

CHATFIELD WATERSHED AUTHORITY



DRAFT

2022 ANNUAL REPORT

WATER QUALITY CONTROL COMMISSION

AUGUST 2023

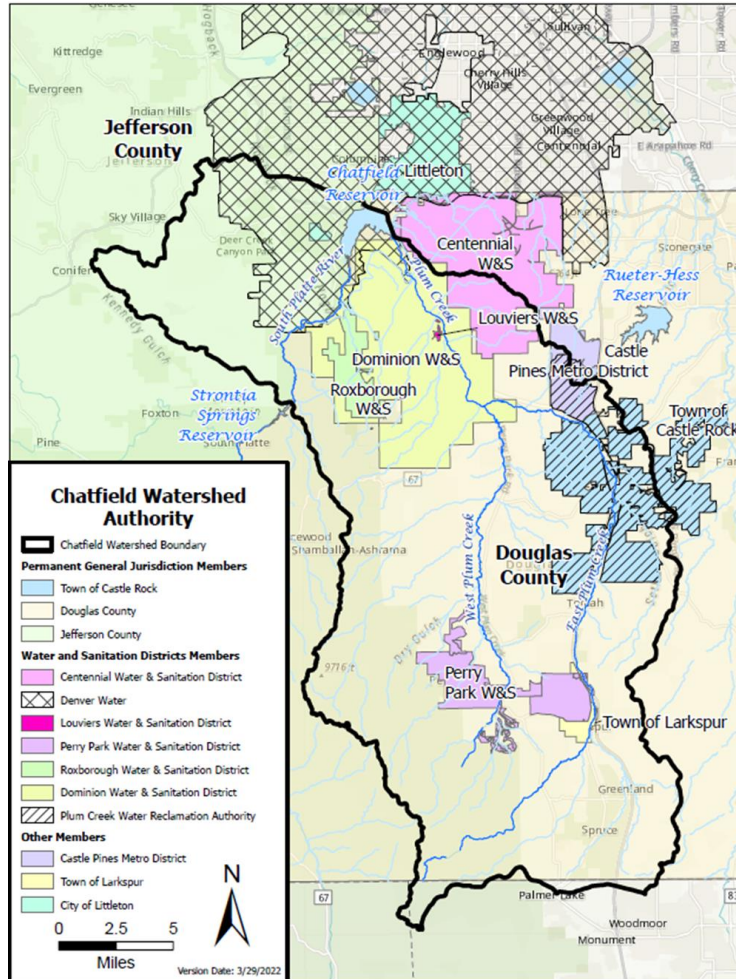
CHATFIELD WATERSHED AUTHORITY

Voluntary organization with self-imposed dues whose mission is to promote protection of water quality in the Chatfield Watershed for recreation, fisheries, drinking water supplies, and other beneficial uses through the promotion of point source and nonpoint source stormwater controls and monitoring.





CWA MEMBERSHIP



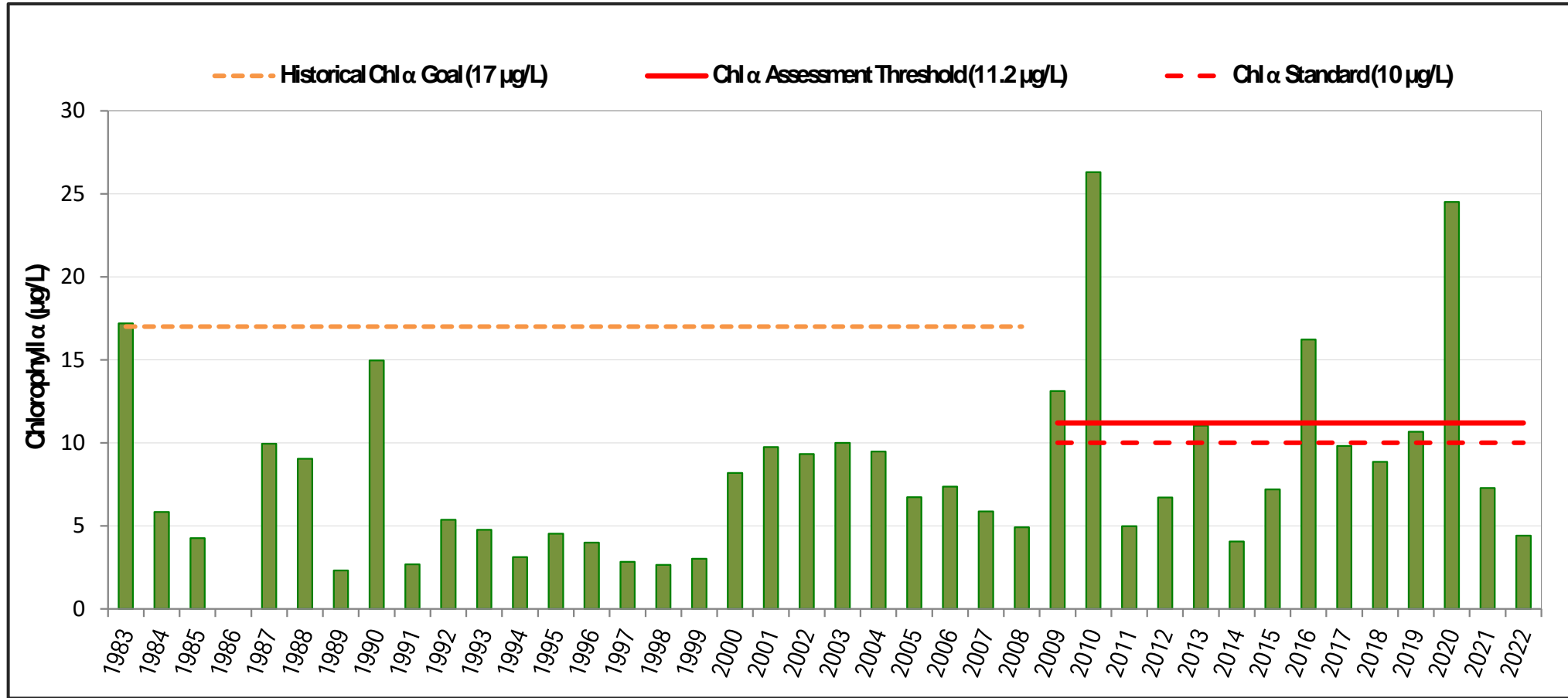
- **Permanent General Jurisdiction Members**
 - Douglas County
 - Jefferson County
 - Town of Castle Rock
- **Water and Sanitation Members**
 - Centennial Water and Sanitation District
 - Denver Water
 - Dominion Water and Sanitation District
 - Louviers Water and Sanitation District
 - Perry Park Water and Sanitation District
 - Plum Creek Water Reclamation Authority
 - Roxborough Water and Sanitation District
- **Other Members**
 - Castle Pines Metropolitan District
 - Town of Larkspur
 - City of Littleton

2022 RESERVOIR REGULATORY COMPLIANCE SUMMARY

- ✓ In compliance with Regulation 38 for chlorophyll α
- ✓ In compliance with Regulation 38 phosphorus standard
- ✗ One point source exceeded its phosphorus concentration limit in Regulation 73



CHLOROPHYLL α



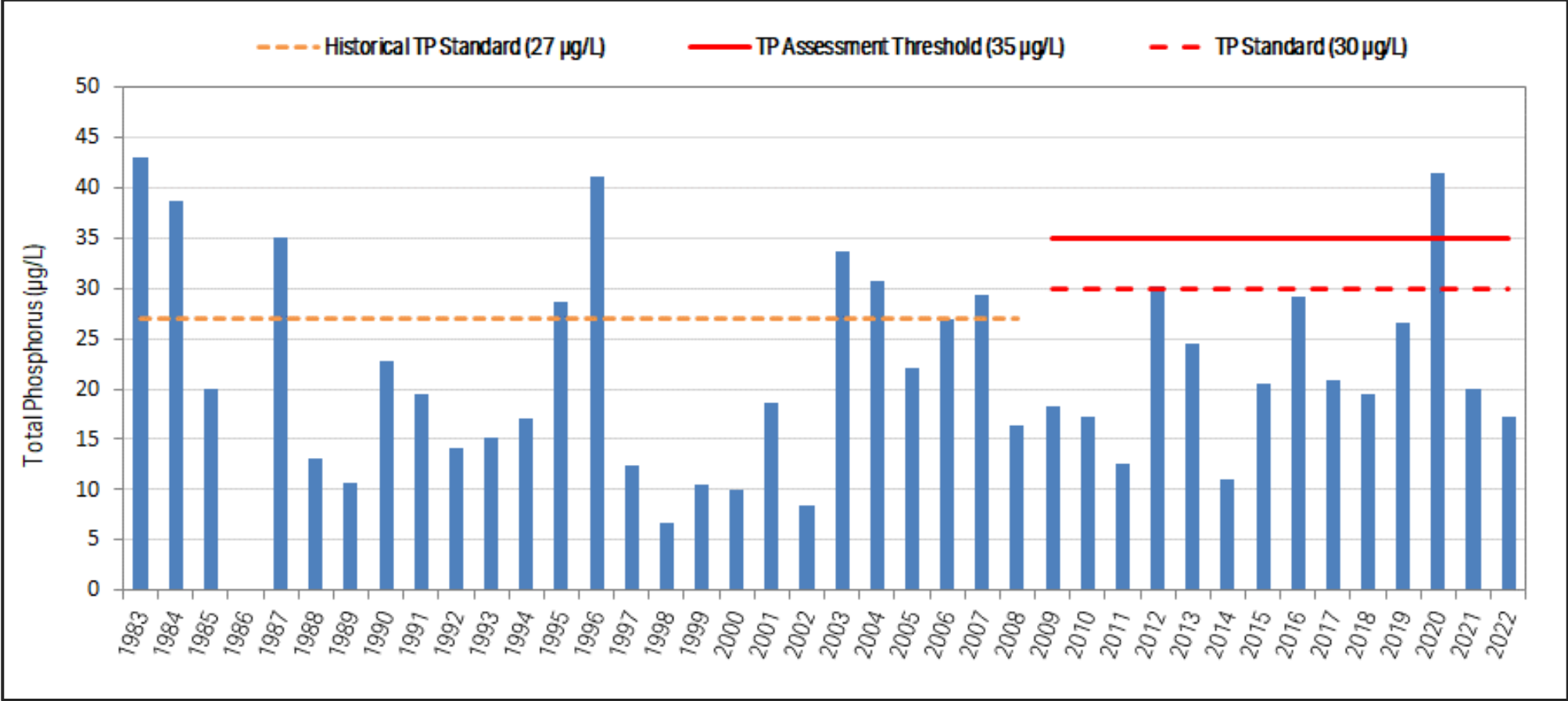
Attainment Assessment Threshold: 11.2 $\mu\text{g/L}$ (Jul. – Sep.)

1 in 5 years allowable exceedance frequency

2022 Summer Average = 4.4 $\mu\text{g/L}$



TOTAL PHOSPHORUS



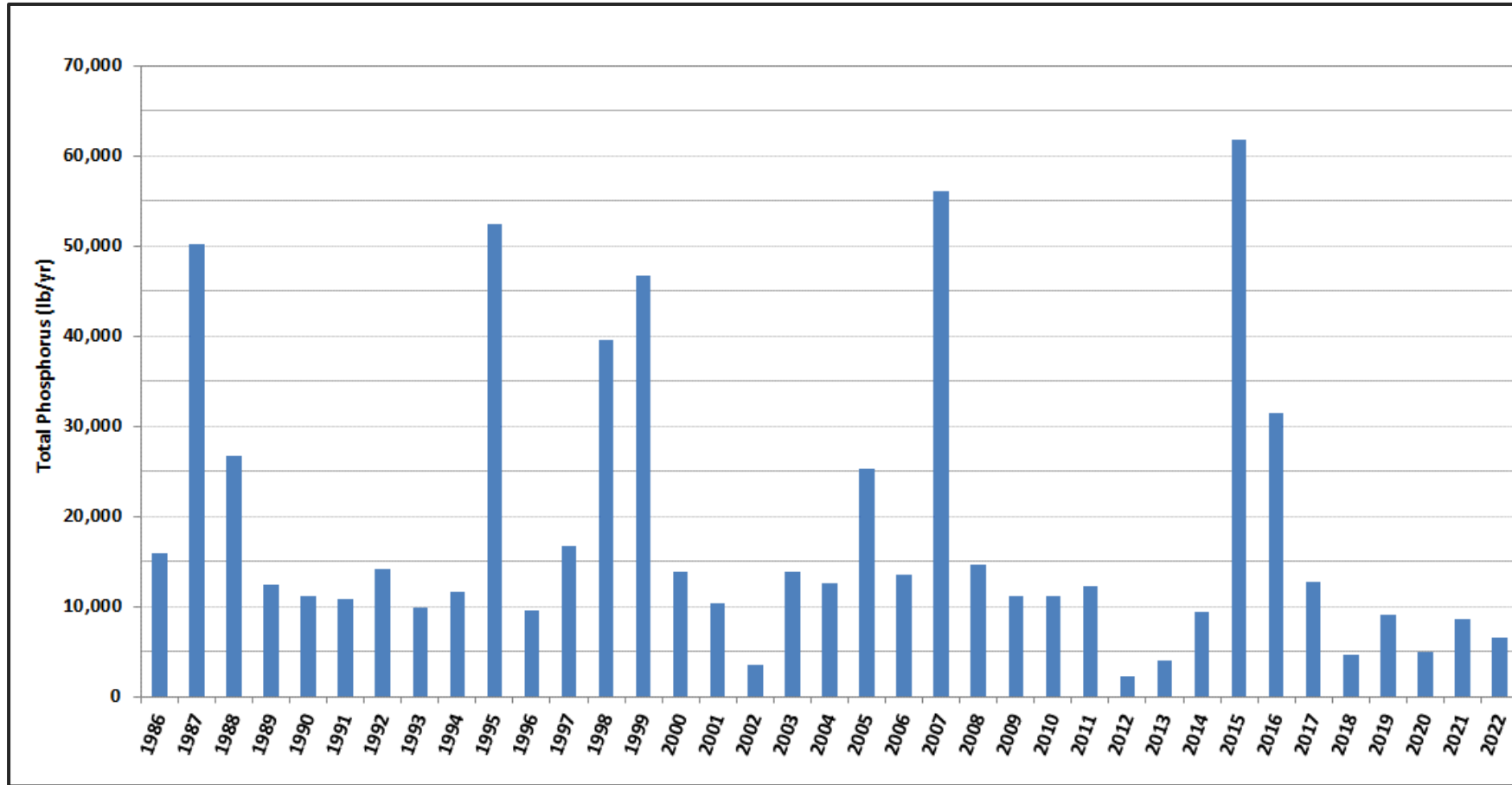
Attainment Assessment Threshold: 35 µg/L (Jul. – Sep.)

1 in 5 years allowable exceedance frequency

2022 Summer Average = 17.2 µg/L



TOTAL PHOSPHORUS LOADING



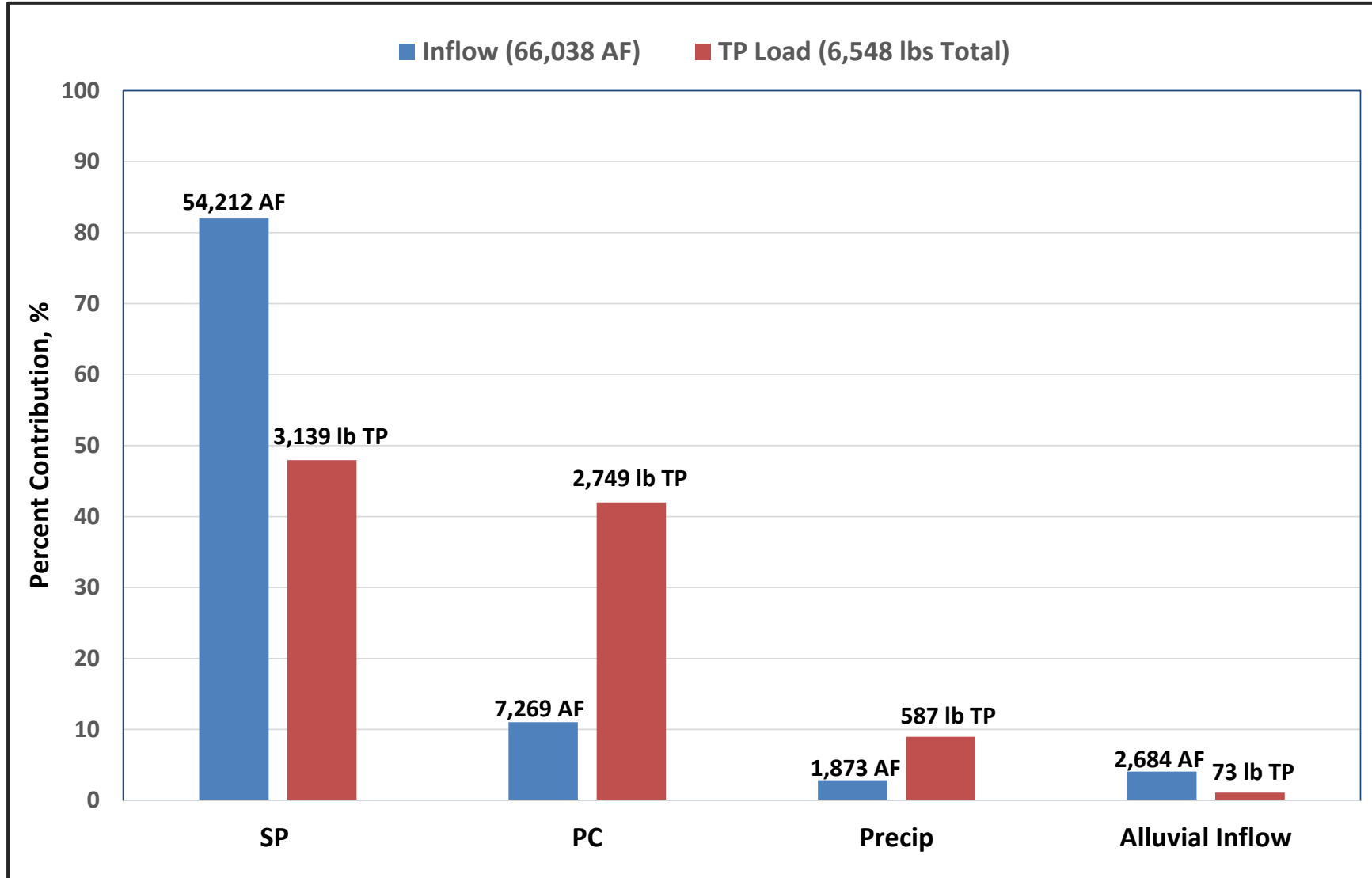
TMAL = 19,600 pounds at an inflow of 100,860 acre-feet

2022 Annual Load to Reservoir

6,548 pounds at an inflow of 66,038 acre-feet



TOTAL PHOSPHORUS LOADING



WHY DID EXCEEDANCE OF THE CHLOROPHYLL α STANDARD OCCUR IN 2020 BUT NOT IN 2021 or 2022?



Very hot and dry summers



No changes in activities at the reservoir



Lowest total phosphorus reaching the reservoir was in 2020



2020 was the 4th lowest annual flow in the last 35 years



2021 saw some changes due to reallocation storage



Phosphorus and Chlorophyll- α data do not show a strong correlation



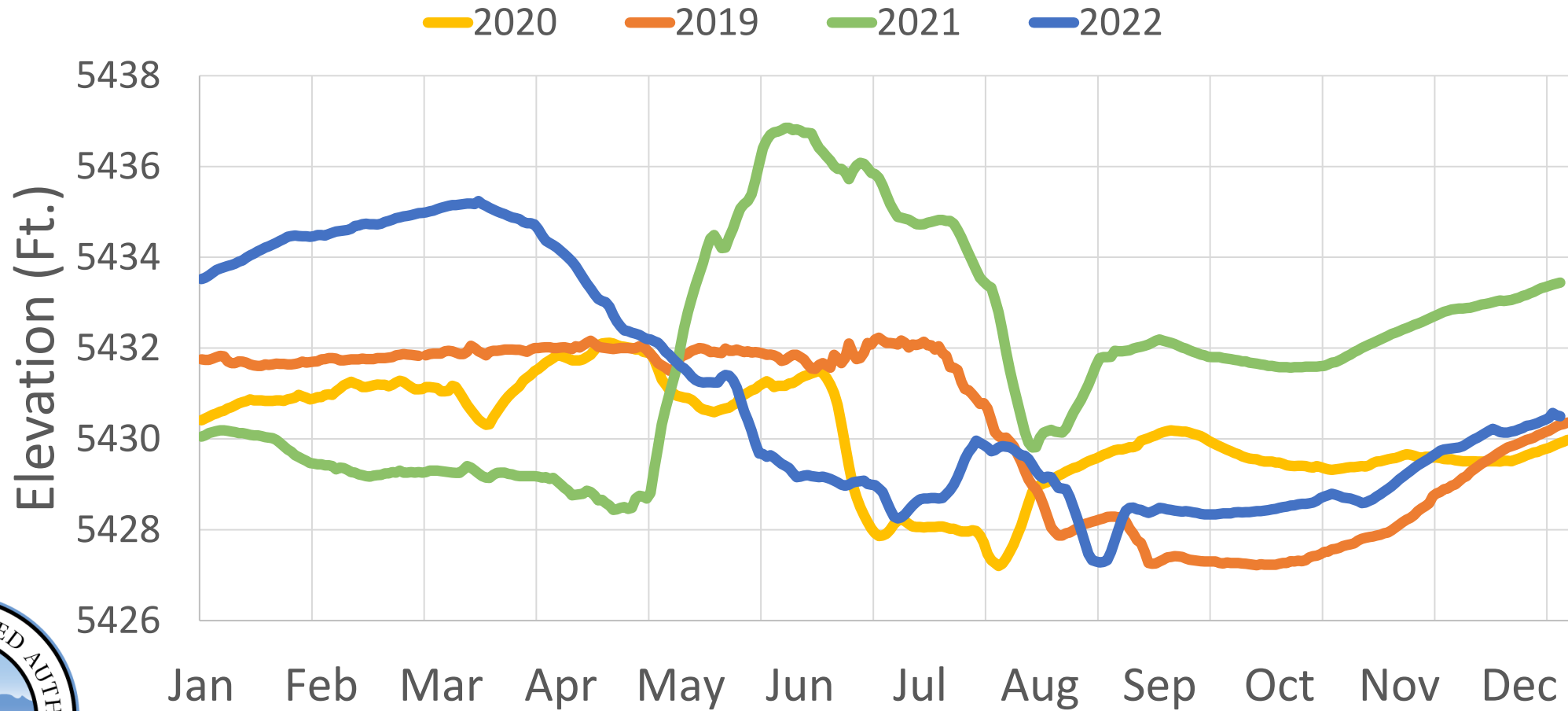
Unclear whether this situation will replicate under similar circumstances



Need more information and analysis – especially looking at other limiting factors

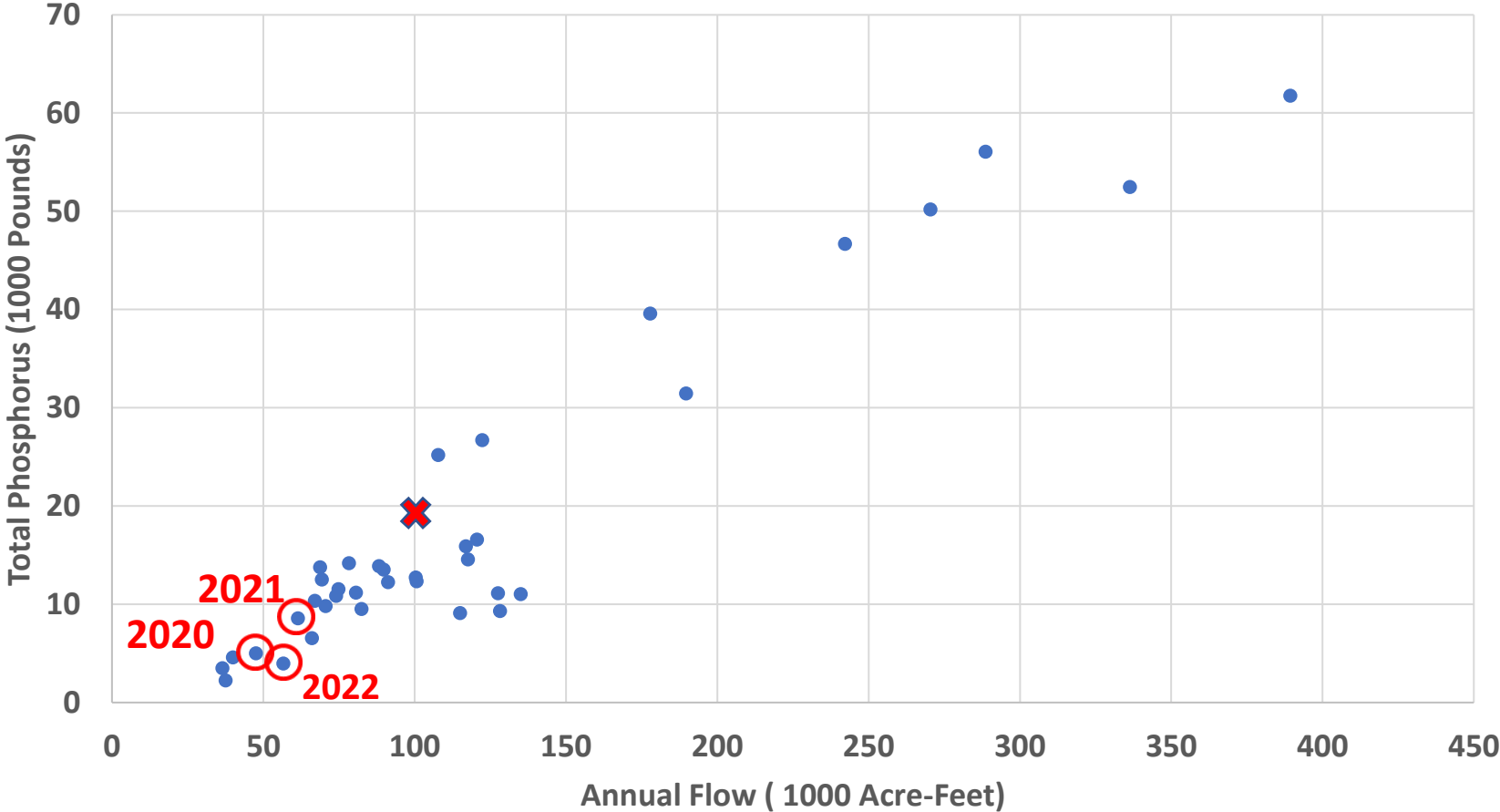


CHATFIELD RESERVOIR STORAGE ELEVATION (2019-2022)



FLOW vs TOTAL PHOSPHORUS

Annual (1986-2022)

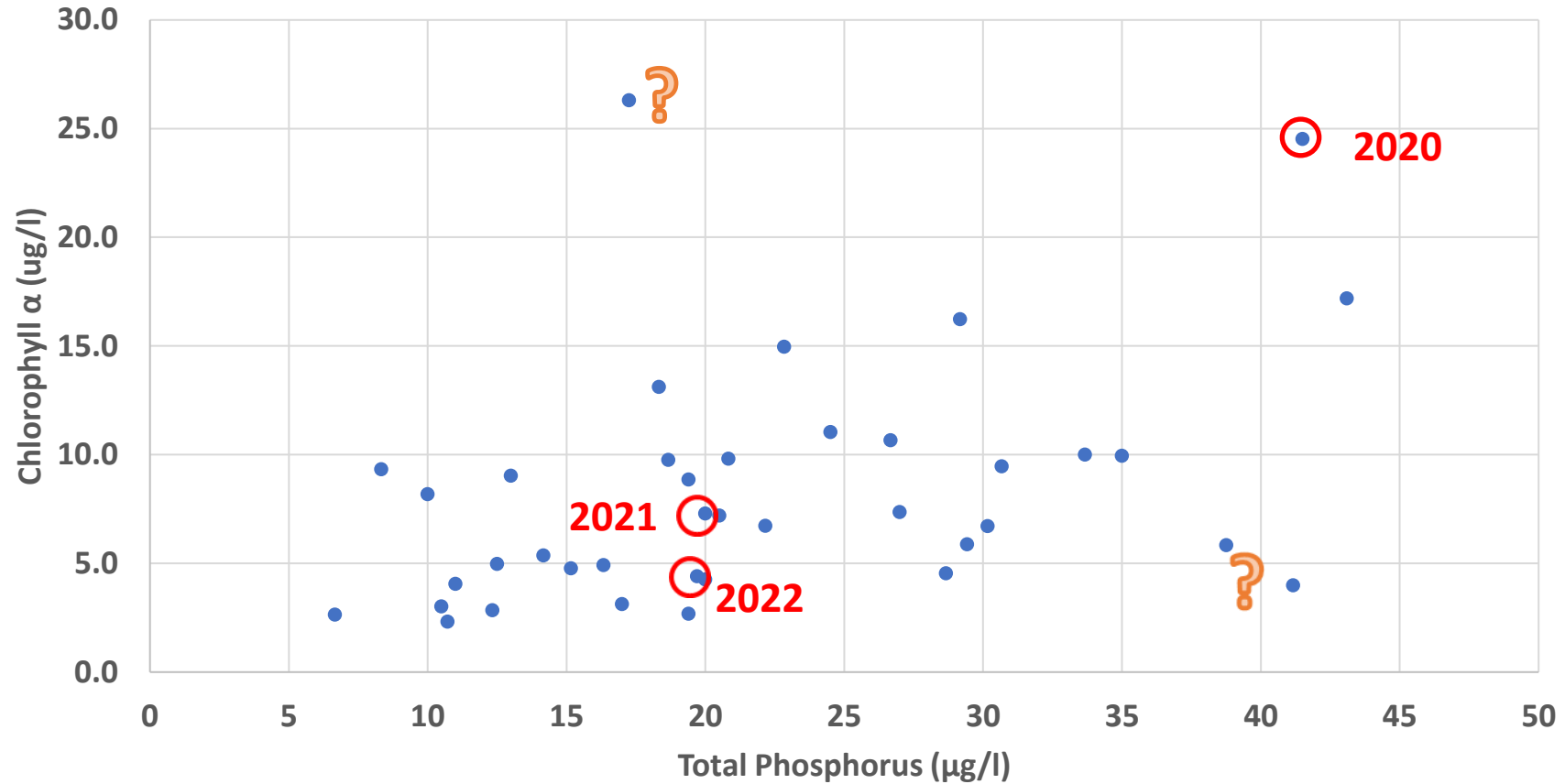


X TMAP = 19,600 pounds at an inflow of 100,860 acre-feet



TOTAL PHOSPHORUS (Concentration) vs CHLOROPHYLL α

Growing Season (1986-2022)

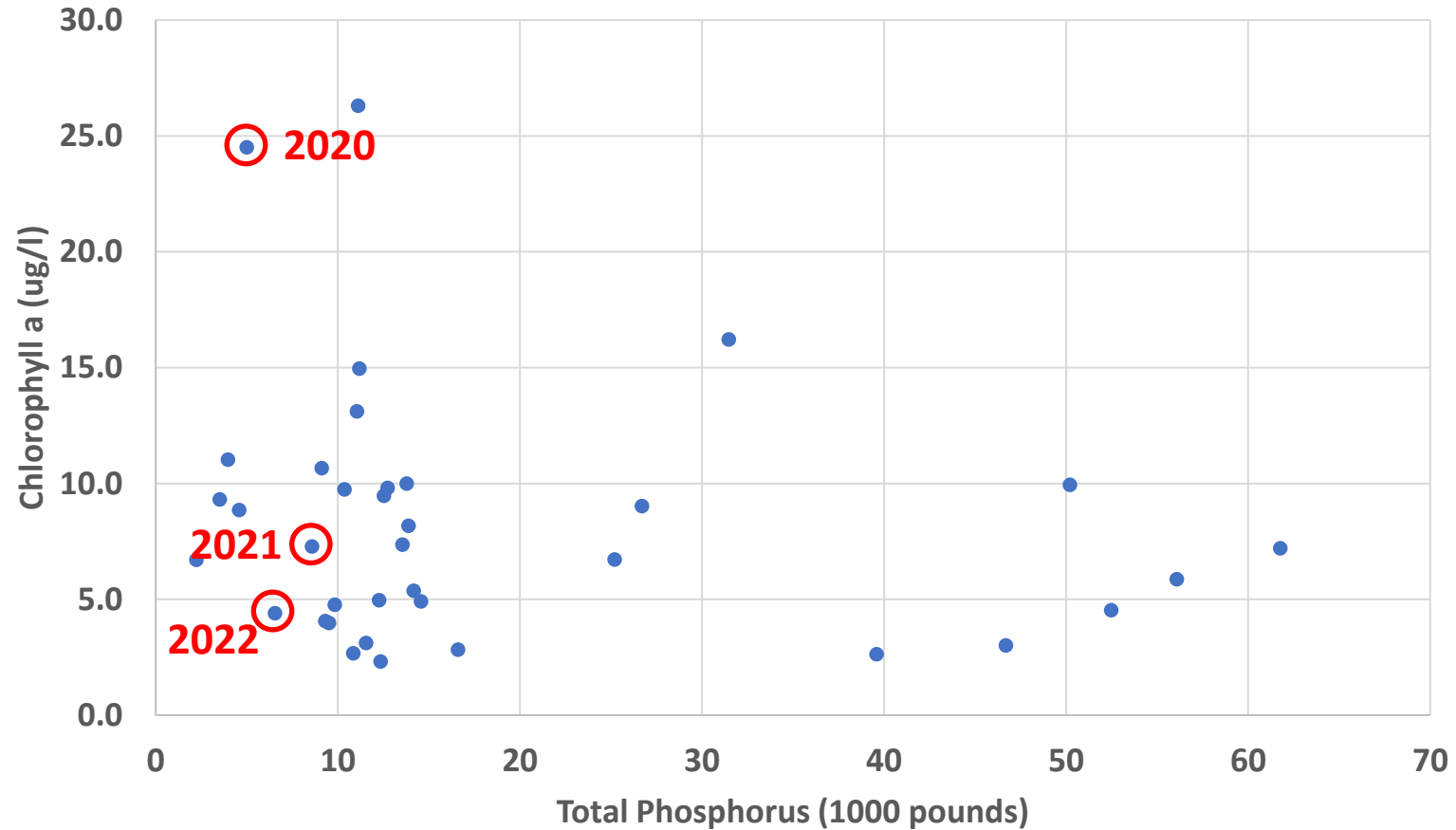


No Reliable Correlation



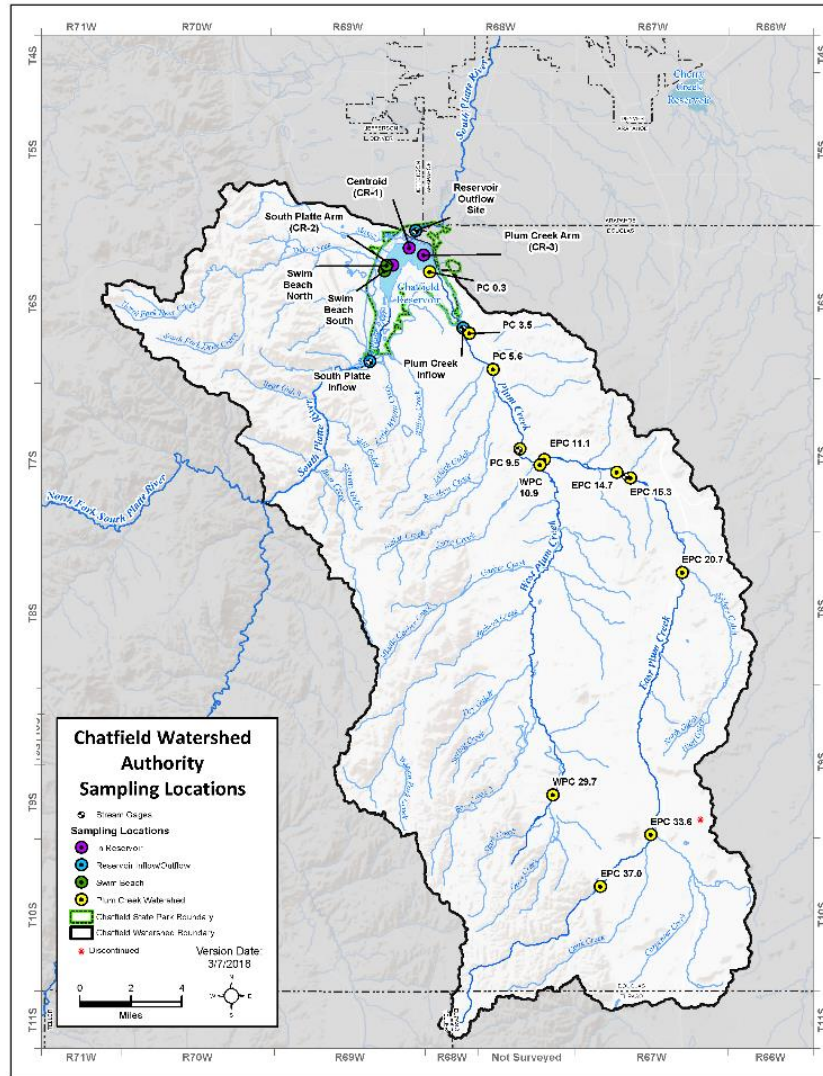
TOTAL ANNUAL PHOSPHORUS (Load) vs GROWING SEASON CHLOROPHYLL α

Growing Season (1986-2022)



No Reliable Correlation





RESERVOIR AND WATERSHED MONITORING PROGRAM

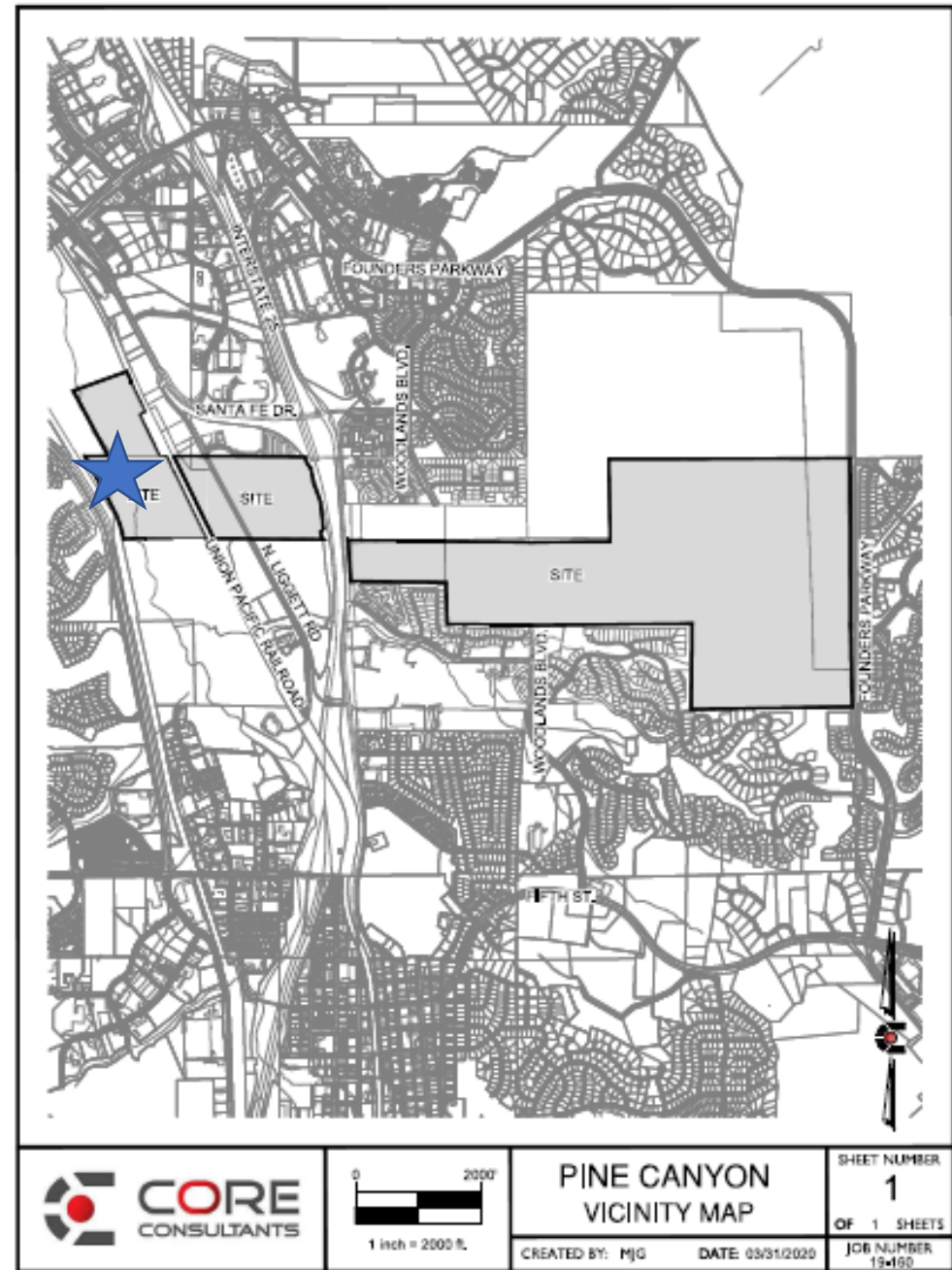
The Authority has been monitoring water quality for over 35 years.

- ✓ Monthly Monitoring at two Reservoir inflow locations, three locations in the Reservoir, and the Reservoir outflow
- ✓ During the growing season (July through September), Reservoir sampling is conducted twice monthly.
- ✓ Monthly Monitoring at 10 Watershed Locations

SITE AND PHOSPHORUS TRADE APPLICATIONS

Pine Canyon Site Application and Phosphorus Trade Application (Initial application submitted in 2020)

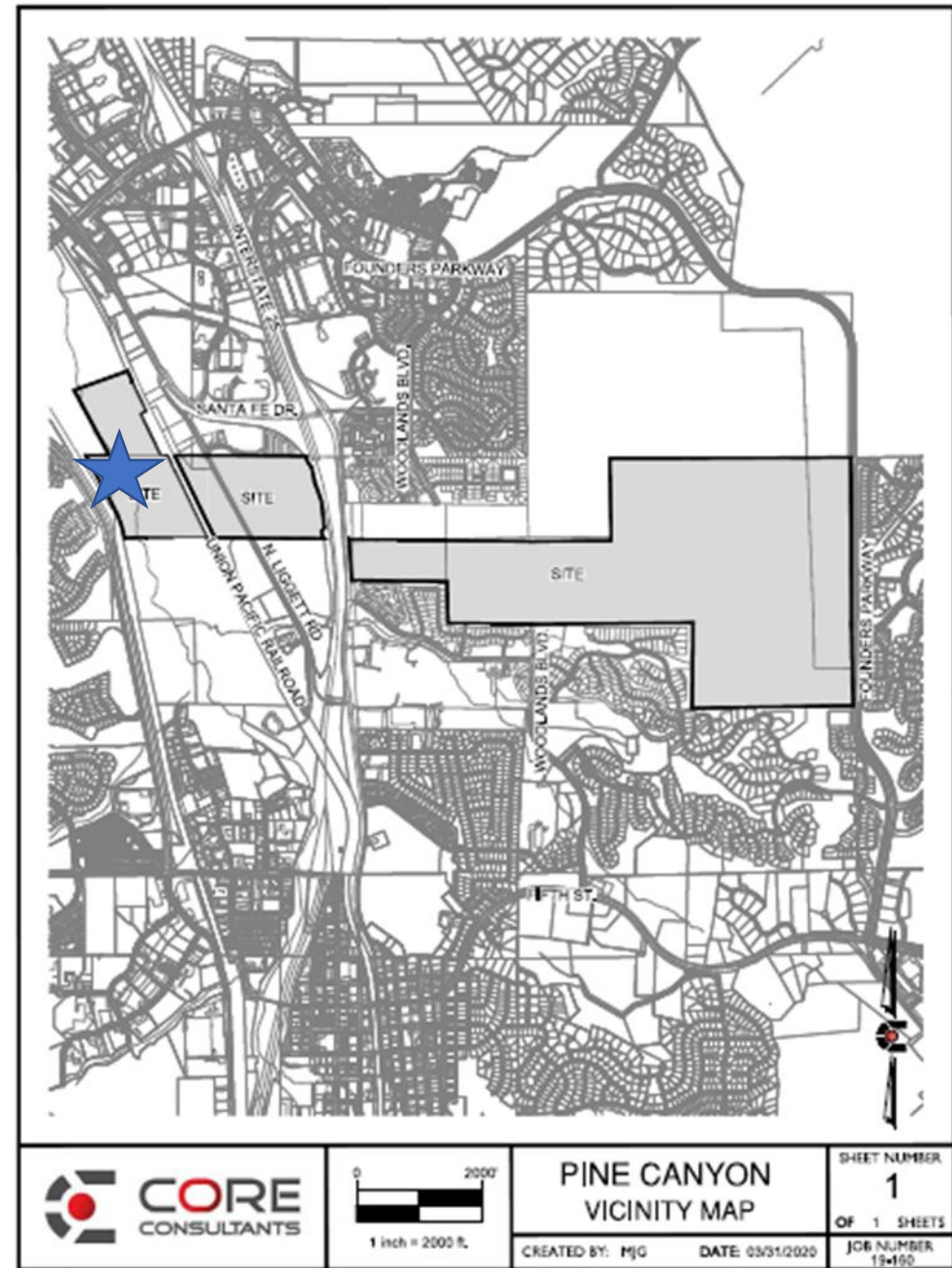
- / Located in the Middle of Castle Rock
- / Site Application for WWTF (0.405 mgd design capacity)
- / Initial Phosphorus Non-Point Source to Point Source Trade Application (1528 lbs/yr on-site cattle operations elimination to 763 lbs/yr WWTF discharging to East Plum Creek)



SITE AND PHOSPHORUS TRADE APPLICATIONS

Pine Canyon Site Application and Phosphorus Trade Application

- ✓ In October 2020, the Division issued a Request for Information (RFI) asking the applicant to address the phosphorus allocation with respect to the MS4 requirements.
- ✓ In December 2020, after CWA review, applicant revised their proposed nonpoint source phosphorus credit to 380.5 lbs./yr. based upon a calculated 761 lbs./yr. of phosphorus reaching East Plum Creek from the JRW property.



PINE CANYON
VICINITY MAP

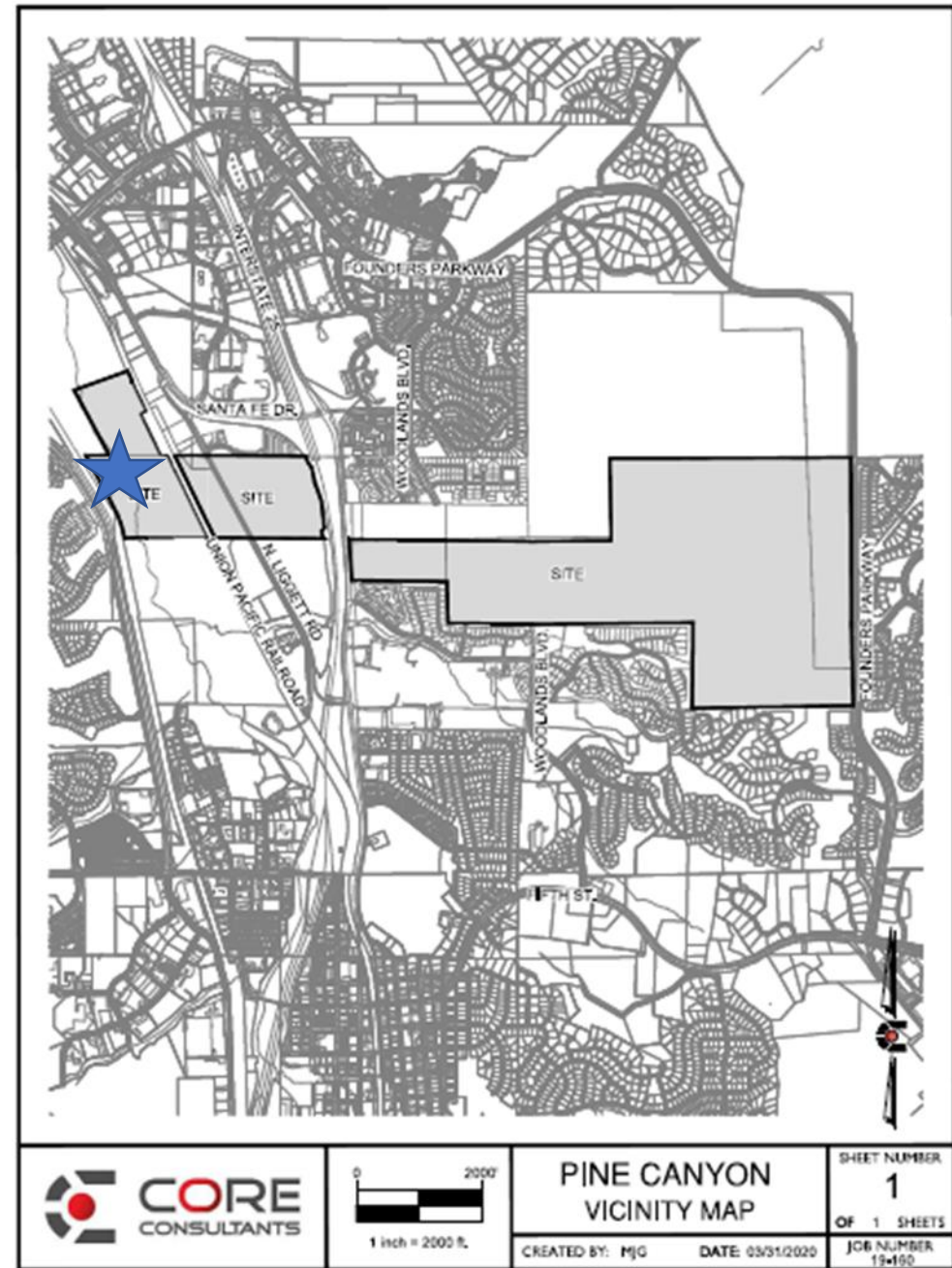
CREATED BY: MJC DATE: 05/31/2020

SHEET NUMBER
1
OF 1 SHEETS
JOB NUMBER
19-160

SITE AND PHOSPHORUS TRADE APPLICATIONS

Pine Canyon Site Application and Phosphorus Trade Application

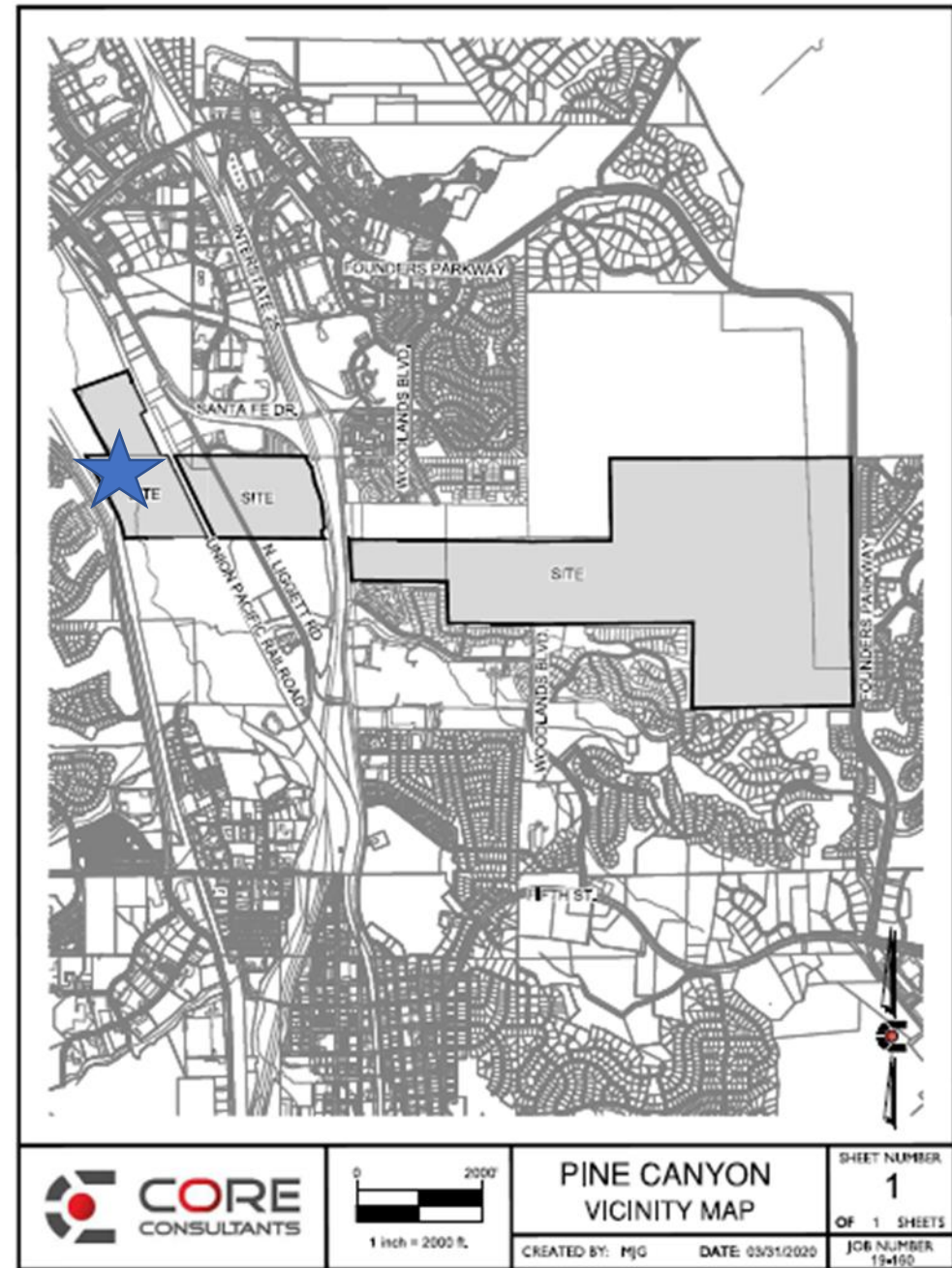
- On January 26, 2021, the Division issued a letter to the Applicant stating that “because the Applicant’s property is subject to Douglas County MS4 permit, the discharge is a point source, not a nonpoint source. Furthermore, discussions with our MS4 workgroup have clarified that trading under an MS4 permit also is not a feasible option at this time”.
- On January 28, 2021, the Division put their review of the Site Application on hold until the phosphorus allocation issue was resolved.



SITE AND PHOSPHORUS TRADE APPLICATIONS

Pine Canyon Site Application and Phosphorus Trade Application

- On February 2, 2021, the CWA Technical Advisory Committee (TAC) formally denied the proposed phosphorus trade based on the Division's January 24, 2021, determination that a phosphorus trade under an MS4 permit is not a feasible option at this time. The CWA documented the review process and its decision to deny the proposed phosphorus trade in a letter to the Division on February 18, 2021.
- On May 4, 2021, the CWA TAC voted to deny the Pine Canyon Site Application on procedural grounds given that there is no phosphorus wasteload allocation available from the proposed phosphorus trade.
- On December 2, 2021, the Division sent a letter to the applicant "to provide more detailed information on the underlying rationale behind our initial determination that the trade is not feasible".



PINE CANYON
VICINITY MAP

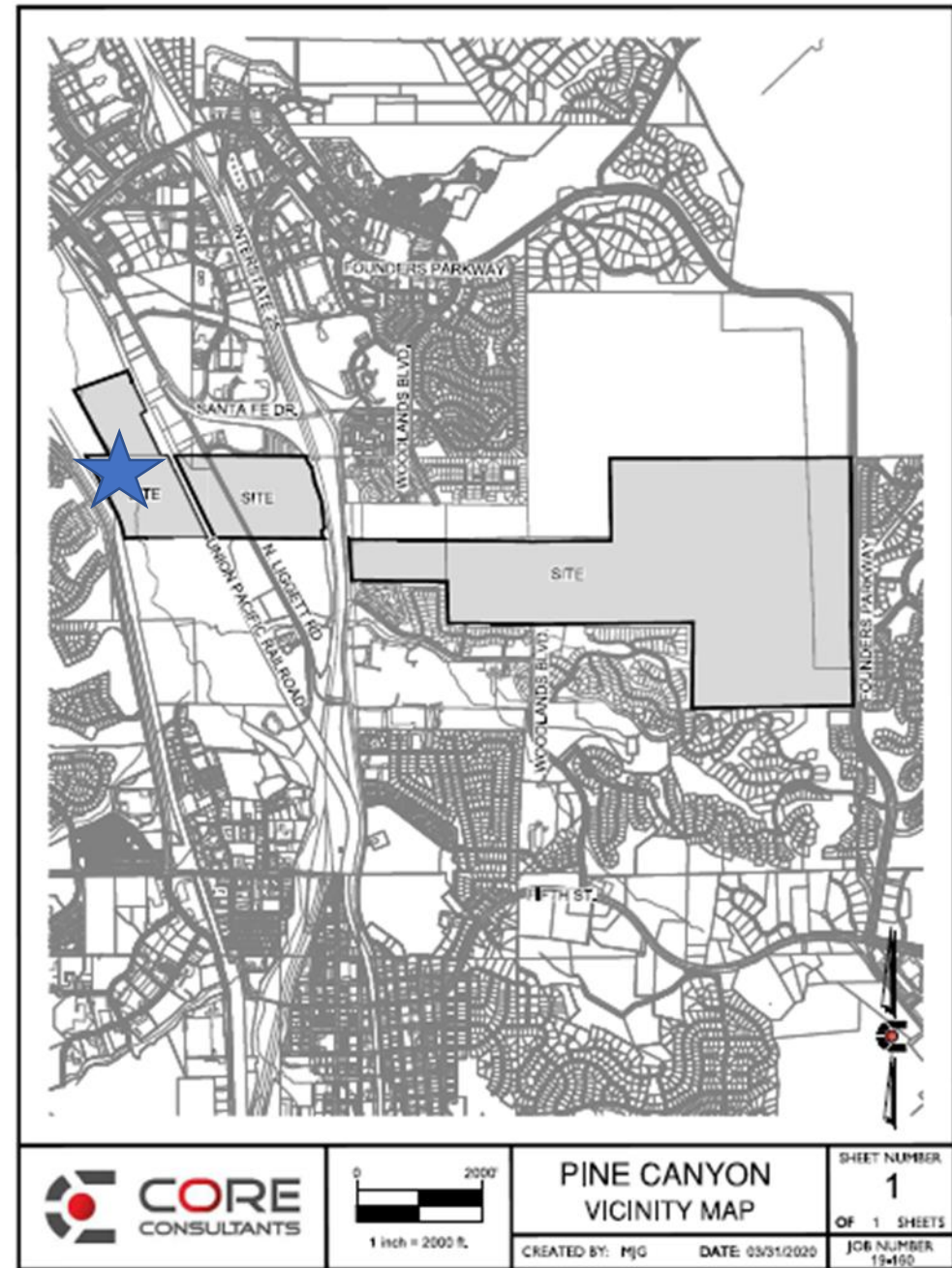
CREATED BY: MJC DATE: 05/31/2020

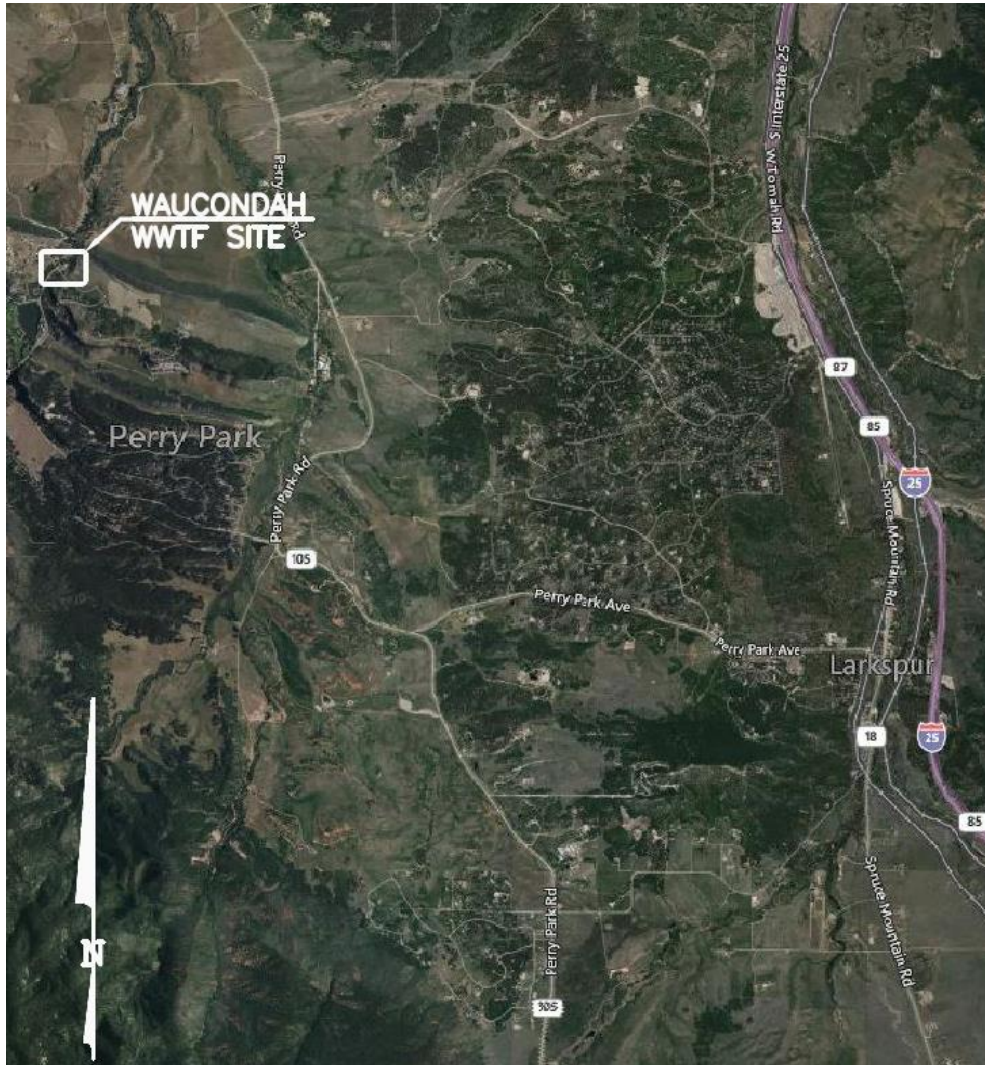
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OF 1 SHEETS
JOB NUMBER
19-100

SITE AND PHOSPHORUS TRADE APPLICATIONS

Pine Canyon Site Application and Phosphorus Trade Application

- ✓ On April 6, 2022, the applicant submitted an amended site application to CWA.
- ✓ On June 7, 2022, the Authority's TAC recommended to the Division that the Pine Canyon Site Application be denied due to concerns with the LAMP.
- ✓ On December 1, 2022, the site location application for the Pine Canyon Water and Sanitation District's PCWRF was found by the Division to be in conformance and was approved.





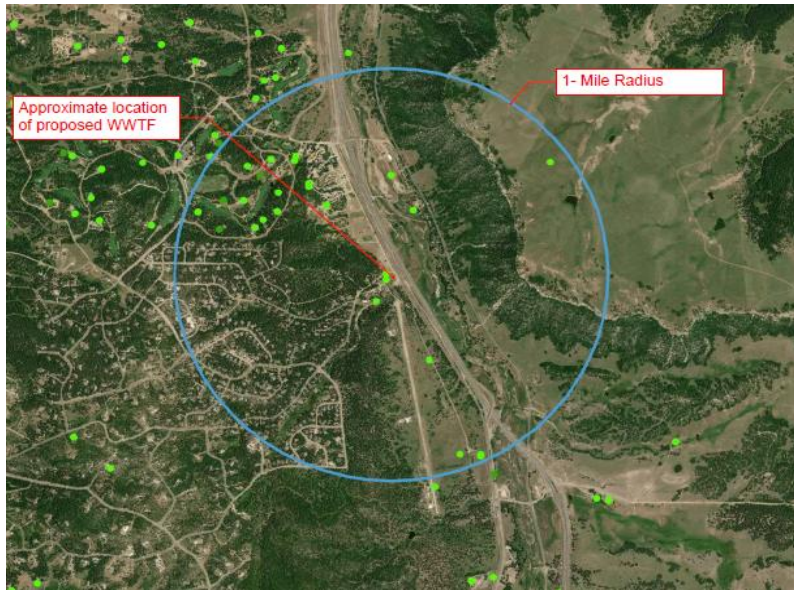
SITE APPLICATION

Perry Park Water and Sanitation District – Waucondah Wastewater Treatment Facility Site Application Review

- / The site application relates to significant changes to the WWTF.
- / Current digesters are over 40 years old.
- / Wasteload allocation not needed.
- / This WWTF falls under the same phosphorus concentration limits and has not exceeded them.
- / CWA recommended approval of this application.



TOTAL PHOSPHORUS WASTELOAD AND CONCENTRATION ALLOCATION VIOLATION



Jellystone RV Park – Jellystone Park at Larkspur WWTF

- / On May 13, 2020, the Division, with CWA concurrence, approved a Phosphorus Trade of 145.2 lbs. from decommissioned OWTS's to 72.6 lbs. of WWTF discharge to groundwater.
- / The Division ultimately approved the associated site application and WWTF design report and construction plans and on May 14, 2020, issued CDPS Certification COX631080.

TOTAL PHOSPHORUS WASTELOAD AND CONCENTRATION ALLOCATION VIOLATION

Jellystone RV Park – Jellystone Park at Larkspur WWTF

- / After beginning operations in June of 2020, the WWTF encountered problems with meeting effluent permit limits.
- / Exceedances included: monthly average total phosphorus concentration limit, monthly total inorganic nitrogen concentration limit, and annual phosphorus wasteload allocation.
- / In 2022, the facility exceeded its average total phosphorus concentration limit in January and April.

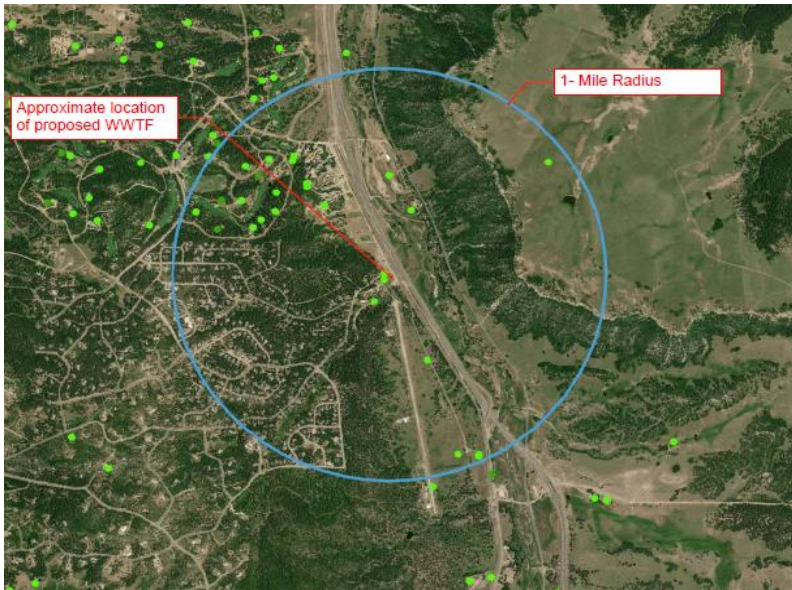




TOTAL PHOSPHORUS WASTELOAD AND CONCENTRATION ALLOCATION VIOLATION

Jellystone RV Park – Jellystone Park at Larkspur WWTF

- / On July 14, 2021, the Division issued a revised CDPS Certification which, among other conditions, requires the WWTF to achieve final compliance with discharge limits by 8/1/2024.
- / The CWA is monitoring the Division's actions regarding enforcement of the CDPS permit and, as of the end of 2022, had not taken any formal action against the facility owner.





EFFORTS IN 2022 TO BETTER UNDERSTAND AND REDUCE POLLUTANT LOADS IN THE WATERSHED AND RESERVOIR

- / Member Activities
- / Watershed Model Update Efforts
- / Colorado School of Mines Project
- / Funding of Non-point Source Projects
- / Plans for 2023



MEMBER ACTIVITIES



Many of the member entities' typical outreach programs continued to be impacted by COVID-19 precautions. However, additional in-person events were able to resume in 2022, such as:

- / The City of Littleton conducted stream clean-ups and manned four stormwater booths.
- / Jefferson County hosted a public cleanup of the Clear Creek corridor on National Public Lands Day (690 volunteers).
- / Douglas County ran 12 informational newspaper ads.
- / The Town of Castle Rock held its annual Spring Up the Creek clean-up event (178 volunteers).



PROGRESS TO PROMOTE WATER QUALITY PROTECTION –TOWN OF CASTLE ROCK

- / Craig and Gould North Infrastructure Improvement Project (\$7.6 million): Persistent flooding in an historic neighborhood is being addressed. The Town is taking the opportunity to improve water quality as well as drainage.
- / Omni Tributary - Prairie Hawk Dr. to Red Hawk Dr. (\$1,345,275): The Town completed these Stormwater Masterplan Improvements to Omni Tributary and Unnamed Tributary in October 2022. The work included repairing extensive damage to both channels.





PROGRESS TO PROMOTE WATER QUALITY PROTECTION – DOUGLAS COUNTY EXAMPLE



Willow Creek Stream Improvements at Sterling Ranch

- / Realigning and stabilizing 8,600 linear feet of streambank
- / Constructing 33 riffle-pool stream features
- / Planting 55 acres of native plant seed
- / Planting 50 trees and nearly 2,000 shrubs
- / Establishing 2 new acres of wetland habitat
- / Creating 18 acres of high-quality riparian habitat
- / Establishing a high functioning and more resilient stream corridor

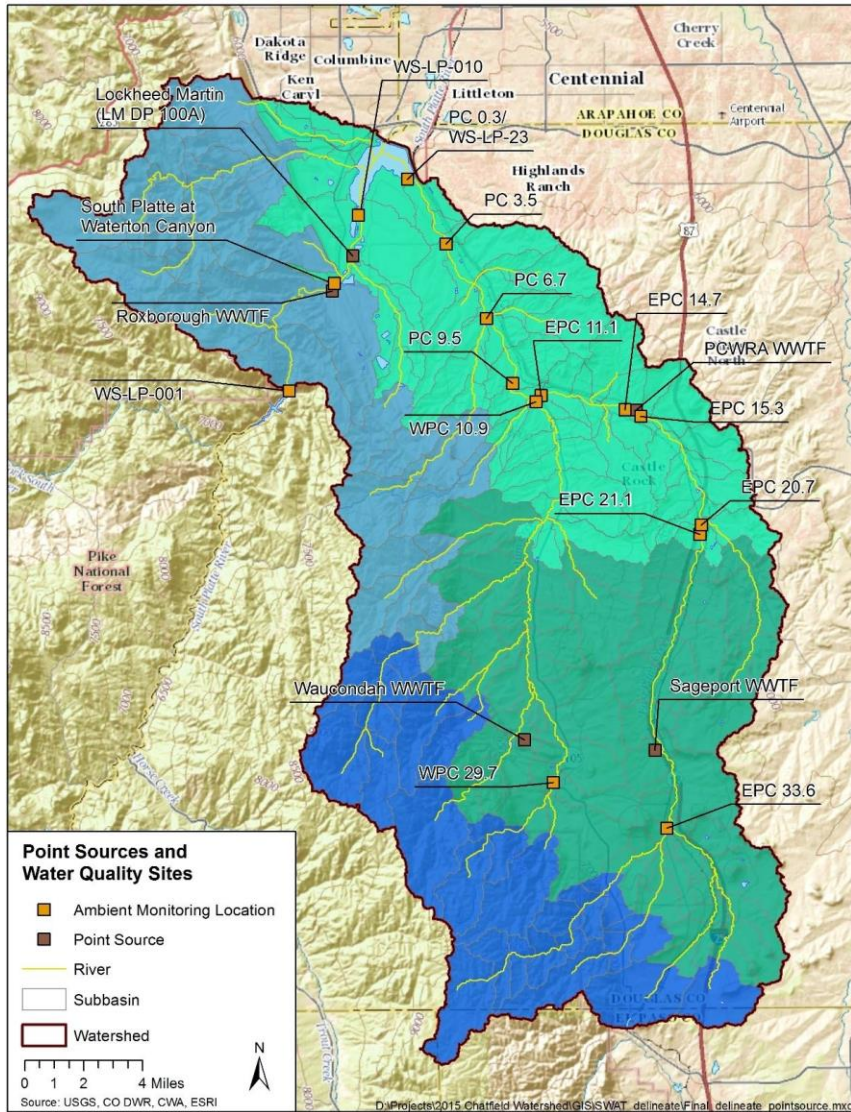


WATERSHED MODELING

Reach ID	Description	Total Phosphorus Load (% / lbs)	Total Nitrogen Load (% / lbs)	Total Sediment Load (% / tons)	Total Flow (% / af)
Percent Increase (%)					
Reach 105	East Plum Creek	5.2	1.6	5.7	1.7
Reach 56	East Plum Creek (upstream of PCWRA)	2.1	0.8	2.4	1.1
Reach 52	East Plum Creek (downstream of PCWRA)	1.1	0.4	2.4	0.7
Reach 45	Plum Creek at Sedalia	0.8	0.2	1.3	0.4
Reach 28	Plum Creek at Titan Rd	0.8	0.2	1.1	0.4
Absolute Increase (lbs, tons, af)					
Reach 105	East Plum Creek	59.1	449.2	21.3	80.4
Reach 56	East Plum Creek (upstream of PCWRA)	55.6	390.4	22.2	80.5
Reach 52	East Plum Creek (downstream of PCWRA)	55.5	388.7	22.2	80.5
Reach 45	Plum Creek at Sedalia	55.6	378.1	22.7	80.6
Reach 28	Plum Creek at Titan Rd	54.4	358.0	22.5	80.7

The Authority contracted with Lynker to use the watershed model to further explore model assumptions and inputs on the model results. In addition, Denver Water funded updating the watershed model by adding additional years of analysis to the original period of analysis. The purposes of the modeling efforts started in 2021 were to:

- ✓ Prepare a more robust model by expanding the model simulation period
- ✓ Simulate the watershed response to removal of modeled point source discharges
- ✓ Simulate the watershed response to wastewater facilities operating in the future at their full wasteload allocations



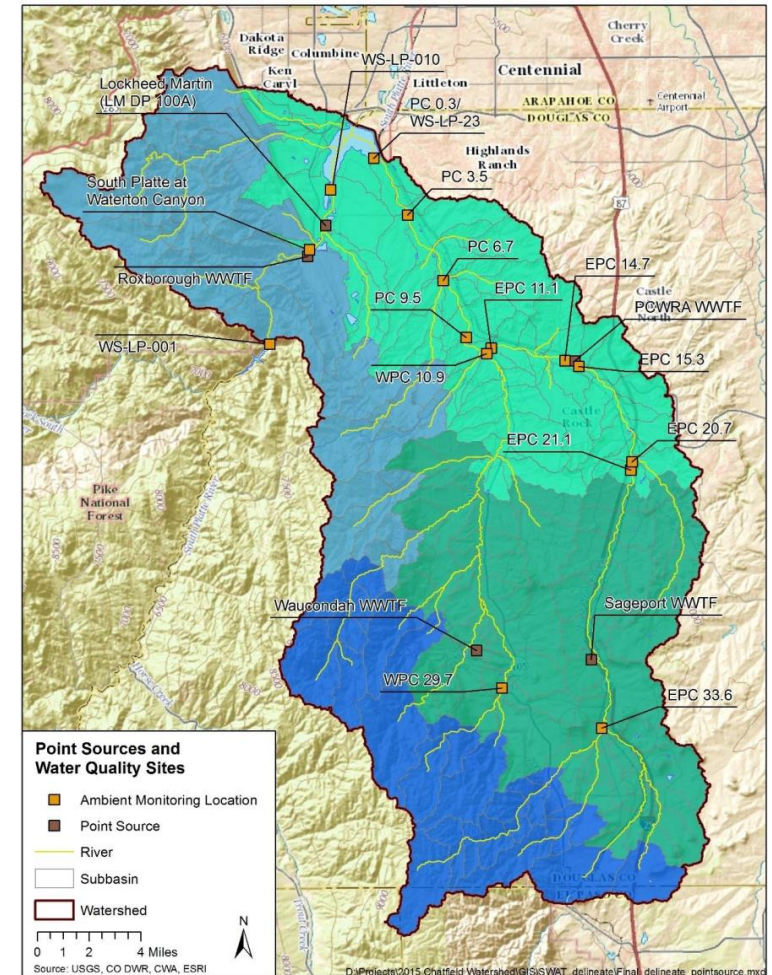
Analysis 1: Watershed Simulated without Point Source Discharges

- ∕ The Chatfield watershed model was used to run scenarios with the point sources turned off. This simulated PCWRA, Lockheed Martin, Sageport WWTF, Waucondah, and Roxborough WWTF discharging no flow, total phosphorus or other water quality constituents into the watershed.
- ∕ The model was run for the full period of record (January 1995 to September 2015) and analyzed the results from January 2000 to December 2014, representing the calibrated model record.
- ∕ On average, the total phosphorus contribution from the South Platte River **decreased by 360 pounds per year** and the total phosphorus contribution from Plum Creek **decreased by 1,740 pounds per year.**



Analysis 2: Full Wasteload Allocation Simulation

- / The Chatfield watershed model ran a scenario where 4 of the 5 point modeled point sources discharge their full wasteload allocation to represent a future potential buildout condition.
- / The TP load simulated by the model in the wasteload allocation scenario is 5,699 pounds (lbs)/year, which represents 75% of the TP wasteload allocation for all point sources in the watershed (7,605 lbs/year).
- / The full wasteload allocation modeling scenario simulates an increase of approximately 3,458 pounds of TP per year
 - / about 950 pounds are to the South Platte River
 - / 2,500 pounds to Plum Creek



COLORADO SCHOOL OF MINES FIELD STUDY

6 groups of ~5 students visited over 30 sites in the watershed in 2022

Locations CRC2, EPC17, and CRC1:

Arsenic and thallium were measured above drinking water standards, and selenium reported below detection limits.

Locations EPC13, EPC14, EPC15, and EPC16:

E. coli and selenium were detected in low concentrations in all samples.

Locations EPC9, EPC10, EPC11, and EPC12:

High levels of E. coli were measured in EPC9, EPC10, and EPC11.

Locations EPC5, SG1, EPC6, EPC7, and EPC8:

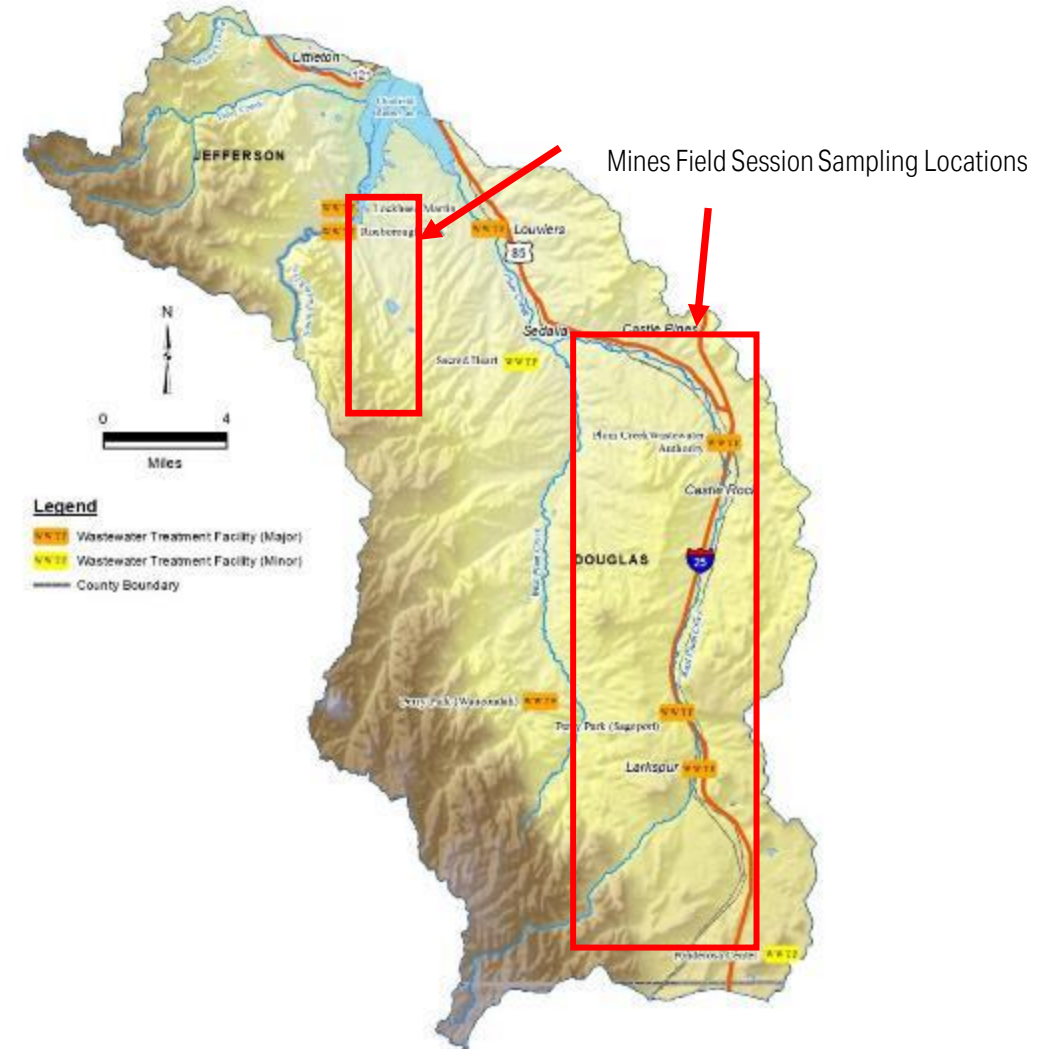
Arsenic was measured above drinking water standards and E. coli was detected at EPC5, SG1, and EPC6.

Locations EPC1, EPC2, EPC3, and EPC4:

Selenium exceeded the EPA aquatic life standard at EPC3. E. coli did not exceed any standards at any site.

Locations WC1, WC2, WC3A, and WC3:

Selenium exceeded CDPHE chronic and acute exposure levels at WC2.



COLORADO SCHOOL OF MINES FIELD STUDY

Example Results

				Analyte (mg/L)								Anion (mg/L)	Pathogens (cfu/100mL)			
Standard				As	Se	P	Tl	Al	Fe	Zn	Pb	F-	Total Coliform	<i>E. coli</i>		
E Plum Creek above Larkspur Analysis 2021 Group 1: Torre Brown, Abby Bullard, Ashley Dunivan, Camila Garcia-Ferreya, Perla Lyon, Linh Vo				EPA Aquatic Life Chronic [1]	0.15	0.0031	0.01	N/A	N/A	1	0.12	0.0025	N/A	N/A		
				EPA Aquatic Life Acute [1]	0.34	N/A	0.01	N/A	N/A	N/A	0.12	0.065	N/A	N/A	N/A	
				EPA Recreation [2]	1.8E-05	0.17	N/A	0.0002	N/A	N/A	7.4	N/A	N/A	N/A	N/A	
				EPA Drinking [3]	0.01	0.05	N/A	0.002	N/A	N/A	N/A	N/A	0.015	4	N/A	N/A
				CDPHE Chronic [4]	2E-05	0.0046	0.17	N/A	N/A	WS	0.0082	N/A	N/A	N/A	200	126
				CDPHE Acute [4]	0.34	0.0184	N/A	N/A	N/A	N/A	0.11	0.05	N/A	N/A	200	N/A
				USDA Livestock [5]	0.01	0.05	N/A	N/A	5	0.3	25	0.015	2	200	N/A	
Detection Limit				0.008	0.008	0.002	0.0006	0.0042	0.0003	0.0031	0.0057	0.1	1	1		
Site	Sample ID/Type	Date	Description	Location	BDL: below detection limit											
CRC2	G1.1 / water	5/18/2021	Creek by I-25	39.132494 -104.51613	2.1E-02	2.0E-02	BDL	6.6E-03	5.1E-02	4.5E-01	3.4E-03	BDL	0.27	1550	17.3	
CRC2	G1.2 / water	5/18/2021	Holding pond by I-25 (south entry ramp)	39.132494 -104.51613	3.3E-02	BDL	1.7E-01	2.3E-02	1.97	1.42	2.5E-02	1.1E-02	0.28	>2420	155	
COC2	G1.3 / water	5/18/2021	Creek with culvert going under road	39.93631 -104.545603	1.2E-02	BDL	4.8E-02	9.1E-03	5.8E-01	3.0E-01	BDL	BDL	1.52	238.2	10.1	
EPC17	G1.4 / water	5/18/2021	Creek running under bridge	39.111605 -104.552934	1.3E-02	BDL	2.6E-02	1.1E-02	6.8E-01	3.6E-01	1.3E-02	BDL	1.53	167	21.2	
EPC14a	G1.5 / water	5/18/2021	Creek by railroad	39.234081 -104.880302	1.6E-02	BDL	9.8E-03	6.0E-04	3.6E-01	3.6E-01	BDL	BDL	1.42	1986.3	6	
EPC14a	G1.6 / water	5/18/2021	Storm runoff under railroad	39.234081 -104.880302	2.3E-02	BDL	2.3E-01	2.2E-02	2.46	1.38	2.2E-01	6.0E-02	0.34	>2420	214	
EPC14a	G1 / soil	5/18/2021	Erosion bank by creek	39.234081 -104.880302	BDL	BDL	2.0E-01	6.6E-03	1.4E-01	1.1E-01	3.2E-02	BDL	X	X	X	
CRC2	G1.7 / water	5/21/2021	Holding pond by I-25 (south entry ramp)	39.132494 -104.51613	3.6E-02	2.3E-02	1.3E-01	1.4E-02	BDL	5.7E-01	1.6E-02	BDL	X	X	X	
CRC2	G1.8 / water	5/21/2021	Holding pond by I-25 (south exit ramp)	39.132494 -104.51613	2.6E-02	BDL	2.5E-01	8.3E-03	1.06	1.23	4.8E-02	1.2E-02	X	X	X	
COC2	G1.9 / water	5/21/2021	Creek with culvert going under road	39.93631 -104.545603	1.1E-02	BDL	1.5E-02	3.2E-03	3.6E-01	2.2E-01	6.5E-03	BDL	X	X	X	
EPC17	G1.10 / water	5/21/2021	Creek running under bridge	39.111605 -104.552934	BDL	BDL	2.6E-02	4.2E-03	4.1E-01	2.5E-01	9.7E-03	BDL	X	X	X	
EPC14a	G1.11 / water	5/21/2021	Creek by railroad	39.234081 -104.880302	BDL	BDL	4.7E-02	5.4E-03	2.4E-01	3.4E-01	7.3E-03	BDL	X	23.4	2	

[1] US EPA, O. (2015). "National Recommended Water Quality Criteria - Aquatic Life Criteria Table." US EPA, Data and Tools. <<https://www.epa.gov/wqc/national-recommended-water-quality-criteria-aquatic-life-criteria-table>>
 [2] US EPA, O. (2015). "National Recommended Water Quality Criteria - Human Health Criteria Table." US EPA, Data and Tools. <<https://www.epa.gov/wqc/national-recommended-water-quality-criteria-human-health-criteria-table>>
 [3] US EPA, O. (2015). "National Primary Drinking Water Regulations." US EPA, Overview and Factsheets. <<https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations>>
 [4] "Water Quality Control Commission regulations." Department of Public Health & Environment. (n.d.). <<https://dohps.colorado.gov/water-quality-control-commission-regulations>>
 [5] Coppenhaver, G. (n.d.). "United States Department of Agriculture." 31.





FUNDING OF NON-POINT SOURCE PROJECTS

- West Plum Creek Stream Management Plan (Total Cost \$265,786 with \$31,000 in-kind match funding, of which \$5,000 cash and \$5,000 in-kind services contributed by CWA).
- Colorado School of Mines Field Session (\$5,000 in-kind services contributed to CWA)

PLANS FOR 2023

- Further explore the relationship of total phosphorus and chlorophyll α in Chatfield Reservoir
- Continue to partner with the Colorado School of Mines for watershed sampling and analysis
- Perform additional watershed modeling and explore potential for linkage with the existing Chatfield Reservoir model
- Implement the NRCS NWQI grant



QUESTIONS?

