

C2.04 - City of Kyle Water Treatment Plant

Beth Agee, Isaac Cisneros, Jesus Galvan
Sponsored By: Josh Milks // STV



Problem Statement

Rising Star Water CO. has been tasked with designing a 19.5 MGD groundwater treatment plant for the City of Kyle. The plant is developed to comply with TCEQ primary and secondary drinking water standards, with the Carrizo-Wilcox Aquifer serving as its water source.

Contaminants

The Table depicts the average constituent levels from eleven test water wells.

Regulated Inorganic Contaminants

Constituent	Units	Secondary Standard	Average Constituent Levels Across 11 Test Wells
Hydrogen Sulfide	ppm	0.05	0.24
Dissolved Iron	ppm	0.3	2.8
Iron	ppm	0.3	6.45
Dissolved Manganese	ppm	0.05	0.16
Manganese	ppm	0.05	0.17

Organic Contaminants

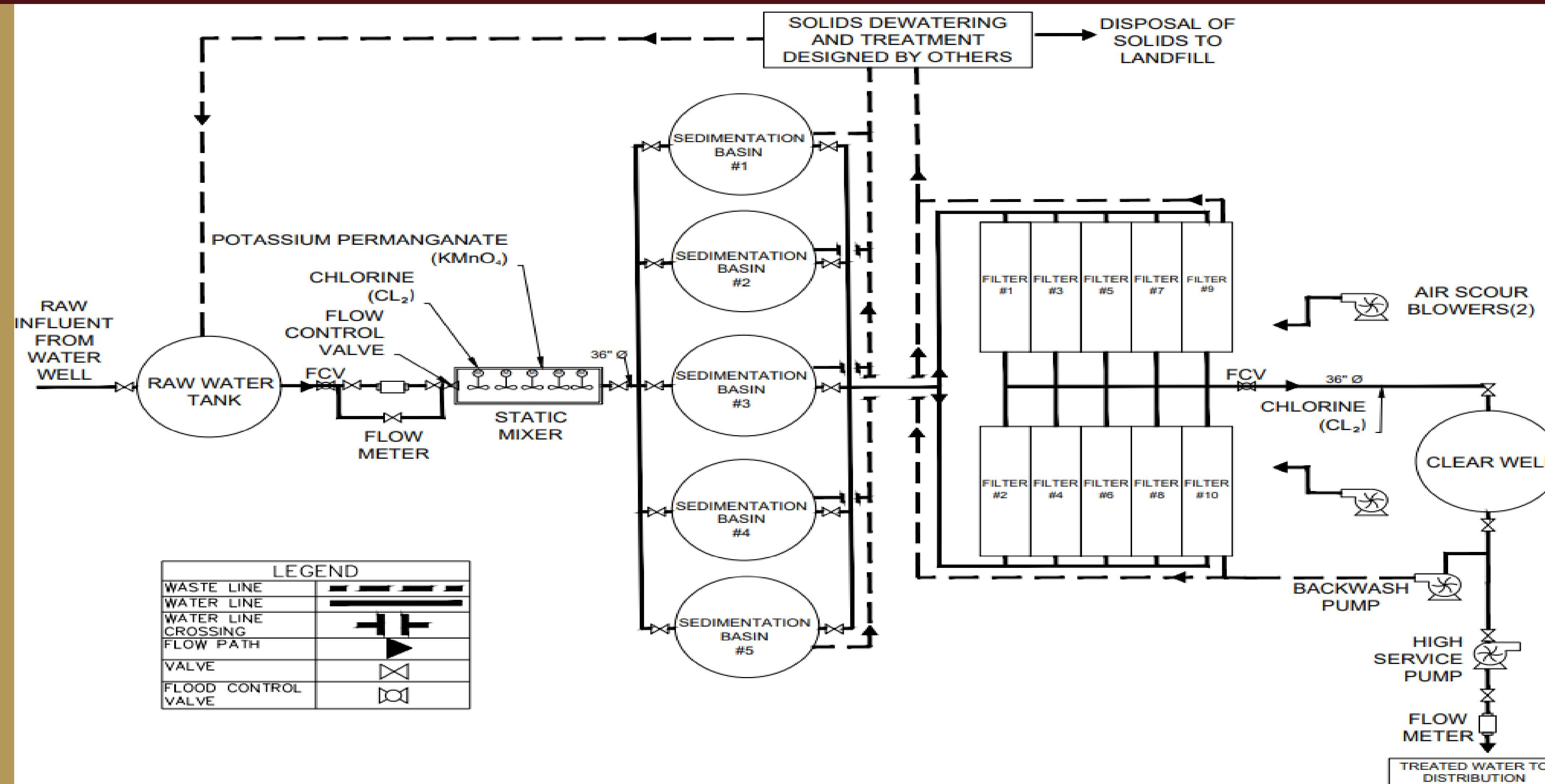
Constituent	Units	Primary Standard	Average Constituent Levels Across 11 Test Wells
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SOCs			
Polychlorinated biphenyls	ppm	0	<0.1

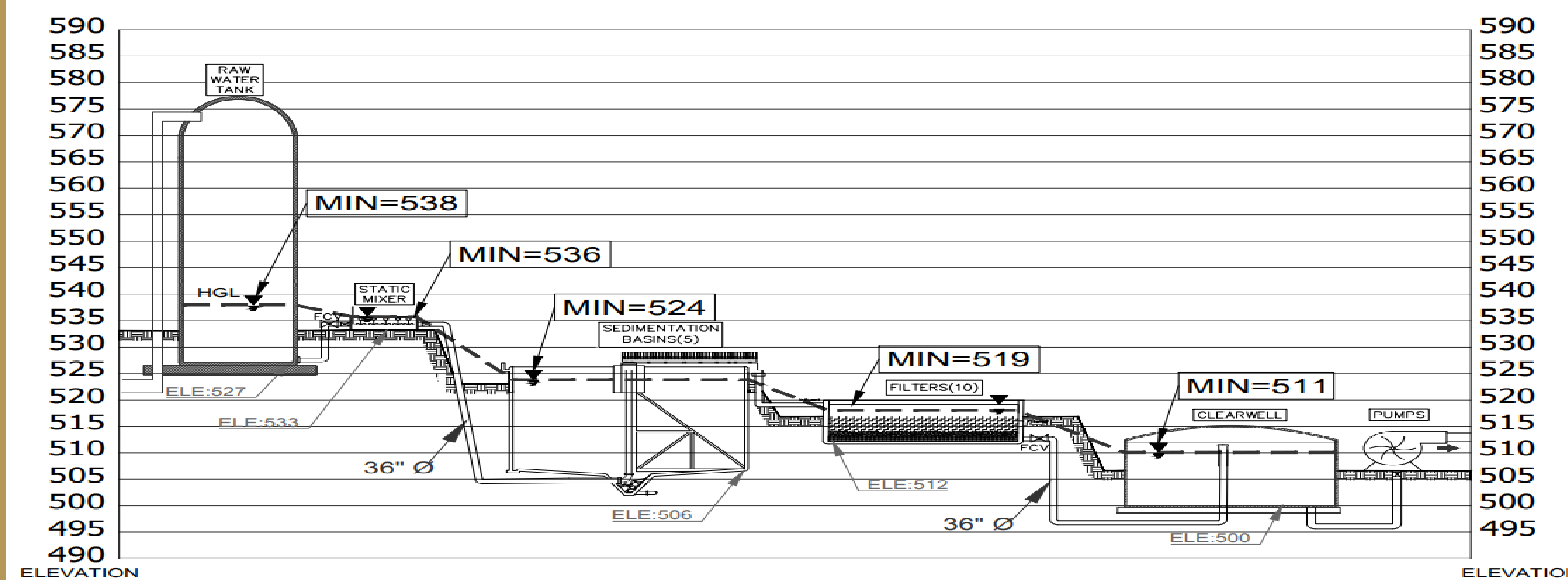
Constraints

- 56-million-dollar budget
- TAC 290
- TCEQ standards
- Topography

Process Flow Schematic



Element Design - Hydraulic Profile



Element Design – Solids Loading Rate

Solids Loading Rate Calculation					Total Oxidated by Chemicals		Solids Removed at Clarification			Solids removed at filtration				
contaminant	TCEQ standard (PPM)	standard (LBS/gal)	Concentration (ppm)	Total Weight (lbs/day)	Meets Or Exceeds Standard	95% oxidation by chemicals	Totals After Oxidation (LBS)	Meets Or Exceeds Standard	85% removal at clarifier	Totals after clarification (LBS)	Meets Or Exceeds Standard	Removal at filtration (LBS)	Totals After Filtration (LBS)	Effluent Water concentration (PPM)
Iron	0.3	48.76	6.45	1048.45	Exceeds	0.00	1479.28	Exceeds	1267.38	221.89	Exceeds	221.89	0.00	0.00
Dissolved Iron	0.3	48.76	2.79	453.51	Exceeds	430.84	22.68	Meet	22.68	22.68	Meet	0	22.68	0.140
Manganese	0.05	8.13	0.17	27.63	Exceeds	0.00	52.34	Exceeds	44.49	7.85	Meet	7.85	0.00	0.00
Dissolved Manganese	0.05	8.13	0.16	26.01	Exceeds	24.71	1.30	Meet	1.30	1.30	Meet	0	1.30	0.008
Hydrogen sulfide	0.05	8.13	0.24	39.01	Exceeds	37.06	1.95	Exceeds	1.95	0.000	Meet	0	0.00	0.000
PCB	0	0	<0.00001	<0.0002	Exceeds	0	<0.0002	Exceeds	<0.0002	<0.0002	Exceeds	<0.0002	0	0.000
Totals				1594.61 lbs/day					1327.81 lbs/day			229.74 lbs/day		
												Total Solids Removed	1557.55 lbs/day	

Team Members



From left to right: Jesus Galvan, Beth Agee, Isaac Cisneros

Summary Cost

Opinion of Probable Construction Cost				
ITEM	DESCRIPTION	UNIT	QUANTITY	UNIT PRICE(\$)
1	Mobilization, Bond And Insurance	L.S	1	\$100,000
2	Construction Operations	L.S	1	\$194,519
3	Gravity Filter	EA.	10	\$900,000
4	Static Mixer	EA.	1	\$35,000
5	Sedimentation Basin	EA.	5	\$2,500,000
6	Clear Well	EA.	1	\$3,000,000
7	Sedimentation tanks	EA.	5	\$950,000
8	HMAC Roads(Width 25ft)	L.S	1	\$225,000
9	Control and Supply Building (100ft x 100ft)	L.S	1	\$850,000
10	Chlorine Injection Disinfection	EA.	1	\$100,000
11	Raw Water Tank	EA.	1	\$3,000,000
12	Piping and Valves	LF	700	\$250
				20% Contingency and other FEE's
				\$13,000,000
				TOTAL ESTIMATED COST
				\$47,000,000

Life Cycle Cost

Using a design period of 100 years with 4% discount rate
RSW estimates the following:
Initial Construction of WTP = \$47 Million
Maintenance every 15 years
Double capacity at 10 years
Rehabilitation (30,60,and 100 years)
Total Net Present Value = \$210 Million

Conceptual Model

