

# **DEXTER WILSON ENGINEERING, INC.**

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CONSULTING ENGINEERS

**SEWER SYSTEM ANALYSIS  
FOR THE  
AVION PROJECT  
IN THE CITY OF SAN DIEGO**

February 9, 2018

**SEWER SYSTEM ANALYSIS  
FOR THE  
AVION PROJECT  
IN THE CITY OF SAN DIEGO**

February 9, 2018



Prepared by:  
**Dexter Wilson Engineering, Inc.**  
**2234 Faraday Avenue**  
**Carlsbad, CA 92008**  
**(760) 438-4422**

Job No. 1010-005

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DEXTER S. WILSON, P.E.  
ANDREW M. OVEN, P.E.  
STEPHEN M. NIELSEN, P.E.  
NATALIE J. FRASCHETTI, P.E.  
STEVEN J. HENDERSON, P.E.

February 9, 2018

1010-005

CalAtlantic  
16465 Via Esprillo, Suite 150  
San Diego, CA 92127

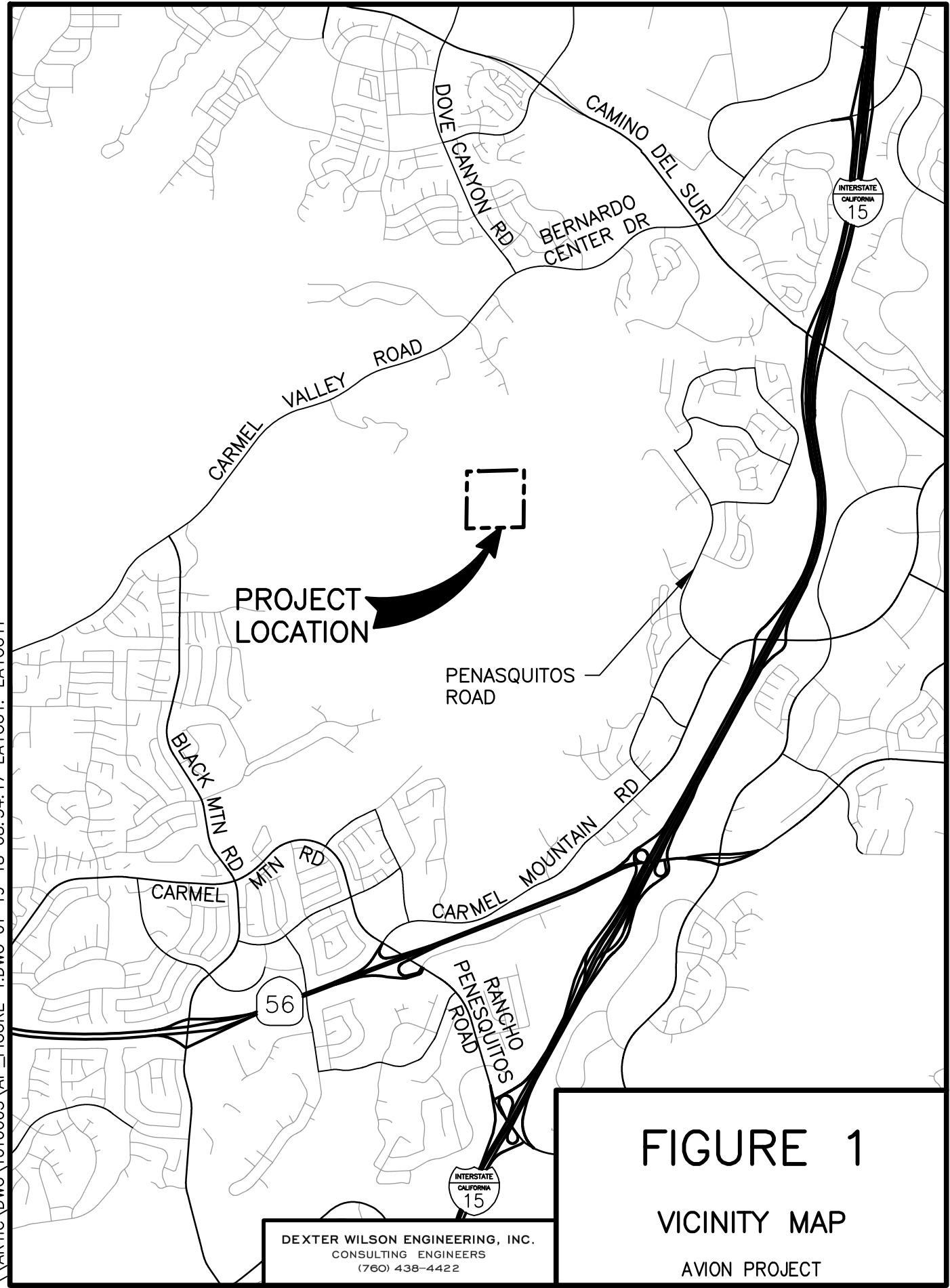
Attention: Alex L. Plishner, Vice President Forward Planning

Subject: Sewer System Analysis for the Avion Project in the City of San Diego

## **Introduction**

This report provides a sewer system analysis for the Avion project in the City of San Diego. The project is located south of Carmel Valley Road/Bernardo Center Drive adjacent to the Black Mountain Ranch East Clusters project. The Avion project has common boundaries and is southwest of the Heritage Bluffs project. Figure 1 provides a location map for the Avion project.

The project encompasses approximately 41.5 acres and proposes 84 single family residential dwelling units and open space. Residential pad elevations within the project range from a low of 769.3 feet to a high of 829 feet. The project topography slopes downward to the north which will facilitate the design of a gravity flow sewer system for the project.



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### **Purpose of Study**

The purpose of this study is twofold:

1. To calculate the sewage flow conditions for the onsite gravity sewer lines: depth of flow and flow velocity.
2. To demonstrate there is adequate gravity sewer line capacity downstream of the Avion project to the offsite sewer lift station.

### **Study Area**

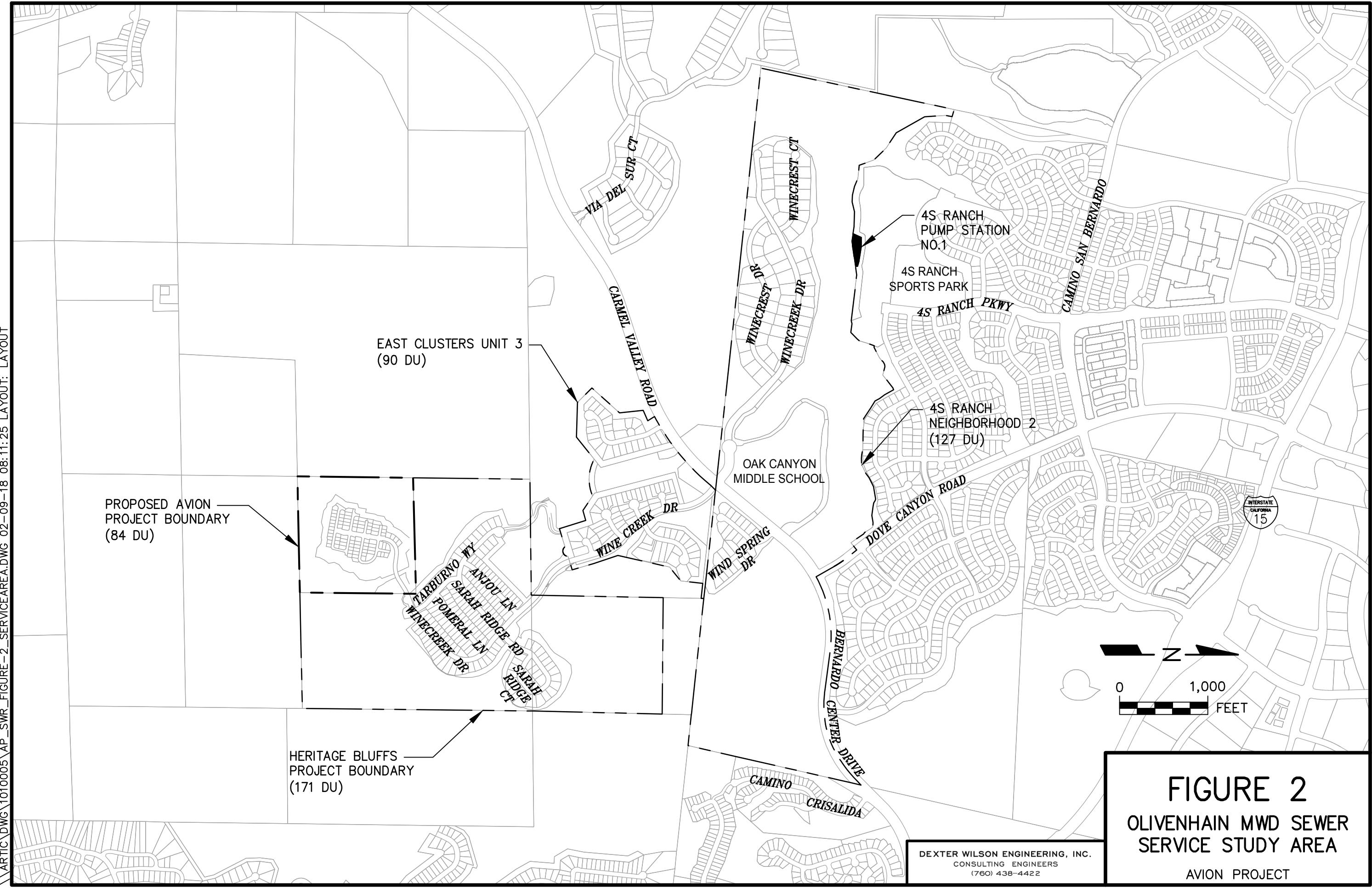
Sewer service to the Avion project will be provided by the Olivenhain Municipal Water District. While the Avion project is within the city limits of the City of San Diego, there is no viable sewer service from the City of San Diego. In addition, existing facilities are in place which allow the Avion project to sewer to Olivenhain MWD. Furthermore, previous sewer studies for development projects adjacent to the Avion project have accounted for the expected flow from the Avion project.

**Previous Sewer Studies.** Two recent sewer studies have been prepared for development projects downstream of the Avion project and are referenced below.

1. *Preliminary Sewer Study, Heritage Bluffs*, November 2016, Project Design Consultants.
2. *Sewer Study for East Clusters Unit 3*, March 17, 2014, Rick Engineering Company.

This sewer study will analyze the existing gravity sewer collection system from the Avion project, through the Heritage Bluffs project, through the East Clusters Unit 3 project, and through the 4S Ranch Neighborhood 2 development up to the 4S Ranch Pump Station No. 1.

Figure 2 shows the sewer service areas within this sewer study which flow to Olivenhain MWD.



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### **Sewer System Design Criteria**

The design criteria utilized in the analysis of the gravity sewer collection system downstream from the Avion project are summarized below.

1. Flow per EDU is 240 gpd average.
2. The peak flow peaking factor is based on the City of San Diego population-based peaking factor, except that it goes no lower than 3.0 times average flow. At low flows the greatest peaking factor is 4.0.
3. Manning's "n" value is 0.013.
4. Minimum gravity sewer pipe size is 8-inch.
5. Minimum sewer slope where a velocity of 2 fps is not achievable is 2 percent.
6. For 8-inch and 10-inch sewer pipe, allowable depth at peak flow is half-full.

### **Existing Gravity Sewer System**

Exhibit A at the back of this report presents the layout of the existing gravity sewer collection system flowing to Olivenhain MWD. Added to the existing system is the Avion project showing the proposed onsite gravity sewer lines.

The sewer sizes and slopes within the 4S Ranch Neighborhood 2 area are taken from an exhibit in Appendix D of the March 2014 Rick Engineering Company sewer study referenced above. The gravity sewer lines within 4S Ranch Neighborhood 2 are 10-inch diameter with slopes ranging from 0.6 percent to 6.7 percent.

The sewer sizes and slopes within the East Cluster Unit 3 along Winecreek Road south and east of Carmel Valley Road are taken from the March 2014 Rick Engineering Company sewer study. The gravity sewer lines within East Cluster Unit 3 are 8-inch diameter with slopes ranging from 4.25 percent to 7.18 percent.

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The sewer sizes and slopes within the Heritage Bluffs development were obtained from Project Design Consultants, the civil engineer for the Heritage Bluffs project. The gravity sewer lines within the Heritage Bluffs project are 8-inch diameter with slopes ranging from 1.0 percent to 10.4 percent.

Within the proposed Avion project, proposed gravity sewers have a minimum slope of 2 percent.

### **Dwelling Units in Service Area**

As previously described, the sewer service area for this analysis includes the proposed Avion project plus three existing development areas. These are 1) 4S Ranch Neighborhood 2; 2) East Clusters Unit 3; and 3) Heritage Bluffs. The number of dwelling units associated with each of these developments is listed below and used in the gravity sewer analysis within this report.

4S Ranch Neighborhood 2	127 EDUs
East Clusters Unit 3	90 EDUs
Heritage Bluffs	171 EDUs
Proposed Avion Project	84 EDUs
<b>TOTAL</b>	<b>472 EDUs</b>

### **Sewer System Analysis and Results**

Results of the sewer calculation spreadsheet are provided in Appendix A; Exhibit A provides the corresponding manhole numbering diagram.

Within the Avion project, minimum flow velocity in the upper-most reach of the sewer collection system is 0.92 fps. Of the 21 segments of gravity sewer line within Avion, eight (8) reaches have flow velocity below 2 fps. Three reaches calculate at 1.96, 1.97, and 1.98 fps. The remaining sewer lines flow over 2 fps with the maximum velocity of 5.59 fps.

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For the offsite gravity sewer collection system through Heritage Bluffs, East Cluster Unit 3, and 4S Ranch Neighborhood 2, the minimum flow velocity is 2.21 fps. Maximum flow velocity is 6.4 fps.

Maximum d/D for the offsite sewer is 0.38 d/D in a 10-inch sewer within 4S Ranch Neighborhood 2.

The results of the offsite gravity sewer collection system analysis indicate that the existing gravity sewer collection system has sufficient flow capacity to accommodate the 84 dwelling units proposed for the Avion project.

### **Conclusions and Recommendations**

The following conclusions and recommendations are summarized based on the gravity sewer analysis prepared for the Avion project.

1. The Avion project will obtain sewer service from Olivenhain MWD.
2. To obtain sewer service, the Avion project will need to be annexed into the Olivenhain MWD sewer service area.
3. The Avion onsite gravity sewer system will be designed with minimum 8-inch sewer lines and minimum 2 percent slope.
4. The offsite gravity sewer system through which the Avion project sewage will flow has adequate flow capacity for Avion's proposed 84 dwelling units.

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If you have any questions regarding the information or conclusions and recommendations presented in this report, please do not hesitate to call.

Dexter Wilson Engineering, Inc.



Andrew Oven, P.E.

AO:pjs

cc: George Briest, P.E., Olivenhain MWD  
Karen Ogawa, Olivenhain MWD  
Marina Wurst, Project Design Consultants

Attachments

## **APPENDIX A**

### **SPREADSHEET CALCULATIONS FOR GRAVITY SEWER COLLECTION SYSTEM**

DATE: 2/8/2018 2/7/2018

JOB NUMBER: 1010-005

**SEWER STUDY SUMMARY**FOR: Avion Project Plus Downstream Developments  
BY: Dexter Wilson Engineering, Inc.SHT 1 OF 1  
REFER TO PLAN SHEET:

Page 1

LINE	FROM	TO	POP. PER D.U.	IN-LINE EDUs	POPULATION SERVED		SEWAGE PER CAPITA/DAY (gpd/person)	AVG. DRY WEATHER FLOW (gpd)	PEAKING FACTOR	PEAK FLOW (gpd)	PEAK FLOW (DESIGN FLOW)		LINE SIZE (inches)	DESIGN SLOPE (%)	DEPTH K <sup>(1)</sup>	dn (feet)	dn/D <sup>(2)</sup>	C <sub>s</sub> for Velocity <sup>(3)</sup>	VELOCITY (f.p.s.)
					IN-LINE	TOTAL					M.G.D.	C.F.S.							
1	121	119	3	2.00	6.0	6.0	80	480	4.0	1,920	0.002	0.003	8	2.00	0.000805	0.02068	0.031	0.0073	0.92
2	119	117	3	10.00	30.0	36.0	80	2,880	4.0	11,520	0.012	0.018	8	2.00	0.004831	0.04792	0.072	0.0252	1.59
3	123	117	3	9.00	27.0	27.0	80	2,160	4.0	8,640	0.009	0.013	8	2.00	0.003623	0.04180	0.063	0.0206	1.46
4	117	115	3	0.00	0.0	63.0	80	5,040	4.0	20,160	0.020	0.031	8	6.20	0.004802	0.04779	0.072	0.0251	2.80
5	125	115	3	10.00	30.0	30.0	80	2,400	4.0	9,600	0.010	0.015	8	4.30	0.002746	0.03664	0.055	0.0169	1.97
6	127	115	3	10.00	30.0	30.0	80	2,400	4.0	9,600	0.010	0.015	8	2.00	0.004026	0.04392	0.066	0.0221	1.51
7	115	113	3	0.00	0.0	123.0	80	9,840	4.0	39,360	0.039	0.061	8	4.00	0.011672	0.07293	0.109	0.0466	2.94
8	129	113	3	8.00	24.0	24.0	80	1,920	4.0	7,680	0.008	0.012	8	2.00	0.003221	0.03963	0.059	0.0189	1.41
9	113	111	3	0.00	0.0	147.0	80	11,760	4.0	47,040	0.047	0.073	8	11.40	0.008263	0.06178	0.093	0.0366	4.48
11	131	133	3	12.00	36.0	36.0	80	2,880	4.0	11,520	0.012	0.018	8	2.00	0.004831	0.04792	0.072	0.0252	1.59
12	133	135	3	2.00	6.0	42.0	80	3,360	4.0	13,440	0.013	0.021	8	2.00	0.005636	0.05153	0.077	0.0280	1.67
13	135	137	3	2.00	6.0	48.0	80	3,840	4.0	15,360	0.015	0.024	8	7.90	0.003241	0.03975	0.060	0.0190	2.81
15	141	137	3	6.00	18.0	18.0	80	1,440	4.0	5,760	0.006	0.009	8	2.00	0.002416	0.03456	0.052	0.0155	1.29
14	137	111	3	2.00	6.0	72.0	80	5,760	4.0	23,040	0.023	0.036	8	2.00	0.009662	0.06664	0.100	0.0409	1.96
10	139	111	3	7.00	21.0	21.0	80	1,680	4.0	6,720	0.007	0.010	8	5.90	0.001641	0.02874	0.043	0.0118	1.98
16	111	109	3	0.00	0.0	240.0	80	19,200	3.9	74,240	0.074	0.115	8	2.00	0.031133	0.11710	0.176	0.0928	2.79
17	109	107	3	4.00	12.0	252.0	80	20,160	3.8	77,146	0.077	0.119	8	14.10	0.012184	0.07440	0.112	0.0480	5.59
18	107	105	3	0.00	0.0	252.0	80	20,160	3.8	77,146	0.077	0.119	8	8.30	0.015881	0.08448	0.127	0.0578	4.64
19	105	103	3	0.00	0.0	252.0	80	20,160	3.8	77,146	0.077	0.119	8	8.60	0.015602	0.08374	0.126	0.0571	4.70
20	103	101	3	0.00	0.0	252.0	80	20,160	3.8	77,146	0.077	0.119	8	7.60	0.016596	0.08639	0.130	0.0597	4.50
21	101	PL	3	0.00	0.0	252.0	80	20,160	3.8	77,146	0.077	0.119	8	2.00	0.032352	0.11936	0.179	0.0954	2.82

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LINE	2/8/2018 FROM	TO	POP. PER D.U.	POPULATION SERVED		SEWAGE PER CAPITA/DAY (gpd/person)	AVG. DRY WEATHER FLOW (gpd)	PEAKING FACTOR	PEAK FLOW (gpd)	PEAK FLOW (DESIGN FLOW)		LINE SIZE (inches)	DESIGN SLOPE (%)	DEPTH K <sup>(1)</sup>	dn (feet)	dn/D <sup>(2)</sup>	C <sub>a</sub> for Velocity <sup>(3)</sup>	VELOCITY (f.p.s.)	
				IN-LINE	TOTAL					M.G.D.	C.F.S.								
PL	MH#15	3	0.00	0.0	252.0	80	20,160	3.8	77,146	0.077	0.119	8	1.00	0.045753	0.14144	0.212	0.1217	2.21	
MH#15	MH#14	3	25.00	75.0	327.0	80	26,160	3.6	93,566	0.094	0.145	8	2.01	0.039140	0.13090	0.196	0.1089	2.99	
MH#14	MH#13	3	33.00	99.0	426.0	80	34,080	3.2	110,646	0.111	0.171	8	2.00	0.046401	0.14243	0.214	0.1229	3.13	
MH#13	MH#10	3	1.00	3.0	429.0	80	34,320	3.2	111,082	0.111	0.172	8	4.72	0.030323	0.11560	0.173	0.0911	4.25	
MH#10	MH#9	3	30.00	90.0	519.0	80	41,520	3.0	124,560	0.125	0.193	8	1.00	0.073873	0.18009	0.270	0.1712	2.53	
MH#9	MH#8	3	10.00	30.0	549.0	80	43,920	3.0	131,760	0.132	0.204	8	1.87	0.057144	0.15812	0.237	0.1425	3.22	
MH#8	MH#7	3	12.00	36.0	585.0	80	46,800	3.0	140,400	0.140	0.217	8	1.73	0.063307	0.16654	0.250	0.1533	3.19	
MH#7	MH#43	3	7.00	21.0	606.0	80	48,480	3.0	145,440	0.145	0.225	8	2.11	0.059381	0.16120	0.242	0.1464	3.46	
MH#43	MH#3	3	40.00	120.0	726.0	80	58,080	3.0	174,240	0.174	0.270	8	1.00	0.103336	0.21402	0.321	0.2177	2.79	
MH#3	MH#2	3	0.00	0.0	726.0	80	58,080	3.0	174,240	0.174	0.270	8	4.26	0.050067	0.14795	0.222	0.1297	4.68	
MH#2	MH#1	3	0.00	0.0	726.0	80	58,080	3.0	174,240	0.174	0.270	8	7.51	0.037708	0.12851	0.193	0.1061	5.72	
MH#1	<b>MH#9</b>	3	0.00	0.0	726.0	80	58,080	3.0	174,240	0.174	0.270	8	10.40	0.032043	0.11878	0.178	0.0947	6.40	
<b>MH#9</b>	MH#10	3	13.00	39.0	765.0	80	61,200	3.0	183,600	0.184	0.284	8	7.18	0.040636	0.13339	0.200	0.1119	5.71	
MH#10	MH#12	3	7.00	21.0	786.0	80	62,880	3.0	188,640	0.189	0.292	8	6.54	0.043747	0.13833	0.207	0.1179	5.57	
MH#12	MH#15	3	16.00	48.0	834.0	80	66,720	3.0	200,160	0.200	0.310	8	4.25	0.057582	0.15873	0.238	0.1433	4.86	
MH#15	MH#19	3	31.00	93.0	927.0	80	74,160	3.0	222,480	0.222	0.344	8	3.85	0.067246	0.17160	0.257	0.1600	4.84	
MH#19	MH#21	3	10.00	30.0	957.0	80	76,560	3.0	229,680	0.230	0.355	8	5.96	0.055796	0.15624	0.234	0.1402	5.70	
MH#21	<b>CVR#1</b>	3	0.00	0.0	957.0	80	76,560	3.0	229,680	0.230	0.355	8	6.74	0.052468	0.15151	0.227	0.1342	5.96	
2	<b>CVR#1</b>	WCR#16	3	24.00	72.0	1029.0	80	82,320	3.0	246,960	0.247	0.382	10	1.00	0.080780	0.23554	0.283	0.1824	3.02
3	WCR#16	WCR#15	3	26.00	78.0	1107.0	80	88,560	3.0	265,680	0.266	0.411	10	3.10	0.049358	0.18363	0.220	0.1284	4.61
4	WCR#15	WCR#14	3	38.00	114.0	1221.0	80	97,680	3.0	293,040	0.293	0.453	10	2.90	0.056287	0.19616	0.235	0.1410	4.63
5	WCR#14	WCR#13	3	0.00	0.0	1221.0	80	97,680	3.0	293,040	0.293	0.453	10	1.00	0.095853	0.25728	0.309	0.2062	3.17
6	WCR#13	WCR#12	3	0.00	0.0	1221.0	80	97,680	3.0	293,040	0.293	0.453	10	1.00	0.095853	0.25728	0.309	0.2062	3.17
7	WCR#12	WCR#11	3	0.00	0.0	1221.0	80	97,680	3.0	293,040	0.293	0.453	10	3.50	0.051235	0.18710	0.225	0.1319	4.95
8	WCR#11	WCR#10	3	5.00	15.0	1236.0	80	98,880	3.0	296,640	0.297	0.459	10	5.00	0.043393	0.17221	0.207	0.1172	5.64
9	WCR#10	WCR#9	3	3.00	9.0	1245.0	80	99,600	3.0	298,800	0.299	0.462	10	1.00	0.097737	0.25989	0.312	0.2091	3.18
10	WCR#9	WCR#8	3	7.00	21.0	1266.0	80	101,280	3.0	303,840	0.304	0.470	10	2.20	0.067006	0.21411	0.257	0.1596	4.24
11	WCR#8	WCR#7	3	4.00	12.0	1278.0	80	102,240	3.0	306,720	0.307	0.475	10	6.70	0.038760	0.16283	0.195	0.1082	6.32
12	WCR#7	WCR#6	3	22.00	66.0	1344.0	80	107,520	3.0	322,560	0.323	0.499	10	1.00	0.105509	0.27044	0.325	0.2209	3.25
13	WCR#6	SLA#1	3	24.00	72.0	1416.0	80	113,280	3.0	339,840	0.340	0.526	10	1.20	0.101476	0.26499	0.318	0.2148	3.52
14	SLA#1	SLA#2	3	0.00	0.0	1416.0	80	113,280	3.0	339,840	0.340	0.526	10	1.20	0.101476	0.26499	0.318	0.2148	3.52
15	SLA#2	SLA#3	3	0.00	0.0	1416.0	80	113,280	3.0	339,840	0.340	0.526	10	1.20	0.101476	0.26499	0.318	0.2148	3.52
16	SLA#3	SLA#4	3	0.00	0.0	1416.0	80	113,280	3.0	339,840	0.340	0.526	10	1.00	0.111161	0.27794	0.334	0.2294	3.30
17	SLA#4	SLA#5	3	0.00	0.0	1416.0	80	113,280	3.0	339,840	0.340	0.526	10	0.60	0.143508	0.31846	0.382	0.2760	2.74
18	SLA#5	Tie-In	3	0.00	0.0	1416.0	80	113,280	3.0	339,840	0.340	0.526	10	1.70	0.085257	0.24218	0.291	0.1896	3.99

Total EDUS  
472.0

Total Pop.  
1,416

Min Slope  
0.60

Max dn/D  
0.38

84.00	EDU	Avion Project
171.00	EDU	Heritage Bluffs
90.00	EDU	East Cluster Unit 3
127.00	EDU	4S Neighborhood 2

127

Heritage Bluffs Study

4S Ranch Neighborhood 2 Study

**EXHIBIT A**

**SEWER CALCULATIONS  
MANHOLE NUMBERING DIAGRAM**

