Basis of Design Report
Wheatland Regional Sewer Pipeline Project

FINAL

4/23/2021

Prepared For:

City of Wheatland
111 C Street
Wheatland, CA 95692

Prepared By:

Dane Schilling, PE
Coastland Civil Engineering
11641 Blocker Drive, Suite 170
Auburn, CA 95603

COASTLAND

REGISTERED PROFESSIONAL ENGINEER
DANE HARLAN SCHILLING
No. 56908
CIVIL
STATE OF CALIFORNIA

Dan Rich, PE
NEXGEN UM, Inc.
4010 Lennane Drive
Sacramento, CA 95834

NEXGEN
UTILITY MANAGEMENT

REGISTERED PROFESSIONAL ENGINEER
DANIEL RICH
NO. 56365
Exp. 3-31-2021
CIVIL
STATE OF CALIFORNIA

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SECTION 1 – SUMMARY

The goals of the Wheatland Regional Sewer Pipeline Project (Project) are to increase the wastewater treatment capacity available to the City of Wheatland (City) and to replace the function of the City's aged wastewater treatment plant. To accomplish these goals the City has chosen to pursue a solution that involves decommissioning the existing wastewater treatment plant and replacing it with a series of pipelines and pump stations to convey wastewater to a regional sewer system north of the City to be treated by Olivehurst Public Utilities District (OPUD) and/or Linda County Water District (LCWD).

The Project in itself is not the complete work necessary to connect Wheatland's wastewater system to another wastewater treatment provider. The Project's northerly terminus is near the intersection of Highway 65 and Rancho Road in Yuba County just inside OPUD's newly annexed service area. Other activities that are underway for completion of a regional connection are as follows:

- OPUD is preparing construction documents for construction of new water and sewer facilities to serve the Highway 65 corridor and Entertainment Zone in the South County.
- Discussions between OPUD and LCWD regarding immediate and long-term treatment capacity have been occurring over the last year.
- Discussions are underway between the City and OPUD regarding Wheatland's treatment needs including EDU count, flows, and connection details.

The idea of a regional sewer project to serve the South County has been under development for several years (see Section 2). Most recently, the City of Wheatland applied for and received a grant from the Yuba Water Agency (YWA) to prepare construction drawings for the "Wheatland portion" of the work to create regional sewer infrastructure.

Because of the potential for stimulus funds in the near future, the goal is to complete "shovel ready" plans, acquire rights of way and obtain environmental clearance for the Project by Fall 2021.

This Basis of Design Report (BODR) is the next phase in the process of becoming shovel ready. It will be followed by field investigations, 50% Design, 90% Design, and Final Design phases. Efforts to obtain rights of way and obtain environmental clearance are occurring concurrent and coordinated with the design phases.

The purpose of the report is to:

1. Identify flow conditions by area for current level of development and predict flows for the end of the design period for the project (Section 3). A summary of Equivalent Dwelling Unit (EDU) capacities and flows in gallons per minute (gpm) they produce is:

Condition	Total EDU	Pump Station 1		Pump Station 2 & Pump Station 3	
		EDU	Max Flow (gpm)	EDU[1]	Max Flow[1] (gpm)
Initial/Existing City	1,520	1,520	1,080	1,520	1,080[2]
Design	5,500	2,880	1,680	5,500	3,080[3]

[1] Includes values from PS1 columns.
[2] Exceeds current OPUD maximum allowable flow of approximately 560 gpm into their system.
[3] Exceeds current OPUD maximum allowable flow of approximately 2,030 gpm into their system.

Table 1-1 Summary of EDU and Flows

2. Decide on a set of published standards on which to base the design (Section 4). These include national standards developed by the engineering community, best practices of the industry, state requirements, local standards that take into account what works best for the City, and project-specific standards like easement requirements and environmental considerations.

3. Identify pipeline alignments and pump station locations (Section 5 and Appendix 1). This is shown diagrammatically on the map in Appendix 1 and was used to determine pipeline lengths for pump sizing calculations, and will soon be used for land acquisition, environmental surveys, land surveying, and geotechnical activities.

4. Summarize preliminary calculations in order to identify the pipeline parameters such as diameter and pressure rating, and to identify pipeline appurtenances necessary for proper operation (Section 5 and Appendix 2). High Density Polyethylene (HDPE) has been chosen as best overall material for the majority of the pipelines:

Parameter	Force Main 1	Force Main 2	Gravity Sewer
Material	HDPE	HDPE	PVC**
Diameter	12-inch	18-inch	36-inch**
Thickness class	DR 17	DR 17	SDR 26**
Pressure class	125	125	N/A
Total Length	8,330 LF	30,400 LF	990 LF

Table 1-2 Summary of Sewer Mains

***Note that the Gravity Sewer pipe type is shown as PVC SDR-26, but HDPE will also be reviewed during design and a determination will be made at that time as to which pipe is most appropriate.*

5. Summarize preliminary calculations in order to identify pump station parameters such as pump horsepower and wet well dimensions. (Sections 6, 7, and 8, and Appendix 2). These calculations will also develop parameters such as flows vs time and connection point(s) to allow further discussion with Olivehurst Public Utility District (the receiver of Wheatland wastewater flows).

Parameter	PS 1	PS 2	PS 3
Location	Malone, south of Main	Jasper, approx. 1,000 ft north of Spenceville	Rancho, near SR 65
Pump Horsepowers	75/75/75	75/75/75 75/75/75	75/75/75
Flow Range	270-1680 gpm	270-3080 gpm	250-3080 gpm
Wet Well Dimensions	30'l x 9'w x 25'd	30'l x 9'w x 25'd	10'dia x 20' h[1]
Standby Generator Capacity	300 kw	500 kw	300 kw
Storage	40,000 gal underground	800,000 gal ground level[2]	None[1]

[1] Ground level tank will provide static back pressure and limited storage capacity.
[2] Amount of storage may change depending on further discussions with OPUD.

Table 1-3 Pump Station Summary

6. Provide an outline of a work plan of necessary steps for decommissioning and demolishing the existing wastewater treatment plant, including responsible parties for each step (Section 9). Major phases of WWTP work include:
    - o Liquids Management, to be done by City personnel;
    - o Biosolids, which may be done by City personnel or a contractor;
    - o Solid Waste Management, to be done by a contractor;
    - o Demolition of existing buildings and infrastructure, by a contractor;
    - o Earthwork and Final Grading (including soil removal/remediation), to be done by a contractor; and
    - o Discharge Permit Termination, to be done by City personnel or consultants.
7. Provide updated construction phase cost estimates for the project (Section 10 and Appendix 3).

	Pump Stations/ Pipeline	WWTP Decommissioning
Total Estimated Construction Costs:	**$** 25,968,000	$2,060,000
Total Estimated Engineering and Administration Costs:	**$** 3,725,000	$450,000
Total Estimated Cost:	**$** 29,693,000	$2,510,000

Table 1-1 Cost Summary

SECTION 2 – PROJECT BACKGROUND

2.01 City's Past Wastewater Planning Efforts

The City of Wheatland currently owns and operates a wastewater treatment plant (WWTP) with a plant capacity of 0.62 million gallons per day (MGD). The existing WWTP is designed to treat wastewater to a secondary level which is not consistent with current State standards of tertiary treatment. The City's General Plan projects that the City will grow from the current 3,400 residents or approximately 1,200 Equivalent Dwelling Units (EDUs) to approximately 14,600 residents, or 7,300 EDUs. The City generates average dry weather wastewater flow of 0.35 MGD, based on current data. According to the Wastewater Treatment Alternatives Analysis Report adopted by the City Council on December 10, 2019, flows are projected to increase to 3.82 MGD at buildout of the General Plan. The City's current WWTP has reached the end of its useful life which means the City will be facing substantial capital costs just to maintain its current capacity and meet water quality regulations and will be difficult and costly to expand to meet the planned City growth.

Over the last 15 years, the City and several nearby agencies; OPUD, LCWD, Beale Air Force Base (Beale), and the City of Lincoln have participated in several efforts exploring options for a regional wastewater conveyance, treatment, and disposal/reuse system for South Yuba County. Previous studies include the South Yuba County Regional Wastewater Treatment Feasibility Study (2010, Kennedy/Jenks) and a study by Beale in 2012 that engaged the nearby agencies to determine the feasibility of sending Beale wastewater to others to for treatment and disposal. These efforts have had difficulty obtaining consensus due to the varying growth and regulatory timelines of each agency, significant upfront design and construction costs, and difficulty securing the substantial funding required.

More recently, the City commissioned a study in 2019 to evaluate all its wastewater treatment and disposal alternatives. The study examined the feasibility of connecting to either OPUD, LCWD, Beale, or the City of Lincoln. The study also looked at the option to expand the City's existing WWTP or construct a new City owned and operated WWTP. The report concluded that that Beale, Lincoln, and a new or upgraded City owned WWTP were not viable alternatives and recommended connecting to either OPUD or LCWD. It further stated that connecting to either agency is technically feasible, would have lower upfront costs by as much as $14 million, would have lower operating costs, and would be consistent with California State Water Resources Board policy of encouraging consolidation of smaller plants into larger, regional systems. The cost differential between the two agencies was close enough to warrant the next step of negotiating with OPUD and LCWD regarding proposed connection fees and estimated monthly rates. These discussions began in mid-2020 and are currently ongoing.

2.02 OPUD and LCWD Regional WWTPs

Connecting Wheatland to either OPUD or LCWD is both technically feasible and in concert with California State Water Resources Board policy of encouraging consolidation of smaller plants into larger, regional systems. OPUD is in the process of expanding their infrastructure in the newly annexed service area towards Wheatland along the Highway 65 Corridor, making it more convenient for Wheatland to tie in. OPUD needs to account for expected flows from Wheatland in their sewer system design when sizing pipes and pump stations. OPUD has retained an engineer to design their new infrastructure in the South County and is waiting on information from Wheatland and the conclusions contained in this report in order to resume their design efforts.

OPUD has a tertiary WWTP with a capacity to treat and dispose 3 MGD. Approximately 1.5 MGD (5,500 EDUs) of capacity is available at OPUD's plant with minor plant improvements and improvements to the conveyance system. However, OPUD has indicated that it would reserve 0.75 MGD of the 1.5 MGD capacity for it's own service area leaving 0.75 MGD available to Wheatland. OPUD's plant has the space (footprint) to eventually expand to 8 MGD.

LCWD has a tertiary WWTP with a capacity to treat and dispose up to 6.8 MGD with minor improvements. Current flows are about 2.5 MGD. LCWD's plant has the space to eventually expand to 15 MGD. Connecting to LCWD would require longer pipelines to reach the existing LCWD service area when compared to the OPUD alternative.

Connecting Wheatland's existing customers to OPUD was previously estimated at $26 million for construction of new conveyance facilities plus $12 million in connection fees for existing system capacity that OPUD has built or will be building along the Highway 65 Corridor. The City's conveyance cost estimates will be updated as part of this BODR.

Connecting Wheatland's existing customers to LCWD was previously estimated at $34 million for construction of new conveyance facilities plus $10 million in connection fees for existing system capacity.

2.03 Current Project to Convey Wastewater from South County to OPUD or LCWD

OPUD has expanded their service area towards Wheatland along the Highway 65 Corridor commercial and industrial area in south Yuba County, including the Entertainment Zone (currently the Toyota Amphitheater and Hard Rock casino) as shown in light blue on Figure 2-1. This expansion of OPUD infrastructure is expected to occur in the near term as funding is available as well as continued expansion of the Plumas Lake Specific Plan. OPUD is conducting engineering studies to lay out and size the sewers for the newly annexed service area which reaches as far south as South Beale Road and Rancho Road. The Regional Sewer Pipeline Project would then tie in to the OPUD project at Rancho Road and Highway 65.

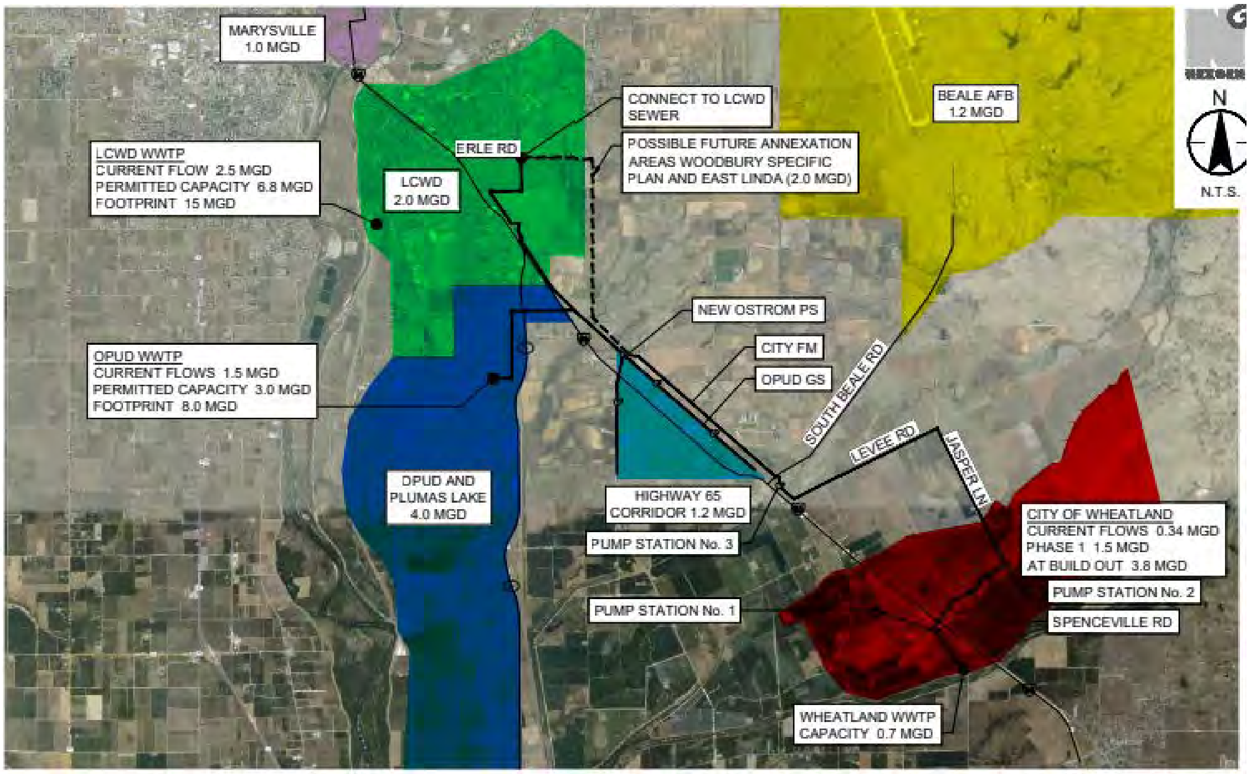

Figure 2-1 Conceptual Pipeline and Pump Station Plan

If LCWD is ultimately selected to receive, treat, and dispose of some or all of Wheatland's flows, then the sewer pipeline would need to be extended approximately 4 miles to tie into their system as it is located further from Wheatland than OPUD. Based on communications with LCWD, the best location to connect Wheatland's flows would be into one of their trunk sewers at the corner of Griffith Avenue and Erle Road.

2.04 City's Project Goals

The City's primary project goal is to construct the necessary pipelines and pump stations to successfully convey all current and future wastewater into a regional sewer system serving south Yuba County. As discussed above, if OPUD is selected, the pipeline will connect to a continuation of the City's force main (currently under design by others) near Rancho Road and Highway 65. OPUD sewers will convey the flow to OPUD's WWTP, where it will be treated to a tertiary level and discharged into a tributary to the Feather River. Alternatively, the City's pipeline may continue farther northward to connect to the Linda County Water District (LCWD) wastewater collection system and then into their WWTP. Lastly, the City's WWTP will eventually be decommissioned and the site re-purposed for sale, into a park or for other uses.

The City's Regional Sewer Pipeline project is currently expected to include the construction of approximately eight miles of pressurized force mains from the existing Malone Pump Station located near the City's WWTP and end near the intersection of South Beale Road and Highway 65. As discussed previously, the pipeline may be extended depending on whether LCWD or OPUD are selected. Most of the pipeline will be routed within existing City and County roadways.

Near the north end, there is an area that will likely go through private properties. Pipeline alignments will be selected to avoid the proposed Highway 65 bypass to the extent possible based on the preliminary bypass information available.

Pipe sizes will range from 12 to 18 inches in diameter and will typically be buried four feet below grade. The pipeline will cross Highway 65 and the Union Pacific tracks in the City, and there will be three additional railroad crossings near South Beale Road. In addition, the project will include two or three creek crossings, with at least one crossing of a levee maintained by Reclamation District 2103. It is preferred by the design team that all highway, railroad, levee and creek crossings will require trenchless construction methods. However, final design of all crossings will be coordinated with the appropriate agency and the design will be updated accordingly.

A new, larger pump station will be constructed to replace the City's existing Malone Pump Station near Malone Avenue and Main Street. In addition, two new sewer pump stations, spaced along the proposed pipeline will be needed. Odors coming from the pump stations may be a concern. Where pump stations are located near homes, odor control systems will be constructed. Other pump stations will be designed with connection points for easy installation of odor controls in the future.

SECTION 3 - EXISTING AND PROJECTED FLOWS

Existing and Projected Flows

The purpose of this section is to define wastewater generation flowrates, peaking factors, pumping rates, and storage requirements for the Wheatland Regional Sewer Pipeline Project.

3.01 Historical Flows into Wheatland WWTP

The City measures daily influent flows into its WWTP. Historical flow data is used to develop average annual flows (AAF), average dry weather flows (ADWF) and peak wet weather flows (PWWF) generated within the City.

3.01.1 Average Wastewater Flows

The last three years of monthly average flows are shown in Table 1. The City currently generates 0.35 MGD ADWF and 0.38 MGD AAF.

	2017	2018	2019	
January	0.48	0.36	0.40	
February	0.43	0.33	0.52	
March	0.33	0.36	0.45	
April	0.33	0.37	0.37	
May	0.30	0.34	0.38	
June	0.32	0.34	0.35	ADWF
July	0.32	0.36	0.34	
August	0.33	0.36	0.36	
September	0.32	0.37	0.36	
October	0.34	0.37	0.35	
November	0.34	0.33	0.33	
December	0.31	0.36	0.36	
AAF	0.35	0.35	0.38	
ADWF	0.33	0.36	0.35	

Table 3-1
Average Monthly Influent Flows into Wheatland WWTP in MGD

3.01.2 Peak Daily Wet Weather Flows

Peak flows generated during rain events are a function of both groundwater infiltration and rainfall inflows. Wetter winters generally produce larger peak flow events. California experienced one of its most persistent droughts from 2011 to 2017, and as a result, many communities' peak wet weather flows were less pronounced during that period. A review of 2016 through 2019 rainfall and flow data indicates six larger storm events producing about 2 inches of rain over 24 hours. Each event resulted in peak daily flows into the WWTP between 1 and 1.11 MGD. Two events in 2019 (Feb 13/14 and Feb 26/27) were two day events and produced sustained flows of 1 MGD each day.

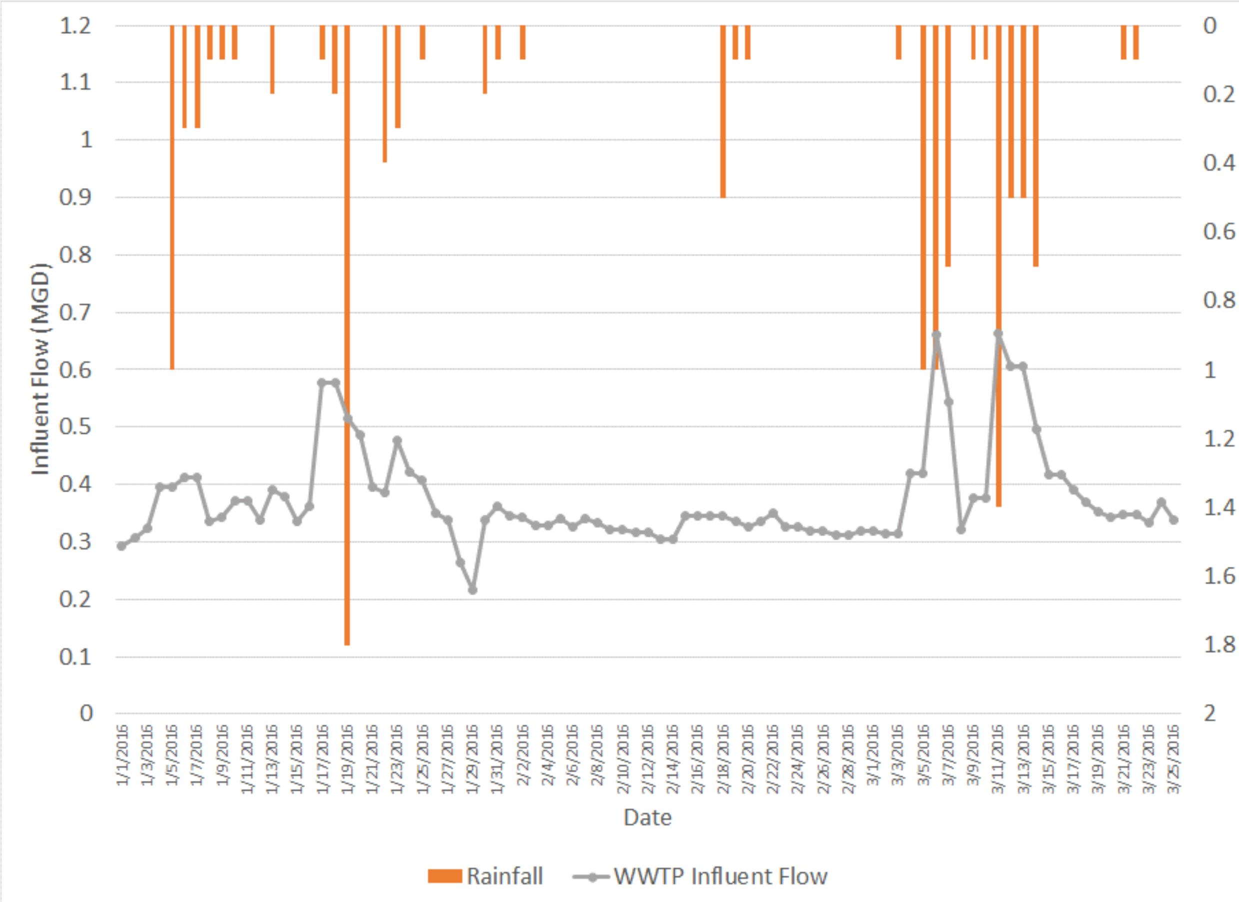

Figure 3-1
Winter 2016 Measured Rainfall and Daily Wastewater Flows into WWTP

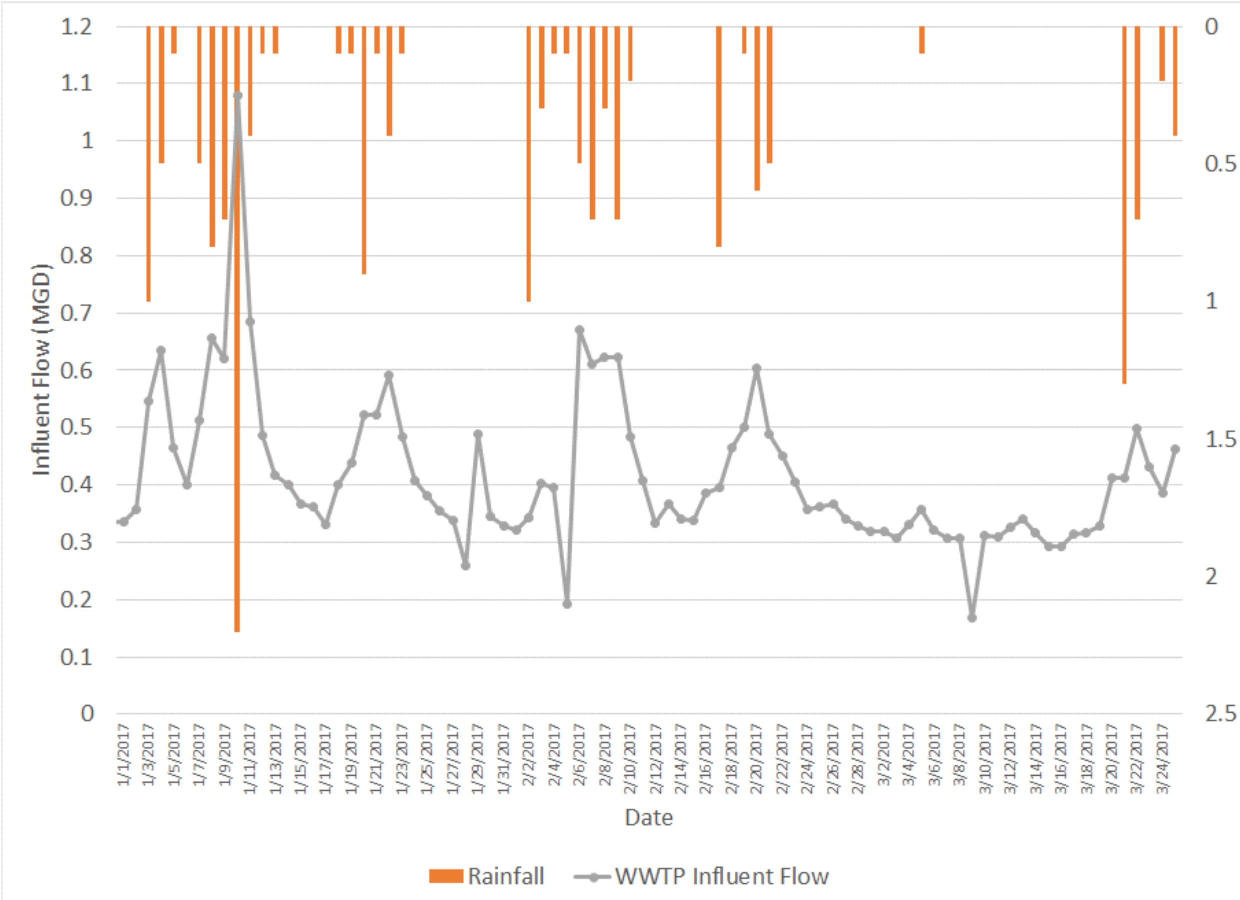

Figure 3-2
Winter 2017 Measured Rainfall and Daily Wastewater Flows into WWTP

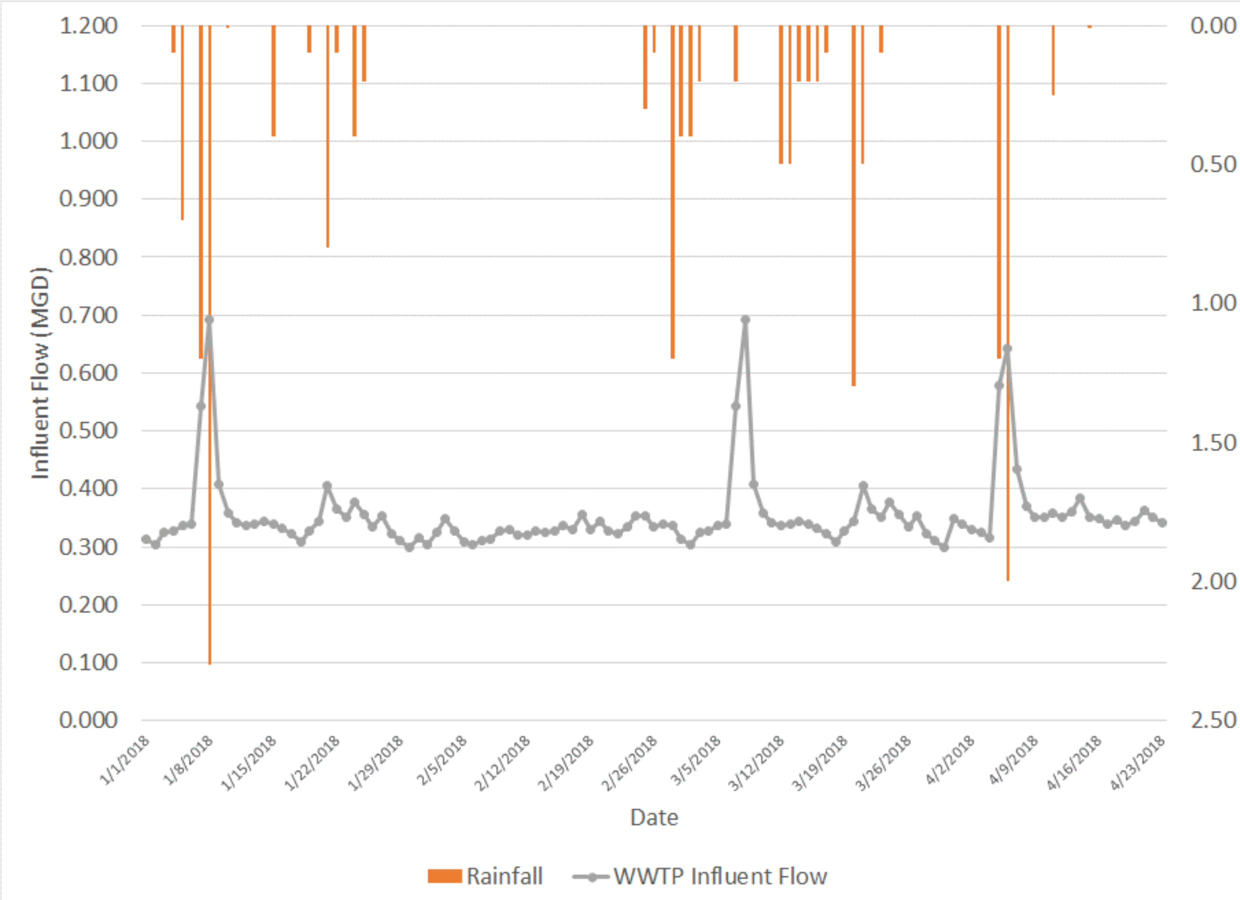

Figure 3-3
Winter 2018 Measured Rainfall and Daily Wastewater Flows into WWTP

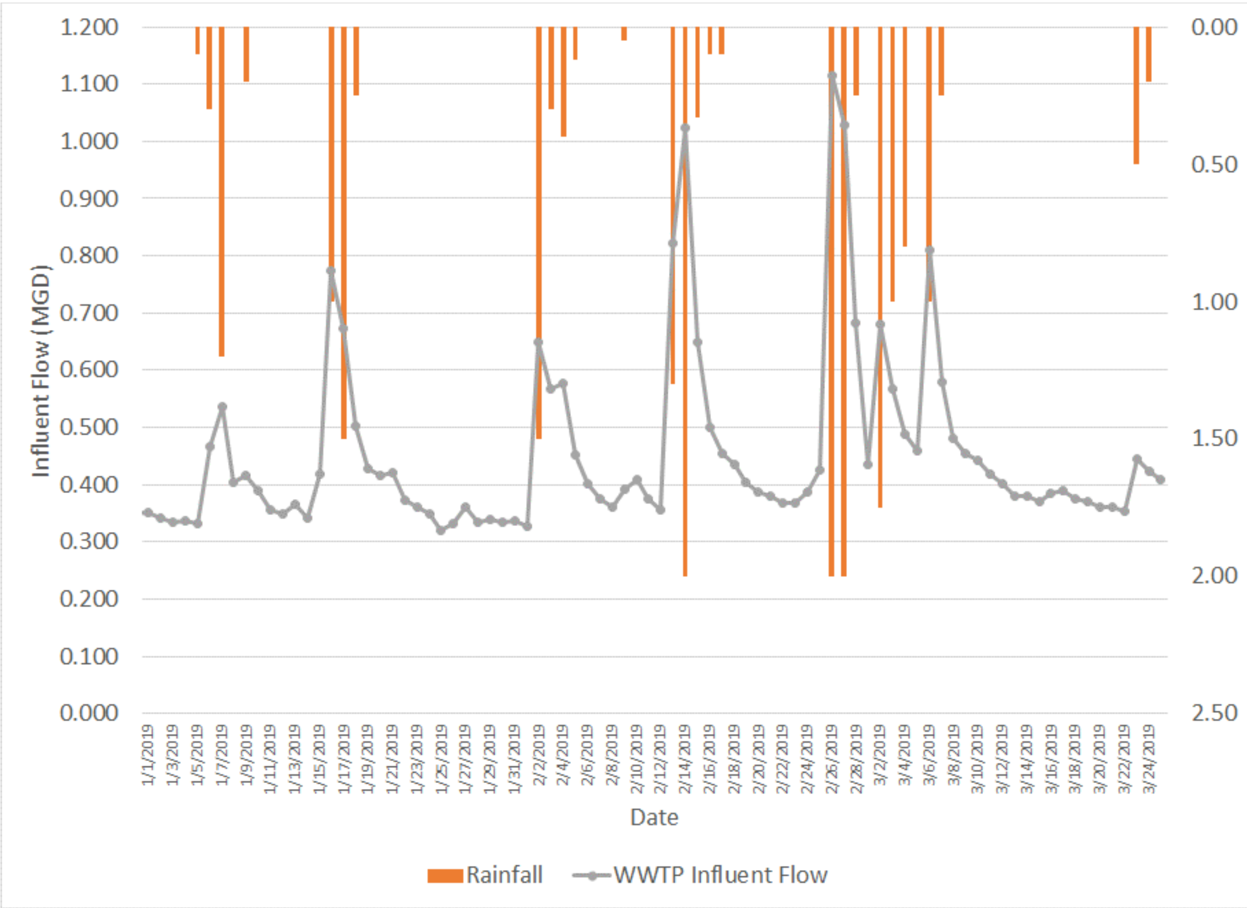

Figure 3-4
Winter 2019 Measured Rainfall and Daily Wastewater Flows into WWTP

3.01.3 PEAK HOURLY WET WEATHER FLOW

The City's Draft 2010 Sewer System Management Plan (SSMP) developed a formula for estimating peak wet weather flow (PWWF) and that formula can be used for the hydraulic design of City's sewer system. The formula is:

PWWF = ADWF x PF + II

PWWF=Peak Wet Weather Flow (Hourly)
ADWF=Average Daily Dry Weather Flow in MGD
PF=Peaking Factor
II=Infiltration and Inflow Allowance

An Infiltration and Inflow allowance is added to the peak sewer flows to determine the design flow in the sewer system. The Infiltration/Inflow allowance for all new development areas shall be 200 gallons per acre per day. The area of streets and lots in all residential and commercial areas shall be included in the gross area. Areas such as parks and greenbelts which do not contain sewer facilities were excluded *from the gross area. The formula below was used to calculate the peaking factors. All Peaking Factors greater than 5 are capped at a maximum value of 5.*

$$PF = 2.8 \times ADWF^{(-0.155)}$$

PF=Peaking Factor
ADWF=Average Daily Dry Weather Flow in MGD

The peaking factor curve generated from 0.35 MGD (existing) to 1.5 MGD (future) is shown in Figure 3-5.

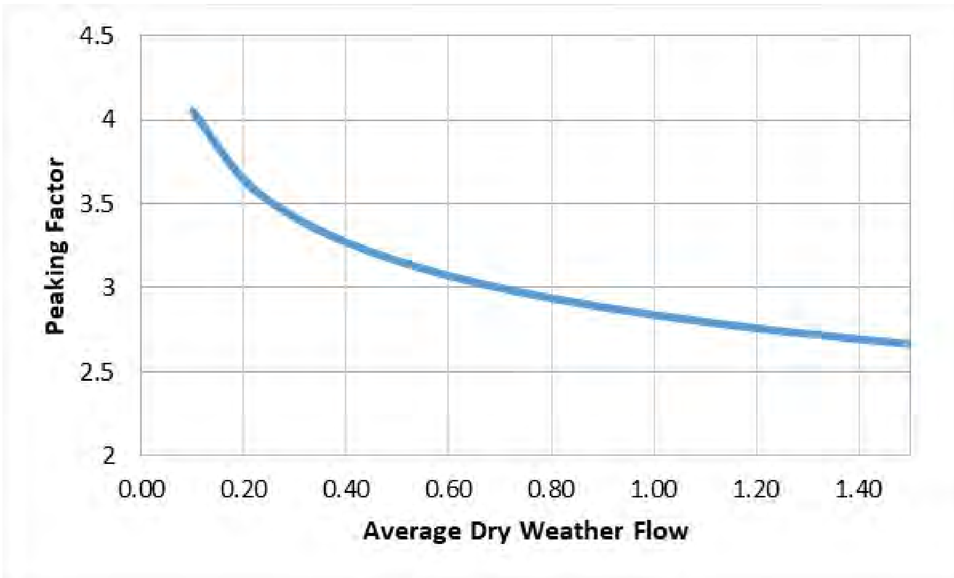

Figure 3-5 Peaking Factor
City PWWF Peaking Factor Curve

At existing average flows and about 250 acres of City commercial and residential development, the City's formula generates 1.22 MGD of PWWF.

The City does not collect peak hourly flow data. However, the operations staff have observed peak flows as high as 1.5 MGD (1,000 gpm) which is likely a result of the hydraulic limitations of the pumps at the Malone Pump Station. To be conservative, the estimated peak flows generated by the City formula have been increased by 0.28 MGD (200 gpm) in this report. In other words, the City's formula has been adjusted to include an extra 0.28 mgd:

$$PWWF = ADWF \times PF + II + 0.28$$

This formula will be used to determine peak hourly flows for the Regional Sewer Project.

3.02 EXISTING DEVELOPMENT AND PLANNED CITY GROWTH

In 2020 the City completed a sewer rate study and a subsequent financial analysis of rate and fee impacts for connecting to OPUD and LCWD. In November of 2020, the City had the following sewer EDU accounts:

1,026	Residential EDUs
215	Apartment EDUs
190	Commercial EDUs
1,431	Total EDUs

Both the City and OPUD assume each EDU generates 260 gal per EDU. The study rounded the current City EDU value slightly up to 1,469 EDUs to make math consistent with existing and future projection.

3.02.1 Known Development Projects

The City has identified a number of development projects that are either infill or adjacent to the City limits. These projects are described in Table 2.

Location	Zoning	Acres	Total Units	Notes	EDU Factor	Sewer EDUs
Phase 1 (2020-2021)						
F and Main Street (Site F)	R-3	2	40	1	0.7	28
Spenceville Road (Site E)	R-3	9	180	1	0.7	126
State Street (Mobile Home Park)	R-3	5.5	110	1	0.7	77
Subtotal:		**16.5**	**330**	-	-	**231**
Phase 2 (2022-2026)						
C Street (Site A)	R-3	2.25	45	1	0.7	31.5
South of Nichols Grove (Site D)	R-3	11.75	235	1	0.7	164.5
Subtotal:		**14**	**280**	-	-	**196**
Phase 3 (2027-2031)						
Webb Property (Site B)	R-3	1.85	37	1	0.7	25.9
HOE Multi-Family Component (Site C)	R-3	6.3	126	1	0.7	88.2
Planned Development (a.k.a. Almond Estates)						
Single Family Component	PD	7.5	36	-	1	36
Multi-Family Component	PD	4.5	90	1	0.7	63
Commercial Component	PD	35	220	2	1	220
Subtotal:		**47**	**346**	-	-	**319**
TOTAL:		**85.6**	**899**	-	-	**860**

Table 3-2
Wheatland Planned Development Projects

These 860 EDUs plus the proposed Caliterra Development (552 EDUs), would represent a total of 2,881 EDUs of growth that could connect into the City's existing WWTP. The new pump station (PS No.1) intercepting sewage prior to the WWTP should be designed to handle existing flows of 0.35 MGD ADWF (1468 EDUs) and up to 0.70 MGD ADWF (2,881 EDUs) in the future.

Development	EDUs
Existing Users	1,469
Caliterra	552
In-Fill 2020-2026	427
In-Fill 2027-2031	433
Subtotal	**2,881**

3.02.2 Development on the Eastern Planned Development Area

Over the long-term, the City expects significant growth to the east of the existing City Limits. The City previously chose a planning objective to accommodate 5,500 EDUs for this project, which represents a four-fold increase over existing level of development. An additional 2,619 EDUs (5,500 - 2,881) would be served in the vicinity of Pump Station No. 2 near Spenceville Road and Jasper Lane. It should be noted that development interests in the vicinity of Spenceville Road and Jasper Lane are considering constructing approximately 1,000 EDUs and possibly a small commercial/business park project by 2030.

A project midpoint would be about 3,500 EDUs. For that midpoint projection it was assumed that 1,000 EDUs in the vicinity of Spenceville Road would be connected and the remaining 2500 EDUs would be from the area east of Jasper Lane through PS No. 2.

3.03 WASTEWATER FLOW PROJECTIONS

Table 3 describes existing and projected development and the resulting flowrates. The flows shown to. However, the peak flows shown (for instance 4.43 MGD or 3,080 gpm at the design condition) are <u>not</u> attenuated.

Tables 4 and 5 provide a summary of the expected flows at each pump station and force main. This information will be used to size the pump stations and pipelines. These projections assume no storage or attenuation of peak flows at the pump station.

3.03.2 OPUD Peak Flow Requirements and Storage During Storm Events

While the system is will be capable of pumping peak hourly flows up to 4.43 MGD, the City and OPUD have agreed to limit its peak flows during storm events so to not overwhelm OPUD's downstream sewers and wastewater treatment plant. The City will store and attenuate peak storm flows at the pump stations such that:

The peaking factor shall not exceed 3.0 during the time period when the City's ADWF is less than 0.75 mgd;

The peaking factor shall be reduced to 2.8 when the City's ADWF is between 0.75 and 0.9 mgd;

The peaking factor shall be reduced to 2.6 when the City's ADWF is between 0.9 mgd and 1.26 mgd; and

The peaking factor shall be reduced to 2.2 when the City's ADWF is above 1.26 mgd for a maximum peak flow of 3.3 mgd into OPUD.

Table 3.5 provides estimates of storage requirements required to attenuate these peak flows at initial, midpoint and design conditions. Initially, storage will be required to dampen peak hourly flows to below OPUD's peak flow requirements. In the future, storage will be needed to reduce both peak hour and peak daily flows. Table 3.5 shows storage volumes needed to dampen peak daily flows for a storm expected to occur over a 2 day period.

	Existing	Initial	Midpoint	Design
Residential Population	3,800	3,940	9,070	14,250
EDUs	1,469	1,520	3,500	5,500
Average Annual Flow (AAF), mgd	0.38	0.40	0.91	1.43
Flow Per EDU (Gal/ EDU)	260	260	260	260
Pump Station No. 1 (West & Infill)				
EDUs	1,469	1,520	2,500	2,881
AAF, mgd	0.38	0.40	0.65	0.75
ADWF, mgd	0.35	0.37	0.60	0.70
Contributing Acres	247	256	420	484
GWI @ 200 gal/ acre/d	0.05	0.05	0.08	0.10
Peak Hourly Flow Peaking Factor	3.29	3.27	3.03	2.96
Peak Hourly Flow from Formula, mgd	1.22	1.25	1.91	2.16
City Observed Additonal Peak Hourly Flow, mgd	0.28	0.28	0.28	0.28
Peak Hourly Flow for Design, mgd	1.50	1.54	2.20	2.44
Peak Daily Flow, mgd	1.10	1.13	1.73	1.95
Eastern Growth Area				
EDUs		-	1,000	2,619
AAF, mgd		-	0.26	0.68
ADWF, mgd		-	0.24	0.63
Assumed Contributing Acres		-	168	440
GWI @ 200 gal/ acre/d		-	0.03	0.09
Peak Hourly Flow Peaking Factor		-	3.49	3.01
Peak Houly Flow, mgd		-	0.88	1.99
Peak Daily, Flow, mgd		-	0.79	1.80
Total Flow into PS 2				
EDUs		1,520	3,500	5,500
AAF, mgd		0.40	0.91	1.43
ADWF, mgd		0.37	0.85	1.33
Assumed Contributing Acres		256	588	925
GWI @ 200 gal/ acre/d		0.05	0.12	0.18
Peak Hourly Flow Peaking Factor		3.27	2.87	2.68
City Observed Additional Peak Hourly Flow, mgd		0.28	0.28	0.28
Peak Houly Flow, mgd		1.54	3.07	4.43
Peak Daily Flow, mgd		1.13	2.52	3.75
Storage at PS2 During Large Peak Wet Weather Events				
OPUD Peaking Factor		3.00	2.80	2.20
Maximum Flow to OPUD, mgd		1.10	2.37	3.30
Daily Maximum Flow Produced		1.13	2.52	3.75
Storage Required (Total Peak Daily - OPUD Daily Max), Mgal		0.03	0.16	0.45
Total Storage Required if 2 Day Duration Storm, Mgal		0.08	0.08	1.36

Table 3-3
Summary of Existing and Projected Flows

Table 3-4
Flows into PS No. 1 and FM No. 1

	EDUs	ADWF MGD	AAF MGD	Peak Day MGD	Peak Hour MGD	Peak Hour GPM
Initial	1,520	0.37	0.40	1.13	1.54	1,080
Midpoint	2,500	0.60	0.65	1.73	2.20	1,520
Design	2,880	0.70	0.75	1.95	2.44	1,680

Table 3-5
Flows into PS and FMs No. 2 and No. 3

	EDUs	ADWF MGD	AAF MGD	Peak Day MGD	Peak Hour MGD	Peak Hour GPM
Initial	1,520	0.37	0.40	1.13	1.54	1,080
Midpoint	3,500	0.85	0.91	2.52	3.07	2,130
Design	5,500	1.33	1.43	3.75	4.43	3,080

SECTION 4 – DESIGN STANDARDS

4.01 General

The following standards will be used for the design and for construction document preparation for the Project.

Exceptions from standards that are known at this time, for local conditions and project-specific circumstances, are noted for each standard. Additional exceptions may be applied as design proceeds.

In the case of conflicting standards, the most restrictive will apply.

4.02 Pipelines

4.02.01 Recommended Standards for Wastewater Facilities, 2014 Edition

The Project will utilize the *Recommended Standards for Wastewater Facilities (2014)*, commonly called the *Ten State Standards.* This standard is primarily for the preparation of plans and specifications for wastewater collection facilities. The handbook states that it should be used for conventional municipal wastewater collection and treatment systems, and not for specialty design such as for very small municipal systems. The scale and scope of the Project is consistent with the intended use of these Standards. These standards will be used where appropriate to the Project, but the sections on engineering plans and specifications, design of sewers and wastewater pumping stations are expected to be most applicable.

Minimum velocity in force mains will be 3.0 feet per second, not 2.0 feet per second as required by this standard. Current research has determined that the higher rate is necessary to resuspend solids that have settled in the pipe during no flow conditions.

4.02.02 Handbook of Polyethylene (PE) Pipe, 2008

The handbook includes information on material properties, design, installation, and applications of solid wall PE pipe. The design section includes Sections on pipe design, joining procedures, and basic information on buried and above-ground installations. The handbook also includes installation techniques, repairs, and operation of PE pipe in a variety of specific applications. This handbook will used to supplement the other standards to ensure the final plans and specifications are consistent with the manufacturer's recommendations on the design and installation of PE pipe.

4.02.03 City Standards

The project will use the *City of Wheatland Public Works Standards (revised 2011).* These standards include design criteria and standard details typical of a small city and primarily address the needs of development projects.

The City standards do not address large scale pipeline project utilizing PE pipe. As such, where appropriate, other standards will be used to supplement the City standards based on the engineering judgement of the City Engineer and the design team.

4.03 Pump Stations

4.03.01 Hydraulic Institutes Standards

The Hydraulic Institute (HI) is the global authority on pumps and pumping systems. HI standards cover pump design and applications, installation, operation and maintenance, pump testing, definitions and nomenclature and address such topics as allowable vibration, pump efficiency, nozzle loads, pump piping, viscosity correction and more. The design will conform with HI standards, specifically the “1 series” standards covering centrifugal pumps. These included the following sections:

ANSI/HI 1.1-1.2 Centrifugal Pumps for Nomenclature and Definitions,
ANSI/HI 1.3 Centrifugal Pumps for Design and Application,
ANSI/HI 1.4 Centrifugal Pumps For Manuals Describing Installation, Operation and Maintenance
ASNI/HI 1.6 Centrifugal Pump Tests

4.03.02 Recommended Standards for Wastewater Facilities, 2014 Edition.

See above.

4.03.03 City Standards

In 2010 the City prepared a Draft Sewer System Management Plan (SSMP) as required by the State’s 2006 Waste Discharge Requirements for Sanitary Sewer Overflows (SSOs). The SSMP included a formula for how peak hourly flows should be calculated. The SSMP also discussed the City’s objective to handle large storm events without SSOs. Storm events that occur every 5 years, about 2.7 inches of rain over a 24-hour period, was discussed as a reasonable planning objective.

4.04 Other Requirements

4.04.01 Environmental Review/Mitigations Documents.

The City may pursue low interest loans and grants through the State Revolving Fund (SRF). The SRF program requires all construction to be in compliance with both federal and state biological and cultural requirements. The City is preparing environmental documentation for the project that will describe these mitigations.

4.04.02 Separation of Water Mains and Non-Potable Pipelines, California Code of Regulations, Title 22, Div 4, Section 16, Section 64572

4.04.03 Caltrans Requirements for Crossings

The project will need a Caltrans encroachment permit for the Highway 65 undercrossing. The most current Caltrans standards and requirements will be utilized in that portion of the project.

4.04.04 UPRR Requirements for Crossings

The *2020 AREMA Manual for Railway Engineering (Section 1)* will be utilized for the design for the four pipeline crossings in UPRR right-of way.

4.04.05 Yuba County Roads/Easement Requirements

The County of Yuba Department of Public Works Improvement Standards (1994) will be used for improvements to roads located within County right-of-way or easements.

4.04.06 Connection to Olivehurst Public Utility District (OPUD) collection system

The connection to OPUD will be made in conjunction with OPUD standards and negotiated agreements between Wheatland and OPUD.

SECTION 5 - PIPELINE ROUTES AND PUMP STATION SITING

5.01 Objectives of Pipeline Route

When evaluating pipeline route alternatives, several factors were considered. The objective of the pipeline route is to select the most cost effective and feasible way to convey wastewater flows to the tie in location while considering the advantages and disadvantages of each alternative. The factors considered when evaluating each alignment option are as follows:

- The proposed pipeline route was selected to best minimize utility conflicts and major roadway and railroad crossings, although crossings could not be avoided. The selected alignment will have one Caltrans crossing at Highway 65, four Union Pacific railroad crossings, and three creek crossings.

- Routes were evaluated to avoid environmentally sensitive areas, such as wetlands and endangered species habitats. Typically, this means keeping the alignment in existing roads or developed areas as much as possible.

- Routes were evaluated with the goal of using existing public rights-of-ways and easements as much as possible. In addition, where public lands are not available, utilize private land that will minimize the project's impacts, such as not being adjacent to private homes or impacts to crops, but might be located near property lines, private roads etc. This will reduce costs by minimizing the land needed to be acquired and increase the likelihood that a private landowner will be willing to grant easements or property.

5.02 Pipeline Alignments

See Appendix 1 for a drawing of the proposed pipeline alignment.

Utilizing the criteria discussed previously, multiple pipeline routes were considered and evaluated. At the beginning of the predesign phase, an alignment was selected which utilized Malone Avenue, Main Street, Spenceville Road, Jasper Lane, and private properties north of the City to the tie in point. After further investigations, a revised alignment was selected to mitigate some of the utility congestion and difficult crossings in the southern portion of the alignment.

The new pipeline alignment will head due east from the existing Malone pump station, cross Highway 65 and the UPRR mainline track, follow Sixth Street, Main Street, Spenceville Road, and Jasper Lane. From the northmost end of Jasper Lane, the pipeline will head due west through private property and will be routed along existing dirt roads to avoid sensitive areas and homes. It will cross two UPRR spur tracks and cross privately owned properties before crossing South Beale Road. The alignment will then cross the UPRR mainline and two drainage culverts in Rancho Road before reaching the tie in location.

The revised alignment has several advantages. First, it will utilize more existing City owned property and easements. It will also minimize construction on arterial roads by diverting the pipeline to 6th Street from Main Street, which can reduce construction costs due to less traffic control and less utility crossings. The crossing at Highway 65 will also be easier to orchestrate as it is not at an existing signalized intersection. Further, the prior alignment would have required repaving Malone Ave which was recently repaved. The pavement on Sixth Street is in poor condition and would benefit from the new paving associated with the project improvements. Lastly, the revised alignment will avoid environmentally sensitive areas near South Beale Road. The middle portion of the alignment on Spenceville Road and Jasper Lane did not change. An overview of the proposed pipeline alignment is given in Appendix 1.

5.03 Recommended Pipeline Route and Design Considerations

5.03.01 Crossings

Although the proposed pipeline route was selected in part with a goal to reduce major crossings, some crossings requiring special construction methods and permitting could not be avoided. The final choice of the crossing construction method will depend on the pipe material used, the topography, and site constraints such as culvert locations or bridge structures that may be used to support a pipeline. Each of the proposed pipeline crossings is described in more detail below.

- Highway 65 (Caltrans): In accordance with Caltrans requirements, this crossing will be constructed using bore and jack method and the HDPE carrier pipe will be installed within a steel casing. Temporary jacking and receiving pits will be placed outside of Caltrans right of way.
- Union Pacific Railroad (UPRR) in City of Wheatland: This UPRR mainline crossing is located near the eastern edge of the City perpendicular to Sixth Street between C Street and State Street. UPRR has specific pipeline crossing requirements that favor bore and jack construction methods. The carrier pipe will be encased in a steel casing set a minimum of 5.5' below grade to meet UPRR design requirements. Emergency shutoff valves and temporary jacking and receiving pits will be placed outside of UPRR right of way.
- Grasshopper Slough Culvert: This crossing is located on Spenceville Road. An existing 48" culvert crosses Spenceville Road with approximately 6-feet of cover. This crossing is planned to be constructed by placing the force main above the culvert using open cut construction method. Pipeline cover may be less than 4-feet and additional pipe protection measures, such as concrete slurry backfill, may need to be implemented to protect the pipe.
- Dry Creek Bridge: This creek crossing is located on Jasper Lane about ¾ of a mile north of Spenceville Road. It is an existing bridge that crosses Dry Creek. The most economical method for this crossing would be to attach the pipeline to the bridge using a steel casing with bolted connections. This method would require coordination with Yuba County to determine if it is acceptable (structurally feasible) and, if so, the specific requirements for construction. The alternative crossing method is to cross under the creek using horizontal directional drilling (HDD). This construction method does not require a casing, but might require coordination with the Department of Fish and Wildlife if construction encroaches on any environmentally sensitive areas. This would need to be reviewed by the biologist. For the purposes of this basis of design report, it is assumed that an HDD crossing will be the most suitable construction method.
- Best Slough: This crossing is located south of South Beale Road within private property. The crossing will utilize HDD to place the pipe below the slough.
- UPRR Spur Tracks: There are two consecutive UPRR spur track crossings located south of South Beale Road. Bore and jack will be used to cross the two spurs, and the carrier pipe will be installed inside a steel casing in accordance with UPRR standards.
- UPRR Mainline Track (near Rancho Rd) and drainage culverts: This crossing is located adjacent to the tie in location and the UPRR tracks run parallel to Rancho Road. Like the other UPRR crossings, this crossing will be constructed using bore and jack method and the carrier pipe will be installed within a steel casing. The bore and jack section will also allow the alignment to cross under two existing drainage culverts which run parallel to Rancho Road.

5.04 Pipeline Design Criteria

5.04.01 Hydraulics and Pipe Materials

The design team selected high density polyethylene (HDPE) pipe for the force main pipe material. HDPE presents significant advantages in wastewater and pressure system applications. A summary of advantages and disadvantages is provided below.

Advantages of HDPE Pipe

- Low Hydraulic Friction: The C value of HDPE pipe ranges from of approximately 120 to 150, which is much higher than the C values of the other pipe types. This property reduces the required pumping head, and therefore requiring less energy associated with pumping.
- Lower Modulus of Elasticity: HDPE has a significantly lower modulus of elasticity, which significantly reduces the velocity of the surge wave and associated surge mitigation facilities.
- Flexible Pipe: HDPE is flexible and conducive to being installed along curva-linear alignments at much tighter radii than other materials can be. HDPE can be installed with very few fittings, which also reduces minor friction losses.
- Fused Joints: Fused HDPE eliminates the need for additional thrust restraints and the likelihood of leaking joints. A fusion joined pipeline may be thought of as a continuous pipeline without joints. This eliminates the potential leak points every 10-20 feet as found with PVC and Ductile Iron bell-and-spigot connections.
- Higher Impact Resistance: The chances of failure are reduced if the pipe is hit by a point load such as a backhoe accidentally hitting the pipe.
- Conducive to trenchless construction methods
- Cost Effective during construction: HDPE is light and easy to handle which reduces both installation and material shipping costs.
- Long-term advantages: HDPE has long-term cost advantages due to the pipe's physical properties, leak-free joints and reduced maintenance costs. The polyethylene pipe industry conservatively estimates the service life for HDPE pipe to be 50-100 years. This relates to savings in replacement costs for generations to come.

Disadvantages of HDPE Pipe

All pipe materials, including HDPE, have characteristics less desirable than their competitors. Consideration of these characteristics will mitigate these, including:

- Handles lower vacuum pressures. HDPE design allows vacuum pressures of 2 psi, compared to values for steel of 3 psi, and Ductile Iron Pipe of 5 psi. This will require larger vacuum release valves to be installed along the length of the pipeline, compared to other piping materials.
- Susceptible to chemical attack by solvents: Construction documents will require the installing contractor to keep solvents away from HDPE pipe.
- Strength affected by sunlight unless UV protected: HDPE pipe will not be used for above-grade portions of the pipeline, such as around valving at pump stations and (potentially) where the pipeline will be attached to the Dry Creek bridge.
- Buoyant, meaning that anchoring is required in areas with higher groundwater. During construction, care will be taken to keep the pipeline trench free of water. Once the pipe is installed and the trench filled above it, the weight of the soil above it will keep it from floating to the surface.

- Requires locating wire to locate: Locating wire will be installed adjacent to the pipe to assist in locating as needed for operation and maintenance activities.
- Requires Special Bedding: Construction documents will require suitable bedding materials for HDPE pipe.

High density polyethylene (HPDE) is the preferred pipe material due to the relatively low friction values, resistance to corrosion, and construction factors associated with curved alignments. Ductile Iron Pipe (DIP) lined with a protective lining comparable to “Protecto-401” will be used for fittings, exposed pipes and fittings at the pump stations, and any crossings where less than 3 feet of ground cover can be achieved.

HPDE pressure pipe dimensions consistent with AWWA C906 and ASTM F714, and ASTM D3035 is provided in Appendix 4.

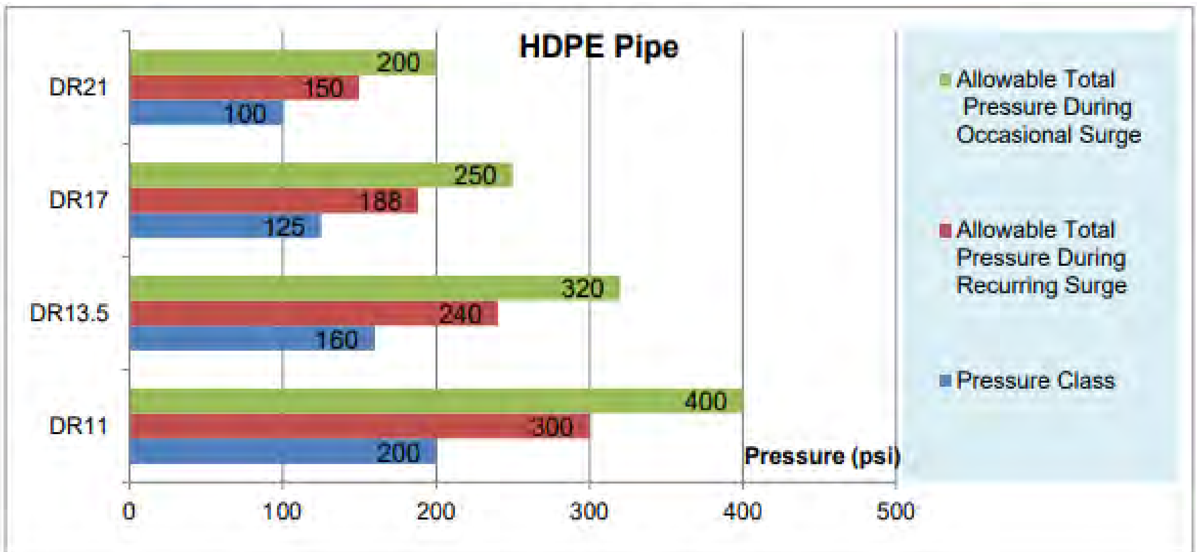

Figure 5-1
Allowable Pressures for Different Classifications of HDPE Pipe

In accordance with AWWA C906, the pressure class of a HDPE pipe includes an allowance for surge pressures. The allowance for recurring surge pressures (regular valve and pump operation) is 50% of the pressure class. For occasional surge pressures (unanticipated system failures), the allowance is 100% of the pressure class. For comparison pressure ratings of DR11, DR13.5, DR17, and DR21 are provided below.

5.04.02 Pipeline Appurtenances

Complete installation of pipelines of this type includes several different appurtenances including: Combination air release/vacuum valves, Emergency shut-off valves, Emergency connections, and Cleaning ports:

- Combination air/vacuum release valves will be installed at relative high points along the pipeline. These valves will do the following:
  - Release high volumes of air when the pipeline is filled from empty.
  - Release the smaller volumes of air that collect during system operation,
  - If the pressure in the pipe becomes negative, the valves will open to prevent a vacuum condition.

- Emergency shutoff valves are full port plug valves. These valves installed are along the pipeline route and can be closed to reduce the amount spilled in the event of a pipeline leak.

- Emergency connections are tees with valves and connectors that are installed along the pipeline. These will allow partial draining of a pipeline section into a tanker truck to facilitate repairs. They may also allow connection of a temporary bypass around a damaged section of pipe.

- Cleaning ports (pig launcher and retrieval installations) allow for cleaning the pipeline of solids. This is needed periodically, especially during the first years of operation when pipeline velocities are lower and do not reach scour. This is called "pigging" and sets of valves and fittings need to be installed to facilitate launching and retrieving the cleaning devices (called "pigs") at each pump station.

5.05 Hydraulic Analysis and Siting of Pump Stations

A preliminary hydraulic analysis has been completed to evaluate the effects of different pipeline lengths, pipe diameters, and roughness coefficients. The preliminary analysis is used to make decisions on pipe sizes, approximate total dynamic head (TDH) requirements at each pump station, and likely pump station location(s). Pipe lengths and elevations were adapted from Google Earth data as well as City as-built drawings from the Malone Pump Station. After completion of the BODR, topographic mapping and input from the project team's biologist may adjust these proposed pipe alignments and pump station locations and will provide more accurate elevation data. The hydraulic model will be updated with this data during final design.

Note that this project will construct only the portion of FM No. 3 from PS No. 3 to Rancho Road. FM No. 3 is assumed to be constructed with OPUD"s planned sewer and water improvements along Rancho Road. However, the hydraulic calculations have been based on PS No. 3 pumping wastewater from PS No. 3 to Ostrom Road.

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5.05.01 Hydraulic Model Assumptions

A spreadsheet model was developed to portray the pump station and force main operation using the following assumptions:

- Hazen Williams "C" values of 120 to 150 were assumed for HDPE piping (worst to best case) assuming the flow carrying capacity would degrade over the life of the pipeline.
- HDPE DR17 (Pressure Class 125) pipe which will allow for system pressures up to 188 psi during daily pump and valve operation.
- An allowance for minor losses "k" about 1.0 feet per 1,000 lf of force main. An estimate of losses associated with fittings at the pump station's discharge piping have also been included. These assumptions will be confirmed in the design phase after plans have been developed to a suitable level.
- The grade is slightly sloped to the east and north from Wheatland to Ostrom Road. The grade increases by about 25 feet along Jasper Road and then decreases about 35 feet toward Ostrom Road.
- The system will be designed to periodically flush accumulated solids. At least 3 feet per second (fps) of water velocity is required to re-suspend and move solids in the pipe. The 3 fps velocity also represents the minimum velocity needed for pigging (cleaning) the line.

Additional back pressure is needed to move the pig through the pipeline. An additional 25 psi has been assumed in 18-inch diameter pipes and 30 psi for 12-inch diameter pipes.

Elevation Assumptions

- The Malone Pump Station wet well bottom is at about elevation 61 feet. We have assumed the Pump Station (PS) No.1's bottom would be slightly lower at elevation 55 feet to accommodate some expected storage. Ground elevation is about 80 feet.
- Forcemain (FM) No. 1 would discharge into the manhole upstream of PS2 at approximate elevation 85-feet. Ground elevation is approximately 110 feet.
- The bottom of PS No. 2 wet well would be about elevation 55 feet, ground elevation about 85 feet.
- The high point in FM No. 2 is located where the pipeline could turn off Jasper Road (about 2.1 miles from PS No. 2) at a ground elevation of 99 feet.
- In the vicinity of where PS No. 3 could be located, the ground surface elevation is about 75 feet.
- The intersection of Ostrom Rd and Rancho Rd is about at elevation 65-feet.

5.05.02 Scenarios Modeled

Several modeling scenarios were developed to understand the range of pump operation required and the impact of pump station location. The peak flows anticipated at design conditions of about 1,500 gpm at PS No. 1 will require a 12 inch nominal (11.56-inch internal diameter) DR17 HDPE pipe. The peak flows anticipated at design conditions of about 3,080 gpm at PS No. 2 and PS No.3 will require an 18 inch nominal (17.07-inch internal diameter) DR17 HDPE pipe. Smaller diameter pipes than these will produce head losses that exceed the capability of submersible sewage pumps. The DR17 12-inch pipe requires 980 gpm to flush at 3 feet per second (fps). The DR17 18-inch pipe requires 2,140 gpm to flush at 3 fps.

The following scenarios were modeled:

1) Initial Average Conditions -270 gpm in FMs 1, 2, and 3
2) Pipeline Flushing and Pigging Conditions- 980 gpm in FM1 and 2,140 gpm in FM2 and FM3.
3) Design Average Conditions- 520 gpm in FM1, 1,000 gpm in FM2 and FM3.
4) Design Peak Conditions – 1,680 gpm in FM1 & 3,080 gpm in FM2 and FM3

5.05.03 Pump Station Siting Assumptions

The location of PS1 will be on City owned property adjacent to the existing Malone Pump Station. It is envisioned that the wet well of the Malone PS will be repurposed as a junction structure prior to PS1. As this property is encumbered with existing easements that might not allow the improvements as shown, alternate locations for siting PS 1 and/or the PS 1 control building is shown in Appendix 1.

The general location proposed for PS2 is on the western side of Jasper Lane, about 1,000 feet north from Spenceville Road. That location is consistent with future road alignments expected as that area develops. FM1 flows and sewage generated in that area would flow into a manhole at Spenceville Road and Jasper Lane and then flow by gravity north to

PS2. That gravity sewer segment will be oversized and as deep as practical to provide some storage during emergencies and wet weather events. As discussion with existing property owners are underway and not final, two alternate locations for the siting of PS 2 are shown in Appendix 1.

There are several options for where PS3 could be located. One option is to locate it on the southern corner of Rancho Road near the intersection of HW 65 and South Beale Rd. The station could also be located near the large antenna serving Beale AFB to the south. This BODR has modeled and provided conceptual station layouts for both locations so they can be described in subsequent environmental surveys. To be conservative, the system curves developed for FM2 have assumed the longer distance to the Rancho Rd location (about 5.7 miles). Similarly, the system curves for FM3 have assumed the longer pipeline route from the Antenna (about 3.5 miles). For either location of PS3, an above ground wet well will be required to ensure the hydraulic grade line (HGL) always remains above the highest point in the pipeline. The highest point in the pipeline is about elevation 95 feet at the top of Jasper Lane. The grade at either PS3 site is about elevation 75. As a result, the ground level wet well will have a standpipe about 20 feet high that maintains the upstream hydraulic grade at elevation 95 at all times, even when PS2 pumps are off.. In other words, FM2's minimum static HGL will be about 95 feet. The water surface in the wet well at PS3 will be maintained below elevation 95 and likely as low as 75 feet (ground surface). A graphic depiction the HGL and TDH needed for FM2 and FM3 is shown in Figure 5-2 below based on topographic profile generated by Google Earth. The example shown is at design peak hourly flows of 3,080 gpm.

5.05.4 Results of Hydraulic Analysis

The expected pipeline pressures in FM1 is shown in Figure 5-3. FM2 is shown in Figure 5-4, FM3 is shown in Figure 5-5. System curves are shown for "new" pipe with low friction as well as "old" pipe with expected higher friction in the future. Also shown is the additional pressure required during flushing and pigging operations. These calculations do not include any additional pressures as a result of surge conditions. Pumps will be selected to meet these flows and head requirements.

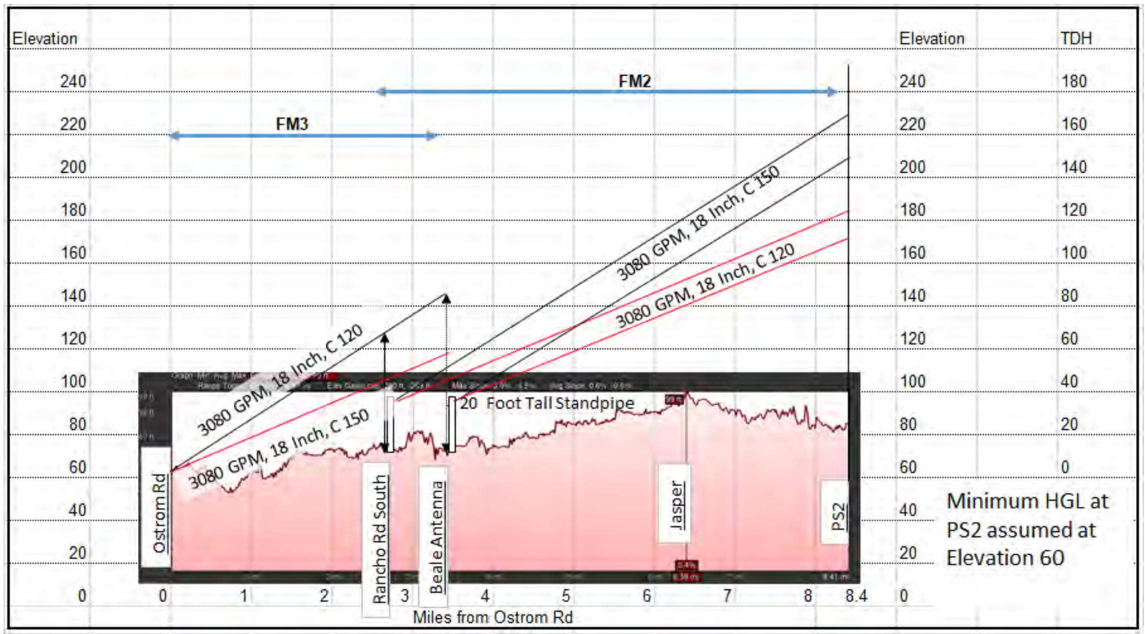


Figure 5-2
Hydraulic Grade Lines of FM2 and FM3 at Peak Design Flows

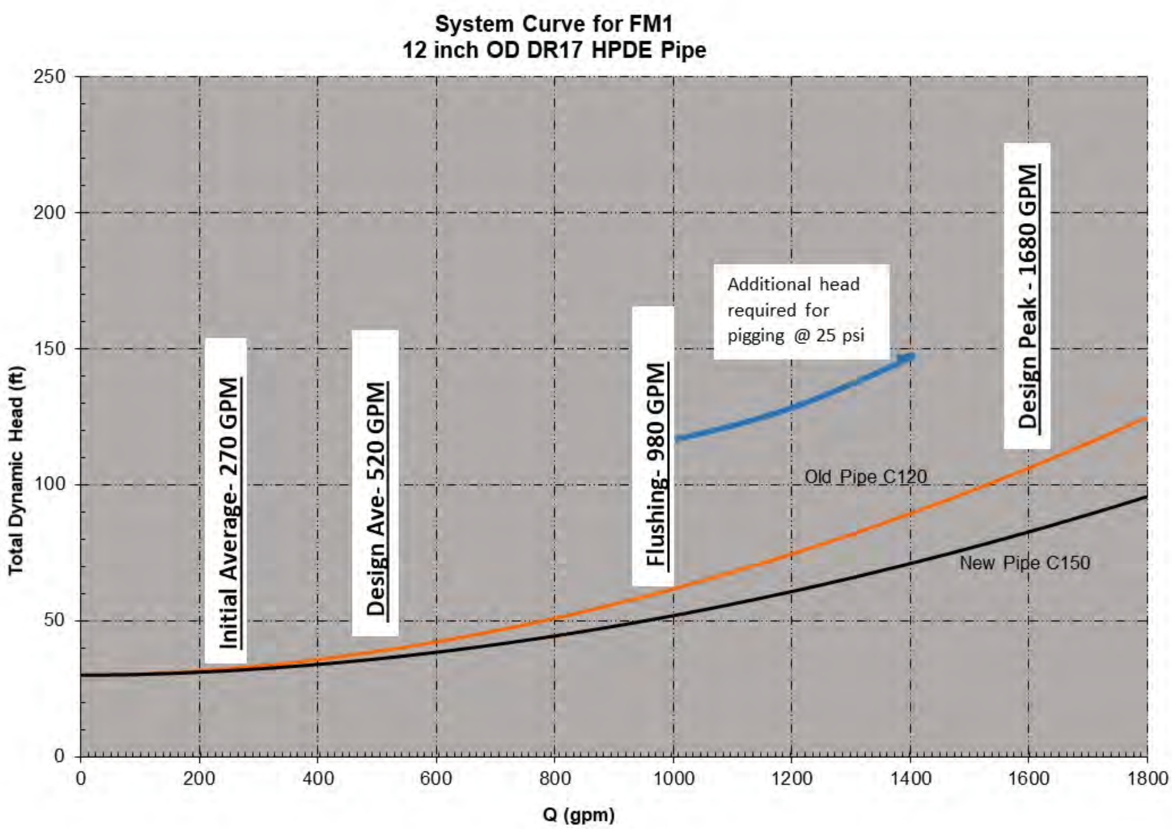


Figure 5-3

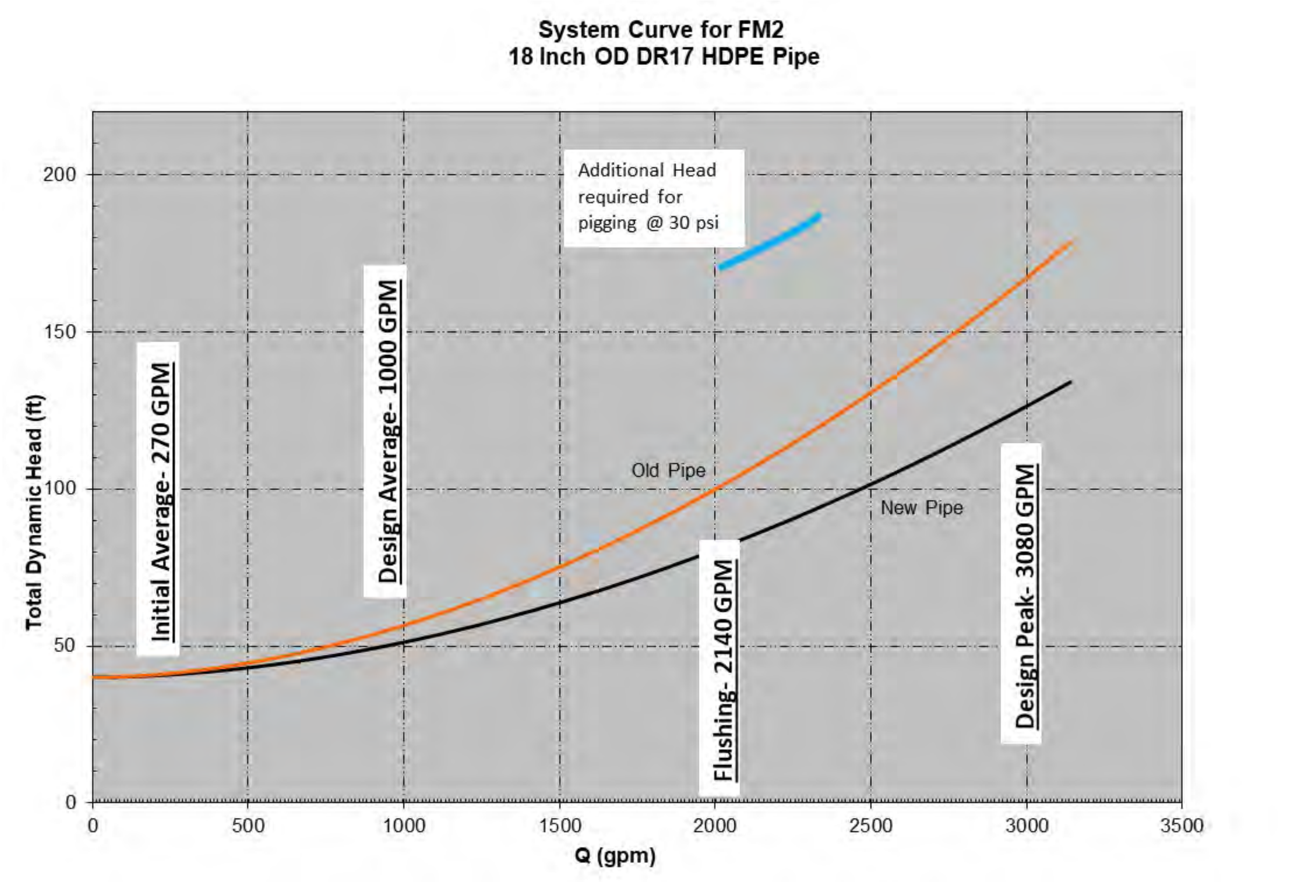

System Curve for FM2
18 Inch OD DR17 HDPE Pipe
Additional Head required for pigging @ 30 psi
Initial Average- 270 GPM
Design Average- 1000 GPM
Flushing- 2140 GPM
Design Peak- 3080 GPM
Old Pipe
New Pipe
Total Dynamic Head (ft)
Q (gpm)
0
50
100
150
200
0
500
1000
1500
2000
2500
3000
3500

Figure 5-4

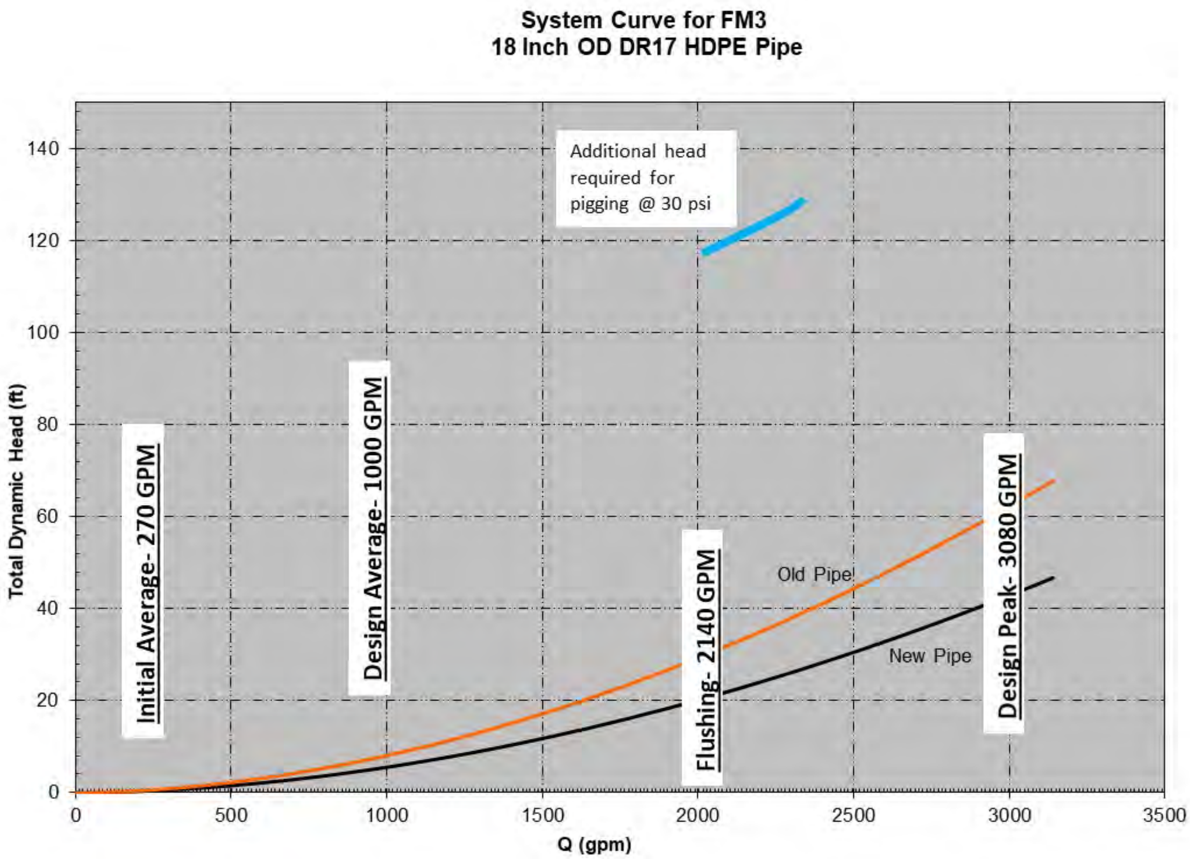


Figure 5-5

5.06 Surge Analysis

A surge analysis was also completed to determine the expected transient pressures that may be developed as a result of pumps or valves opening or closing quickly. Maximum surge pressure was calculated to be 35 psi for DR17 pipe, which is well below the allowable 63 psi for the selected pressure class and provides a factor of safety of 2.1. This confirms that the pressure class selected is acceptable, and that surge control tanks/valves are unnecessary.

SECTION 6 – PUMP STATION NO. 1 (PS1)

6.01 Overview and Station Location

PS1 will convey all existing flows from the City of Wheatland, as well as flows from the identified infill areas west of the proposed Highway 65 realignment. It will be located adjacent to the existing Malone Pump Station, which conveys a majority of the wastewater flows to the existing WWTP located about 0.7 miles southeast of this site. The parcel is owned by the City.

6.01.01 Location

The PS1 location has many significant constraints that will affect the design and construction. It is located along and south of South Grasshopper Slough, which has a 30-foot setback requirement.

The site is also in the sight lines of existing nearby residences and odors from the existing Malone PS have resulted in complaints to the City.

Existing utilities such as an underground high pressure gas main running adjacent to the site will need to be protected, and above ground power lines that transverse the site will require careful planning and construction considerations. The primary planning consideration the power lines pose is a prohibition of building structures under the lines. This requires moving the control building and generator to the north side of South Grasshopper Slough and running power and control wiring from the control building to the PS site underground in Malone Road.

Flood Protection

The proposed layout includes raising the site elevation as necessary to be 2 feet above the 100-year flood elevation. This will likely require a retaining wall to keep fill from encroaching on the 30-foot creek setback. An alternate control building site is shown on elevated ground north of Grasshopper Slough, well above flood elevations.

During design the sitework design will require coordination with the City's flood plain administrator to ensure it does not exacerbate local flood risk.

6.02 Current and Future Capacity

Section 3 of the BODR described existing and expected future flows at each pump station. Flowrates into PS1 are summarized in Table 6-1 below.

	EDUs	ADWF MGD	AAF MGD	Peak Day MGD	Peak Hour MGD	Peak Hour GPM
Initial	1,520	0.37	0.40	1.13	1.54	1,080
Midpoint	2,500	0.60	0.65	1.73	2.20	1,520
Design	2,880	0.70	0.75	1.95	2.24	1,680

Table 6-1
Flowrates into PS No. 1

6.03 Pump Sizing, Pumping Strategy, and Wet Well Configuration

PS1, as well as PS2, are to be designed to receive flows from gravity flow sewer pipes, and therefore must have an in-ground wet well structure. A submersible pump type design is recommended. Submersible pump design consists of a wet well with pumps specifically designed for submergence in wastewater. Discharge piping and valving are at grade or in a below grade vault. If the site allows, discharge pipes will be above ground for ease of access/inspection. With only one deep below grade structure, submersible pump stations are usually the least expensive to construct. Access to pumps for maintenance is completed by removal of equipment from the wet well from above using a gantry crane or boom truck. We expect a boom truck is sufficient for the size of equipment proposed for the Wheatland system. The site will be configured to allow boom and vactor truck access to service the pumps as well as cleaning sumps and rock pockets.

Grit, scum and floatable debris are common in influent sewage and will cause problems (odor, excessive pump wear, increased corrosion, etc.) if allowed to build up in the wet well. Therefore, a self-cleaning, channel-type, wastewater pumping station is recommended here. This type station's development dates back to 1990 and it is becoming the preferred design for many municipal systems. A rock pocket structure will be located up stream of the wet well to protect the pumps from large rocks and heavy debris.

The station's "normal operating mode" is comparable to the other designs. In addition, however, an intermittent mode of operation includes a "cleaning" cycle to periodically remove floatables and settled solids in the wet well. The wet well design includes a narrow channel with pumps in line to facilitate cleaning. The "self-cleaning" wet well base includes an ogee slope entry that creates a hydraulic jump during the cleaning cycle to re-suspend settled solids and mix floatables. Solids and floatables are carried down to the end of the channel into a lower sump at the last pump. This allows the wastewater level to be lowered below the floor elevation in the upstream portion of the wet well, concentrating grit and scum at the pump inlet.

At least three pump manufactures have recommended installation details for applying this self-cleaning design and many nearby agencies have operated similar systems with good success including City of Dixon, City of Colusa, and the South Placer Municipal Sanitation District. Construction costs for a self-cleaning station are comparable to conventional submersible pump stations of similar size.

At the PS1 site the existing sewer lines are not especially deep, approximately 10 feet below existing grade. Two other sewer force mains will also be directed into the existing Malone PS wet well, which will be refurbished and modified to serve as a junction structure.

When selecting pumps to convey sewage it is important that the pump not clog due to solids, typically specified to be up to 3-inches and a more recent concern is passing flushable wipes that although less than 3 inches are made of plastic fabric that is exceptionally strong and is known to wrap up in impellers and shafts causing severe damage to the pumps. Many pump manufacturers have developed modifications to the standard centrifugal impellers to cut or pass wipes and other solids, but based on our experience with Northern California clients, the screw-centrifugal impeller design, developed by Hidrostal, has provided superior non-clog performance, especially in the smaller pump sizes. The screw impeller design is also more efficient at most duty points compared with standard centrifugal impellers. The Hidrostal pumps cost more than similar sized pumps with standard impellers, but its superior non-clog performance and efficiency will minimize on-going O&M costs for the City.

Hidrostal screw-centrifugal pumps, or their functional equivalent, are recommended for all three pump station sites.

PS1 Pump Selection

PS1 is a 3-pump station with all pumps proposed as the Wemco-Hidrostal 8" x 4" Model F4K-S screw centrifugal pumps. The pumps are equipped with 75 hp x 1800 rpm immersible motors for mounting in a wet pit with quick disconnect base elbows and guide rails. A single F4K-S pump will cover the entire flow range of 270 gpm - 1680 gpm while the force main is fairly new and the C coefficient is near 150. However, as the pipe interior becomes rougher and the C coefficient falls toward 120, a second pump will be necessary to meet the 1680 gpm peak flow at the higher head. The 3rd pump will serve as a redundant back-up. Note that the flows between the design average and flushing flow rates all fall within this pump's best efficiency range. (See multispeed pump curve in the Appendix of this section.

6.04 Emergency Storage

Approximately 40,000 gallons of underground storage will be provided at PS1 to provide a "wide spot in the line" between the incoming sewers and new wet well. 40,000 gallons was selected for several reasons: 1) It appears that 40,000 gallons of storage could be accommodated on the site directly west of Malone PS wet well, 2) 40,000 gallons is about the volume of 8,300 lf of 12 inch FM1 which would allow the entire pipe volume to be flushed at one time, and 3) 40,000 gallons is also the approximate volume of the 36-inch diameter sewer pipe preceding PS2. This storage may be provided by two underground tanks constructed of either reinforced fiberglass or lined precast concrete units. The tops will be placed no higher than the maximum water level in the new wet well, the bottom will be at the sewer invert elevation. The in-ground storage may be utilized for wet well cleaning cycles, attenuation of wet weather peak flows, and to provide water for pigging the PS1 discharge pipeline.

PS1 will also temporarily connect to the existing 12-inch Malone PS force main to the existing WWTP. Until the WWTP site is decommissioned the connection could be maintained to allow sewage to be diverted to that facility in an emergency.

The inlet to the PS wet well will have a motorized isolation gate to build up water in the in-ground storage for a wet well cleaning cycle; or to provide the opportunity to isolate the wet-well for several hours to facilitate emergency, or infrequent, repairs.

6.05 Cleaning Operations

At this PS there are three cleaning systems that can be employed to ensure reliable operation and low odors. As discussed previously, the wet well will be of a self-cleaning channel configuration. An automated cleaning cycle will be programmed to initiate as needed based on the extent of fats oils and grease generated by the City.

For infrequent force main cleaning, a pig launcher will be provided to flush and clean accumulated material in the pipe.

The storage tank(s) may need to have built in cleaning features, such as a wash down system, to be utilized after storage events. To facilitate wash down activities a direct connection to City water (with an air-gap system) will be provided. A pedestal type pressure washer station will be provided to facilitate efficient cleaning of equipment and work areas. And, designated paved and chemical storage areas will direct all washdown (and rainfall) water to the influent sewer so as to preclude potential contaminated stormwater discharges. This should simplify or even eliminate the need for an ongoing permitted Stormwater Pollution (SWPPP) monitoring plan. Due to the small size of this site the runoff from all impervious surfaces will be directed to the sewer system, so a stormwater detention/infiltration basin is not needed.

6.06 Control Building

The control building will, at a minimum, provide (conditioned) space for indoor electrical controls, and an emergency generator. Consideration will be given to providing a restroom, for use of City operations staff. Chemical feed, and odor control facilities will be located at the PS site.
The control building will be constructed out of CMU block, or prefabricated concrete.

Since pump stations will not be accessible to the public, it is assumed that design of the pump station sites and buildings will not require compliance with state and federal accessibility standards for disabled persons.

6.07 Surge Protection

Surge protection is not expected to be required based on the force main modelling.

6.08 Odor/Corrosion Control

The existing Malone PS was not designed with odor controls. With additional infill development expected in the future, new odor control facilities are recommended to mitigate possible odor impacts in the surrounding community.

Due to space constraints, carbon adsorber vessels will be used to scrub foul air from the wet well and storage within the site. Table 6-2 details a preliminary set of design criteria anticipated for potential carbon adsorption.

Design Parameter	**Criteria**
Average Inlet Hydrogen Sulfide Concentration [a]	10 ppmv
Hydrogen Sulfide Removal Requirement	90 %
Air Exchanges per Hour [b]	12 ACPH
Total Volume of Air Treated [c]	13,000 cf
Carbon Face Velocity [d]	50 fpm
Detention Time [e]	4 seconds
Average Air Flow Rate	2,600 cfm

(a) Inlet hydrogen sulfide concentration is based on typical domestic sewage values.
(b) The number of air changes per hour (ACPH) is such that is recommended by the EPA for wet wells.
(c) Total volume of air to be treated includes daily sources of air flow and not intermittent storage.
(d) Carbon face velocity has been assumed based on typical values. This assumption will be re-evaluated during detailed design.
(e) Detention time has been assumed based on typical values. This assumption will be re-evaluated during detailed design.

Table 6-2 Summary of carbon adsorption design criteria for PS1.

In addition to using carbon adsorbers at this site, it is recommended to also accommodate a chemical feed system to drip an oxidant such as calcium nitrate to reduce the formation of hydrogen sulfide at this and downstream sewers and pump stations. The chemical feed system will include a 500 gallon tank or tanks with dual containment, and a metering pump to drip the chemical directly into the pump station wet well.

6.09 Site Improvements

As previously discussed, the site must be raised above the 100-year flood elevation, and coordinated with planned future development in regards to future access. Outdoor lighting will be selected to shield adjacent properties from glare. Perimeter fencing will be provided, with pass through gates to allow access to the unimproved area and sewer lines east of the PS, and west of Highway 65.

The site layout must accommodate boom truck access to the wet well, vactor truck access to the junction structure (and wet well), and chemical delivery trucks. This site will not allow "drive through" access, but the proposed layout will allow space for turnaround, or backing in, of service trucks.

There is not sufficient space within the fence line for vegetative screening, although opportunities for planting around the outside perimeter will be evaluated during design.

Space is expected to be available at the control building site for limited vegetative screening

6.10 Sampling and Flow Measurement

A magnetic flowmeter will be provided on the PS discharge manifold, with pig launching fittings on the flowmeter bypass piping.

Sampling connections (piping/electrical) will be provided such that portable compositing samplers are easily installed, as may be necessary for future source control evaluations.

6.11 Electrical and Controls

The electrical system design for the pump station will incorporate the requirements of the latest National Electric Code (NEC) - NFPA 70, applicable provisions of the California Electric Code (CEC), Pacific Gas & Electric (PG&E) Service Requirements (TD-70001) Greenbooks Standards, and City Standards and Ordinances, as applicable.

6.11.1 Electrical Service

The new electrical service will be provided by PG&E from existing overhead power lines. Based on site observations, overhead power distribution line from PG&E is located adjacent to the new control building site, and the service will be routed underground to an on-site PG&E furnished outdoor rated transformer located adjacent to the control building. The PG&E transformer will connect to the PG&E metering cabinet inside the proposed control building and new 480Y/277-VAC, three-phase (3PH), four-wire (4W) distribution system, with load rating to be determined and automatic transfer switch (ATS) for standby power provisions.

A PG&E electric service application will be submitted at least three months prior to the commencement of the construction to initiate the service planning. The costs associated with the electric service will be arranged and paid for by the City as determined by PG&E service estimation department.

6.11.2 Motor Control Systems

The electrical equipment will be installed in the new control building. Motor Control Centers (MCC) will feed 480V rated variable frequency drives (VFD's) and auxiliary loads not requiring a motor starter within the MCC. VFDs will be pulse width modulated type.

VFD driven pumps will be used to maintain desired constant flow to the distribution pipe systems. The VFDs automatically adjust the pump speed up or down to maintain a constant level setpoint or constant line flow while meeting varying flow conditions. VFDs are also used to minimize hydraulic transients like surging in the pipe systems and to reduce the number of pump on/off cycles.
Voltage and current harmonic distortions, as defined by IEEE 519-2014 as 'Total Harmonic Distortion' (THD), are inherent characteristics of the VFDs that can have major negative functional impact on the electrical and control systems and utility lines causing malfunction of the equipment and damage to the equipment in short or long runs. To mitigate this problem, active or passive harmonic filters and/or line and load reactors will be used in the application of VFDs.

The MCC will use National Electrical Manufacturers Association (NEMA) type motor starters and feeder breakers to feed the power panel and the lighting transformer. For small loads requiring lower voltages, a dry-type transformer will be located in the Control Building and will step the voltage down to a 208Y/120 volt, three-phase panelboard.

The panelboard will distribute power to HVAC, lighting, receptacle, and other miscellaneous small loads. The lighting transformer and panelboard will be mounted external to the MCC. Control panels, as applicable, will conform to UL 508A. This includes requirements for conformance to the latest short circuit equipment rating requirements.

Low-Voltage Switchboard

NEMA 1 rated switchboard will be installed in the Control Building on each pump station. Cabling will be insulated and rated for 600V. Feeders powered from the switchboard will be 480V, three-phase and all equipment will be rated to handle short circuit currents equal to or greater than the available fault current.

Power overcurrent protection main breakers with solid-state trip units with long-time (L), short-time (S), instantaneous (I) and ground-fault (G) protection functions. Distribution breakers will be molded case type with solid-state adjustable trip units to improve coordination and downstream arc flash characteristics. Surge Protective Device (SPD) will be rated with a minimum surge rating of 240kA per phase. The total calculated load for the pump station site shall not exceed 90% of utility service or service panel rating.

Low-Voltage Motor Control Center and Starters

NEMA 1 rated MCC will be installed in the Control Building. MCC power monitoring units will have ethernet network protocol to communicate with SCADA System. Control cabling installed within the MCC will be insulated and rated for 600V.

Feeder circuit powering the MCC originating from the switchboard feeder breaker will be 480 volt, three-phase, three-wire. The MCC will have a tin-plated copper phase bus and a copper ground bus. MCC will be a single bus configuration and will be rated to handle short circuit currents equal to or in excess of the available fault current. The MCC main breaker will be molded case type with solid-state trip units with LSI protection functions. The MCC main breaker will also be provided with ground-fault protection when required by the NEC. Distribution breakers on the MCC will be molded case type with solid state or thermal-magnetic trip units.

MCC will measure 20 inches deep. The MCC shall be equipped with a minimum of two (2) 12" spare spaces above and beyond that anticipated for any future loads.

Except for packaged equipment and HVAC equipment, motor starters will generally be located within the MCC. Starters will include a GREEN indicated lamp for RUNNING (ON), a RED indicating lamp for OFF, and an AMBER indicating lamp for trouble or FAILURE (where applicable). All pilot lamps will be push-to-test type.

Motors and Variable Frequency Drives

Motors will be specified with "NEMA Premium" high efficiency ratings. Motor enclosures will be suitable for the environment in which they are installed. All motors driven from variable frequency drives (VFDs) will be inverter-duty rated and will be rated for such applications. The heaters will be designed to operate on 120V AC power from the associated motor starter or VFD. VFDs will be pulse width modulated type. VFDs will be fed from a dedicated 480V, three-phase feeder.

Drives for motors smaller than 75HP will be 6-pulse type drive.

Power Transformers

Transformers that supply 208Y/120 volts or 240/120 volts for lighting requirements will be dry type with copper windings and suitable for the area in which they are to be located. Transformers will be industry standard sizes.

Panelboards

Power distribution panelboards or power centers, if required, will be 480V, three-phase, with a copper bus and a main circuit breaker. Lighting panelboards will be either 208Y/120V, three-phase, four wire type with a copper bus and a main circuit breaker sized to match the lighting transformer capacity. Each panelboard will have a minimum of 20 percent of its capacity reserved for spare breakers with spaces, bus work, and terminations to complete the standard sized panelboard. SPDs will be provided integral to each panel assembly, when specified on electrical design.

Receptacles

Convenience receptacles for general service will be located on walls. Provisions for receptacles at all air conditioning units and air handling units will be made as required by NEC. Convenience receptacles will generally be mounted 18-inches above floors, except outdoors or in rooms where equipment could be hosed down. Receptacles in such areas will be mounted 36-inches above the floor or grade.

Weatherproof in-use receptacles will be utilized outdoor, and in wet and damp locations. Receptacles installed outdoors will be provided with ground fault circuit interrupting capability.

Raceways and Cable

Specific types of raceways will be chosen for locations vulnerable to damage by moisture, extreme temperature, or corrosion, and considering voltage and cost. An underground duct bank consisting of direct buried schedule 40 PVC type conduits for non-traffic area and concrete encased schedule 40 PVC type conduits for traffic area will be provided for most circuits that are routed outside of buildings. Duct banks will include spare conduits. The following systems will be separately grouped in duct banks: Power and discrete control wiring 600 volts and below, Process instrumentation analog and communication wiring, including 24-volt discrete signals, and 600V rated CAT6 for ethernet communication. The following general guidelines will be used for raceway sizing, selection, and installation:

- Conduit will be sized for XHHW-2 insulation for all conductors 600 volts and less.
- The minimum diameter of all conduit will be 1-inch.
- Raceways in duct banks will not be smaller than 1-inches.
- Exterior Conduit Installation:
- Exposed conduit will be PVC-Coated galvanized rigid steel.
- Underground, direct buried and concrete-encased conduit will be schedule 40 PVC.
- Interior Conduit Installation:
- Exposed conduit in non-corrosive areas will be rigid galvanized steel.
- Exposed conduit in corrosive areas will be Schedule PVC-Coated galvanized rigid steel.
- Power and control wiring rated 600 volts and less will be stranded copper conductors with XHHW- 2 insulation.
- Lighting and receptacle circuit wiring rated 600 volts and less will be single solid conductor copper with THHN/THHW insulation.
- Individual 14 AWG conductors will be used for discrete control circuits, unless it is practical to use multi conductor cables to group control circuits. Cables will have 600-volt insulation.
- Power cable to equipment controlled by a variable frequency drive operating 600 volts or less will be 1000-volt VFD cable with stranded copper conductors and XLP insulation.
- Twisted shielded pair control cable with 16 AWG individual stranded copper conductors, PVC insulation, and an aluminum Mylar tape shield around the pair will be used for analog signals. Multi pair cables will be used where grouping of circuits is practical. Cables will have 600-volt insulation.

Grounding System

The electrical system and equipment will be grounded in compliance with the National Electrical Code (NEC). Conductors will be at least 4/0 AWG copper, minimum, for interconnecting ground rods and for connections to transformers and switchboard. A grounding ring will be provided for each building. Electrical equipment, devices, panelboards, and metallic raceways that do not carry current will be connected to the ground ring as well as building steel and metal water piping.

Transformer neutrals of wye connected transformers will be solidly grounded through a grounding electrode conductor connected to the grounding electrode system.

Lighting Systems

LED lighting systems will be used for all areas including interior, exterior building and site lighting. Illumination levels in the Electrical Building will be provided following the recommended levels suggested in the Illuminating Engineering Society (IES) handbook for the space and tasks being performed. Lighting fixture types are to be suitable for the environments where installed and will be located (serviceable and accessible) for routine maintenance.

Indoor Locations: Fixtures will be switched. Emergency lighting will include an emergency battery pack integral with the fixture.

Exit Signs: Provide LED type and placed inside the facilities per the latest requirements of NFPA.

Exterior Locations: Fixtures mounted to exterior building will be photocell controlled. Site lighting will be photocell controlled with bypass switched to allow facility to manually turnoff each light pole.

6.11.3 Standby Generator

Backup electrical power will be provided by an generator, located in, or adjacent to, the control building. Due to the fact that for the foreseeable future power delivery may have "semi-routine" prolonged interruptions due to regional fire safety and solar blackout concerns, we recommend the backup power generator be supplied by natural gas fuel so as to avoid the need for scheduling fuel deliveries during such events. Natural gas fuel also avoids the spill risks associated with handling diesel fuel on-site. The fuel selection will be investigated further during design in regards to reliability of natural gas vs. diesel fueled generators.

The ATS will have an emergency power source connection from a 300KW, 480V, three-phase, four-wire generator which will be located outdoor and adjacent to Electrical Building. The ATS will feed the indoor switchboard located in the Electrical Building, with a feeder to the MCC.

The engine-generator package will consist of an engine-generator, control panel, cooling system, and accessory items all installed inside a room in the control building, or outside in a weather-proof sound attenuating enclosure on a concrete base.

In the event of a utility company power outage, the generator will automatically start and the ATS will transfer power from utility to generator to power the pump station electrical loads. Once utility power is restored, the ATS will transfer back to the utility power and then shut down the standby generator after a pre-set cooling time.

The engine-generator size is based on operating demand requirements. The demand load will be based on the number of pumps required and miscellaneous loads for the worst-case operating scenario.

The generator will be housed in a control building room or in a sound attenuated and weather-protected enclosure to have lowest possible noise and exhaust emission per the City of Wheatland noise ordinance and Feather River Air Quality Management District (FRAQMD) air pollution requirements. The Contractor will be specified to apply and pay all costs to obtain all the required local permits including 'Permit to Construct' and 'Permit to Operate' the generator within residential area surrounding Pump Station.

6.11.4 Electrical Safety

During the construction phase of the project, an arc flash hazard analysis will be performed by the electrical subcontractor. The analysis will cover all electrical equipment in accordance with OSHA 29 CFR Part 1910, NEC, NFPA 70E, and IEEE 1584, down to 208VAC-3PH systems.

The arc flash analysis will be performed in coordination with the short circuit and coordination studies. Arc flash study results will be used to properly label all electrical equipment as to the severity of the arc flash hazard and the minimum personal protective equipment (PPE) required to perform work on each piece of energized equipment.
These labels will provide the Arc Flash compliance requirements associated with NEC Section 110.16. For any locations that exceed a NFPA 70E Flash Protection Boundary of Category 2, design approaches will be implemented to reduce this Flash Protection Boundary (FPB) to Category 2 or below.

Applicable federal and local codes and UL listing requirements will be followed. Exit signs, emergency egress lighting, and emergency lighting power supply will conform to requirements of the local code authority.

Hazardous Area Classification - All equipment will comply with latest version of NFPA 820. The design will include specification for the components and installation to meet these requirements, including but not limited to seal off fittings, junction boxes, disconnects, light fixtures, and ventilation systems and control stations where required.

6.11.5 Control Systems

A control panel equipped with Allen-Bradley CompactLogix class PLC and local OIT will be designed for automatic control and monitoring of the pump station processes and equipment. The PLC ladder logic and OIT graphics will need to be developed from the control strategies prepared by NEXGEN with input from the City. Close coordination with the City will be required to ensure the PLC program and OIT application are written in compliance with City standards.

Manual control devices will be provided on the control panel door for operating the pumps in case of PLC failure.

Pump station flow measurement system will use a transducer / transmitter to measure the discharge flow and transmit the data to the PLC for controlling the pumps. The OIT will display the pressure data and provide the operators a means to adjust pumping setpoints and alarm setpoints. Pump station control data and alarms will displayed OIT for operator viewing.

The OIT will be programmed and configured with screens to provide a window to the pump station processes. The operators will be able to set the process set points and view the alarms and status of the equipment. Some of the screens will enable the operators to manually control the equipment.

The PLC will collect and transfer various pump station controls, status and alarms to the City's new SCADA system via radio.

Radio equipment shall be determined during the design phase and may consist of serial, ethernet, or cellular solutions.

If a pump failure occurs, a 'Reset' pushbutton will be used in the control panel to locally reset the failure alarm after investigation of the failure.

Pump station alarms will include:

- Flowmeter failure
- Pump failures
- Motor 'Hi Temperature' (may not be required)
- VFD failures
- Utility company power failure
- Generator failures including low fuel level alarm
- Generator battery charger failure
- ATS Failure
- UPS failure
- Low voltage power source failure
- Intrusion
- Other alarms as required during the design review.

Pump station data and status will include:

- Discharge flow
- Pump running
- Control switch status
- ATS status for utility power on
- ATS status for generator power on
- Generator status
- Generator charger / battery status
- Other data and statuses as required during the design review

System Reliability

The pump stations will utilize redundancy and backup power to increase system reliability. The SCADA system will utilize physically redundant historian and I/O servers so SCADA functionality is not affected in the event of a server failure.

The pump station main PLC will be equipped with redundant power supplies to reduce the possibility of total PLC failure.

In the event of a power loss Uninterruptible Power Supplies (UPS) will provide backup power to the PLC. The UPSs will be sized to allow for communication to continue during a short power outage of at least 30 minutes, or to properly power down systems if the outage is expected to last longer than what the UPS backup can supply.

6.11.6 Control Modes

All process equipment will be operated in one or more of the following modes:

- Local Manual: The equipment is manually controlled from a local control station or from the MCC (if no local control station exists).

- Local Automatic: The equipment is automatically controlled locally by the packaged equipment PLC or through hardwired interlocking scheme.

- Remote Manual: The equipment is controlled manually through the PLC based upon commands issued from an OIT. Such commands are received by the local PLC and converted into physical outputs to the field devices.

- Remote Automatic: The equipment is controlled automatically through the PLC based upon measured process parameters, or calculated values received from field devices, or remote PLCs and upon commands and set points issued from an OIT. Such commands, set points, and process values are received by the local PLC. The local PLC will adjust the equipment accordingly, through physical outputs, to meet the process set point. Some equipment may have more than one remote automatic mode of control.

The control mode will be selectable where applicable based on local/off/remote and hand/off/auto switches located at the devices, MCC, and device control panels. Selector switch position feedback will be wired to the PLC, allowing an operator using an HMI to know whether a device is available for remote control from the HMI.

6.11.7 SCADA

The SCADA system will utilize the Inductive Automation Ignition platform and will consist of redundant SCADA servers, redundant historian software, and redundant I/O server software, Ignition Edge (OIT) and a SCADA client computer. Operators will remotely interact with equipment by interfacing with the SCADA Human Machine Interface (HMI) graphical displays. The graphical displays will represent system processes and will be designed based on design standards listed herein and as shown on the P&ID's from the final drawings. The SCADA system will be accessible via internet access point made available to operations through secure methods such as VPN and individual account verification.

Accurate flowmeter data, augmented by pressure and current sensors data, will be scrutinized by the SCADA system to give advance notice of pump performance problems. This SCADA data may also be utilized by a computerized CMMS preventative maintenance system that will allow City staff to minimize and even predict future operating, and equipment replacement, costs.

Nexgen provides municipal and commercial clients computerized maintenance management systems (CMMS) systems and we recommend the City require such a system to be included in the implementation of this entire pumping system.

6.12 PS1 SUMMARY OF DESIGN CRITERIA

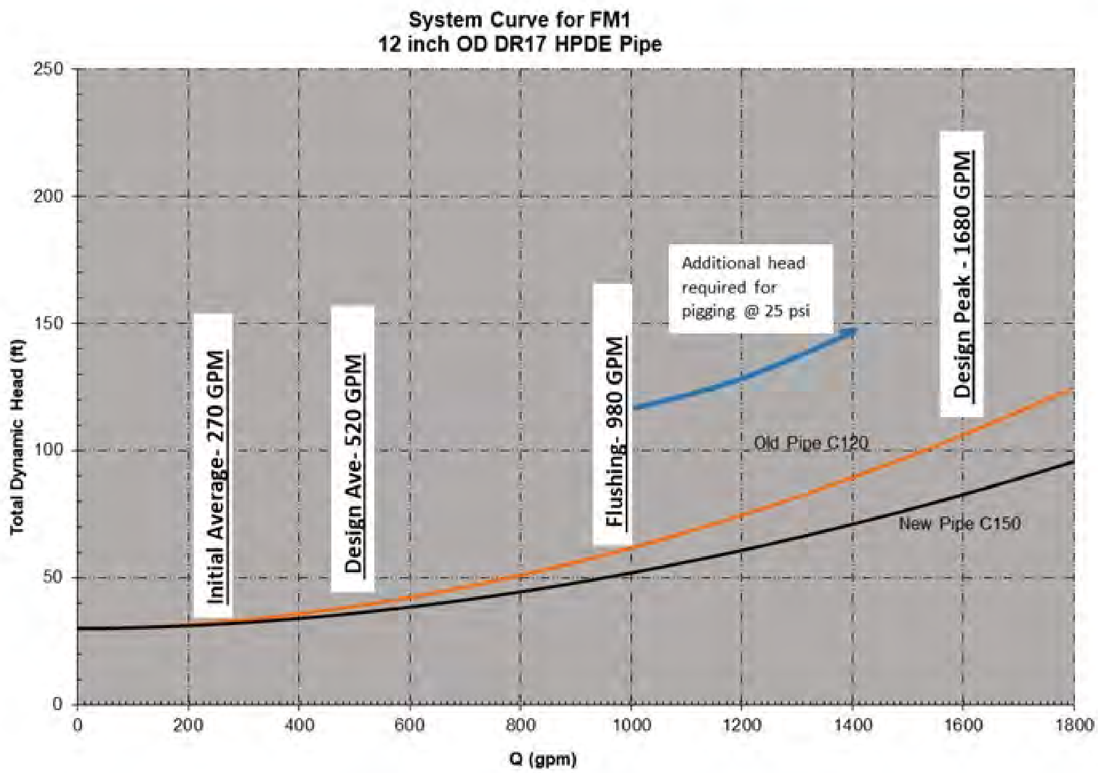


Figure 6-1 provides the system curve developed for FM1 in Section 5. Pumps will be selected to meet these flow and head requirements.

Pump Station No. 1 Design Criteria Summary

	Initial	Design
Type of Station	Self-Cleaning Channel Type w/ Submersible Pumps	
Type of Pump	Screw Centrifugal	Screw Centrifugal
Total Number of Pumps	3 (1 duty)	3 (2 duty)
Max. Pump Solids Handling (in)	3	3
Capacity, Each gpm	1,680	1,680
Reliable Pumping Capacity, gpm	2,600	2,600
First Flow (gpm) / Operating Point (feet)	270 / 35	520 / 40
Second Flow (gpm) / Operating Point (feet)	980 / 120 (a)	980 / 120 (a)
Third Flow (gpm) / Operating Point (feet)	1,080 / 55	1,680 / 110
Variable Speed Drive Type	Adjustable Frequency Rated for 100 HP Each	Adjustable Frequency Rated for 100 HP Each
Pump Motor, HP	75	75
Total Installed HP	225	225
Flowmeter type	Magnetic	Magnetic
Emergency Storage Provided, gals	40,000	40,000
Surge Controls	N/A	N/A
Odor Control	Nitrate Addition and Carbon Adsorber	Nitrate Addition and Carbon Adsorber
Emergency Generator, KW	300	300

a. Flushing flows and head required to pig line

Table 6-3 Summary of Design Criteria for PS1.

SECTION 7 – PUMP STATION NO. 2 (PS2)

7.01 Overview and Station Location

PS2 will convey all flows from PS1, and collect flows from proposed future development areas, generally east of this location. All wastewater generated by Wheatland will flow through this facility as it is conveyed north to OPUD/LCWA. This, as well as less stringent space constraints, is why above ground storage tanks, associated with limiting peak flows to OPUD/LCWA, are proposed to be located here.

This location is essentially a greenfield site without the area constraint of PS1 so operations facilities will require facilities consistent with a public works corporation yard, such as a restroom, small office, and equipment/supply storage.

In addition, the City requires space to stage equipment consistent with operations and maintenance of the sewage pumping facilities, pipeline, collection systems, and facilities supportive of other public works operations. Especially those served by the existing WWTP, such as Vactor/pump truck dumping. A Vactor dump facility, where debris is placed directly in a specially designed "draining" dumpster, and the dirty water drainage is directed into the pump station wet well. The control building will be expanded to provide secured workshop and storage space, equipment staging, and office space. A master SCADA control terminal and display may be provided here, or at another designated location.

This area is considered to be a desirable future business corridor, so mitigation of odor, noise, and visual impact of this facility and its operations are paramount. Other agencies have utilized building facades on the front facing walls/fence lines to make the group of industrial facility buildings appear to be similar to other neighborhood buildings. Such an approach is recommended for this site.

7.01.01 Location

PS2 is to be located on the westerly side of Jasper Lane, approximately 2,000 ft north of Spenceville Road. In anticipation of the proposed Hwy 65 bypass alignment, it is understood that Jasper Lane will serve as a frontage street to the freeway, with future business infill in its immediate vicinity. We have assumed the Jasper Lane right of way will extend 70 feet from its current centerline, and that there will be an additional 20 foot setback requirement to any structures.

Flood Protection

The proposed PS2 site is on relatively high local ground so it should not be prone to significant flood risk. However, during design the local 100-year flood elevation will be determined and the site, and especially the rims of any hydraulic structures and controls rooms, will be filled/raised to at least 2-feet above the 100-year flood elevation.

7.02 Current and Future Capacity

Section 3 of the BODR described existing and expected future flows at each pump station. Flowrates into PS2 are summarized in Table 7-1 below.

	EDUs	ADWF MGD	AAF MGD	Peak Day MGD	Peak Hour MGD	Peak Hour GPM
Initial	1,520	0.37	0.40	1.13	1.54	1,080
Midpoint	3,500	0.85	0.91	2.52	3.07	2,130
Design	5,500	1.33	1.43	3.75	4.43	3,080

Table 7-1
Flowrates into PS No. 2

7.03 Pump Sizing, Pumping Strategy, and Wet Well Configuration

PS2 will utilize two channel style self-cleaning, submersible pump wet well configurations, similar to that proposed at PS1 but built back to back, with a common wall. The trough style utilizes a pump in a sump at the end of the channel to regularly pump the wet well down such that the heavier debris is scoured and scum mats and other floating materials are evacuated during a cleaning cycle. (See discussion for PS1 for more details)

The sewer manhole will discharge to a flow splitter/rock pocket structure that will allow either, or both, wet wells to be isolated for servicing. As with PS1, Hidrostal screw-centrifugal pumps, or their functional equivalent, are recommended for this PS. In fact, the exact same 8" x 4" Model FSK – S pumps as proposed for PS1 can be used here, with five pumps running in parallel sufficient for peak flow future design conditions. Six pumps are required for redundancy so just like PS1 each wet well with have three 8" x 4" pumps.

Having the identical pumps has the added advantage of minimizing spare parts necessary to have on hand and would even allow moving a pump to a different station in the highly unlikely situation where more than one pump fails and timely parts or service is unavailable.

7.04 Emergency and Peak Flow Storage

The trunk sewer serving PS2 will be oversized to 36-in diameter to provide approximately 50,000 gallons of in-line storage over its approximately 1,100 feet. This is functionally similar to the storage to be provided in underground tanks at PS1. The inground storage may be utilized for wet well cleaning cycles, attenuation of wet weather peak flows, and to provide water for pigging the PS2 discharge pipeline.

In addition to the in-ground storage, PS2 will also include ground level storage of up to 1.2 million gallons, in three (3) 400,000 gallon steel tanks. The 1.2 million gallon volume plus volume within the wet wells and in line storage reflects difference between projected peak daily flows and OPUD's criteria of limiting peak flows to no more than 3.3 mgd at design conditions. Initially two tanks will be constructed with the remaining tank added as flows increase.

The inlet to the PS will have a motorized isolation gate to build up water in the inground storage for a wet well cleaning cycle; or to provide the opportunity to isolate the PS2 wet-well for several hours to facilitate emergency, or infrequent, repairs. The above ground storage will be fed from a modulating control valve on the PS discharge which will open to divert an adjustable (programmable) portion of flow into the tank(s), primarily during peak flow events, and the tank(s) will drain back to the wet well to be pumped out once flows subside. Either of the above storage locations may be utilized for emergency storage for emergency servicing of the force main from PS2 to PS3.

7.05 Cleaning Operations

At this PS there are three systematic cleaning requirements that must be facilitated. First, the wet well will be of the same self-cleaning channel configuration as PS1. (See PS1 description for further details).

Second, to facilitate infrequent force main cleaning, a pig launcher will be provided for the PS2 to PS3 force main. Pigs launched from PS1 will be caught at the first 36" diameter gravity sewer manhole, and PS3 will have a pig catcher. FM2 has a total pipe volume of about 360,000 gallons over its 3.5-mile distance between PS2 and PS3. During pigging operations one of the 400,000-gallon tanks will be filled to supply water to move the pig to PS3.

And finally, the storage tank(s) will need to have built in cleaning features, such as a spray/wash down system, to be utilized after storage events. This system will require a water source to provide adequate water, as well as high pressure (250psi) booster pumps. Other uses around the site such as irrigation, washdowns, biofilter moisture control, as well as toilet facilities will not need to be boosted to more than 60 psi. Therefore two air-gap tanks of sufficient size are proposed for this site. 5,000 gallons to wash the large storage tanks and 1,000 gallons for other uses.

Initially they will be fed from a relatively small irrigation type well (5 gpm is sufficient), after development occurs in the area a direct connection to City water (through the air-gap system) should be provided. The temporary well will be located near the space allotted for the third storage tank so separation of the well from wastewater is maximized. It is likely City water will be available at PS2 by the time the third storage tank will be required

A pedestal type pressure washer station will be provided to facilitate efficient cleaning of equipment and work areas. And, designated paved, and chemical storage areas will direct all washdown (and rainfall) water to the influent sewer so as to preclude potential contaminated stormwater discharges. This should simplify or even eliminate the need for a permitted SWPPP monitoring plan.

7.06 Control Building

As with the other PS a prefabricated cement, or block building will be provided for the controls. Because this site is not size constrained, and it serves as the largest pumping facility in the regional pipeline system, we recommend extra space be allocated for a City operations staff office and washroom. This office could also serve as the central SCADA location for the pipeline system. As discussed previously, due to this site being in a desirable development location we propose to utilize a facade like wall to make the control building and ancillary structures appear similar to planned adjacent structures.

7.07 Surge Protection

Surge protection requirements are not anticipated to be incorporated, based on the surge analysis performed for the pipeline design.

7.08 Odor Control

PS2 will include robust odor control systems due to its size, the storage tanks provided which can vent foul air, and the possibility for development surrounding the station in the future.

PS2 will be equipped with two types of odor systems. Biofilters will be used to collect and clean foul air from the wet wells and manholes. Carbon adsorbers will be attached to vents from the wet weather storage tanks. Biofilters represent a low operating cost solution for odors where bacteria within engineered compost are used to clean foul air. Table 7 – 2 details design criteria associated with odor control facilities anticipated at PS 2.

Design Parameter	**Criteria**
Average Inlet Hydrogen Sulfide Concentration [a]	10 ppmv
Hydrogen Sulfide Removal Requirement	90 %
Air Exchanges per Hour [b]	12 ACPH
Total Volume of Air Treated [c]	16,700 cf
Media Loading Rate (LR)	3 cfm/sq ft
Empty Bed Residence Time (EBRT)	60 seconds
Average Air Flow Rate	3,400 cfm

(a) Inlet hydrogen sulfide concentration is based on typical domestic sewage values.
(b) The number of air changes per hour (ACPH) is such that is recommended by the EPA for wet wells.
(c) Total volume of air to be treated includes daily sources of air flow.
(d) Media loading rate has been assumed based on typical values for bulky organic media. This assumption will be re-evaluated during detailed design.
(e) Empty bed residence time has been assumed based on typical values for bulky organic media. This assumption will be re-evaluated during detailed design.

Table 7-2 Summary of the biofilter design criteria for PS2.

Using the criteria specified in Table 7-2, it is estimated that an area of 30 feet by 20 feet (600 SF) will be sufficient for each of two biofilters to treat the expected volume of air. It is anticipated that foul air will be supplied to the biofilters from vents from the influent junction box and the PS wet well. A vent pipe, with a quick connect hose will be provided to attach to the Vactor station dumpster, which will also be supplied with a cover to help contain and treat any odors from the debris.

The biofilter units are to be filled with biological growth media, either organic or inorganic, and equipped with an exhaust fan to pull foul air through the specified bed. Depending upon the type selected, media operational lives range anywhere from 2 to 20 years, where organic media such as woodchips demonstrate shorter life cycles and a larger footprint, and inorganic, engineered media demonstrate longer life cycles and smaller footprints. The specified media type and biofilter configuration will be determined during design, however at this time it is anticipated that the biofilters will include the following components:

- An In-ground structure lined and filled with basic organic media consisting of a mixture of woodchips, gravel, and large organic materials
- A duct manifold foul air distribution system
- Foul air collection piping equipped with an exhaust fan and humidifier for the collection and conveyance of foul air
- Irrigation piping for moisture control within the biofilter
- Moisture collection piping

Because biofilters are biological systems, they tend to not perform as well during episodic odor evets such as when the storage tanks are used to fill during storm events. As a result, the vent from each tank will be equipped with a carbon adsorber vessel. Table 7-3 details a preliminary set of design criteria anticipated for potential carbon adsorption at PS2.

Design Parameter	**Criteria**
Average Inlet Hydrogen Sulfide Concentration [a]	10 ppmv
Hydrogen Sulfide Removal Requirement	90 %
Air Exchanges per Hour [b]	12 ACPH
Total Volume of Air Treated [c]	161,000 cf
Carbon Face Velocity [d]	50 fpm
Detention Time [e]	4 seconds
Average Air Flow Rate	32,000 cfm

(f) Inlet hydrogen sulfide concentration is based on typical domestic sewage values.
(g) The number of air changes per hour (ACPH) is such that is recommended by the EPA for wet wells.
(h) Total volume of air to be treated includes daily sources of air flow and not intermittent storage.
(i) Carbon face velocity has been assumed based on typical values. This assumption will be re-evaluated during detailed design.
(j) Detention time has been assumed based on typical values. This assumption will be re-evaluated during detailed design.

Table 7-3 Summary of carbon adsorption design criteria for PS1.

It may be practical to design, accommodate, but not construct these odor facilities until development encroaches closer to the pump station site. The possible phasing of facilities will be determined prior to completion of the design.

7.09 Site Improvements

Site improvements will include paving the areas requiring regular access for servicing and monitoring operations, as well as the equipment staging areas. In the areas designated for the above ground storage tanks we propose AB or crushed rock access ways around the tanks to minimize impervious surfaces.

While paved areas where chemicals washdowns may occur will be drained to the wet well, much of the site runoff will be directed to a stormwater retention/infiltration swale, or other BMP, located on the westerly side of the site.

7.10 Sampling and Flow Measurement

As with the other PSs flow will be measured by a magnetic flowmeter in the above ground discharge manifold. Pig launch fittings will be provided in the flowmeter bypass piping.

At a minimum a location with connections for a portable composite sampler will be provided on site. However, because all flow to OPUD/LCWA will pass through this location for the foreseeable future a permanent sampler installation is recommended. Flow and sampler data collected at this location could be used for determining/confirming the treatment billing from OPUD/LCWA. Although such facilities may also be located at PS3

7.11 Electrical and Controls

As with PS1, the electrical system design for the pump station will incorporate the requirements of the latest National Electric Code (NEC) - NFPA 70, applicable provisions of the California Electric Code (CEC), Pacific Gas & Electric (PG&E) Service Requirements (TD-70001) Greenbooks Standards, and City Standards and Ordinances, as applicable.

7.11.1 Electrical Service

The new electrical service will be provided by PG&E from existing overhead power lines. Based on site observations, overhead power line from PG&E are located adjacent to the PS site, and the service will be routed underground to an on-site PG&E furnished outdoor rated transformer. The PG&E transformer will connect to the PG&E metering cabinet inside the proposed control building and new 480Y/277-VAC, three-phase (3PH), four-wire (4W) distribution system, with load rating to be determined and automatic transfer switch (ATS) for standby power provisions.

A PG&E electric service application will be submitted three months prior to the commencement of the construction to initiate the service planning. The costs associated with the electric service will be arranged and paid for by the City as determined by PG&E service estimation department.

7.11.2 Motor Control Systems

Please refer to Section 6.11.2 in the write up for PS1 for this information, as identical type systems will be installed at this location.

7.11.3 Standby Generator

Please refer to Section 6.11.3, in the write-up for PS1 as the generator installation will be very similar. The generator at this location will be larger at 500 KW, and it will initially be fueled by an LP gas, or diesel, tank and converted to natural gas as that utility service becomes available. The fuel tank will be sized for several days of service under maximum design flows and it will be located in an accessible location for servicing.

7.11.4 Electrical Safety

Please refer to Section 6.11.4 in the PS1 write-up as electrical safety considerations are identical.

7.11.5 Controls Systems

A control panel equipped with Allen-Bradley CompactLogix class PLC and local OIT will be designed for automatic control and monitoring of the pump station processes and equipment. The PLC ladder logic and OIT graphics will need to be developed from the control strategies prepared by NEXGEN with input from the City. Close coordination with the City will be required to ensure the PLC program and OIT application are written in compliance with City standards.

Manual control devices will be provided on the control panel door for operating the pumps in case of PLC failure.

Pump station flow measurement system will use a transducer / transmitter to measure the discharge flow and transmit the data to the PLC for controlling the pumps. The OIT will display the pressure data and provide the operators a means to adjust pumping setpoints and alarm setpoints. Pump station control data and alarms will displayed OIT for operator viewing.

The OIT will be programmed and configured with screens to provide a window to the pump station processes. The operators will be able to set the process set points and view the alarms and status of the equipment. Some of the screens will enable the operators to manually control the equipment.

The PLC will collect and transfer various pump station controls, status and alarms to the City's new SCADA system via radio.

Radio equipment shall be determined during the design phase and may consist of serial, ethernet, or cellular solutions.

If a pump failure occurs, a 'Reset' pushbutton will be used in the control panel to locally reset the failure alarm after investigation of the failure.

Pump station alarms will include:

- Flowmeter failure
- Pump failures
- Motor 'Hi Temperature' (may not be required)
- VFD failures
- Utility company power failure
- Generator failures including low fuel level alarm
- Generator battery charger failure
- ATS Failure
- UPS failure
- Low voltage power source failure
- Intrusion
- Other alarms as required during the design review.

Pump station data and status will include:

- Discharge flow
- Pump running
- Control switch status
- ATS status for utility power on
- ATS status for generator power on
- Generator status
- Generator charger / battery status
- Other data and statuses as required during the design review

System Reliability

The pump stations will utilize redundancy and backup power to increase system reliability. The SCADA system will utilize physically redundant historian and I/O servers so SCADA functionality is not affected in the event of a server failure.

The pump station main PLC will be equipped with redundant power supplies to reduce the possibility of total PLC failure.

In the event of a power loss Uninterruptible Power Supplies (UPS) will provide backup power to the PLC. The UPSs will be sized to allow for communication to continue during a short power outage of at least 30 minutes, or to properly power down systems if the outage is expected to last longer than what the UPS backup can supply.

7.11.6 Control Modes

All process equipment will be operated in one or more of the following modes:

- Local Manual: The equipment is manually controlled from a local control station or from the MCC (if no local control station exists).
- Local Automatic: The equipment is automatically controlled locally by the packaged equipment PLC or through hardwired interlocking scheme.
- Remote Manual: The equipment is controlled manually through the PLC based upon commands issued from an OIT. Such commands are received by the local PLC and converted into physical outputs to the field devices.
- Remote Automatic: The equipment is controlled automatically through the PLC based upon measured process parameters, or calculated values received from field devices, or remote PLCs and upon commands and set points issued from an OIT. Such commands, set points, and process values are received by the local PLC. The local PLC will adjust the equipment accordingly, through physical outputs, to meet the process set point. Some equipment may have more than one remote automatic mode of control.

The control mode will be selectable where applicable based on local/off/remote and hand/off/auto switches located at the devices, MCC, and device control panels. Selector switch position feedback will be wired to the PLC, allowing an operator using an HMI to know whether a device is available for remote control from the HMI.

7.11.7 SCADA

The SCADA system will utilize the Inductive Automation Ignition platform and will consist of redundant SCADA servers, redundant historian software, and redundant I/O server software, Ignition Edge (OIT) and a SCADA client computer. Operators will remotely interact with equipment by interfacing with the SCADA Human Machine Interface (HMI) graphical displays. The graphical displays will represent system processes and will be designed based on design standards listed herein and as shown on the P&ID's from the final drawings. The SCADA system will be accessible via internet access point made available to operations through secure methods such as VPN and individual account verification.

PS2 control building and/or another City operations location would serve as locations for the SCADA servers and system overview displays/interfaces.

Accurate flowmeter data, augmented by pressure and current sensors data, will be scrutinized by the SCADA system to give advance notice of pump performance problems. This SCADA data may also be utilized by a computerized CMMS preventative maintenance system that will allow City staff to minimize and even predict future operating, and equipment replacement, costs.

Nexgen provides municipal and commercial clients CMMS systems and we recommend the City require such a system to be included in the implementation of this entire pumping system.

7.12 PS2 Summary of Design Criteria

Figure 7-1 provides the system curve developed for FM2 in Section 5. Pumps will be selected to meet these flow and head requirements.

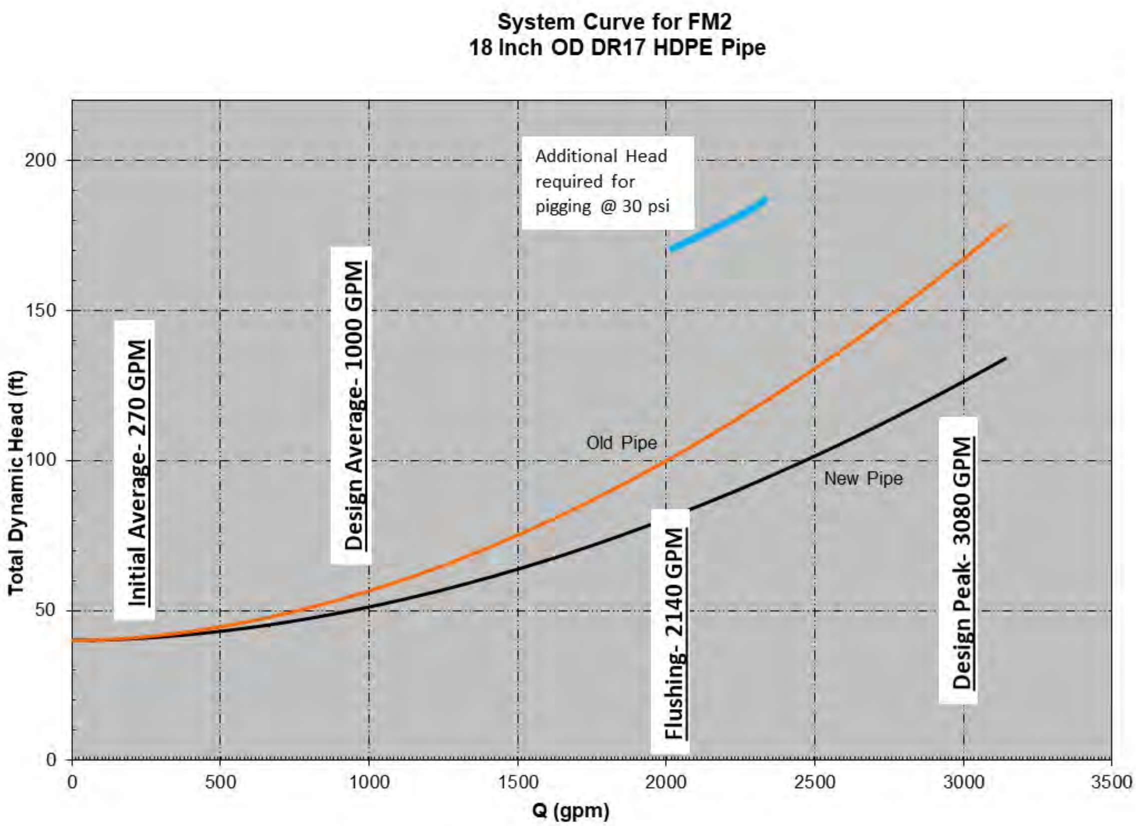


Figure 7-1

	Initial	Design
Type of Station	Self Cleaning Channel Type w/ Submersible Pumps	
Type of Pump	Screw Centrifugal	Screw Centrifugal
Total Number of Pumps	5 (4 duty) (b) +	6 (5 duty) +
Max. Pump Solids Handling (in)	3+	3+
Capacity, Each gpm	1,750	1,750
Reliable Pumping Capacity, gpm	3,200	3,200
First Flow (gpm) / Operating Point (feet)	270 / 45	1,000 / 60
Second Flow (gpm) / Operating Point (feet)	2,140 / 180 (a)	2,140 / 180 (a)
Third Flow (gpm) / Operating Point (feet)	2,140 / 80	3,080 / 170
Variable Speed Drive Type	Adjustable Frequency Drives Rated for 100 HP	Adjustable Frequency Drives Rated for 100 HP
Pump Motor, HP	75	75
Total Installed HP	450	450
Flowmeter type	Magnetic	Magnetic
Emergency Storage Provided, gals	800,000 (2 - 400,000 Gal Tanks)	1,200,000 (3 - 400,000 Gal Tanks)
Surge Controls	N/A	N/A
Odor Control	Biofilter and Carbon	Biofilter and Carbon
Emergency Generator, KW	500	500

(a) Flushing flows and head required to pig line, (b) Recommend initial installation of six pumps with one available as a spare for this and other stations.

Table 7-4
Pump Station No. 2 Design Criteria Summary

SECTION 8 - PUMP STATION NO. 3 (PS3)

8.01 Overview Station and Location

PS3 will convey all flows from PS2, serving as a booster PS, without collecting any additional flow from its immediate surroundings. All wastewater generated by Wheatland will flow through this facility as it is conveyed to OPUD/LCWA.

Like PS2, this location is essentially a greenfield site without the area constraint of PS1 however its general location, determined by hydraulic considerations, is at a confluence of Highway 65, UPRR, and US Government RR, with major underground utilities corridors. On top of those constraints, the Highway 65 bypass project plans envision a new interchange which may further constrain our recommended location. Therefore, we are presenting two alternative sites that work hydraulically for consideration, as the land acquisition process proceeds.

8.01.01 Location

The first site (Option 1) is located at the confluence of Highway 65 and Rancho Road. There are no nearby residences, and it is at the end of the planned OPUD gravity sewer system. However, the new Highway 65 interchange plans essentially surrounds the site, so coordination with Caltrans may present challenges.

Option 1 is the preferred location, due to the proximity of the OPUD sewer, and its potential to better serve moving future flows to LCWA. However, if the coordination with Caltrans is problematic Option 2 will work, although there are nearby residences that may be affected by operations, and more extensive spill containment facilities may be required due to lack of proximate sewer pipes.

Flood Protection

The 100-year flood elevations should be verified during design and it may require some buildup of the site to be above it, however neither site is adjacent to a significant drainage course so we do not expect this to be a major factor. It is likely Option 1 is less prone to local flooding, being on the downslope side of the UPRR alignment.

8.02 Current and Future Capacity

Section 3 of the BODR described existing and expected future flows at each pump station. Flowrates are summarized in Table 8-1 below.

	EDUs	ADWF MGD	AAF MGD	Peak Day MGD	Peak Hour MGD	Peak Hour GPM
Initial	1,520	0.37	0.40	1.13	1.54	1,080
Midpoint	3,500	0.85	0.91	2.52	3.07	2,130
Design	5,500	1.33	1.43	3.75	4.43	3,080

Table 8-1
Flowrates into PS No. 3

8.03 Pump Sizing, Pumping Strategy, and Wet Well Configuration

8.03.1 Initial Conditions

The configuration of the wet well for this PS is not typical as it is only receiving flow from the force main system and it is located above ground in a stainless-steel tank, rather than underground like a typical gravity fed sewage PS. This unconventional approach is proposed due to need to control the hydraulics of the PS2 force main by utilizing a standpipe at the PS3 location. The standpipe effectively raises the static hydraulic grade to ensure a full pipe at the highest points of its alignment (approximately 95 feet elevation), which is about 20 feet above grade at PS3. From the standpipe the sewage will convey downward, through a drop pipe, to the operating level in the above ground wet well. The standpipe will be equipped with an air valve that is normally open to the atmosphere and that closes before sewage reaches the top of the standpipe and spills.

The other non-typical aspect of PS3 is that it is downhill to the point of discharge to the OPUD system at Ostrom Road (approximately 65 feet elevation). So, until the dynamic losses in the PS3 force main to Ostrom Road increase to about 20 feet, corresponding to the operating WSEL in the above ground wet well, it will flow by gravity. So, pumps need to turn only once flows from PS2 reach about 1,000 gpm under new pipe conditions and decreasing to about 500 gpm at lower C factors, after which the pumps will come on to boost the head as necessary to move higher flows.

The pumping function will be in an above ground pump room, with a check valve to allow low flows to bypass the pumps. This is identical in function to water system booster pumping stations. These types of booster pumping stations are so common they are available as prefabricated buildings, delivered on a truck and placed on a slab ready to go. We propose to install a prefabricated booster pump station at PS3 and specify sewage specific pumps and valving which are suited to pass solids and debris.

This is proposed to be a 3-pump station, once again using the Wemco-Hidrostal 8" x 4" Model F4K-S screw centrifugal pump. In this case, however, the pumps will be mounted horizontally in a dry pump room.

A single F4K-S pump will accommodate the very low flows up to approximately 500 gpm (to stay in its BEP range) against a minimal discharge head. This requires running the pump at minimal speed over this range. For flows in excess of 500 gpm, the manufacturer recommends operating two pumps in parallel so as to move the system curve up into the pump's performance area...as you can see on the attached performance curve for this station. With this operating mode, these pumps will easily cover the full station flow range up to the peak flow requirement of 3080 gpm for both the new and old pipe friction coefficients. These pumps would require 60 hp x 1800 rpm TEFC motors direct coupled to the pumps.

The pumps currently selected for PS3 would be the same volute/impeller as the small pumps selected for PS1 and PS2, but they would have a smaller motor and be on a horizontal dry-pit frame. *Although, they could be supplied as identical to the PS1/PS2 pumps with the 75HP immersible motors, and mounted in the prefabricated building pump room.* This would facilitate moving a pump from, or to, any of the three PSs; and minimize the number of spare parts necessary to keep on hand.

Controlling these pumps will require careful consideration to properly pace them to coincide with the required flow through this station. Care must be taken to avoid over speeding these pumps against minimal discharge head conditions to avoid damage due to runout operation.

8.04 Emergency Storage

While the above ground standpipe/wet well will provide some operational storage, no emergency storage is proposed for this site.

During design the exact size of the wet well will be further evaluated to confirm the volume stored will be sufficient to smooth out transient conditions that may occur as pumps at PS2 modulate its output flow and PS3 pumps turn on and react to the changing influent flow, considering the transit times of the pressure/flow waves that are induced. If additional volume is necessary (i.e. to prevent a transient related spill, or excessive pump cycling) the diameter or number of wet well tanks may change in final design.

8.05 Cleaning Operations

At this PS there are two systematic cleaning requirements that must be facilitated. First, the wet well will need to be routinely cleared of debris. We propose to facilitate this function by providing a pump recirculation line with motorized valve to regularly agitate the tank contents. We will also install an internal spray system to occasionally wash down the walls of the tank, similar to but much smaller than the system at the PS2 storage tanks. Until a water service is available a water truck will need to provide the water for tank washdowns. The wet well tank will also have a drain connection so a Vactor or septic pump type truck can pump out settled debris as required.

Second, to facilitate force main cleaning, a pig catcher will be provided just upstream of the standpipe/wet well, and a pig launcher will be installed in parallel with the effluent flow meter, similar to PS1 and PS2.

A pedestal type pressure washer station will be provided to facilitate efficient cleaning of equipment and work areas. And, designated paved, and chemical storage areas will direct all washdown (and rainfall) water via small sump pump(s) to the influent sewer or above ground wet well, so as to preclude potential contaminated stormwater discharges. This should simplify or even eliminate the need for a permitted SWPPP monitoring plan.

8.06 Control Building

The control building will be prefabricated and include the pumping room and adjacent backup generator. Washroom facilities are not proposed to be located at this site.

8.07 Surge Protection

Due to the low pressure downstream of this PS we do not expect to need surge protection facilities, however there is ample room to place surge tanks as required for future flow scenarios.

8.08 Odor Control

The standpipe/wet well is the only place that should generate odors at PS3. Odors will be controlled by installing the standpipe and vent inside the wet well tank and providing a drop pipe to below the normal WSEL to control the cascade of water falling. Furthermore, the wet well tank will be connected to an odor scrubber with foul air piping. Because water service will not be available it will probably be more practicable to use carbon adsorbers rather than a biofilter as described previously. Although, either of the proposed site plans has space a biofilter could be installed at a later date when a water supply may become available.

8.09 Site Improvements

Improvements for the PS3 site include paving and fencing, and once a water source becomes available, buffer landscaping and/or a biofilter. A relatively small swale for stormwater retention/infiltration is also anticipated. Both site options allow for a pass thru entrance/exit to facilitate service trucks without the need to turn around.

8.10 Sampling and Flow Measurement

As with PS1 flows will be measured via a magnetic flowmeter, and provisions for a portable compositing sampler will be provided. In this case the sampler would draw from the stainless steel wet well. Like PS2 all sewage being conveyed to OPUD/LCWA will pass through this site so metering and sampling may be desirable for treatment billing verification. The flowmeter would also be a redundant check on total flow conveyed to OPUD/LCWA when compared to the PS2 flow readings, although instantaneous reading may not always be identical. The sampling could give a reading on how much the strength of the sewage changes while in transit, again, compared to samples taken at PS2.

8.11 Electrical and Controls

As with PS1and 2, the electrical system design for the pump station will incorporate the requirements of the latest National Electric Code (NEC) - NFPA 70, applicable provisions of the California Electric Code (CEC), Pacific Gas & Electric (PG&E) Service Requirements (TD-70001) Greenbooks Standards, and City Standards and Ordinances, as applicable.

8.11.1 Electrical Service

The new electrical service will be provided by PG&E from existing overhead power lines. Based on site observations, overhead power line from PG&E are located adjacent to the PS site, and the service will be routed underground to an on-site PG&E furnished outdoor rated transformer. The PG&E transformer will connect to the PG&E metering cabinet inside the proposed control building and new 480Y/277-VAC, three-phase (3PH), four-wire (4W) distribution system, with load rating to be determined and automatic transfer switch (ATS) for standby power provisions.

A PG&E electric service application will be submitted three months prior to the commencement of the construction to initiate the service planning. The costs associated with the electric service will be arranged and paid for by the City as determined by PG&E service estimation department.

8.11.2 Motor Control Systems

Please refer to Section 6.11.2 in the write up for PS1 for this information, as identical type systems will be installed at this location.

8.11.3 Standby Generator

Please refer to Section 6.11.3, in the write-up for PS1 as the generator installation will be very similar. The generator at this location will be 250 KW, and it will initially be fueled by an LP gas tank and converted to natural gas as that utility service becomes available. The LP tank will be sized for several days of service under design flows and it will be located in an accessible location for servicing. A CMU block wall will be placed around it to minimize the opportunities for vandalism.

8.11.4 Electrical Safety

Please refer to Section 6.11.4 in the PS1 write-up as electrical safety considerations are identical.

8.11.5 Controls Systems

A control panel equipped with Allen-Bradley CompactLogix class PLC and local OIT will be designed for automatic control and monitoring of the pump station processes and equipment. The PLC ladder logic and OIT graphics will need to be developed from the control strategies prepared by NEXGEN with input from the City. Close coordination with the City will be required to ensure the PLC program and OIT application are written in compliance with City standards.

Manual control devices will be provided on the control panel door for operating the pumps in case of PLC failure.

Pump station flow measurement system will use a transducer / transmitter to measure the discharge flow and transmit the data to the PLC for controlling the pumps. The OIT will display the pressure data and provide the operators a means to adjust pumping setpoints and alarm setpoints. Pump station control data and alarms will displayed OIT for operator viewing.

The OIT will be programmed and configured with screens to provide a window to the pump station processes. The operators will be able to set the process set points and view the alarms and status of the equipment. Some of the screens will enable the operators to manually control the equipment.

The PLC will collect and transfer various pump station controls, status and alarms to the City's new SCADA system via radio.

Radio equipment shall be determined during the design phase and may consist of serial, ethernet, or cellular solutions.

If a pump failure occurs, a 'Reset' pushbutton will be used in the control panel to locally reset the failure alarm after investigation of the failure.

Pump station alarms will include:

- Flowmeter failure
- Pump failures
- Motor 'Hi Temperature' (may not be required)
- VFD failures
- Utility company power failure
- Generator failures including low fuel level alarm
- Generator battery charger failure
- ATS Failure
- UPS failure
- Low voltage power source failure
- Intrusion
- Other alarms as required during the design review.

Pump station data and status will include:

- Discharge flow
- Pump running
- Control switch status
- ATS status for utility power on
- ATS status for generator power on
- Generator status

- Generator charger / battery status
- Other data and statuses as required during the design review

System Reliability

The pump stations will utilize redundancy and backup power to increase system reliability. The SCADA system will utilize physically redundant historian and I/O servers so SCADA functionality is not affected in the event of a server failure.

The pump station main PLC will be equipped with redundant power supplies to reduce the possibility of total PLC failure.

In the event of a power loss Uninterruptible Power Supplies (UPS) will provide backup power to the PLC. The UPSs will be sized to allow for communication to continue during a short power outage of at least 30 minutes, or to properly power down systems if the outage is expected to last longer than what the UPS backup can supply.

8.11.6 Control Modes

All process equipment will be operated in one or more of the following modes:

- Local Manual: The equipment is manually controlled from a local control station or from the MCC (if no local control station exists).

- Local Automatic: The equipment is automatically controlled locally by the packaged equipment PLC or through hardwired interlocking scheme.

- Remote Manual: The equipment is controlled manually through the PLC based upon commands issued from an OIT. Such commands are received by the local PLC and converted into physical outputs to the field devices.

- Remote Automatic: The equipment is controlled automatically through the PLC based upon measured process parameters, or calculated values received from field devices, or remote PLCs and upon commands and set points issued from an OIT. Such commands, set points, and process values are received by the local PLC. The local PLC will adjust the equipment accordingly, through physical outputs, to meet the process set point. Some equipment may have more than one remote automatic mode of control.

The control mode will be selectable where applicable based on local/off/remote and hand/off/auto switches located at the devices, MCC, and device control panels. Selector switch position feedback will be wired to the PLC, allowing an operator using an HMI to know whether a device is available for remote control from the HMI.

8.11.7 SCADA

The SCADA system will utilize the Inductive Automation Ignition platform and will consist of redundant SCADA servers, redundant historian software, and redundant I/O server software, Ignition Edge (OIT) and a SCADA client computer. Operators will remotely interact with equipment by interfacing with the SCADA Human Machine Interface (HMI) graphical displays. The graphical displays will represent system processes and will be designed based on design standards listed herein and as shown on the P&ID's from the final drawings. The SCADA system will be accessible via internet access point made available to operations through secure methods such as VPN and individual account verification.

PS2 control building and/or another City operations location would serve as locations for the SCADA servers and system overview displays/interfaces.

Accurate flowmeter data, augmented by pressure and current sensors data, will be scrutinized by the SCADA system to give advance notice of pump performance problems. This SCADA data may also be utilized by a computerized CMMS preventative maintenance system that will allow City staff to minimize and even predict future operating, and equipment replacement, costs.

Nexgen provides municipal and commercial clients CMMS systems and we recommend the City require such a system to be included in the implementation of this entire pumping system.

8.12 PS3 Summary of Design Criteria

Figure 8-1 provides the system curve developed for FM3 in Section 5. Pumps will be selected to meet these flow and head requirements.

Table 8-2 provides a summary of the design criteria for PS3.

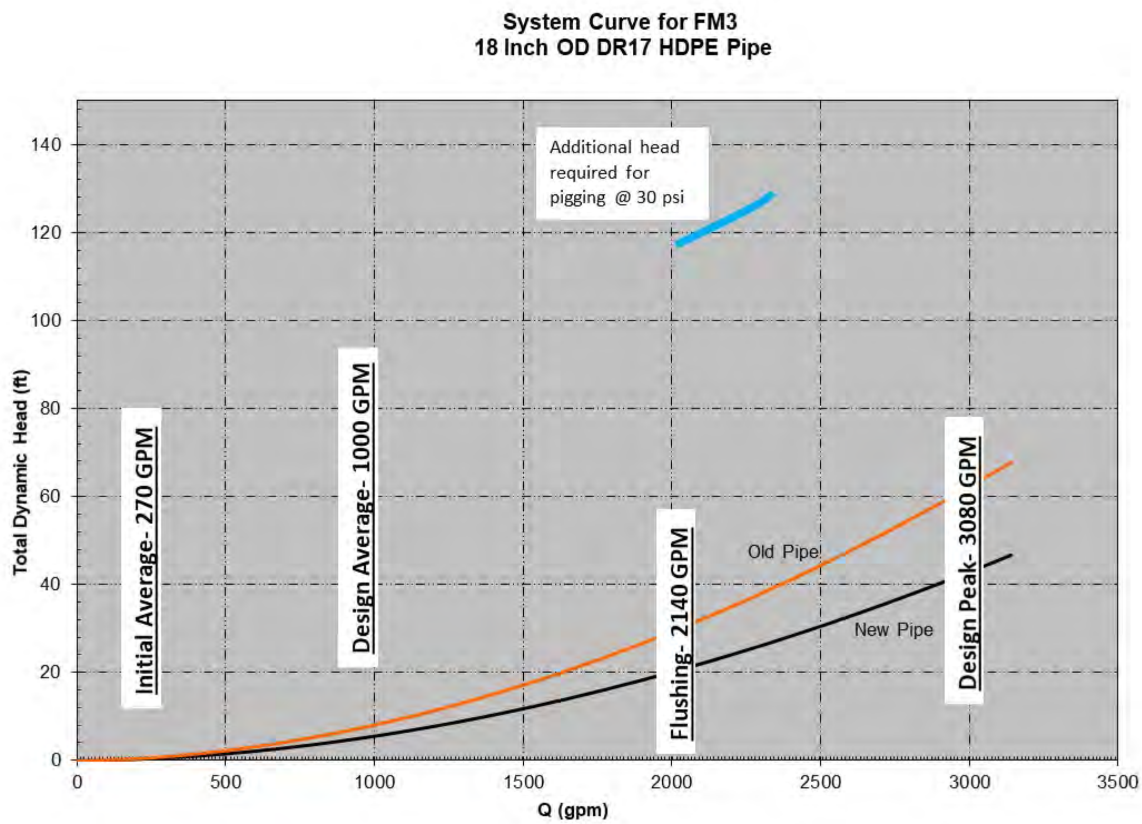


Figure 8-1. FM 3 System Curve

	Initial	Design
Type of Station	Dry Pump Room w/ Separate Wet Well	
Type of Pump	Screw Centrifugal,	Screw Centrifugal
Total Number of Pumps	3 (1 duty)	3 (2 duty)
Max. Pump Solids Handling (in)	3	3
Capacity, Each gpm	1,600	1,600
Reliable Pumping Capacity, gpm	3,200	3,200
First Flow (gpm) / Operating Point (feet)	270/ 20 (a)	1,000 / 40 (a)
Second Flow (gpm) / Operating Point (feet)	2,140 / 120 (a) (b)	2,140 / 120 (a)(b)
Third Flow (gpm) / Operating Point (feet)	2,140 / 30 (a)	3,080 / 80 (a)
Variable Speed Drive Type	Adjustable Frequency Drives Rated for 100 HP	Adjustable Frequency Drives Rated for 100 HP
Pump Motor, HP	75	75
Total Installed HP	210	210
Flowmeter type	Magnetic	Magnetic
Operating Storage Provided, gals	10,000	10,000
Surge Controls	N/A	N/A
Wet Well Tank Volume, gals	20,000	20,000
Odor Control	Carbon Adsorber	Carbon Adsorber
Emergency Generator, KW	250	250

(a) Two pumps in operation
(b) Flushing flows and head required to pig line

Table 8-2
Pump Station No. 3 Design Criteria Summary

SECTION 9 – WASTEWATER TREATMENT PLANT DECOMMISSIONING

Section 9.01 Introduction

The City currently owns and operates a wastewater treatment plant (WWTP) with a plant capacity of 0.62 million gallons per day (MGD). The plant was originally built in 1967, with subsequent upgrades in 1980 and 1990. This plant will be decommissioned because this existing WWTP has limited capacity and will be difficult to expand to meet planned City growth. The infiltration basins (the disposal component of the plant) are located on the river side of the Bear River Levee and are subject to flood damage, as most recently realized in the winter of 2005/2006. In addition, the plant provides only secondary-level treatment and due to changes in wastewater treatment requirements since the plant was constructed, the Regional Water Quality Control Board (Regional Board) will require treatment upgrades for any new permit or expansion. For these reasons, the City has elected to construct a pipeline to allow the City to connect to a more modern wastewater treatment plant and decommission the existing facility.

When the pipeline project is complete, the next step will be to address the existing WWTP. There are several components that need to be addressed. The City will need to buydown the user rate for the existing City users to allow them to connect to OPUD. Once this is complete, the City will need to transfer its existing users to the new pipeline and decommission the existing plant. To date, the timeline for moving the City users to the new pipeline has not been finalized by the City. As such, the goal will be to prepare a report that will outline the process of the WWTP decommissioning. This will provide a baseline for the City's future consultant to build on when the City is ready to pursue this stage of the project.

Once decommissioned, the ultimate use of the WWTP site has not been determined. Based on conversations with the City engineer, it will likely be either be developed as a park or sold to a developer for a residential subdivision. Regardless, the City has confirmed that decommissioning the WWTP will involve the following: identifying and remediating all hazardous materials above grade and within 5 feet of the ground surface, removal of all structures, properly removing or abandoning-in-place any underground piping, filling in the existing ponds to create a level surface.

See Figure 9-1, for a site map showing the location of the existing WWTP.

Figure 9-1: Existing City of Wheatland Wastewater Treatment Plant

Section 9.02 Components of existing WWTP and Steps Required for Removal:

There are four components that need to be addressed as part of the decommissioning of a WWTP: Liquid Management, Biosolids Management, Solid Waste Management and Disposal, and Earthwork and Final Grading. Each component is discussed in more detail below.

- Liquids Management: Raw and partially treated wastewater remaining in the plant will need to be addressed once the flows into the WWTP cease at connection of the City to the pipeline. It is understood that the current plant operators will handle this wastewater.
- Biosolids Management and Disposal Biosolids (sludge): All sludge must be completely removed from the decommissioned WWTP and managed in accordance State and Federal requirements. The City has a current contract for addressing sludge and will be able to utilize this contract for all remaining sludge at decommissioning of the WWTP.
- Solid Waste Management and Disposal: Waste materials at a decommissioned WWTP (e.g., structures, liners, basins, etc.) must be properly managed and disposed. Below is a list of components likely to be present in the WWTP based on information available to date.

- Headworks: usually include pumps, mechanical screens, screening compactors, grit removal systems and grit washing systems. These will need to be removed and disposed.
- Aeration Ditch: The aeration ditch is located in the north edge of the WWTP and is lined with concrete and has associated piping and other mechanical equipment which will need to be removed prior to filling the aeration ditch.
- Sludge Drying Basins/Sludge Storage Pond: The WWTP has three sludge drying beds at the eastern edge of the site that are lined with AC pavement. These beds were added in the 1990 remodel. One older sludge drying bed is located in the middle of the site and is unlined. The sludge storage pond was added in the 1980 remodel and is concrete lined. All sludge will need to be removed and disposed per applicable code. In addition, any contaminated material will need to be removed and disposed as required per applicable code.
- Infiltration basins: The site's infiltration basin are located southwest of the site near the Bear River. They are not lined and are surrounded by a berm that was built when the basin was excavated. It is expected that this material will be used to fill in the basin when the WWTP is decommissioned. Any contaminated soils will also need to be removed and disposed per applicable code.
- Secondary Clarifier and RAS: The project includes two clarifier tanks (50-foot and 30-foot diameter). Each clarifier is a large concrete circular tank and might include a concrete pad, metal staircase, walkway, underground piping and outlet box. The RAS/WAS Sludge pump station scope will include the removal of existing concrete pad, pumps, above and below ground piping, wet well, and sump.
- Site Piping: As typical of a WWTP, the site has underground pipe connecting the various components of the WWTP. Due to the age of the site, it is possible that the existing pipe is asbestos pipe and may therefore require special treatment.
- Structures: Structures on the site include the control building and pumping plant, Lab Building, and other miscellaneous structures south of the sludge storage basin. Although the site has been updated twice since the initial construction in 1967, record drawings indicate that at least portions of the control building are original. Due to its age, it is likely that the control building and possibly other structures have lead paint and potentially asbestos and other hazardous material typical of older buildings.
- Miscellaneous Site items – The site currently boast a small parking area and yard lighting that will need to be removed. There are also other miscellaneous components such as a fuel tanks, generators with associated concrete pads, potable water well, miscellaneous yard piping etc. The City will recycle or sell any items with value and the remaining items will be removed as allowed under code.

- Earthwork and Final Grading: Scope of work will include filling in holes and leveling grade. As discussed above, removal of contaminated soil and final site grading will be required for several of the components of the existing WWTP.

Section 9.03 Permitting Requirements

The exact scope of permits required to decommission the WWTP will not be fully determined until the due diligence is complete, but likely permits will include the following:

- Discharge Permit Termination: The facility will need to terminate the existing discharge permit, once the WWTP discharge has been eliminated, the WWTP biosolids have been removed and managed, and the decommissioned WWTP waste materials have been managed in accordance solid waste regulations, the permittee must request termination of the permit

- Reclamation District 2103: The City will need to coordinate with Reclamation District 2103 when they remove the dikes associated with the pond along the Bear River so they will no longer hold water. Scope will include removing the pipe that goes over the dike to the ponds. SWPPP/NPDES permitting will be required to address the earthwork and ground disturbance. The site will need to be fully stabilized prior to completion.

SECTION 10 – ENGINEER'S OPINION OF PROBABLE CONSTRUCTION COST

10.01 Background

A detailed estimate of probable costs for the project is provided in Appendix 3. The first step in preparing the cost estimate is understanding any site constraints and potential construction issues. Because the project will not complete due diligence until after completion of the BODR, the project team had to use alternate resources to make reasonable assumptions. Below is a brief list of the background sources used in preparation of the opinion of probable cost. Because the available information is for planning level, the project will utilize a planning-level contingency of 30%, which will be reduced as the project is finalized and more information becomes available.

- Topographic information was obtained from USGS maps.
- Groundwater and soils types are based on information received from the City Engineer and are based on typical soil types and the USDA NRCS Soil classification and general knowledge of the project area. A soils report will be completed at a later stage.
- Wetlands and biological studies are not complete. The proposed pipe alignment attempts to avoid areas that have potential to be environmentally sensitive, based on our consultants' general understanding of the area.

This information was then used to develop a conceptual plan with preliminary pipe alignment and pump station locations.

10.02 Assumptions

The estimate of probable costs was compiled using a variety of sources, including bid results from comparable projects, current quotations from material manufacturers, and prevailing wage labor costs. A combination of these sources was used to determine the probable cost for each item. Location and project specific challenges also play a role in figuring out probable cost. For example, the presence of groundwater can heavily impact excavation and therefore pipe installation costs. Disruptions in the material supply chain can also affect costs. These disruptions can vary from season to season or year to year and are often unpredictable. For the purposes of compiling this estimate of probable costs, the following assumptions were made:

- Inflation was projected to the midpoint of the construction window (January 2024)
- Inflation cost index was used to inflate costs from previous bid results to today's dollars. The ENR construction cost index was used in the preparation of this estimate.
- Groundwater is assumed to be present at 15-feet below ground surface elevation.
- Soils are assumed to be cemented sands and clayey sands (no alluvium).

- The sewer force main is assumed to be installed at 4-ft to 8-ft of cover with an average of 6-ft of cover.
- The estimated construction cost includes a 30% estimating contingency. The contingency will be reduced as further estimates are prepared throughout the design process.

10.03 Summary Cost Estimate

Regional Sewer Project Costs	Estimate of Probable Cost
Construction Costs	
Force Main "1"	$2,280,000
Force Main "2"	$10,785,000
36" Gravity Sewer	$703,000
Pump Station 1	$2,700,000
Pump Station 2	$7,500,000
[1] Pump Station 3	$2,000,000
Total Estimated Construction Costs:	**$25,968,000**
Engineering and Administration Costs	
Engineering Design	$2,000,000
Land Acquisition and ROW Clearance	$75,000
Project Administration	$500,000
Environmental	$350,000
Construction Management and Inspection	$800,000
Total Engineering and Administration Costs:	**$3,725,000**
Total Project Cost	**$29,693,000**
[1] Pump Station 3 Cost includes City of Wheatland portion of Force Main 3	

Wastewater Treatment Plant Decommission Project Costs	Estimate of Probable Cost
Construction Costs	
Total Estimated Construction Costs:	**$2,060,000**
Engineering and Administration Costs	
Engineering Design	$100,000
Project Administration	$100,000
Environmental	$40,000
Construction Management and Inspection	$210,000
Total Engineering and Administration Costs:	**$450,000**
Total Project Cost	**$2,510,000**

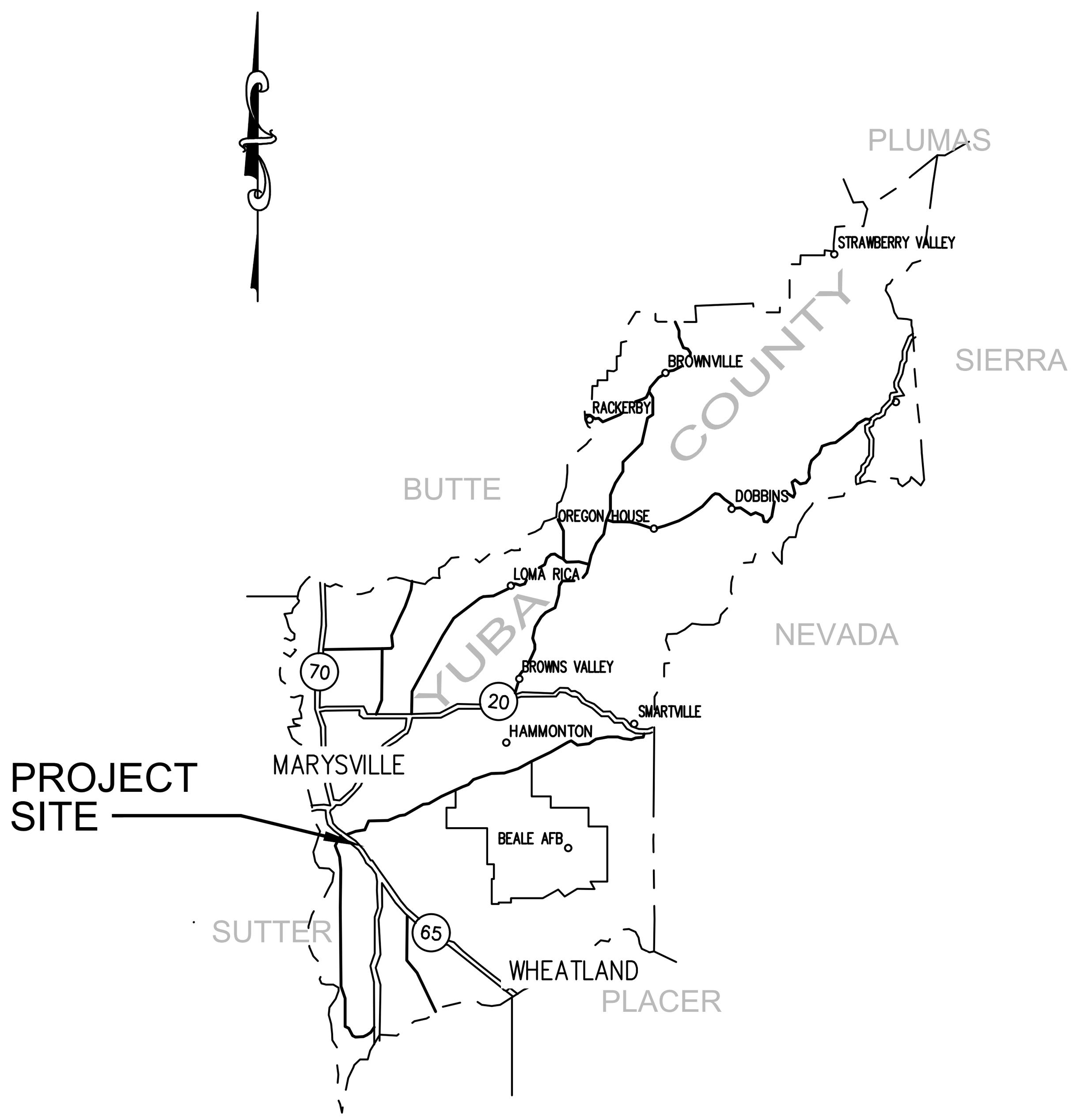
See Appendix 3 for details of project costs.

REGIONAL SEWER PIPELINE PROJECT

FOR THE

CITY OF WHEATLAND

YUBA COUNTY, CALIFORNIA



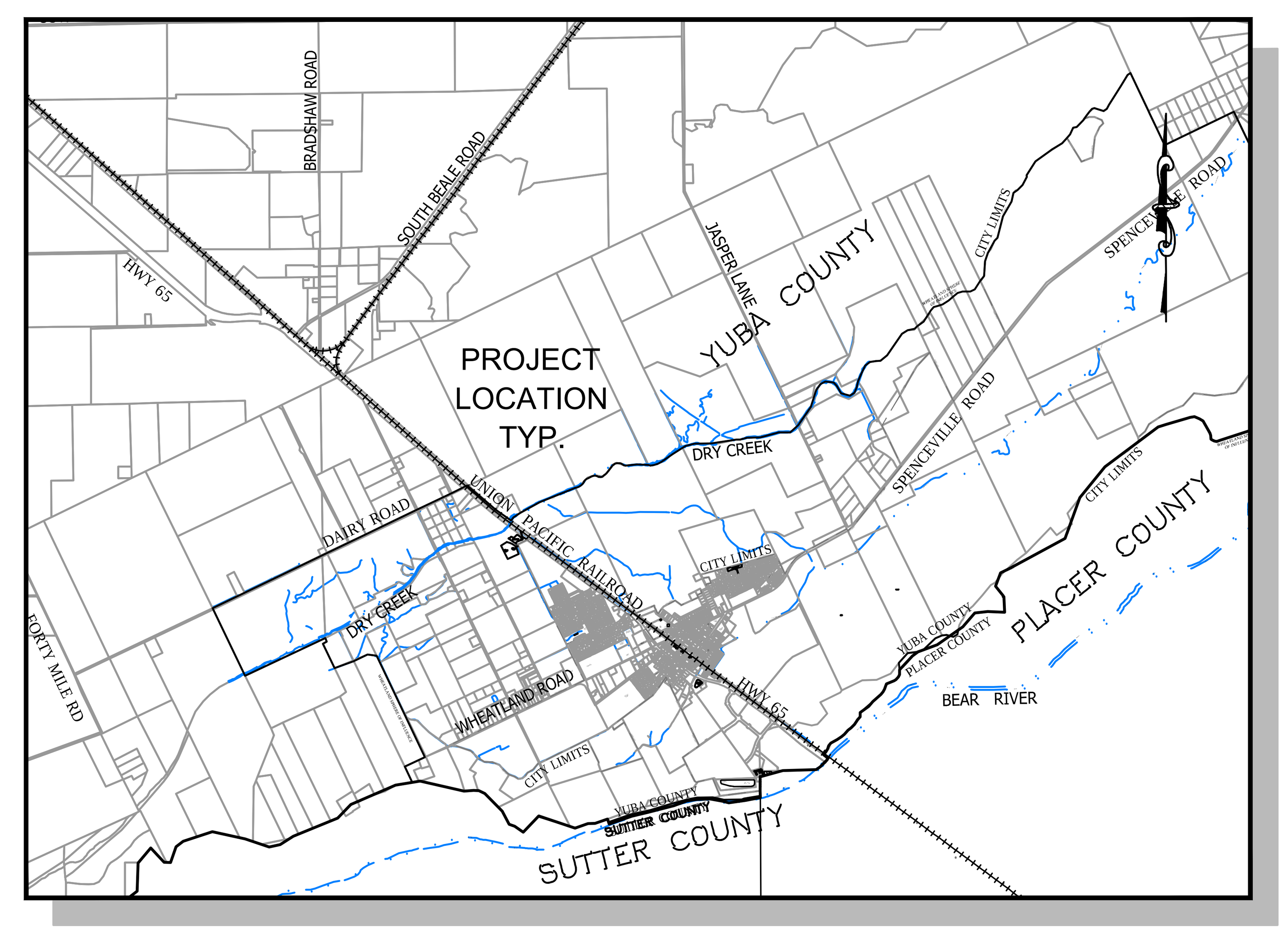
VICINITY MAP

APRIL 2021

BASIS OF DESIGN REPORT

APPENDIX 1

SYSTEM OVERVIEW AND PIPELINE ROUTE



LOCATION MAP

NOT TO SCALE

INDEX OF SHEETS

Sheet Number	Sheet Title
1	TITLE SHEET
2	SYSTEM OVERVIEW & PIPELINE ROUTE
3	PIPELINE ROUTE OVERVIEW 1
4	PIPELINE ROUTE OVERVIEW 2
5	PIPELINE ROUTE OVERVIEW 3
6	PIPELINE ROUTE OVERVIEW 4
7	PIPELINE ROUTE OVERVIEW 5
8	PIPELINE ROUTE OVERVIEW 6

PRELIMINARY

PRELIMINARY DESIGN

DATE: APRIL 2021

PROJECT NUMBER

DRAWING DATE
APRIL 2021

DRAWING NUMBER
1 OF 8

APPENDIX 1 - SYSTEM OVERVIEW AND PIPELINE ROUTE

FOR REDUCED PLANS, THE ORIGINAL SCALE IS IN INCHES

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ORIGINAL PLOT DATE: APRIL 2021

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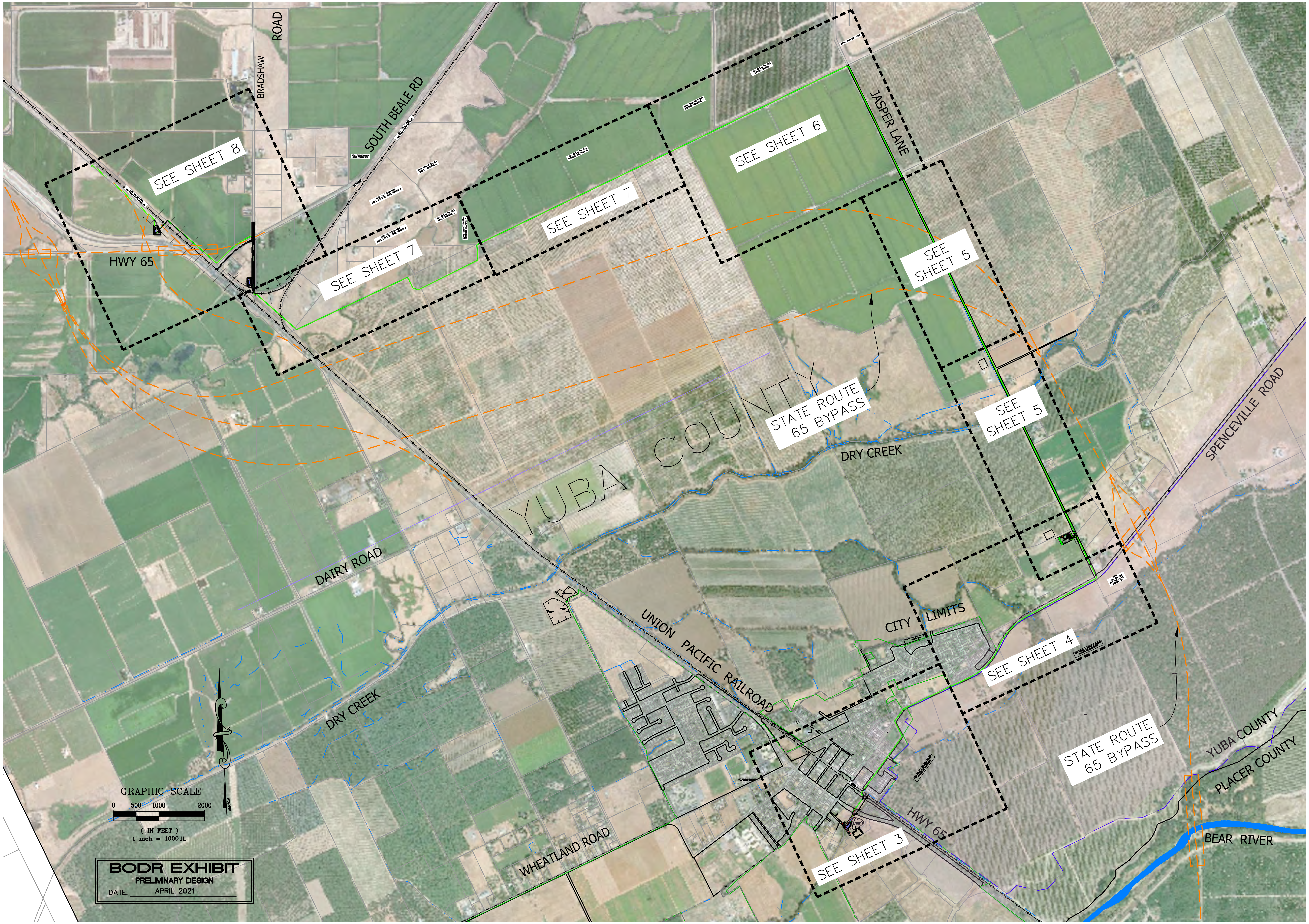

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PRELIMINARY DESIGN
DATE: APRIL 2021

FOR REDUCED PLANS, THE ORIGINAL SCALE IS IN INCHES
0 1 2 3

ORIGINAL PLOT DATE:

PREPARED UNDER THE DIRECTION OF

DATE

DESIGNED BY	DRAWN BY	REVIEWED BY
DHS	PGC	HEU

Coastland Civil Engineering, Inc.
11641 Blocker Dr, Ste 170, Auburn, CA 95603
530.888.9929 530.889.9979 Fax

CITY OF WHEATLAND
PRELIMINARY SEWER DESIGN
CITY OF WHEATLAND CALIFORNIA

REGIONAL SEWER PIPELINE PROJECT
SYSTEM OVERVIEW & PIPELINE ROUTE

PROJECT NUMBER

DRAWING DATE
APRIL 2021

SHEET NUMBER
2 OF 8

LEGEND

PROPOSED FORCE MAIN — 12" FM

SANITARY SEWER MANHOLE

HOP FARM/JOHNSON RANCH FUTURE DEVELOPMENT

PROPOSED STAGING AREA

SEWER LEGEND

CLEANOUT & IDENTIFYING NUMBER — SCO19M

MANHOLE & IDENTIFYING NUMBER — SMH181S

SEWER MAIN & SIZE — 6"SS

FLOW DIRECTION — 6"SS

FORCE MAIN & SIZE — 8"FM

LIFT STATION & IDENTIFYING NUMBER — LS1

HAZARDOUS PIPELINE SIZE & TYPE — 8"HPG

CREEK, STREAM, RIVER

CITY LIMIT

MANHOLE & CLEANOUT NUMBERING REFERENCES:

M – MALONE LIFT STATION
F – FOREST GLEN LIFT STATION
SP – SPRUCE LIFT STATION
S – SUNRISE LIFT STATION
C – "C" STREET LIFT STATION

NOTE:
HAZARDOUS PIPELINES DEPICTED ON THIS MAP REPRESENT GAS TRANSMISSION AND HAZARDOUS LIQUID LINES ONLY. GAS GATHERING AND GAS DISTRIBUTION SYSTEMS ARE NOT REPRESENTED. PIPELINE LOCATIONS PER NATIONAL PIPELINE MAPPING SYSTEM WWW.NPMS.PHMSA.DOT.GOV OCTOBER 20, 2016

UNION PACIFIC RAILROAD GRADE CROSSING HOTLINE: 1-800-848-8715

THIS MAP SHOULD NEVER BE USED AS A SUBSTITUTE FOR CONTACTING A ONE-CALL CENTER PRIOR TO EXCAVATION ACTIVITIES. PLEASE CAL 811 BEFORE ANY DIGGING OCCURS.

LEGEND

TOWN WELL NUMBER — WELL #5

WATER SERVICE

WATER VALVE

BLOW OFF

CAPPED WATER MAIN

WATER MAIN CONTINUES

WATER MAIN & SIZE — 6"

AIR RELEASE VALVE

FIRE HYDRANT (VALVE NOT SHOWN FOR CLARITY)

CITY LIMITS

RIGHT-OF WAY/PARCELS

HAZARDOUS PIPELINE SIZE & TYPE — 8"HPG

NOTE:
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GRAPHIC SCALE

0 100 200 400

(IN FEET)
1 inch = 200 ft.

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11641 Blocker Dr. Ste 170, Auburn, CA 95603
530.888.9929
530.889.9979 Fax

CITY OF WHEATLAND, CALIFORNIA
PRELIMINARY SEWER DESIGN

REGIONAL SEWER PIPELINE PROJECT
PIPELINE ROUTE OVERVIEW 1

CITY OF WHEATLAND

PROJECT NUMBER

DRAWING DATE
APRIL 2021

SHEET NUMBER
3 OF 8

FOR REDUCED PLANS, THE ORIGINAL SCALE IS IN INCHES

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ORIGINAL PLOT DATE:

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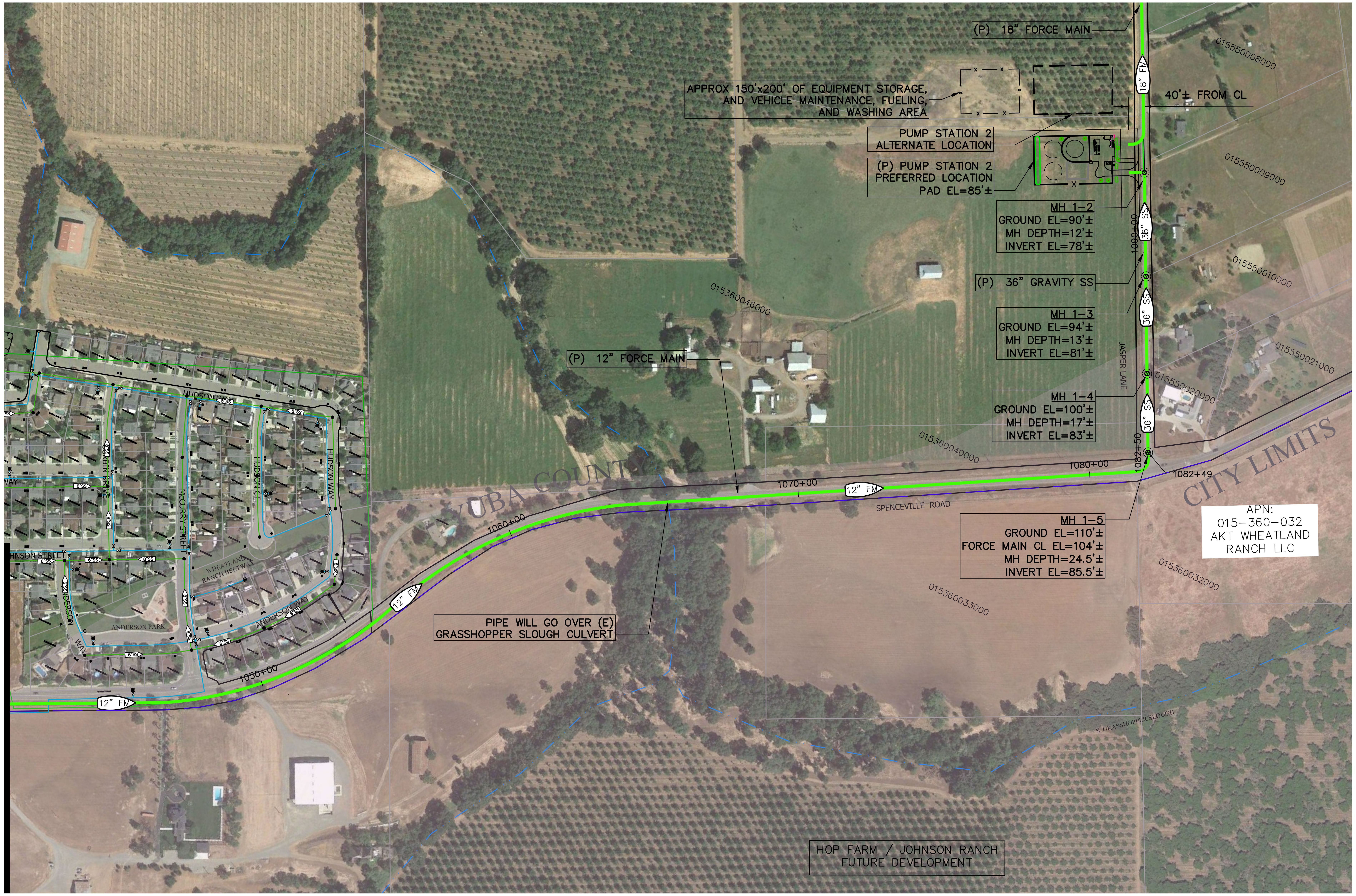
SEE SHEET 5



MATCHLINE - SEE SHEET 3

LEGEND

- PROPOSED FORCE MAIN — 12" FM
- PROPOSED GRAVITY SEWER — 36" SS
- FUTURE SYTIA SR 65 IMPROVEMENT PROJECT
- SANITARY SEWER MANHOLE
- HOP FARM/JOHNSON RANCH FUTURE DEVELOPMENT
- PROPOSED STAGING AREA

SEWER LEGEND

CLEANOUT & IDENTIFYING NUMBER
MANHOLE & IDENTIFYING NUMBER
SEWER MAIN & SIZE
FLOW DIRECTION
FORCE MAIN & SIZE
LIFT STATION & IDENTIFYING NUMBER
HAZARDOUS PIPELINE SIZE & TYPE
CREEK, STREAM, RIVER
CITY LIMIT

LEGEND

TOWN WELL NUMBER
WATER SERVICE
WATER VALVE
BLOW OFF
CAPPED WATER MAIN
WATER MAIN CONTINUES
WATER MAIN & SIZE
AIR RELEASE VALVE
FIRE HYDRANT (VALVE NOT SHOWN FOR CLARITY)
CITY LIMITS
RIGHT-OF WAY/PARCELS
HAZARDOUS PIPELINE SIZE & TYPE

GRAPHIC SCALE
0 100 200 400
(IN FEET)
1 inch = 200 ft.

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530.888.9929
530.889.9979 Fax

CITY OF WHEATLAND
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REGIONAL SEWER PIPELINE PROJECT
PIPELINE ROUTE OVERVIEW 2

PROJECT NUMBER

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APRIL 2021

SHEET NUMBER
4 OF 8

FOR REDUCED PLANS, THE ORIGINAL SCALE IS IN INCHES
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ORIGINAL PLOT DATE:

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Images: Sheet 1.jpg; Sheet 2.jpg; Sheet 3.jpg; Sheet 4.jpg; Sheet 5.jpg; Sheet 6.jpg; Sheet 7.jpg; Sheet 8.jpg; Sheet 8.1.jpg; Spenceville and Jasper.JPG; Wheatland Loop large Oct 2015.jpg; Wheatland Loop Oct 2015.jpg; Wheatland Loop Oct 2015.jpg
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LEGEND

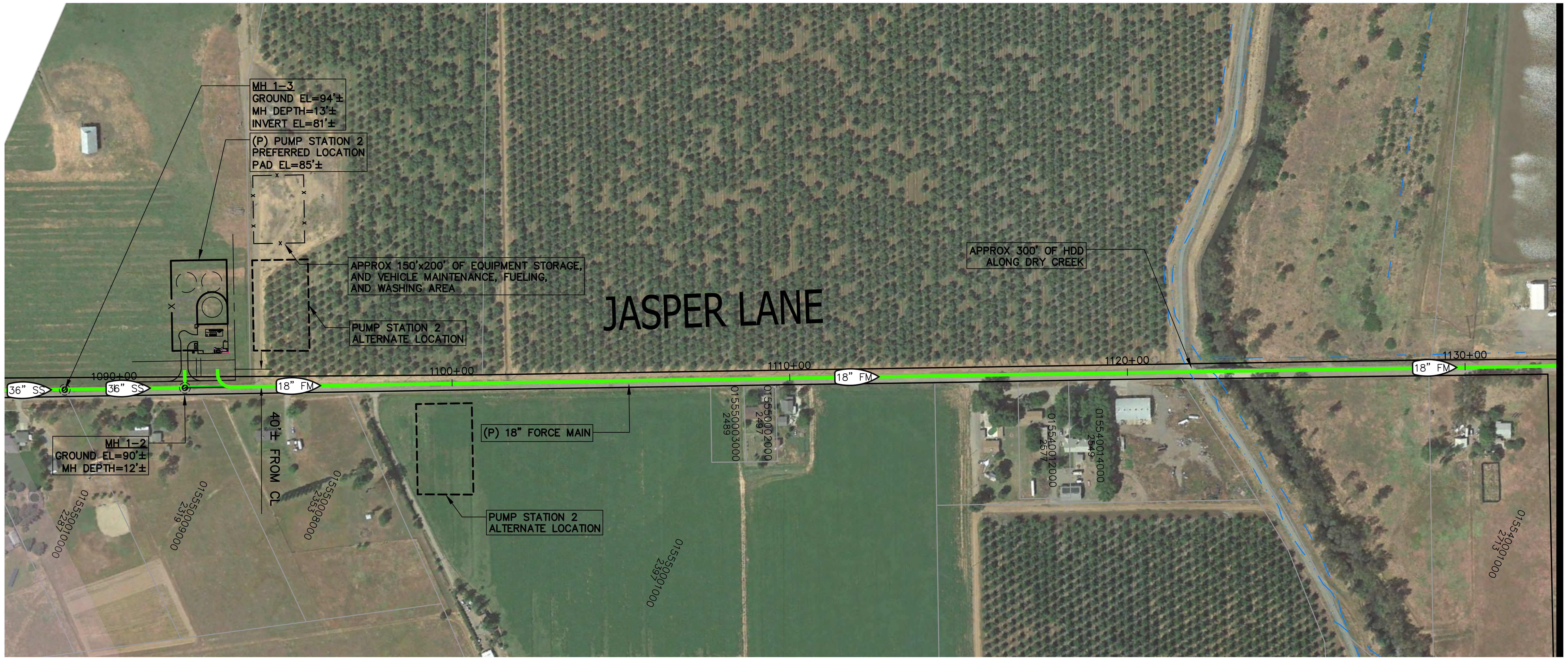
PROPOSED FORCE MAIN — 12" FM

PROPOSED GRAVITY SEWER — 36" SS

FUTURE SYTIA SR 65 IMPROVEMENT PROJECT

SANITARY SEWER MANHOLE

PROPOSED STAGING AREA



GRAPHIC SCALE

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CITY OF WHEATLAND, CALIFORNIA

REGIONAL SEWER PIPELINE PROJECT
PIPELINE ROUTE OVERVIEW 3

PROJECT NUMBER

DRAWING DATE
APRIL 2021

SHEET NUMBER
5 OF 8

FOR REDUCED PLANS, THE ORIGINAL SCALE IS IN INCHES
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ORIGINAL PLOT DATE:

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ORIGINAL PLOT DATE:

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MATCHLINE - SEE SHEET 5

LEGEND

PROPOSED FORCE MAIN	18" FM
FUTURE SYTIA SR 65 IMPROVEMENT PROJECT	

GRAPHIC SCALE

0 100 200 400

(IN FEET)
1 inch = 200 ft.

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CITY OF WHEATLAND CALIFORNIA

REGIONAL SEWER PIPELINE PROJECT
PIPELINE ROUTE OVERVIEW 4

PROJECT NUMBER

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6 OF 8

LEGEND

PROPOSED FORCE MAIN — 18" FM

FUTURE SYTIA SR 65 IMPROVEMENT PROJECT

GRAPHIC SCALE

0 100 200 400

(IN FEET)
1 inch = 200 ft.

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CITY OF WHEATLAND
CITY OF WHEATLAND, CALIFORNIA
PRELIMINARY SEWER DESIGN

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PIPELINE ROUTE OVERVIEW 5

PROJECT NUMBER

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SHEET NUMBER
7 OF 8

FOR REDUCED PLANS, THE ORIGINAL SCALE IS IN INCHES
0 1 2 3

ORIGINAL PLOT DATE:

FOR REDUCED PLANS, THE ORIGINAL SCALE IS IN INCHES
0 1 2 3

ORIGINAL PLOT DATE:

LEGEND

PROPOSED FORCE MAIN	18" FM
(F) OPUD GRAVITY MAIN	SS
(F) OPUD FORCE MAIN	18" FM
FUTURE SYTIA SR 65 IMPROVEMENT PROJECT	

GRAPHIC SCALE
0 100 200 400
(IN FEET)
1 inch = 200 ft.

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PRELIMINARY SEWER DESIGN

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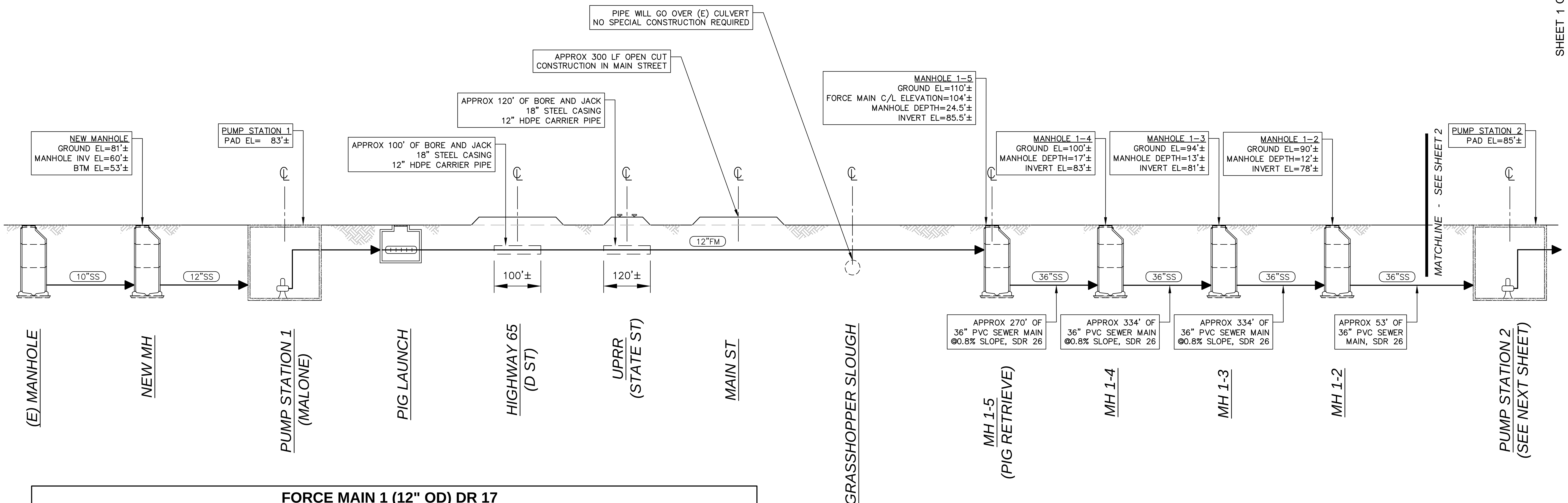
REGIONAL SEWER PIPELINE PROJECT
PIPELINE ROUTE OVERVIEW 6

PROJECT NUMBER

DRAWING DATE
APRIL 2021

SHEET NUMBER
8 OF 8



FORCE MAIN 1 (12" OD) DR 17			
PARAMETER	EXPECTED	ALLOWABLE	SAFETY FACTOR
MINIMUM PIPE BENDING RADIUS (FT)	40	27	1.48
PIPE BEDDING (%DEFLECTION, ASSUMES 3' MIN. COVER)	4.01%	7.50%	1.87
MAXIMUM OPERATING PRESSURE (PSI)	55	125	2.27
MAXIMUM RECURRING SURGE PRESSURE (PSI)	35	63	1.81
MAXIMUM WORKING PRESSURE (PSI)	50	125	2.50

FLOWS INTO PUMP STATION NO. 1						
	EDUs	ADWF MGD	AAF MGD	PEAK DAY MGD	PEAK HOUR MGD	PEAK HOUR GPM
INITIAL	1,520	0.37	0.40	1.13	1.54	1,080
MIDPOINT	2,500	0.60	0.65	1.73	2.20	1,520
DESIGN	2,880	0.70	0.75	1.95	2.44	1,680

PUMP STATION NO. 1					
	HP	LOW FLOW	LOW HEAD	HIGH FLOW	HIGH HEAD
PUMP NO. 1	75	270 GPM	35 FEET	1,680 GPM	110 FEET
PUMP NO. 2	75	270 GPM	35 FEET	1,680 GPM	110 FEET
PUMP NO. 3	75	270 GPM	35 FEET	1,680 GPM	110 FEET

FORCE MAIN 1

TOTAL FORCE MAIN LENGTH: 8,330 LINEAR FEET
TOTAL FORCE MAIN VOLUME: 45,339 GALLONS
NOMINAL DIAMETER: 12"

BORE AND JACK CONSTRUCTION (HDPE IN STEEL CASING): 220 LINEAR FEET
OPEN CUT CONSTRUCTION (HDPE): 8,110 LINEAR FEET
DR=17, O.D.= 13.20", I.D.=11.55"
MATERIAL SPEC ASTM F714

GRAVITY SEWER

TOTAL LENGTH: 990 LINEAR FEET
TOTAL VOLUME: 52,348 GALLONS

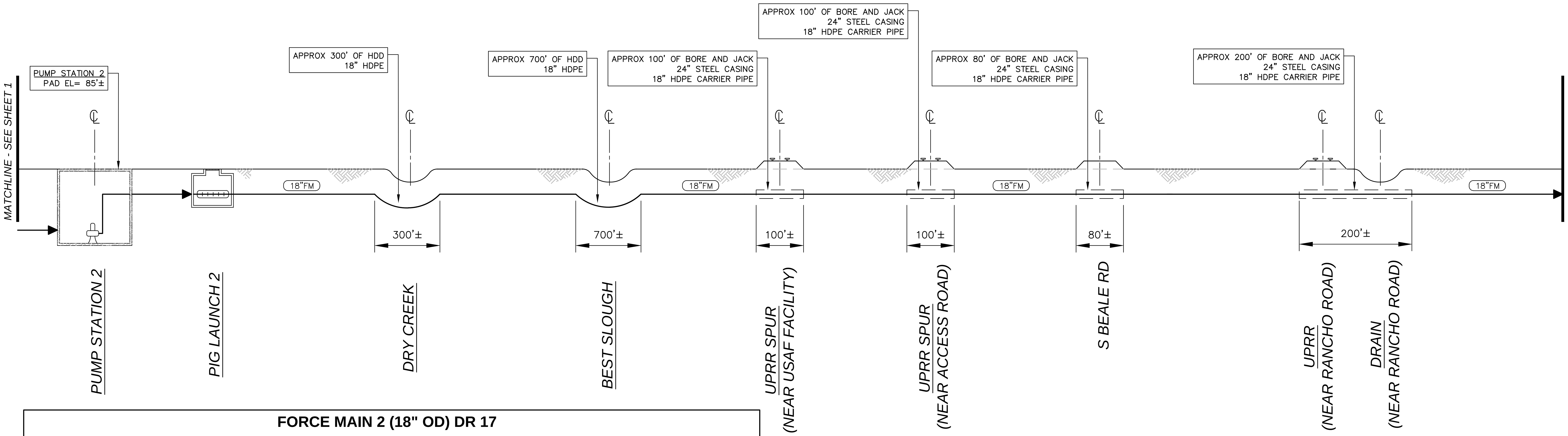
FORCE MAIN 1 CLEANING REQUIREMENTS	
	VALUE
FLUSHING VELOCITY	3 FPS
PRESSURE DROP	25 PSI
VOLUME REQUIRED	45,000 GALLONS
PUMP REQUIREMENTS	
OPERATING PUMPS	1-75 HP PUMP
MINIMUM FLOW	980 GPM
MINIMUM HEAD	50 PSI / 120 FEET TDH

FORCE MAIN 1 AND GRAVITY SEWER

CITY OF WHEATLAND
REGIONAL SEWER PIPELINE PROJECT
APPENDIX 2
PIPELINE FLOW SCHEMATICS

Coastland Civil Engineering, Inc.
11641 BLOCKER DRIVE #170, AUBURN, CA 95603
530.888.9929

CITY OF WHEATLAND
REGIONAL SEWER PIPELINE PROJECT
APPENDIX 2
PIPELINE FLOW SCHEMATICS



FORCE MAIN 2 (18" OD) DR 17			
PARAMETER	**EXPECTED**	**ALLOWABLE**	**SAFETY FACTOR**
MINIMUM PIPE BENDING RADIUS (FT)	41	41	1.00
PIPE BEDDING (%DEFLECTION, ASSUMES 3' MIN. COVER)	4.01%	7.50%	1.87
MAXIMUM OPERATING PRESSURE (PSI)	70	125	1.79
MAXIMUM RECURRING SURGE PRESSURE (PSI)	35	63	1.81
MAXIMUM WORKING PRESSURE (PSI)	80	125	1.56

FLOWS INTO PS NO. 2						
	EDUs	**ADWF MGD**	**AAF MGD**	**PEAK DAY MGD**	**PEAK HOUR MGD**	**PEAK HOUR GPM**
INITIAL	1,520	0.37	0.40	1.13	1.54	1,080
MIDPOINT	3,500	0.85	0.91	2.52	3.07	2,130
DESIGN	5,500	1.33	1.43	3.75	4.43	3,080

PUMP STATION NO. 2					
	HP	**LOW FLOW**	**LOW HEAD**	**HIGH FLOW**	**HIGH HEAD**
PUMP NO. 1	75	270 GPM	45 FEET	1,750 GPM	70 FEET
PUMP NO. 2	75	270 GPM	45 FEET	1,750 GPM	70 FEET
PUMP NO. 3	200	500 GPM	48 FEET	2,500 GPM	170 FEET
PUMP NO. 4	200	500 GPM	48 FEET	2,500 GPM	170 FEET

FORCE MAIN 2

TOTAL FORCE MAIN LENGTH: 30,400 LINEAR FEET
TOTAL FORCE MAIN VOLUME: 361,410 GALLONS
NOMINAL DIAMETER: 18"

BORE AND JACK CONSTRUCTION (HDPE IN STEEL CASING): 480 LINEAR FEET
HDD CONSTRUCTION (HDPE): 1,000 LINEAR FEET
OPEN CUT CONSTRUCTION (HDPE): 28,920 LINEAR FEET
DR=17, O.D.= 19.50", I.D.=17.07"
MATERIAL SPEC ASTM F714

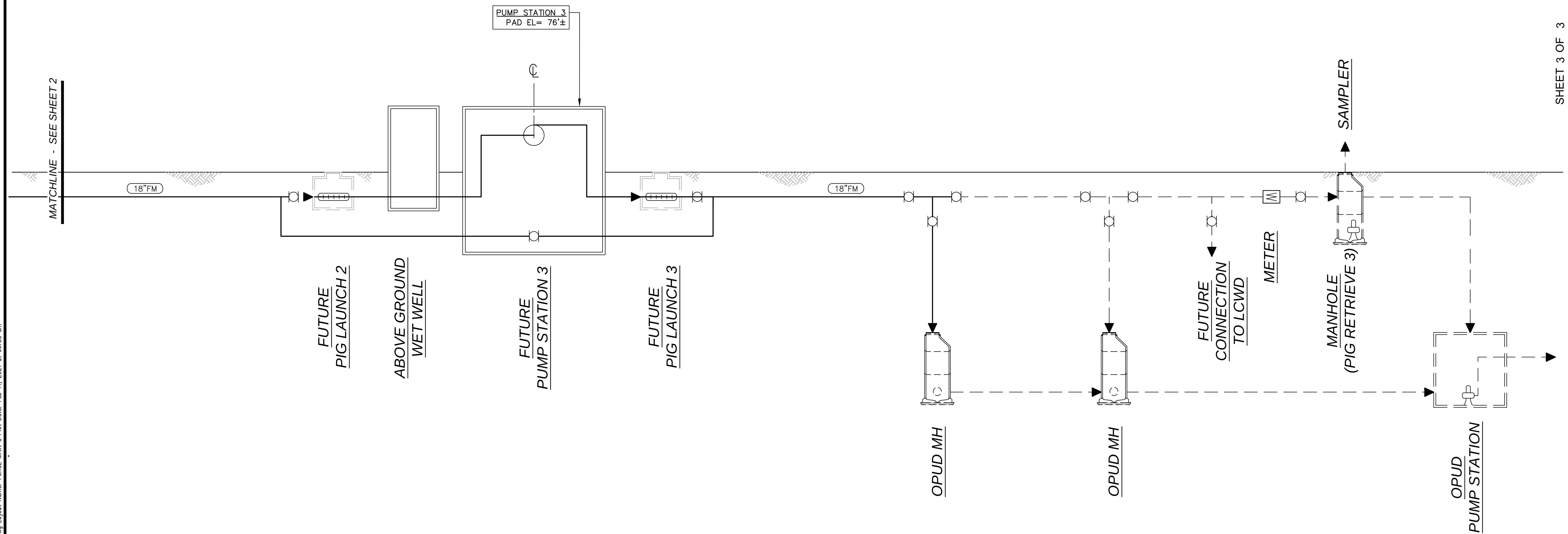
FORCE MAIN 2 CLEANING REQUIREMENTS	
	VALUE
FLUSHING VELOCITY	3 FPS
PRESSURE DROP	30 PSI
VOLUME REQUIRED	360,000 GALLONS
PUMP REQUIREMENTS	
OPERATING PUMPS	1-200 HP PUMP
MINIMUM FLOW	2,140 GPM
MINIMUM HEAD	75 PSI / 170 FEET TDH

FORCE MAIN 2

Coastland Civil Engineering, Inc.
11641 BLOCKER DRIVE #170, AUBURN, CA 95603
530.888.9929

FOR REDUCED PLANS, THE ORIGINAL SCALE IS IN INCHES

ORIGINAL PLOT DATE:



FLOWS INTO PUMP STATION NO. 3						
	EDUs	ADWF MGD	AAF MGD	PEAK DAY MGD	PEAK HOUR MGD	PEAK HOUR GPM
INITIAL	1,520	0.37	0.40	1.13	1.54	1,080
MIDPOINT	3,500	0.85	0.91	2.52	3.07	2,130
DESIGN	5,500	1.33	1.43	3.75	4.43	3,080

PUMP STATION NO. 3					
	HP	LOW FLOW	LOW HEAD	HIGH FLOW	HIGH HEAD
PUMP NO. 1	60	270 GPM	20 FEET	1,700 GPM	80 FEET
PUMP NO. 2	60	270 GPM	20 FEET	1,700 GPM	80 FEET
PUMP NO. 3	60	270 GPM	20 FEET	1,700 GPM	80 FEET

(a) At low flows 2 pumps are operating. 500 GPM Total.

FORCE MAIN 3
TOTAL FORCE MAIN LENGTH: 14,300 LINEAR FEET *TOTAL FORCE MAIN VOLUME: 170,000 GALLONS* *NOMINAL DIAMETER: 18" INCH*

FORCE MAIN 3 CLEANING REQUIREMENTS	
	VALUE
FLUSHING VELOCITY	3 FPS
PRESSURE DROP	30 PSI
VOLUME REQUIRED	220,000 GALLONS
PUMP REQUIREMENTS	
OPERATING PUMPS	2-75HP PUMP
MINIMUM FLOW	2,140 GPM
MINIMUM HEAD	50 PSI / 120 FEET TDH

FORCE MAIN 3

SHEET 3 OF 3

CITY OF WHEATLAND

REGIONAL SEWER PIPELINE PROJECT

APPENDIX 2

PIPELINE FLOW SCHEMATICS

Coastland Civil Engineering, Inc.

11641 BLOCKER DRIVE #170, AUBURN, CA 95603

530.888.9929

COASTLAND
CIVIL ENGINEERING - CONSTRUCTION MANAGEMENT - BUILDING DEPARTMENT SERVICES

Engineer's Estimate of Probable Cost - Pipeline Cost Estimate

City of Wheatland
Wheatland Regional Sewer Pipeline Project
30-Percent (BODR) Class 1 Estimate (DRAFT)

Date: **2-Feb-21**
By: **ERG**
OK'd: **ELL**

Item No.	Item Description	Estimated Quantity	Unit of Measure	Unit Cost	Item Total
1	Mobilization	1	LS	$504,340.40	$504,340.40
2	SWPPP	1	LS	$153,000.00	$153,000.00
3	Traffic Control	1	LS	$330,000.00	$330,000.00
4	Sheeting and Shoring	1	LS	$269,000.00	$269,000.00
5	Force Main 1-12" HDPE	8,100	LF	$120.00	$972,000.00
6	Force Main 1-Highway 65 Crossing-Jack and Bore	100	LF	$1,600.00	$159,856.00
7	Force Main 1-Railroad Crossing-Jack and Bore	120	LF	$1,600.00	$191,472.00
8	Force Main 1-Air/Vac Installations	10	EA	$4,100.00	$41,000.00
9	Force Main 1-Emergency Shutoff Valve and Flushing Point	20	EA	$9,100.00	$182,000.00
10	Gravity Sewer Main A-36" PVC	990	LF	$310.00	$306,900.00
11	Gravity Sewer Main A-60" Manholes	4	EA	$42,400.00	$169,600.00
12	Force Main 2-18" HDPE	29,160	LF	$140.00	$4,082,400.00
13	Force Main 2-Dry Creek Crossing-HDD	300	LF	$2,300.00	$690,000.00
14	Force Main 2-Best Slough Crossing-HDD	700	LF	$2,100.00	$1,470,000.00
15	Force Main 2-Railroad Spur Crossing #1-Jack and Bore	100	LF	$1,600.00	$160,000.00
16	Force Main 2-Railroad Spur Crossing #2-Jack and Bore	100	LF	$1,600.00	$160,000.00
17	Force Main 2-South Beale Road Crossing-Jack and Bore	100	LF	$1,600.00	$160,000.00
18	Force Main 2-Railroad and Rancho Road Crossing-Jack and Bore	200	LF	$1,400.00	$279,580.00
19	Force Main 2-Air/Vac Installations	20	EA	$4,100.00	$82,000.00
20	Force Main 2-Emergency Shutoff Valve and Flushing Point	20	EA	$11,400.00	$228,000.00
		Subtotal			$10,591,148
		Contingency		30%	$3,177,345
		Total Cost (Rounded)			**$13,768,000**

Nexgen Utility Management Inc

Project Name: Wheatland Regional Sewer Pipeline Project
Description : BODR Opinion of Probable Cost for Pump Stations
Prepared by: Dan Rich, PE
Checked by : Joe DiGorgio, PE
Date: 4/20/21

No.	DESCRIPTION	QTY	TOTAL
1	PUMP STATION NO.1		$1,700,000
2	PUMP STATION NO.2		$4,800,000
3	PUMP STATION NO.3		$1,300,000
PROJECT TOTAL DIRECT COST			**$7,800,000**
	Contingency	25%	$ 1,950,000.00
	Subtotal		**$ 9,750,000.00**
	Contractor Overhead & Profit	15%	$ 1,170,000.00
	Subtotal		**$ 10,900,000.00**
	Inflation to Midpoint of Construction (2024)	12%	$ 1,300,000.00
	Subtotal		**$ 12,200,000.00**
PROJECT TOTAL ESTIMATED CONSTRUCTION COST			**$ 12,200,000.00**

Nexgen Utility Management Inc

Project Name: Wheatland Regional Sewer Pipeline Project
Description : BODR Cost Estimate PS No. 1
Prepared by: Joe DiGiorgio., PE
Checked by : Dan Rich, PE
Date: 4/20/21

	Item	Unit	Unit Cost	Quantity	Subtotal
	DIVISION A - MOBILIZATION				
	Bonding and Insurance	EA	$30,000.00	1	$30,000.00
	Mobilization	EA	$30,000.00	1	$30,000.00
	Stormwater Pollution Protection Plan (SWPPP) Implementation	EA	$10,000.00	1	$10,000.00
				Subtotal A	**$70,000.00**
	DIVISION B - EARTHWORK				
	Excavation	CY	$40.00	3000	$120,000.00
	Shoring	EA	$20,000.00	1	$20,000.00
	Import Material	CY	$10.00	2000	$20,000.00
	Site grading and compaction	SF	$10.00	4800	$48,000.00
				Subtotal B	**$208,000.00**
	DIVISION C- UTILITIES				
	Utility trench and backfill	LF	$25.00	200	$5,000.00
	PG&E Service & New Transformer	LS	$20,000.00	1	$20,000.00
	Gas service	LS	$10,000.00	1	$10,000.00
	Concrete Pad for Transfomer	LS	$2,000.00	1	$2,000.00
				Subtotal C	**$37,000.00**
	DIVISION D -ROADWAYS/ PAVING/ FENCING				
	Pavement- 3" AC/ 6" ab	SF	$10.00	2700	$27,000.00
	New Gate	EA	$10,000.00	1	$10,000.00
	New Fencing	EA	$15,000.00	1	$15,000.00
	CMU Retaining Wall	LF	$300.00	100	$30,000.00
				Subtotal D	**$82,000.00**
	DIVISION E - ELECTRICAL				
	Controls and Instrumentation	EA	$150,000.00	1	$150,000.00
	100 HP VFDs	EA	$40,000.00	3	$120,000.00
	Electrical Install	EA	$60,000.00	1	$60,000.00
				Subtotal E	**$330,000.00**
	DIVISON F - SANITARY SEWER FACILITIES AND LIFT STATION				
	Concrete wet well structure, 30' long x 9' wide x 25' deep	EA	$80,000.00	1	$80,000.00
	5-FT Dia Manhole - Base, Barrell, & Top with 24" MH lids	EA	$10,000.00	0	$0.00
	Wemco 75 HP Pumps and Rails	EA	$90,000.00	3	$270,000.00
	Distribution Vault with Gates	EA	$50,000.00	1	$50,000.00
	GateValve	EA	$2,600.00	2	$5,200.00
	Plug Valve	EA	$3,600.00	3	$10,800.00
	Check Valve	EA	$3,800.00	3	$11,400.00
	Pipe Supports	LS	$25,000.00	1	$25,000.00
	Pressure Gauge	EA	$600.00	3	$1,800.00
	Tee, DI	EA	$1,800.00	3	$5,400.00
	Flow Meter	EA	$12,000.00	1	$12,000.00
	Elb, DI 90-Degree	EA	$2,100.00	8	$16,800.00
	Elb, DI 45-Degree	EA	$1,700.00	4	$6,800.00
	Air Release Valve	EA	$4,000.00	1	$4,000.00
	Sewer Pipe	LF	$100.00	50	$5,000.00
	Sewer Force Main	LF	$80.00	100	$8,000.00
	Site Concrete	CY	$750.00	27	$20,000.00
	CMU Building	LS	$80,000.00	1	$80,000.00
	Carbon Scrubber and Calcium Nitrate Feed System	LS	$75,000.00	1	$75,000.00
	FRP Storage Tanks	EA	$30,000.00	2	$60,000.00
	300 KW Generator	EA	$120,000.00	1	$120,000.00
	100% Epoxy Coating of new wet well and Malone wet well	EA	$40,000.00	1	$40,000.00
	Painting	LS	$10,000.00	1	$10,000.00
				Subtotal F	**$917,200.00**
	DIVISION G - WATER				
	Water Service Valve Box and Meter	EA	$0.00	0	$0.00
	Water Line (1"SCH 80 PVC) and Hose Bib	LF	$60.00	20	$1,200.00
				Subtotal G	**$1,200.00**
	DIVISION H - DEMOLITION/ REHABILITATION / TIE INS				
	Core into Malone & rehab wet well	EA	$40,000.00	1	$40,000.00
	Demo Existing Fence and Gate	EA	$5,000.00	1	$5,000.00
	Bypass Piping / Tie Ins	EA	$20,000.00	1	$20,000.00
				Subtotal H	**$65,000.00**
	SUBTOTAL				**$1,700,000.00**

Nexgen Utility Management Inc

Project Name: Wheatland Regional Sewer Pipeline Project
Description : BODR Cost Estimate PS No. 2
Prepared by: Joe DiGiorgio., PE
Checked by : Dan Rich, PE
Date: 4/20/21

	Item	Unit	Unit Cost	Quantity	Subtotal
	DIVISION A - MOBILIZATION				
	Bonding and Insurance	EA	$50,000.00	1	$60,000.00
	Mobilization	EA	$50,000.00	1	$50,000.00
	Stormwater Pollution Protection Plan (SWPPP) Implementation	EA	$10,000.00	1	$10,000.00
				Subtotal A	**$120,000.00**
	DIVISION B - EARTHWORK				
	Excavation	CY	$40.00	4000	$160,000.00
	Shoring	EA	$20,000.00	1	$20,000.00
	Import Material	CY	$10.00	3000	$30,000.00
	Site grading and compaction	SF	$10.00	2400	$24,000.00
				Subtotal B	**$234,000.00**
	DIVISION C- UTILITIES				
	Utility trench and backfill	LF	$25.00	500	$12,500.00
	PG&E Service & New Transformer	LS	$50,000.00	1	$50,000.00
	Water service	LS	$0.00	0	$0.00
	Concrete Pad for Transfomer	LS	$2,000.00	1	$2,000.00
				Subtotal C	**$64,500.00**
	DIVISION D -ROADWAYS/ PAVING/ FENCING				
	Pavement- 3" AC/ 6" AB	SF	$12.00	15000	$180,000.00
	New Gate	EA	$10,000.00	1	$10,000.00
	New Fencing	EA	$90,000.00	1	$90,000.00
	AB Import	SF	$4.00	10,000	$40,000.00
				Subtotal D	**$320,000.00**
	DIVISION E - ELECTRICAL				
	Controls and Instrumentation	EA	$300,000.00	1	$300,000.00
	100 HP VFDs	EA	$40,000.00	6	$240,000.00
	Electrical Install	EA	$100,000.00	1	$100,000.00
				Subtotal E	**$640,000.00**
	DIVISON F - SANITARY SEWER FACILITIES AND LIFT STATION				
	Concrete wet well structure, 30' long x 9' wide x 25' deep	EA	$150,000.00	1	$150,000.00
	5-FT Dia Manhole - Base, Barrell, & Top with 24" MH lids	EA	$10,000.00	5	$50,000.00
	Wemco 75 HP Pumps and Rails	EA	$90,000.00	6	$540,000.00
	Rock Trap Vault with gates	EA	$70,000.00	1	$70,000.00
	GateValve	EA	$3,000.00	5	$15,000.00
	Motorized Plug Vlves	EA	$8,000.00	4	$32,000.00
	Plug Valve	EA	$4,000.00	4	$16,000.00
	Check Valve	EA	$4,000.00	4	$16,000.00
	Pipe Supports	LS	$35,000.00	1	$35,000.00
	Pressure Gauge	EA	$600.00	4	$2,400.00
	Tee, DI	EA	$1,800.00	5	$9,000.00
	Flow Meter	EA	$18,000.00	2	$36,000.00
	Elb, DI 90-Degree	EA	$2,100.00	10	$21,000.00
	Elb, DI 45-Degree	EA	$1,700.00	6	$10,200.00
	Air Release Valve	EA	$4,000.00	1	$4,000.00
	Sewer Pipe	LF	$100.00	200	$20,000.00
	Sewer Force Main	LF	$80.00	100	$8,000.00
	Site Concrete	CY	$750.00	33	$25,000.00
	Buildings for Electrical, Generator, Bathroom,Controls, Maintenace	LS	$500,000.00	1	$500,000.00
	Biofilter & Carbon Odor Systems	LS	$300,000.00	1	$300,000.00
	Vactor Receiving Station	LS	$150,000.00	1	$150,000.00
	500 KW Generator	EA	$200,000.00	1	$200,000.00
	100% Epoxy Coating of new wet well	EA	$60,000.00	1	$60,000.00
	400,000 Gal SST Storage Tank	EA	$500,000.00	2	$1,000,000.00
	Painting	LS	$20,000.00	1	$20,000.00
				Subtotal F	**$3,289,600.00**
	DIVISION G - WATER				
	Water Service Valve Box and Meter	EA	$0.00	0	$0.00
	Non Potable water Well, Air Gap , and Booster PS	EA	$150,000.00	1	$150,000.00
	Water Line (1"SCH 80 PVC) and Hose Bib	LF	$60.00	300	$18,000.00
				Subtotal G	**$168,000.00**
	SUBTOTAL				**$4,800,000.00**

COASTLAND

CIVIL ENGINEERING - CONSTRUCTION MANAGEMENT - BUILDING DEPARTMENT SERVICES

Engineer's Estimate of Probable Cost

City of Wheatland

Wastewater Treatment Plant Decommission

Cost Estimate (DRAFT)

Date: **2-Feb-21**
By: **ERG**
OK'd: **ELL**

Item No.	Item Description	Estimated Quantity	Unit of Measure	Unit Cost	Item Total
Aeration Ditch					
1	Aeration Ditch Liner Removal	230	CY	$50.00	$11,500.00
2	Aeration Basin Sidewalk Removal	4	CY	$50.00	$200.00
3	Access Bridge Removal	2	EA	$200.00	$400.00
4	Aeration Rotor Removal	3	EA	$300.00	$900.00
5	Non Potable Wash (Water XX") Line Removal	400	LF	$30.00	$12,000.00
6	Required Fill	2,400	CY	$50.00	$120,000.00
Miscellaneous Items to be removed					
7	Miscellaneous Yard Piping - Underground Pipe Removal (>2"≤12")	4,000	LF	$30.00	$120,000.00
8	Potable Water Well	1	EA	$5,000.00	$5,000.00
9	Fuel Tank	1	EA	$500.00	$500.00
10	Emergency Generator	1	EA	$500.00	$500.00
11	Generator Pad, 12" thick reinforced concrete (100 SF)	1	CY	$150.00	$150.00
12	Other miscellaneous items	1	LS	$50,000.00	$50,000.00
Clarifier No. 1					
13	Remove Clarifier No. 1 (30' diameter), bridge, underground piping, and outlet box.	1	LS	$50,000.00	$50,000.00
Clarifier No. 2					
14	Remove Clarifier No. 2 (50' diameter), concrete pad, stairs, walkway, underground piping, and outlet box.	1	LS	$100,000.00	$100,000.00
Structures					
15	Control Building and Pumping Plant	500	SF	$150.00	$75,000.00
16	Lab Building	600	SF	$100.00	$60,000.00
17	Miscellaneos Structures South of Sludge Storage Basin	700	SF	$50.00	$35,000.00
Parking Area					
18	Remove Asphalt Pavement, unknown thickness	5,400	SF	$5.00	$27,000.00
Yard Lighting					
19	Remove conduit, Light poles, etc.	450	LF	$150.00	$67,500.00
Sludge Drying Bed					
20	Remove Contaminated Soils (top 2')	400	CY	$80.00	$32,000.00
21	Remove 6" VCP Underdrain	300	LF	$30.00	$9,000.00
22	Required Fill	400	CY	$30.00	$12,000.00
Sludge Storage Pond					
20	Remove and dispose sludge storage pond concrete liner	50	CY	$50.00	$2,500.00
21	Required Fill	950	CY	$30.00	$28,500.00
Infiltration Basins					
22	Remove Contaminated Soils (assume top 2')	1,000	CY	$80.00	$80,000.00
23	Required Fill	1,000	CY	$30.00	$30,000.00
24	Earthwork & Grading	45,000	CY	$7.00	$315,000.00
RAS/WAS Sludge Pump Station					
25	Remove existing concrete pad, pumps, above and below ground piping, wet well, and sump; fill in holes.	1	LS	$5,000.00	$5,000.00
Sludge Drying Beds					
26	Remove and dispose asphalt liner	300	CY	$50.00	$15,000.00
27	Required Fill	3,600	CY	$30.00	$108,000.00
		Subtotal			$1,372,650
		Contingency		50%	$686,325
		Total Cost (Rounded)			**$2,060,000**

HDPE Water/Sewer | DIPS

PRESSURE-RATED HDPE PIPE

JM Eagle™

DELIVERING GOOD WATER TO YOU

SUBMITTAL AND DATA SHEET

HDPE DUCTILE IRON OUTSIDE DIAMETER PRESSURE PIPE

PIPE SIZE (IN)	AVG O.D. (IN)	MIN. T. (IN)	AVG I.D. (IN)	WGT (LBS/FT)	MIN. T. (IN)	AVG I.D. (IN)	WGT (LBS/FT)	MIN. T. (IN)	AVG I.D. (IN)	WGT (LBS/FT)
		DR 7 (335 psi)			DR 9 (250 psi)			DR 11 (200 psi)		
4	4.800	0.686	3.346	3.87	0.533	3.670	3.13	0.436	3.876	2.62
6	6.900	0.986	4.868	7.99	0.767	5.274	6.46	0.627	5.571	5.41
8	9.050	1.293	6.309	13.75	1.006	6.917	11.12	0.823	7.305	9.32
10	11.100	1.586	7.738	20.68	1.233	8.486	16.72	1.009	8.961	14.01
12	13.200	1.886	9.202	29.25	1.467	10.090	23.65	1.200	10.656	19.82
14	15.300	2.186	10.666	39.29	1.700	11.696	31.77	1.391	12.351	26.63
16	17.400	2.486	12.130	50.82	1.933	13.302	41.08	1.582	14.046	34.44
18	19.500	2.786	13.594	63.82	2.167	14.906	51.61	1.773	15.741	43.25
20	21.600	3.086	15.058	78.31	2.400	16.512	63.32	1.964	17.436	53.07
24	25.800	N/A	N/A	N/A	2.867	19.722	90.35	2.345	20.829	75.69
30	32.000	N/A	N/A	N/A	N/A	N/A	N/A	2.909	25.833	116.46
36	38.300	N/A	N/A	N/A	N/A	N/A	N/A	3.482	30.918	166.84

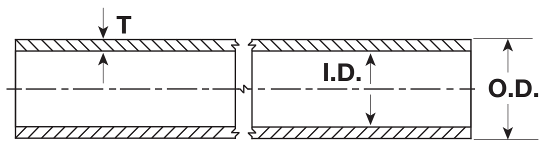
PIPE SIZE (IN)	AVG O.D. (IN)	MIN. T. (IN)	AVG I.D. (IN)	WGT (LBS/FT)	MIN. T. (IN)	AVG I.D. (IN)	WGT (LBS/FT)	MIN. T. (IN)	AVG I.D. (IN)	WGT (LBS/FT)
		DR 13.5 (160 psi)			DR 17 (125 psi)			DR 19 (111 psi)		
4	4.800	0.356	4.045	2.18	0.282	4.202	1.76	0.253	4.264	1.59
6	6.900	0.511	5.817	4.50	0.406	6.039	3.64	0.363	6.130	3.27
8	9.050	0.670	7.630	7.74	0.532	7.922	6.25	0.476	8.041	5.63
10	11.100	0.822	9.375	11.64	0.653	9.761	9.41	0.584	9.862	8.47
12	13.200	0.978	11.127	16.47	0.776	11.555	13.30	0.695	11.727	11.99
14	15.300	1.133	12.898	22.12	0.900	13.392	17.88	0.805	13.593	16.10
16	17.400	1.289	14.667	28.61	1.024	15.229	23.13	0.916	15.458	20.84
18	19.500	1.444	16.439	35.92	1.147	17.068	29.04	1.026	17.325	26.15
20	21.600	1.600	18.208	44.09	1.271	18.905	35.64	1.137	19.190	32.10
24	25.800	1.911	21.749	62.90	1.518	22.582	50.84	1.358	22.921	45.80
30	32.000	2.370	26.976	96.76	1.882	28.123	78.18	1.684	28.430	70.45
36	38.300	2.837	32.286	138.62	2.253	33.524	112.02	2.016	34.026	100.94
42	44.500	N/A	N/A	N/A	2.618	38.950	151.24	2.342	39.535	136.24
48	50.800	N/A	N/A	N/A	2.988	44.465	197.05	2.674	45.131	177.57

PIPE SIZE (IN)	AVG O.D. (IN)	MIN. T. (IN)	AVG I.D. (IN)	WGT (LBS/FT)	MIN. T. (IN)	AVG I.D. (IN)	WGT (LBS/FT)	MIN. T. (IN)	AVG I.D. (IN)	WGT (LBS/FT)
		DR 21 (100 psi)			DR 26 (80 psi)			DR 32.5 (63 psi)		
4	4.800	0.229	4.315	1.44	0.185	4.408	1.18	0.148	4.486	0.95
6	6.900	0.329	6.203	2.98	0.265	6.338	2.43	0.212	6.451	1.96
8	9.050	0.431	8.136	5.13	0.348	8.312	4.18	0.278	8.461	3.37
10	11.100	0.529	9.979	7.72	0.427	10.195	6.29	0.342	10.375	5.08
12	13.200	0.629	11.867	10.91	0.508	12.123	8.91	0.406	12.339	7.18
14	15.300	0.729	13.755	14.66	0.588	14.053	11.95	0.471	14.301	9.65
16	17.400	0.829	15.643	18.96	0.669	15.982	15.46	0.535	16.429	12.49
18	19.500	0.929	17.531	23.81	0.750	17.910	19.95	0.600	18.228	15.67
20	21.600	1.029	19.419	29.22	0.831	19.838	23.84	0.665	20.190	19.24
24	25.800	1.229	23.195	41.68	0.992	23.697	33.99	0.794	24.117	27.44
30	32.000	1.524	28.769	64.11	1.231	23.390	52.31	0.985	29.912	42.22
36	38.300	1.824	34.433	91.84	1.473	35.177	74.92	1.178	35.873	60.43
42	44.500	2.119	40.008	123.96	1.712	40.871	101.17	1.369	41.480	81.59
48	50.800	2.419	45.672	161.55	1.954	46.658	131.83	1.563	47.486	106.34

Product Standard: ANSI/AWWA C906
ASTM F714, ASTM D3035
Pipe Compound: PPI TR-4 PE 4710,
ASTM D3350 Cell Class 445574 C/E
Certification: ANSI/NSF 61, ANSI/NSF 14*
Additional Option: Perforated (4" - 8")*
Nominal Laying Length: 40/50 feet
(Laying length tolerances are in accordance with AWWA and ASTM standards)
Coil option available upon request for size 6" and below.
Installation: JM Eagle™ HDPE Water/Sewer Installation Guide

Manning Coefficient (n) = 0.009
Hazen-Williams Coefficient (c) = 150

*Supply may vary based on plant location.
Please call regarding availability.



T: (Wall Thickness)
I.D.: (Inside Diameter)
O.D.: (Outside Diameter)

This information may have been updated. Please visit www.jmeagle.com for all updated information and warranty details.

CUSTOMER SERVICE:1.800.621.4404

THIS PRODUCT IS MADE IN AMERICA

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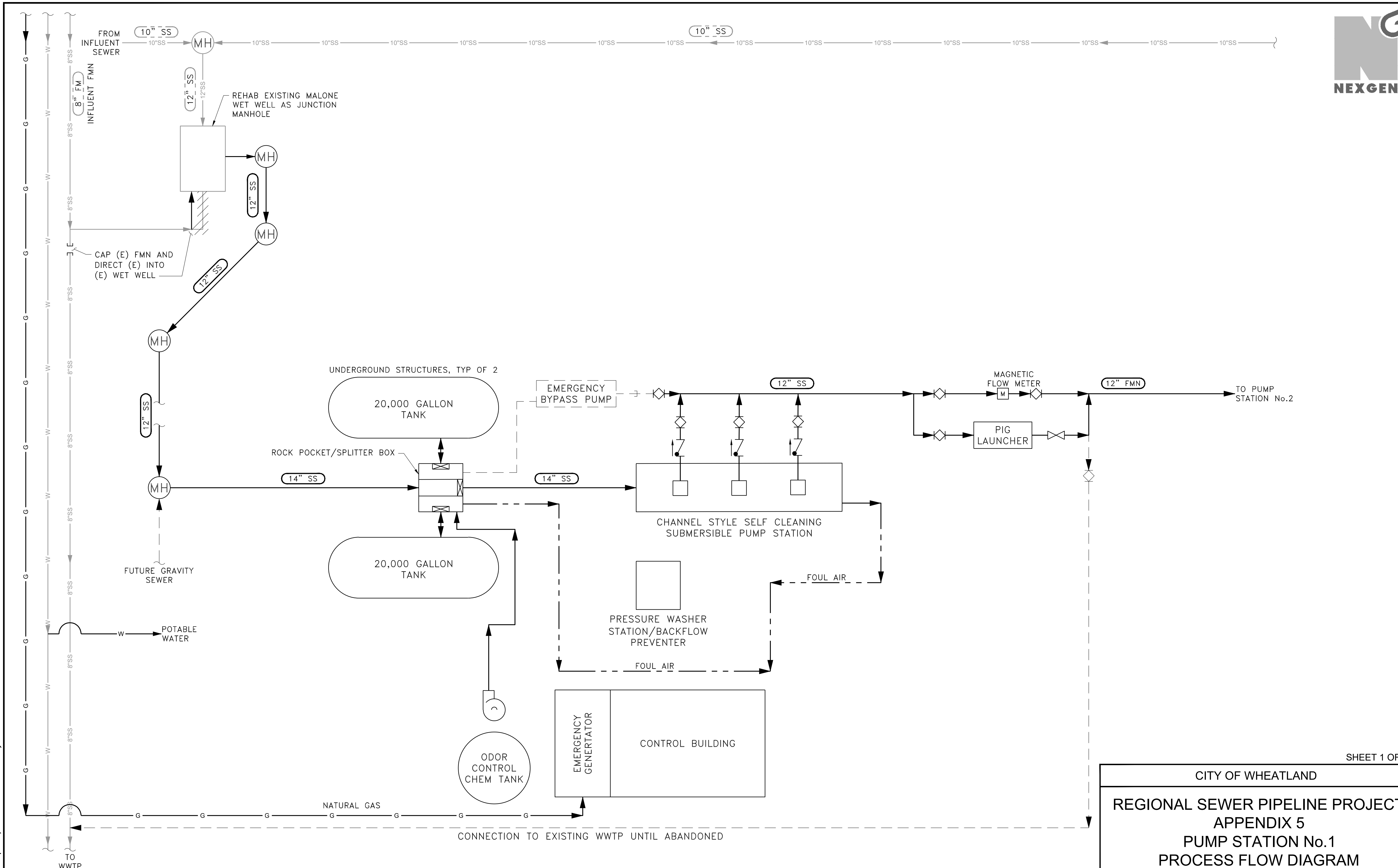

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SHEET 1 OF 9

CITY OF WHEATLAND

REGIONAL SEWER PIPELINE PROJECT
APPENDIX 5
PUMP STATION No.1
PROCESS FLOW DIAGRAM

SHEET 2 OF 9

CITY OF WHEATLAND

REGIONAL SEWER PIPELINE PROJECT
APPENDIX 5
PUMP STATION No.1

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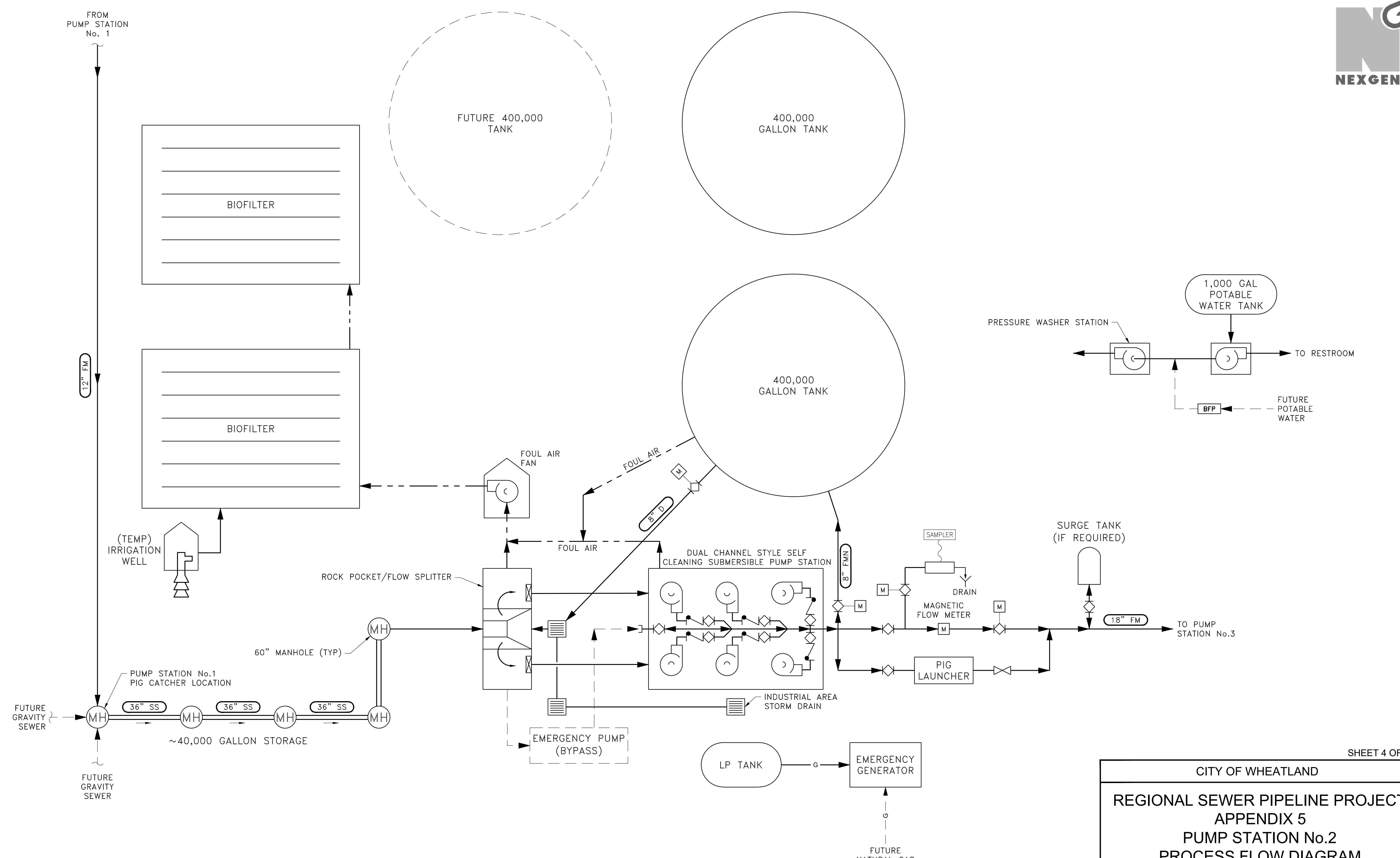

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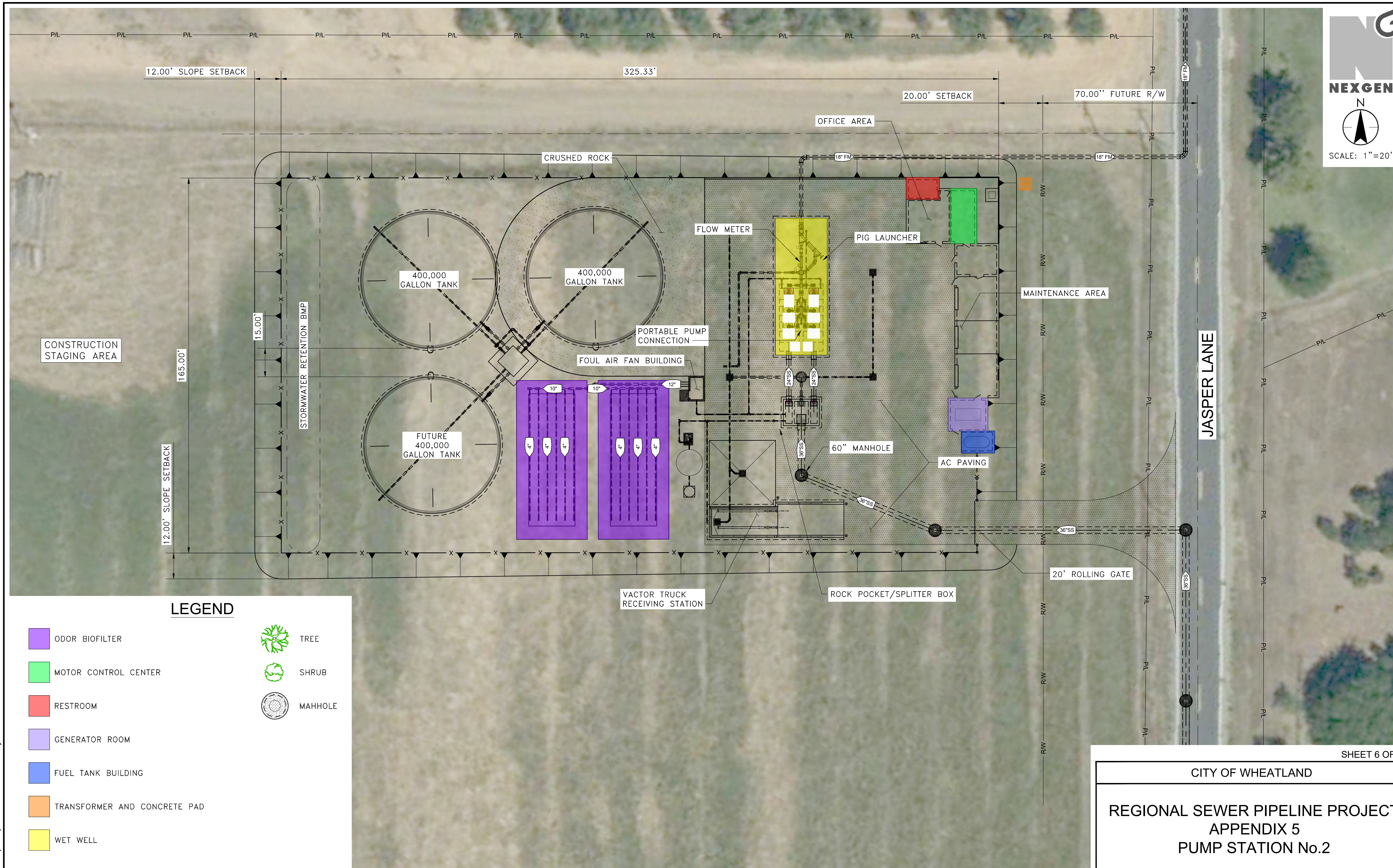
NEXGEN

SHEET 4 OF 9

CITY OF WHEATLAND

REGIONAL SEWER PIPELINE PROJECT
APPENDIX 5
PUMP STATION No.2
PROCESS FLOW DIAGRAM



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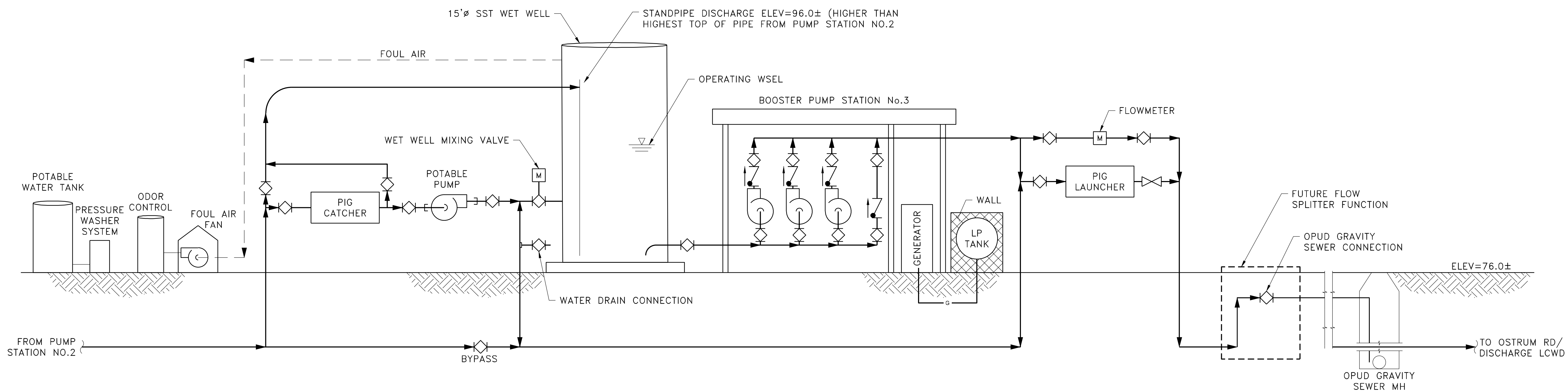
CITY OF WHEATLAND

REGIONAL SEWER PIPELINE PROJECT
APPENDIX 5
PUMP STATION No.2



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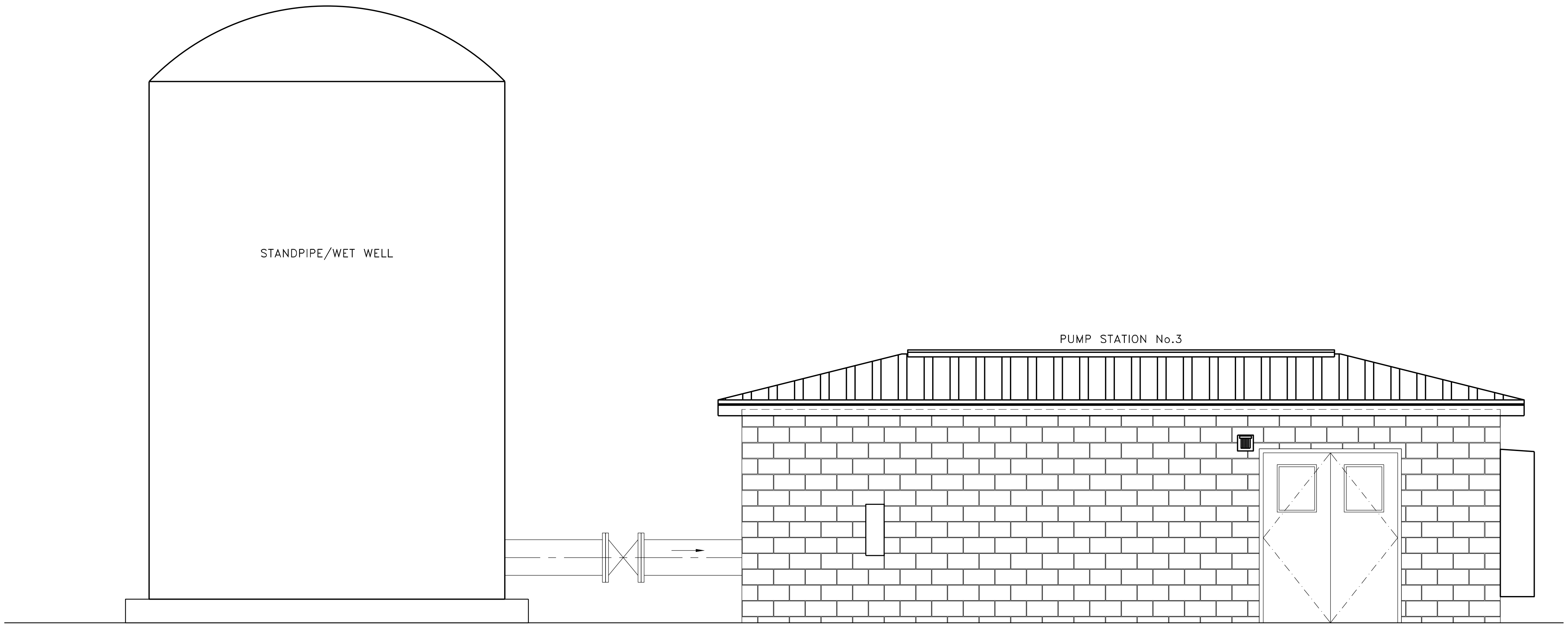
SHEET 7 OF 9

CITY OF WHEATLAND

REGIONAL SEWER PIPELINE PROJECT
APPENDIX 5
PUMP STATION No.3
PROCESS FLOW DIAGRAM

NEXGEN



SHEET 7 OF 9

CITY OF WHEATLAND

REGIONAL SEWER PIPELINE PROJECT
APPENDIX 5
PUMP STATION No.3
ELEVATION DRAWING

SHEET 8 OF 9

CITY OF WHEATLAND

REGIONAL SEWER PIPELINE PROJECT
APPENDIX 5
PUMP STATION No.3
PROPOSED LAYOUT AT RANCHO RD

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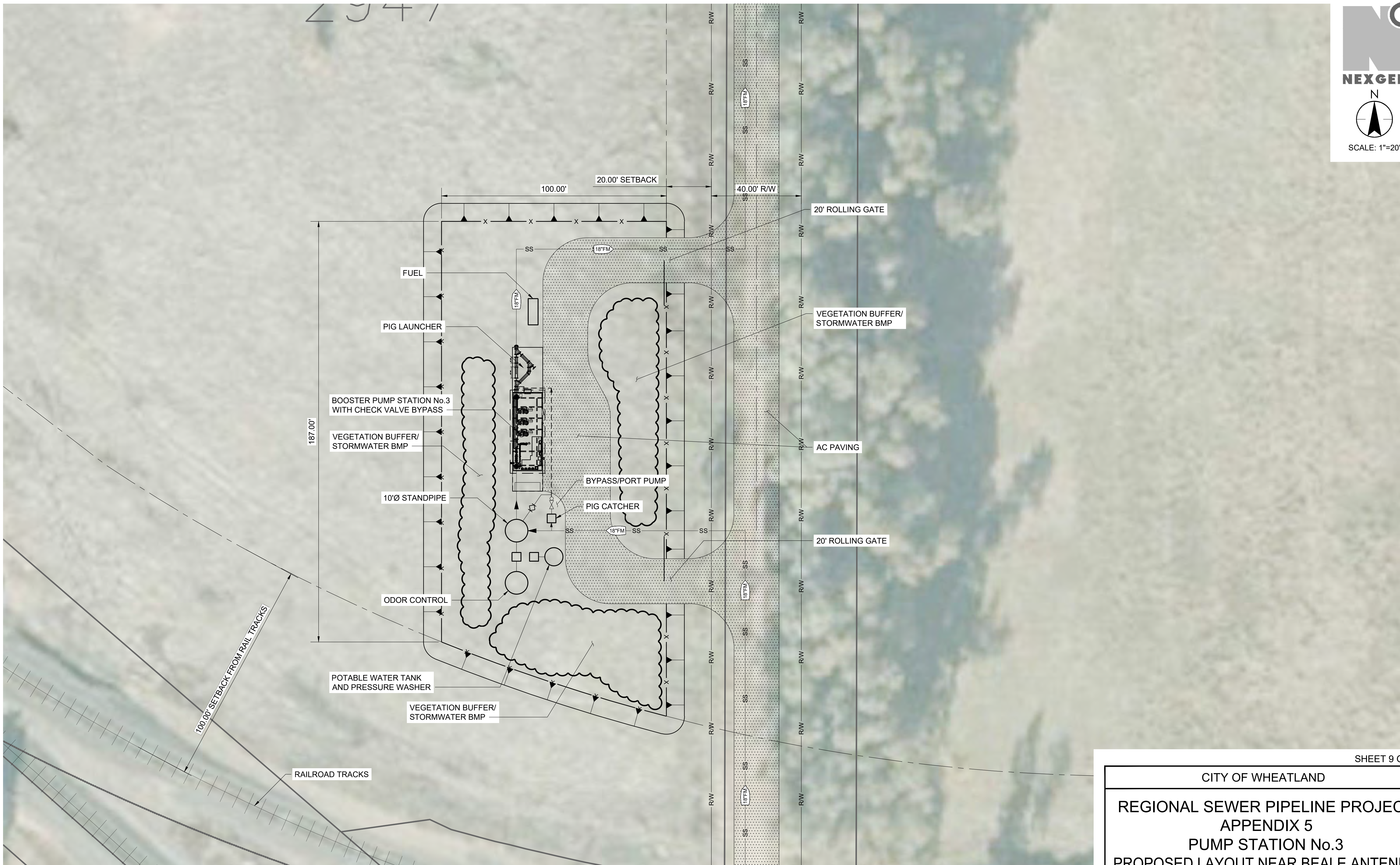

SHEET 9 OF 9

CITY OF WHEATLAND

REGIONAL SEWER PIPELINE PROJECT
APPENDIX 5
PUMP STATION No.3
PROPOSED LAYOUT NEAR BEALE ANTENNA

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