

# SANITARY SEWER STUDY

FOR

# BARRETT RANCH EAST

COUNTY OF SACRAMENTO, CA

NOVEMBER 7, 2014

PREPARED FOR:

**Barrett Winn, LP, A California Limited Partnership**  
**Antelope RBVP, LP, A California Limited Partnership**  
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Sacramento, CA 95816

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ROSEVILLE, CA 95661

**SACRAMENTO AREA  
SEWER DISTRICT**  
SERVING YOU 24/7

December 02, 2014

Ellaine Taraya  
Mackay and Soms  
1552 Eureka Road, Ste. 100  
Roseville, CA 95661

**Subject: Barrett Ranch East Sewer Study: Approved**

Dear Ms. Taraya:

Sacramento Area Sewer District staff reviewed the subject submittal and finds it sufficiently addresses District requirements and is considered approved. Any significant change in the proposed and/or assumed land use presented in this document, which impacts the sewer design, may require a revision to this study.

Improvement plans associated with this project may be submitted for review.

If you have any questions regarding these comments please call me at 916-876-6278, or call Amandeep Singh at 916-876-6296.

Sincerely,

*Stephen Moore*

Stephen Moore, P.E., M.B.A.  
Development Services

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## EXECUTIVE SUMMARY

The purpose of this sewer study is to demonstrate to the Sacramento Area Sewer District (SASD), that the downstream sewer network has adequate capacity to provide sanitary sewer service to the Barrett Ranch East development (the "Project") through a gravity network of pipelines. This sewer study will be used as the basis for preparing improvement plans for the proposed project as well as to support the EIR documentation and setting the groundwork for the projects sanitary sewer construction financing.

This sewer study design criteria will be based on SASD's Standards and Specifications dated July 24, 2013. This study will ensure technical compliance with the latest SASD Master Plan as well as demonstrate that it is possible to provide gravity sewer service to the Project. Focus of this study will be on topography, available downstream capacity, and proposed land uses.

Barrett Ranch East project site is in the City of Antelope and one of the last remaining residential "In Fill" subdivisions in the City of Antelope. The Project is located in the DRY Antelope East Shed Area and will ultimately convey sewer flows into the Elverta Road trunk sewer, which connects to the existing CSD-1 Antelope area system. This study references the approved Barrett Ranch sanitary sewer study dated April 21, 2004, and the improvement plan record drawing sets.

The proposed Barrett Ranch East project will develop 128+/- acres with a total equivalent single-family dwellings (ESD's) of 918. The site is currently zoned Urban Reserve (UR), Special Planning Area (SPA), Agricultural Residential (AR-2), and Single-Family Residential (RD-5) but is in the process of being rezoned to a mixed land use of Single-Family Residential (RD-5, RD-7), Multi-Family Residential (RD-20, RD-25), Commercial (SC), Parks (O), or Open Space (O). For the proposed Land Use Plan refer to Exhibit C.

The Project will utilize three of the six existing sanitary sewer pipe stubs that were previously approved and constructed as part of the Barrett Ranch development west of the project site. The three points of connections (POC's) to service the project have adequate depth and capacity to accommodate the project at full buildout. Refer to the Sewer Flow Information section of this study for detail specifics and locations of each existing sanitary sewer pipe stub.

The Barrett Ranch East development phasing has not been determined at this time. However, the sewer network can be expected to expand, as development occurs in the project area in such a manner that interim sewer facilities will not be required to serve the project.

## INTRODUCTION

### LEVEL OF STUDY

This is a Level III (Subdivision Level) sanitary sewer study for the Barrett Ranch East development project. This sewer study will be used as a basis for preparing improvement plans for the proposed project.

### LOCATION

The proposed Barrett Ranch East project is located within the City of Antelope, County of Sacramento. Antelope Road on the south, Elverta Road on the west, with Don Julio Boulevard passing through the site north to south. For a vicinity map refer to Exhibit A.

This is an infill project with existing development surrounding the Barrett Ranch East project area including Antelope High School and Barrett Ranch Elementary School west of the site. The Barrett Ranch East development site map is shown in Exhibit B.

### TOPOGRAPHY

The overall site can be characterized as flat to gently rolling terrain with elevations ranging from 135 to 176 feet above mean sea level. The site generally drains from east to west across the site except for a small area on the north west corner of the site draining to the north. This project will be on NAVD88 datum, where as previous studies and improvement plans were on NGVD29 datum. The elevation difference for this project is 2.58 feet (NAVD88 = NGVD29 + 2.58 feet).

### DETAIL DESCRIPTION

The Barrett Ranch East project proposes to develop 128+/- acres into mainly single-family residential land uses. A total of 918 equivalent single-family dwellings (ESD's). The proposed project includes parks, open spaces, multi-family residential, and commercial lots. The existing Don Julio Boulevard, which bisects the project area, will be reconstructed from a two lane roadway into a four lane roadway with a raised median. The existing Antelope Road will be realigned and extended to match up to the existing Elverta Road alignment.

There is one existing residence within the study area that is assumed to be on a private septic sewage disposal system as there are no SASD facilities currently on site. There are, however, six sewer points of connections (POC's) adjacent to the site. Five on the west side and one on the north side of the project.

## **LAND USE AND ZONING**

The existing 128+/- acres is currently zoned Urban Reserve (UR), Special Planning Area (SPA), Agricultural Residential (AR-2), or Single-Family Residential (RD-5). The APN's are 203-0120-059, 203-0120-067, 203-0120-065, and 203-0120-018.

The proposed zoning for the Barrett Ranch East project is Single-Family Residential (RD-5, RD-7), Multi-Family Residential (RD-20, RD-25), Commercial (SC), Parks (O), or Open Space (O) and the proposed Tentative Subdivision Map consists of 496 single-family dwelling units on 95.5 acres, 196 multi-family dwelling units on 10.5 acres, 7.8 acres of parks, 7.9 acres of open space/landscape, and 6.4 acres of commercial. The proposed Land Use Plan and Tentative Subdivision Map is shown in Exhibit C.

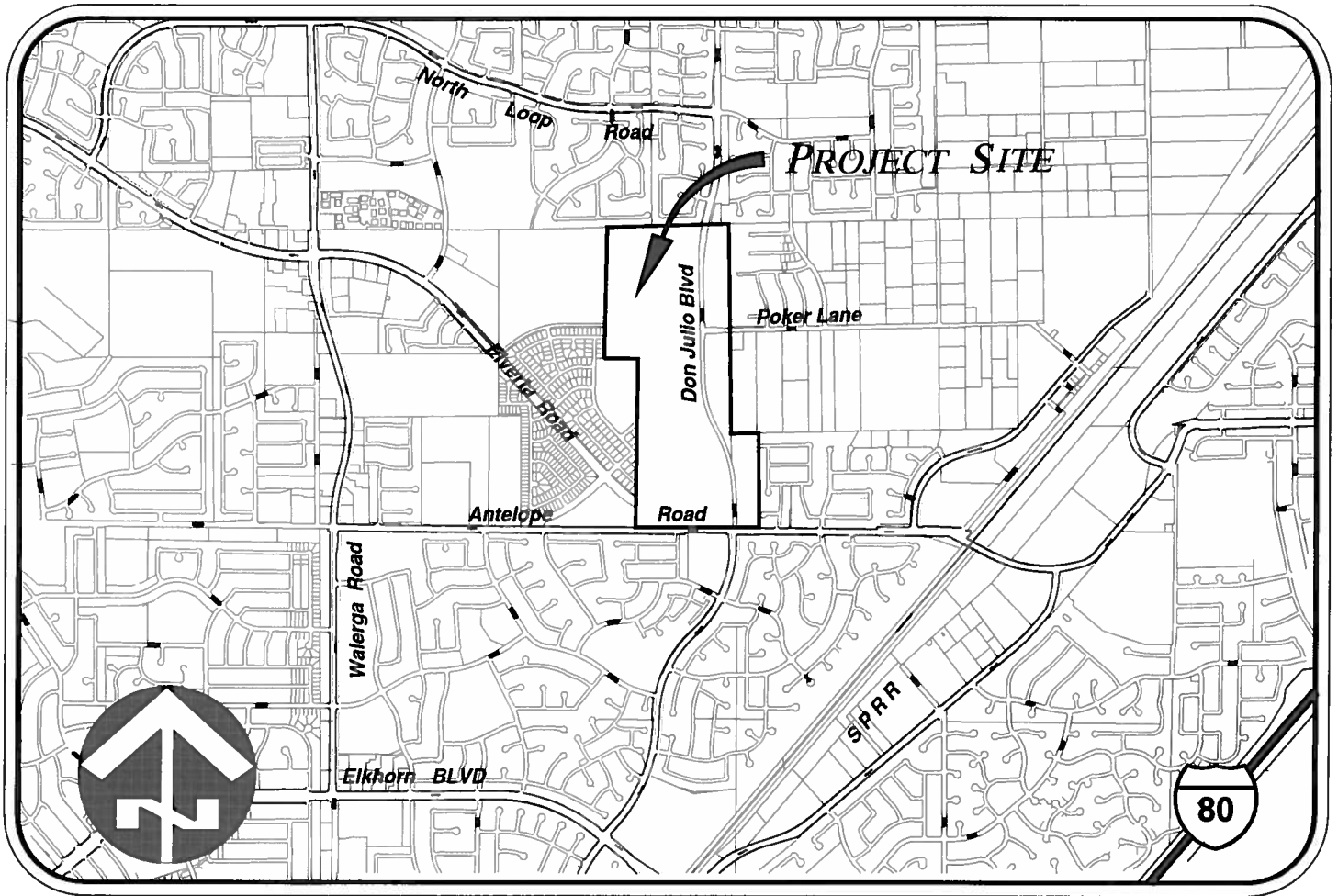
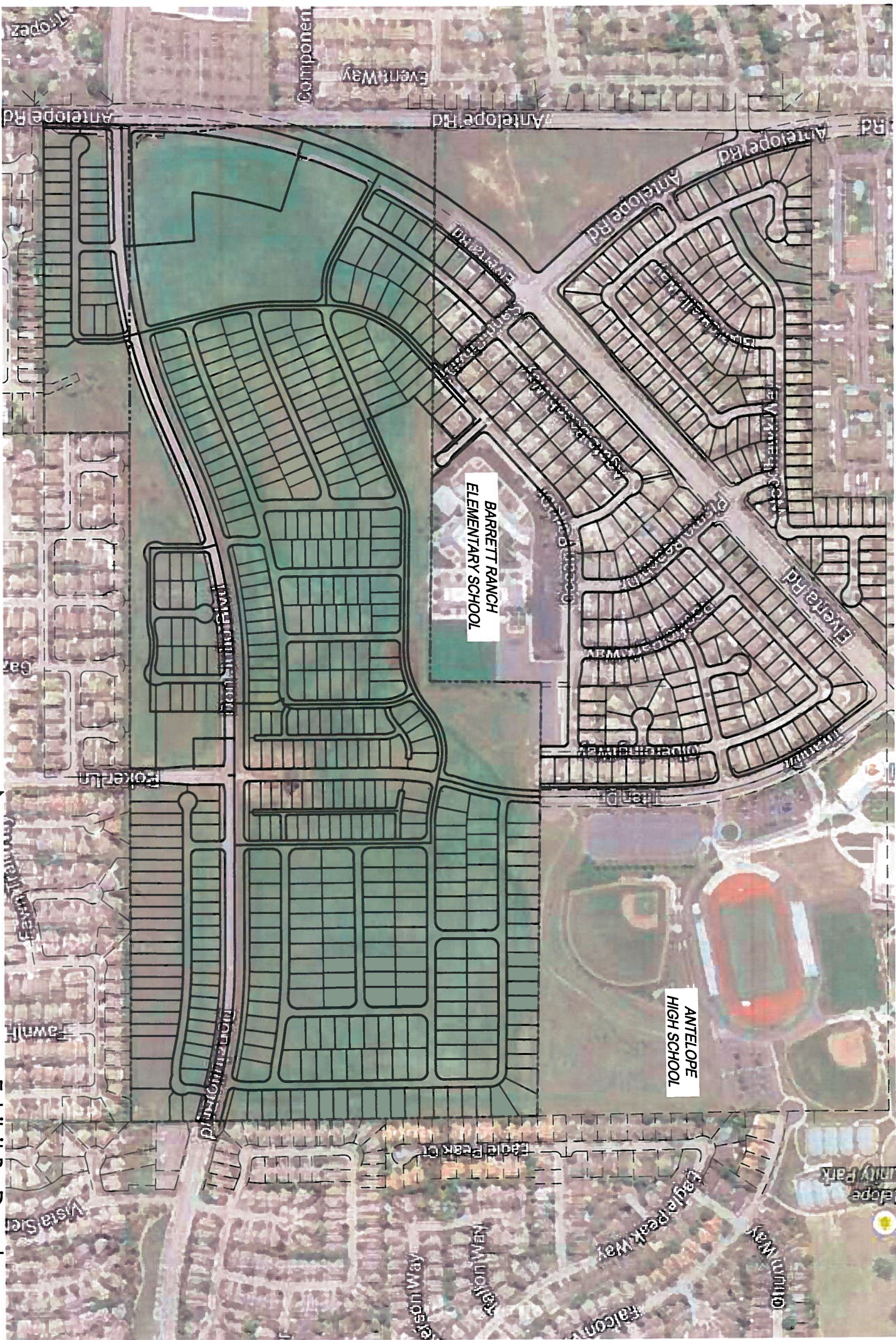


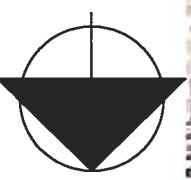
Exhibit A: Vicinity Map

NTS



ANTELOPE  
HIGH SCHOOL

BARRETT RANCH  
ELEMENTARY SCHOOL



NORTH

Exhibit B: Development Site Map

**Barrett Ranch East**

Sacramento County, CA

**MACKAY & SOMPS**  
ENGINEERS PLANNERS SURVEYORS  
1552 Eureka Road, Suite 100, Roseville, CA 95661 (916) 773-1188

September, 2014

27131



**EXHIBIT C**  
**LAND USE PLAN & TENTATIVE SUBDIVISION MAP**



ILLUSTRATIVE SITE PLAN

Date: May 2014

Barrett Ranch East  
Antelope, CA

1" = 300'



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## DESIGN

### ASSUMPTIONS




For the purpose of this report, it is assumed that the Barrett Ranch sanitary sewer study dated April 21, 2004 was adequately analyzed and that the record drawings correctly reference the as built sewer invert elevations.

A geotechnical report is not available at this time. It is assumed that high ground water tables do not exist in the project area.

### APPROACH

The Barrett Ranch East sewer shed boundary map is shown in Exhibit D. The Barrett Ranch East shed boundaries were defined from project topography, project roadway alignment, land uses and selected points of connection into the Elverta Road trunk sewer system.

The project design flows were calculated by using the SASD Design Standards and the design criteria noted in this study. The three existing sewer lines that this project is connecting to, were analyzed to determine if the existing sewer pipe had sufficient capacity to carry the projected peak wet weather flows. SASD design standards for mains smaller than 12 inches in diameter requires the depth of flow to pipe diameter ratio be no greater than 70%.

-  SHED A
-  SHED B
-  SHED C

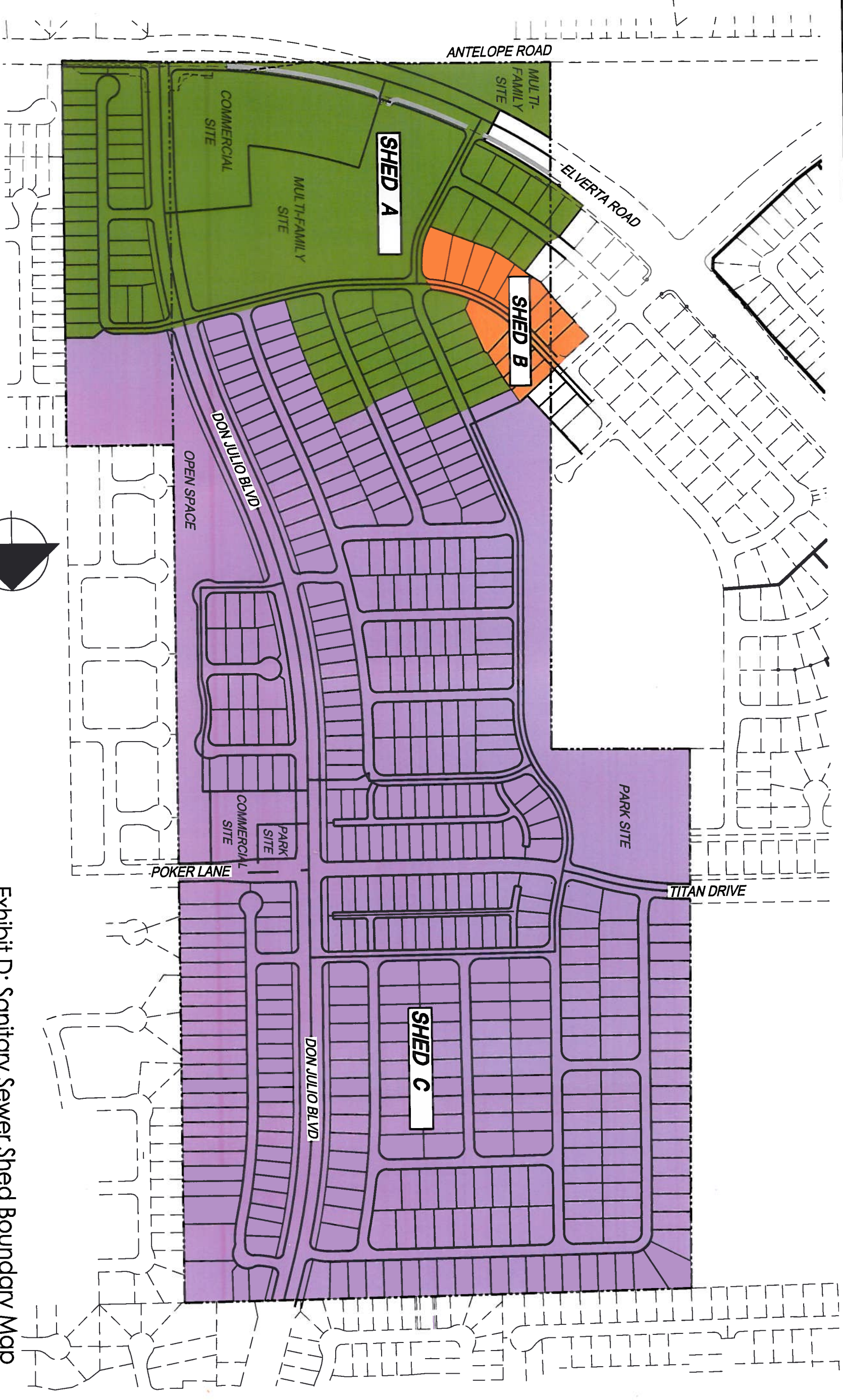


Exhibit D: Sanitary Sewer Shed Boundary Map

# Barrett Ranch East

Sacramento County, CA



November 7, 2014  
27131

**DESIGN CRITERIA**

This Sanitary Sewer Study has followed the Sacramento Area Sewer District Standards and Specifications, July 2013.

- Equivalent Single Family Dwelling Units (ESD)
- Average Dry Weather Flow (ADWF)
- Peak Dry Weather Flow (PDWF)
- Peaking Factor (PF)
- Peak Wet Weather Flow (PWWF).
- Infiltration and Inflow (I&I)

PDWF has been computed based on 310 GPD per ESD entering the pipe system.

Table 1 shows the different land uses and their associated ESDs taken from the SFEMP.

**TABLE 1: LAND USE AND ESD DENSITIES**

<b>Land Use</b>	<b>County Land Use Designations</b>	<b>ESDs/acre</b>
Low Density Residential	RD-4 to 7	6 Minimum or Lot Count
Medium Density Residential	RD-20 TO 25	15
Commercial	SC	6
Recreation / Parks	RR	6
Open Space / Detention Basin	O	6

Tables 2 & 3 show the design flow values and criteria taken from the Sacramento Area Sewer District Standards and Specifications and used in the flow calculations.

**TABLE 2: DESIGN VALUES**

<b>ITEM</b>	<b>VALUE</b>
ESD Flow Factor	310 GPD/ESD for Single Family Unit 233 GPD/ 0.75 ESD for Multi-Family Unit 1900 GPD/ 6 ESD for Commercial 1900 GPD/ 6 ESD for Open Space & Parks
Dry Weather Peaking Factor	$PF = 3.5 - (1.8 \times Q^{0.05})$ (1.2 Minimum)
Infiltration and Inflow	1,400 GPD/acre for new pipelines

**TABLE 3: KEY HYDRAULIC DESIGN CRITERIA**

<b>ITEM</b>	<b>VALUE</b>
Manning "n"	0.013
Minimum Velocity (feet per second)	2 fps
Maximum Velocity (feet per second)	8 fps
Maximum d/D (pipes less than 12" diameter)	0.7
Maximum d/D (pipes greater then 12" diameter)	1

d/D = depth of flow/diameter of pipe

**DESIGN FLOW FORMULAS**

- ESDs = Number of equivalent residential dwelling units.
- $ADWF \text{ (MGD)} = (310 / \text{ESD}) \times (\# \text{ ESDs} / \text{acre}) \times (\# \text{ acres}) \div 1,000,000$
- $Q_{II} \text{ (MGD)} = (\text{Cumulative Area} \times 1,400) \div 1,000,000$
- $PF = 3.5 - (1.8 \times (ADWF)^{0.05})$ , Minimum value shall be 1.2
- $PDWF \text{ (MGD)} = ADWF \times PF$
- $PWWF \text{ (MGD)} = PDWF + Q_{II}$

**PIPE SLOPES**

Table 4 shows the minimum slope allowed for the pipes and velocities when a pipe is flowing at full or half capacity.

**TABLE 4: MINIMUM PIPE SLOPE & VELOCITIES**

<b>PIPE DIA.</b>	<b>SLOPE</b>	<b>VELOCITY</b>
8"	0.0035	2.00 fps
10"	0.0025	2.00 fps
12"	0.0020	2.00 fps
15"	0.0015	2.04 fps
18"	0.0012	2.06 fps
21"	0.0011	2.19 fps

## SEWER FLOW INFORMATION

### ON-SITE FLOWS

The Barrett Ranch East project area is currently an undeveloped infill property so there is no existing sanitary sewer flow. Based on this study, the Barrett Ranch East project has a total of 918 equivalent single-family dwellings (ESD's) and will generate a total flow of 0.712 million gallons per day (MGD) Peak Wet Weather Flow (PWWF). No pump station or interim facilities are anticipated. The calculated flows for the study area were determined to be within the total shed area capacity with no proposed sewer shed shifts required.

Land Use Designation	Calculated Acres	Calculated ESD	Peak Wet Weather Flow (mgd)
Single Family Residential	94.94	582	0.454
Multi-Family Residential	10.30	198	0.136
Parks	7.13	43	0.038
Open Space / Landscape	8.59	52	0.046
Commercial	7.14	43	0.038
	<b>128.1 ac</b>	<b>918</b>	<b>0.712 mgd</b>

Project sanitary sewer flows will converge into three of the five existing sanitary sewer stubs west of the Project located on Agate Beach Way, Ocean Park Drive, and Titan Drive. From the approved Barrett Ranch sewer master plan, a total of 792 future ESD's was allocated for this project to flow into the Elverta Road trunk sewer system.

For the 8" sewer stub on Agate Beach Way, the calculated ESD will be 316. As a result, an additional 200 ESD's not previously accounted for in the approved Barrett Ranch sewer master plan will be added to this POC. However when analyzing the ratio of depth of flow into the existing 8" pipe, it shows the existing pipe to have ample capacity to account for the additional ESD's. The flow depth to pipe diameter ratio is 45%.

For the 8" sewer stub on Ocean Park Drive, the calculated ESD's will be 18. As a result, two additional ESD not previously accounted for in the approved Barrett Ranch sewer master plan will be added to this POC. However when analyzing the ratio of depth of flow into the existing 8" pipe, it shows the existing pipe to have ample capacity to account for the one additional ESD. The flow depth to pipe diameter ratio is 9%.



For the 10" sewer stub on Titan Drive, the calculated ESD's will be 584. This POC will have fewer ESD's than was previously accounted for in the approved Barrett Ranch sewer master plan. The ratio of depth of flow into the existing 10" pipe is 46%.

Point of Connection	Existing Sewer Diameter	2004 Allocated ESD's <sup>1</sup>	2014 Calculated ESD's	PWWF (mgd)	Flow Depth/Ex. Diameter	Velocity (fps)
Agate Beach Way	8"	116	316	0.239	34%	3.55
Ocean Park Drive	8"	16	18	0.027	11%	1.18
Titan Drive	10"	621	584	0.468	46%	2.98

<sup>1</sup> ESD's from Approved Barrett Ranch Sanitary Sewer Study dated April 21, 2004

There is also an existing 6-inch POC north of the site off of Clydebank Way, but per SASD staff, the 6-inch sewer line is not a feasible connection point and is marked for decommissioning.

The sanitary sewer master plan is shown in Appendix 1 and the sewer calculations are shown in Appendix 2.

**OFF-SITE FLOWS**

There are no off-site flows anticipated at this time.

## **SEWER ALIGNMENTS AND FACILITIES**

### **INTERIM FACILITIES**

The Barrett Ranch East development project does not require interim sewer facilities in order for SASD to provide sanitary sewer service.

### **ULTIMATE FACILITIES**

The Elverta Road trunk sewer system together with the local collectors built with the Barrett Ranch project are the ultimate facilities that are necessary to provide sanitary sewer service for the project. There are no other facilities necessary to serve this project.

## CONCLUSION

The Barrett Ranch East project proposes to develop 128+/- acres with 918 equivalent single-family dwelling units, generating 0.712 million gallons per day of peak wet weather flow. The Barrett Ranch East development will be built out in phases. The phasing for the project build out is not known at this time but it can be expected that development will occur in such a manner that interim sewer facilities will not be required.

In comparing the allocated ESD's from the approved Barrett Ranch Sanitary Sewer Study, dated April 21, 2004, with the project calculated ESD's, there are minor differences which are negligible as demonstrated in the study. Nonetheless in our analysis it shows ample capacity within the existing pipes to handle the additional flows.

This Level III sanitary sewer study will be used as the basis for preparing improvement plans for the Barrett Ranch East development. This study demonstrates to the Sacramento Area Sewer District that the downstream sanitary sewer network, the Elverta Road trunk sewer system, has adequate capacity to serve the proposed project. This sewer study also demonstrates to SASD that the proposed project can be provided sanitary sewer service utilizing a gravity network of local collectors.

**APPENDIX 1**

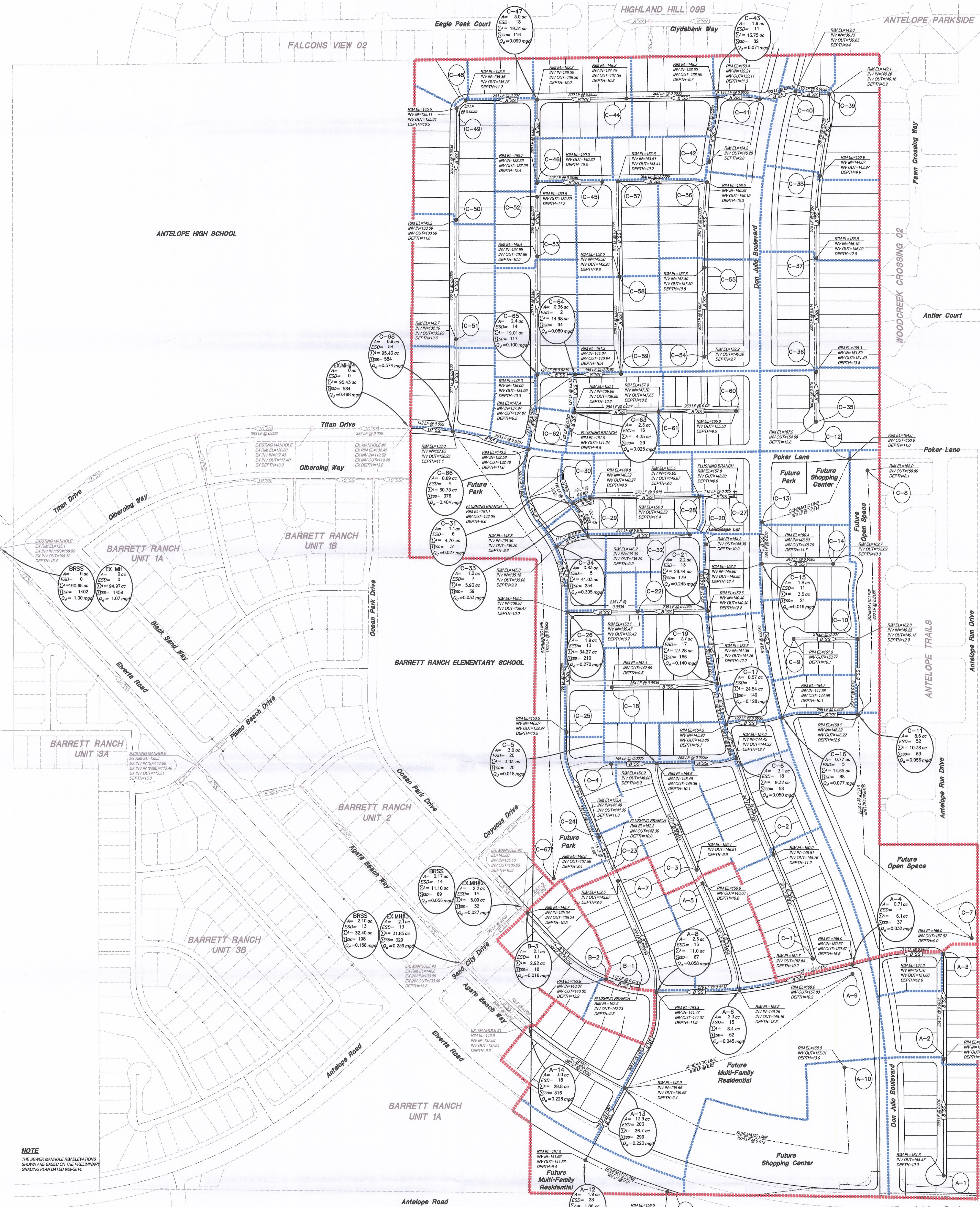
**APPENDIX 2**

### Barrett Ranch East Sanitary Sewer Calculations Spreadsheet

Node ID	Down-stream Node	Land Use	ESD by Land Use	ESD by Lot Count	ESD Largest	Sum ESD	Q ave. (mgd)	Peaking Factor	Q PDWF (mgd)	Area (acres)	Sum Area (acres)	I/I (mgd)	Q PDWF (mgd)	Q PDWF (gpm)	Q PDWF (cfs)	Dia. (in.)	Min. Slope	Pipe Length (ft.)	Upstream Invert	Downstream Invert	Upstream Rim Elevation	Depth @ Upstream Invert	Velocity (fps)	Depth of Flow (ft.)	(d/D)%
A-1	A-2	RD-7	19	16	19	19	0.006	2.11	0.013	3.24	3.24	0.005	0.017	12	0.027	8	0.0035	390	154.47	153.10	164.5	10.0	1.07	0.08	12
A-2	A-3	RD-7	13	13	13	32	0.010	2.07	0.021	2.13	5.37	0.008	0.028	20	0.044	8	0.0035	354	153.00	151.76	166.5	13.5	1.07	0.12	18
A-3	A-4	RD-7	4	3	4	37	0.011	2.06	0.023	0.71	6.08	0.009	0.032	22	0.049	8	0.0035	311	151.66	150.57	164.3	12.6	1.14	0.12	18
A-4	A-6	RD-7	0	0	0	37	0.011	2.06	0.023	0.00	6.08	0.009	0.032	22	0.049	8	0.0035	391	150.47	145.26	166.0	15.5	1.99	0.08	12
A-5	A-6	RD-7	14	15	15	15	0.005	2.04	0.010	2.28	2.28	0.003	0.013	9	0.020	8	0.0035	381	146.60	145.26	156.6	10.0	0.98	0.07	11
A-6	A-8	RD-7	0	0	0	52	0.016	2.04	0.033	0.00	8.36	0.012	0.044	31	0.069	8	0.0132	279	145.16	141.47	158.5	13.3	2.00	0.10	15
A-7	A-8	RD-7	16	16	16	16	0.005	2.12	0.011	2.62	2.62	0.004	0.014	10	0.022	8	0.0035	400	142.87	141.47	152.5	9.6	1.05	0.07	11
A-8	A-13	RD-7	0	0	0	68	0.021	2.02	0.042	0.00	10.98	0.015	0.058	40	0.089	8	0.0200	346	141.37	139.65	153.3	11.9	1.64	0.14	21
A-9	A-13	RD-25	127	170	170	170	0.053	2.02	0.103	8.44	8.44	0.012	0.115	80	0.177	8	0.0200	910	157.83	139.65	168.0	10.2	3.19	0.14	22
A-10	A-13	SC	33	33	33	33	0.010	2.07	0.021	5.43	5.43	0.008	0.029	20	0.045	8	0.0150	1,025	155.01	139.65	168.0	13.0	1.97	0.08	12
A-11	A-12	RD-20	28	26	28	28	0.009	2.08	0.018	1.86	1.86	0.003	0.021	14	0.032	8	0.0100	300	144.66	141.66	158.0	9.4	1.60	0.07	11
A-12	A-13	RD-20	0	0	0	28	0.009	2.08	0.018	0.00	1.86	0.003	0.021	14	0.032	8	0.0070	275	141.56	139.65	151.0	9.4	1.37	0.08	12
A-13	A-14	RD-5	18	11	18	316	0.098	1.90	0.187	3.04	29.75	0.042	0.228	159	0.353	8	0.0050	382	139.55	137.64	148.9	9.4	2.31	0.30	45
A-14	EX MH#1	RD-5	0	0	0	316	0.098	1.90	0.187	0.00	29.75	0.042	0.228	159	0.353	8	0.0050	10	137.64	137.59	146.8	9.2	2.31	0.30	45
EX MH#1	EX MH#3		13	13	13	329	0.102	1.89	0.194	2.10	31.85	0.045	0.239	166	0.369	8	0.0150	299	137.54	133.05	146.8	9.3	3.55	0.23	34
B-1	B-2	RD-7	5	3	5	5	0.002	2.20	0.003	0.81	0.81	0.001	0.004	3	0.007	8	0.0231	115	142.73	140.07	152.5	9.8	1.28	0.03	5
B-2	B-3	RD-7	13	11	13	18	0.005	2.11	0.011	2.11	2.92	0.004	0.016	11	0.024	8	0.0134	349	140.02	136.34	153.9	13.9	1.61	0.06	9
B-3	EX MH#2	RD-7	13	14	14	32	0.010	2.07	0.020	2.17	5.09	0.007	0.027	19	0.042	8	0.0050	22	135.24	135.15	145.7	10.5	1.18	0.07	11
C-1	C-2	RD-7	19	17	19	19	0.006	2.11	0.013	3.19	3.19	0.004	0.017	12	0.026	8	0.0100	373	152.54	148.81	162.7	10.2	1.57	0.06	9
C-2	C-6	RD-7	14	13	14	34	0.010	2.07	0.021	2.40	5.59	0.008	0.029	20	0.045	8	0.0125	347	148.76	144.42	160.0	11.2	1.88	0.08	12
C-3	C-5	RD-7	15	16	16	16	0.005	2.12	0.011	2.46	2.46	0.003	0.014	10	0.022	8	0.0035	383	146.81	145.46	156.4	9.6	1.06	0.07	11
C-4	C-6	RD-7	3	4	4	4	0.001	2.21	0.003	0.57	0.57	0.001	0.004	2	0.005	8	0.0035	154	146.00	145.46	154.9	8.9	1.58	0.02	3
C-5	C-5	RD-7	4	4	4	24	0.008	2.09	0.016	0.70	3.73	0.005	0.021	15	0.032	8	0.0035	268	145.36	144.42	155.5	10.1	1.09	0.09	14
C-6	C-17	RD-7	3	2	3	61	0.019	2.02	0.038	0.57	9.89	0.014	0.052	36	0.081	8	0.0035	120	144.32	143.90	157.0	12.7	1.38	0.15	23
C-7	C-11	O	41	0	41	41	0.013	2.05	0.026	6.77	6.77	0.009	0.036	25	0.056	8	0.0117	915	157.02	146.32	166.0	9.0	1.94	0.09	14
C-8	C-11	O	11	0	11	11	0.003	2.14	0.007	1.82	1.82	0.003	0.010	7	0.015	8	0.0163	830	159.89	146.32	168.0	8.1	1.65	0.04	6
C-9	C-10	RD-7	11	8	11	11	0.003	2.15	0.007	1.79	1.79	0.003	0.010	7	0.015	8	0.0070	216	150.77	148.25	161.5	10.7	0.93	0.06	9
C-10	C-11	RD-7	0	0	0	11	0.003	2.15	0.007	0.00	1.79	0.003	0.010	7	0.015	8	0.0120	252	149.15	146.32	162.0	12.9	1.14	0.05	8
C-11	C-16	RD-7	5	4	5	67	0.021	2.02	0.043	0.77	11.15	0.016	0.058	40	0.090	8	0.0060	256	146.22	144.88	159.1	12.9	1.73	0.14	21
C-12	C-13	SC/O	10	0	10	10	0.003	2.15	0.007	1.71	1.71	0.002	0.009	7	0.015	8	0.0114	370	148.70	144.88	164.0	11.0	1.13	0.05	8
C-13	C-15	SC/O	0	0	0	10	0.003	2.15	0.007	0.00	1.71	0.002	0.009	7	0.015	8	0.0200	140	153.00	145.90	160.4	11.7	1.66	0.04	6
C-14	C-15	RD-7	11	10	11	11	0.003	2.15	0.007	1.79	1.79	0.003	0.010	7	0.015	8	0.0283	240	152.69	145.90	162.7	12.4	1.47	0.07	11
C-15	C-16	RD-7	0	0	0	21	0.007	2.10	0.014	0.00	3.50	0.005	0.019	13	0.029	8	0.0086	515	152.80	144.88	158.2	10.1	1.53	0.07	11
C-16	C-17		0	0	0	88	0.028	2.00	0.055	0.00	14.65	0.021	0.076	53	0.117	8	0.0035	192	144.58	143.90	154.7	10.1	1.53	0.18	27
C-17	C-19	RD-7	3	2	3	152	0.048	1.95	0.093	0.57	25.11	0.035	0.128	89	0.189	8	0.0174	140	143.80	141.36	154.5	10.7	3.13	0.16	24
C-18	C-19	RD-7	13	14	14	14	0.004	2.13	0.009	2.17	2.17	0.003	0.012	9	0.019	8	0.0035	354	142.60	141.36	152.1	12.2	2.08	0.07	11
C-19	C-21	RD-7	6	5	6	172	0.105	1.89	0.199	0.98	28.26	0.040	0.239	166	0.370	8	0.0035	244	141.26	140.40	153.5	12.2	2.11	0.34	51
C-20	C-21	RD-7	7	6	7	7	0.002	2.17	0.005	1.18	1.18	0.002	0.006	4	0.010	8	0.0173	225	144.30	140.40	154.3	10.0	1.71	0.03	5
C-21	C-22	RD-7	8	8	8	187	0.110	1.89	0.208	1.29	30.73	0.043	0.251	174	0.388	8	0.0035	235	140.30	139.47	152.5	12.2	2.11	0.35	52
C-22	C-26	RD-7	4	4	4	192	0.112	1.89	0.211	0.69	31.42	0.044	0.255	177	0.394	8	0.0036	235	139.42	138.57	150.1	10.7	2.14	0.35	52
C-23	C-24	RD-7	4	4	4	4	0.001	2.21	0.003	0.59	0.59	0.001	0.004	2	0.006	8	0.0070	115	142.30	141.49	152.3	11.0	1.55	0.02	3
C-24	C-25	RD-7	6	5	6	10	0.003	2.15	0.007	1.00	1.59	0.002	0.009	6	0.014	8	0.0035	375	139.97	138.57	152.4	11.0	1.02	0.06	8
C-25	C-26	RD-7	8	7	8	18	0.005	2.11	0.012	1.26	2.85	0.004	0.015	11	0.024	8	0.0035	400	139.97	138.57	153.5	13.5	1.08	0.08	12
C-26	C-26	RD-7	8	7	8	215	0.119	1.88	0.223	0.83	35.10	0.049	0.272	189	0.422	8	0.0060	228	138.47	135.18	148.5	10.0	2.60	0.32	47
C-27	C-34	RD-7	5	4	5	8	0.002	2.17	0.005	1.34	3.50	0.002	0.007	5	0.011	8	0.0250	115	148.80	145.92	157.8	9.0	1.84	0.03	5
C-28	C-28	RD-7	8	7	8	8	0.002	2.09	0.016	2.29	3.63	0.005	0.021	15	0.033	8	0.0150	370	145.87	140.32	155.5	9.6	1.79	0.07	10
C-29	C-29	RD-7	14	17	17	25	0.008	2.09	0.016	2.29	3.63	0.005	0.021	15	0.033	8	0.0162	59	140.27	139.30	149.8	9.5	1.91	0.07	10
C-30	C-31	RD-7	2	2	2	27	0.008	2.08	0.018	0.37	4.00	0.006	0.023	16	0.036	8	0.0162	59	140.27	139.30	149.8	9.0	0.99	0.03	5
C-31	C-33	RD-7	4	4	4	4	0.001	2.21	0.003	0.70	0.70	0.001	0.004	3	0.006	8	0.0230	110	142.05	139.30	151.1	9.0	0.99	0.03	5
C-31	C-33	RD-7	1	1	1	33	0.010	2.07	0.021	0.23	4.93	0.007	0.028	19	0.043	8	0.0230	122	139.20	136.39	148.8	9.6	2.27	0.07	10

## Barrett Ranch East Sanitary Sewer Calculations Spreadsheet

Node ID	Down-stream Node	Land Use	ESD by Land Use	ESD by Lot Count	ESD Largest	Sum ESD	Q ave. (mgd)	Peaking Factor	Q PDWF (mgd)	Area (acres)	Sum Area (acres)	I/I (mgd)	Q PDWF (mgd)	Q PDWF (gpm)	Q PDWF (cfs)	Dia. (in.)	Min. Slope	Pipe Length (ft.)	Upstream Invert	Downstream Invert	Upstream Rim Elevation	Depth @ Upstream Invert	Velocity (fps)	Depth of Flow (ft.)	(d/D)%
C-32	C-33	RD-7	6	6	6	6	0.002	2.19	0.004	1.00	1.00	0.001	0.005	4	0.008	8	0.0180	344	142.59	136.39	154.0	11.4	1.74	0.03	4
C-33	C-34	RD-7	0	0	0	39	0.012	2.06	0.025	0.00	5.93	0.008	0.033	23	0.051	8	0.0100	111	136.29	135.18	146.2	9.9	1.78	0.09	14
C-34	C-66	RD-7	0	0	0	254	0.131	1.87	0.245	0.00	41.03	0.057	0.302	210	0.468	8	0.0070	356	135.08	132.58	145.0	9.9	2.83	0.32	48
C-35	C-36	RD-7	15	9	15	15	0.005	2.12	0.010	2.53	2.53	0.004	0.014	9	0.021	8	0.0150	166	154.08	151.59	167.9	13.8	1.45	0.06	9
C-36	C-37	RD-7	21	16	21	36	0.011	2.06	0.023	3.49	6.02	0.008	0.032	22	0.049	8	0.0140	385	151.49	146.10	165.3	13.8	2.02	0.08	12
C-37	C-38	RD-7	15	12	15	51	0.016	2.04	0.032	2.51	8.53	0.012	0.044	31	0.068	8	0.0070	275	146.00	144.07	158.8	12.8	1.59	0.12	18
C-38	C-39	RD-7	17	10	17	68	0.021	2.02	0.043	2.81	11.34	0.016	0.058	41	0.090	8	0.0133	278	143.97	140.26	153.9	9.9	2.21	0.12	17
C-39	C-40	RD-7	3	2	3	71	0.022	2.01	0.044	0.47	11.81	0.017	0.061	42	0.094	8	0.0035	116	140.16	139.75	149.1	8.9	1.45	0.16	24
C-40	C-41	RD-7	0	0	0	71	0.022	2.01	0.044	0.00	11.81	0.017	0.061	42	0.094	8	0.0035	123	139.65	139.21	149.0	9.4	1.45	0.16	24
C-41	C-43	RD-5	4	3	4	75	0.023	2.01	0.047	0.74	12.55	0.018	0.064	45	0.100	8	0.0035	144	139.11	138.60	150.4	11.3	1.49	0.17	25
C-42	C-43	RD-5	7	4	7	7	0.002	2.17	0.005	1.20	1.20	0.002	0.007	5	0.010	8	0.0300	220	145.20	138.60	154.2	9.0	2.12	0.03	4
C-43	C-44	RD-5	10	9	10	93	0.029	1.99	0.057	1.70	15.45	0.022	0.079	55	0.122	8	0.0035	300	138.50	137.45	148.2	9.7	1.56	0.18	28
C-44	C-47	RD-5	12	11	12	105	0.032	1.98	0.064	2.02	17.47	0.024	0.089	62	0.138	8	0.0035	300	137.35	136.30	148.2	10.8	1.60	0.20	30
C-45	C-46	RD-5	5	4	5	5	0.002	2.20	0.003	0.85	0.85	0.001	0.005	3	0.015	8	0.0070	225	140.30	138.36	150.3	10.0	1.92	0.02	3
C-46	C-47	RD-5	6	5	6	11	0.003	2.14	0.003	0.99	1.84	0.003	0.010	7	0.015	8	0.0070	280	138.26	136.30	150.7	12.4	0.93	0.06	9
C-47	C-48	RD-5	4	4	4	120	0.037	1.97	0.073	0.67	19.98	0.028	0.101	70	0.157	8	0.0070	241	136.20	135.35	152.2	16.0	2.13	0.18	26
C-48	C-49	RD-5	3	2	3	123	0.038	1.97	0.075	0.52	20.50	0.029	0.104	72	0.161	8	0.0035	40	135.25	135.11	146.5	11.2	1.68	0.21	32
C-49	C-50	RD-5	15	14	15	138	0.043	1.96	0.084	2.55	23.05	0.032	0.116	81	0.180	8	0.0035	375	135.01	133.69	145.5	10.5	1.69	0.23	34
C-50	C-51	RD-5	16	14	16	155	0.048	1.95	0.094	2.74	26.79	0.036	0.130	90	0.201	8	0.0035	400	133.59	132.19	145.2	11.6	1.75	0.24	36
C-51	C-68	RD-5	11	8	11	166	0.051	1.95	0.100	1.78	27.57	0.039	0.139	96	0.215	8	0.0163	311	132.09	127.03	142.7	10.6	3.13	0.17	25
C-52	C-53	RD-5	10	8	10	10	0.003	2.15	0.007	1.64	1.64	0.002	0.009	6	0.014	8	0.0330	200	139.39	137.99	150.6	11.2	1.92	0.04	5
C-53	C-65	RD-5	14	12	14	24	0.007	2.09	0.016	2.39	4.03	0.006	0.021	11	0.024	8	0.0070	400	137.89	135.09	148.4	10.5	1.39	0.08	12
C-54	C-55	RD-5	18	12	18	18	0.005	2.11	0.011	2.92	2.92	0.004	0.016	11	0.024	8	0.0035	300	149.50	146.29	157.8	10.5	1.26	0.07	10
C-55	C-56	RD-5	13	9	13	31	0.009	2.07	0.020	2.18	5.10	0.007	0.027	19	0.041	8	0.0035	287	147.30	146.19	157.8	10.5	1.03	0.12	17
C-56	C-57	RD-5	6	5	6	37	0.011	2.06	0.024	1.05	6.15	0.009	0.032	22	0.050	8	0.0089	300	146.19	143.51	156.5	10.3	1.72	0.09	14
C-57	C-58	RD-5	12	10	12	49	0.015	2.04	0.031	2.06	8.21	0.011	0.043	30	0.066	8	0.0035	317	143.41	142.30	153.6	10.2	1.30	0.14	20
C-58	C-59	RD-5	12	10	12	62	0.019	2.02	0.039	2.06	10.27	0.014	0.053	37	0.082	8	0.0035	329	142.20	141.04	152.0	9.8	1.38	0.15	23
C-59	C-64	RD-5	0	0	0	62	0.019	2.02	0.039	0.00	10.27	0.014	0.053	37	0.082	8	0.0192	155	140.94	137.97	151.3	10.4	2.40	0.10	15
C-60	C-61	RD-7	12	13	13	13	0.004	2.13	0.009	2.07	2.07	0.003	0.011	8	0.018	8	0.0300	260	155.50	147.70	165.0	9.5	2.00	0.04	6
C-61	C-63	RD-7	11	14	14	27	0.008	2.08	0.017	1.88	3.95	0.006	0.023	16	0.036	8	0.0270	284	147.65	139.98	157.9	10.2	2.26	0.06	9
C-62	C-63	RD-7	2	2	2	2	0.001	2.24	0.002	0.40	0.40	0.001	0.002	2	0.003	8	0.0200	63	141.24	139.98	151.0	9.8	3.00	0.01	1
C-63	C-64	RD-7	2	2	2	32	0.010	2.07	0.020	0.36	4.71	0.007	0.027	19	0.042	8	0.0150	127	139.88	137.97	150.1	10.2	1.91	0.08	11
C-64	C-65	-	0	0	0	93	0.029	1.99	0.058	0.00	14.98	0.021	0.079	55	0.121	8	0.0219	127	137.87	135.09	147.4	9.5	2.89	0.12	18
C-65	C-66	RD-5	4	3	4	122	0.038	1.97	0.074	0.69	19.70	0.028	0.102	71	0.158	8	0.0095	253	134.99	132.58	145.3	10.3	2.37	0.16	25
C-66	C-68	-	0	0	0	375	0.168	1.85	0.312	0.00	60.73	0.085	0.397	276	0.614	8	0.0207	263	132.48	127.03	143.5	11.0	4.54	0.27	41
C-67	C-68	O	43	0	43	43	0.014	2.05	0.028	7.13	7.13	0.010	0.038	26	0.058	8	0.0062	1,700	137.59	127.03	146.0	8.4	1.48	0.11	17
C-68	EX MH#4	-	0	0	0	584	0.181	1.85	0.334	0.00	95.43	0.134	0.468	325	0.724	10	0.0520	142	126.93	119.52	138.0	11.1	6.54	0.21	26
EX MH#4	EX MH#4	-	0	0	0	584	0.181	1.85	0.334	0.00	95.43	0.134	0.468	325	0.724	10	0.0060	327	119.49	117.43	132.5	13.0	2.98	0.38	46



**NOTE**  
THE SEWER MANHOLE RIM ELEVATIONS  
SHOWN ARE BASED ON THE PRELIMINARY  
GRADING PLAN DATED 9/26/2014.

- LEGEND**
- |                    |  |          |
|--------------------|--|----------|
| PROPOSED           | DESCRIPTION  | EXISTING |
| 8" SS              | SEWER LINE SIZE INDICATED                                | 8" SS    |
| Red dashed line    | SANITARY SEWER SHED AREA                                 |          |
| Blue dashed line   | MINOR SS SHED AREA                                       |          |
| Blue dashed line   | SCHEMATIC SANITARY SEWER LINE                            |          |
| BRSS               | BARRETT RANCH SANITARY SEWER STUDY, dated April 21, 2004 |          |
| Circle with 'S'    | SANITARY SEWER NODE                                      |          |
| Circle with 'A-1'  | NODE SEQUENCE  |          |
| Circle with 'A-10' | AREA TRIBUTARY TO THIS NODE                              |          |
| Circle with 'ΣA'   | LARGEST EQUIVALENT SINGLE FAMILY DWELLING UNIT           |          |
| Circle with 'ΣSD'  | SUMMATION OF ESD   |          |
| Circle with 'Qd'   | DESIGN FLOW  |          |
| Circle with 'B-1'  | SANITARY SEWER NODE                                      |          |

Sanitary Sewer Master Plan  
**Barrett Ranch East**  
Sacramento County, CA  
**MACKAY & SOMPS**  
ENGINEERS  
1501 Eureka Road, Suite 200, Roseville, CA 95678 (916) 775-1789

November 6, 2014