This meeting will start at 1:00pm

Please ensure you have the latest version of Zoom

December 2, 2021

CALIFORNIA Water Boards

Public Workshop to Support the Development of Efficiency Standards

Methods used to evaluate efficiency standards' effects on local wastewater management

December 2, 2021

CALIFORNIA Water Boards

Office of Research, Planning, and Performance

Please introduce yourself via chat

- What's your name?
- What group or organization are you representing?
    - Example: Chris Martinez - State Water Resources Control Board

Max Gomberg

Mary Yang

Paola Gonzalez, presenter

Marielle Rhodeiro

Chris Martinez, presenter

Office of Research

Planning and Performance

Climate & Conservation Team

Beti Girma

Chris Hyun

Charlotte Ely

Karina Herrera

Bethany Robinson

Research team

Presenters:

- Erik Porse, Research Engineer, OWP at Sacramento State | Assistant Adjunct Professor, UCLA Institute of the Environment and Sustainability
- Harold Leverenz, Research Engineer, OWP at Sacramento State and UC Davis Civil and Environmental Engineering
- Caitlyn Leo, Research Engineer, OWP at Sacramento State

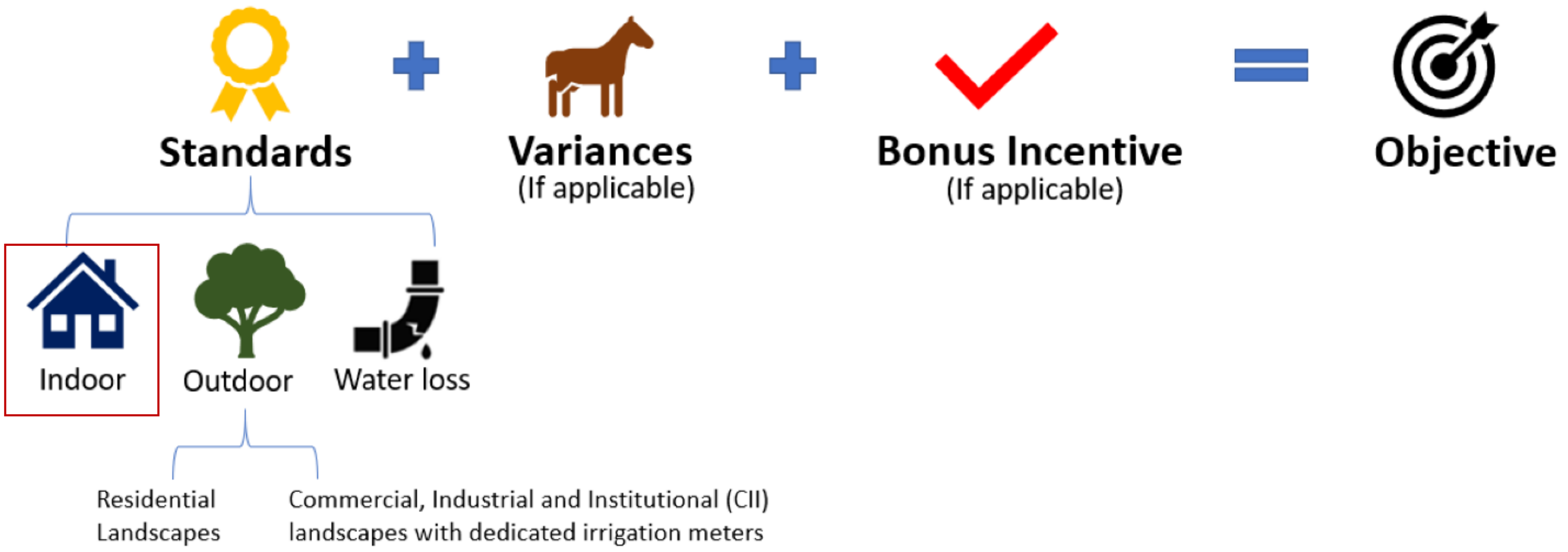
Agenda

- Background
  - Legislation and new efficiency framework
  - Update on the residential indoor report
  - 10609.2 requirements
- **Methods used** to evaluate efficiency standards' effects on local wastewater management
- Planned schedule and next steps
- Q&A
- Next steps

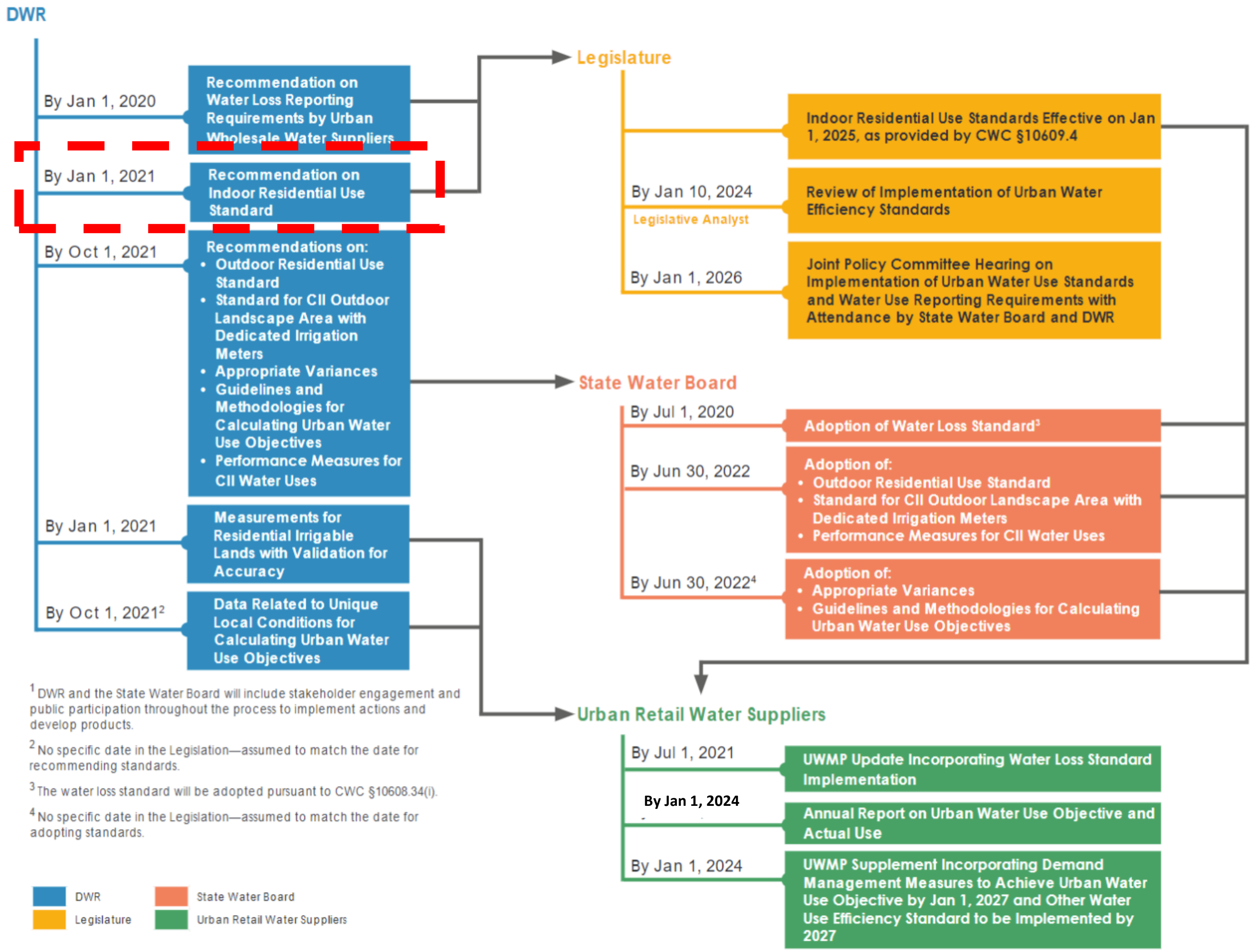
Legislation Background

- 2018 conservation legislation:
  - Senate Bill (SB) 606 (Hertzberg)
  - Assembly Bill (AB) 1668 (Friedman).
- Established a new water use efficiency framework
- Major actions:
  - DWR provides recommendations (2021)
  - State Water Board conducts rulemaking (2022)
  - Urban Retail Water Suppliers calculate "objectives" (2024)

Urban Water Use Objective



Residential Indoor Water Use Report



Residential Indoor Water Use Report

- Report & recommendations went to the legislature on 11/30/21.
- Legislation required to change the residential indoor standard.

Effective Dates	Water Code	**DWR-SWB Recommendation**	SB 1434 (Friedman)
Gallons Per Capita Per Day (GPCD)			
Until 2024	55	**No change**	48
2025 to 2030	52.5	**47**	45
2030 onward	50	**42**	40

Link to Report

- You can find the draft report at the bottom of this page:

https://water.ca.gov/Programs/Water-Use-And-Efficiency/2018-Water-Conservation-Legislation/Urban-Water-Use-Efficiency-Standards-and-Water-Use-Objective

Recommendations and Reports

The Department has released the following report(s):

1. Public Review Draft Report to the Legislature on the Results of Indoor Residential Water Use Study
2. Report to the Legislature on the Results of Indoor Residential Water Use Study (11/30/21)
   - Appendices A-J
   - Appendix K: Comment Letters and DWR Summary Responses

For additional information, please email wue@water.ca.gov.

Wastewater, Parklands, and Trees

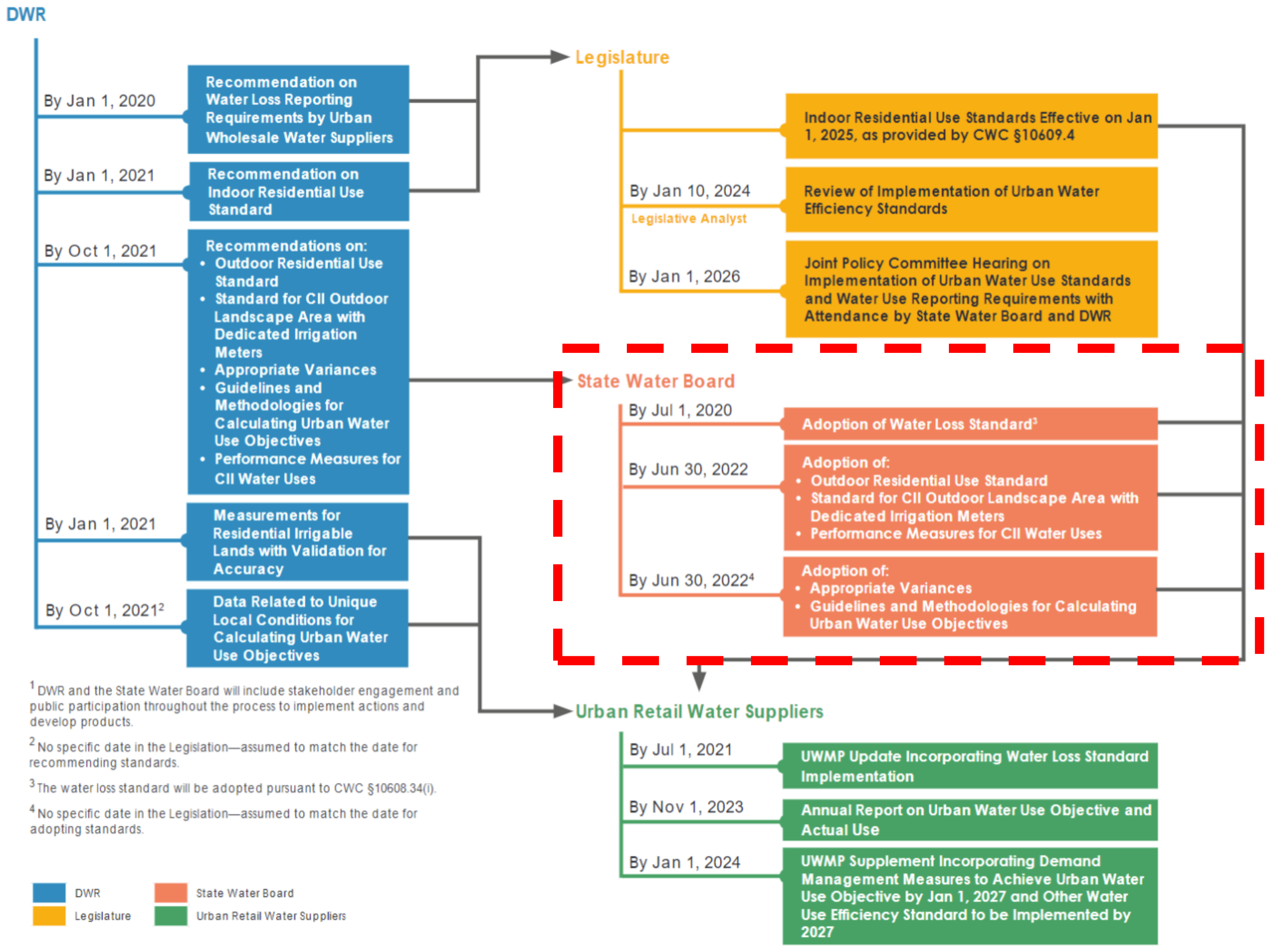
CWC Section 10609.2(c)

- (c) When adopting the standards under this section, the board shall consider the policies of this chapter and the proposed efficiency standards’ ***effects on local wastewater management, developed and natural parklands, and urban tree health***. The standards and potential effects shall be identified by May 30, 2022. The board shall allow for public comment on potential effects identified by the board under this subdivision.

Evaluating the impact of the new efficiency framework on local wastewater management

- Understanding indoor water use trends
- Connecting water suppliers to sewersheds
- Understanding how changes in flows may affect collection, treatment, and reuse facilities
- Evaluating risk and potential impacts

How does 10609.2(c) fit into the overall process?



How does 10609.2(c) fit into the overall process?

State Water Board

TBD

Adoption of water loss standards

By May 30, 2022

Identify impacts on local wastewater management, parklands, and urban tree health.

TBD

Adoption of water loss standards

- Outdoor Residential Use Standard
- Standard for CII outdoor landscapes with dedicated irrigation meters
- Performance Measures for CII water uses
- Appropriate variances
- Guidelines and methodologies for calculating urban water use objectives

Benefits of Efficient Indoor Use

- Water savings
- Energy savings

Adapting to and mitigating the impacts of climate change

- Reduced water bill
- Protects water quality
- Reduced need for infrastructure investments
- Mitigated rate increases

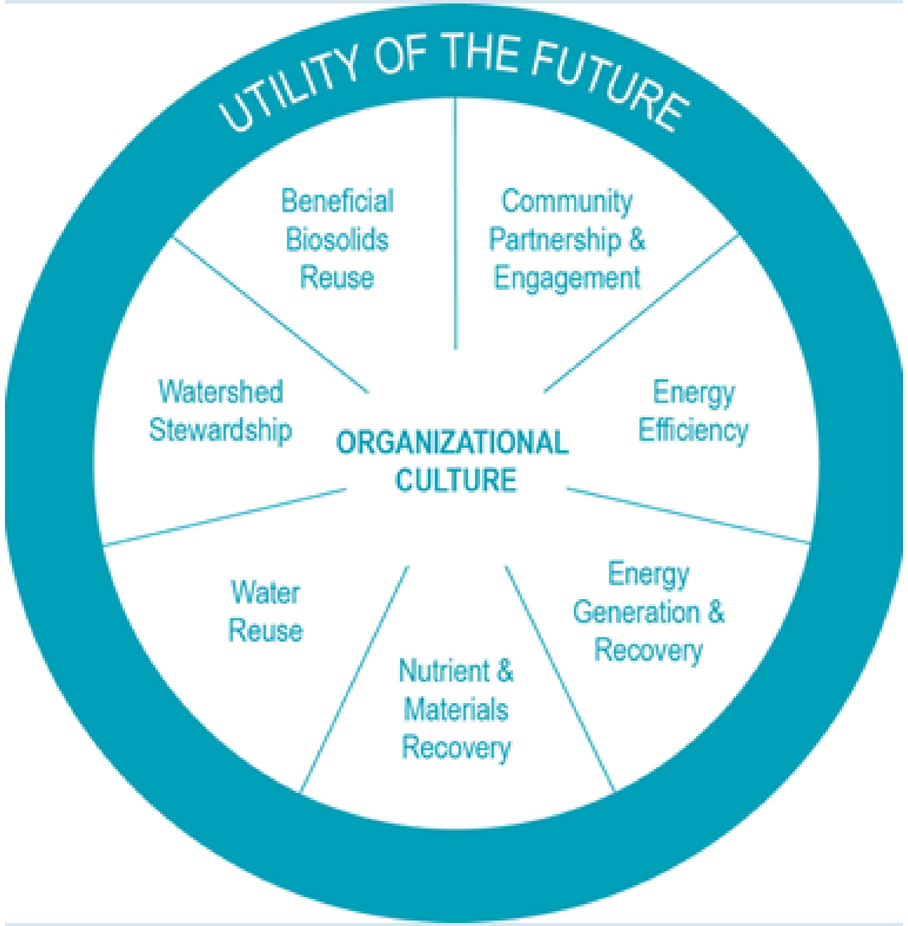
Poll (please answer on chat):

Increased water efficiency is inevitable and necessary.

What's your vision for a drought and climate resilient sewershed?

C&C team's vision for the future

- Preparing for the challenges ahead
- Leveraging infrastructure funding to support needed repairs, maintenance, and upgrades
- Adhering to "utility of the future" principles

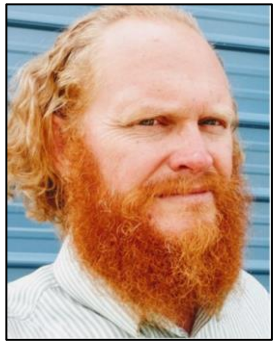


Economic and Environmental Effects of AB 1668-SB 606

Effects on urban water suppliers and wastewater management

December 2, 2021

Erik Porse, PhD, OWP at Sacramento State | UCLA
Caitlyn Leo, OWP at Sacramento State
Harold Leverenz, PhD, OWP at Sacramento State | UC Davis



WATER PROGRAMS Sacramento State

UCLA Institute of the Environment and Sustainability

Full Project Scope

Key sectors:

- Urban Retail Water Suppliers: costs & benefits, low-income communities
- Wastewater: conveyance, treatment, and reuse
  - Odor & corrosion, water quality, recycled water production potential
- Developed and natural parklands within service areas
  - Effects of irrigation regimes on vegetation
- Urban trees
  - Effects of irrigation regimes on health and number of trees

Full Project Team

Expertise in urban water supply, wastewater management, urban ecology, and economics related to AB 1668-SB 606

WATER PROGRAMS
Sacramento State

Erik Porse, PhD
Jonathan Kaplan, PhD
Maureen Kerner, PE
John Johnston, PhD, PE
Harold Leverenz, PhD, PE
Khalil Lezzaik, PhD
Dakota Keene
David Babchanik
Patrick Maloney
Scott Meyer
Samira Moradi
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UCLA
Institute of the Environment and Sustainability

Stephanie Pincetl, PhD
Lawren Sack, PhD
Felicia Federico, PhD
Robert Cudd
Julia Skrovan
Hannah Gustafson
Marvin Browne
Lauren Strug

The University of California Davis

Mary Cadenasso, PhD
Joanna Solins, PhD
Bogumila Backiel

Humboldt State University, Founded 1913

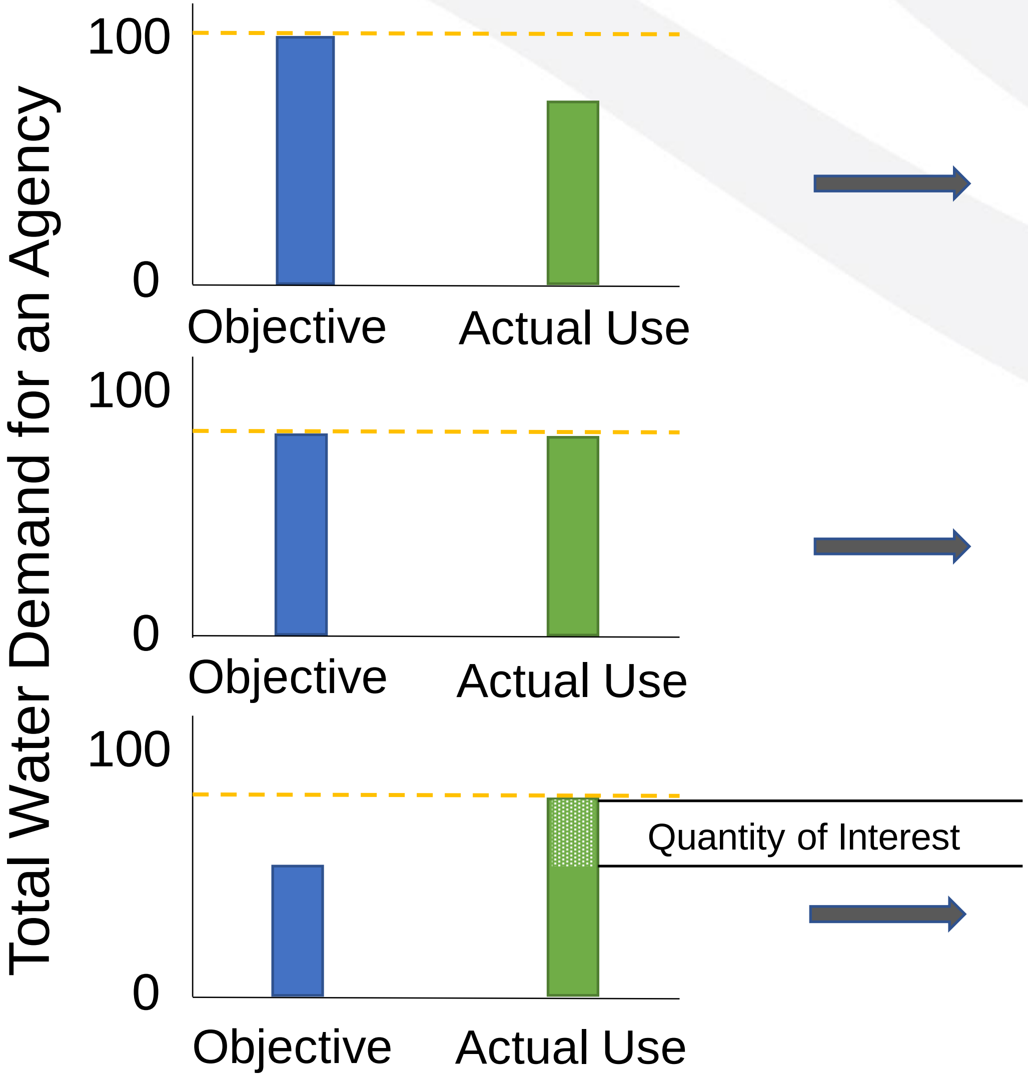
Erick Eschker, PhD
Jonathan Sander

Overall Evaluation Approach

1) Calculate scenarios of objectives based on parameters provided by state agencies
2) Evaluate current and future water demand
3) Evaluate Suppliers that will need reductions
4) Project likely compliance actions and effects
5) Assess effects “downstream” for wastewater management & landscapes

Source: circleofblue.org

Assessing Effects: Comparing Objectives and Actual Use



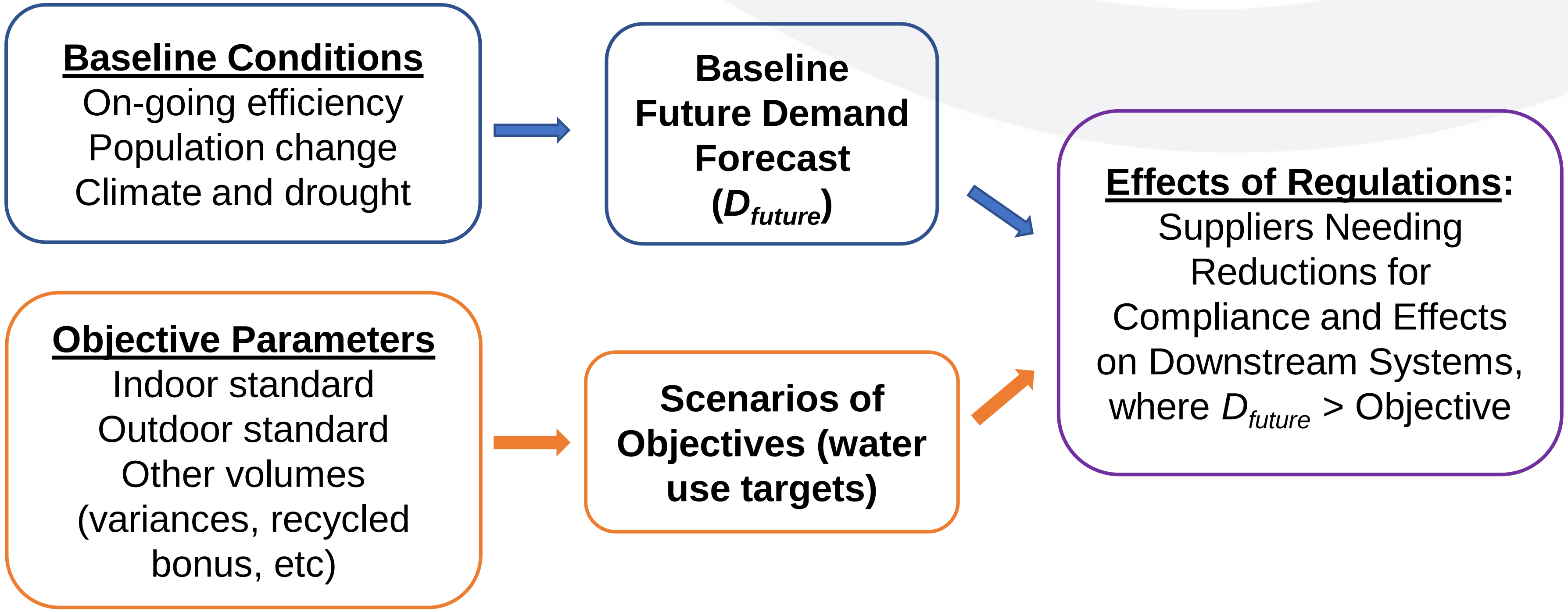
No new economic and environmental effects

Limited/no new economic and environmental effects

Assess effects based on likely mitigation actions for compliance

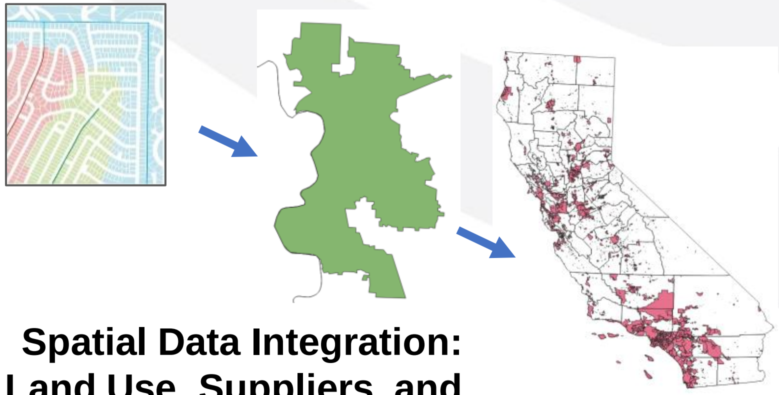
Baseline and Forecasting:
Marginal Effects of AB 1668-SB 606 Regulations

Must evaluate what "will" happen with no regulations as part of a baseline, then evaluate the future effects of regulations

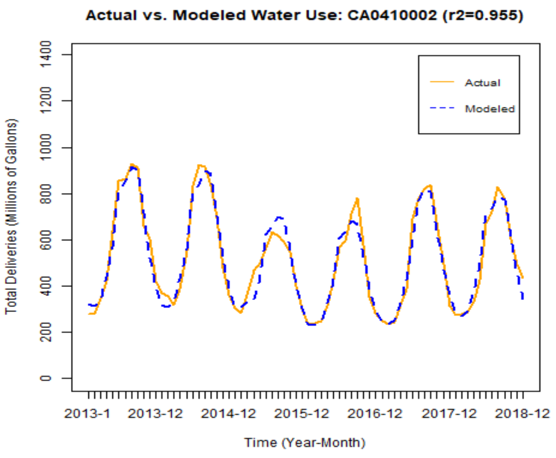


Integrating Data and Methods

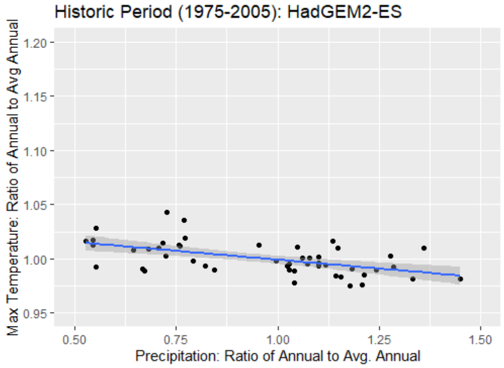
Modeling future water demand for water suppliers in California based on multiple methods



Spatial Data Integration: Land Use, Suppliers, and Statewide Data



Regression Modeling



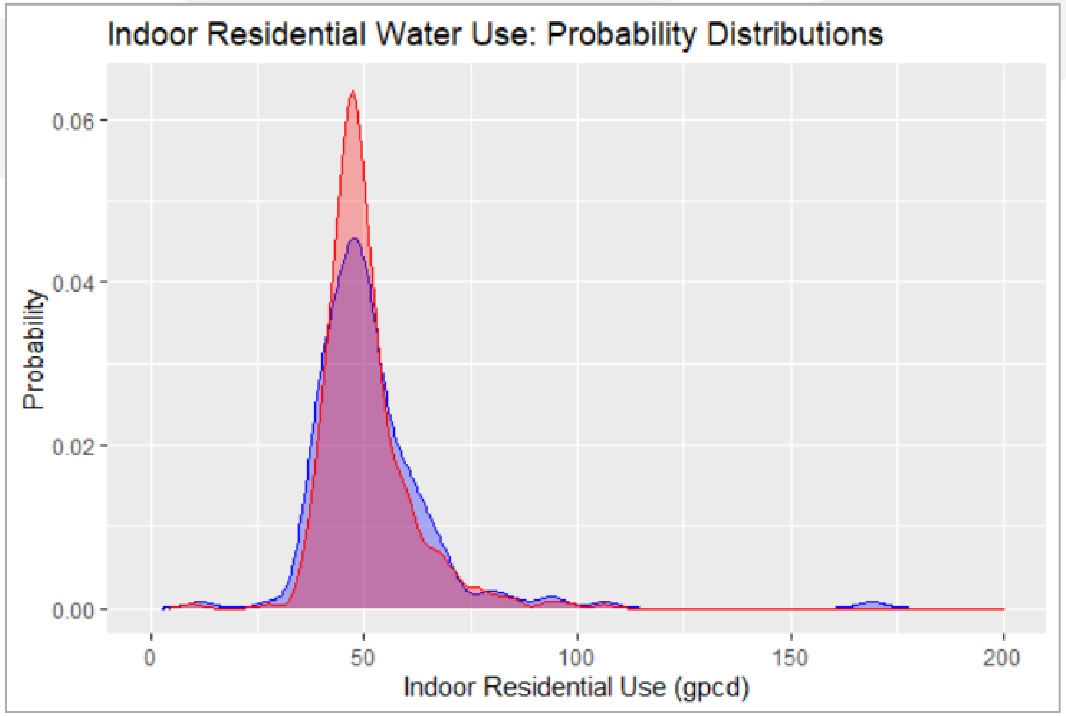
Climate and Drought Effects

Time Intervals		Appliances					
Years	Reason	Bath Faucet	Kitchen Faucet	Toilet	Clothes Washer	Dishwasher	Shower
pre-1980	Toilets (6 gpf)[1]			Y			
1981-1993	Toilets (3.5 gpf)[2]			Y			
1994-2006	U.S. Energy Policy Act	Y	Y	Y			Y
2007-2009	Washers[3]				Y		
2010	Toilets			Y		Y	
2011	EISA 2007 (42 U.S.C. 6295(g)(9))				Y		
2014	Title 20 & 24 (CalGreen)	Y	Y	Y			Y
2015	Clothes Washers					Y	
2016-2018	Title 20	Y					Y
2018-present	Title 20 &77 FR 32307 (2012)				Y		Y

End-Use Modeling of Indoor Fixtures

Current Residential Indoor Per Capita Use

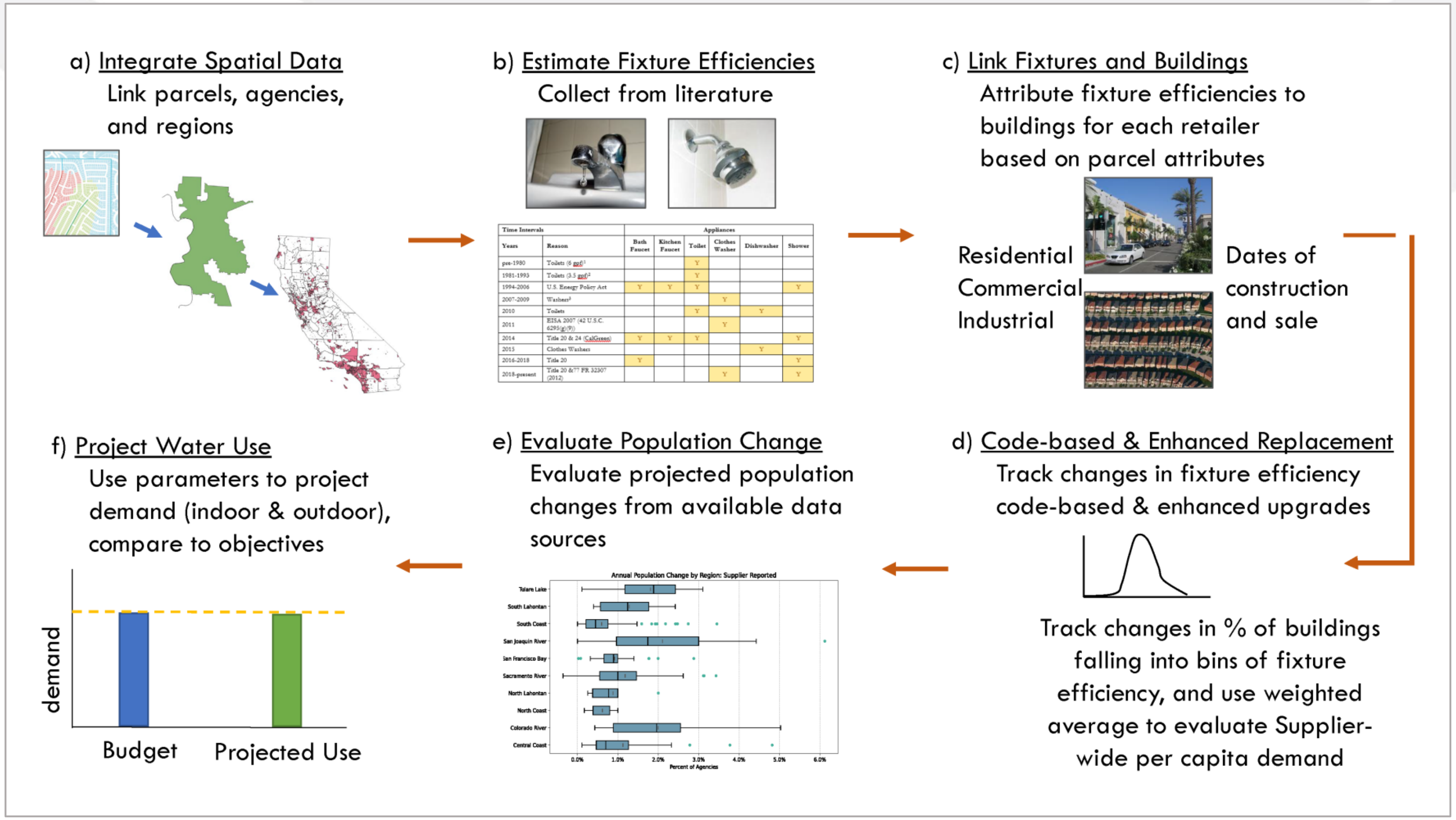
- Evaluate current indoor use estimates for all Suppliers
  1) Indoor residential water use study estimates (n = 158)
  2) Extrapolate remaining Suppliers: (n = 251)
     a) Transfer function approach
     b) Minimum month method
     c) Regression-based modeling
- Naming (ID) and boundary inconsistencies



Observed ***(mean = 51.2, median = 48.8)***
Extrapolated ***(mean = 50.7, median = 48.2)***

Future Indoor and Outdoor Per Capita Use

- Parcel data
- Evaluate existing conservation and estimated saturation rates of efficient indoor fixtures
- Code-based & enhanced replacement of indoor fixtures
- Turf replacement



Climate Forecast and "Net Drought Effects"

- A drought period was assumed as part of 2020-30 forecast
  - Historical data indicates that water use does not rebound to pre-drought levels

Residential Water Demand and Drought

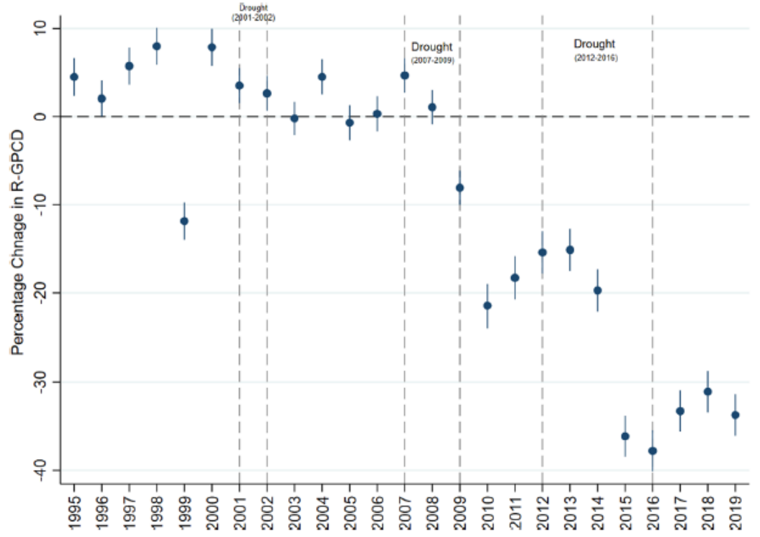
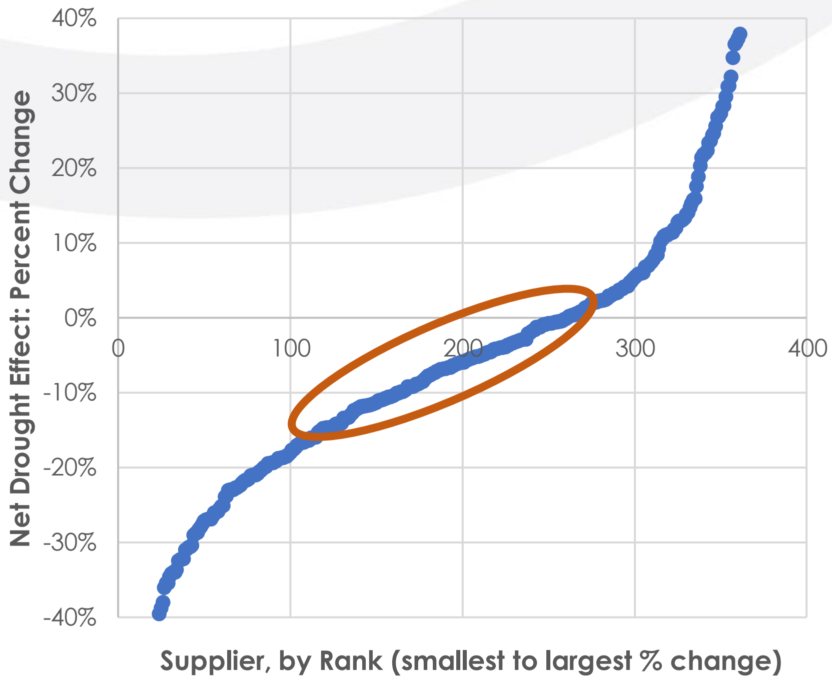


FIGURE 4 Comparison over time change in residential GPCD with the 1994 level. *Notes*: We used agency and month fixed effects and weather and demographics (income and household size) controls in the regression estimation. The average residential GPCD in 1994 was 142.03. The number of observations is 74,486 from 1994–2019 that includes 365 agencies [Color figure can be viewed at wileyonlinelibrary.com]

Source: Lee, Nemati, and Dinar, 2021

Distribution of "Net Drought Effect" on Total Water Demand (2014-2018)



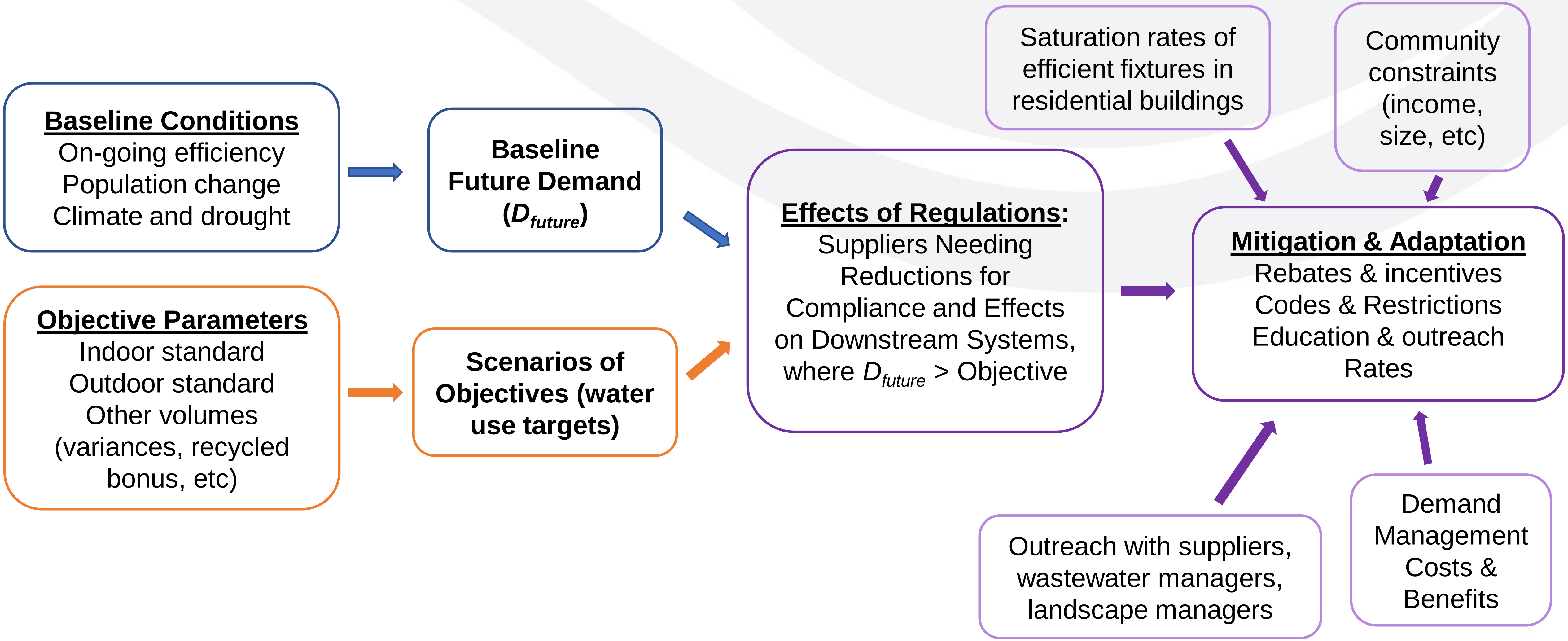
Source: Porse, n.d.

Other Sectors in the Objectives

- Other sectors in objective calculations compiled from available data sources

Sector	Data Source for Objective Values
Commercial, Industrial, and Institutional (CII) demand with dedicated irrigation meters	Landscape irrigation values as reported in electronic Annual Reporting
Variances	As reported by Suppliers
Leak Losses	Based on SB 555 reporting
Recycled bonus	Based on data provided by the State Water Board

Evaluating Mitigation and Adaptation Actions



Effects on Wastewater Management: Collection, Treatment and Reuse Systems

Historical Perspective

United States Environmental Protection Agency | Municipal Environmental Research Laboratory Cincinnati OH 45268 | EPA-600/2-80-137 August 1980

Research and Development

EPA

Effects of Water Conservation Induced Wastewater Flow Reduction

A Perspective

Effects of water conservation on sanitary sewers and wastewater treatment plants

Jeffrey T. DeZellar
Los Angeles County Sanitation Districts, Calif.

Walter J. Maier
University of Minnesota, Minneapolis

Water conservation is becoming an important policy and planning objective in many parts of the country because available fresh-water supplies are insufficient to meet the anticipated needs of growing urban centers. The obvious first step in this direction is to reduce excessive water use by households and industry.

Reduced water usage will also affect the

design correlations; treatment system performance is evaluated using a published computer program. The results are compared with field data obtained from several California wastewater treatment systems during the 1975–1977 drought condition.

VOLUME AND STRENGTH OF WASTEWATERS

Sources: Koyosako (1980), DeZellar and Maier (1980)

Overall Approach: Effects on Wastewater Management Systems

Approach:

1) Identify potentially-affected systems
   - Link Urban Retail Water Suppliers with wastewater collection, treatment and reuse systems
   - Evaluate trends from historical operations data
2) Develop and validate risk indicators for systems/facilities at risk of effects from lower flows (and source of lower flows)
   - Modeling operations and mitigation actions
   - Outreach: validation and calibration
3) Clustering/binning of systems with key risk factors to extrapolate effects

Analytical Methods

No single analytical approach is available to assess statewide effects on wastewater management systems

- **Analysis of Historical Data**
- **Process Modeling of Wastewater Collection and Treatment**
- **Engineering Field Experience**
- **Outreach: Insights and Validation**

Identifying Affected Systems

Network Modeling: Potential Impacts of Demand Reductions

How will demand reductions affect wastewater management systems and facilities?

Indoor demand reductions in Suppliers lead to reduced wastewater generation and influent flows

→

Network modeling to evaluate flow changes for collection and treatment systems

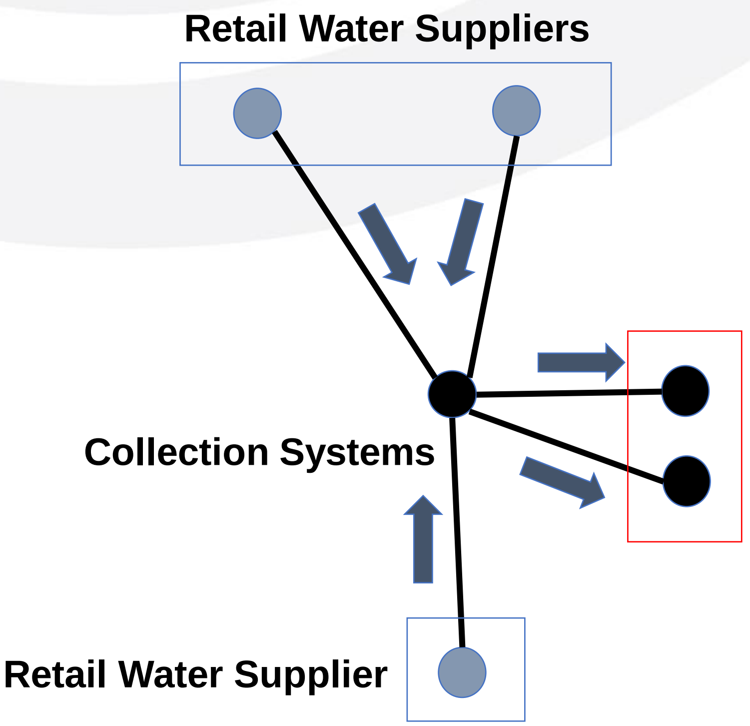
Reductions for AB 1668-SB 606 Compliance

Baseline indoor reductions

Water Use Efficiency Objective Impact Factor:

$$WEO_{wwtf} = \frac{\sum_r^R V_{wwtf,future}}{\sum_r^R V_{wwtf,actual}}$$

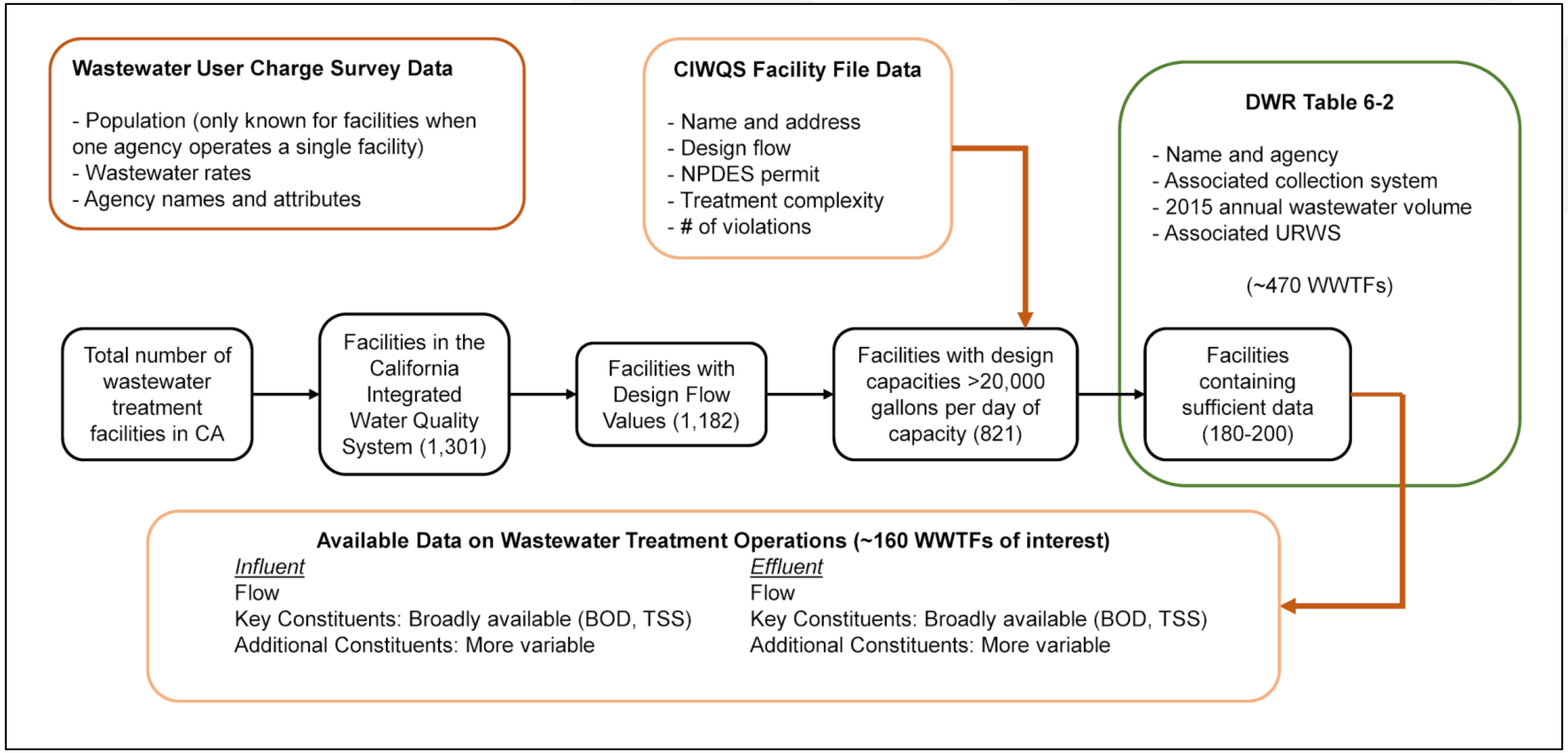
Network Modeling to Project Effects



WWTF = Wastewater Treatment Facility

Integrating Historical Operations Data

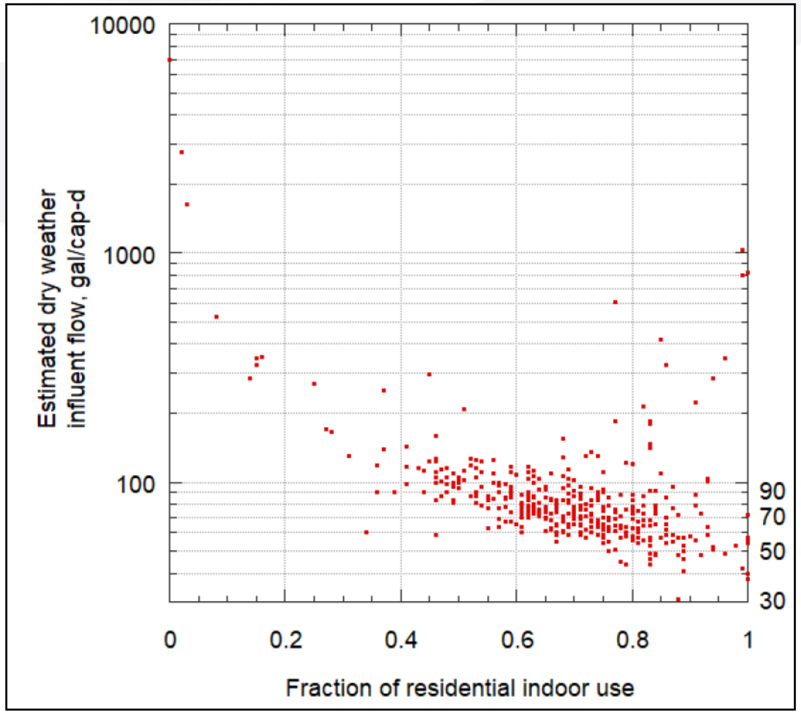
- Data does not exist for all facilities. Must use percentages and extrapolations



Residential Influent and Effects

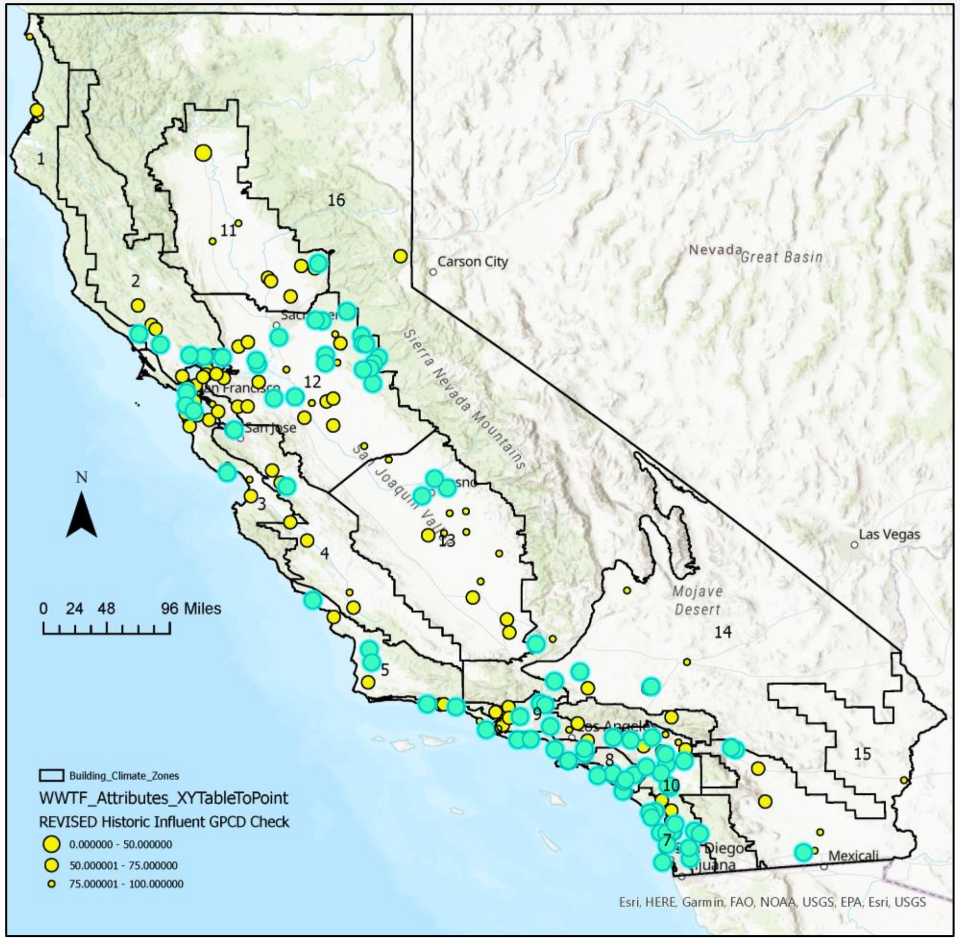
- Systems with a larger percent of influent from residential buildings at greater risk of effects if reductions are necessary
- Concentrations vs. Mass Loading

Use	Flow, gal/capita•d					
	2015		2020		2030	
	Range	Typical	Range	Typical	Range	Typical
Domestic						
Indoor use	40 - 80	60	35 - 65	55 (50)	30 - 60	40 (35)
Outdoor use	16 - 50	35	16 - 50	35	16 - 50	35
Commercial	10 - 75	40	10 - 70	35	10 - 65	30
Public	15 - 25	20	15 - 25	18	15 - 25	15
Loss and waste	15 - 25	20	15 - 25	18	15 - 25	15
Total	96 - 255	175		161		135



Risk Indicators: Identifying Systems with Potential Effects

- WEO Impact Factor
- Per capita wastewater influent flow
- Operational indices
  - Integrity Index
  - Dry Weather Capacity Index
- Climate zone
- Slope
- Tree canopy cover
- Percent of 6”-8” pipes

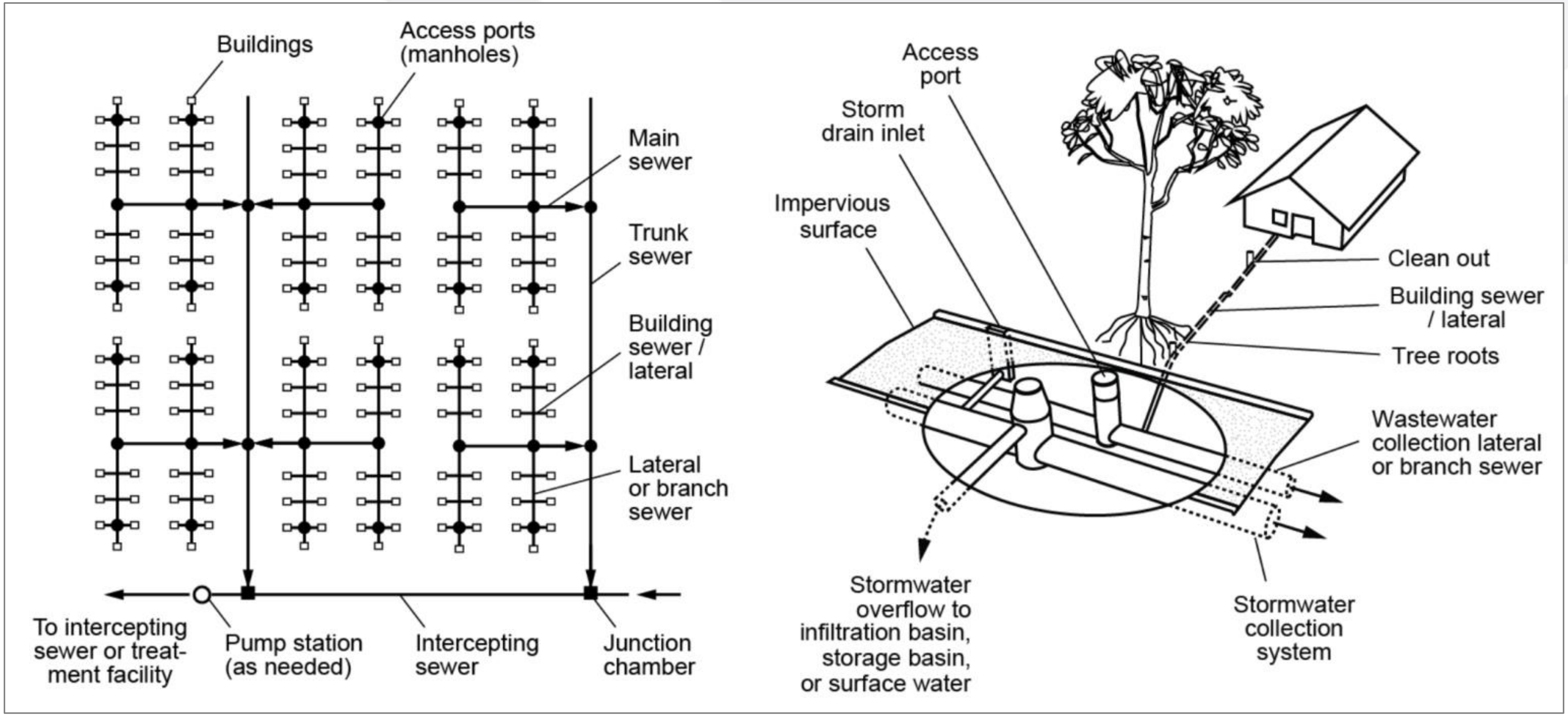


Wastewater Collection Systems

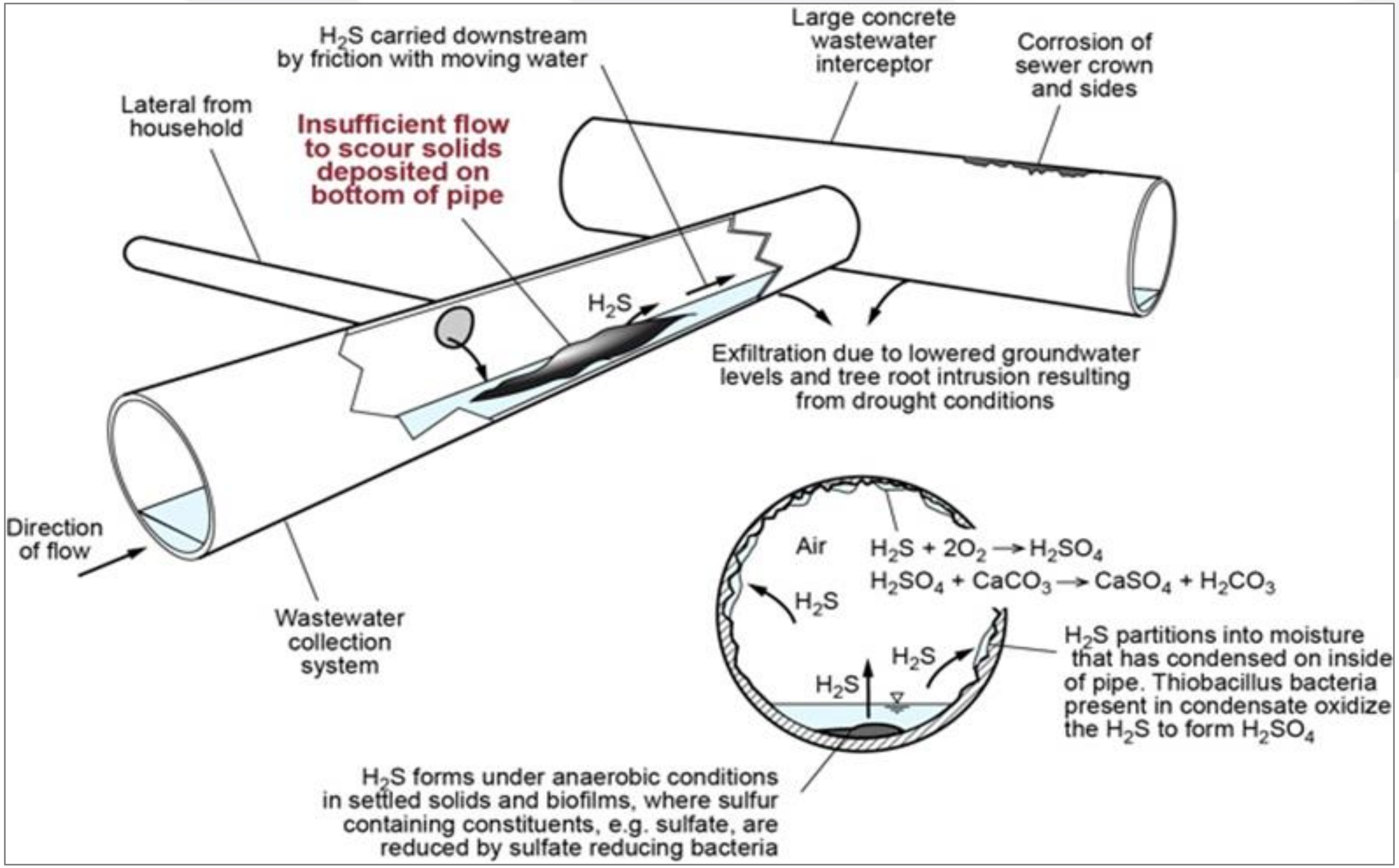
Known Effects of Lower Flows on Wastewater Collection

Low flow effects	Response
Deposition of solids in wastewater collection system	Increased labor to flush solids, equipment purchases
Increased sulfide generation causing corrosion of pipes	Replace or upgrade collection pipes
Increased sulfide generation causing odor complaints	Increased chemical usage, equipment needs
Root intrusion and blockages in small diameter laterals	Increased labor and chemical usage, equipment purchases
Generation of methane gas	No response
Increased cycling of lift station pumps, reduced pumping efficiency	Reduced pipe life, lift station upgrades
Blockages of lift station pumps	Increased labor
Lift station corrosion from increasing sulfide causing	Reduced life, lift station upgrades

Layout and Operations of Collection Systems



Accelerated Odors and Corrosion in Wastewater Collection



Courtesy:
Dr. George Tchobanoglous

Process Modeling

- Developed an Excel-based model to evaluate effects of lower flows on collection systems and WWTF influent
  - No existing tool in literature

Inputs:

- Collection system characteristics
- Influent water quality

Model key processes:

- Sediment deposition
- H_2S production
- COD transformation

Output:

- Numerical values for changes in collection system effects and WWTP influent concentrations

Inputs and Modeled Processes

System Inputs:		
Sewer System Characteristics:		
Population	250000	
Per Capita Use	52.8	gal/capita/d
Average Flow	13.2	MGD
Miles of Sewer	1234	miles
Time b/w Flushing Events	100	days
Collection System Influent:		
Temperature	27	°c
TSS Concentration	431	mg/L
Total COD Concentration	966	mg/L
Biodegradable COD	869	mg/L
Readily Biodegradable	579	mg/L
Slowly Biodegradable	290	mg/L
Inert COD	97	mg/L
BOD Concentration	454	mg/L
Total Kjeldahl Nitrogen as N	66.1	mg/L
Ammonia as N	38.5	mg/L
Total Sulfur	20.0	mg/L
Sulfate Concentration	58.0	mg/L
Sulfide Concentration	0.69	mg/L

Model Inputs:

- Population
- Per Capita Use
- Miles of Sewer Network
- Pipe Size Distribution
- Temperature

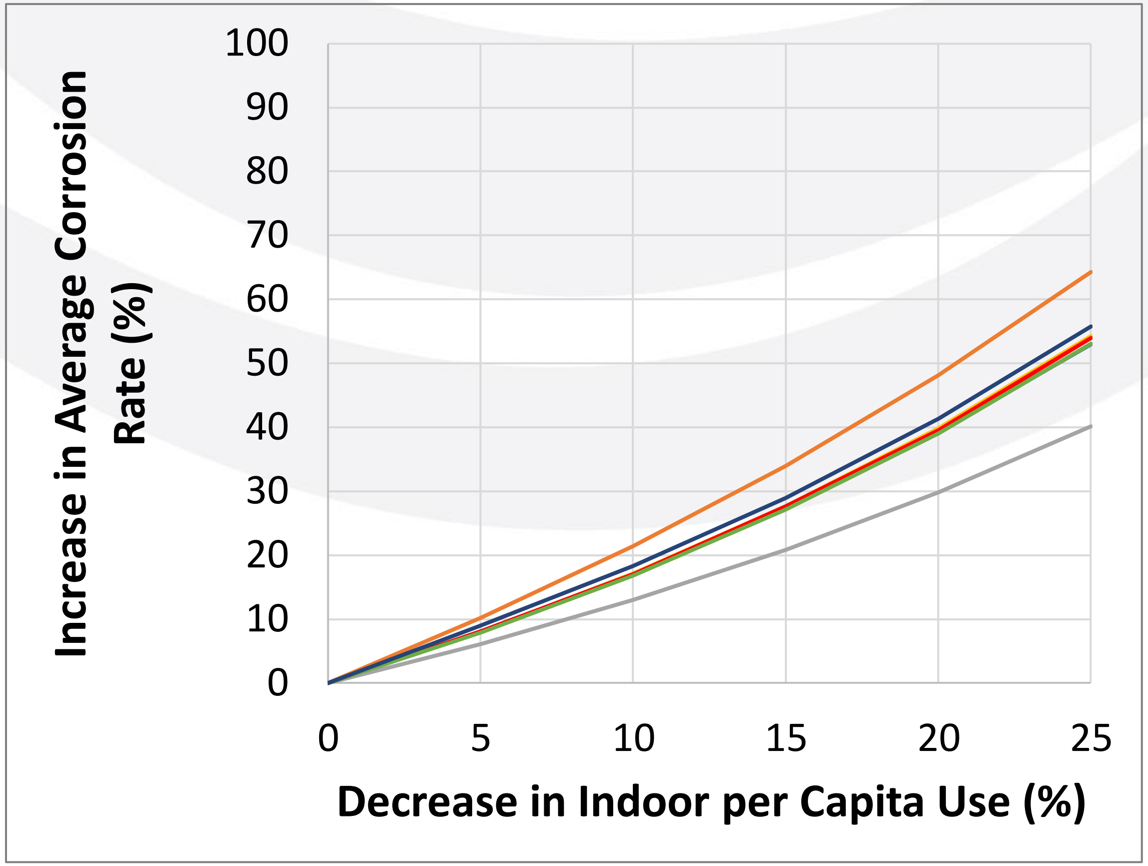
Modeled Processes:

- Flow velocities
- Sediment deposition
- Reaeration
- BOD consumption
- COD transformation
- Corrosion rate
- H_2S emission
- CH_4 production
- NH_3 production

Model Outputs

Outputs:

- Average sediment depth
- Average corrosion rate
- H_2S emissions
- Rate of chemical addition
- Pipe life expectancy
- Pumping Energy



- Ran model for 50 collection systems using data from SSO questionnaire reducing current per capita flow by 25% in increments of 5

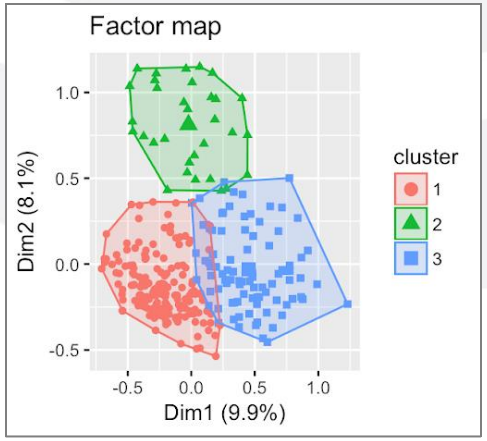
Estimating Effects of Reduced Flows

Use model outputs to extrapolate effects of reduced flows on collection systems

Model Results

Collection System	% Increase per % Decrease in Per Capita Use			
	Corrosion Rate	H_2S Emissions	Sedimentation	Chemical Addition
1	1.98	0.34	0.31	0.38
2	2.00	2.52	0.24	0.61
3	3.20	0.46	0.19	0.76
4	1.98	1.67	0.30	0.35
5	2.11	2.36	0.27	0.62

Clustering Systems Based on Risk Indicators



Determine Average Incremental Changes and Apply to Projected Flow Reductions

Cluster	% Increase per % Decrease in Per Capita Use			
	H_2S Emissions	Corrosion Rate	Sedimentation	Chemical Addition
1	1.29	2.15	0.22	0.42
2	2.01	1.88	0.26	0.37
3	2.05	2.01	0.25	0.49

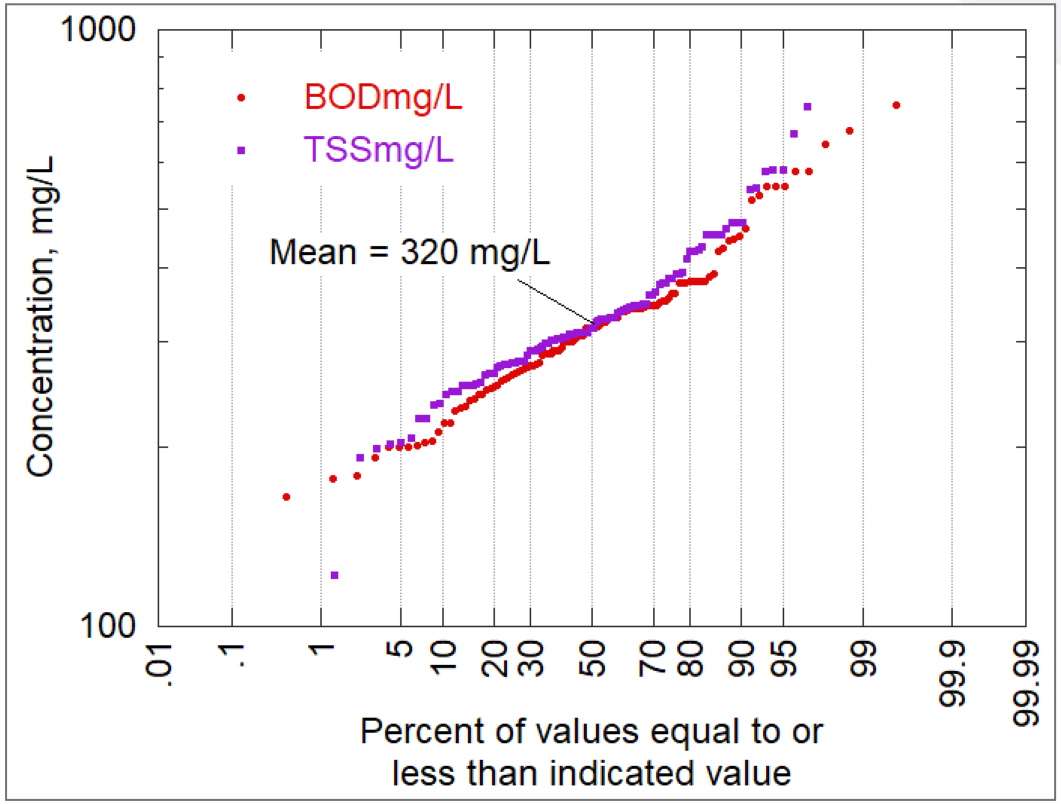
Wastewater Treatment and Reuse Systems

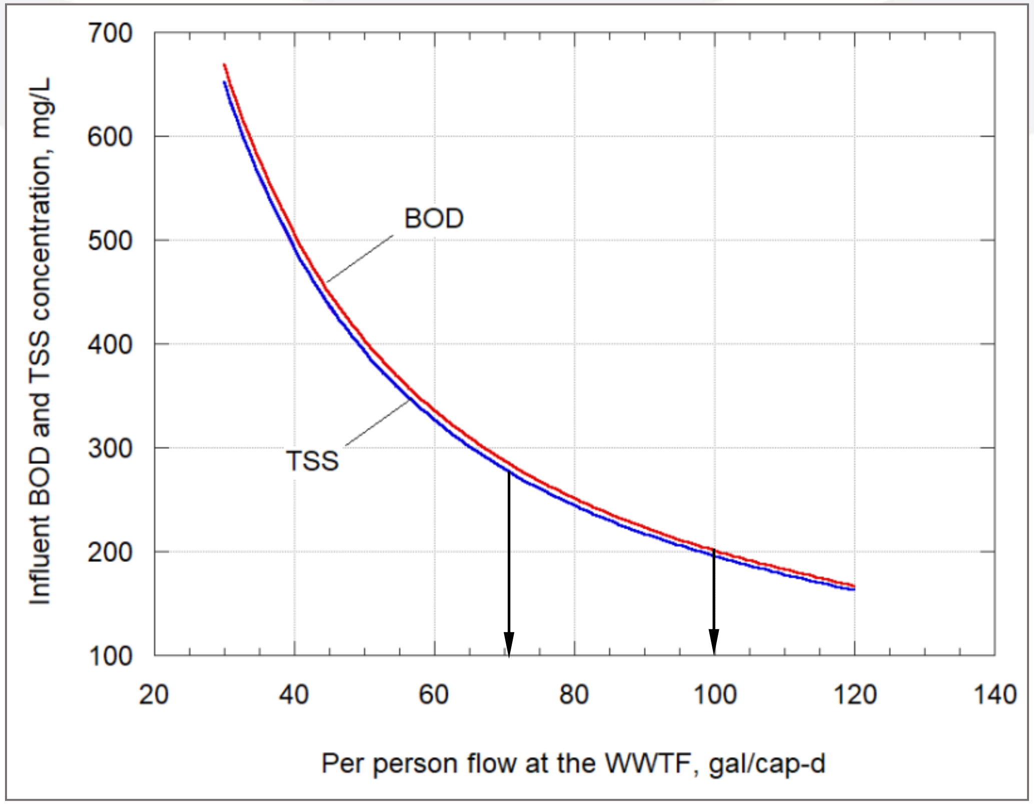
Known Effects of Lower Flows on Wastewater Treatment

Low flow effects	Response
Management of solids scouring events at headworks	Increased labor
Increased sulfide at headworks	Increased chemical cost, upgrade structures
Grit removal less effective	Process upgrades
WWTFs with conventional trickling filter and activated sludge technology process performance deterioration	Increased energy and chemical usage, upgrade process, increased labor/consulting needs
WWTFs with nitrogen removal at or near discharge limits due to increasing ammonia concentrations	Increased energy and chemical usage, upgrade process, increased labor/consulting needs
Increased cost for disinfection	Increased energy (UV) and chemical (chlorine) usage
Capacity limitations for increased loading and co-digestion	Process upgrades, increased chemical and energy use, increased labor/consulting needs
Increasing dissolved solids (salts) and volumetric limitations impacting recycled water	Revenue losses, increased treatment costs
Wastewater fermentation and transformation	Process & operational modifications, energy

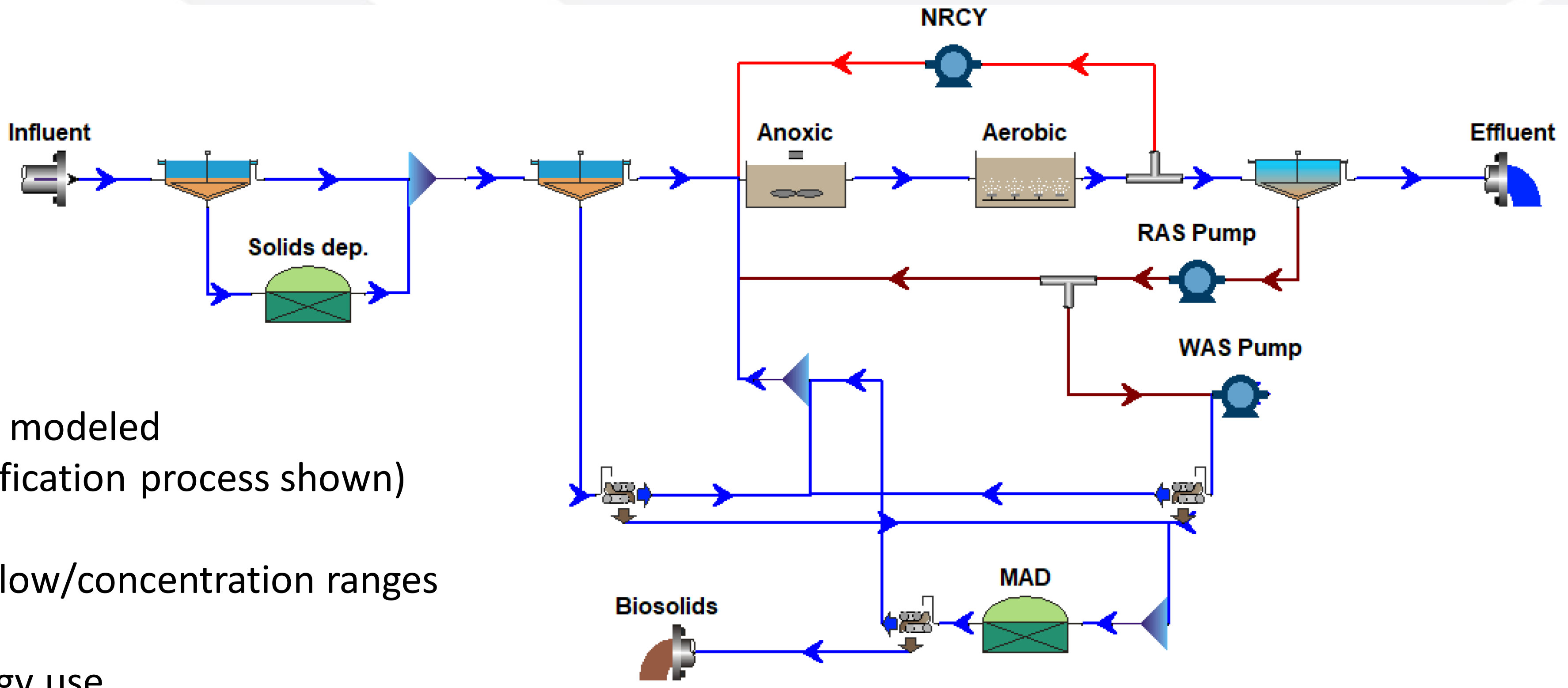
Constituent Concentrations and Loading:
System Designs vs. Current Operating Conditions

- Most facilities designed for 100 gpcd, BOD & TSS < 200mg/L
- Increasing concentrations are out of design scope for some facilities





Identification of threshold values for process operations



Typical WWTF processes modeled
(ex: nitrification/denitrification process shown)

Simulations at selected flow/concentration ranges

Variable chemical / energy use

Identification of threshold values for process operations

As total influent flows (Residential + CII) drop below ~70 gpcd:

- Older aeration systems need to be upgraded or replaced
- Trickling filters need to be upgraded or replaced
- Nitrogen removal systems not able to meet effluent standard without chemical addition and increased pumping
- Operations and capital needs increase proportional to gpcd reductions

CII = Commercial, industrial, and institutional flows

Effects of Reduced Flows on Wastewater Treatment Facilities:
Thresholds and Extrapolation

Parameter	Consideration	Scaling	Data source
Current / future GPCD	Identify potential operational challenges	>70 gpcd – limited issues <70 gpcd – proportional challenges	DWR, AVR
Type of process	Increased O&M, upgrades associated with treatment process	Primary – least impacted Secondary Tertiary Advanced – most impacted	AVR, CIWQS
Use of disinfection	Increase O&M, upgrades associated with disinfection	With disinfection Without disinfection – not impacted	AVR
Increased loading	Increased loading from population increase, organics diversion	Proportional with population	UWMPs, AVR
Recycled water capacity	Potential for lost revenue from RW supply limitations	>80% effluent flow used to produce recycled water	AVR
Increase in salinity	Increased cost for salinity removal and management	>70 gpcd – limited issues <70 gpcd – proportional challenges	Modeled

AVR = Annual Volumetric Reporting, CIWQS = California Integrated Water Quality System

Key Themes

- Identified wastewater systems that serve Suppliers affected by AB 1668-SB 606, but better GIS data is needed
- Site-specific factors influence effects of lower flows on wastewater collection, treatment and reuse
- Past designs, recent upgrades, and emerging future conditions all contribute to risk
- We can use available data for better planning and risk assessments

Special Thanks

CalWEP, Alliance for Water Efficiency

Urban retail water supply community

Wastewater management community, including CASA, SCAP, BACWA, CVCWA, CWEA

Urban parkland management community

Dongyue Li, Ruth Engel, Dennis Lettenmaier, Tom Gillespie (UCLA)

Matthew Ritter, Andrew Fricker (Cal Poly SLO)

Diane Pataki (Arizona State), Liza Litvak (University of Utah)

Contact: erik.porse@owp.csus.edu

Short Break (5 minutes)

Presentation Highlights

- Urban water demand related to AB 1668-SB 606 is being forecasted through 2030, including how changes in climate, technology, and population will influence water use. Future demand will be compared to scenarios of water use objectives recommended by state agencies to identify affected areas

- Network modeling is being used to evaluate effects on wastewater collection, treatment, and reuse systems across the state that manage wastewater from affected water suppliers

Presentation Highlights

- A process model was developed to evaluate changes in collection systems operations with reduced flows, including effects on pipe corrosion, odors, and maintenance

- A risk-based approach is being used to evaluate likely mitigation and adaptation actions that will be necessary to address lower flows as a result of AB 1668-SB 606, including factors for existing flow conditions, climate, collection system layout, wastewater treatment facility process operations, and permit requirements

Planned Schedule

Wastewater, Parklands, and Trees

Step	Date
Release draft methods document for public comment	February 2022
Methods document comment period	February- March 2022
Publish draft report for public comment	April 2022
Review and address comments	End of May – July 2022
Publish final report	September 2022

Planned Schedule

AB 1668/SB 606 rulemaking

Step	Date
Receive recommendations from DWR	**This winter**
Start Rulemaking Process	Spring 2022
Adoption	Spring 2023
Effective Date	Fall 2023

Q&A

- Please state your name, agency, and question

Next Steps

- Upload presentations and recording to website
- Schedule additional meetings
- Start Rulemaking

Where to find more information

- **State Water Resources Control Board**
  - Water Conservation Portal
    - www.waterboards.ca.gov/water_issues/programs/conservation_portal/
  - About SB 606 & AB 1668:
    - www.waterboards.ca.gov/water_issues/programs/conservation_portal/california_statutes.html
  - About the rulemaking process:
    - www.waterboards.ca.gov/water_issues/programs/conservation_portal/regs/water_efficiency_legislation.html

- **Department of Water Resources**
  - Primer of 2018 Legislation on Water Conservation and Drought Planning
  - About urban water use efficiency, including SB 606 & AB 1668:
    - https://water.ca.gov/Programs/Water-Use-And-Efficiency/Urban-Water-Use-Efficiency
  - Sharepoint site with materials for DWR workgroup members only:
    - https://cawater.sharepoint.com/sites/dwr-wusw/SitePages/Home.aspx

Thank you!

See you tomorrow at 2pm

Contact: ORPP-WaterConservation@waterboards.ca.gov with questions