

Santa Ana River Wasteload Allocation Model Update

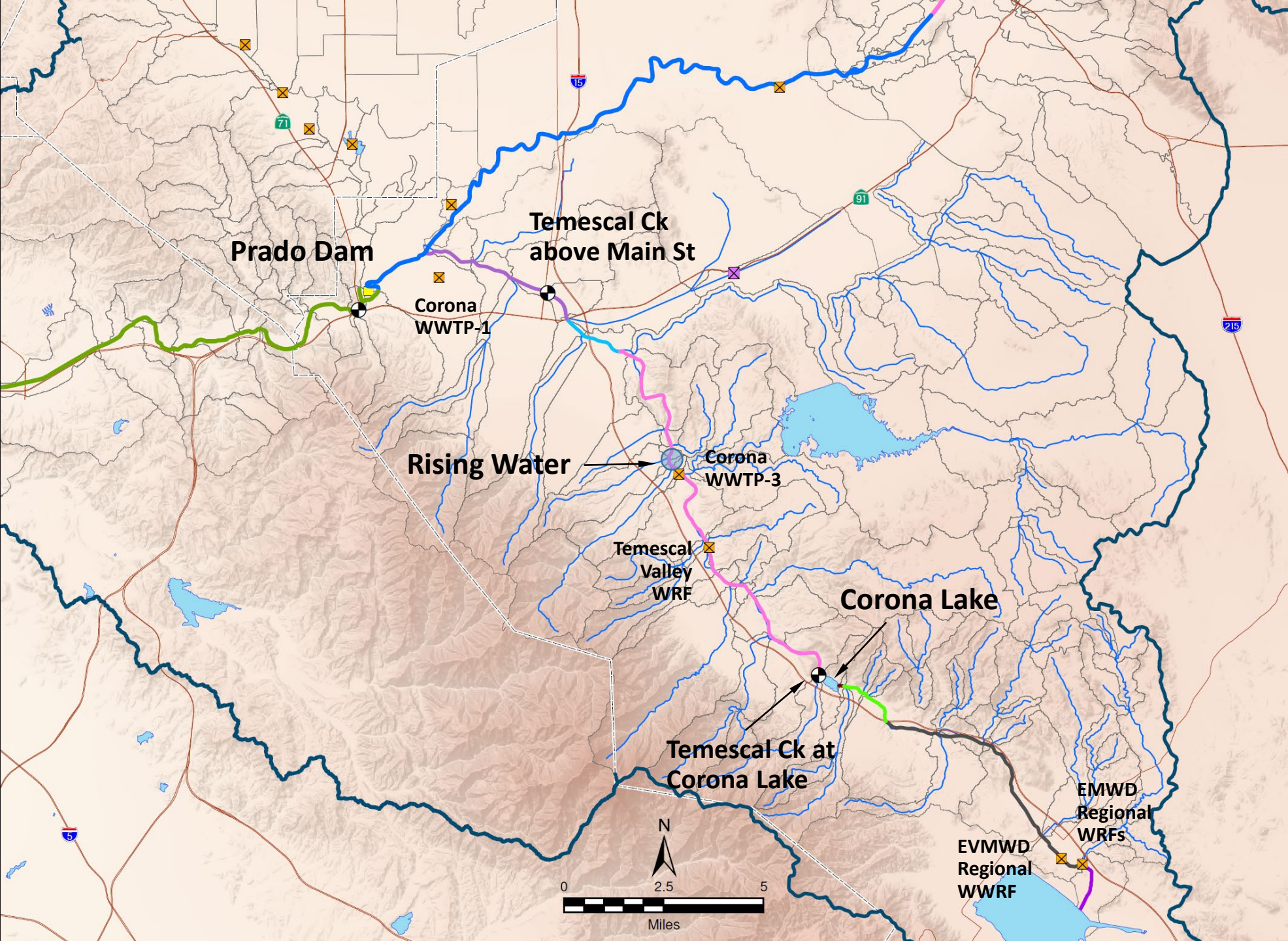
April 22, 2020



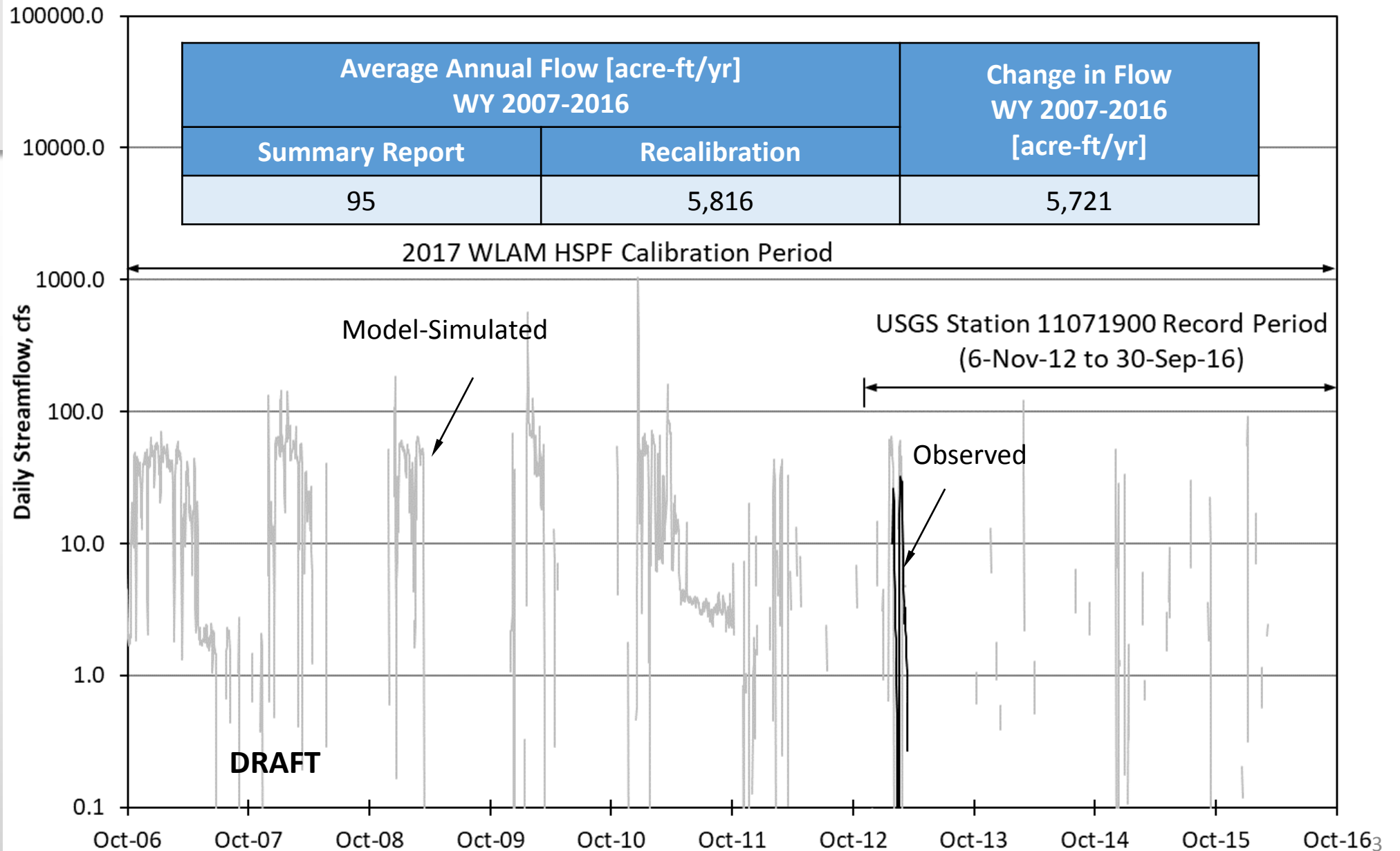
4/22/2020



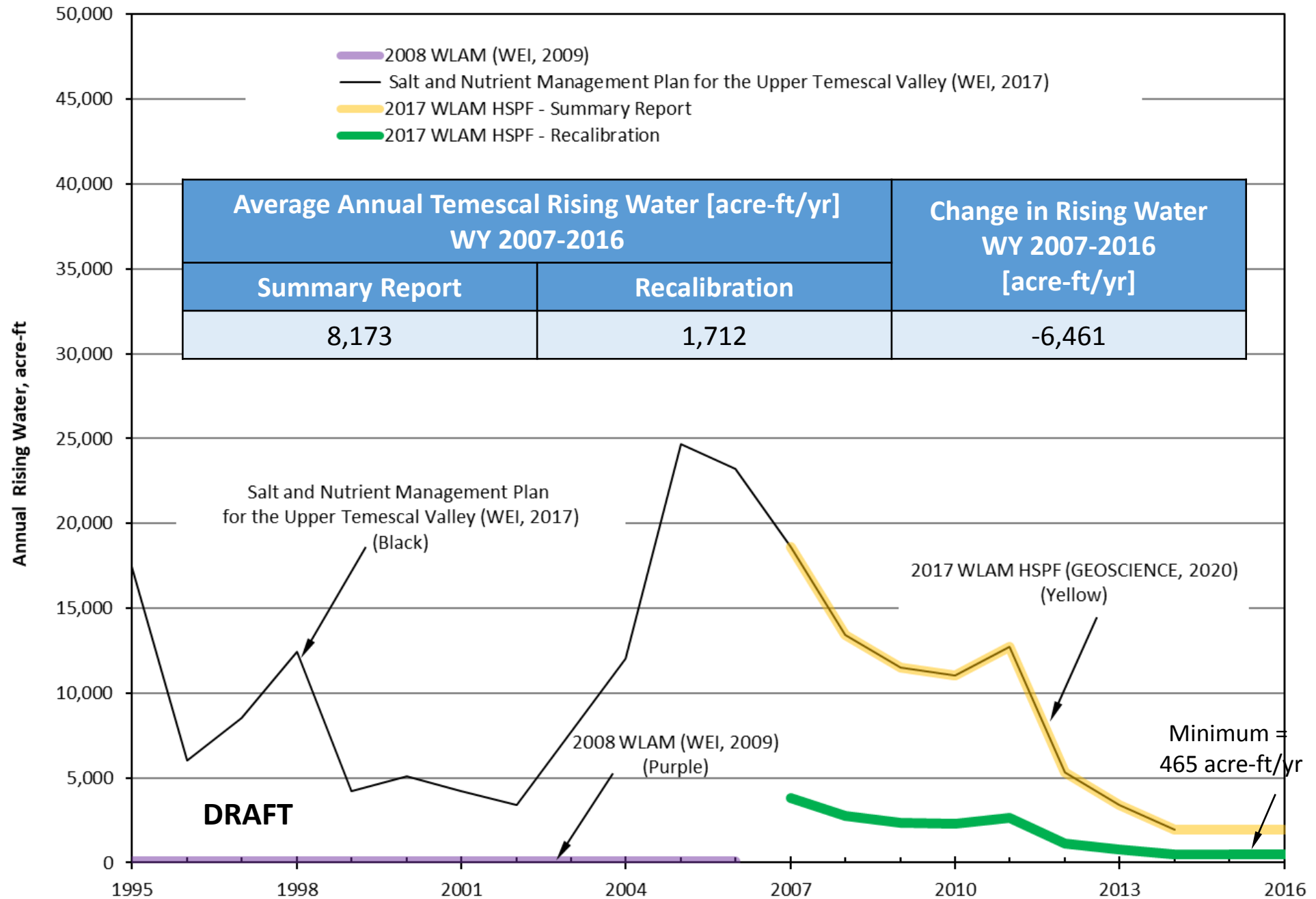
Temescal Creek Subwatersheds



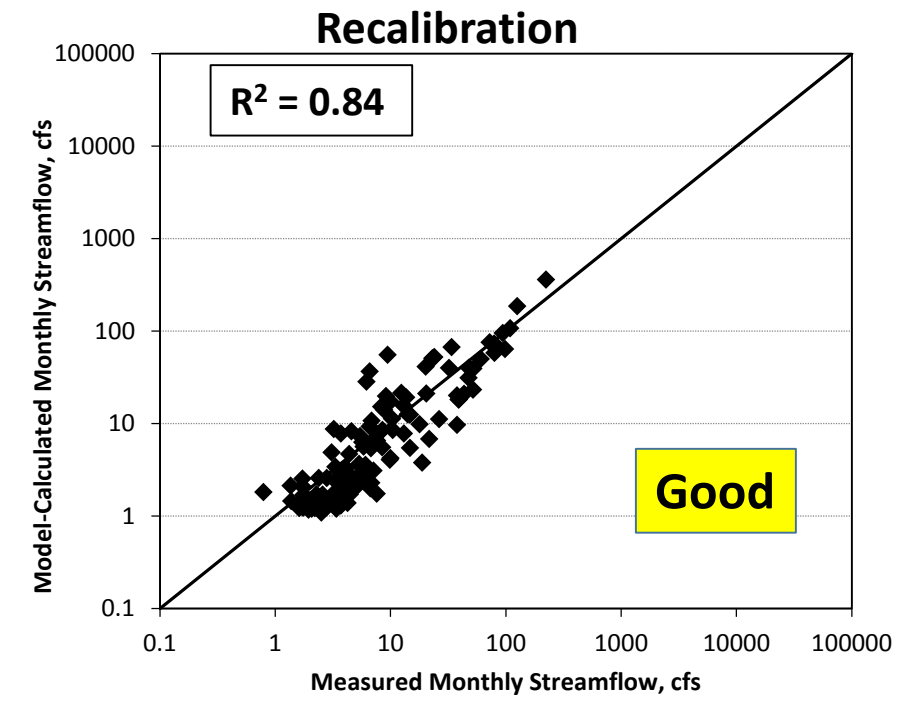
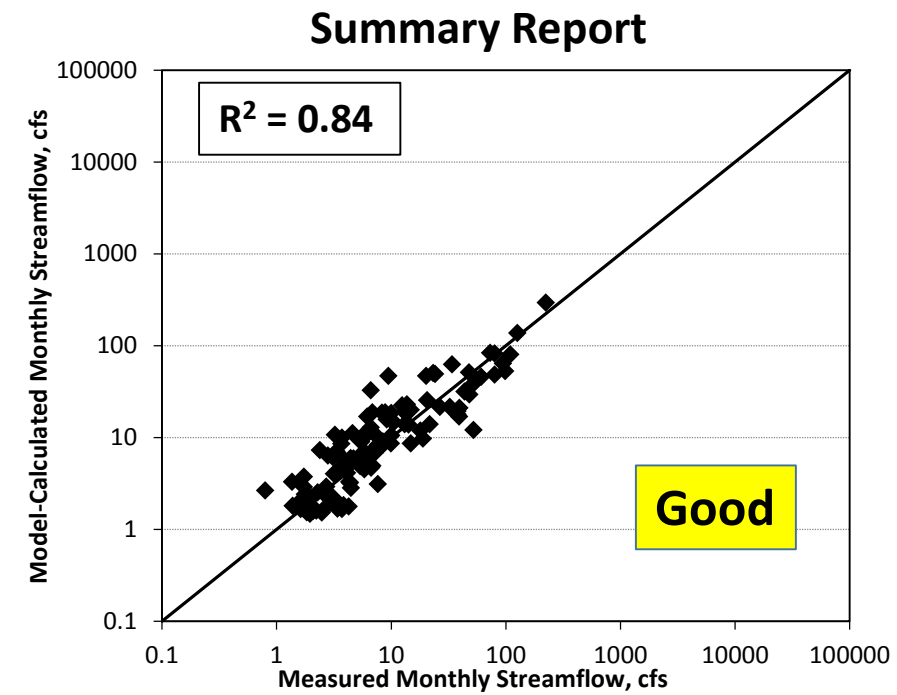
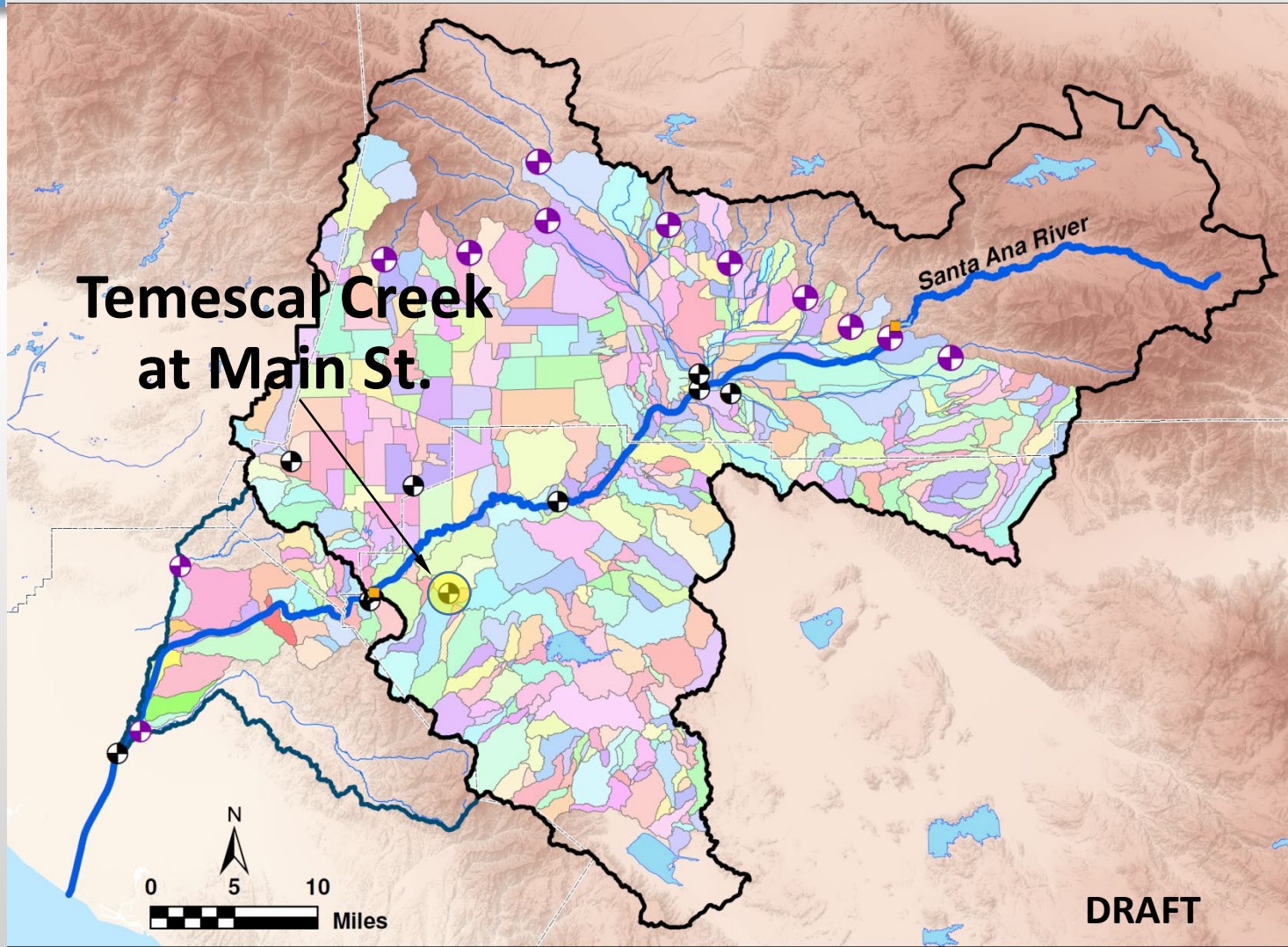
Daily Streamflow at Temescal Ck at Corona Lake



Annual Rising Water from Upper Temescal Valley to Temescal Creek



XY Scatter Plot of Monthly Streamflow –WY 2007-2016 Temescal Creek at Main St.

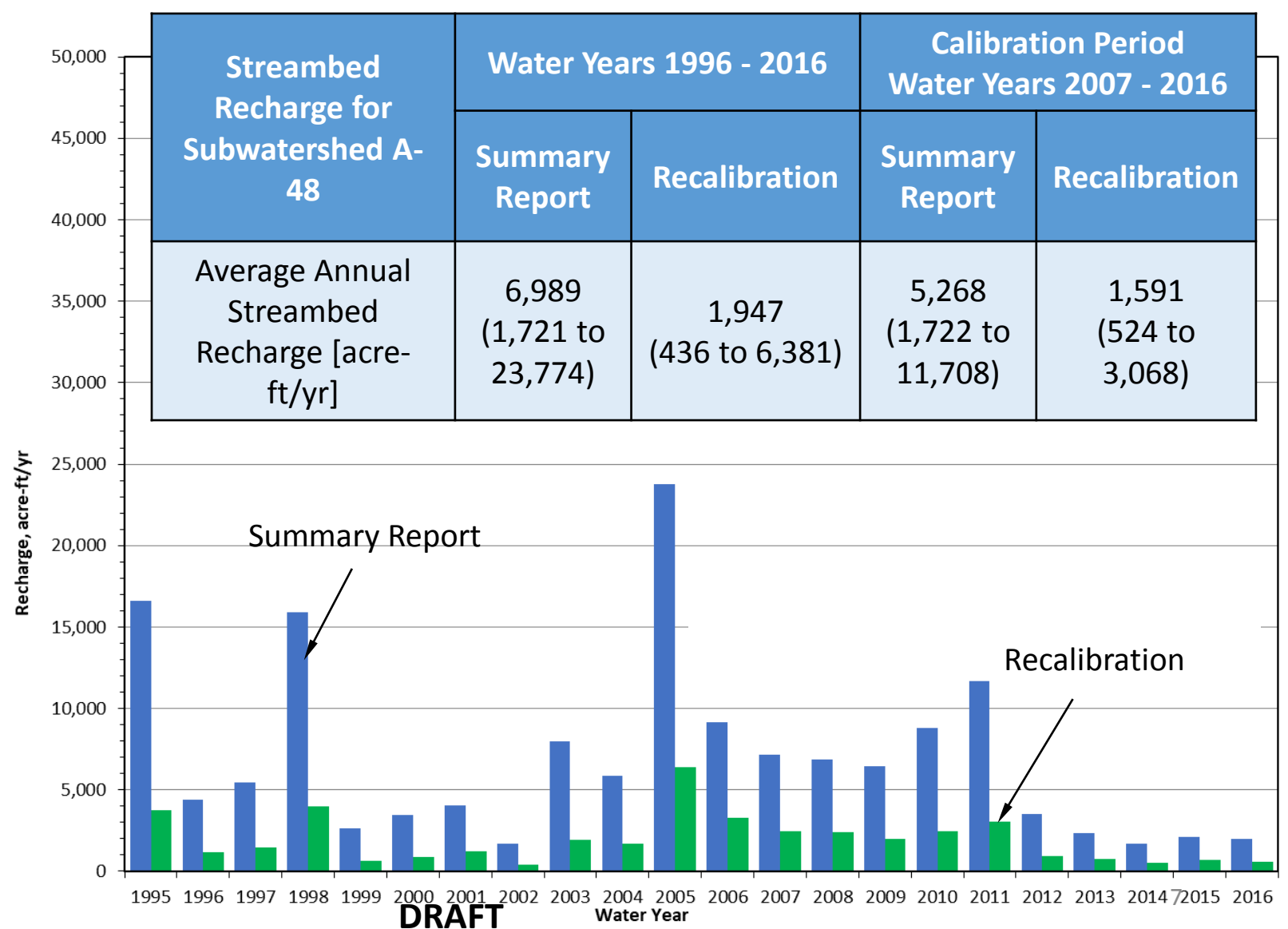
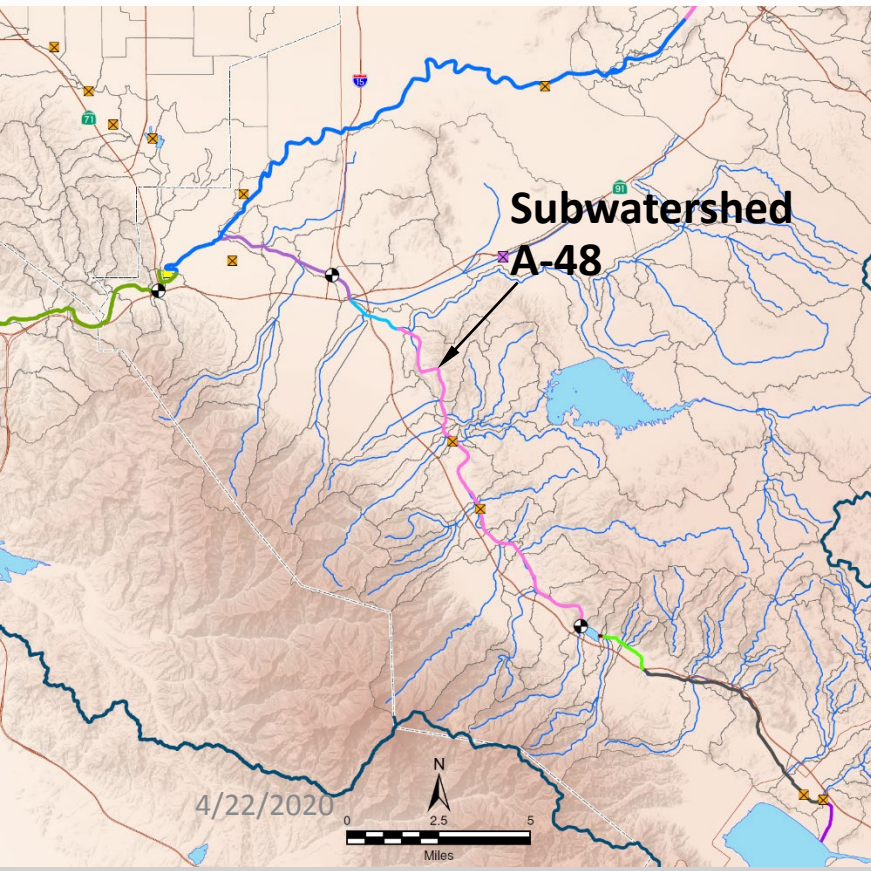


Calibration Results

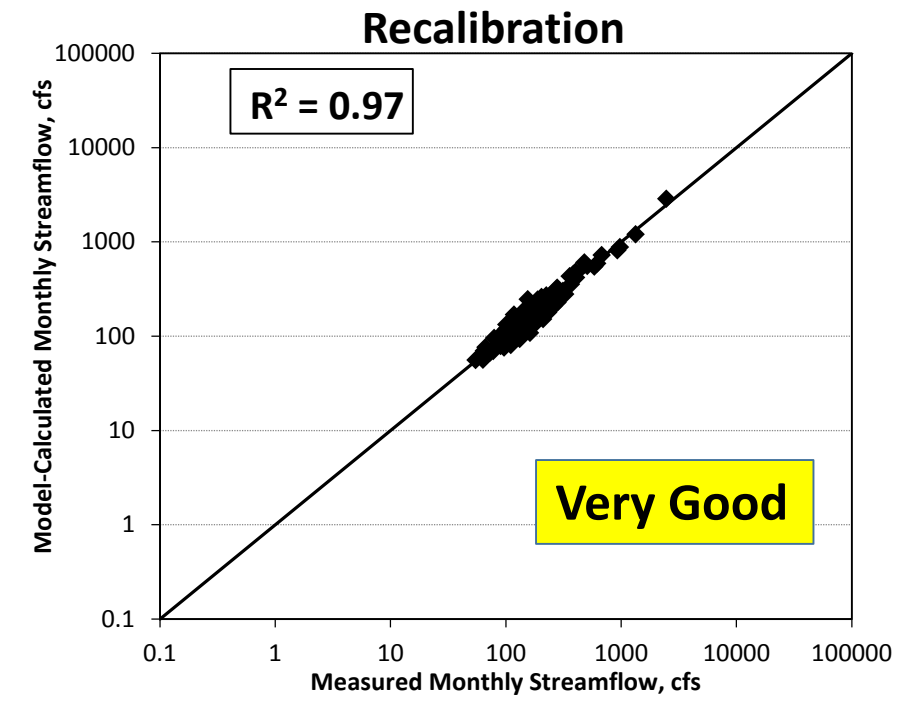
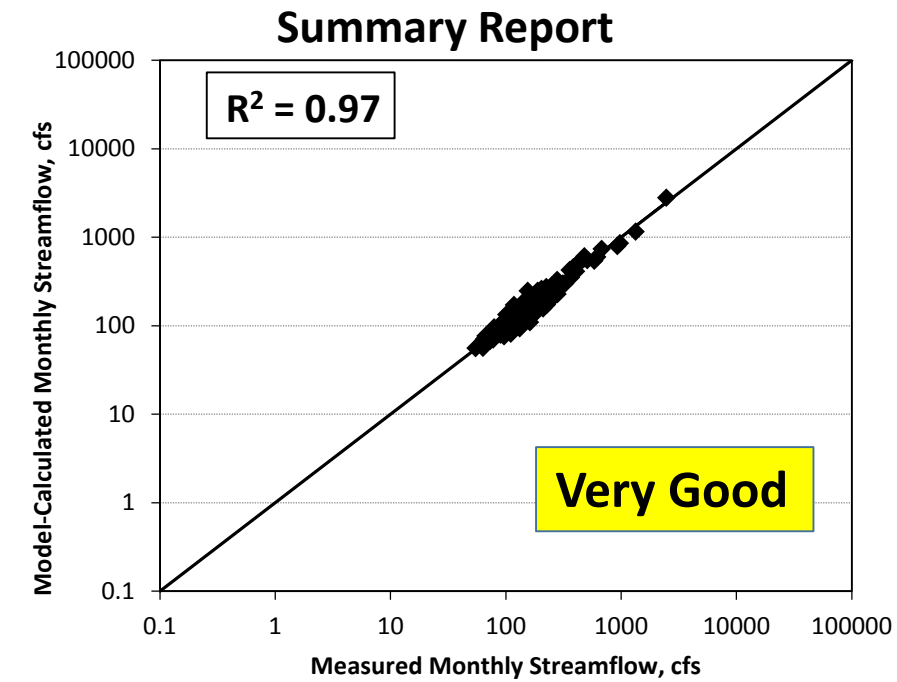
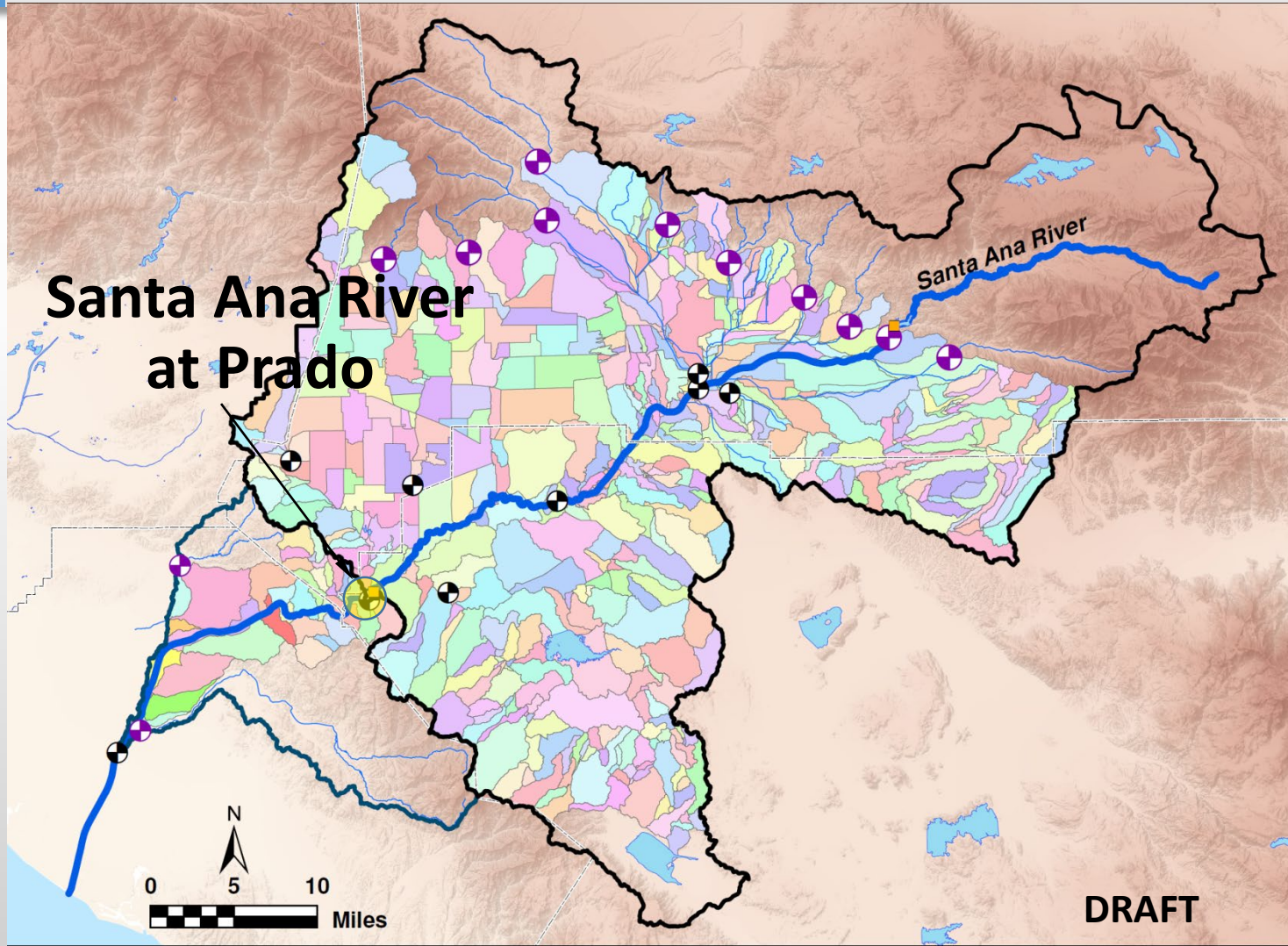
Monthly Streamflow at the Temescal Creek at Main Street

Gaging Station	2017 WLAM HSPF Summary Report WY 2007-2016	2017 WLAM HSPF Recalibration WY 2007-2016
Temescal Ck at Main Street		
R ²	0.84	0.84
Calibration Performance	Good	Good
Average Residual, cfs	-0.7	-0.5
Average of Observed, cfs	17.3	17.3
Average Residual Percentage of Average Observed, %	-4%	-3%
RMSE	13.2	17.4
RMSE as Percentage of Range of Observed, %	6%	8%

Streambed Recharge for Subwatershed A-48



XY Scatter Plot of Monthly Streamflow –WY 2007-2016 Santa Ana River at Prado

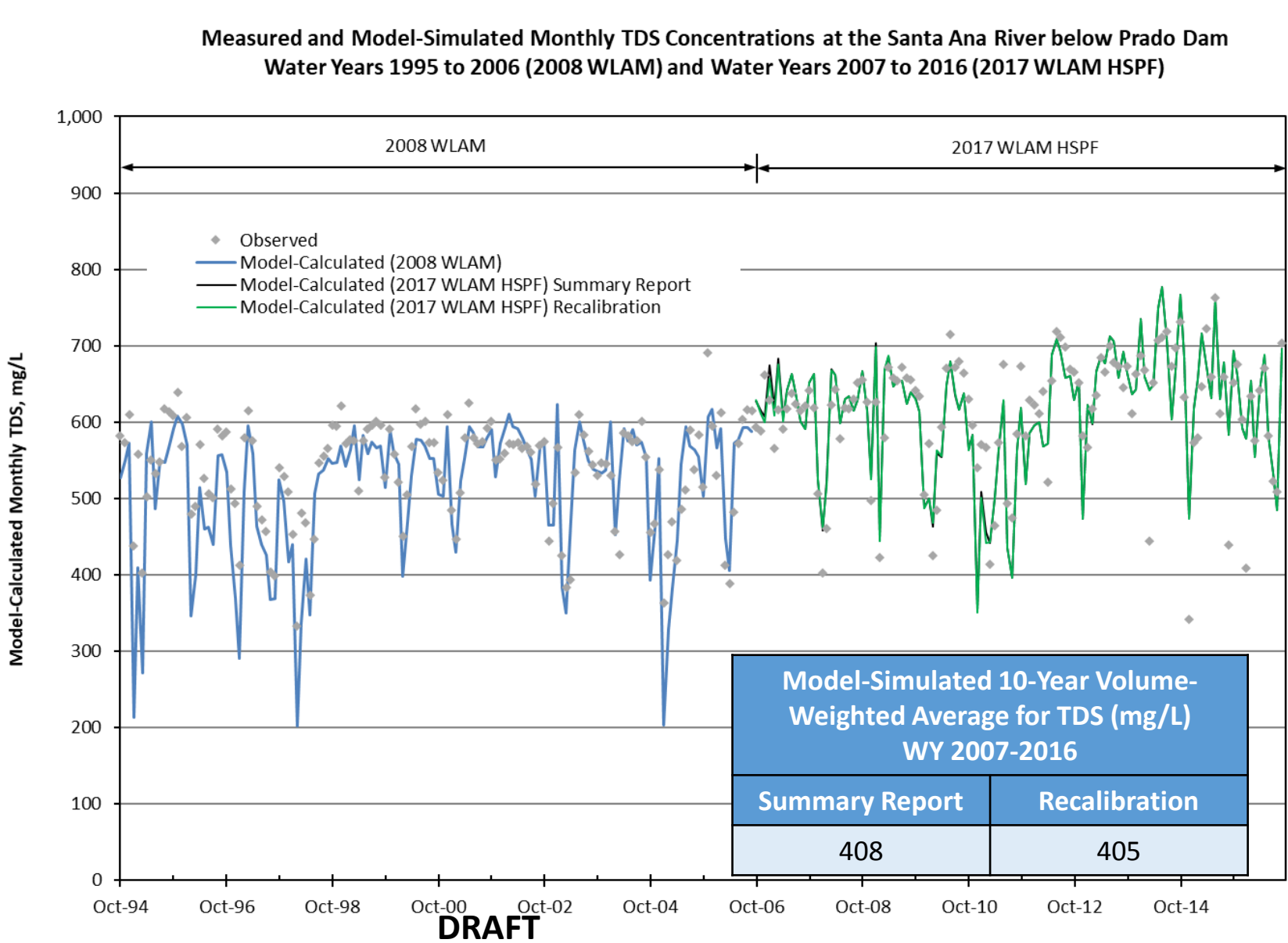
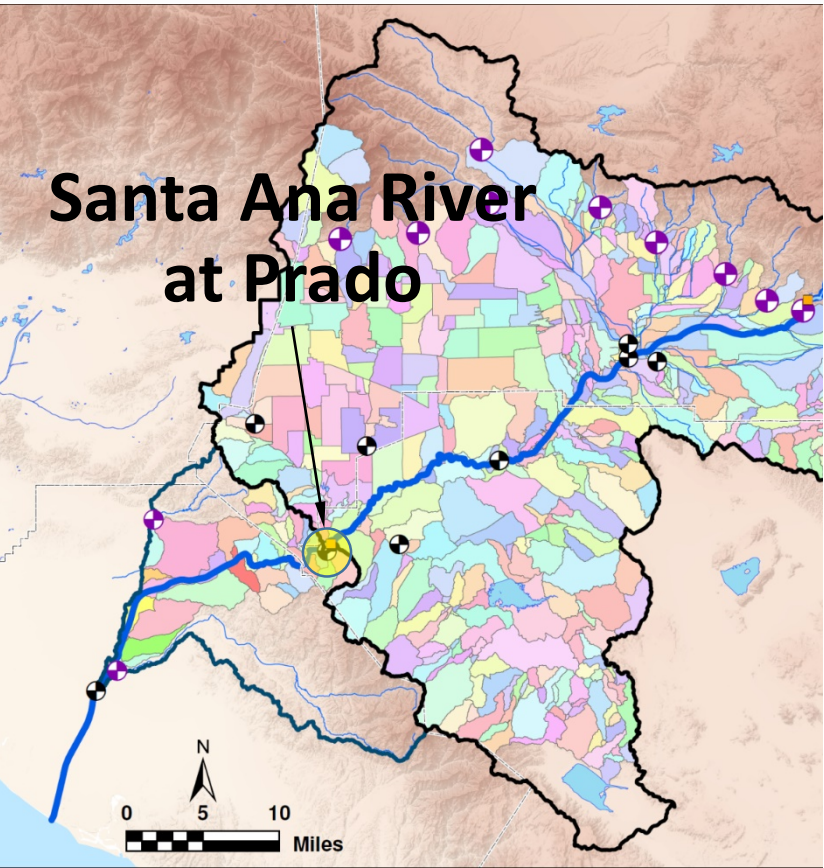


Calibration Results

Monthly Streamflow at the Santa Ana River at Prado

Gaging Station	2017 WLAM HSPF Summary Report WY 2007-2016	2017 WLAM HSPF Recalibration WY 2007-2016
Santa Ana River into Prado Dam		
R ²	0.97	0.97
Calibration Performance	Very Good	Very Good
Average Residual, cfs	0.1	-1.7
Average of Observed, cfs	223.6	223.6
Average Residual Percentage of Average Observed, %	0%	-1%
RMSE	50.7	52.3
RMSE as Percentage of Range of Observed, %	2%	2%

Monthly TDS Concentration Santa Ana River at Prado

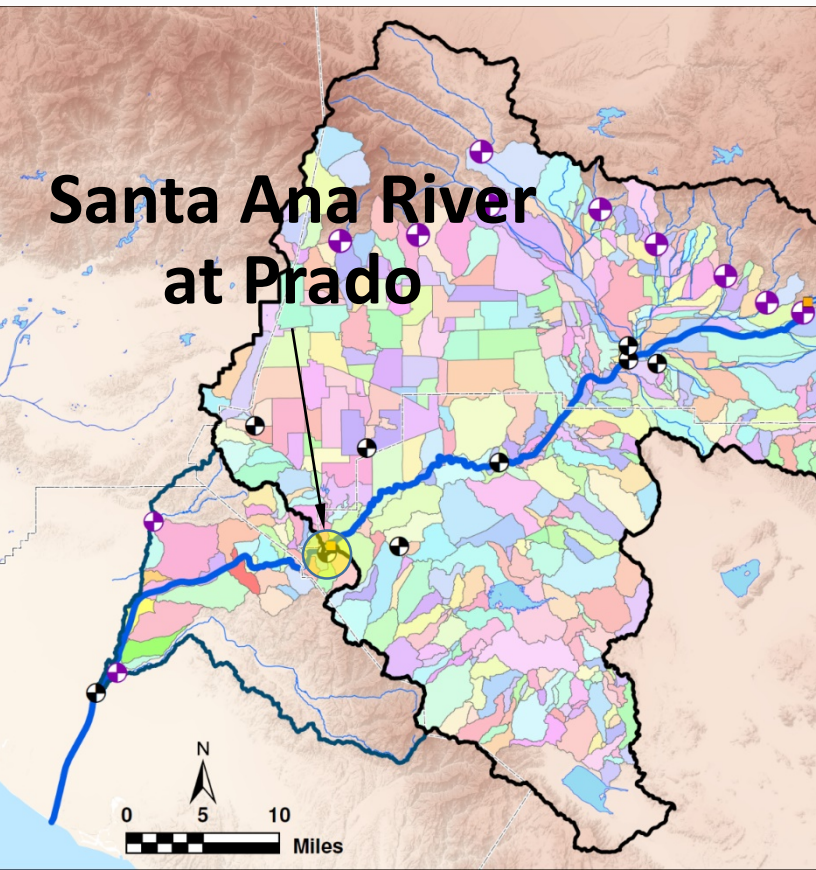


Calibration Results

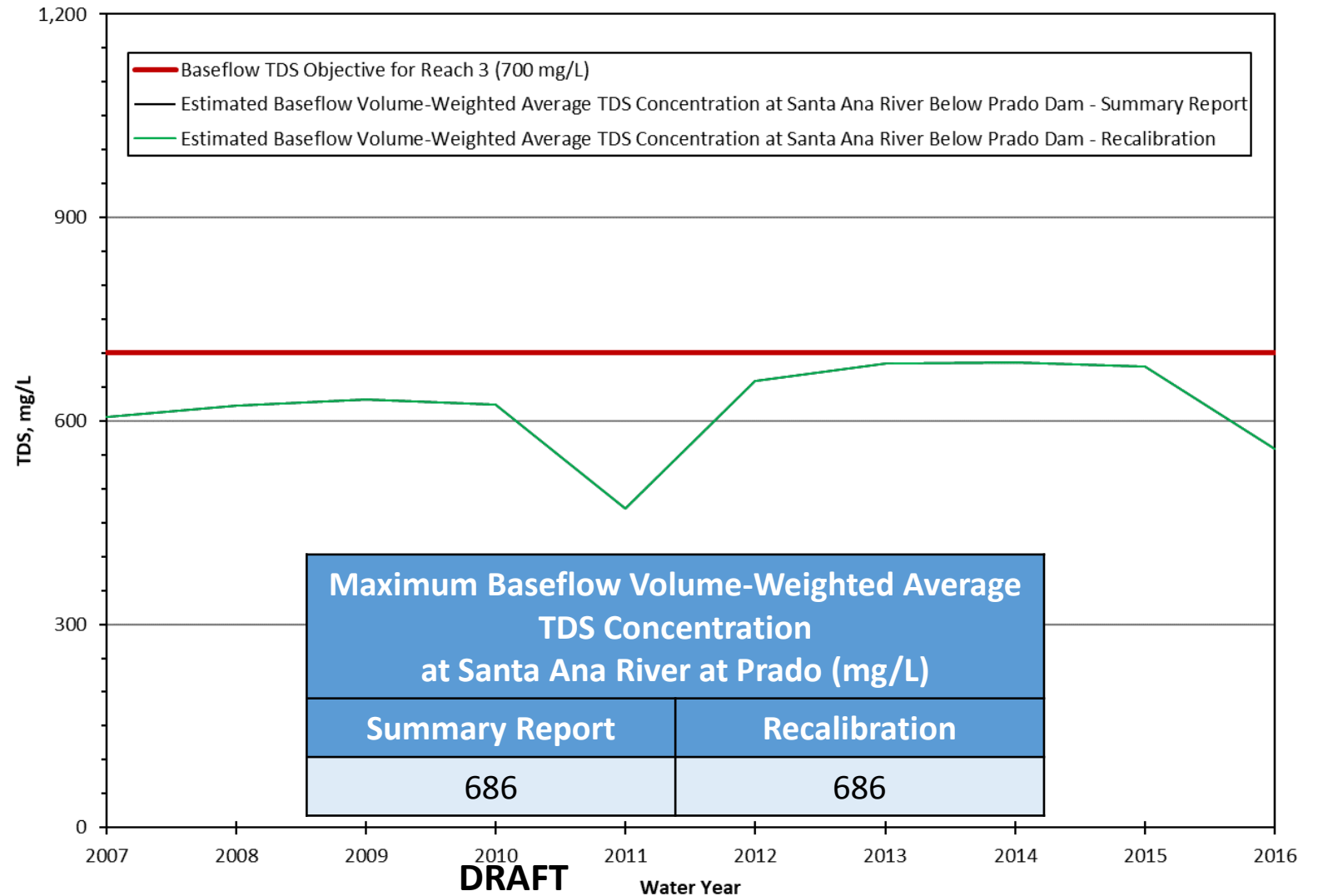
Monthly TDS Concentration at the Santa Ana River at Prado

Gaging Station	2017 WLAM HSPF Summary Report WY 2007-2016	2017 WLAM HSPF Recalibration WY 2007-2016
Santa Ana River below Prado Dam		
Average Residual, mg/L	-6.1	-5.5
Average of Observed, mg/L	613	613
10-Year Volume-Weighted Average of Observed, mg/L (3,300 out of 3,653 Days of Data Available)	527	527
Average Residual Percentage of Average Observed, %	-1.0%	-0.9%
Standard Deviation, mg/L	48.9	49.0
RMSE	49.1	49.1

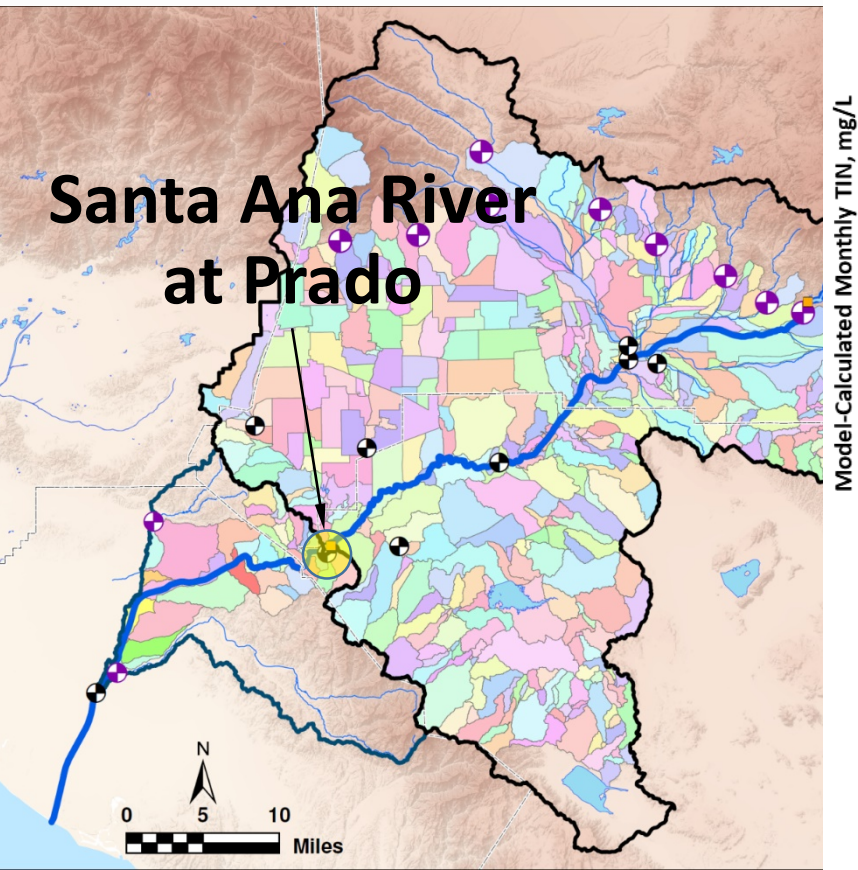
2017 WLAM HSPF Summary Report (Nov, 2019) vs. Recalibration Baseflow Volume-Weighted Average TDS Concentration



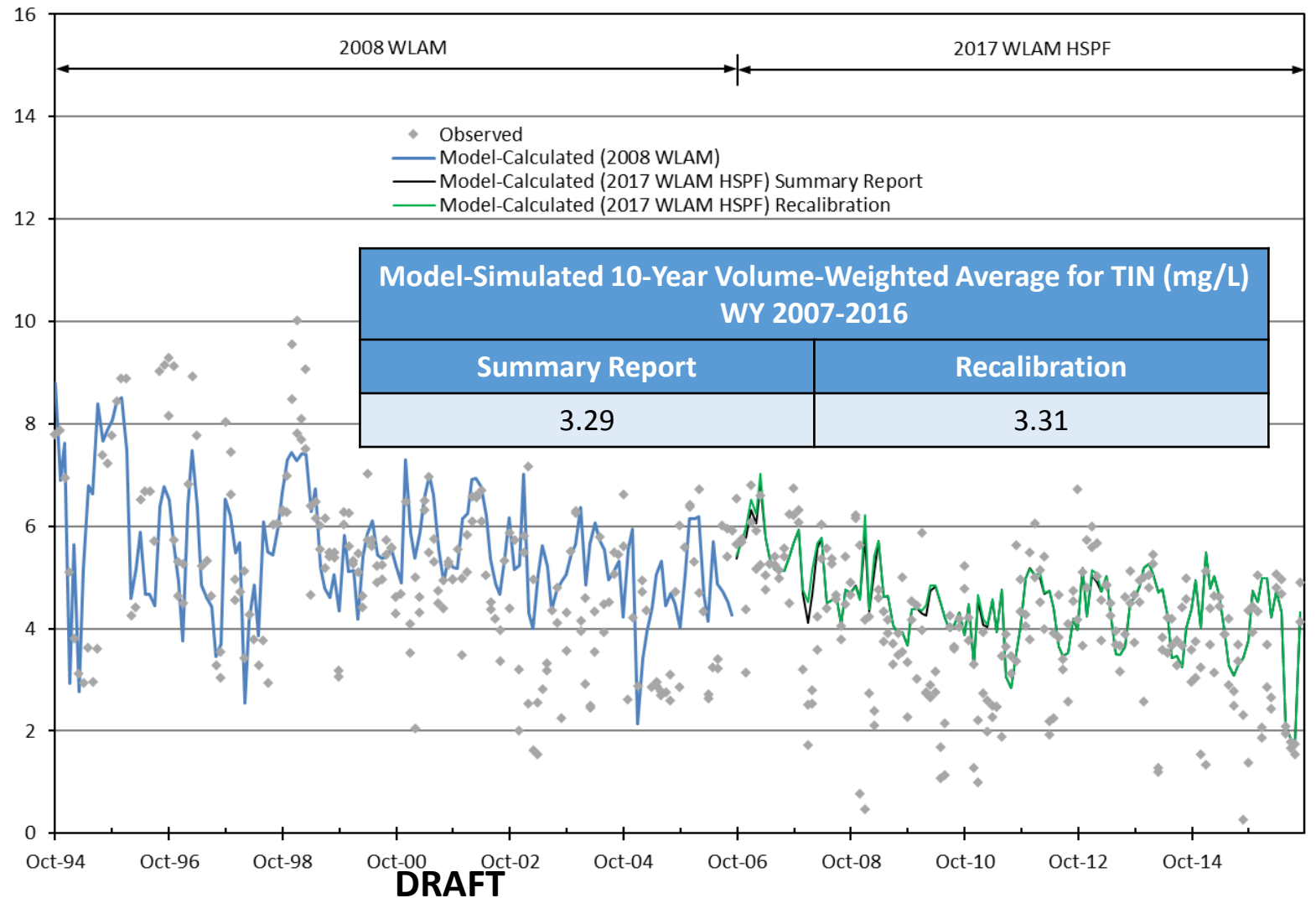
Estimated Baseflow Volume-Weighted Average TDS Concentration
at Santa Ana River Below Prado Dam



Monthly TIN Concentration Santa Ana River at Prado



Measured and Model-Simulated Monthly TIN Concentrations at the Santa Ana River below Prado Dam
Water Years 1995 to 2006 (2008 WLAM) and Water Years 2007 to 2016 (2017 WLAM HSPF)



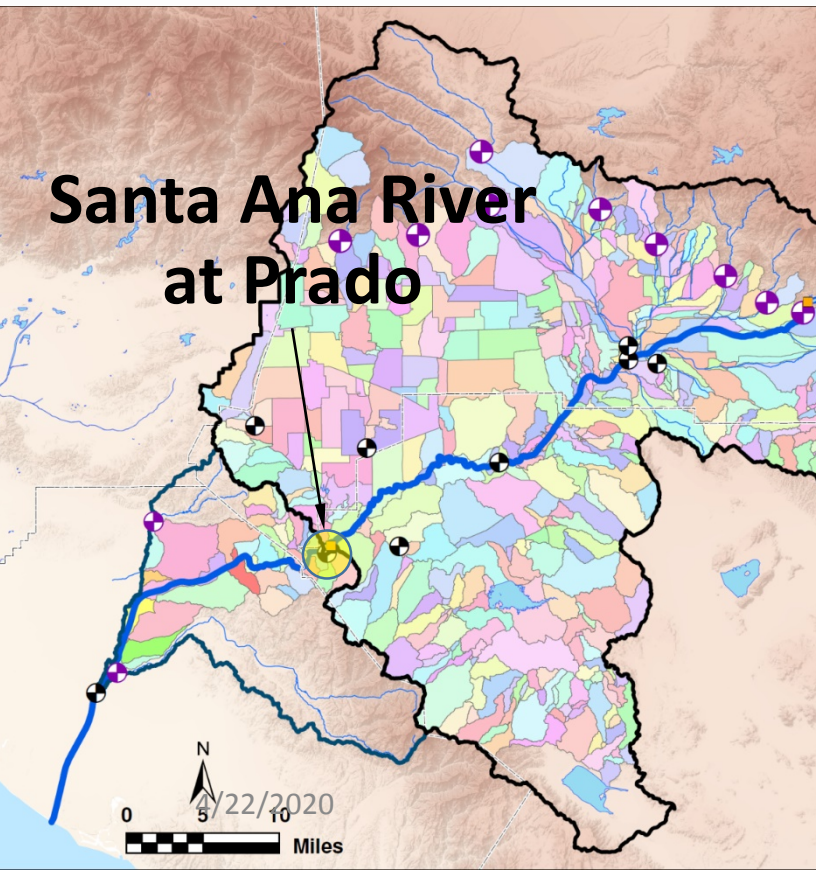
Calibration Results

Monthly TIN Concentration at the Santa Ana River at Prado

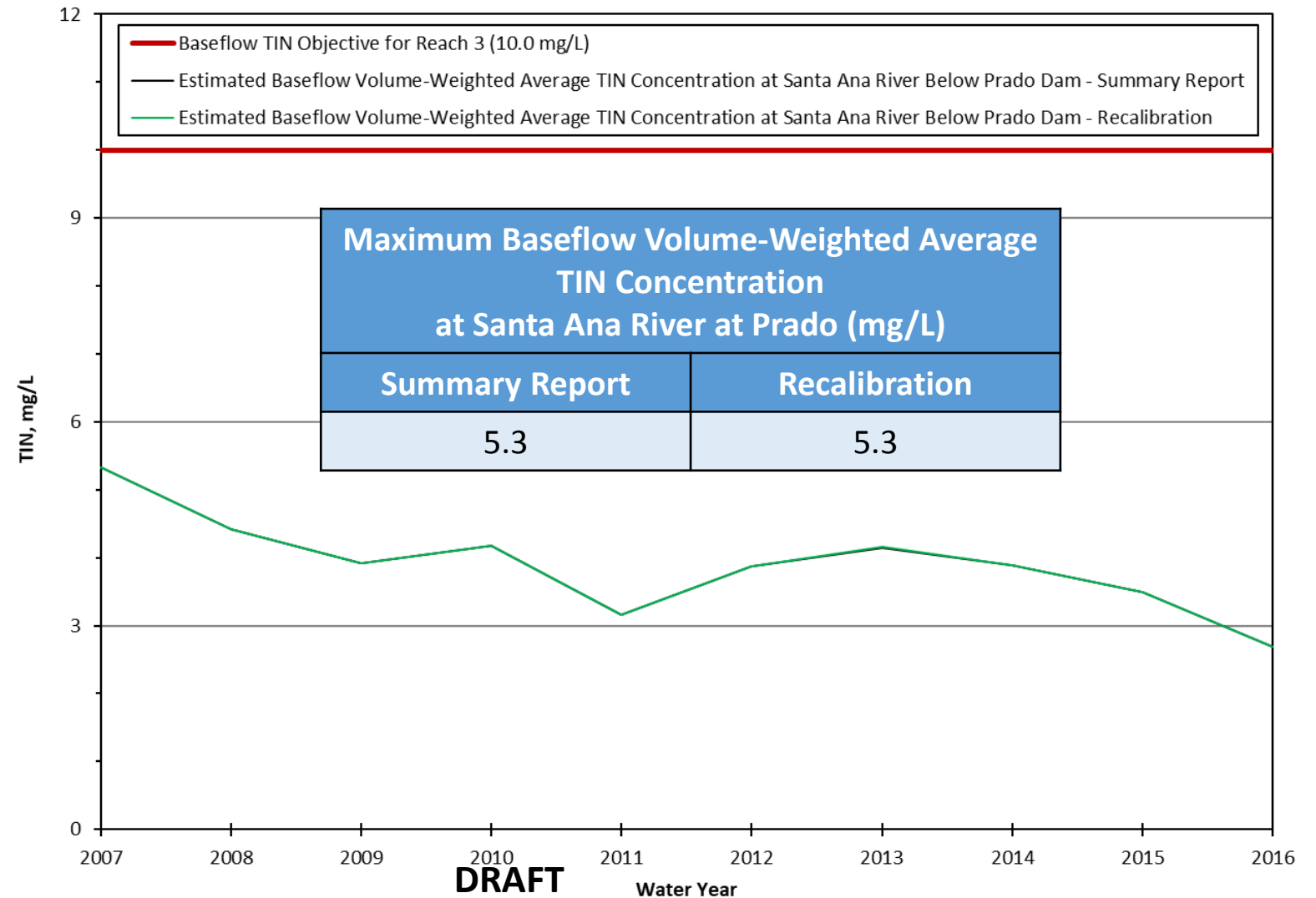
Gaging Station	2017 WLAM HSPF Summary Report WY 2007-2016	2017 WLAM HSPF Recalibration WY 2007-2016
Santa Ana River below Prado Dam		
Average Residual, mg/L	-0.50	-0.54
Average of Observed, mg/L	3.96	3.96
10-Year Volume-Weighted Average of Observed, mg/L (323 out of 3,653 Days of Data Available)	3.45	3.45
Average Residual Percentage of Average Observed, %	-12.7%	-13.6%
Standard Deviation, mg/L	1.09	1.14
RMSE	1.20	1.26

2017 WLAM HSPF Summary Report (Nov, 2019) vs. Recalibration

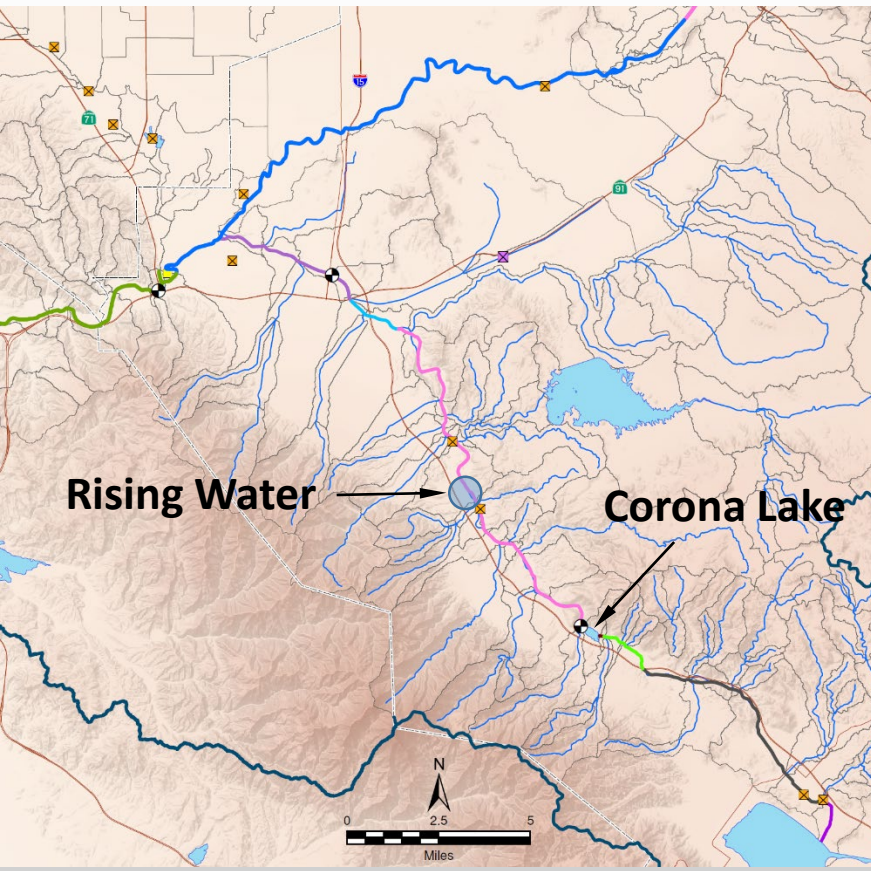
Baseflow Volume-Weighted Average TIN Concentration



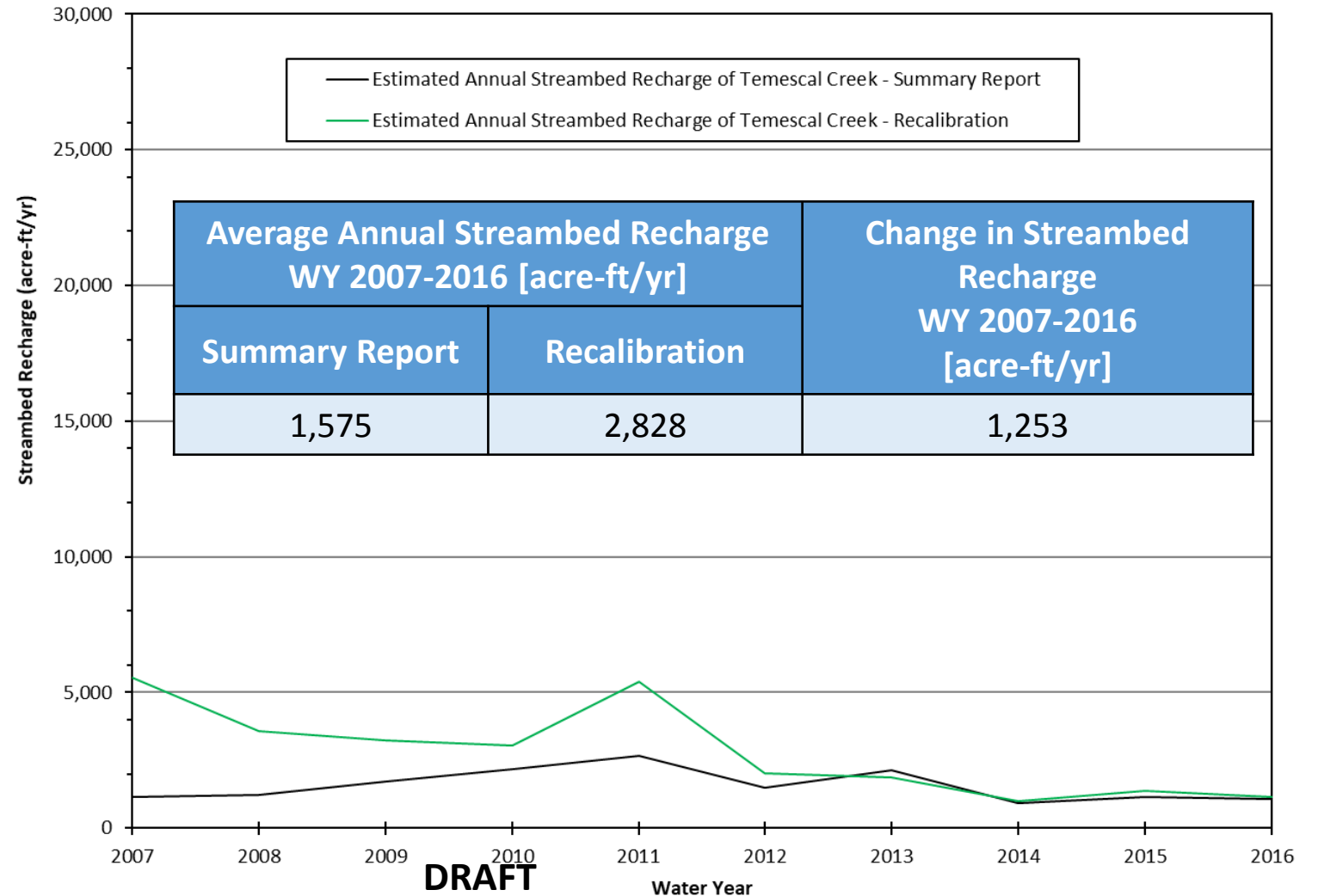
Estimated Baseflow Volume-Weighted Average TIN Concentration
at Santa Ana River Below Prado Dam



Model-Simulated Streambed Recharge Temescal Ck Segment between Corona Lake and Rising Water Area

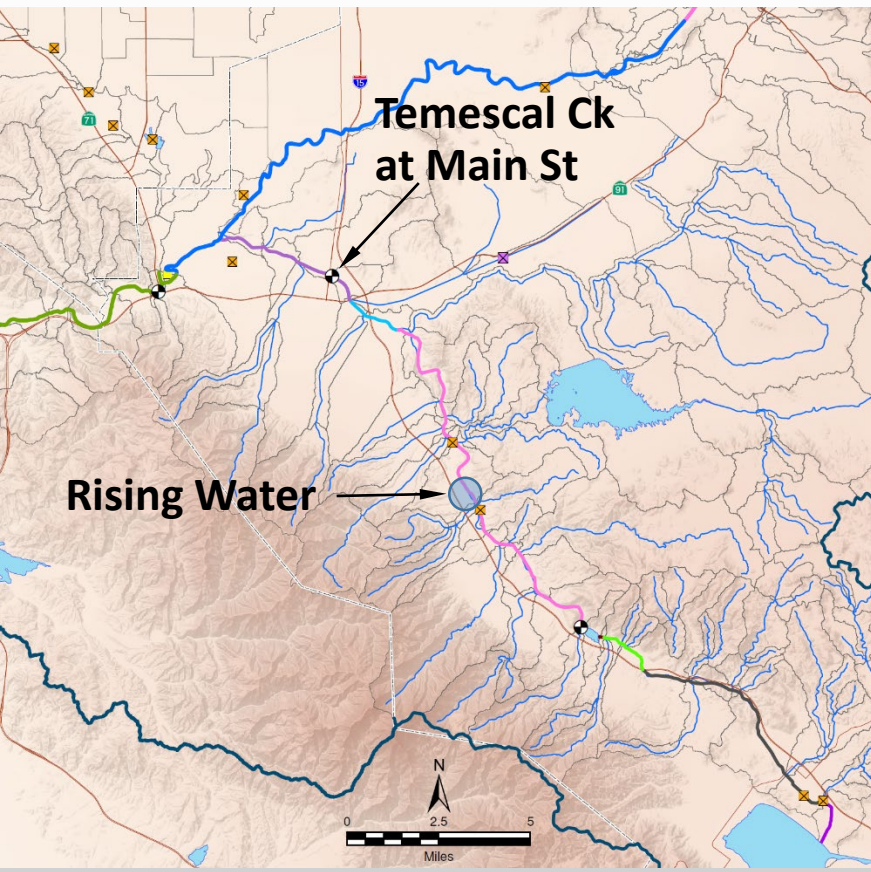


Estimated Annual Streambed Recharge of Temescal Creek
Downstream Corona Lake and Upstream Temescal Rising Water

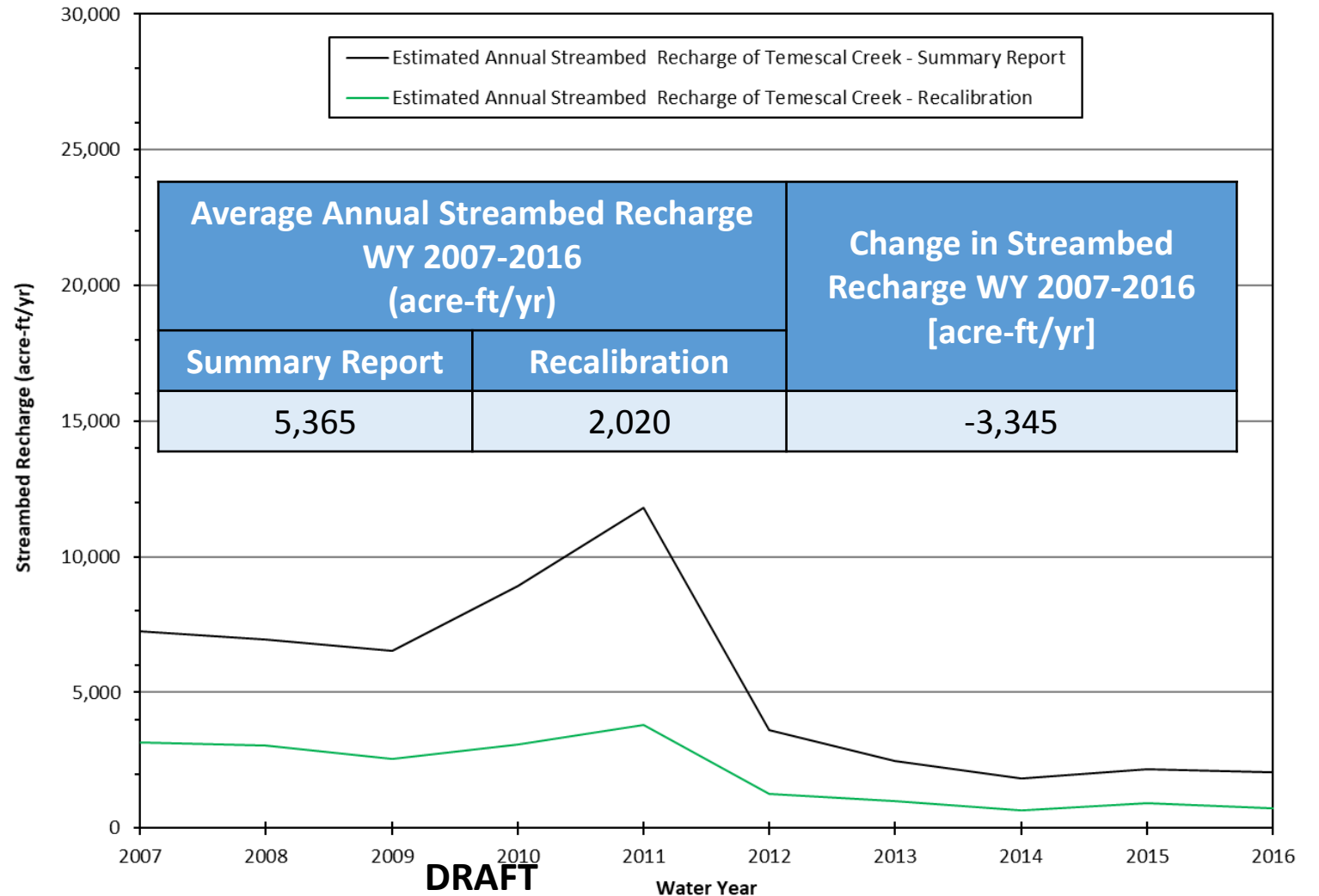


Model-Simulated Streambed Recharge

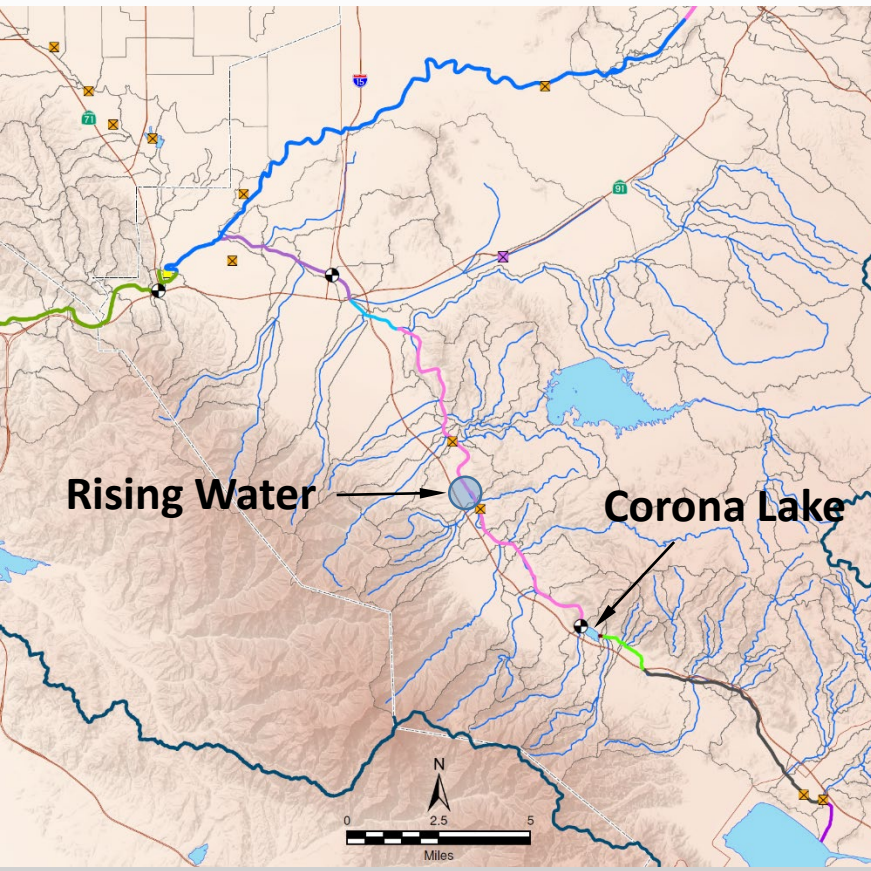
Temescal Ck Segment Between Rising Water Area and Main St Gaging Station



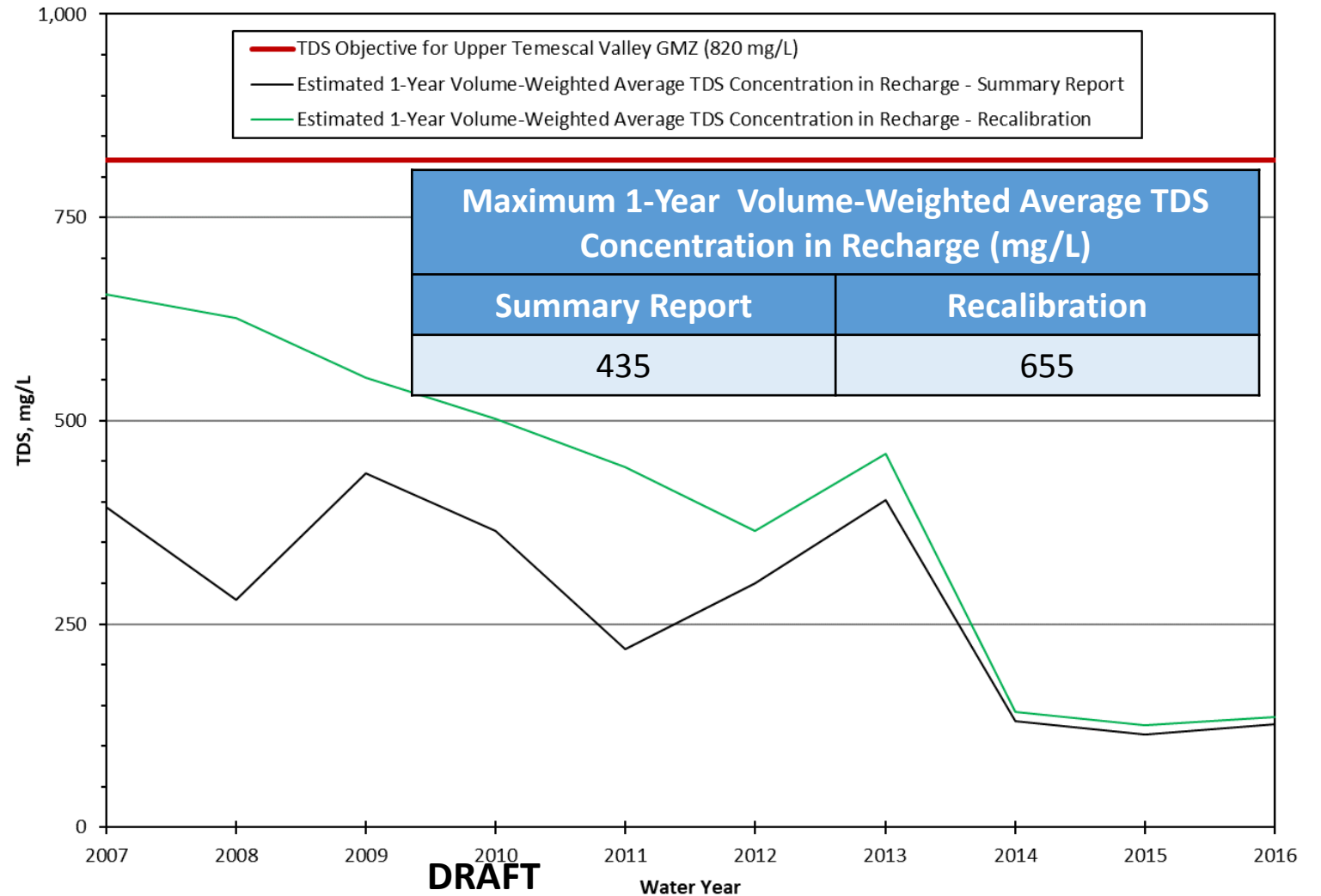
Estimated Annual Streambed Recharge of Temescal Creek
Downstream Temescal Rising Water and Upstream Temescal Creek at Main Street



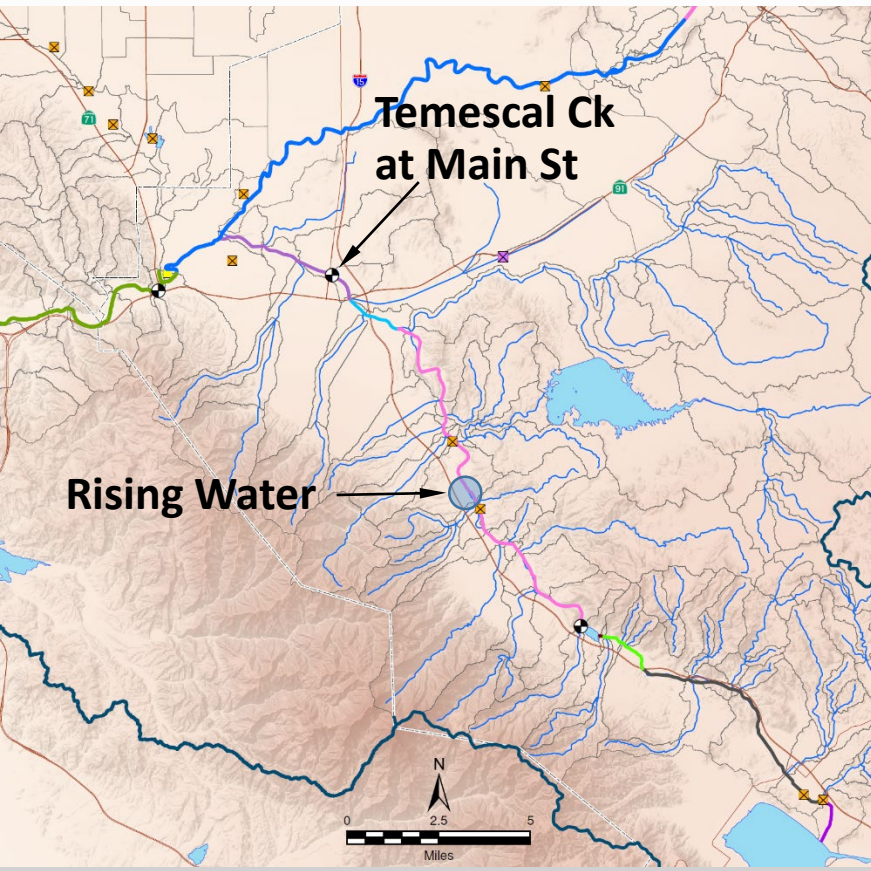
Streambed Recharge Volume-Weighted Average TDS Concentration Temescal Ck Segment between Corona Lake and Rising Water Area



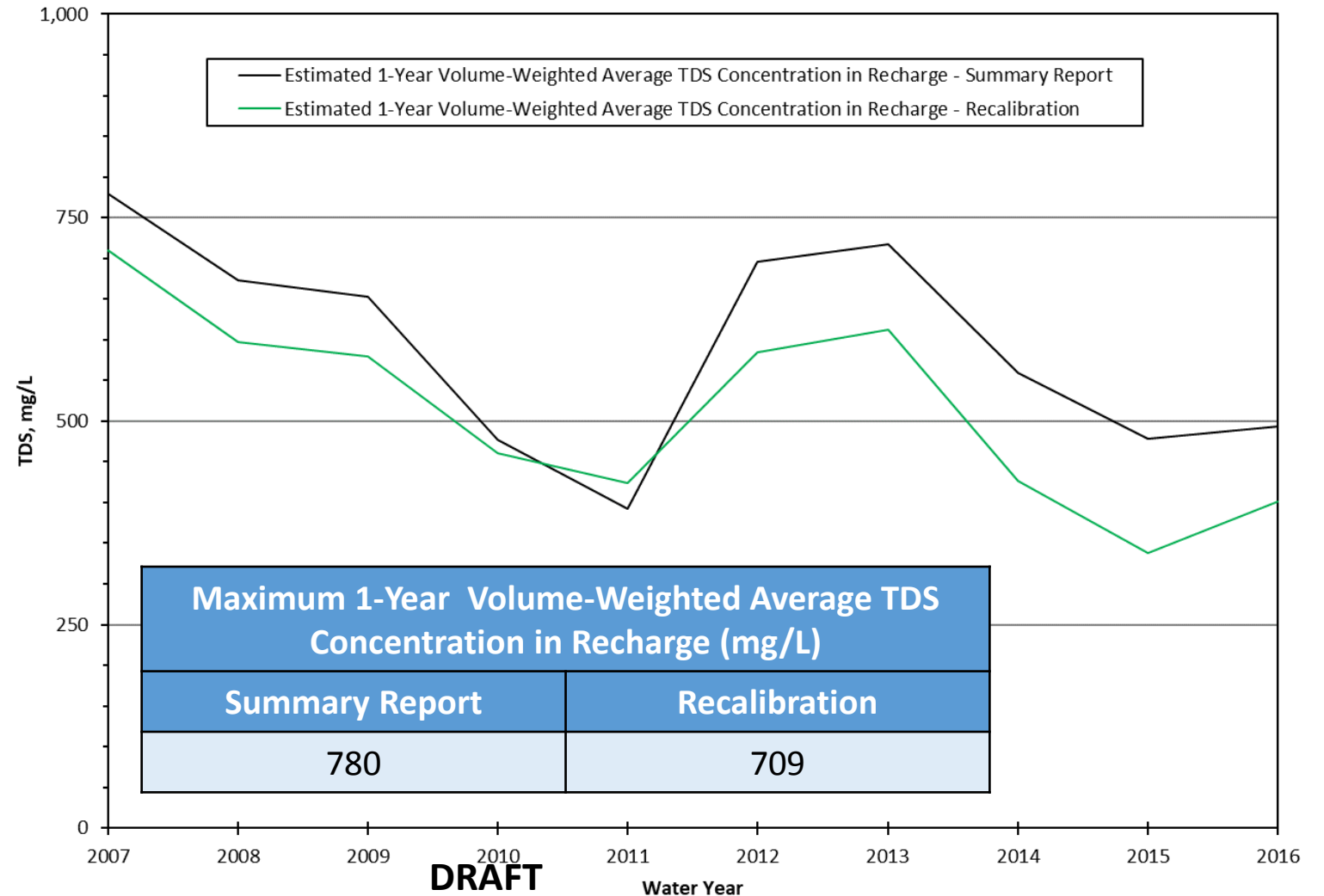
Estimated 1-Year Volume-Weighted Average TDS Concentration in Recharge
of Temescal Creek Downstream Corona Lake and Upstream Temescal Rising Water



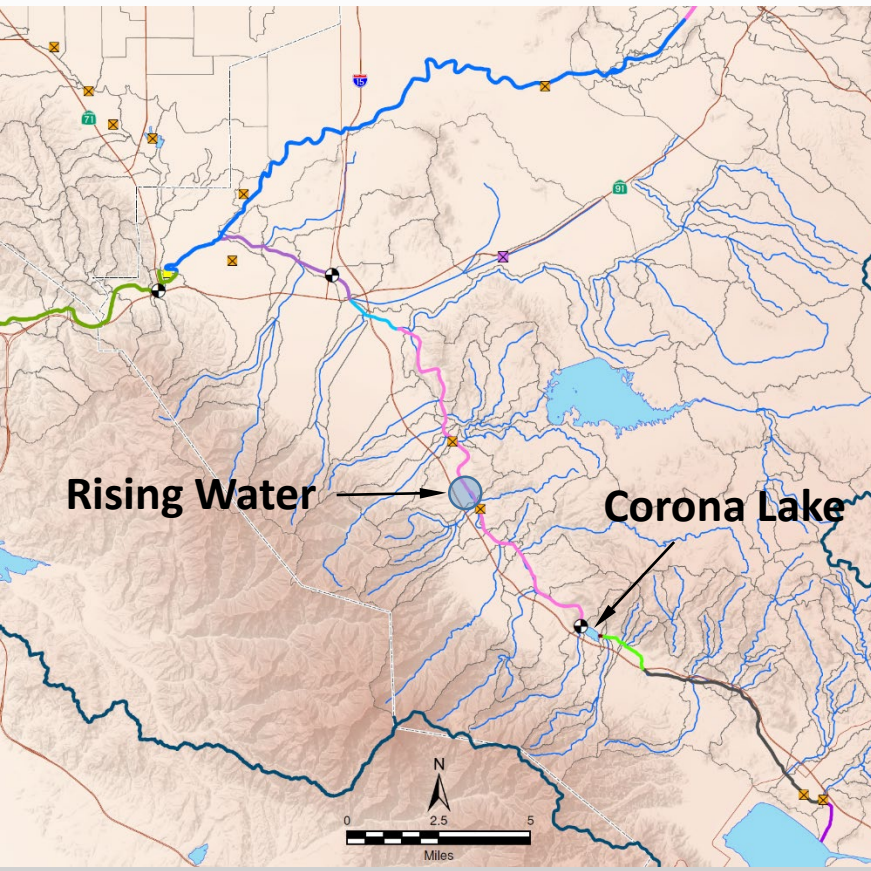
Streambed Recharge Volume-Weighted Average TDS Concentration Temescal Ck Segment Between Rising Water Area and Main St Gaging Station



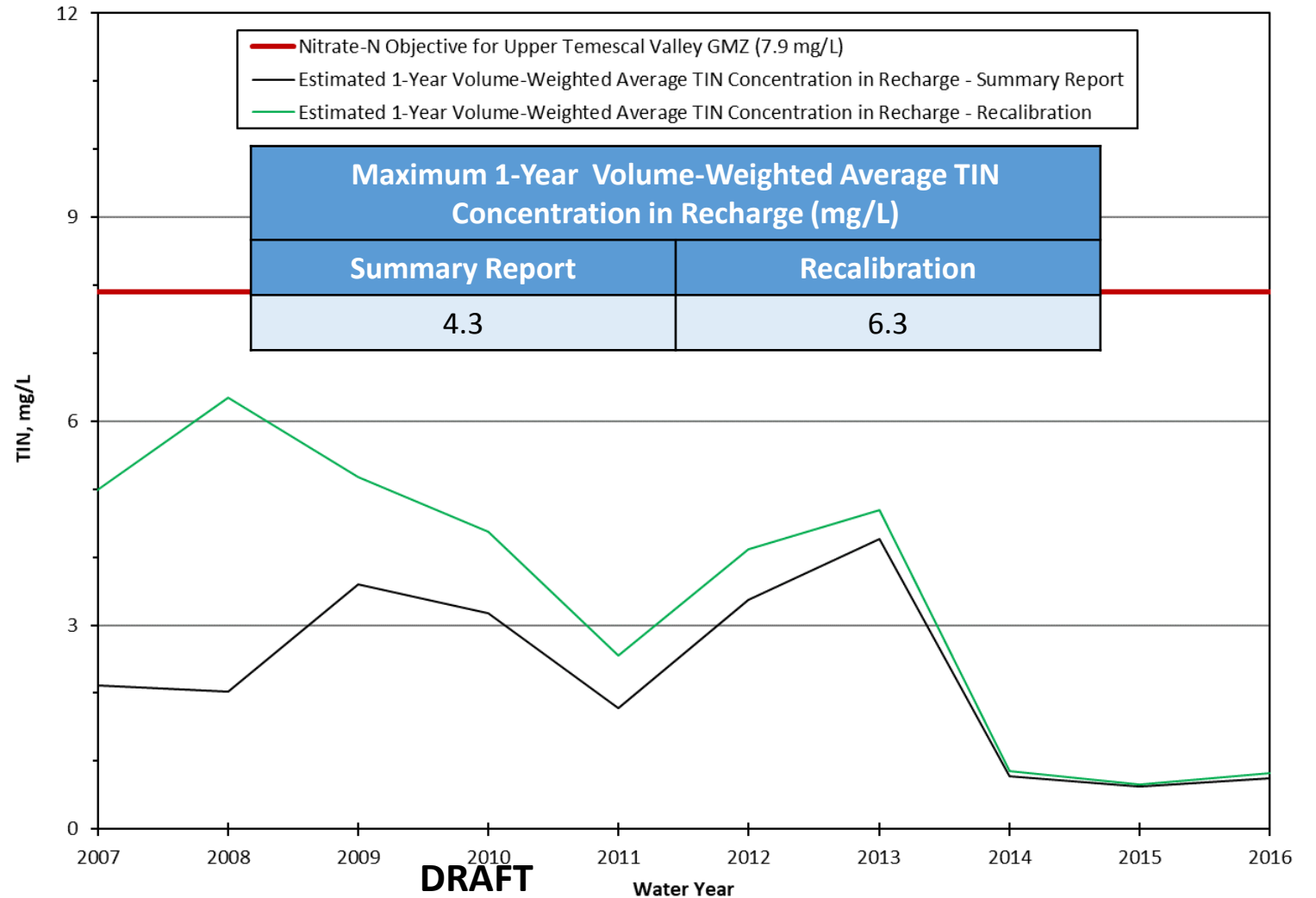
Estimated 1-Year Volume-Weighted Average TDS Concentration in Recharge
of Temescal Creek Downstream Temescal Rising Water and Upstream Temescal Creek at Main Street



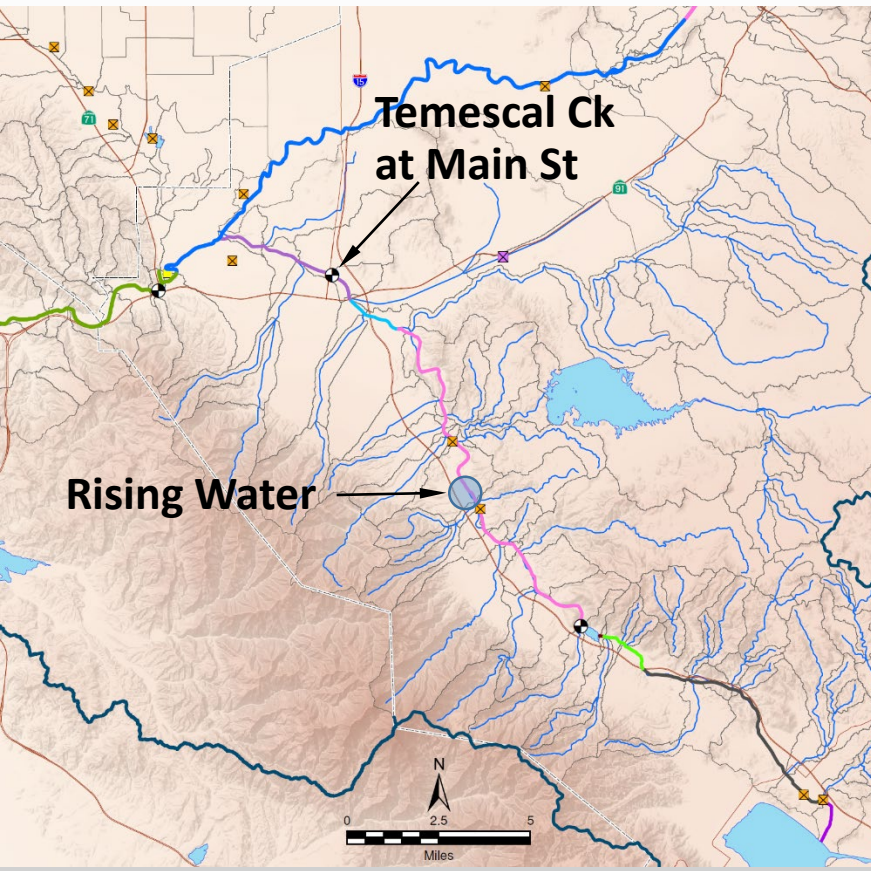
Streambed Recharge Volume-Weighted Average TIN Concentration Temescal Ck Segment between Corona Lake and Rising Water Area



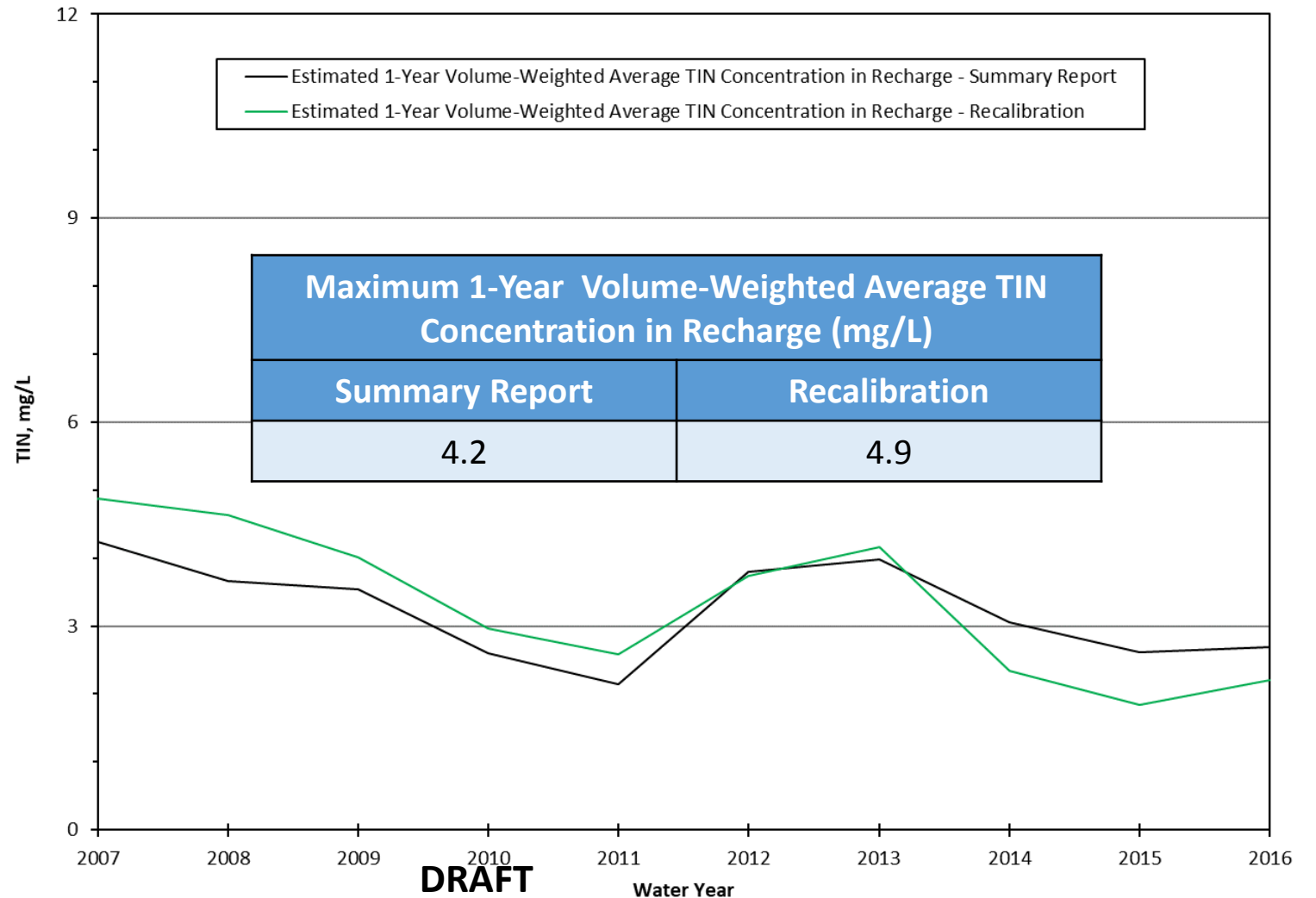
Estimated 1-Year Volume-Weighted Average TIN Concentration in Recharge
of Temescal Creek Downstream Corona Lake and Upstream Temescal Rising Water



Streambed Recharge Volume-Weighted Average TIN Concentration Temescal Ck Segment Between Rising Water Area and Main St Gaging Station



Estimated 1-Year Volume-Weighted Average TIN Concentration in Recharge
of Temescal Creek Downstream Temescal Rising Water and Upstream Temescal Creek at Main Street



Streambed Recharge to Temescal Creek - Reach 2,3, 4, 5 and 6 Overlying Upper Temescal Valley GMZ

TDS and TIN of Streambed Recharge to Temescal Creek - Reach 2,3, 4, 5 and 6 Overlying Upper Temescal Valley GMZ
Retrospective Mode WY 2005 - 2016

Water Year	2017 WLAM HSPF Summary Report			2017 WLAM HSPF Recalibration		
	Streambed Percolation (ac-ft)	1-Year Volume-Weighted Average TDS Concentration (mg/L)	1-Year Volume-Weighted Average TIN Concentration (mg/L)	Streambed Percolation (ac-ft)	1-Year Volume-Weighted Average TDS Concentration (mg/L)	1-Year Volume-Weighted Average TIN Concentration (mg/L)
2005	9,357	428	2.17	14,842	512	2.46
2006	6,776	604	2.97	12,106	643	3.37
2007	5,716	645	4.11	10,471	647	4.65
2008	4,241	567	5.28	6,912	592	5.53
2009	4,328	474	4.12	6,131	510	4.32
2010	4,898	408	3.11	6,086	461	3.47
2011	7,141	417	2.10	10,224	463	2.40
2012	3,490	353	3.61	4,151	384	3.32
2013	3,866	429	4.18	3,675	454	3.45
2014	2,231	214	1.01	2,331	358	1.48
2015	2,692	189	0.85	2,959	322	1.54
2016	2,413	203	1.09	2,487	365	1.90
Maximum	9,357	645	5.28	14,842	647	5.53
Average	4,762			6,865		