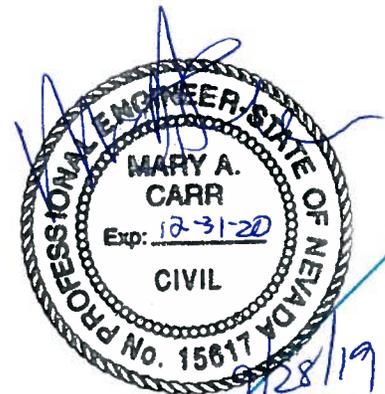


West Henderson Phase 1 Wastewater Backbone Infrastructure Rate

Bermuda Sewer Phase 1 Analysis

City of Henderson

29 August 2019



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1. Project Background

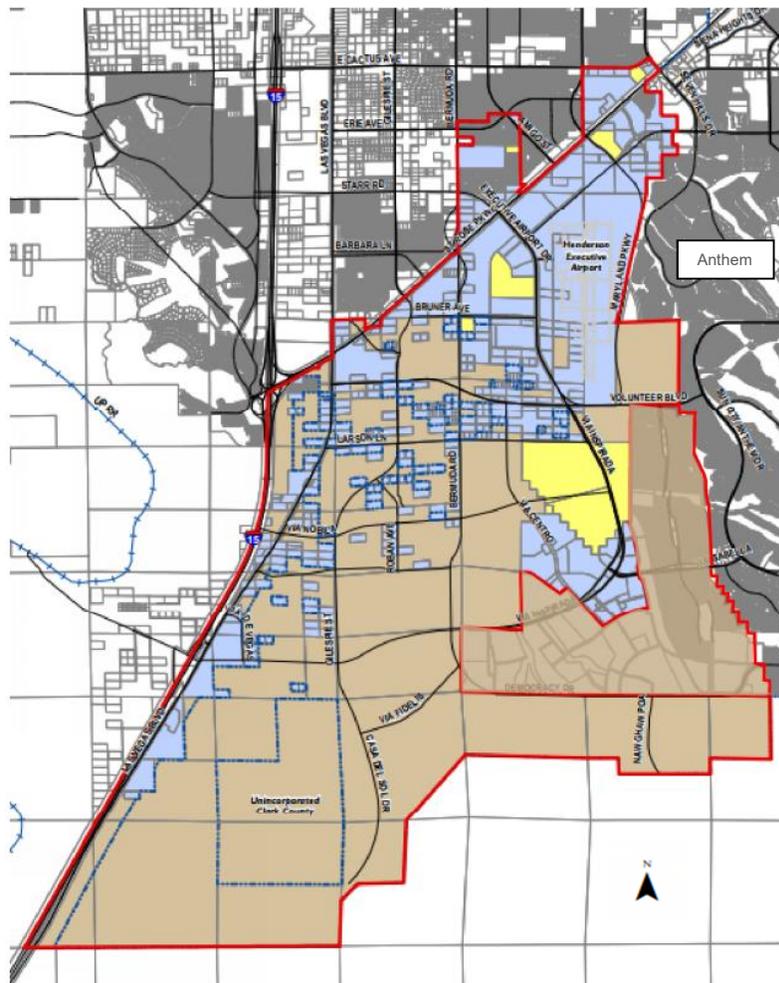
The purpose of this Report is to provide the engineering basis for determining the project cost and the cost for each Equivalent Residential Unit (ERU) for the proposed sanitary sewer in the Bermuda Road alignment between Volunteer Blvd and St Rose Pkwy.

The West Henderson planning area consists of approximately 12,100 acres as identified in the City of Henderson’s (City) 2017 Public Facility Needs Assessment. To determine the cost of the sewer backbone infrastructure to serve a portion of this area, the City needs to update the sewer master plan for the West Henderson planning area.

2. Location

As stated above, the planning area consists of approximately 12,100 acres. The area is located south of St. Rose Parkway, east of Interstate I-15 and west of the Anthem development as shown on Figure 1 below.

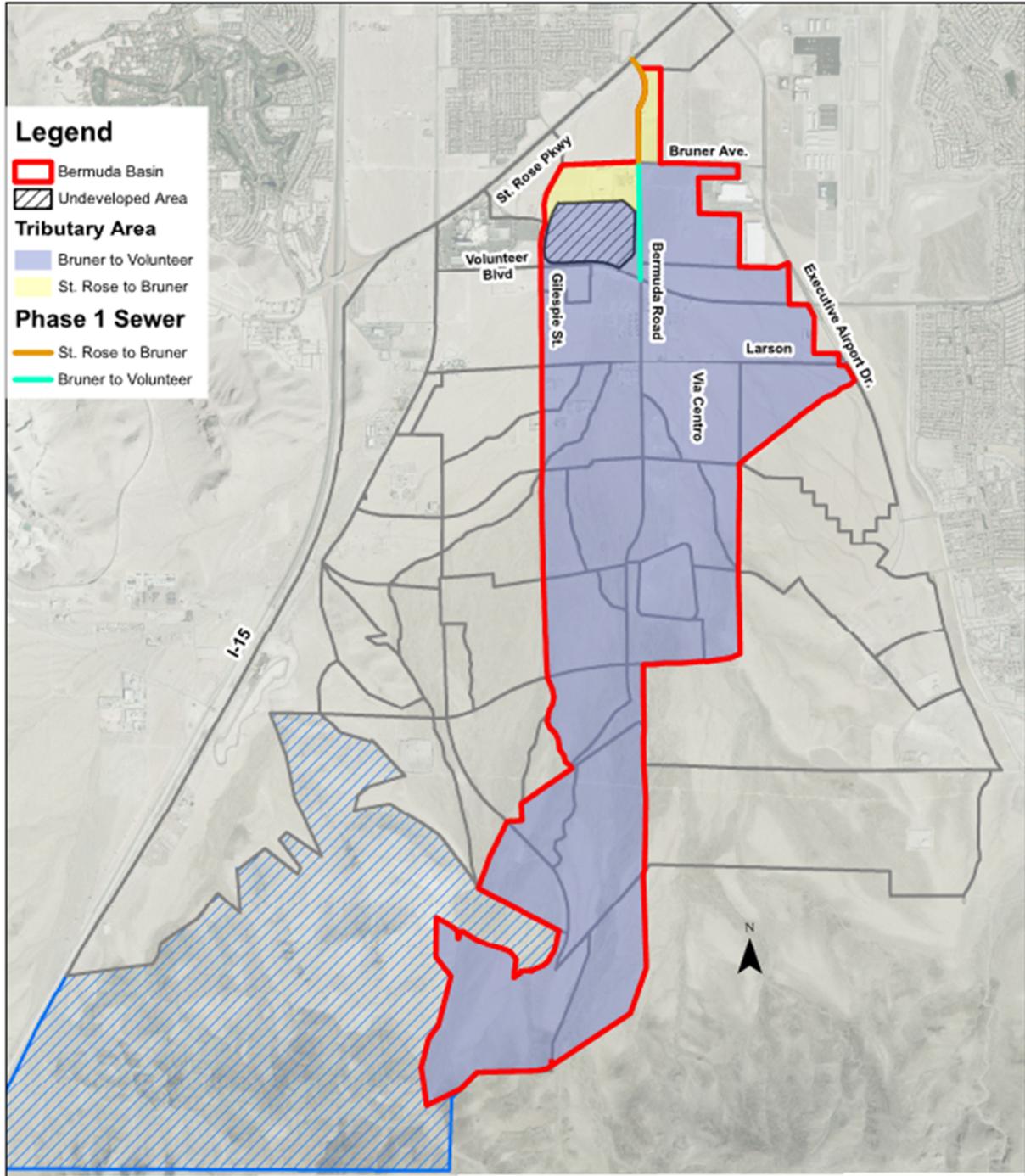
Figure 1 – West Henderson Planning Area



3. Bermuda Sewer Basin

The tributary area for the Bermuda Sewer, defined as the Bermuda Basin, is delineated on the west by Gilespie Road, St. Rose Parkway on the north and Executive Airport Drive on the east. The Bermuda Basin is approximately 4,135 gross acres as shown on Figure 2.

Figure 2 – Bermuda Sewer Basin



4. Wastewater Flow Projections

Wastewater flows projections are based on the West Henderson Land Use Plan and the following assumptions:

- 250 gpd (average daily flow) per ERU
- Wastewater peaking factor according to ASCE curve
- Wet weather allowance, an additional twenty five percent of dry weather peak hourly flow
- Maximum Depth/Diameter (d/D) = 0.75 with peak wet weather flow.
- Manning's n value = 0.013
- Downstream pipes sizes are equal to or greater diameter

5. Project Elements

Project elements of Bermuda Sewer Phase 1 (PCOH 08408) consist of pipelines and manholes between St. Rose Pkwy and Volunteer Blvd. The total length of proposed sewer pipe to be installed is 5,835 ft of 27" PVC. There are 18 sewer manholes total in this sewer line, all of which are 72" diameter apart from one 96" diameter manhole located where the Bermuda Sewer Phase 1 line meets St. Rose Parkway.

6. Land Acquisition

All construction for the Bermuda Sewer Phase 1 is to be done within public Right-of-Way. Therefore, no land acquisition costs were factored into this Rate Study.

7. Cost Apportionment

Table 2 presents the available flow capacity for the Bermuda Sewer Phase 1 as well as the pipe characteristics that affect capacity determination.

Table 2 – Available ERUs

Description	Limiting Slope	Diameter (in)	d/D	Pipeline Capacity (MGD)	Average Flow (MGD)	Available ERUs
St. Rose to Bruner	0.0141	27	0.75	21.67	8.08	32,338
Bruner to Volunteer	0.0091	27	0.75	17.41	6.35	25,386

Project costs include construction cost, according to the change order included as an appendix, and engineering cost. The project costs and the basis for apportionment are presented in Table 3.

Table 3 – Cost Apportionment

Description	Construction Cost	Engineering	Total Cost	Available ERUs	Cost Per ERU
St. Rose to Bruner	\$934,100	\$85,197	\$1,019,297	32,338	\$31.52
Bruner to Volunteer	\$1,114,951	\$101,693	\$1,216,644	25,386	\$47.93

The cost apportionment for the Bermuda Sewer Phase between St. Rose and Bruner is \$31.52 per ERU.

The cost apportionment for the Bermuda Sewer Phase between Bruner and Volunteer is \$47.93 per ERU.

Appendix A – Detailed Cost Estimates



CITY OF HENDERSON
CONTRACT CHANGE ORDER

CONTRACT NAME: Pittman North Detention Basin and Outfall, Phase III

C.O. NUMBER:

CO-3

CONTRACT NO.: 19050 (PCOH 2017-88-3019)

DATE:

12/18/2018

CONTRACTOR: Fisher Sand & Gravel Co.

Funding Sources:

CCRFCD Direct Pay	HEN16F47
DUS Water	5203-3620-701014-U0168
DUS Sewer	5303-3720-701014-U0168

CMTS: 19050

SUBJECT:

Change Order No. 3 for construction of the Bermuda Sewer Phase 1 project.

CONTRACTOR:

You are hereby requested to comply with the following change from the contract plans and specifications. Execution of this change order represents full and final costs of all direct, indirect, and delay costs for the scope of services identified hereon unless noted otherwise. This document shall become an amendment to the contract and all provisions of the contract will apply hereto:

ITEM #	QTY or % INCREASE/ (DECREASE)	UNIT	UNIT PRICE	BID ITEM DESCRIPTION AND NECESSITY OF CHANGE	INCREASE/ (DECREASE) TO CONTRACT
ADDITIONAL WORK:					
1	1	LS	\$ 25,000.00	Traffic Control	\$ 25,000.00
2	100	CY	\$ 57.00	R&R Type 2 Base Under Asphalt	\$ 5,700.00
3	1	LS	\$ 32,280.00	1" Mill and Place UTACS on Volunteer	\$ 32,280.00
4	385	SF	\$ 14.00	R&R 2-Inch AC on Trail	\$ 5,390.00
5	600	SF	\$ 50.00	R&R 6-Inch Asphalt	\$ 30,000.00
6	1	LS	\$ 5,400.00	R&R Median Island & Landscaping	\$ 5,400.00
7	1	LS	\$ 15,000.00	Remove 10" Sewer (193 LF) & Manholes (3 Each)	\$ 15,000.00
8	1	LS	\$ 10,500.00	Demo Existing Structures in ROW	\$ 10,500.00
9	210	LF	\$ 225.00	Install 10" PVC Sewer Line	\$ 47,250.00
10	5835	F	\$ 200.00	Install 27" PVC Sewer	\$ 1,167,000.00
11	17	EA	\$ 28,000.00	Install 72" Sewer Manholes	\$ 476,000.00
12	1	EA	\$ 35,000.00	Install 96" Sewer Manhole	\$ 35,000.00
13	1	EA	\$ 15,000.00	Well Abandonment	\$ 15,000.00
14	1	LS	\$ 102,531.45	60 & 66 Inch Casings	\$ 102,531.45
ADDITIONAL WORK SUB-TOTAL:					\$ 1,972,051.45

ADDITIONAL ALTERNATIVES:

AddAlt 1	1	LS	\$ 27,000.00	Bypass Sewer Line @ Volunteer	\$ 27,000.00
AddAlt 2	1	LS	\$ 50,000.00	Bypass Sewer Line @ St Rose Parkway	\$ 50,000.00
ALTERNATIVES SUB-TOTAL:					\$ 77,000.00

Total This Change Order **\$ 2,049,051.45**

COMPLETION DATE: 7/9/2019
 DAYS ADDED THIS CO: 0
 Days Added--PRIOR COs/Conflicts: 0
 Adjusted COMPLETION DATE: 7/9/2019

Total PREVIOUS Change Orders (529,645.96)
NET CHANGE TO CONTRACT 1,519,405.49
ORIGINAL CONTRACT TOTAL 23,500,000.00
ADJUSTED CONTRACT TOTAL **\$ 25,019,405.49**

Effect on Operation and Maintenance NONE
 Will this affect expiration or extent of insurance coverage?...NO If "YES" will policies be extended?

Contractor: <u>Fisher Sand & Gravel Co.</u>	Name/Title: <u>Robert Nelson, Sr. Project Manager</u>	Date: _____
Quality Control: _____	Name/Title: <u>Lance Olson, P.E. Quality Control Manager</u>	Date: _____
Utility Services: _____	Name/Title: <u>John Day, Deputy Dir-Util Eng/Asset Mgmt (or designee)</u>	Date: _____
Engineering: _____	Name/Title: <u>Thomas Davy, P.E. City Engineer (or designee)</u>	Date: _____
Public Works: _____	Name/Title: <u>Edward McGuire, P.E. Director of Public Works (or designee)</u>	Date: _____

Council Approval Date: 2/6/2018 **Contract Funding:** Construction - \$23,500,000.00 Contingency - \$1,000,000.00

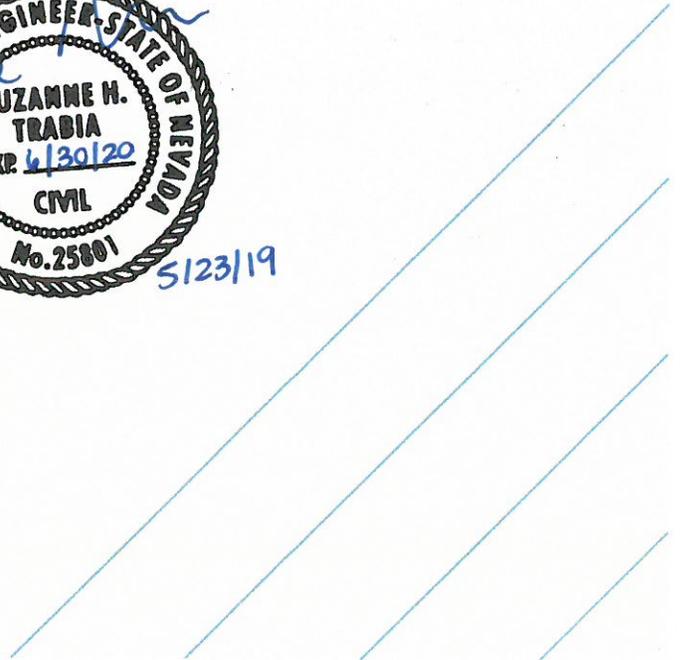
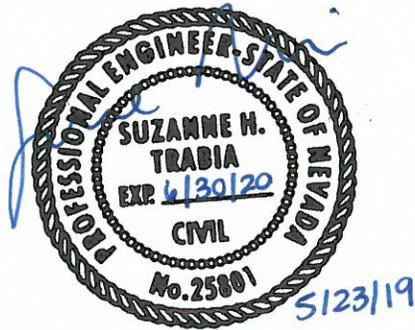
DISTRIBUTION-----> Original: City Clerk's Office Copies: **CONTRACTOR** QC Sr Inspector--Ed Babine
Project Engineer--Al Jankowiak QC--Lance Olson
QC Inspector(s)--Derek Ritchie/Rick Gwartney

	CAT CS56 B Compactor	Cat 8K Water Truck	Volvo 700 Excavator	Cat 825 Compactor	Cat D9 Dozer
MONTHLY	\$4,752.00	\$13,680.00	\$22,000.00	\$14,080.00	\$13,865.00
HOURLY	\$27.00	\$77.73	\$125.00	\$80.00	\$78.78
OPR COST	\$26.10	\$113.55	\$115.60	\$87.35	\$109.10
TOTAL RATE	\$53.10	\$191.28	\$240.60	\$167.35	\$187.88
	Cat 14H Blade	Volvo A60 Rock Truck	CAT 621 Water Pull	3/4 Ton Pickup	Klein Tank
MONTHLY	\$9,695.00	\$11,590.00	\$7,720.00	\$625.00	\$1,360.00
HOURLY	\$55.09	\$65.85	\$43.86	\$3.55	\$7.73
OPR COST	\$57.00	\$91.85	\$52.80	\$11.50	\$7.10
TOTAL RATE	\$112.09	\$157.70	\$96.66	\$15.05	\$14.83

West Henderson Phase 2 Wastewater Backbone Infrastructure Rate

Bermuda Sewer Phase 2 Analysis
City of Henderson

May 23, 2019



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Figure 1 – West Henderson Planning Area

Figure 2 – Bermuda Sewer Phase 2 Tributary Area

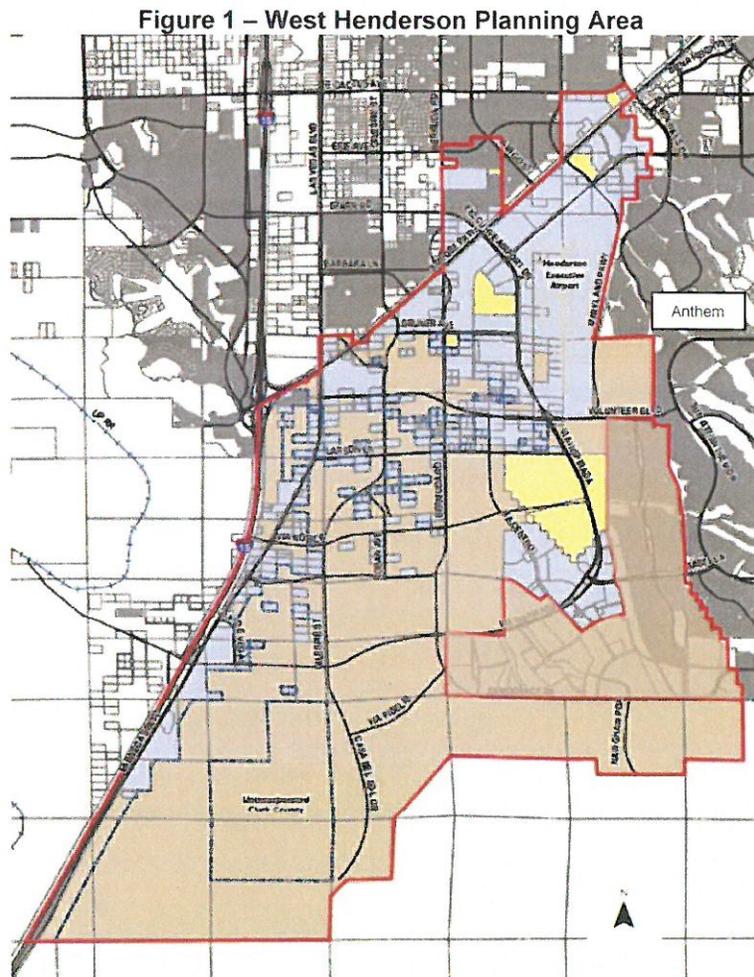
1. Project Background

The purpose of this Report is to provide the engineering basis for determining the project cost and the cost for each Equivalent Residential Unit (ERU) for the proposed sanitary sewer in the Bermuda Road alignment between Larson Lane and Volunteer Boulevard, Larson Lane between Via Centro and Bermuda Road, and Via Centro from Via Nobila to Larson Lane.

The West Henderson planning area consists of approximately 12,100 acres as identified in the City of Henderson's (City) 2017 Public Facility Needs Assessment. To determine the cost of the sewer backbone infrastructure to serve a portion of this area, the City needs to update the sewer master plan for the West Henderson planning area.

2. Location

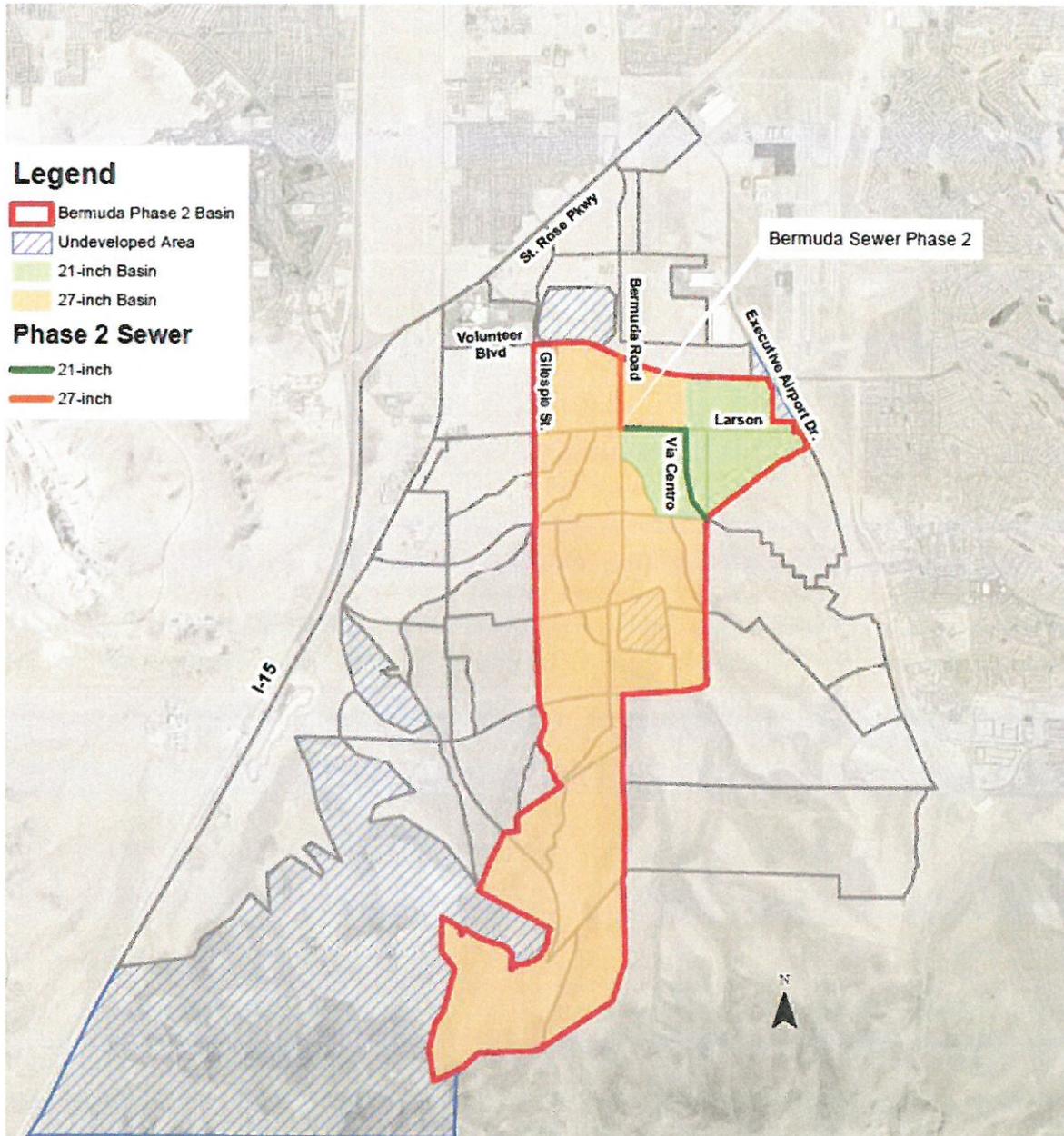
As stated above, the planning area consists of approximately 12,100 acres. The area is located south of St. Rose Parkway, east of Interstate I-15 and west of the Anthem development as shown on Figure 1 below.



3. Bermuda Sewer Basin

The tributary area for the Bermuda Sewer, defined as the Bermuda Basin, is delineated on the west by Gilespe Road, St. Rose Parkway on the north and Executive Airport Drive on the east. The Bermuda Sewer Phase 2 is south of Volunteer Boulevard (Phase 1 is north) and has a tributary area of approximately 2,273 gross acres as shown on Figure 2.

Figure 2 – Bermuda Sewer Phase 2 Tributary Area



4. Wastewater Flow Projections

Wastewater flows projections are based on the West Henderson Land Use Plan and the following assumptions:

- 250 gpd (average daily flow) per ERU
- Wastewater peaking factor according to ASCE curve
- Wet weather allowance, an additional twenty five percent of dry weather peak daily flow
- Maximum Depth/Diameter (d/D) = 0.75 with peak wet weather flow.
- Manning's n value = 0.013
- Downstream pipes sizes are equal to or greater diameter

5. Project Elements

Project elements of Bermuda Sewer Phase 2 consist of pipelines and manholes in the Bermuda Road alignment between Larson Lane and Volunteer Boulevard, Larson Lane between Via Centro and Bermuda Road, and Via Centro from Via Nobila to Larson Lane. The total length of proposed sewer pipe to be installed is 2,155 feet of 27-inch PVC and 5,095 feet of 21-inch PVC. There are 18 sewer manholes total in this sewer line, all of which are 72" diameter.

6. Land Acquisition

The construction for the Bermuda Sewer Phase 2 to be done within public Right-of-Way includes Bermuda Road alignment between Larson Lane and Volunteer Boulevard, Larson Lane between Via Centro and Bermuda Road. There is right-of-way required on Via Centro from Via Nobila to Larson Lane.

7. Cost Apportionment

Table 1 presents the available flow capacity for the Bermuda Sewer Phase 2 as well as the pipe characteristics that affect capacity determination.

Table 1 – Available ERUs

Description	Limiting Slope	Diameter (in)	d/D	Pipeline Capacity (MGD)	Average Flow (MGD)	Available ERUs
Bermuda: Volunteer to Larson	0.0086	27	0.75	16.90	6.14	24,565
Bermuda/Larson to Via Centro/Via Nobila	0.0140	21	0.75	11.00	3.82	15,280

The projected project costs and the basis for apportionment are presented in Table 2.

Table 2 – Cost Apportionment

Description	Pipeline Length (ft)	Diameter (in)	Construction Cost	Engineering	Total Cost	Available ERUs	Cost Per ERU
Bermuda: Volunteer to Larson	2,155	27	\$878,050	\$131,708	\$1,009,758	24,565	\$41.11
Bermuda/Larson to Via Centro/Via Nobila	5,095	21	\$1,731,130	\$259,670	\$1,990,800	15,280	\$130.29

The cost apportionment for the Bermuda Sewer Phase 2 is \$41.11 per ERU from Larson to Volunteer and \$130.29 from Via Nobila to Larson.

Appendix A – Detailed Cost Estimates

Basin	Description	Pipeline Length (ft) ¹	Diameter (in)	Pipe Cost/Lf	Pipeline Cost	No of Manholes ²	Manhole Cost (ea)	Manhole Cost	Construction Cost	Engineering/Design (15%)	Total Cost	Direct ERUs	Segment Cost per ERU
1	Bermuda: Volunteer to Larson	2,155	27	\$310	\$668,050	7	\$30,000	\$210,000	\$878,050	\$131,708	\$1,009,758	24,565	\$41.11
2	Bermuda/Larson to Via Centro/Via Nobila	5,095	21	\$275	\$1,401,130	11	\$30,000	\$330,000	\$1,731,130	\$259,670	\$1,990,800	15,280	\$130.29

¹ Rounded to the nearest tenth

² Manhole every 450 feet rounded up

Basin 1 - Pipe Unit Cost	
Jack and bore length (LF)	158
Jack and bore unit cost (\$/LF)	\$ 1,500.00
Jack and bore cost (\$)	\$237,000.00
27-inch length (LF)	2155
27-inch unit cost (\$/LF)	\$ 200.00
27-inch cost (\$)	\$431,000.00
Total cost of jack and bore + 27-inch (\$)	\$668,000.00
Pipe unit cost (\$/LF)	\$ 309.98