Shephard Wesnitzer, Inc.

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Camp Verde
Sewer Collection System Expansion
Design Concept Report

February 23, 2018
Revised February 28, 2018

SWI #15089

Prepared for:
Mr. Troy Odell, PE, Town Engineer
Town of Camp Verde
395 S. Main Street
Camp Verde, AZ 86322
928-301-7486

Prepared By:
David Monihan, Jr., PE, RLS
Shephard - Wesnitzer, Inc

Table of Contents

BACKGROUND

The purpose of this report is to present engineering support for the Sewer Collection System Expansion Master Plan (Master Plan) for the Town of Camp Verde (Camp Verde, Town). The section below contains the Master Plan project description including the general organization of the current collection system, the expansion area location and basis of design.

CURRENT SYSTEM

The current sewer system in Camp Verde uses gravity sewer lines to transport sewage from the historic town area of Camp Verde southwest of Interstate 17 (I-17) to the single lift station located near the intersection of Highway 260 and the Verde River. This lift station handles all of the Town's wastewater which averages 300,000 gallons per day (according to Camp Verde Utility Staff). The wastewater is treated at the Town's wastewater plant overlooking the Verde Valley from the southeast.

PROPOSED SYSTEM EXPANSION

The sewer collection expansion includes areas of Camp Verde located to the north and west of the I-17 and Highway 260 interchange. The Camp Verde Town limits and the Sewer Collection System Expansion Master Plan project area are both shown in Exhibit A. The Master Plan area for the sewer collection expansion was limited to the portions of Camp Verde that are located West of I-17, along State Route 260, (SR260) and west of the Verde River. There are areas within the town limits that are not included in the project because they are across the river or the areas are public or tribal land.In order to provide sewer service to the property within the Camp Verde boundary, the proposed collection system requires a combination of gravity sewer mains and sewer force mains.

It is difficult to serve the various neighborhoods along the foot hills of the Mingus Mountains extending towards the Verde River with gravity sewer alone and still connect to the current system end point location at the northwest corner of the intersection of I-17 and Highway 260. The reason for this is twofold:

- The topography of the area includes washes and ridges that make some of the areas impossible and cost prohibitive (due to excessive excavation depths) to connect via typical gravity lines.
- Camp Verde does not maintain Right-of-Way within the Yavapai-Apache Nation (YAN). The YAN owns property along the Verde River adjacent and downhill from much of the project area.

The solution to providing sewer lines for the project area is to use gravity to bring the flows to a local collection point, and then provide a sewer lift station to move the sewage to a receiving manhole connected to the main gravity system for the Town.

TOWN OF CAMP VERDE AREAS NOT INCLUDED

This Master Plan does not include areas of Camp Verde that are on the northwest side of the Verde River or those that are discontinuous with the town border primarily due to the fact that those parcels and subdivisions surrounded on three sides by Yavapai Apache-Nation land. For the purpose of this report it was recognized that the Town does not have Rights-of-Way within the YAN. There is no plan to seek easements or Rights of Way from the YAN at this time. The zoning figure in Exhibit B indicates the areas within the Town limits that are not part of the study as NPS.

METHODOLOGY

Sewer line sizing is primarily about peak flows. In order to justify the expense of installation, lines must, at a minimum be adequately sized to handle the peak flows for the next 50 years. Sewer lift stations and pressure pipes are more critical as failures in these locations may result in accidental sewage discharge.

SEWER LINE LAYOUT

Sewer areas were defined by the topography, and gravity and force main lines were laid out to collect sewage from all of the areas noted on the map. Areas within the project were identified and lines were placed to collect sewage through gravity lines where possible. The location of the lines was used to create a flow calculation table based on the location of each of the gravity sewer areas.

The table, located in Exhibit C includes the areas of the town that connect to the sewer lines and their zoning to allow for a calculation by area and cumulative flows to be converted to a total area for each of the lift stations. These flows were used to design the future sewer build-out for Camp Verde within the project Area. The calculated flows were used to size the gravity and force main lines shown in the master plan.

FLOW CALCULATION

Predicting future flows is not an exact science. Many things can change the trajectory of growth in a city or town. When a town has zoning in place, to guide land use, it is a clear starting point to predict development density going forward. The Town of Camp Verde has zoning in place.

The engineer used the current zoning (as shown on the Exhibit B: Zoning Map) to establish the future flow conditions for the master plan area. All parcels as indicated were included whether developed or undeveloped. Properties were identified by their zoning as either residential or commercial and density of development was assumed to match the density allowed by the zoning. For residential zones, the allowed density in units per acre was used for the calculation. Acres of commercial property were used as the basis of the commercial property calculation.

Commercially zoned property flow was calculated using 1,000 gallons per acre day and residential property flow was calculated at 280 gallons per unit per day. Cumulative flows were calculated along the lines and at each of the concentration points where gravity sewers were tied to lift stations. The flows were used to develop the needed wet well volume and the pumping rates for the lift stations. A tabulation of the results can be found in Exhibit C of the Appendix.

SIZING THE SYSTEM OF SEWER LINES AND THE LIFT STATIONS

LINE SIZING

Sewer lines included in Camp Verde were sized using procedures detailed in ADEQ Rule R18-9-E301. There were no special procedures required. Sewer lines must be a minimum of 8 inches in diameter. Larger flows require larger sewer lines. Exhibit D shows the gravity sewer lines and

force mains included in the system as designed. Three lift stations and their approximate locations are also shown on the plans.

LIFT STATION

Lift stations consist of a wet well fitted with submersible sewage pumps that pump the sewage into the force main. The pressure from the pump pushes the sewage through the line and into a discharge manhole. Sewage then flows by gravity through the attached sewer main.

Pumps are sized to handle the peak sewage flows. According to ADEQ Rule, the lift station pumps must have the capacity to "provide a total pumping capability equal to the maximum anticipated flow with at least one of the largest pumps out of service". The sewage lift station wet well must hold the anticipated volume of sewage during the peak flows plus a safety factor and at least two pumps.

DESIGN FLOWS LIFT STATIONS

This section provides the components included in the lift stations needed for the system as designed.

LIFT STATION #1

Lift Station #1 (34° 30' 21.7" N, 111° 55' 54.5" W) is located at the north end of N. Hayfield Draw Road. The Lift station will lift the sewage to a discharge manhole located at the intersection of N. Hayfield Draw Road and W. Old State Highway 279. The force main is expected to be 6 inch PVC pipe, 1,900 feet long. Flows from all areas west of Hayfield Draw and the area of Hayfield draw flow to Lift Station #1.

These are the design elements for the final proposed development for this lift station:

Lift Station #1		
Element	**Value**	**Units**
Daily Flow	126,650	Gallons per day (gpd)
Peak Flow	234,303	Gallons per day (gpd)
Peak Flow*	186	Gallons per minute (gpm)
Wet Well Volume	1,057	Gallons
Wet Well	6.00	Diameter, Feet
	20.00	Depth, Feet
Pumps - duplex	Sulzer XFP 100E CB1	
Capacity	327	Gallons per minute (gpm)
Total Dynamic Head	68.9	Feet
Power	15	Horse Power

*The peak flow in gpm is upsized because ADEQ regulations for small lift stations require a higher peaking factor.

The Lift Station will be provided with odor control and with diesel driven backup generator. A round wet will is shown however rectangular vaults will be considered in the final design.

The pump may be resized smaller during the design flow if velocity can be maintained.

LIFT STATION #2A AND #2B

Lift Station #2 (34° 36; 38,2: N, 111° 55' 36.7" W) located on W. Old State Highway 279 between Aultman Parkway and Cloverleaf Ranch Road. The force main is 13,500 feet of 6 inch and 10 inch PVC. (The initial pumping system will use the 6 inch line and the final pumping system will use both lines.) These are the design elements for the final proposed development flow which will have a total of 4 pumps.

Lift Station #2A		
Element	**Value**	**Units**
Daily Flow	830,675	Gallons per day (gpd)
Peak Flow	1,536,749	Gallons per day (gpd)
Peak Flow	1,067	Gallons per minute (gpm)
Wet Well Volume	3,008	Gallons
Wet Well	8.00	Diameter, Feet
	34.00	Depth, Feet
Initial Pumps - duplex	Sulzer XFP 101G CB1	
Capacity	223	Gallons per minute (gpm)
Total Dynamic Head	150	Feet
Power	25	Horse Power
Future Pumps - duplex	Sulzer XFP 105J CB2	
Capacity	821	Gallons per minute (gpm)
Total Dynamic Head	150	Feet
Power	90	Horse Power

Due to the head pressures developed over the length of the force main from Lift Station 2 to the discharge manhole, a booster station may be more economic. (Pumps to meet the required head are limited and expensive.) It will be considered as part of the final design. If economically sound then it will be included. The proposed location for Lift Station 2B is shown on Exhibit D.

Due to the depth of this lift station wet well, a non-submersible pumping system may be considered in the final design.

The Lift Station will be provided with odor control and with diesel driven backup generator. A round wet will is shown however rectangular vaults will be considered in the final design.

LIFT STATION #3

Lift Station #3 (34° 35' 22.0" N, 111° 53' 3.3" W) is located just beyond the end of Dickson Circle and discharges to the manhole in Dickson Circle. The force main is 100 feet of 6 inch and 10 inch PVC. (The initial pumping system will use the 6 inch line and the final pumping system will use both lines.) These are the design elements for the final proposed development flow which will have a total of 4 pumps.

Lift Station #3		
Element	Value	Units
Daily Flow	1,394,990	Gallons per day (gpd)
Peak Flow	2,580,732	Gallons per day (gpd)
Peak Flow	1,792	Gallons per minute (gpm)
Wet Well Volume	4,700	Gallons
Wet Well	10.00	Diameter, Feet
	24.00	Depth, Feet
Initial Pumps - duplex	Sulzer XFP 150E CB1	
Capacity	433	Gallons per minute
Total Dynamic Head	20	Feet
Power	5	Horse Power
Future Pumps - duplex	Sulzer XFP 201G CB2	
Capacity	1,710	Gallons per minute
Total Dynamic Head	20	Feet
Power	20	Horse Power

The Lift Station will be provided with odor control and with diesel driven backup generator. A round wet will is shown however rectangular vaults will be considered in the final design.

Pumps may be resized smaller in the design phase if all design conditions can be met.

SYSTEM SUMMARY

The discharge from Lift Station 3 joins some additional gravity flows that go to and existing manhole and into the existing 12 inch sewer that goes under Interstate 17.

The system design flows for the future proposed development are as follows:

Average Daily Flow	1,593,340 gpd
Peak Flow	2,947,679 gpd
Peak Flow	2,047 gpm

COST ESTIMATE

The Lift Station cost estimate includes construction for a complete pumping system as described above for the full development. It does not include the cost of bringing power to the site. All costs are in 2018 US dollars.

Lift Station #1	$175,000
Lift Station #2	$735,000
Lift Station #3	$320,000

Lift Station 2 and 3 are large enough that pumps were sized for an initial flow of approximately 20% of the fully developed design flow. It is expected that the additional pumps required for full development will not be installed until the initial pumps are no longer adequate to provide service to the developing area. It is expected that the vault and force main will be adequate for the fully developed design flow. Components that can be upsized easily in the future would not be completed during the initial construction.

System sewer cost estimates are located in the table below. Gravity sewer serves each lift station. A single sewer force main from Lift station 1 is required while dual force mains are required from Lift stations 2 and 3.

Gravity Sewer Main	$3,500,000
Force Mains	$910,000

CONCLUSION AND RECOMMENDATIONS

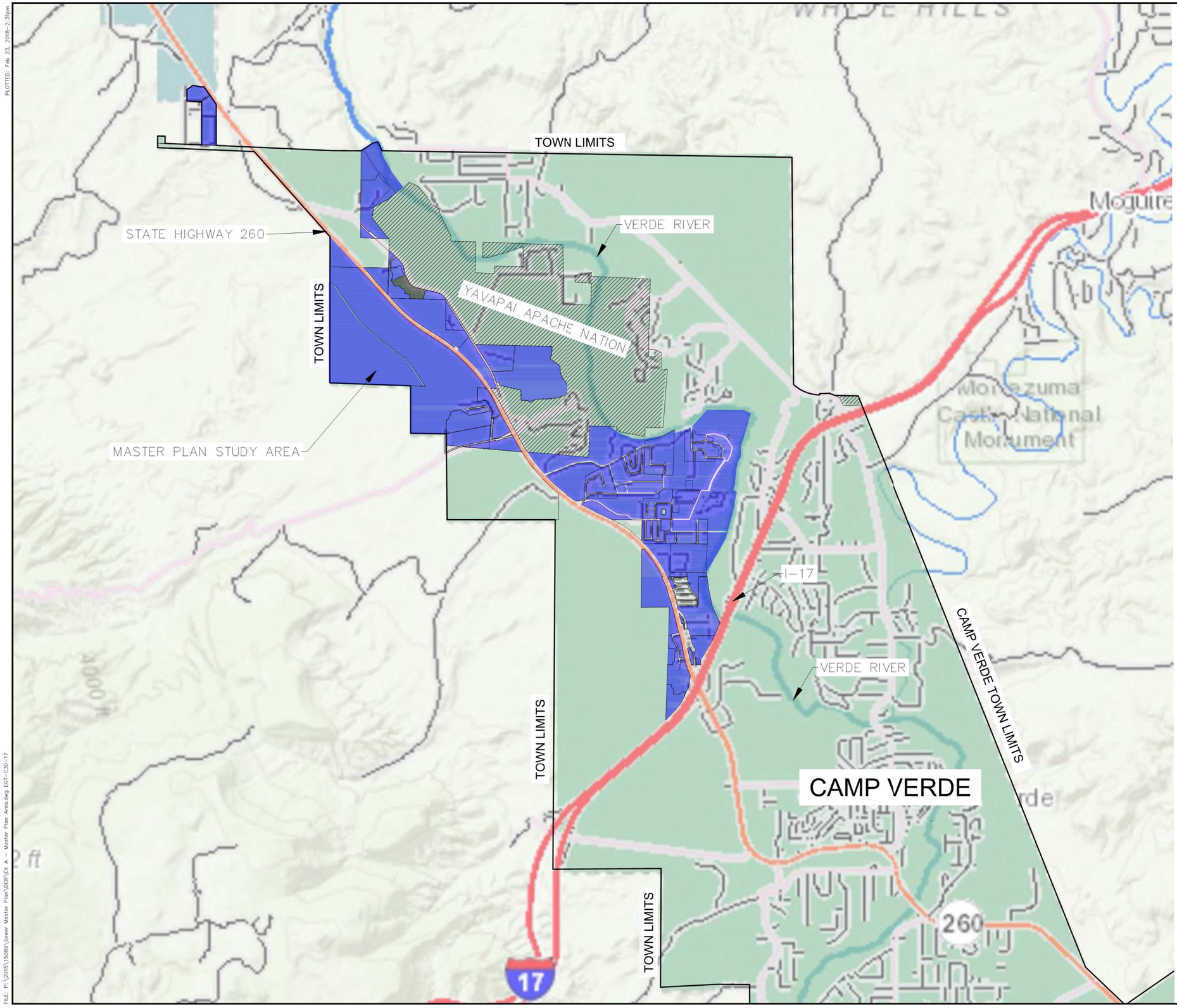
The Town of Camp Verde will need to provide a system of gravity and pressure sewer lines to serve the areas within the Town limits within the project area. The Town will need to build and operate a series of four lift stations in addition to adding more capacity to the current lift station.

The Town should begin property surveys and plan for property acquisitions and an electrical power source for the lift stations. Locations for the three of the four lift stations were provided in the master plan drawings.

The lift stations will require 3-phase, 460 Volt electrical service to operate. For the purpose of this report the availability of this power at the lift station locations is assumed. Camp Verde will need to coordinate with APS to tie in to their facilities.

APPENDIX

PLOTTED: Feb 23, 2018–2:31pm



LEGEND

- YAVAPAI APACHE NATION
- CAMP VERDE TOWN AREA
- MASTER PLAN STUDY AREA
- CAMP VERDE TOWN LIMITS

SCALE: 1" = 2000'

0 1000' 2000'

EXHIBIT A:
MASTER PLAN AREA MAP

CAMP VERDE SEWER EXPANSION MASTER PLAN
CAMP VERDE ARIZONA

JOB NO: 15089
DATE: FEB 18
SCALE: AS SHOWN
DRAWN: LSB/TNO
DESIGN: TRL
CHECKED: TMM

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Shephard Wesnitzer, Inc.

REVISIONS

NO.	DESCRIPTION	DATE	BY

Call at least two full working days Before you begin excavation
ARIZONA811 Arizona Blue Stake, Inc.
Dial 8-1-1 or 1-800-STAKE-IT (782-5348)

DRAWING NO.
EX A

SHT NO. 1 OF 1

FILE: P:\2015\15089\Sewer Master Plan\DGN\EX A - Master Plan Area.dwg EGT-C30-17

PLOTTED: Feb 23, 2018-10:03am

- C1- COMMERCIAL NEIGHBORHOOD
- C2- COMMERCIAL GENERAL
- C3- HEAVY COMMERCIAL
- M1- INDUSTRIAL GENERAL
- PLANNED AREA DEVELOPMENT
- PLANNED UNIT DEVELOPMENT
- R1L- RESIDENTIAL SINGLE FAMILY LIMITED
- R1- RESIDENTIAL SINGLE FAMILY
- R2 RESIDENTIAL DUPLEX
- RR- RESIDENTIAL RURAL
- YAVAPAI APACHE NATION
- NPS NOT PART OF STUDY
- ## AREA ID

SCALE: 1" = 2500'

0 1250' 2500'

FILE: P:\2015\15089\Sewer Master Plan\DCR\EX B - Camp Verde Zoning.DWG EGT-C3D-17

CAMP VERDE SEWER EXPLANSION MASTER PLAN
CAMP VERDE ARIZONA

EXHIBIT B:
CAMP VERDE ZONING

JOB NO: 15089
DATE: MAR 2017
SCALE: AS SHOWN
DRAWN: KMB/LSB/RNJ
DESIGN: TRL
CHECKED: DMM

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REVISIONS

NO.	DESCRIPTION	DATE	BY

Call at least two full working days before you begin excavation.
ARIZONA 811 Arizona Blue Stake, Inc.
Dial 8-1-1 or 1-800-STAKE-11 (782-5348)

DRAWING NO.
EX B

SHT NO. 1 OF 1

EXHIBIT C - SEWER CALCULATIONS

SEWAGE FLOW CALCULATIONS - Design Sewer Flow

SWI JOB #: *15089*
PROJECT NAME: *CAMP VERDE SEWER MASTER PLAN*
DATE CREATED: *9/1/2017* ***DESIGNER:*** *EGT*
DATE LAST UPDATED: *2/23/2018* ***CHECKED:*** *DMM*

Design Sewer Flow								
AREA ID	**ZONE**	**AREA (AC)**	**DESIGN FLOW (GPD)**		**PEAK FLOW (GPD)**	**PEAK FLOW (GPM)**	**PEAK FLOW (GPD)**	**PEAK FLOW (GPM)**
17	**C3-2A**	24.85	24,850		45,973	31.9		
59	**M1-10A**	19.93	19,930		36,871	25.6		
31B	**RR-2A**	30.38	4,200		7,770	5.4		
53	**M1**	77.67	77,670		143,690	99.8		
Lift Station 1							234,303	162.7
From LS1					234,303	162.7		
11	**C3**	29.04	29,040		53,724	37.3		
23	**RR-2A**	225.31	31,360		58,016	40.3		
54	**M1**	6.62	6,620		12,247	8.5		
20	**RR-2A**	5.94	560		1,036	0.7		
55	**M1**	16.62	16,620		30,747	21.4		
12	**C3**	403.96	403,960		747,326	519.0		
21	**RR-2A**	6.99	840		1,554	1.1		
22	**RR-2A**	2.09	280		518	0.4		
56	**M1**	10.70	10,700		19,795	13.7		
60	**PAD**	102.98	38,065		70,420	48.9		
4	**C2**	13.85	13,850		25,623	17.8		
13	**C3**	64.08	64,080		118,548	82.3		
24	**RR-2A**	126.16	17,640		32,634	22.7		
25	**RR-2A**	34.98	4,760		8,806	6.1		
57	**M1**	65.65	65,650		121,453	84.3		
Lift Station 2							1,536,749	1,067.2

Design Sewer Flow								
AREA ID	**ZONE**	**AREA (AC)**	**DESIGN FLOW (GPD)**		**PEAK FLOW (GPD)**	**PEAK FLOW (GPM)**	**PEAK FLOW (GPD)**	**PEAK FLOW (GPM)**
From LS2					1,536,749	1,067.2		
10	**C2-4**	2.03	2,030		3,756	2.6		
26C	**RR-2A**	544.39	76,160		140,896	97.8		
27B	**RR-2A**	3.69	280		518	0.4		
34	**R1-12**	14.74	17,920		33,152	23.0		
37	**R1-35**	35.57	43,120		79,772	55.4		
38	**R1-35**	3.11	3,640		6,734	4.7		
40	**R1-35**	30.46	36,960		68,376	47.5		
42	**R1-70**	32.47	39,480		73,038	50.7		
45	**R1L-35**	49.60	80,640		149,184	103.6		
63	**PAD**	19.50	7,115		13,163	9.1		
3	**C1**	1.84	1,840		3,404	2.4		
6	**C2**	3.67	3,670		6,790	4.7		
14	**C3**	63.98	63,980		118,363	82.2		
28	**RR-2A**	5.45	560		1,036	0.7		
29	**RR-2A**	20.53	2,800		5,180	3.6		
32	**R1-10**	19.46	23,520		43,512	30.2		
35	**R1-18**	5.13	6,160		11,396	7.9		
44	**R1-70**	48.34	58,800		108,780	75.5		
46	**R1L-70**	34.77	56,280		104,118	72.3		
52	**R2**	11.33	39,360		72,816	50.6		
Lift Station 3							2,580,732	1,792.2
From LS 3					2,580,732	1,792.2		
1	**C1**	0.92	920		1,702	1.2		
2	**C1**	2.75	2,750		5,088	3.5		
5	**C2**	17.00	17,000		31,450	21.8		
8	**C2-3**	3.65	3,650		6,753	4.7		
9	**C2-4**	32.02	32,020		59,237	41.1		
15	**C3**	1.37	1,370		2,535	1.8		
16	**C3**	4.00	4,000		7,400	5.1		
47	**R1L-70**	5.03	8,120		15,022	10.4		
48	**R1L-70**	16.46	26,600		49,210	34.2		
50	**R1L-70**	62.75	101,920		188,552	130.9		
Exisiting MH							2,947,679	2,047.0

Design Sewer Flow								
AREA ID	**ZONE**	**AREA (AC)**	**DESIGN FLOW (GPD)**		**PEAK FLOW (GPD)**	**PEAK FLOW (GPM)**	**PEAK FLOW (GPD)**	**PEAK FLOW (GPM)**
7	**C2-1**	10.33	10,330		0	0		
18	**RR-2A**	19.88	2,520		0	0		
19	**RR-2A**	364.51	50,960		0	0		
26A	**RR-2A**	1,080.01	151,200		0	0		
26B	**RR-2A**	80.46	11,200		0	0		
26D	**RR-2A**	12.89	1,680		0	0		
27A	**RR-2A**	1,527.38	213,640		0	0		
30	**RR-2A**	1,398.44	195,720		0	0		
31A	**RR-2A**	328.62	45,920		0	0		
31C	**RR-2A**	34.16	4,760		0	0		
33	**R1-10**	21.41	26,040		0	0		
36	**R1-35**	85.57	104,160		0	0		
39	**R1-35**	38.70	47,040		0	0		
41	**R1-70**	12.47	15,120		0	0		
43	**R1-70**	71.97	87,640		0	0		
49	**R1L-70**	33.27	54,040		0	0		
51	**R1L-175**	48.07	78,120		0	0		
58	**M1-10A**	2.55	2,550		0	0		
61	**PAD**	16.30	6,035		0	0		
62	**PAD**	3.25	1,093		0	0		
	TOTAL	**7,554.05**	**2,703,108**		**5,000,749**	**3,473**		

SEWAGE FLOW CALCULATIONS - Summary

SWI JOB #: *15089*
PROJECT NAME: *CAMP VERDE SEWER MASTER PLAN*
DATE CREATED: *1/19/2017* ***DESIGNER:*** *KMB and LSB*
DATE LAST UPDATED: *2/23/2018* ***CHECKED:*** *DMM*

SUMMARY							
AREA ID	ZONE	AREA (AC)	DESIGN FLOW (GPD)		MASTER PLAN DESIGN FLOW (GPD)	PEAK FLOW (GPD)	PEAK FLOW (GPM)
1	C1	0.92	920		920	1,702	1.2
2	C1	2.75	2,750		2,750	5,088	3.5
3	C1	1.84	1,840		1,840	3,404	2.4
4	C2	13.85	13,850		13,850	25,623	17.8
5	C2	17.00	17,000		17,000	31,450	21.8
6	C2	3.67	3,670		3,670	6,790	4.7
7	C2-1	10.33	10,330		0	0	0.0
8	C2-3	3.65	3,650		3,650	6,753	4.7
9	C2-4	32.02	32,020		32,020	59,237	41.1
10	C2-4	2.03	2,030		2,030	3,756	2.6
11	C3	29.04	29,040		29,040	53,724	37.3
12	C3	403.96	403,960		403,960	747,326	519.0
13	C3	64.08	64,080		64,080	118,548	82.3
14	C3	63.98	63,980		63,980	118,363	82.2
15	C3	1.37	1,370		1,370	2,535	1.8
16	C3	4.00	4,000		4,000	7,400	5.1
17	C3-2A	24.85	24,850		24,850	45,973	31.9
18	RR-2A	19.88	2,520		0	0	0.0
19	RR-2A	364.51	50,960		0	0	0.0
20	RR-2A	5.94	560		560	1,036	0.7
21	RR-2A	6.99	840		840	1,554	1.1
22	RR-2A	2.09	280		280	518	0.4
23	RR-2A	225.31	31,360		31,360	58,016	40.3
24	RR-2A	126.16	17,640		17,640	32,634	22.7
25	RR-2A	34.98	4,760		4,760	8,806	6.1
26A	RR-2A	1,080.01	151,200		0	0	0.0
26B	RR-2A	80.46	11,200		0	0	0.0
26C	RR-2A	544.39	76,160		76,160	140,896	97.8
26D	RR-2A	12.89	1,680		0	0	0.0
27A	RR-2A	1,527.38	213,640		0	0	0.0
27B	RR-2A	3.69	280		280	518	0.4
28	RR-2A	5.45	560		560	1,036	0.7
29	RR-2A	20.53	2,800		2,800	5,180	3.6
30	RR-2A	1,398.44	195,720		0	0	0.0
31A	RR-2A	328.62	45,920		0	0	0.0
31B	RR-2A	30.38	4,200		4,200	7,770	5.4
31C	RR-2A	34.16	4,760		0	0	0.0

SUMMARY							
AREA ID	**ZONE**	**AREA (AC)**	**DESIGN FLOW (GPD)**		**MASTER PLAN DESIGN FLOW (GPD)**	**PEAK FLOW (GPD)**	**PEAK FLOW (GPM)**
32	**R1-10**	19.46	23,520		23,520	43,512	30.2
33	**R1-10**	21.41	26,040		0	0	0.0
34	**R1-12**	14.74	17,920		17,920	33,152	23.0
35	**R1-18**	5.13	6,160		6,160	11,396	7.9
36	**R1-35**	85.57	104,160		0	0	0.0
37	**R1-35**	35.57	43,120		43,120	79,772	55.4
38	**R1-35**	3.11	3,640		3,640	6,734	4.7
39	**R1-35**	38.70	47,040		0	0	0.0
40	**R1-35**	30.46	36,960		36,960	68,376	47.5
41	**R1-70**	12.47	15,120		0	0	0.0
42	**R1-70**	32.47	39,480		39,480	73,038	50.7
43	**R1-70**	71.97	87,640		0	0	0.0
44	**R1-70**	48.34	58,800		58,800	108,780	75.5
45	**R1L-35**	49.60	80,640		80,640	149,184	103.6
46	**R1L-70**	34.77	56,280		56,280	104,118	72.3
47	**R1L-70**	5.03	8,120		8,120	15,022	10.4
48	**R1L-70**	16.46	26,600		26,600	49,210	34.2
49	**R1L-70**	33.27	54,040		0	0	0.0
50	**R1L-70**	62.75	101,920		101,920	188,552	130.9
51	**R1L-175**	48.07	78,120		0	0	0.0
52	**R2**	11.33	39,360		39,360	72,816	50.6
53	**M1**	77.67	77,670		77,670	143,690	99.8
54	**M1**	6.62	6,620		6,620	12,247	8.5
55	**M1**	16.62	16,620		16,620	30,747	21.4
56	**M1**	10.70	10,700		10,700	19,795	13.7
57	**M1**	65.65	65,650		65,650	121,453	84.3
58	**M1-10A**	2.55	2,550		0	0	0.0
59	**M1-10A**	19.93	19,930		19,930	36,871	25.6
60	**PAD**	102.98	38,065		38,065	70,420	48.9
61	**PAD**	16.30	6,035		0	0	0.0
62	**PAD**	3.25	1,093		0	0	0.0
63	**PAD**	19.50	7,115		7,115	13,163	9.1
	TOTAL	**7,554.05**	**2,703,108**		**1,593,340**	**2,947,679**	**2,047**

Notes:

1) This is a summary of all of the areas West of Interstate 17.

2) Only the flows south of the Verde River are included in this Master Plan.

3) Some additional areas were dropped from the study as inaccessible or limited potential development.

4) Assuming 80 gpdpc this represents a population of 23,254.

5) A peaking factor of 1.85 is acceptable per ADEQ for a population of 10,000.

SEWAGE FLOW CALCULATIONS - Residential

SWI JOB #: *15089*
PROJECT NAME: *CAMP VERDE SEWER MASTER PLAN*
DATE CREATED: *1/19/2017*
DATE LAST UPDATED *2/23/2018*

DESIGNER: *KMB and LSB*
CHECKED: *DMM*

RESIDENTIAL											
AREA ID	ZONE	AREA (AC)	MAX. LOT COVER.	MAX. LOT COVER (AC)	MAX. LOT COVER. (SF)	MIN. LOT AREA (SF)	MIN. AREA PER DWELLING (SF)	UNIT FLOW (GPD/UN.)	MAX. NO. OF UNITS (Note 5)	DESIGN FLOW (GPD)	UNIT FLOW, ACREAGE (GPD/AC)
18	**RR-2A**	19.88	15%	2.98	129,896	87,120	87,120	280	9	**2,520**	126.76
19	**RR-2A**	364.51	15%	54.68	2,381,708	87,120	87,120	280	182	**50,960**	139.80
20	**RR-2A**	5.94	15%	0.89	38,812	87,120	87,120	280	2	**560**	94.28
21	**RR-2A**	6.99	15%	1.05	45,673	87,120	87,120	280	3	**840**	120.17
22	**RR-2A**	2.09	15%	0.31	13,656	87,120	87,120	280	1	**280**	133.97
23	**RR-2A**	225.31	15%	33.80	1,472,176	87,120	87,120	280	112	**31,360**	139.19
24	**RR-2A**	126.16	15%	18.92	824,329	87,120	87,120	280	63	**17,640**	139.82
25	**RR-2A**	34.98	15%	5.25	228,559	87,120	87,120	280	17	**4,760**	136.08
26A	**RR-2A**	1,080.01	15%	162.00	7,056,785	87,120	87,120	280	540	**151,200**	140.00
26B	**RR-2A**	80.46	15%	12.07	525,726	87,120	87,120	280	40	**11,200**	139.20
26C	**RR-2A**	544.39	15%	81.66	3,557,044	87,120	87,120	280	272	**76,160**	139.90
26D	**RR-2A**	12.89	15%	1.93	84,223	87,120	87,120	280	6	**1,680**	130.33
27A	**RR-2A**	1,527.38	15%	229.11	9,979,901	87,120	87,120	280	763	**213,640**	139.87
27B	**RR-2A**	3.69	15%	0.55	24,110	87,120	87,120	280	1	**280**	75.88
28	**RR-2A**	5.45	15%	0.82	35,610	87,120	87,120	280	2	**560**	102.75
29	**RR-2A**	20.53	15%	3.08	134,143	87,120	87,120	280	10	**2,800**	136.39
30	**RR-2A**	1,398.44	15%	209.77	9,137,407	87,120	87,120	280	699	**195,720**	139.96
31A	**RR-2A**	328.62	15%	49.29	2,147,203	87,120	87,120	280	164	**45,920**	139.74
31B	**RR-2A**	30.38	15%	4.56	198,503	87,120	87,120	280	15	**4,200**	138.25
31C	**RR-2A**	34.16	15%	5.12	223,201	87,120	87,120	280	17	**4,760**	139.34
32	**R1-10**	19.46	50%	9.73	423,839	10,000	10,000	280	84	**23,520**	1,208.63
33	**R1-10**	21.41	50%	10.71	466,310	10,000	10,000	280	93	**26,040**	1,216.25
34	**R1-12**	14.74	50%	7.37	321,037	10,000	10,000	280	64	**17,920**	1,215.74
35	**R1-18**	5.13	50%	2.57	111,731	10,000	10,000	280	22	**6,160**	1,200.78
36	**R1-35**	85.57	50%	42.79	1,863,715	10,000	10,000	280	372	**104,160**	1,217.25

RESIDENTIAL											
AREA ID	ZONE	AREA (AC)	MAX. LOT COVER.	MAX. LOT COVER (AC)	MAX. LOT COVER. (SF)	MIN. LOT AREA (SF)	MIN. AREA PER DWELLING (SF)	UNIT FLOW (GPD/UN.)	MAX. NO. OF UNITS (Note 5)	DESIGN FLOW (GPD)	UNIT FLOW, ACREAGE (GPD/AC)
37	**R1-35**	35.57	50%	17.79	774,715	10,000	10,000	280	154	**43,120**	1,212.26
38	**R1-35**	3.11	50%	1.56	67,736	10,000	10,000	280	13	**3,640**	1,170.42
39	**R1-35**	38.70	50%	19.35	842,886	10,000	10,000	280	168	**47,040**	1,215.50
40	**R1-35**	30.46	50%	15.23	663,419	10,000	10,000	280	132	**36,960**	1,213.39
41	**R1-70**	12.47	50%	6.24	271,597	10,000	10,000	280	54	**15,120**	1,212.51
42	**R1-70**	32.47	50%	16.24	707,197	10,000	10,000	280	141	**39,480**	1,215.89
43	**R1-70**	71.97	50%	35.99	1,567,507	10,000	10,000	280	313	**87,640**	1,217.73
44	**R1-70**	48.34	50%	24.17	1,052,845	10,000	10,000	280	210	**58,800**	1,216.38
45	**R1L-35**	49.60	50%	24.80	1,080,288	7,500	7,500	280	288	**80,640**	1,625.81
46	**R1L-70**	34.77	50%	17.39	757,291	7,500	7,500	280	201	**56,280**	1,618.64
47	**R1L-70**	5.03	50%	2.52	109,553	7,500	7,500	280	29	**8,120**	1,614.31
48	**R1L-70**	16.46	50%	8.23	358,499	7,500	7,500	280	95	**26,600**	1,616.04
49	**R1L-70**	33.27	50%	16.64	724,621	7,500	7,500	280	193	**54,040**	1,624.29
50	**R1L-70**	62.75	50%	31.38	1,366,695	7,500	7,500	280	364	**101,920**	1,624.22
51	**R1L-175**	48.07	50%	24.04	1,046,965	7,500	7,500	280	279	**78,120**	1,625.13
52	**R2**[6]	11.33	50%	5.67	246,767	7,500	3,000	240	164	**39,360**	3,473.96

Notes:

1) YCZC - Yavapai County Zoning Code. Checked as a reference only.
2) CVZC - Camp Verde Zoning Code. Used in calculations.
3) Not Applicable.
4) Not Applicable.
5) The maximum number of units value is assumed to be the Area divided by the minimum lot area per dwelling rounded down to a whole number.
6) It is assumed that the R2 zoning was 50% single family units and 50% multi-family units.
7) Unit Flow for Single Family Residential is assumed to be 80 gpdpc with 3.5 residents per unit.
8) Unit Flow for a Multi-Family Residential Unit is assumed to be 80 gpdpc with 2.5 residents per unit.

SEWAGE FLOW CALCULATIONS - Commercial and Industrial

SWI JOB #: *15089*
PROJECT NAME: *CAMP VERDE SEWER MASTER PLAN*
DATE CREATED: *1/19/2017* ***DESIGNER:*** *KMB and LSB*
DATE LAST UPDATED: *2/23/2018* ***CHECKED:*** *DMM*

COMMERCIAL									
AREA ID	ZONE	AREA (AC)	MAX. LOT COVER. (CVZC)	MAX. LOT COVER. (AC)	MAX. LOT COVER. (SF)	MIN. LOT AREA (SF)	UNIT FLOW, ACREAGE (GPD/AC) (Note 7)	DESIGN FLOW (GPD)	UNIT FLOW, BUILDING (GPD/1,000 SF) (Note 8)
1	**C1**	0.92	50%	0.46	20,038	7,500	1,000	**920**	45.91
2	**C1**	2.75	50%	1.38	59,895	7,500	1,000	**2,750**	45.91
3	**C1**	1.84	50%	0.92	40,075	7,500	1,000	**1,840**	45.91
4	**C2**	13.85	50%	6.93	301,653	7,500	1,000	**13,850**	45.91
5	**C2**	17.00	50%	8.50	370,260	7,500	1,000	**17,000**	45.91
6	**C2**	3.67	50%	1.84	79,933	7,500	1,000	**3,670**	45.91
7	**C2-1**	10.33	50%	5.17	224,987	7,500	1,000	**10,330**	45.91
8	**C2-3**	3.65	50%	1.83	79,497	7,500	1,000	**3,650**	45.91
9	**C2-4**	32.02	50%	16.01	697,396	7,500	1,000	**32,020**	45.91
10	**C2-4**	2.03	50%	1.02	44,213	7,500	1,000	**2,030**	45.91
11	**C3**	29.04	50%	14.52	632,491	7,500	1,000	**29,040**	45.91
12	**C3**	403.96	50%	201.98	8,798,249	7,500	1,000	**403,960**	45.91
13	**C3**	64.08	50%	32.04	1,395,662	7,500	1,000	**64,080**	45.91
14	**C3**	63.98	50%	31.99	1,393,484	7,500	1,000	**63,980**	45.91
15	**C3**	1.37	50%	0.69	29,839	7,500	1,000	**1,370**	45.91
16	**C3**	4.00	50%	2.00	87,120	7,500	1,000	**4,000**	45.91
17	**C3-2A**	24.85	50%	12.43	541,233	7,500	1,000	**24,850**	45.91

INDUSTRIAL									
AREA ID	ZONE	AREA (AC)	MAX. LOT COVER. (CVZC)	MAX. LOT COVER. (AC)	MAX. LOT COVER. (SF)	MIN. LOT AREA (SF) (CVZC)	UNIT FLOW, ACREAGE (GPD/AC) (Note 7)	DESIGN FLOW (GPD)	UNIT FLOW, BUILDING (GPD/1,000 SF) (Note 8)
53	**M1**	77.67	50%	38.84	1,691,653	7,500	1000	**77,670**	45.91
54	**M1**	6.62	50%	3.31	144,184	7,500	1000	**6,620**	45.91
55	**M1**	16.62	50%	8.31	361,984	7,500	1000	**16,620**	45.91
56	**M1**	10.70	50%	5.35	233,046	7,500	1000	**10,700**	45.91
57	**M1**	65.65	50%	32.83	1,429,857	7,500	1000	**65,650**	45.91
58	**M1-10A**	2.55	50%	1.28	55,539	7,500	1000	**2,550**	45.91
59	**M1-10A**	19.93	50%	9.97	434,075	7,500	1000	**19,930**	45.91

Notes:

1) YCZC - Yavapai County Zoning Code. Checked as a reference only.
2) CVZC - Camp Verde Zoning Code. Used in calculations.
3) Not Applicable.
4) Not Applicable.
5) Not Applicable.
6) Not Applicable.
7) Source: Flagstaff Engineering Standards used 1,000 gpd per AC for commercial and industrial property.
8) The unit flow for the building is calculated assuming the maximum size building is constructed.

SEWAGE FLOW CALCULATIONS - Planned Unit Development

SWI JOB #: *15089*
PROJECT NAME: *CAMP VERDE SEWER MASTER PLAN*
DATE CREATED: *1/19/2017*
DATE LAST UPDATED *2/23/2018*

DESIGNER: *KMB and LSB*
CHECKED: *DMM*

PLANNED AREA DEVELOPMENT

AREA ID	ZONE	AREA (AC)	OPEN SPACE (AC)		COMM. AREA (AC)	MAX. LOT COVER.	MAX. LOT COVER	MAX. LOT COVER	MIN. LOT AREA (SF)			UNIT FLOW (GPD/AC) (Note 7)	COMMERCIAL DESIGN FLOW (GPD)
60	PAD[4]	102.98	25.75		25.75	50%	12.87	560,726	7,500			1,000	25,745
61	PAD[4]	16.30	4.08		4.08	50%	2.04	88,754	7,500			1,000	4,075
62	PAD[4]	3.25	0.81		0.81	50%	0.41	17,696	7,500			1,000	813
63	PUD[3]	19.50	4.88		4.88	50%	2.44	106,178	7,500			1,000	4,875

AREA ID	ZONE	AREA (AC)	OPEN SPACE (AC)		RES. AREA (AC)	MAX. LOT COVER.	MAX. LOT COVER (AC)	MAX. LOT COVER. (SF)	MIN. LOT AREA (SF)	MIN. AREA PER DWELLING (SF)	FLOW/UNIT (GPD/UNIT)	MAX. NO. OF UNITS (Note 5)	RESIDENTIAL DESIGN FLOW (GPD)
60	PAD[4]	102.98	25.75		51.49	15%	7.72	336,436	7,500	7,500	280	44	12,320
61	PAD[4]	16.30	4.08		8.15	15%	1.22	53,252	7,500	7,500	280	7	1,960
62	PAD[4]	3.25	0.81		1.63	15%	0.24	10,618	7,500	7,500	280	1	280
63	PUD[3]	19.50	4.88		9.75	15%	1.46	63,707	7,500	7,500	280	8	2,240

AREA ID	ZONE	AREA (AC)	OPEN SPACE (AC)								COMMERCIAL DESIGN FLOW (GPD)	RESIDENTIAL DESIGN FLOW (GPD)	DESIGN FLOW (GPD)
60	PAD[4]	102.98	25.75								25,745	12,320	**38,065**
61	PAD[4]	16.30	4.08								4,075	1,960	**6,035**
62	PAD[4]	3.25	0.81								813	280	**1,093**
63	PUD[3]	19.50	4.88								4,875	2,240	**7,115**

Notes:

1) YCZC - Yavapai County Zoning Code. Checked as a reference only.
2) CVZC - Camp Verde Zoning Code. Used in calculations.
3) Not Applicable.
4) Not Applicable.
5) The maximum number of units value is assumed to be the max. lot area (SF)/min. area per dwelling.
6) Not Applicable
7) Source: Flagstaff Engineering Standards used 1,000 gpd per AC for commercial property.
8) The unit flow for the building is calculated assuming the maximum size building is constructed.
9) It is assumed that the Planned Unit Development is 25% open space, 50% Residential, and 25% Commercial
10) Maximum lot coverage for commerical development is assumed to be 50% for 60 - 62.
11) Minimum lot area for commercial is assumed to be 7,500.

PLOTTED: Feb 23, 2018–10:29am

TOWN LIMITS

VERDE RIVER

LIFT STATION 3A

LIFT STATION 3

DICKISON CIRCLE

INTERSTATE 17

LIFT STATION 2A

LIFT STATION 1

GRAVITY SEWER

NEWTON LANE

DREAMCATCHER DR

PARK VERDE RD

OLD HIGHWAY 279

STATE HIGHWAY 260

LIFT STATION 2B
(POTENTIAL)

CHERRY CREEK RD

SEWER FORCED MAIN

LEGEND

- CITY LIMITS
- 260 RIGHT OF WAY
- S — EXISTING GRAVITY SEWER
- S — PROPOSED GRAVITY SEWER
- FSS — PROPOSED FORCED MAIN SEWER
- PROPOSED 18" PVC PIPE SLEEVE FOR FUTURE CROSSING

SCALE: 1" = 1000'

0 500' 1000'

EXHIBIT D:
MASTER PLAN OVERVIEW

CAMP VERDE SEWER EXPANSION MASTER PLAN

CAMP VERDE
ARIZONA

JOB NO: 15089
DATE: FEB 18
SCALE: AS SHOWN
DRAWN: LSB/TNO
DESIGN: TRL
CHECKED: TWM

110 W. Dale Avenue
Flagstaff, AZ 86001
928.773.0354
928.774.8934 fax
www.swiaz.com

Shephard Wesnitzer, Inc.

REVISIONS

NO.	DESCRIPTION	DATE	BY

Call at least two full working days before you begin excavation.
ARIZONA811
Arizona Blue Stake, Inc.
Dial 8-1-1 or 1-800-STAKE-IT (782-5348)

DRAWING NO.
EX D

SHT NO. 1 OF 1

FILE: P:\2015\15089\Sewer Master Plan\DGN\EX D - Plan Overview.dwg EGT-C3D-17