



Trussell Tech – SAWPA Discussion

January 7, 2021

Discussion Topics

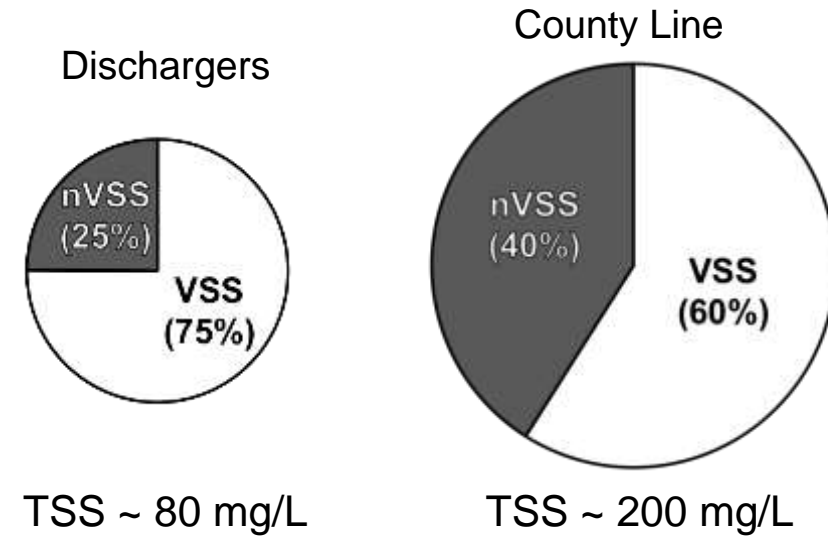
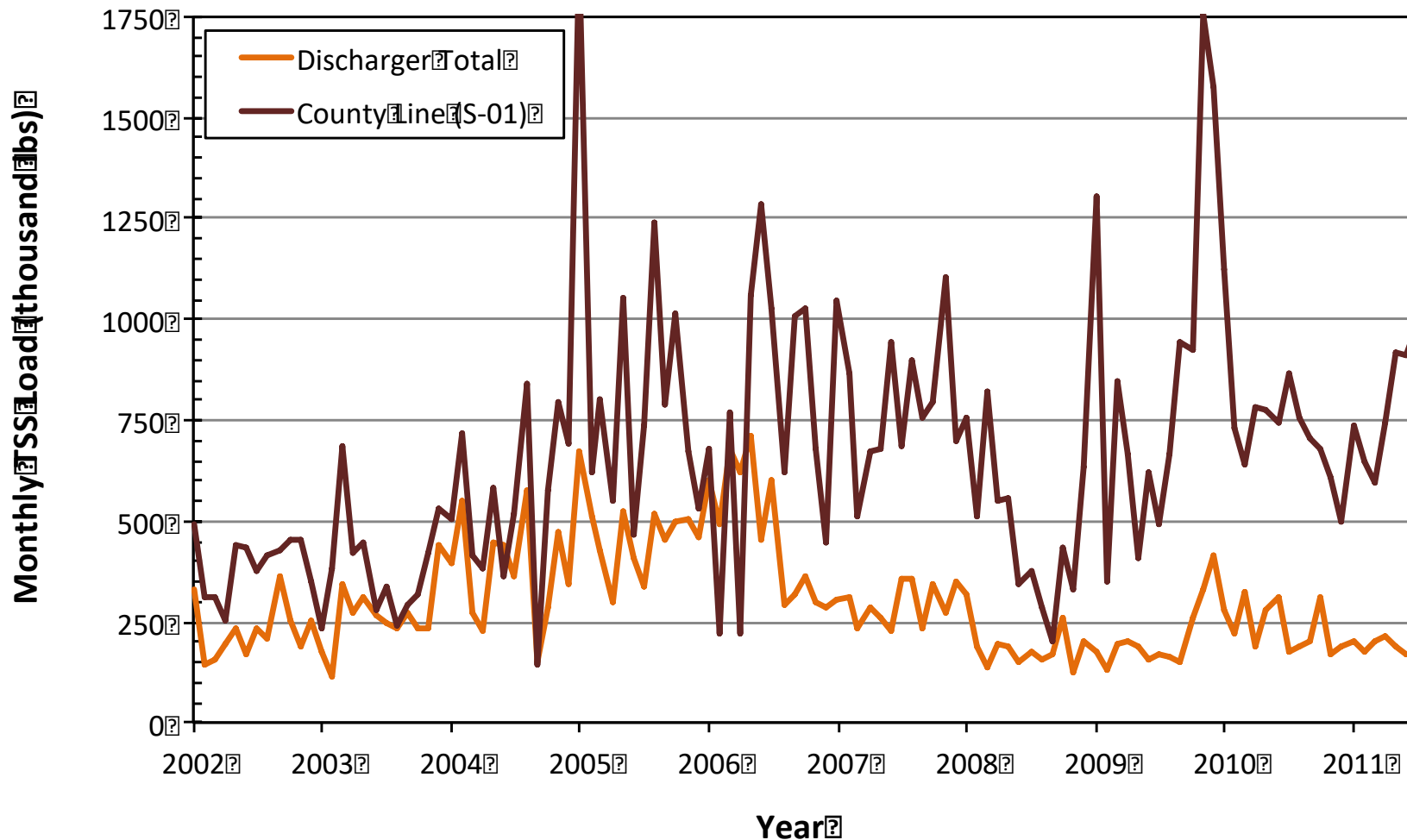
- Brine Line Solids Formation
- PFOA/PFOS
- Zero Ocean Discharge Concept



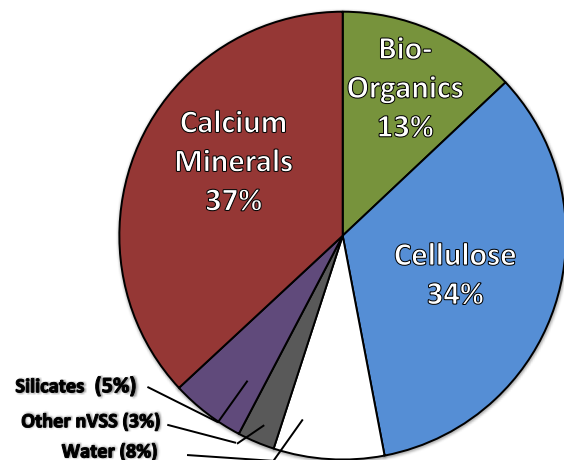
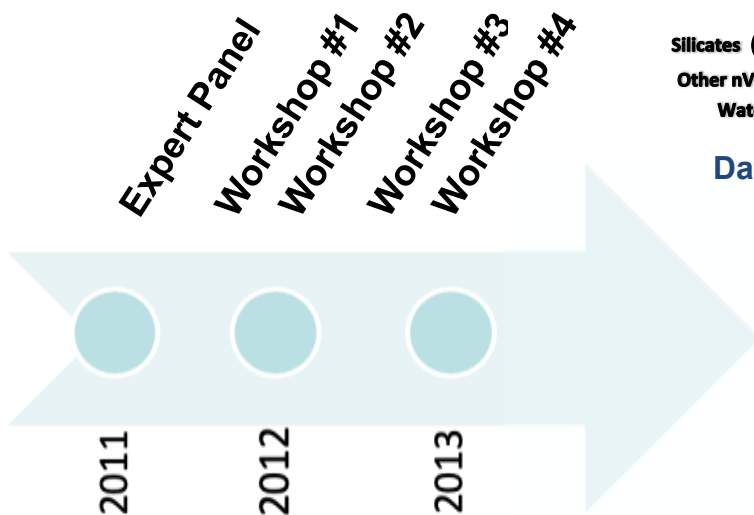
BRINE LINE SOLID FORMATION REVIEW



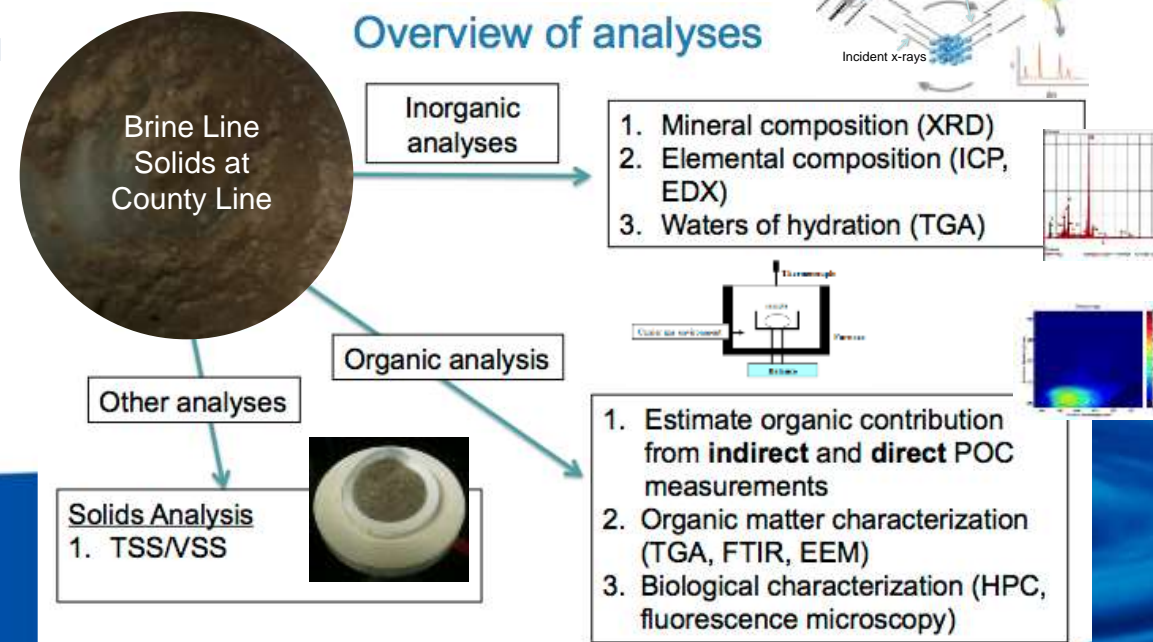
Brine Line Solids Formation - 2011



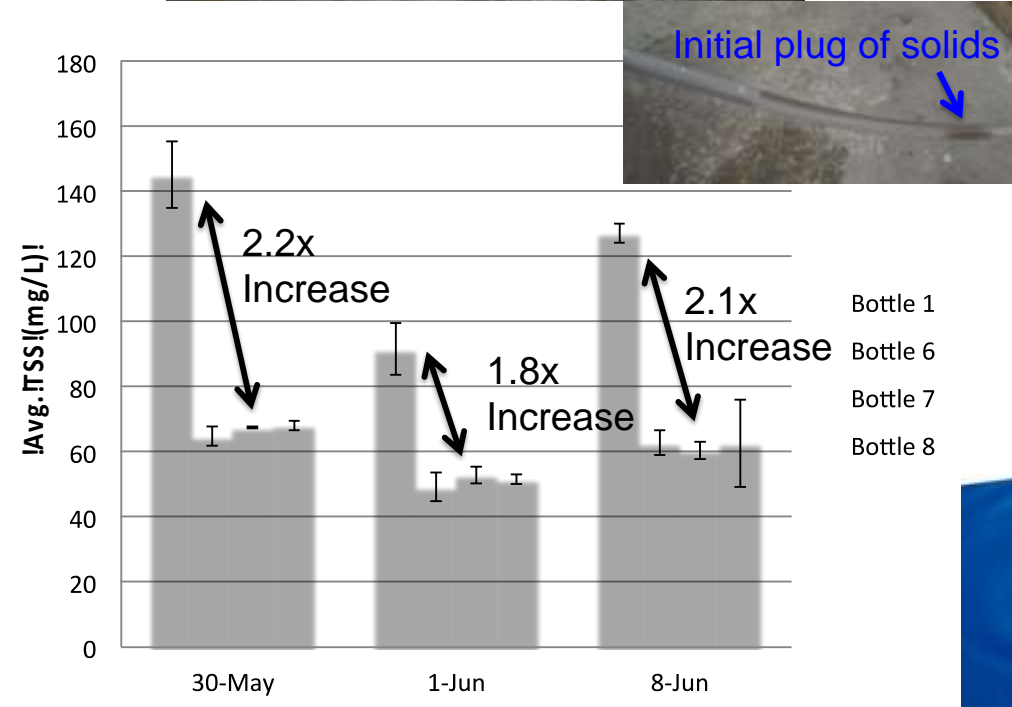
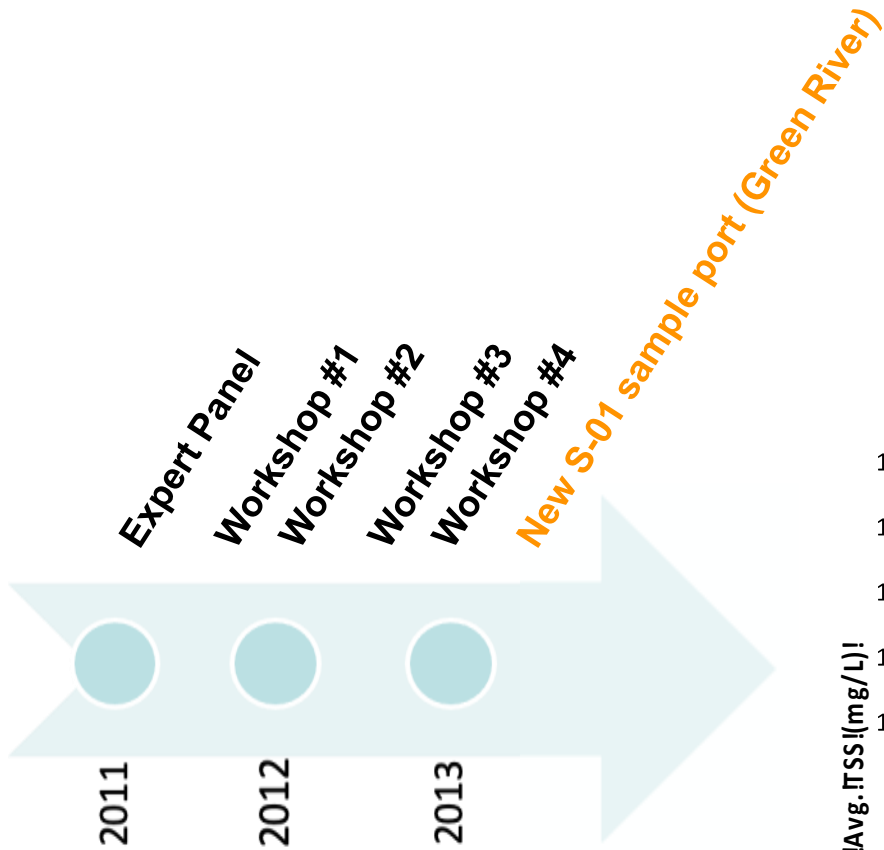
Review of Brine Line Solids Formation



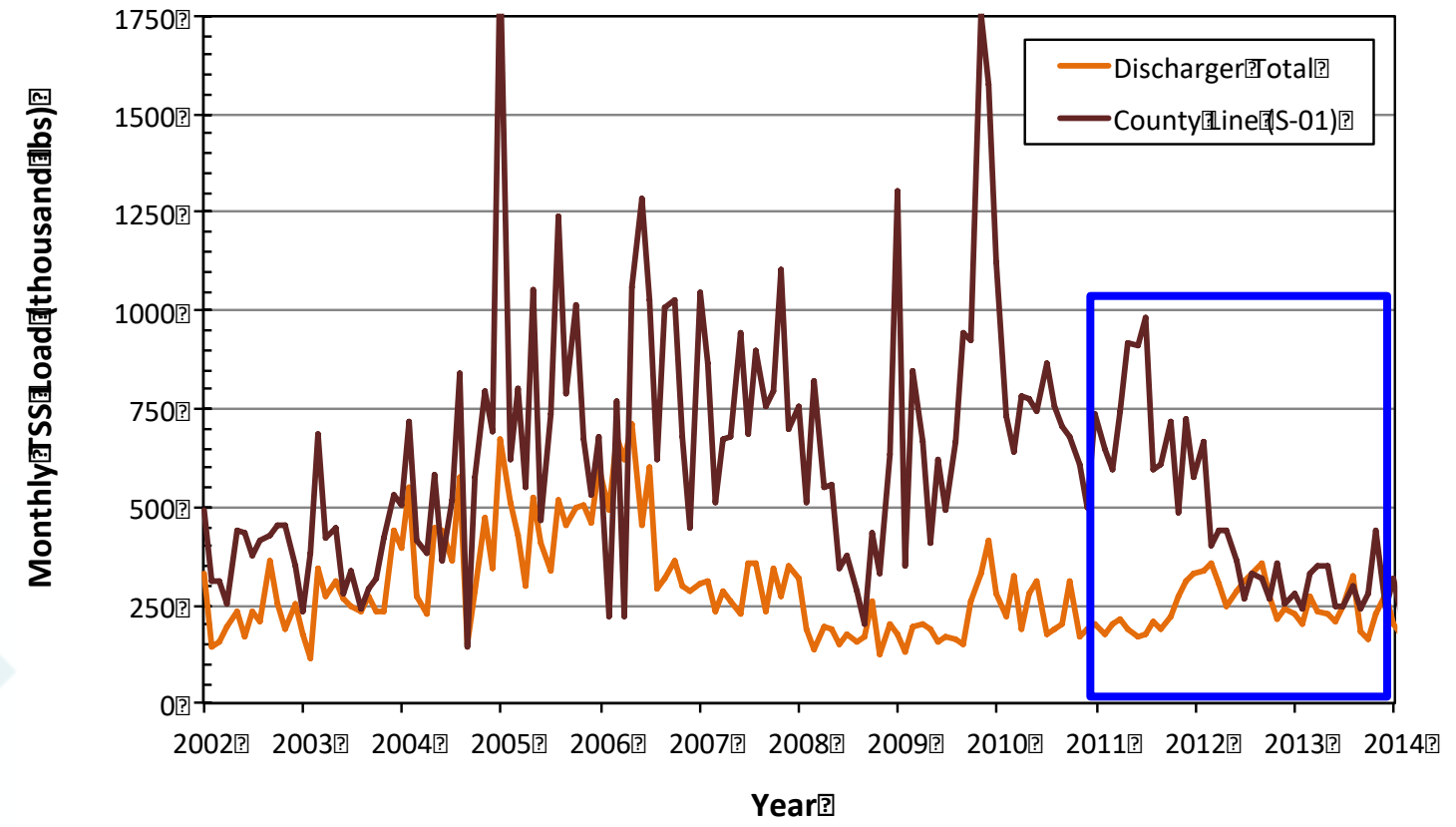
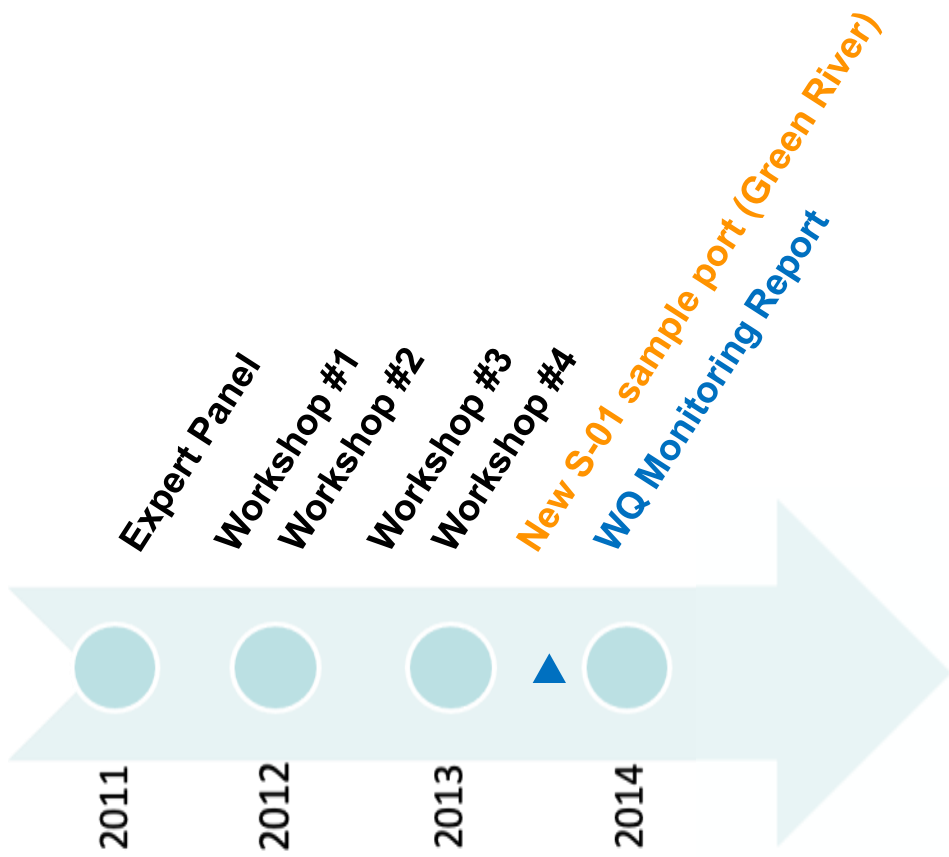
Data from October-December 2011



Review of Brine Line Solids Formation

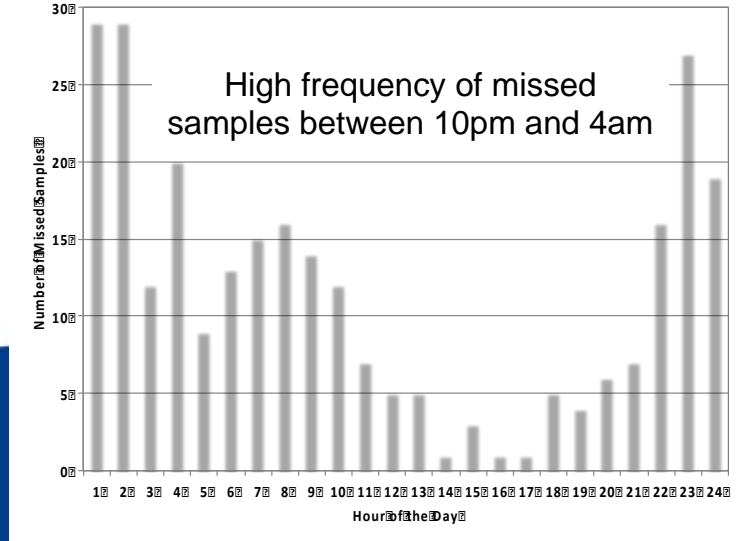
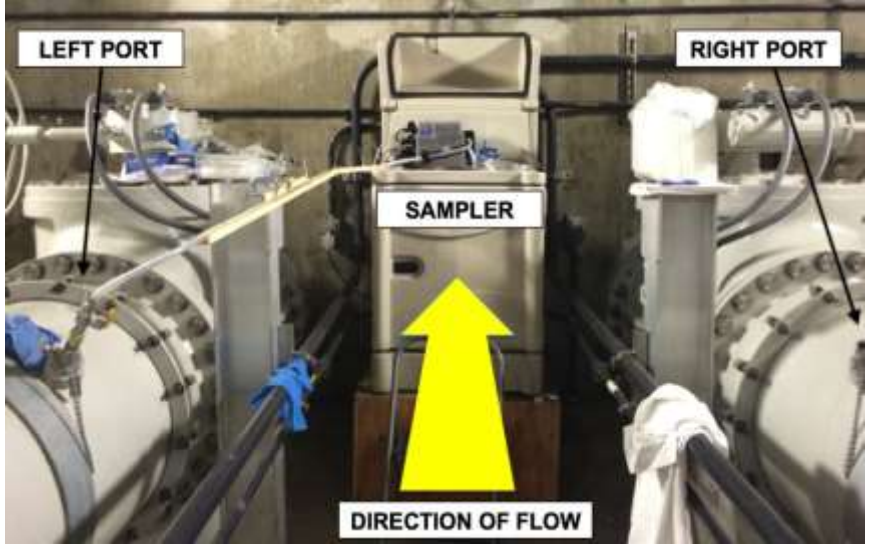
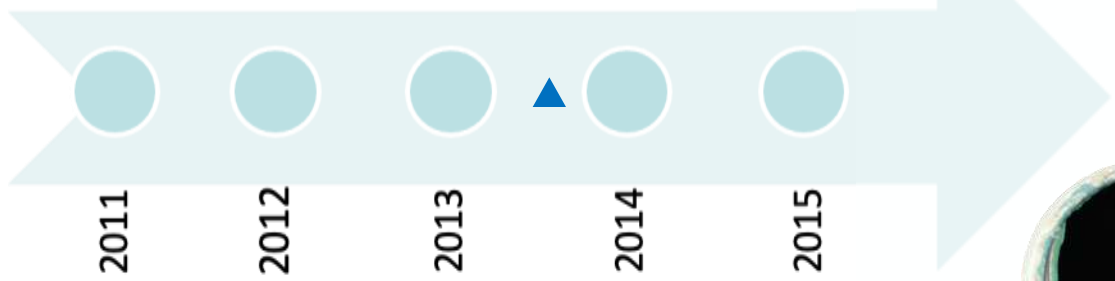


Review of Brine Line Solids Formation

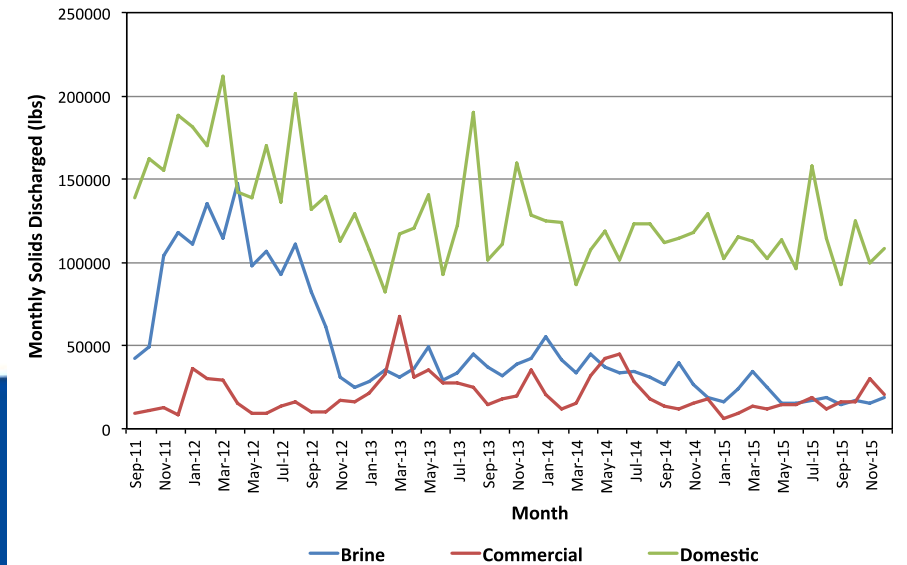
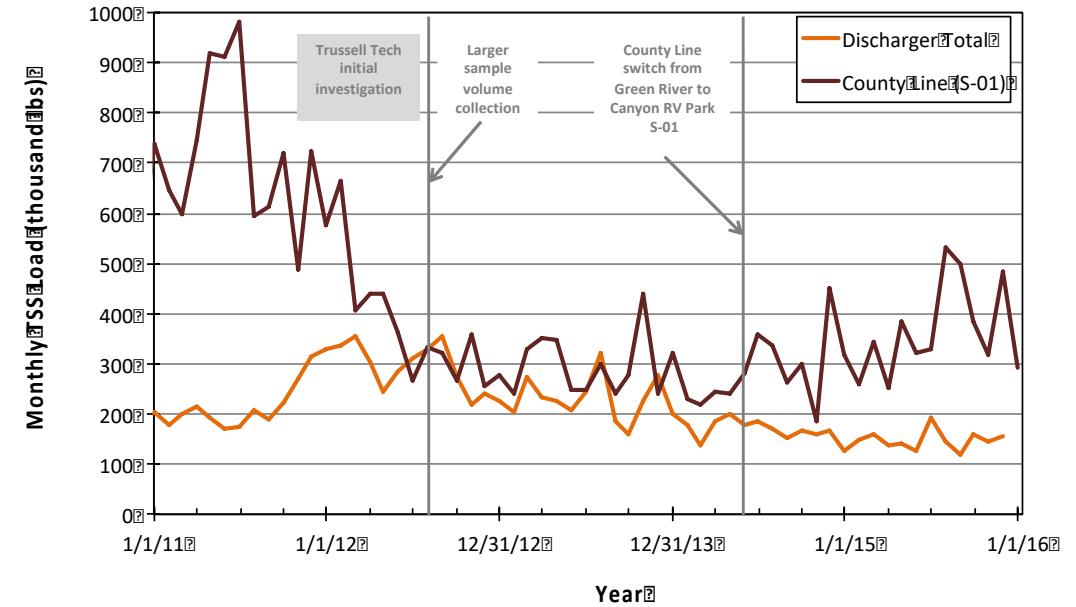
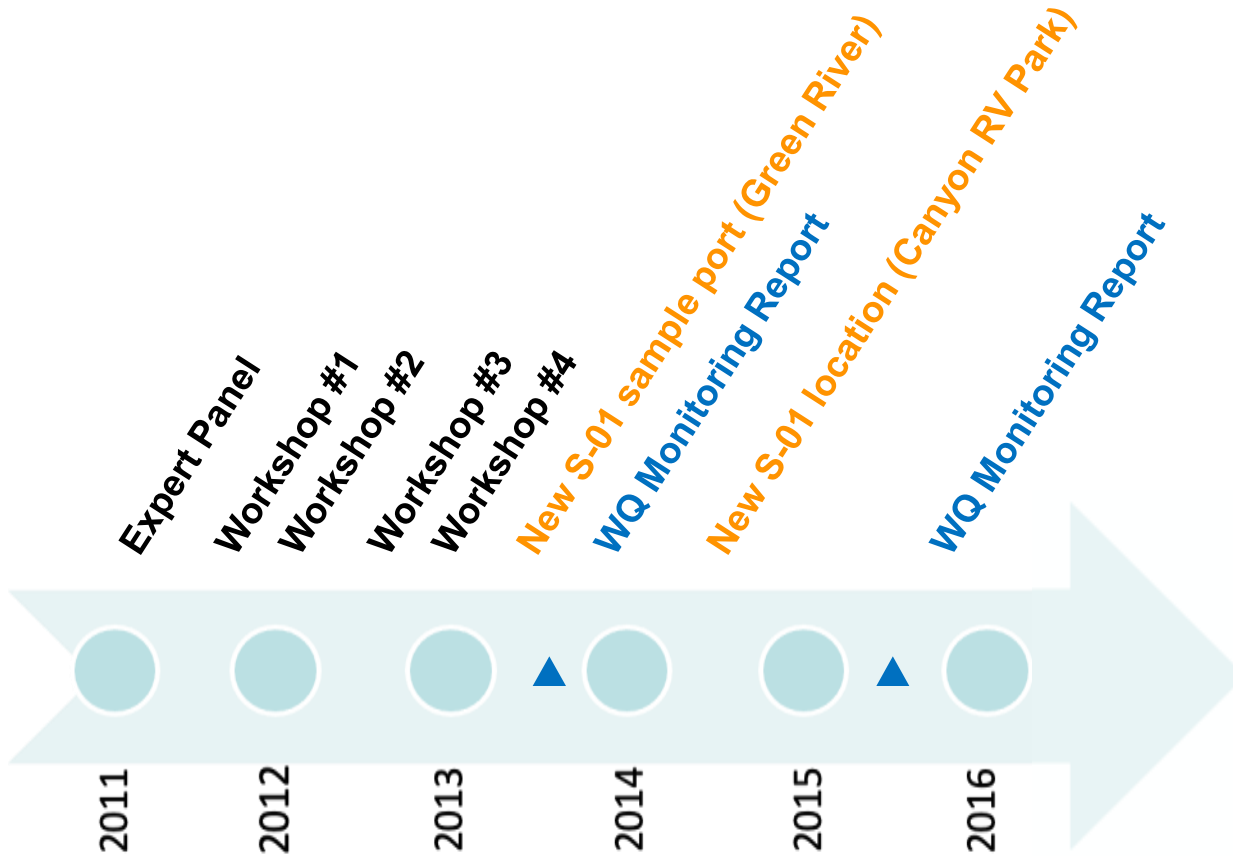


Review of Brine Line Solids Formation

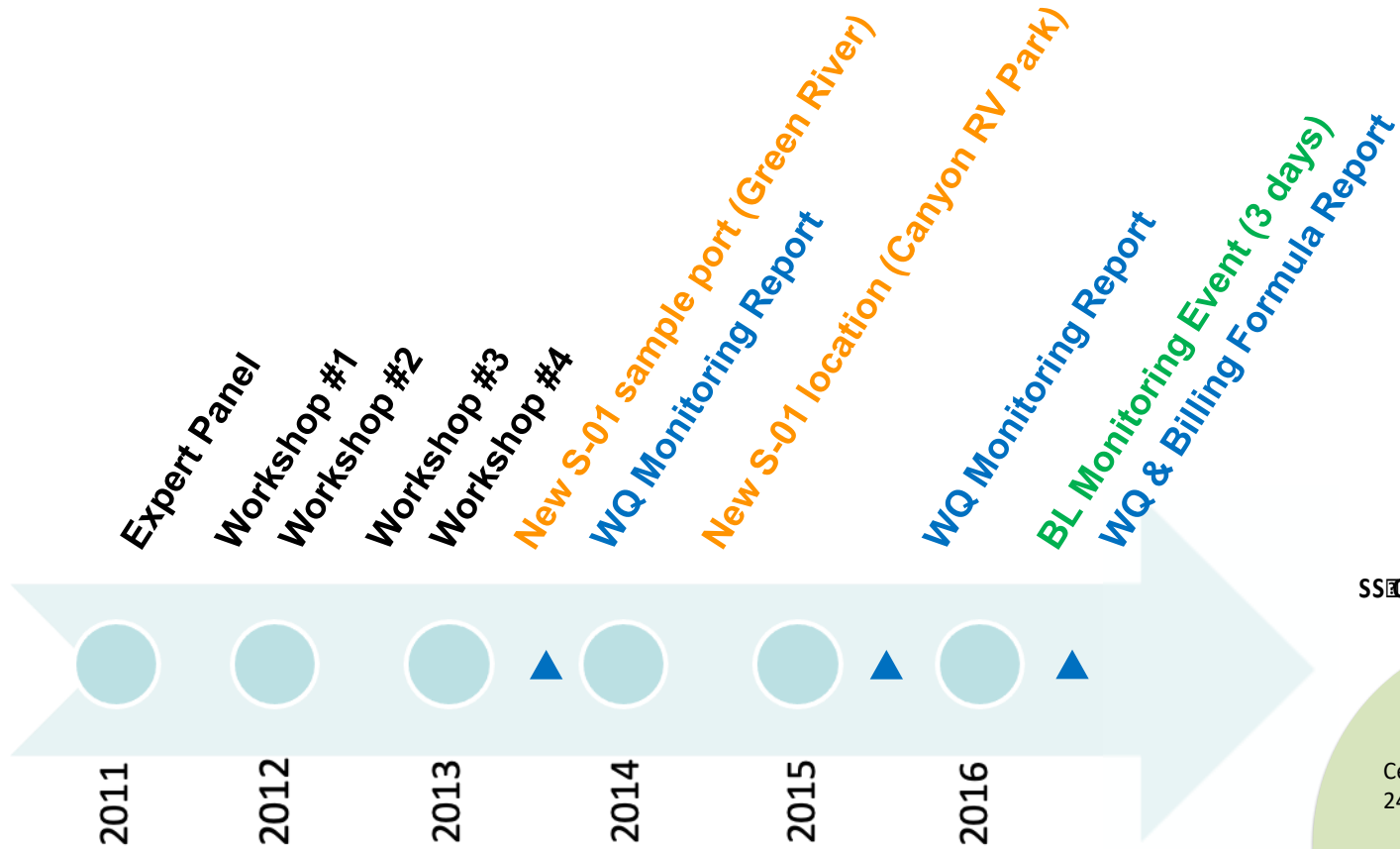
Expert Panel
 Workshop #1
 Workshop #2
 Workshop #3
 Workshop #4
 New S-01 sample port (Green River)
 WQ Monitoring Report
 New S-01 location (Canyon RV Park)



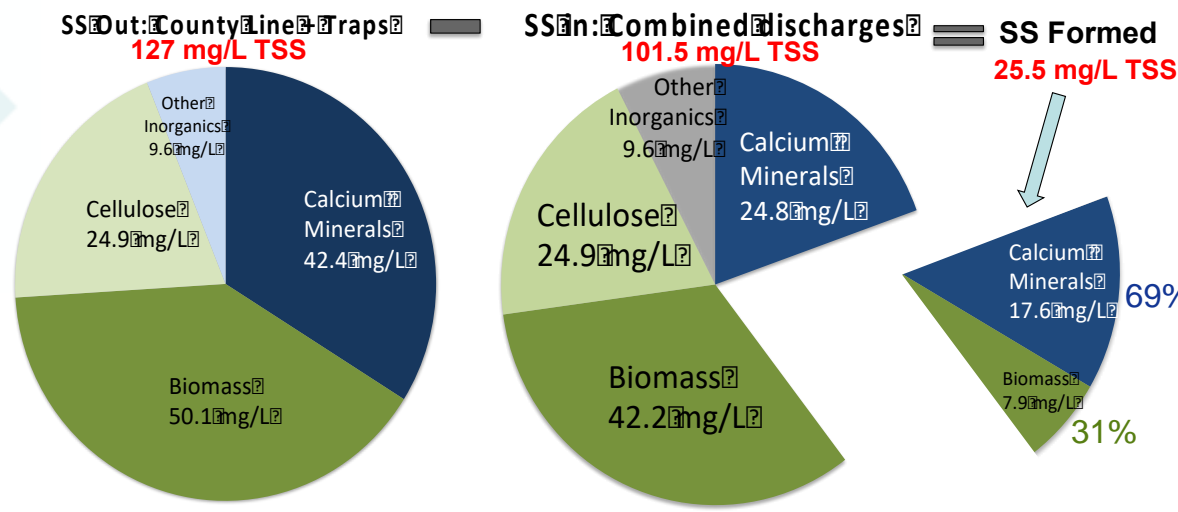
Review of Brine Line Solids Formation



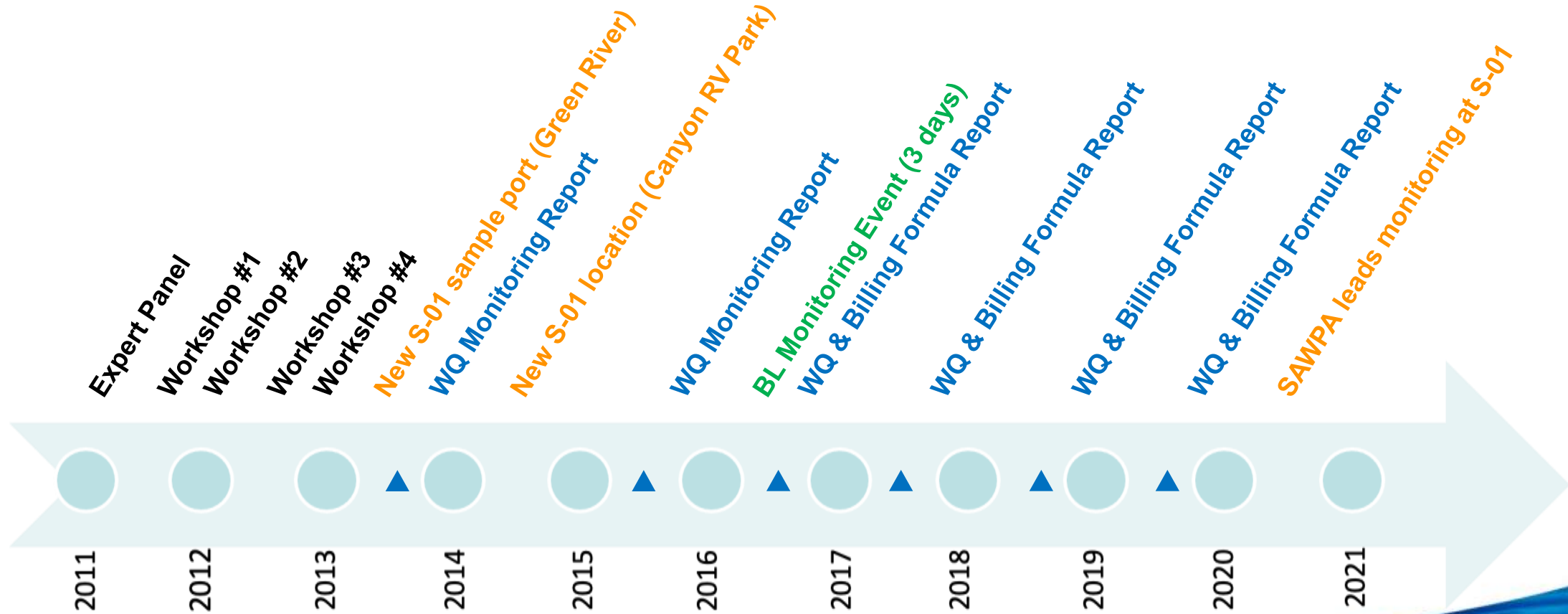
Review of Brine Line Solids Formation



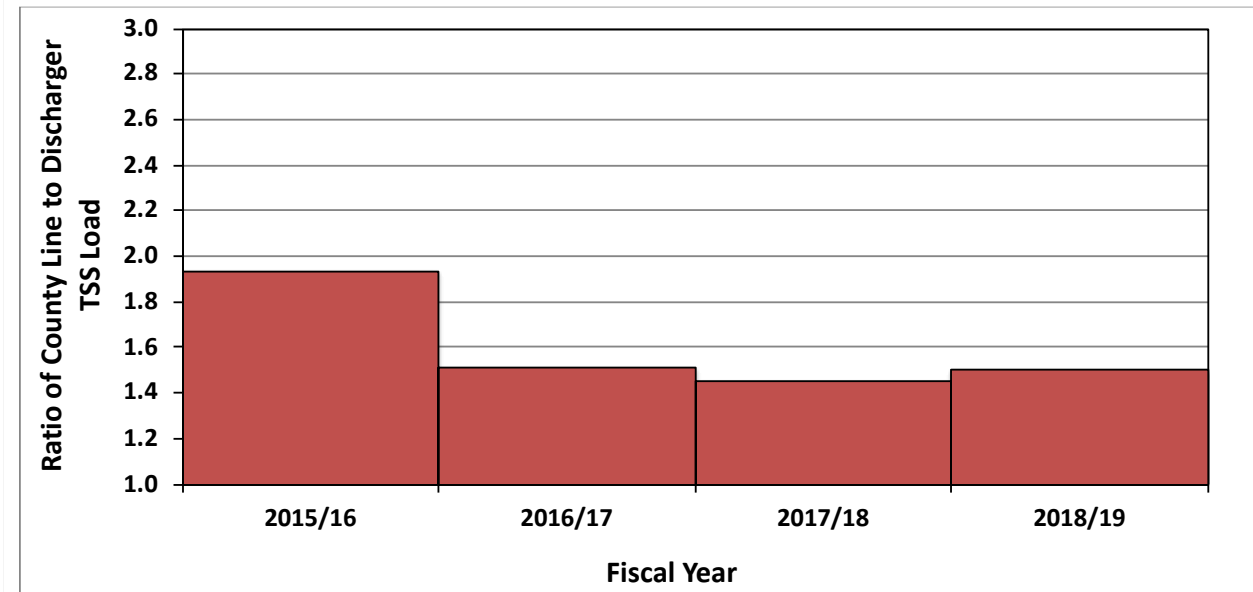
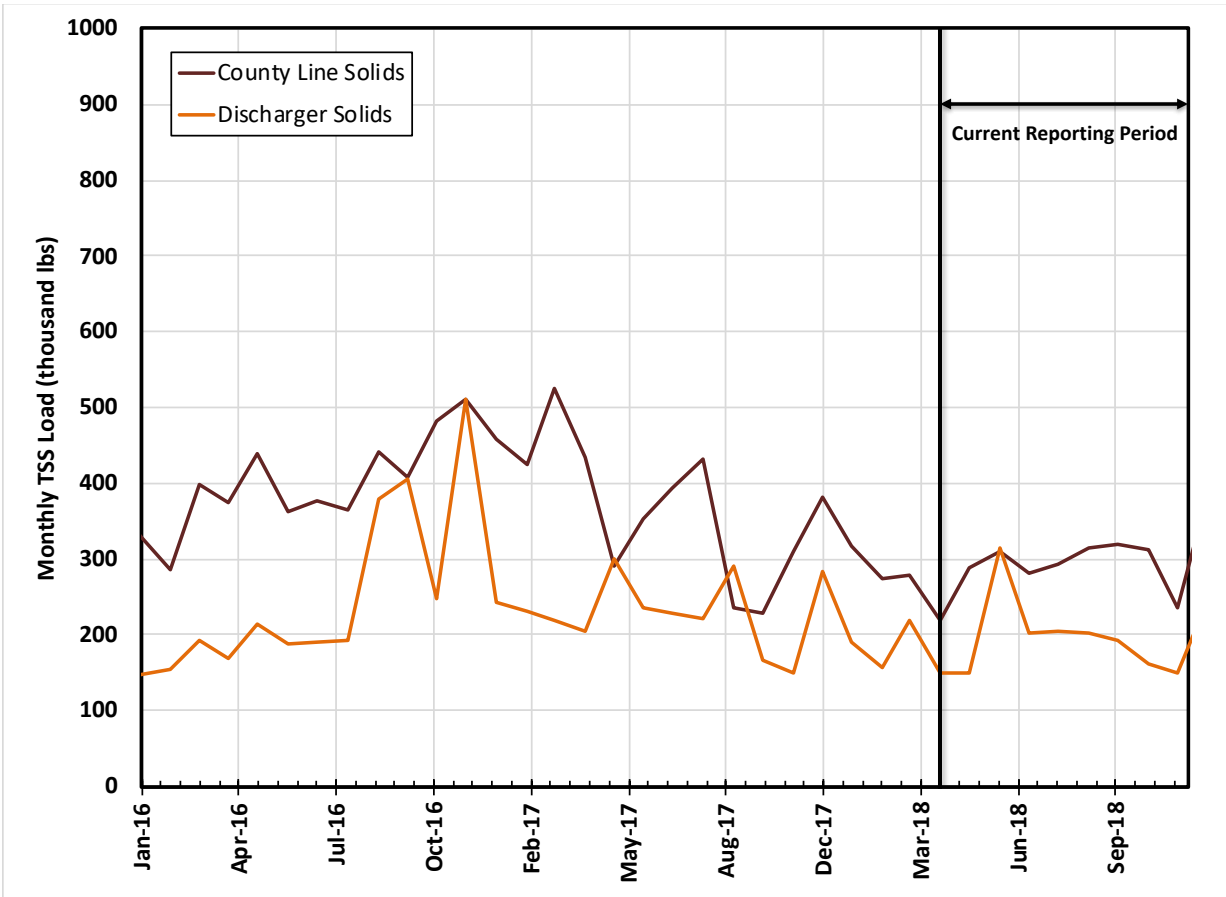
Formation Mechanism	Water Quality Surrogate*
Biological growth	Soluble BOD removal Flow
Calcium carbonate precipitation Calcium phosphate precipitation	Calcium and alkalinity removal Calcium and orthophosphate removal Flow
Other inorganic precipitation	Silica Aluminum Iron Flow



Review of Brine Line Solids Formation



Solids Difference in Brine Line



*Values represent monthly average loading. When no monitoring occurred for an individual discharger in a given month, surrounding average measurements were substituted.

Monitoring Program

County Line

Dischargers

Constituent/Analysis	Test Method	Frequency	Notes
Flow	-	Online monitoring	
pH	-	Online monitoring	
BODs	SM 5210B	Weekly	Total and dissolved (TSS filter); Total analysis in triplicate
TSS	SM 2540D	Weekly	Analysis in triplicate; Expedited analysis (<24h hold)
VSS	EPA 160.4	Weekly	Analysis in triplicate; Expedited analysis (<24h hold)
Alkalinity	SM 2320B	Weekly	Total and dissolved (TSS filter)
pH	-	Weekly	Field measurement
Temperature	-	Weekly	Field measurement
Calcium	EPA 200.7	Weekly	Total and dissolved (TSS filter)
TDS	SM 2540C	Monthly	
Metals via ICP (<i>on suspended solids</i>)	EPA 6010B	Monthly	Ca, Mg, Na, K, Fe, Si, Al; Trussell Tech to separate solids via centrifugation
Orthophosphate	SM 4500P E	Monthly	Total and dissolved (TSS filter)
Particulate Organic Carbon (POC)	EPA 9060	Monthly	Trussell Tech to separate solids via centrifugation
Dissolved Organic Carbon (DOC)	SM 5310B	Monthly	Using TSS filter paper substitution
X-ray diffraction (XRD)	XRD	Quarterly	Provides mineral characterization
Scanning electron microscopy (SEM) with energy dispersive x-ray spectroscopy (EDX)	SEM/EDX	Quarterly	Provides elemental characterization
Thermogravimetric analysis (TGA)	TGA	Quarterly	Provides cellulose identification and quantification

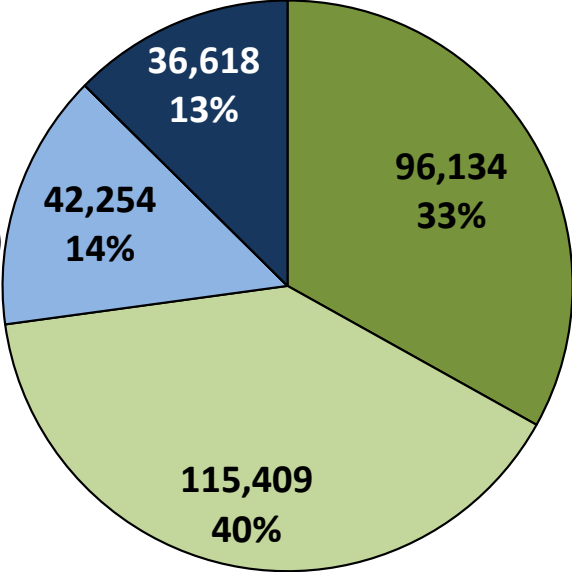
Flow Rank	Industrial Discharger	Top 3		75% of loading		95% of loading				
		Total Solids	Volatile Solids	BOD		Alkalinity		Calcium		
				Total	Dissolved	Total	Dissolved	Total	Dissolved	Particulate
1	Perris and Menifee Desalter	M	M	M	M	M	M	M	M	M
2	Chino Desalter	M	M	M	M	M	M	M	M	M
3	Temescal Desalter	M	M	M	M	M	M	M	M	M
4	Arlington Desalter	M	M	M	M	M	M	M	M	M
5	Chino Desalter II East	M	M	M	M	M	M	M	M	M
6	JCSD-Etiwanda	M	M	M	M	M	M	M	M	M
7	Bonview*	-	-	-	-	-	-	-	-	-
8	Mountainview Power Plant	M	M	M	M	M	M	M	M	M
9	YWWD - Henry Wochholz Plant	M	M	M	M	M	M	M	M	M
10	CIW/Womens Prison	M	M	M	M	M	M	M	M	M
11	Mission Linen	M	M	M	M	M	M	M	M	M
12	Stringfellow	M	M	M	M	M	M	M	M	M
13	CIM/Mens Prison	M	M	M	M	M	M	M	M	M
14	Chino Desalter II West	Q	Q	Q	Q	Q	Q	Q	Q	Q
15	JCSD-Wineville	M	M	M	M	M	M	M	M	M
16	Inland Empire Energy Center	Q	Q	Q	Q	Q	Q	Q	Q	Q
17	OLS	Q	Q	Q	Q	Q	Q	Q	Q	Q
18	JCSD Hamner	M	M	M	M	M	M	M	M	M
19	Dart Container	Q	Q	Q	Q	Q	Q	Q	Q	Q
20	Repet	M	M	M	M	M	M	M	M	M
21	JCSD Scholar Way Metering Station	M	M	M	M	M	M	M	M	M
22	Wellington Foods	Q	Q	Q	Q	Q	Q	Q	Q	Q
23	Eastside Water Treatment Plant	Q	Q	Q	Q	Q	Q	Q	Q	Q
24	JCSD Harrison	Q	Q	Q	Q	Q	Q	Q	Q	Q
25	Inland Bioenergy*	-	-	-	-	-	-	-	-	-
26	Flavor Specialities	Q	Q	Q	Q	Q	Q	Q	Q	Q
27	Giuliano and Sons Briners	M	M	M	M	M	M	M	M	M
28	JCSD Chandler	Q	Q	Q	Q	Q	Q	Q	Q	Q
29	Green River Golf Course	Q	Q	Q	Q	Q	Q	Q	Q	Q
30	Rubidoux CSD	M	M	M	M	M	M	M	M	M
31	Agua Mensa Power Plant	Q	Q	Q	Q	Q	Q	Q	Q	Q
32	JCSD Archibald	Q	Q	Q	Q	Q	Q	Q	Q	Q
33	EMWD Railroad Canyon Pipeline	Q	Q	Q	Q	Q	Q	Q	Q	Q
34	WRCRWA	Q	Q	Q	Q	Q	Q	Q	Q	Q
35	City of Corona Ion Exchange Treatment Plant	Q	Q	Q	Q	Q	Q	Q	Q	Q
36	Temporary Discharge	Q	Q	Q	Q	Q	Q	Q	Q	Q

*Discharger has been taken offline, no sampling frequency recommendation required.

County Line SS



Bacteria
(dead & alive)



Calcium carbonate
(scale at bottom of teapot)

■ Microbial Biomass ■ Cellulosic Material ■ Other nVSS ■ Calcium Minerals



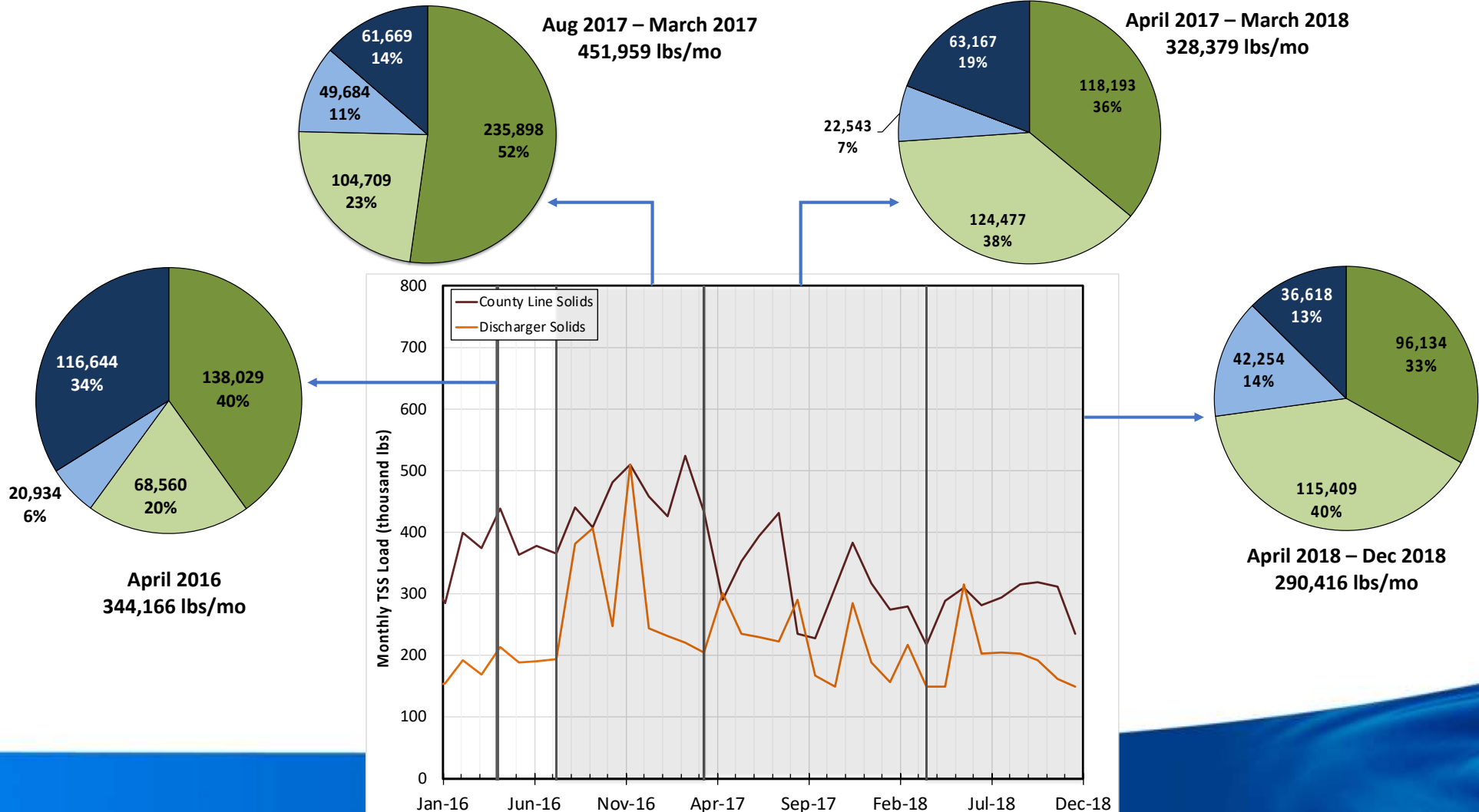
Non-calcium inorganics
(silica, aluminum, etc.)



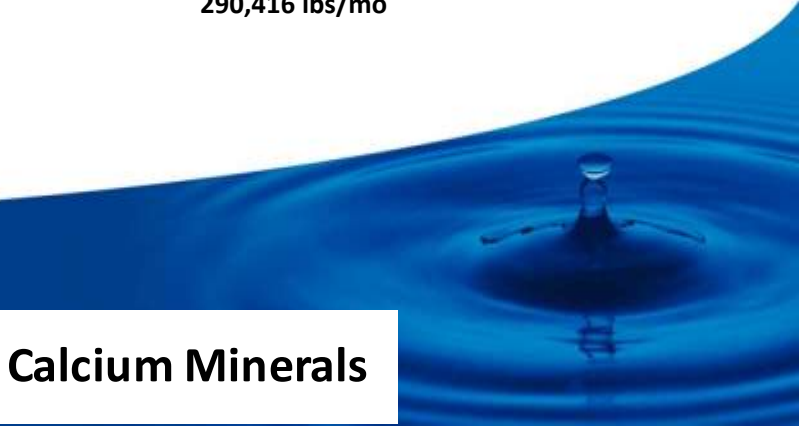
Cellulosic material from plant fibers
(paper products, cotton fabrics)



County Line SS

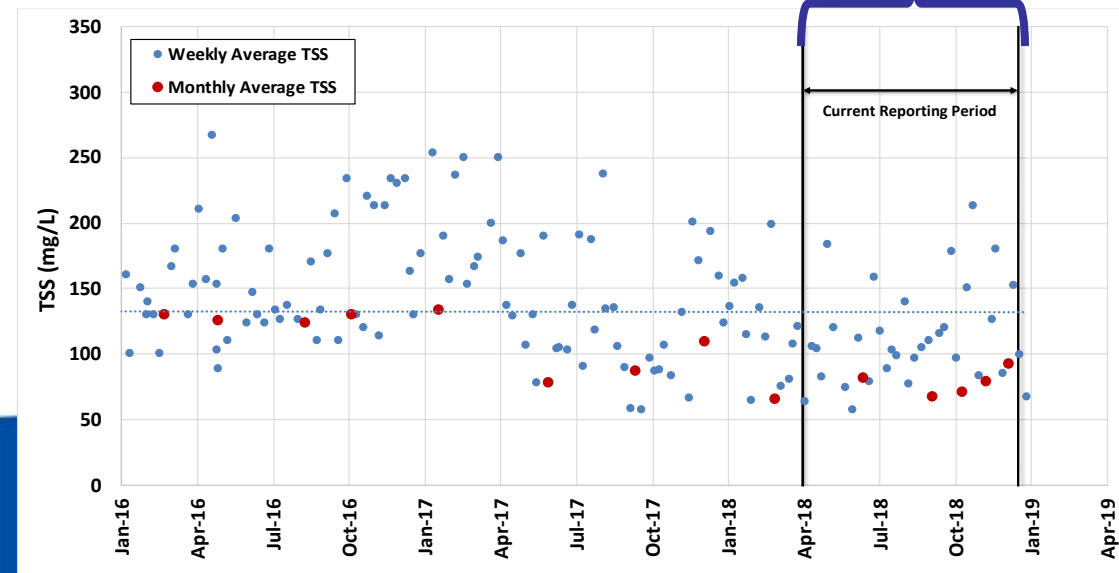
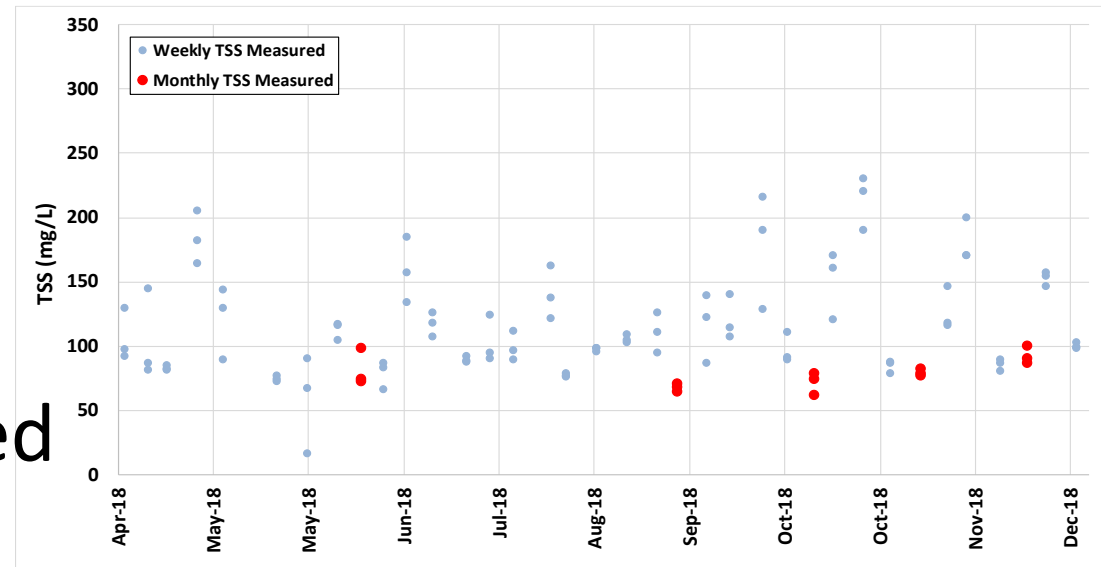


Microbial Biomass
 Cellulosic Material
 Other nVSS
 Calcium Minerals



County Line SS

- Triplicate TSS analysis has reduced variability for individual samples
- Real week-to-week variability (nature of discharges)
- Lower solids with larger sample volumes (monthly)



Methodology (2018 data)

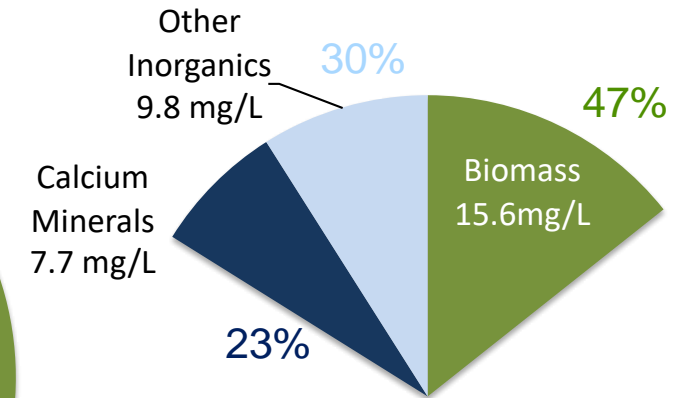
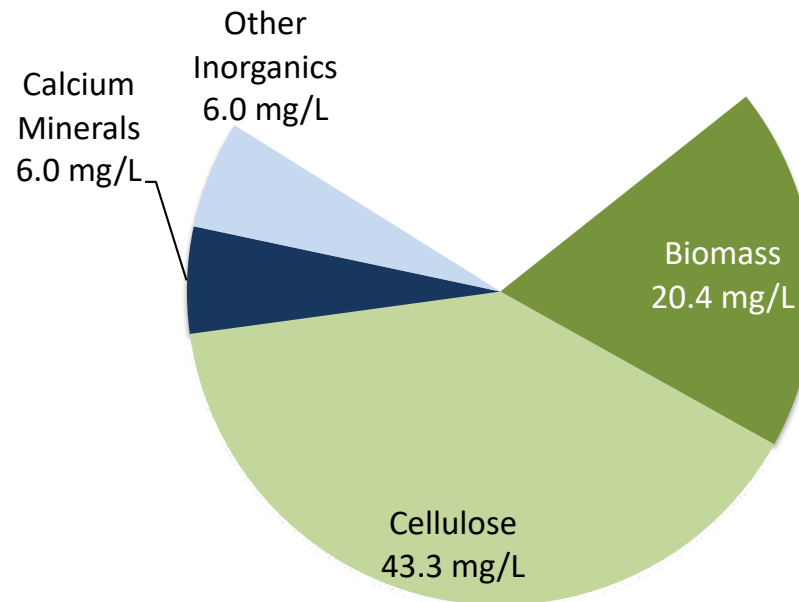
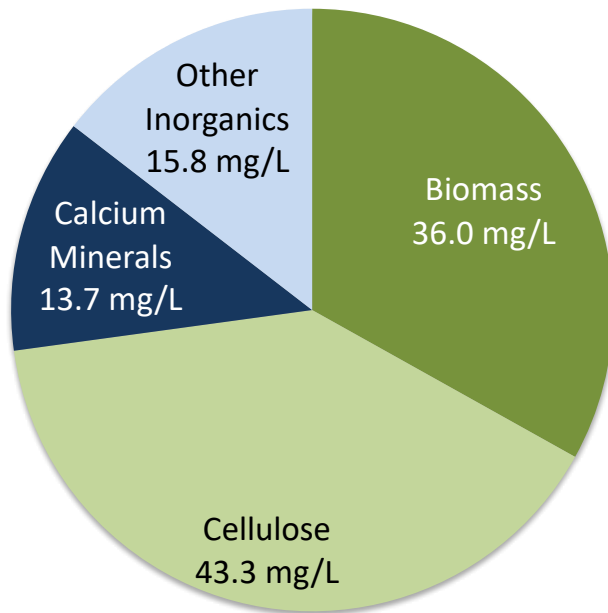
SS Out: County Line

-

SS In: Combined Dischargers

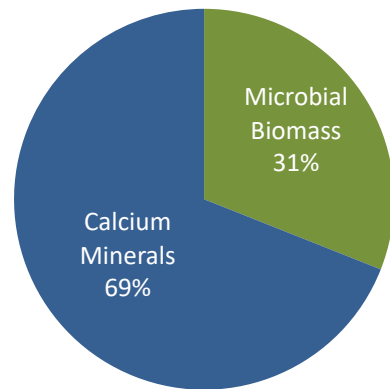
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SS Formed

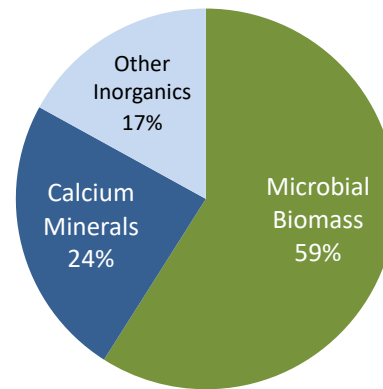


Solids Formation Characterization

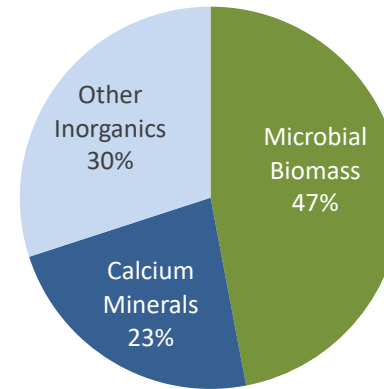
Component	Percent of Total Suspended Solids			Cost Allocation Parameter
	April 2016	April 2017 - March 2018	April 2018 - December 2018	
Microbial Biomass	31%	59%	47%	Dissolved BOD5
Calcium Minerals	69%	24%	23%	Dissolved Calcium (40%) Alkalinity (60%)
Other Inorganics	0%	17%	30%	Flow-based maintenance charge
Total	100%	100%	100%	
	April 2016	April 2017 – March 2018	April 2018 – December 2018	



66,600 lbs/month



111,400 lbs/month



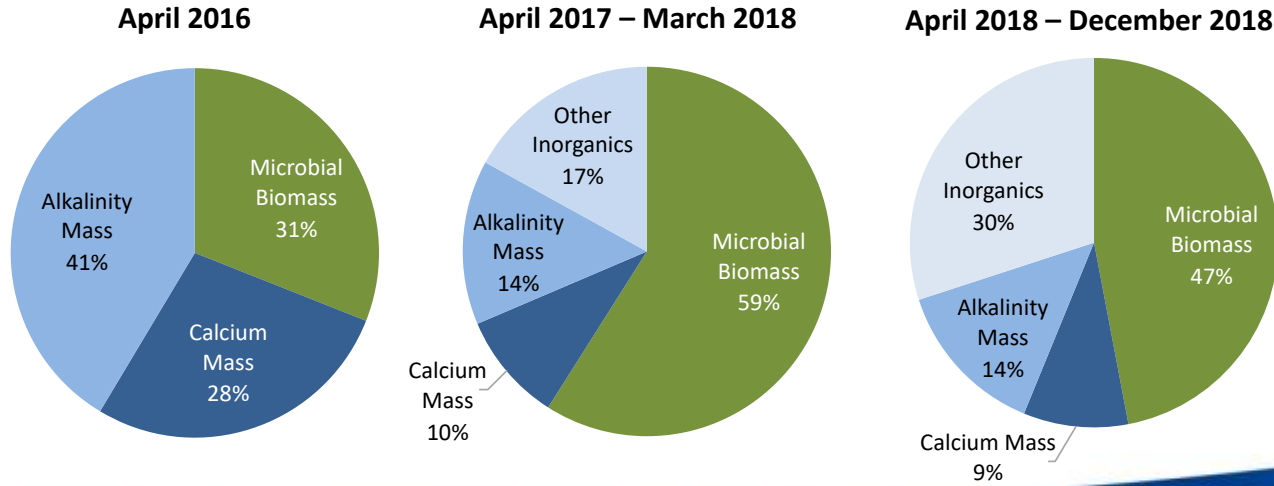
86,730 lbs/month

- Magnitude of solids formation has decreased
- Shift in composition of the formed solids over time



Solids Formation Characterization

Component	Percent of Total Suspended Solids			Cost Allocation Parameter
	April 2016	April 2017 - March 2018	April 2018 - December 2018	
Microbial Biomass	31%	59%	47%	Dissolved BOD5
Calcium Minerals	69%	24%	23%	Dissolved Calcium (40%) Alkalinity (60%)
Other Inorganics	0%	17%	30%	Flow-based maintenance charge
Total	100%	100%	100%	



Brine Line Changes

- 2020 changes
 - Negative TSS formation until August
 - Lower industrial flows (10-30%)
 - Higher desalter flows
- Recent changes
 - City of Beaumont tertiary effluent RO brine 300,000 gpd November 2020
 - Biosolids facility 250,000 gpd December 2020



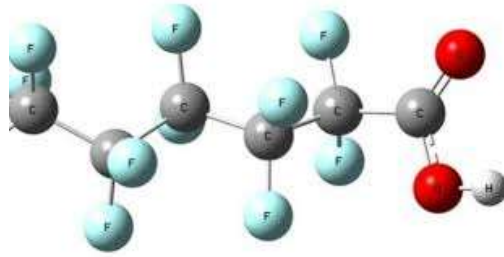
Next Steps

- Continue to implement monitoring program
 - Monthly County Line solids characterization
 - Correlated analysis of total and dissolved parameters
- Review solids formation methodology
 - Improve understanding of non-calcium inorganics at the County Line
 - Update solids formation and water quality analysis (2019-2020 data)
 - Build on strong understanding of solids at the County Line, water quality data from 2016-2018
 - Challenges associated with partitioning of solids using measurements of total and dissolved parameters



PFAS



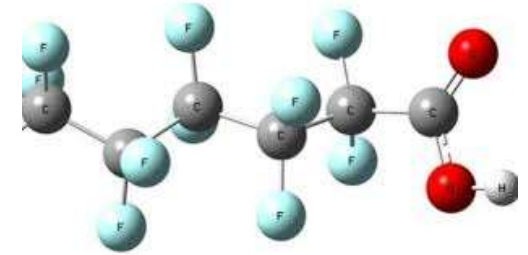


PFAS

- Per- and polyfluoroalkyl substances (PFAS)
- High molecular weight:
 - PFOA: 414 g/mol
 - PFOS: 500 g/mol
- Hydrophobic (non-polar) carbon-fluorine chain:
 - Hydrophobicity (affinity to carbon) increases with chain length
- Used extensively in consumer products for decades
- Persist in environment and the human body (likely carcinogen)



PFAS Timeline



January 2009	EPA provisional HA of 400 ng/L for PFOA, 200 ng/L for PFOS
May 2016	EPA HA of 70 ng/L for combined PFOA + PFOS
July 2018	CA interim NL: 14 ng/L for PFOA, 13 ng/L for PFOS CA interim RL: 70 ng/L for combined PFOA + PFOS
February 2019	EPA PFAS Action Plan
August 2019	CA OEHHA reference levels (correspond to 10^{-6} risk of illness over lifetime): Cancer effects: 0.1 ng/L for PFOA, 0.4 ng/L for PFOS Non-cancer effects: 2 ng/L for PFOA, 7 ng/L for PFOS CA OEHHA NL recommendation: set at the lowest level at which PFOA/PFOS can be reliably detected
August 2019	New CA NL: 5.1 ng/L for PFOA, 6.5 ng/L for PFOS
January 2020	New CA RL: 10 ng/L for PFOA, 40 ng/L for PFOS
Long term (~3 yrs)	CA OEHHA is developing PHG prior to potential MCL, then MCL process

PFAS Monitoring

Jan 2013 – Dec 2015: UMCER3

- All public water systems (PWS) serving more than 10,000 people and 800 select ones serving less
- Method reporting limits of 20 and 40 ng/L for PFOA and PFOS
- 1.3% of PWS had PFOA and PFOS conc greater than 70 ppt

March 2019: Phase 1 of DDW-ordered monitoring

- 660 PWS sites selected based on:
 - Within 2 mi of airport
 - Within 1 mi of landfill
 - Sites part of UCMR3
 - Within 1 mi of UCRM3 site with detections of PFOA/PFOS
- Quarterly sampling for one year
- New method reporting limits of ~2 ng/L (EPA 357.1)

June 2019: Phase 2 of DDW-ordered monitoring

- Manufacturing facilities, refineries, non-airport fire training, urban wildfire areas

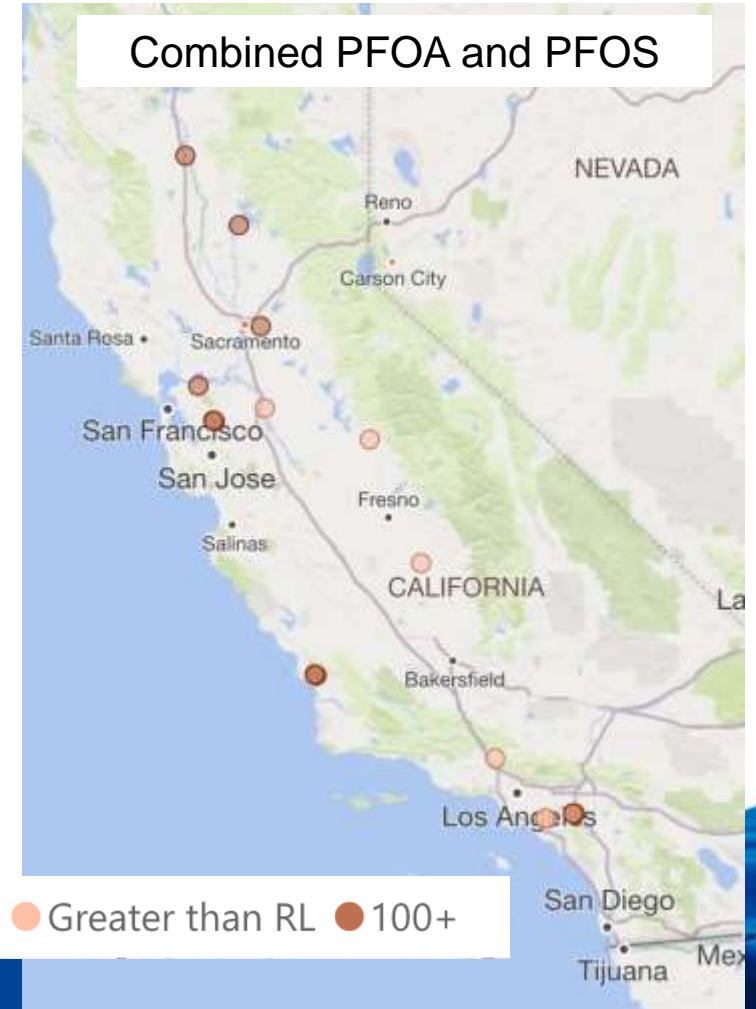
September 2019: Phase 3 of DDW-ordered monitoring

- Wastewater treatment facilities

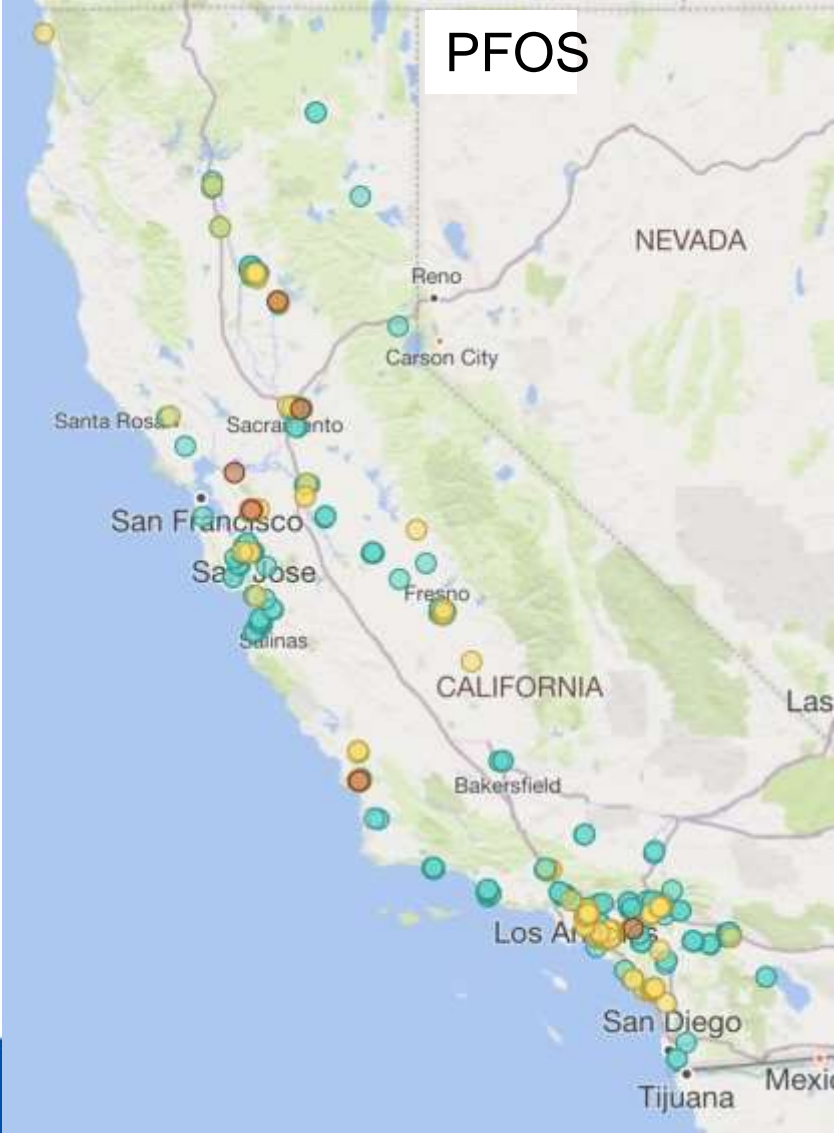
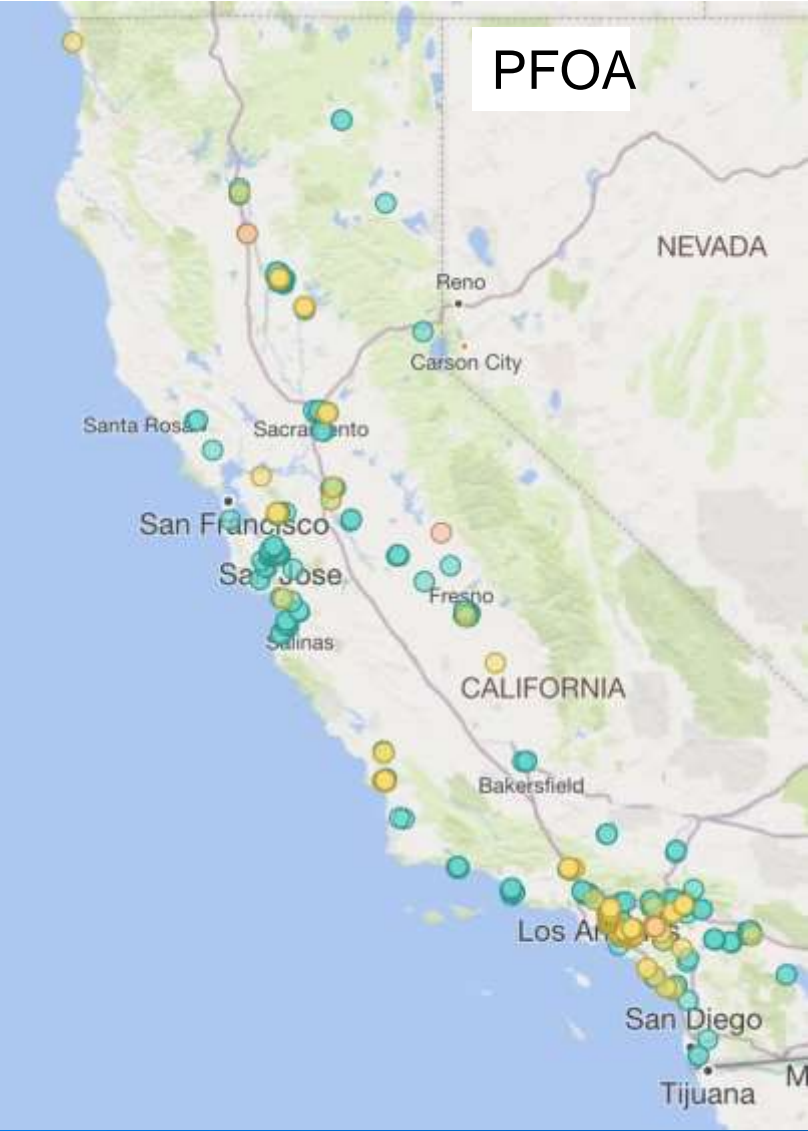


Results of Phase 1 Monitoring

- 12 water systems with concentrations greater than current RL:
 - PACTIV LLC Well #1
 - Cal-water service co. Oroville
 - CalAm – Suburban
 - Golden eagle small water system
 - Zone 7 water agency
 - City of Lathrop
 - Mariposa industrial park water company
 - CWS – Visalia
 - Whitson industrial park
 - Santa Clarita water division
 - City of Anaheim
 - City of Corona
- Many more that exceed the new RL



Results of Phase 1 Monitoring



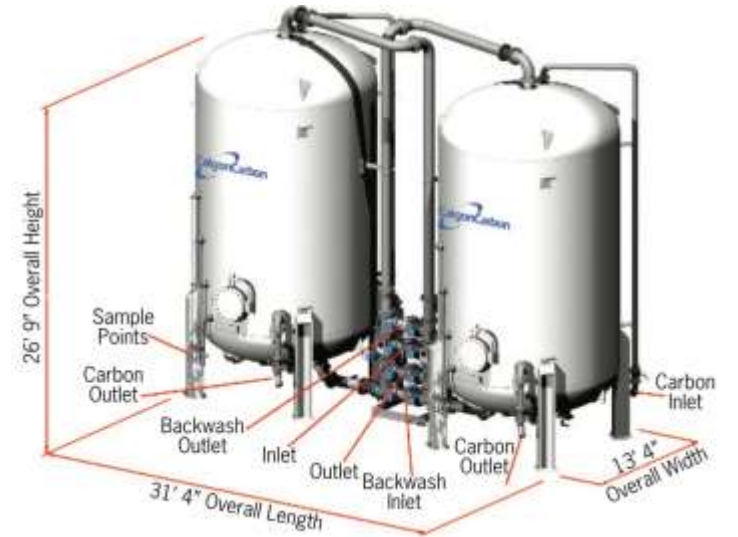
Advisory Levels: ● Less than NL ● Greater than NL ● Greater than RL ● 100+

<https://www.waterboards.ca.gov/pfas/>



PFOA and PFOS Treatment Options

- **Granular Activated Carbon (GAC)**
 - Adsorption of non-polar organics
 - PFOA/PFOS non-detect until breakthrough
- **Ion exchange (IX)**
 - Adsorption of anions
 - PFOA/PFOS non-detect until breakthrough
- **Reverse Osmosis (RO)**
 - >90% rejection
 - Requires disposal of continuous waste stream
 - More expensive than GAC or IX



PFAS

- Association with solids is being studied by WateReuse and others
- Future limits on discharge to ocean?
- Santa Ana River PFAS concentrations
 - Wastewater Treatment Plants

Recommend monitoring PFAs at S-01



ZERO OCEAN DISCHARGE



Zero Ocean Discharge

- Elimination of secondary effluent discharge – environmental lobbyists
 - Several utilities actively addressing, but brine exempt
- OCSD modifications to route brine from SARI and GWRS to Plant 2 for treatment and ocean discharge
- California Ocean Plan discharge limits
 - Nitrogen species
 - PFAs?

Recommend monitoring ammonia, nitrate, and TKN at S-01



Monitoring Program

County Line

Recommended monitoring additions:

- PFAs
- ammonia
- Nitrate
- TKN

Constituent/Analysis	Test Method	Frequency	Notes
Flow	-	Online monitoring	
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Particulate Organic Carbon (POC)	EPA 9060	Monthly	Trussell Tech to separate solids via centrifugation
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Scanning electron microscopy (SEM) with energy dispersive x-ray spectroscopy (EDX)	SEM/EDX	Quarterly	Provides elemental characterization
Thermogravimetric analysis (TGA)	TGA	Quarterly	Provides cellulose identification and quantification

Questions?

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Thank you!

