Appendix J

WATER STUDY

FOR

THE PRESERVE

City of Rancho Cordova, California

September 2018

Prepared For:

Winn Properties

RJA
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Technical Memorandum

To:	John Zellmer – Ruggeri-Jensen-Azar & Associates Rich Radoycis – Ruggeri-Jensen-Azar & Associates Steve Bowman – Ruggeri-Jensen-Azar & Associates
From:	Christian Kesler – Coleman Engineering Chad Coleman – Coleman Engineering
Date:	September 17, 2018
Project:	Winn Community Development
Subject:	Distribution Pipeline Sizing

PURPOSE

The purpose of this technical memorandum is to detail recommended pipe sizes and connection points for the proposed potable water distribution system for the Winn Communities development in Rancho Cordova, CA. Water modeling has demonstrated that the system is sized appropriately and that the resulting flows and pressures will be provided in accordance with Sacramento County Water Agency (SCWA/County) Operating Goals.

SITE

The Winn Communities Development is located on the east side of the City of Rancho Cordova and is planned to include 434 lots of single family residential housing. The development is located just north of Douglas Road and slightly west of Grant Line Road. Drinking water is to be supplied by Sacramento County Water Agency.

WATER SYSTEM DESIGN CRITERIA

Water system design criteria was determined using the criteria detailed in the *Zone 40 Water System Infrastructure Plan Update* (WSIP) dated February 2018. The criteria itemized in this section include:

- Water demands
- Peaking factors
- Water system materials and sizes
- Water system performance criteria

Water Demands

The system was designed using criteria detailed in the WSIP. Table 3-13 of the WSIP lists the Average Daily Demand per Single Family Residence as 490 gpd/connection. There are 434 lots on the developments which equates to an Average Daily Demand of 212,688 gpd or 148 gpm.

- 490 gpd/connection * 434 lots = 212,688 gpd
- 212,688 gpd /24 hours /60 min = 148 gpm

The demand was split up and applied throughout the nodes in the model as the Average Day Demand (ADD).

Table 6 of the WSIP lists the required fire flow for single family residences less than 3,600 square feet as 1,500 gpm. All residential homes in the proposed Winn development are assumed to be less than 3,600 square feet.

Peaking Factors
Table 5-15 of the WSIP lists the peaking factors that are shown in Table 1 below:

Table 1 – Water System Peaking Factors

Demand	Peaking Factor
Maximum Day Demand (MDD)	2.0 ADD
Peak Hour Demand (PHD)	2.0 MDD

Water System Materials and Sizes
According to the *Sacramento County Water Agency's 2018 Improvement Standards*, the specified pipe material for distribution pipes is cement-lined pipe, polyvinyl chloride pipe, or ductile iron pipe and a Hazen-Williams "C" value of 125 should be used for all three pipe types.

Table 5-14 of the WSIP indicates that the minimum size for all distribution pipes is 8-inches in diameter.

Water System Performance Criteria
The County dictates required performance for water distribution system pipes. Table 2 below lists the applicable operating goals for SCWA water systems, as dictated by Table 5-14 of the WSIP.

Table 2 – Water System Performance Criteria

Operating Goal	Requirement
PHD Minimum Pressure	35 psi
PHD Maximum Pressure	65 psi
ADD Maximum Velocity	5 fps
PHD Maximum Velocity	7 fps
PHD Maximum Unit Headloss	3 ft/1,000 ft
MDD+FF Minimum Pressure	20 psi

Operating Goal	Requirement
MDD+FF Maximum Velocity	10 fps

MODEL

After laying out the water distribution pipe network, Coleman Engineering modeled the system using Bentley WaterCAD v8i to verify conformance with County design and operating criteria. The planned street layout and elevations were detailed by Ruggeri-Jensen-Azar (RJA). Pipe materials, pipe diameters, water demands, etc. were selected by Coleman Engineering. Model elevations were taken from the *Preliminary Grading Plan* prepared by RJA and were verified on Google Earth.

The locations and alignments of existing public water transmission and distribution system pipes were provided by the County. See Figure 2 attached to this memo. Existing County pipes that were modeled to be connected to the new system include:

- 12-inch distribution main in Edington Way
- 8-inch distribution main in Thornberg Way
- 12-inch to 10-inch distribution main in Raymer Way.

According to Table 5-14 of the WSIP, the minimum allowable pressure in a Zone 40 transmission main at peak hour flow conditions is 40 psi. The supply water pressure in the model assumes 40 psi in the 24-inch transmission main in Edington Way. That transmission main supplies all other pipes in the modeled system.

Water system pressures in the development were modeled at ground level. Building heights were not considered in the model since Building MEP's and Fire Sprinkler designers will calculate losses interior to the buildings.

To verify water system performance versus County criteria, the following modeling runs were calculated:

- ADD
- MDD
- PHD
- MDD + Fire Flow
- Redundancy Check #1 - MDD + Fire Flow with the connection at Edington Way out of service
- Redundancy Check #2 - MDD + Fire Flow with the connection at Thornberg Way out of service
- Redundancy Check #3 – MDD + Fire Flow with the connection at Raymer Way out of service

RESULTS

Model result tables are attached as Figure 3. Table 3 below shows the summary of results from the model runs compared to the applicable County operating goals.

Table 3 – Modeling Results vs. Water System Performance Criteria

Operating Goal	Operating Goal	Modeled Minimum	Modeled Maximum	Meets Goal?
PHD Minimum Pressure (psi)	35	36	-	Yes
PHD Maximum Pressure (psi)	65	-	43	Yes
ADD Maximum Velocity (fps)	5	-	0.3	Yes
PHD Maximum Velocity (fps)	7	-	1.2	Yes
PHD Maximum Unit Headloss (ft/1,000 ft)	3	-	0.9	Yes
MDD+FF Minimum Pressure (psi)	20	25	-	Yes
MDD+FF Maximum Velocity (fps)	10	-	9.7	Yes
MDD+FF Minimum Pressure – Redundancy Check #1 Edington Way Out of Service (psi)	20	21	-	Yes
MDD+FF Maximum Velocity – Redundancy Check #1 Edington Way Out of Service (psi)	10	-	9.7	Yes
MDD+FF Minimum Pressure – Redundancy Check #2 Thornberg Way Out of Service (psi)	20	24	-	Yes
MDD+FF Maximum Velocity – Redundancy Check #2 Thornberg Way Out of Service (psi)	10	-	9.7	Yes
MDD+FF Minimum Pressure – Redundancy Check #3 Raymer Way Out of Service (psi)	20	25	-	Yes
MDD+FF Maximum Velocity – Redundancy Check #3 Raymer Way Out of Service (psi)	10	-	9.7	Yes

All of the County operating goals stated in the WSIP were met as shown in Table 3 above. 8-inch diameter pipe throughout the system is calculated to be able to deliver water under all of the conditions that were tested in the model.

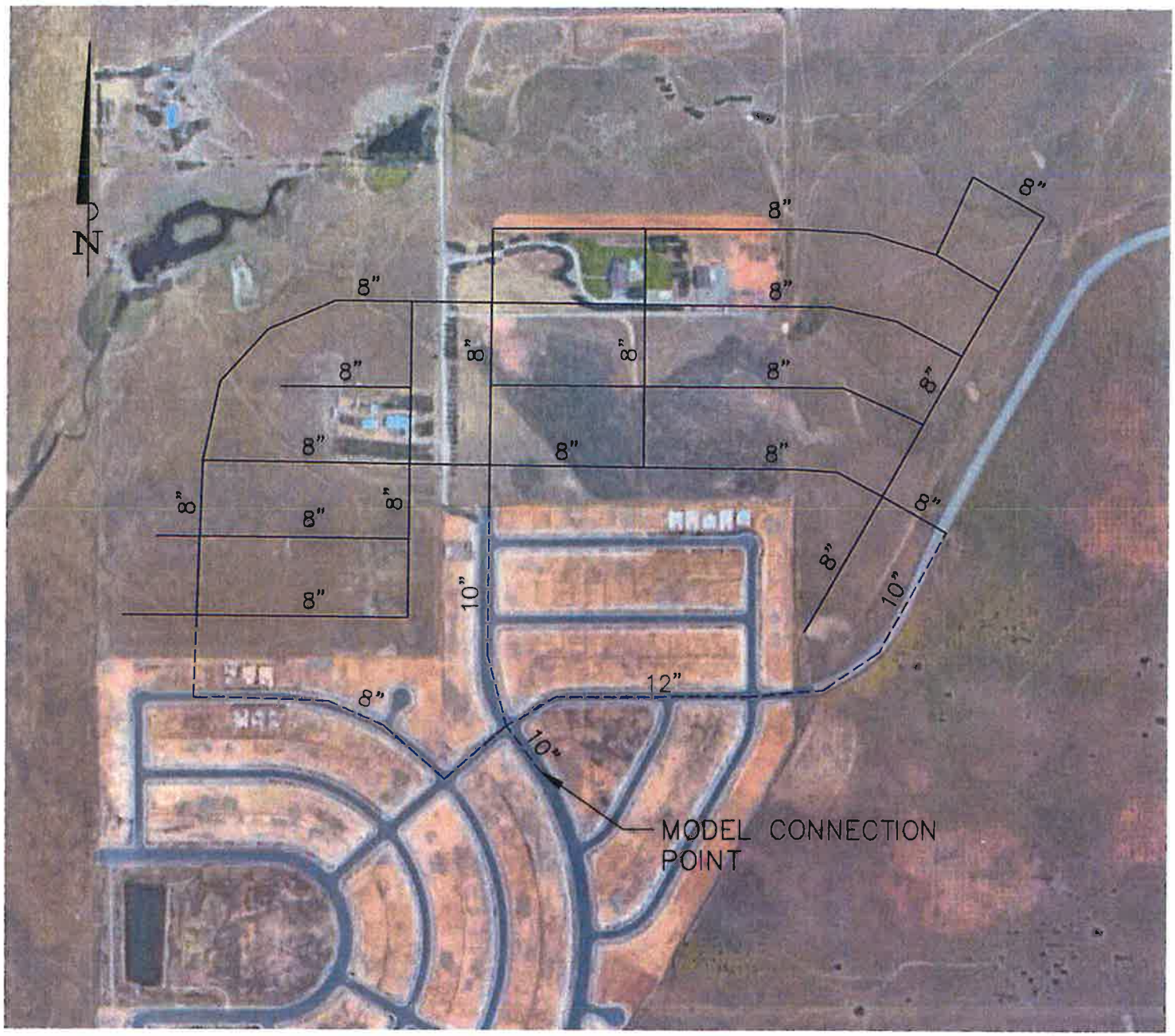
During fire flow conditions, the lowest pressures and highest velocities occurred at dead ends, but the criteria were still met at these locations. The modeling results attached as Figure 3 summarize results of the water modeling runs.

The modeling results show that the water distribution pipe networks shown in the attached Figure 1 is calculated to be able to deliver sufficient water to the development. To summarize, the new water system is modeled to include the following features:

- Connections to the 12-inch main in Edington Drive, the 8-inch main in Thornberg Way, and the 10-inch main in Raymer Way
- 8-inch pipes for all distribution mains in the Winn Development

ATTACHMENTS

- Figure 1 – Water System Layout
- Figure 2 – County Water Map
- Figure 3 – Water Modeling Results



LEGEND

PROPOSED PIPE ——————

EXISTING PIPE - - - - - -

500 0 500 1000

SCALE OF FEET

COLEMAN ENGINEERING

FIGURE 1

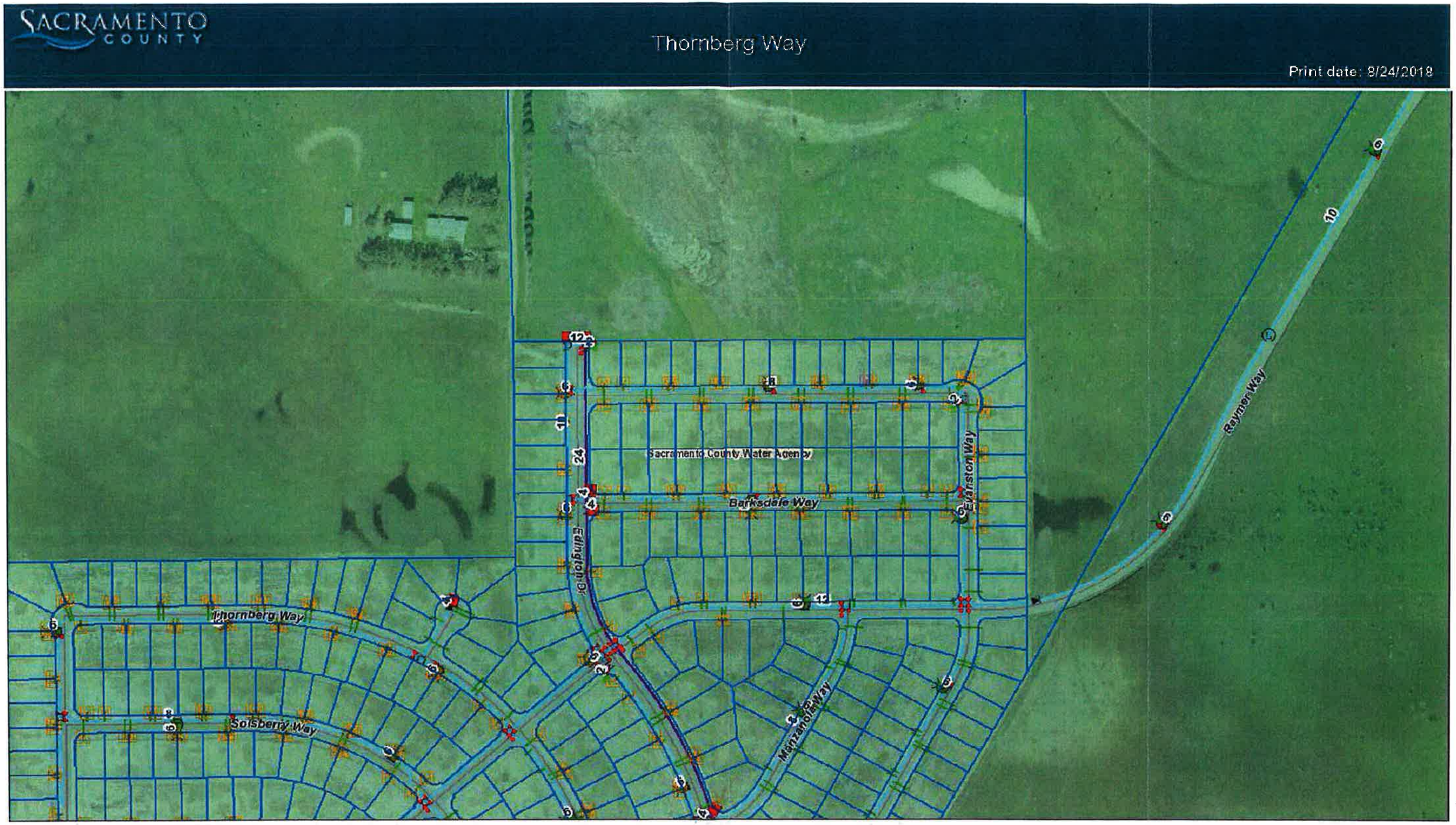
WINN DEVELOPMENT WATER SYSTEM LAYOUT

CITY OF RANCHO CORDOVA

COLEMAN ENGINEERING
1358 Blue Oaks Boulevard, Suite 200, Roseville California (916) 791-1188

DATE: 9-17-18
DRN: CPK
CKD: CRC
SCALE: 1"=500'
JN: RJAA18-003

Figure 2



1" = 200'

N

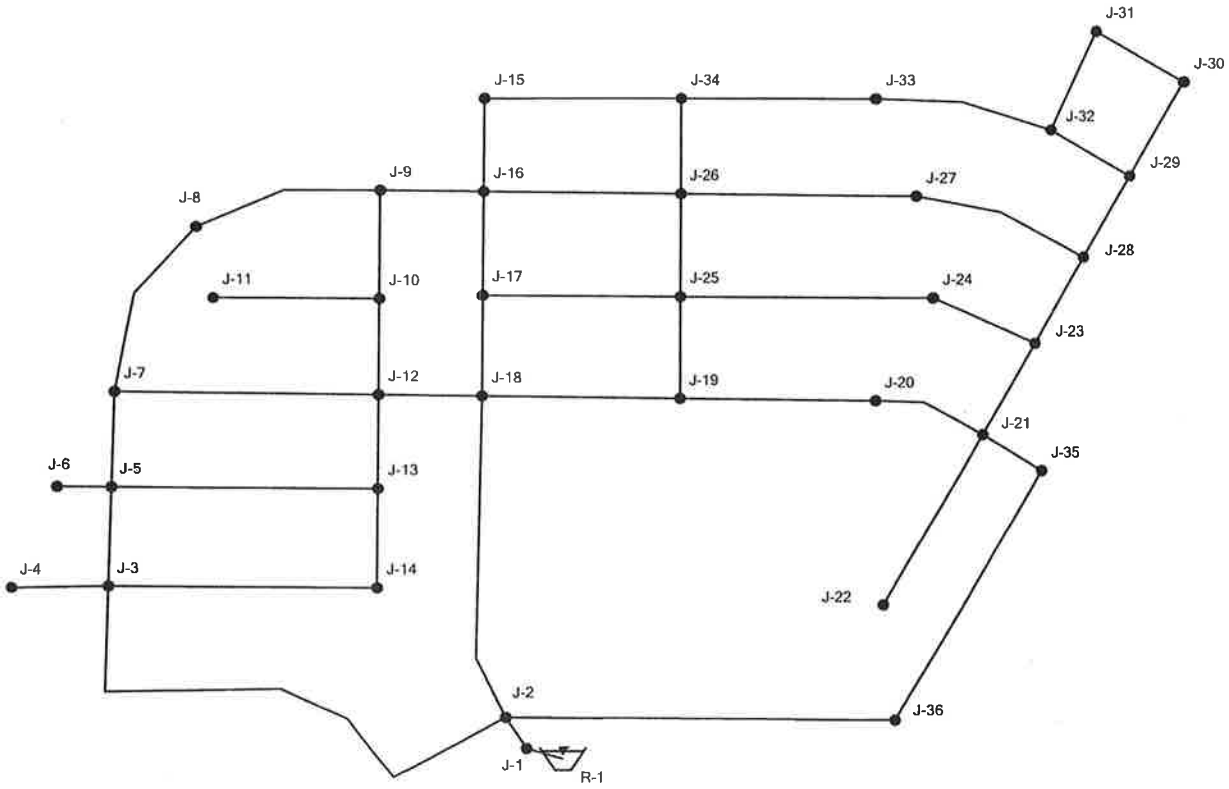
Independent verification of all data contained on this map product should be obtained by any user thereof. The County of Sacramento does not warrant the accuracy or completeness of this map product and therefore disclaims all liability for its fitness of use.

Figure 3

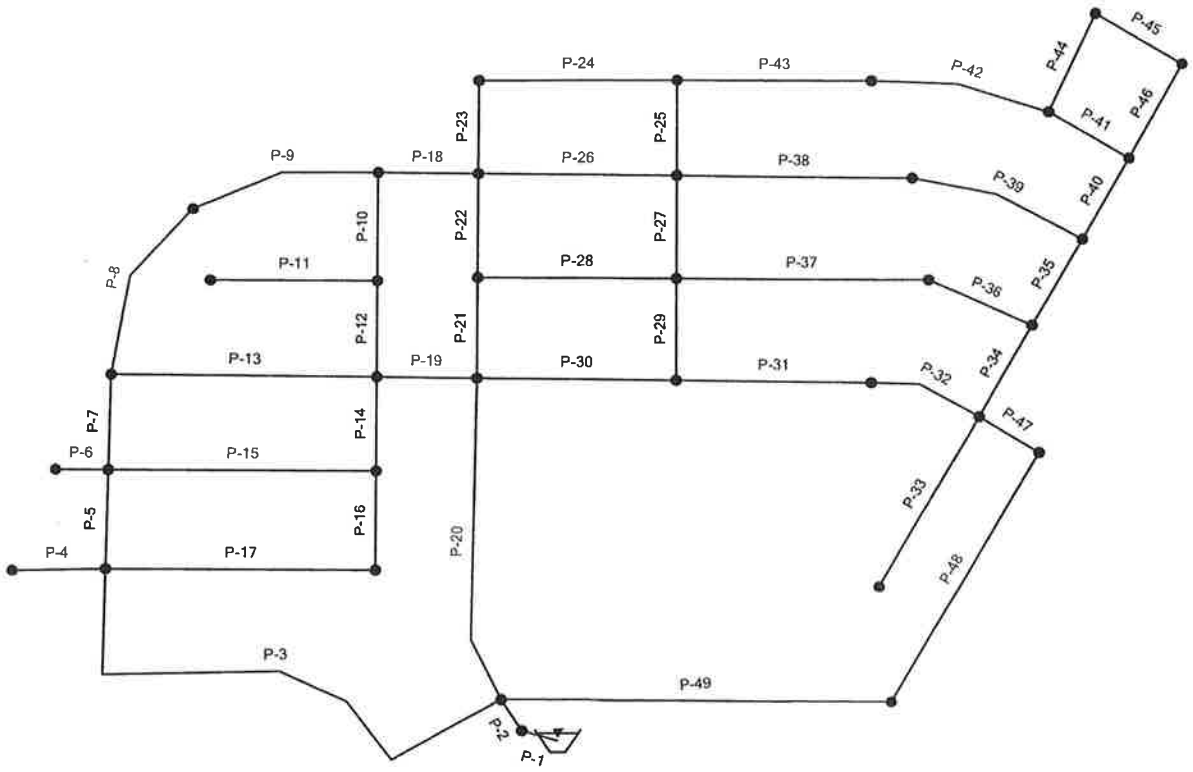
(pages 1-15)

Model: Winn Development

Node Labels



Model: Winn Development
Pipe Labels



Model: Winn Development
Active Scenario: ADD
Node Results

Label	Elevation (ft)	Demand (gpm)	Pressure (psi)
J-1	236.20	0	40
J-2	236.20	0	40
J-3	233.50	4	41
J-4	229.60	3	43
J-5	232.90	4	41
J-6	232.50	2	42
J-7	232.00	7	42
J-8	231.00	2	42
J-9	233.70	5	41
J-10	233.60	3	41
J-11	231.90	5	42
J-12	233.70	6	41
J-13	237.60	7	39
J-14	236.10	7	40
J-15	236.10	2	40
J-16	235.00	5	40
J-17	234.60	5	41
J-18	236.30	5	40
J-19	236.80	7	40
J-20	238.80	4	39
J-21	240.60	5	38
J-22	242.40	4	37
J-23	240.90	4	38
J-24	238.90	5	39
J-25	236.60	5	40
J-26	237.50	6	39
J-27	239.70	7	38
J-28	241.80	4	38
J-29	242.70	3	37
J-30	243.60	7	37
J-31	244.00	3	37
J-32	242.90	5	37
J-33	238.90	4	39
J-34	237.40	2	39
J-35	241.50	0	38
J-36	237.00	0	40

Model: Winn Development
Active Scenario: ADD
Pipe Results

Label	Diameter (in)	Hazen-Williams C	Length (ft)	Flow (Absolute) (gpm)	Velocity (ft/s)
P-1	99.0	125.0	95	148	0.01
P-2	99.0	125.0	96	148	0.01
P-3	8.0	125.0	1,433	31	0.20
P-4	8.0	125.0	247	3	0.02
P-5	8.0	125.0	258	15	0.09
P-6	8.0	125.0	138	2	0.02
P-7	8.0	125.0	248	7	0.05
P-8	8.0	125.0	496	5	0.03
P-9	8.0	125.0	499	3	0.02
P-10	8.0	125.0	282	3	0.02
P-11	8.0	125.0	433	5	0.03
P-12	8.0	125.0	250	11	0.07
P-13	8.0	125.0	685	5	0.03
P-14	8.0	125.0	245	4	0.03
P-15	8.0	125.0	690	1	0.00
P-16	8.0	125.0	258	2	0.01
P-17	8.0	125.0	696	9	0.05
P-18	8.0	125.0	262	1	0.00
P-19	8.0	125.0	261	27	0.17
P-20	10.0	125.0	853	69	0.28
P-21	8.0	125.0	262	25	0.16
P-22	8.0	125.0	271	15	0.10
P-23	8.0	125.0	243	7	0.04
P-24	8.0	125.0	504	4	0.03
P-25	8.0	125.0	249	7	0.04
P-26	8.0	125.0	505	4	0.02
P-27	8.0	125.0	268	15	0.09
P-28	8.0	125.0	506	4	0.03
P-29	8.0	125.0	265	16	0.10
P-30	8.0	125.0	507	13	0.08
P-31	8.0	125.0	506	10	0.06
P-32	8.0	125.0	297	13	0.08
P-33	8.0	125.0	511	4	0.02
P-34	8.0	125.0	275	26	0.16
P-35	8.0	125.0	259	18	0.11
P-36	8.0	125.0	290	4	0.02
P-37	8.0	125.0	651	1	0.01
P-38	8.0	125.0	608	5	0.03
P-39	8.0	125.0	469	1	0.01
P-40	8.0	125.0	244	13	0.08
P-41	8.0	125.0	242	4	0.03
P-42	8.0	125.0	463	4	0.03
P-43	8.0	125.0	504	9	0.06
P-44	8.0	125.0	284	4	0.02
P-45	8.0	125.0	264	1	0.01
P-46	8.0	125.0	283	6	0.04

Model: Winn Development
Active Scenario: ADD
Pipe Results

Label	Diameter (in)	Hazen-Williams C	Length (ft)	Flow (Absolute) (gpm)	Velocity (ft/s)
P-47	8.0	125.0	181	47	0.30
P-48	10.0	125.0	751	47	0.19
P-49	12.0	125.0	1,003	47	0.13

Model: Winn Development
Active Scenario: MDD
Node Results

Label	Elevation (ft)	Demand (gpm)	Pressure (psi)
J-1	236.20	0	40
J-2	236.20	0	40
J-3	233.50	9	41
J-4	229.60	6	43
J-5	232.90	9	41
J-6	232.50	5	42
J-7	232.00	5	42
J-8	231.00	14	42
J-9	233.70	5	41
J-10	233.60	11	41
J-11	231.90	5	42
J-12	233.70	10	41
J-13	237.60	12	39
J-14	236.10	14	40
J-15	236.10	13	40
J-16	235.00	5	40
J-17	234.60	10	41
J-18	236.30	10	40
J-19	236.80	10	40
J-20	238.80	10	39
J-21	240.60	13	38
J-22	242.40	12	37
J-23	240.90	7	38
J-24	238.90	10	39
J-25	236.60	13	40
J-26	237.50	7	39
J-27	239.70	8	38
J-28	241.80	7	37
J-29	242.70	13	37
J-30	243.60	9	37
J-31	244.00	10	37
J-32	242.90	5	37
J-33	238.90	7	39
J-34	237.40	10	39
J-35	241.50	0	38
J-36	237.00	0	40

Model: Winn Development
Active Scenario: MDD
Pipe Results

Label	Diameter (in)	Hazen-Williams C	Length (ft)	Flow (Absolute) (gpm)	Velocity (ft/s)
P-1	99.0	125.0	95	295	0.01
P-2	99.0	125.0	96	295	0.01
P-3	8.0	125.0	1,433	61	0.39
P-4	8.0	125.0	247	6	0.04
P-5	8.0	125.0	258	29	0.18
P-6	8.0	125.0	138	5	0.03
P-7	8.0	125.0	248	13	0.08
P-8	8.0	125.0	496	16	0.10
P-9	8.0	125.0	499	2	0.01
P-10	8.0	125.0	282	9	0.06
P-11	8.0	125.0	433	5	0.03
P-12	8.0	125.0	250	25	0.16
P-13	8.0	125.0	685	8	0.05
P-14	8.0	125.0	245	7	0.04
P-15	8.0	125.0	690	3	0.02
P-16	8.0	125.0	258	3	0.02
P-17	8.0	125.0	696	17	0.11
P-18	8.0	125.0	262	6	0.04
P-19	8.0	125.0	261	50	0.32
P-20	10.0	125.0	853	138	0.56
P-21	8.0	125.0	262	50	0.32
P-22	8.0	125.0	271	28	0.18
P-23	8.0	125.0	243	20	0.13
P-24	8.0	125.0	504	7	0.05
P-25	8.0	125.0	249	18	0.12
P-26	8.0	125.0	505	9	0.06
P-27	8.0	125.0	268	27	0.17
P-28	8.0	125.0	506	11	0.07
P-29	8.0	125.0	265	32	0.21
P-30	8.0	125.0	507	28	0.18
P-31	8.0	125.0	506	15	0.09
P-32	8.0	125.0	297	24	0.15
P-33	8.0	125.0	511	12	0.08
P-34	8.0	125.0	275	47	0.30
P-35	8.0	125.0	259	33	0.21
P-36	8.0	125.0	290	7	0.04
P-37	8.0	125.0	651	4	0.02
P-38	8.0	125.0	608	10	0.06
P-39	8.0	125.0	469	2	0.01
P-40	8.0	125.0	244	28	0.18
P-41	8.0	125.0	242	5	0.03
P-42	8.0	125.0	463	9	0.06
P-43	8.0	125.0	504	16	0.10
P-44	8.0	125.0	284	8	0.05
P-45	8.0	125.0	264	1	0.01
P-46	8.0	125.0	283	10	0.06

Model: Winn Development
Active Scenario: MDD
Pipe Results

Label	Diameter (in)	Hazen-Williams C	Length (ft)	Flow (Absolute) (gpm)	Velocity (ft/s)
P-47	8.0	125.0	181	96	0.61
P-48	10.0	125.0	751	96	0.39
P-49	12.0	125.0	1,003	96	0.27

Model: Winn Development
Active Scenario: PHD
Node Results

Label	Elevation (ft)	Demand (gpm)	Pressure (psi)
J-1	236.20	0	40
J-2	236.20	0	40
J-3	233.50	18	41
J-4	229.60	12	43
J-5	232.90	18	41
J-6	232.50	10	41
J-7	232.00	29	42
J-8	231.00	10	42
J-9	233.70	22	41
J-10	233.60	11	41
J-11	231.90	20	42
J-12	233.70	25	41
J-13	237.60	29	39
J-14	236.10	26	40
J-15	236.10	10	40
J-16	235.00	20	40
J-17	234.60	20	40
J-18	236.30	20	40
J-19	236.80	26	39
J-20	238.80	15	39
J-21	240.60	19	38
J-22	242.40	15	37
J-23	240.90	16	38
J-24	238.90	20	39
J-25	236.60	19	40
J-26	237.50	25	39
J-27	239.70	26	38
J-28	241.80	15	37
J-29	242.70	14	37
J-30	243.60	26	36
J-31	244.00	11	36
J-32	242.90	19	37
J-33	238.90	18	39
J-34	237.40	10	39
J-35	241.50	0	38
J-36	237.00	0	40

Model: Winn Development
Active Scenario: PHD
Pipe Results

Label	Diameter (in)	Hazen-Williams C	Length (ft)	Flow (Absolute) (gpm)	Velocity (ft/s)	Headloss Gradient (ft/1000ft)
P-1	99.0	125.0	95	591	0.02	0.00
P-2	99.0	125.0	96	591	0.02	0.00
P-3	8.0	125.0	1,433	123	0.79	0.41
P-4	8.0	125.0	247	12	0.08	0.01
P-5	8.0	125.0	258	59	0.38	0.10
P-6	8.0	125.0	138	10	0.06	0.00
P-7	8.0	125.0	248	29	0.18	0.03
P-8	8.0	125.0	496	20	0.13	0.01
P-9	8.0	125.0	499	10	0.06	0.00
P-10	8.0	125.0	282	14	0.09	0.01
P-11	8.0	125.0	433	20	0.13	0.01
P-12	8.0	125.0	250	45	0.29	0.06
P-13	8.0	125.0	685	19	0.12	0.01
P-14	8.0	125.0	245	17	0.11	0.01
P-15	8.0	125.0	690	3	0.02	0.00
P-16	8.0	125.0	258	8	0.05	0.00
P-17	8.0	125.0	696	34	0.22	0.04
P-18	8.0	125.0	262	2	0.01	0.00
P-19	8.0	125.0	261	106	0.68	0.31
P-20	10.0	125.0	853	278	1.13	0.62
P-21	8.0	125.0	262	98	0.63	0.27
P-22	8.0	125.0	271	60	0.38	0.11
P-23	8.0	125.0	243	26	0.17	0.02
P-24	8.0	125.0	504	17	0.11	0.01
P-25	8.0	125.0	249	28	0.18	0.03
P-26	8.0	125.0	505	15	0.10	0.01
P-27	8.0	125.0	268	58	0.37	0.10
P-28	8.0	125.0	506	18	0.11	0.01
P-29	8.0	125.0	265	65	0.41	0.12
P-30	8.0	125.0	507	53	0.34	0.08
P-31	8.0	125.0	506	38	0.24	0.05
P-32	8.0	125.0	297	53	0.34	0.09
P-33	8.0	125.0	511	15	0.10	0.01
P-34	8.0	125.0	275	103	0.66	0.29
P-35	8.0	125.0	259	71	0.46	0.15
P-36	8.0	125.0	290	15	0.10	0.01
P-37	8.0	125.0	651	5	0.03	0.00
P-38	8.0	125.0	608	21	0.14	0.02
P-39	8.0	125.0	469	4	0.03	0.00
P-40	8.0	125.0	244	52	0.33	0.08
P-41	8.0	125.0	242	16	0.10	0.01
P-42	8.0	125.0	463	18	0.11	0.01
P-43	8.0	125.0	504	35	0.22	0.04
P-44	8.0	125.0	284	15	0.09	0.01
P-45	8.0	125.0	264	4	0.02	0.00

Model: Winn Development
Active Scenario: PHD
Pipe Results

Label	Diameter (in)	Hazen-Williams C	Length (ft)	Flow (Absolute) (gpm)	Velocity (ft/s)	Headloss Gradient (ft/1000ft)
P-46	8.0	125.0	283	22	0.14	0.02
P-47	8.0	125.0	181	190	1.21	0.91
P-48	10.0	125.0	751	190	0.78	0.31
P-49	12.0	125.0	1,003	190	0.54	0.13

Model: Winn Development
Active Scenario: MDD + Fire Flow
Fire Flow Analysis

Label	Satisfies Fire Flow Constraints?	Flow (Total Needed) (gpm)	Pressure (Calculated Residual @ Total Flow Needed) (psi)	Velocity of Maximum Pipe (ft/s)
J-1	True	1,500	40	0.61
J-2	True	1,500	40	0.61
J-3	True	1,509	37	3.94
J-4	True	1,506	34	9.62
J-5	True	1,509	37	4.09
J-6	True	1,505	35	9.61
J-7	True	1,505	38	4.09
J-8	True	1,514	37	5.00
J-9	True	1,505	37	4.57
J-10	True	1,511	37	5.21
J-11	True	1,505	30	9.62
J-12	True	1,510	38	4.63
J-13	True	1,512	35	5.06
J-14	True	1,514	34	5.86
J-15	True	1,513	35	6.02
J-16	True	1,505	37	3.71
J-17	True	1,510	38	4.24
J-18	True	1,510	38	3.74
J-19	True	1,510	37	3.96
J-20	True	1,509	35	5.49
J-21	True	1,513	35	4.82
J-22	True	1,512	25	9.66
J-23	True	1,507	34	4.61
J-24	True	1,510	34	5.53
J-25	True	1,513	37	3.93
J-26	True	1,507	36	3.88
J-27	True	1,508	33	4.87
J-28	True	1,507	33	5.01
J-29	True	1,513	31	6.36
J-30	True	1,509	29	6.24
J-31	True	1,509	29	6.16
J-32	True	1,505	31	5.95
J-33	True	1,507	32	5.40
J-34	True	1,509	35	4.78
J-35	True	1,500	35	3.85
J-36	True	1,500	38	3.28

Model: Winn Development

Active Scenario: MDD + Fire Flow - Redundancy Check #1 Edington Way Out of Service

Fire Flow Analysis

Label	Satisfies Fire Flow Constraints?	Flow (Total Needed) (gpm)	Pressure (Calculated Residual @ Total Flow Needed) (psi)	Velocity of Maximum Pipe (ft/s)
J-1	True	1,500	40	1.15
J-2	True	1,500	40	1.15
J-3	True	1,509	33	6.37
J-4	True	1,506	30	9.62
J-5	True	1,509	33	6.57
J-6	True	1,505	31	9.61
J-7	True	1,505	33	6.69
J-8	True	1,514	32	6.77
J-9	True	1,505	32	6.87
J-10	True	1,511	32	6.82
J-11	True	1,505	25	9.62
J-12	True	1,510	33	6.78
J-13	True	1,512	31	6.64
J-14	True	1,514	30	6.56
J-15	True	1,513	30	7.01
J-16	True	1,505	32	6.97
J-17	True	1,510	32	6.98
J-18	True	1,510	32	6.94
J-19	True	1,510	32	7.09
J-20	True	1,509	30	7.33
J-21	True	1,513	32	7.44
J-22	True	1,512	21	9.66
J-23	True	1,507	30	7.23
J-24	True	1,510	29	7.16
J-25	True	1,513	32	7.05
J-26	True	1,507	31	7.05
J-27	True	1,508	28	7.10
J-28	True	1,507	29	7.13
J-29	True	1,513	27	7.11
J-30	True	1,509	24	7.11
J-31	True	1,509	24	7.11
J-32	True	1,505	26	7.11
J-33	True	1,507	27	7.08
J-34	True	1,509	30	7.05
J-35	True	1,500	33	5.10
J-36	True	1,500	37	4.05

Model: Winn Development

Active Scenario: MDD + Fire Flow - Redundancy Check #2 Thornberg Way Out of Service

Fire Flow Analysis

Label	Satisfies Fire Flow Constraints?	Flow (Total Needed) (gpm)	Pressure (Calculated Residual @ Total Flow Needed) (psi)	Velocity of Maximum Pipe (ft/s)
J-1	True	1,500	40	0.76
J-2	True	1,500	40	0.76
J-3	True	1,509	32	6.23
J-4	True	1,506	29	9.62
J-5	True	1,509	34	5.90
J-6	True	1,505	32	9.61
J-7	True	1,505	35	5.78
J-8	True	1,514	35	5.55
J-9	True	1,505	36	5.34
J-10	True	1,511	35	5.59
J-11	True	1,505	28	9.62
J-12	True	1,510	36	6.16
J-13	True	1,512	32	6.22
J-14	True	1,514	31	6.44
J-15	True	1,513	34	5.98
J-16	True	1,505	36	4.52
J-17	True	1,510	37	4.49
J-18	True	1,510	37	4.61
J-19	True	1,510	36	4.68
J-20	True	1,509	34	5.59
J-21	True	1,513	35	5.37
J-22	True	1,512	24	9.66
J-23	True	1,507	34	4.93
J-24	True	1,510	33	5.57
J-25	True	1,513	36	4.65
J-26	True	1,507	35	4.63
J-27	True	1,508	32	4.91
J-28	True	1,507	32	5.12
J-29	True	1,513	30	6.39
J-30	True	1,509	28	6.28
J-31	True	1,509	28	6.20
J-32	True	1,505	30	5.99
J-33	True	1,507	31	5.37
J-34	True	1,509	34	4.81
J-35	True	1,500	35	3.95
J-36	True	1,500	38	3.43

Model: Winn Development

Active Scenario: MDD + Fire Flow - Redundancy Check #3 Raymer Way Out of Service

Fire Flow Analysis

Label	Satisfies Fire Flow Constraints?	Flow (Total Needed) (gpm)	Pressure (Calculated Residual @ Total Flow Needed) (psi)	Velocity of Maximum Pipe (ft/s)
J-1	True	1,500	40	0.61
J-2	True	1,500	40	0.61
J-3	True	1,509	37	3.94
J-4	True	1,506	34	9.62
J-5	True	1,509	37	4.09
J-6	True	1,505	35	9.61
J-7	True	1,505	38	4.09
J-8	True	1,514	37	5.00
J-9	True	1,505	37	4.57
J-10	True	1,511	37	5.21
J-11	True	1,505	30	9.62
J-12	True	1,510	38	4.63
J-13	True	1,512	35	5.06
J-14	True	1,514	34	5.86
J-15	True	1,513	35	6.02
J-16	True	1,505	37	3.71
J-17	True	1,510	38	4.24
J-18	True	1,510	38	3.74
J-19	True	1,510	37	3.96
J-20	True	1,509	35	5.49
J-21	True	1,513	35	4.82
J-22	True	1,512	25	9.66
J-23	True	1,507	34	4.61
J-24	True	1,510	34	5.53
J-25	True	1,513	37	3.93
J-26	True	1,507	36	3.88
J-27	True	1,508	33	4.87
J-28	True	1,507	33	5.01
J-29	True	1,513	31	6.36
J-30	True	1,509	29	6.24
J-31	True	1,509	29	6.16
J-32	True	1,505	31	5.95
J-33	True	1,507	32	5.40
J-34	True	1,509	35	4.78
J-35	True	1,500	35	3.85
J-36	True	1,500	38	3.28

SEWER STUDY

FOR

THE PRESERVE

City of Rancho Cordova, California

June 2020

Prepared For:

Winn Properties

Prepared By:

RJA
RUGGERI-JENSEN-AZAR
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Exhibits

Attachments

Executive Summary

This report has been prepared to present onsite and offsite sewer conveyance facilities to gravity serve the study area as well as identifying off-site contributing areas and downstream impacted areas. It addresses the viability of sewering the project, as well as consistency with the existing interceptor and trunk sewer master plans.

The Preserve is a proposed single family development (**See Exhibit D**). The Preserve is in the eastern part of Sacramento County, approximately 4,500 feet north of the intersection of Douglas Road and Americanos Boulevard. (**See Exhibit A**).

The Preserve encompasses a total of 279± acres, of which 184 acres are designated to be open space. Based on land use, with a minimum of 6 equivalent single-family dwelling (ESD's) per acre (RD-6), the remaining 95 acres will be 440 single family homes and approximately 20± acres of public park and open space. The project proposes two points of connection to the existing system and the 440.0 ESD's have Peak Wet Weather Flows (PWWF) of 0.210 MGD and 0.155 MGD. The flows leave the site at Node WP/MH-1 and Node WP-6/MH-26A.

There are no upstream areas that will contribute flow to the project sewer shed.

The Preserve is part of the BR East Rancho Area 1 Trunk Shed area per the SFEMP and would receive ultimate service from the Aerojet Interceptor Section 2S.

There are no required pump stations or force mains. This project proposes a permanent shed shift of 75± acres of The Preserve to the BR East Rancho Area 2. The designated open space north of Morrison Creek (184 Ac) is not part of the proposed shift (See Attachment A). The offsite facilities that are required to develop The Preserve have been constructed with the North Douglas development.

Section 1: Introduction

This study has been prepared at a Subdivision Plan level. At this level, it serves as a design guide for the creation of the subsequent improvement plans.

The Preserve covers 279± acres. The ground ranges in elevation from 205 feet on the west side to 245 feet above sea level on the east side. The 184 acres north of Morrison Creek are currently in the South Sacramento Habitat Conservation Plan (SSHCP) as a preserve. This property is currently in negotiation to be sold to the SSHCP. As open space, the area is not included in the flow calculations. The proposed open space areas will not be developed and will be set aside for conservation purposes only.

There are no offsite upstream areas that will contribute to the flows produced by The Preserve. The flow created from the project will utilize the existing North Douglas subdivision sewer system.

The Preserve will ultimately be serviced by the Aerojet Interceptor.

Section 2: Design

This study has been prepared in accordance with the current master plans.

Assumptions

Future upstream areas will not be served through The Preserve. It is anticipated that undeveloped areas within the (BR East Rancho Area 1) will be served according to the SFEMP, and will not be served to the south, through The Preserve and North Douglas developments.

Per the approved North Douglas Sewer Study, there are 1390 acres and 8522 ESD's at Node DR-4 in Douglas Road, producing 5.442 MGD. This study proposes to increase Node DR-4 to 1462.5 acres and 8969.6 ESD's producing 5.927 MGD. From Node DR-4, flows travel west in a 24" sewer pipe at a slope of 0.0021. A 24" sewer pipe at s= 0.0021 has a capacity of 6.697 MGD.

High ground water tables typically don't exist in this area of Sacramento County.

Approach: Mater Plan Design Procedures

The following general procedures are used in the development of this Sewer Master Plan:

- Major sewer sheds defined.
- A detailed collection system established.
- Major sheds divided into sub-sheds in order to define the areas, which contribute flows to certain points (nodes) on the collection system.
- Equivalent Single-Family Dwellings (ESDs) should be determined by lot count or by using 6 Equivalent Single-Family Dwellings (ESDs/acre), whichever is greater

The methodology for estimating sewage flows in collectors and trunk lines in the Plan area sewer system is defined in the Sacramento Area Sewer District Standards and Specifications dated March 2019. The primary design criteria used in our analysis are listed in Table 1 below.

Table 1

Category	Conditions	Modifiers
Development Density	Planned Development Density	Minimum Plan Density shall be RD-5
Flow Generation	310 gpd/ESD	I/I-new 1400 gpd/ac < 5 Years 1600 gpd/ac > 5 Years
Peaking Factor	$PF=3.5 - 1.8Q_a^{0.05}$ (local sewers) Where: Q_a = ADWF	
Velocity Criteria	Min. 2 fps at Peak Wet Weather Flow	
Hydraulic Grade Line	Maximum HGL at crown of pipe Peak Wet Weather Flow	
Friction Factor	N=0.013	
Minimum Depth	6.3' at periphery of plan. 6.3' min depth @ last line manhole	8" sewer from periphery to collection point
Minimum Slope	Slope = 0.007 Minimum	Main to last line manhole

Peak Dry Weather Flows are computed based on 310 gallons per day (gpd) per Equivalent Single Family Dwelling Unit (ESD) entering each trunk pipe system. ESD values used in Sewer Master Plans assumed a minimum plan density of 6 ESD's per acre.

Regional San and SASD

Sanitary sewer service in the project area is provided by the Sacramento Regional County Sanitation District (Regional San) and the Sacramento Area Sewer District (SASD).

Regional San is responsible for the interceptor collection (sanitary sewers which are designed to carry flows in excess of 10 million gallons per day) and treatment of wastewater.

SASD is responsible for the local collection facilities (up to 1 MGD) and trunk sewers with capacity of 1 million to 10 million gallons per day.

Regional San and SASD own, operate and are responsible for the public collection, trunk and interceptor sewer systems throughout Sacramento County as well as the Regional Wastewater Treatment Plant located south of Freeport.

Section 3: Sewer Flow Information

Currently there are no existing sewer facilities within The Preserve. When the 75 acres develops, it will produce 440.0 ESD's and have a combined Peak Wet Weather Flow (PWWF) of 0.365 mgd. These flows leave the site at nodes MH-1 and MH-26A, and enter the North Douglas development. We are reducing the Peak Wet Weather Flow (PWWF) at node 2623-EN01 and increasing the Peak Wet Weather Flow (PWWF) at node 2875-EN01. See the approved Sewer Master Study for North Douglas 1, dated March 2004, and prepared by Wood Rodgers, Inc. for reference.

Section 4: Sewer Alignments and Facilities

The most feasible way to serve this project is by gravity through the North Douglas development down to Douglas Road. This is a permanent shed shift. At this time, there are no other alternatives to sewer The Preserve.

Section 5: Conclusion

This study was prepared with the intent of providing support documentation for use in the development of The Preserve improvement plans. As configured, all of the project flows will sewer south through the North Douglas project, and eventually into the Aerojet Interceptor. No offsite upstream sewer flows through The Preserve, thus this study has only accounted for flows originated onsite. This project's 75 developable acres account for approximately 440.0 ESD's and produces a combined Peak Wet Weather Flow of 0.365 MGD's. The Preserve does not adversely affect the downstream system.

Exhibits

Exhibit A: Project Location Map

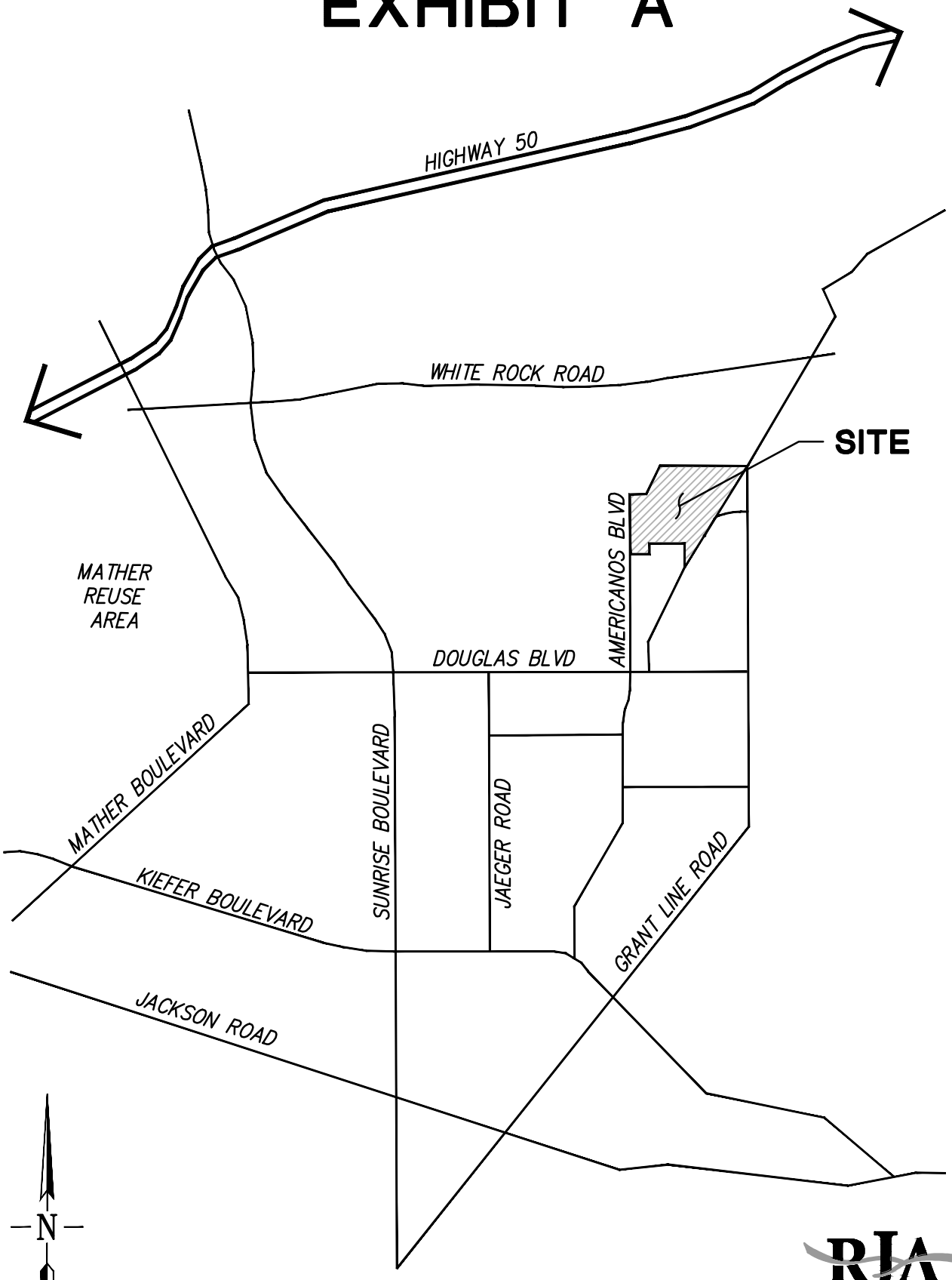
Exhibit B: Sewer Study (11x17 & Insert)

Exhibit C: Sewer Flow Calculations

Exhibit D: Land Use Plan

Exhibit E: Grading Plan

PROJECT LOCATION
EXHIBIT A



NOT TO SCALE

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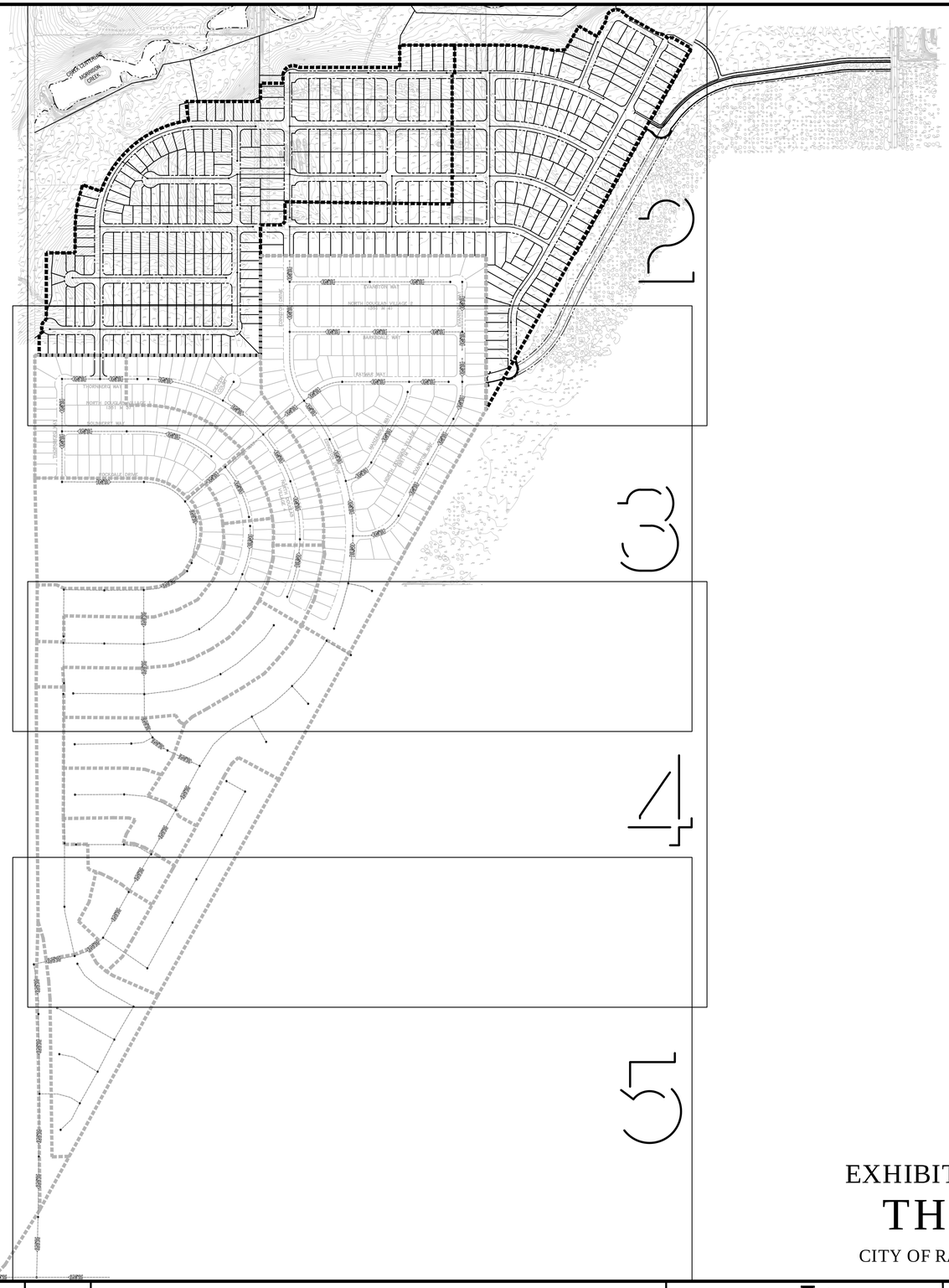
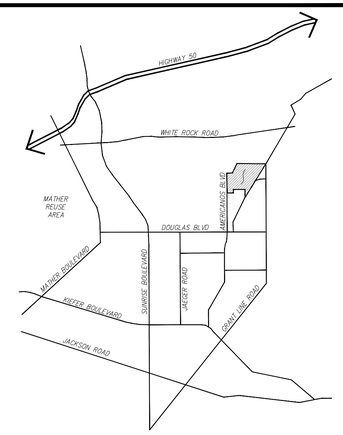
DATE: 6-23-2020 JOB NO. 165018





VICINITY MAP
NTS

0 300 600 900
1 inch = 300 ft.

LEGEND

D.C.	DROP CONNECTION
P.S.	PARALLEL SERVICE
200'	PIPE LENGTH
XX"SS	PROPOSED SEWER PIPE (INCHES)
S=0.0018	PIPE SLOPE
INV=150.00	PIPE INVERT (FEET)
RIM=50.0	MANHOLE RIM ELEVATION (FEET)
D=10.0	DEPTH (FEET)
200' EXX"SS S=0.0018	PIPE INFORMATION PER APPROVED NORTH DOUGLAS 1 & 2 SEWER STUDY BY WOOD RODGERS, INC. DATED MARCH 2004.
INV=150.00 RIM=50.0 D=10.0	MANHOLE INFORMATION PER APPROVED NORTH DOUGLAS 1 & 2 SEWER STUDY BY WOOD RODGERS, INC. DATED MARCH 2004.
	PROPOSED SEWER MANHOLE
	SEWER MANHOLE PER NORTH DOUGLAS
	MAJOR SHED BOUNDARY
	INDIVIDUAL SHED BOUNDARY
	PROJECT BOUNDARY
	NODE NUMBER POINT ACREAGE CUMULATIVE ACREAGE POINT ESD CUMULATIVE ESD PEAK WET WEATHER FLOW (MGD)
1 A= 00.0 ac. ΣA= 10.0 ac. ESD= 0.0 ΣESD= 10.0 Q_{PWWF}=0.10 mgd	NODE INFORMATION PER APPROVED NORTH DOUGLAS 1 & 2 SEWER STUDY BY WOOD RODGERS, INC. DATED MARCH 2004.

EXHIBIT B SEWER STUDY FOR

THE PRESERVE

CITY OF RANCHO CORDOVA, CALIFORNIA

REVISIONS NO.	DESCRIPTION	DATE	BY

SCALE
HORIZ. ____
VERT. ____

CITY OF RANCHO CORDOVA

DRAWN BY: A. ZAMORANO DATE 2/2020
DESIGNED BY: S. BOWMAN R.C.E. 71924 DATE 2/2020
CHECKED BY: S. BOWMAN R.C.E. 71924 DATE 2/2020

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SEWER STUDY FOR
THE PRESERVE

PROJECT NO.

DWG. NO.
SHEET
— OF —
5

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MORRISON CREEK TRAIL

CREEK CENTERLINE
MORRISON CREEK

STREET 'A'
STREET 'B'
STREET 'C'
STREET 'D'
STREET 'E'
STREET 'F'
STREET 'G'
STREET 'H'
STREET 'I'
STREET 'J'
STREET 'K'
STREET 'L'
STREET 'M'
STREET 'N'
STREET 'O'
STREET 'P'

EDINGTON DRIVE
EVANSTON WAY
RAYMER WAY
DEACON COURT
THORNBERG WAY
SOISBERRY WAY

NORTH DOUGLAS VILLAGE 1
(351 M 5)

NORTH DOUGLAS VILLAGE 2
(351 M 4)

BARKSDALE WAY

SUMMIT MANHOLE
RIM 236.63
INV 228.06 8" OUT (N)
INV 224.44 8" OUT (W)

0 100 200 300
1 inch = 100 ft.

REVISIONS NO.	DESCRIPTION	DATE	BY

SCALE
HORIZ. ____
VERT. ____

CITY OF RANCHO CORDOVA

DRAWN BY: A. ZAMORANO
DATE 2/2020

DESIGNED BY: S. BOWMAN
R.C.E. 71924 DATE 2/2020

CHECKED BY: S. BOWMAN
R.C.E. 71924 DATE 2/2020

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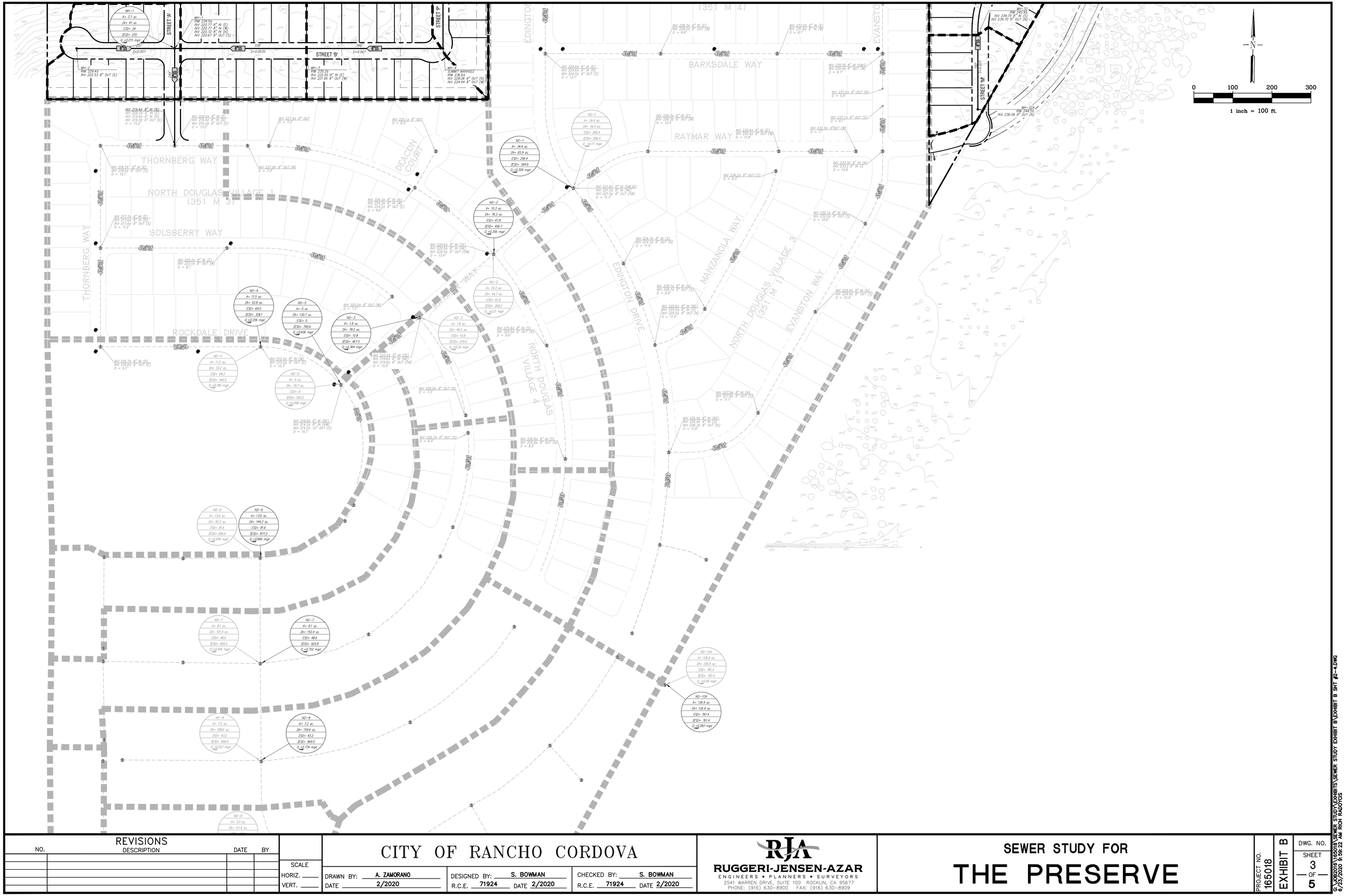

REVISIONS NO.	DESCRIPTION	DATE	BY

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CITY OF RANCHO CORDOVA

DRAWN BY: A. ZAMORANO
DATE 2/2020

DESIGNED BY: S. BOWMAN
R.C.E. 71924 DATE 2/2020

CHECKED BY: S. BOWMAN
R.C.E. 71924 DATE 2/2020

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THE PRESERVE

PROJECT NO. 165018

EXHIBIT B

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ΣA= 101.4 ac.
ΣSD= 48.6
ΣΣSD= 655.2
Q =0.485 mgd

ND-7
A= 8.1 ac.
ΣA= 152.4 ac.
ΣSD= 48.6
ΣΣSD= 925.8
Q =0.702 mgd

ND-8
A= 7.2 ac.
ΣA= 108.6 ac.
ΣSD= 43.2
ΣΣSD= 698.4
Q =0.527 mgd

ND-8
A= 7.2 ac.
ΣA= 159.6 ac.
ΣSD= 43.2
ΣΣSD= 969.0
Q =0.734 mgd

ND-9
A= 3.3 ac.
ΣA= 111.9 ac.
ΣSD= 19.8
ΣΣSD= 718.2
Q =0.542 mgd

ND-9
A= 3.3 ac.
ΣA= 162.9 ac.
ΣSD= 19.8
ΣΣSD= 988.8
Q =0.748 mgd

ND-10
A= 8.9 ac.
ΣA= 298.7 ac.
ΣSD= 53.4
ΣΣSD= 1803.6
Q =1.278 mgd

ND-10
A= 8.9 ac.
ΣA= 247.7 ac.
ΣSD= 53.4
ΣΣSD= 1533.0
Q =1.035 mgd

ND-11
A= 4.0 ac.
ΣA= 302.7 ac.
ΣSD= 24.0
ΣΣSD= 1837.6
Q =1.294 mgd

ND-11
A= 4.0 ac.
ΣA= 251.7 ac.
ΣSD= 24.0
ΣΣSD= 1557.0
Q =1.051 mgd

ND-12
A= 2.8 ac.
ΣA=305.5 ac.
ΣSD= 16.8
ΣΣSD= 1844.4
Q =1.306 mgd

ND-12
A= 2.8 ac.
ΣA= 254.5 ac.
ΣSD= 16.8
ΣΣSD= 1573.8
Q =1.062 mgd

ND-13
A= 2.3 ac.
ΣA= 315.0 ac.
ΣSD= 13.8
ΣΣSD= 1901.4
Q =1.345 mgd

ND-13
A= 2.3 ac.
ΣA= 264.0ac.
ΣSD= 13.8
ΣΣSD= 1630.8
Q =1.100 mgd

ND-13A
A= 7.2 ac.
ΣA=7.2 ac.
ΣSD= 43.2
ΣΣSD= 43.2
Q =0.04 mgd

ND-13A
A= 7.2 ac.
ΣA= 7.2 ac.
ΣSD= 43.2
ΣΣSD= 43.2
Q =0.56 mgd

ND-14
A= 0 ac.
ΣA= 269.6 ac.
ΣSD= 0
ΣΣSD= 1664.4
Q =1.122 mgd

ND-14
A= 0 ac.
ΣA= 320.6 ac.
ΣSD= 0
ΣΣSD= 1935.0
Q =1.368 mgd

ND-14A
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ΣA= 5.6 ac.
ΣSD= 33.6
ΣΣSD= 33.6
Q =0.044 mgd

ND-14A
A= 5.6 ac.
ΣA= 5.6 ac.
ΣSD= 33.6
ΣΣSD= 33.6
Q =0.03 mgd

ND-15
A= 0 ac.
ΣA= 269.6 ac.
ΣSD= 0
ΣΣSD= 1664.4
Q =1.122 mgd

ND-15
A= 0 ac.
ΣA= 320.6 ac.
ΣSD= 0
ΣΣSD= 1935.0
Q =1.368 mgd

ND-104
A= 126.9 ac.
ΣA= 126.9 ac.
ΣSD= 761.4
ΣΣSD= 761.4
Q =0.583 mgd

ND-104
A= 126.9 ac.
ΣA= 126.9 ac.
ΣSD= 761.4
ΣΣSD= 761.4
Q =0.58 mgd

0 100 200 300

1 inch = 100 ft.

REVISIONS			
NO.	DESCRIPTION	DATE	BY

SCALE
HORIZ. ____
VERT. ____

CITY OF RANCHO CORDOVA

DRAWN BY: A. ZAMORANO
DATE 2/2020

DESIGNED BY: S. BOWMAN
R.C.E. 71924 DATE 2/2020

CHECKED BY: S. BOWMAN
R.C.E. 71924 DATE 2/2020

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SEWER STUDY FOR
THE PRESERVE

PROJECT NO. 165018
EXHIBIT B
DWG. NO.
SHEET 4 — OF — 5

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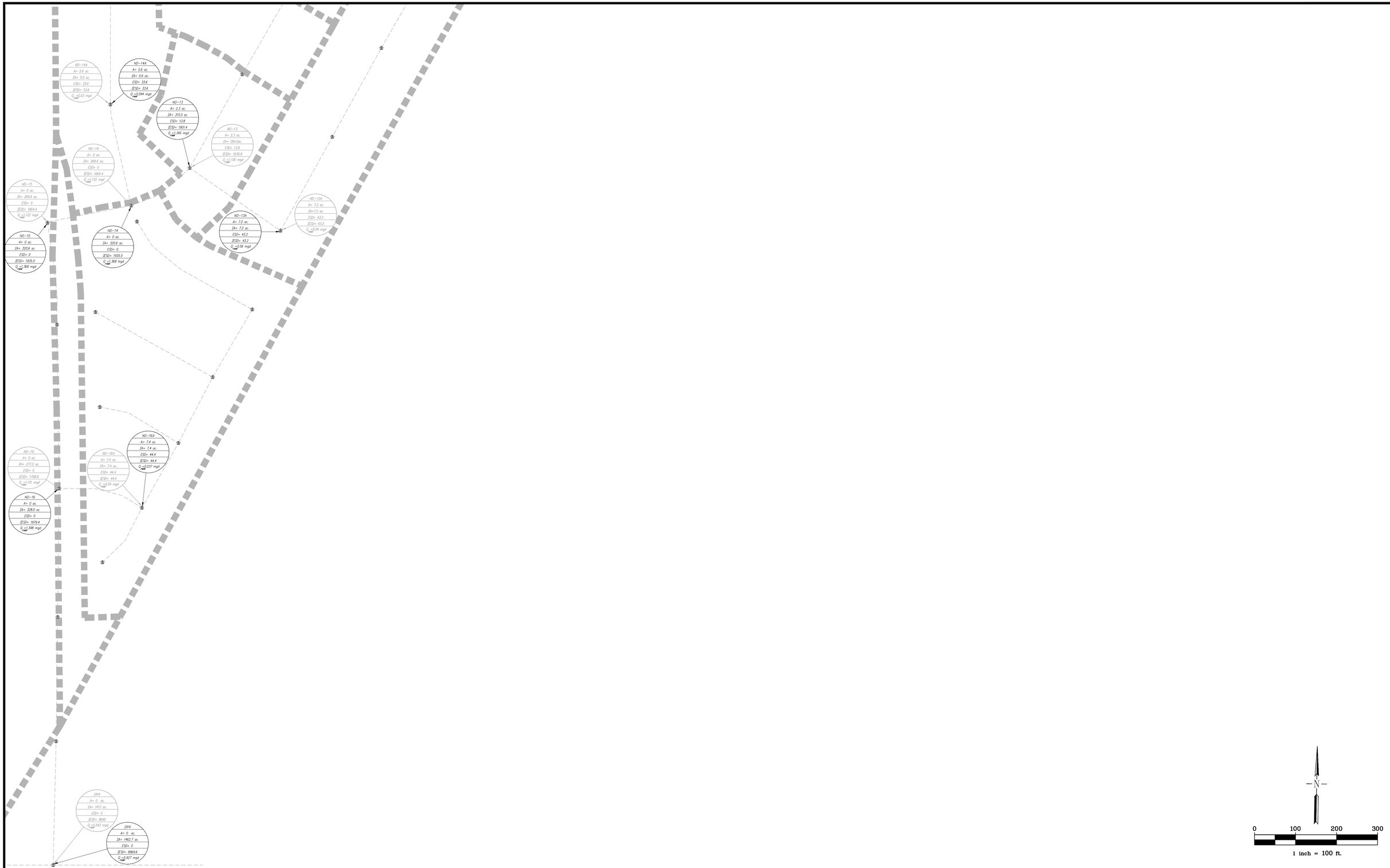
6/23/2020 16:06:09 AM RICH RADOYOS



REVISIONS NO.	DESCRIPTION	DATE	BY

SCALE
HORIZ. ____
VERT. ____

CITY OF RANCHO CORDOVA

DRAWN BY: A. ZAMORANO
DATE 2/2020

DESIGNED BY: S. BOWMAN
R.C.E. 71924 DATE 2/2020

CHECKED BY: S. BOWMAN
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SEWER STUDY FOR
THE PRESERVE

PROJECT NO. 165018

EXHIBIT B

DWG. NO.
SHEET 5 — OF — 5

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EXHIBIT C
THE PRESERVE

(Note: Node (MH) Data Applies to Pipes Downstream of Subject Node)

Up Stream Node#	Down Stream Node#	**LDR (ac)**	ESD's (By Area)	ESD's (By Lot)	**Park (ac)**	ESD's	Total Area (ac)	Total ESD's	Cumulative Area (ac)	Cumulative ESD's	Qavg (MGD)	Q I/I (MGD)	Peaking Factor	Q Peak DWF (MGD)	Q Peak PWWF (MGD)	Q Peak (cfs)	Dia (in)	Slope (ft/ft)	C=COLL. T=TRUNK	Capacity @ $S_{.7}$ (cfs)	Capacity @ $S_{.8}$ (cfs)	Capacity @ $S_{.9}$ (cfs)	Capacity @ S_{Full} (cfs)	@ $S_{.7}$ (MGD)	Velocity @ Qpeak & S (fps)	Upsteam MH Rim	Upstream MH INV	Upstream MH Depth
MH-60	MH-55	1.5	8.8	9.0		0.0	1.5	8.8	1.5	9.0	0.003	0.002	2.159	0.006	0.008	0.012	8	0.0070	C	0.85	0.99	1.08	1.01	0.55	0.14	244.8	238.40	6.4
MH-56	MH-55	0.6	3.6	3.0		0.0	0.6	3.6	0.6	3.6	0.001	0.001	2.219	0.002	0.003	0.005	8	0.0070	C	0.85	0.99	1.08	1.01	0.55	0.06	244.1	237.59	6.5
MH-55	MH-54	1.2	7.2	8.0		0.0	1.2	7.2	3.3	20.0	0.006	0.005	2.104	0.013	0.018	0.027	8	0.0035	C	0.60	0.71	0.77	0.72	0.39	0.31	243.1	236.69	6.4
MH-54	MH-53	1.4	8.1	9.0		0.0	1.4	8.1	4.6	29.0	0.009	0.006	2.078	0.019	0.025	0.039	8	0.0035	C	0.60	0.71	0.77	0.72	0.39	0.45	242.2	235.76	6.4
MH-52	MH-51	1.3	7.5	7.0		0.0	1.3	7.5	1.3	7.5	0.002	0.002	2.175	0.005	0.006	0.010	8	0.0070	C	0.85	0.99	1.08	1.01	0.55	0.11	241.2	233.51	7.7
MH-53	MH-45	0.2	1.2	0.0		0.0	0.2	1.2	4.8	29.0	0.009	0.007	2.078	0.019	0.025	0.039	8	0.0035	C	0.60	0.71	0.77	0.72	0.39	0.45	241.2	234.93	6.3
MH-47	MH-46	1.0	6.0	6.0		0.0	1.0	6.0	1.0	6.0	0.002	0.001	2.186	0.004	0.005	0.008	8	0.0070	C	0.85	0.99	1.08	1.01	0.55	0.10	242.6	236.12	6.5
MH-46	MH-45	1.7	10.0	13.0		0.0	1.7	10.0	2.7	19.0	0.006	0.004	2.108	0.012	0.016	0.025	8	0.0035	C	0.60	0.71	0.77	0.72	0.39	0.29	241.8	235.40	6.4
MH-44	MH-43	1.4	8.1	8.0		0.0	1.4	8.1	1.4	8.1	0.003	0.002	2.166	0.005	0.007	0.011	8	0.0070	C	0.85	0.99	1.08	1.01	0.55	0.13	239.8	232.28	7.5
MH-45	MH-38	0.2	1.2	0.0		0.0	0.2	1.2	7.7	48.0	0.015	0.011	2.042	0.030	0.041	0.064	8	0.0035	C	0.60	0.71	0.77	0.72	0.39	0.73	240.8	233.95	6.9
MH-59	MH-58	1.0	6.0	4.0		0.0	1.0	6.0	1.0	6.0	0.002	0.001	2.186	0.004	0.005	0.008	8	0.0070	C	0.85	0.99	1.08	1.01	0.55	0.10	245.9	239.42	6.5
MH-58	MH-57	2.3	14.0	14.0		0.0	2.3	14.0	3.3	20.0	0.006	0.005	2.104	0.013	0.018	0.027	8	0.0035	C	0.60	0.71	0.77	0.72	0.39	0.31	244.4	238.09	6.3
MH-57	MH-48	1.3	8.0	9.0		0.0	1.3	8.0	4.7	28.1	0.009	0.007	2.080	0.018	0.025	0.038	8	0.0035	C	0.60	0.71	0.77	0.72	0.39	0.44	243.0	236.58	6.4
MH-48	MH-40	0.9	5.5	6.0		0.0	0.9	5.5	5.6	33.6	0.010	0.008	2.067	0.022	0.029	0.045	8	0.0035	C	0.60	0.71	0.77	0.72	0.39	0.52	242.4	235.58	6.8
MH-40	MH-39	1.3	7.6	8.0		0.0	1.3	7.6	6.9	41.2	0.013	0.010	2.053	0.026	0.036	0.055	8	0.0035	C	0.60	0.71	0.77	0.72	0.39	0.64	241.4	234.66	6.7
MH-39	MH-38	1.1	6.8	7.0		0.0	1.1	6.8	8.0	48.0	0.015	0.011	2.042	0.030	0.042	0.064	8	0.0035	C	0.60	0.71	0.77	0.72	0.39	0.74	240.7	233.72	7.0
MH-37	MH-36	1.0	6.0	6.0		0.0	1.0	6.0	1.0	6.0	0.002	0.001	2.186	0.004	0.005	0.008	8	0.0070	C	0.85	0.99	1.08	1.01	0.55	0.10	239.3	232.92	6.4
MH-38	MH-29	0.2	1.2	0.0		0.0	0.2	1.2	15.9	96.0	0.030	0.022	1.990	0.059	0.081	0.126	8	0.0035	C	0.60	0.71	0.77	0.72	0.39	1.46	239.4	232.94	6.5
MH-33	MH-30	0.8	4.5	5.0		0.0	0.8	4.5	0.8	5.0	0.002	0.001	2.197	0.003	0.004	0.007	8	0.0070	C	0.85	0.99	1.08	1.01	0.55	0.08	241.4	234.69	6.7
MH-32A	MH-32	1.0	6.0	6.0		0.0	1.0	6.0	1.0	6.0	0.002	0.001	2.186	0.004	0.005	0.008	8	0.0070	C	0.85	0.99	1.08	1.01	0.55	0.00	244.5	236.08	8.4
MH-32	MH-31	1.2	6.9	7.0		0.0	1.2	6.9	2.2	13.0	0.004	0.003	2.134	0.009	0.012	0.018	8	0.0070	C	0.85	0.99	1.08	1.01	0.55	0.21	242.9	234.75	8.2
MH-31	MH-30	1.4	8.1	9.0		0.0	1.4	8.1	3.5	22.0	0.007	0.005	2.097	0.014	0.019	0.030	8	0.0035	C	0.60	0.71	0.77	0.72	0.39	0.34	241.5	234.10	7.4
MH-30	MH-29	1.9	11.5	11.0		0.0	1.9	11.5	6.2	38.0	0.012	0.009	2.058	0.024	0.033	0.051	8	0.0035	C	0.60	0.71	0.77	0.72	0.39	0.58	240.6	233.11	7.5
MH-29	MH-28	1.1	6.3	6.0		0.0	1.1	6.3	23.1	140.0	0.043	0.032	1.961	0.085	0.117	0.182	8	0.0035	C	0.60	0.71	0.77	0.72	0.39	2.11	239.3	231.95	7.4
MH-51	MH-50	2.1	12.5	11.0		0.0	2.1	12.5	3.3	20.0	0.006	0.005	2.104	0.013	0.018	0.027	8	0.0070	C	0.85	0.99	1.08	1.01	0.55	0.31	238.8	232.33	6.5
MH-50	MH-49	1.2	7.3	6.0		0.0	1.2	7.3	4.6	27.4	0.008	0.006	2.082	0.018	0.024	0.037	8	0.0035	C	0.60	0.71	0.77	0.72	0.39	0.43	237.6	230.90	6.7
MH-49	MH-41	0.9	5.6	4.0		0.0	0.9	5.6	5.5	32.9	0.010	0.008	2.069	0.021	0.029	0.045	8	0.0035	C	0.60	0.71	0.77	0.72	0.39	0.51	236.0	229.47	6.5
MH-43	MH-42	2.3	14.0	12.0		0.0	2.3	14.0	3.7	22.1	0.007	0.005	2.097	0.014	0.020	0.030	8	0.0070	C	0.85	0.99	1.08	1.01	0.55	0.35	239.0	231.30	7.7
MH-42	MH-41	2.2	13.0	12.0		0.0	2.2	13.0	5.9	35.1	0.011	0.008	2.064	0.022	0.031	0.047	8	0.0035	C	0.60	0.71	0.77	0.72	0.39	0.54	237.2	229.88	7.3
MH-41	MH-24	0.8	4.8	3.0		0.0	0.8	4.8	12.1	72.8	0.023	0.017	2.011	0.045	0.062	0.097	8	0.0035	C	0.60	0.71	0.77	0.72	0.39	1.11	235.4	228.46	6.9
MH-36	MH-36A	1.8	10.5	10.0		0.0	1.8	10.5	2.8	16.5	0.005	0.004	2.117	0.011	0.015	0.023	8	0.0070	C	0.85	0.99	1.08	1.01	0.55	0.26	238.5	232.15	6.3
MH-36A	MH-27	0.2	1.2	0.0		0.0	0.2	1.2	3.0	17.7	0.005	0.004	2.112	0.012	0.016	0.024	8	0.0035	C	0.60	0.71	0.77	0.72	0.39	0.28	237.4	231.02	6.4
MH-35	MH-24	1.8	10.7	10.0		0.0	1.8	10.7	2.8	28.4	0.009	0.004	2.079	0.018	0.022	0.035	8	0.0035	C	0.60	0.71	0.77	0.72	0.39	0.40	236.3	228.67	7.6
MH-35A	MH-35	1.1	6.3	6.0		0.0	1.1	6.3	1.1	6.3	0.002	0.001	2.182	0.004	0.006	0.009	8	0.0035	C	0.60	0.71	0.77	0.72	0.39	0.10	236.8	229.58	7.2
MH-25	MH-24	0.8	4.9	4.0		0.0	0.8	4.9	0.8	4.9	0.002	0.001	2.199	0.003	0.004	0.007	8	0.0070	C	0.85	0.99	1.08	1.01	0.55	0.08	235.3	228.99	6.3
MH-24	MH-22	0.0	0.0	0.0		0.0	0.0	0.0	15.8	106.1	0.033	0.022	1.982	0.065	0.087	0.135	8	0.0035	C	0.60	0.71	0.77	0.72	0.39	1.56	234.4	227.48	6.9
MH-23	MH-22	0.8	4.7	6.0		0.0	0.8	4.7	0.8	6.0	0.002	0.001	2.186	0.004	0.005	0.008	8	0.0070	C	0.85	0.99	1.08	1.01	0.55	0.09	234.6	227.54	7.1
MH-22	MH-21	0.0	0.0	0.0		0.0	0.0	0.0	16.6	110.8	0.034	0.023	1.979	0.068	0.091	0.141	8	0.0035	C	0.60	0.71	0.77	0.72	0.39	1.63	233.6	226.46	7.1
MH-18	MH-16	0.6	3.5	3.0		0.0	0.6	3.5	0.6	3.5	0.001	0.001	2.220	0.002	0.003	0.005	8	0.0070	C	0.85	0.99	1.08	1.01	0.55	0.06	234.0	227.35	6.7
MH-17	MH-16	0.5	3.2	4.0		0.0	0.5	3.2	0.5	4.0	0.001	0.001	2.212	0.003	0.003	0.005	8	0.0070	C	0.85	0.99	1.08	1.01	0.55	0.06	234.7	226.85	7.8
MH-16	MH-15	1.4	8.1	10.0		0.0	1.4	8.1	2.4	17.0	0.005	0.003	2.115	0.011	0.015	0.022	8	0.0035	C	0.60	0.71	0.77	0.72	0.39	0.26	233.9	226.25	7.7

EXHIBIT C
THE PRESERVE

(Note: Node (MH) Data Applies to Pipes Downstream of Subject Node)

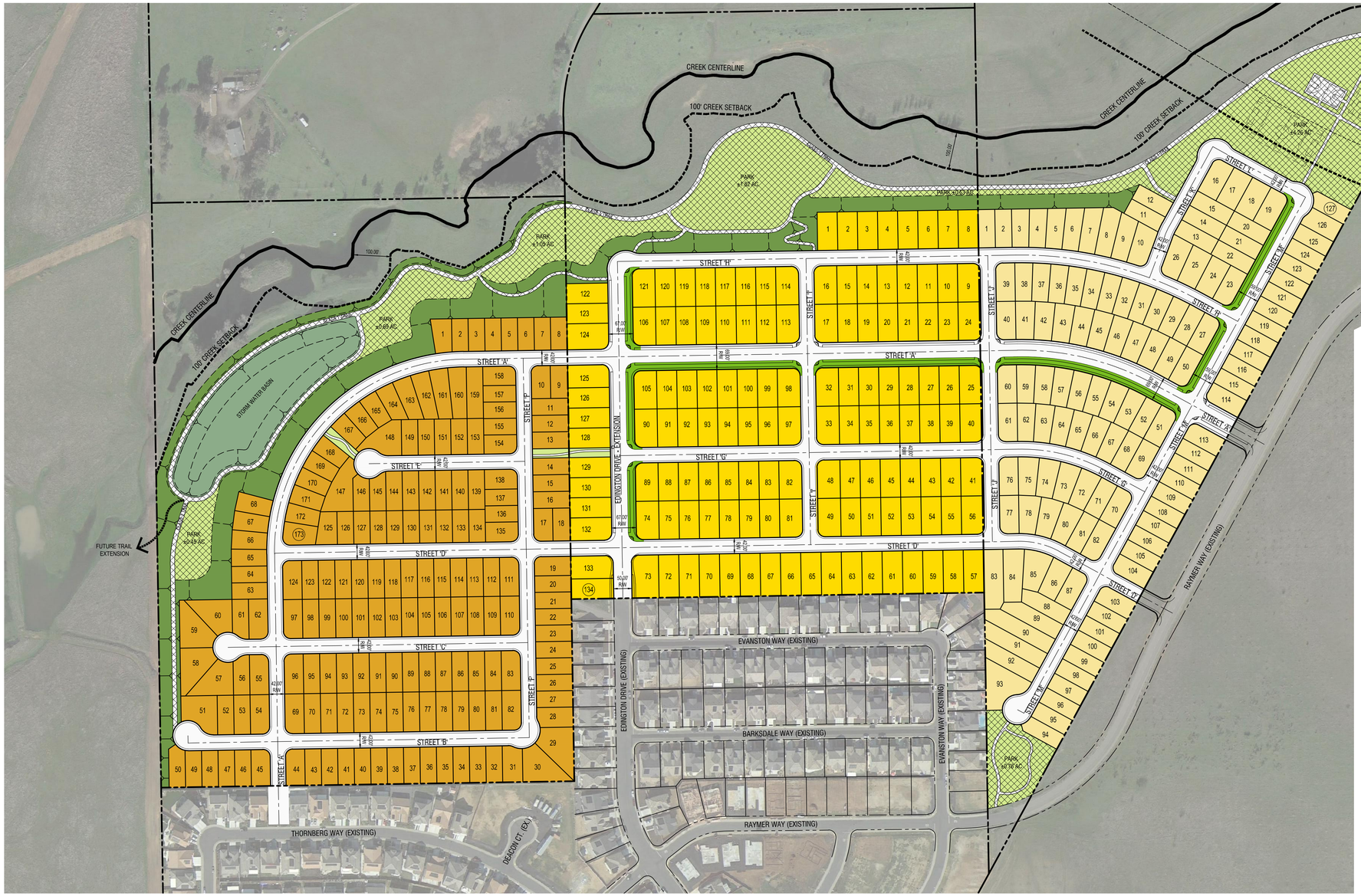
Up Stream Node#	Down Stream Node#	**LDR (ac)**	ESD's (By Area)	ESD's (By Lot)	**Park (ac)**	ESD's	Total Area (ac)	Total ESD's	Cumulative Area (ac)	Cumulative ESD's	Qavg (MGD)	Q I/I (MGD)	Peaking Factor	Q Peak DWF (MGD)	Q Peak PWWF (MGD)	Q Peak (cfs)	Dia (in)	Slope (ft/ft)	C=COLL. T=TRUNK	Capacity @ $S_{.7}$ (cfs)	Capacity @ $S_{.8}$ (cfs)	Capacity @ $S_{.9}$ (cfs)	Capacity @ S_{Full} (cfs)	@ $S_{.7}$ (MGD)	Velocity @ Qpeak & S (fps)	Upsteam MH Rim	Upstream MH INV	Upstream MH Depth
MH-21	MH-20	0.8	4.6	5.0		0.0	0.8	4.6	17.3	115.4	0.036	0.024	1.976	0.071	0.095	0.147	8	0.0035	C	0.60	0.71	0.77	0.72	0.39	1.70	232.6	226.20	6.4
MH-20	MH-19	1.7	10.0	11.0		0.0	1.7	10.0	19.0	125.5	0.039	0.027	1.970	0.077	0.103	0.160	8	0.0035	C	0.60	0.71	0.77	0.72	0.39	1.85	232.8	225.47	7.3
MH-19	MH-14	1.4	8.4	0.0		0.0	1.4	8.4	19.0	125.5	0.039	0.027	1.970	0.077	0.103	0.160	8	0.0035	C	0.60	0.71	0.77	0.72	0.39	1.85	231.2	224.56	6.6
MH-15	MH-14	1.2	6.9	8.0		0.0	1.2	6.9	3.6	25.0	0.008	0.005	2.088	0.016	0.021	0.033	8	0.0035	C	0.60	0.71	0.77	0.72	0.39	0.38	232.9	225.34	7.6
MH-14	MH-9	1.4	8.4	9.0		0.0	1.4	8.4	24.0	155.6	0.048	0.034	1.953	0.094	0.128	0.198	8	0.0035	C	0.60	0.71	0.77	0.72	0.39	2.30	231.2	223.94	7.3
MH-4	MH-12	1.2	6.9	7.0		0.0	1.2	6.9	1.2	7.0	0.002	0.002	2.175	0.005	0.006	0.010	8	0.0070	C	0.85	0.99	1.08	1.01	0.55	0.11	236.6	228.06	8.5
MH-12	MH-11	0.5	3.0	3.0		0.0	0.5	3.0	1.7	10.0	0.003	0.002	2.152	0.007	0.009	0.014	8	0.0035	C	0.60	0.71	0.77	0.72	0.39	0.16	237.2	226.02	11.2
MH-11	MH-10	1.8	10.6	13.0		0.0	1.8	10.6	3.9	26.0	0.008	0.005	2.086	0.017	0.022	0.034	8	0.0035	C	0.60	0.71	0.77	0.72	0.39	0.40	233.6	225.22	8.4
MH-10	MH-9	1.6	9.5	12.0		0.0	1.6	9.5	5.5	38.0	0.012	0.008	2.058	0.024	0.032	0.049	8	0.0035	C	0.60	0.71	0.77	0.72	0.39	0.57	232.6	223.90	8.7
MH-9	MH-5	0.4	2.6	3.0		0.0	0.4	2.6	29.9	190.9	0.059	0.042	1.937	0.115	0.156	0.242	8	0.0035	C	0.60	0.71	0.77	0.72	0.39	2.84	231.0	222.67	8.3
MH-8	MH-7	2.2	13.0	16.0		0.0	2.2	13.0	2.2	16.0	0.005	0.003	2.119	0.011	0.014	0.021	8	0.0070	C	0.85	0.99	1.08	1.01	0.55	0.24	236.5	225.11	11.4
MH-7	MH-5	1.6	9.8	12.0		0.0	1.6	9.8	3.8	28.0	0.009	0.005	2.080	0.018	0.023	0.036	8	0.0035	C	0.60	0.71	0.77	0.72	0.39	0.41	234.4	222.86	11.5
MH-6	MH-5	1.5	9.2	8.0		0.0	1.5	9.2	1.5	9.2	0.003	0.002	2.157	0.006	0.008	0.013	8	0.0035	C	0.60	0.71	0.77	0.72	0.39	0.15	232.4	222.69	9.7
MH-5	MH-1	0.0	0.0	0.0		0.0	0.0	0.0	35.2	222.8	0.069	0.049	1.925	0.133	0.182	0.282	8	0.0035	C	0.60	0.71	0.77	0.72	0.39	3.33	232.8	221.72	11.1
MH-4	MH-3	2.1	12.7	15.0		0.0	2.1	12.7	2.1	15.0	0.005	0.003	2.124	0.010	0.013	0.020	8	0.0070	C	0.85	0.99	1.08	1.01	0.55	0.23	236.6	228.06	8.5
MH-3	MH-1	1.9	11.2	14.0		0.0	1.9	11.2	4.0	29.0	0.009	0.006	2.078	0.019	0.024	0.038	8	0.0035	C	0.60	0.71	0.77	0.72	0.39	0.43	235.3	222.00	13.3
MH-2	MH-1	1.8	10.6	10.0		0.0	1.8	10.6	1.8	10.6	0.003	0.002	2.148	0.007	0.009	0.015	8	0.0035	C	0.60	0.71	0.77	0.72	0.39	0.17	229.4	222.53	6.9
MH-1	MH-1A	0.0	0.0	0.0		0.0	0.0	0.0	41.0	257.3	0.080	0.057	1.914	0.153	0.210	0.325	8	0.0035	C	0.60	0.71	0.77	0.72	0.39	3.88	234.5	220.77	13.7
MH-1A	ND-4	11.0	66.0	62.0		0.0	11.0	66.0	52.0	323.3	0.100	0.073	1.896	0.190	0.263	0.406	8	0.0035	C	0.60	0.71	0.77	0.72	0.39	4.96	234.5	219.40	15.1
MH-28	MH-27	1.9	11.3	11.0		0.0	1.9	11.3	25.0	151.0	0.047	0.035	1.955	0.092	0.127	0.196	8	0.0035	C	0.60	0.71	0.77	0.72	0.39	2.28	238.7	231.14	7.6
MH-27	MH-27A	1.4	8.3	8.0		0.0	1.4	8.3	29.3	175.0	0.054	0.041	1.944	0.105	0.147	0.227	8	0.0035	C	0.60	0.71	0.77	0.72	0.39	2.65	236.9	230.03	6.9
MH-27A	MH-26	1.5	9.1	8.0		0.0	1.5	9.1	30.9	183.0	0.057	0.043	1.941	0.110	0.153	0.237	8	0.0035	C	0.60	0.71	0.77	0.72	0.39	2.78	236.7	229.04	7.7
MH-11A	MH-11	0.4	2.6	3.0		0.0	0.4	2.6	0.4	3.0	0.001	0.001	2.230	0.002	0.003	0.004	8	0.0070	C	0.85	0.99	1.08	1.01	0.55	0.05	233.0	225.72	7.3
MH-26	MH-26A	0.6	3.6	2.0		0.0	0.6	3.6	31.5	185.0	0.057	0.044	1.940	0.111	0.155	0.240	8	0.0035	C	0.60	0.71	0.77	0.72	0.39	2.82	235.2	228.10	7.1
MH-26A	ND-1	15.0	90.0	82.0		0.0	15.0	90.0	45.9	274.9	0.085	0.064	1.909	0.163	0.227	0.351	8	0.0035	C	0.60	0.71	0.77	0.72	0.39	4.21	234.6	227.40	7.2
ND-1	ND-2	20.0	120.0			0.0	20.0	120.0	65.9	394.9	0.122	0.079	1.879	0.230	0.309	0.478	8	0.0035	C	0.60	0.71	0.77	0.72	0.39	2.20			
ND-2	ND-3	10.3	61.8			0.0	10.3	61.8	76.2	456.7	0.142	0.091	1.868	0.264	0.356	0.551	8	0.0035	C	0.60	0.71	0.77	0.72	0.39	2.26			
ND-3	ND-5	1.8	10.8			0.0	1.8	10.8	78.0	467.5	0.145	0.094	1.866	0.270	0.364	0.563	8	0.0035	C	0.60	0.71	0.77	0.72	0.39	2.28			
ND-4	ND-5	0.8	4.8	4.0		0.0	0.8	4.8	52.8	328.1	0.102	0.063	1.894	0.193	0.256	0.396	8	0.0035	C	0.60	0.71	0.77	0.72	0.39	2.12			
ND-5	ND-6	0.0	0.0			0.0	0.0	0.0	130.7	795.6	0.247	0.157	1.822	0.449	0.606	0.938	10	0.0034	C	1.07	1.24	1.35	1.26	0.69	2.56			
ND-6	ND-7	4.6	27.6		9.0	54.0	13.6	81.6	144.3	877.2	0.272	0.173	1.813	0.493	0.666	1.031	10	0.0036	C	1.10	1.27	1.39	1.30	0.71	2.68			
ND-7	ND-8	8.1	48.6			0.0	8.1	48.6	152.4	925.8	0.287	0.183	1.809	0.519	0.702	1.086	10	0.0036	C	1.10	1.27	1.39	1.30	0.71	2.71			
ND-8	ND-9	7.2	43.2			0.0	7.2	43.2	159.6	969.0	0.300	0.192	1.805	0.542	0.734	1.135	10	0.0025	C	0.92	1.06	1.16	1.08	0.59	2.30			
ND-9	ND-10	3.3	19.8			0.0	3.3	19.8	162.9	988.8	0.307	0.195	1.803	0.553	0.748	1.158	10	0.0031	C	1.02	1.18	1.29	1.21	0.66	2.56			
ND-10A	ND-10	126.9	761.4			0.0	126.9	761.4	126.9	761.4	0.236	0.152	1.825	0.431	0.583	0.902	12	0.0097	C	2.94	3.43	3.74	3.51	1.90	3.81			
ND-10	ND-11	8.9	53.4			0.0	8.9	53.4	298.7	1803.6	0.559	0.299	1.752	0.979	1.278	1.977	15	0.0015	T	2.10	2.45	2.67	2.50	1.36	2.23			
ND-11	ND-12	4.0	24.0			0.0	4.0	24.0	302.7	1827.6	0.567	0.303	1.750	0.992	1.294	2.003	15	0.0015	T	2.10	2.45	2.67	2.50	1.36	2.23			
ND-12	ND-13	2.8	16.8			0.0	2.8	16.8	305.5	1844.4	0.572	0.306	1.750	1.000	1.306	2.020	15	0.0036	T	3.25	3.79	4.13	3.88	2.10	3.14			
ND-13A	ND-13	7.2	43.2			0.0	7.2	43.2	7.2	43.2	0.013	0.009	2.049	0.027	0.036	0.056	8	0.0035	C	0.60	0.71	0.77	0.72	0.39	1.23			
ND-13	ND-14	2.3	13.8			0.0	2.3	13.8	315.0	1901.4	0.589	0.315	1.747	1.030	1.345	2.081	15	0.0015	T	2.10	2.45	2.67	2.50	1.36	2.25			
ND-14A	ND-14	5.6	33.6			0.0	5.6	33.6	5.6	33.6	0.010	0.007	2.067	0.022	0.028	0.044	8	0.0096	C	0.99	1.17	1.28	1.20	0.64	1.67			

EXHIBIT C
THE PRESERVE

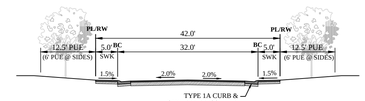
(Note: Node (MH) Data Applies to Pipes Downstream of Subject Node)

Up Stream Node#	Down Stream Node#	**LDR (ac)**	ESD's (By Area)	ESD's (By Lot)	**Park (ac)**	ESD's	Total Area (ac)	Total ESD's	Cumulative Area (ac)	Cumulative ESD's	Qavg (MGD)	Q I/I (MGD)	Peaking Factor	Q Peak DWF (MGD)	Q Peak PWWF (MGD)	Q Peak (cfs)	Dia (in)	Slope (ft/ft)	C=COLL. T=TRUNK	Capacity @ $S_{.7}$ (cfs)	Capacity @ $S_{.8}$ (cfs)	Capacity @ $S_{.9}$ (cfs)	Capacity @ S_{Full} (cfs)	@ $S_{.7}$ (MGD)	Velocity @ Qpeak & S (fps)	Upsteam MH Rim	Upstream MH INV	Upstream MH Depth
ND-14	ND-15	0.0	0.0			0.0	0.0	0.0	320.6	1935.0	0.600	0.321	1.745	1.047	1.368	2.116	15	0.0015	T	2.10	2.45	2.67	2.50	1.36	2.25			
ND-15	ND-16	0.0	0.0			0.0	0.0	0.0	320.6	1935.0	0.600	0.321	1.745	1.047	1.368	2.116	15	0.0137	T	6.33	7.39	8.06	7.56	4.09	5.19			
ND-16A	ND-16	7.4	44.4			0.0	7.4	44.4	7.4	44.4	0.014	0.009	2.047	0.028	0.037	0.057	8	0.0035	C	0.60	0.71	0.77	0.72	0.39	1.23			
ND-16	DR4	0.0	0.0			0.0	0.0	0.0	328.0	1979.4	0.614	0.328	1.743	1.070	1.398	2.163	15	0.0144	T	6.49	7.58	8.26	7.75	4.19	5.32			
DR4	OUT	1134.7	6990.2			0.0	1134.7	6990.2	1462.7	8969.6	2.781	1.463	1.606	4.464	5.927	9.171	24	0.0021	T	8.68	10.13	11.05	10.37	5.61	3.71			

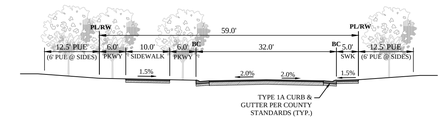
		321.0			9.0		330.0	
ΣESD			1926.0			54.0		1980.0



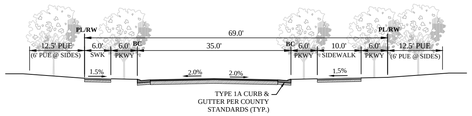
STREET SECTIONS



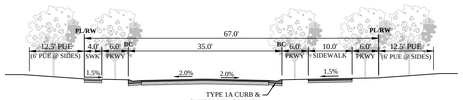
42' RIGHT OF WAY
RESIDENTIAL STREET
NOT TO SCALE



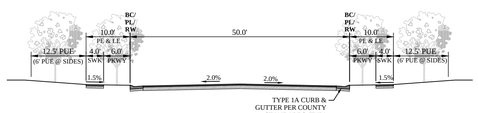
59' RIGHT OF WAY
RESIDENTIAL STREET
NOT TO SCALE



69' RIGHT OF WAY
RESIDENTIAL COLLECTOR STREET
NOT TO SCALE



67' RIGHT OF WAY
EDINGTON DRIVE EXTENSION
NOT TO SCALE



50' RIGHT OF WAY
EDINGTON DRIVE EXTENSION
NOT TO SCALE

NOTES

1. The shown yield may vary once grading and utility concepts are prepared.
2. The shown trail and park configuration is conceptual in nature. Final design will vary based on grading, utilities, client consultation and City consultation.
3. The shown yield and layout may vary if other constraints are identified not known at the time of conceptual site plan preparation.
4. The conceptual site plan is subject to change based on City consultation.
5. Shown residential blocks do not exceed the maximum 800' block length, but the block bounded by Streets A, B, C, D & F (Lots 69 - 134 of the 45'x90' lot type) exceeds the recommended 600' block length.

REQUIRED PARK LAND

ZONING CODE CHAPTER 22.40

Formula: (# of dwelling units) x (Factor for SFD) = Amount of land in acres

Calculation: 434 x 0.01475 = 6.40 Acres

Park Area Shown: ±11.42 Acres (Includes trails, walkways, flat usable recreation areas & recreation area within future Centennial Drive Right-of-Way.)

YIELD & LOT MIX

LOT TYPE: 45'x90' (minimum)
Yield: 173 Units

LOT TYPE: 55'x105' (minimum)
Yield: 134 Units

LOT TYPE: 45'x105' (minimum)
Yield: 127 Units

Total Yield: 434 Units

LEGEND

22 Lot Number
Parcel Boundary
Lot Line
Right of Way
Street Center Line
Creek Setback
Creek Centerline
10' Sidewalk w/ 6' parkways on either side

N

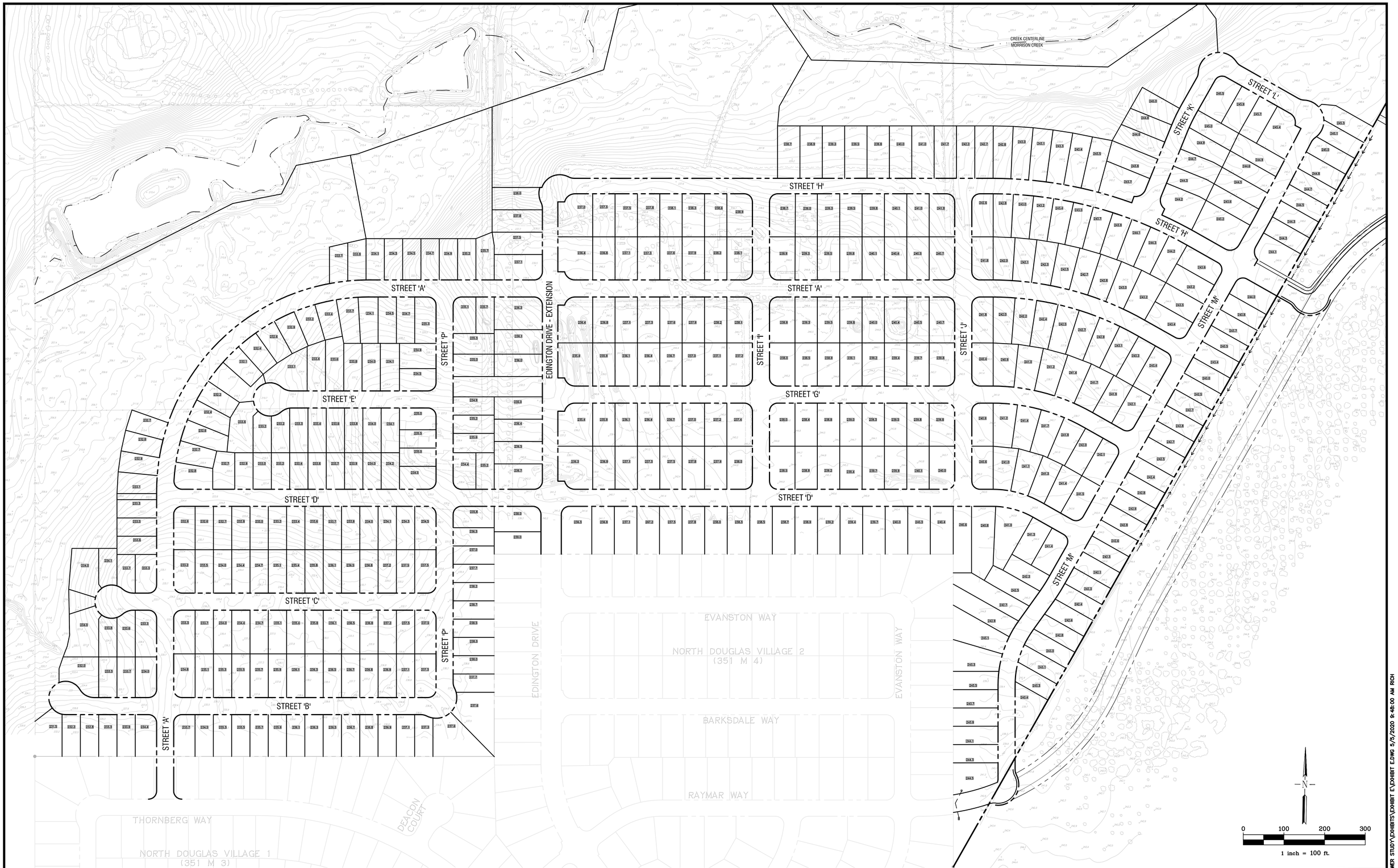
0 150 300 450
SCALE IN FEET: 1"= 150'

WINN NORTH DOUGLAS
CONCEPTUAL SITE PLAN
RANCHO CORDOVA, CA

RUGGERI-JENSEN-AZAR
ENGINEERS + PLANNERS + SURVEYORS
2541 WARREN DRIVE, SUITE 100 ROCKLIN, CA 95677
PHONE: (916) 630-8900 FAX: (916) 630-8909

AUGUST 2018
165018

EXHIBIT D



REVISIONS NO.	DESCRIPTION	DATE	BY

SCALE
HORIZ. ____
VERT. ____

CITY OF RANCHO CORDOVA

DRAWN BY: A. ZAMORANO
DATE 10/2019

DESIGNED BY: S. BOWMAN
R.C.E. 71924 DATE 10/2019

CHECKED BY: S. BOWMAN
R.C.E. 71924 DATE 10/2019

RUGGERI-JENSEN-AZAR
ENGINEERS ▪ PLANNERS ▪ SURVEYORS
2541 WARREN DRIVE, SUITE 100 ROCKLIN, CA 95677
PHONE: (916) 630-8900 FAX: (916) 630-8909

GRADING PLAN FOR
THE PRESERVE

PROJECT NO. 165018
EXHIBIT E
DWG. NO.
SHEET 1 — OF — 1

G:\2020\165018\SEWER STUDY\EXHIBITS\EXHIBIT E\EXHIBIT E.DWG 5/5/2020 9:48:00 AM RICH RADOYOS

RUGGERI-JENSEN-AZAR
ENGINEERS • PLANNERS • SURVEYORS

January 7, 2021 JN: 165018

Mr. Bob Shattuck
Shattuck Community Planning
6589 Laurel Crest Circle
Roseville, CA 95678

RE: The Preserve – Unit Count Increase on Sewer and Water Studies

Mr. Shattuck:

As you are aware, the original Tentative Map for The Preserve had a unit count of 434 lots, as the project evolved, the unit count increased to 440 lots.

The Sewer Study reviewed and approved by the Sacramento Area Sewer District (SASD) was based on the current unit count of 440. During our last submittal to the District, we notified them of the increase and updated the sewer shed calculations.

The Water Study for the project was completed in September of 2018 and used the original unit count of 434. The additional 6 lots result in a 1.4% increase in unit count and will have a negligible impact on the water model. The existing water system has sufficient supply to support the development.

If you have any questions, please feel free to call me at (916) 630-8900.

Sincerely,

RUGGERI-JENSEN-AZAR

Rich Radoycis, P.E., LEED AP
Project Manager