

Potential Ambient Water Effects



RESEARCH THEME #3

OCTOBER 29, 2014

Why Ambient Water Issues

Work on water reuse has focused heavily on human health

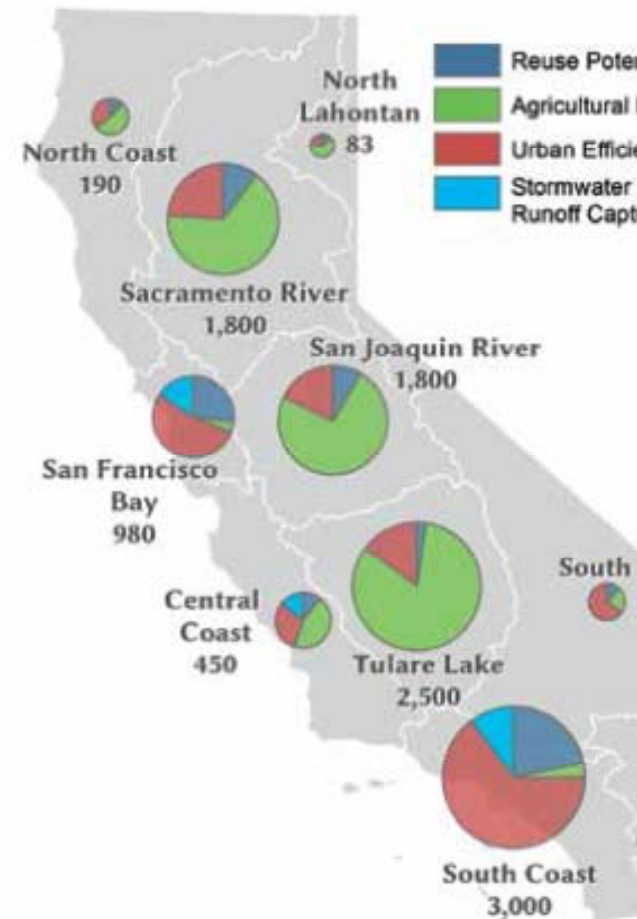
relatively less attention on ecological health issues

Need to increase reuse of wastewater AND stormwater

Wastewater use for IPR and DPR

Stormwater traditionally managed as a waste product NOT as a resource

State recycled water policy calls for an increase in stormwater use by 100,000 acre feet by 2020 and 1 million acre feet by 2030

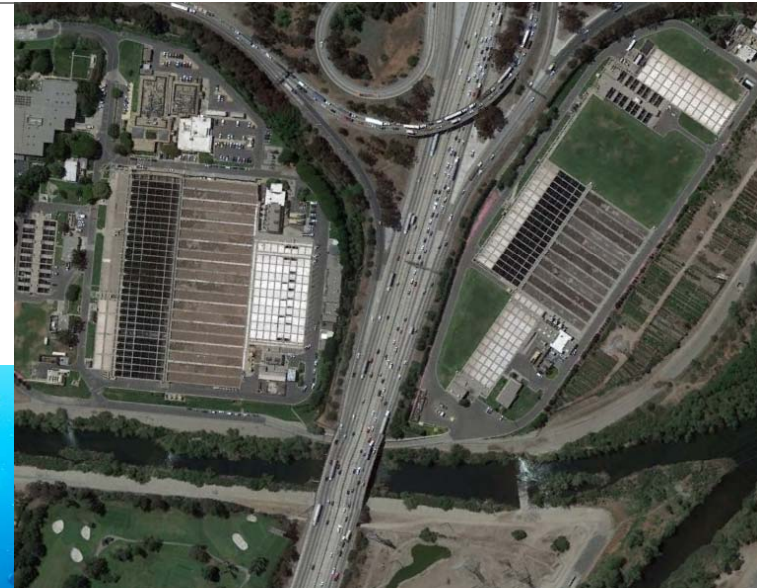
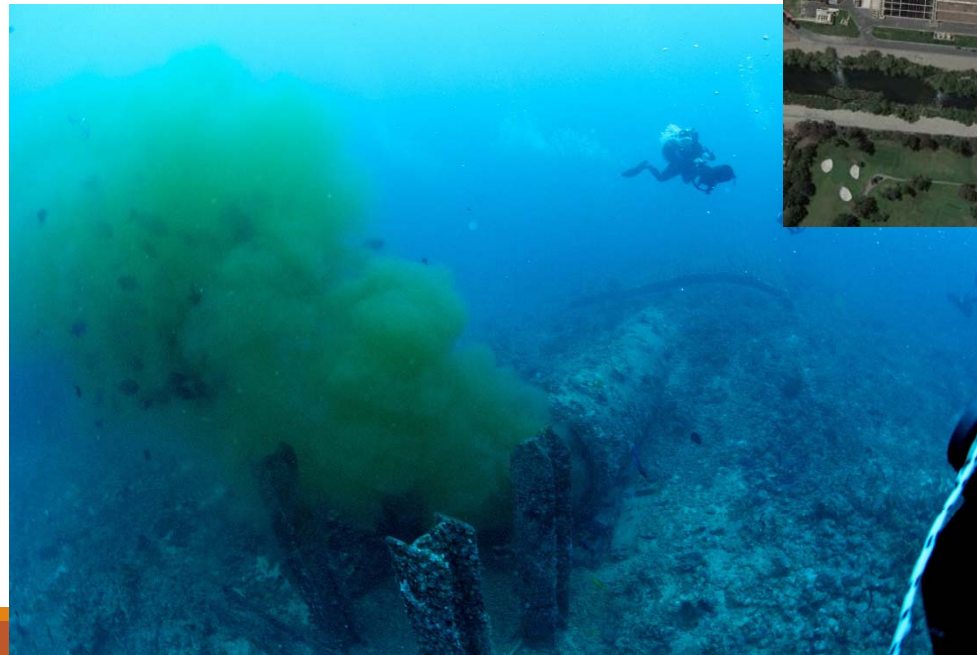


Management Drivers

- ❑ Water rights issues may limit diversions, capture, or alternative uses
- ❑ In-stream flow requirements for fisheries
 - San Francisco Region (San Pablo Bay)
- ❑ Sensitive species needs
 - State or Federal Endangered Species Act
- ❑ Hydromodification management
 - Reduced hydromodification effects vs. changes in substrate composition
- ❑ Biointegrity programs
 - Potential future flow requirements to protect instream biological condition
 - Salinity effects on instream biota
- ❑ Water Quality
 - Effects on ocean plume behavior associated with more concentrated salts/brine
 - Change in instream dilution of urban pollutants

Potential Effects on the Ambient Environment

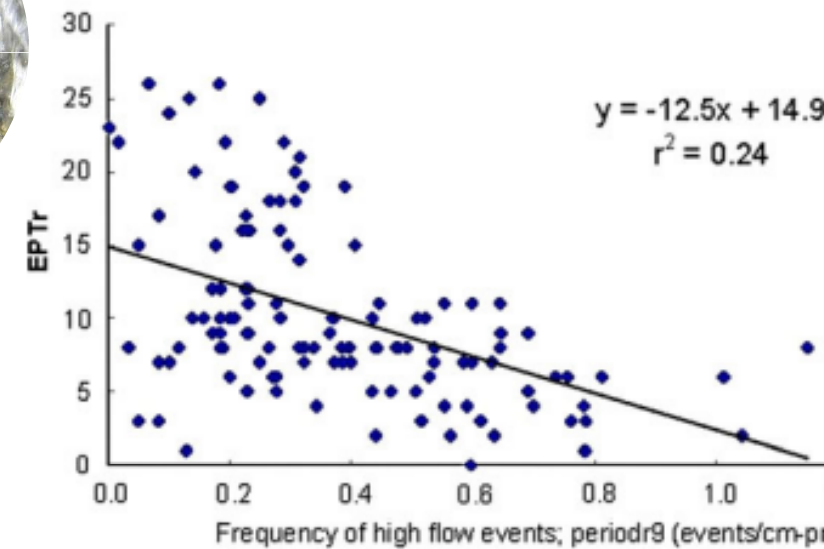
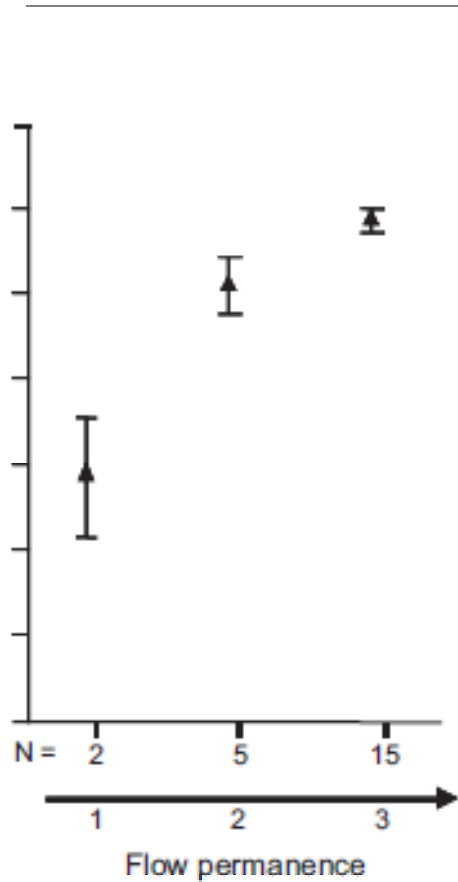
- ❑ Changes in flow patterns
- ❑ Changes in concentration
- ❑ Environmental fate



Flow Effects on Species Needs

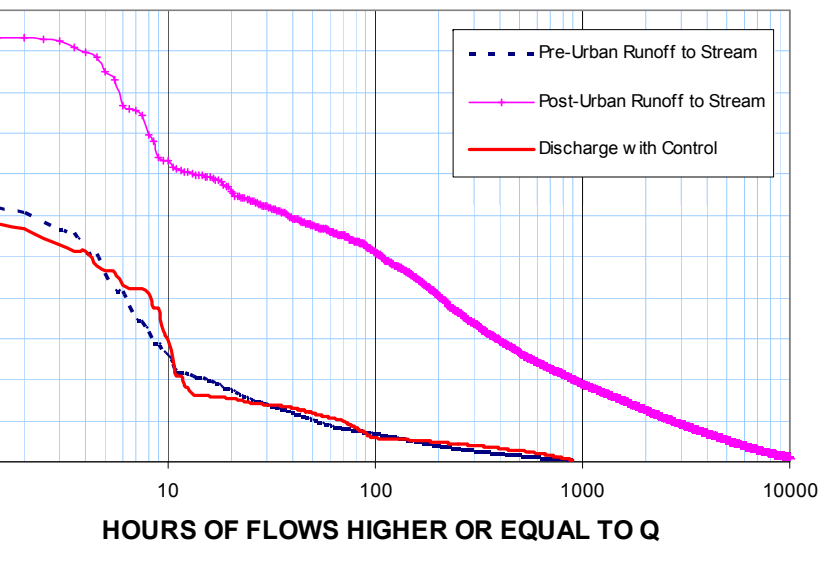


Flow Effects on Biological Indicators



and Pardo. 2007. Fund. Appl. Limn.

Flow Effects on Hydromodification



Flow Effects : Science Needs

- ❑ Develop flow-ecology relationships to protect desired beneficial uses
 - Sensitive species
 - Fisheries
 - Benthic invertebrates and other bioassessment targets
- ❑ Develop models to better predict how reduced flow may affect stream morphology
 - Changes to water balance of watersheds
 - Potential management tool to meet hydromodification management requirements



**Recommendations for Determining
Regional Instream Flow Criteria for Priority Tri
to the Sacramento-San Joaquin Delta**

A report to the
California State Water Resources Control Board

Concentration Effects: Stream Impacts

Many urban streams are dominated by wastewater effluent during the dry season

Reduced wastewater effluent may alter dilution characteristics and affect instream concentrations

Stormwater can account for 30-40% of the total annual volume discharged

Increased stormwater use can reduce contaminant loading → help achieve TMDL compliance



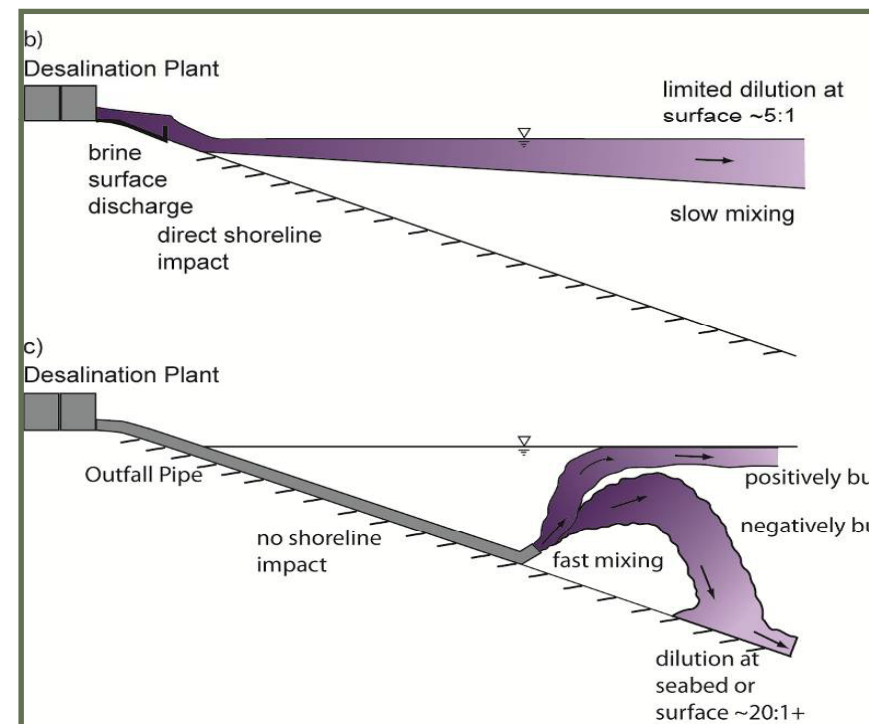
Concentration Effects: Ocean Impacts

Changes in the behavior of effluent plumes

- Reduced volume → higher concentrations
 - Salts, reclamation byproducts, emerging contaminants
- less mixing/dispersion of plume due to lower volumes
- increased buoyancy plume



effects on condition of benthos and fish



Concentration Effects: Science Needs

Conduct studies to determine how recycled water practices can be designed to optimize application rates to help meet water quality objectives

Centralized vs. distributed systems

MP retrofit for multiple functions

Optimum physical and biological design parameters

Refine existing models (both nearfield and regional circulation) and *in situ* measurements to assess the potential dilution occurrence of more concentrated (denser) wastewater plumes.

Evaluate effects of contaminants of emerging concern on in-stream, and marine and estuarine receiver biological communities.

Chronic effects of higher salts and brines on marine benthic communities

Toxicity and bioaccumulation of emerging contaminants and their transformation products

Environmental Fate

- ❑ Water quality requirements for contact recreation
 - Surface water augmentation

- ❑ Infiltration limits for groundwater quality or geotechnical stability issues
 - Groundwater recharge

- ❑ Few new science needs
 - Mostly site specific monitoring issues
 - Application of existing models



Summary of Ambient Environment Research Needs

Develop an assessment and management framework for considering effects on the ambient environment as part of recycled water policies

Include mechanisms to increase coordination among public and private agencies

low-ecology relationships

effects on hydromodification

MP optimization to meet water quality objectives

ate and transport of denser wastewater plumes

effect of salts, brines, disinfection byproducts, and other CECs



Thank You

Eric Stein

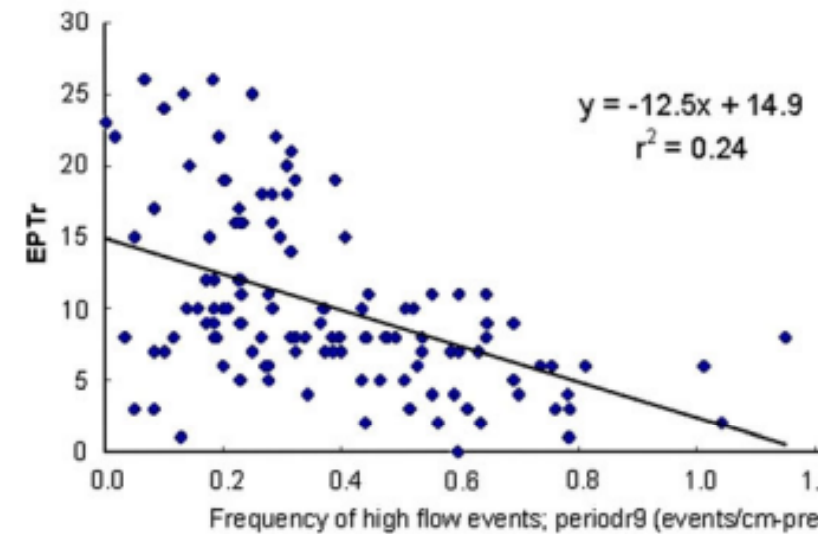
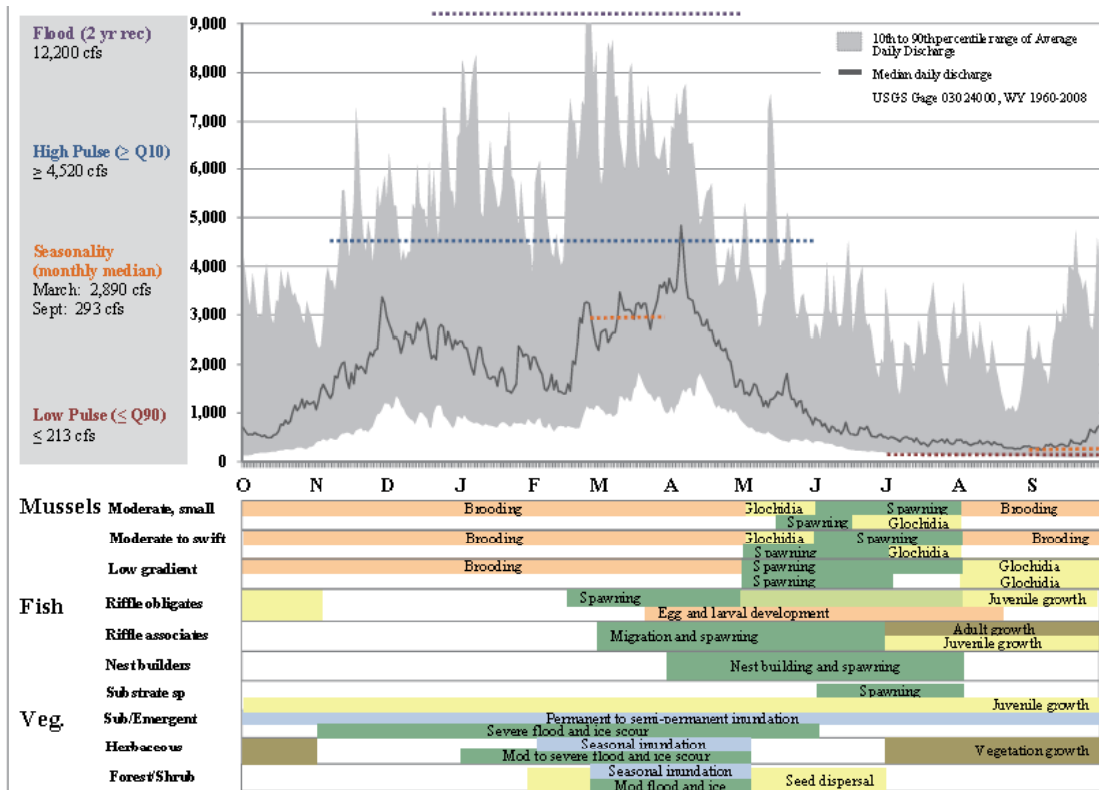
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EXTRA SLIDES

Flow Effects on Biological Indicators

Flow-ecology program to inform in-stream flow management targets



Concentration Effects: Science Needs

- ❑ Determination of potential sublethal /chronic effects of elevated salinity to sensitive life stages, especially for California benthic species.
- ❑ Evaluation of potential ecological risk of chemicals, including CECs, in water reclamation plant discharges (e.g. RO brine)
- ❑ Modeling/assessment of plume behavior
 - turbulence impacts on plankton
 - risk of increased benthic effects near outfall

Concentration Effects: SCCWRP Research

- ❑ Targeted and non-targeted analysis of contaminants with the greatest potential for ecological and human health impacts
- ❑ Bioanalytical screening for known and unknown chemicals/by-products that indicate the potential for adverse outcomes and that direct toxicity identification evaluation (TIE)
- ❑ Stressor Identification
 - Macro- and molecular level indicators of toxicity to benthic invertebrates and fish
 - Sentinel estuarine and marine species inhabiting ocean outfall zones

SCCWRP Research

Ecology/Biology

predictive tools to evaluate changes in flow duration associated with land use and management actions
development of in-stream flow-ecology relationships

Morphology

tools/models to assess risk of hydromodification to changing land use practices

Toxicology

watershed modeling to predict changes in pollutant loading under various BMP scenarios
analytical tool development for screening of water quality (CECs)
risk assessment/stressor ID studies

General Assumptions

Increased water reuse has the potential to impact quality of receiving waters

- ❑ Receiving water effects may be an issue in streams and the ocean due to reuse of stormwater and wastewater, respectively
- ❑ Surface water augmentation would involve RO quality discharges; therefore, minimal concerns for ambient quality of lakes and reservoirs
- ❑ Stormwater reuse affects primarily stream habitats
 - Seasonality of stormwater capture
 - Changes in baseflow due to increased infiltration
- ❑ Wastewater reuse can affect either stream or ocean habitats

Issues to Investigate

Hydrology/Biology

Return to historical conditions  loss of instream habitat

Geomorphology

Reduced hydromodification effects  changes in substrate composition

Ecotoxicology

Reduced discharge volume  higher salinity (TDS), chemical concentrations

Concentration Effects: Drivers

- ❑ Water quality standards
 - Effluent concentrations
 - Receiving water limits

- ❑ Total Maximum Daily Loads (TMDLs)
 - Instream flow can be a component of load reduction

- ❑ Biological endpoints
 - Chemical effects on biology
 - Toxicological responses