

Task Force Planning Priorities - Task 1: Prepare Updated Surface Water Monitoring Program for TDS/N for the Santa Ana River Reaches, 2, 3 ,4 and 5

## **Overview of Recommended Surface Water Monitoring Plan**

June 22, 2022





# 2022 Santa Ana River Water Quality Work Plan

## Tables of Contents:

1. Background
  - 2004 TDS/N Management Plan; 2021 BPA; methods to prepare 2022 update; work plan objectives
2. Evaluation of the 2005-2020 Surface Water Monitoring Program
3. 2022 Surface Water Monitoring Program to assess compliance with Basin Plan TDS and Nitrogen objectives
4. Recommendation for Special Studies

# 2022 Santa Ana River Water Quality Work Plan

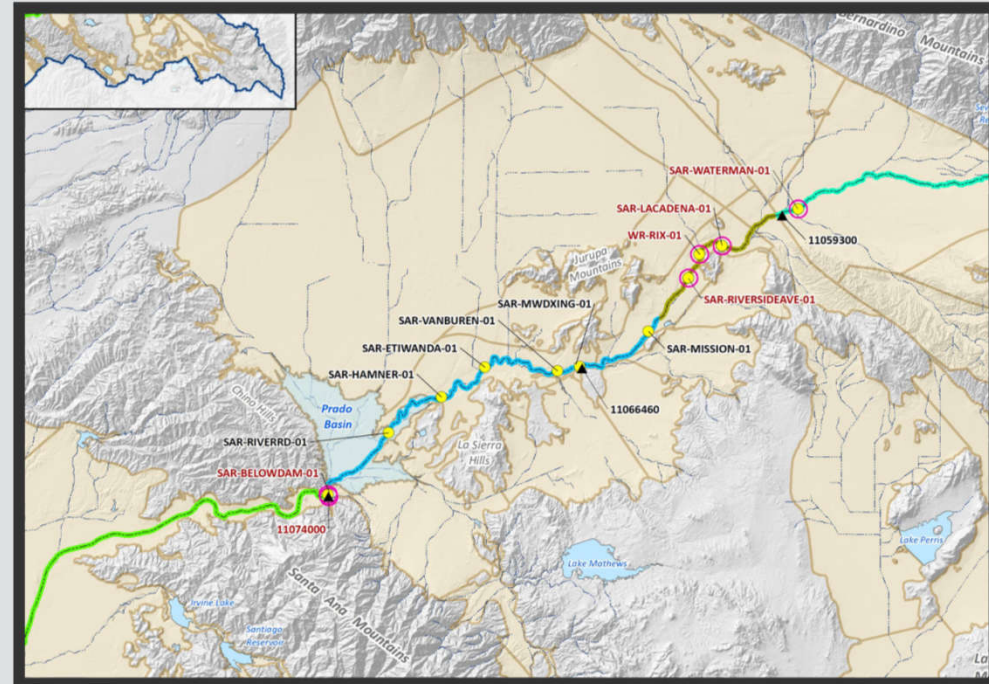
**Objectives: Collect the Surface Water Data necessary to assess compliance with Basin Plan Objectives.**

1. Compliance with Basin Plan Objectives is assessed in two ways under the Basin Plan SNMP:
  - i. Annual assessment of current water quality data – are we in compliance today?  *Sections 2 and 3*
    - monitoring data
    - compliance metrics
  - ii. Predictive assessment of the wasteload allocation – will we comply in the future?  *Section 4*
    - Wasteload Allocation Model (WLAM)
      - Calibrated based on historical data
      - Input future planning data (recycled water discharges, land use, climate conditions)

## Section 2. Evaluation of the 2005-2020 Surface Water Monitoring Program

For each Reach, evaluated and described:

- the Basin Plan TDS/TIN objectives
- the Basin Plan description of the criteria and approach for assessing compliance with the objectives
- surface water data collected since 2004
- the metrics computed to assess compliance with objectives and data used to compute the metrics;
- the questions to be answered by the surface water monitoring data;
- the history of compliance with the Basin Plan objectives
- any data or information gaps to answer the monitoring program questions



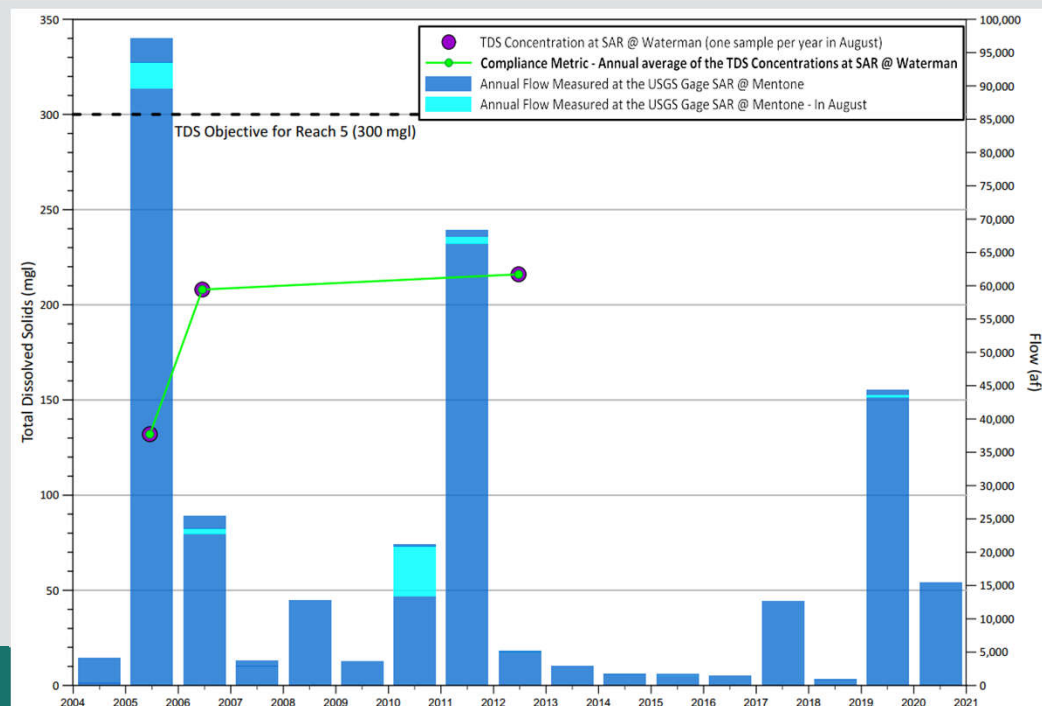
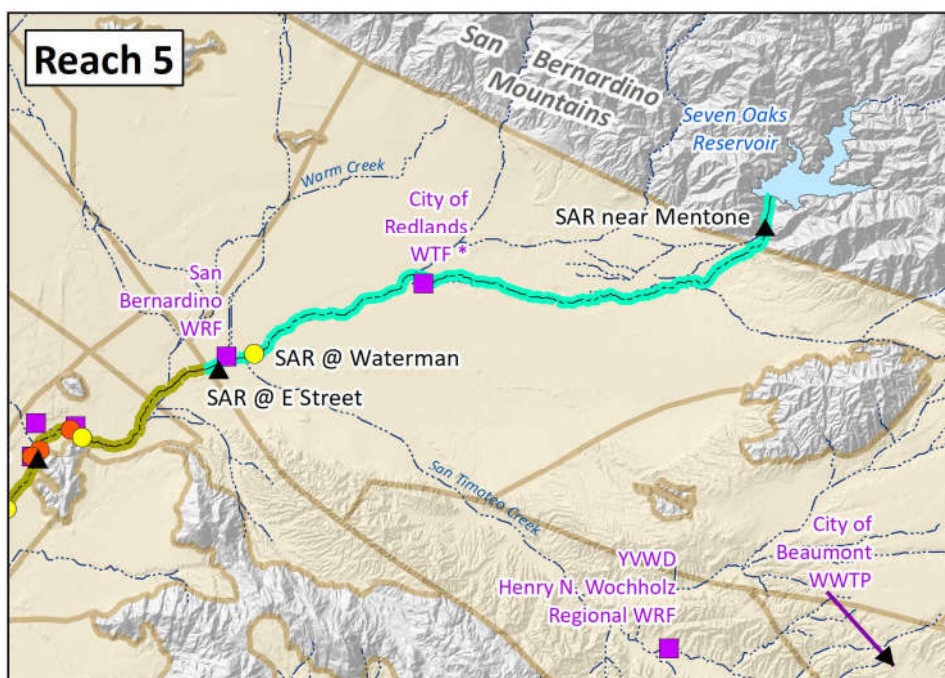
# 2022 Santa Ana River Water Quality Work Plan

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4. Recommendation for Special Studies

## Reach 5 – Monitoring and Compliance from 2005 to 2020

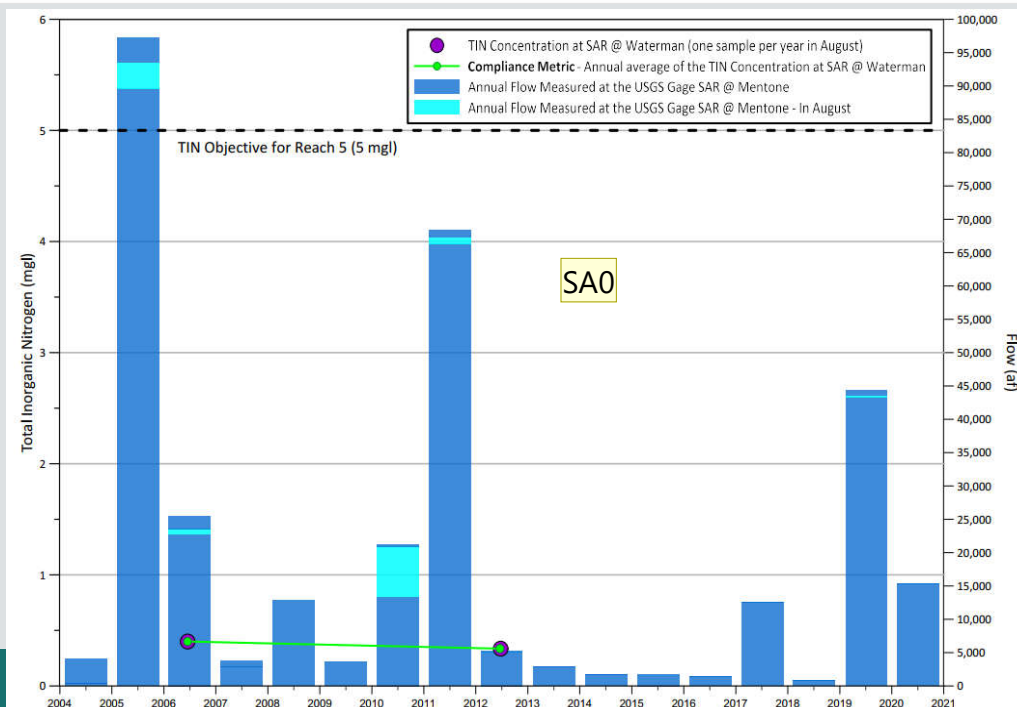
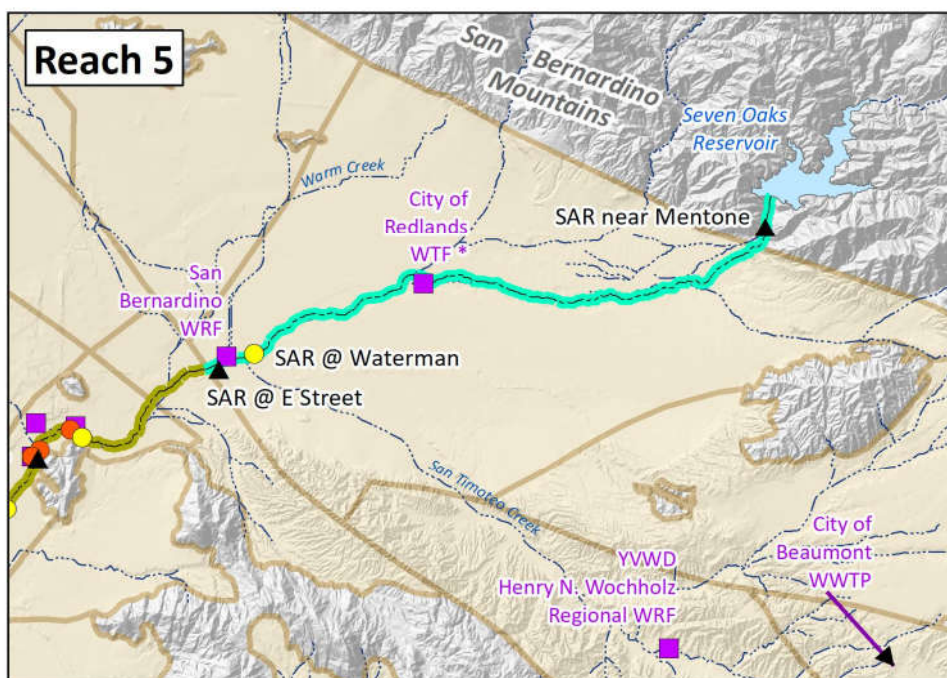
Reach	TDS/TIN Objectives	Question Answered by the Monitoring Data	Monitoring Site	Data Collected	Frequency	Monitoring Entity	Compliance Metric
5	TDS = 300 mg/l TIN = 5 mg/l	What is the TDS and TIN concentration of the flow in Reach 5 that is recharged to Bunker Hill-B GMZ and that flows into Reach 4 and recharged to the Colton GMZ throughout the year?	SAR @ Waterman	WQ (Including TDS, TIN)	Annually	OCWD	Annual average TDS and TIN of all samples





## Reach 5 – Monitoring and Compliance from 2005 to 2020

Reach	TDS/TIN Objectives	Question Answered by the Monitoring Data	Monitoring Site	Data Collected	Frequency	Monitoring Entity	Compliance Metric
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## Slide 7

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**SA0**

Drop in TIN plot

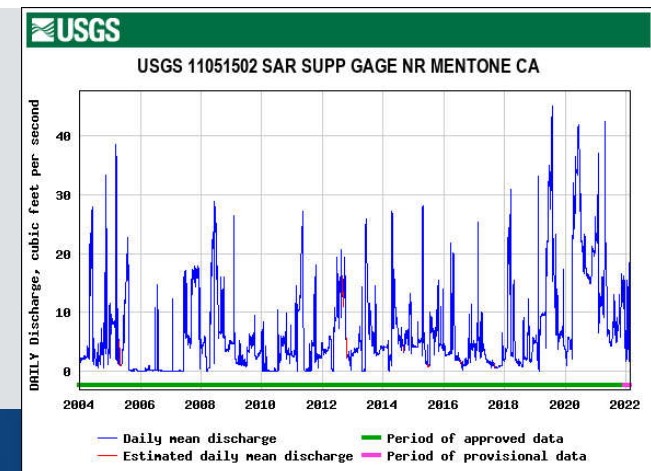
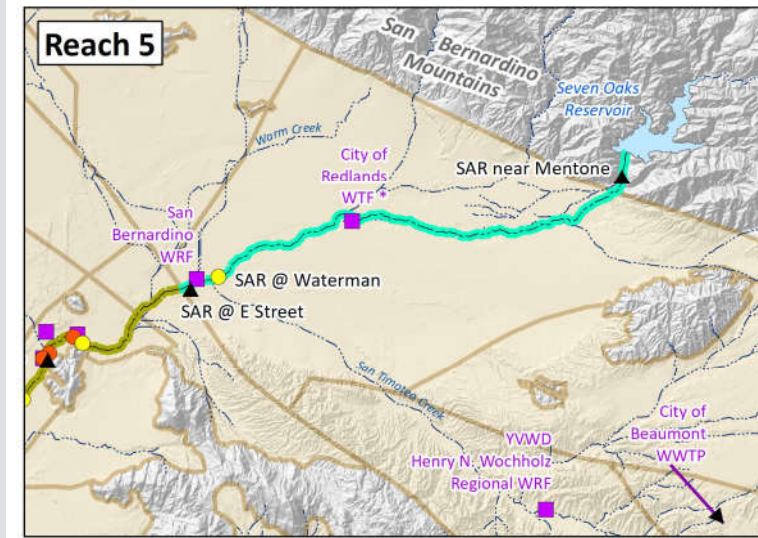
Samantha Adams, 2022-06-21T02:20:19.943



## Reach 5 – Monitoring and Compliance from 2005 to 2020

### Considerations, Data Gaps, and Uncertainties with Monitoring and Compliance:

- No description in the Basin Plan for monitoring or compliance assessment
- Since 2004, sampling has not occurred at *SAR @ Waterman* in 14 of the 17 years because no flow was present in August.
- Only know the quality of the flow in August, which is not representative of the recharge to Bunker Hill-B. One single sample per year is used to assess compliance. Exceedance of the objective based on one sample would be misleading.
- **ISA0** data upstream of *SAR @ Waterman* to characterize the quality of stream bed recharge to the Bunker Hill-B GMZ
- No data downstream of *SAR @ Waterman* to assess the influence of tributary flows and POTW discharges that flow into Reach 4 and that can recharge Colton GMZ.



## Slide 8

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**SA0** This is not a data gap. This is just a fact. Suggest to delete.  
Samantha Adams, 2022-06-21T02:02:32.645

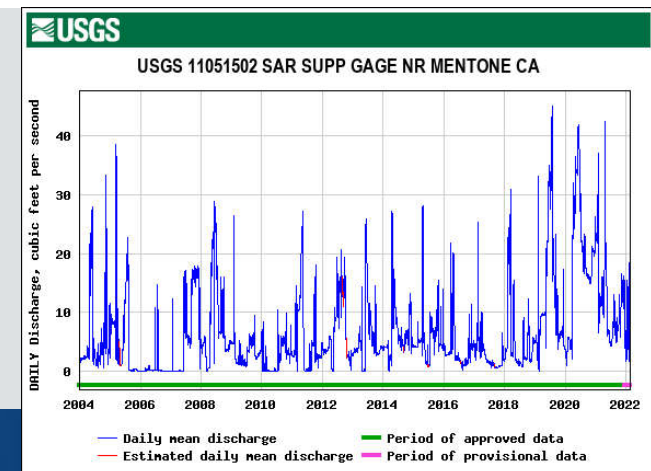
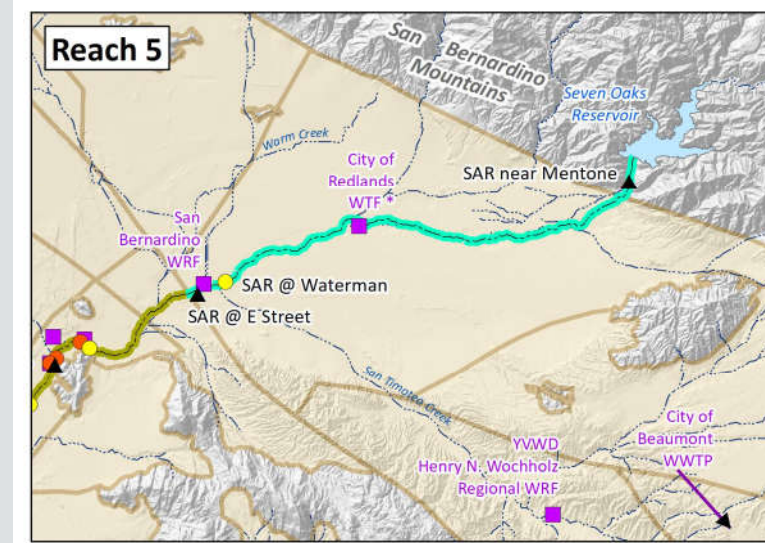
**SA0 0** Fourth bullet, I mean on Reach 5 losing reach  
Samantha Adams, 2022-06-21T13:01:45.227

## Reach 5 – Monitoring and Compliance from 2005 to 2020

### Recommendations for the 2022 Work Plan:

- Increase the frequency of sampling to better understand the variability of water quality throughout the year.
- Add sample locations upstream and downstream of SAR @ *Waterman* to more fully understand the quality of the river in Reach 5 that recharges to the Bunker Hill-B GMZ and the flows into Reach 4 overlying the Colton GMZ.
- Document compliance metric for annual assessment of compliance with TDS and TIN objectives\*

\*Amend Basin Plan to Incorporate this into the SNMP Compliance Plan

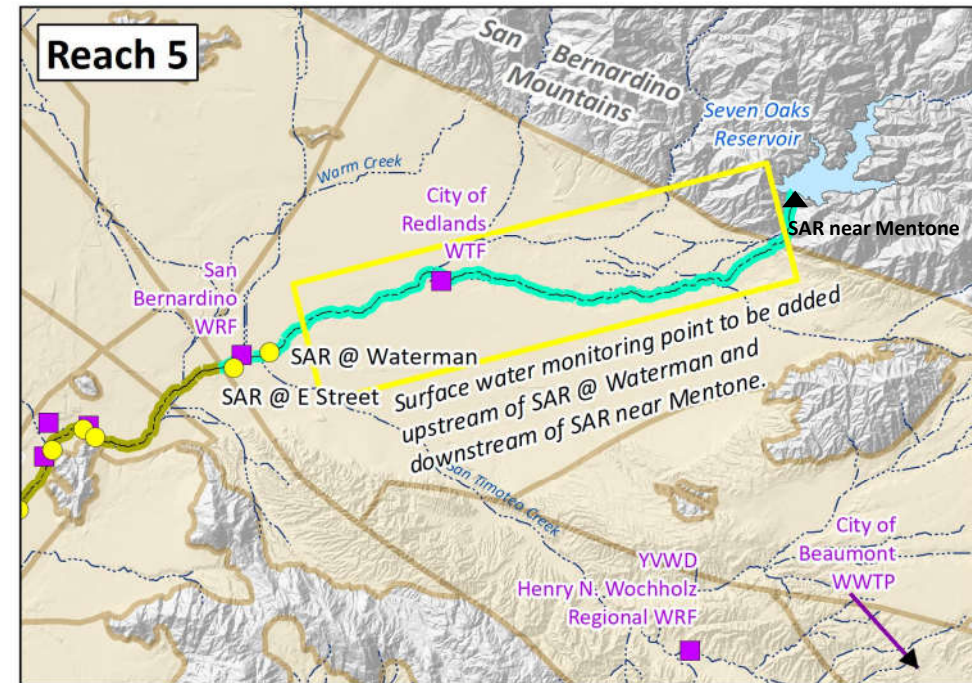


## Reach 5 – 2022 Work Plan

Site	Monitoring Performed	Monitoring Entity	Monitoring Frequency
New Site (TBD) – between SAR near Mentone and SAR @ Waterman	Water quality: TDS and TIN	Task Force (?)***	quarterly
SAR @ Waterman	Water quality: TDS and TIN	Task Force (?)***	quarterly
SAR @ E Street	Water quality: TDS and TIN	Task Force (?)***	quarterly

\*\*\*For discussion on how to determine monitoring entity

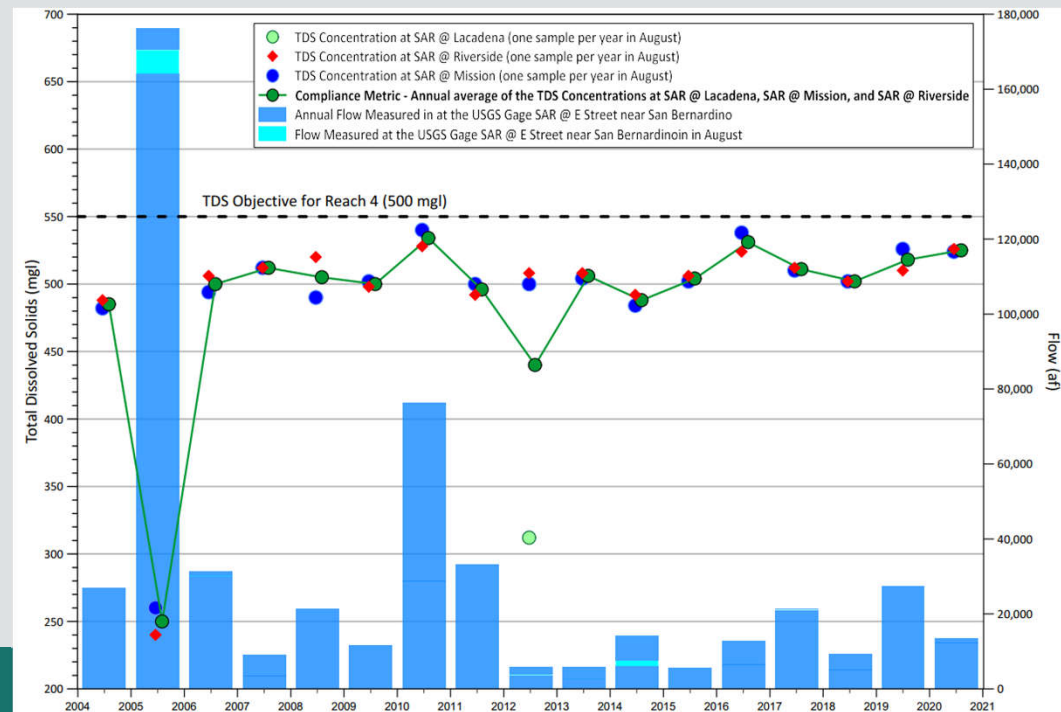
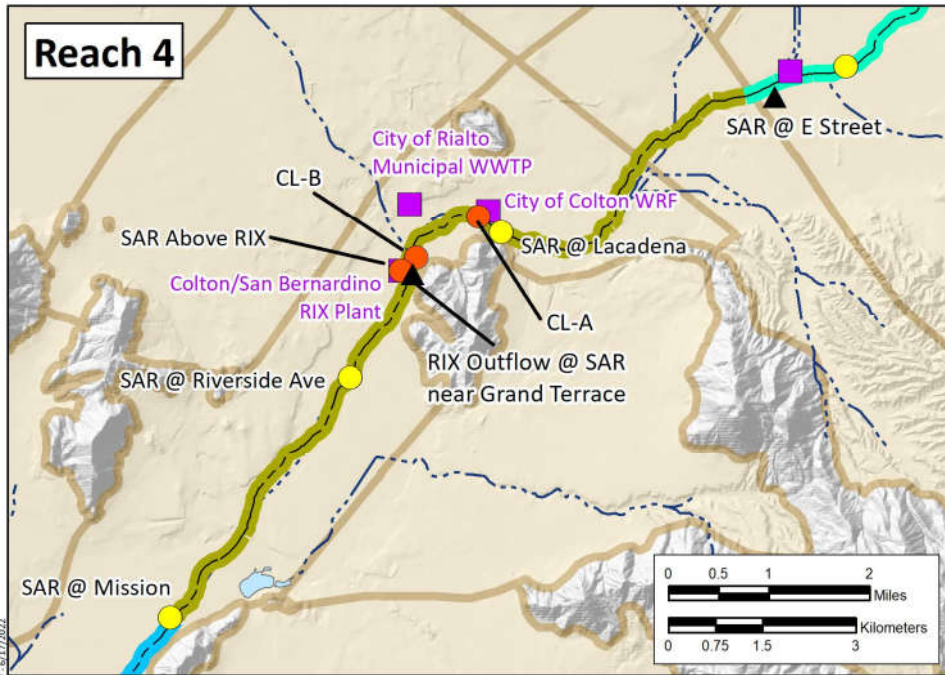
**Compliance Metric:** Annual Average TDS and TIN of all samples collected during the year





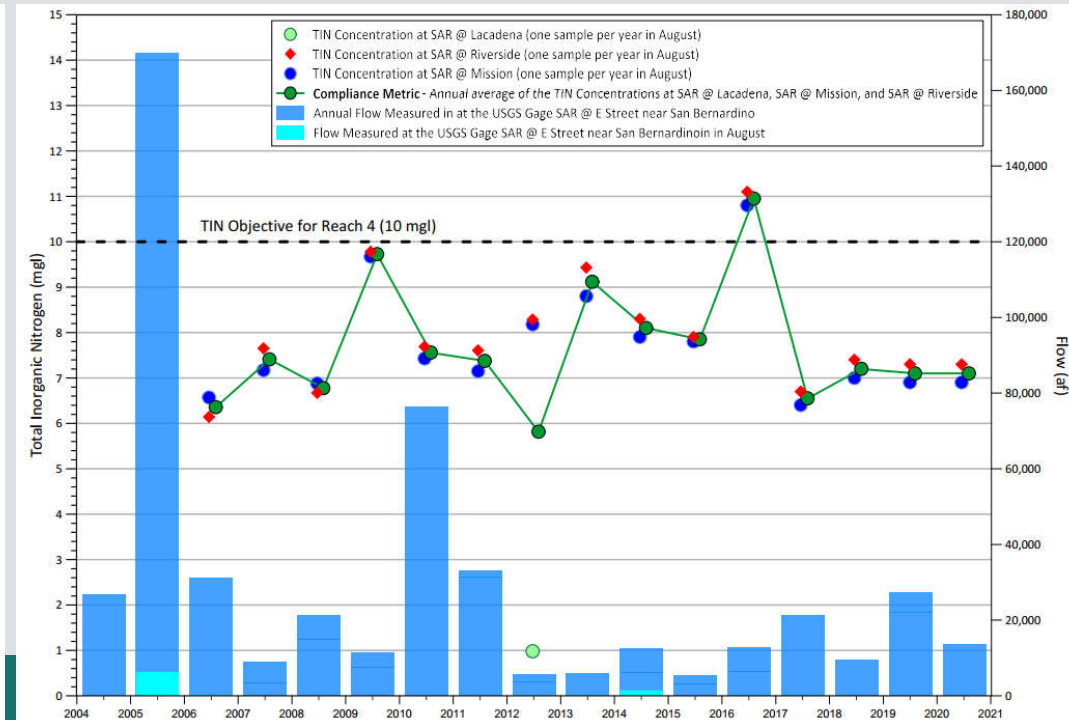
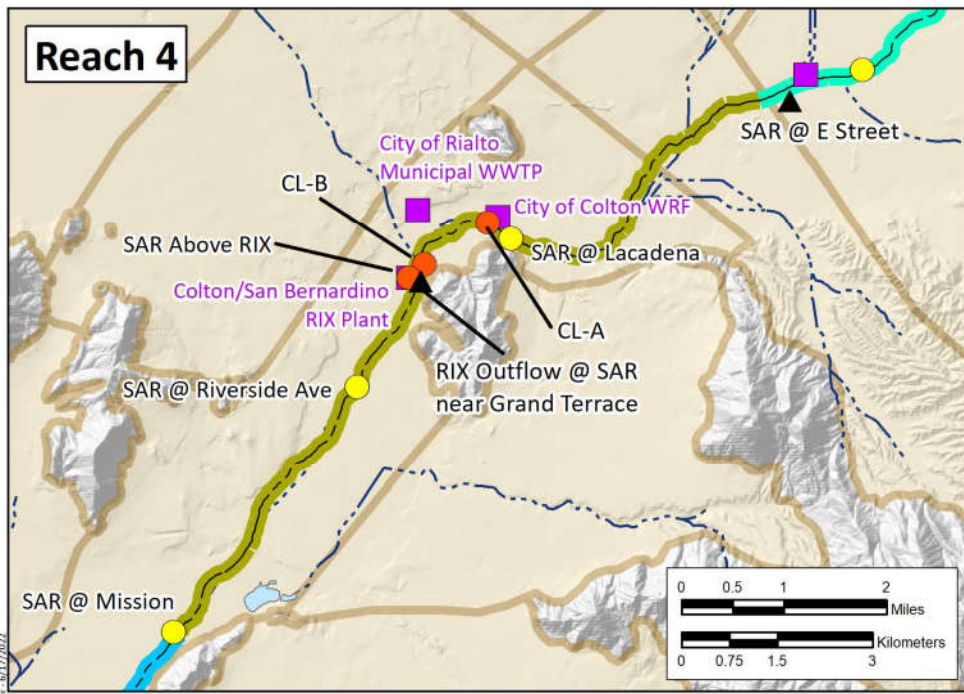
## Reach 4 – Monitoring and Compliance from 2005 to 2020

Reach	TDS/TIN Objectives	Question Answered by the Monitoring Data	Monitoring Site	Data Collected	Frequency	Monitoring Entity	Compliance Metric
4	TDS = 550 mg/l TIN = 10 mg/l	What is the TDS and TIN concentration of the flow in Reach 4 that is recharged to Riverside-A GMZ throughout the year?	SAR @ Lacadena	TDS, TIN	Annually	OCWD	Annual average TDS and TIN of all samples
			SAR @ Riverside Ave	TDS, TIN	Annually	OCWD	
			SAR @ Mission	TDS, TIN	Annually	OCWD	
			CL-A	TDS, Nitrate-Nitrogen	Semi-Annually	San Bernardino County	
			CL-B	TDS, Nitrate-Nitrogen	Semi-Annually	San Bernardino County	



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4	TDS = 550 mg/l TIN = 10 mg/l	What is the TDS and TIN concentration of the flow in Reach 4 that is recharged to Riverside-A GMZ throughout the year?	SAR @ Lacadena	TDS, TIN	Annually	OCWD	Annual average TDS and TIN of all samples
			SAR @ Riverside Ave	TDS, TIN	Annually	OCWD	
			SAR @ Mission	TDS, TIN	Annually	OCWD	
			CL-A	TDS, Nitrate-Nitrogen	Semi-Annually	San Bernardino County	
			CL-B	TDS, Nitrate-Nitrogen	Semi-Annually	San Bernardino County	

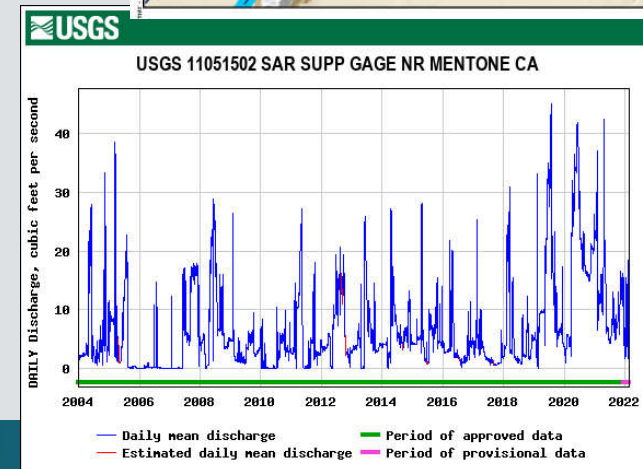
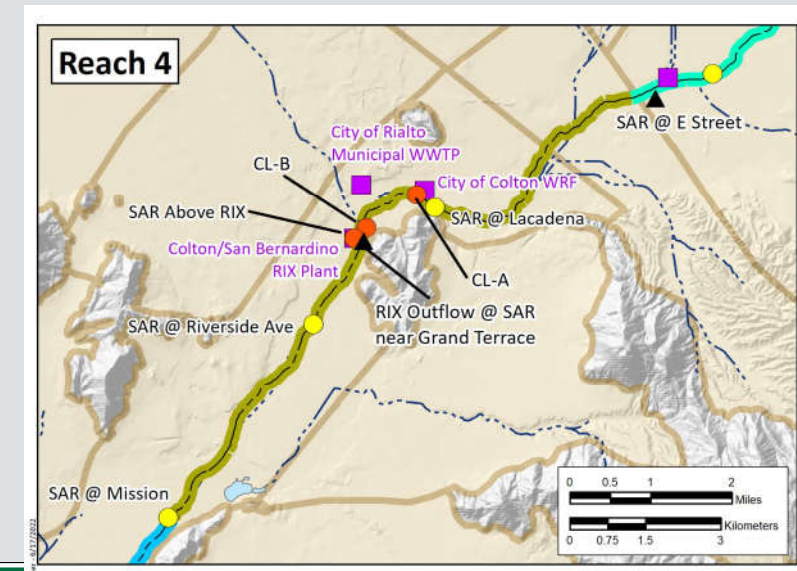




## Reach 4 – Monitoring and Compliance from 2005 to 2020

### Considerations, Data Gaps, and Uncertainties with Monitoring and Compliance:

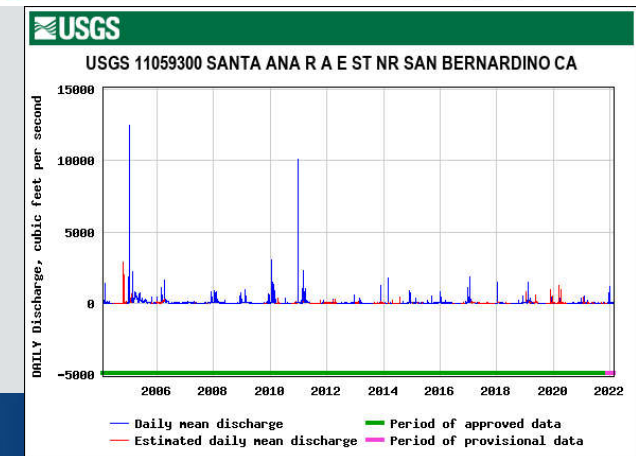
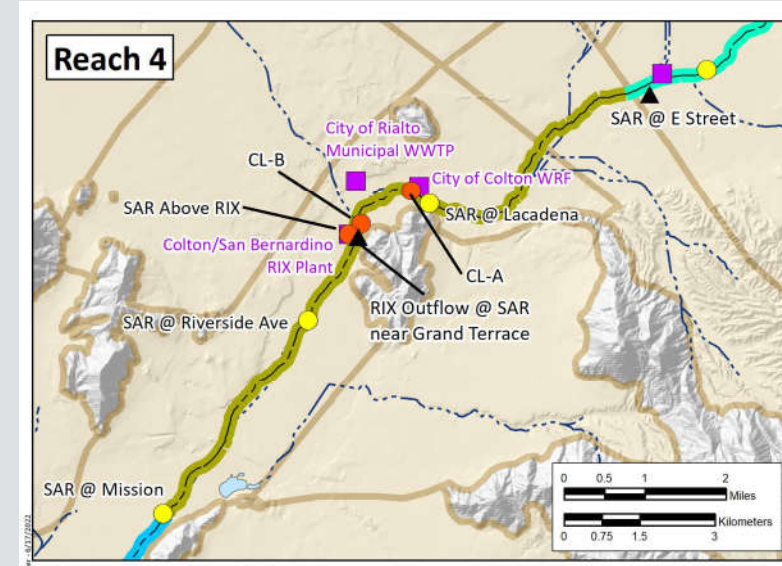
- No description in the Basin Plan for monitoring and compliance
- Since 2004, sampling has not occurred at *SAR @ Lacadena* 16 of the 17 years because no surface water flow was present in August.
- Only know the quality of the flow in August at the two downstream locations *SAR @ Riverside Ave* and *SAR @ Mission*, which is not representative of the recharge to Riverside-A.
- One single sample event per year is used to assess compliance. Exceedance of the objective based on August would be misleading.



## Reach 4 – Monitoring and Compliance from 2005 to 2020

### Recommendations for the 2022 Work Plan:

- Increase the frequency of sampling at locations in Reach 4 to better understand the variability of water quality over high-flow and low-flow conditions throughout the year at all locations.
- Document compliance metric for annual assessment of compliance with TDS and TIN objectives\*



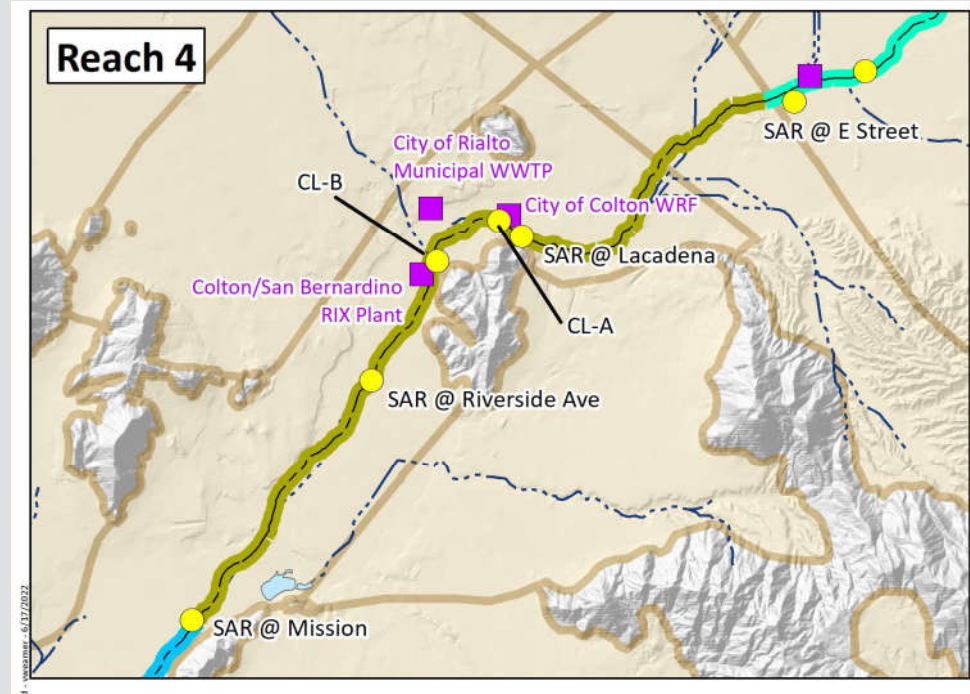
\*Amend Basin Plan to Incorporate this into the SNMP Compliance Plan

## Reach 4 – 2022 Work Plan

Site	Monitoring Performed	Monitoring Entity	Monitoring Frequency
SAR @ Lacadena	Water quality: TDS and TIN	Task Force (?)***	Quarterly
SAR @ Riverside Ave	Water quality: TDS and TIN	Task Force (?)***	Quarterly
SAR @ Mission	Water quality: TDS and TIN	Task Force (?)***	Quarterly
CL-A	Water quality: TDS and nitrate	County of San Bernadino	Semi-annual
CL-B	Water quality: TDS and nitrate	County of San Bernadino	Semi-annual

\*\*\*For discussion on how to determine monitoring entity

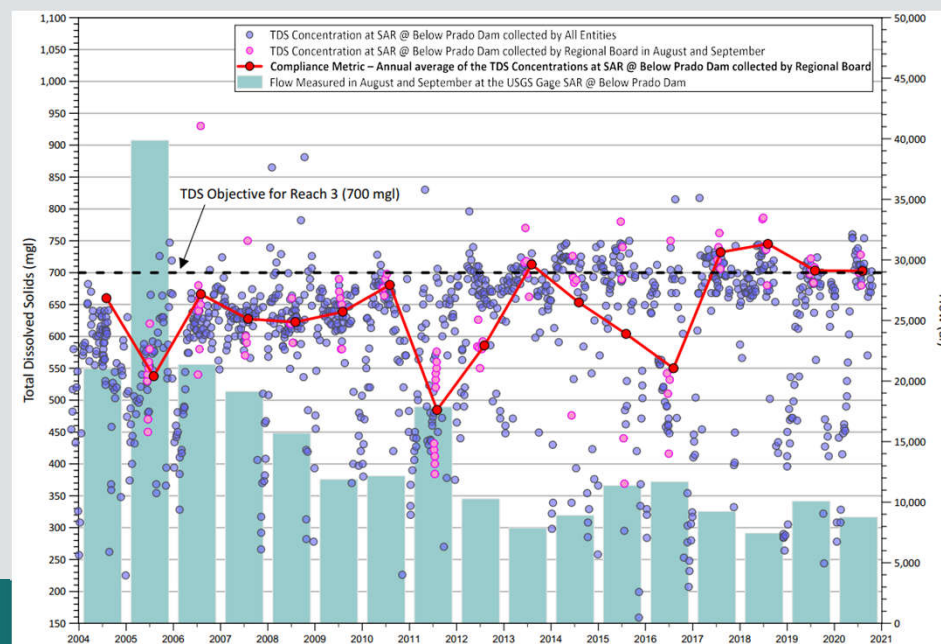
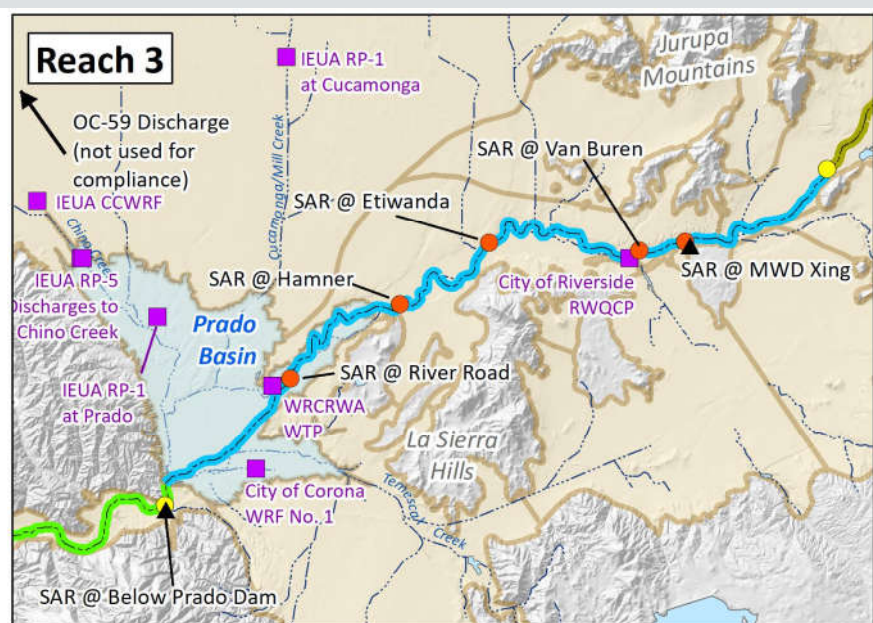
**Compliance Metric:** Annual Average TDS and TIN of all samples collected during the year





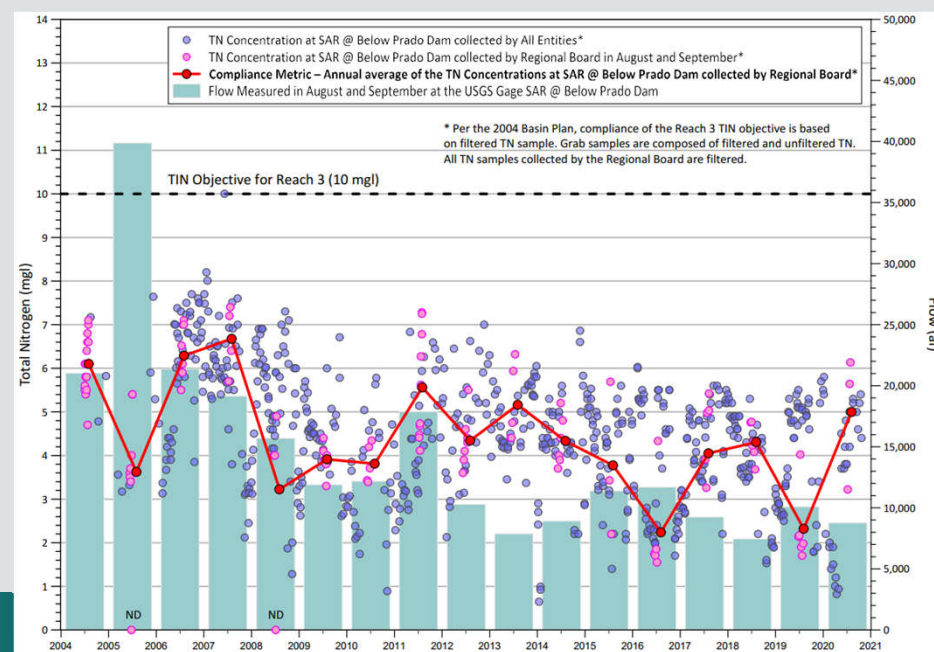
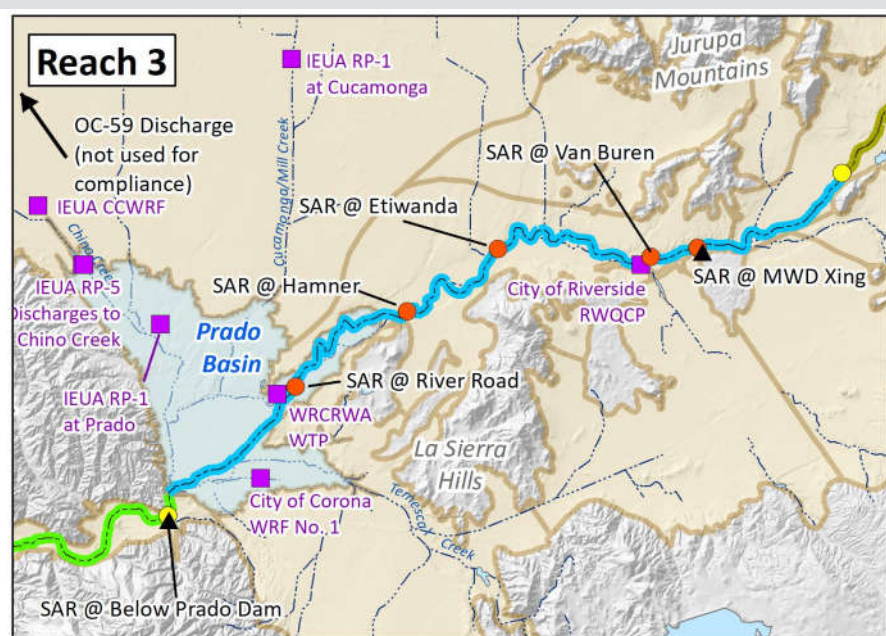
## Reach 3 – Monitoring and Compliance from 2005 to 2020

Reach	TDS/TIN Objectives	Question Answered by the Monitoring Data	Monitoring Site	Data Collected	Frequency	Monitoring Entity	Compliance Metric
3	TDS = 700 mg/l TIN = 10 mg/l  - Base Flow Objectives	What is the TDS and TIN of the base flow in Reach 3 that flows into Reach 2 and used for beneficial uses in the Orange County GMZ?	SAR @ Below Prado Dam	TDS, TIN	Monthly/Bi-weekly/Aug & Sept	OCWD / USGS/Regional Board	Annual average TDS and TIN of all samples collected by Regional Board
			USGS Gage SAR @ Below Prado Dam	Flow, EC	Daily	USGS	
			SAR @ MWD Xing	TDS, TIN	Annually/Quarterly	OCWD/CBWM	
			SAR @ Van Buren	TDS, TIN	Annually	OCWD	
			SAR @ Etiwanda	TDS, TIN	Annually/Quarterly	OCWD/CBWM	
			SAR @ Hamner	TDS, TIN	Annually	OCWD	
			SAR @ River Road	TDS, TIN	Annually	OCWD/CBWM	



## Reach 3 – Monitoring and Compliance from 2005 to 2020

Reach	TDS/TIN Objectives	Question Answered by the Monitoring Data	Monitoring Site	Data Collected	Frequency	Monitoring Entity	Compliance Metric
3	TDS = 700 mg/l TIN = 10 mg/l  - Base Flow Objectives	What is the TDS and TIN of the base flow in Reach 3 that flows into Reach 2 and used for beneficial uses in the Orange County GMZ?	SAR @ Below Prado Dam	TDS, TIN	Monthly/Bi-weekly/Aug & Sept	OCWD / USGS/Regional Board	Annual average TDS and TIN of all samples collected by Regional Board
			USGS Gage SAR @ Below Prado Dam	Flow, EC	Daily	USGS	
			SAR @ MWD Xing	TDS, TIN	Annually/Quarterly	OCWD/CBWM	
			SAR @ Van Buren	TDS, TIN	Annually	OCWD	
			SAR @ Etiwanda	TDS, TIN	Annually/Quarterly	OCWD/CBWM	
			SAR @ Hamner	TDS, TIN	Annually	OCWD	
			SAR @ River Road	TDS, TIN	Annually	OCWD/CBWM	

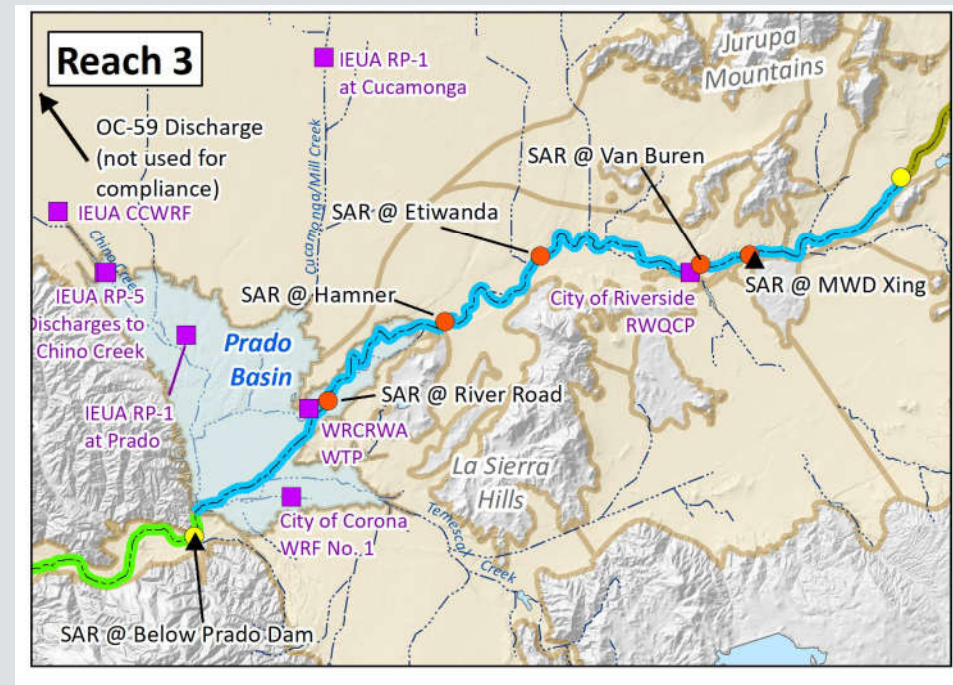




## Reach 3 – Monitoring and Compliance from 2005 to 2020

### Considerations with Monitoring and Compliance:

- The *SAR @ Below Prado Dam* location is the best suited location to characterize the quality of flow from Reach 3 into Reach 2 and there is sufficient monitoring of TDS/TIN at this location
- The compliance metric evaluation excludes good data collected at *SAR @ Below Prado Dam* and relies only on a small number of samples collected by the Regional Board in August and September. Excluded:
  - Grab samples data by OCWD
  - Grab samples data by USGS
  - Daily EC measurements at the USGS gage which can be used to create daily time history of TDS, as is done for Reach 2

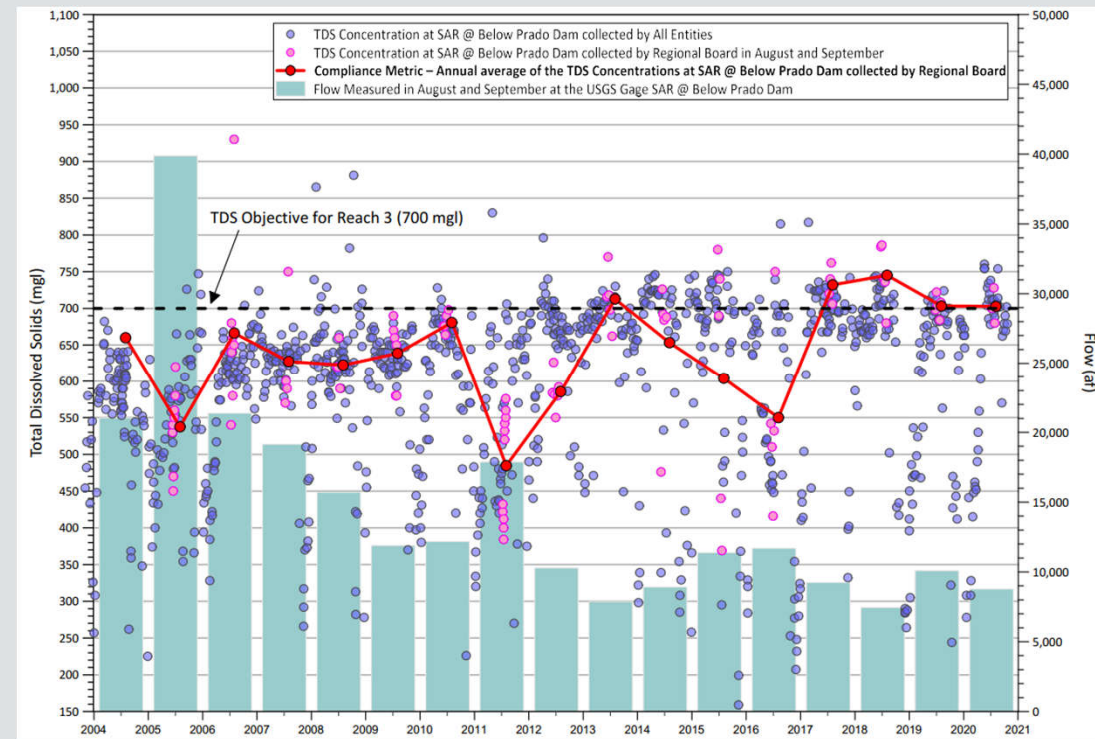




## Reach 3 – Monitoring and Compliance from 2005 to 2020

### Considerations, Data Gaps, and Uncertainties with Monitoring and Compliance:

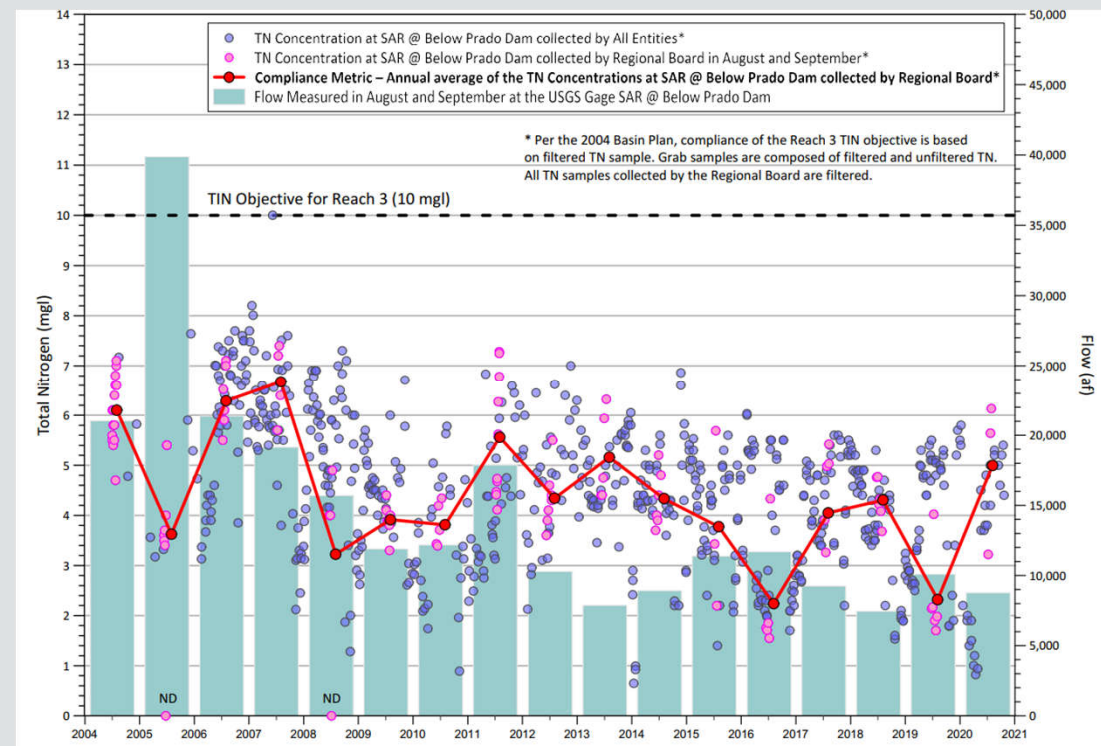
- The Basin Plan does not provide a clear definition of “base flow” conditions in Reach 3.
- Some “base flow” samples collected by the Regional Board in Aug/Sept occurred during conditions indicative of base flow:
  - influenced by stormwater,
  - conservation pool behind Prado Dam,
  - presence of non-tributary discharge from OC-59
- Base flow conditions are occurring in more than the months of August and September, and likely occur at different times and durations from year to year based on climate conditions and other factors



## Reach 3 – Monitoring and Compliance from 2005 to 2020

### Considerations, Data Gaps, and Uncertainties with Monitoring and Compliance:

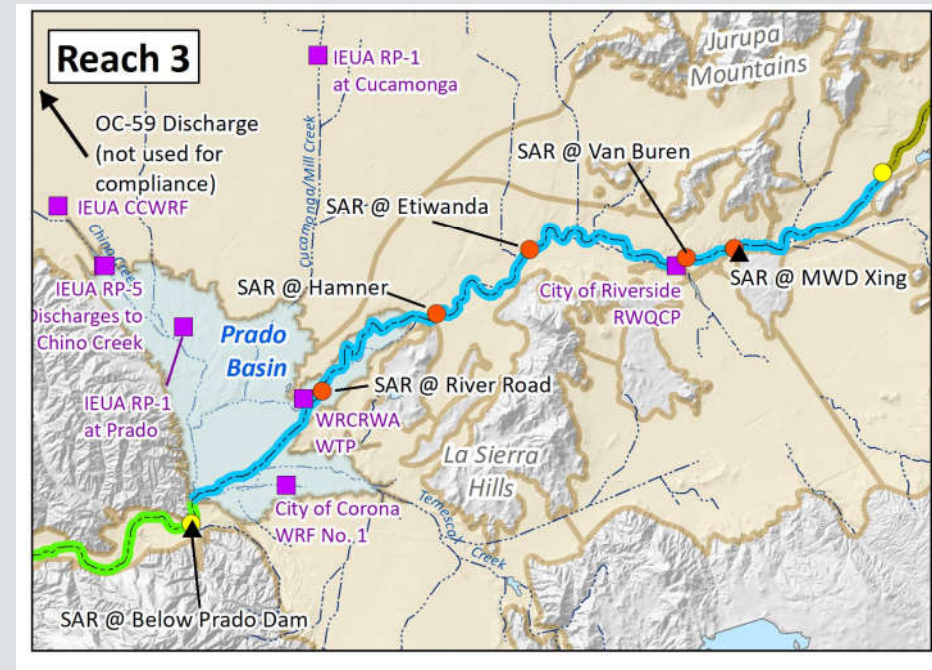
- Reach 3 is the only reach of the Santa Ana River that requires a filtered total nitrogen sample for compliance with the TIN objective?
  - Is it necessary to collect a filtered total nitrogen sample or can a TIN sample be collected instead?
  - The Basin Plan does not provide an explanation of intent of a filter total nitrogen sample.
  - Reported TIN and filtered total nitrogen results from the Regional Board samples are similar (within 1 mg/l)
- Since 2004, no exceedance of Reach 3 TIN objectives → and decreasing trend, based on TN samples



## Reach 3 – Monitoring and Compliance from 2005 to 2020

### Recommendations for the 2022 Work Plan:

- Develop a clear definition of Reach 3 “base flow” conditions that enables use of the detailed daily\*
- Use available USGS flow and ACOE reservoir levels at Prado Dam to assess base-flow conditions annually
- Use the available water quality data collected by USGS and OCWD during base flow conditions to assess compliance
- Eliminate Regional Board sampling requirement\*
- Remove the requirement to collect filtered total nitrogen samples for compliance\*



\*Amend Basin Plan to Incorporate this into the SNMP Compliance Plan

## Reach 3 – 2022 Work Plan

Site	Monitoring Performed	Monitoring Entity	Monitoring Frequency
USGS Gage at SAR @ Below Prado	Flow, EC	USGS	Daily
SAR @ Below Prado	Water quality: TDS and TIN	USGS	Bi-weekly
		OCWD	Monthly
Prado Basin	Water level elevation	ACOE	Quarterly

**Compliance Metric:** Annual Average TDS and TIN of all samples collected during base flow conditions.

- For TDS, use daily TDS record constructed from relationship between daily EC measured by USGS and periodic grab samples.
- For TIN, use TIN data, not filtered total nitrogen

### Proposed Definition of Base Flow Conditions in Reach 3:

*“when there are no precipitation events and OC-59 discharge within the last four days, and the water-level elevation of the conservation pool behind Prado Dam is at or below the level that is considered empty.”*

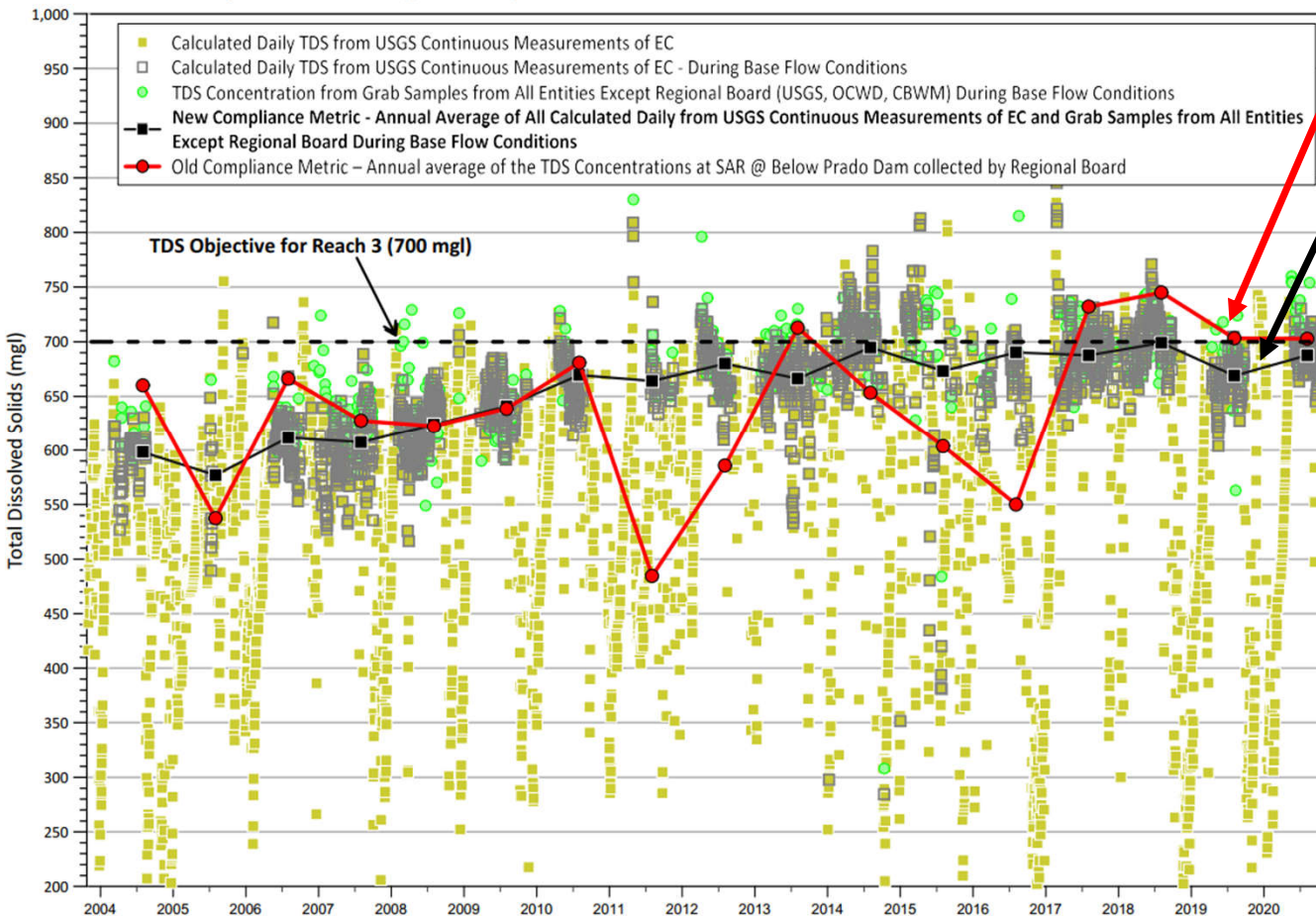
*\*\*\*OCWD has proposed an alternative for consideration and discussion*



## Reach 3 – 2022 Work Plan

Example from historical data of the new Reach 3 TDS monitoring and compliance

Time-Series of TDS Concentrations at Below Prado Dam and Compliance Determination of Reach 3 Surface Water Objective with Proposed Method Using USGS Daily EC Measurements and Calculated TDS for Periods of Baseflow Conditions



**Old Compliance Metric**

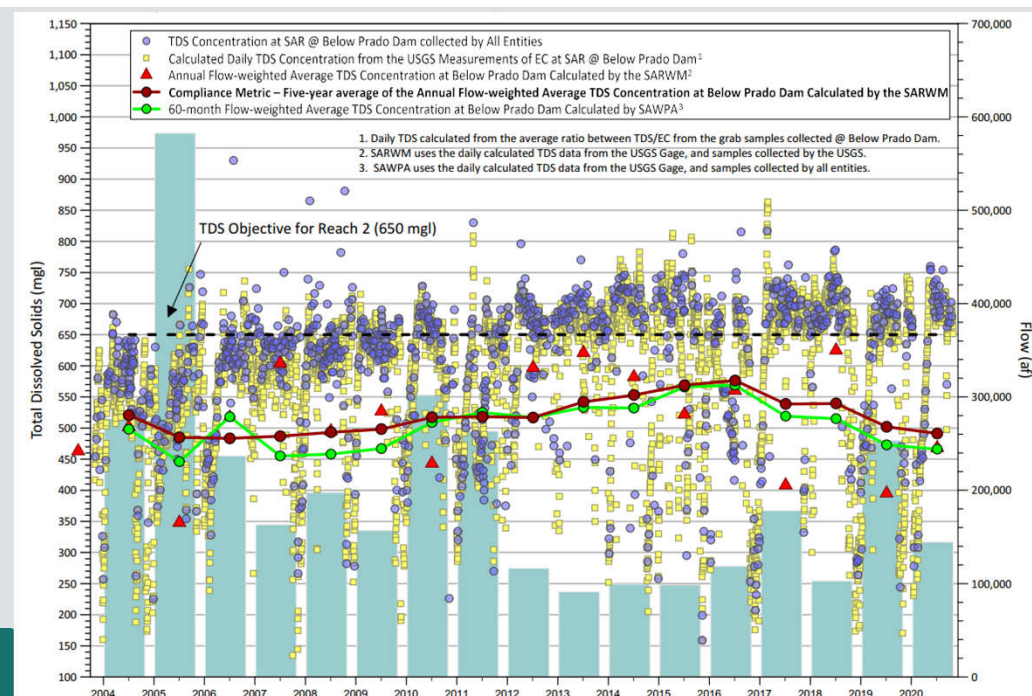
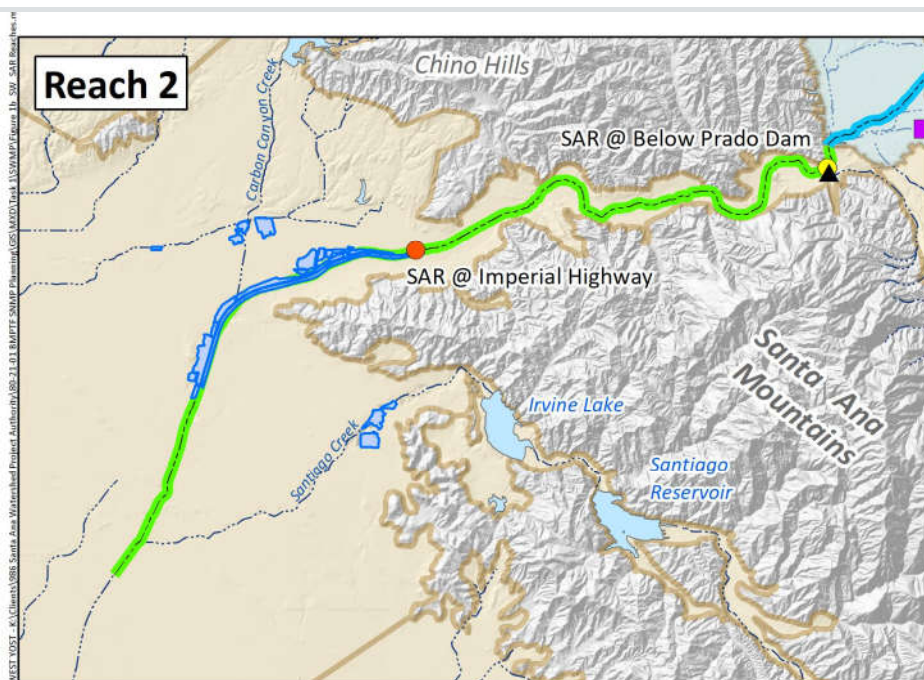
**New Compliance Metric**

Steps:

1. Compile and evaluate the daily precipitation, water-level behind the dam, and OC-59 discharge → determine days with base flow conditions
2. Calculate daily TDS from daily EC
3. Compile all data for days that are base flow conditions from the daily TDS and all the grab samples collected by all Entries (no Regional Board)
4. Calculate metric - average of all base flow data

## Reach 2 – Monitoring and Compliance from 2005 to 2020

Reach	TDS/TIN Objectives	Question Answered by the Monitoring Data	Monitoring Site	Method	Data Collected	Frequency	Monitoring Entity	Compliance Metric
2	TDS = 650 mg/l TIN = None	What is the volume-weighted TDS and TIN concentration of the flow entering Reach 2 throughout the year?	SAR @ Below Prado Dam	Basin Plan Method	Annual Flow-weighted TDS concentration	Annual calculation	SARWM	The average of the five most recent SARWM reported annual flow-weighted TDS concentrations at Prado Dam
				Alternative Method	60-month Flow-weighted TDS concentration	Annual calculation	SAWPA	60-month Flow-weighted TDS concentration at Prado Dam



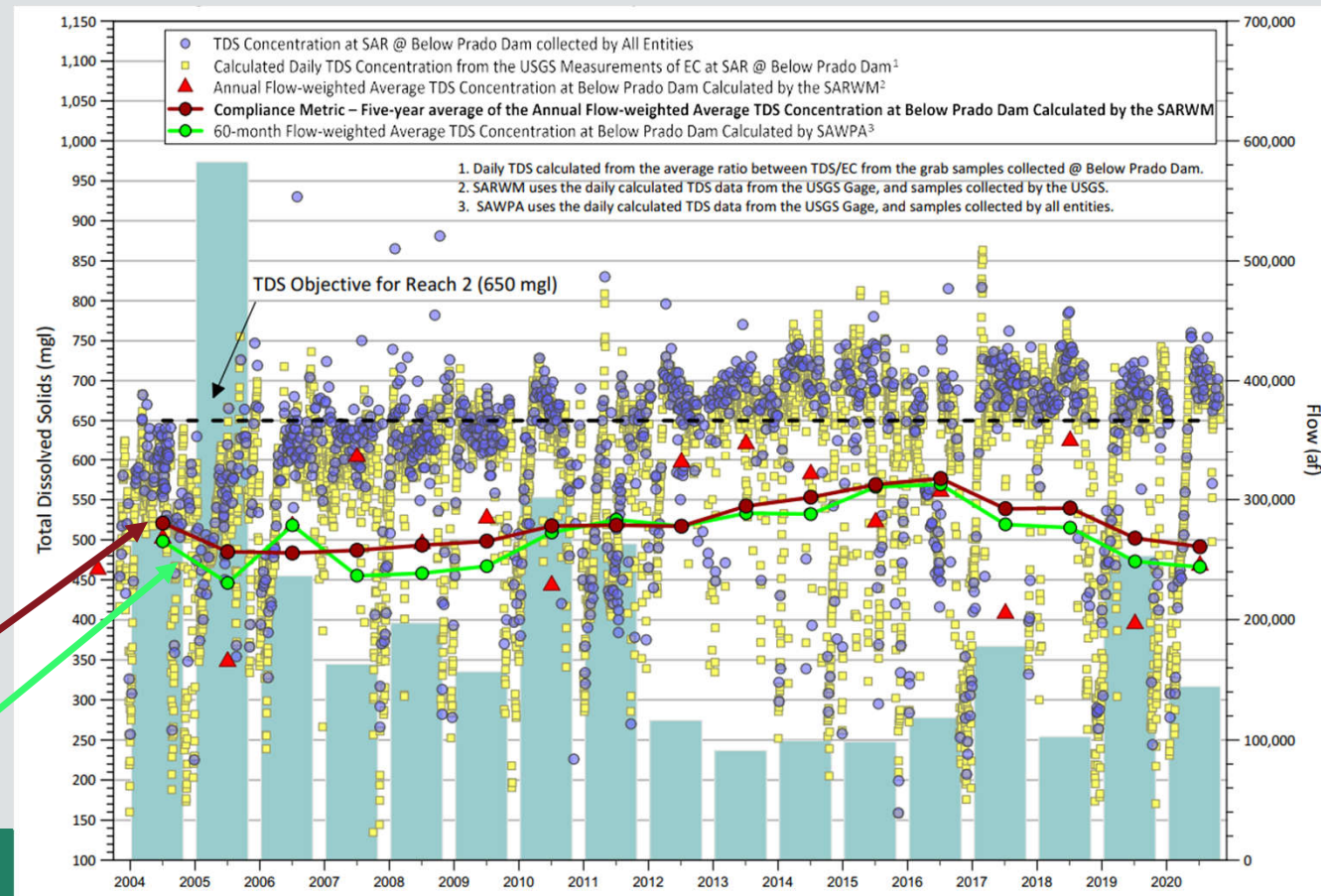


## Reach 2 – Monitoring and Compliance from 2005 to 2020

### Considerations, Data Gaps, and Uncertainties with Monitoring and Compliance:

- The Basin Plan compliance metrics are clearly defined
- The available data are appropriately used
- Is it necessary for SAWPA to perform and report on the alternative method (60-month volume-weighted TDS concentration) in addition to the compliance metric defined in the Basin Plan, which is computed by SARWM annually?

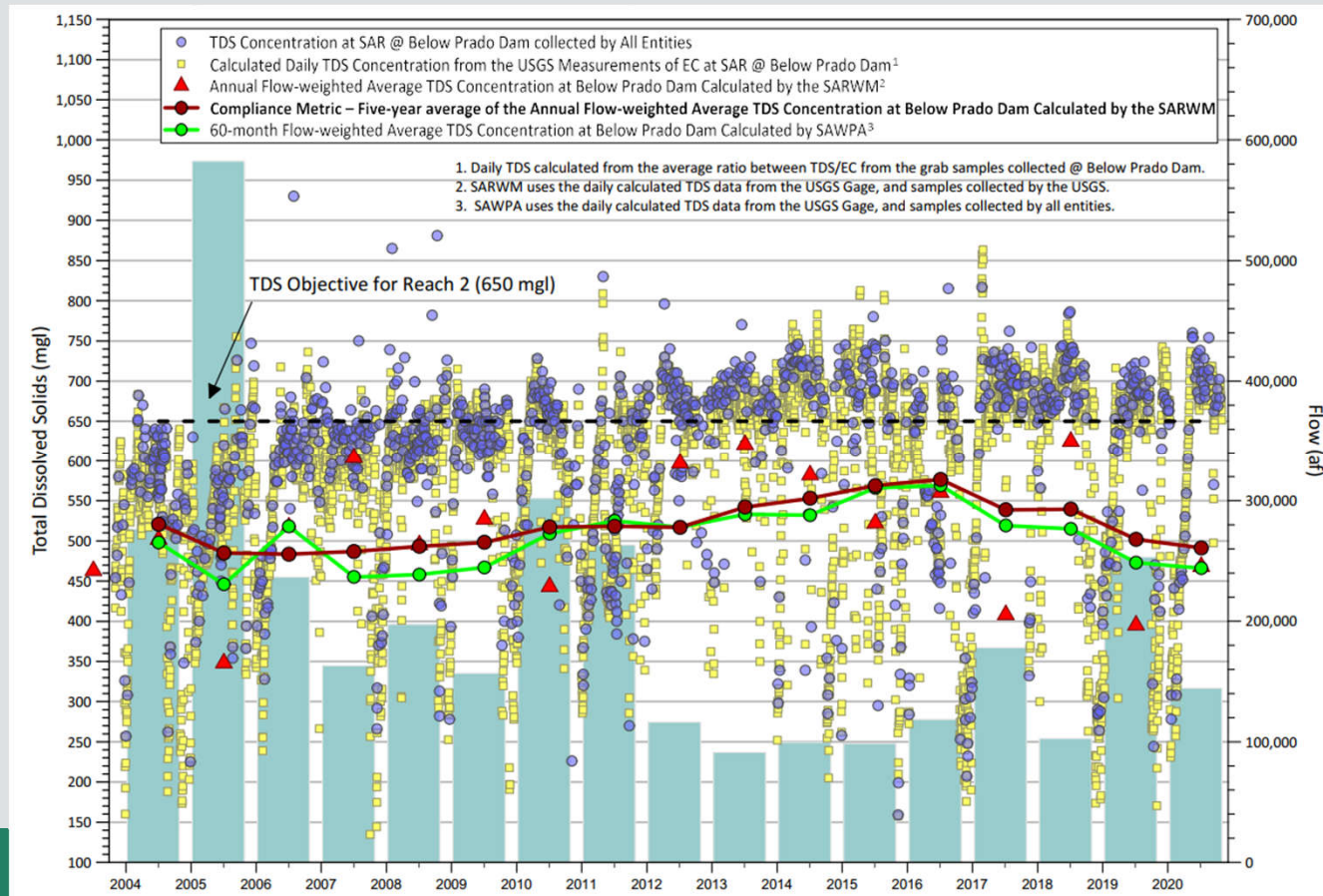
SARWM  
Task Force



## Reach 2 – Monitoring and Compliance from 2005 to 2020

### Recommendations for the 2022 Work Plan:

- Eliminate the annual reporting of the Task Force alternative method (60-month volume-weighted TDS concentration)
- No recommendations for improved monitoring.



# What is left to Discuss to Finalize Sections 2 and 3?

- Definition of Reach 3 base flow conditions
  - OCWD alternative method
- Proposed frequency and analyte list of sampling for expanded monitoring on Reaches 4 and 5:
  - Quarterly
  - TDS/TIN (calculated from nitrate-N, nitrite-N, and ammonia-N) or general minerals
- Proposed monitoring entity for new monitoring: Task Force
  - What does this mean? Flexible in implementation, Task Force responsible to ensure it is done. Monitoring could be physically done by:
    - member-agency staff
    - Task Force/SAWPA consultants

# Outline

1. Background
2. Evaluation of the 2005-2020 Surface Water Monitoring Program
3. 2022 Surface Water Monitoring Program to assess compliance with Basin Plan TDS and Nitrogen objectives
4. Recommendation for Special Studies

## Recommendation for Special Studies

- Basin Plan provides for additional studies beyond what is necessary to assess annual compliance
- Address data gaps identified by the Task Force, and investigated by West Yost, in the development and use of the WLAM
  - Recent TDS Exceedances in Reach 3
  - Understanding the Surface-Water/Groundwater Interaction in Reach 3 and Reach 4

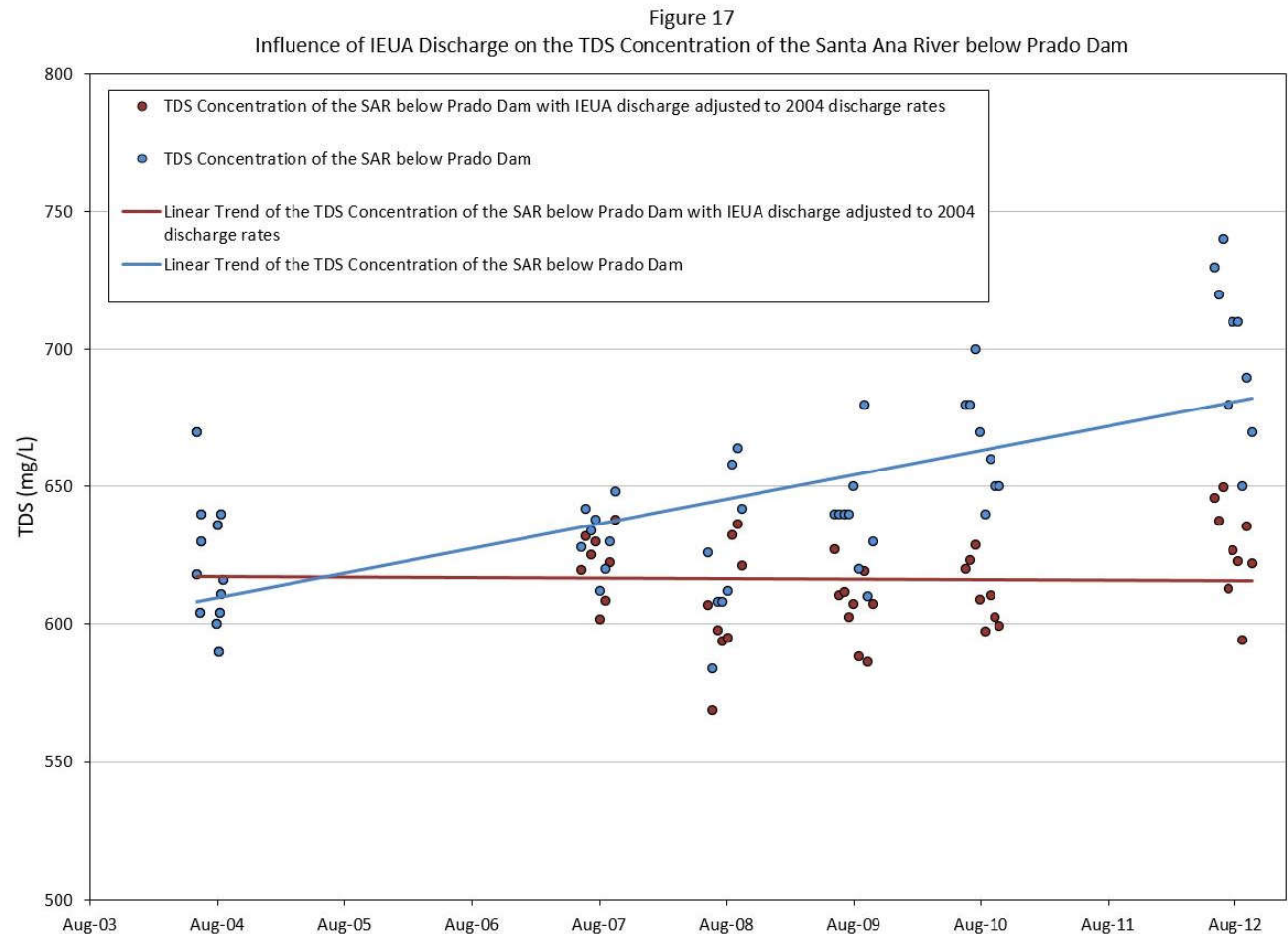
# What is left to Discuss to Finalize Section 4?

- Sampling timing, frequency, duration
  - Quarterly sampling for two years
- Sampling locations
  - Reach 3, Reach 4, and major tributaries (~11 sites)
- Proposed monitoring entity for new surface water monitoring sites: Task Force
  - What does this mean? Flexible in implementation, Task Force responsible to ensure it is done. Monitoring could be physically done by:
    - Member-agency staff
    - Task Force/SAWPA consultants
- Report will include map and table with description of monitoring plan, including a more refined cost estimate



# Recent TDS Exceedances in Reach 3

- Prior studies (2015) indicated that TDS concentrations were increasing due to decreasing POTW discharges tributary to the SAR
- Did not constrain the precise dynamics of the surface-water/groundwater interactions along Reach 3 and 4
- Difficult to identify potential strategies for maintaining compliance with Basin Plan Objectives

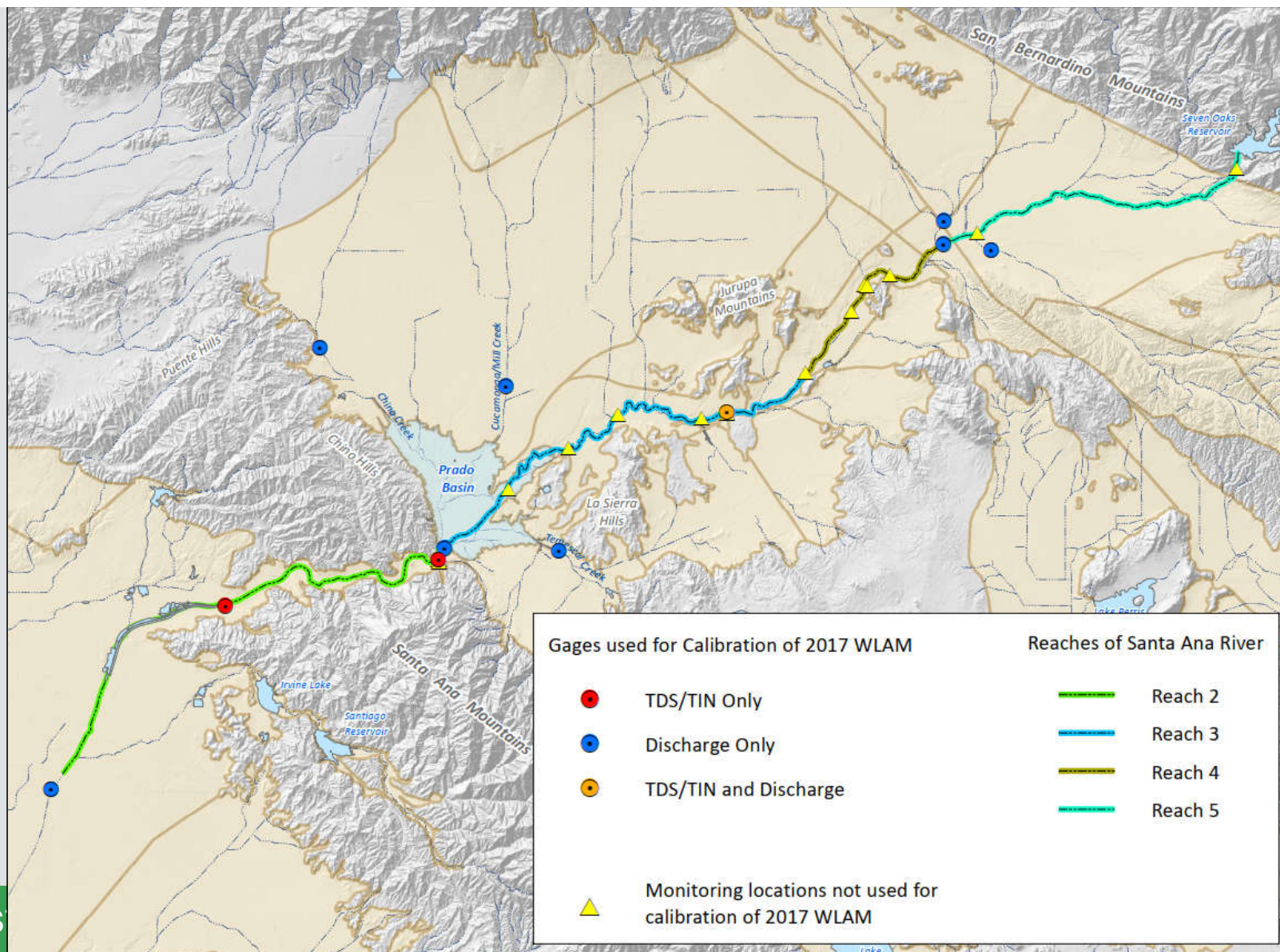


# Understanding the Surface-Water/Groundwater Interaction in Reach 3 and Reach 4

- Sensitivity analysis performed during the development of the WLAM indicated high uncertainty in the representation of streambed infiltration and rising groundwater
- Multiple representations of the Santa Ana River can yield the same flow/quality at monitoring (calibration) points.

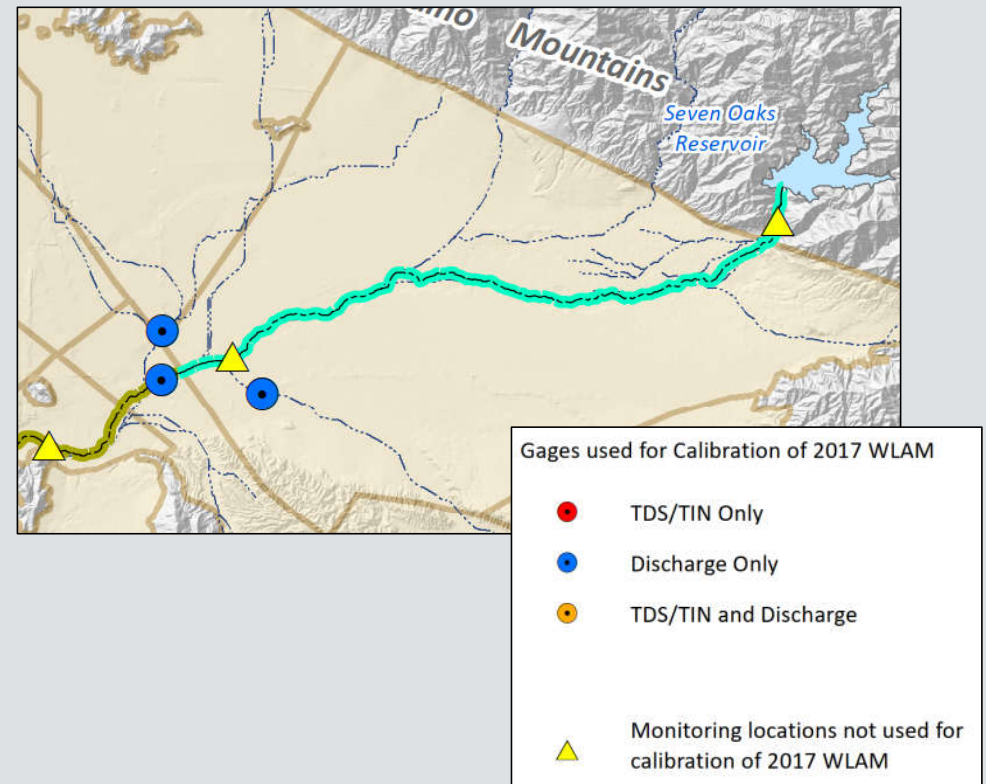
# Understanding the Surface-Water/Groundwater Interaction in Reach 3 and Reach 4

- Unknown quantity and quality of streambed infiltration or rising water; insufficient to understand the quality/quantity of water infiltrating into the GMZs
- The models that simulate surface-water/groundwater interaction have results that disagree with the WLAM assumptions/results.
- Field data to understand these dynamics and represent them in a model is lacking.



## Data Gaps – Reach 5

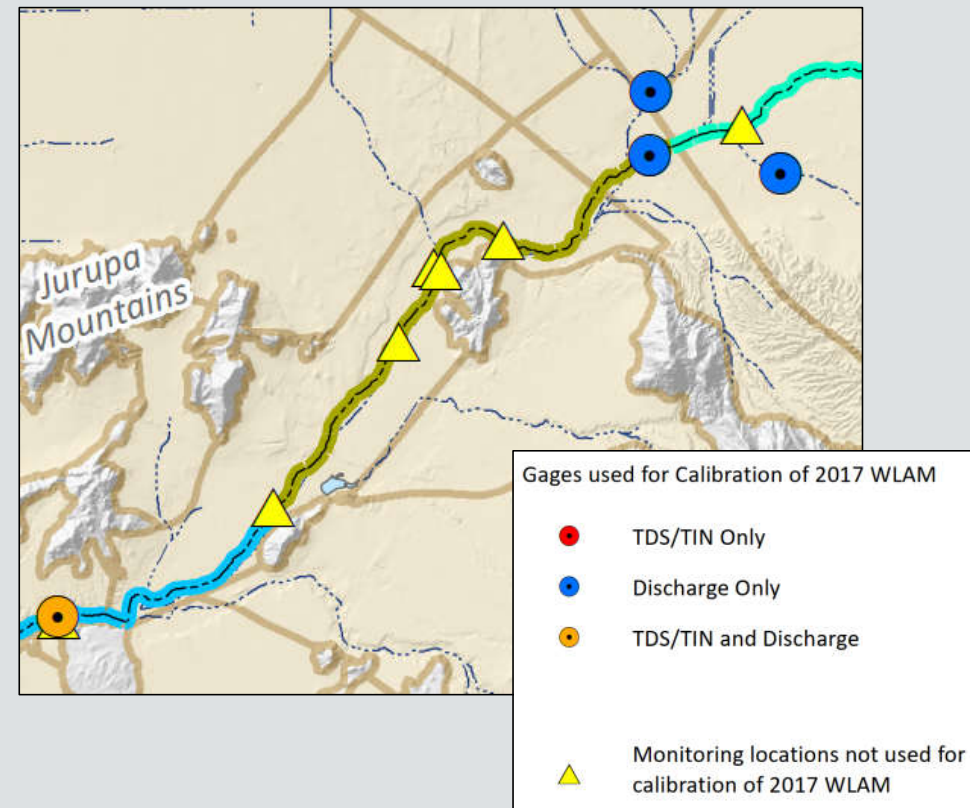
- Uncertainty in TDS/N concentration of recharge to Bunker Hill-B because no measured data to compare simulated results





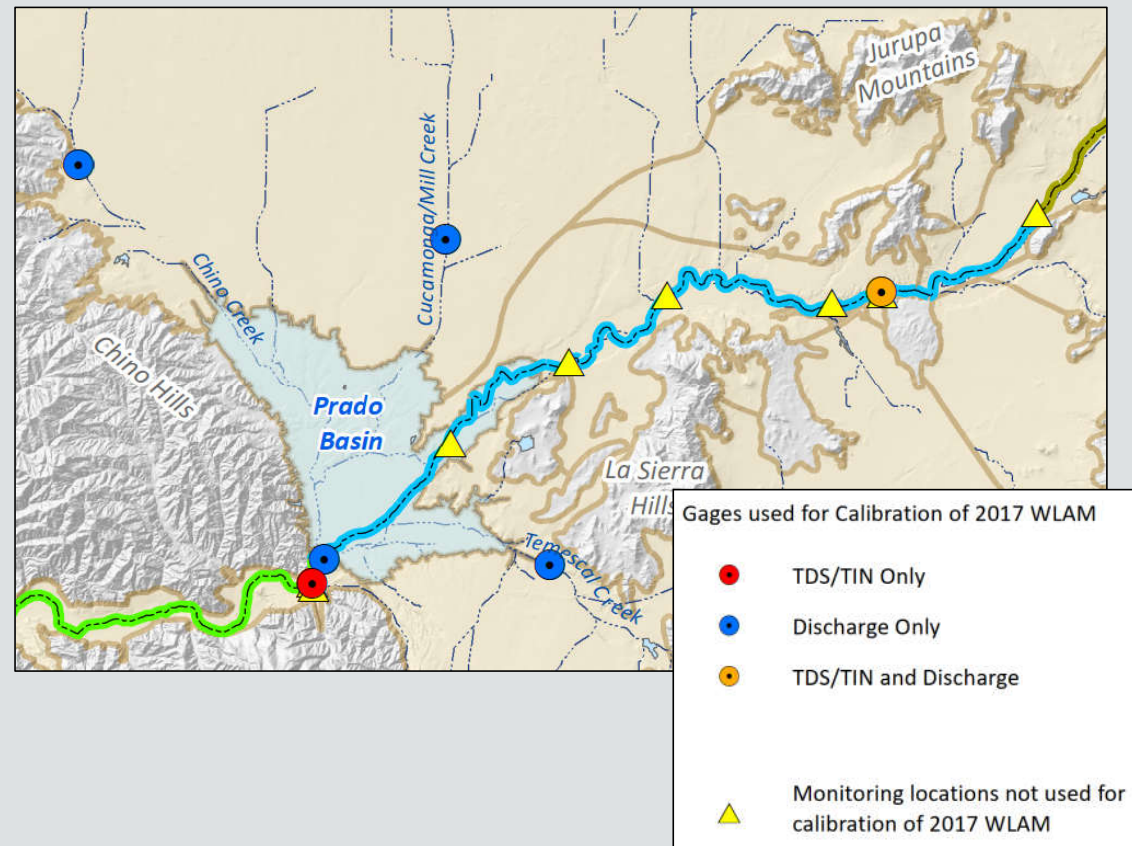
## Data Gaps – Reach 4

- Uncertainty in magnitude and quality of streambed recharge in Riverside-A GMZ



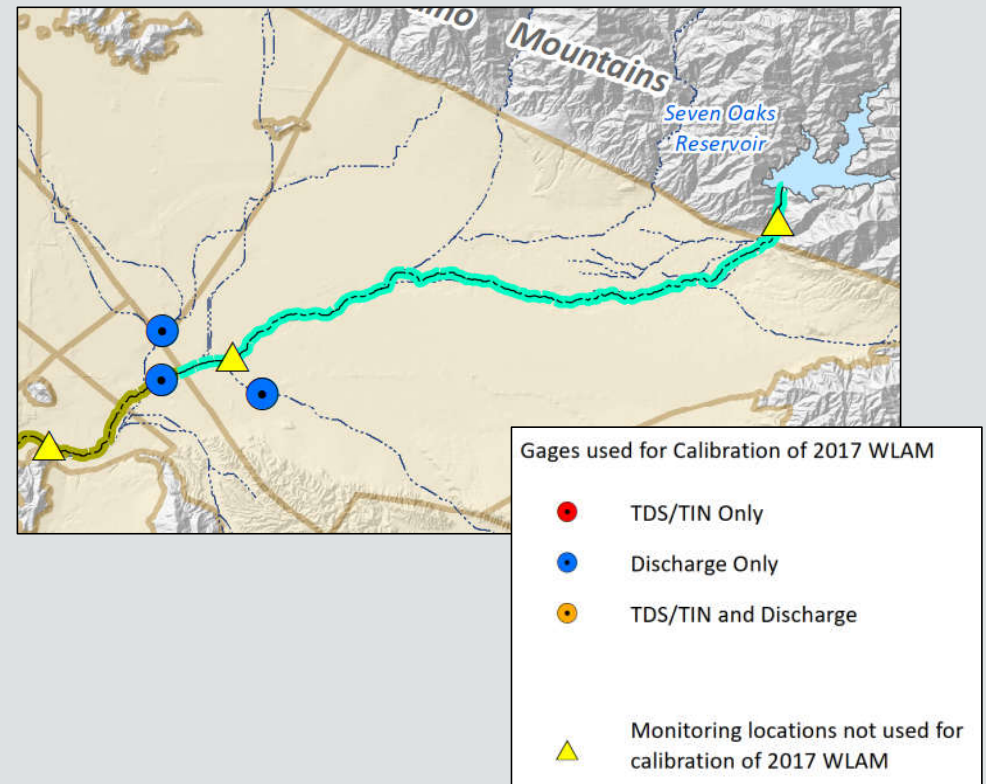
## Data Gaps – Reach 3

- Uncertainty in magnitude, quality, and location of rising groundwater and streambed recharge in Reach 3 and its tributaries



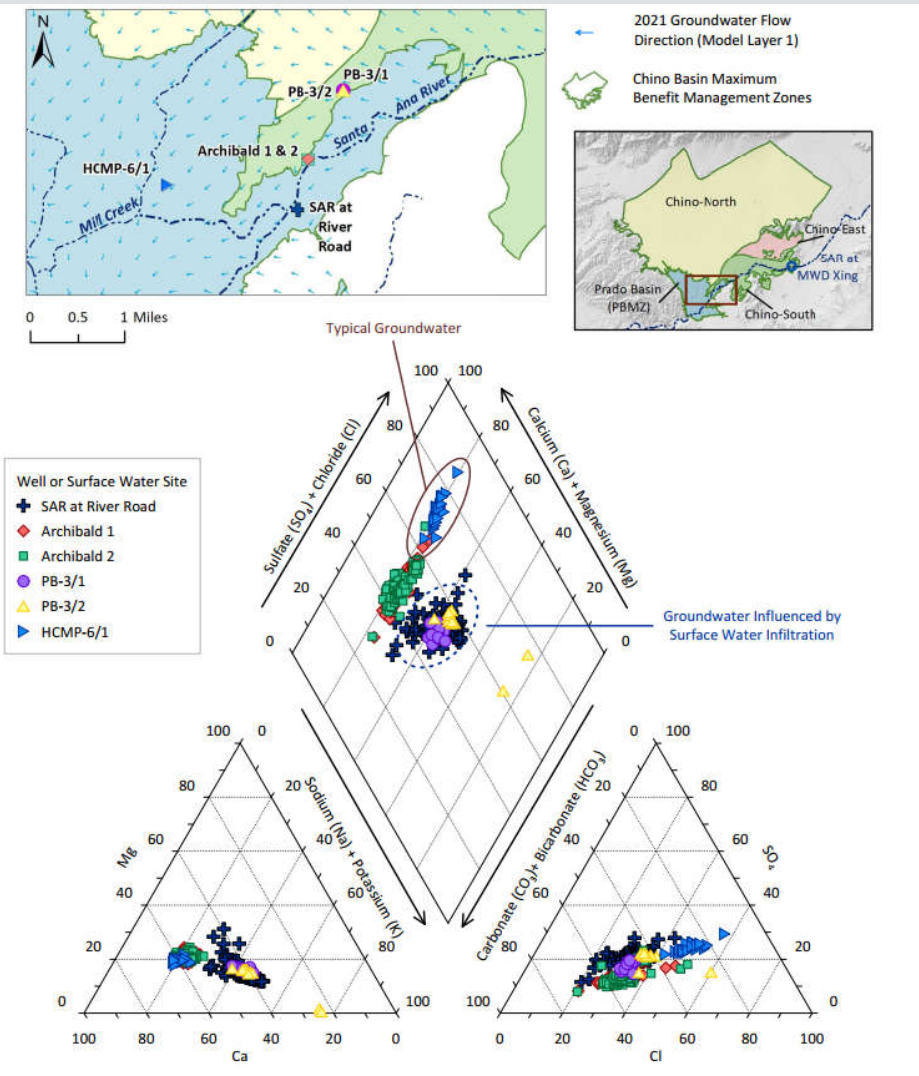
# Recommended Monitoring Program to Support the Special Study – Reach 5

- Recommended monitoring to assess annual compliance with Reach 5 TDS/TIN objectives is sufficient to address data gaps



# Recommended Monitoring Program to Support the Special Study – Reach 3 and 4

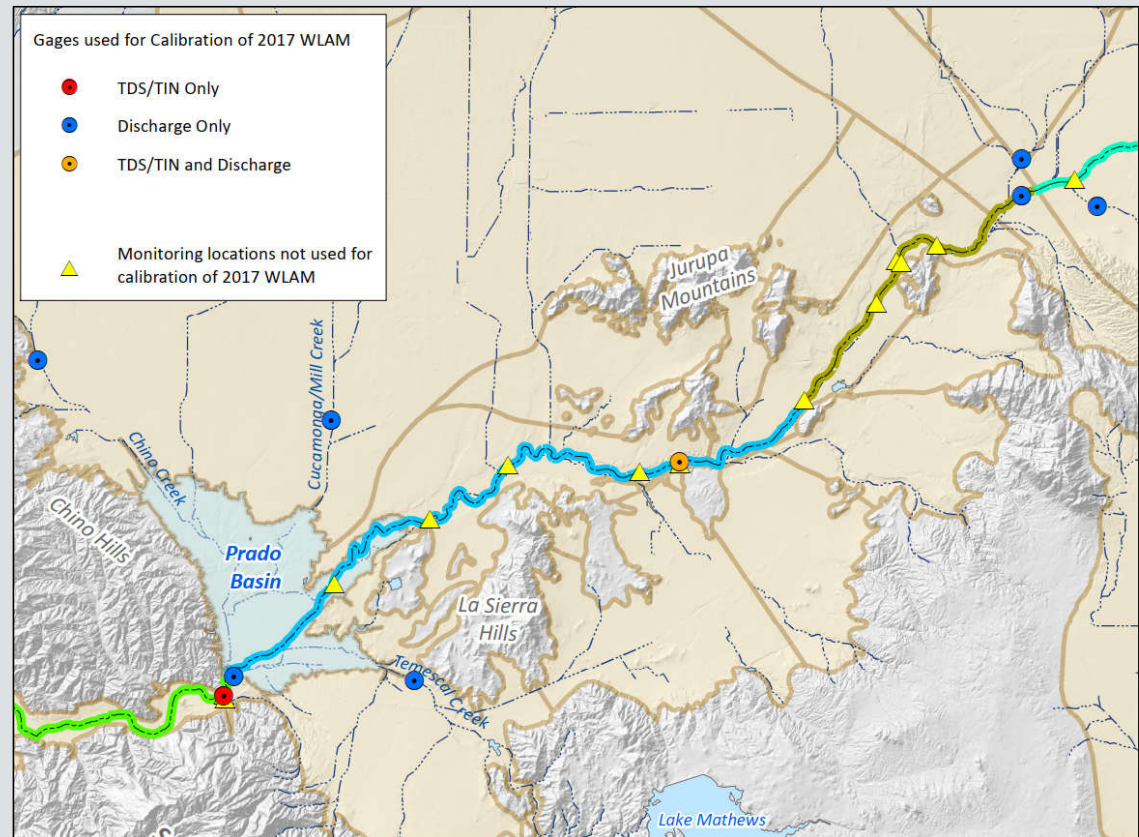
- Review available surface water and groundwater quality data from existing monitoring programs and determine applicability to address data gaps
  - Chino Basin Maximum Benefit monitoring





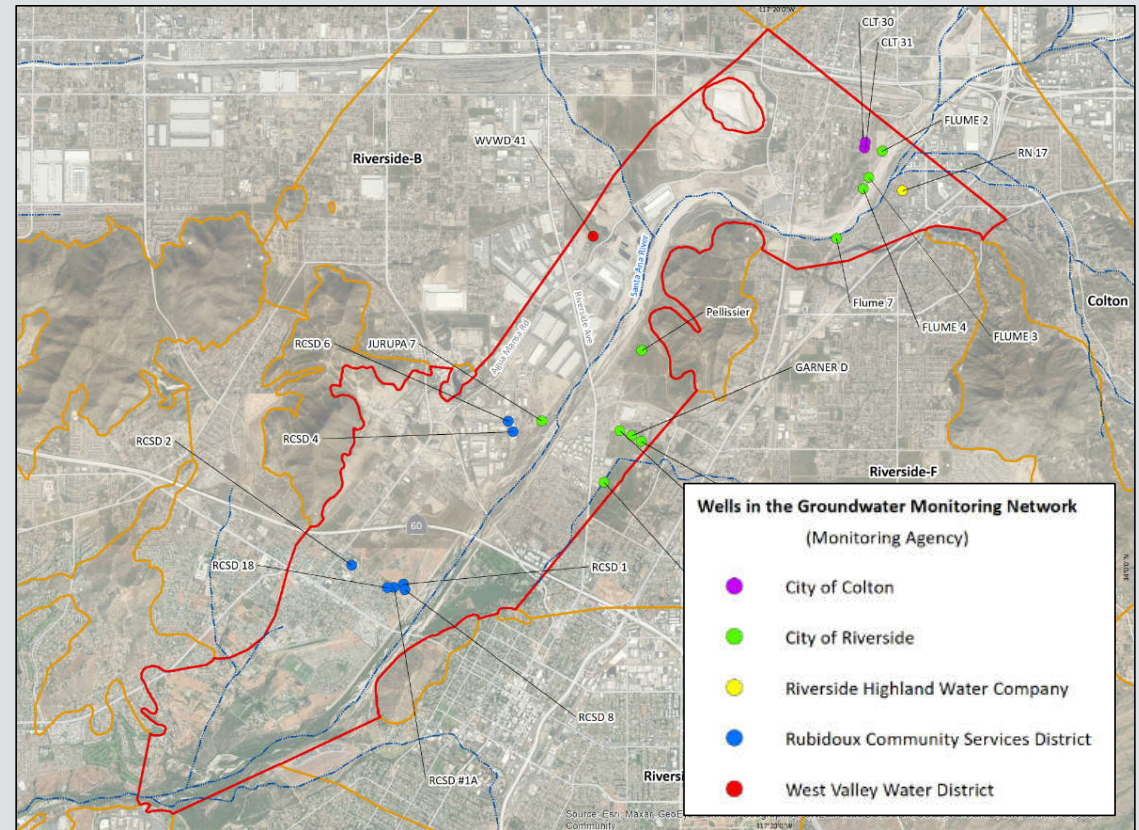
# Recommended Monitoring Program to Support the Special Study – Reach 3 and 4

- Surface water monitoring:
  - Reach 3 – 4 locations
    - Includes Chino Basin Max Benefit monitoring
  - Reach 4 – 3 locations
  - 1 monitoring point in each major tributary to Reach 3
    - Chino Creek
    - Cucamonga/Mill Creek
    - Temescal Creek
    - Arlington Drain
  - Quarterly monitoring



# Recommended Monitoring Program to Support the Special Study – Reach 3 and 4

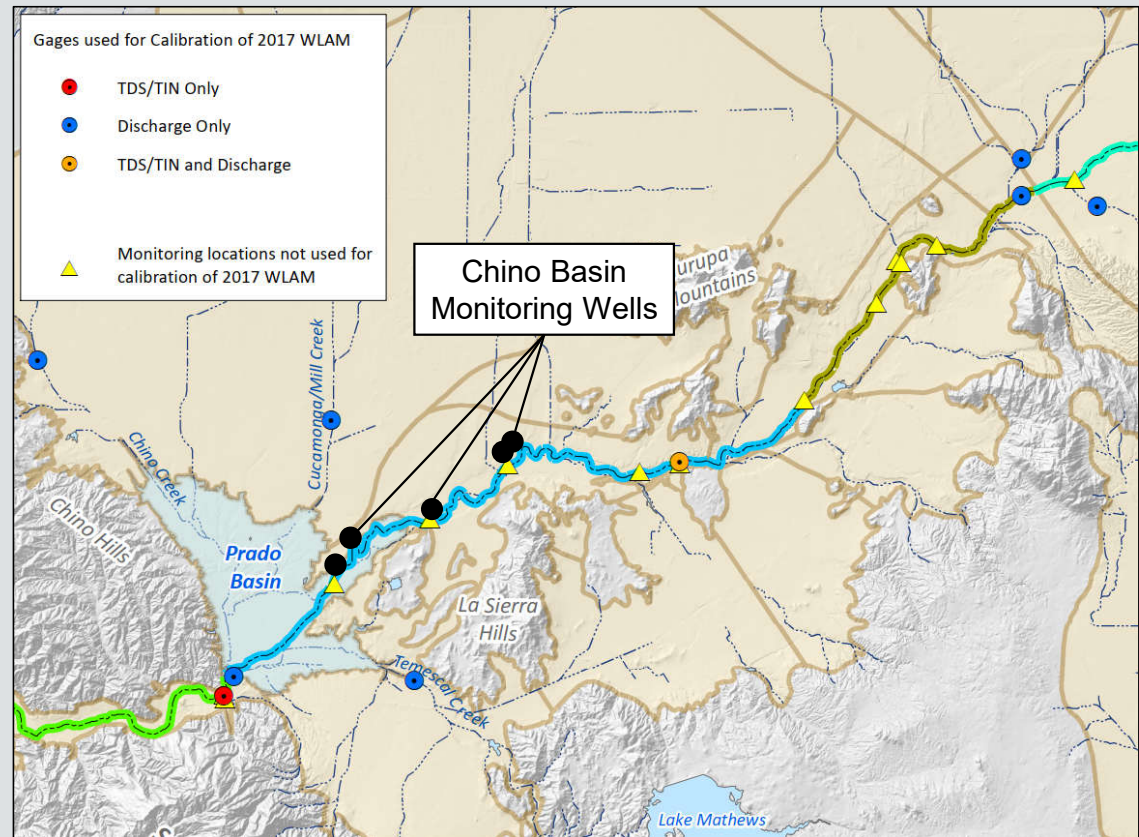
- Groundwater monitoring:
  - Collect water quality data, levels if available
  - Leverage existing monitoring locations near SAR
    - Riverside-A GMZ monitoring
    - Chino Basin Max Benefit (near Etiwanda, River Road)
    - Near RIX
    - OCWD wells in Prado





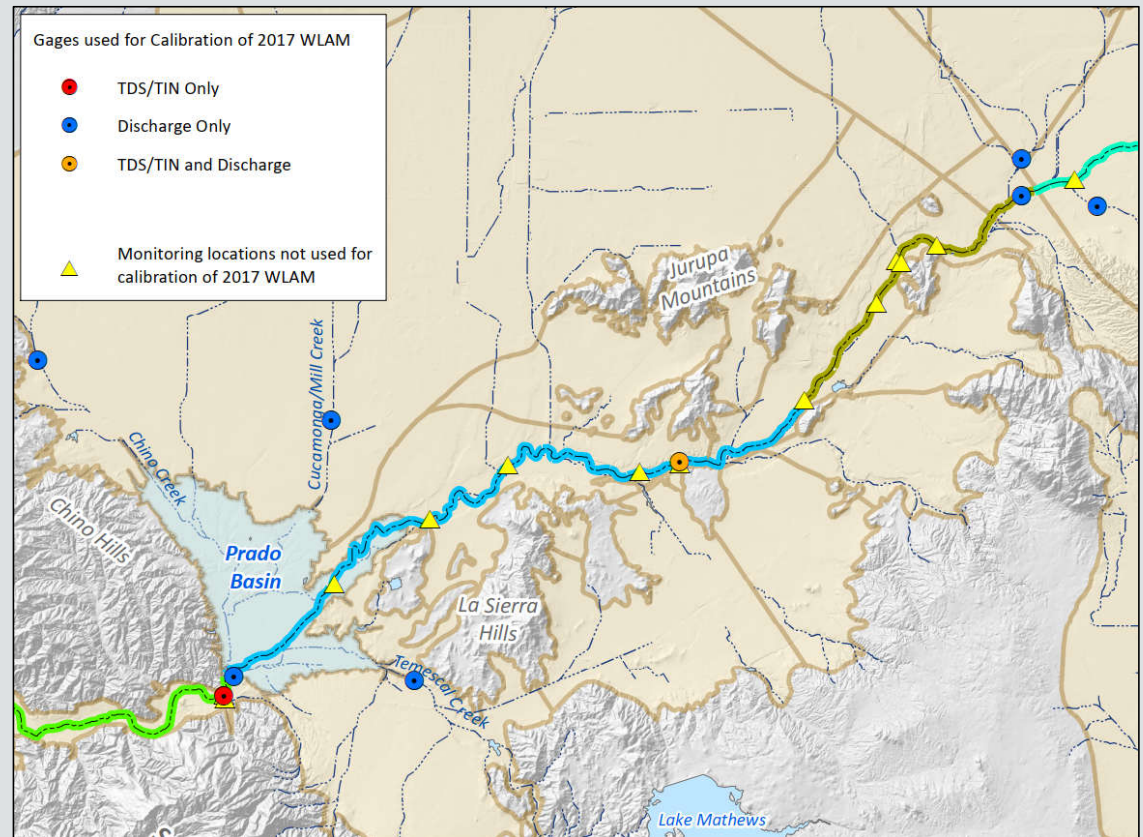
# Recommended Monitoring Program to Support the Special Study – Reach 3 and 4

- Groundwater monitoring:
  - Collect water quality data, levels if available
  - Leverage existing monitoring locations near SAR
    - Riverside-A GMZ monitoring
    - Chino Basin Max Benefit (near Etiwanda, River Road)
    - Near RIX
    - OCWD wells in Prado



# Recommended Monitoring Program to Support the Special Study – Reach 3 and 4

- Groundwater levels (if available)
  - Temperature
  - TDS/TIN
  - Major cations
  - Carbonate
  - Bicarbonate
  - Chloride
  - Sulfate
- Used to calculate source water character (WCI, Piper, Stiff, etc.)





# Recommended Monitoring Program to Support the Special Study

- Estimated cost of first year of monitoring: **\$85,000 to \$138,000**
- Assumptions:
  - Quarterly sampling at 11 surface water locations
  - Collecting and reviewing relevant monitoring data from outside agencies
  - Outside consultant
  - TM documenting analysis and recommendations
- Feedback?

# What is left to Discuss to Finalize Section 4?

- Sampling timing, frequency, duration
  - Quarterly sampling for two years
- Sampling locations
  - Reach 3, Reach 4, and major tributaries (~11 sites)
- Proposed monitoring entity for new surface water monitoring sites: Task Force
  - What does this mean? Flexible in implementation, Task Force responsible to ensure it is done. Monitoring could be physically done by:
    - Member-agency staff
    - Task Force/SAWPA consultants
- Report will include map and table with description of monitoring plan, including a more refined cost estimate

## Next Steps

- **Complete Draft Report of the 2022 Santa Ana River Water Quality Work Plan**
  - Send questions to Veva Weamer [vweamer@westyost.com](mailto:vweamer@westyost.com) or Garrett Rapp [grapp@westyost.com](mailto:grapp@westyost.com)



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