

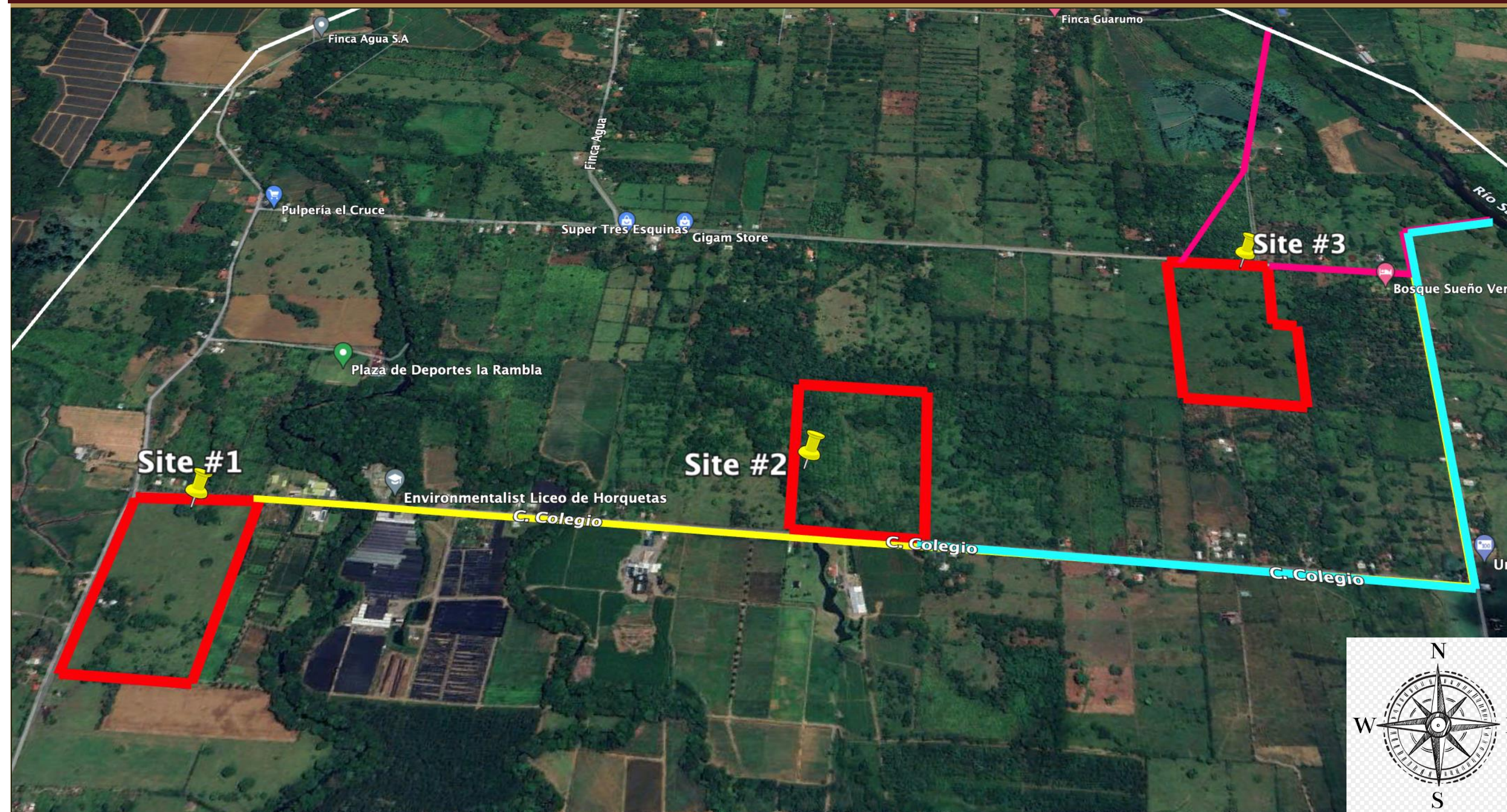
C1.04 – Designing a Wastewater Treatment System in Horquetas, Costa Rica

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Problem Statement

The team will design a wastewater treatment plant for the town of Horquetas, Costa Rica. Some challenges for the project include the city's mountainous terrain, seasonal tourism, population growth, and affordability. The project will replace households' individual septic systems. The community needs a centralized system to stop septic tank effluents from being washed away by runoff.

Alternatives Considered



Our alternatives based on a grading scale that considered key factors such as lot size, flood potential, and potential for lingering odors to disturb the community's nearby schools and residences. Alternatives 1, 2, and 3 would require pumps to discharge into the river. Alternative 4 would discharge by gravity without the use of a pump, however its discharge path would cut through several properties.

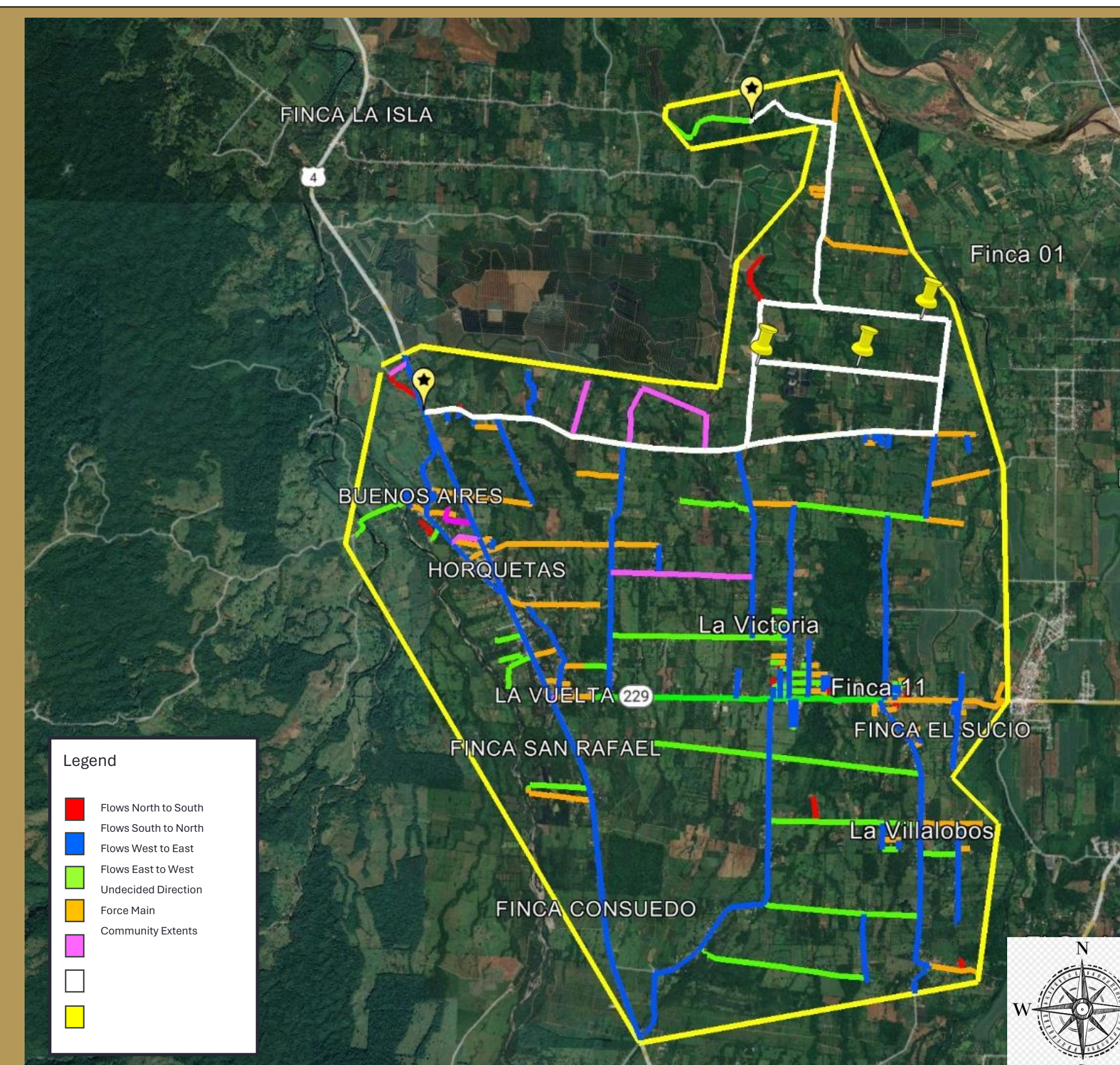
	Weights	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Lot Size	2	6	5	7	7
Cost	6	4	4	5	6
Flood Potential	8	3	8	5	5
Distance From Schools	5	1	8	10	10
Total		65	138	134	140

Life Cycle Cost Analysis

Item	Units	Unit Cost (USD)	Quantity	Cost (USD)
PVC Pipe, 8"	Linear ft	28.04	390,672	\$10,954,442.88
PVC Pipe, 10"	Linear ft	37.39	49,955	\$1,867,317.90
PVC Pipe, 12"	Linear ft	48.6	32,920	\$1,599,912.00
House Connection	house	186.92	5,615	\$1,049,532.71
Manholes (Lid and Frame)	manhole	1,775.70	900	\$1,598,130.84
200,000 GPD Packaged Lift Station	each	298,800.00	1	\$298,800.00
800,000 GPD Packaged Lift Station	each	422,400.00	1	\$422,400.00
			Total	\$17,790,536.33

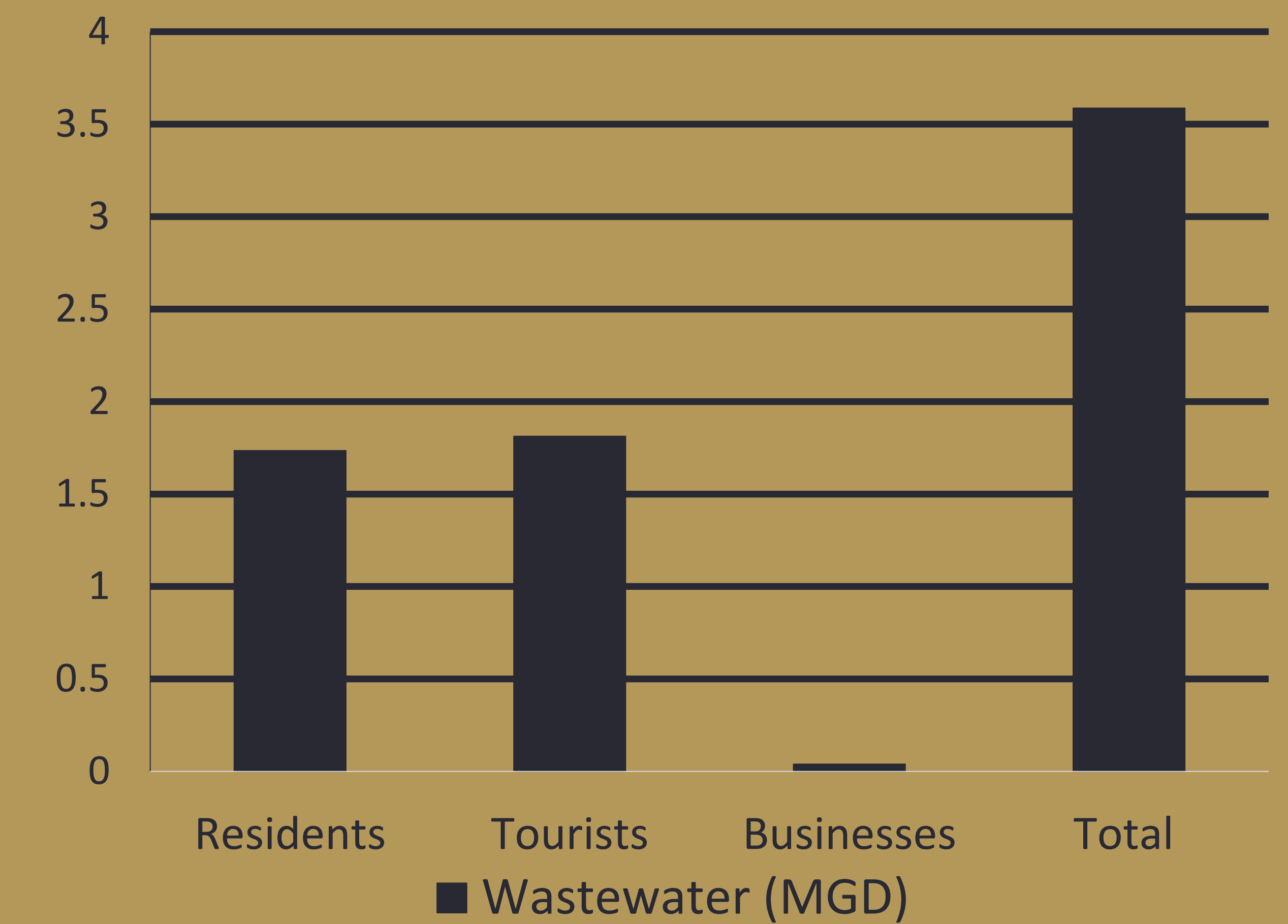
- Data was referenced from the city of Kyle, Texas' WWT plant.
- Design period of 50 years with 4% discount rate.
- \$30 million to construct Horquetas' WWTP based on 3 bids from contractors to build Kyle's plant.
- \$75 million for Operation and Maintenance for the 50-year lifespan of the plant, based on Kyle's \$3.5 million per year.
- \$1.4 million for rehabilitation
 - The pumps of both lift stations will need to be replaced every 20 years, twice over 50 years.
- \$4.7 million salvage value.

$$NPV = 47 + 75 + 1.4 - 4.7 = \$118.7 \text{ Million}$$



Community Outlook

Wastewater Generated in 10 Years



Sustainability

VERIFIED 23%	Submitted Score Information			
	Credit Category	Applicable	Submitted	Percentage
	Quality of Life	156	45	29%
	Leadership	182	45	25%
	Resource Allocation	196	66	34%
	Natural World	170	26	15%
	Climate and Resilience	170	23	14%
	Total Points / %	874	205	23%

Constraints & Standards

- 30 Texas Administrative Code (2020).
- ASCE Manuals and Reports on Engineering Practice No. 60