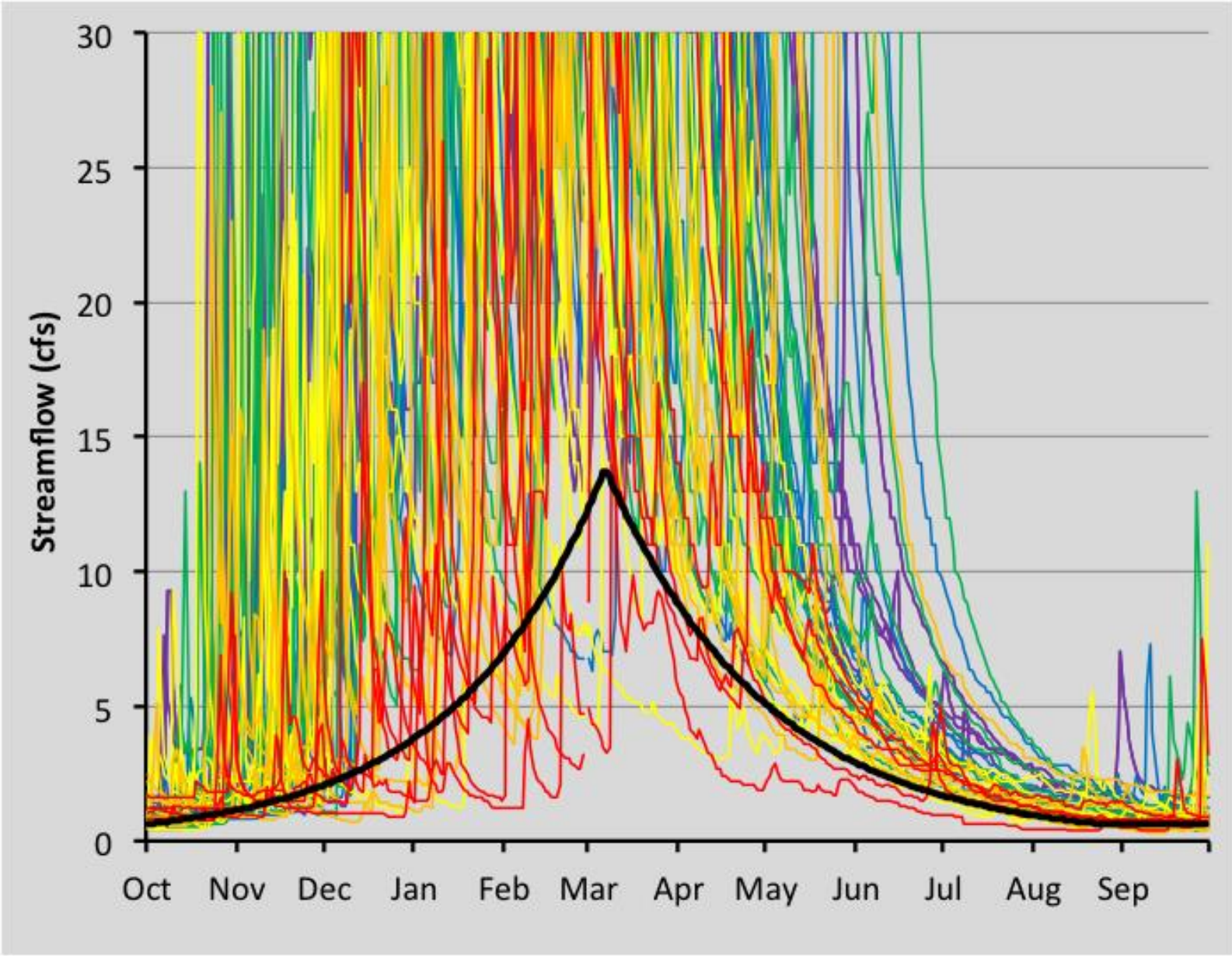
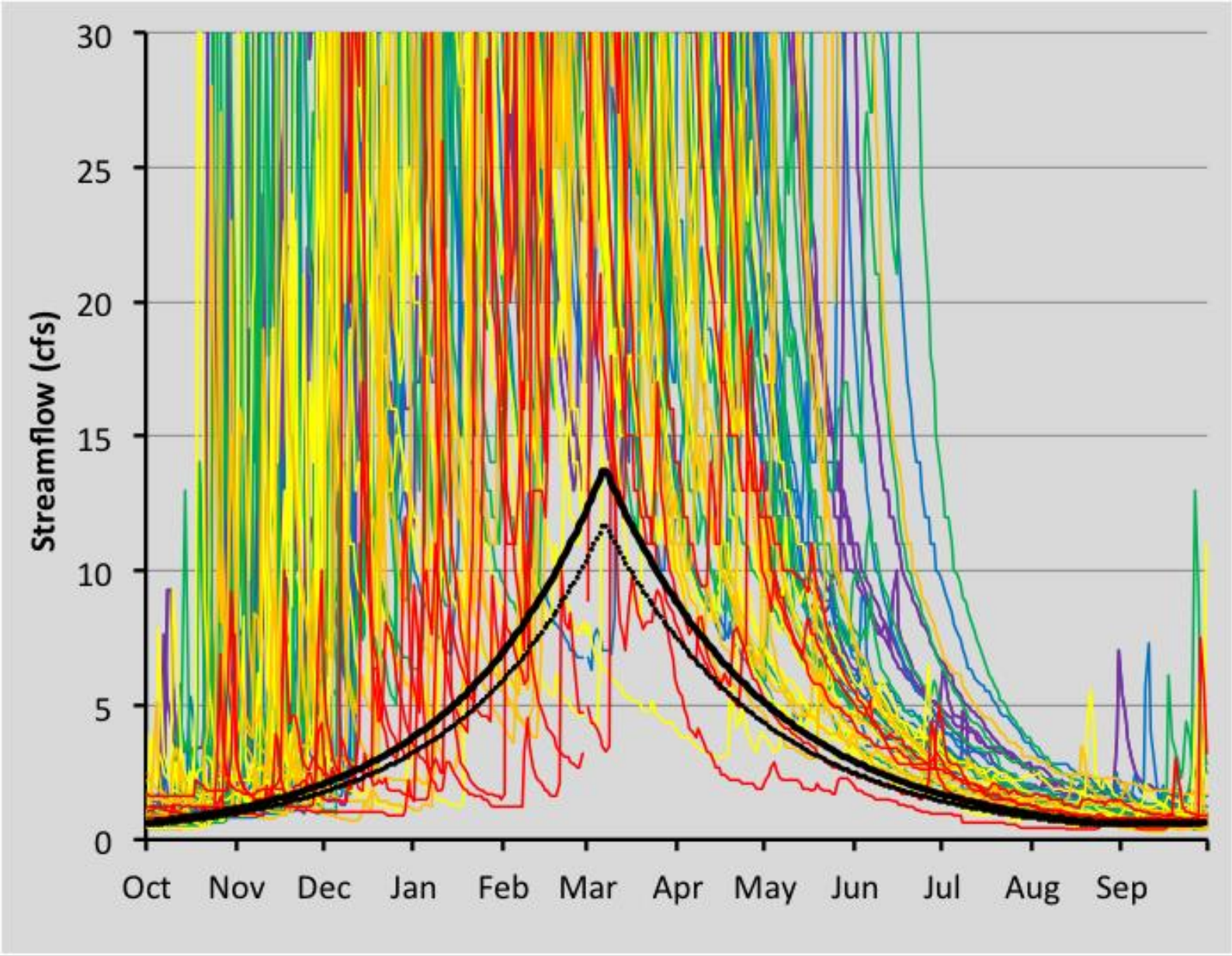

Streamflow (cfs)
1000
900
800
700
600
500
400
300
200
100
0
Oct
Nov
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep


Streamflow (cfs)
100
90
80
70
60
50
40
30
20
10
0
Mar
Apr
May
Jun
Jul
Aug
Sep
Unimpaired Streamflow
15% Diversion Rate
Traditional Bypass Threshold
Appropriable flow (15%)
Appropriable flow (bypass)

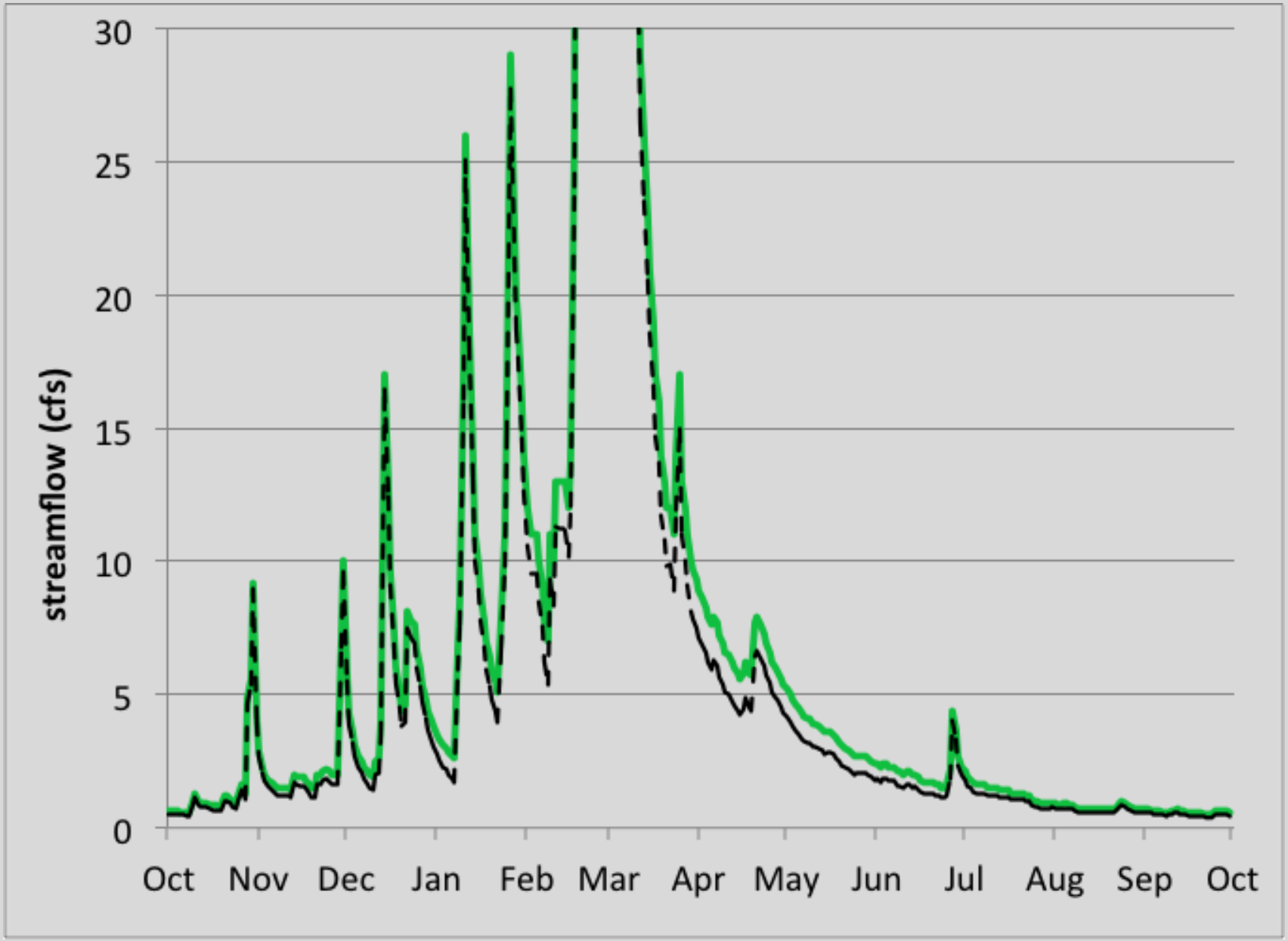
❑ Regional Baseline Hydrograph



❑ Apply a percent diversion rate to the baseline hydrograph



❑ Diverted hydrographs are conservatively protective flows



Water Volumes Available for Consumptive Uses

Assuming a 15% Diversion Rate:

[6.5 mi2 watershed]:

- 122 riparian water users (@500 gpd) = 68 ac-ft/yr

  and

- 712 acres of grape vineyard (0.5 ac-ft/acre)

  or

- 129,000 plants (900 gal/plant/yr)

Diversion Rate	Acre-Feet per Year	Gallons Per Day (Average)	Gallons Per Day (Minimum)
10%	283	250,000	41,000
15%	424	375,000	61,000
20%	566	500,000	81,600
NCIFP	300		0

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Site-Specific Instream Flow Methods

- ❑ Sproul Creek Flow Study funded by CWA 319(h) Program
- ❑ Focus on site-specific instream flow study methods and water management approaches
- ❑ SWRCB and RWB requested "Technical Working Group"
- ❑ Goal is to develop standardized and defensible instream flow methodologies

CALIFORNIA TROUT

Sproul Creek Technical Working Group

Examine a Regional Approach and Site-Specific Methodologies

Bryan McFadin	Regional Water Board
Michele Fortner	Regional Water Board
Adona White	Regional Water Board
Dan Schultz	State Water Board
Matt McCarthy	State Water Board
Paige Uttley	CDFW Instream Flow Program
Robert Holmes	CDFW Instream Flow Program
Jane Arnold	CDFW HabCon Region 1
David Manthorn	CDFW HabCon Region 1
Clarence Hostler	NMFS
Zane Ruddy	NMFS
Darren Mierau	CalTrout
Brian Johnson	TU
Matt Deitch	CEMAR
Gabe Rossi	MA
Bill Trush	HSU
Jeanette Howard	TNC
Jen Carah	TNC

Thank You!

QUESTIONS?

CALIFORNIA TROUT

Steve Moore, PE
Board Member
State Water Resource Control Board

Matt St. John
Executive Officer
North Coast Water Quality Control Board

Board Questions and Discussion

Public Comment

Board Discussion