C2.03 – San Marcos Wastewater Force Main

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Sponsor: Freese and Nichols

TEXAS STATE INGRAM SCHOOL OF ENGINEERING

PRIMESTREAM PIPING

FREESE AND NICHOLS

Project Overview

The increasing population in San Marcos Texas requires improvements in the conveyance of wastewater for surrounding developments to the city's wastewater treatment plant. We are tasked to design a wastewater force main to operate with an existing 6 MGD lift station.

Constraints and Standards

Texas Administrative Code Title 30 Part 1 Chapter 217 – Subchapter A, B, & C

Texas Administrative Code Title 43 Part 1 Chapter 21 – Subchapter C

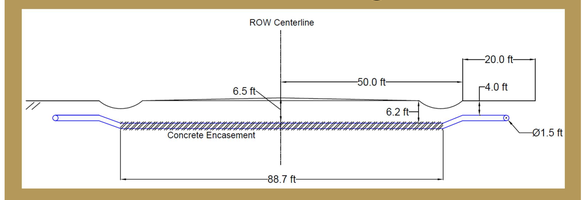
Hays County Development Regulations Chapter 715 – Subchapter 4

City of San Marcos Standard Details – Series 500

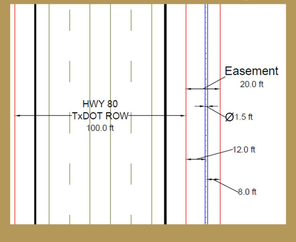
City of San Marcos Infrastructure Utilities Criteria Manuals – Wastewater Design Guide

Force Main Alignment

HWY-80 Vertical Alignment



HWY-80 Horizontal Alignment



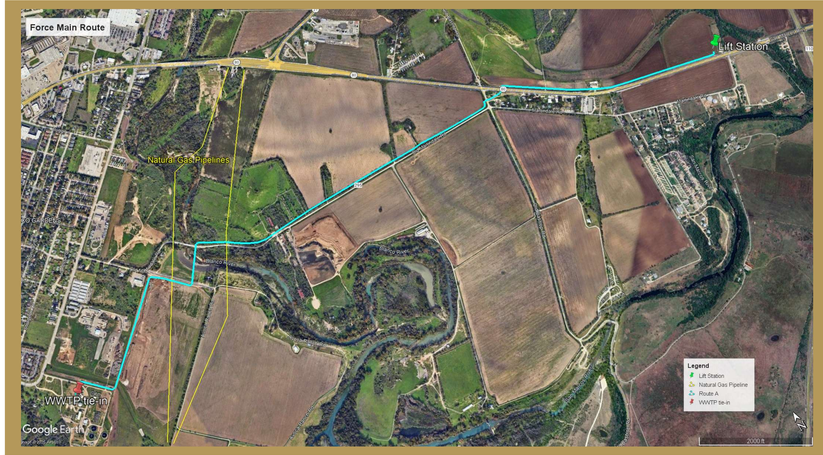
Highway 80 was selected to showcase the representative alignment for the full pipeline route

Sustainability Analysis

ISI Envision Framework was used and a verified score of 24% was achieved.

	Submitted Score Information		
Credit Category	**Applicable**	**Submitted**	**Percentage**
Quality of Life	184	52	28%
Leadership	*Not Applicable*		
Resource Allocation	196	33	17%
Natural World	232	57	25%
Climate and Resilience	42	14	33%
Total Points / %	654	156	**24%**

Pipeline Design Specifications



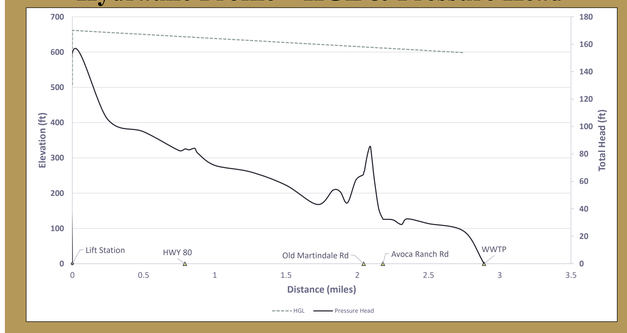
System Design Specifications	
Route Length	2.89 miles
Material	HDPE
Installation Method	Horizontal Directional Drilling & Open Trenching
Pipe Inner Diameter	18 in
Flowrate	6 MGD
Velocity	5.3 ft/s
Max Operating Pressure	66.52 psi
Max Surge Pressure	128.27 psi
Pipe Strength Rating	130 psi & 100 psi
Surge Mitigation	14 ARVs needed

Hydraulic Design

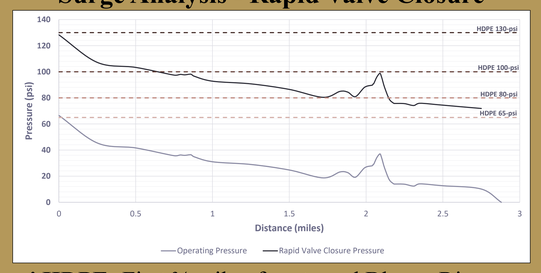
Hydraulic analysis was conducted to evaluate system behavior under steady and transient conditions

Results confirm performance reliability across all operating scenarios

Hydraulic Profile – HGL & Pressure Head

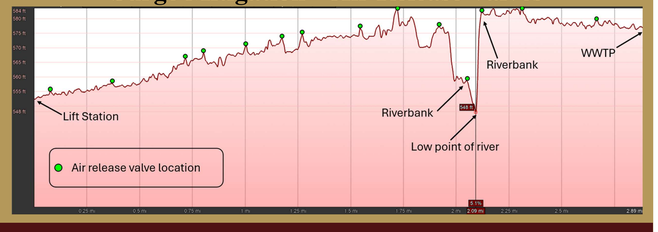


Surge Analysis - Rapid Valve Closure



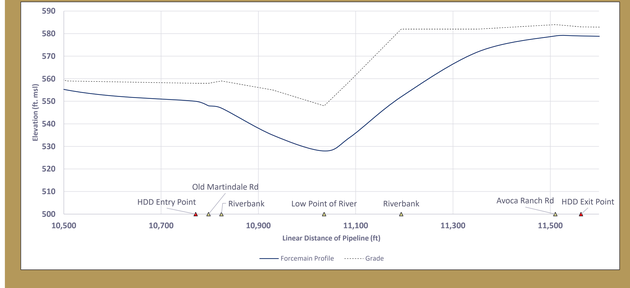
130 psi HDPE: First ¾ mile of route and Blanco River crossing
100 psi HDPE: Rest of route

Surge Mitigation – Air Release Valves



HDD Design - Blanco River Crossing

Vertical Alignment Profile – HDD Borehole

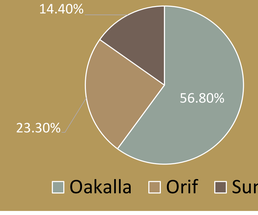


Min depth of cover: 5ft under roadways & 20ft under riverbed

Horizontal Directional Drill Process

Pilot Bore (6" diameter) → Back-ream #1 (15" diameter) → Back-ream #2 w/ Pipeline Pullback (20" diameter)

Geotech Analysis at Drilling Location



Bentonite slurry selected for drilling fluid

- *Increases borehole stability*
- *Lubricates drilling head*
- *Reduces pullback friction*

Meet the Team

Cameron, Ethan, Raul

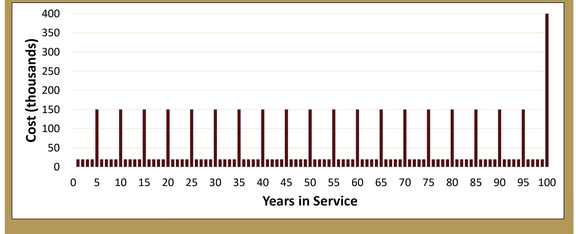
Special thanks to our sponsor, Freese and Nichols – Caden Smith, Collin Brewer, Ryan Ramsey

Cost Analysis

Capital Cost

Opinion of Probable Construction Costs				
Item	**Measurement**	**Unit**	**Unit Cost**	**Total Cost**
Land Acquisition				
ROW private easement	7	Acre	$30,000	$210,000
Temporary construction easement	3.5	Acre	$600	$2,100
Construction Materials				
HDPE, 18-inch diameter (50 ft sections)	15,143	LF	$38	$575,434
3–4-inch crushed limestone	4,400	CY	$40	$176,000
Concrete Encasement	250	LF	$96	$24,000
Air release valve, 3-inch orifice	12	EA	$2,537	$30,444
Isolation valve	12	EA	$10,000	$120,000
Elbows, 45 degree	25	EA	$2,400	$60,000
Thrust block	25	EA	$2,000	$50,000
Coupling (restrained joint)	280	EA	$3,000	$840,000
Water for dust suppression & HDD drill	10,000	Gal	$0.002	$20.00
Machinery				
CAT Excavator 313	3	Monthly	$15,500	$46,500
CAT Pipelayer	3	Monthly	$14,600	$43,800
Backhoe loader (68-70 HP)	3	Monthly	$2,700	$8,100
HDD Vermeer D100X140 S3	3	Monthly	$70,000	$210,000
Vermeer R250C Drill Fluid Reclaimer	3	Monthly	$50,000	$150,000
Water truck (2000-gallon capacity)	3	Monthly	$8,000	$24,000
Safety/Personnel				
Labor	2,500	Hrs	$150	$375,000
PPE	25	EA	$250	$6,250
Silt Fence	30,000	LF	$5	$150,000
			Total Cost	**~$3,100,000**
			Total Cost w/ 15% cont.	**~$3,600,000**

Life Cycle Cost



Annual O&M: $20,000
ROV inspection every 5 years: $85,000
Ice pigging every 5 years: $45,000
Grout fill at end of service life: $400,000
Total life cycle cost: $4.85 Million