BLD18-4516, DF01

PCI

THORPE DESIGN, INC.
410 BEATRICE COURT SUITE A
BRENTWOOD, CA 94513

OFFICE COPY

HYDRAULIC CALCULATIONS

FOR

NEW RESIDENCE
49 DORCHESTER DRIVE
SANTA ROSA, CA
DESIGN/LAYOUT BY: ANGEL AMEZCUA
FILE NUMBER: 19-009
DATE: JAN 16, 2019



-DESIGN DATA-

| | |
|---|---|
| OCCUPANCY CLASSIFICATION: | RESIDENTIAL |
| GPM REQ. PER HEAD: | 13 GPM |
| SPRINKLER SPACING: | 16 X 16 SQ. FT. |
| NUMBER OF SPRINKLERS CALCULATED: | 2 sprinklers |

AUTHORITY HAVING JURISDICTION: SONOMA COUNTY

CONTRACTOR CERTIFICATION NUMBER: 541016

-SPRINKLERS-

MANUFACTURER: TYCO
MODEL: FLAT PLATE (TY3596)
SIZE: 1/2"
K-FACTOR: 4.9K
TEMP. RATING: 160 DEG.

-WATER FLOW-

STATIC: 67
RESIDUAL: 56
FLOW: 100 GPM
PROVIDED BY: CALIFORNIA AMERICAN WATER

-DEMAND-

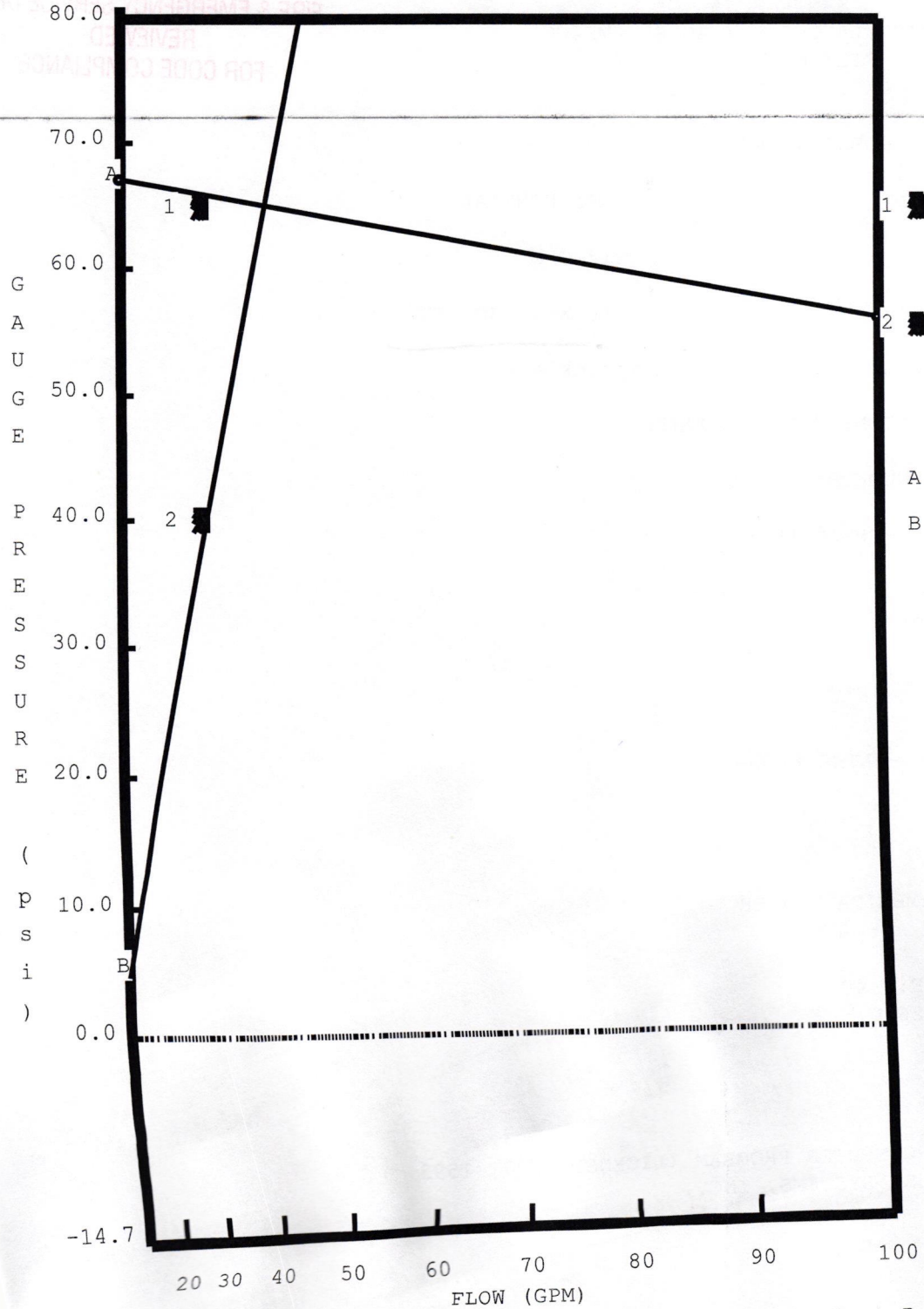
SPRINKLER REQUIRED PRESSURE: 40.9
SPRINKLER REQUIRED FLOW: 26.0
ADDITIONAL FLOWS: 5 GPM
TOTAL FLOW: 31.0

CALCULATIONS BY HASS COMPUTER PROGRAM (LICENSE # 27111593 )
HRS SYSTEMS, INC..

DATE: 1/16/2019TER DRIVE(SONOMA COUNTY)\CALCS\19-009 49 DORCHESTER DR.SDF
JOB TITLE:

WATER SUPPLY ANALYSIS

Static: 67.00 psi Resid: 56.00 psi Flow: 100.0 gpm




LEGEND

1 Available pressure
65.74 psi @ 31.0 gpm

2 Required pressure
40.94 psi @ 31.0 gpm

A. Source Supply Curve

B. System Demand Curve

Note: (1) Dashed Lines indicate extrapolated values from Test Results

DATE: 1/16/2019TER DRIVE(SONOMA COUNTY)\CALCS\19-009 49 DORCHESTER DR.SDF
JOB TITLE:

NFPA WATER SUPPLY DATA

| SOURCE NODE TAG | STATIC PRESS. (PSI) | RESID. PRESS. @ (PSI) | FLOW (GPM) | AVAIL. PRESS. @ (PSI) | TOTAL DEMAND (GPM) | REQ'D PRESS. (PSI) |
|---|---|---|---|---|---|---|
| SOURCE | 67.0 | 56.0 | 100.0 | 65.7 | 31.0 | 40.9 |

Available pressure is 24.8 psi (38%) greater than required pressure.

AGGREGATE FLOW ANALYSIS:

| | |
|---|---|
| TOTAL FLOW AT SOURCE | 31.0 GPM |
| TOTAL HOSE STREAM ALLOWANCE AT SOURCE | 0.0 GPM |
| OTHER HOSE STREAM ALLOWANCES | 5.0 GPM |
| TOTAL DISCHARGE FROM ACTIVE SPRINKLERS | 26.0 GPM |

NODE ANALYSIS DATA

| NODE TAG | ELEVATION (FT) | NODE TYPE | PRESSURE (PSI) | DISCHARGE (GPM) | NOTES |
|---|---|---|---|---|---|
| 1 | -1.5 | - - - - | 40.4 | - - - | |
| 2 | -1.5 | - - - - | 36.4 | - - - | |
| 3 | -1.5 | - - - - | 32.8 | - - - | |
| 4 | 2.5 | HOSE STREAM | 30.7 | 5.0 | |
| 5 | 3.5 | - - - - | 29.9 | - - - | |
| F1 | 5.0 | - - - - | 29.1 | - - - | |
| F2 | 5.0 | - - - - | 26.1 | - - - | |
| 6 | 6.5 | - - - - | 25.4 | - - - | |
| 7 | 10.0 | - - - - | 23.5 | - - - | |
| 8 | 9.5 | - - - - | 16.4 | - - - | |
| 9 | 9.5 | - - - - | 9.7 | - - - | |
| 9A | 9.5 | - - - - | 9.7 | - - - | |
| 10 | 11.0 | - - - - | 8.1 | - - - | |
| 11 | 11.0 | - - - - | 8.1 | - - - | |
| 12 | 13.0 | - - - - | 17.4 | - - - | |
| S1 | 9.0 | - - - - | 9.9 | - - - | |
| S2 | 10.5 | K= 4.90 | 7.0 | 13.0 | |
| S3 | 10.5 | K= 4.90 | 7.1 | 13.0 | |
| SOURCE | 0.0 | SOURCE | 40.9 | 31.0 | |

DATE: 1/16/2019TER DRIVE(SONOMA COUNTY)\CALCS\19-009 49 DORCHESTER DR.SDF
JOB TITLE:

NFPA PIPE DATA

| Pipe Tag / Frm Node / To Node | El (ft) | K-fac / PT | Add Fl (q) / Tot.(Q) | Fl To Node/ Disch | Vel / Nom ID / Act ID | Fit: / Eq.Ln. (ft.) | L / F / T | C / Pf/ft. | (Pt) / (Pe) / (Pf) | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| Pipe: SOURCE | | Source | 0.0 | | 5.8 | | 25.00 | 150 | 0.5 | |
| SOURCE | 0.0 | 40.9 | 31.0 | 2 | K1.500 | T: 8.0 | 8.00 | | -0.6 | |
| 1 | -1.5 | 40.4 | 31.0 | | 1.481 | | 33.00 | 0.036 | 1.2 | |
| Pipe: 1 | | | 0.0 | | Fixed Pressure Loss Device | | | | | |
| 1 | -1.5 | 40.4 | 31.0 | 3 | 4.0 psi, | 31.0 gpm | | | | |
| 2 | -1.5 | 36.4 | 31.0 | | | | | | | |
| Pipe: 2 | | 0.0 | 0.0 | | 5.0 | | 125.00 | 150 | 3.6 | |
| 2 | -1.5 | 36.4 | 31.0 | 4 | S1.500 | 4E:16.0 | 16.00 | | 0.0 | |
| 3 | -1.5 | 32.8 | 31.0 | | 1.593 | | 141.00 | 0.025 | 3.6 | |
| Pipe: 3 | | H.S. | 5.0 | Disch | 5.6 | | 4.00 | 150 | 2.1 | |
| 3 | -1.5 | 32.8 | 26.0 | 5 | L1.500 | E: 4.0 | 7.00 | | 1.7 | |
| 4 | 2.5 | 30.7 | 31.0 | | 1.505 | G: 3.0 | 11.00 | 0.033 | 0.4 | |
| Pipe: 4 | | 0.0 | 0.0 | | 4.7 | | 3.00 | 150 | 0.8 | |
| 4 | 2.5 | 30.7 | 26.0 | F1 | L1.500 | 2E: 8.0 | 11.00 | | 0.4 | |
| 5 | 3.5 | 29.9 | 26.0 | | 1.505 | R: 3.0 | 14.00 | 0.024 | 0.3 | |
| Pipe: 5 | | 0.0 | 0.0 | | 4.2 | | 1.50 | 150 | 0.8 | |
| 5 | 3.5 | 29.9 | 26.0 | F2 | Y1.500 | C: 7.0 | 7.00 | | 0.6 | |
| F1 | 5.0 | 29.1 | 26.0 | | 1.598 | | 8.50 | 0.018 | 0.2 | |
| Pipe: F1 | | | 0.0 | | Fixed Pressure Loss Device | | | | | |
| F1 | 5.0 | 29.1 | 26.0 | 6 | 3.0 psi, | 26.0 gpm | | | | |
| F2 | 5.0 | 26.1 | 26.0 | | | | | | | |
| Pipe: F2 | | 0.0 | 0.0 | | 4.2 | | 1.50 | 150 | 0.7 | |
| F2 | 5.0 | 26.1 | 26.0 | 7 | Y1.500 | 2R: 2.0 | 2.00 | | 0.6 | |
| 6 | 6.5 | 25.4 | 26.0 | | 1.598 | | 3.50 | 0.018 | 0.1 | |
| Pipe: 6 | | 0.0 | 14.3 | 12 | 4.2 | | 15.58 | 150 | 2.0 | |
| 6 | 6.5 | 25.4 | 11.7 | 8 | Y1.500 | E: 9.0 | 10.00 | | 1.5 | |
| 7 | 10.0 | 23.5 | 26.0 | | 1.598 | R: 1.0 | 25.58 | 0.018 | 0.5 | |
| Pipe: 7 | | 0.0 | 0.0 | | 6.3 | | 64.92 | 150 | 7.0 | |
| 7 | 10.0 | 23.5 | 11.7 | 9 | Y0.750 | 3E:21.0 | 28.00 | | -0.2 | |
| 8 | 9.5 | 16.4 | 11.7 | | 0.874 | 7R: 7.0 | 92.92 | 0.078 | 7.3 | |
| Pipe: 8 | | 0.0 | 0.0 | | 6.3 | | 33.75 | 150 | 6.7 | |
| 8 | 9.5 | 16.4 | 11.7 | 10 | Y0.750 | 7E:49.0 | 52.00 | | 0.0 | |
| 9 | 9.5 | 9.7 | 11.7 | | 0.874 | 3R: 3.0 | 85.75 | 0.078 | 6.7 | |
| Pipe: 9 | | 0.0 | 13.0 | S2 | 6.3 | | 11.17 | 150 | 1.6 | |
| 9 | 9.5 | 9.7 | -1.3 | 11 | Y0.750 | R: 1.0 | 1.00 | | 0.6 | |
| 10 | 11.0 | 8.1 | 11.7 | | 0.874 | | 12.17 | 0.078 | 1.0 | |

DATE: 1/16/2019TER DRIVE(SONOMA COUNTY)\CALCS\19-009 49 DORCHESTER DR.SDF
JOB TITLE:

| Pipe Tag / Frm Node / To Node | El (ft) | K-fac / PT | Add Fl (q) / Tot.(Q) | Fl To Node/ Disch | Vel / Nom ID / Act ID | Fit: / Eq.Ln. (ft.) | L / F / T | C / Pf/ft. | (Pt) / (Pe) / (Pf) | Notes |
|---|---|---|---|---|---|---|---|---|---|---|
| Pipe: 9A | | 0.0 | 0.0 | | 0.0 | | 1.67 | 150 | 0.0 | |
| 9A | 9.5 | 9.7 | 0.0 | | Y0.750 | R: 1.0 | 1.00 | | 0.0 | |
| 9 | 9.5 | 9.7 | 0.0 | | 0.874 | | 2.67 | 0.000 | 0.0 | |
| Pipe: 10 | | 0.0 | 13.0 | S2 | 0.7 | | 15.75 | 150 | 0.0 | |
| 11 | 11.0 | 8.1 | -11.7 | 9 | Y0.750 | R: 1.0 | 1.00 | | 0.0 | |
| 10 | 11.0 | 8.1 | 1.3 | | 0.874 | | 16.75 | 0.001 | 0.0 | |
| Pipe: 11 | | 0.0 | 13.0 | S3 | 7.6 | 5E:35.0 | 46.08 | 150 | 9.2 | |
| 12 | 13.0 | 17.4 | 1.3 | 10 | Y0.750 | 2T: 6.0 | 44.00 | | -0.9 | |
| 11 | 11.0 | 8.1 | 14.3 | | 0.874 | 3R: 3.0 | 90.08 | 0.112 | 10.1 | |
| Pipe: 12 | | 0.0 | 0.0 | | 7.6 | 2E:14.0 | 23.67 | 150 | 6.1 | |
| 7 | 10.0 | 23.5 | 14.3 | 11 | Y0.750 | T: 3.0 | 19.00 | | 1.3 | |
| 12 | 13.0 | 17.4 | 14.3 | | 0.874 | 2R: 2.0 | 42.67 | 0.112 | 4.8 | |
| Pipe: S1 | | 0.0 | 0.0 | | 0.0 | | 6.92 | 150 | 0.2 | |
| S1 | 9.0 | 9.9 | 0.0 | | Y0.750 | T: 3.0 | 3.00 | | 0.2 | |
| 9A | 9.5 | 9.7 | 0.0 | | 0.874 | | 9.92 | 0.000 | 0.0 | |
| Pipe: S2 | | 4.90 | 13.0 | Disch | 7.0 | | 3.50 | 150 | 1.1 | |
| 10 | 11.0 | 8.1 | 0.0 | | Y0.750 | E: 7.0 | 10.00 | | -0.2 | |
| S2 | 10.5 | 7.0 | 13.0 | | 0.874 | T: 3.0 | 13.50 | 0.094 | 1.3 | |
| Pipe: S3 | | 4.90 | 13.0 | Disch | 7.0 | | 3.50 | 150 | 1.1 | |
| 11 | 11.0 | 8.1 | 0.0 | | Y0.750 | E: 7.0 | 10.00 | | -0.2 | |
| S3 | 10.5 | 7.1 | 13.0 | | 0.874 | T: 3.0 | 13.50 | 0.095 | 1.3 | |

NOTES (HASS):

(1) Calculations were performed by the HASS 8.8 computer program
in accordance with NFPA13 (2016)
under license no. 27111593 granted by
HRS Systems, Inc.
208 Southside Square
Petersburg, TN 37144
(931) 659-9760

(2) The system has been calculated to provide an average
imbalance at each node of 0.003 gpm and a maximum
imbalance at any node of 0.054 gpm.

(3) Total pressure at each node is used in balancing the system.
Maximum water velocity is 7.6 ft/sec at pipe 11.

(4) Items listed in bold print on the cover sheet

are automatically transferred from the calculation report.

(5) Available pressure at source node SOURCE under full flow conditions is

64.89 psi with a flow of 40.95 gpm.

(6) PIPE FITTINGS TABLE

User Pipe Table Name: SIGMA1.PIP

PAGE: K MATERIAL: Copper HWC: 150

| Diameter | Equivalent Fitting Lengths in Feet | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| (in) | F | E | T | B | G | C | R | A | Q |
| | F45Ell | Ell | Tee | BfyVlv | GatVlv | ChkVlv | TeeRun | AngVlv | QFITTI |
| 1.481 | 2.00 | 4.00 | 8.00 | 2.00 | 3.00 | 6.00 | 3.00 | 7.00 | 9.00 |

PAGE: L MATERIAL: Copper HWC: 150

| Diameter | Equivalent Fitting Lengths in Feet | | | | | | |
|---|---|---|---|---|---|---|---|
| (in) | F | E | T | B | G | C | R |
| | F45Ell | Ell | Tee | BfyVlv | GatVlv | ChkVlv | TeeRun |
| 1.505 | 2.00 | 4.00 | 8.00 | 2.00 | 3.00 | 6.00 | 3.00 |

PAGE: S MATERIAL: PVC - Sch 40 HWC: 150

| Diameter | Equivalent Fitting Lengths in Feet | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| (in) | F | E | T | B | G | C | R | Z |
| | F45Ell | Ell | Tee | BfyVlv | GatVlv | ChkVlv | TeeRun | 10runZ |
| 1.593 | 2.10 | 4.00 | 8.00 | 0.00 | 1.00 | 8.91 | 2.70 | 0.00 |

PAGE: Y MATERIAL: Blazem HWC: 150

| Diameter | Equivalent Fitting Lengths in Feet | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| (in) | F | E | T | B | G | C | R | Z |
| | F45Ell | Ell | Tee | BfyVlv | GatVlv | ChkVlv | TeeRun | 10runZ |
| 0.874 | 1.00 | 7.00 | 3.00 | 0.00 | 1.00 | 7.00 | 1.00 | 10.00 |
| 1.598 | 2.00 | 9.00 | 8.00 | 1.00 | 1.00 | 7.00 | 1.00 | 10.00 |

CALIFORNIA
AMERICAN WATER

BLD18-4516.DF01
PC1

August 8, 2018

**SUBJECT: HYDRANT FLOW TEST – LARKFIELD SYSTEM**
**DARBSTER PLACE**

To whom it may concern:

On June 15, 2018 at approximately 1:45 P.M., a flow test was conducted by California American Water staff using fire hydrants located along Folsom Blvd. (see Attachment "A"- Location Map). These fire hydrants are located in the Suburban System of California American Water Sacramento District. The following measurements were collected during the flow test:

| **Residual Hydrant (FH # 3105)** | | **Flowing Hydrant (FH # 3101)** | |
|---|---|---|---|
| Static Pressure | = 72 psi | Outlet Diameter | = 2.4 inches |
| Residual Pressure | = 62 psi | Pitot Pressure | = 21 psi |

The calculated results of this flow test indicate that, based on the data collected at the time and date tested and under the exhibited system operational conditions, the distribution system in this area would be capable of delivering a flow of approximately **1,688 gpm, for a 2 hour duration, with a 20 psi residual system pressure** (see fire hydrant flow test information, Attachment "B").

Hydrant flow tests are known to fluctuate with operational conditions, routine maintenance, and system demands, which are influenced by time of day, season, temperature, and day of the week. Static water pressures fluctuate in accordance with system demands; water systems are designed with the intent of meeting CPUC GO 103 & Title 22 requirements, with minimum operating pressures of 40 psi for normal operation, 30 psi for peak hour and 20 psi for fire flow conditions.

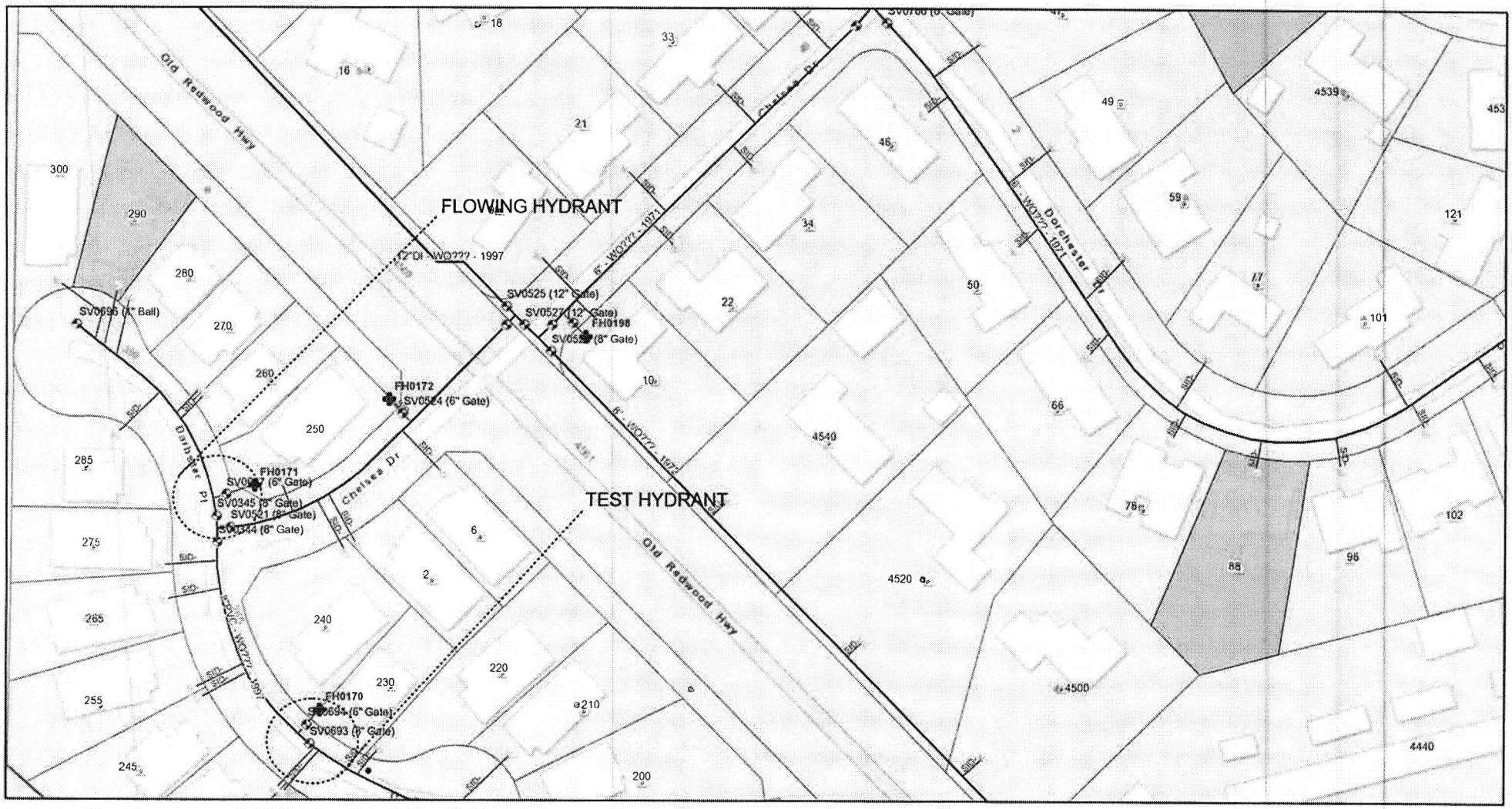
I hope this information satisfies your needs. Please contact me at (916) 568-4210, or at spencer.phillips@amwater.com if you have questions or require additional information.

Sincerely,

Spencer Phillips
California American Water

2 Attachments

# Attachment "A"




May 29, 2018

CALIFORNIA AMERICAN WATER; LARKFIELD DISTRICT - FIRE HYDRANT FLOW TEST LOCATION MAP

1:1,128

Water - Meter Pit

Water - Lateral Fire Service

Hydrant Laterals

Water - Lateral Service

Domestic

Hydrant Laterals

Override 1

ServiceAreaBoundary

Premise

LK_NewMeters

Property - Property Point

Property - Assessment

As-Builts

MapCall_OperatingCenter_Index

0 0.01 0.02 0.04 mi

0 0.02 0.04 0.07 km

Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community

California American Water

Sonoma County, Bureau of Land Management, Esri, HERE, Garmin, INCREMENT P, NGA, USGS | Esri, HERE | Bailey Morrison, Tom Dilts, and Jonathan Greenberg | Esri, HERE, Garmin, FAO, NOAA, USGS, Bureau of Land Management, EPA, NPS |

Attachment "B"

CALIFORNIA
AMERICAN WATER

# FIRE HYDRANT FLOW TEST INFORMATION

**Project Address:** Darbster Place
**CAW System:** Larkfield
**Test Date & Time:** 6/15/2018; 1:45 P.M.
**Performed By:** Jason C., Corey K.

**Residual Hydrant No.:** FH-170
**Flowing Hydrant No.:** FH-171
**Location:** Along Darbster Pl.
(see Location Map in Attachment "A")

**Field Observations:**

| | | | |
|---|---|---|---|
| Static Pressure | 71 | psi | Pressure measured at the residual hydrant with no hydrants flowing |
| Residual Pressure | 52 | psi | Pressure measured at the residual hydrant when flow hydrant is flowing |
| Pitot Pressure, $P$ | 41 | psi | Pitot gage reading taken from the outlet of flowing hydrant |
| Outlet Diameter, $d$ | 2.4 | in | Opening size of hydrant outlet being flowed |

**Calculations:**

a. Determination of Discharge

$$Q_F = 29.83\ c\ d^2\sqrt{P}$$

Where:

c = coefficient of discharge, 0.9
$d$ = diameter of outlet, in
$P$ = pitot gauge pressure, psi

$Q_F$ = 990 gpm Actual hydrant flow during test

b. Determining Available Flow

$$Q_R = Q_F \times \frac{h_r^{0.54}}{h_f^{0.54}}$$

Where:

$h_r$ = pressure difference between static pressure and the desired residual pressure of 20 psi
$h_f$ = pressure difference between static pressure and the residual pressure, psi

$Q_R$ = 1,688 gpm Available flow @ 20 psi residual pressure

The calculated results shown above indicate that the distribution system in this area where the hydrant was tested exhibited that it would be capable of delivering a flow of approximately 1,688 gpm at 20 psi residual pressure.

Notes: The above flow test and calculations were in accordacne wih the recommended practices for fire flow testing per AWWA M17 Manual and NFPS 291 Standards. The company provides no warranty that it will supply at any specific flows, quantities or pressures for fire protection or other purposes, except as required by law. For questions, please contact Spencer Phillips at (916) 568-4210 or at