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WATER   •   WASTEWATER   •   RECYCLED WATER

CONSULTING ENGINEERS

WATER SYSTEM ANALYSIS
FOR THE
WEST OAKS PROJECT

January 18, 2019

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Prepared by:
Dexter Wilson Engineering, Inc.
2234 Faraday Avenue
Carlsbad, CA 92008

Job No.: 930-011

DEXTER WILSON ENGINEERING, INC.

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.

January 18, 2019   930-011

Integral Communities
2235 Encinitas Blvd., Suite 216
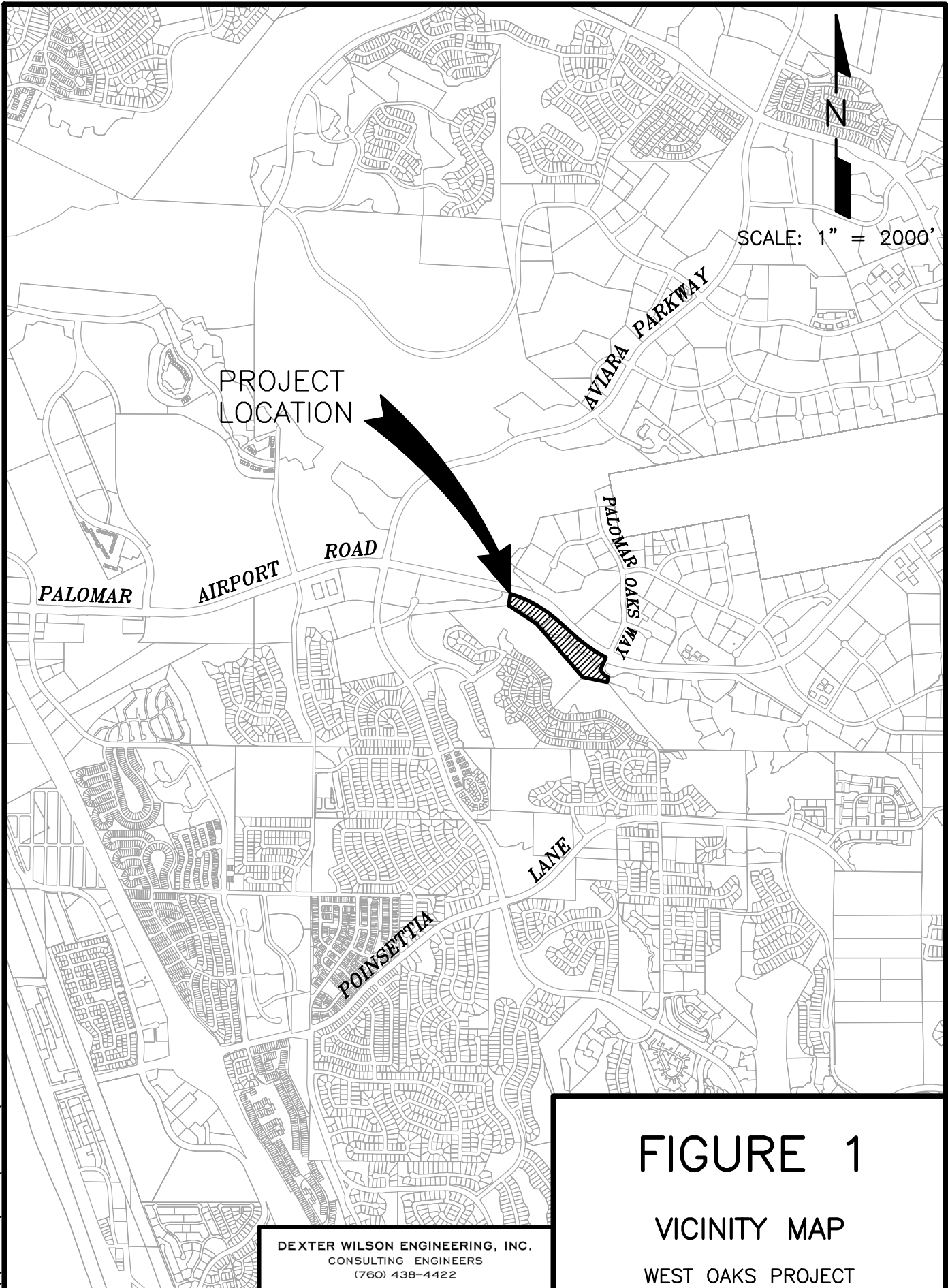Encinitas, CA 92024

Attention: Greg Waite, Project Manager

Subject: West Oaks Project Water System Analysis

Introduction

This letter-report summarizes our evaluation of the water system that will serve the proposed West Oaks Project in Carlsbad. The project is located along the south side of Palomar Airport Road at Palomar Oaks Way. Figure 1 provides a vicinity map for the project.

The existing zoning for the property is industrial. The proposed land use for the project is a mix of market rate and affordable multi-family residential units totaling 192 units. The project area is within the Carlsbad Municipal Water District (CMWD) for service. This study provides recommendations for the water system that will provide service to the project.

PROJECT
LOCATION

AVIARA PARKWAY

PALOMAR OAKS WAY

PALOMAR   AIRPORT   ROAD

POINSETTIA   LANE

SCALE: 1" = 2000'

N

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FIGURE 1

VICINITY MAP

WEST OAKS PROJECT

Water Service Design Criteria

The water system planning criteria used in this study are in accordance with the 2016 City of Carlsbad Engineering Standards Volume 2. The criteria pertinent to this study are summarized below:

- Minimum Pressure, Static = 60 psi
- Maximum Pressure, Static = 125 psi (up to 150 psi allowed with approval of City Engineer)
- Minimum Pressure, Peak Hour = 40 psi
- Minimum Pressure, Max Day plus Fire = 20 psi
- Multi-Family Demand Factor = 250 gpd/unit
- Maximum Pipeline Velocity, Peak Hour = 8.0 ft/s
- Maximum Day Demand Factor = 1.65
- Peak Hour Demand Factor = 2.9

The fire flow requirement will ultimately be provided by the fire marshal based on building square footage and construction materials. For planning purposes, the Carlsbad guidelines recommend a fire flow of 3,000 gpm for two hours for multi-family residential units.

Projected Water Demands

Table 1 summarizes the projected water demands for the West Oaks Project.

TABLE 1 WEST OAKS PROJECT PROJECTED WATER DEMANDS			
Description	Quantity	Demand Factor	Average Day Demand, gpd
Multi-Family Residential	192 units	250 gpd/unit	48,000

The projected maximum day demand for the project is 79,200 gpd (55 gpm). The projected peak hour demand is 139,200 gpd (97 gpm).

Existing Water System

The West Oaks project site has already been graded and West Oaks Way has already been constructed with utilities through the project. The project is within the CMWD 375 Zone for water service and there is a 16-inch transmission line in Palomar Airport Road that supplies the area. There is a 12-inch line in West Oaks Way that loops to the transmission line in Palomar Airport Road with connections at Palomar Oaks Way and at the west end of the project through an easement. Figure 2 graphically shows the location of existing facilities in the vicinity of the project.
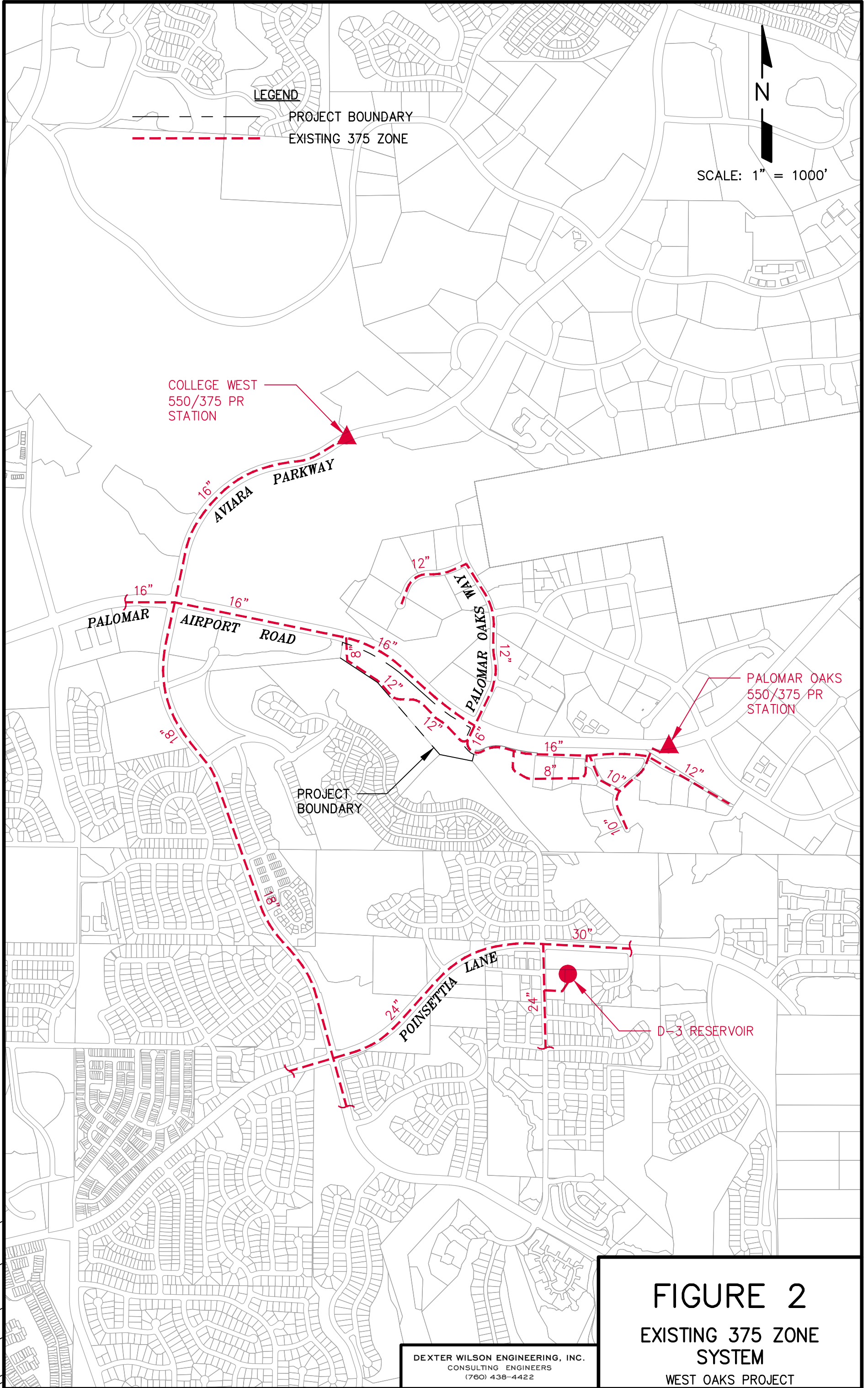
The primary sources of supply to the 375 Zone are the 550/375 Zone College West pressure reducing station located along Aviara Parkway to the north and the 550/375 Zone Palomar Oaks pressure reducing station located just east of the project. The D-3 reservoir to the south of the project provides 8.5 million gallons of storage in the 375 Zone.

Proposed Water System

It is proposed to serve the project by making connections to the existing 375 Zone line in West Oaks way to provide separate private domestic and private building fire systems for each building. Fire hydrants along the existing 12-inch line in West Oaks Way will provide fire protection for the project. Figure 3 provides the proposed water system layout and Table 2 summarizes the anticipated static pressures based on a hydraulic gradeline of 375 feet.

TABLE 2 WEST OAKS PROJECT STATIC PRESSURE SUMMARY				
Zone	Pad Elevation, Ft.		Static Pressure, PSI	
	Minimum	Maximum	Minimum	Maximum
375	113	133	105	114

LEGEND

PROJECT BOUNDARY

EXISTING 375 ZONE

N

SCALE: 1" = 1000'

COLLEGE WEST
550/375 PR
STATION

16" AVIARA PARKWAY

16" PALOMAR AIRPORT ROAD 16"

16"

12"

PALOMAR OAKS WAY

12"

8" 16"

12"

12"

16"

16"

8"

10"

12"

10"

PALOMAR OAKS
550/375 PR
STATION

PROJECT
BOUNDARY

18"

18"

30"

24"

24"

POINSETTIA LANE

D-3 RESERVOIR

FIGURE 2

EXISTING 375 ZONE
SYSTEM

WEST OAKS PROJECT

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LEGEND

—————— — — PROJECT BOUNDARY

– – – – – EXISTING WATER

⋈ EXISTING FIRE HYDRANT

⋈ PROPOSED FIRE HYDRANT

NOTE: PRIVATE WATER SYSTEM AND
PRIVATE HYDRANTS NOT SHOWN

SCALE: 1" = 200'

0   200
▬▬▬▬▬ FEET

PALOMAR OAKS WAY

PALOMAR AIRPORT ROAD

WEST OAKS WAY

16"   16"   12"   12"   16"   16"   8"   12"

PROJECT
BOUNDARY

\ARTIC\DWG\930011\WATER\FIGURE-3-PRO-W.DWG 01-18-19 08:30:46 LAYOUT: LAYOUT
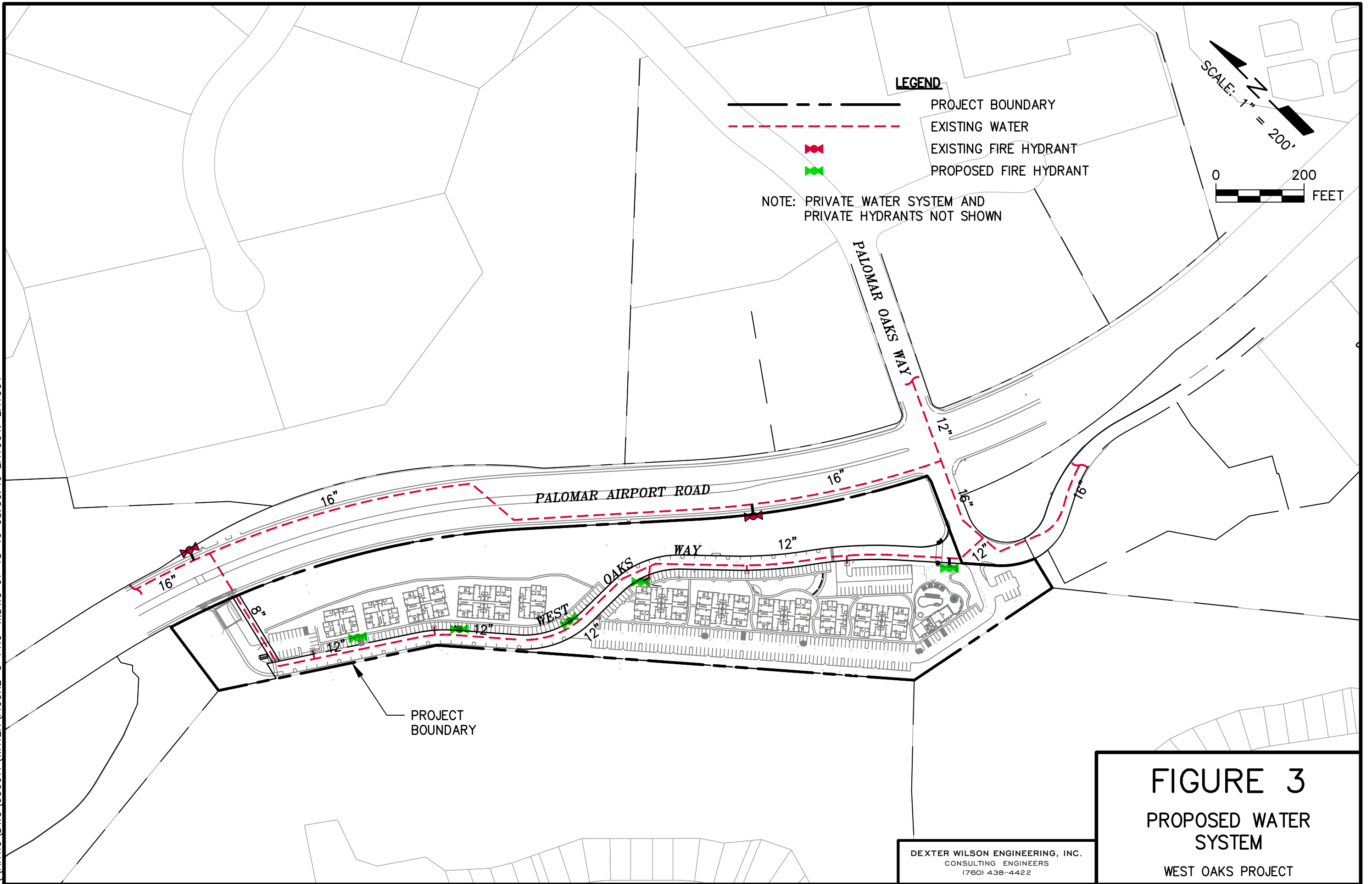
FIGURE 3

PROPOSED WATER SYSTEM

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Water System Hydraulic Analysis

Analysis using the KYPIPE computer software developed by the University of Kentucky determined residual pressures for the proposed fire protection system. This computer software utilizes the Hazen-Williams equation for determining headloss in pipes. The Hazen-Williams "C" value used in the analysis is 130. To simulate losses through the backflow preventer, a minor loss coefficient was input.

The system was modeled under average day, peak hour, and maximum day demand plus fire flow scenarios. The hydraulic gradeline used for the model was 375 feet for average day demands and 360 feet during peak hour and maximum day demand plus fire flow scenarios. These gradelines are based on data in the Carlsbad Master Plan for the pressure reducing stations that feed the project area. The system has been designed to provide a minimum residual pressure of greater than 20 psi during a fire flow scenario at all locations within the proposed project development. For the project, fire flows were modeled at the most remote location within the site, splitting the required fire flow between two hydrants.

Appendix A provides the computer modeling output for the hydraulic analysis and Exhibit A provides the corresponding node and pipe diagram. The results of the analysis indicate that the system is capable of meeting the required fire flow with greater than 20 psi residual pressure at all locations within the project.

Local Facilities Management Plan

The West Oaks project is within Zone 5 of the Local Facilities Management Plan (LFMP) prepared by the City of Carlsbad in 1987. The LFMP does not provide existing or projected demand estimates for the development within Zone 5. The LFMP indicates that all development will be conditioned to install adequate domestic water and fire flow facilities to ensure conformance with adopted standards. Development will also pay applicable fees for capital improvements.

The change in zoning from industrial to multi-family residential will not impact the existing utilities that have been constructed to serve the property. Aside from the hydraulic analysis that has been conducted in this study to verify this, Carlsbad guidelines require a fire flow of 4,000 gpm for industrial areas for planning purposes whereas multi-family residential sites are planned for a less stringent fire flow of 3,000 gpm. The average annual water demand from a multi-family residential use will be more than anticipated from industrial use, but the increase for this site will have a negligible impact on local and regional water distribution facilities that serve the area.

Conclusions

Water service can be provided to the West Oaks project by the Carlsbad Municipal Water District 375 Zone system. Water service is proposed to be provided by connecting to the existing 375 Zone water line in West Oaks Way. The project will have a higher annual average water use than what was projected with the existing industrial zoning, but the fire flow requirement is less for multi-family than industrial so the existing line in West Oaks Way will adequately serve the proposed project. The hydraulic analysis conducted in this study verifies the adequacy of the existing system. Figure 3 provides the proposed water system layout for the project.

If you have any questions on the information contained herein, please let us know.

Dexter Wilson Engineering, Inc.

Stephen M. Nielsen, P.E.

SMN:pjs

APPENDIX A

COMPUTER MODELING OUTPUT

The following conditions were modeled:

1. Average Day Demands

2. Peak Hour Demands

3. Maximum Day Demands plus 3,000 gpm fire flow split between Nodes 14 and 16.

FLOWRATE IS EXPRESSED IN GPM AND PRESSURE IN PSIG

A SUMMARY OF THE ORIGINAL DATA FOLLOWS

PIPE NO.	NODE NOS.		LENGTH (FEET)	DIAMETER (INCHES)	ROUGHNESS	MINOR LOSS K	FIXED GRADE
1	0	2	350.0	16.0	130.0	.00	375.00
3	2	4	200.0	16.0	130.0	.00	
5	2	6	325.0	12.0	130.0	.00	
7	6	8	425.0	12.0	130.0	.00	
9	8	10	350.0	12.0	130.0	.00	
11	10	12	180.0	12.0	130.0	.00	
13	12	14	275.0	12.0	130.0	.00	
15	14	16	90.0	12.0	130.0	.00	
17	16	18	275.0	8.0	130.0	.00	
19	4	18	1700.0	16.0	130.0	.00	

JUNCTION NUMBER	DEMAND	ELEVATION	CONNECTING PIPES		
2	4.00	140.00	1	3	5
4	.00	150.00	3	19	
6	5.00	125.00	5	7	
8	5.00	118.00	7	9	
10	5.00	112.00	9	11	
12	5.00	110.00	11	13	
14	5.00	109.00	13	15	
16	4.00	108.00	15	17	
18	.00	110.00	17	19	

OUTPUT SELECTION: ALL RESULTS ARE OUTPUT EACH PERIOD

   THIS SYSTEM HAS 10 PIPES WITH   9 JUNCTIONS ,   1 LOOPS AND   1 FGNS

THE RESULTS ARE OBTAINED AFTER 7 TRIALS WITH AN ACCURACY = .00441

WEST OAKS WATER SYSTEM ANALYSIS   930011A

AVERAGE DAY DEMANDS

PIPE NO.	NODE NOS.		FLOWRATE	HEAD LOSS	PUMP HEAD	MINOR LOSS	VELOCITY	HL/1000
1	0	2	33.00	.00	.00	.00	.05	.00
3	2	4	9.59	.00	.00	.00	.02	.00
5	2	6	19.41	.00	.00	.00	.06	.00

7	6	8	14.41	.00	.00	.00	.04	.00
9	8	10	9.41	.00	.00	.00	.03	.00
11	10	12	4.41	.00	.00	.00	.01	.00
13	12	14	-.59	.00	.00	.00	.00	.00
15	14	16	-5.59	.00	.00	.00	-.02	.00
17	16	18	-9.59	.00	.00	.00	-.06	.00
19	4	18	9.59	.00	.00	.00	.02	.00

JUNCTION NUMBER	DEMAND	GRADE LINE	ELEVATION	PRESSURE
2	4.00	375.00	140.00	101.83
4	.00	375.00	150.00	97.50
6	5.00	375.00	125.00	108.33
8	5.00	375.00	118.00	111.37
10	5.00	375.00	112.00	113.97
12	5.00	375.00	110.00	114.83
14	5.00	375.00	109.00	115.27
16	4.00	375.00	108.00	115.70
18	.00	375.00	110.00	114.83

THE NET SYSTEM DEMAND =   33.00

SUMMARY OF INFLOWS(+) AND OUTFLOWS(-) FROM FIXED GRADE NODES

PIPE NUMBER	FLOWRATE
1	33.00

THE NET FLOW INTO THE SYSTEM FROM FIXED GRADE NODES =   33.00
THE NET FLOW OUT OF THE SYSTEM INTO FIXED GRADE NODES =   .00

A SUMMARY OF CONDITIONS SPECIFIED FOR THE NEXT SIMULATION FOLLOWS

THE DEMANDS ARE CHANGED FROM ORIGINAL VALUES BY A FACTOR =   2.90

THE FOLLOWING CHANGES IN PIPE DATA ARE SPECIFIED

FOR PIPE NUMBER   1 THE VALUE OF THE FIXED GRADE IS CHANGED TO   360.0

THE RESULTS ARE OBTAINED AFTER 2 TRIALS WITH AN ACCURACY =   .00000

PEAK HOUR DEMANDS

PIPE NO.	NODE	NOS.	FLOWRATE	HEAD LOSS	PUMP HEAD	MINOR LOSS	VELOCITY	HL/1000
1	0	2	95.70	.00	.00	.00	.15	.01
3	2	4	27.81	.00	.00	.00	.04	.00
5	2	6	56.29	.00	.00	.00	.16	.01
7	6	8	41.79	.00	.00	.00	.12	.01
9	8	10	27.29	.00	.00	.00	.08	.00
11	10	12	12.79	.00	.00	.00	.04	.00
13	12	14	-1.71	.00	.00	.00	.00	.00

```
15      14      16      -16.21      .00       .00       .00      -.05       .00
17      16      18      -27.81     -.01       .00       .00      -.18      -.02
19       4      18       27.81      .00       .00       .00       .04       .00
```

```
JUNCTION NUMBER       DEMAND    GRADE LINE    ELEVATION    PRESSURE
       2              11.60       360.00       140.00        95.33
       4                .00       360.00       150.00        91.00
       6              14.50       359.99       125.00       101.83
       8              14.50       359.99       118.00       104.86
      10              14.50       359.99       112.00       107.46
      12              14.50       359.99       110.00       108.33
      14              14.50       359.99       109.00       108.76
      16              11.60       359.99       108.00       109.20
      18                .00       360.00       110.00       108.33
```

THE NET SYSTEM DEMAND =   95.70

SUMMARY OF INFLOWS(+) AND OUTFLOWS(-) FROM FIXED GRADE NODES

```
   PIPE NUMBER      FLOWRATE
        1             95.70
```

THE NET FLOW INTO THE SYSTEM FROM FIXED GRADE NODES =   95.70
THE NET FLOW OUT OF THE SYSTEM INTO FIXED GRADE NODES =   .00

A SUMMARY OF CONDITIONS SPECIFIED FOR THE NEXT SIMULATION FOLLOWS

THE DEMANDS ARE CHANGED FROM ORIGINAL VALUES BY A FACTOR =   1.65

THE FOLLOWING SPECIFIC DEMAND CHANGES ARE MADE :
JUNCTION NUMBER   DEMAND
        14   1508.00
        16   1507.00

THE FOLLOWING CHANGES IN PIPE DATA ARE SPECIFIED

FOR PIPE NUMBER   1 THE VALUE OF THE FIXED GRADE IS CHANGED TO 360.0

THE RESULTS ARE OBTAINED AFTER   3 TRIALS WITH AN ACCURACY = .00038

MAXIMUM DAY DEMANDS PLUS 3000 GPM FIRE FLOW SPLIT BETWEEN NODES 14 AND 16

PIPE NO.	NODE NOS.		FLOWRATE	HEAD LOSS	PUMP HEAD	MINOR LOSS	VELOCITY	HL/1000
1	0	2	3054.60	1.73	.00	.00	4.87	4.94
3	2	4	1331.95	.21	.00	.00	2.13	1.06
5	2	6	1716.05	2.24	.00	.00	4.87	6.89
7	6	8	1707.80	2.90	.00	.00	4.84	6.83
9	8	10	1699.55	2.37	.00	.00	4.82	6.77
11	10	12	1691.30	1.21	.00	.00	4.80	6.71

```
13    12    14    1683.05      1.83      .00      .00     4.77     6.65
15    14    16     175.05       .01      .00      .00      .50      .10
17    16    18   -1331.95     -8.54      .00      .00    -8.50   -31.06
19     4    18    1331.95      1.81      .00      .00     2.13     1.06
```

```
JUNCTION NUMBER      DEMAND    GRADE LINE    ELEVATION    PRESSURE
      2               6.60       358.27       140.00       94.58
      4                .00       358.06       150.00       90.16
      6               8.25       356.03       125.00      100.11
      8               8.25       353.13       118.00      101.89
     10               8.25       350.76       112.00      103.46
     12               8.25       349.55       110.00      103.80
     14            1508.00       347.72       109.00      103.44
     16            1507.00       347.71       108.00      103.87
     18                .00       356.25       110.00      106.71
```
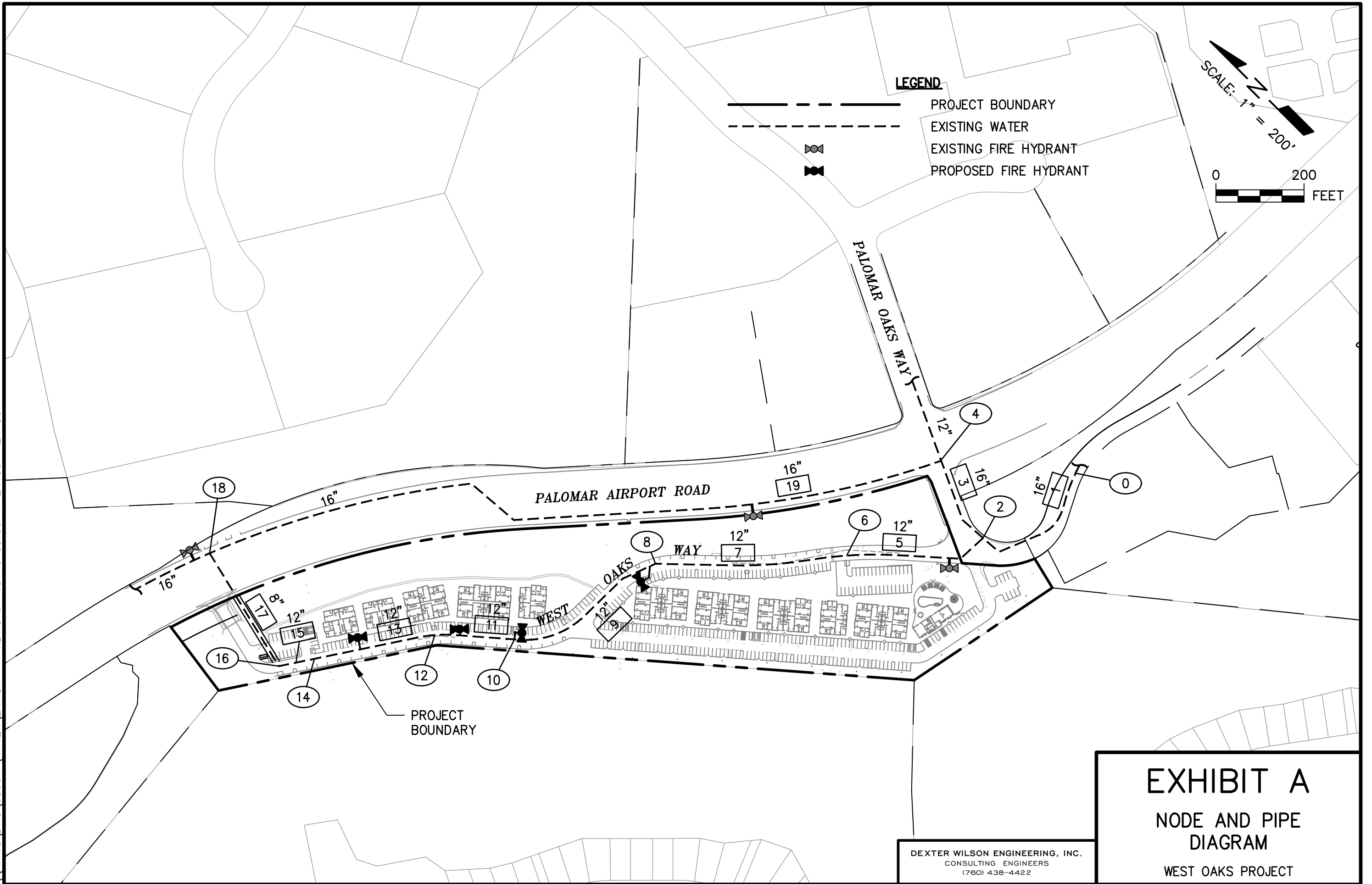
THE NET SYSTEM DEMAND =   3054.60

SUMMARY OF INFLOWS(+) AND OUTFLOWS(-) FROM FIXED GRADE NODES

```
   PIPE NUMBER      FLOWRATE
        1           3054.60
```

THE NET FLOW INTO THE SYSTEM FROM FIXED GRADE NODES =   3054.60
THE NET FLOW OUT OF THE SYSTEM INTO FIXED GRADE NODES =   .00

SCALE: 1" = 200'

N

0   200
—————————
FEET

PALOMAR OAKS WAY

PALOMAR AIRPORT ROAD

WEST OAKS WAY

16"

16"

16"

16"

16"
17
8"

12"
15

12"
13

12"
11

12"
9

12"
7

12"
5

16"
19

16"
3

16"

18

4

0

2

6

8

12

10

14

16

PROJECT
BOUNDARY

EXHIBIT A

NODE AND PIPE
DIAGRAM

WEST OAKS PROJECT

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